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Broadband Planning Study

A regional study of broadband infrastructure in Franklin County and the Town of Livermore Falls in Androscoggin County

Prepared for:

Franklin County Broadband Initiative

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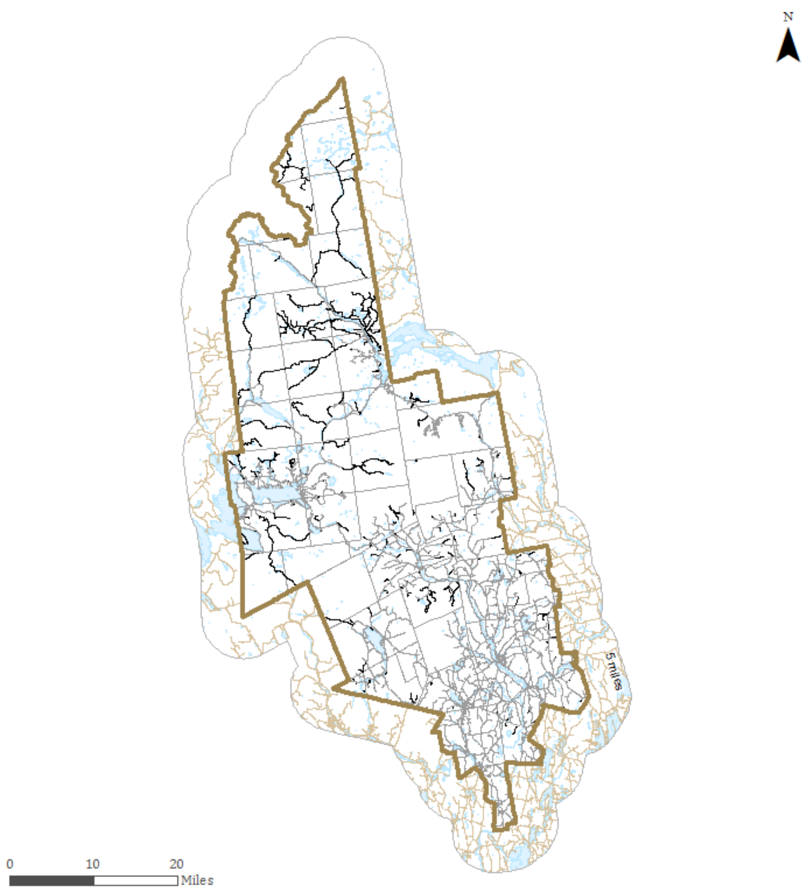

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Acknowledgments and Disclaimer

James W. Sewall Company (Sewall) would like to acknowledge the tireless work of the Franklin County Broadband Initiative team and the participants of the 36 communities within the Study Area who are passionate about the value of expanding broadband. The 100% collaboration and participation of the impacted communities to fund this initiative is a rare demonstration of the value of working together as neighbors to improve their social fabric and economic future.

It is also important to understand this report contains high level costs and projections based on the information readily available and should not be interpreted as providing the level of detail required for investing purposes.

All costs contained in this report are estimates based upon high level desk-top engineering designs, our estimates of construction costs for the various existing providers, and our knowledge of costs for similar types of projects. In order to develop precise costs, a detailed engineering analysis will need to be performed and actual construction costs determined.

All revenue and operating expense projects contained in this report are estimates developed based on our experience and knowledge with similar types of projects. In order to develop precise projections, a business plan will need to be developed based on actual construction costs, a known source of funding will need to be determined and an operating model will need to be chosen.

With the exception of Maine Fiber Company, who supplied detailed route mapping in a GIS format to illustrate the location of their dark fiber network, all other providers declined to provide mapping or data to illustrate the location of their assets. In the absence of the service provider data, we performed a detailed field audit to visually capture and note the location of existing phone company fiber optic cables, remote terminals and central offices. At the same time, we visually captured and noted the location of the hybrid fiber/coax infrastructure of the cable TV companies. We believe the process used to visually capture the presence of infrastructure is 95% accurate.

In the case of DSL infrastructure deployment, visually capturing the location of cables and remote terminals in the field does not provide us with the directional flow of the twisted copper cabling, wire gauge, or condition of the copper pairs. Rather, we have made conservative assumptions as to the reach and speed associated with these types of deployments.

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1.0 Executive Summary

James W. Sewall Company (Sewall) is proud to present this study to the Franklin County Broadband Initiative (FCBI), examining the infrastructure gaps and the level of effort required to bring the power of the Internet to all unserved and underserved areas of Franklin County and the Town of Livermore Falls in Androscoggin County, Maine (Study Area[1]).

The intent of this report is not to analyze Internet usage trends, determine how much bandwidth will be required in the future, or explain why the Internet is important to the Study Area. As a society, we already understand that the Internet is pervasive and integrated into all facets of everyday life, and that we all must have unrestricted access to the Internet in order to participate in the increasingly global economy, especially in the areas of healthcare, education, entertainment, financial services, consumer goods and services, and global commerce. Rather, this report presents a foundational understanding of the different Internet access technologies, the existing broadband infrastructure supporting the community, and the gaps that exist in coverage and/or service capacity. With this baseline in hand, we review and present options to leverage and extend the existing infrastructure that will provide ubiquitous availability and sufficient capability to benefit the current residents, businesses and future generations in an economical and sustainable manner.

The study examined the benefits and costs of leveraging the existing and planned FairPoint Communications (FairPoint) and TDS Telecom (TDS) DSL-based infrastructure and the potential to expand the cable TV infrastructure, and contrasted these options with the costs to deploy a completely new and ubiquitous open-access dark fiber Fiber-to-the-Premise (FTTP) network. We also recognize the solution for the Study Area may not be any one of these individual solutions by itself, but may involve a portion of each, creating a hybrid infrastructure that takes advantage of potential partners and funding wherever it may exist.

Given the extent of existing service coverage and the plans already underway to increase the level of service within the current systems, it does not appear economically feasible for the community to consider overbuilding this

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[1] Appendix C – Map C-1

infrastructure with another competing network. An approach with the potential to increase the overall capacity and capability might be to assist one or several of the operators in extending coverage through short term subsidies that would offset construction costs. With this foundational understanding, we believe the municipalities within the Study Area will be well positioned to begin collaboration and partnership with existing Internet service providers and potential new entrants. We recommend negotiations with all of the providers to develop one or more Public/Private Partnerships to solve the Internet access challenge facing the Study Area.

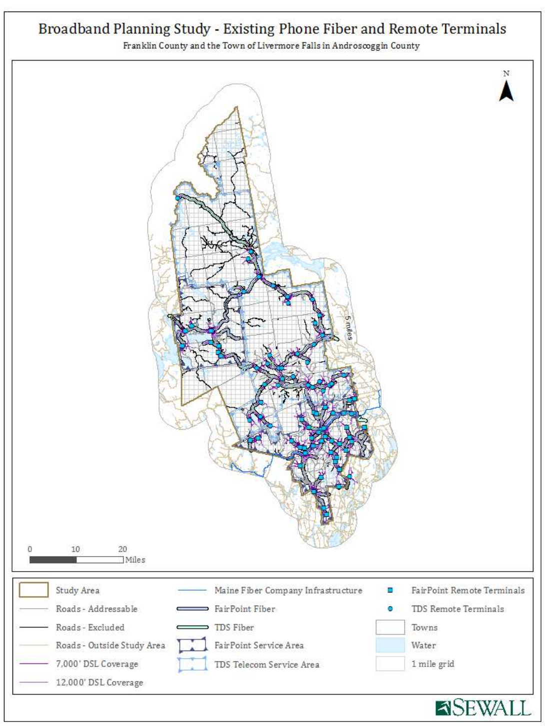
2.0 How to Utilize this Report

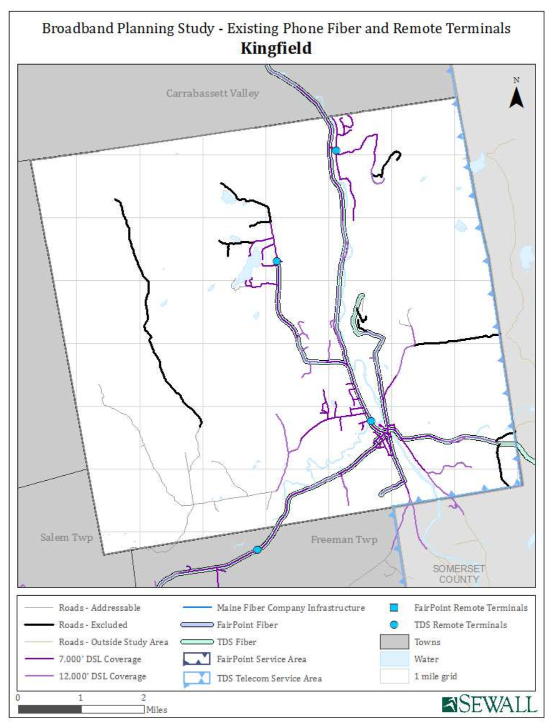
The content of this study is organized such that Sections 1 through 11 and Appendix A and B apply to the Study Area as a whole and are applicable to all individual municipalities in the Study Area. Costs cited in these Sections represent Study Area-wide amounts.

