Snohomish County PUD Broadband Study: Findings & Considerations

December 13, 2022

This memorandum is provided to brief and educate the Commission on the results of the Snohomish PUD Broadband Study, with specific attention to combining the work of our internal broadband team and the external consultant (Magellan Advisors) report. It is our goal to walk you through the process, key findings, considerations, and deliberations that resulted in the Snohomish PUD Executive Leadership Team (ELT) coalescing around a single recommendation for a future organizational posture toward broadband service.

Understanding Broadband

The Federal Communications Commission (FCC) defines broadband as "high-speed, switched, broadband telecommunications capabilities that enables users to originate and receive high quality voice, data, graphics, and video telecommunications using any technology." In the common vernacular, "broadband" is typically used to refer to high-speed internet access that is faster than dial-up access. High-bandwidth broadband technologies include fiber optics, cable modem, and cellular data. In some cases, lower-bandwidth broadband can be offered using digital subscriber line (DSL) over traditional "twisted pair" telephone lines.

Broadband delivery technologies in use within the Snohomish PUD service territory include:

- Digital Subscriber Line ("twisted pair")
- Copper coaxial cable
- Wireless: Fixed public wi-fi, cellular data (4G/5G), point-to-multipoint radio
- Satellite (Viasat, Hughesnet, Starlink)
- Fiber: Passive Optical Network, Active Ethernet

Fiber optic technology converts electrical signals carrying data to light and sends the light through transparent glass fibers about the diameter of a human hair. Fiber transmits data at speeds far exceeding current DSL or cable modem speeds making fiber the technology of choice for providing high-speed broadband across large geographic areas, including providing the "backhaul" for many wireless technologies.

Broadband benchmark speeds are set by the FCC and are useful in determining areas where service may be inconsistent or lacking. "Unserved" populations are generally defined as a geographic area not served by any form of broadband, or where connectivity is consistently below 10Mbps (download/1 Mbps (upload), whereas "underserved" populations may have broadband availability but no provider offers service at or above the speed of 25Mbps/3Mbps. The Washington State Broadband Office (WSBO) set its threshold for determining underserved areas at or below 100Mbps/20Mbps, with a goal of providing 100Mbps/20Mbps across the state by 2028.

Variations in broadband technology use and the speeds realized by end users results in a concept called the digital divide. Broadly, the digital divide is the gap between those who have access to telecommunications and information technologies and those who do not. While broadband service providers continue to make progress in expanding broadband in our service territory, the rate of deployment in urban areas has outpaced deployment in rural and tribal areas. For the Snohomish PUD service territory, lower population density and difficult topography of rural and tribal areas contributes to lower broadband penetration rates compared to more populated and easily accessed urban and suburban areas. Further, greater geographical distance between customers in sparsely populated areas results in the inability to spread infrastructure costs over a large customer base. Thus, there is often less financial incentive for companies to invest in broadband in rural areas than in urban areas.

Our Study

The need for reliable broadband to engage in commerce, education, telemedicine, and telecommuting is more important than ever. Cognizant of the digital divide in our community, public officials, community leaders and customers in Snohomish County and Camano Island requested that Snohomish PUD examine if there was a way for the utility to help address broadband deficiencies across our service territory. The convergence of inequities – highlighted by the pandemic – and requests for Snohomish PUD to consider how we might help to address known needs suggested it was prudent to educate and examine the issue of broadband for ourselves. In 2020, Snohomish PUD set out to study if there was a responsible way for us to help unserved or underserved areas of our community gain access to broadband service.

Throughout our study, we examined questions surrounding broadband service in our territory to identify if there is a responsible way for Snohomish PUD to engage in a solution. We assembled a team of internal and external experts representing diverse perspectives.

We began our study of broadband by creating three internal workgroups to leverage internal expertise and educate ourselves. We focused our workgroups on legislative and regulatory considerations with members from Government Relations, Legal, Corporate Communications, and Data Privacy; operational feasibility and impacts with members

Snohomish PUD Broadband Study Members

Shawn Aronow | Asst. General Council

Brian Booth | Rates, Economy & Energy Risk Mgmt

Julee Cunningham | Communications & Marketing

Anders Dahl | Transmission and Standards Engineering

Jim Herrling | Finance & Risk Mgmt (retired)

Eleanour Hunstock | Telecommunications

Kevin Johnston (Study Lead) | ITS Security Architect

Nick Johnston | Telecommunications

Kirk Lien | ITS Operations

Moe Matthews | Joint Use Permits

Matt McReynolds | Transmission & Standards Engineering

Marc Rosson | ITS Enterprise Architect

Anne Spangler | General Council (retired)

Aaron Swaney | Communications & Marketing

Brenda White | Government Relations

Todd Wunder | ITS Infrastructure Operations

Clark McIsaac | Government Relations (former employee)

Jim McDougal | Telecommunications (retired)

from Distribution and Engineering, Telecommunications, and Information Technology Services; and fiscal prudence with members from Finance, Risk, and Telecommunications.

Our workgroups researched and analyzed markets and data, identified key stakeholders, and advised executive leadership as to where outside expertise would bring value in balancing internal experience with external perspective.

To select an external partner, the Broadband Study team drafted a competitive Request For Proposal (RFP), conducted interviews from a pool of six respondents, and ultimately selected Magellan Advisors as our external partner for this study. Over a 12-month external phase, Magellan Advisors conducted a broad study to help educate the PUD Broadband Study team on gaps, feasibility, options, and risks. PUD staff utilized Magellan's knowledge, experience, and data to enhance our understanding of broadband technology and delivery within our service territory. Together, the PUD/Magellan team conducted 50-plus hours of outreach with peer utilities, community and regional government institutions, and internet service providers.

Unserved & Underserved in our Communities

The major internet service providers for both residential and businesses in our service territory are Comcast Xfinity, Ziply Fiber, and Wave Broadband.

Approximately 5-7% of Snohomish PUD customers have inadequate access to broadband. Gaps in coverage deemed inadequate by the FCC are generally located in the north and east parts of Snohomish County and the central and southern parts of Camano Island. These areas tend to be more rural and create a lower return on investment for traditional service providers.

Notable insights from our outreach:

- Camano Island appears to have the largest service gaps and fewest options for closing them.
- The Tulalip Tribes plans to replace portions of their Salish Network provided by Ziply.
- The City of Marysville is deploying dark fiber for sites currently connected with Comcast.
- ISPs have stated goals to close connectivity gaps, particularly along US2 and SR530 and along the coast from Tulalip to Stanwood.
- Stated long-term goals of those we interviewed were generally related to revitalization and economic growth, not specifically toward improving broadband infrastructure.

Notable broadband expansion efforts:

- Snohomish County and Ziply Fiber project to construct a FTTP network from Arlington to Darrington along the SR530 corridor, connecting approximately 5,600 premises.
- Two service providers covering significant portions of the unserved areas in our service territory were awarded federal Rural Digital Opportunity Fund (RDOF) funding to bring high speed fixed broadband service to rural homes and small businesses. Because grants have already been provided for these areas, it makes any potential entry into those areas

increasingly complex as Snohomish PUD would likely need to coordinate with the service provider receiving federal funds.

Mapping Broadband Speeds & Service

The FCC released new broadband maps in mid-November 2022, approximately 6-months after the conclusion of the external phase of our study. The FCC believes that greater transparency will create market pressures on internet providers to improve their coverage and service. Previous FCC maps were overly optimistic, lacked location-specific information, and glossed over gaps in coverage. New maps are far more detailed and accurate, offering a better picture of fixed broadband availability, to include:

- Providers serving an area
- Broadband technologies in use
- Maximum download and upload speeds advertised for each technology

Figures 1 and 2, below, are the FCC National Broadband Map products for Snohomish County and Camano Island denoting approximately 95% coverage across the Snohomish PUD service territory at the 25/3 benchmark speed. The FCC and WSBO acknowledge that these maps have limitations and may not accurately reflect user experience at a "house-by-house" level. In response, the FCC has created a challenge process that is outlined on the FCC National Broadband Map website.

