Broadband 101:
Improving Broadband infrastructure

Project Partners:
Addison County Regional Planning Commission
Rural Innovation Strategies, Inc

ValleyNet

October 6, 2020

Agenda

1. Project partners
2. Communication Union Districts
3. Introduction to broadband technologies
4. Fiber to the Premise (FTTP) networks
5. Project overview
6. From feasibility to construction: building a FTTP network
7. Next steps

Project Partners

About ValleyNet

- Non-profit dedicated to advocating for universal and effective Internet access, and providing services to facilitate Internet use

- Partnered with the East Central Vermont Telecommunications District to build and operate ECFiber

- Working with RISI to write feasibility studies and business plan for several Vermont CUDs

About RISI

- Working with ValleyNet on 5 broadband projects in New England, and more projects around the country

- Work on economic development with ~20 communities across the country, all of whom have already built out Fiber to the Home in different ways

- With ValleyNet, providing strategy, policy, and market analysis for fiber deployment feasibility and business plan

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ValleyNet

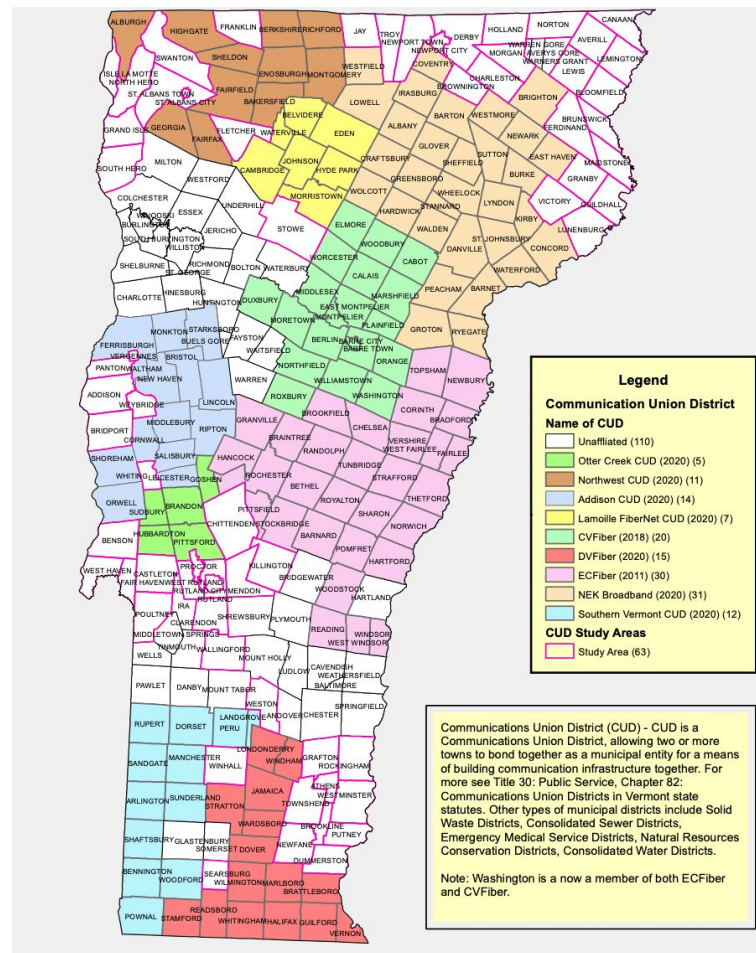**RISI** **Rural Innovation Strategies Inc.**

