Carroll County, NH Feasibility Study

March 2022

Produced for the Carroll County Broadband Committee by
Rural Innovation Strategies, Inc, and ValleyNet

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Executive Summary

This feasibility study, performed for the Carroll County Broadband Committee, describes multiple viable paths that a Communication District or other municipal entity consisting of Carroll County towns can pursue to ensure every currently unserved premise in the county is served by fiber broadband infrastructure.

The towns of Carroll County have decided to work together to provide universal broadband access to all premises. Throughout the document, Communication District (CD) is used as a stand-in term for the cooperating body of towns, however it is understood that the decision to move forward with a Communication District model, or via the county, has not been made.

To complete this study, Rural Innovation Strategies, Inc (RISI) and ValleyNet completed the following work:

1) Survey of current service, with over 1,000 responses from the county
2) GIS work to combine RFI responses, survey, FCC data to create an understanding of current gaps in service
3) Technical feasibility assessment
4) Network models and financial models that look at multiple strategies for funding and building

This work was done in the context of the NH regulatory environment as well as the rules that developed during this work around Communication Districts, the RFI process, and the NH grant program. In addition, the broadband market in general has been incredibly dynamic during this work. The FCC Rural Development Opportunity Fund (RDOF) auction, and importantly, rising costs due to materials and labor shortages spurred by increased investments in broadband across the country.

Feasibility studies are used to gain a high level understanding of what is possible and what isn't in a jurisdiction, as well as to provide some guidance on how to compare multiple pathways if multiple pathways exist. The financial models created for this project will not describe exactly how the network deployment will play out -- among other things, construction costs are not fully known until they are put out to bid, and the exact structure of partnership between the CD and their private partner is not yet known. However, this document should be used for the CD to discuss the pros and cons of different approaches, and align on the exact path they wish to pursue via a detailed business plan.

Today, there are substantial resources available to build new broadband, which are making rural projects feasible that would not have been viable before. The proposed NH Broadband Grants as well as the ability to issue General Obligation bonds to build infrastructure are two such developments. Both of these resources are restricted to use in areas that are currently unserved (less than 25 Mbps Download/ 3 Mbps Upload).

In the case of Carroll County, the viable paths involve using one or more of these funding sources to first build to the unserved areas (as that funding dictates). Once that is complete and the CD has established that cashflow is sufficient and predictable, the CD may elect to use revenue generated by the network using Revenue Bonds to finance construction into areas already served by cable.

If the CD elects to use a General Obligation bond (GO bond) to match against the NH Grant Program, this will allow the CD to build the fastest and most efficiently, as the interest rates on GO bonds is quite low. Under this scenario, the speed at which the CD can build may only be limited by the construction season, finding construction vendors with availability, as well as potentially other factors such as the electric utility's ability to do make-ready work, if needed.

If the CD does not wish to use a GO bond, the CD may be able to use the NH grant program matched 50% with private debt;[1] however, the private debt will need to be unsecured and so will carry a higher interest rate (assume 8%). This private debt should be replaced by revenue bonds as the network matures to allow the CD to build to all of the areas they wish to serve. Because of the more expensive funding and the need to replace private debt with revenue bonds, the CUD will likely not be able to build as quickly under this scenario, and the rate of construction may need to be slowed to accommodate the need to minimize the unsecured debt required.

The substantial resources available for broadband are resulting in a difficult environment to plan. As the CD pursues a business plan and then implementation, they will need to continually assess the market conditions, ongoing private investments in the region, competitive behavior, materials and labor costs, and more. Another unknown is the amount of resources the CD will be able to secure from known programs (e.g., the NH Broadband Grant program) and other sources, e.g., the funding in the infrastructure bill. One cannot model every possible scenario given the permutations and variability present. However, we have modeled two scenarios that represent the extremes of the funding landscape; one that assumes the CD can obtain substantial grant money (half of their construction costs) and match that against low-cost GO bonds, and another that assumes the CD can only obtain a modest amount of grant money, which is matched against higher-cost unsecured debt. Given that both of these scenarios show a viable path, we are confident that the project is likely viable and that the CD should move ahead with a business plan and execution.

Ultimately, the CD should not worry as much about refining the construction costs until they figure out their ideal private partner, and the structure they would like to utilize, as this will make a big impact on the ultimate cost to the CD. More importantly, the private partner selected by the CD is likely to be their partner for decades; this decision deserves significant care and attention and should be the focus of the CD after the completion of this report.

[1] At the time of this report's writing, the matching requirement for the NH grant program is reported to be 50%. This match requirement may change before the grant program rules are finalized.

Introduction & Background

Rural Innovation Strategies Inc. (RISI), and ValleyNet received an RDCI grant from the USDA to work with several communities, including Carroll County, New Hampshire. The purpose of this work is to create a feasibility study for a fiber network in Carroll County, incorporating construction cost estimates and a timeline, high level pro forma financial models, potential funding sources, and potential operational/partnership options and models. This document reflects the work completed.

The ultimate goal of this project is to understand the viability of, and optimal course for, providing universal broadband access. The FCC defines an area served with broadband as having access to speeds of at least 25 Megabits per second (Mbps) download, and at least 3 Megabits per second (Mbps) upload (known as 25/3Mbps); otherwise the area is considered unserved. This standard was set in 2015, and it is generally believed these speeds will be inadequate in the near future.

Fiber as the solution

Fiber technology is considered the optimum choice for broadband connectivity and thus is the focus of this feasibility study. Fiber is the "future-proof" choice, as it can provide symmetrical high speeds (ex. 100mbps download / 100 Mbps upload) and adapt as society becomes increasingly reliant on the Internet of Things, where faster and consistent upload speeds will be required to handle the amount of data these devices will generate.

In addition to symmetrical high speeds, fiber infrastructure has a useful life of 40 to 50 years or more, requiring maintenance on the electronics but largely not on the fiber itself (except in the case of fallen trees and storms). Bandwidth and capacity can be increased on fiber networks by replacing the electronics on either end of the line, meaning the network can meet the needs of business and residences for decades with relatively simple electronics upgrades. Fiber is not affected by the line of sight issues or reliability issues of wireless networks, and lastly, it provides the greatest impact on housing values and economic development potential in communities where it is deployed.

The study area

In 2020, New Hampshire passed legislation allowing the formation of Communication Districts (CDs), NH RSA 53-G. CDs allow towns to band together to provide broadband services; they function similarly to water and sewer districts or solid waste districts. RSA 53-G includes a provision stating that municipalities (including CDs) can issue general obligation bonds to fund broadband infrastructure projects in unserved locations.[2] NH RSA 53-G also states that CDs can enter public-private partnerships to provide broadband.

[2] Before a municipality can issue bonds, the municipality must issue a request for information to existing providers to determine which locations are served; the providers have two months to respond to the request for information. If a provider does not respond, locations covered by that provider are considered "unserved".

Carroll County is creating a Communications District Planning Committee that currently includes 14 of the county's 19 towns. The study area for this feasibility study includes all 19 towns in Carroll County.

Determining Need

A foundational part of broadband feasibility studies is determining need by understanding where existing broadband infrastructure capable of meeting the needs of constituents is and is not. Typically in hilly and wooded areas, only other fiber infrastructure or cable infrastructure is viewed as sufficient to constituents.

National data on broadband availability, collected via the FCC's Form 477 reporting process, is widely considered too misleading and inaccurate to use for planning purposes. If no better data is immediately available, it is considered best practices to augment or calibrate this data with other data sources. This section outlines how the Form 477 data was improved. Note: while the granularity of data compiled for this study is sufficient for the purposes of understanding feasibility, the CD will ultimately need much more detailed pole-level data prior to construction, which will be collected via a pole survey.

To determine need, the study reviewed data from:

- FCC form 477 from the most recent data set available (June 30, 2020);
- Street-level availability data generated through an RFI process for the towns of Albany, Effingham, Madison, and Tuftonboro; and
- Responses from a resident survey to assess internet availability.

Using these three sources, we created GIS maps of the RFI responses and plotted the survey responses in an overlay with the FCC data. We then manually adjusted and edited the FCC data to reflect the on the ground experiences of the survey respondents and the presence of infrastructure indicated in the RFI responses. The output of this exercise was a more complete indication of broadband availability in the region.

