

An analysis of current internet status in Whatcom County, and a proposal for a public internet development strategy to foster economic and social prosperity.

Authored by Erik Alm, Jon Humphrey, Jamie Douglass, Michael Gan, and Andrew Reding.

Draft Comments

Public comments are welcome directly to this draft document via the Google Workspace system until end of day on June 26th, 2022. Afterwards, comments will be considered and integrated to create the first public version.

Executive Summary

The purpose of this paper is to outline internet communication standards necessary for the residents of Whatcom County to thrive into the coming decades. Currently, like many other counties in the US, Whatcom County has inadequate internet infrastructure and residents are at a disadvantage as a result. Recognizing federal and state service data, speed and price standards to be lacking when put up against the demands of current household and business demands, We propose the current standard be no less than 100 Mbps symmetrical (i.e. 100 Mbps download, 100 Mbps upload). This should be upgraded to 1Gbps Mbps symmetrical (with less than 30 ms of latency) by 2032. These fiber to the premises speed standards should be available for no more than \$40 / month for 100 Mbps symmetrical service, and \$70 / month for 1 Gbps service, with free 50 Mbps services offered to households below a predetermined income threshold. This standard should be delivered through a publicly owned, open access fiber-optic network similar to that of several nearby locales such as Kitsap County (managed by Kitsap Public Utilities District) and Mount Vernon, WA. To take advantage of the benefits of existing expertise and to maximize market based competition, internet service providers (ISPs) should lease bandwidth from the public network, maintaining and administering services to end users.

I. Current Internet Availability in Whatcom County

According to the latest public release of data from the FCC, 100% of Washington's population has access to the federal minimum standard of 25Mbps download and 3Mbps upload. However, the latest report (2019) issued by the State of Washington acknowledges this is not the lived experience of most Washingtonians and inaccuracies in the FCC data have been demonstrated.

The COVID-19 pandemic brought to light the inadequate speeds experienced by many residents of Whatcom County and highlighted the unaffordability of associated costs. Many residents need to pay for several wireless services concurrently in order to cobble together speeds and data allowances that barely cover their family's needs. Furthermore, a large percentage of residents in areas the FCC claims have adequate coverage do not. These premises are being considered "served" with the federal minimum standard, while not being able to accomplish simple, integral tasks such as video conferencing, remote learning and telehealth. This discrepancy means that many areas in Whatcom County are not being considered for communications infrastructure improvements.

Current Standards

In its effort to determine the number of Americans with adequate internet coverage, the FCC has decided on a minimum speed standard measured in megabits per second (Mbps). Meeting this minimum standard, using either a fixed (wired) or mobile (radio signal) device earns the home or business the designation of "served". The FCC's designations and corresponding speed standards are as follows:

Table 1. Current FCC Broadband Service Designations

Classification	Speed Standard, Download/Upload (Mbps)
Served	25/3
Underserved	Less than 25/3
Unserved	No available providers, wired or radio

As we briefly discussed in the previous section, the FCC's data detailing internet coverage in Washington is flawed. Claims that 100% of Washingtonians are able to receive service that provides the federal minimum standard of 25 Mbps download and 3 Mbps upload are often made using data from only one residence within each census block. All others within the census block are assumed to have the same service availability.

In 2022, Washington State Senate Bill 5715 defined a new statewide standard of 100 Mbps download and 20 Mbps upload. In its *Broadband in Washington 2019* report, the state commits to 150 Mbps download and upload (150 Mbps symmetrical) by 2028.

Table 2. Washington Broadband Service Minimums

Speed, Download, Upload (Mbps)	Commencing in (Year)
100/20	2022
150/150	2028

Neither the FCC nor Washington State have set service price standards. However, in its latest report regarding the allocation of funds in the Final Rule of the Coronavirus State and Local Fiscal Recovery Funds (SLFRF), effective 4-1-22, the US Treasury Department has recognized high service prices as being a hindrance to availability and has qualified funding allocations for new service options in areas with unaffordable existing service.