The Addison County Regional Planning Commission

- The ACRPC serves 21 towns and cities in Western Vermont
- Recipient of Vermont Broadband Innovation Grant
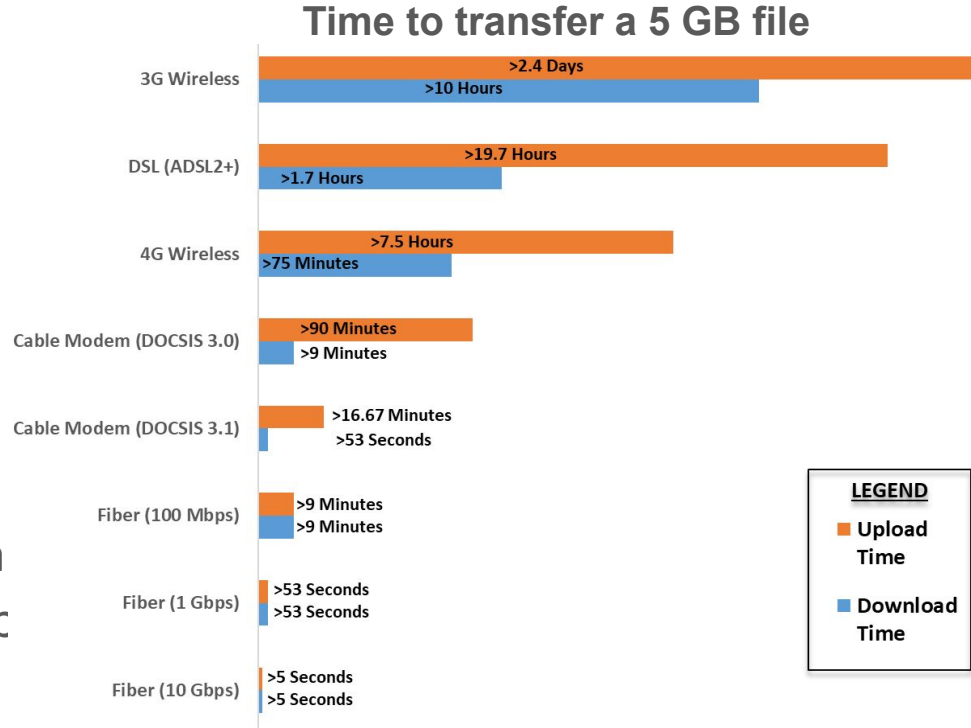- Region comprised of ~35,000 residents
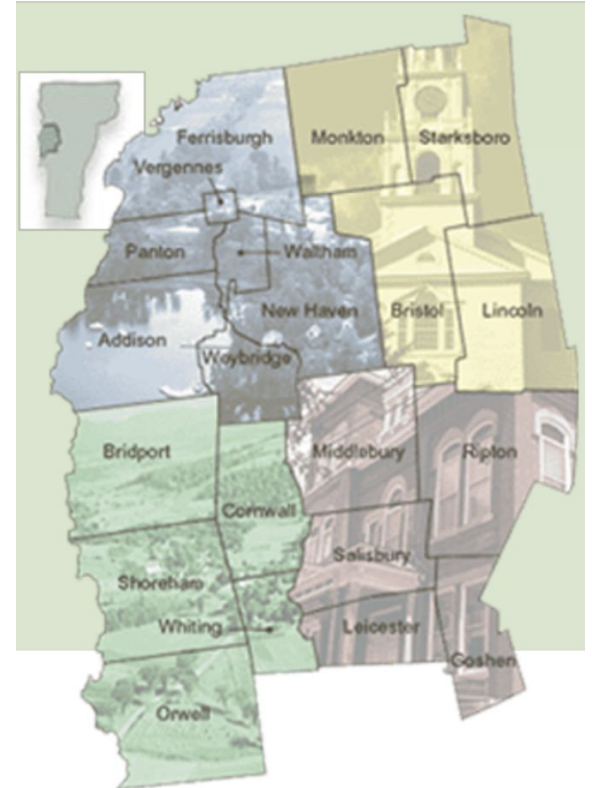
Communication Union Districts

- Vermont authorized formation of CUDs in 2015
- Similar to water and sewer or solid waste districts; allow towns to join together to aggregate demand
- CUDs cannot use taxpayer money from member towns
- Addison CUD includes 14 towns as of October 2

