Digital Access Master Plan

November 2022

Digital Access Master Plan

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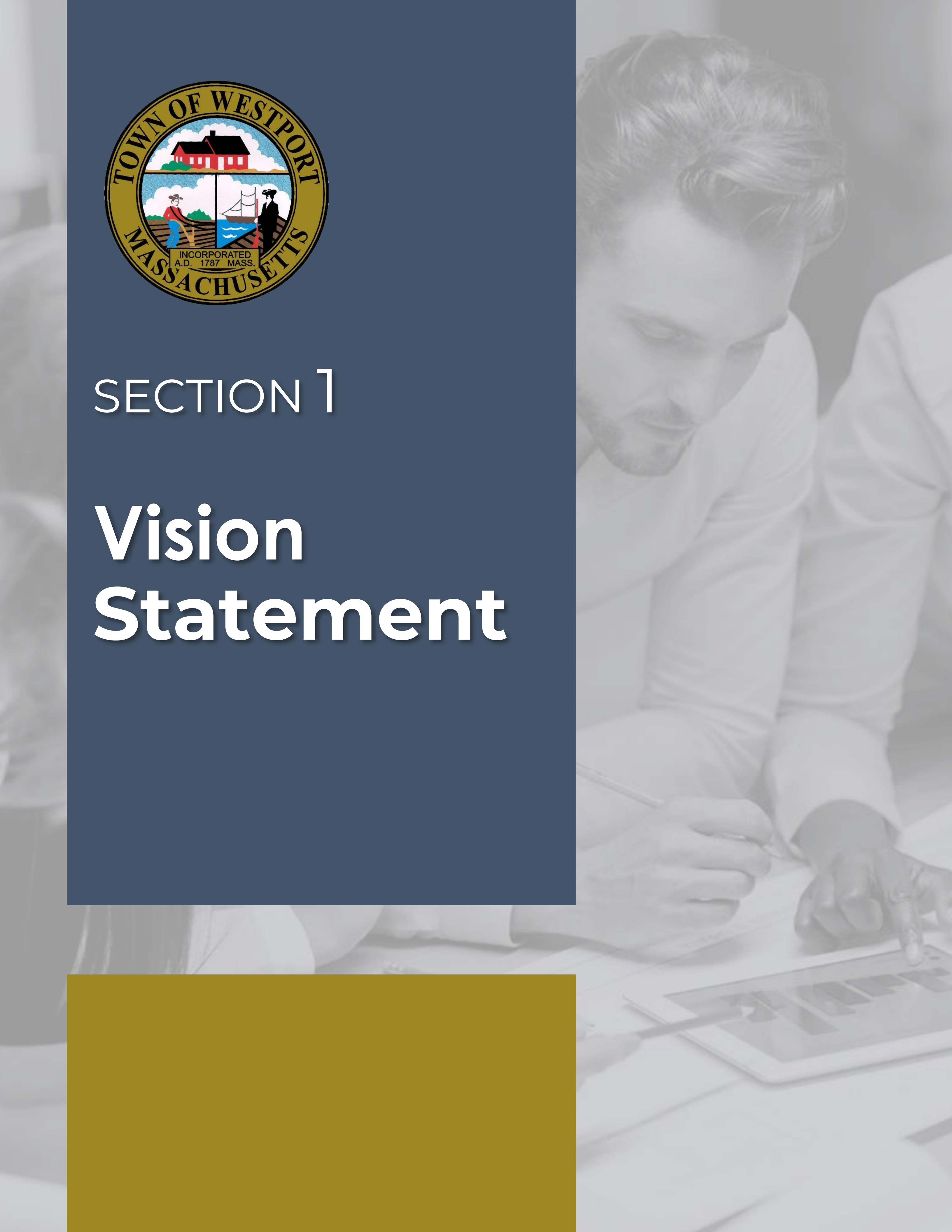


SECTION 1

Vision Statement

VISION STATEMENT

Reliable internet is critical infrastructure – no different than roads or electricity. Creating a Town-owned fiber optic network would treat it as such. The potential benefits of this effort include providing competitive options for our residents and in the process dramatically improving access to the internet.

If this initiative goes forward, the project would be developed with the following principles and objectives:

1. **Nobody will be forced to participate. Participation would be on a voluntary, opt-in basis.**
2. **Tax revenues would not be used to fund the network.**
3. **The ongoing operation of the network would be self-sustaining and not dependent on any kind of subsidy from the Town.**

Primary goals for this infrastructure initiative include the following:

1. **Significantly increase the speed and reliability of internet access.**
2. **Lower the cost of internet access for both residents and businesses.**
3. **Increase competition giving residents and businesses additional choices of four to five new Internet Service Providers (ISPs).**
4. **Build a state-of-the-art network that will promote economic development and foster innovation.**
5. **Leverage the network to improve the services provided in the town including public safety, transportation, healthcare, education, emergency communications, transactive energy (smart grid) and new services that will become possible with advanced network infrastructure.**

Westport Select Board

SECTION 2

Overview
Key Questions
The Why

Digital Access Master Plan

Overview

The Westport Broadband Committee has worked with EntryPoint Networks to develop this Digital Access Master Plan to help Town residents determine whether it is feasible and advisable to deploy and operate a municipally owned fiber network for the residents, businesses, and anchor institutions in the Town of Westport. This report seeks to assist Town residents in understanding the operational implications, important risk factors, and a realistic cost framework for developing and operating Town-owned fiber optic infrastructure.

This Digital Infrastructure Access Master Plan is a living document. If Town residents determine the project has sufficient merit, the planning process will continue toward a potential townwide fiber deployment.

Key Questions

This Plan is organized around three key questions:

1) **Why should Westport consider building a municipal fiber optic network?**
2) **What would a sustainable financial model look like for building a municipal fiber network?**
3) **What are the next steps to advance the process?**

Why Should Westport Consider Building a Municipal Fiber Network?

Digital infrastructure is the road system in a digital economy and is now strategic infrastructure which is critical to nearly everything that is important in a town. The current service provider model is not organized to optimize the strategic importance of this infrastructure. Cities and towns are uniquely positioned to deploy an infrastructure asset that can have a far-reaching impact on all the systems that are important in a town.

Key limitations of the current service provider model include:

1. The infrastructure is treated as an amenity or luxury item rather than as essential in modern life.
2. The infrastructure and services are bundled together. This obscures the actual cost of infrastructure and services and adds to the lack of competition among service providers.
3. Competition happens at the infrastructure layer rather than at the services layer. This is very expensive and not financially sustainable. It also leads toward monopoly control over services.

4. The interests of current service providers are misaligned with the interests of subscribers. Providers want the maximum price the market will bear, and subscribers want the minimum price for the maximum service. The lack of competition is a market failure and accentuates this misalignment.
5. There is little to no local influence over the pricing, governance, or quality of digital infrastructure and services (internet).

The Town of Westport is evaluating the feasibility of deploying a municipal fiber network to overcome these limitations.

8 Reasons

The following opportunities to improve digital infrastructure are unique to a municipal entity and may enable long-term benefits in education, health care, public safety, efficient delivery of government services, and the general economy. Commercial internet service providers (ISPs) are unlikely to pursue any of these opportunities because they are contrary to profit motives and to existing incentives.

1) Improved Affordability

The dominant national internet service providers have developed a rent seeking model that is sustained by control over the infrastructure. Network control allows current providers to impose premium pricing on network rents (ISP fees). There is a set of proven tools that can effectively overcome these rent seeking practices and drive down the cost of access in a meaningful way. These include:

1. Apply established municipal utility operational models for funding, construction, operation, and fees and leverage established municipal utility structures, tax exemptions, access to public grant funding, lowering borrowing rates, and better liability treatment to drive costs down.
2. Put downward pressure on price by enabling dynamic competition between service providers via an Open Access network model.
3. Separate and optimize the key cost components of digital access into the three main network categories: (1) Capital Infrastructure Investment, (2) Monthly Maintenance & Operations Expenses, and (3) Monthly Internet Access Free from the ISP.
4. Allow households in multi-tenant buildings to share the infrastructure, maintenance, and operations costs.
5. Allow subscribers to pay off the cost of infrastructure and eliminate that line item once the infrastructure debt has been retired.
6. Leverage automation to lower operational expenditures.
7. Apply for state and federal grants targeted to offset the cost of deploying new fiber optic infrastructure.

2) A Reduced Digital Divide

Persistent barriers to universal internet access, availability, affordability, and adoption are now public domain concerns. The internet has moved from being a luxury item to a necessary feature of modern life – like other utility infrastructure. The incentives for private industry are not aligned toward resolving persistent gaps and the solutions advanced by them have not addressed these critical public needs or provided effective sustainable solutions. Informed public policies coupled with targeted public investments are needed to provide lasting solutions. These public policies must be informed by the fact that reliable internet is now necessary for access to educational systems, economic activities, healthcare, public safety systems, and many other cultural and societal interactions.

3) Spurred Economic Development

We have a digital economy. Communication infrastructure is now fundamental to economic development because it provides the foundation for a digital economy. Historically, economic development has followed investment in infrastructure for all major systems including transportation, water, sewer, or communications. Until now, municipalities have mostly remained independent of a governance role over digital infrastructure. Private companies have decided where they will build, what they will build, the cost of services, and the kind of innovation that will happen on these systems. However, the network is now so fundamental to modern life and economic development that municipalities are increasingly taking a more active role over governance of this infrastructure. Many residents now work and run their businesses from home and would benefit greatly from higher speed internet services.

4) Fiber Optic Infrastructure is Treated as a Public Utility

Fiber optic networks managed as a public utility makes sense because it is essential infrastructure in the modern economy. Utility frameworks exist to support essential functions critical for societal success. Providing digital access as a public utility will result in maximum service at the lowest possible cost for residents, businesses, and anchor institutions. The current lack of adequate competition and the practice of treating this as an amenity rather than a utility affects affordability and quality of service.