II. An Internet Strategy for Whatcom County

To accomplish the aims we have identified as critical to making Whatcom County's internet infrastructure capable of handling the needs of residents and businesses alike, we propose a staged approach following an aggressive, but realistic timeline.

First, a robust service map must be developed using data from homes and businesses, by conducting a county-wide survey using robust real-time response under load (RRUL) testing. Recognizing website based speed-tests as unreliable, often claiming speeds that do not correspond with users' actual internet performance, any data collected for the service map should not rely on these inaccurate speed tests.

While the service map is being developed, public entities (PUD, Port, Whatcom County) should proceed with their plans to install fiber lines along major corridors and to anchor locations such as schools, fire stations and other municipal buildings. This backbone infrastructure should be used to service areas identified by the map as being most in need. The service map should be completed by January 1, 2024.

Next, the Public Utilities District (hereafter *the PUD*), Port of Bellingham (hereafter *the Port*) or Whatcom County (hereafter *the County*) should set up a mechanism that allows for prioritization of network development, such as Local Utility Districts (LUDs) or Fiberhoods. Both of these structures invite premises to express interest in having the network extended to their area. When enough premises in a single geographic locale express interest, that area is then targeted for network buildout. For simplicity, in this document we will focus on LUDs as a development prioritization mechanism, though we recognize there are several other systems that function equally well.

The LUD system should begin with the development of a website clearly explaining how interested neighborhoods can petition for and create LUDs covering their area. The website should also provide information on how ISPs may lease space and begin providing service to end users.

Each premises within a newly created LUD should be assessed by the PUD for service to determine the neighborhood's fiber layout. Premises in each LUD should be charged no more than \$100 for a connection to the public fiber network.

While the installation of fiber to each premises within each LUD will likely cost more than the \$100 connection fee we propose, financing for this effort can be covered initially through federal and state grants available to the PUD and the Port, and eventually through monthly user service charges collected by these same entities using their retail authority. LUDs that wish to expedite commencement of service should be granted the opportunity to install their own infrastructure, which should then be purchased by the relevant public entity upon completion, provided it meets standards established by this entity.

The time from the creation of an LUD to the installation of functioning service should not exceed two years. A county-wide network serving all residents and businesses with 1Gbps service should be completed within 10 years. The PUD and Port should exercise their rights to be retail service providers on the network in order to facilitate affordable installation financing and to ensure there is a minimum number of ISPs in each area.

Figure 1. Whatcom County public network development flowchart

Testing → Develop Service Map → LUD Provider / User System → Approve LUDs → Build Fiber to LUDs → Commencement of Service

Collaboration between Public and Private Entities

The strategy we outline here provides opportunities for collaboration between Whatcom County's many public and private entities. The county's public agencies, including the Port, the County, the PUD and the City of Bellingham (COB) all play an integral part in making a county-wide network a success. Likewise, the many private companies delivering current internet-related services to Whatcom County should continue to be relied upon for their demonstrated expertise in the installation and maintenance of the network, and for the provision of service to end users. The involvement of neighborhood associations, non-profit groups and interested community members is also critical in guiding the development of the public network to ensure it meets the needs of all stakeholders.

The PUD should take the lead in many essential ways. To begin, the PUD has available to it federal and state financial resources that should be applied for and used to initiate the network development process. It should be responsible for setting up the LUD system, complete with a website detailing all of the information residents and business owners will need to set up LUDs. Using its newly granted retail authority, it should collect fees from users and internet service providers (ISPs) leasing bandwidth on the open-access network to fund connections for new LUDs and to complete ongoing network maintenance.