Legend

Communication Union District
Name of CUD
- Unaffiliated (110)
- Otter Creek CUD (2020) (5)
- Northwest CUD (2020) (11)
- Addison CUD (2020) (14)
- Lamoille FiberNet CUD (2020) (7)
- CVFiber (2018) (20)
- DVFiber (2020) (15)
- ECFiber (2011) (30)
- NEK Broadband (2020) (31)
- Southern Vermont CUD (2020) (12)

CUD Study Areas
- Study Area (63)

Communications Union District (CUD) - CUD is a Communications Union District, allowing two or more towns to bond together as a municipal entity for a means of building communication infrastructure together. For more see Title 30: Public Service, Chapter 82: Communications Union Districts in Vermont state statutes. Other types of municipal districts include Solid Waste Districts, Consolidated Sewer Districts, Emergency Medical Service Districts, Natural Resources Conservation Districts, Consolidated Water Districts.

Note: Washington is a now a member of both ECFiber and CVFiber.

What is Broadband?

- Internet speeds of 25 Mbps download/3 Mbps upload
- Transmission media
  - Coaxial cable
  - Optical fiber
  - Radio
  - Twisted pair
- Vermont Legislature stated goa[l] of universal 100/100 coverage b[y] 2024

Time to transfer a 5 GB file

	Upload Time	Download Time
3G Wireless	>2.4 Days	>10 Hours
DSL (ADSL2+)	>19.7 Hours	>1.7 Hours
4G Wireless	>7.5 Hours	>75 Minutes
Cable Modem (DOCSIS 3.0)	>90 Minutes	>9 Minutes
Cable Modem (DOCSIS 3.1)	>16.67 Minutes	>53 Seconds
Fiber (100 Mbps)	>9 Minutes	>9 Minutes
Fiber (1 Gbps)	>53 Seconds	>53 Seconds
Fiber (10 Gbps)	>5 Seconds	>5 Seconds

LEGEND
- Upload Time
- Download Time

Overview of broadband technologies

Fiber to the Premise (FTTP)

Nothing is faster than the speed of light

Only technology to provide upload and download speed symmetry

More up-front costs, but will remain relevant for decades

Additional capacity can be added through electronics upgrades; no redeployment needed

Cable

Cable does offer broadband (25/3) and higher, but not symmetrical speeds

Cable meets many consumer's internet needs today, but may not be able to keep up with future applications

Redeployment of cable often needed to add capacity

Fixed Wireless

Cheapest and fastest to install

Requires fiber backhaul (so fiber still needs to be built/designed)

Does not offer symmetrical speeds

Service and consistency affected by weather, distance, walls, leaves

Equipment needs to be replaced every few years; similar cost to fiber after 15+ years

DSL

Uses copper phone lines to transmit internet; faster than dial-up

Most households already have a phone line

DSL has slow upload speeds that are often inadequate for technologies like videoconferencing

Slower speeds when many users in a neighborhood use the internet at the same time

Overview of broadband technologies (continued)

Traditional Satellite

Satellites is sometimes the only option in remote areas

Satellite plans almost always have data caps

High latency (lag) because signal must travel from internet provider up to the satellite and then back down to the consumer

Satellite internet plans are often very expensive

LEO Satellite

Startups are developing low earth orbit "satellite constellations" to provide internet

Closer to earth than traditional satellites, but may still have high latency

Satellites decay in orbit and need to be replaced as often as every 5 years. If this model is not profitable, companies may stop replacing their satellites, letting the service shutter

TV White Space

Emerging technology that uses unlicensed TV spectrum to transmit wireless service

TV signals can travel farther than traditional WiFi

Speeds may be similar to 4G cellular internet

Connectivity may not be sufficient in the long term, especially for applications like telehealth

5G

5G is the next generation of cellular wireless internet

5G can be high-band, mid-band, or low-band

Mid- and low-band 5G has similar speeds to 4G, but lower latency

High-band 5G can reach gigabit speeds, but requires small cell nodes 300-500 feet apart; cellular carriers unlikely to bring high frequency 5G to rural areas any time soon

Why fiber?

