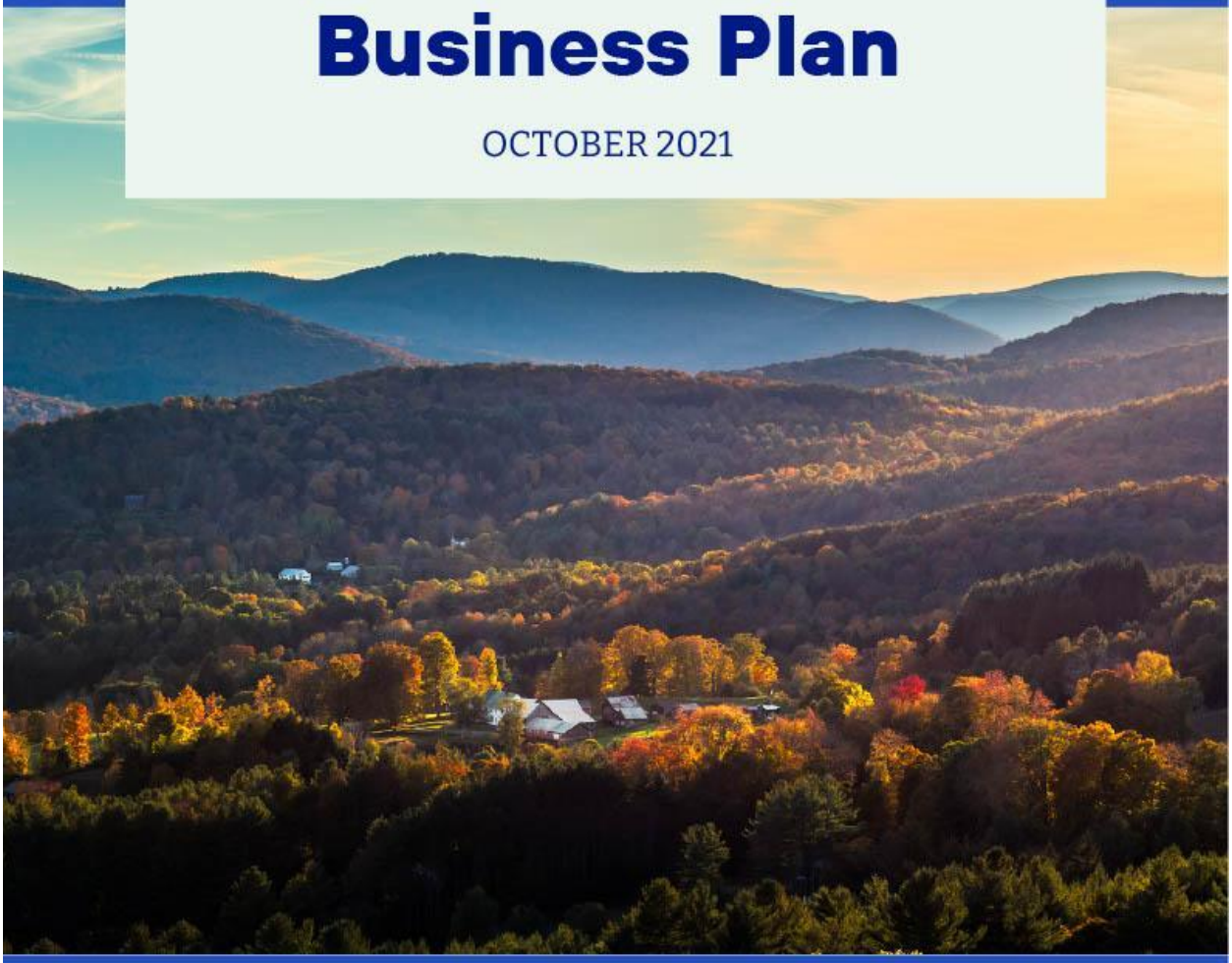
Maple Broadband Business Plan

OCTOBER 2021



PREPARED BY
RURAL INNOVATION STRATEGIES, INC AND
VALLEYNET

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1. Executive Summary

Deploying future-proof broadband is a time and resource-intensive process. However, for the first time, Vermont's Addison Region has a clear path to universal service via the Addison County Communications Union District d/b/a Maple Broadband (Maple Broadband). Importantly, this path is the product of Addison County towns and local leaders taking their telecommunications needs into their own hands to ensure quality service, establish local control, and bring world-class fiber optic internet to even the most remote locations in the area

This Business Plan (the Plan) details the path Maple Broadband is taking to deploy a fiber optic broadband network in Addison County to all on-grid unserved and underserved premises. The Plan presents financial projections that demonstrate clear prudence and fiscal health, and provides important context, strategies, and recommendations to ensure Maple Broadband's ongoing success.

The Plan builds on the substantial amount of work Maple Broadband has done already, including completing a third-party reviewed feasibility study, finalizing negotiations with its chosen operator, Waitsfield and Champlain Valley Telecom (WCVT), and procuring a vendor (Vantage Point Solutions) for a substantial amount of the pre-construction work.

This Plan is predicated on several important assumptions regarding financing and costs, namely:

1) Maple Broadband will receive grants totaling $2.4million for pre-construction and $7.3million for construction. On October 4, 2021, the Vermont Community Broadband Board (VCBB) approved Maple Broadband's $2,339,200 pre-construction grant application. The VCBB has indicated it expects to issue an RFP for construction grant applications in December.
2) Maple Broadband will be able to raise additional funds to augment grant money, likely from local institutions, private sources, and municipal revenue bonds.
3) Pre-construction and construction costs will continue to increase; driven by demand for labor and materials, but not to a degree that jeopardizes the viability of the project.

If the above conditions do not vary greatly, Maple Broadband will be able to execute its mission and build to every unserved and underserved premises in its territory over the next three years.

2. Introduction & Background

Who is Maple Broadband?

Maple Broadband is a Communications Union District (CUD) formed in September 2020. As a CUD, Maple Broadband is an all-volunteer, not-for-profit municipal corporation, formed to achieve this mission: To enhance the economic, educational, and medical well-being of the communities we serve in Addison County by providing a high-speed, reliable, affordable fiber internet network to all households and businesses; supported by prompt, skilled, helpful customer service. Maple Broadband is comprised of the following 20 member towns: Addison, Bridport, Bristol, Cornwall, Ferrisburgh, Leicester, Lincoln, Middlebury, Monkton, New Haven, Orwell, Panton, Ripton, Salisbury, Shoreham, Starksboro, Vergennes, Waltham, Weybridge, and Whiting. (Goshen, Granville and Hancock are in Addison County but have joined other CUDs.)

The Governing Board, which meets monthly, has 20 delegates appointed by the Selectboards of each of the member towns. The Maple Broadband Executive Committee, composed of five members of the Governing Board, meets weekly. The Maple Broadband Leadership Team also includes Adam Lougee, Executive Director of the Addison County Regional Planning Commission (ACRPC). Please see **Appendix A** for bios of key executive committee members and advisors.

Maple Broadband is actively developing accounting and management systems and creating a web and marketing presence in its service region. It is committed to providing a superior internet product with excellent customer service, and programs to support and assist lower-income Vermonters in affording service.

The Project Team

This Business Plan was prepared by two organizations with support from Maple Broadband. They include:

Rural Innovative Strategies, Inc. (RISI)|[1] Based in Hartland, VT, RISI, is dedicated to helping rural areas find renewed prosperity by growing entrepreneurship, digital economy jobs, and skills training. RISI's broadband team specifically works to set the foundation for this economic development work by creating comprehensive and actionable Fiber to the Home (FTTH) broadband plans for our rural partners and clients.

ValleyNet[2] | A nonprofit organization, ValleyNet operates the ECFiber and LymeFiber networks. ValleyNet acts as the design/build/operate partner to these providers and provides consulting services to a number of new and emerging New England fiber networks.

[1] "Rural Innovation Strategies, Inc." Accessed September 2021, *https://ruralinnovationstrategies.com/*

[2] "ValleyNet," Accessed September 2021, *https://www.valley.net/*

Organizations Contributing to Maple Broadband's Planning and Deployment

Waitsfield and Champlain Valley Telecom[3] (WCVT) | Since 1904 WCVT has been serving the Mad River and central Champlain Valley regions of Vermont with telephone, and then cable and fiber service. WCVT is independently and privately owned. WCVT will be the operator of Maple Broadband's network and has been instrumental in planning the deployment since the partnership was formed in August 2021.

ECFiber[4] | ECFiber is a Communications Union District providing 25 to 800 Mbps service in its area which extends north to Brookfield, south to West Windsor, west to Rochester and Hancock, and east to Thetford. Data from the ECFiber network was used extensively in the Maple Broadband planning process. ECFiber launched in 2011, and is currently the only Communications Union District in Vermont actively providing broadband service to customers.

Municipal Capital Markets Group, Inc.[5] (MCM) | MCM is a municipal bond underwriting and advisory firm. MCM reviewed the feasibility study for this project and provided significant input and guidance in the contract negotiations with WCVT to ensure the management agreement preserved the tax-exempt nature of the transaction to facilitate financing in the municipal bond market. MCM has led all of ECFiber's municipal debt offerings.

Vermont Community Broadband Board[6] (VCBB) | The VCBB is developing policies and programs to accelerate community efforts to deploy broadband, in accordance with the State of Vermont's goal of facilitating universal access to reliable, high-quality, affordable, fixed broadband of 100 Mbps symmetrical speeds or greater. The board of the VCBB, and Executive Director Christine Hallquist, bring substantial experience in telecommunications, utility management, legal, regulatory, and business planning. The VCBB is charged with managing the $150 million in funding for rural broadband that the State of Vermont received from the American Recovery Plan Act. The VCBB intends to grant those funds to entities, including CUDs, to build out Vermont's broadband network.

Broadband Innovation Grant Process

The Addison County Regional Planning Commission was awarded a Broadband Innovation Grant (BIG) from the Vermont Department of Public Service in August 2019. It used the BIG funding to create a Feasibility Study as well as this Business Plan.

The Feasibility Study found that the Addison County Region presented no major technical challenges to building a fiber network and presented multiple pathways to project viability for Maple Broadband

[3] "Waitsfield Champlain Valley Telecom," Accessed September 2021, *https://www.wcvt.com/*
[4] "ECFiber," Accessed September 2021, *https://www.ecfiber.net/*
[5] "Municipal Capital Markets Group, Inc," Accessed September 2021, *https://www.municapital.com/*
[6] "VT Community Broadband Board," Accessed September 2021, *https://publicservice.vermont.gov/vcbb*

including partnering with a local and proximate Internet Service Provider (ISP), or merging with another CUD to achieve a scale that would be attractive to an ISP from outside the region.