The Port, like the PUD, has retail authority that also allows it to collect fees that can be used for maintenance and installation of new fiber routes. In 2019, the Port commissioned a feasibility study that summarizes their options for making investments in broadband throughout Whatcom County. This study contains several business model case studies. In the *Lit Fiber Open Access Focus* case study, it outlines a strategy whereby the Port owns the fiber optic network and sells access on the system to ISPs. This is the strategy we endorse as it provides a truly open access model, creating a competitive environment that allows users to choose between many providers. Responsibilities of the network can be shared with the PUD, with which the Port already collaborates in the Broadband Steering Committee. Another collaborative effort of the Port, Petrichor Broadband, LLC, which works with five other Ports on business opportunities and broadband policy, can help with funding and technical interface with partner Ports.

As the fund management agency for the PUD, Whatcom County plays an integral role in investing the funds necessary for network installation and maintenance. The County is also responsible for the Whatcom County Code, which should be amended by the relevant boards and commissions to establish a Dig-Once ordinance.

The City of Bellingham owns a fiber optic network bought from the PUD in 2004. While it was purchased to provide internet access to a number of public entities, the existing infrastructure should be expanded to include connections to homes and businesses. With the basic infrastructure already in place, expansion is far less expensive than planning a new network for the city. Using the same funding strategy, Open Access and Dig-Once policies proposed above for the Port and PUD, the city can enhance economic opportunities, educational opportunities and health care availability for residents and businesses while minimizing costs.

Private entities, such as ISPs, technology vendors and communications contractors should also play a crucial role in the development and installation of the network, and in providing final service to end users. The PUD, Port and City of Bellingham should work with communications contractors for much of the network planning and installation. Furthermore, the Dig-Once ordinance that requires installation of conduit during trenching work conducted along predetermined public right-of-ways will also depend upon contractors. The network's Open Access policy creates a competitive environment that will benefit experienced ISPs with existing systems for billing and customer service in place. Technology vendors should be relied upon to recommend and supply the best network components and suggest appropriate periodic upgrades as technology advances.

A public network also leaves room for community input to guide network standards and best policies. It is critical that neighborhood associations interested in receiving service, non-profit groups providing funding or technical expertise, and interested residents are all considered equal stakeholders, and a process to take their recommendations into consideration should be implemented.

All of the stakeholders listed in this section should be valued as offering necessary input into the development and operation of the public network. No one stakeholder group, whether public, private or community, should have more weight in influencing outcomes.

Table 3. Stakeholder Roles

Stakeholder	Funding	Policy	Construction	Operations	Maintenance
Public Utilities District #1	✓	✓	✓	✓	✓
Port of Bellingham	✓	✓	✓	✓	✓
Whatcom County	✓	✓	✓		
City of Bellingham	✓	✓	✓		
Internet Service Providers		✓	✓	✓	✓
Communications Contractors		✓	✓		✓
Non-Profits	✓	✓			
Community Groups & Residents		✓	✓		

III. Standards and Policies

Testing Standard

During the first step in our proposed network development strategy, the creation of an existing service map, an accurate testing method is of paramount importance. Since internet browser based testing protocols such as Speedtest and MLabs do not use methods simulating the way modern networks are used by residents, they cannot be relied upon. Therefore, it is necessary to use a more accurate test. We propose the aforementioned RRUL. Robust, statistically significant sample sizes using on-site testing will maximize the accuracy of the service map, while also ensuring marginalized members of our populations are also included in the data.

Further details about RRUL can be found at www.bufferbloat.net/projects/bloat/wiki/RRUL_Spec/.

Speed and Price Standards

Studies have shown that between 1983 and 2019, internet users bandwidth requirements have grown by 50% per year. (<https://www.nngroup.com/articles/law-of-bandwidth/>) In order to allow all Whatcom County residents to participate in activities related to economic development, education and telehealth services, we propose upgrading the current speed standard outlined in SB 5715 (100 Mbps download / 20 Mbps upload) to 100 Mbps symmetrical. Furthermore, we propose upgrading the future goal outlined in the State's Broadband in Washington 2019 report (150 Mbps symmetrical by 2028) to 1 gigabit per second (1 Gbps) symmetrical by 2030 with less than 30ms of latency. All connections should be verified with an RRUL test upon installation.