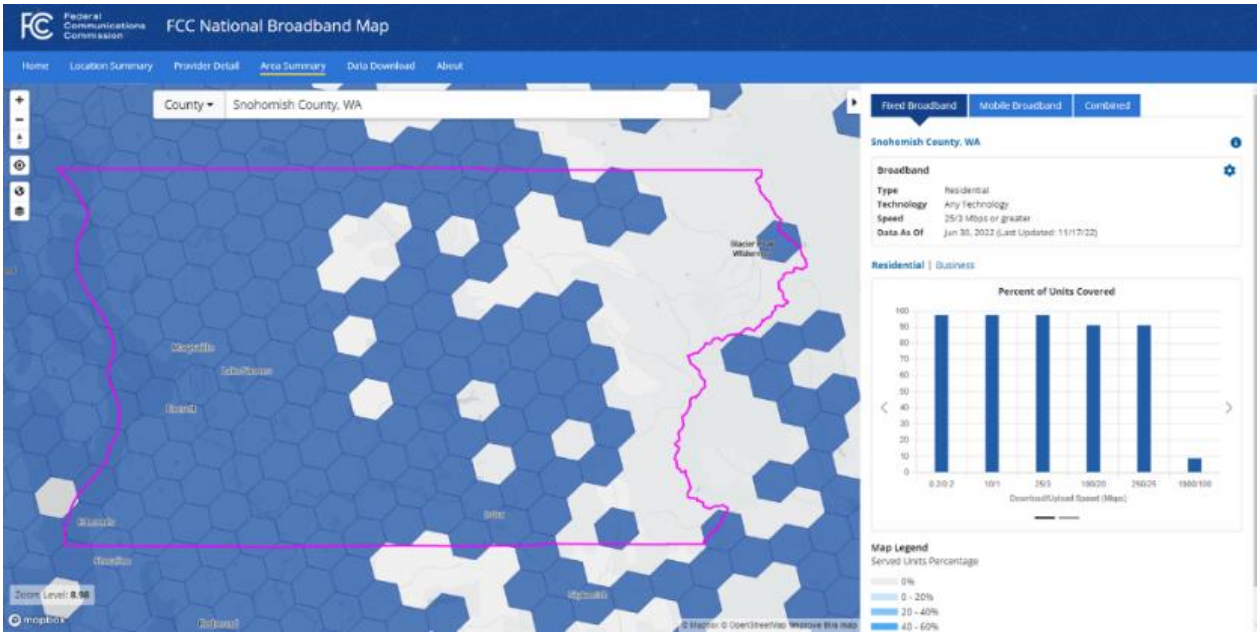

Figure 1: FCC National Broadband Map – Snohomish County

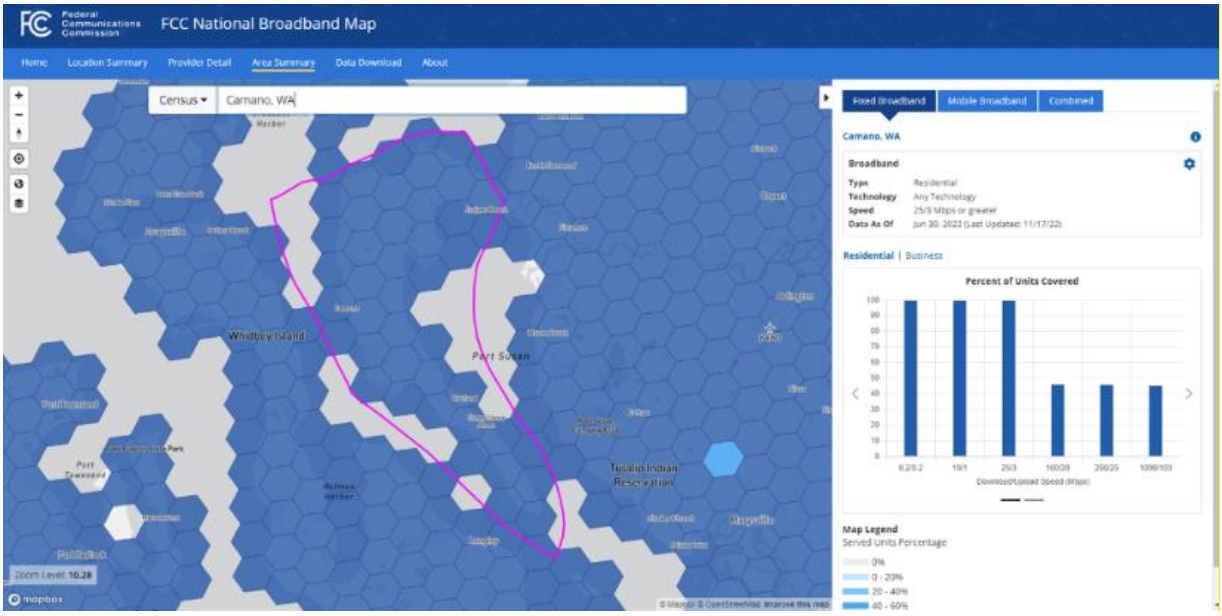

Figure 2: FCC National Broadband Map – Camano Island

Snohomish PUD Fiber Infrastructure Limitations

The Snohomish PUD fiber network was purpose built to provide reliable, efficient, and effective data transport to support the business and operational needs of the utility. The primary purpose of the network is to provide Supervisory Control and Data Acquisition (SCADA) communication between the Energy Control Center and electrical substations. The secondary purpose is to transport data between our offices, data centers, telecommunications facilities, and hydropower generation sites.

A network designed to meet the needs of a power and water utility is fundamentally different than a network designed to provide broadband services to residential and business customers. The number of fibers in a cable, locations of data centers, cable paths and routing, access point locations, and construction methods are fundamentally different between the two types of networks.

Snohomish PUD used fiber cables consisting of 36 or 72 fibers. This simplifies construction by utilizing the same attachment hardware for both sizes of cables while still providing enough flexibility for efficient design of the network. In comparison, a fiber-to-the-premises (FTTP) network designed to provide broadband service to residential and business customers should consist of cables large enough to serve each existing premise and any future development; with a dedicated distribution fiber and one dedicated feeder fiber for every 16-32 locations served. FTTP designs often have multiple 864 fiber cables branching off to smaller cables as the network extends to the edge of the service territory.

Utility fiber networks are designed to connect substations and offices using the most efficient path possible to minimize construction cost and signal degradation. This design passes the least number of premises possible. Access points are also kept to a minimum to reduce construction labor costs and potential points for failure. In contrast, a FTTP network is designed to maximize the number of premises passed and access points to reduce the cost of connecting those homes. The two types of networks are optimized to perform two different functions: operational networks optimize efficiency for business and operational use, whereas FTTP networks optimize service coverage and flexibility.

Snohomish PUD uses aerial dielectric self-supporting (ADSS) cable in our network. The non-metallic construction of this cable allows it to be installed in close proximity to high voltage lines making it possible for the PUD to install fiber in the electrical supply space on our poles – away from the congested cabling found in the communication space. This significantly reduces the need for additional make-ready work and is easier and more cost effective to initially install. The alternative lashed-cable construction used by most broadband service providers requires a metallic messenger strand to first be attached to the pole then the communication cable is lashed to the strand with metallic wire. Lashed construction is more difficult to initially install, raising construction costs, but does have the benefit of being easier to access to add additional cable and attach equipment to support network expansion. Although it is possible to provide broadband over an ADSS fiber network such as the PUD's current network, the additional cost to overcome access and engineering challenges to overbuild our current operational network will likely result in significant cost and risk.

How Snohomish PUD Currently Enables Connectivity

- To date in 2022, Snohomish PUD has received over 300 applications and has approved over 4,000 pole attachments and over-lashes
- 140+ Macro sites on distribution and/or transmission poles
- 11 monopole sites on Snohomish PUD properties with multiple cellular carriers
- 1,200 PSE AMI sites on Snohomish PUD poles
- 4 strands of fiber to Northwest Open Access Network (NoaNet)
- 4 strands of fiber to Snohomish County for Homeland Security
- 2 strands of fiber to City of Everett for Everett Filtration Plant
- 12 strands of fiber across the Delta for Wave Broadband

In sum, the fiber size, pole location, cable routing, and construction limitations of the PUD's existing fiber network are not advantageous to a FTTP broadband network deployment. An entirely new fiber network would be required to support broadband residential and business customers.

Service Delivery Costs & Considerations

For this initial, high-level study Snohomish PUD asked Magellan Advisors to provide an overview of a conceptual network for the sole purpose of establishing cost estimates. To keep cost estimates relative across projects of different scopes and scales, it is helpful to use "cost-per-mile" as the unit of analysis. Based on Magellan's data, experience, and projections they forecasted an average cost-per-mile for our service territory and topography of approximately $218,000/mile.

Although a good starting point for determining broad gauge costs, it is not an all-inclusive estimate. Real estate-to-premises cable terminations and broadband equipment, power, operational cost to run the network, and leased circuits connecting the network to the internet would be in addition to this estimate. The Broadband Study team believes the final cost to deploy and manage a broadband network would be significantly higher than the cost-per-mile estimate above would indicate.

Key Findings

- Currently, approximately 5-7% of Snohomish PUD customers have inadequate access to broadband. As noted above, there are projects in the making and/or underway that could reduce these numbers.
- The current Snohomish PUD fiber network is designed for operational use. Snohomish PUD would be required to build an entirely new fiber network to extend broadband service to currently unserved and underserved areas.
- There is an extremely high per-customer cost of entry to build an entirely new fiber network in unserved and underserved areas due to the low population density and rural environment.
- Emerging technologies and a large influx of federal funding creates uncertainty for the role that Snohomish PUD can play in the broadband market.

Broadband Engagement Models

Through our research and engagement with Magellan Advisors, peer utilities, and service providers, the Broadband Team identified three models for utility engagement in broadband. These models can be generally summarized as follows:

- Active Infrastructure:
    - Provide switched services using equipment to transmit and route data packets over the physical network.
    - Bandwidth is leased to retail providers using a wholesale model.
    - Used to consolidate traffic for efficient utilization of physical infrastructure.
    - Customers are the retail service providers vs end users
    - Notable implementors: Kitsap PUD, Chelan County PUD

- Retail Provider:
    - Provide the access interface to the customer and all associated services including service provisioning, billing, and advertising.
    - Customer point of contact, service, and technical support.
    - Requires significant employee resources and the ability to compete with traditional service providers.
    - No Washington PUDs currently provide retail services.
- Passive Infrastructure:
    - Provide dark fiber, conduit, real estate, and pole and wireless communication tower attachments (Joint Use).
    - Applicable to all fiber and network types (long haul to last mile).
    - Utility can choose to either build-to-lease or lease excess capacity.
    - Notable implementors: Grays Harbor PUD, Benton PUD

Peer PUDs in Washington provide a wealth of knowledge and experience in implementing the engagement models described above, but it is important to note the differences between the Snohomish PUD service territory relative to other utilities' choices of whether, and how, to best serve the broadband needs of their customers. Each service territory must be assessed according to unique operational and business factors including population location, geography and topology, service provider participation, competitive environment of the broadband market, and the type of network each utility chose to deploy at the time they were constructing their initial fiber builds. Many PUDs in Washington have achieved successes in expanding broadband service across their territories, but none has achieved full coverage, often struggling to serve the last 5-10% of their populations, which is where Snohomish County and Camano Island are currently.

It is also important to note that insufficient fiber backhaul (a.k.a. "the middle mile") is the not the primary barrier to expanding broadband coverage in our service territory. The primary need identified by our study is one of extending service from existing fiber backhaul to customer premises ("the last mile"): this necessitates construction of a FTTP network that would exist beyond our current infrastructure.

ELT Recommendation

To properly communicate and consider the detailed complexities of our study we conducted a five-hour workshop with the Snohomish PUD ELT, during which we:

- Reviewed key findings from both the internal and external phases of our study
- Discussed key considerations of each engagement model
- Weighed benefits and risks to the PUD, our communities, and our customers
- Considered whether the PUD could responsibly implement each engagement model and/or develop a unique engagement model that would best enable broadband connectivity for Snohomish County and Camano Island.

Through this process the ELT reached a single recommendation for future broadband engagement: Bolstered Passive Infrastructure.

After deliberate study, the Snohomish PUD Executive Leadership Team does not believe there is a responsible or economically feasible way for Snohomish PUD to build or utilize our own fiber infrastructure to provide broadband in unserved and underserved areas.

We do believe that Snohomish PUD can bolster its current approach to offering shared passive infrastructure, develop clear criteria for performing due diligence when opportunities to leverage our infrastructure and capabilities arise, and remain open to potential partnerships with community groups and/or ISPs.

This recommendation includes:

- Repealing the PUD directive prohibiting broadband ISP providers from leasing our current inter-office dark fiber (based on specific business case criteria)
- Creating a Continuous Improvement (CI) initiative to assess if there are meaningful ways to bolster our current engagement with service providers
- Developing a decision framework to create clarity on criteria, costs, and risk to serve as a baseline for considering potential partnerships in the future.

SNOHOMISH COUNTY PUBLIC UTILITY DISTRICT

Broadband Study

JUNE 2022

Magellan ADVISORS

www.MAGELLAN-ADVISORS.COM

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Executive Summary

Magellan Advisors studied the environment around and elements of a potential business case for offering broadband— always-on, high-speed internet access—to the Snohomish County Public Utility District's (Snohomish PUD) customers in Snohomish County and on Camano Island.

Many economic and personal activities have moved online in recent years. This trend accelerated during the COVID-19 pandemic. Without broadband, people have limited access to arts and culture, education, healthcare, social services, and work. This is especially true in remote rural areas but also suburban fringe and urban core areas among people with limited mobility options. They have been digitally excluded.

The study starts with information about broadband gaps and why they exist, then focuses on options for closing the gaps, including costs and risks. We identify implications for Snohomish PUD and recommend next steps for further study depending on strategic priorities. Substantial collaboration, learning, planning, and capital investment will be required for any broadband development. Magellan Advisors recommends focusing on specific needs and opportunities, building on the result of this study.