5) Increased Competition Through an Open Access Model

Open Access is a model which divides the infrastructure and services into two separate systems and then shares the infrastructure between multiple service providers, like road systems and airports. A key goal of an Open Access system is to lower costs and improve service by increasing choice and competition. For an Open Access system to realize its potential, it is critical for the infrastructure owner to be a **Neutral Host of the infrastructure**. The role of a Neutral Host is to control and manage the infrastructure without privileging one service provider over another. A true Open Access network depends on enabling robust shared infrastructure that is operated on a non-discriminatory basis.

6) Unbundled Infrastructure and Services

The dominant national Internet Service Providers (ISPs) bundle the infrastructure and services together to insulate the infrastructure owner from outside service providers. An Open Access model depends on unbundling or separating the primary functions and network costs into three buckets: 1) Infrastructure Capital Deployment, 2) Ongoing Network Operations, and 3) Services. To optimize each function and to enable the Town to become a Neutral Host, it is important to unbundle the key network functions and costs.

7) Alignment with Users

Subscribers want maximum value for minimum cost. The Town wants to enhance livability, support local businesses, enable important anchor institutions like healthcare and education, and care for natural and human resources. As digital infrastructure becomes increasingly important to each of these things, the significance of alignment with the network owner and operator also increases. The Town of Westport is aligned with the interests of subscribers to support a network that delivers maximum value for the minimum cost.

8) Local Control Over Pricing and Reliability

The enabling power of networks is important locally. The dominant ISPs today are nationwide companies that are not organized to align the network with local needs and interests. Digital infrastructure will be positioned to increase local value when it is owned and controlled by a local Neutral Host. The digital divide, education, economic development, public safety, and healthcare are all examples of local variables that can best be understood and addressed locally. Control over network infrastructure will allow Westport to leverage the power of the network in advancing communication solutions for these issues.

SECTION 3

Feasibility Analysis

Feasibility Analysis

Evaluating the feasibility of deploying municipal infrastructure is a function of comparing current market factors (pricing, customer satisfaction, services, speeds) to realistic projections for Town controlled infrastructure.

Financial Feasibility

A key objective of Westport is that the internet infrastructure should be available to everyone at affordable rates. Westport's pursuit of universal availability and affordability will lead to completely different outcomes than the current state for the businesses and residents of Westport.

> Estimated Current Internet Spend in Westport
> Projected Total Cost of Townwide Deployment
> Projected Cost per Household at 60% Take-Rate

Aggregate Internet Connectivity Cost in Westport Today

The following table provides a reasonable estimate of the amount of money the residents of Westport are paying for internet access today. This is based on a national average of $68.38 from the Cost of Connectivity report (New America – the cost of connectivity). Note: The actual average cost of connectivity in Westport is likely higher than the national average used in the illustration below. **This estimate is meant to illustrate the current cash flow available to support a locally owned network.**

Internet Spend in Westport Today

Average monthly cost of home internet connectivity in U.S. today is $68.38

Number of Premises	6,000
Average Monthly Internet	$68.38
Annual Internet Spend	$4,923,360
20 Year Internet Spend	$98,467,200

Projected Monthly Cost to Subscribers

The main cost categories for deploying and operating broadband networks are:

> Infrastructure Capital Costs (Financed over 20 years)
> Network Maintenance & Operations (Monthly Utility Fee)
> Services (Paid Directly to Service Providers)
> Public Access Programs (Similar to Those Currently Provided Such as Public Access TV)

To optimize the subscriber cost for each category, it is recommended that the costs are separated and transparent to each stakeholder (Subscriber, Network Operator, and Service Provider).

The monthly cost for subscribers is modeled below (**assuming 90% of the network will be aerial and 10% buried**, with a 40%, 50%, and 60% take-rate).

Projected Subscription Cost (Gig Speed)

Projected Residential Services Monthly Costs	40% Take-Rate	50% Take-Rate	60% Take-Rate
Infrastructure	$49.56	$40.58	$34.61
Maintenance and Operations	$21.50	$21.50	$21.50
ISP Services (Dedicated 1 GB Symmetrical)	$9.99	$9.99	$9.99
Public Access Programs	$4.00	$4.00	$4.00
Monthly Total	**$85.05**	**$76.07**	**$70.10**

Projected Townwide Infrastructure Capital Costs

The total projected construction costs for a townwide deployment are summarized in the table below. This projection assumes that 90% of the network will be aerial and 10% buried, with a 40%, 50%, and 60% take-rate and an interest rate of 4.5%.

Projected Infrastructure Investment Total Costs

Financial Pro-Forma of Full Project Costs - Two Year Build - Ethernet Architecture

Network Segment	40% Take-Rate	50% Take-Rate	60% Take-Rate
Common*	$18,864,949	$18,864,949	$18,864,949
Drop*	$1,992,066	$2,490,082	$2,988,383
Total Projected Costs	**$20,857,015**	**$21,355,031**	**$21,853,332**

[Note: The modeled aerial costs do not include the possibility of pole replacement fees or other unexpected make-ready charges.]

* See page 21 for definition.

Why Take-Rate is Important to Total Infrastructure Cost

Take-rate is a variable that is critical to project success because the operational sustainability of a project depends on crossing a certain take-rate across a broad number of subscribers, therefore translating into an attractive and affordable cost per premise.

The following table illustrates the impact of take-rate on total cost per premise under a 100% aerial network with a take-rate of 60% as neutral on impact.

Take-Rate Modeling

Take-Rate	Cost/Sub	Subscribers	vs. 60% Take-Rate*
30.00%	$9,947	2,103	($4,614)
40.00%	$7,640	2,804	($2,307)
50.00%	$6,256	3,506	($923)
60.00%	**$5,334**	**4,207**	$0
70.00%	$4,675	4,908	$659
80.00%	$4,180	5,609	$1,153
90.00%	$3,796	6,310	$1,538

*Difference in subscriber infrastructure cost (capital cost to build the network).

Network Management and Operations

The work required for network operations includes network monitoring, network troubleshooting, physical infrastructure repairs, and new customer installations. The Westport Committee is recommending that the Town own the network and outsource operations to a third-party. Our recommendation is that the Open Access partner provide customer support, NOC support, monitoring, and troubleshooting, and then utilize a public process to select a local group to manage outside plant – which includes physical repairs, splicing, new customer connections, maintenance of the physical asset, and emergency response for the physical plant. The proposed budget includes $21.50 per subscriber per month for network operations.

Financial Feasibility

Feasibility is a function of take-rate. Take-rate is a function of creating value and effectively communicating that value to subscribers. As the report indicates, higher take-rates lead to lower shared infrastructure costs.

Westport is semi-rural with relatively low density and a substantial amount of rock that may be problematic for a buried network implementation. Projected costs are provided for both an aerial and buried implementation. The aerial projections do not include an analysis or cost projection for pole make-ready work.

Spectrum charges $115 per month for Gig download (940 x 50 Mbps). If Westport can achieve the projected take-rate of 60% (the number used for financial modeling), the projected monthly subscription cost at 90% aerial and 10% buried is $76 per month for 1,000 x 1,000 Mbps. This represents a savings of $39 per month and a 20 times improvement in upload speed.

Ultimately, feasibility will depend on the quality of services and the effectiveness of community engagement to educate residents on the value proposition of a locally controlled and municipally sponsored network.

Financial Modeling Assumptions

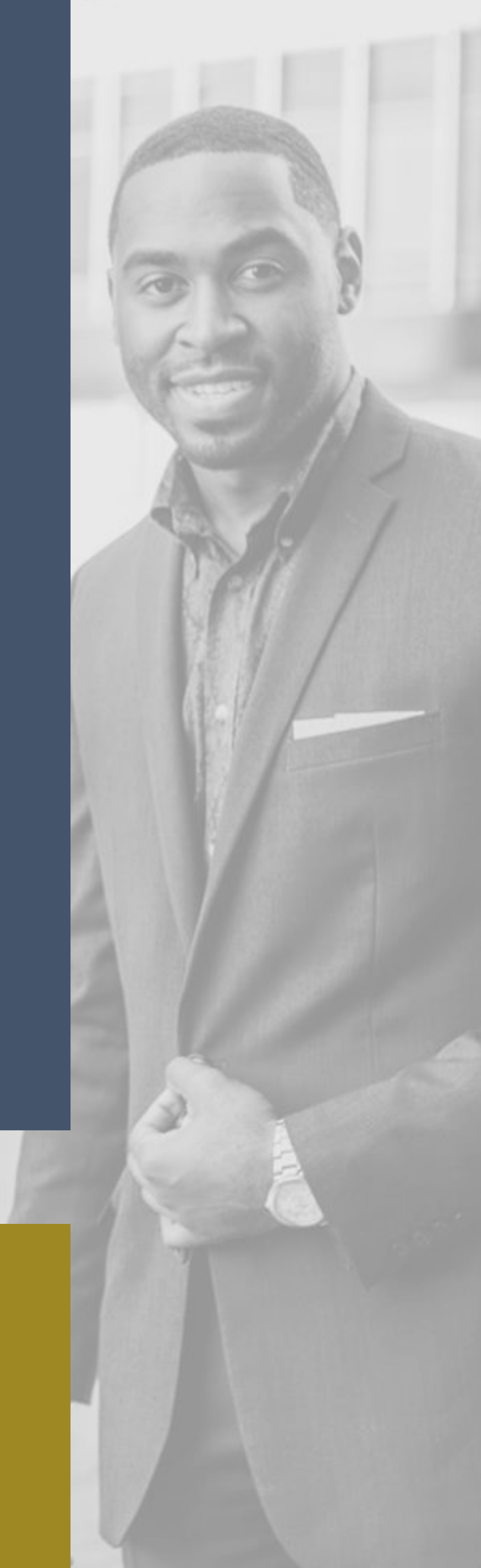
EntryPoint based its analysis on the following demographic information for the Town of Westport:

Total Potential Premises: 7,011
(Households and Businesses)

Subscribers @ 60% Take-Rate: 4,207

SECTION 4

Market Assessment



Market Analysis

Current Service Provider Offers and Pricing

In Westport, most residents and businesses subscribe to wireline internet services from the cable operator (Spectrum / Charter) or the telephone provider (Verizon). The information below comes from the websites of these providers.