Our findings from this analysis are outlined in the table below. While data from the FCC indicates just 3.3% of premises in the county are unserved by service of over 25/3Mbps, a review of this data by overlaying survey data and provider street-level data indicates that *at least* 12.8% of premises in the county are actually unserved - a total of 5,323 premises. Our estimates of unserved households by town are as follows:

Unserved Premises by Town, Carroll County, NH

Town	Population	Premises	% Unserved Premises	# Unserved Premises
Albany	741	592	25.9%	153
Bartlett	2,794	4,225	0.1%	6
Brookfield	718	351	36.2%	127
Chatham	343	278	90.3%	251
Conway	10,102	7,161	0.7%	49
Eaton	399	315	38.4%	121
Effingham	1,528	1,023	14.8%	151
Freedom	1,568	1,675	1.6%	26
Hale's	119	101	0.0%	0
Hart's Location	41	55	81.8%	45
Jackson	804	1,051	1.2%	13
Madison	2,561	2,001	8.3%	167
Moultonborough	4,135	5,158	6.8%	349
Ossipee	4,462	3,247	19.8%	643
Sandwich	1,386	1,153	98.7%	1,138
Tamworth	2,913	2,093	26.0%	545
Tuftonboro	2,437	2,551	27.1%	692
Wakefield	5,175	3,990	1.2%	48
Wolfeboro	6,684	4,644	17.2%	798
TOTAL	**48,910**	**41,664**	**12.8%**	**5,323**

Source: RISI, FCC Form 477, ACS

Please see Appendix A: Survey and RFI results, for more detail on the data collected.

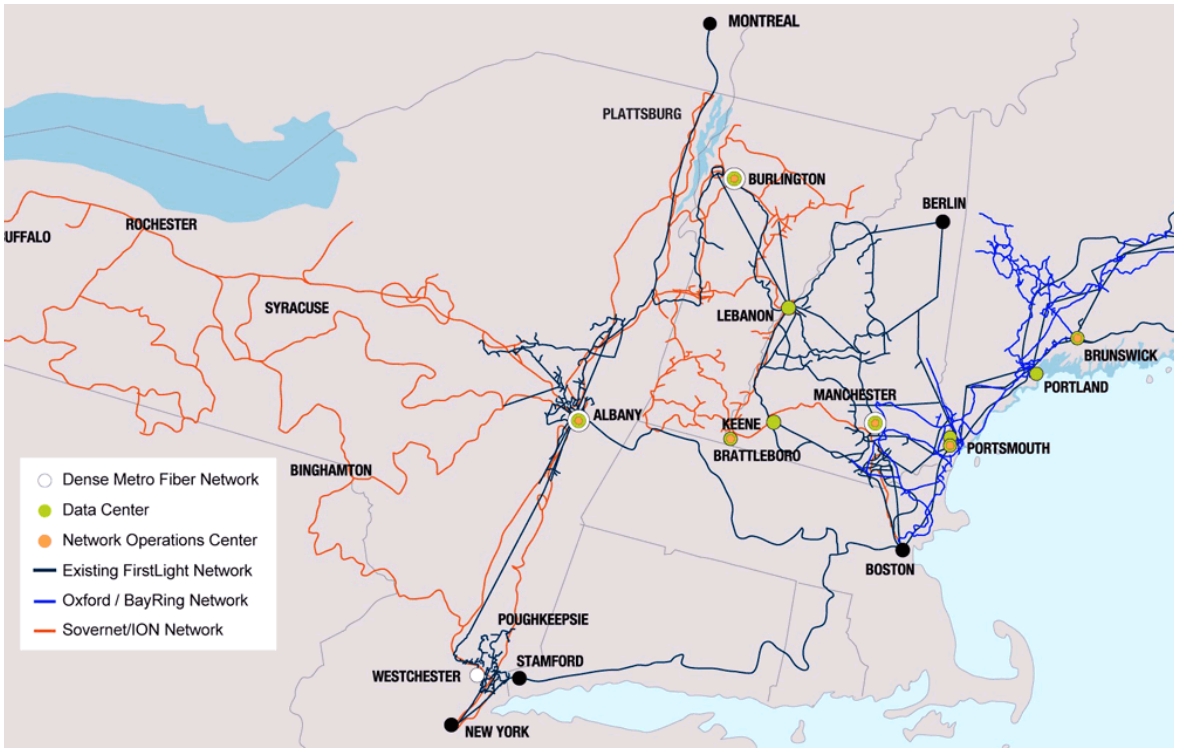
Technical Feasibility

In sum, Carroll County does not pose any specific technical threats that would hinder a multi-town FTTP system. The existing infrastructure in the region will not present any barriers to creating a viable and detailed engineering plan for the region at a later stage in the process.

Backhaul Availability

Backhaul is needed to support networks created and expanded throughout the county. Backhaul is the fiber infrastructure needed to carry information between a regional network's router location to the "carrier hotel" where it connects to the greater global Internet network.

Several providers have backhaul in Carroll County, such as FirstLight Fiber, Consolidated Communications, and Lumen (Level 3). For example, the following is a high level map of FirstLight's backhaul. (Backhaul providers typically do not provide detailed maps of their infrastructure without the signing of an NDA.)



As part of the detailed design and implementation process, the CD will have to secure quotes from backhaul providers and obtain information about ideal backhaul access points. Suffice it

to say, however, that in general the CD has options for procuring backhaul from providers with networks that terminate in colocation centers within New England, New York, and Montreal, offering geographic route diversity. As a result, the technical viability of a new fiber network in the region is not a concern.

Additional existing fiber assets

Middle Mile Resources

In December 2013 a major middle-mile project was completed across all 10 counties in New Hampshire funded by the Broadband Technology Opportunities Program (BTOP) and managed by the National Telecommunications Information Administration (NTIA). 865 miles of Fiber Optic Network, owned and managed by New Hampshire Optical Systems was created, opening up the potential to connect to un- and underserved areas.[3] This network is now owned by FirstLight.