Appendix C contains mapping referenced in Sections 1 through 11 for the entire Study Area and individually for each municipality. An overview for each municipality addressing any unique circumstance, suggested collaborations or other items to be highlighted, as well as municipal specific costs, prefaces the mapping pages for each individual municipality.

- Maps A-C are provided for the entire Study Area only and are not provided for the individual municipalities. Map D is provided for the entire Study Area and only for those municipalities where the Maine Fiber Company (MFC) 3 Ring Binder (3RB) network resides.

- Map numbers referenced in the body of this report are the same for the Study Area and the individual municipalities. See Map 1 examples below.





- Please note that some communities will not have a CAF-II Map 3, an A-CAM Map 4, and/or a Hybrid Fiber/Coax Infrastructure Map 5, because these maps do not apply to their communities.

Appendix D contains a single table illustrating the statistics and costs by municipality and totals for the Study Area.

3.0 Internet Access and Broadband Definition

The terms "Internet access" and "broadband" are often used interchangeably. There is frequently confusion between the two, especially as the definitions evolve with technology changes.

Internet access connects individual computer terminals, computers, mobile devices, and computer networks to the Internet, enabling users to access Internet services such as email, applications and information delivered via the World Wide Web. Internet service providers (ISPs) offer Internet access through various technologies that offer a wide range of data signaling rates (speeds).

Consumer use of the Internet first became popular through dial-up Internet access in the 1990s. By the first decade of the 21st century, many consumers in developed nations used faster, broadband Internet access technologies.

Broadband is a generic term representing any wide-bandwidth data transmission method with the ability to transport multiple signals and traffic types simultaneously. This data can be transmitted using coaxial cable, optical fiber, radio or twisted pair copper. In the context of Internet access, broadband is used much more loosely to mean any high-speed Internet access that is always on and faster than traditional dial-up access. Different governing authorities have developed inconsistent definitions of what constitutes broadband service based on access speed.

In January 2015, the Federal Communications Commission (FCC) voted to define broadband as at least 25 Mbps (megabits per second) download and 3 Mbps upload. Their definition affects policy decisions and the FCC's annual assessment of whether broadband is being deployed to all Americans quickly enough.

In Maine, the ConnectME Authority Board[2] currently defines effective broadband network capacity as 10 Mbps download and 10 Mbps upload. Areas of Maine that have maximum available broadband speeds of at least 10 Mbps/10 Mbps are considered served. Areas with available broadband speeds that are lower than 1.5 Mbps download are considered unserved. Areas where the maximum available service is between 1.5 Mbps and 10 Mbps download are considered by the Authority as underserved.

For those rural and high-cost areas served by FairPoint where FairPoint has accepted subsidies through the Connect America Fund – Phase II (CAF-II), the FCC has adopted a minimum speed standard of 10 Mbps downstream and 1 Mbps upstream (10/1 Mbps).

Similar to FairPoint, where TDS has accepted subsidies through the Connect America Fund – Alternative Cost Model (A-CAM), the FCC has adopted a minimum speed standard of 25 Mbps downstream and 3 Mbps upstream (25/3 Mbps).

The municipalities within this study area may elect to pursue access options based on one of these established standards or define its own standard depending upon the serving technology architecture it wishes to pursue, the costs for deployment and funding strategies.

[2] In recognition of the critical importance of modern technology for education, health care, and business success in Maine, the Legislature created the ConnectME Authority (Authority) in 2006 as an independent State agency to develop and implement broadband strategy for Maine. The Authority is governed by a Board which is comprised of members appointed by the Governor or specifically identified and designated by statute.

4.0 Internet Access Technology Overview

In this section, we present an overview of different Internet access technology, including digital subscriber line, cable modem, fixed wireless, 4G/LTE Advanced, satellite, and Fiber-to-the-Premise.

4.1 DSL

Digital subscriber line (DSL) is a technology used by traditional telephone system operators such as FairPoint and TDS to deliver advanced services (high-speed data and potentially video) over twisted pair copper telephone wires. This technology typically has lower data carrying capacity than the hybrid fiber coaxial network deployed by cable system operators like Charter Communications (Spectrum) and Bee Line Cable (Beeline). Data speeds are range-limited by the length of the copper cable serving the premise, the wire gauge of the copper conductors and the condition of the copper.

Until recently, the most commonly installed DSL technology for Internet access has been asymmetric digital subscriber line (ADSL). DSL service can be delivered simultaneously with wired telephone service on the same telephone line. This is possible because DSL uses higher frequency bands for data transmission than are required for the voice service transmission. On the customer premises, a DSL filter on each non-DSL outlet blocks any high-frequency interference to enable simultaneous use of the voice and DSL services.

The bit rate of consumer DSL services can range from 256 Kbps (kilobits per second) to over 100 Mbps in the direction of the service provider to the customer (downstream), depending on the DSL technology, line conditions, and the length of the copper loop. With ADSL, the data throughput in the upstream direction (the direction from the consumer to the service provider) is lower, hence the designation of *asymmetric* service.

At the central office, a digital subscriber line access multiplexer (DSLAM) terminates the DSL circuits and aggregates them, where they are handed off to other networking transport equipment. The DSLAM terminates all connections and recovers the original digital information. For locations beyond the maximum distance from the central office for the particular type of DSL technology deployed

(7,000 – 12,000 feet), DSLAMs can be deployed in the field in outside plant cabinets (remote terminals) and connected to the central office by fiber optic cables. A shorter distance from the premise to the DSLAM results in greater bandwidth (speed and/or capacity) for the connected users.

The customer end of the connection consists of a terminal adaptor or "DSL modem." This converts data between the digital signals used by computers and the voltage signal of a suitable frequency range which is then applied to the phone line.

There are additional formats of DSL technologies that can enhance the capacity of the network. ADSL2+ extends the capability of basic ADSL by doubling the number of downstream channels, increasing the frequency from 1.1 Mhz to 2.2 Mhz. The data rates can be as high as 24 Mbps downstream and up to 1.4 Mbps upstream, depending on the distance from the DSLAM to the customers' premises. Like the previous standards, ADSL2+ will degrade from its peak bit rate after a certain distance.

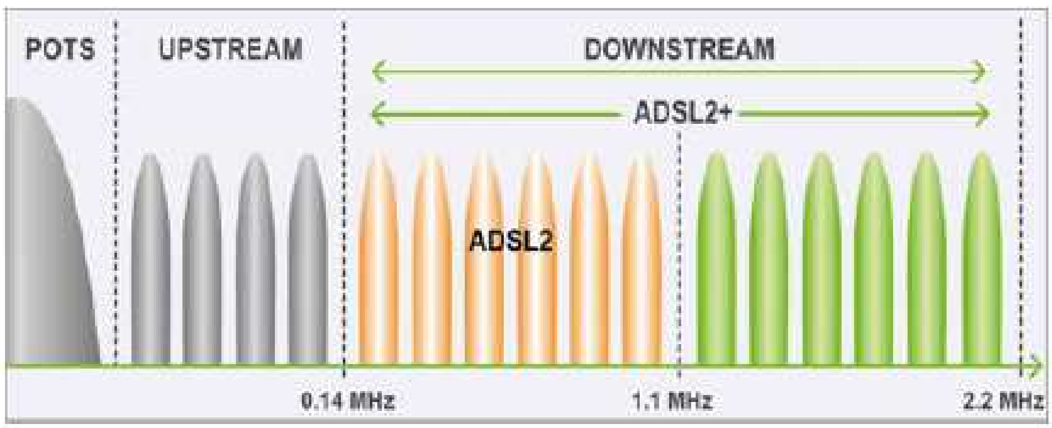


Figure 1: ADSL2+ Frequency Utilization

ADSL2+ allows port bonding, where multiple ports are physically provisioned to the end user and the total bandwidth is equal to the sum of all provisioned ports. When two lines capable of 24 Mbps are bonded, the end result is a connection capable of 48 Mbps download and twice the original upload speed.

Very-high-bit-rate digital subscriber line 2 (VDSL2) permits the transmission of asymmetric and symmetric aggregate data rates up to 200 Mbps downstream and upstream on twisted pairs using a bandwidth up to 30 Mhz. It deteriorates quickly from a theoretical maximum of 250 Mbps at the source to 100 Mbps at 1,600 feet and 50 Mbps at 3,300 feet, but degrades at a much slower rate from there. Starting from one mile, its performance is similar to ADSL2+. Bonding may be used to combine multiple wire pairs to increase available capacity, or extend the copper network's reach.