Just as important as reliable speeds, affordability is critical. Our proposed current standard of 100 Mbps symmetrical should be offered on the public network for no more than \$40 / month, and 1Gbps service at no more than \$70 / month. 50Mbps service should be offered to low-income residents free of charge including the cost of installation and equipment. The installation charge should not exceed \$100.

The speed and price standards outlined here are already available in several municipalities in other parts of Washington and have been proven to be both technologically and economically feasible.

Table 4: Service and Price Levels.

Speed (Symmetrical)	Price / Month	Year Available Countywide
1 Gbps	\$70	2030
100 Mbps	\$40	2024
50 Mbps	\$0*	2024

*This tier of service is only available to households below a predetermined income threshold.

Technology Standards

The strategies outlined in this document all rely upon one common technology, optical fiber. Optical fiber is cheaper to manufacture and transmits data far faster than other materials. It is often considered “future-proof” due to the amount and speed of data that it can transmit. Compared to data transmission through copper cabling or the use of radio waves, optical fiber networks are considered the most energy efficient and reliable.

To maximize the energy efficiency, reliability and longevity of optical fiber networks, we propose the network serving Whatcom County minimize non-fiber connections. Connections using radio frequencies, e.g. satellite, LTE, 5G, fixed wireless, should be considered temporary, only being installed as stop-gap solutions, with plans for replacement with fiber to the premises (FTTP) within five years.

Likewise, aerial installation of optical fiber should be considered temporary due to the likelihood of service interruptions from breakages and the high cost of leasing utility poles from utilities. We recommend buried installation of all optical fiber in 2”, schedule 40 PVC or HDPE conduit be considered the standard throughout the county with a minimum of two 2” schedule 40 PVC or HDPE conduit, housing 144-strands of fiber, being the minimum standard. Fiber vaults should be placed a maximum of 1,500 feet apart. This standard ensures the greatest longevity of the conduit and fiber optic cabling, while also making future replacement or additions of cabling simple and affordable.

Many different types of optical fiber and transmission hardware exist on the market, each designed for specific applications. To ensure the greatest useful life of all installed components, we recommend the installation of only single-mode cabling, capable of at least 1 Gbps symmetrical transmission rates with corresponding transmission hardware. All components should be able to accommodate a minimum of 64 channels per strand using Wavelength Division Multiplexing (WDM).

Repairs of any existing communications cabling in the county should be upgraded to the technology standards outlined in this section. All newly installed or repaired components should be verified with RRUL testing over a period of ten minutes, and should display jitter of no more than 30 milliseconds.

Policies

We have identified a number of policies that should be implemented to ensure Whatcom County’s public network provides the highest quality of service and affordability to all residents and businesses. These policies address all aspects of the network’s development, installation and operation. Each policy should be adopted by the relevant public entity with jurisdiction over the activities involved.

Dig-Once

We propose the relevant public entities enact a Dig Once policy, similar to the one authored by Jon Humphrey, which specifies the installation of buried conduit during any projects that involve opening of trenches along predetermined public right-of-ways. This enables the simple and affordable installation or upgrading of optical fiber cabling by pulling it through existing conduit.

Open-Access

FTTP Networks with open-access policies allow bandwidth to be leased to any provider who wishes to offer service to end-users. This policy ensures a competitive array of providers, avoids the construction of parallel, proprietary networks, and keeps prices down for end-users. Any proprietary network upgrades using public funds should be required to enact an open-access policy for the funded portion of that network, where legally and technically possible.

Transparency

The public agencies leading the effort to develop the network should be required to publicly disclose their financial data. Any financial data pertaining to the development and operations of the network should be disclosed in yearly reports with cooperation from all involved agencies. All information about development of the network should also be available through an online map.