Municipal Capital Markets Group, Inc. provided a third-party review of the Feasibility Study, writing that the assumptions in the Feasibility Study are reasonable and that it is "viable and realistic to serve rural markets in Vermont." After this third-party validation, the State of Vermont formally certified the Feasibility Study. This Plan reflects the sound fiscal and technical planning that underpins Maple Broadband's efforts and communicates specifics about Maple Broadband's implementation path.

Between the Feasibility Study's publication and the publication of this Plan, the Vermont Legislature passed H.360/Act 71, which established the Vermont Community Broadband Board (VCBB) and established guidelines and priorities for all CUDs. The VCBB is the primary governmental entity responsible for overseeing the CUDs' deployments, including setting standards and guidelines for engineering and facilitating grant applications and awards. This Plan is consistent with the priorities outlined in H.360/Act 71 and the guidelines established by the VCBB. Maple Broadband will use this Plan to demonstrate its viability and to secure funding.

About Addison County

Towns in Addison County, Vermont range in size from less than 500 to over 8,000 in population. There are a approximately 32,000 full-time residents in the region and 17,200 premises.

The economy is diverse and includes a mix of tourism and recreation, education, healthcare, professional services, manufacturing, retail, and more. Median household income varies by town from approximately $54,000 to $91,000; median household income in Addison County is about $65,000.[7] There are a sizable number of second homes in the region, as well as a range of part-time student residences associated with Middlebury College.

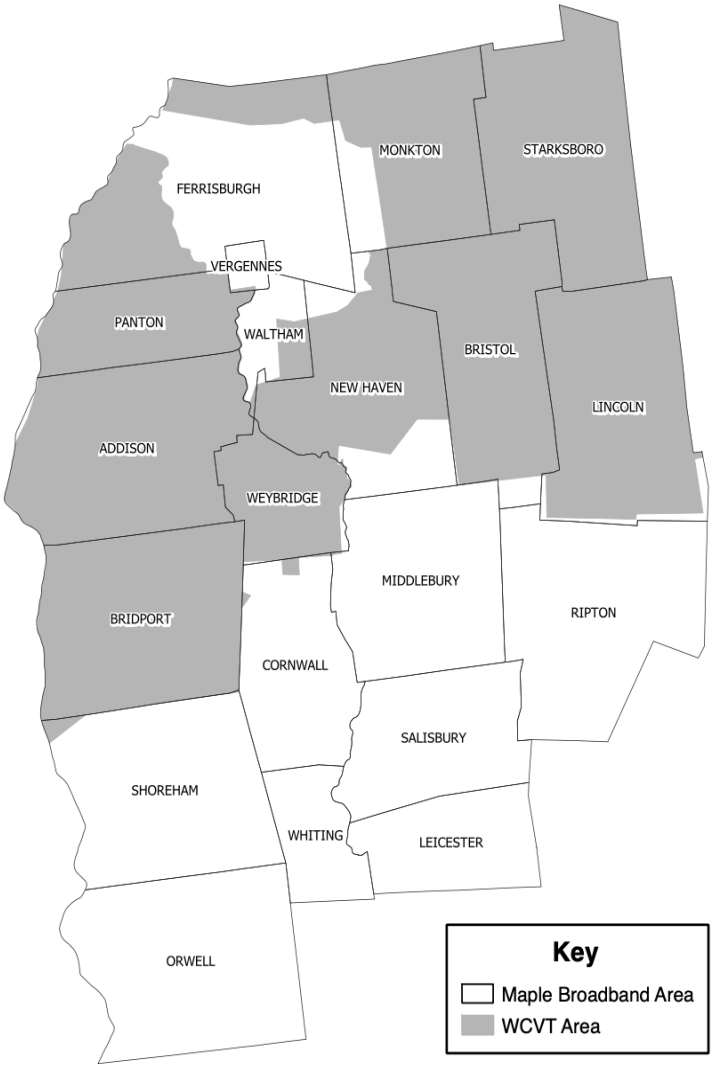
The region is similar to that of the ECFiber in its varied income levels and rural nature. Given the similarities, some components of this Plan have been calibrated using current and historical data from ECFiber's network, via its operator ValleyNet.

[7] Income statistics from 2018 American Community Survey.

3. Operational Model and Partnership

Maple Broadband has finalized a fee-for-service network management agreement with Waitsfield and Champlain Valley Telecom (WCVT) to be the operator of the Maple Broadband network. The agreement was drafted by legal counsel with local telecommunications experience; and received significant input and guidance from Municipal Capital Markets (MCM) to ensure the agreement with WCVT would qualify as a tax-exempt arrangement and therefore be eligible for financing in the municipal bond market. Waitsfield and Champlain Valley Telecom is an ideal partner for Maple Broadband for many reasons, including the fact that it has an excellent reputation in Vermont for being responsive and community minded. In addition, because its Local Exchange Carrier (LEC) territory in part overlaps with Maple Broadband, it is one of the most efficient choices for an operator that Maple Broadband could make.

The following shows the Maple Broadband region as well as WCVT's LEC region. Maple Broadband and WCVT will be building out a Fiber-to-the-Home network in the entire region.



WCVT has agreed to manage Maple Broadband's network in the portion of Maple Broadband's territory that falls outside of its LEC boundaries. WCVT has also agreed to build fiber inside its LEC boundaries at a comparable rate to Maple Broadband to ensure that the entire build is completed at approximately the same time.

The table below details the underserved and unserved premises[8] by town in the Maple Broadband territory, and in the existing WCVT incumbent local exchange carrier (ILEC) territory. By serving these premises Maple Broadband and WCVT will achieve universal service within every town in Maple Broadband's district, including those within WCVT.

Unserved and Underserved Premises by Town for Maple Broadband and WCVT Territories

Town	Total Premises	Total Unserved/ Underserved	Total % Unserved/ Underserved	Maple Unserved/ Underserved	Maple % of Total	WCVT Unserved/ Underserved	WCVT % of Total
Addison	853	468	55%	NA	NA	468	55%
Bridport	662	553	84%	NA	NA	553	84%
Bristol	1,600	92	6%	2	0%	90	6%
Cornwall	582	472	81%	463	80%	9	2%
Ferrisburgh	1,667	730	44%	323	19%	407	24%
Leicester	699	26	4%	26	4%	NA	NA
Lincoln	682	240	35%	1	0%	239	35%
Middlebury	2,926	124	4%	124	4%	0	0%
Monkton	905	229	25%	86	10%	143	16%
New Haven	820	286	35%	98	12%	188	23%
Orwell	748	748	100%	748	100%	NA	NA
Panton	330	153	46%	NA	NA	153	46%
Ripton	377	341	90%	341	91%	NA	NA
Salisbury	877	743	85%	743	85%	NA	NA
Shoreham	741	641	87%	576	78%	65	9%
Starksboro	916	279	30%	NA	NA	279	31%
Vergennes	1,017	0	0%	0	0%	NA	NA
Waltham	225	107	48%	87	39%	20	9%
Weybridge	409	231	56%	9	2%	222	54%
Whiting	185	185	100%	185	100%	NA	NA
Total:	**17,221**	**6,648**	**39%**	**3,812**	**22%**	**2,836**	**17%**

[8] As defined in Act 71, unserved premises only have access to internet capable of speeds of less than 4 Mbps download and 1 Mbps upload. Underserved premises have access to internet service capable of speeds of at least 4 Mbps download and 1 Mbps upload, but less than 25 Mbps download and 3 Mbps upload. Served premises have access to broadband capable of 25 Mbps download and 3 Mbps upload.

Summary of the Network Management Agreement between Maple Broadband and WCVT

Maple Broadband's Roles

- Finance, engineer, construct and own a Fiber-to-the-Premises network in its member towns outside of WCVT's regulated territory
- Determine location, timing, and scope of construction
- Set rates, and terms and conditions, for retail services and wholesale users
- Prepare operating and capital budgets
- Responsible for all marketing

WCVT's Roles

- Network Manager, acting on behalf of Maple Broadband
    - Maintain and repair the network
    - Connect the network to retail and business customers
    - Offer and provide use of the network to wholesale users
- Designated Service Provider, acting on behalf of Maple Broadband
    - Deliver high-speed internet, voice, and other retail services to customers on the network
    - Install, monitor, and maintain all equipment within customer premises
    - Responsible for all aspects of the customer relationship, including
        - Customer service and technical support
        - Billing and collection

Agreement Term

The term of the agreement is 10 years, with the option to renew for two additional 10-year terms.

4. Ensuring Universal and Affordable Service

Maple Broadband's mission, informed by Act 71, is to provide universal service in its district. The Business Plan shows a clear path to achieve this outcome both in the towns served only by Maple Broadband, and in the towns that are in Maple Broadband district and also in WCVT's local exchange carrier (LEC) footprint.

Maple Broadband has designed the network to cover the entirety of its territory outside WCVT's ILEC footprint. The financial projections show a clear ability to leverage initial grant money into additional funding that will allow Maple Broadband to build throughout its territory in three years. This is demonstrated by the strong EBITDA margin, which will allow Maple Broadband to access the long-term municipal bond market.

Importantly, Maple Broadband's agreement with WCVT stipulates that WCVT must connect to unserved and underserved locations inside its territory at a rate similar to Maple Broadband's connection rate for its unserved and underserved locations. This provision in the agreement will ensure that all the unserved and underserved locations in the Maple Broadband CUD are served at a similar pace, thereby meeting Maple Broadband's goal for enabling universal service its in keeping with its mission and in accordance with the rules established by the State of Vermont and the VCBB.

Bringing access to broadband throughout the region is only a part of Maple Broadband's challenge. As Maple Broadband deploys, it will also implement strategies to address affordability challenges.

To be positioned to access the long-term, tax-exempt debt market, Maple Broadband and WCVT have structured their Network Management Agreement to ensure Maple Broadband will be able to cover its debt service by 1.25X. Maple Broadband intends to use a portion of the revenue margin to subsidize monthly service for low-income Vermonters.

Another strategy Maple Broadband will use to support monthly service for low-income Vermonters includes supporting "Equal Access to Broadband", a Vermont non-profit organization, founded to provide mechanisms for subsidizing service to low-income households.

In addition to subsidizing monthly services, Maple Broadband will work to reduce or eliminate installation costs for low-income customers. The planned standard installation fee of $150 may be a prohibitive barrier to service for some people. Additionally, non-standard installation costs, like houses on private roads or with long driveways or those that must be connected with underground conduit, are typically passed on to the customer. This can be a significant expense. Maple Broadband will use revenue from the network, or grant funding if available, to subsidize these installations.

Lastly, Maple Broadband will investigate becoming a FCC "Eligible Service Provider". If successful, this program will enable Maple Broadband subscribers to avail themselves of federal Lifeline subsidies.

Lifeline provides up to a $9.25 monthly discount for eligible low-income subscribers.[9] The State of Vermont also offers limited Lifeline subsidies for telephone service. However, because these subsidies are a small part of the cost of providing service, at this time, Maple Broadband has not committed to this strategy.