- VT Legislature - goal of universal 100/100 service
- Only technology that offers **symmetrical speeds all the way up**
  - Fast upload speeds are necessary to collaborate on large files, video-conference, media production, big data analysis, gaming
- **Considered "future proof"** — can upgrade speeds without replacing underlying fiber
- **Cheapest option** over the long term
  - Fiber does not naturally degrade for long periods of time
  - Technologies like fixed wireless are cheaper to deploy, but require replacing expensive equipment every 4-5 years
  - **Fiber is most cost effective technology when you look out 15-20 years**
- **Increases home values**, helps apartments fill faster
- Provides foundation for a **strong digital economy ecosystem**

What does a FTTP network look like?

Key terms:

- Last mile
- Backhaul
- Middle Mile
- Internet backbone

Lines of Fiber

- ● ACTIVE
- ● UNDER CONSTRUCTION
- ● PLANNED FOR 2020
- ● DESIGNED FOR 2021
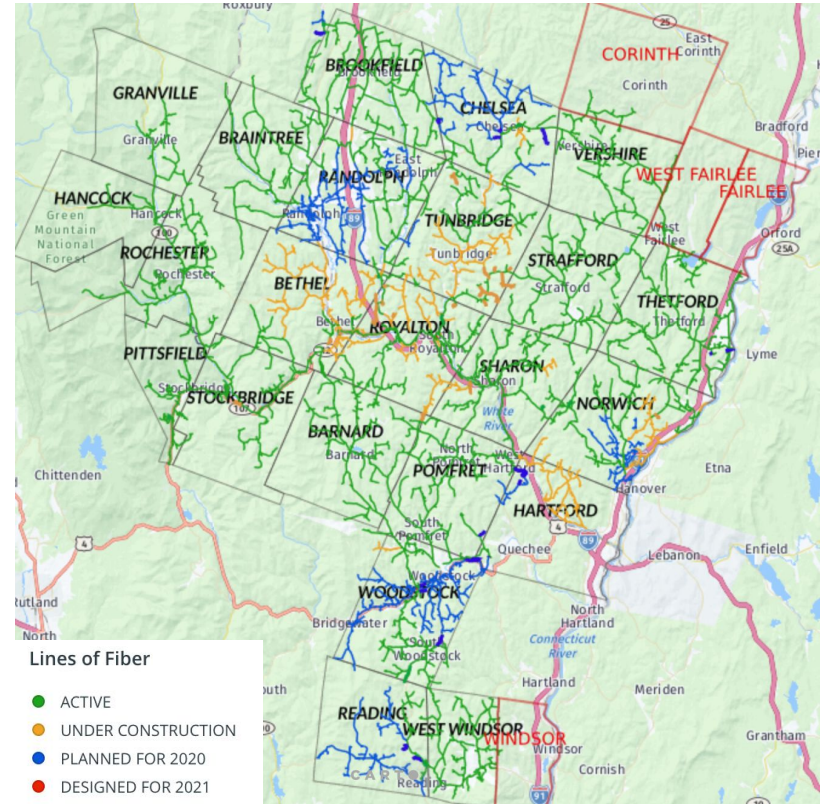
ECFiber's last-mile network

Last Mile Options

- Gigabit Passive Optical Network

  ○ Initial network consists of a hub location in each town connected to each other
  ○ One strand of fiber serves multiple homes using a (passive) fiber optic splitter
  ○ Quickly becoming standard for rural FTTP networks