New Hampshire Electric Cooperative (NHEC) & Other Electric Utilities

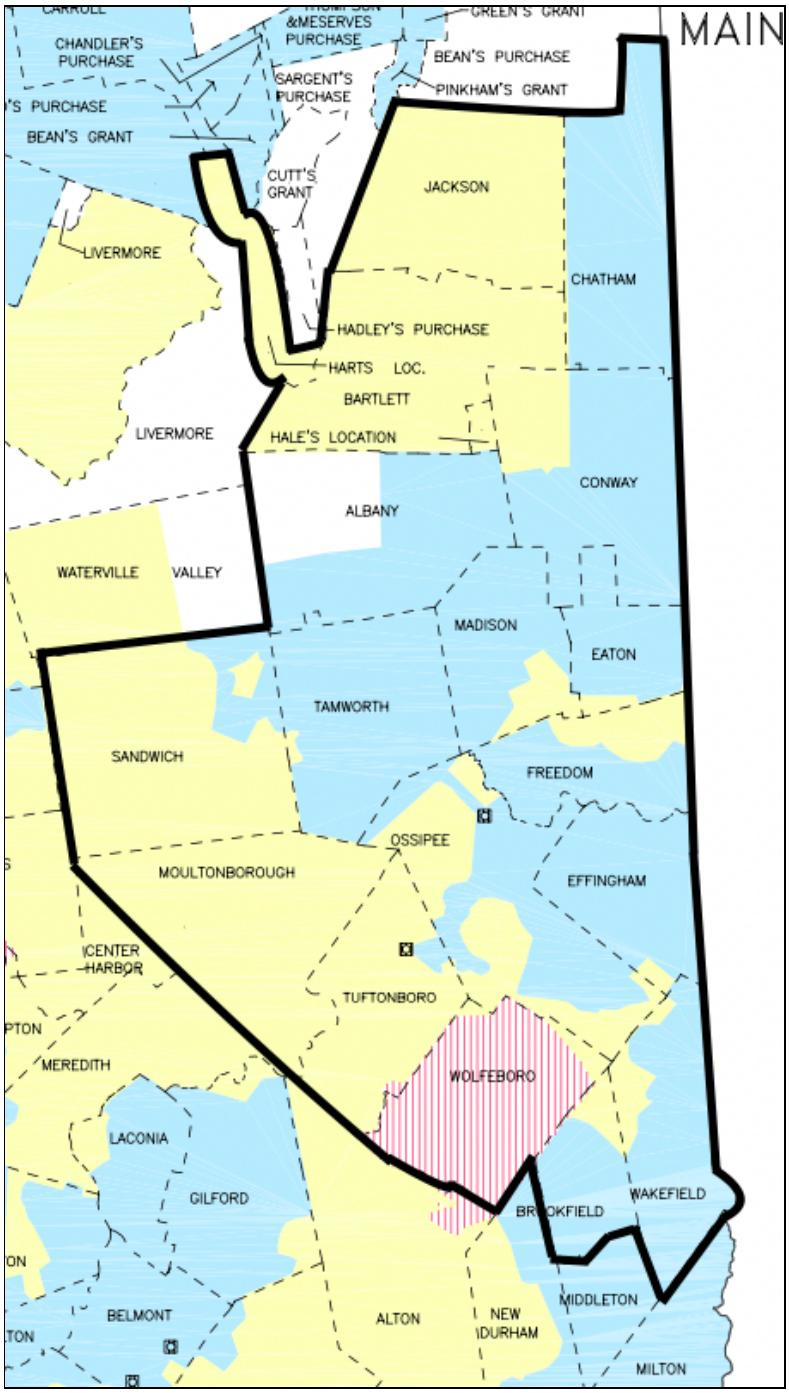
The three electrical service providers in Carroll County are Eversource, New Hampshire Electric Cooperative (NHEC), and Wolfeboro Electrical Department (a municipal division). While Eversource, as of this writing, is not intending on expanding to broadband service in its territory, NHEC *is* working toward a goal of providing broadband service to its territory. NHEC, under the subsidiary NH Broadband, is currently working to get broadband service to Carroll County residents in Sandwich and connect customers by early 2022.[4] As such, they are also a potential partner for serving the rest of the CD, and we recommend engaging in discussions with them to assess the likelihood of partnership in the remaining Carroll County towns. Lastly, the Town of Wolfeboro has recently expanded broadband access to some of its residents via CARES Act funding with service provided by Atlantic Broadband.[5]

The following map outlines who across the county is serviced by what utility.

[3] Network New Hampshire Now Connect Newsletter, http://unh.edu/networknhnow/CONNECT_Final.pdf
[4] NH Broadband Sandwich – Acworth Expansion July 2021 Frequently Asked Questions, https://www.nhec.com/wp-content/uploads/2021/07/Sandwich-Acworth-FAQs-7-22.pdf
[5] In Progress: CARES Act Broadband Expansion in Wolfeboro, November 5, 2020 https://www.wolfeboronh.us/home/news/progress-cares-act-broadband-expansion-wolfeboro

Electric Utility Map, Carroll County

(Blue = Eversource; yellow = NHEC; red striped = Wolfeboro Municipal Electric)



Source: State of New Hampshire Public Utilities Commission

Utility Poles

Our study is focused on the deployment of Fiber-to-the-Premise (FTTP) and not wireless solutions or other mechanisms for providing broadband; therefore, the only important vertical infrastructure are utility poles. The deployment will be 90% or greater aerial deployment on poles versus buried underground.

Eversource New Hampshire owns or maintains poles in about three-quarters of the state, about 450,000 poles.[6] Their territory in Carroll County extends to Chatham and Tamworth; the majority of Albany, Conway, Madison, Eaton, and Freedom; about half of Ossipee; and the majority of Wakefield and Brookfield.[7] The New Hampshire Electric Cooperative (NHEC) maintains or owns poles in its service territory, which in Carroll County constitute all towns except Albany and parts of Brookfield and Wakefield.[8] However, it is important to note that even in the footprints of those two utility entities, there are additional poles with shared ownership between the electric utility and Consolidated Communications, Inc. (CCI), and there are some poles owned exclusively by CCI. The exact poles that will be used for deployment will be based on the partner selected and pole data collection work done in the field.

The average cost to make space on the pole for a new fiber attachment in a New Hampshire rural area where there are few attachments on the pole is between $100 and $200 per pole, or on average $5,000 per mile (assuming roughly 30 poles per mile). Extremely old poles, typically under 30 feet, and poles that have two or more attachees in the communications space will more often need to be fully replaced to be used for fiber attachment, increasing the cost of deployment.

Underground Construction

A small percentage of utility infrastructure in each town will likely be underground, typically in a Town right-of-way (ROW). Underground construction is several times more costly than aerial construction and can be very difficult in New Hampshire's rocky terrain. Without a detailed design, it is impossible to predict exactly what percentage of the network construction is underground, but it averages between 5 and 10% of total mileage and has not significantly impacted build costs in New Hampshire. Documenting the ROW process by applicable Town will be useful when ready to install underground utilities.

Network Design

An optical fiber Gigabit Passive Optical Network (GPON) with distributed splitting in the field is recommended. GPON networks have become the standard for municipal broadband and for

[6] "There are 500,000 utility poles in New Hampshire, yet we hardly notice them" Brooks, David. 12/24/2016 https://www.concordmonitor.com/electricity-utility-poles-4469151

[7] Eversource Territory Map, https://www.eversource.com/content/docs/default-source/nh---pdfs/service-territory-nh.pdf?sfvrsn=3730ea62_16

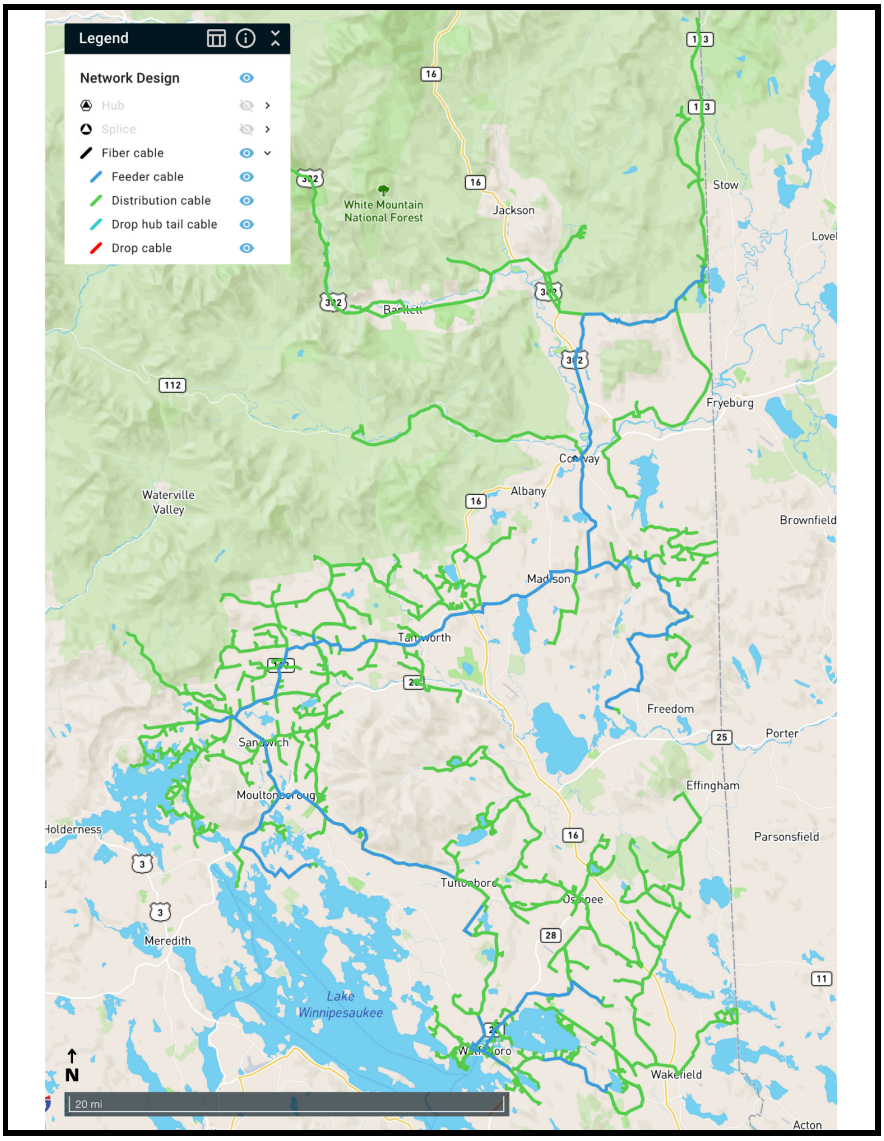
[8] NHEC Territory Map, https://www.nhec.com/your-coop/