This is a summary of the report. The first section, "Broadband Gaps and Impacts," is the core of the report. It addresses basic questions about the digital divide in Snohomish County and surrounding area and provides a framework for assessing broadband gaps and impacts. Conclusions from the various parts of the study and their implications for Snohomish PUD are included in this section.

The other sections contain the details behind the conclusions in section one. The second section covers the local broadband market. Sections three and four analyze Snohomish PUD's partnership prospects and some of its peers. Regulatory considerations at all levels are detailed in section six. Section seven lists the full range of funding opportunities. The final section summarizes the situation, identifies areas in which Snohomish PUD may clarify strategic priorities, and provides possible next steps.

METHODOLOGY

The study focused on closing gaps and maximizing impacts. We identify major broadband gaps but point out that the "digital divide" is in devices, skills, and adoption as well as access. Impacts of broadband come from enabling people to act more effectively, for their wellbeing and for economic and social purposes. Gaps have negative impacts and block positive impacts. This study analyzes needs and opportunities for Snohomish PUD to offer broadband.

Needs are defined as unmet requirements. Needs were identified via available data, which has some limitations, and interviews with Snohomish PUD's prospective partners and other

stakeholders. At a high level, resources that can be used for or can support improved connectivity create opportunities. Stakeholder interviews revealed types of opportunities, as did analysis of funding programs, legislation, and regulations. Analysis of comparable businesses and current technologies identified possible options for Snohomish PUD. These methods also revealed details and nuances of threats to broadband development and their associated risks.

The study includes conceptual design to identify major components, costs required to close gaps, and ways to achieve impacts. The major components of this design are:

- High-capacity fiber backbone in all populated areas of Snohomish PUD's service area
- Network equipment necessary to light backbone fiber
- Fiber-to-the-home (FTTH) passive optical network (PON) infrastructure
- Citizens Broadband Radio Service (CBRS) radio access network (RAN) infrastructure

Each of these components could support various business models. The fiber backbone could be leased to generate revenue. Network gear literally lights the fiber by shining laser light into it, enabling transport services for enterprise or wholesale customers. Access infrastructure—passive optical network and radio access network—connects customers' premises for retail broadband. Wireless radio networks are more flexible and less costly, while fiber optic networks have more capacity and are more reliable. Both require fiber backbone and transport to aggregate local traffic and route it to and from the rest of internet. Snohomish PUD can provide any of this infrastructure, recognizing that the value of any of it depends on all of it being deployed; access equipment doesn't do anything without distribution infrastructure, which is useless without central office equipment.

FINDINGS

Different parts of the service territory have different connectivity needs. Rural areas need basic access, particularly to meet Washington state's adopted standard of 100 Mbps download and 20 Mbps upload speeds. Smaller cities and towns need to interconnect their sites and those of community anchors, including fire stations. Libraries and schools have excellent connectivity but need to extend it to their patrons, students, and their families. Core urban areas need consistent high speeds, lower costs, and more options. There are general needs for backhaul capacity and redundancy, as well as feeder network infrastructure, particularly in areas targeted for economic development. A multi-county network would close regional gaps and provide great value in conjunction with investment in access infrastructure for underserved areas. Opportunities and options to improve broadband come from numerous funding sources, prospective partners, and technologies.

Public funding from the American Rescue Plan Act (ARPA) and the Infrastructure Investment and Job Act (IIJA) is available for broadband development, as is private capital. Every stakeholder engaged in the study was open to partnering with Snohomish PUD. Most would welcome such participation. Comparable businesses were reasonably successful

with various models, although some arrangements were less than optimal. Technologies to deliver broadband are well developed and highly functional. State and federal policies and funding programs are generally supportive of broadband development by public entities like Snohomish PUD.

It would be quite costly to build broadband infrastructure for the entire Snohomish PUD service territory. A district wide fiber based passive optical network (PON) would cost approximately $2.8B to construct before operating expenses and real estate acquisition, and a similar wireless radio access network (RAN) would cost approximately $278M. A fiber backbone to fully cover the Snohomish PUD service area, connecting all of its substations, would cost $114M to build and $2.2M to light with wave division multiplexing technology, including central office facilities. These estimates are based on numerous assumptions and are financially conservative. Actual costs would be reduced with the scale of broadband development and via more detailed design and planning.

Snohomish PUD may get more specific about broadband. Snohomish PUD has some competencies in telecommunications that could be applied to broadband. What does broadband mean to Snohomish PUD's core business and its customers? What additional competencies would need to be developed and maintained? How has the playing field in the area of broadband changed, and how is it continuing to evolve? The local economy, population, and social situation have changed substantially in 70 years, due in large part to technological advances like the internet. How could Snohomish PUD address and capitalize on these changes? More fundamentally, what is Snohomish PUD able and willing to do about broadband?

Magellan Advisors recommends a comprehensive, methodical approach to broadband, tailoring investments to each area and stakeholder. Incremental investment to meet well-defined need and clear opportunity consistent with purpose is a practical approach to building broadband. This broad extensive study proves a solid jumping off point for further, more focused study and planning.

1. Broadband Gaps and Impacts

Broadband is essential to life today, but it is inherently technical and provided via infrastructure most people do not notice. The reality is that many people face socioeconomic barriers because they do not have always-on, high-speed internet access. The service is unevenly available and, even where it is nominally available, it may be too expensive, slow, or unreliable for consumers.

Official data provides a contradictory picture of broadband in the Snohomish PUD area. Data from service providers to the Federal Communications Commission (FCC), illustrated in Figure 1-1, shows many areas nominally have at least 100 Mbps wired broadband available. Yet, actual speed test data from Ookla show many locations with less—many below the FCC's standard of 25 Mbps download. Data from providers indicate that large areas of unpopulated public lands have broadband.

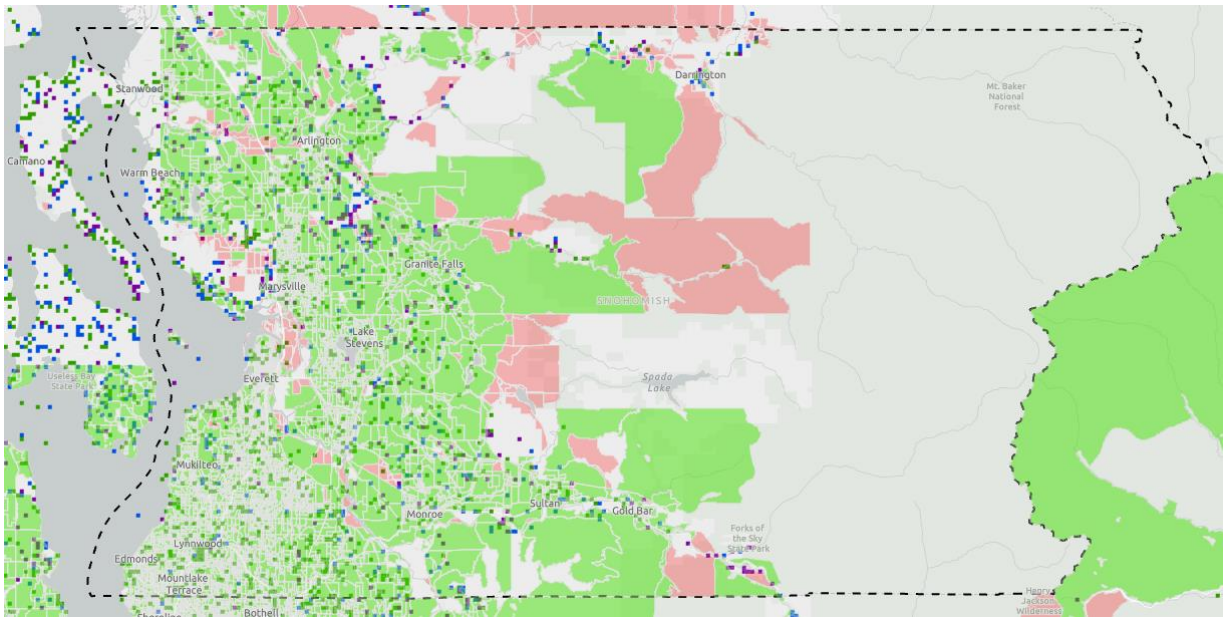


Figure 1-1. Nominal Availability Over Speed Test Results[1]

A more telling picture comes from overlaying incomes with speed tests, as shown in Figure 1-2. It becomes clearer that lower speeds are more prevalent in areas with a high percentage of households earning below median income for the area. The federally

[1] Source: FCC and Ookla, Inc., via NTIA, see https://broadbandusa.ntia.doc.gov/resources/data-and-mapping.

designated Low to Moderate Income (LMI) areas of the Snohomish PUD service territory tend to be both rural and urban with more affluence in the suburbs and exurbs.

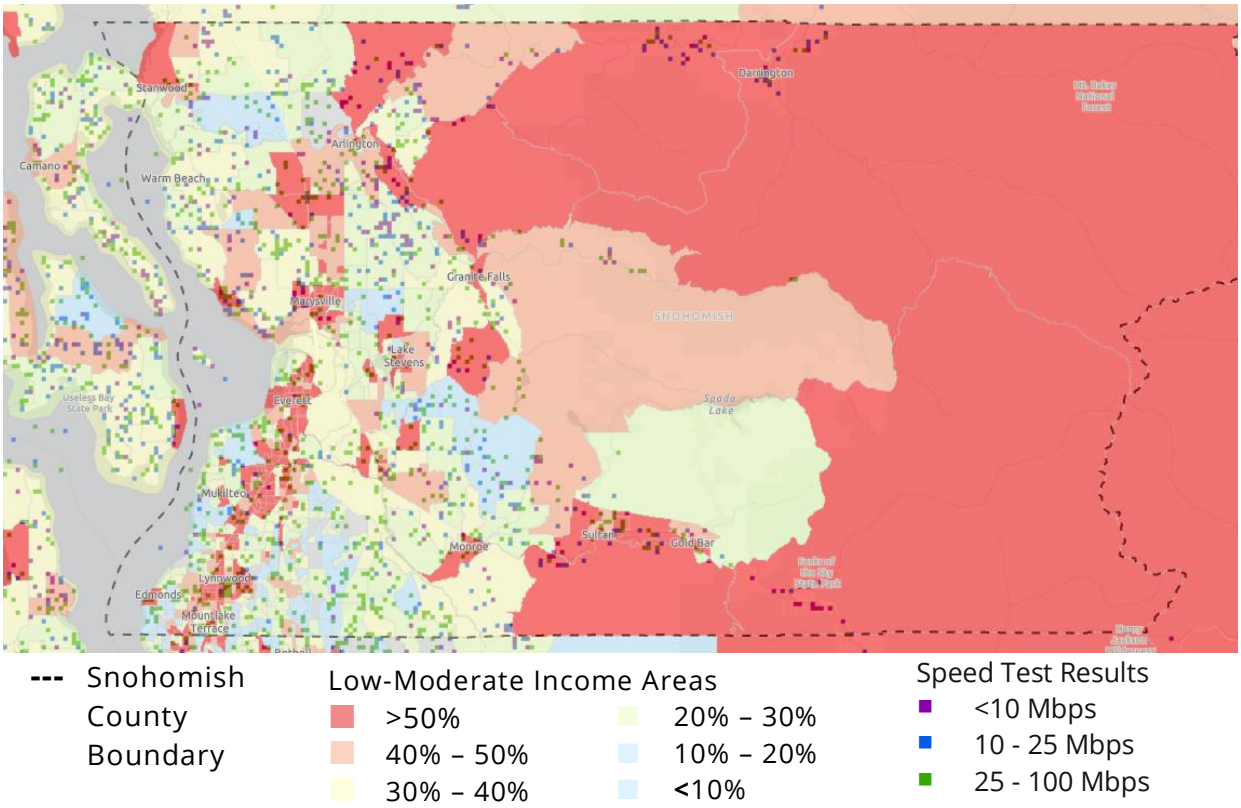


Figure 1-2. Low-Moderate Income Areas over Ookla Speed Test Results[2]

Broadband infrastructure and services in the Snohomish PUD service area are described and analyzed in detail below in the Market Analysis section of this Report. The high-level assessment presented here simply suggests the nature of broadband gaps in the Snohomish PUD area. It is important to put this in context. The federal availability data is dubious and the market is evolving quickly, as discussed in detail in other sections of this Report. Data suggests the Snohomish PUD area is generally well served by broadband, but that there are gaps on the edges of populated areas and in older residential areas. There is also evidence of gaps for cellular services in urban core areas and a need for site interconnection in small towns. Key economic areas lacked fiber as did areas on the economic and geographic fringe.