Spectrum

Spectrum/Charter advertises the following residential ISP services in Westport:

Speed (Mbps) [Down / Up]	12 Month Rate [Conditions Apply]	Standard Pricing [+ Taxes and Fees]	Install [Fee]
200 / 10	$50.00	$75.00	TBD
400 / 20	$70.00	$95.00	TBD
940 / 50	$90.00	$115.00	TBD

Information in the table above is from Spectrum's website

Taxes and fees often represent an additional (20%-30%) of standard pricing
Shared Network – Speeds are "up to" and are not guaranteed
Speeds are not symmetrical
Modem with Wi-Fi – additional $5.00 per month
Availability depends upon location – not available in all areas

Verizon

Verizon advertises the following residential services in Westport:

Speed (Mbps) [Down / Up]	Service Media [Platform]	Standard Pricing [+ Taxes and Fees]	Install [Fee]
1.1-3 / .5	DSL	$75.00*	Self-Install
25 / 4	4G LTE Wireless	$60.00	Self-Install

Information in the table above is from Verizon's website

*$40.00 Internet + $35.00 Required Phone Line

Taxes and fees often represent an additional (10%-15%) of standard pricing
Speeds are "up to" and are not guaranteed
Speeds are not symmetrical
Modem with Wi-Fi – no data
Soft data caps apply to all service plans
Availability depends upon location – not available in all areas

Spectrum Business

Spectrum / Charter advertises the following business ISP services in Westport:

Speed (Mbps) [Down / Up]	Promo Pricing [12 months rate]	Standard Pricing [+ Taxes and Fees]	Equipment [Required]	Install [Fee]
200 / 20	$65.00	Not Disclosed	Not Disclosed	Not Disclosed
600 / 35	$115.00	Not Disclosed	Not Disclosed	Not Disclosed
940 / 35	$165.00	Not Disclosed	Not Disclosed	Not Disclosed

Information in the table above is from Spectrum's website

Taxes and fees often represent an additional (20%-30%) of standard pricing
Shared Network – Speeds are "up to" and are not guaranteed
Speeds are not symmetrical
Availability depends upon location – not available in all areas

Verizon Business

Verizon advertises the following DSL and 4G LTE Wireless business ISP services in Westport:

Speed (Mbps) [Down / Up]	Service Media [Platform]	Year 1 Pricing [+ Taxes and Fees]	Year 2 Pricing [+ Taxes and Fees]	Year 3 Pricing [+ Taxes and Fees]	Year 4 Pricing [+ Taxes and Fees]
3 / .5	DSL	$69.00	$79.00	$89.00	$99.00
10 / 2	4G LTE Wireless	$69.00	$79.00	$89.00	$99.00
25 / 4	4G LTE Wireless	$99.00	$109.00	$119.00	$129.00
50 / 5	4G LTE Wireless	$199.00	$209.00	$219.00	$229.00

Information in the table above is from Verizon's website

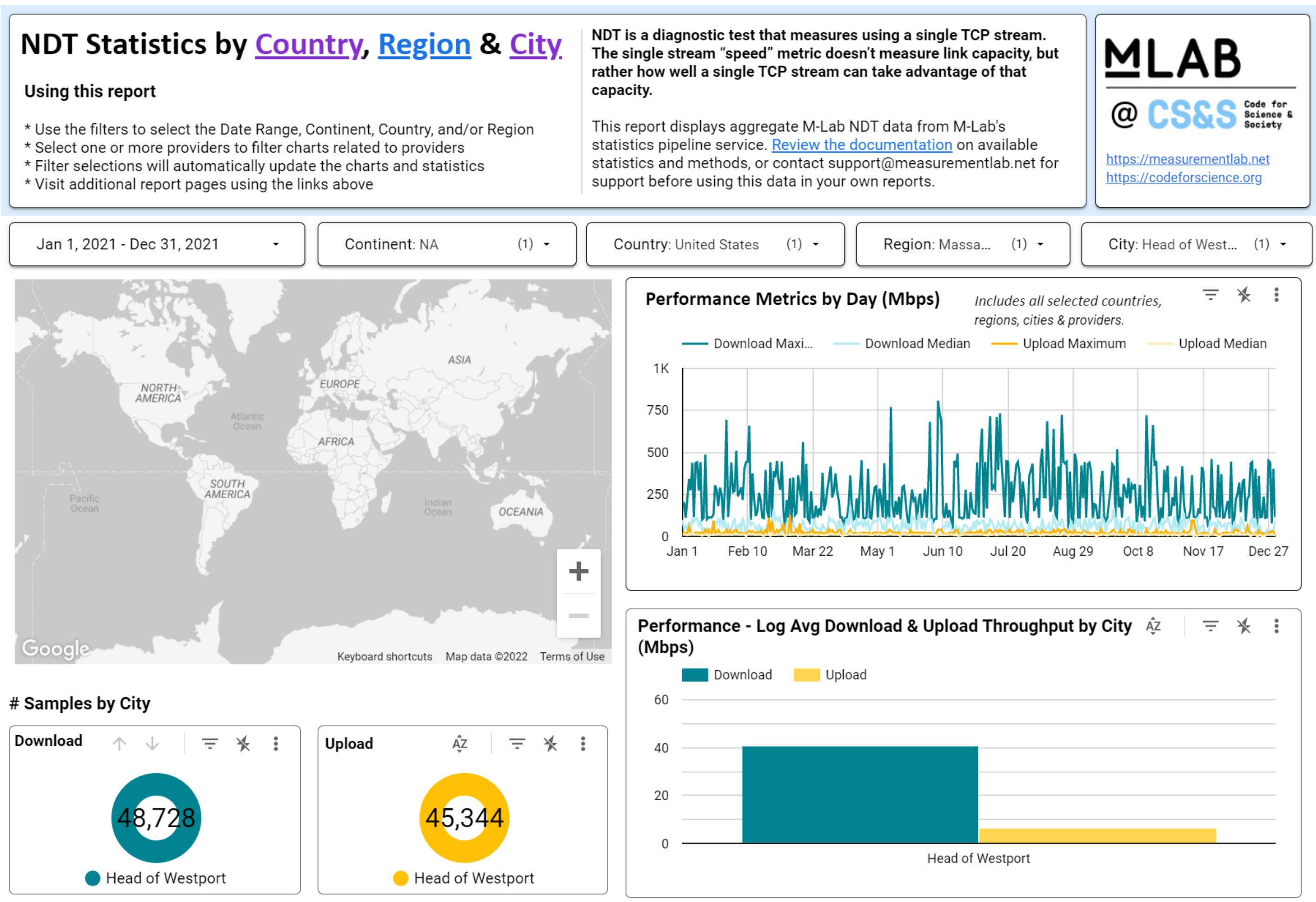
Taxes and fees often represent an additional (10%-15%) of standard pricing
Speeds are not symmetrical
4G LTE Wireless Install Fee = $49.00
Modem with Wi-Fi – N/A
Availability depends upon location – not available in all areas

[Market research conducted in June 2022]

Speed Test Data

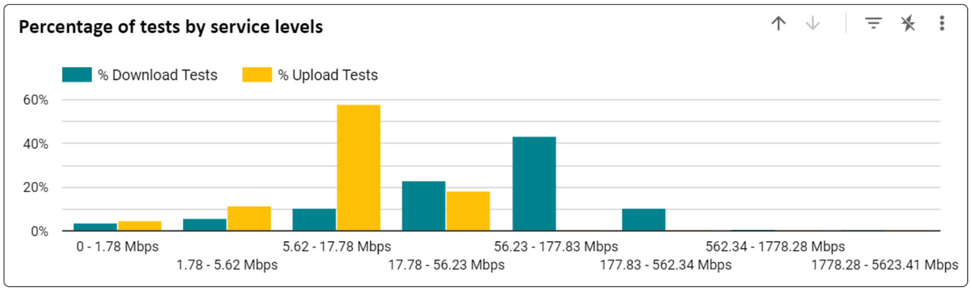
mLABS is an academic group that provides authoritative data from speed tests on a city-by-city basis across the United States. Academic and scientific research organizations rely on mLAB data. Every time an individual runs a speed test through an affiliate of mLABS, the data is saved in Cloud Storage hosted by Google and made available to the public. The data below are the speed test results in the Town of Westport from January 1, 2021, to December 31, 2021. The sample size for this 12-month period includes 48,728 speed tests.

The average speed delivered by Spectrum / Charter in Westport is 47.58 Mbps download / 6.97 Mbps upload. Verizon's average speed in Westport is 3.18 Mbps download / 0.73 Mbps upload.



NDT statistics used in this report are provided as daily histograms, consisting of the percentage of measurements within a range of "service levels" or speed ranges.

The chart on the right presents the histogram of tests that measured at these levels over the selected date range and locations, across all providers.

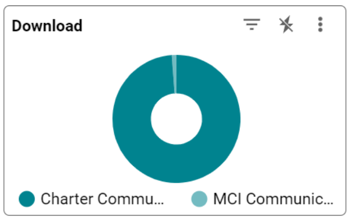


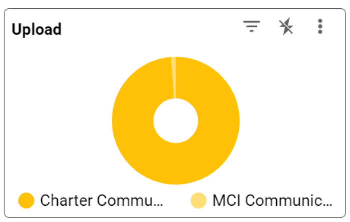
In the NDT dataset, each test is associated with the Autonomous System operating the IP address from which each test was conducted. This may be different than the ISP that offers service.