[9] "Lifeline Support for Affordable Communications," *FCC,* Accessed July 2021. https://www.fcc.gov/consumers/guides/lifeline-support-affordable communications#:~:text=Lifeline%20is%20the%20FCC's%20program,service%20purchased%20from%20participating%20providers.

5. Market Analysis

What Should be Considered a Competitive Service?

There are many technologies that can be used to transfer data from one point to another and connect to the internet. Some are greater competitive threats to fiber networks than others. DSL (digital subscriber line) service, 4G LTE Cellular Service, and satellite internet do not offer universal access or the speed and quality connections that consumers want and need today. Although LEO (low earth orbit) satellites (i.e., Starlink) provide better service than traditional satellites, upload speeds are still significantly constrained, service is expensive compared to most wireline options, a connection is not reliable 100% of the day, and service can be blocked by trees and weather. Given these constraints, Maple Broadband believes that DSL service, 4G LTE Cellular Service, and satellite internet do not represent significant competition to Maple Broadband's fiber offerings.

5G service, though it represents a technological breakthrough that provides high-capacity data transfer wirelessly, is unlikely to impact the customer market in Addison County. The propagation characteristics of 5G are not suited for sparse rural areas because the signal decays quickly from the source and is severely impacted by walls and other obstacles. As such, investment in 5G technology is unlikely in rural areas in the foreseeable future. See *Appendix B: Information on Alternate Broadband Technologies* for more information on DSL, 4G, 5G, and LEO satellites.

Maple Broadband will face competition from cable providers and potentially other fiber providers. Maple Broadband intends to avoid directly competing with other existing fiber providers. This is not a wise strategy due to a lack of total available customers, the challenges of being second to market, and the diseconomies of scale. Instead, Maple Broadband intends to focus on serving residential customers in underserved and unserved areas first. This strategy reduces the risk of provoking a competitive reaction from incumbent cable providers and fulfills Maple Broadband's mission. Maple Broadband will also generally avoid directly competing with existing cable providers and will only amend this strategy if the business case and conditions associated with funding permit.

Cable Competition in Addison County

Comcast is the primary cable internet provider in Addison County. It serves many towns with cable. However, cable services often do not cover the rural parts of these towns and approximately 31% of premises in Addison County do not currently have access to cable or fiber.

Cable internet packages and pricing for residential and business customers are summarized in *Appendix C: Fiber and Cable Plans and Pricing*. It is important to note that Comcast does not provide clear pricing for its services online. It also utilizes aggressive "teaser rates" linked to long term contracts and many fees in the fine print. Providers of this size are adept at changing prices at will when they deem it beneficial. It may be the case that when overbuilt, Comcast will drop its prices to compete for customers

or offer special short-term discounts. There have been examples of both in Vermont. Comcast has dropped prices in Burlington after the deployment of Burlington Telecom's network but kept prices stable in smaller Vermont markets even after being overbuilt by fiber. Through the entire build and especially in instances of overbuilding direct competitors like cable, Maple Broadband will monitor its competitor's activities and adapt its actions appropriately.

Fiber Competition in Addison County

In addition to existing cable offerings, there is a limited amount of existing fiber deployed in the region. Waitsfield and Champlain Valley Telecom offers fiber services and has been building within its ILEC territory steadily over the past few years, focusing on denser downtown areas . WCVT's fiber roll out and exceptional service were two features that led Maple Broadband to choose WCVT as a partner. Maple Broadband's ability to tie its network into its operating partner's existing network provides it with a substantial operating advantage.

OTELCO, an ILEC that covers several towns on the western side of Addison County, is reportedly investing upwards of $5 million in fiber within its footprint. How much of this investment OTELCO puts towards last-mile fiber is not public information. OTELCO was recently acquired by Oak Hill Capital, a private equity firm that also owns GoNetSpeed, another FTTP operator, and Lantek Fiber Optic Services, Inc., a fiber construction company.[10] Oak Hill Capital's and OTELCO's investment strategy and competitive deployments are being closely monitored.

Consolidated Communications, Inc. (CCI) serves a portion of northern Addison County and also won blocks in the FCC's latest Rural Digital Opportunity Fund (RDOF) auction to deploy fiber to 251 premises in Salisbury and 250 premises in a census block that covers part of Ripton and part of Goshen (Goshen is not in the Maple Broadband territory). CCI will deploy substantial fiber in Vermont. However, reportedly 98% of it will be in locations that already have a cable option. Maple Broadband is aware that CCI may have plans to deploy fiber in the cabled areas of the Addison Region to compete directly with Comcast.

Generally, the first company to deploy fiber in an area enjoys a significant head start with customer acquisition among consumers seeking top-tier connectivity. Maple Broadband will not overbuild existing fiber plants unless that overbuilding needs to reach unserved or underserved locations.

Fiber and cable internet packages and pricing, as well as a coverage map of cable and fiber in the region, can be found in *Appendix C: Fiber and Cable Plans and Pricing*.

[10]Otelco, *April 5, 2021,* "Oak Hill Completes Acquisition of Otelco, Inc." https://www.otelco.com/news/oak-hill-capital-completes-acquisition-of-otelco-inc/

Dark Fiber Services

FirstLight, Consolidated Communications, and Vermont Electric Power Company (VELCO) have dark fiber (currently unused fiber) availability throughout this region. In addition, Lumen connects from Albany, NY through Vermont to Burlington. Maple Broadband will rely exclusively on WCVT to handle connections to the broader internet. However, it may decide to make arrangements with a dark fiber provider to facilitate local network resiliency by creating redundant rings or connecting hubs together.

Maple Broadband's mission is to provide an FTTP distribution network to all unserved and underserved locations throughout the area. Only if there is excess fiber on the network might it compete with dark fiber providers in the region. One possible scenario would be if Maple Broadband was built with a fiber bundle of 36 or 48 strands, where only 12 to 24 strands are needed and could supply a local cell tower or other users with backhaul using the excess capacity. Maple Broadband does not intend to pursue this strategy in the short term.

Ethernet Services

FirstLight, Consolidated Communications, Lumen, and VTEL offer ethernet services to large commercial and municipal customers. Ethernet services provide dedicated fiber to enterprise businesses and entities. Bandwidths range from 1 Gbps to 100 Gbps. Prices depend on the bandwidth, location, network configuration, whether the service is protected or unprotected, has a switched or mesh structure, and a service level agreement. Generally, these services are not available to non-commercial premises. Maple Broadband may compete for these contracts in situations where its network passes large entities, such as hospitals, large municipal buildings, or major employers. Rural networks are supported primarily by residential customers; ethernet services are unlikely to make up a significant portion of the network's revenue.

Businesses Customers

Rural fiber networks need to be built around a critical mass of residential customers. Unlike urban areas where business customers and large entities are numerous and are willing to pay enterprise rates, in an area like Vermont, residential subscribers are the engine that allows rural networks to succeed. This Plan is based on revenue generated by residential subscribers, however, Maple Broadband will compete strategically for business revenue when opportunities arise.

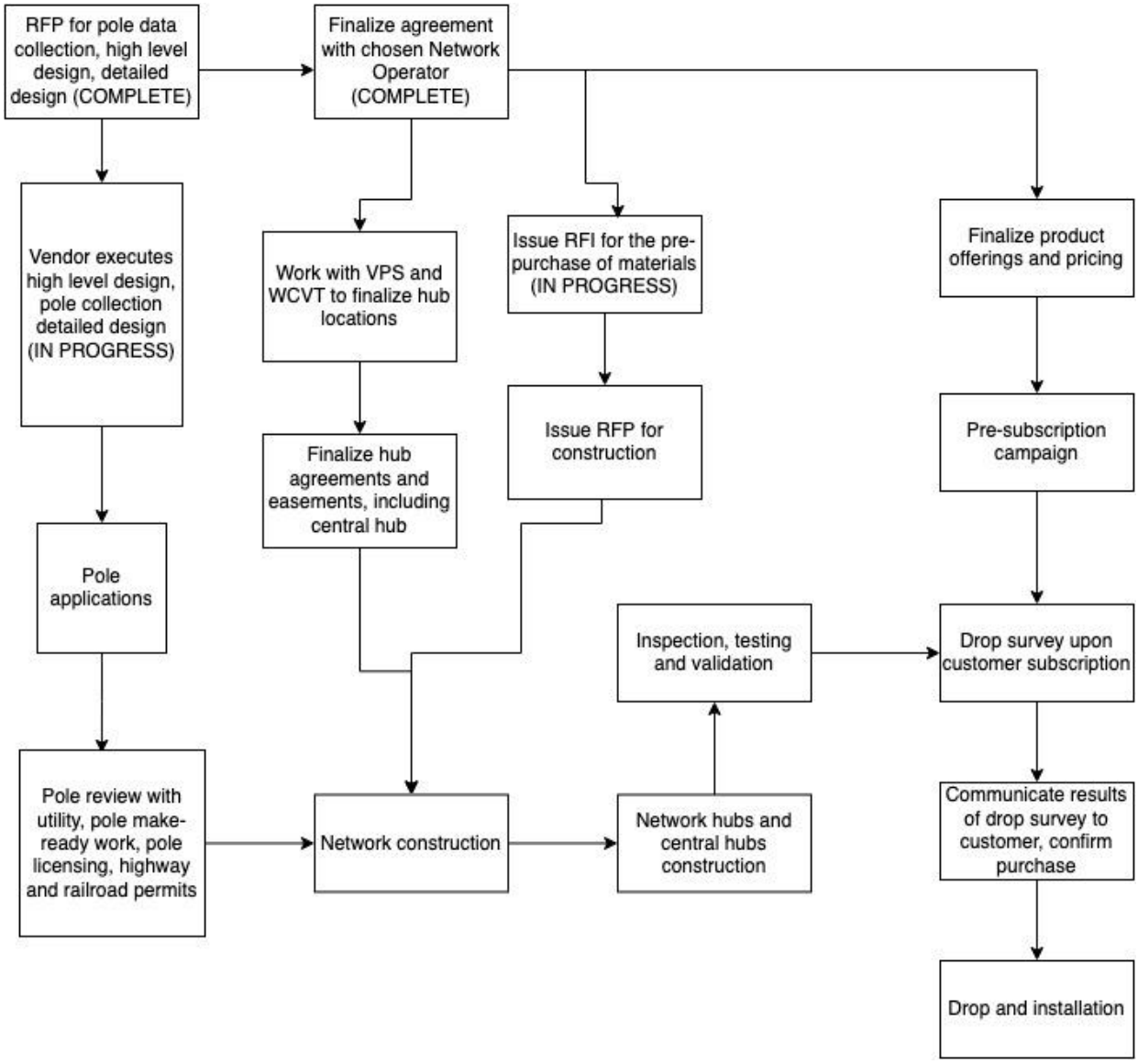
Businesses, which are typically located in downtown areas with existing cable or fiber, can have a larger potential revenue impact and improve take-rates in those areas. Unlike residential customers who may be hesitant to switch from cable due to their service being bundled with TV, historical data from ValleyNet indicates that a greater share of businesses often do not need TV packages but do need the synchronous upload capability provided by a fiber network. The business service prices that Maple Broadband may offer may be less expensive than services from incumbent cable or phone companies.