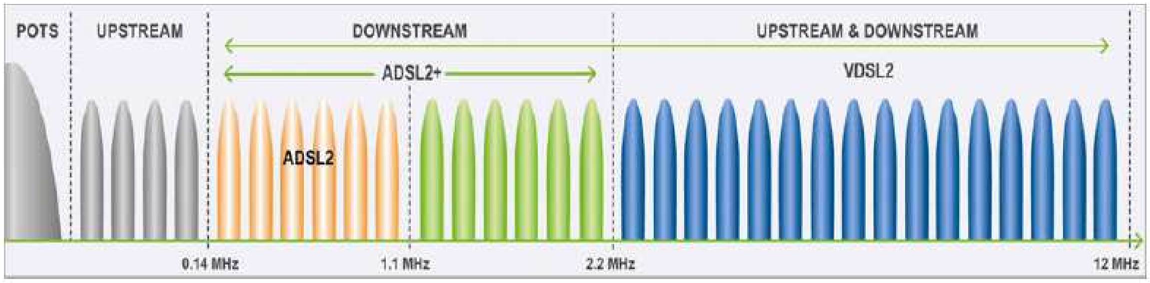


Figure 2: VDSL2 Frequency Utilization

Both FairPoint and TDS have begun deploying VDSL2 in support of the FCC CAF-II and A-CAM programs that are discussed later in this report.

4.2 CABLE MODEM

Cable modem Internet access is provided over a hybrid fiber-coaxial (HFC) broadband network. It has been employed globally by cable television operators since the early 1990s, and is the network architecture utilized by Spectrum and Beeline to provide service within the study area. In a HFC cable system, the television channels are sent from the cable system's distribution facility, the headend, to local communities through optical fiber trunk lines. The fiber-optic trunk lines provide adequate bandwidth to allow future expansion for bandwidth-intensive services. At the local community, an optical node translates the signal from a light beam to an electrical signal, and sends it over coaxial cable lines for distribution to subscriber residences.

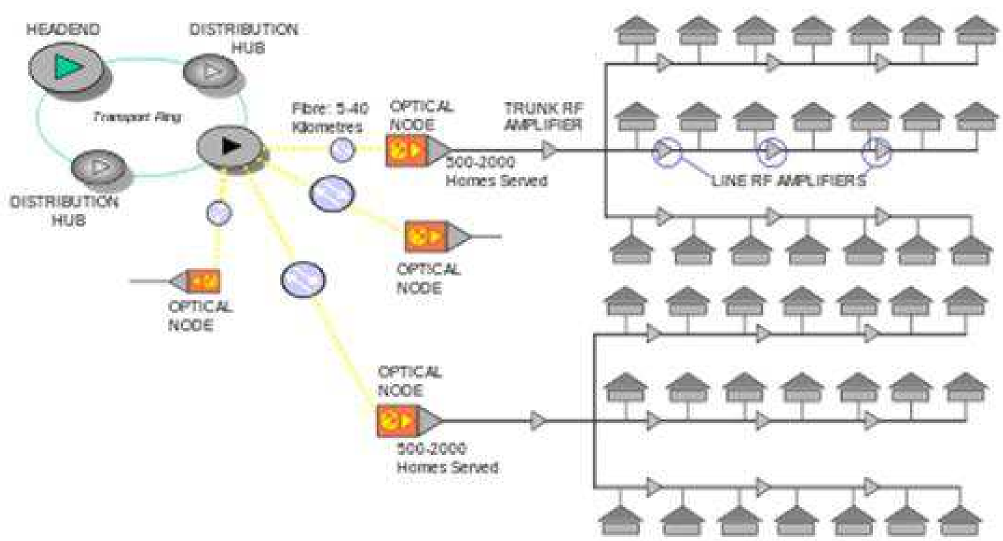


Figure 3: Hybrid Fiber/Coax Network Architecture Diagram

The coaxial portion of the network connects 25–2,000 homes in a tree-and-branch configuration off the node. RF amplifiers are used at intervals to overcome cable attenuation and passive losses of the electrical signals caused by splitting or "tapping" the coaxial cable.

The HFC broadband network is typically operated bi-directionally, meaning that signals are carried in both directions on the same network from the headend/hub office to the home, and from the home to the headend/hub office. The forward-path or downstream signals carry information such as video content, voice and data. The return-path or upstream signals carry information such as video control signals to order a movie or Internet data to send an email. The forward-path and the return-path are carried over the same coaxial cable in both directions between the optical node and the home.

Data Over Cable Service Interface Specification (DOCSIS) is an international telecommunications standard that permits the addition of high-bandwidth data transfer to an existing cable TV (CATV) system. DOCSIS 3.1 has been deployed by Spectrum and will soon be deployed by BeeLine to provide Internet access over their existing HFC infrastructure. The DOCSIS 3.1 standard is capable of supporting Internet speeds of up to 10 Gbps (gigabits per second), but most providers are currently offering speeds of less than 1 Gbps service for residential users.

4.3 FIXED WIRELESS

Fixed wireless broadband is the operation of wireless devices or systems used to connect two fixed locations (e.g., building to building or tower to building) with a radio or other wireless link. Fixed wireless data (FWD) links are often a cost-effective alternative to leasing fiber or installing cables between the buildings. The point-to-point signal transmissions occur through the air over a terrestrial microwave platform. The advantages of fixed wireless include the ability to connect with users in remote areas without the need for laying new cables and the capacity for broad bandwidth that is not impeded by fiber or cable capacities. Fixed wireless services typically use a directional radio antenna on each end of the signal. These antennas are generally larger than those seen in Wi-Fi setups and are designed for outdoor use. They are typically designed to be used in the unlicensed Industrial, Scientific, and Medical (ISM) radio frequency bands (900 MHz, 1.8 GHz, 2.4 GHz and 5 GHz). However, in many commercial installations licensed frequencies may be used to ensure quality of service (QoS) or to provide higher connection speeds.

To receive this type of Internet connection, consumers mount a small dish to the roof of their home or office and point it to the transmitter. Line-of-sight is usually necessary for Wireless Internet Service Providers (WISPs) operating in the 2.4 and 5 GHz bands. The 900 MHz band offers better non-line-of-sight (NLOS) performance. Providers of unlicensed fixed wireless broadband services typically provide equipment to customers and install a small antenna or dish somewhere on the roof. This equipment is usually deployed and maintained by the company providing that service.

4.4 4G/LTE ADVANCED BROADBAND

4G/LTE Advanced is the latest wireless technology being deployed by cellular telephone providers such as AT&T, Verizon Wireless, US Cellular, Sprint and T-Mobile for traditional mobile phone and data services. The latest standard incorporates two new technologies - Carrier Aggregation, and Multiple Input Multiple Output (MIMO), in order to provide speeds in excess of 100 Mbps, and eventually up to 1 Gbps and beyond. While standard data connections use one antenna and one signal at any given time, 4G LTE Advanced has the capability of utilizing multiple signals and multiple antennas.

Mobile LTE wireless service uses MIMO technology to combine multiple antennas on both the transmitter and the receiver. A 2×2 MIMO configuration has two antennas on the transmitter and two on the receiver, but the technology is not limited to 2x2. More antennas could theoretically operate at faster speeds as the data streams can travel more efficiently. The signal is then combined with “carrier aggregation,” which allows a device to receive multiple different 4G signals at once. The received signals don’t have to be on the same frequency; you could receive an 1800 MHz and an 800 MHz signal at the same time, which is not possible with standard 4G. Up to five different 20 MHz signals can be combined to create a data pipe of up to 100 MHz of bandwidth.

LTE wireless is a rapidly evolving technology and the next generation (5G) is already being field tested and deployed. The term “5G” is the fifth generation of wireless systems and expected to provide significant increases in bandwidth.

4.5 SATELLITE

Satellite Internet is available to virtually the entire lower 48 states, with some coverage in Alaska, Hawaii and Puerto Rico. The satellites are positioned more than 22,000 miles above the equator. These satellites are geostationary, which means they are always above a specific point on the earth as it rotates. The first Internet satellites successfully brought the Internet to a larger audience, but the rates were incredibly slow. Modern satellites use more advanced technology to transmit information which provides faster Internet access, but still much slower than landline-based Internet and terrestrial wireless Internet services.

When a consumer subscribes to satellite Internet, the company installs household equipment, which consists of an antenna dish and a modem. The antenna is located outside of the house and is generally two or three feet in diameter. The antenna must have an unobstructed view of the sky, called the line-of-sight, in order to communicate with the satellite. The antenna is connected to a modem, which connects to a computer with an Ethernet cable.

To manage bandwidth quality for all users, each plan comes with a cap on the data you can transmit or consume per month. The amount of data allotted depends on the subscriber’s plan. Plans typically range from 5 GB to 50 GB of data transmission per month with use limits prescribed. If you exceed the allotted data amount, Internet speeds will be throttled back until the next month. However, some companies allow subscribers to pay for more data capacity once the threshold is met, resetting normal operation levels.

Looking forward, a new company – OneWeb (shareholders include Qualcomm, Hughes, Intelsat, Coca-Cola, Airbus Group, the Virgin Group and SoftBank Group) is shooting for 2021 to achieve 2.5 Gbps direct to a rural home. The company received permission from the FCC in June to deploy a global network of 720 low-Earth orbit satellites using the Ka (20/30 GHz) and Ku (11/14 GHz) frequency bands. Earlier this year, the company broke new ground for a satellite manufacturing facility in Exploration Park, Florida, that will be capable of producing 15 satellites per week.