[2] Sources: Ookla, Inc. via NTIA and US Census via Housing and Urban Development (HUD). See https://www.hudexchange.info/programs/cdbg/cdbg-low-moderate-income-data/.

IMPACT ASSESSMENT

The impact of broadband has traditionally been assessed simply in terms of revenue and return on investment. Telecom has always been a private sector endeavor. While telephone service originally focused on connecting everyone, that ethos disappeared from the industry last century. Most of the communitarian culture of the internet also faded with its commercialization. The driving purpose of broadband and other telecom investment has been to increase shareholder value.

The digital divide emerged from this approach to assessing impact and guiding investment. Rural areas and urban core areas populated by low-income families and small businesses were deemed locations where it was too costly to build broadband infrastructure with too little ability to pay subscription fees. Lack of investment in technical skills—from basic digital literacy to advanced talent—in these same areas created further barriers to getting and using broadband.

For planning purposes, it is important to consider the various ways digital technologies like broadband can be used. As illustrated in Figure 1-3, at the basic level, digital technology can be used automate processes to reduce labor and related costs, increasing efficiency (same product with less work). Higher-level uses involve tailoring products to customers for competitive advantage, higher profits, and more revenue. The greatest impact of digital technology comes from new, unique products and services that are radically different and better than prior technologies— think streaming video versus broadcast television.

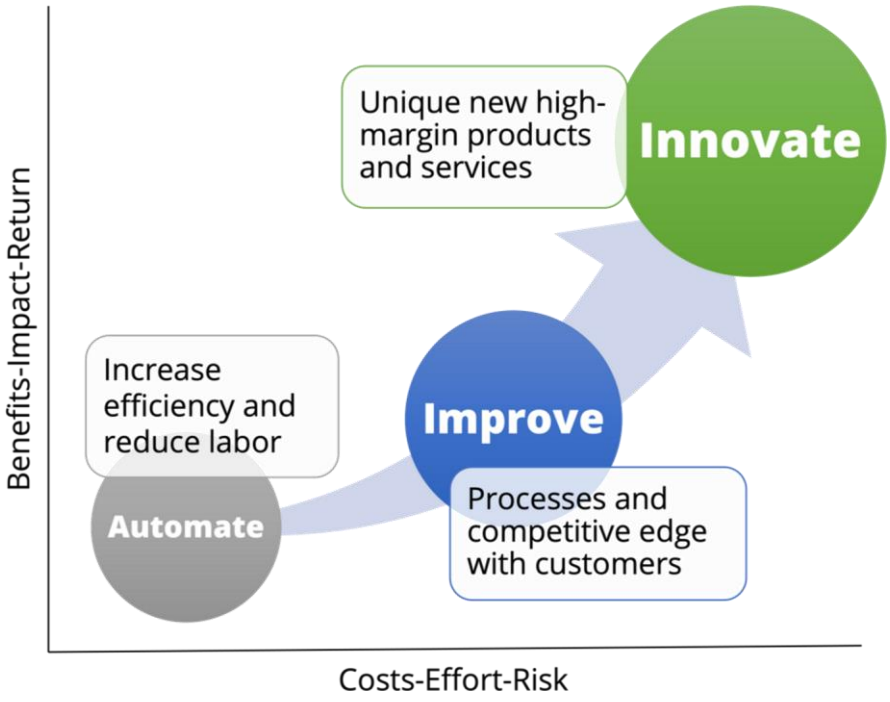


Figure 1-3. The "Digital Development" Framework for Technology Impacts

As an example, Snohomish PUD itself has automated processes via supervisory control and data acquisition (SCADA) and similar technologies. It has improved services using sophisticated marketing and operational analyses. Broadband is another example of services made possible via technology. Many of Snohomish PUD's customers have taken similar journeys. Customers' ability to realize the full value of technology—which incidentally impacts demand for power— depends on broadband because broadband makes other applications of digital technology possible. This study suggests:

- **Commerce and Industry** – Lack of broadband in major industrial areas and commercial areas, especially in small towns, undermines their competitive positions, particularly for innovative companies.
- **Education and Workforce** – The pandemic forced education to automate—replacing in-person school with video—with generally negative impacts on learning, particularly for those students without broadband. More workers are mobile, enabled by digital devices. Even greater connectivity will be needed to improve education and workforce with technology.
- **Health and Medicine** – Similar to education but even more data intensive. While this study did not have input from this sector, digital technology has automated many medical activities and improved wellness for those who can get it.
- **Remote Work** – Anecdotes from stakeholders suggest a major ongoing influx of residents working remotely, particularly out of the Seattle area. More rural areas are especially attractive due to lower housing costs and quality of place.
- **Aging in Place** – Snohomish County's population is projected to skew older in the coming decades.[3] Technology is already making it possible for seniors to remain independent longer with remote monitoring and telehealth. Coming innovations such as assistive robots will need flexible, high-capacity connections.
- **Public Safety** – Data is essential for deploying resources, mitigating risks, and responding to incidents. Communication and coordination are literally a matter of life and death. "Dead spots" in rural and urban core areas, specifically at fire stations, undermine responsiveness and put lives and property at risk.
- **Quality of Life and Quality of Place** – Snohomish County has high quality of life and place. Influx of more affluent remote workers and tech-intensive industry bolsters both. Broadband directly benefits both, as well, particularly as it enables amenities and essential services.

[3] See https://ofm.wa.gov/washington-data-research/population-demographics/populationforecasts-and-projections/projections-state-population-age-sex-race-and-hispanic-origin for estimates.

- **Tourism** –Snohomish PUD is geographically distinct as it includes islands and peaks, mountains, and shorelines. Visitors expect connectivity even in remote areas. A range of apps help plan and support trips in ways that can directly generate income for residents. Abundant, flexible, high-speed connectivity is needed on both sides of the tourism economy.

Minding the Gaps

Positive impacts of broadband are only possible where it exists. Areas without broadband are negatively impacted economically, in education, healthcare, and public safety, and with fewer lifestyle options. The gaps generally seem to be outside the metro area, along the sound, on the island, and up in the mountains. There seems to be somewhat limited or older access infrastructure in the lower income neighborhoods along Pacific Hwy, in industrial areas around the Arlington Airport, Stanwood, and areas east of it. Additional backhaul or middle-mile capacity is needed, especially into Tulalip, through the airport area, to Camano Island, and for mountain communities.

Historically, there have been no more than two options for broadband—"cable" or "telephone"—in most areas due to economic and historical factors. Some areas have had one option, some have had none. Gaps in broadband exist because the costs of serving some areas and customers are too high relative to potential revenue. Consequently, internet service providers have historically avoided investing in those areas.

The cable and telephone business models are based on wholly owning and controlling infrastructure, which enables them to limit prospective competitors. New entrants must over-build the incumbents' infrastructure. The capital expense required for that are a barrier to better, cheaper, faster broadband from more providers. Risks of investing in broadband come from competitive threats and uncertainty about customers' willingness to pay for network infrastructure or services. These are major factors in our analysis of the business case for Snohomish PUD to offer broadband services to its customers.

The task for PUD leadership is to determine what role, if any, the Snohomish PUD should play in developing broadband and promoting digital transformation . Further study will be necessary if Snohomish PUD leadership decides to take further steps to address the gaps and potential impacts described above. Should Snohomish PUD decide to move forward, Magellan Advisors suggests starting by defining purpose, services, and targeted areas. Clarification of why Snohomish PUD would offer broadband services—for what reasons, toward what ends—is necessary to get useful insights from further study.

The "tech stack" is a useful model for determining what is available and what is required to achieve specific purposes, and for identifying gaps between the two. Each component, or layer, of the tech stack provides key functions for the layers above and depends on the layer below. The extended tech stack, illustrated in Figure 1-4, links technology to specific activities in processes with outcomes. Automation, improvement, and innovation necessarily require changes in technology, and changes in technology impact processes

and outcomes via activities, depending on people's abilities. Individuals, entire organizations, particular departments or divisions, and entire regions can be assessed in terms of their tech stacks. Indeed, this is common practice among technologists.

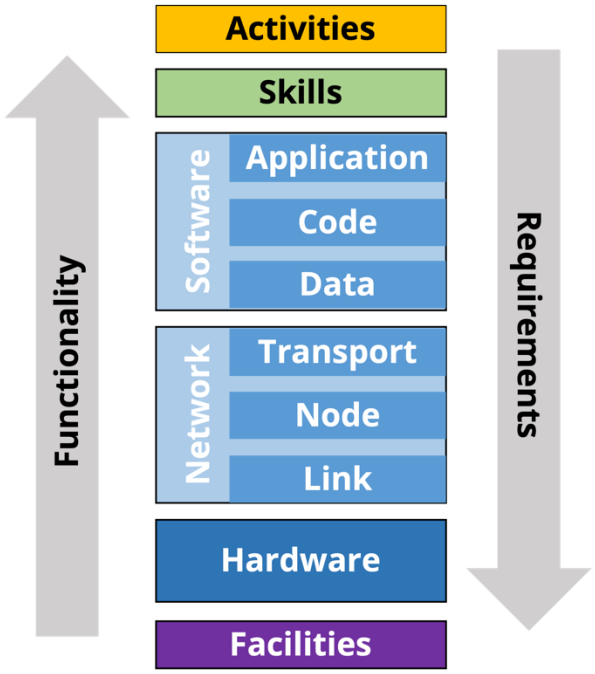


Figure 1-4. The Extended Tech Stack

Technology companies want to locate in places with solid, complete technology stacks—abilities and activities that use tech as well as tech infrastructure. Individuals and organizations literally rely on their stacks to function. The benefits and costs for them to use technology depends on the components—particularly broadband but also devices, software, technical services, etc.—available in their territory. Availability depends on clear, sustained demand. Thus "low tech" areas do not get broadband development because of weak manifest demand, which means they cannot get "high tech" because they don't have access. An initial infusion of capital can be critical as a catalyst to break this "chicken or egg" cycle.