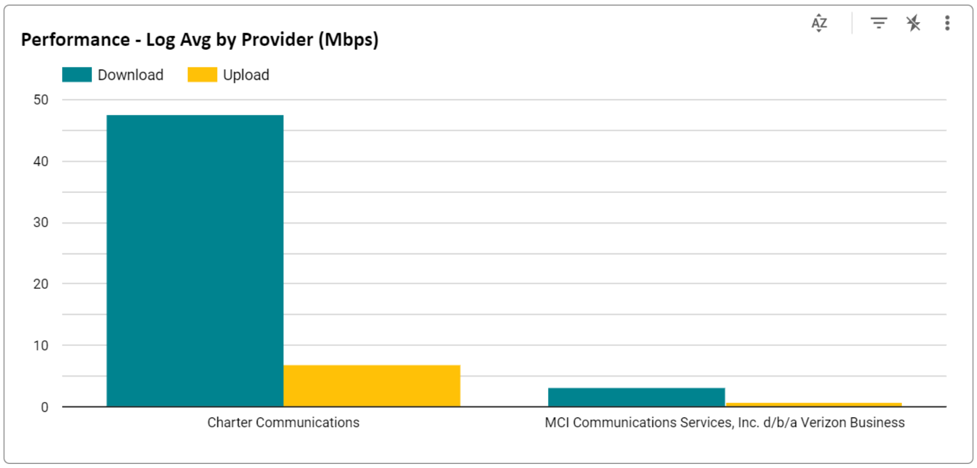
Provider Statistics

Provider: Charter Communication... (2)

 # Samples by Provider







Westport Broadband Survey Results

During the months of July and August 2021, two surveys were conducted targeting Westport residents and business owners to understand opinions regarding current internet services and future needs. A total of 543 residents and 54 businesses completed the surveys which were conducted on a purely voluntary basis. In each case, the number of responses represents approximately a 10% sample of the population.

Survey Results

The major findings from these two surveys are that there is considerable dissatisfaction with current internet services for many reasons but primarily for unreliability, cost, and lack of provider choice. Most respondents indicate that they depend heavily on the internet, that their dependence increased significantly during the pandemic, and many expect that trend will continue in the post-pandemic era.

The survey of residents indicated very high reliance on the internet for a diverse range of uses such as entertainment – 94%, banking/bill paying – 92%, shopping – 91%, socializing – 83%, education – 82%, work – 72% and telehealth – 67%.

The survey of business owners indicated that internet speed is very important for their business and that 80% would welcome access to a higher-speed fiber optic network. One business commented: “Guest requirements for speed and connectivity have grown exponentially, and higher-speed is needed.”

SECTION 5

Next Steps

Next Steps

If the Town decides to move forward with this initiative, the following are key steps to be taken:

1. Establish legal authority.
2. Determine the appropriate governance structure.
   - Determine how the Town will manage and oversee construction and network operations and establish that management entity.
3. Decide on the project phasing for a deployment.
4. Identify middle mile options and conduct a bid process to select middle mile partner.
5. Conduct a public process to select an open access partner.
6. Conduct a public process to select a design / engineering partner.
7. Conduct a public process to select a construction partner.
8. Refine the strategy for financing a phased townwide construction project.
9. Develop and implement a community engagement strategy for the initial phase(s).

A description for each of these key steps is summarized below:

Establish Legal Authority

Several cities and towns in Massachusetts have established Municipal Light Companies and others are currently pursuing this objective. Massachusetts statute allows cities and towns to build, own, and operate digital infrastructure – specifically under the Municipal Light Plant statute. Some cities are building this infrastructure under the Enterprise Fund statute. Westport is mid-process in establishing the Municipal Light Plant structure having approved the first phase of the two-step process at the last Town Meeting.

It is important for Westport's legal advisors to summarize their interpretation of Massachusetts law in a legal memo to be included with this Plan. See summary in Regulatory Risk Mitigation.

Determine Appropriate Governance Structure

Identify the optimal governance structure available for financing and managing the infrastructure capital project under state statute. This structure may be one of the following:

> Municipal Light Plant
> Town Department
> Utility - Proprietary or Enterprise Fund
> Special Assessment District
> Town Owned, Third-Party Operated
> Cooperative
> Other

Develop Project Phasing for a Deployment

Divide the Town into districts or phases and then prioritize construction based on several factors including infrastructure costs and availability, equity, and expected demand (take-rate).

Identify Middle Mile Options and Conduct a Bid Process to Select Middle Mile Partner

Conduct a public process to solicit bids from potential middle mile partners.

Determine How the Town Will Manage and Oversee the Project

Determine what responsibilities will be outsourced vs. insourced for network construction and network operations. If construction and operations will be outsourced, identify internal resources that will be needed to oversee these functions and be a liaison for the Town.

Conduct Public Procurements for Implementation

Conduct a public procurement process (Request for Proposal (RFP), Request for Information (RFI), or Request for Qualifications (RFQ)) to select an open access partner. This partner should also be prepared to assist with project oversight, including design, quality control on construction, and oversee provisioning and turn-up of network electronics. Westport can utilize RFP examples from other cities who have issued similar RFPs (see Chico, CA).

Conduct Public Procurements for Design / Engineering

Conduct a public procurement process (Request for Proposal (RFP), Request for Information (RFI), or Request for Qualifications (RFQ)) to select design / engineering for either the initial phase project or for townwide design that leverages current high-level design and produces low level design that is construction ready and includes construction ready design documents. Refine cost modeling based on network design. Prepare RFP documents with the help of consultant.

Launch make-ready process for utility pole attachments for portion of the network that is aerial.

Conduct Public Procurements for Construction

Conduct a public procurement process (Request for Proposal (RFP), Request for Information (RFI), or Request for Qualifications (RFQ)) to select the construction partner. Prepare RFP documents with the help of consultant.

Determine Financing Strategy

Formulate a strategy for financing the initial phases of the project. This may include:

- Revenue Bonds
- Property Improvement Assessments
- Other

In conjunction with debt financing, the Town should pursue state and federal grant opportunities, including an evaluation of leveraging the State's Loan Loss Reserve Fund.

Develop a Robust Community Engagement Plan

Collaboratively develop a community engagement plan. Community engagement is a critical component of gaining public support for a publicly owned fiber optic infrastructure.

1. Determine whether the Town will use an outside professional marketing firm.
2. Develop the project plan for participation from all external marketing resources.
3. Organize additional survey work.
4. Develop a web presence.
5. Conduct direct signup outreach.
6. Implement grassroots initiatives.

[Implement community engagement and demand aggregation process in the initial phase area.]

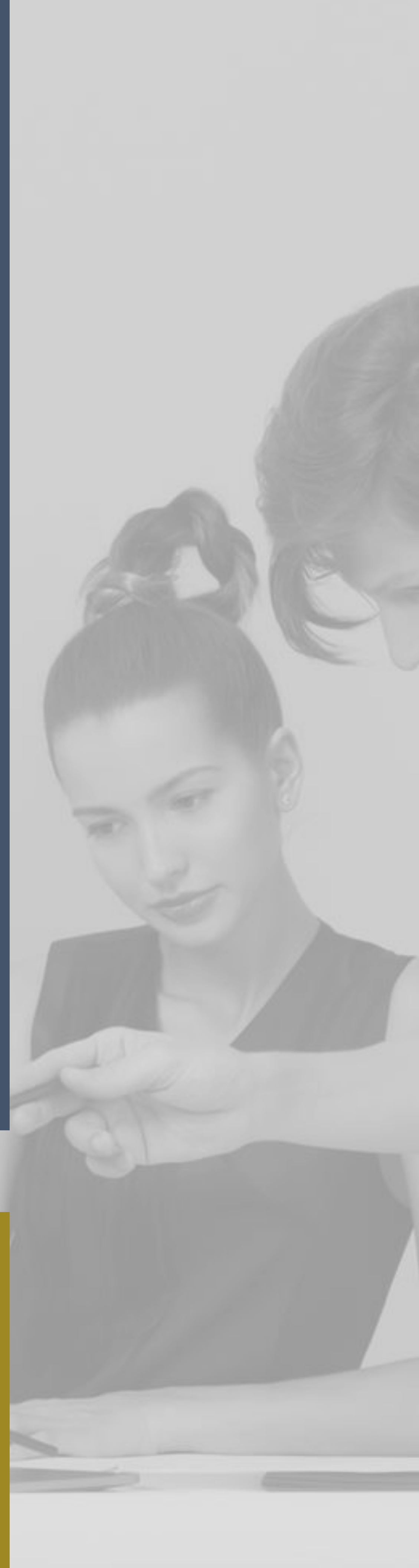
Town Leadership Approval

Prepare to advance the full initiative to the Town Select Board for approval.

1. Brief individual Town leaders on analysis and findings.
2. Move forward as directed by the Town Select Board.

SECTION 6

Addendum



Addendum

The content in the Addendum provides additional detail related to:

- > Infrastructure Grants
- > Network Architecture
- > Media Comparison
- > Business Model Options
- > Risk Assessment
- > Community Engagement

Infrastructure Grants

The Town and its partners should pursue all available federal and state broadband grant opportunities that may be a fit for Westport's proposed project.

American Rescue Plan Act (ARPA)

The final rule significantly broadens eligible broadband infrastructure investments to address challenges with broadband access, affordability, and reliability.

The Coronavirus State and Local Fiscal Recovery Funds may be used to make necessary investments in broadband infrastructure, which has been shown to be critical for work, education, healthcare, and civic participation during the public health emergency. The final rule broadens the set of eligible broadband infrastructure investments that recipients may undertake to address challenges with access, affordability, and reliability.