Fiber-to-the-Premise projects in the US. The infrastructure is scalable and is limited only by the equipment on both ends of the fiber. The fiber network is future-proof; as increased bandwidth and capacity are necessary, the electronic equipment can be upgraded without needing to rebuild the base fiber architecture. The initial network will consist of a hub location in each town connected to each other with 10 Gb fiber transport, eventually creating interconnecting, redundant rings. The initial design will include two central hub locations that will also house the routing equipment to access the Internet. These two locations will provide redundancy, in the case of a failure, for each other. Home equipment (e.g, Internet routers) will also be gigabit compatible.[9]

High Level Route Map

The following is a route map designed using fiber planning software to be the most efficient way to serve all of the unserved areas in the Carroll County Communications District.

[9] An alternative fiber network option is an Active Ethernet Optical Network (AON). This network would dedicate a strand of fiber from the hub location to each premise. This type of network is not recommended because more fiber would need to be deployed throughout the network, increasing construction and operation costs for very little additional customer benefit.



It should be noted that even though this route is designed to reach unserved areas, substantial construction will need to happen through already served areas to reach those areas. Building through these areas will not only bring competition to those cabled areas, but will give the CD valuable data about customer demand for service in those areas. That data should then inform the CD's decisions in later years about where to build and how aggressively to build in areas with existing service.

The following table summarizes the route miles and passings by town, in the build sequence used in the feasibility study. Note, the build sequence here may not be the ultimate build sequence used: it is sufficient for planning purposes. The ultimate build sequence should be determined in the business plan with input from the high level engineering.

Town	Cabled Passings	Uncabled Passings	Cabled Miles to buildd	Uncabled Miles to build
Sandwich	31	1,178	1	111
Wolfeboro	3,427	879	49	25
Ossipee	752	647	24	39
Tamworth	562	556	14	47
Moultonbor	1,773	340	27	23
Chatham	27	256	1	25
Brookfield	136	162	8	14
Eaton	179	125	13	19
Hart's Loca	11	73	2	9
Conway	4,668	59	42	3
Albany	144	51	10	3
Wakefield	518	46	9	2
Effingham	118	28	5	4
Freedom	415	23	6	4
Madison	540	23	15	5
Jackson	8	18	-	1
Tuftonboro	351	15	19	2
Bartlett	2,803	4	23	-
Hale's	-	-	-	-
Total:	16,463	4,483	268	336

Lastly, it is strongly recommended that the CD design their network with the assumption that they will build entire towns eventually. The incremental cost of including enough fiber capacity to serve a full town is negligible compared to the cost of adding more fiber capacity layer.

Financial Feasibility Inputs and Assumptions

The preliminary financial feasibility analysis for universal coverage of Carroll County has been developed with a range of inputs informed by historical data from regional comparable projects and deployments, GIS work, standard industry assumptions, and assumptions that reflect the project team's current understanding of changing market conditions. It is important to note the purpose of this work is to produce a high-level determination of the project's feasibility. The following outline our assumptions:

Revenue

The financial model depends on several assumptions to determine revenue: 1) served and unserved premises, 2) penetration rates for served and unserved areas, and 3) Average Revenue Per User (ARPU).

Served and Unserved Premises | Data inputs were derived via RFI responses from cable providers when provided. Where not available, they were derived via FCC data calibrated by local survey results about served premises, a manual review of census polygons designated as served by the FCC, and a final adjustment of served/unserved road miles to ensure that densities were within a typical industry range (e.g., it is unlikely that the unserved areas of a town would have a density of 30 premises/mile).

Penetration Rates |The project team has elected to use historical data from East Central Vermont Telecommunications District's (ECFiber's) network to calculate penetration rates (also called take-rates) by year in our model. We have adjusted the penetration rates to reflect increased subscriptions due to COVID-19. COVID-19 has created a significant increase in subscriptions and service tier upgrades. Penetration rate assumptions are as follows:

Take Rate Assumptions

	Penetration by Year	
Year	**Cabled**	**Uncabled**
1	11%	22%
2	19%	38%
3	25%	50%
4	30%	60%

Source: RISI, ValleyNet

After year 4, the models project that customers increase at 1% each year.

For instances where the route passes through areas determined to have cable already, penetration rates are half of what they would be in an unserved/uncabled area. A premise was considered served by cable If GIS work determined that a premise was within 400 feet of cable infrastructure.

Average Revenue Per User (ARPU) | Feasibility modeling considers the average revenue for a network based on service tiers and service prices. The assumptions used in the model are as follows:

Average Revenue Per User (ARPU)	cost per mo	subscription mix	blended ARPU

base offering	$65.00	50%	$32.50
tier 1	$95.00	35%	$33.25
tier 2	$125.00	15%	$18.75
phone service	$25.00	50%	$12.50
		ARPU	**$97.00**

As indicated in the chart, the ARPU also includes the assumption that the CD will offer Voice Over IP phone service as part of their package at $25/mo. This is important to offer because it increases the ARPU overall, and can increase penetration rates from people who want to leave their DSL but wish to keep their phone service.

The modeling also assumes an installation fee of $100.

In general ARPU can be adjusted if the feasibility outlook changes. The prices assumed here are reasonable and generally in the middle of what other entities charge. Increasing the costs to the end customer is possible if need be; for example, ECFiber in Vermont did not have access to grants in their startup years; as such, their prices are higher to reflect their need to pay debt service. A network in Carroll County could likely sustain an ARPU of $105/month if need be.

Capital Expenditures

These assumptions are based on data from the recent build of LymeFiber in Lyme, NH. Due to high demand, long wait times, and tariffs on foreign goods, materials costs have recently increased. Construction labor prices have also gone up, due to increased demand for skilled labor. The feasibility study incorporates some increased costs, however, the CD will need to continually update construction costs once they select a partner and partnership model, especially considering more resources will be put towards broadband expansion across the country in the coming year.

The following table outlines the cost assumptions for capital expenditures.

Expense	Cost
Pole Data Collection/FTTH Design & Engineering	$2,500 per mile

Make-Ready, unserved/uncabled areas	$5,000 per mile
Make-Ready, served/cabled areas	$15,000 per mile
Distribution Hubs	$40,000 each
Central Hubs	$150,000 each
Aerial Construction Materials + Labor	$27,300/mile
Underground Construction (Materials + Labor)	$70,000/mile
Drop & Installation	$1,400/customer
Capex Contingency	10%

Source: RISI, ValleyNet

Operating Expenses

The CD does not yet know who their likeliest operating partner is, and/or how that arrangement will be set up. The model assumes a common arrangement as a placeholder; that the operator is charged on a per-customer basis, as in, the CD pays their operator a per-customer, per month fee to be the internet service provider, operate, and maintain the network.

Expense	Amount
Per Customer Operations Fee for Operations + Maintenance	$40.35/customer/mo
Communications District overhead (admin/audit/legal/other)	$150,000/year
Network insurance	$30/mi
Pole rental	$10/pole/year
Average poles per mile	30
Bad debt/ACH/credit card fees	3%
Hub electricity/rental/upgrades	$2,500/year/hub
Marketing	$100/new customer
Revenue reserve fund (for unexpected costs)	2.00% of revenues

Financing

For the purpose of this feasibility study, several sources of financing were considered:

NH Matching Broadband Grant | While the details of the program have yet to be released, the general program will be a 1:1 matching grant with $50M in grants available. Given Carroll County's disproportionate need compared to southern regions of the state, and their relative head start in planning compared to other North Country counties where there is also significant need, it is possible that they could receive a disproportionate amount of funding from the first year of this program.[10]

General Obligation Bonds | In 2018 New Hampshire Towns gained the right to use general obligation bonds for broadband projects and since then, 18 towns have done so.[11] In our financial model we assume these bonds can be accessed at a 3% interest rate. Interest rates now are slightly lower, but may rise in the coming years.