Further clarification of goals and priorities is necessary to identify the specific gaps. This study was too broad and comprehensive to specify where more broadband infrastructure is needed. Without more information it would be necessary to blanket the entire area to address the gaps. If Snohomish PUD were to enter broadband market in any way, Magellan Advisors recommends a focused approach to close the most critical gaps with minimal investment. The present study is a starting point. Snohomish PUD, if it is inclined to move forward, will need additional data and analysis to identify and determine the feasibility of effectively closing those gaps.

Market Analysis

A small portion of the Snohomish PUD area—the southwest corner, closest to the Seattle metropolitan area—has multiple options for fast, relatively inexpensive broadband. Beyond there, most of the area seems to have only lower-speed service available from one or two providers. While these services are less expensive in absolute terms, the cost per Mbps of bandwidth per month can be ten times higher than more expensive, ultrafast connections. The State's broadband survey results suggest the entire region is under-served, especially areas to the north and east.

The relatively slow upload speeds of these services limit uses that involve sending data into the internet such as content creation, distance learning, gaming, telehealth, and telecommuting. These uses require symmetrical[4] connections. As they increase, demand for faster upload speeds and symmetric services will accelerate.

Ziply, which is the only provider in much of the area, has stated plans to rebuild its network with fiber and offer much faster and more economical services in at least portions of the Snohomish PUD area. Comcast and Wave serve the western portion of the area, but we see no evidence that they compete head-to-head or that their services extend into rural east county.

The southwest corner of the Snohomish PUD region has abundant long-haul and metropolitan network infrastructure, both of which stretch north along Interstate 5. The metro fiber infrastructure extends into Monroe to the east and out to Camano Island to the west. Long-haul fiber routes reach into eastern Washington as well as north into Canada and south into Seattle.

Comparable Business Examples

Numerous Washington PUDs are involved in telecommunications, broadband, and fiber. Their business models include opportunistic wholesaling of extra fiber, shared construction projects, and building and operating major Fiber-to-the-Premises (FTTP) active (lit) open access networks. Some PUDs participate in multiple ways. The commonality is simply that these PUDs have used their capabilities and resources to help close the digital divide in un-served and under-served areas of their respective counties. The existing industry structure and the separation of passive and active assets gives the PUDs the ability to selectively enter the market on a highly localized basis.

Other PUDs' approaches reveal the potential ways Snohomish PUD could help close the digital divide. The simplest strategy would be to provide assets for existing broadband providers' gigabit and fiber upgrades, which would require revenue or other clear benefits

[4] "Symmetrical" refers to service offerings with equal download and upload speeds. Most broadband services are asymmetrical, with faster download than upload speeds, and providers commonly only advertise download speeds.

for Snohomish PUD and its customers. This could entail sharing existing passive infrastructure, such as utility poles, as well as sharing land and building space for fiber aggregation points and for large and small cell sites, which Snohomish PUD does already. For new fiber opportunities, Snohomish PUD could take a purely opportunistic approach and share construction projects and costs with private transport providers when connecting fiber between PUD facilities or wholesale extra fiber strands to other entities needing a point to-point run of fiber throughout the county. This is similar Gray's Harbor PUD and Skagit PUD. Of course, the fundamental question is how such practices will benefit Snohomish PUD and its customers. Snohomish PUD cannot do these things "for free."

At the other end of the spectrum of options, Snohomish PUD could deploy a full Fiber-to-the-Premises (FTTP) network to address local needs. This is the approach that Chelan, Grant, and Kitsap PUDs have taken. Each PUD operates their FTTP network on a wholesale basis. Snohomish PUD could build network infrastructure to lease the dark fiber to one or more retail internet service providers. It could take a more active approach, operating the network electronics and operations center. Or it could partner with a third party, such as NoaNet, for some or all of these functions.

The level of participation should be based on the situation in specific areas as well as Snohomish PUD's strategic priories. Snohomish County includes dense urban areas, sprawling suburban areas, and sparsely populated rural areas. Most other PUDs simply do not serve as large or such complex markets. Each community should be assessed on its respective existing and emerging fiber and broadband assets and the local competitive environment. Thus, Snohomish PUD may need to consider a combination of approaches or multiple, nuanced approaches to address the full range of opportunities.

Partnership Opportunities

Snohomish PUD has many available options and opportunities to consider for potential investment in fiber infrastructure across the area. Generally, these are to increase capacity and redundancy in both east-west and north-south corridors if it would improve access for unserved/underserved portions of the service territory. While options for broadband and similar services are limited—especially outside the southwestern corner of the territory—there are some obvious potential partners for Snohomish PUD to address these gaps. There is a potential collaboration with Island, Skagit, and Snohomish counties on a regional network, for example, and another general opportunity to help a local provider close gaps in its infrastructure. There are also several general opportunities to coinvest in network assets with local governments.

The county, municipalities, and other institutions have been and plan to continue investing in network infrastructure and systems for internal purposes. Only one local jurisdiction has an interest in or plans for providing connectivity. Several interviewees advocated for approaching broadband as a utility, incorporating it into comprehensive planning, and working toward ubiquitous public Wi-Fi. None indicated actively working on such things or noted a clear role for Snohomish PUD. All interviewees were glad to hear Snohomish PUD

was studying the issue, but none had any particular expectations or requests of Snohomish PUD.

Generally, there seemed to be unmet and growing demand for broadband beyond the southwestern corner of Snohomish County, and general need to supplement cellular coverage. While Snohomish PUD could develop fiber routes to address the opportunities noted above, opportunities to improve availability, costs, or performance of last mile connections depend on network service providers. There are potential opportunities to build local distribution infrastructure, but it was not clear—except in one case—what entity would use that infrastructure to deliver services.

The cellular providers have made use of such network capacity in other places. We also have seen smaller, relatively more entrepreneurial providers eager to use such infrastructure to enter new markets, especially where there is strong growth. It is unlikely that the major players would use PUD infrastructure, although Wave and Ziply may be open to co-investment. The implication is that Snohomish PUD needs to further investigate potential demand by private providers, especially beyond the cable-telephone company duopoly. The best way to do this is through a coalition with other stakeholders.

Partnership opportunities generally follow the broadband gaps. In each area there are prospective partners who could help drive investment. There was only one specific provider partnership opportunity identified in this study. Investment in other areas requires Snohomish PUD to identify a provider or for Snohomish PUD to work with other stakeholders to attract providers. The basic strategies are to co-develop broadband with a provider to meet stakeholders' requirements or co-develop with stakeholders to sell to providers as wholesale customers. Either strategy could result in new revenue for Snohomish PUD. Clearly it will take a lot work to build such partnerships but they could enable the area to leap ahead, increase investment and consumer options, and build more resilient networks for everyone.

Provider Partnership Opportunities

All the service providers we met with expressed interest in potentially working with Snohomish PUD to help close the digital divide in Snohomish PUD's service area and those currently operating in the area maintain solid relationships with Snohomish PUD. Each provider, however, had a different idea of how an agreement would be structured. Ziply is generally open to collaboration and jointly applying for public grants. Comcast is more restricted due to the state's mandate that all public funds go to open access networks, though they are interested in pole attachments and joint trenching opportunities. Since AT&T is not a local provider, they would like to continue to work with Snohomish PUD to lease assets to support their 4G and 5G cellular network. NoaNet and Petrichor are service organizations that would be willing to structure a long-term business arrangement with Snohomish PUD.

The fundamental aspects of any potential partnership are questions around who funds the initial construction of the passive assets (conduit and fiber), who owns and maintains it over the life of the asset and which entity, or entities, offer lit, or active, services on the passive infrastructure.

Funding, Legislative, and Regulatory

Snohomish PUD provides energy infrastructure for a service area that spans Snohomish County and Camano Island. Like most electric utilities, Snohomish PUD has embarked on a grid modernization program which includes deployment of high-speed communications infrastructure for real-time monitoring, advanced sensing, communications, analytics and controls. State and national policy is very supportive of extending broadband infrastructure to Snohomish County's underserved and unserved areas – which is most of the County except for the southwest corner. Snohomish PUD may be able to leverage funding from the favorable policy environment to expand its communications facilities for underserved and unserved areas, on a wholesale or retail basis as determined by Snohomish PUD.

American Rescue Plan Act (ARPA) funds can be used for broadband and the Infrastructure Investment and Jobs Act (IIJA) also provides substantial additional funds for broadband through the National Telecommunications and Information Administration (NTIA) for unserved areas (following a six month rulemaking process). IIJA also provides funding for grid infrastructure and resiliency (including $3 billion for the Department of Energy's Smart Grid Investment Matching Grant Program). There are several implications of the current legislative and regulatory environment.

For broadband infrastructure planning purposes, any possible development should enable or provide 100 Mbps down and 20 Mbps up minimum speeds required by the IIJA, not the outdated 25/3 Mbps FCC definition of broadband. Broadband speeds should be scalable to 150 Mbps symmetrical service by 2028 per the State Broadband Office under SB 5511.

For broadband infrastructure planning purposes, Snohomish PUD would need to anticipate the use of the more accurate broadband mapping developed by the FCC as required by the Broadband DATA Act. This mapping is required to be used and available for IIJA funded projects by mid-year. Snohomish PUD would need to avoid facilities deployment in areas where the FCC has awarded Rural Digital Opportunity Funds (see Section 3.4), unless in partnership with Frontier and/or SpaceX (the two awardees).

Given that IIJA funds will be disbursed through state agencies, it will be crucial for any entity seeking funds to maintain close communications with the State Broadband Office and other state agencies, and to start such communications with state agencies and legislators early. Applicants will also need to follow major developments in the NTIA rulemaking process for IIJA broadband funding and evaluate final rules when promulgated by NTIA. IIJA middle mile grant funding could be used to extend backbone infrastructure and IIJA RUS ReConnect funding could be used to extend rural broadband infrastructure.

Snohomish PUD may continue participation in the Snohomish County Broadband Action Team and Snohomish County Tomorrow and could provide information to those organizations regarding opportunities for broadband infrastructure expansion supported by IIJA. Snohomish PUD could also seek appropriate partnerships. Snohomish PUD may also maintain communications with Washington State Department of Transportation to take advantage of "dig once" opportunities for fiber projects in coordination with transportation projects. Intergovernmental relationships with cities, neighboring counties and tribes could reveal additional broadband needs and opportunities.