- Active Ethernet Optical Network

  ○ Dedicate a strand of fiber from the hub location to each premises
  ○ More fiber must be deployed throughout the network, with little additional customer benefit
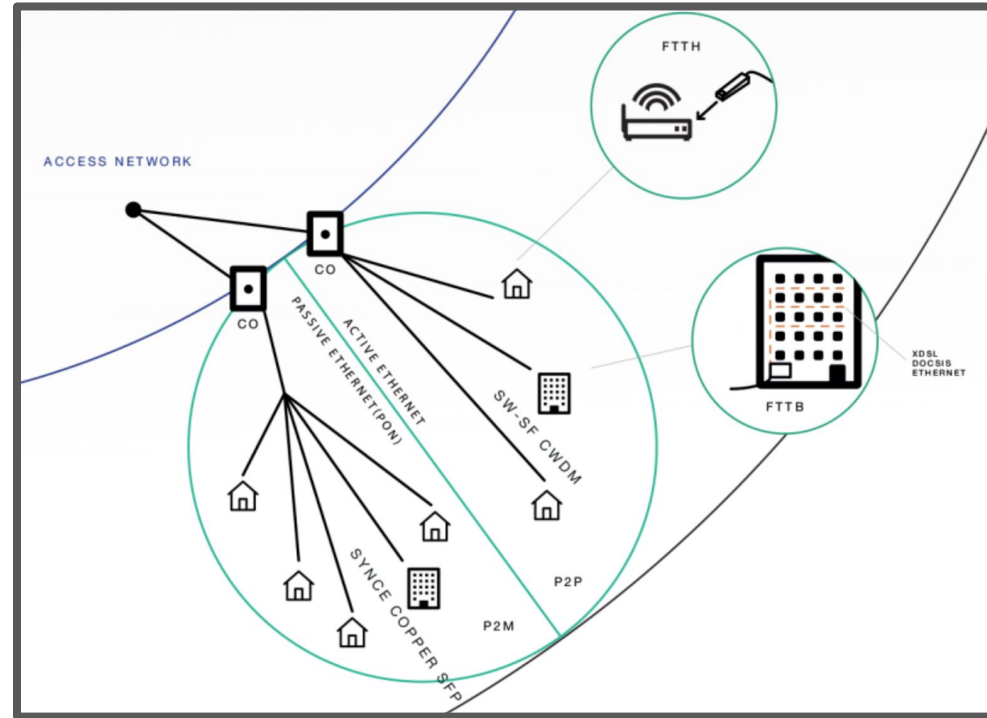
Middle mile / backhaul availability