OneWeb is the first of several entities that filed for FCC authority to deploy a large constellation of non-geostationary-satellite orbit (NGSO) fixed satellite system satellites. According to the Satellite Industry Association, the FCC received more than 15 NGSO applications in three processing rounds for system constellations in the Ku and Ka bands and V band. SpaceX and Boeing are among those proposing new, huge constellations.

Satellite industry proponents say that now, unlike decades ago when Teledesic and the earlier iteration of Iridium failed to make successful businesses, technology advancements are enabling satellite service to be offered more affordably and efficiently.

4.6 FIBER-TO-THE-PREMISE (FTTP)

Fiber-to-the-Premise (FTTP) is a network utilizing fiber optic cables directly to the home or business and is capable of offering virtually unlimited symmetrical bandwidth. Most FTTP networks can offer 1 Gbps of bandwidth in both download and upload directions, with some providers offering 2 Gbps and even 10 Gbps service capacity.

5.0 Existing Broadband Assets – Documentation and Mapping

Work on the study began by establishing the extent and capacity of coverage already deployed within each community. This foundational information is required to properly assess the technical options and cost comparisons for Study Area broadband solutions.

First, we contacted all service providers who serve the Study Area to determine which service providers have deployed physical outside plant infrastructure. The Study Area is currently physically served in part by FairPoint, TDS, Spectrum, Beeline and Maine Fiber Company (MFC). See Appendix C, Study Area Maps B, C, and D, for maps of the service areas for each provider.

With the exception of MFC, who supplied detailed route mapping in a GIS format to illustrate the location of their dark fiber network, all other providers declined to provide mapping or data to illustrate the location of their assets. In the absence of the service provider data, we performed a detailed field audit to visually capture and note the location of the phone company fiber optic cables, remote terminals and central offices. At the same time, we visually captured and noted the location of the hybrid fiber/coax infrastructure of the cable TV companies.

Back in the Sewall offices, this data was meticulously inputted into a geodatabase that provides the ability to visualize and analyze the location of the assets spatially, project service availability by road segment and identify the gaps in coverage.

Since the majority of this infrastructure is attached aerially to the utility poles in the public right-of-way, we are confident we have captured the majority of these assets, but allow that we may have missed up to 5% of these facilities. Improving the accuracy is only possible with the full cooperation of the service providers or spending more time in the field than our schedule/budget permitted.

In the case of DSL infrastructure deployment, visually capturing the location of cables and remote terminals in the field does not provide us with the directional flow of the twisted copper cabling, wire gauge or condition of the copper pairs. Rather, we have made conservative assumptions as to the reach and speed associated with these types of deployments.

5.1 FAIRPOINT COMMUNICATIONS

FairPoint offers residential and commercial broadband utilizing DSL technology via their ubiquitous twisted pair copper network, which is currently limited to customer locations within approximately 18,000 feet from their central offices or remote terminals. Customer locations closer than 7,000 feet from their central office or remote terminals should receive service of a minimum 25 Mbps download/3 Mbps upload. Locations between 7,000 feet and 12,000 feet should receive service of a minimum 10 Mbps download/1 Mbps upload. In these configurations, we are assuming the deployment of ADSL2+. See Map 1.

FairPoint also offers commercial broadband services via their fiber network as illustrated on Map 2. Commercial broadband services are available up to 10 Gbps on their fiber optic network.

FairPoint agreed to accept Connect America Fund – Phase II (CAF-II) funding from the FCC to deploy broadband services to many of their currently high cost unserved areas of the Study Area at a minimum 10 Mbps/1 Mbps speeds with a commitment to deploy those services by the end of year 2020. (See Section 6.0 for a more detailed discussion of the CAF-II program and Map 3).

5.2 TDS TELECOM

TDS offers the same capabilities as FairPoint within their defined service territory (Map 1). This includes commercial broadband services via their fiber network as illustrated on Map 2.

Similar to FairPoint, TDS agreed to accept Connect America Fund – Alternative Cost Model (A-CAM) funding from the FCC to deploy broadband services to many of their currently high-cost unserved areas of the Study Area at a minimum 25 Mbps/3 Mbps speeds with a commitment to deploy those services by the end of year 2027, although TDS hopes to complete many of these projects earlier than the deadline (See Section 6.0 for a more detailed discussion of the A-CAM program and Map 4).

5.3 SPECTRUM CABLE

Spectrum offers broadband service to locations adjacent to their hybrid fiber/coax network in the municipalities of Avon, Carrabassett, Coplin Plantation, Eustis, Jay, Kingfield, Livermore Falls, New Vineyard, Phillips, Strong and Wyman (see Map 5). Service is currently available with speeds starting at 100 Mbps/10 Mbps. For commercial customers, TWC is able to offer up to 10 Gbps through their Business Class service.

In eight communities outside of Maine, serving more than 8.8 million consumers, Spectrum has launched Gigabit capable services and increased the minimum speeds in those markets to 200 Mbps download at no additional cost. The press release goes on to explain that this same capability will be launched in additional Spectrum communities in 2018.[3]

5.4 BEELINE CABLE

BeeLine offers broadband service to locations adjacent to their hybrid fiber/coax network in the municipalities of Farmington, Industry and Wilton (see Map 5). Service is currently available with speeds up to 35 Mbps/5 Mbps. BeeLine is currently in the process of upgrading their network and plans to match or exceed the broadband speeds provided by Spectrum by the end of year 2018.

5.5 MAINE FIBER COMPANY

Maine Fiber Company (MFC) is an open-access dark-fiber leasing company supporting all telecom carriers and service providers. The Company was originally formed in 2010 to oversee the construction, maintenance, leasing and operations of a 1,100-mile, high-capacity fiber optic network in the State of Maine. The MFC network enters the Study Area following Route 43 through Industry and into Farmington, connecting to Route 2 on to Wilton and exits the Study Area headed toward Oxford. (See Map D.) The network is built through a combination of federal grants and private investment.

Also known as the ´Three Ring Binder," the network is a true "dark fiber" asset and provides the optical transmission medium for telecom carriers to provide service to their customers. The MFC network is available to all qualified users on an equal basis and includes national and international telecommunications carriers, local service providers, wireless providers, ISPs and business or public sector entities with a high demand for data transmission. In accordance with the initial federal grant application, a portion of the network has been reserved for use by the University of Maine System and the State of Maine. The network is expected to have sufficient capacity to meet customer needs for the foreseeable future.

5.6 OTHER SERVICE PROVIDERS

Other service providers are providing services within the Study Area by leasing capacity from those providers discussed above.

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[3] Press Release – Spectrum Launches Spectrum Internet Gig in Seven Additional Markets, December 20, 2017.

6.0 FCC - Connect America Fund

6.1 CONNECT AMERICA FUND — PHASE II — FAIRPOINT INVESTMENT

On August 18, 2015, FairPoint announced it had accepted $13.3 million in annual support from the Federal Communications Commission's (FCC) Phase II of the Connect America Fund (CAF-II) for the State of Maine. By accepting these funds, the Company is committing to constructing and operating network infrastructure that offers broadband service speeds of at least 10 Mbps download and 1 Mbps upload to approximately 35,500 additional Maine households, extending their existing network to new rural locations in Maine. The support program and the FairPoint commitment will be executed over six years beginning in 2015.

The FCC developed CAF-II as a part of its mandate to shift federal support focus from voice service in high-cost service areas to broadband build out and operation in high-cost service areas. It is important to note that these funds are for build out and *operation* in high cost areas. This means that not all of the funds are necessarily intended to be used for deploying the equipment and fiber necessary to provide the 10 Mbps/1 Mbps service. Rather, it is intended that some portion of those funds would be devoted to operating the network in the high-cost areas being deployed. CAF-II will accelerate the FCC's mandate by explicitly supporting the development and operation of broadband in high-cost service areas. Qualifying locations eligible for service as a part of the six-year build have been predetermined by the FCC. The CAF-II funding available for the Study Area is intended to provide service to 2,429 currently unserved locations. See CAF-II Funding – Map 3.

We understand that FairPoint began deploying ADSL2+ technology to provide the service by installing remote terminals within these currently unserved geographic areas, but began deploying the more capable VDSL2 technology in the second half of 2017. Connection speeds are expected to be a minimum of 10 Mbps down and 1 Mbps up for customer locations the furthest away from these remote terminals. Locations closer to the remote terminals will realize speeds in excess of 10 Mbps/1 Mbps with potential speeds of more than 100 Mbps, depending upon the distance from the remote terminal and the condition of the existing twisted pair copper cabling (see the general discussion of DSL technology in Section 4.1).

It is important to understand that FairPoint is not required to spend the entire CAF-II subsidy for network enhancement in the Study Area to meet the service commitment criteria. Rather, they simply need to meet the service commitment regardless of how much or how little they spend on deployment. Monies not needed for construction or other system upgrades can be applied to operation and maintenance costs or to other indirect items. That said, they do have performance commitments they must demonstrate to the FCC.

As part of the CAF-II program, FairPoint will need to demonstrate they are meeting the following performance requirements:

- A minimum usage allowance of 100 Gbps per month at or above the usage level for 80 percent of all of its broadband subscribers, including those subscribers that live outside CAF-II funded areas.