Unsecured or Subordinated Debt | This debt raised from private investors has a high interest rate — accrued, not cash pay (8% assumed) -- due to the likelihood the debt would need to be unsecured and/or subordinated to other funding. This is a conservative estimate for private capital given that there may be more favorable sources available to the CD once they go to raise money, from sources like Community Foundations, impact investors, CDFIs, or other entities.

Revenue Bonds | Revenue bonds will be available to the CD once the network reaches a maturity so that the revenue is predictable and the EBITDA (Earnings before interest, taxes, depreciation, and amortization) stays above a 1.25 ratio to the debt service. These bonds typically carry an interest rate of 5-6%.

Additional Funding Sources | The following sources are potentially viable for the CD, but were not modeled directly. The most viable pathways were modeled based on the funding sources most available to the CD, however, depending on the timing of grant cycles and/or new programs, the following funding sources should be monitored as the CD matures.

1) **USDA Reconnect program -** The current Reconnect program closes in February 2022; it will likely open up again in fall 2022.
2) **US Infrastructure Investment and Jobs Act** - At the time of writing, the federal infrastructure bill had not passed, but does have significant funding for broadband. Even if it passes, the timing and parameters around that funding won't be known for some time.

[10] New Hampshire Creates New Broadband Matching Grants, July 15, 2021
Kevin Landrigan, https://www.govtech.com/network/new-hampshire-creates-new-broadband-matching-grants

[11] New Hampshire prepares for federal funding to boost broadband access, April 29, 2021, Amanda Gokee
https://www.nhbr.com/nh-prepares-for-federal-funding-to-boost-broadband-access/

Financial Feasibility Findings

The following is a summary of two viable paths the CD could take. These paths illustrate two ends of the funding spectrum - one in which the funding is assumed to be highly favorable to the CUD in terms of cost and ease, and another in which the funding is assumed to be much costlier. In all likelihood, the path for the CD may lie between these two extremes.

Model 1: Significant grant funding and low-cost bonds.

The assumptions in this model is that the CD or municipal entity is able to access a disproportionate amount of grant funding from the NH grant program, and match that against low-interest General Obligation bonds.

Key summary indicators from this scenario are as follows:

- Grant = $18.5M
- General Obligation bond = $18.5M
- Time to build to all unserved premises: 3 years
- 25 year IRR = 7.52%
- Cash-flow positive by year 4
- Strong ability to begin overbuilding cabled areas starting in year 3 or 4 using revenue bonds

Please see Appendix B for 10 year summary financial projections.

Model 2: Some grant funding and higher cost unsecured debt.

The assumptions in this model are that the CD can access some grant funding, but needs to match that against high-cost unsecured debt. The CD then replaces the high cost debt with revenue bonds (not backed by taxpayers but by future revenues of the network) as soon as the network is mature enough to access revenue bonds. The threshold for accessing revenue bonds is that the EBITDA (Earnings before Interest, Taxes, Depreciation, and Amortization) needs to be at least 1.25% of the debt service of the bonds.

Key takeaways from this scenario are:

- Grant = $7.5M
- Unsecured debt = $9.5M at 8%
- Revenue bonds = $39M total over years 3, 4, 5 and 6
- Time to build to all unserved premises = 5 years
- 25 year IRR = 6.43%
- Lowest EBITDA ratios = 1.35 in year 4 and 1.37 in years 4 and 5 respectively

- Potential ability to begin overbuilding cable in year 6

Please see Appendix C for 10 year summary financial projections for this scenario.

Recommendations & Next Steps

Carroll County Broadband should be encouraged by the results of this feasibility study, which indicates multiple paths to constructing a network. In addition, the projections indicate the Committee has multiple avenues of recourse if construction costs continue to rise, finding an operator costs more money than anticipated, or financing sources do not come with as favorable rates as anticipated. The two biggest levers the Committee can pull in these situations are to slow down the build time frame, or to raise customer rates. The models indicate that both of these interventions are available to the Committee if needed.

Creation of a Business Plan

Carroll County Broadband should move forward with the creation of a business plan. The business plan should clearly outlines the plan that the CD or municipal entity will take, and contain, at minimum, the following:

- Clear service area delineation
- Pro forma financial projections
- Summary of ISP/operator partner(s) and partnership model
- Roles and responsibilities of partners and entities involved
- Clearly defined of funding sources and funding stack objectives
- Plan for executing pre-construction and construction
- Marketing plan and marketing strategies
- Risks and risk mitigation strategies

In addition, it is common practice to request a high level design as part of the business planning phase. This can add an additional $50-70K on the cost, however, the high level design will provide another level of detail to the cost estimates to make the business plan and financial stack more fine tuned.

The business plan should allow the entity to raise the money they need to move into the pre-construction phase and then construction phase. (The pre-construction phase primarily entails finding a vendor to do pole-collection, create a detailed design, and then to ultimately request make-ready work from the utilities to prepare the poles for a new attachment. The construction phase can begin in select towns after the pre-construction phase is complete. ValleyNet and RISI are happy to provide Carroll County Broadband Committee leadership more details on the pre-construction and construction process.)

Given the aforementioned list, there are a number of questions the CD Planning Committee will need to resolve in the coming months to be able to procure a detailed business plan. These questions can be worked through with the help of a consultant. Questions include:

- Does the Communications District Model work for Carroll County? Is it possible to use the County itself as the public partner instead? Is Carroll County open to this possibility? Key considerations for this decision include:
    - Are there sources of funding that are available to one entity but not the other? Are those sources of funding essential?
    - What is the anticipated administrative burden and which entity would be best suited to handle the administrative work?
    - Could one entity move faster or more nimbly than the other?
    - Are there scenarios where the focus area expands to include towns outside the county, or some towns *within* the county do not want to participate, and does this impact the viability of using the county as the vehicle?
- Given the lack of RFI response from Spectrum for most jurisdictions, does the CD Planning Committee (and the towns in the District, if this is the route chosen) have an appetite for bonding to build infrastructure to the entirety of towns, to the extent allowed under NH law? If an existing carrier does not respond adequately to the RFI, those areas can be considered unserved, if not covered by a second provider, for the sake of Bonding). Bond funds can be used as match funds for the NH broadband Infrastructure grants.
- What - if any - amount of overbuilding will be allowed under the terms of the NH grant program? Will the terms be so strict that the region will need to find another source of financing to build the infrastructure needed to *reach* the unserved areas?
- Do individual towns have ARPA funding they want to contribute to the project?
- What are NHEC's plans and how should the region coordinate with NHEC so as to prevent significant overbuilding?
- What types of match funding will be required against the state grant program? It is not yet known if in a Public/Private partnership, the Private funding can count to the 50% match.

Finding an operator

In addition, the CD or municipal entity will need to find an entity to operate and maintain the network. It is recommended that the CD or municipal entity has informal conversations with the likely operators before issuing a formal RFP. Potential operators and partners include but are not limited to:

- **The NH Electric Coop -** NHEC is currently deciding whether or not they will operate a network in their electric footprint, or perhaps partner with someone to do so. Given the amount of overlap between Carroll County and NHEC's region, it could be a very efficient partnership to partner with the same entity as NHEC to serve the entire network.