Provider Minimum

A minimum of two ISPs offering each of the three service standards should be available to all end users. This ensures end-users have a choice in providers and maintains a competitive atmosphere that spurs innovation and maintains competitive pricing. The relevant public entity (e.g. PUD, Port, City of Bellingham) shall also offer retail service.

IV. Challenges

Recognizing the strategy and standards we have detailed here will require broad cooperation between multiple stakeholder groups and the creation of new systems for funding and network operations, the growing number of municipalities building public optical fiber networks using similar strategies is proof that Whatcom County can find success in this endeavor. However, we are also confident that challenges will arise. In analyzing the history and continuing progress of other public fiber networks, we have identified a list of challenges we may encounter, and proposed solutions for each.

Equity in Bandwidth

Whatcom County's public fiber network should be a competitive field for ISPs, allowing any qualified ISP to lease enough bandwidth to offer end-users service. Therefore, we propose ISP qualifications be just stringent enough to protect service quality without creating undue hurdles that small or newer providers may not be able to overcome.

With more providers may come bandwidth leasing overallocations, allowing one provider to tie up unused bandwidth they have leased, preventing it from being used by others. To avoid this, periodic evaluation of actual bandwidth usage for each provider should occur. If one provider is leasing more bandwidth than it is using, that bandwidth should be reallocated to those running at or above their leased amounts. Lease charges for each provider can then be readjusted to reflect new allocations.

Rural Development without Encouraging Sprawl

The idea that creating a funding mechanism to keep installation costs low for rural end users has unwittingly encouraged urban sprawl has been voiced as a concern. One way to prevent this is through coordination of the multiple public agencies with jurisdiction over zoning and policies related to the provision of services such as electricity and public water. Just as premises built in certain areas do not expect a public utility to build infrastructure to their location, the same should be written into policies regarding the eligibility for network connection financing.

Wireless Public Access

The design of a network prioritizing optical fiber has occasionally excluded planning for access by some of our society's most vulnerable populations, such as people without housing and those living in areas not zoned to receive services. To alleviate this potential problem, a policy of having fast and reliable wireless access points available in public spaces free of charge should be implemented. Public schools, libraries and high usage public parks should all be considered for wireless service, and they should be reasonably spaced within the county so that no resident has to travel an excessive distance for service.

Funding

FCC service speed designations (served, underserved, unserved) are used by public entities to prioritize eligibility for improved infrastructure funding, despite the widely acknowledged inaccuracy of FCC data. Many areas in Whatcom County that are considered "served" by the FCC, i.e. able to receive service speeds of 25Mbps download / 3Mbps upload, can not, when tested, receive these speeds reliably. This results in areas receiving substandard services, from either a cost or speed perspective, unable to receive funding for the development of a new, fiber based, public network.

The Final Rule of the Coronavirus State and Local Fiscal Recovery Funds (SLFRF), effective 4-1-22, contains clear language providing a partial solution to this problem. Expanding on the Interim Rule that relied on FCC designations to determine funding eligibility, the Final Rule significantly broadens eligible broadband infrastructure investments to address challenges with broadband access, affordability, and reliability. Therefore, areas that can demonstrate deficiencies in any of these three criteria are eligible for funding. This underscores the need for RRUL testing to correct the flawed data provided by the FCC.

V. Existing Municipal Models

The recommendations detailed in this document were developed through the analysis of public broadband projects throughout the country. The policies, funding mechanisms, service standards and technologies these projects used were scrutinized to determine the best way forward for Whatcom County. The following are some of the municipal networks that provided the most valuable insight.

Chattanooga, TN

In 2010, the Electric Power Board of Chattanooga, a municipally-owned utility, began providing fiber internet service to the community. A recently commissioned study found that Chattanooga's fiber system has led to \$2.69 billion in economic benefits and accounts for about 40 percent of all jobs created in Hamilton County over the last decade. For more information, please visit <https://epb.com/fi-speed-internet/>.