- Maximum 100 milliseconds (ms) latency. To show that FairPoint is meeting this standard, they will need to certify that 95 percent or more of peak period measurements (also referred to as observations) of network round trip latency are at or below 100 ms. FairPoint will have two options to satisfy this requirement.

    - Option #1 – Measurements will be taken during peak period (defined as weeknights between 7:00 PM and 11:00 PM local time) between customer premises and the closest designated Internet core peering interconnection point (often referred to as an Internet Exchange Point – IXP). The measurements must be conducted over a minimum of two consecutive weeks during peak hours for at least 50 randomly-selected customer locations within the census blocks for the State of Maine, using existing network management systems, ping tests, or other commonly available network measurement tools.

    - Option #2 – For providers participating in the FCC's Measuring Broadband America program (MBA)[4], they may use the results from

[4] The FCC's Measuring Broadband America program is built on principles of openness and transparency. The FCC has made available to stakeholders and the general public the open source software used on both its fixed and mobile applications, the data collected, and detailed information regarding the FCC's technical methodology for analyzing the collected data. The measurement methodology for the Measuring Broadband America program has been developed in collaboration with SamKnows, the FCC's contractor supporting the Measuring Broadband America program, which performs similar projects for other countries around the world. Over the course of the multi-year program, the FCC has released the comprehensive measurement methodology used to collect the data and produce reports, and in addition to the various data sets, the actual software source code that was used for the

that testing to support certification that they meet the latency requirements. To use MBA results, FairPoint will need to deploy at least 50 white boxes to customers within the CAF-II funded areas within Maine. Because white boxes take measurements on a continuous basis, FairPoint would prove compliance with the latency limit by certifying that 95 percent or more of the measurements taken during peak periods for a period of two weeks were at or below 100 ms.

6.2 ALTERNATIVE CONNECT AMERICA COST MODEL – TDS TELECOM INVESTMENT

On February 17, 2017, TDS announced the Federal Communications Commission's (FCC) Alternative Connect America Cost Model (A-CAM) for the State of Maine. The FCC allocated to TDS $3.5 million a year for the next ten years to reach residents in some of the hardest to serve areas in the State. The funding will also be used to maintain existing voice and broadband network as well as build outs to new locations.

It is important to understand that like FairPoint under the CAF-II program, TDS is not required to spend the entire A-CAM subsidy for network enhancement in the Study Area to meet the service commitment criteria. Rather, they simply need to meet the service commitment regardless of how much or how little they spend on deployment. Monies not needed for construction or other system upgrades can be applied to operation and maintenance costs or to other indirect items. That said, they do have performance commitments they must demonstrate to the FCC.

As part of the A-CAM program, TDS will need to demonstrate they are meeting the following performance requirements:

- A minimum usage allowance of 150 Gbps per month at or above the usage level for 80 percent of all of its broadband subscribers, including those subscribers that live outside of A-CAM funded areas.

- Maximum 100 ms latency. To show that TDS is meeting this standard, they will need to certify that 95 percent or more of peak period measurements (also referred to as observations) of network round trip latency are at or below 100 ms.

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testing has been made available for academic and other researchers for non-commercial purposes by SamKnows. The goal of SamKnows is to help create a standard methodology for measuring Internet performance globally, and in pursuit of this goal, SamKnows is now making the source code of the actual tests available as open source under a GNU General Public License.

Depending on location, most TDS customers in eligible rural areas will receive guaranteed broadband speeds of 25 Mbps download and 3 Mbps upload (25/3). Under the agreement with the FCC, the remaining customers will receive broadband service at lower speeds of 10/1 and 4/1 Mbps. At this point, TDS has not identified what portions of the Study Area will receive which level of capability. The A-CAM funding available for the Study Area is intended to provide service to 1,600 currently unserved locations. See Map 4 for A-CAM funding areas.

7.0 Infrastructure Gap Analysis

Based on the information collected and incorporated into the GIS database described in Section 5.0 above, we have defined the geographic areas that do not meet the respective service levels as:

- Areas with service less than 1 Gbps/1 Gbps
- Areas with service less than 10 Mbps/10 Mbps
- Areas with service less than 25 Mbps/3 Mbps
- Areas with service less than 10 Mbps/1 Mbps

7.1 SERVICE AREAS LESS THAN 1 GBPS/1 GBPS

Symmetrical gigabit services can be provided by a Fiber-to-the-Premise (FTTP) network or by a fully upgraded cable TV system (hybrid fiber/coax) operating with the DOCSIS 3.1 standard. Within the Study Area, no cable operator is currently operating a ubiquitous symmetrical gigabit network. As such, we have defined this area as any area with access to commercial electrical service and roadways serving 911 addresses, as defined by the State of Maine 911 system. Roadways without 911 addresses have been excluded. Essentially, this gap area is equal to the entire Study Area where any potential subscriber resides that has commercial power available.

Map 6 illustrates those roadways included in the 1 Gbps/1 Gbps gap area.

7.2 SERVICE AREAS LESS THAN 10 MBPS/10 MBPS

The current ConnectME Authority infrastructure grant program requires deployment of service with a minimum 10 Mbps download and a minimum 10 Mbps upload speed. The practical reality of this specification limits the deployment technology to either FTTP or hybrid fiber/coax architectures. Given that Spectrum currently offers a 100 Mbps/10 Mbps service and BeeLine has announced they will be offering service equal to or greater than that which is currently offered by Spectrum, we have defined this gap area as identical to the 1 Gbps/1 Gbps service area, excluding those areas currently served by a cable TV system.

Map 7 illustrates those roadways included in the 10 Mbps/10 Mbps gap area.

7.3 SERVICE AREAS LESS THAN 25 MBPS/3 MBPS

This gap area is defined as any areas not currently served by a cable TV system and areas greater than 7,000 feet along roadways from an existing phone company remote terminal. This assumes that the phone companies are deploying a bonded ADSL2+ or VDSL2 solution from each remote terminal or central office.

Since the phone companies have not shared their final plans to implement CAF-II or A-CAM, some potential subscribers within this gap area may be able to enjoy this level of service as these programs are completed, which may ultimately cause this gap area to be overstated.

Map 8 illustrates those roadways included in the 25 Mbps/3 Mbps gap area.

7.4 SERVICE AREAS LESS THAN 10 MBPS/1 MBPS

This gap area is defined as any areas not currently served by a cable TV system and areas greater than 12,000 feet along roadways from an existing phone company remote terminal. This assumes that the phone companies are deploying a bonded ADSL2+ or VDSL2 solution from each remote terminal or central office.

Since the phone companies have not shared their final plans to implement CAF-II or A-CAM, some potential subscribers within this gap area may be able to enjoy this level of service as these programs are completed, which may ultimately cause this gap area to be overstated.

Map 9 illustrates those roadways included in the 10 Mbps/1 Mbps gap area.

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8.0 Network Design Options to Close Identified Gaps and Their Costs

This section will suggest options to address the Study Area's broadband needs and goals, including capabilities and high level cost estimates. We recognize there is no "one size fits all" solution, and as such, we provide multiple solutions.

8.1 LEVERAGE FCC CONNECT AMERICA FUND INVESTMENTS

As noted previously, FairPoint and TDS have accepted funding from the FCC Connect America Fund to deploy DSL based broadband solutions to the majority of the "high-cost" census blocks within the Study Area, but have not shared their final deployment plans to allow us to identify those potential subscribers who will not benefit from this program. Therefore, Sewall's network design options build on the assets that exist today as identified and discussed in Section 5.0 of this report.

Our first design provides a minimum 10 Mbps/1 Mbps service to all potential subscribers and assumes the deployment of new fiber-fed VDSL2 enabled remote terminals within 12,000 roadway feet of all existing 911 addresses. See Map 10. While we do not necessarily recommend deployment of such a low speed service, it is important to the overall analysis to understand the costs of such a deployment in comparison to the costs for higher speed solutions.

Our second design provides a minimum 25 Mbps/3 Mbps service to all potential subscribers and assumes the deployment of new fiber-fed VDSL2 enabled remote terminals within 7,000 roadway feet of all existing 911 addresses. See Map 11. Total costs for these two solutions are itemized in the table below for the entire Study Area.

Table 1: DSL Expansion Costs

	10 Mbps/1 Mbps	25 Mbps/3 Mbps
New Miles of Fiber	74	182
New Remote Terminals	93	270
Total Cost	**$4,167,973**	**$11,305,524**
Potential Subscribers	2,925	4,931
Cost per Potential Subscriber	**$1,425**	**$2,293**

8.2 LEVERAGE AND EXTEND EXISTING CABLE TV INFRASTRUCTURE

We believe expansion of the Spectrum and/or BeeLine systems to all currently unserved areas is a potential solution with benefits to the Study Area above and beyond what can be provided by FairPoint and TDS with a DSL solution. Those benefits would be greater bandwidth speeds (100 Mbps/10 Mbps for residential services) and a cable TV package not currently offered by FairPoint and TDS.

The expanded cable solution will require the construction of approximately 900 miles of network to reach all corners of the Study Area. Given that there is little difference in the cost of deploying fiber versus deploying hybrid fiber/coax, the cable companies could potentially deploy a FTTP expansion. See Map 7.