In Vermont, tourist-centric areas often have a higher number of hotels, resorts, and restaurants, which all are likely subscribers to high-speed internet. Not only will sections of routes near those areas provide dense clusters of potential business customers, the high density of second homes and wealthier residents in the area make these areas desirable to overbuild competition. However, it is important to note that these areas may have more underground conduit than others. In addition, some condominiums or Home Owners Associations sign exclusive contracts with internet providers. As such, the decision to build into these areas, to the extent they exist in the Maple Broadband footprint, will be made on a case-by-case basis.

This Business Plan does not consider the potential positive impact of business customers' higher ARPU (Amount of Revenue Per User) because businesses are expected to account for a small portion of Maple Broadband's customers.

6. Sequence of Work

This section describes the sequence of the work needed to be done in order to deploy the network and connect customers. The diagram indicates Maple Broadband's progress as of the publication of this Plan. See **Appendix D: Explanation of Required Work Activities** for more information on the activities listed here.



7. Schedule of Work

Maple Broadband is striving to provide internet service to its first customers in late fall of 2022. There are many factors that will affect the timeline of work in the coming year, including the speed at which funding can be secured, the speed at which vendors can be selected, the speed at which vendors can start work, labor and material availability issues, etc. In addition, the construction timeline will be impacted by the severity of the winter season, as it is often not possible to complete pole collection, make-ready, or construction during much of the winter in Vermont.

The following table describes the best-case timeline for building the network in the first towns and connecting those customers.

Project	Task/Milestone	Start	End	Construction start
High-level design	Network topology, routing, sizing	Jun 2021	Sep 2021	
	Pre-purchase of long lead-time materials	Oct 2021	Nov 2021	
	Planning/Location verification	Oct 2021	Nov 2021	
	Initial routing	Oct 2021	Nov 2021	
Detailed design	Field data collection / mapping	Oct 2021	Aug 2022	
	Make-ready engineering – Phase I, II	Nov 2021	Aug 2022	
	Plans & specifications preparation – Phase I	Feb 2022	Mar 2022	
	Construction RFP – Phase I	Mar 2022	Apr 2022	
Construction	Network construction process – Phase I	May 2022	Nov 2022	May 2022
	Subscribers activated – Phase I	Sep 2022	Nov 2022	
	Plans & specifications preparation – Phase II	Aug 2022	Sep 2022	
	Construction RFP – Phase II	Jan 2023	Feb 2023	
	Network construction process – Phase II	May 2023	Nov 2023	
	Subscribers activated – Phase II	Sep 2023	Nov 2023	
	Make-ready engineering – Phase III	May 2023	Aug 2023	
	Plans & specifications preparation – Phase III	Aug 2023	Sep 2023	
	Construction RFP – Phase III	Jan 2024	Feb 2024	
	Network construction process – Phase III	May 2024	Nov 2024	
	Subscribers activated – Phase III	Sep 2024	Nov 2024	

8. Design and Engineering

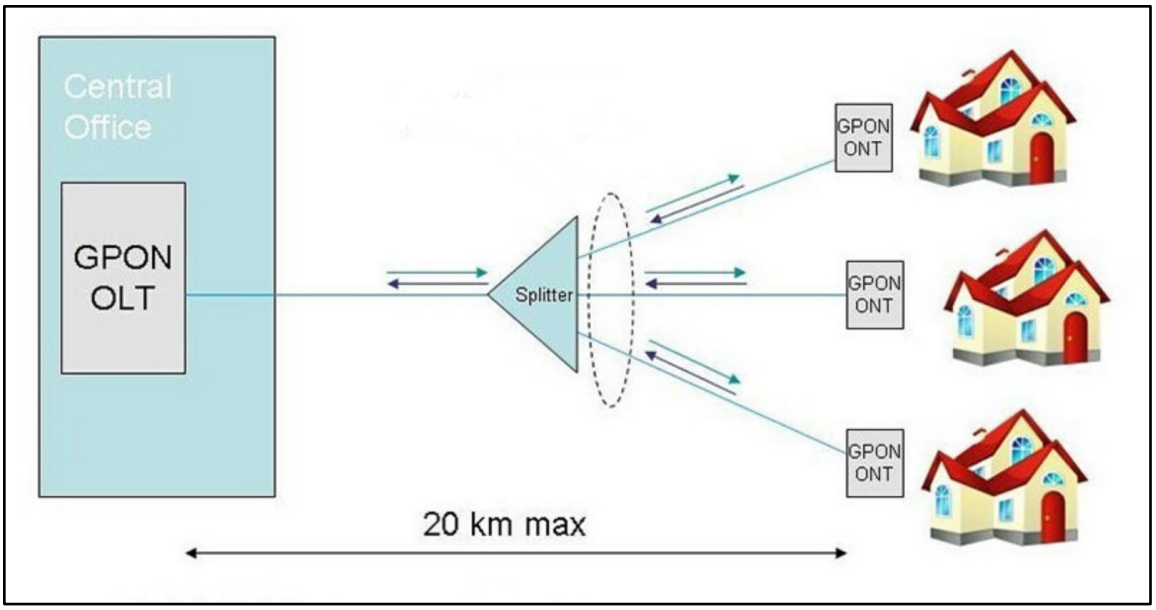
The Feasibility Study found that a network was technically feasible in the Maple Broadband Area. Based on that conclusion, Maple Broadband has issued an RFP for pre-construction work and has selected Vantage Point Solutions to perform the work. Vantage Point Solutions is a nationally respected telecommunications engineering firm based in South Dakota that provides fiber network engineering services to clients like municipalities and electric cooperatives across the country.

Gigabit Passive Optical Network (GPON) Architecture

Maple Broadband will build a GPON network for residential and small business use, complying with the priorities listed in H.360/Act 71 and the guidelines issued by the VCBB. In the network design phase, fiber strands within the network are set aside for future direct connections from the hub if direct connections are needed. The primary use of these direct connections will be to serve a large commercial business or to provide service to a cell tower.

GPON technology is a well-known, cost-effective, and yet robust infrastructure utilized by most rural Fiber-to-the-Premise (FTTP) carriers today. This is the technology currently being used by ECFiber and which Maple Broadband intends to deploy. The basic premise of all Passive Optical Network (PON) architecture is to share the optical feeder and port on the Optical Line Terminal (OLT) among as many subscriber terminals as possible, most often at 32 subscribers per OLT port. Passive optical splitters terminate the fiber and provide the optical connection to the Optical Network Terminal (ONT) at the customer premises. The passive optical splitters do not require a power source and can be deployed along the network route attached to the fiber strand. PON standards provide for a maximum distance of about 12 miles, or 20 kilometers, between the OLT location in a local hub cabinet and the end-user ONT.

Importantly, new, and emerging multi-gigabit speed PON technology, sometimes called XPON technology, will allow the network to scale from 1 gigabit symmetrical to 10 gigabits as bandwidth needs increase.



Basic diagram of a GPON network

The typical alternative to GPON is called Active Ethernet. Active Ethernet FTTP architecture requires a larger hub location to house OLT equipment with a port and fiber strand for every possible subscriber at a higher cost. The result is an actively powered solution, and the maximum distance from the hub to the end-user is much farther, up to 75 miles. However, the cost of deploying an Active Ethernet network in rural areas almost always exceeds the benefits. The shared nature of the fiber strands in a passive GPON network means a lower total count fiber (at a lesser cost) can be deployed and fewer ports are required on the OLT equipment. The passive nature of the network mitigates the need for cabinets requiring power in the field. PON architecture has advantages in lower capital expenditures, energy consumption, rack and hub space, mean-time-to-repair (MTTR), and mean-time-between-failures (MTBF).

Central Hubs and Backhaul

Central hubs provide everything that network hubs provide and house routing and switching equipment that allows for a connection to network backhaul. Currently, Maple Broadband's plan is to locate one central hub in Middlebury or Shoreham, and another in Vergennes. (Lease agreements will need to be arranged with landowners, so there is flexibility regarding the exact location of the hubs.) The deployment of multiple hubs will help ensure network resiliency and redundancy.

These hubs will provide Maple Broadband's connection to backhaul. Backhaul refers to the side of the network that communicates with the global internet at an internet exchange point, often housed in co-location centers. In much of Vermont, FirstLight, Consolidated Communications, and Lumen have available fiber that terminates in co-location centers within New England, New York, and Montreal, offering geographic route diversity. Procuring backhaul via one of the providers listed will be the responsibility of WCVT; and WCVT will be able to achieve efficiencies of scale by aggregating the backhaul needs of its network with Maple Broadband's bandwidth requirements.

Network Hub Locations

A network hub is the central termination point of the distribution of optical fiber lines on the network and is about the size of a refrigerator. The hub houses the optical line terminals (OLT) which operate as a switch on the network. On a GPON network, each optical splitter in the field connects back to a port on the OLT. The OLT connects to other hubs, often at 10 Gbps or higher, to create a ring topology and redundancy.

Within Maple Broadband's territory, there will be a hub in most towns, though in cases where the network is serving a partial town, the hub serving those locations could be in an adjoining town. Current design work by Vantage Point Solutions indicates that Maple Broadband may need one hub each in the following towns: Ripton, Middlebury, Cornwall, Shoreham, and Orwell; one hub shared between Whiting and Leicester; and one hub for Vergennes and Ferrisburgh, for a total of seven hubs.

The location of each hub will be central to the network infrastructure within the served area. Although each hub will be designed with battery backup and resiliency measures in accordance with the standards outlined in the most recent Vermont 10-Year Telecom Plan, it is also advantageous to locate the hub in an area with access to a generator in case of an extended power outage. It is preferable to locate hubs outside as they can emit noise that could be disruptive inside a building. As a community network, the most logical locations are at community buildings such as town halls, libraries, or police and fire stations. Schools are also a viable option, however, small schools that may ultimately consolidate with another school district in the future should be avoided.

Maple Broadband's network will employ a ring topology between hubs to ensure the highest redundancy and resiliency for customers. In addition, the network will utilize at least two paths to backhaul, for routing redundancy, as well as four peering locations with WCVT throughout the territory to improve network resiliency and security.