- Connects regional network to the "carrier hotel" that connects to the greater global Internet network
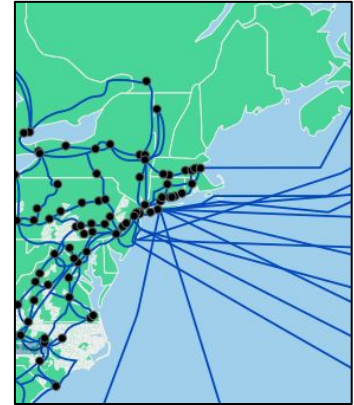- Addison has several options for backhaul providers
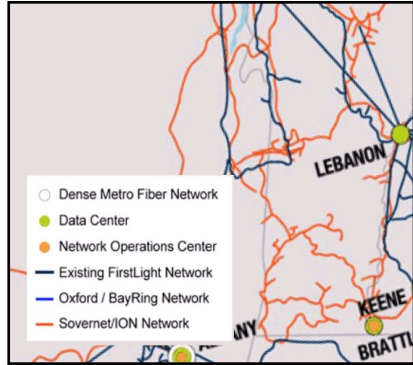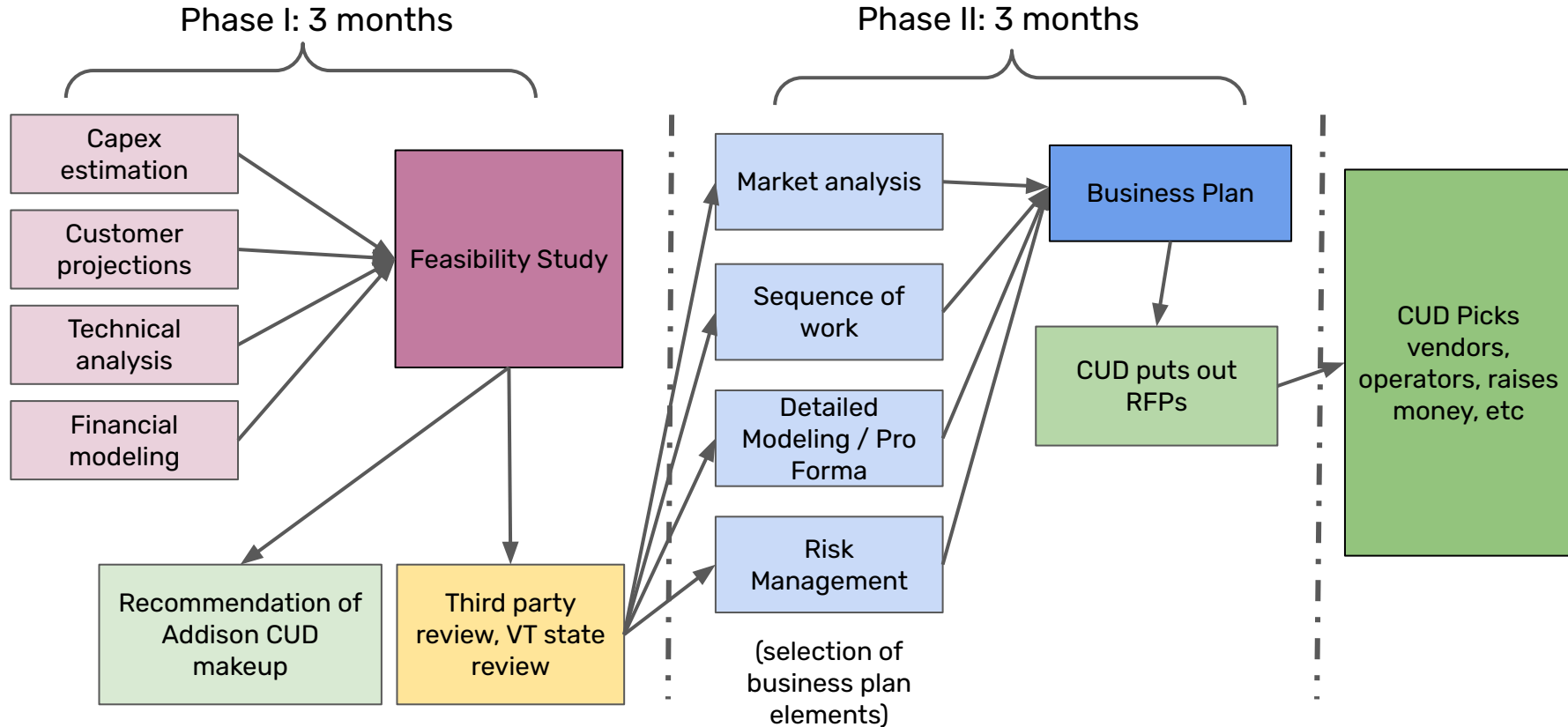

Firstlight

VELCO
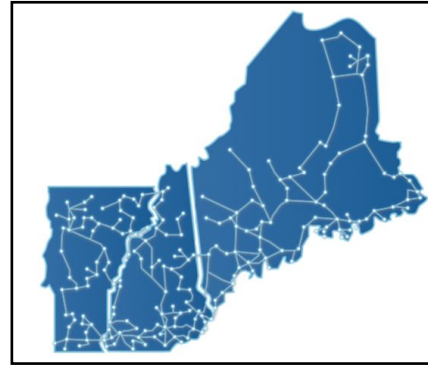
Consolidated Communications

CenturyLink

Project overview

Phase I: 3 months

Phase II: 3 months

Capex estimation

Customer projections

Technical analysis

Financial modeling

Feasibility Study

Recommendation of Addison CUD makeup

Third party review, VT state review

Market analysis

Sequence of work

Detailed Modeling / Pro Forma

Risk Management

(selection of business plan elements)