- **Great Works Internet (GWI) -** Based in Maine, GWI is a B corporation that has been forming partnerships in the New England area to operate and maintain publicly owned broadband networks. GWI brings extensive experience to construction management, network operations and internet service provider operations. They also have relationships with equity investors, loan investors and subordinated debt which could act as match funds to the State grant. These funds would not be restricted to the unserved areas.
- **Google Fiber** - Google Fiber has expressed an interest in partnering in smaller New England jurisdictions, including Communications Union Districts in Vermont. Although their terms for the partnership vary, they have offered to build the entire footprint, overbuilding cable with their own funds.
- **Consolidated Communications**, **Inc (CCI)** - CCI has formed many successful partnerships with individual NH towns, and with new leadership in their fiber services division, has expressed interest in partnerships with multi-town districts. Generally speaking, Consolidated has requested the municipality bond or draw down State infrastructure funds to fund the unserved areas. Where CCI has a Rural Development Opportunity Fund obligations in unserved areas, they would also fund those areas. (Note: CCI is currently re-branding their fiber product under the name Fidium Fiber.)
- **National Rural Telecommunication Cooperative** (NRTC)- NRTC has recently been chosen to partner with two Communication Union Districts in VT. They will do the construction design and management and work with a small telecommunication company in VT to do network management and be the internet service provider. Such an arrangement in NH would also work for Districts or multiple town municipalities, like the County.

Thank you

Lastly, ValleyNet and RISI would like to thank the Carroll County broadband committee and North Country Council for their work and collaboration until this point. Though the performance period for the USDA RCDI grant that funded this feasibility work will end mid-year next year, we are happy to continue to provide assistance and consultation as the CD navigates the decisions it has to make.

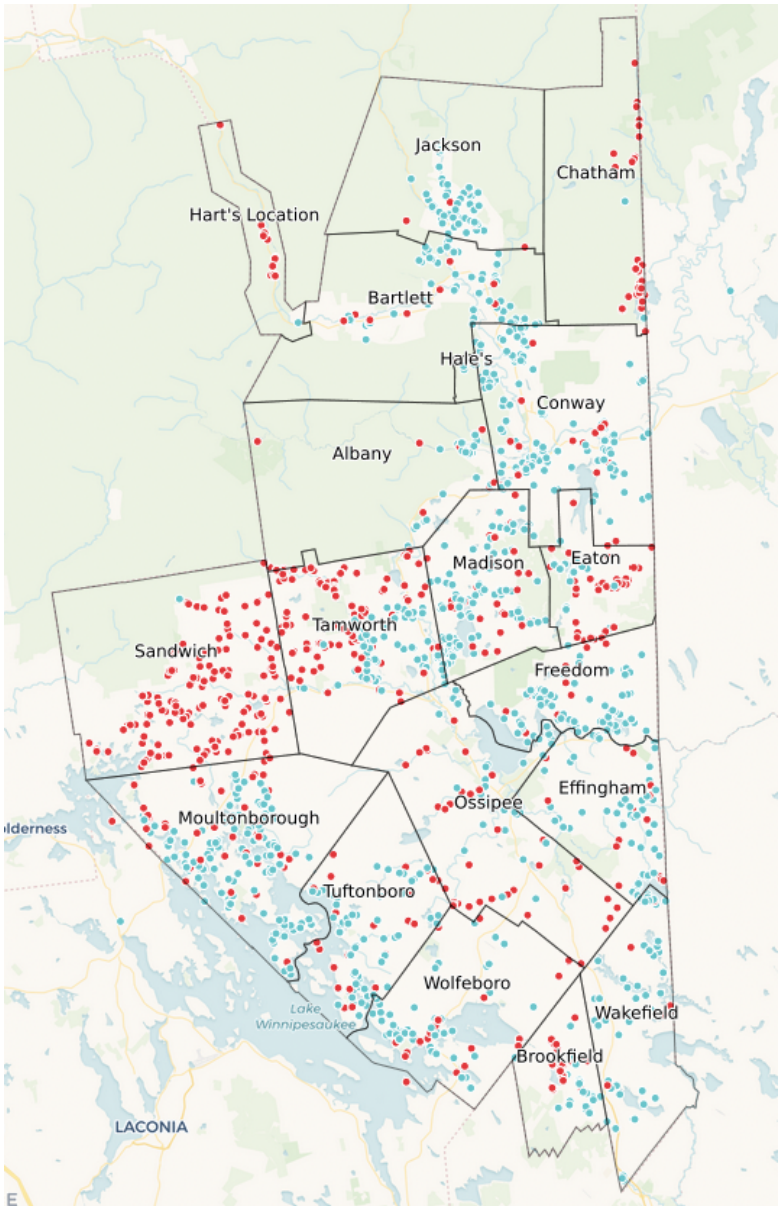
Appendix A: Survey Results and RFI Results

Survey Results

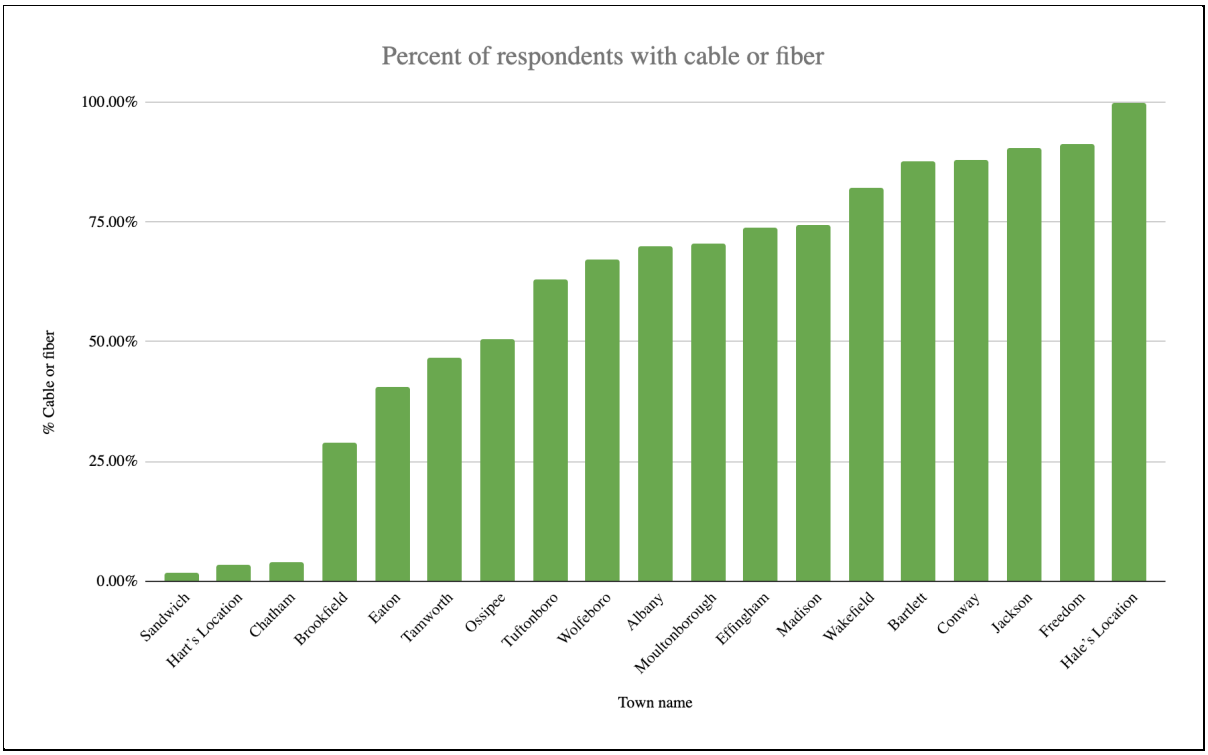
In June 2020 a resident survey was distributed to Carroll County residents via a variety of online and physical announcements directed by representatives from across the county. 1,961 responses were received; 5.8% of the population. The map below illustrates responses by type of internet available.

Survey Responses

(Blue = served by fiber or cable; red indicates un- or underserved.)


Jackson
Chatham
Hart's Location
Bartlett
Hale's
Conway
Albany
Madison
Eaton
Tamworth
Sandwich
Freedom
Effingham
Ossipee
Moultonborough
Tuftonboro
Wolfeboro
Wakefield
Brookfield
Lake Winnipesaukee
LACONIA

The survey found that the percentage of respondents with cable or fiber varied considerably across the county with a low of 1.8% in the Town of Sandwich and a high of 100% in Hale's Location.