Build Sequence

Though the exact build sequence Maple Broadband plans on following constitutes confidential business information, the sequence that has been devised is based on a number of factors:

- Maple Broadband will focus on serving the unserved and underserved locations first as prioritized by Maple Broadband's mission and by the VCBB.
- To manage costs, Maple Broadband will avoid overbuilding in high-cost areas that are adequately served.
- Maple Broadband has a clear path to building to all un- and underserved locations in their footprint
- To accommodate network resiliency, Maple Broadband will select a build sequence that allows interconnection with WCVT's network at more than one point.

The pace at which the network can be built will be impacted by the parameters associated with funding sources, material and labor availability, and make-ready constraints at Green Mountain Power. Currently, Maple Broadband projects an ability to build its network in three construction seasons.

Procuring a Network Design

Maple Broadband is working with an experienced and well-regarded vendor, Vantage Point Solutions, to design the network, and to identify additional practical engineering considerations such as where middle-mile transport may be needed, or railroad permits required. The high-level design will be completed using utility pole data provided in the Vermont Geodata Portal. The high-level design will also be used to validate cost assumptions.

To streamline this process and reduce error in the vendor work product hand-offs, Maple Broadband has elected to use the same vendor for both the high-level and detailed designs. After the high-level design is complete, Vantage Point Solutions will collect detailed pole data (beyond what is available via the VT Geodata Portal) so that a detailed, construction grade network design can be created. This detailed design will serve as the template for the construction vendor's work and thus must accurately and precisely describe the network.

Throughout the design process, Maple Broadband is consulting with and updating WCVT to ensure that it leverages WCVT's extensive local knowledge and experience and that its designs meet WCVT's specifications.

9. Marketing Plan and Pre-subscription Campaign

Maple Broadband is leveraging several competitive advantages in its marketing and outreach efforts. These advantages include public ownership, local control, and other competitive distinctions such as speed, transparent pricing, and customer service.

Maple Broadband has already been highlighting these benefits in its communications. It has invested in several marketing efforts to date and will continue to grow brand awareness in the community. Having already made significant investments in a public website, direct mailers to all residents, and online pre-subscription outreach tools, an understanding of the Maple Broadband mission is forming within the community. To build on its successes to date, Maple Broadband will focus strategically on increasing brand awareness during a pre-subscription campaign and then move to a more action-oriented approach when internet service is available to more residents.

Maple Broadband has established a subscription list of community members interested in its progress. Curating messaging to subscribers is key to establishing good will in the community and will lead to future supporters, advocates, and subscribers. Combining email, social media campaigns, and local event attendance such as its participation in the recent 'Welcome to Middlebury, USA' event provides a forum for Maple Broadband to engage with community members and grow the potential customer base to support future campaigns.

With the advantage of a local marketing partner in WCVT, Maple Broadband can leverage industry experience and relationships to accelerate marketing deliverables. With marketing goals aligned between the two organizations, the partnership can act as a force multiplier for marketing efforts that support symbiotic growth for both teams. The nature of the agreement between Maple Broadband and WCVT means that incentives are aligned to add customers to the network, so Maple Broadband and WCVT will continue to coordinate to amplify each other's efforts as marketing becomes a focus in later stages of the deployment.

As the Maple Broadband brand evolves, it will partner with a marketing agency that can provide strategic and tactical support for sustainable marketing operations. A marketing agency will provide value through story articulation, asset creation, and campaign management to reinforce the mission and values of the organization.

Pre-Subscription Campaign

Maple Broadband will be establishing a pre-subscription campaign, where people sign up indicating they will subscribe to the service as soon as it is available. ValleyNet's historical experience shows that about 85% percent of those who sign up during a pre-subscription campaign eventually became customers. Another advantage of a pre-subscription campaign is an economic one, allowing for substantial savings

in the first series of installations. Whereas a piecemeal installation performed one residence at a time can cost $1,400, performing multiple installations in a row in a single neighborhood can yield hundreds of dollars of savings.

As Maple Broadband gets closer to a network construction start date the pre-subscription campaign will also be used as a marketing tool to create grassroots energy and word-of-mouth excitement. It is best to wait to perform significant outreach until after product offerings and pricing are established so that potential customers can accurately evaluate whether they would like to subscribe. Lastly, a strong pre-subscription campaign should increase lenders' confidence in the project and can increase the likelihood of securing a variety of funding sources.

While it is not necessary to take deposits during a pre-subscription campaign, it is necessary to entice the potential customer to choose their service level and to morally commit to subscribing.

Ultimately, community engagement and grassroots energy are more important to the success of a pre-subscription campaign than, for example, the software used or the use of a deposit. Promotion through digital outreach and social media will be a major component of the pre-subscription campaign. Maple Broadband will create a social media toolkit complete with graphics, pre-made posts, and links that can be shared with CUD representatives, and also with town email and social accounts, local institutions, and local businesses interested in co-marketing.

10. Summary of Financial Projections

The financial projections created for this Plan constitute confidential business information and are included in a confidential addendum to this Plan. In summary, the model indicates that Maple Broadband can achieve the following:

- Positive EBITDA (Earnings Before Interest, Taxes, Depreciation, and Amortization) starting in year 2;
- EBITDA coverage ratio never falling below 1.35X
- Yearly revenue leveling off at approximately $5 million/year after construction is complete and penetration rates mature;
- 25-year IRR (Internal Rate of Return) of 4.3%, demonstrating a small but sufficient rate of return for a not-for-profit municipal entity; and
- Cumulative cost per customer approaching $6,250/customer at year 10.

The model also projects the following financing will be required:

- $9.7 million in grants, including $2.4 million for pre-construction and $7.3 million for construction;
- $12 million in debt across years 2 and 3 at an assumed 8% interest to bridge between the grant resources and the long-term debt market; and
- $26 million in revenue bonds during years 3, 4, and 5 at 6% initially and dropping to 5.5% for later issuances.

11. Risk Management

Maple Broadband's Business Plan carries significantly less risk than many other new deployments. Maple Broadband's partner, Waitsfield and Champlain Valley Telecom, is established and knowledgeable in the region. WCVT does not need to establish a new base of operations nor reach a critical mass of customers at a certain pace to be viable. Data collected from the State of Vermont, combined with historical ECFiber data, indicates the project team can be confident in the revenue and penetration assumptions in the projections.

The following three items are the greatest risks to the project.

Materials Availability

Manufacturing of essential fiber network materials has been delayed, primarily due to factories experiencing temporary shutdowns during the COVID-19 pandemic. Additionally, it is likely that there will be increased demand that could cause delays and result in increased materials costs should a large amount of broadband infrastructure investment occur at once. In 2010, the American Recovery and Reinvestment Act (ARRA) funded broadband projects, causing lead time for the delivery of optical fiber to increase from four to six weeks to four to six months in a very short period. As of Fall 2021, suppliers are reporting delays on fiber of nine or even 12 months on certain types of fiber (typically higher count fiber).

Maple Broadband is pursuing three strategies to order materials as early as possible. It is soliciting funds from municipal ARPA allocations to pre-purchase materials. It is also coordinating with WCVT to pre-purchase fiber and necessary electronics, and utilizing secure, climate-controlled storage space at a WCVT facility to house materials safely until deployment. It is in discussions with various vendors so materials can be ordered as soon as possible. Finally, it has requested Vantage Point Solutions prepare a Bill of Materials for Year 1 needs as part of the design process. This strategy requires that Maple Broadband have sufficient cash to purchase materials in advance, which entails being able to successfully access resources from local ARPA allocations, and more importantly, grant money from the VCBB in a timely manner.

Pole Make-Ready Delays

To deploy fiber, it is first necessary to complete make-ready on utility poles, which involves moving existing wires to make room for new attachments. If this work must be done by the pole owner, who may not always be motivated to move quickly, significant delays are possible. Make-ready delays are one of the most common obstacles in broadband deployment.

Historically, there has been a limit to the amount of make-ready work that can be completed each year. Most utility poles in Maple Broadband's territory are owned by Green Mountain Power (GMP); in prior years, GMP has been able to perform 250 miles of make-ready a year for ECFiber. With several CUDs

beginning broadband deployment at the same time, GMP may be unable to keep up with make-ready requests and unable to complete 250 miles of make-ready per year in Addison County.

In 2019, the governor of Vermont signed House Bill 513 into law, which, in addition to creating the BIG Grant and VEDA broadband loans, also included a one-touch make-ready (OTMR) provision to facilitate the make-ready process.[11] This new regulation states that if the make-ready work is not completed on schedule, after 30 days the pole owner must refund payment for uncompleted work, and the network constructor can hire a qualified contractor to complete the remaining make-ready work.[12] Hopefully, one-touch make-ready regulations will reduce delays in the make-ready process. In addition, utilities are aware of the growing demand for make-ready work and report being prepared to meet the demand.

The only guaranteed solution to mitigating make-ready delays may involve state policymakers providing funding or incentives to support make-ready work. This involves support to increase GMP's capacity, and potentially to provide support to increase the local capacity of private construction and technician groups via Vermont Training Grants or other programs. Maple Broadband should seize every opportunity to inform legislators and the VCBB of this risk and should keep them informed of make-ready issues as that work is performed.

Construction Vendor Scarcity & Inflation

Construction costs for fiber deployment have already begun to increase and given demand and the scarcity of vendors and labor able to do the required work, costs will likely continue to increase. Maple Broadband will employ the following strategies to mitigate construction cost inflation:

- Re-evaluate all financial projections at each juncture that bids for vendor services are received;
- Include contingency plans in contractual agreements to account for rising costs;
- Proactively coordinate with partners during each project phase to ensure that costs have not risen prohibitively;
- Consider ways to work with other CUDs or partners to achieve efficiencies on materials, labor, and other equipment and services; and
- Continue to advocate to entities such as the legislature, VCBB, and institutions like Vermont Tech to communicate the gravity of any construction labor shortage.

[11] "Governor signs bill to expand broadband coverage across state," Vermont Biz*, June 20, 2021,* https://vermontbiz.com/news/2019/june/20/governor-signs-bill-expand-broadband-coverage-across-state

[12] V.S.A H.513, "An Act pertaining to broadband deployment throughout Vermont." https://legislature.vermont.gov/Documents/2020/Docs/ACTS/ACT079/ACT079%20As%20Enacted.pdf

12. Conclusion

There is a reason that broadband has not yet been universally deployed in Vermont: the logistical hurdles are immense, the capital costs are significant, the subject matter is esoteric, the legal constraints are often challenging, and the return on investment is often minimal or nonexistent in sparsely populated areas.