An additional benefit to this solution would be the opportunity to assess a franchise fee for the cable TV service that could be utilized by the municipalities to offset the cost to the municipalities for their portion of any public/private partnership with the cable companies to expand their service[5].

Total estimated cost for this solution is itemized in the table below for the entire Study Area.

Table 2: Hybrid Fiber/Coax Expansion Costs

	100 Mbps/10 Mbps
Total Cost	**$34,438,469**
Potential Subscribers	8,351
Cost per Potential Subscriber	**$4,124**

8.3 DEPLOY COUNTY-WIDE OR MUNICIPAL FIBER-TO-THE-PREMISE OPEN-ACCESS DARK FIBER NEWORK

The final option we explore is a ubiquitous Fiber-to-the-Premise (FTTP) network to every home and business within the Study Area to compete with the existing phone, cable and wireless providers, and owned by the county, municipality or public/private partnership. This would be an “open access dark fiber” network that would be available for lease on an individual premise basis to any Internet provider seeking to provide service. The fiber would be “dark,” meaning that no optical electronics would be included and the service provider would be responsible for providing the optical electronics required for each customer premise. See Map 6.

The benefits of this type of network are:

[5] Note that the requirement for a franchise agreement is only related to the provision of cable TV service and franchise fees can only be assessed on cable TV video services. Franchise fees and franchise agreements are not applicable to telephone or broadband services.

- Maximum potential for competing service providers
- The existing phone and cable companies could theoretically utilize the network
- Potentially unlimited symmetrical bandwidth
- No municipally owned electronics to become obsolete or requiring repair

Our high level estimate for the cost to construct an open access dark fiber FTTP network along 1,363 miles of roadway, including utility pole make ready expenses, materials, construction labor, taxes, engineering, project management and project contingency, is approximately $69,872,775. Our conservative estimate for annual operating expenses, including annual pole rental, insurance, maintenance and administration, with no debt service, is approximately $2,032,390 per year. Our revenue estimate, based upon a 50% take rate and per premise fiber lease of $15.00 per month from the Internet service providers, generates an annual revenue amount of approximately $2,025,000.

Based on these high level estimates, it appears the revenue could potentially cover the operating expenses if the subscriber take rate reaches 50% or greater. However, a lesser take rate will generate operating deficits and it will likely require at least five years to reach the 50% take rate level. The sensitivity table below illustrates the sustainability risk in 10% increment levels of subscriber take rate.

Table 3: Sustainability Sensitivity Analysis

Sustainability Sensitivity Analysis					
Take Rate	10%	20%	30%	40%	50%
Annual Revenue	$405,000	$810,000	$1,215,000	$1,620,000	$2,025,000
Annual Expense	$2,032,390	$2,032,390	$2,032,390	$2,032,390	$2,032,390
EBITDA	**$(1,627,390)**	**$(1,222,390)**	**$(817,390)**	**$(412,390)**	**$(7,390)**

Assuming this solution would achieve a 10% increase in take rate per year for five years until the 50% target was achieved, Earnings Before Interest, Taxes, Depreciation and Amortization (EBITDA) losses would total over $4.1 million.

Factors negatively impacting the cost of this solution include:

- Sparsely populated rural nature of the Study Area in comparison to more densely populated urban areas that can economically support multiple providers
- Existing competitors that are able to provide sufficient bandwidth service to much of the population of the Study Area, which impacts the take rate of any potential offering
- The high cost of utility pole make-ready fees and annual license fees in relation to the low average premises per mile

Total estimated construction cost for this solution is itemized in the table below for the entire Study Area.

Table 4: Fiber-to-the-Premise Construction Costs

	1 Gbps/1 Gbps
Total Construction Cost	**$69,872,775**
Potential Subscribers	22,500
Cost per Potential Subscriber	**$3,105**

8.4 DEVELOP INFRASTRUCTURE TO SUPPORT WIRELESS PROVIDERS

A significant barrier to ubiquitous wireless coverage is the lack of sufficient wireless towers, fiber backhaul from those towers and lack of subscriber density. Further complicating a wireless solution is the topography of the Study Area which is comprised of densely forested hills, mountains and valleys. The quantity of towers and the cost of deployment, along with the amount and cost of fiber backhaul can only be determined by performing a wireless propagation analysis and design, which is outside the scope of this study. Nonetheless, the concept of subsidized towers is an alternative that could be explored. See Study Area Map 12 for location of all FCC register towers within the Study Area and within five miles outside the Study Area boundary.

9.0 Public/Private Partnership Strategies - Potential Operating Models

Below, we examine potential operating models with an eye toward sustainability and limiting day-to-day municipal operating responsibility and risk. Each of these models recognizes the fact that it is uneconomical for any provider to invest 100% of the capital required to deploy a ubiquitous solution and realize a reasonable return on that investment, given the rural nature of the Study Area.

9.1 PUBLIC/PRIVATE PARTNERSHIP - SUBSIDY FOR SERVICE PROVIDERS

Providing a one-time capital subsidy to one or more service providers will require the least amount of capital investment for the municipalities and eliminate any requirement for the municipality to be responsible for day-to-day operations. The amount of subsidy should anticipate a capital contribution from the providers as well, with the public subsidy amount limited to an amount required for the provider to realize a reasonable rate of return on their investment.

In return for the subsidy, the providers should be held to certain performance standards, reliability metrics and pricing equal to or better than what is provided to the service providers' customers in other parts of the State. Annual reporting and methodologies for these performance metrics could be based upon requirements similar to what the FCC has implemented for the Connect America program as discussed in Section 6.0 above. It is important to recognize that service providers cannot be expected to develop individual municipal performance metrics that differ from municipality to municipality, which would be an unrealistic burden on the providers and would limit the provider's interest in participating in such an arrangement.

At the same time, there should be recognition and understanding that service providers likely will not be interested in a scenario whereby the municipality retains an ownership percentage in the network being deployed. Shared ownership will be viewed negatively, especially by those providers and their shareholders who are regional or national in scope. As such, any type of subsidy in this scenario should be viewed as a one-time grant with little recourse or expectation that the municipality will be able to influence future enhancements to the network or services provided by the service provider.

In spite of these limitations, we believe that providing subsidies to service providers is the most viable solution given the limited funds available from the municipality or from other state and federal broadband grant programs.

9.2 MUNICIPALLY OWNED OPEN-ACCESS DARK FIBER NETWORK

An open-access dark fiber network, as discussed in Section 8.3 above, would be a completely new fiber network serving all locations throughout the municipality. Any number of service providers would be provided non-discriminatory access to the network on an equal basis at a uniform wholesale cost to lease fibers from a central location to any premise. The service providers would be responsible for deploying optical electronics at a centralized point of presence and at the customer location. Internet providers would compete for customers based upon retail price, service capability, reliability and customer service.

The municipality would own the network in this scenario, but would contract with one or more entities to maintain and administer the physical fibers leased to the competitive providers. The cost of engineering, project management, materials and installation would be borne solely by the municipality, as well as any operating expenses in excess of the wholesale revenue received from leasing of the fiber.

As discussed previously, this is the most expensive solution, provides the potential for the greatest amount of competition and carries the most risk from a sustainability perspective. For these reasons, we do not recommend this solution unless the municipality is unable to reach an agreement to subsidize an existing or new provider to meet the goals of the community.

9.3 PUBLIC/PRIVATE PARTNERSHIP – JOINTLY OWNED DARK FIBER NETWORK

Like the municipally owned dark fiber network discussed above, a new or existing provider may be interested in partnering with the Town to construct a completely new fiber network under a joint ownership arrangement. As mentioned previously, we do not believe the large national providers would be interested in this arrangement, but there may be other smaller providers who operate FTTP networks in other parts of the State, or perhaps from outside of Maine, who would be interested.

The advantage of this scenario would be the ability of such a provider to perform engineering, project management and construction with their own resources at a much lower cost than what would be available under the municipally owned model discussed above. The amount of investment on the part of the municipality would be limited to the amount required to ensure a reasonable rate of return for the service provider partner. Maintenance, insurance and operating costs would be borne by the service provider partner, as well as deployment and ownership of any optical electronics, and any profits could potentially be shared with the Town, depending upon the negotiated arrangement.

Most potential service provider partners under this arrangement would likely expect exclusive use of the network for an extended period of time before opening the network for use by competing providers. The cost to the municipality under this arrangement should be significantly less than the 100% municipally owned network as discussed above, but the actual amount cannot be estimated without the benefit of a detailed engineering analysis and negotiation with the potential partner(s).

10.0 Adoption Plan to Increase Broadband Usage

Universal availability of high-speed broadband access is critical to retaining our existing residents, supporting our economy and educating future generations. In order to achieve these goals and support a robust broadband infrastructure in a sustainable manner, all members of the community must be included, must be digitally literate, and must have the opportunity to participate on an equitable basis.

Definition: Digital Literacy
The ability to find, evaluate, utilize, share, and create content using information technologies and the Internet.

Definition: Digital Equity
Digital Equity is a condition in which all individuals and communities have the information technology capacity needed for full participation in our society, democracy and economy. Digital Equity is necessary for civic and cultural participation, employment, lifelong learning, and access to essential services.