Business Plan

CUD puts out RFPs

CUD Picks vendors, operators, raises money, etc

Feasibility Study will provide high-level analysis

- **Can you access a critical mass of customers?**
    - Number of households
    - Percent served by cable internet
- Construction timeline
- Construction cost estimation
- Build sequence
- Make-ready cost estimates
- May recommend merging with another CUD, or forming "operational partnership"
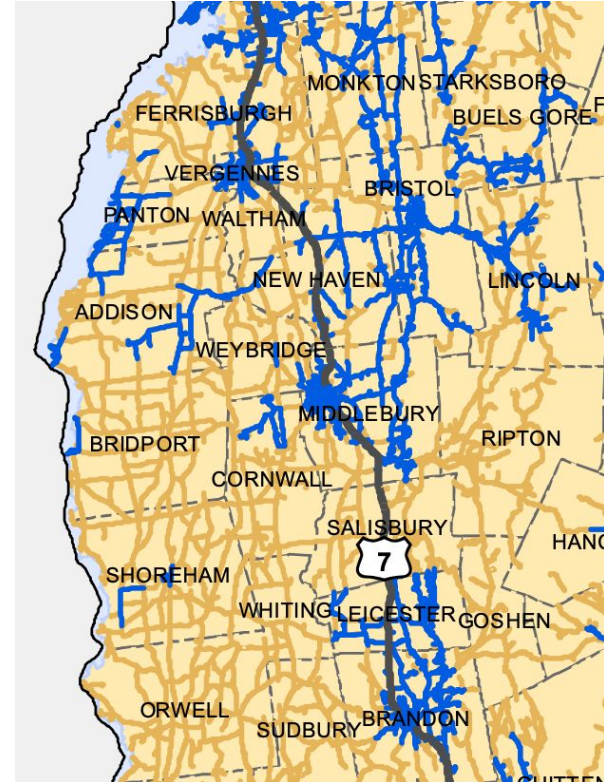
Blue = Access to 25/3

Business plan will set CUD up for action

Business plan will allow CUD to fundraise around viable project, issue RFPs, and understand steps to implementation

- High level engineering and design plans
- Market analysis and evaluation of incumbent providers
- Financing models, 10 year pro forma projections
- Ideal operational models
- Risk management plan
- Recommended vendors and partners
- Detailed funding stack
- Sequence of work needed to launch network

What will CUD issue RFPs for?
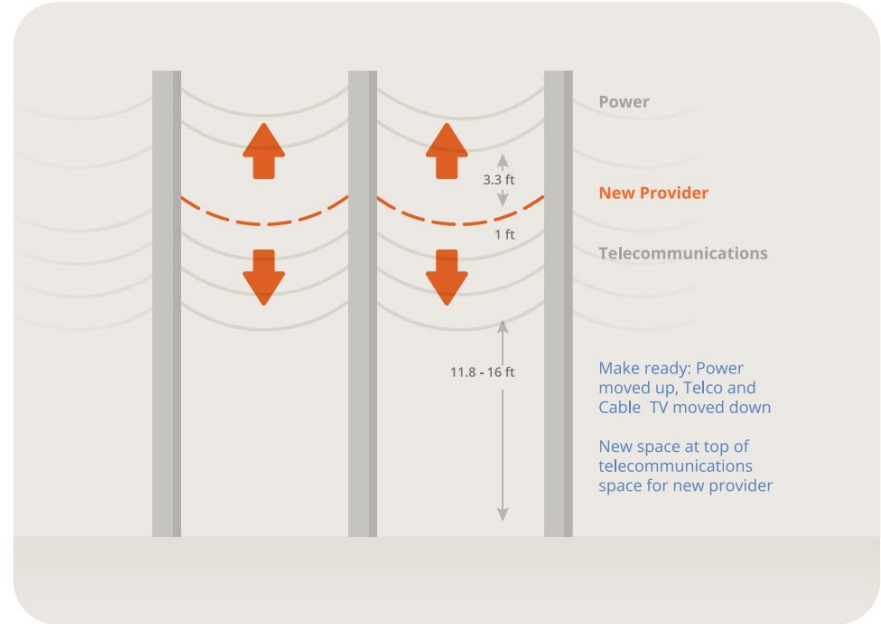
Steps required before construction