Maple Broadband has spent the past year overcoming these obstacles. Today this plan provides a defined strategy for a path to success: Build quickly and deliver service to residents of its member towns who are desperate for service, create cash flow to access the long-term debt market quickly, and provide the region with a clear trajectory towards universal service within three construction seasons. To that end, Maple Broadband has:

1. Secured WCVT, a reputable local partner, to manage the network and provide retail services;
2. Engaged Vantage Point Solutions, a nationally recognized vendor, to provide all pre-construction activities, including production of construction bid documents;
3. Actively solicited funds from the VCBB, other grant funders and member towns to finance the pre-purchase of key construction materials to mitigate the delays currently being seen in the construction market;
4. Identified viable options for the pre-purchase of key construction materials both with its operator and distributors;
5. Discussed with Middlebury College the prospect of being a financial investor; and, in the longer term, a potential customer; and
6. Engaged in discussions with a local financial institution concerning financing for construction needs prior to being able to access the long-term debt market.

Maple Broadband has and will continue to work quickly and intentionally to successfully deploy broadband to the underserved and unserved locations in Addison County.

Appendix A: Bios of Key Maple Broadband Board Members and Advisors

Steve Huffaker, Chair, Maple Broadband Board Executive Committee
Steve began his career in 1978 installing business telephone systems in the Champlain Valley and New England. In 1994, he changed his focus to designing and installing fiber and copper cable plants in large multi-tenant commercial office buildings in Tier 1 cities across the U.S. In the last decade of his career, he was employed by JP Morgan Chase designing and building data centers across the U.S. and in Pacific rim countries including Australia, South Korea and Hong Kong. Over the course of his career, Steve has written, and was responsible for, multiple ANSI-approved telecommunications infrastructure standards, including pathways, spaces, and administration. Steve recently retired from JP Morgan Chase and assumed the role as chair of Maple Broadband in October of 2020.

Nancy Cornell M.Ed., Vice Chair, Maple Broadband Board Executive Committee
Nancy, was an Associate Superintendent of Schools/Curriculum Coordinator for 23 years, focusing on curriculum, instruction, assessment, professional development, and grant administration. She was a founding member, and also served as the Steering Committee Chair, of the Vermont Curriculum Leaders Association (VTCLA). Formerly a high school English teacher in Vermont and Massachusetts, and a freelance writer, Nancy was also a member of the Board of the Robinson Elementary School in Starksboro. Nancy currently works as an educational consultant, with a focus on Facilitative Leadership; and she is the editor and publisher of Vermont Learning, a free, weekly online newspaper for educators. She is a member of the board of Equal Access to Broadband (EAB), a non-profit dedicated to ensuring that high-speed internet is available AND affordable for all low-income Vermonters. Nancy is also a member of the Mt. Abraham Unified School District Community Engagement Committee.

Magna Dodge, Member of the Maple Broadband Board Executive Committee; Chair, Maple Broadband Finance Committee
For over 30 years Magna was involved in the financial services industry in New York City and Hong Kong, specializing in the media, entertainment, and telecom industries. In addition to serving as a member of the Maple Broadband Executive Committee and the Town Hall Theater Board, she is active in the town of Cornwall, serving on the Select Board, the Development Review Board, and the Capital Committee. Magna is a graduate of Middlebury College and Harvard Business School.

Ellie Hagopian, Member of the Maple Broadband Board Executive Committee
Ellie holds a number of positions, with a focus on telecommunications and commercialization of new technologies. These include looking after affordable access initiatives for Liquid Telecom Group, and technology solution design for Connect Earth. The former Chairperson of the Wireless Access Providers' Association of South Africa (WAPA), and Entrepreneur-in-Residence at the Council for Scientific and Industrial Research (CSIR), Ellie also has strong credentials in public policy, commercialization, and strategy as it applies to innovation and industry development. Her specific areas of interest and expertise are identifying new ideas and the commercial modelling and technical assessment required to deliver on those ideas. She holds an MBA from Babson College (ranked number one for entrepreneurship for 25 consecutive years by U.S. News and World Report).

Dan Sonneborn, Member of the Maple Broadband Board Executive Committee
Raised in Vermont, Dan received a degree in Artificial Intelligence from the University of Rochester in New York. After cutting his teeth in information technology for a large real estate organization in California, Dan returned to Vermont to become the Director of Information Technology for a construction company and then for the United States District Court. Dan is now the owner of Aerie Consulting, a software development company that partners with Microsoft to deliver business applications in the cloud.

Adam Lougee, Esq., Clerk of the Maple Broadband Board
As Maple Broadband's Clerk, Adam helps the chair oversee the administration of Maple Broadband and works with the Treasurer and Finance Committee on organizational finances. Adam currently serves as the Executive Director of the Addison County Regional Planning Commission; a position he has held for over 20 years. In his capacity with the regional planning commission, Adam has helped numerous municipalities and organizations create and implement plans to improve their communities. Adam also currently serves on the Board of Tri-Valley Transit, Addison County Transit Resources (ACTR's) parent company. Prior to working with the Addison County Regional Planning Commission, Adam practiced law in Burlington and South Burlington in the areas of real estate and corporate transactions and served as the Vice President of the Bolton Valley Corporation where he managed the resort's permitting requirements and infrastructure needs. Adam is a graduate of Washington and Jefferson College and Cornell Law School.

Cy Day Tall, Treasurer of the Maple Broadband Board and Executive Committee
Cy spent twenty years in the direct response marketing industry as an account executive and Director of Account Services prior to launching a marketing consulting company - and becoming an orchardist. A decade later, she was invited to become the Marketing Director for Beau Ties of Vermont and was named Co-President of the company in 2015 - retiring from that position in 2020. Cy has served on the Boards of the Middlebury Volunteer Ambulance Association, the

United Way of Addison County and the Henry Sheldon Museum and is the moderator for the Town of Cornwall.

Appendix B: Glossary of Terms

1G/10G/100G	Short for 1/10/100 Gigabits per second connection speed
Accrued Interest	Interest that is not paid in cash, but 'accrued' and added to the principal balance
Aerial Drop	Drop that is all above ground on poles
ARPU	Average Revenue per Unit – a standard telecom metric measuring the average revenue derived each month from a customer
Attenuation	The measure of the loss in signal strength due to distance, splicing, bends, etc.
Backhaul	Refers to an ISP's connection from its network to the broader Internet
Balloon Repayment	The repayment of a loan or bond in one lump sum at the end of its maturity – i.e., principal not amortized over time
Capex per Customer	Amount of capital expenditures required to reach a customer
Capex per Passing	Amount of capital expenditures required to pass a customer
Conduit	Pipe or tubing through which cables can be pulled or housed. Usable conduit for pulling fiber is typically 2+" in diameter and must have rounded sweeps, i.e., fiber cannot be bent at a sharp angle without a significant attenuation in signal strength
Cost of Goods Sold	Variable cost of providing service – for ISPs, this includes wholesale cost of phone service, Internet backhaul, video (if offered) and sometimes pole rental
Customer	A residence or business that is receiving service
Customers per Mile	An alternative to Penetration Rate which considers the density of the network
Dark Fiber	Fiber that is in place on the poles but not "lit" by electronics at either end – allows companies to buy/lease fiber infrastructure rather than an actual connection
Debt Service Covenant	An agreement with lender to maintain debt service at a certain level – ex., EBITDA must be greater than 1.25X Debt Service
Debt Service Coverage	A standard financial ratio measuring the ability to service interest and principal payments on debt = EBITDA / Debt Service (Interest and Principal) for a given time period (usually annually)

Density	Linear Density of an area equals homes per linear mile of network
Distributed Splitting	32-way fiber signal splitter located in the field (not the hub) – reduces fiber count
Distribution Fiber	Typically, 12-24 strands used for local distribution
Drop	The connection from the road to a premise
EBITDA Margin	EBITDA divided by revenue as a percentage
EBITDA	Earnings Before Interest Taxes Depreciation and Amortization – a standard financial metric that measures the ability to service debt
FAP	Fiber Access Point – the point at which a connection is spliced from the road (mainline network) to a premise
Fiber Count	The number of fiber strands in each fiber cable – typically highest close to hubs and between hubs and lowest on dead-end roads – a multiple of 12 (see Fiber Tube)
Fiber Strand	A single strand of fiber thinner than a human hair coated with a colored material to make it identifiable when splicing
Fiber Tube	Fiber is divided into tubes of 12 fiber strands
FTTH/P	Fiber to the Home or Premise – fiber goes all the way to each customer
GPON	Gigabit Passive Optical Network – requires no electronics between central hub site and premise – uses 32 way splitters – used by Verizon Fios and most FTTH providers in the US
Gross Margin	A measure of network profitability = Revenues less Cost of Goods Sold – can also be expressed as a percentage of revenue
Hub Site	Houses transceivers to distribute and receive laser light signals for the "last mile". Typically 10-15 miles in Vermont or roughly one hub site in the center of each town
Installation	Installing the home transceiver (ONT) for the fiber network (and attaching phone where necessary)
ISP	Internet Service Provider - the entity providing Internet service
Last Mile Fiber	Fiber designed for local distribution with FAPs (a local road with access to each driveway along it)
Latency	The delay between sending a bit and receiving a response – can be very high for geo-stationary satellite connections making certain Internet capabilities (such as VPN) impossible
Lit	A network is lit once light levels have been tested and electronics are activated in the hub

Long Haul Fiber	Like Middle Mile but longer – typically used for Internet backhaul (to Boston or Albany or Portland)
Make-Ready	The process and cost of making utility poles ready to accept an ISP's gear – this is performed by utilities – the timing and cost of this can be a major factor in a new ISP's success (or failure)
Middle Mile fiber	Fiber typically routing from town to town, with no FAPs for local distribution (similar to an Interstate highway with limited exits)
Non-recourse Debt	Debt that is not supported by a general obligation of the town – can be secured by assets or revenues or be unsecured
ONT/CPE	Optical Network Transceiver/Consumer Premises Equipment – typically comes with a WiFi router built in
OTMR	One Touch Make-Ready – regulations whereby one (or at most two) trucks/crews are sent out to make a pole ready (rather than each attachee – phone/cable/other ISP sending its own). Does not generally apply to make-ready by electric utilities because of the special training and equipment needed to operate in the electrical "space"
Passing	A residence/business/E911 location that is passed by the lit network
Peak Hour	The hour of the day where Internet usage peaks – typically 9-11 PM (streaming) but changing now due to the pandemic
Penetration Rate	Customers divided by Passings, also referred to as Take Rate
Revenue Bonds	Bonds that are supported by the revenues from a given asset financed by the bonds
Strand	The "other" strand - The metal carrier cable to which fiber is attached between poles
Streaming	Usually refers to watching video over an internet connection (but can also be music/audio) – Streaming requirements vary by user hardware and streaming video providers
Subscriber	A residence or business that has signed up for service
Symmetrical	A connection supporting the same upload and download speeds
Transport Fiber	Fiber used for communications from hub-to-DSP (digital signal processor) or hub-to-hub
Underground Drop	Drop that is underground – typically in a conduit., Fiber can share the conduit with phone or cable plant but not electricity – some homes with underground drops have only one conduit (for electricity) – the phone lines are "direct buried" without conduit – in these cases the customer must install new conduit

Universal Coverage / Universal Service	Access to broadband for every on-grid premises in a town or region
VOIP	Voice Over Internet Protocol (i.e., voice service over Internet)
VPN	Virtual Private Network – used by companies to secure their employee's connection to company servers when working away from the office - can also be used to disguise an Internet user's actual location by sending and receiving traffic through an intermediate server

Appendix C: Information on Alternate Broadband Technologies

VTel 4G Wireless Internet Services

VTel provides wireless internet from a range of towers throughout the region, supported primarily through the USDA Reconnect program in 2010. VTel has received $2 million[13] from the State of Vermont to expand its wireless services in the region; however, neither the existing service nor potential expansion of 4G wireless should be considered a threat to Maple Broadband's plans.