Source: RISI

To understand the potential demand for fiber in the county, we asked the question, *"If fiber internet that was competitively priced to your current service came to our community, how likely would you be to subscribe?"* The following outlines the answers for both those with cable internet and those with another or no service:

If fiber internet that was competitively priced to your current service came to our community, how likely would you be to subscribe?

	With Cable Service	With Another or No Service
Definitely Would	45.9%	56.1%
Probably Would	39.4%	32.7%
Unsure	13.3%	9.8%
Probably Would Not	1.2%	1.1%
Definitely Would Not	0.2%	0.3%
TOTAL	**100.0%**	**100.0%**

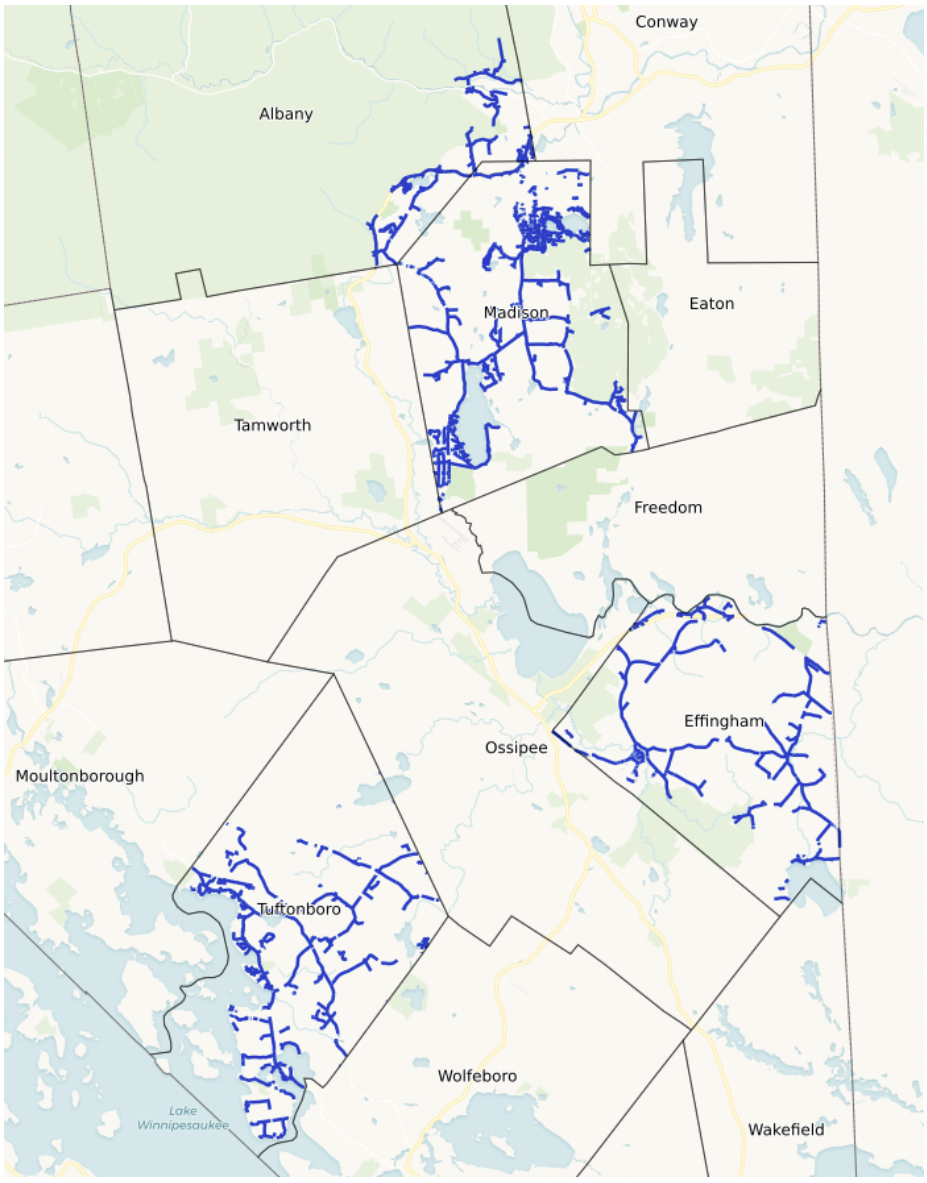
Source: RISI

RFI Response Data

The CD acquired four PDF maps showing the availability of cable infrastructure: Albany, Madison, Effingham, and Tuftonboro. RISI took these PDFs and transformed the data into a geospatial format. This data is displayed on the map below:

Served Roads in Albany, Madison, Effingham, and Tuftonboro

(Blue indicates a served road.)



Source: RISI

Appendix B: Significant grant funding and low-cost GO bonds

FORECAST			1	2	3	4	5	6	7	8	9	10
			2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
METRIC												
Cumulative: All Miles			248	538	604	604	604	604	604	604	604	604
Cumulative: All Passings			6,914	17,184	20,946	20,946	20,946	20,946	20,946	20,946	20,946	20,946
Cumulative: All Customers			1,058	3,146	5,103	6,609	7,466	7,723	7,800	7,878	7,957	8,036
Avg: Customer throughout year (Yr_t - Yr_t-1)/2			264	2,102	4,125	5,856	7,038	7,595	7,761	7,839	7,917	7,996
Customers per mile			4.3	5.8	8.4	10.9	12.4	12.8	12.9	13.0	13.2	13.3
Penetration			15%	18%	24%	32%	36%	37%	37%	38%	38%	38%
ARPU ($97 per month to start)			$ 1.17	$ 1.16	$ 1.16	$ 1.15	$ 1.15	$ 1.14	$ 1.13	$ 1.13	$ 1.12	$ 1.12
Cumulative cost per customer			$ 13,775	$ 8,835	$ 6,430	$ 5,307	$ 4,879	$ 4,783	$ 4,769	$ 4,756	$ 4,742	$ 4,728
REVENUE												
Revenue - recurring	2024		77	2,447	4,776	6,746	8,065	8,658	8,801	8,842	8,883	8,924
Revenue - installation	$100		106	209	196	151	86	26	8	8	8	8
Total Revenue			**183**	**2,656**	**4,972**	**6,897**	**8,151**	**8,683**	**8,809**	**8,850**	**8,891**	**8,932**
EXPENSES												
Total Expenses (1000s)			**(482)**	**(1,706)**	**(2,815)**	**(3,708)**	**(4,282)**	**(4,522)**	**(4,595)**	**(4,638)**	**(4,682)**	**(4,727)**
admin/audit/legal/overhead/misc			*(150)*	*(153)*	*(156)*	*(159)*	*(162)*	*(166)*	*(169)*	*(172)*	*(176)*	*(179)*
network insurance			$ *(7)*	$ *(17)*	$ *(19)*	$ *(20)*	$ *(20)*	$ *(20)*	$ *(21)*	$ *(21)*	$ *(22)*	$ *(22)*
pole rental			$ *(74)*	$ *(162)*	$ *(181)*	$ *(181)*	$ *(181)*	$ *(181)*	$ *(181)*	$ *(181)*	$ *(181)*	$ *(181)*
bad debt/ACH/cc fees			$ *(5)*	$ *(80)*	$ *(149)*	$ *(207)*	$ *(245)*	$ *(261)*	$ *(264)*	$ *(266)*	$ *(267)*	$ *(268)*
hub electricity/rental			$ *(8)*	$ *(15)*	$ *(18)*	$ *(18)*	$ *(18)*	$ *(18)*	$ *(18)*	$ *(18)*	$ *(18)*	$ *(18)*
per customer operator Fee			$ *(128)*	$ *(1,018)*	$ *(1,997)*	$ *(2,835)*	$ *(3,408)*	$ *(3,677)*	$ *(3,758)*	$ *(3,796)*	$ *(3,834)*	$ *(3,872)*
marketing			$ *(106)*	$ *(209)*	$ *(196)*	$ *(151)*	$ *(86)*	$ *(26)*	$ *(8)*	$ *(8)*	$ *(8)*	$ *(8)*
revenue reserve fund			$ (4)	$ (53)	$ (99)	$ (138)	$ (163)	$ (174)	$ (176)	$ (177)	$ (178)	$ (179)
EBITDA			**(299)**	**950**	**2,156**	**3,188**	**3,869**	**4,161**	**4,214**	**4,212**	**4,209**	**4,205**
EBITDA COVERAGE RATIO (EBITDA/Debt Service)			*N/A*	*1.76*	*3.99*	*5.89*	*7.28*	*8.25*	*8.99*	*9.71*	*10.63*	*11.74*
CAPEX - TOTAL (not cumulative)			**(16,024)**	**(14,532)**	**(5,498)**	**(2,473)**	**(1,475)**	**(549)**	**(273)**	**(274)**	**(275)**	**(277)**
CAPEX - Construction + capex reserve			*(15,961)*	*(14,395)*	*(5,344)*	*(2,319)*	*(1,321)*	*(395)*	*(119)*	*(120)*	*(121)*	*(123)*
CAPEX - Maintenance			*(64)*	*(137)*	*(154)*	*(154)*	*(154)*	*(154)*	*(154)*	*(154)*	*(154)*	*(154)*
Free Cash Flow	**25 YEAR IRR**	**7.52%**	**(16,323)**	**(13,582)**	**(3,342)**	**715**	**2,394**	**3,613**	**3,941**	**3,938**	**3,933**	**3,929**
GRANTS	assumes grant = half of the build capex (capex for 3 years), matched 1:1 against		$ 18,027									
SUBORDINATED DEBT principal			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Sub Debt Repayment			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Interest			$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
GENERAL OBLIGATION BOND ISSUANCE	(less 4% issuance fee and 3% debt		$ -	$ 16,765	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Bond repayment			$ -	$ -	$ -	$ -	$ (321)	$ (901)	$ (1,172)	$ (1,172)	$ (1,262)	$ (1,262)
Interest			$ -	$ (541)	$ (541)	$ (541)	$ (531)	$ (504)	$ (469)	$ (434)	$ (396)	$ (358)
Cash Flow			**1,704**	**2,643**	**(3,883)**	**174**	**1,541**	**2,207**	**2,301**	**2,332**	**2,276**	**2,309**
Cash Balance			*1,704*	*4,346*	*464*	*637*	*2,179*	*4,386*	*6,687*	*9,019*	*11,294*	*13,603*