Source – https://home.treasury.gov/system/files/136/SLFRF-Final-Rule-Overview.pdf

Infrastructure Investment and Jobs Act

President Biden's Infrastructure Investment and Jobs Act seeks to ensure every American has access to reliable high-speed internet. Broadband internet is necessary for Americans to do their jobs, to participate equally in school learning, health care, and to stay connected. Yet, by one definition, more than 30 million Americans live in areas where there is no broadband infrastructure that provides minimally acceptable speeds – a particular problem in rural communities throughout the country. And, according to the latest OECD data, among 35 countries studied, the United States has the second highest broadband costs. The Bipartisan Infrastructure Law will deliver $65 billion to help ensure that every American has access to reliable high-speed internet through a historic investment in broadband infrastructure deployment. The legislation will also help lower prices for internet service and help close the digital divide, so that more Americans can afford internet access.

Source: https://www.whitehouse.gov/bipartisan-infrastructure-law/

Individual State Broadband Grants

Broadband Equity, Access, and Deployment (BEAD) Program Funding includes $42.45 billion for a new program focused on connecting underserved areas by distributing money through state grants. The legislation gives the National Telecommunications and Information Administration (NTIA) 180 days to establish the program and develop funding guidelines.

Each of the 50 states will receive an initial allocation of $100 million from the $42.45 billion pot, with additional funding to be distributed based on coverage maps that have yet to be put out by the Federal Communications Commission (FCC). To receive funding, each state must submit a five-year action plan that identifies locations that should be prioritized for support; outlines how to serve unconnected locations; and assesses how long it would take to build out universal broadband.

Facilitate Access to the Affordable Connectivity Program

The $14 billion Affordable Connectivity Program (ACP) is a targeted subsidy which provides up to $30 per month for qualifying households. However, analysis done by the Town of Baltimore in 2021 found that only 40.7% of city residents have access to a broadband subscription. A key takeaway from the Baltimore study that is relevant for Westport and other cities with a known digital divide gap was that a "trusted point of contact for community members to call made it easier to help wary residents enroll in the program." Additionally, having resources available to help overcome language barriers also made It easier to get residents enrolled.

Source: https://www.benton.org/headlines/baltimore-and-emergency-broadband-benefit-program

Overview of Network Financing Considerations

Historic levels of funding for digital infrastructure seek to close existing gaps, support public ownership, and encourage open access. Public opinion supports treating digital access just like roads, bridges, water, sewer, and power. Taking advantage of these funding opportunities can provide Westport with a fiber optic access utility capable of achieving maximum service for least cost.

Network Architecture

Network architecture has a meaningful impact on network reliability. The description below covers variables that should be considered for network reliability.

The two main network designs are Switched (Active) Ethernet and Passive Optical Networks (PON). The key difference between these two models is that PON is a shared infrastructure (32, 64, or 128 neighbors share a connection) and ethernet gives subscribers their own connection.

Switched Ethernet Network

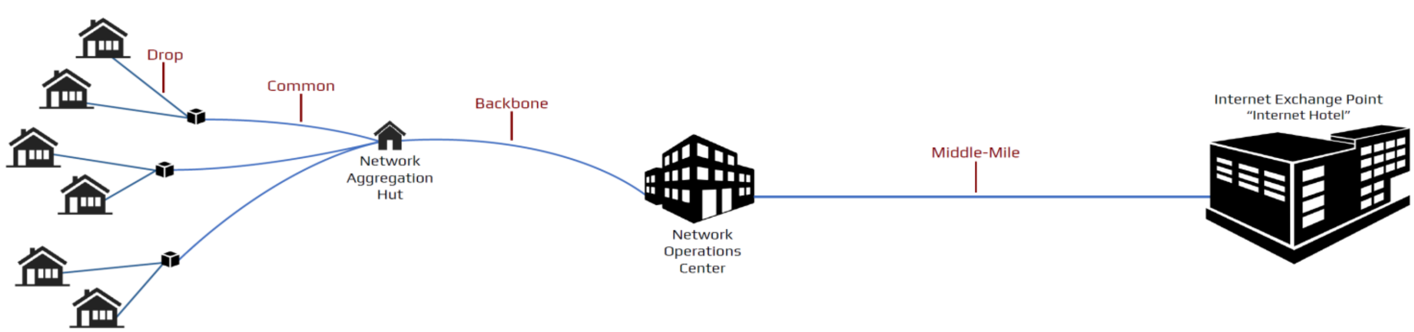
The switched ethernet architecture provides a dedicated connection for each customer rather than a shared connection and the customer experience is significantly better than in a shared architecture during periods of network congestion because the throughput of a switch-based architecture is superior.

Passive Optical Network (PON)

Passive Optical Networks (PON) make use of Time Division Multiplexing (TDM) technologies to create a bus or shared architecture with performance very similar to coaxial cable installations. In a PON network, splitters are placed in the field and a single fiber connection is shared between 32, 64, or 128 premises. This shared architecture may result in packet loss during periods of peak usage. Additionally, upgrading individual connections relies on complicated vendor specific solutions if possible. It can also be more difficult to isolate and troubleshoot faults in a PON network because of the topology. PON equipment suppliers also use proprietary management platforms to establish long term vendor lock-in.

Proponents of PON architecture will argue that PON is less expensive than an ethernet design. That was true historically. This change in pricing differences was driven by the fact that all data center deployments use switched ethernet architectures and the enormous growth of data centers over the past 20 years has driven down the cost of ethernet electronics.

Network Segments – Definitions & Costs Allocations



Drop = The drop is the fiber that runs from the street to the premise (home or business).

Common = The common is the shared fiber infrastructure in a neighborhood that runs from a drop to the closest aggregation hut.

Backbone = The backbone fiber runs from an aggregation hut back to the network operations center.

Middle Mile = The middle mile is usually third-party fiber that runs from the network operations center to the closest internet exchange point. The cost of the middle mile is included in the monthly maintenance and operations (M&O) utility fee and is borne by all network subscribers.

Internet Exchange Point = An internet exchange point is the central point where all internet traffic flows for routing. This is analogous to the role of a central post office for the U.S. postal system.

Comparison of Available Media

The primary media used for internet access today in the United States includes DSL, coaxial cable, wireless, and fiber optic cable.

DSL stands for Digital Subscriber Line, and it is one of the technologies used to provide internet connectivity to homes and businesses. DSL uses existing telephone lines and a transceiver, or modem to bring a connection into a home or business and allows the household to use the internet and make telephone calls at the same time. Verizon is the current telephone company in Westport and uses DSL technology. DSL is asymmetrical (the download speed is much faster than the upload speed), is a dedicated connection capable of download speeds up to 100 Mbps depending on the DSL standard, copper line age, and distance. Most consumers accessing the internet via DSL experience speeds between 5 – 25 Mbps.

Coaxial Cable uses copper cable designed with one physical channel that carries the signal surrounded by a layer of insulation and then another physical channel, both running along the same axis – hence the coaxial name. Coaxial cable is primarily used by cable TV companies to connect transmission facilities to customer homes and businesses to deliver cable TV and internet access. Comcast / Xfinity is the current cable company in the Westport area. Coaxial cable is asymmetrical and shared between up to 200 customers or more. The most recent cable standard of DOCSIS 4.0 can provide up to 10 Gbps in shared bandwidth depending on supported standards and other environmental factors. The standard currently implemented in Westport is 3.1 and the maximum speed available is 940 Mbps. In addition to the limitation of sharing among many customers, another limitation of coaxial infrastructure is that the signal begins to degrade after 300-400 feet.

Fiber Optic Cable sends information down strands of glass known as optical fibers which are less than the size of a human hair. These fiber optic strands can transmit 25 Tbps today and researchers have successfully demonstrated a transmission experiment over 1045 km with a data-rate of 159 Tbps.
Source: https://phys.org/news/2018-04-fiber-transmission.html

Fiber optic cables carry information between two places using optical (light-based) technologies which convert electrical information from the computer into a series of light pulses. Fiber optic cable is capable of symmetrical speeds up to 25 Tbps and the signal can travel as far as 60 kilometers or approximately 37 miles without degrading. Fiber optic infrastructure is also less expensive to deploy than any other existing wireline infrastructure. Because the difference in capacity between fiber optics and alternative media is so significant, fiber optics should be the foundational media for any new broadband infrastructure project when financially feasible.

Wireless Internet access is made possible via radio waves communicated to a person's home computer, laptop, smartphone, or mobile device. Wireless internet can be accessed directly through cellular providers like AT&T Wireless, Verizon Wireless, T-Mobile, or by a wireless internet service provider (WISP). Wireless reliability can be affected by poor weather conditions and may require line of sight.

5G is the 5th generation of technology used in cellular networks and refers to a standard for speed and connection. Because of the extensive marketing around the emergence of 5G, many people wonder whether 5G will replace fiber optic cables. In fact, 5G depends on fiber optic infrastructure. All wireless technologies work better the faster they get back to fiber optics. 5G is not broadcast on a single frequency rather there are several frequencies used by 5G networks and these different frequencies have different advantages and disadvantages – depending on the application.

- **Low-band 5G** operates between 600-850 MHz. This is only moderately faster than 4G with speeds between 50-250 Mbps and offers similar coverage areas for each cell tower.

- **Mid-band 5G** operates in the 2.5-3.7 GHz range and delivers speeds between 100-900 Mbps. While offering less range per cell tower, this type of 5G is going to be the most common implementation of 5G networks for many years to come. It is a compromise between network speed and range in both medium-density urban areas and less dense rural regions.