Definition: Digital Inclusion
Digital Inclusion refers to the activities necessary to ensure that all individuals and communities, including the most disadvantaged, have access to and use of Information and Communication Technologies (ICTs). This includes five elements:

1. Affordable, robust broadband internet service
2. Internet-enabled devices that meet the needs of the user
3. Access to digital literacy training
4. Quality technical support
5. Applications and online content designed to enable and encourage self-sufficiency, participation and collaboration.

Digital Inclusion must evolve as technology advances. Digital Inclusion requires intentional strategies and investments to reduce and eliminate historical, institutional and structural barriers to access and use technology.

Local Resources Necessary to Foster Digital Literacy, Equity and Inclusion

1. Full-time digital inclusion staff
2. Established digital inclusion planning process
3. Active collaboration with regional and national digital inclusion peers
4. Periodic assessment of resident's Internet access and use
5. Community based digital inclusion programs
6. Availability of public access computer labs
7. Programs for discount Internet service for low and moderate income users
8. Affordable equipment program

Below we evaluate these eight resources as they relate to the Study Area.

10.1 FULL-TIME DIGITAL INCLUSION STAFF

While not specifically identified as "digital inclusion staff," the Franklin County Adult & Community Education Program[6] has a staff of 11 professionals focused on a wide variety of classes including the technology classes listed in Section 10.5 below. Establishing a digital inclusion/literacy program, led by an assigned staff member under the auspices of the Franklin County Adult & Community Education Program and in collaboration with the Franklin County Broadband Initiative, may address this requirement and foster an expansion of the course selection and delivery locations.

10.2 ESTABLISHED DIGITAL INCLUSION PLANNING PROCESS

Our research finds no established digital inclusion planning process for the Study Area, but Maine is fortunate to have one of the nation's premier organizations headquartered in Machias, Maine. The Axiom Education & Training Center's "National Digital Equity Center" (NDEC), led by nationally recognized Susan Corbett, can provide a complete planning process to facilitate a robust digital literacy, equity and inclusion program.

10.3 ACTIVE COLLABORATION WITH REGIONAL AND NATIONAL DIGITAL INCLUSION PEERS

Collaboration with regional peers and national digital inclusion experts will be important to leverage the work of other successful programs and share resources within the region. The digital inclusion planning process should incorporate active collaborations with the State of Maine and the counties adjacent to the Study Area.

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[6] The Franklin County Adult & Community Education program is a collaboration of RSU 9 (Wilton, Farmington, Weld, Temple, Chesterville, New Vineyard, Industry, and New Sharon), RSU 78 (Rangeley region) and MSAD 58 (Strong, Phillips, Kingfield area).

10.4 PERIODIC ASSESSMENT OF RESIDENT'S INTERNET ACCESS AND USE

This study identifies where Internet access is available and the download and upload speeds available, but makes no effort to determine how the residents use the Internet. A periodic survey to support the planning process in Section 10.2 above will be important to define the needs and better understand the use of the Internet within the Study Area.

10.5 COMMUNITY BASED DIGITAL INCLUSION PROGRAMS

The table below highlights the digital literacy courses available beginning in the Fall of 2017. Users are encouraged to contact the Franklin County Adult Education office to request additional classes.

Table 5: Digital Literacy Classes

RSD #9 Franklin County Adult Basic Education (Farmington)
Computer & Technology Basics for Career & Education
Demystifying Technology
Facebook for Business
Google Photos
Introduction to QuickBooks
iOS Essentials (iPhone & iPad)
Mike's Café (Multiple Technology & Career Skills Topics)
Staying Tech-Savvy in the 21st Century
Working in "The Cloud" with Gmail, Google Drive & Docs

10.6 AVAILABILITY OF PUBLIC ACCESS COMPUTER LABS

For those currently without access to the Internet at home or who cannot afford to subscribe to the Internet or have their own computer, availability of public computers is critical. The table below lists the public libraries and the quantity of computers available for public use. We note that most of these library locations have limited days of the week and time of day in which these locations are open.

Table 6: Public Access Computer Locations

Public Access Computers		
Library	**Location**	**Public Access Computers**
Carrabassett Valley Library	Carrabassett	7
Farmington Public Library	Farmington	17
Jay-Niles Memorial Library	North Jay	
Jim Ditzler Memorial Library	New Sharon	12
Mantor Library at the University of Maine at Farmington	Farmington	5
New Vineyard Public Library	New Vineyard	

Phillips Public Library	Phillips	5
Rangeley Public Library	Rangeley	12
Stratton Public Library	Stratton	3
Strong Public Library	Strong	
Treat Memorial Library	Livermore Falls	6
Webster Free Library	Kingfield	2
Weld Public Library	Weld	
Wilton Free Public Library	Wilton	4

10.7 PROGRAMS FOR DISCOUNT INTERNET SERVICE FOR LOW AND MODERATE INCOME USERS

For those who cannot afford Internet service, FairPoint, TDS and Spectrum offer discounted services to those who qualify.

10.7.1 FCC Lifeline Program (FairPoint & TDS)[7]

Lifeline is the FCC's program to help make communications services more affordable for low-income consumers. Lifeline provides subscribers a discount on monthly telephone service purchased from participating providers in the marketplace. Subscribers can also purchase discounted broadband from participating providers. The discounts, which can be applied to stand-alone broadband, bundled voice-broadband packages (either fixed or mobile, along with stand-alone voice service) will help ensure that low-income consumers can afford 21st-century broadband and the access it provides to jobs, education and opportunities.

How Lifeline Works

Lifeline provides a discount on monthly service of $9.25 per month for eligible low-income subscribers. Subscribers may receive a Lifeline discount on either a wireline or a wireless service, but may not receive a discount on both services at the same time. Lifeline also supports broadband and broadband-voice bundles. FCC rules prohibit more than one Lifeline service per household.

Lifeline is available to eligible low-income subscribers in every state, territory, and commonwealth and on Tribal lands.

To participate in the program, subscribers must either have an income that is at or below 135% of the federal Poverty Guidelines or participate in certain assistance programs. Eligibility can be assessed using the Lifeline Eligibility Pre-Screening Tool on the Universal Service Administrative website at www.lifelinesupport.org .

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[7] Further information, including application forms, can be found at: www.fairpoint.com/home/residential/phone/lifeline.html, and at: www.tdstelecom.com/content/dam/tdstelecom/pdfs/lifeline/lifelineapplication.pdf

Following is a list of assistance programs that qualify a participant for Lifeline:

- Medicaid
- Supplemental Nutrition Assistance Program (Food Stamps or SNAP)
- Supplemental Security Income
- Federal Public Housing Assistance (Section 8)

How to find a Lifeline provider near you

If a person determines that s/he is eligible, s/he can use the resources on this web page to locate a Lifeline Program service provider near them: https://data.usac.org/publicreports/CompaniesNearMe/Download/Report

Modernizing Lifeline

On March 31, 2016, the FCC adopted an Order to modernize the FCC's Lifeline program to efficiently and effectively meet a critical 21st Century need: making broadband more affordable for low-income consumers.

Congress directed the FCC to ensure that all Americans have access to advanced telecommunications and information services. With affordability still the largest single barrier to broadband adoption in low-income households, the Order will reboot Lifeline to enable all Americans to share in the opportunities broadband connectivity provides, while building on recent reforms to the program. The Order, for the first time, allows low income consumers to apply Lifeline's $9.25 per month discount to stand-alone broadband service as well as bundled voice and data service packages. The Order frees up the Lifeline marketplace to encourage wide participation in the program by broadband providers, giving consumers competitive service options. Minimum service standards will ensure that supported services meet modern needs. Building substantially on the Commission's landmark 2012 reforms of the program, the Order establishes a National Eligibility Verifier to further deter waste, fraud and abuse, while reducing provider burden. In addition, a budget mechanism limits Lifeline's cost to ratepayers.

The Lifeline program will focus on qualifying applicants only through other federal assistance programs that best support the FCC's objectives for the National Verifier: those that support electronic validation, are accountable, and best identify people needing support (SNAP, SSI, Medicaid, Veterans Pension, and Tribal-specific programs.)

10.7.2 Spectrum Internet Assist[8]

Through the Spectrum Internet Assist program, qualified households can receive:

- High-speed 30 Mbps Internet with no data caps
- Internet modem included

[8] Further information can be found at: www.SpectrumInternetAssist.com

- No contracts required
- Add in-home WiFi for $5 more per month

To qualify for Spectrum Internet Assist, a member of the household must be a recipient of one of the following programs:

- The National School Lunch Program (NSLP) free or reduced lunch
- The Community Eligibility Provision (CEP) of the NSLP
- Supplemental Security Income (>/= age 65 only)

10.8 AFFORDABLE EQUIPMENT PROGRAMS

Low or moderate income should not be a barrier to participating in our digital society. The following organizations focus on making computers available for all:

- **PC's for Maine**[9] – A nonprofit effort to increase technology access for people and nonprofits that need technology to achieve important goals. So far, this program has provided more than 9,000 computers that have been used by more than 120,000 Mainers. The average actual cost for each computer with all of its support services is $277.
- **Goodwill Technology Access Program**[10] **-** Goodwill's GoodTech Technology Access Program (TAP) offers refurbished computers to qualified individuals at discounted prices. Computers are guaranteed to work and come with new, legal installations of Windows and Microsoft Office obtained directly from Microsoft.