Appendix C: Some grant funding and higher cost unsecured debt

FORECAST			1	2	3	4	5	6	7	8	9	10
			2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
METRIC												
Cumulative: All Miles			111	248	385	529	604	604	604	604	604	604
Cumulative: All Passings			1,209	6,914	10,428	16,746	20,946	20,946	20,946	20,946	20,946	20,946
Cumulative: All Customers			263	1,249	2,484	4,165	5,834	6,851	7,494	7,772	7,850	7,928
Avg: Customer throughout year (Yr_t - Yr_t-1)/2			66	756	1,866	3,325	5,000	6,342	7,172	7,633	7,811	7,889
Customers per mile			2.4	5.0	6.5	7.9	9.7	11.3	12.4	12.9	13.0	13.1
Penetration			22%	18%	24%	25%	28%	33%	36%	37%	37%	38%
ARPU ($97 per month to start)			$ 1.17	$ 1.16	$ 1.16	$ 1.15	$ 1.15	$ 1.14	$ 1.13	$ 1.13	$ 1.12	$ 1.12
Cumulative cost per customer			$ 26,040	$ 11,300	$ 8,979	$ 7,334	$ 6,080	$ 5,408	$ 5,084	$ 4,972	$ 4,956	$ 4,941
REVENUE												
Revenue - recurring	2024		19	880	2,161	3,830	5,730	7,230	8,133	8,610	8,764	8,804
Revenue - installation	$100		26	99	123	168	167	102	64	28	8	8
Total Revenue			**45**	**978**	**2,285**	**3,998**	**5,896**	**7,332**	**8,198**	**8,638**	**8,772**	**8,812**
EXPENSES												
Total Expenses (1000s)			**(250)**	**(756)**	**(1,438)**	**(2,328)**	**(3,264)**	**(3,924)**	**(4,336)**	**(4,548)**	**(4,625)**	**(4,669)**
admin/audit/legal/overhead/misc			*(150)*	*(153)*	*(156)*	*(159)*	*(162)*	*(166)*	*(169)*	*(172)*	*(176)*	*(179)*
network insurance			*(3)*	*(8)*	*(12)*	*(17)*	*(20)*	*(20)*	*(21)*	*(21)*	*(22)*	*(22)*
pole rental			*(33.43)*	*(74)*	*(115)*	*(159)*	*(181)*	*(181)*	*(181)*	*(181)*	*(181)*	*(181)*
bad debt/ACH/cc fees			*(1.36)*	*(29)*	*(69)*	*(120)*	*(177)*	*(220)*	*(246)*	*(259)*	*(263)*	*(264)*
hub electricity/rental			*(2.50)*	*(8)*	*(13)*	*(15)*	*(18)*	*(18)*	*(18)*	*(18)*	*(18)*	*(18)*
per customer operator Fee			*(31.78)*	*(366)*	*(904)*	*(1,610)*	*(2,421)*	*(3,071)*	*(3,473)*	*(3,696)*	*(3,782)*	*(3,820)*
marketing			*(26)*	*(99)*	*(123)*	*(168)*	*(167)*	*(102)*	*(64)*	*(28)*	*(8)*	*(8)*
revenue reserve fund			(1)	(20)	(46)	(80)	(118)	(147)	(164)	(173)	(175)	(176)
EBITDA			**(204)**	**222**	**847**	**1,670**	**2,633**	**3,408**	**3,862**	**4,090**	**4,147**	**4,144**
EBITDA COVERAGE RATIO (EBITDA/Debt Service)			*N/A*	*N/A*	*1.54*	*1.35*	*1.37*	*1.60*	*1.84*	*2.03*	*2.19*	*2.36*
CAPEX - TOTAL (not cumulative)			**(7,518)**	**(7,996)**	**(8,998)**	**(9,058)**	**(5,397)**	**(1,720)**	**(1,145)**	**(583)**	**(274)**	**(275)**
CAPEX - Construction + capex reserve			*(7,491)*	*(7,933)*	*(8,899)*	*(8,923)*	*(5,243)*	*(1,566)*	*(991)*	*(429)*	*(120)*	*(121)*
CAPEX - Maintenance			*(28)*	*(64)*	*(99)*	*(134)*	*(154)*	*(154)*	*(154)*	*(154)*	*(154)*	*(154)*
Free Cash Flow	**25 YEAR IRR**	**6.43%**	**(7,722)**	**(7,774)**	**(8,151)**	**(7,387)**	**(2,764)**	**1,688**	**2,717**	**3,507**	**3,873**	**3,869**
GRANTS	Source: NH Grant program. Assumes it is matched against unsecured/subordinated debt		$ 7,500									
SUBORDINATED DEBT principal			$ 970	$ 8,245	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Sub Debt Repayment			$ -	$ -	$ -	$ (2,000)	$ (6,500)	$ (3,681)	$ -	$ -	$ -	$ -
Interest			$ (80)	$ (766)	$ (828)	$ (734)	$ (273)	$ 0	$ 0	$ 0	$ 0	$ 0
GENERAL OBLIGATION BOND ISSUANCE	(less 4% issuance fee and 3% debt		$ -	$ -	$ 9,300	$ 11,625	$ 11,625	$ 3,720	$ -	$ -	$ -	$ -
Bond repayment			$ -	$ -	$ -	$ -	$ -	$ 178	$ 723	$ 1,498	$ 2,159	$ 2,525
Interest			$ -	$ -	$ (550)	$ (1,238)	$ (1,925)	$ (2,135)	$ (2,095)	$ (2,013)	$ (1,894)	$ (1,755)
Cash Flow			**668**	**(296)**	**(229)**	**266**	**163**	**(230)**	**1,345**	**2,992**	**4,138**	**4,638**
Cash Balance			*668*	*372*	*143*	*409*	*573*	*343*	*1,688*	*4,680*	*8,818*	*13,456*