- Pole data collection
  - Lat/long, stability poles, transformers, DSL boxes, down guys, and more
- Engineering design
  - Hub locations (with generators)
  - Egress / redundancy
  - Refined sequence
  - Strand length limits
- Pole make-ready: Move existing wires to make room for fiber cable

FIGURE 18: EXAMPLE OF MAKE-READY REQUIREMENT FOR NEW PROVIDER

Power

New Provider

3.3 ft

1 ft

Telecommunications

11.8 - 16 ft

Make ready: Power moved up, Telco and Cable TV moved down

New space at top of telecommunications space for new provider

Gigabit Communities (2013)

Contracting for a pole data collection likely first RFP you issue

- Image: Utility poles owned by Green Mountain Power
- Pole data collection requires documenting
  - Pole ID number and lat/long coordinates
  - Guy wires
  - Transformers
  - Number of attachments in communications space
  - Picture of each pole
  - Condition of each pole
- Data used to apply to be on the pole, understand "make-ready" requirements, and plan exact construction requirements
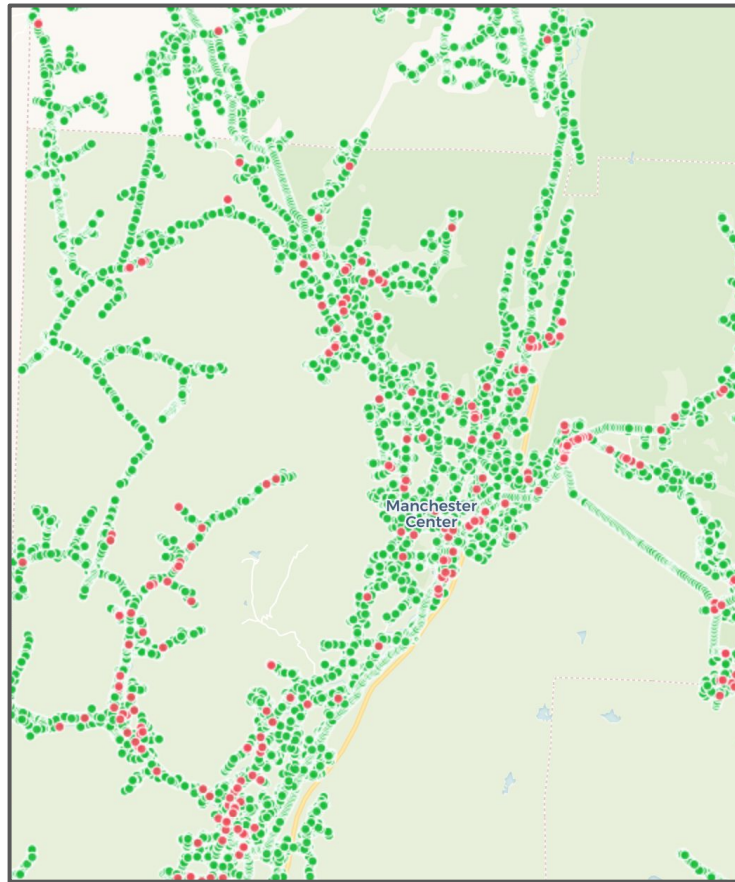
Constraints on speed of deployment

- Pole application process / make ready process
- Pole owner make-ready capacity
  - Historically 250 miles/year

- Winter weather

- Financial constraints
  - Construction increases debt and therefore risk
  - Some financial instruments require project to maintain a certain EBITDA ratio

Next Steps

- Completion of feasibility study and submission to state and third party for approval
- Presentation to CUD about feasibility findings
- Continued CUD formation and education
- CARES act funding usage
- Creation and RFPs as needed
- Business planning work will begin right away once feasibility submitted

Thank you!

If you have further questions about this project, please feel free to reach out to the project team.

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