This service purports to provide download speeds of *up to* 100 Mbps, or in VTel's words "Faster than DSL." These packages require customers to pay per GB (gigabit) of data used, from $10/month for 2GB, to $140/month for 500GB; a customer can receive service capped at 100GB for $60 monthly after the promotional price of $50 monthly for 2 years. This service is not typically competitive with cable or fiber, unless a household has a direct line of sight to a tower and very low data needs. Importantly, VTel does not require long-term contracts, thus any new customers on an expanded VTel Wireless Network will be able to switch to a fiber option as it becomes available.

Cellular (4G LTE)

The primary 4G LTE providers in Addison County are AT&T, Verizon, and VTel. While cell phone providers have claimed that Vermont is well covered by 4G LTE mobile service, the Vermont Public Service Department (PSD) tested those claims in 2018 by driving every mile of Vermont state roads and measuring the actual speeds provided by each carrier. The PSD found actual speeds were slow or nonexistent in many areas.[14]

PSD 2020 Mobile Wireless Drive Test[15]

Moreover, there are serious coverage gaps in Addison County. Towns in the far eastern and western parts of the region have particularly uneven service. Even Middlebury and other relatively populous towns have "dead spots" where no 4G LTE coverage is available. While several cell carriers may have improved their coverage since 2018 by leasing tower access from VTel, the drive test showed many areas where no cell coverage existed from any provider.

Cellular broadband is less reliable, more expensive, and slower than wired broadband such as coaxial cable or fiber, and therefore is not a competitor to fiber internet. However, as cell service continues to improve in the region, more people will use only a cell phone and have no "landline" in their homes.

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[13] Trombly, Justin. "Nearly $4 million in state grants announced for internet providers," *VTDigger,* August 25, 2020. https://vtdigger.org/2020/08/25/nearly-4-million-in-state-grants-announced-for-internet-providers/

[14] Dillon, John. "State official went roaming around Vermont testing cell service claims." *VPR.* January 16, 2019. https://www.vpr.org/post/state-official-went-roaming-around-vermont-test-cell-coverage-claims#stream/0

[15] An interactive version of this map is available at https://publicservice.vermont.gov/content/mobile-wireless-drive-test

This will result in fewer people bundling phone service and internet together. This anticipated decline in phone service is incorporated in the financial model.

Low Earth Orbit (LEO) Satellite Internet

LEO satellite internet is an emerging technology that has received significant attention in the past year. Elon Musk's company SpaceX and its internet company Starlink is currently emerging from a beta test of the service, which was available to a select number of Vermonters as well as others across the country.

LEO satellite companies aim to create a constellation of satellites to provide better internet coverage than traditional satellites. Because these satellites are closer to earth, they provide connections with lower latency than traditional satellite internet.

Anecdotal user reports in the press indicate that users without a better option were generally happy with the service during the beta test, however reliability issues, price, and the possibility of data caps on the service in the future caused some concerns.[16,17]

The reliability of LEO service is impacted by a few factors. First, trees and other obstacles have a material effect on the service and can block the signal for a time until the satellite moves past the obstacle, which means service is less consistent in a hilly and forested place like Vermont. Second, the receiver dishes will always have to reorient from one satellite to the next as they pass over (the satellites are not geo-synchronous meaning they do not orbit at the same rate the earth spins), potentially resulting in an interruption in service until the satellite constellation is complete. Third, and most importantly, it is yet to be seen how speed and reliability will be affected as more people join the network. Like any network and in particular wireless networks, as user volume increases, speeds become progressively slower since there is a fixed amount of bandwidth available to be shared amongst users.

In general, LEO satellite service may be a good option for camps and off-grid premises across the state. Starlink's service does not replace the need to build fiber to as many premises as possible. Starlink's service may not scale on track with accelerating bandwidth demand and is incapable of symmetrical speeds. Importantly, the satellites will also need to be replaced approximately every five years. If the service is not successful, SpaceX may choose to abandon the project rather than replace failed satellites, or the service may shutter altogether.

[16] Michael Sheetz, "What early users of SpaceX's Starlink satellite internet think about the service, speed and more," *CNBC*, April 15, 2021, https://www.cnbc.com/2021/04/15/spacexs-starlink-early-users-review-service-internet-speed-price.html.

[17] Amanda Gokee, "Lawmakers skeptical of Starlink solution for broadband problems," *VTDigger*, March 7, 2021, https://vtdigger.org/2021/03/07/lawmakers-skeptical-of-starlink-solution-for-broadband-problems/.

5th Generation Mobile (5G)

There are no known 5G networks in Addison County. In fact, there are limited 4G services available to Addison County residents. 5G will not be a relevant offering in Addison County soon, or perhaps ever for the following reasons:

- The potential internet speeds 5G is capable of supporting are often overstated. 5G providers promote the fastest potential speeds, not the real world speeds achieved. For example, 5G signals are hindered by common physical barriers such as hills and trees.[18] Overall, actual speeds experienced by wireless users are often only 15 percent of the peak data connection rate, even though the peak data connection rate is the speed advertised.[19]
- Wireless internet solutions are generally less stable than wired internet solutions.
- Not all 5G is created equal. When people speak about 5G internet, they often refer to "high-band" 5G., Rural areas will likely be served on a "low-band" frequencies, which will provide the user with lower latency than 4G networks, but only marginally faster speeds than 4G networks.[20] Fast "high-band" 5G internet, in particular, relies on small cell nodes that are only 300 to 500 feet apart.[21] This type of wireless internet is unlikely to be profitable in less dense areas. As cell carriers decide where to begin deploying 5G networks, they will likely focus first on high density cities and may never bring 5G to rural areas.

Each 5G antenna requires a fiber service to provide backhaul, so if the service is eventually deployed in rural Vermont, it may be a source of revenues for CUDs providing fiber.

Ultimately, as Vantage Point Solutions (an engineering and consulting firm; and coincidentally Maple Broadband's engineering design vendor) concluded in a 2017 report, 5G internet can complement, but not successfully replace, cable or fiber internet.[22]

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[18] Sascha Segan, "Testing Verizon 5G in Chicago: Speedy, But Watch Out for That Tree," *PC Mag*, May 17, 2019 https://www.pcmag.com/news/testing-verizon-5g-in-chicago-speedy-but-watch-out-for-that-tree.

[19] Larry Tompson and Warren Vande Stadt, "5G is Not the Answer for Rural Broadband," *BroadbandCommunities Magazine*, March/April 2017, https://www.bbcmag.com/rural-broadband/5g-is-not-the-answer-for-rural-broadband.

[20] Sascha Segan, "What Will 5G Do for Rural Areas?," PC Mag, December 19, 2018, https://www.pcmag.com/news/what-will-5g-do-for-rural-areas.

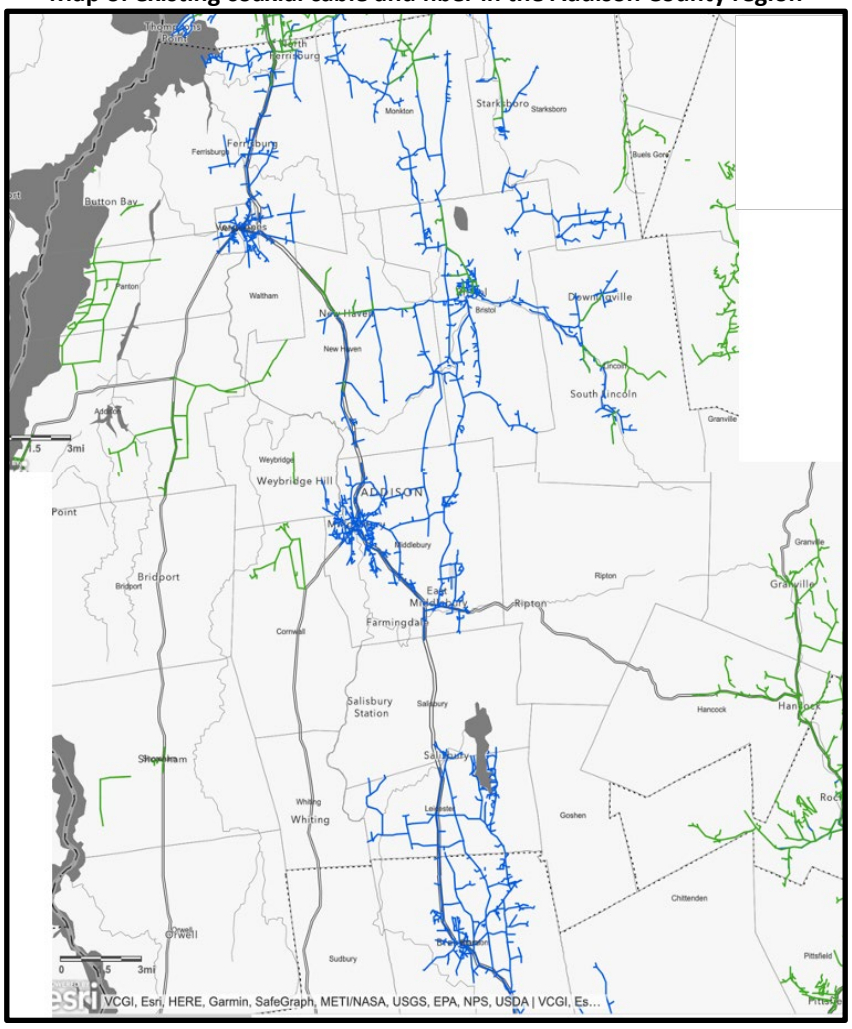
[21] Larry Tompson and Warren Vande Stadt, "5G is Not the Answer for Rural Broadband," *BroadbandCommunities Magazine*, March/April 2017, https://www.bbcmag.com/rural-broadband/5g-is-not-the-answer-for-rural-broadband.

[22] Larry Tompson and Warren Vande Stadt, "Evaluating 5G Wireless Tecnology as a complement or Substitute for Wireline Broadband," *Vantage Point,* February 2017, https://www.ntca.org/sites/default/files/legacy/images/stories/Documents/Press_Center/2017_Releases/02.13.17%20fcc%20ex%20parte-ntca%20letter%20submitting%202017%20technical%20paper%20wc%2010-90.pdf.