Technology Options and Costs

There are multiple technology options for providing broadband to Snohomish PUD. A detailed evaluation of the options and costs is beyond the scope of this study. For illustration purposes, however, we provide a conceptual design that identifies the major cost components for each option, demonstrates how those components interact financially and functionally, and provides "extreme case" full build-out cost estimates. The purpose is to illustrate the scale of the capital investment required for fiber and wireless infrastructure to connect everyone throughout Snohomish PUD. Insights from prospective partners and market characteristics detailed elsewhere in this report provide important context for interpreting these estimates and utilizing the conceptual design as a planning tool. The conceptual design appears in Appendix II.

MAXIMIZING BROADBAND IMPACTS

Broadband can be a costly undertaking. While Snohomish PUD could likely become a broadband provider more economically than most enterprises, the scale of investment for Snohomish PUD-wide coverage is simply not practical. If Snohomish PUD were to invest at any scale, basic business principles dictate that it should be within fiscal capacity and generate reasonable returns. For most of the communications sector, "reasonable returns" simply means increasing shareholder value at general market rates. There are many ways Snohomish PUD could provide or support broadband but those depend on what leadership deems to be in the realm of possibilities.

As a public utility, rates and timeframes on return on investment are inherently different for Snohomish PUD than for private telecom companies. Snohomish PUD has the advantage of operating as a not-for-profit entity but with the statutory requirement to recoup costs. By investing in broadband, Snohomish PUD could improve operational efficiency and reliability. It could support economic development with broadband services, which could translate into greater, more sustainable demand for power. Snohomish PUD could focus on funding opportunities work to have those funds flow into the area, if not Snohomish PUD itself. And broadband could diversify Snohomish PUD's revenue streams.

Input from stakeholders, local market dynamics, the regulatory environment, and funding options represent various opportunities for Snohomish PUD. Investment in broadband

could have substantial impacts and benefits, including profitable revenue. Opportunities remain ill-defined in part because goals and intended impacts have not been specified. Deeper, "full stack" analysis and planning for opportunities, risks, and threats require definitions of what Snohomish PUD hopes to accomplish with broadband for focus. Generally, we recommend focusing on core competencies and business requirements. Snohomish PUD may create the most impact by targeting specific geographic areas, routes, and sites, working closely with relevant stakeholders. Exactly how, whether, and which gaps to address broadband gaps depend on Snohomish PUD's capacity and strategic priorities.

2.Snohomish Broadband Market Analysis

Magellan Advisors analyzed the broadband market to determine the options available to residents and small and large (enterprise) businesses in the Snohomish PUD service area. The analysis focused on internet speeds and pricing from commercial service providers. Technically, broadband refers to a communications circuit that is split into multiple, separate channels. Broadband has come to mean always on, high-speed internet access. As of January 2015, the FCC defines "broadband" as a minimum of 25 megabits per second (Mbps) download speed and 3 Mbps upload speed, or "25/3." In January 2018, the FCC reaffirmed that definition, which they deemed this adequate for a single user engaged in telecommuting or student activity. Most broadband services are asymmetrical, with faster download than upload, and providers commonly only advertise download speeds.

For this market assessment we reviewed data from federal agencies, including the Census Bureau, the FCC, and the NTIA. We identified internet service providers from these sources and researched their service offerings. This information generally indicated available speeds and other service features along with monthly recurring costs (MRC) or non-recurring costs (NRC). An online service, Fiber Locator, was used to identify network infrastructure through the area.

Where cited, costs will be classified as monthly recurring costs (MRC) or nonrecurring costs (NRC). MRC are fees for service representing recurring payments which may or may not be part of a subscription tied to a committed service term. Non-recurring costs are typically required up front for service installation. Quoted costs are exclusive of federal and local taxes, subscriber fees, Universal Service fees, and equipment rental costs. Often, the existing providers will also advertise teaser rates, good sometimes for only 6 months, then revert to their usual rates.

BROADBAND AVAILABILITY

The FCC requires providers to report where they offer services. Figure 2-1 shows median speeds by Census tract based on the FCC definition of broadband. This data, which comes from providers, indicates that most of the service area has median speeds well below the baseline for broadband of 25/3.

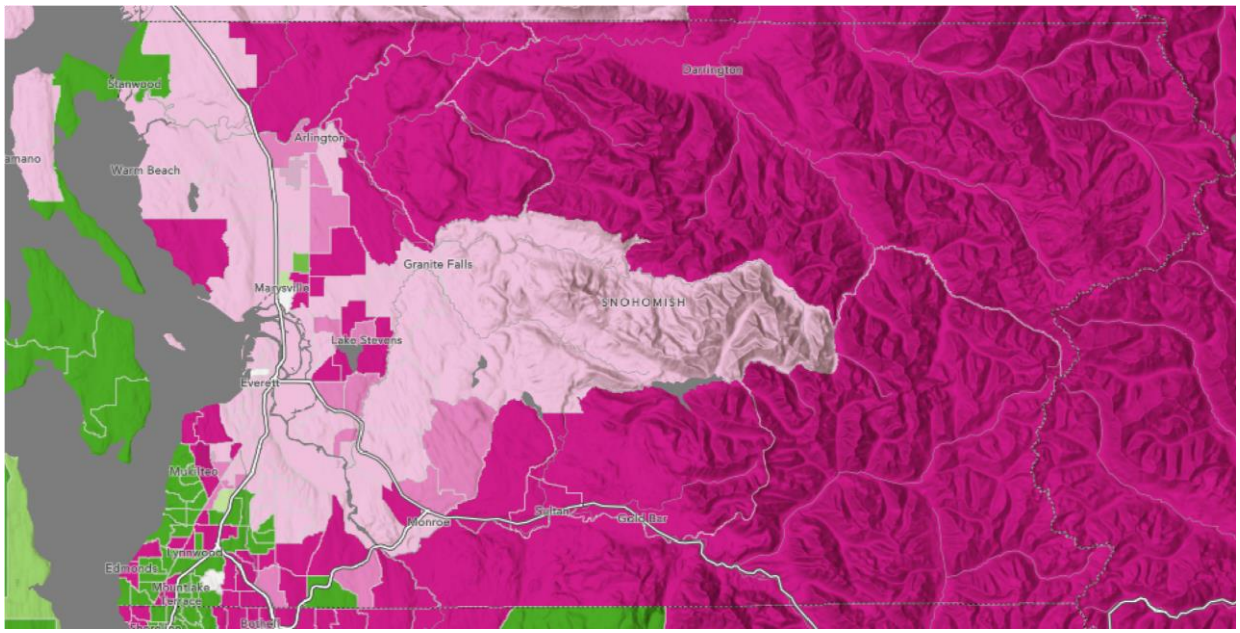


Figure 2-1. Median Broadband Speeds per Census Tract Based on FCC Data[5]

The Washington State Broadband Office conducts on on-going survey of broadband availability and performance. Recent results, shown in Figure 2-2, reveal that sub-broadband speed service exists across the area. Non-broadband connections—those less than 25Mbps download—are most prevalent in the north and east, as are locations that report having no broadband available. Given the very low incidents of connections faster than 500Mbps, it is reasonable to assume that many of the results between 25 and 500Mbps are on the lower end of this range.

[5] Source: *FCC Form 477 Fixed Broadband Deployment Summary by Census Geography with Provider Data*, Esri, Inc., https://www.arcgis.com/home/item.html?id=8c116982c0c444e5bda2f2416ee78f31

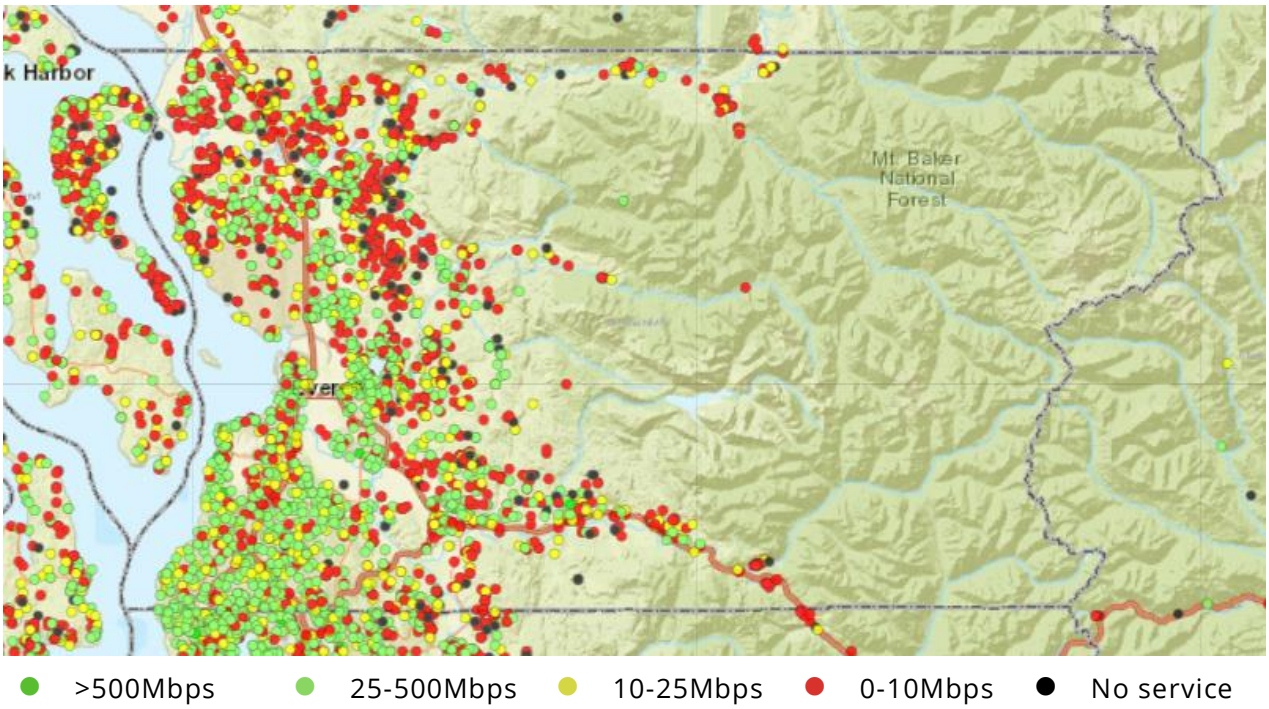


Figure 2-2. Washington State Broadband Download Speed Test Results[6]

Figure 2-3 provides a bit more nuanced analysis of this data for Snohomish County. Note the marked difference between 25/3 and 100/10, which might be considered "real" broadband. The number of options for most consumers drops precipitously. Keep in mind that this is provider-provided data that has been widely criticized for its overstatement of service offerings.[7]

[6] Source: *Washington State Broadband Access and Speed Survey* results, Washington State Broadband Office,

[7] See, for example, https://www.bbcmag.com/law-and-policy/broadband-mapping-is-amess-no-one-knows-what-to-do-about-it.