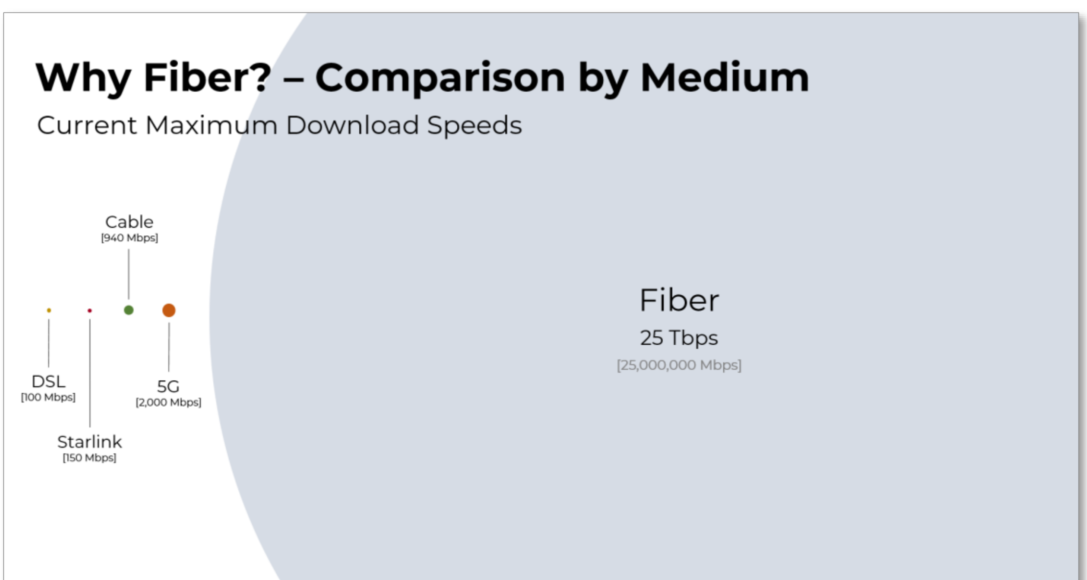
- **High-band 5G** is the band that is most commonly associated with 5G. Operating at 25-39 GHz, this is known as "millimeter wave" spectrum and delivers gigabit speeds (currently tested as high as 3 Gbps). The millimeter wave transmitters have very limited range and requires the deployment of many small transmitters. Each transmitter connects to fiber optics.

  Source: https://www.businessinsider.com/what-frequency-is-5g

Satellite Internet is a wireless internet connection that is available nearly everywhere in the U.S. While it is relatively slow in comparison to cable or fiber optic connections, satellite internet access is faster than some DSL options. This makes it a good option for some rural premises.

Satellite internet speeds range from 1 Mbps – 100 Mbps for download speeds and it is common to have latency and packet loss issues because the signal must travel to space and back. Satellite internet providers include HughesNet, ViaSat, and Starlink. These providers DO NOT promote themselves as a solution for suburban or metro areas.

Satellite internet does require special equipment, including a satellite dish that connects to a communication satellite in space.



Wi-Fi is common in homes and commercial buildings and is a way to deliver a network connection from a network hub over a wired connection to wireless devices via a wireless access point. Most people access the internet over a wireless connection, but it is important to remember that wireless connectivity ultimately depends on a wired connection and wireless access works best the faster it gets back to a wire.

Upload vs Download Speeds

In addition to the fact that fiber optic cable will offer exponentially greater bandwidth than DSL and coaxial cable, fiber optic cable also offers the ability to deliver symmetrical speeds. In an asymmetrical connection, the download speeds are much faster than upload speeds.

Upload speed is the amount of data a person can ***send*** in one second and download speed is the amount of data a person can ***receive*** in one second. Upload speeds can be especially important for businesses, including home-based businesses or people who work from home. Applications that depend on good upload speeds include sending large files, cloud applications like Google Docs, Dropbox, VoIP, FaceTime, Skype, Zoom, WebEx, hard drive backups and in-house web hosting.

Municipal Network Models

Municipal Broadband Models Comparison

To compare the various models that exist in the United States today, the following model variables are important to understand:

Broadband Network Models

> Privately Owned & Privately Operated
> Publicly Owned & Privately Operated
> Publicly Owned & Publicly Operated

Access

> Closed Networks (Single ISP)
> Open Access Networks (Multiple ISPs)
- Dark Fiber
- Lit Manual
- Lit Automated

A mix of prominent municipal fiber optic projects were selected to illustrate the types of models that have been deployed. The following comparison summarizes different approaches to funding and operating municipal broadband infrastructure and services followed by a description of the advantages and disadvantages of each:

Municipality	Population	Model Type	Open vs. Closed	Dark vs. Lit	Manual vs. Automated	Take-Rate	Cost of 1 Gig
Chattanooga, TN	179,139	Electrical Utility ISP	Closed	Lit	Manual	60%	$68.00
Lafayette, LA	126,000	Electrical Utility ISP	Closed	Lit	Manual	40%	$99.95
Westminster, MD	19,000	Town Fiber, Private ISP	Closed	Lit	Manual	20%	$89.99
Huntsville, AL	194,585	Dark Fiber Open Access	Closed	Dark	Manual	No Data	$70.00
Sandy, OR	10,000	Municipal ISP	Closed	Lit	Manual	60%	$59.95
Longmont, CO	86,000	Electrical Utility ISP	Closed	Lit	Manual	55%	$69.95
Ammon, ID	17,000	Automated Open Access	Open	Lit	Automated	65%	$47.50
Monmouth, OR	15,083	Municipal ISP	Closed	Lit	Manual	80%	$129.65
Lexington, KY	321,959	Private Partner Owned	Closed	Lit	Manual	No Data	$59.95
Santa Monica, CA	110,000	Dark Fiber Business Only	Closed	Lit	Manual	N/A	N/A
Fort Collins, CO	165,000	Electrical Utility ISP	Closed	Lit	Manual	No Data	$59.95
UTOPIA	150,000+	Manual Open Access	Open	Lit	Manual	15%	$70.00

[Disclosure: Ammon, Idaho is a client of EntryPoint Networks.]

Ownership Considerations

Privately Owned & Privately Operated
A private owner designs, builds and operates a network. The private builder and operator assumes all the risk and does the work of overseeing design, project management, construction, customer acquisition and operations.

This model leaves the community vulnerable to the private owner operating as a monopoly or selling the network to a monopoly operator. A national or regional private operator reduces the ability of the subscriber to influence the policies, practices, and pricing of the operator. Historically, private owners have not demonstrated a willingness or ability to solve the digital divide.

Publicly Owned & Privately Operated
A town, city, or county owns the network and utilizes a third-party operator to maintain and operate the network. The primary value of publicly owned infrastructure is that the network will not be under the control of an unregulated monopoly that is not accountable or vulnerable to an election cycle where subscribers are empowered to influence outcomes. A private operator may be more expensive for subscribers due to the additional cost for profit. However, this depends on variables like efficiency, the cost of employee benefits, and the percentage the operator takes for profits. Public owners have greater incentives to solve the digital divide.

The current service provider model is that each ISP builds their own infrastructure. That is not necessary with the capacity of fiber optics. One good fiber network will provide a 50 to 100-year infrastructure and a second fiber network will only drive up the costs for consumers and will provide no new value.

Publicly Owned & Publicly Operated
A town or county owns and operates the network. This model protects the community from a private owner operating as an unregulated monopoly or selling the network to a monopoly operator. It also makes the network operator accountable to subscribers via an election cycle where subscribers are empowered to influence outcomes. Public owners have greater incentives to solve the digital divide.

Access Model Considerations (Single ISP vs Open Access)

Single ISP - Closed Access
This model mainly provides advantages for the ISP. A single ISP does not expand choice or competition and may be more expensive for subscribers than an open access model.

Dark Fiber Open Access
Dark fiber open access is a model where infrastructure is built to the curb and the subscriber then selects an ISP as its provider. The ISP finishes the connection to the home with its own infrastructure and electronics. Operating a dark fiber network is less complicated than operating a lit network and the dark fiber model also enables public ownership of infrastructure. While the dark fiber model increases choice for consumers, the downside is that the subscriber and operator give up control over last mile infrastructure via giving up control over the drop from the curb to the premise. The dark fiber model therefore limits the usability of each strand of fiber. With an isolated dark fiber connection, it is impossible to connect to other services that may be available through other service providers other than services running across the internet. The dark fiber model

also does not scale efficiently due to difficulty in anticipating the required fiber count to meet the demand. This can create significant complications for the network operator.

Lit Fiber – Manual Open Access

Lit Fiber – Manual Open Access is a model where the network is lit end to end. This means the network operator places and controls the electronics at both ends of the network. Switching internet service providers can be requested from a web portal and may appear to be automated but the network provisioning is done manually. A manual open access network increases choice for consumers. However, it does not necessarily produce the desired effects of competition if the business model presents barriers to competition. Operating a manual open access network is more complex than operating other models because of the requirement for human management of network tasks and any increase in the number of service providers operating on the network adds to network complexity.

Lit Fiber – Automated Open Access

Lit Fiber – Automated Open Access is a model where the network operator places electronics at both ends of the network and subscribers can dynamically select service providers in real-time. Software Defined Networking is used to automate various network management tasks. In this model, multiple service providers can deliver services simultaneously and independently across a single wire. When a subscriber selects a new service provider, the provisioning is done using automation and therefore happens on-demand. The automated provisioning creates a marketplace for services which includes ISP's and private networks for other services. The ability to switch service providers on demand increases choice and competition. This network model also includes the ability to provide local network resilience via local communications if connections over the middle mile are down.

Disclosure: EntryPoint Networks owns and operates a SaaS model Automated Open Access solution and is a technology solution provider in these networks.