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[9] www.pcsformaine.org
[10] www.goodwillnne.org/stores/goodtech/

11.0 Next Steps

While many municipalities across the United States have built their own broadband networks that provide ubiquitous coverage and increased bandwidth, it is especially difficult to attract the required capital and operate a sustainable network in the presence of other existing competitors. Given the evident challenge to the community that would exist in developing another competing network, we believe it is important to explore all options in leveraging the investments of existing providers, and those providers who are exploring expansion into the Study Area.

Our recommendation is for the municipalities to invite each of the existing and potential future providers to enter into individual discussions with the municipality in an effort to clearly understand the goals and motivations of each party, and the willingness to collaborate on expanding broadband service and capabilities. Through these discussions, the municipality should be able to validate the provider costs and the conditions upon which a collaborative partnership can be pursued.

We also recognize the potential value of working with multiple providers who may be interested in serving a portion of a municipality, or limited areas that may be a natural extension of their assets in an adjacent geography, in place of a completely ubiquitous solution. Finally, any discussions should acknowledge that funding subsidies or revenues may not be available or sufficient to implement a universal solution in a single project. As such, any solution may need to be implemented in phases as funding becomes available.

Finally, scale matters. A Study Area wide solution will generate lower per unit and per potential subscriber capital costs, generate greater interest from more providers and lower operating expenses. At the same time, if an all-in solution is not feasible, collaboration and cooperation between multiple municipalities contiguous to each other will provide similar benefits. Therefore, we recommend that communities work together wherever possible.

All residents of the Study Area should have access to the Internet at speeds sufficient to meet their current and future needs, with pricing comparable to that enjoyed by consumers in the more densely populated areas of the State. Working with providers to correlate this need with their network enhancements and future planned offerings seems the best opportunity to close these gaps without creating a significant long term financial impact on the community. This study forms a solid foundation to continue the effort to meet that need.

Appendix A – Definitions

Definitions of Terms Used in this Study

1. **3RB – Three Ring Binder –** Name for the Maine Fiber Company middle-mile open access dark fiber network. The network is deployed in a design that creates three rings serving southern, middle and northern Maine.

2. **A-CAM –** The FCC's Alternative Connect America Fund Cost Model program.

3. **Broadband –** Any wide-bandwidth data transmission method with the ability to transport multiple signals and traffic types simultaneously.

4. **CAF-II –** The FCC's Connect America Fund – Phase II program.

5. **Central Office –** A local telephone company building typically located in the center of a community or group of communities that houses optical and electronic equipment to distribute services via cables which emanate from the central office to all locations of the community.

6. **CLEC –** Competitive Local Exchange Carrier. (Examples in Maine are GWI, LCI, Pioneer Broadband, Otelco, and FirstLight.)

7. **ConnectME Authority –** An independent State agency formed to develop and implement broadband strategy for Maine.

8. **Dark Fiber –** A single fiber optic strand without the optical electronics required to light the fiber and provide services.

9. **DECD –** State of Maine Department of Economic and Community Development.

10. **DSL –** Digital Subscriber Line. A technology used to deliver Internet Access over twist-pair copper cable.

11. **DSLAM –** Digital Subscriber Line Access Multiplexer. Electronic device used to aggregate multiple DSL circuits into a single downstream connection to the Internet. Commonly located in a central office or remote terminal.

12. **Drop –** The connection from the service provider's cabling running along the roadway in front of a subscriber to the subscriber building.

13. **FCC –** Federal Communications Commission.

14. **Fiber Optic –** A glass strand smaller than a human hair that it capable of transmitted a virtually unlimited amount of bandwidth using optical lasers.

15. **FTTP –** Fiber-to-the-Premise (FTTP) is a network utilizing fiber optic cables directly to the home or business and is capable of offering virtually unlimited symmetrical bandwidth.

16. **Hybrid Fiber/Coax –** The infrastructure deployed by cable TV providers that utilizes fiber optic cables to a node and coaxial cable from the node to the subscriber.

17. **ILEC – Incumbent Local Exchange Carrier –** The local telephone company serving the area. In the Study Area, this includes FairPoint and TDS Telecom.

18. **ISP –** Internet Service Provider. Most all ILECs, RLECs, RBOCs and CLEC are ISPs.

19. **Internet access –** Connects individual computer terminals, computers, mobile devices, and computer networks to the Internet, enabling users to access Internet services, such as email, applications and information delivered via the World Wide Web. Internet service providers (ISPs) offer Internet access through various technologies that offer a wide range of data signaling rates (speeds).

20. **Lit Fiber –** Dark fiber that has been activated (lit) with optical electronics on either end of the dark fiber to provide broadband or telecommunications services.

21. **Make-Ready –** Process to make a utility pole ready for attachment of a new communications cable.

22. **Outside Plant –** Communications cabling attached to utility poles or run through underground conduits.

23. **OSP –** Outside Plant

24. **POTS –** Plain Old Telephone Service

25. **Potential Subscriber –** A residential or business location that could potentially subscribe to broadband service.

26. **RBOC – Regional Bell Operating Company –** The regional companies that were created at the breakup of AT&T in 1984. FairPoint is considered the RBOC for Maine.

27. **RLEC – Rural Local Exchange Carrier –** A local telephone company that is not an RBOC. TDS Telecom is a RLEC.

28. **Remote Terminal –** An outside plant cabinet located on the ground or attached to a utility pole or some other supporting structure that houses optical electronics for the provision of DSL service over a twisted-pair copper cable.

29. **Three Ring Binder (3RB) –** Name for the Maine Fiber Company middle-mile open access dark fiber network. The network is deployed in a design that creates three rings serving southern, middle and northern Maine.

30. **Twisted-pair copper –** The type of outside plant cabling initially used to provide POTS and more recently to provide DSL-based Internet access.

31. **World Wide Web –** The World Wide Web (abbreviated WWW or the Web) is an information space where documents and other web resources are identified by Uniform Resource Locators (URLs), interlinked by hypertext links, and can be accessed via the Internet.

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Appendix B – Design & Analysis Assumptions

Design and Analysis Assumptions for the Franklin County Broadband Project

1. In the case of **DSL infrastructure deployment**, visually capturing the location of cables and remote terminals in the field does not provide us with the directional flow of the twisted copper cabling, wire gauge or condition of the copper pairs. Rather, we have made conservative assumptions as to the reach and speed associated with these types of deployments.

2. **Public/Private Partnership – Potential public and private investment ratio**. From a capital contribution perspective, we have found that cable TV providers will contribute capital in ratio to the quantity of potential subscribers per mile and will consider fully funding a project with at least 20 potential subscribers per mile. As an example: if there were 15 potential subscribers per mile, the cable TV company will contribute 75% of the total capital cost. If 10 potential subscribers per mile, the cable TV company will contribute 50%.

   Of course, the fewer subscribers per mile, the greater the operating expense per subscriber. As such, we would expect the private service provider to further discount their capital contribution to offset the greater operating expense per subscriber.

   For the purposes of the "potential public and private investment ratio" contained in our analysis, we simply use the ratio of potential subscribers where the divisor is equal to 20.

3. If it were economical (profitable) for the existing service providers to deploy higher speed capabilities in the unserved and under-served areas of the Study Area, they would have already deployed the desired services.

4. Given the lack of density in rural areas, it is difficult for more than one service provider to secure a sufficient quantity of subscribers to operate profitably. As such, fostering competition in low-density areas may not be realistic.

5. Construction Costs Assumptions

Table 7: Unit Construction Costs

Deployment Type	Per Mile	Per Potential Subscriber	Per Remote Terminal
DSL	$25,000	N/A	$25,000
Hybrid Fiber / Coax	$35,000	$350	N/A
FTTP	$40,000	$700	N/A

The difference in the per mile construction cost assumes the following:

a. DSL – The ILECs that are the most likely providers to deploy DSL services already have strand and cabling deployed and can avoid the time and expense associated with the make-ready process by simply over-lashing the fiber required to deploy the backhaul for remote terminals.

b. Hybrid Fiber/Coax – This type of deployment would occur in less populated rural areas where significant make-ready may be required due to age of the utility poles and the shorter poles present as a result of fewer attachees.

c. FTTP – This type of deployment would cover the entire area, both urban and rural. Competition for limited pole attachment space from the ILECs and cable TV infrastructure in the more densely populated areas increases the overall make-ready costs per mile.

6. The greatest variable in outside plant aerial construction is the cost of make-ready.

7. Costs by municipality assume each municipality would participate in a Study Area wide solution. Costs by municipality may be greater if a municipality pursues a solution on its own or within a group of municipalities that is less than a Study Area wide solution.

8. Potential subscriber locations are identified by the State of Maine 911 addressing information. This 911 addressing information is supplied to the State by the individual municipalities with varying degrees of accuracy.