Appendix D: Fiber and Cable Plans and Pricing

Below is a map of existing cable (blue) and fiber (green) coverage in the Addison County region. An interactive version of this map can be found at the Vermont Department of Public Service.[23] Note: this map is built based on the most recent available data; WCVT has reported making meaningful additional deployments in their region since this data was collected.

Map of existing coaxial cable and fiber in the Addison County region



[23] State of Vermont Department of Public Service, Interactive Broadband Map, https://publicservice.vermont.gov/content/interactive-broadband-map

Residential Retail Broadband in Addison County Region

Download MBPS	PRICE	INCLUDES
Consolidated Communications DSL (lower speeds most widely available)		
7	$28.99	New Residential, Limited Time Offer, 2 Yr Contract
7	$43.98	New Residential bundled with phone, Limited Time Offer, 2 Yr Contract
7	$68.99	New Residential bundled with Direct TV, Limited Time Offer, 2 Yr Contract
7	$78.98	New Residential bundled with Direct TV & Phone, Ltd Time Offer, 2 Yr Contract
10	$31.39	New Residential, Limited Time Offer, 2 Yr Contract
15	$34.59	New Residential, Limited Time Offer, 2 Yr Contract
25	$40.99	New Residential, Limited Time Offer, 2 Yr Contract
Comcast/Xfinity*		
100	$54.99	For first 12 months
200	$49.99	For first 12 months
400	$75.99	For first 12 months
*This reflects updated pricing as of September, 2021.		
OTELCO Fiber		
100	$59.95	
300	$69.95	
Waitsfield and Champlain Valley Telecom Fiber		
25	$53.95	
50	$63.95	
100	$76.95	
500	$91.95	
1000	$103.95	

Small Business Retail Broadband in Addison County Region

Consolidated Communications		
7	$42.58	3 Year Contract
25	$60.58	3 Year Contract
100	$83.98	3 Year Contract
Comcast/Xfinity		
35	$69.95	2 Year Contract
100	$69.99	For 24 months with 3 year contract
200	$89.99	For 24 months with 3 year contract
300	$139.99	For 24 months with 3 year contract
600	$189.99	For 24 months with 3 year contract

Appendix E: Explanation of Required Work Activities

Pole collection

- Information to collect includes:
    - Exact latitude/longitude location
    - Pole ID numbers — Electric and Telephone
    - Pole Height
    - Attachments (electricity, telephone, cable internet)
    - Other elements (e.g., transformer box, DSL box, guy wires, stabilization poles)
    - Picture of the pole
    - Number of customers served from the pole
    - The project team recommends that Maple Broadband follows Vermont Communication Union District Association (VCUDA) standards for pole collection to allow for a uniform state-wide database.
- Green Mountain Power (GMP) has published location data for all its poles, but additional information is still needed about the poles. Existing GMP data can be used for quality control of new data collected.
- Pole data contributes to network design and engineering.

Pole applications

- Applications must be submitted to pole owners (GMP, Consolidated Communications, etc.) for each pole that will be incorporated into the network.
- A maximum of 200 poles can be applied for in one application.
- The poles on each application should be properly sequenced to facilitate drive out and pole inspection.
- Pole applications lead to the “ride-out” with the utility for a pole-by-pole review of the route with the utility

Pole review with utilities

- The joint “ride-out” with the utility company occurs within 60 days of the Pole Application.
- The objective of Pole review is to determine how many poles must be replaced (older, shorter poles may not have room for new attachments) and determine which facilities on the poles must be relocated to accommodate the new attachment
- The Ride-out should be performed by someone who is able to negotiate with the pole owners about who should pay for replacement poles. Poles that no longer meet the standards required in support of their existing purposes (e.g., power distribution), should be the obligation of the utility to replace. Poles with insufficient room to accommodate the new attachment may be Maple Broadband’s responsibility.

- This is also the best opportunity to discuss whether a pole application qualifies for one-touch make-ready work.

Pole make-ready work

- The pole owner will submit estimates per application for the required make-ready work. Maple Broadband will contract with the pole owner to complete make-ready or will utilize one-touch make-ready for eligible poles.
- Make-ready work involves replacing poles with inadequate space to accommodate another attachment. In other cases, make-ready involves relocating attachments on existing poles to accommodate fiber cable.
- GMP has historically been able to perform up to 250 miles of make-ready work per year for a typical CUD.
- Make-ready work is more expensive in areas that are heavily cabled because poles are more crowded.
- In 2019 the governor of Vermont signed House Bill 513 into law, which includes a "one-touch make-ready" provision, intending to speed the make-ready process. Part of this law stipulates that if make-ready is not completed on schedule, after 30 days pole owner must provide refunds for any uncompleted work and the network builder is permitted to hire a qualified contractor to perform the make-ready instead.

Pole licensing

- Maple Broadband must obtain a license for attaching to poles. A Pole License fee is charged for each pole annually. This fee was recently changed from $15 per year to $10 in acknowledgement of the fact that new entrants were often being allocated less than the requisite two feet of clearance on the pole.

Highway and Railroad permits

- If needed, additional permits or easements are required to cross or build in the right of way of federal and state highways or railroads. Railroad permitting can be a lengthy, so permits need to be requested as soon as design and engineering are complete.

RFP for construction

- Maple Broadband will collaborate with WCVT on the construction RFP to ensure compatibility with WCVT's design parameters. For improved economies of scale, the RFP may be expanded to include construction in WCVT's territory.

Identify hub locations

- The first step in the design process is finding hub locations — the network is built from the hubs out.
- Hubs house optical line terminals (OLT), power supply, and battery back-up. The central hubs also include internet routers and sometimes network switches.
- An analysis of the towns currently in Maple Broadband's territory indicates the likely need for hub locations in Ripton, Middlebury, Cornwall, Shoreham, and Orwell; with one hub shared between Whiting and Leicester; and one hub serving Vergennes and Ferrisburgh.
- Hubs should be equipped with backup battery power, but it is ideal to be in or near buildings with emergency generator power.
    - An outside 10'x10' location adjoining emergency services (including fire and police stations), town offices, schools, or library buildings make good hub sites.
      If no suitable public hub location is identified, Maple Broadband can lease space in a private building or build on private land, which is typically more expensive.

Hub lease agreement and easements

- Create a leasing agreement, including negotiation of an easement, between town/school/public safety and network to install hub equipment in their building as necessary.
- The leasing cost can often be traded for internet access costs.

Identify central hub location

- In addition to OLT, central hubs contain routing and switching equipment attached to the backhaul.
- Central hubs require air conditioning.
- There should be at least one central hub for redundancy with WCVT.

Central Hub Locations and Easements Complete a leasing agreement for up to two central hub locations, which may include office space if Maple Broadband chooses.

Design/validation

- Once pole data is collected and hubs and central hub locations have been identified, the detailed design and engineering process can commence.
- The design/engineering process includes all necessary elements for the construction team to build the network.
- Detailed construction maps are created for use by the construction team.
- Construction map validation — The construction maps should be validated in the field to ensure all elements are accurate and impacted premises are included in the design.

Procure Internet backhaul

- WCVT is responsible for procuring backhaul (connecting central hubs to the worldwide internet)
- All hubs must be connected to each other. Optimally, Maple Broadband can construct middle-mile fiber, lease fiber from Vermont Electric Power Company (VELCO), or lease from an existing carrier (e.g., FirstLight).

Bill of materials

- A bill of materials is generated from the network design and engineering. Materials will include strand (steel messenger cable to which fiber is lashed), fiber cable, attachment hardware, splitters, and fiber access point enclosures, OLTs (Optical Line Termination), and additional transport electronics.

Order materials

- Materials are ordered from various vendors.
- Materials should be stored in a clean, secure, dry location.
- Construction firms will often order certain components and/or store materials that are drop shipped directly to the construction site.

Network construction

- Construction is based on detailed engineering/design and construction mapping and materials. With permitting in place, the chosen network builder will begin construction.
- The contractor will place fiber along the route, splicing fiber at splitter locations, installing fiber access points, and terminating fiber in the hub locations.
- Red-lined drawings, which capture deviations between construction documents and actual finished environment are created.
- Testing — the light levels of network fiber should be tested for standards - compliant performance before Maple Broadband accepts the network.
- Inspection — the fiber network should be inspected for quality to ensure the construction maps are being followed and all elements are correctly in place.

Network hub and central hub construction

- Before the construction of hub locations can begin, hub agreements and easements must be in place.
- Construct hub locations and place hub cabinets. Install necessary equipment at hubs and central hubs (OLT, routers/switches, etc.).

Voice service

- Voice service will be provided by WCVT; WCVT's existing equipment can be expected to provide a cost effective, experienced, and secure phone solution for subscribers who wish to bundle voice and internet service.

Product offering and pricing

- Decide on service tiers and prices, including prices for installation, in-home equipment, and other services.

Pre-subscription campaign

- Allows Maple Broadband to perform installations more efficiently, attract more customers, and increase penetration rates in the critical early years.
- See the Pre-subscription Campaign and Marketing section for further details.

Customer signup

- As construction rolls out, outreach must be performed to confirm pre-subscribers are still committed to becoming customers.
- This can be coupled with renewed efforts to get other subscriptions (e.g., tell your neighbors!).
- Localized "Guerilla Marketing" is also inexpensive and effective.
    - Door hangers, road signs, postcards, neighbor referral program.
- Radio/TV/newspaper ads are not effective until an area is fully covered.
- See the Pre-subscription and Marketing section for further details.

Drop survey

- Determine what is necessary to install a drop to a customer.
    - Do existing utilities utilize an aerial connection? Underground with conduit? Underground without conduit?
    - How far is the premises from the road?
- Some information can be collected via a pre-subscription campaign, but it is best to field verify before dispatching an installation crew.

Communicate results of drop survey to customers

- For long aerial drops (greater than 400 feet) and underground drops, additional charges may apply as described in Maple Broadband's long drop policy.
    - For example, Maple Broadband could charge $1 per foot for any drop longer than 400 feet (underground or aerial).
- If a house does not have an aerial drop and requires underground conduit, the customer is recommended to hire a third party to install the conduit.

Drop and installation process

- The final step is connecting customers to fiber.
    - Connect house to fiber (drop)
        - Install an enclosure on the outside of the building (network interface device).
        - *Customer does not need to be present for this work*.
    - Install Customer Premises Equipment (CPE)

- Connect a network interface device to an indoor ONT (Optical Network Terminal) and connect to a resident gateway (combination router, Wi-Fi access points).
- Install battery backup for phone service where applicable.
- Customer must be present; requires appointment scheduling.
- Since this is the operator's only face-to-face meeting with the customer, we advise using mostly in-house installers and allowing up to 3 hours for each installation.