Massachusetts Municipal Fiber Networks

There are several towns and cities in Massachusetts operating fiber optic networks under the authority of a Municipal Light Plant. All of these are closed networks. An open access network has not yet been built in Massachusetts. Existing municipal networks in Massachusetts include:

Municipality	Model Type	Public vs Private ISP & M&O	Residential Gig	Commercial Gig
Concord, MA	Municipal Light Plant	Municipal ISP & M&O	$89.95	Call for Pricing
Leverett, MA	Municipal Light Plant	Third-Party ISP & M&O	$83.40	$299.95
Taunton, MA	Municipal Light Plant	Municipal ISP & M&O	$69.95	Call for Pricing
New Salem, MA	Municipal Light Plant	Third-Party ISP & M&O	$85.00	$110 - $260
Shutesbury, MA	Municipal Light Plant	Municipal ISP & M&O	$75.00	Call for Pricing
Wendell, MA	Municipal Light Plant	Third-Party ISP & M&O	$99.00	$99.00
Peabody, MA	Municipal Light Plant	Closed	$89.95	$299.95
Westfield MA	Municipal Light Plant	Third-Party ISP & M&O	$69.95	$84.95 - $399.95

Whip City Fiber is a third-party network operator for several small Western Mass towns. Whip City was created and is operated by Westfield Gas & Electric in Western Massachusetts. Whip City partners with and provides services to Municipal Light Plants in Westfield, Alford, Ashfield, Becket, Blandford, Charlemont, Chesterfield, Colrain, Cummington, Goshen, Heath, Leyden, New Ashford, New Salem, Otis, Planfield, Rowe, and Washington.

Note: None of the municipal networks listed above are open access. The open access municipal fiber network model is relatively new to the United States. It is the standard throughout Europe and has recently gain significant traction in the U.S. due the many advantages open access networks offer to subscribers

Risk Assessment

The Town seeks to understand the primary risks of building and operating a municipal fiber optic network and to actively manage those risks during construction and then on an ongoing basis during network operations.

The following is an analysis of the main risk factors facing the Town of Westport if it pursues its fiber-to-the-premise deployment. Eleven risk factors are analyzed:

1. Take-Rate Risk
2. Subscriber Churn Risk
3. Project Execution Risk
4. Equipment and Technology Risk
5. Community Engagement Risk
6. Cost Modeling Risk
7. Timeline Risk
8. Regulatory Risk
9. Middle Mile Risk
10. Pole Attachment & Make-Ready Risk
11. Financing Risk

Take-Rate Risk

Take-rate risk (demand risk) is the risk that the Town builds out the network and ends up with a take-rate that is lower than expected.

Likelihood: Take-rate risk is an important risk factor and is a function of the expected and realized value of the network and how well those values are communicated and managed before, during, and after construction. High take-rates lead to lower network costs for subscribers. This creates a virtuous cycle where lower costs lead to higher take-rates. The reverse is also true.

Impact: Higher take-rates and performance will compound to the benefit of all stakeholders. Negative take-rates lead to higher costs and churn which create a negative spiral that compounds until the network is not sustainable.

Mitigation: To mitigate take-rate risk, demand aggregation must be managed before, during, and after construction and give consumers a realized value that encourages them to voluntarily commit to the network infrastructure.

Subscriber Churn Risk

Subscriber Churn is the risk that customers sign-up and then do not remain subscribers to the network.

Likelihood: Today, customers are primarily motivated by cost, speed, and customer service. Churn is possible and is a consequence of the customers pursuing an option to get better value from an alternative solution. The likelihood of churn is higher if a new service simply replicates the current model.

Impact: The impact of churn on the network can affect the sustainability of the network if it reaches a level where the capital and operational cost of abandoned infrastructure cannot reasonably be shared by remaining subscribers.

Mitigation: The risk of churn goes down under a business model where 1) the customer connection is treated as an improvement to the property, and 2) the expected value is strong enough to make the customer commit to the network.

Project Execution Risk

Project Execution includes strategy, planning, project management and fulfillment of the project plan and operational execution.

Likelihood: Project execution failure is possible and is a function of the effectiveness of project planning, management, controls, and execution.

Impact: The severity of impact is in proportion to the effectiveness of project management and execution. A worst-case scenario is one where project execution reduces the realized value, which in turn affects take-rate and churn.

Mitigation: This risk is reduced by hiring or partnering with skilled project managers and key strategic partners and creating alignment among key team members on the project and operational plans. Further, it is important to develop project controls that are monitored and reported to senior leadership monthly.

Equipment & Technology Risk

Equipment & Technology Risk includes both software and hardware solutions and is the risk that equipment failure rates are higher than expected, major software bugs are unresolved, operational reliability is lower than expected, and/or that the technology lifecycle leads to faster obsolescence than is expected. For a network the size of Westport, an additional risk is scalability risk.

Likelihood: Solutions with short deployment histories, unreliable references, unclear quality assurance and test procedures, weak professional teams, and poorly architected scalability abstractions present increased equipment and technology risk.

Impact: The impact of this risk category is moderate because it is possible to vet both software and hardware systems to assess this risk. The base technology of the network will be fiber optic cable and that has sufficient history to present a minor risk to the project. Remaining risks include electronics and software systems.

Mitigation: Implement thorough due diligence processes with trained professionals to scrutinize references, architecture, software abstractions, quality control systems, and the professional histories of vendors being considered.

Community Engagement Risk

Community Engagement includes the marketing, education, and communication processes and strategies used to inform residents and businesses about the expected value offered by the network.

Likelihood: Community engagement risk is possible but nonetheless a risk that can be managed and monitored. Poor planning, management and execution of community engagement increases the level of risk. Community engagement can be handled by internal Town staff. However, risk increases if staff member resources are inadequate for a project of this size. There is an abundant supply of marketing professionals available to assist with community engagement processes.

Impact: Community engagement is a key driver of project success due to the relationship between community engagement and take-rate.

Mitigation: Leverage the skills of competent marketing professionals and provide sufficient resources to make it easy for every resident to learn the basic values expected from the network in comparison to alternatives through a variety of marketing, education, and communication strategies.

Cost Modeling Risk

Cost Modeling Risk is the risk that financial modeling significantly misstates actual design, construction, and/or operational costs.

Likelihood: There is enough industry data to reasonably validate cost estimates. However, there is significant market volatility currently due to supply chain disruptions and labor supply pressures.

Impact: Cost overruns can have a moderate to meaningful impact on network sustainability.

Mitigation: Risk is reduced by validating financial assumptions against industry assumptions, market conditions, and account for local economic variables.

Timeline Risk

The benefits of building the network in an accelerated pace include the following:

1. Each phase requires legal, financing, and accounting transaction costs. Building the network with fewer phases will lower the overall transaction costs for the project.
2. Building at a faster pace will result in an accelerated time to break-even.
3. An accelerated timeline reduces the potential for unexpected moves in interest rates.

Likelihood: Costs are likely to be higher for an extended buildout period. However, there may be execution risk exposure for accelerating the buildout, depending on the experience and capacity of the construction partner. These trade-offs need to be weighed by Town leaders.

Impact: Costs will be incrementally higher for an extended buildout schedule and maintenance and operations will have a longer ramp to sustainability.

Mitigation: The Town can manage the buildout schedule following a cost / benefit analysis of the options. An important consideration is alignment with construction partners. If the Town is going to outsource construction, it should consult with potential construction partners about the alternative construction schedules to make sure that the Town's strategy is amenable to key construction partners.

Regulatory Risk

Regulatory Risk is the risk that state or federal regulations become an impediment or barrier to the Town successfully building or operating a municipal network. Westport's legal counsel should prepare a separate analysis describing the Town's legal authority to build, own, and operate broadband infrastructure as well as information on the legal structures that are available to cities in the State of Massachusetts to house the operation.

EntryPoint has not sought a legal opinion on this, nor do we have an attorney on staff, but our reading of the state regulation is that the Town of Westport is explicitly allowed to borrow money to establish a telecommunications system, including internet infrastructure, to provide internet services under Municipal Light Plant regulations.

Likelihood: Historically, current operators have taken legal action to stop several municipalities from building a competing network whenever they have a legal basis for doing so. It seems clear that cities and towns in Massachusetts have a legal basis for Westport to build this infrastructure as summarized above and the likelihood of a legal challenge is relatively low.

Impact: If a claim were to be brought against Westport, it could take a meaningful amount of time and cost to contest or appeal the claim – but this is unlikely.

Mitigation: It is important for the Town legal counsel to summarize their findings under Massachusetts law in a legal memo to be included with this plan.

Middle Mile Risk

Middle Mile risks include the following:

1) Lack of redundant options on divergent paths
2) Pricing risk
3) The risk of being stranded or isolated without a viable path to an internet exchange point

Likelihood: Westport will likely have multiple middle mile paths back to an internet exchange point in Boston or Providence.

Impact: Each of the middle mile risks listed above could have a significant impact on network success but all of them have a low likelihood of occurring because of Westport's location.

Mitigation: The Town can mitigate and possibly eliminate middle mile risk by building in redundancy to the network by having multiple backhaul providers or multiple independent paths back to an internet exchange point.

Pole Attachment & Make-Ready Risk

This is the risk that pole owners cause unexpected and significant impact on costs or timeline due to delays in make ready and pole attachment work.

Likelihood: Because Westport does not own the utility poles in its service area, this risk is important. There may be poles that need replacement or repair which will add to the total cost of the project.

Impact: Make-ready work for pole attachments can have a meaningful impact on costs and timeline if the pole owners are non-responsive or want the Town to replace old poles.

Mitigation: The Town can manage the pole attachment process or pursue a buried network – which is more expensive up front but has many long-term maintenance advantages and should be considered.

Financing Risk

This is the risk that financial markets, including interest rates and funding availabilities will change significantly during the implementation of a time-phased buildout process and that this will impact the costs of implementation and ultimately the costs to subscribers.

Likelihood: The probability of this risk is high at the time of the release of this report, in that inflation is at a 40-year high and the Federal Reserve Board has responded to inflation by aggressively increasing interest rates.