Longmont, CO

In 1997, Longmont Power & Communications, in conjunction with Platte River Power Authority, installed a 17-mile fiber-optic loop to support citywide fiber-optic internet service. Due largely to legislative challenges, it took until 2014 until the utility could offer residential service. Now it's rated the fastest in the nation and it offers 1Gbps service for \$70 / month. For more information, please visit <https://mynextlight.com/>.

Kitsap County, WA

Beginning in 1999, Kitsap Public Utilities District initiated a county-wide fiber optic network building plan and officially began the deployment of a "robust, redundant, world class, high capacity fiber optic network throughout the county." KPUD employs an LUD system to prioritize development of their network. Please see <https://www.kpud.org/telecom.php> for more information.

Mason County, WA

Since 2000, when Mason County PUD #3 began construction of their fiber network to connect utility meters and substations, its scope has broadened to also include wholesale bandwidth leasing to ISPs. Mason County uses a system called Fiberhoods to determine where to build its network. <https://www.pud3.org/service/additional-services/pud-3-fiber-optic-network/>

Anacortes, WA

The city of Anacortes began its fiber optic network in 2019, and now offers retail service to businesses and residents. 1Gbps service is priced at \$69 month with a \$100 installation fee. For more information, please visit <https://www.anacorteswa.gov/436/Fiber-Project-Background>.

Mount Vernon, WA

In 1995, Mount Vernon began constructing a fiber optic network to connect its municipal buildings. Since then it has created a "backbone" fiber network, which leases bandwidth to six ISPs. It is connected to SONNET OC192, a larger network ring that runs around the Puget Sound. Through this arrangement, Mt Vernon can offer service "at rates well below what the bigger urban areas can provide. <https://www.mountvernonwa.gov/870/Fiber-Optic-Services>.

Wilson, NC

Since 2008, Greenlight Community Broadband has served the residents of Wilson with 1Gbps, Fiber to the Home service. It is installed in all neighborhoods throughout the city and is expanding into the county. For more information about Greenlight Community Broadband, please visit: <https://www.greenlightnc.com/>.

VI. Summary

Whatcom County has the exciting opportunity to bring together public and private interests to create a world class, open access network that will benefit the whole community. By fostering economic development, remote learning, telehealth and emergency services, a public fiber optic network will help bring prosperity to Whatcom County. The network development strategy outlined here represents a tangible way to proceed, one that has been proven by many other municipalities to be economically and technologically practicable.

Table 5. Network Development Goals

Goal	Completion
Finalize Service Map	January 1, 2024
County-Wide 100Mbps Service	January 1, 2028
County-Wide 1Gbps Service	January 1, 2032
Formation of LUD to Active Service	< 2 Years

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Authors

This document was authored by Erik Alm. However, all of the strategies, policies and standards represented here were developed collaboratively by the [TAGNW Connectivity Community Group](#). This includes, but is not limited to, technological expertise, research, review, and editing. For further information, please contact members of the group using the contact information below.

Name	E-mail	Other Affiliations
Erik Alm	epa2100@gmail.com	Y Road Gate Association
Jamie Douglass	james.r.douglass@gmail.com	McGee Rd Local Loop
Michael Gan	michael.gan@tagnw.org	TAGNW
Jon Humphrey	bellinghampublicfiber@gmail.com	TAGNW Reconnect/Connectivity
Andrew Reding	aareding@gmail.com	Public Policy Professional

This document was produced with the guidance and support of Technology Alliance Group for Northwest Washington (TAGNW).

About TAGNW

[Technology Alliance Group for Northwest Washington](#) (TAGNW) is a 501(c)(3) nonprofit organization located in Bellingham, WA. We advocate for technology education while fostering innovation. We strive to assist business, workforce, economic development, and community for students, professionals, businesses, nonprofit organizations, and local government in Northwest Washington. We provide events, programs, and services to strengthen our technology community, and serve our community with technology. Foremost, we build relationships and infrastructure in our community to do the things we do better, together.

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