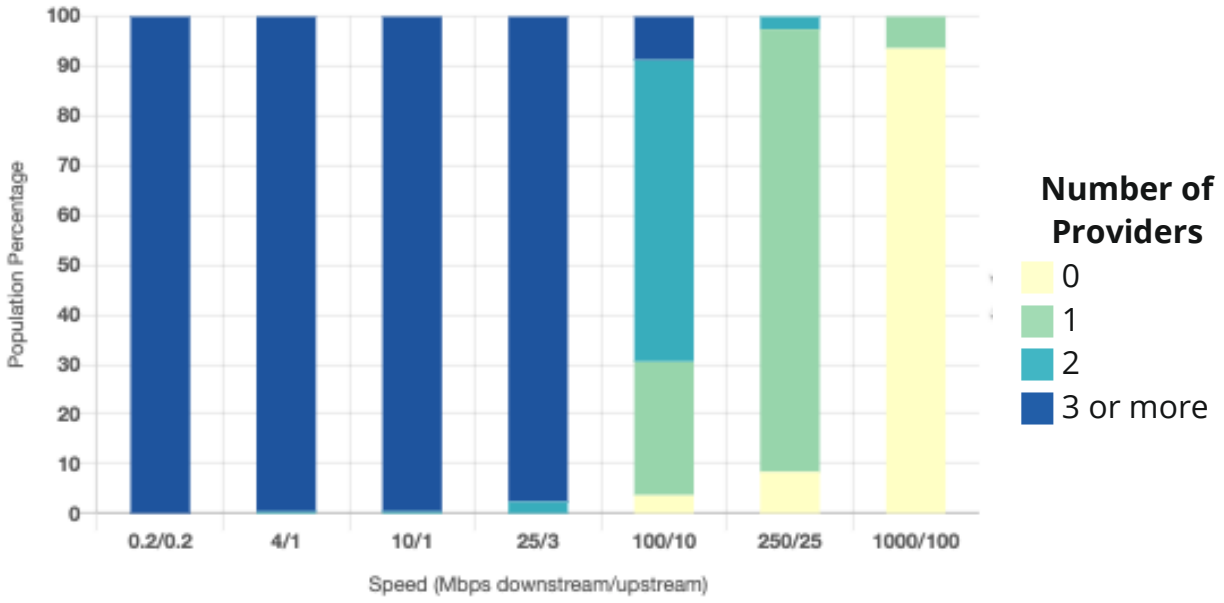


Figure 2-3. Number of Providers per Connection Speed by Percentage of the Population for Snohomish County[8]

The number of providers—based on self-reports to the FCC—doesn't just decrease rapidly by speed; there is also a huge geographic disparity. Figure 2-4 illustrates that more rural areas have far fewer connectivity options than more densely populated urban areas. It also illustrates how unreliable the FCC data is: Based on the data, the Wild Sky Wilderness area has three broadband providers. Magellan Advisors knows from work done in the area that the Upper Skykomish Valley has only a single broadband provider.

[8] Source: Fixed Broadband Deployment, Area Summary, Federal Communications Commission, https://broadbandmap.fcc.gov/#/area-summary?version=jun2020&type=county&geoid=53061&tech=acfosw&speed=25_3&vlat=48.05563755193148&vlon=-121.7961749635607&vzoom=9.044585417469536

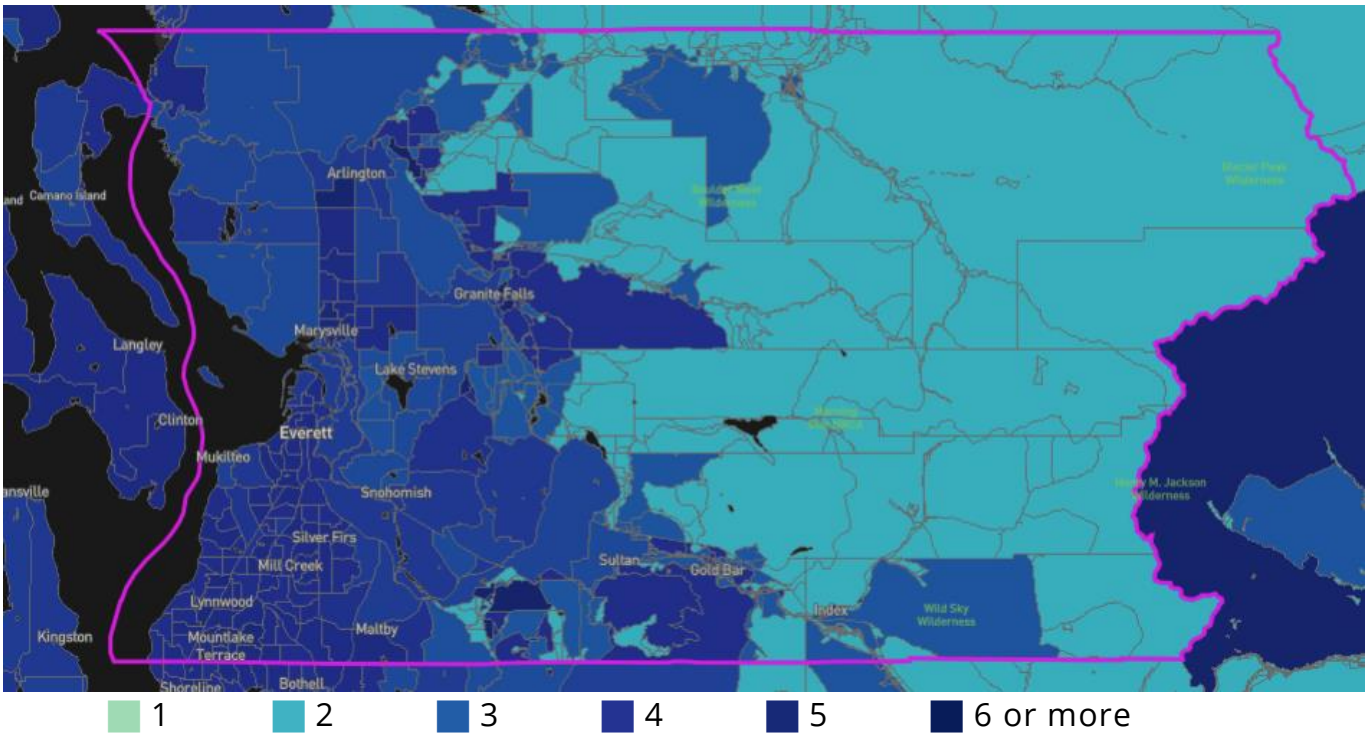


Figure 2-4. Number of Fixed Residential Broadband Providers[9]

The United States Department of Commerce NTIA, uses data from multiple sources to provide information on broadband availability. Figure 2-5 shows a combination of FCC 477 data and speed test data from Ookla. The red areas represent those areas that are clearly below the FCC's 25/3 benchmark. Lighter red areas are empirically underserved, while the darker red areas are underserved by providers' own admission. A key difference is that the empirical data is for Census tracts, which are larger areas, while the provider data is by Census blocks, which are relatively small.

[9] Source: Fixed Broadband Deployment, Area Summary, Federal Communications Commission, https://broadbandmap.fcc.gov/#/area-summary?version=jun2020&type=county&geoid=53061&tech=acfosw&speed=25_3&vlat=48.05563755193148&vlon=-121.7961749635607&vzoom=9.044585417469536

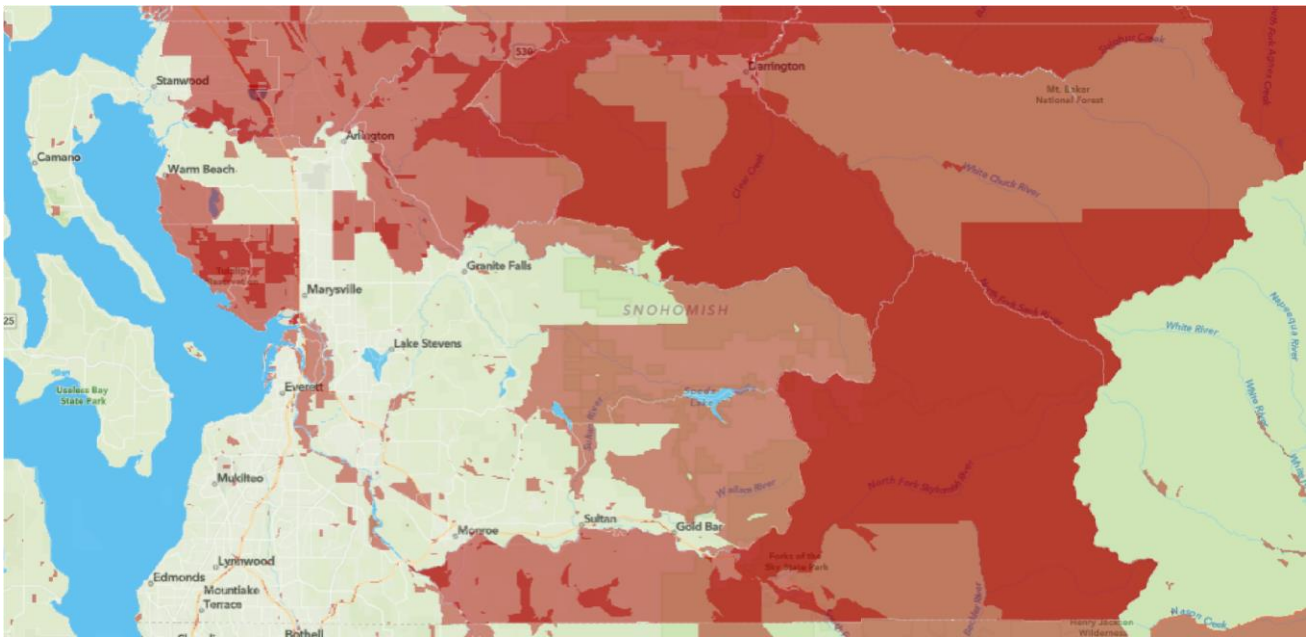


Figure 2-5. Under-served Areas in Snohomish County

BROADBAND PROVIDERS AND OFFERINGS[10]

The major internet service providers for both residential and businesses in Snohomish County are Comcast Xfinity and Ziply Fiber. Xfinity lists coverage greater than 99% throughout urban areas of Edmonds and Everett, while Ziply Fiber lists greater than 78% coverage for those same areas. Wave Broadband is the dominant provider for Camano Island.[11]

To gain an understanding of offerings and prices from Xfinity/Comcast, Ziply Fiber, and Wave Broadband, the City of Edmonds was researched for a representative sample of published services, displayed in the tables below. Overall, Ziply Fiber offers the most economical plans in the areas serviced. Note that the FCC data on fixed broadband deployment shows 56% of rural Snohomish County (57,200 people) either have no broadband service or are served by a single provider (not including satellite).

Xfinity is the broadband brand for Comcast. Comcast is the largest cable internet provider in the US. Xfinity offers internet plans in the urban portions of Snohomish County, but service is not available in Camano Island. Coverage varies greatly

[10] Offerings and providers change. All information in this section is as-of October 2021.

[11] Source: BroadbandNow.com

within the remaining areas of the county. Table 2-1 below displays Xfinity's published offerings for residents in Edmonds and Table 2-2 displays offerings for businesses.