Impact: The current impact is measurable, but the future impact is difficult to predict and must be monitored closely. The cost of materials to build a fiber network has gone up 20-30% and construction labor costs have remained high as inflation has increased month over month in 2022. Interest rates are expected to continue to rise, and will have a material impact on project costs, which may translate through to take rate. The dynamic nature of the current environment adds to uncertainty for lending institutions.

Mitigation: Westport will need to monitor the financial environment closely as it advances its planning process. Community engagement and getting accurate projections on take rate will be an important mitigating initiative. Additionally, there may be offsetting factors that provide some counterbalance to rising interest rates and inflation. For example, rising interest rates are likely to cause a significant softening in residential construction, which may translate through to lower labor costs for building a fiber network. The Town will need to be strategic in the timing of advancing a project to construction based on the financial environment at the time that Town is prepared to move a project forward into construction.

Community Engagement

Evaluation & Education

Document the current state of broadband and determine the level of interest among residential users and business owners.

Community Survey

A survey for residents and business owners was conducted to determine the level of interest in a municipal fiber network. Education and promotion programs should be influenced by ongoing survey engagement and response. *Note: The first phase of community surveys has launched in Westport. As outlined above, during the months of July and August 2021, two surveys were conducted of Westport residents and business owners to learn their views on current internet services and future needs and desires.*

Publish Educational Information

Leverage website content specific to the municipal fiber program to outline the core message of broadband as a utility lower cost, increase choice and subscriber control, and foster digital inclusion. Emphasize the viability of Grant or Low-cost Sources of Funding and Potential Incentives for Customers and the efforts and achievements of the Westport authorities in pursuing these sources. Use customized videos to educate online visitors on topics such as: functionality of the community fiber network, options for services, frequently asked questions (FAQ's), and more.

Mapping Community Interest

Distribute an "I am interested" sign-up form with associated heat map where residential and business property owners can register as someone interested in municipal fiber.

Marketing & Promotion

Utilize press releases to promote the municipal fiber network, driving traffic to the fiber website with the goal of educating community members and generating interest and encouraging community participation. Use all available social media platforms (Facebook, Instagram, Twitter, etc.) to promote the fiber network.

Neighborhood Entrance and Yard Signs

As construction (fiber build) begins in a neighborhood, Westport can post signs at neighborhood entrances announcing the construction and letting residents know they can still sign-up to get connected while crews are in the neighborhood.

As homes are connected in the neighborhood, yard signs are placed in the yards of subscribers indicating that the home now enjoys a fiber broadband connection.

Grassroots Engagement

Webinars & Open House Events

Westport can use webinars and open house events to educate residents and business owners about the fiber project, ask questions, become educated about the business model, infrastructure, and costs.

Webinars and open houses are promoted using utility bill inserts, press releases, public service announcements, local news reports, town websites, social media platforms, etc.

Webinars and open house events are intended to educate residents, promote the network, and identify Fiber Champions in the various neighborhoods (fiber zones).

Fiber Champions

Fiber Champions are individuals that demonstrate a voluntary commitment to promoting the network within their neighborhood. Fiber Champions may be incentivized by a practice of building to those neighborhoods that have the highest level of engagement or demand (initial fiber zones are connected in order of take-rates – highest to lowest). Fiber Champions assist sign-up efforts within their designated neighborhood (fiber zone). They organize and lead neighborhood meetings where neighbors can learn about the Westport fiber program. Westport leaders and employees provide support to the Fiber Champions in their efforts. Fiber Champions drive conversations and contractual commitments of neighbors via the Door-to-Door Sales and Education campaign.

Door-to-Door Campaign

Individuals (possibly college students) representing the network contact residents and business operators within the planned footprint to answer questions and ascertain the potential subscribers' interest for participating. [Yes (Opt-in) or No (Opt-out)].

This direct person-to-person contact gives everyone in the community an opportunity to ask questions, clarify understanding, and express a level of interest in participating.

To maximize the effectiveness of this process, door hangers are distributed to every home and business prior to canvassing a neighborhood. These inform property owners that a representative will be stopping by to explain the value proposition, answer questions, and determine the level of interest from potential subscribers.

Door-to-door campaigns are very effective in giving people an opportunity to learn and ask questions in a one-on-one interaction.

It is important to support this effort with public notifications, press releases, mass emails, websites, social media sites, mobile applications, and other community outreach venues. This may include outside professional marketing or PR firms.

Commissions for a door-to-door campaign can be funded by a sign-up fee or wrapped into the infrastructure installation cost.

Community Resources

A townwide broadband project creates an opportunity to collaborate with students and faculty at local universities, community colleges, and even high schools and encourage them to become effective representatives for a Westport network and gain real world marketing and business experience.

SECTION 7

Glossary

Glossary

Industry Terms and Abbreviation

Term	Description	Definition / Narrative
Aerial	Fiber-optic network cables installed on existing utility poles	Aerial fiber deployments are one of the most cost-effective methods of installing fiber cables. Rather trenching and/or boring for underground installations, operators can simply use existing pole infrastructure to deploy the cables.
Asymmetrical	Broadband Download and Upload Speeds are nor the same	An asymmetrical connection does not have equal download/upload speeds. For example, 60/3 means 60 Mbps download and 3 Mbps upload speed.
Bit	Binary Digit	The most basic unit of data in telecommunications and computing. Each bit is represented by either a 1 or a 0 in binary code.
Buried	Fiber-optic network cables installed underground in conduit	Buried fiber deployments, unlike aerial, are protected from weather damage by being buried below the freezing point in the ground.
Microtrenching	Fiber strands in conduit are placed in a 2”-3” wide trench that is usually cut in asphalt roadways.	Microtrenching is a fiber network construction technique that lays the protective conduit that houses the fiber strands below and at the side of a roadway. It requires much less digging and much less disruption than other network building methods.
Digital Divide	Digitally unserved and/or underserved neighborhoods and/or demographic - typically low-income and rural communities	The gulf between those who have ready access to computers and the internet, and those who do not.
DOCSIS	Data Over Cable Service Interface Specification	An international telecommunications standard that permits the addition of high-bandwidth data transfer to an existing cable television (CATV) system.
DSL	Digital Subscriber Line	A technology for the high-speed transmission of digital information over standard phone lines.
Fiber	Fiber-optic	Thin flexible fibers with a glass core through which light signals can be sent with very little loss of strength.
GB or Gig	Gigabit = 1,000,000,000 Bits or 1,000 Megabits	A unit of information equal to one billion (10^9) or, strictly, 2^{30} bits.
Gbps	Gigabits per Second	Billions of bits per second.
GHz	Gigahertz	One billion hertz, especially as a measure of the frequency of radio transmissions or the clock speed of a computer.

Internet Exchange Point	IXPs or IXes or Internet Exchange Hotel	Internet exchange points (IXes or IXPs) are common grounds of IP networking, allowing participant Internet service providers (ISPs) to exchange data destined for their respective networks.
ISP	Internet Service Provider	A company that provides subscribers with access to the internet.
K or KB	Kilobit(s)	A unit of computer memory or data equal to 1,024 (2^{10}) bits.
MB or Meg	Megabit = 1,048,576 Bits	A unit of data size or network speed, equal to one million or 1,048,576 bits.
Mbps	Megabits per Second	Millions of bits per second.
MHz	Megahertz	One million hertz, especially as a measure of the frequency of radio transmissions or the clock speed of a computer.
Middle Mile	Middle Mile Communications Provider	In the broadband Internet industry, the "middle mile" is the segment of a telecommunications network linking a network operator's core network (central office) to the nearest internet aggregation point.
mLAB	Measurement Lab	M-Lab provides the largest collection of open Internet performance data on the planet.
NTIA	National Telecommunications and Information Administration	NTIA is the Executive Branch agency that is principally responsible for advising the President on telecommunications and information policy issues.
PON	Passive Optical Network	A passive optical network, or PON, is designed to allow a single fiber from a service provider the ability to maintain an efficient broadband connection for multiple end users.
Symmetrical	Broadband Download and Upload Speeds are the same	A connection with equal download and upload speeds. For example, with a 500/500 Mbps fiber internet connection you get 500 Mbps of download AND 500 Mbps of upload speeds.
Take-Rate	The Percentage of Subscribers in a given network	A tabulation of broadband penetration rates. The calculation is determined by dividing the number of subscribers by the total number of potential subscribers in a given network footprint.
Tbps	Terabits per Second	Trillions of bits per second.
8K Video	Ultra-High-Definition Video	Television resolutions of 7,680 pixels horizontal x 4,320 pixels vertical.

Open Access Network Terms

Term	Description	Definition / Narrative
Backbone	Shared Fiber Infrastructure from Aggregation Point to Network Operations Center	The Backbone fiber runs from an Aggregation Hut back to the Network Operations Center.
Common	Shared Fiber Infrastructure from Drop to the Closest Aggregation Point	The Common is the shared fiber infrastructure in a neighborhood that runs from a Drop to the closest Aggregation Hut.

Drop	Segment of the Fiber Network from Street into Home or Business	Drop is the fiber that runs from the street to the premise (home or business).
Middle Mile	Shared Fiber Infrastructure from Network Operations Center to Internet Exchange Point	The Middle Mile is usually third-party fiber that runs from the Network Operations Center to the closest Internet Exchange Point. The cost of the Middle Mile is included in the monthly M&O utility fee and is borne by all network subscribers.
Network Operator	Department or Company that Manages the Network Physical Infrastructure	The organization that manages the network physical infrastructure on a day-to-day basis. The network operator may or may not be the owner of the physical network infrastructure.
Service Provider	A Company that offers Services to Consumers on the Network	A company or organization that offers services (ISP and other) over the open access physical network infrastructure.
Subscriber	A Customer/Consumer on the Network	Household or business that participates as a subscriber on the network.

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