Table 2-1. Xfinity's Published Residential Internet Service Offerings in the City of Edmonds, WA

PACKAGE	SPEED[12]	MRC[13]	MRC PER MBPS[14]	NOTES
Performance Starter+	50/5	$29.99	$0.55	1-year promo rate
Performance Select	100/10	$44.99	$0.41	1-year promo rate
Performance Pro+	200/10	$54.99	$0.26	1-year promo rate
Blast! Pro+	400/15	$74.99	$0.18	1-year promo rate
Extreme Pro+	800/20	$84.99	$0.10	1-year promo rate
Gigabit	1200/35	$94.99	$0.08	1-year promo rate
Gigabit Pro	2000/2000	$299.95	$0.07	2-year promo rate

Table 2-2. Comcast's Published Business Internet Service Offerings in the City of Edmonds, WA

PACKAGE	SPEED	MRC	MRC PER MBPS	NOTES
Business Starter Internet	35/5	$69.95	$1.75	2-year contract
Business Internet 100	100/15	$138.44	$1.20	2-year contract
Business Internet 200	200/20	$173.44	$0.79	2-year contract
Business Internet 300	300/30	$203.44	$0.62	2-year contract
Business Internet 600	600/35	$278.44	$0.44	2-year contract
Business Internet 1 Gig	1,000/35	$378.44	$0.37	2-year contract

[12] Speeds are in megabits per second (Mbps) download over megabits per second upload. cited in this section are those advertised by providers and should be considered maximum possible speeds. Actual speeds are likely to be lower.

[13] MRC is "monthly recurring cost."

[14] This metric is the MRC divided by the total aggregate throughput, downstream plus upstream.

Ziply Fiber is a relatively new company that purchased most of Frontier Communications' plant in the northwest. It offers services throughout Snohomish County including Camano Island. It advertises residential speeds up to 1000 Mbps download and upload. For areas not served by fiber, DSL connections at varying speeds may be available, priced at $40 per month residential and $50 per month business. Tables 2-3 and 2-4 display Ziply's service offerings for residents and businesses, respectively.

Table 2-3. Ziply Fiber's Published Residential Internet Service Offerings

PACKAGE	SPEED	MRC	MRC PER MBPS	NOTES
Fiber 50/50	50/50	$20.00	$0.20	Pricing with autopay & paperless billing
Fiber 200/200	200/200	$40.00	$0.10	Pricing with autopay & paperless billing
Fiber Gig	1000/1000	$60.00	$0.03	Pricing with autopay & paperless billing
Internet (DSL)	?/?	$40.00	n/a	Pricing with autopay & paperless billing. Speed depends on location.

Table 2-4. Ziply Fiber's Published Business Internet Service Offerings

PACKAGE	SPEED	MRC	MRC PER MBPS	NOTES
Fiber 100/100 (business)	100/100	$50.00	$0.25	Pricing with autopay & paperless billing
Fiber 500/500 (business)	500/500	$100.00	$0.10	Pricing with autopay & paperless billing
Internet (business DSL)	N/A	$50.00	n/a	Pricing with autopay & paperless billing. Speed depends on location.

Wave Broadband is a cable TV, broadband internet, and telephone provider serving customers in Washington, Oregon, and California. The company was formed through purchases of cable systems previously owned by Northland Communications, Cedar Communications and Charter Communications.

Although Wave is primarily a cable internet provider, fiber or DSL service is available in limited areas. Except for Camano Island, areas of Snohomish County served appear to be significantly less than other providers. Tables 2-5 and 2-6 display Wave's published offerings for residents and businesses.

Table 2-5. Wave's Published Residential Internet Service Offerings

PACKAGE	SPEED	MRC	MRC PER MBPS	NOTES
High Speed 100	100/5	$69.95	$0.67	400 GB data limit
High Speed 250	250/10	$89.95	$0.35	1TB data limit
High Speed Gig	940/10	$99.95	$0.11	Unlimited data

Table 2-6. Wave's Published Business Internet Service Offerings

PACKAGE	SPEED	MRC	MRC PER MBPS	NOTES
HIGH SPEED 15	15/5	49.95	$2.50	2-year contract
HIGH SPEED 55	55/10	$69.95	$1.08	2-year contract
HIGH SPEED 110	110/20	$99.95	$0.77	2-year contract
HIGH SPEED 250	250/20	$124.95	$0.46	2-year contract
HIGH SPEED GIG	1000/30	$249.95	$0.24	2-year contract

Fixed Wireless Service

Ptera is a fixed wireless provider that offers services throughout Inland Northwest, with coverage listed for the Snohomish County and Camano Island market. The plans range from 10 Mbps download with 4 Mbps upload for $59.00 to 25 Mbps download with 8 Mbps upload for $109.00 per month. The order page of their website says they are currently pausing new installs and site surveys to focus on improving existing infrastructure.

Satellite Services

Satellite providers Viasat and HughesNet have plans that nominally meet the minimum broadband definition of 25/3 Mbps. In practice, the connections do not perform at broadband speeds due to technical reasons—basically, their antenna are 23,000 miles above the earth. Costs are significantly higher than other services and data caps apply to many of the plans.

ViaSat advertises speeds up to 100 Mbps download and 1 Mbps upload in select areas. Plans range from Bronze 12 Mbps with a 40 GB data cap for $99.99 to the Platinum plan of 30 Mbps service with 150 GB of data for $299.99 per month; all prices are after a 3-month introductory period at a lower price. Latency is approximately .5 seconds for a round trip. This makes gaming difficult and could affect voice calls.

HughesNet offers similar plans as ViaSat in the Snohomish County/Camano Island market, but with lower speeds and data caps. All HughesNet plans are 25 Mbps download speed with different data caps. The plans range from 10 GB data cap for $59.99 after promo discount to 50 GB data cap for $149.99 per month. Offers are for a 2-year contract.

StarLink is piloting services in the area. All reports suggest it has good performance—up to 150 Mbps download—at $99 per month and $600 upfront cost for equipment, shipping, and taxes. It currently has limited availability but is slated for general roll out in the Snohomish PUD area as of the writing of this report. Recent information suggests costs for most StarLink subscribers will be substantially higher than for the pilot services.

FIBER OPTIC NETWORKS

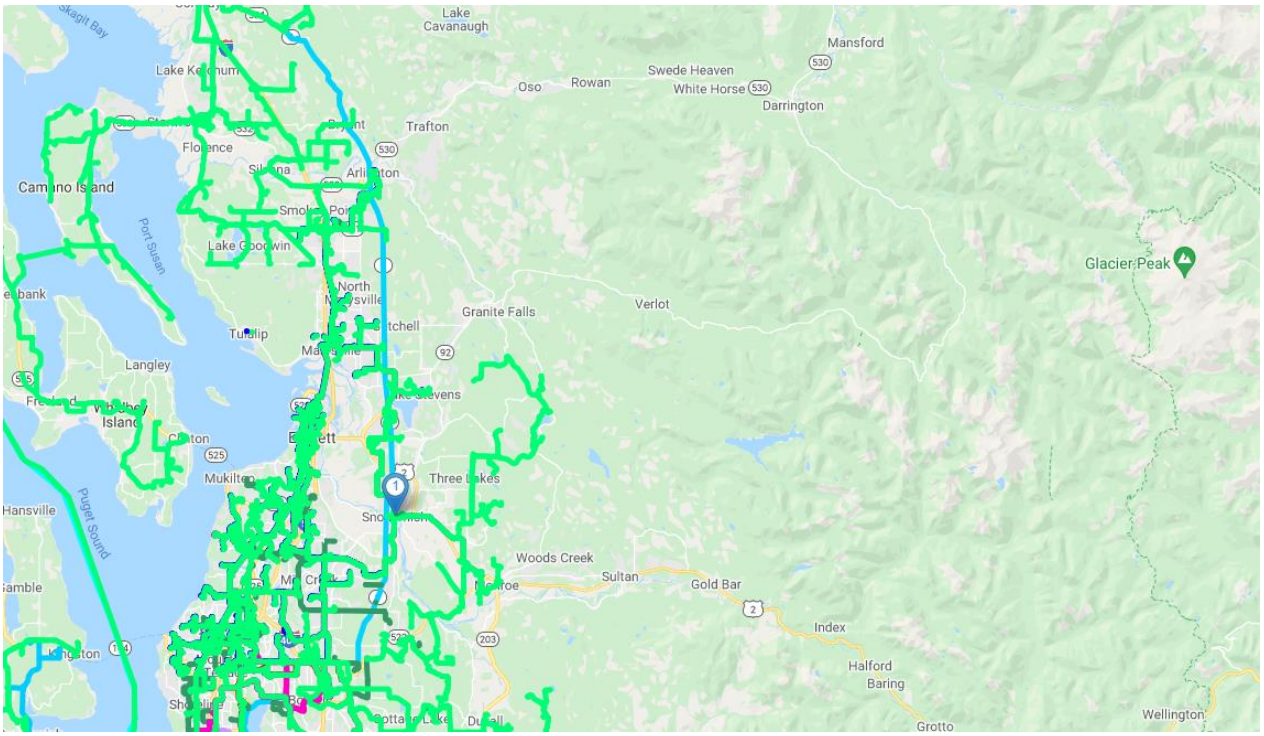
Fiber optic networks are classified by the types of access they accommodate. Long-haul networks allow access only at major carrier points-of-presence (POPs). Long-haul customers want as few points of failure as possible, which translates into very limited access.

Metro networks, as the name implies, are designed to connect major sites in relatively dense metropolitan areas to each other, to long-haul networks, and to other service providers, typically via colocation, data center, or exchange facilities. Middle-mile networks are like metro networks but typically extend access to interconnection points and major sites in more rural areas.

Both long-haul and metro/middle-mile connectivity are priced on an individual case basis, based on the service level, number of sites, distance, and bandwidth required. Some of these companies—especially long-haul providers—will lease dark fiber strands on some routes, but these are generally lit services. Many of the companies prefer to sell connectivity as part of a suite of managed services.

Metro/Middle-mile Fiber Routes

Metro or middle-mile fiber generally passes, if not enters, major commercial and industrial sites. Access is typically limited to large buildings or similar facilities. There are several companies with such infrastructure in the Snohomish County area, as illustrated in Figure 2-6. A notable feature of this sector is the amount of acquisition activities: Four of the six companies identified in Fiber Locator have been acquired in recent years. One, Lumen, was a former independent local telco that grew into broader network services via multiple acquisitions before rebranding in the last year.



- Cascadia FiberNet
- Lumen (formerly CenturyLink)
- Allstream (formerly Integra)
- GTT Communications (formerly Hibernia)
- Zayo

Figure 2-6. Metro Fiber Routes in the Snohomish PUD Area[15]

Long-Haul Fiber Routes

Four companies have long-haul routes through Snohomish County, primarily located in the western region near the coast, as shown in Figure 2-7. These routes connect providers' POPs with effectively no physical access in between. T-Mobile's long-haul is primarily used to connect its switching centers and carries cellular call and data traffic. In addition to assets included in Fiber Locator and shown in Figure 2-7, the Bonneville Power Administration and Verizon have long-haul fiber along US Hwy 2 through the Upper Sky Valley.

[15] Source: FiberLocator, accessed August 2021.

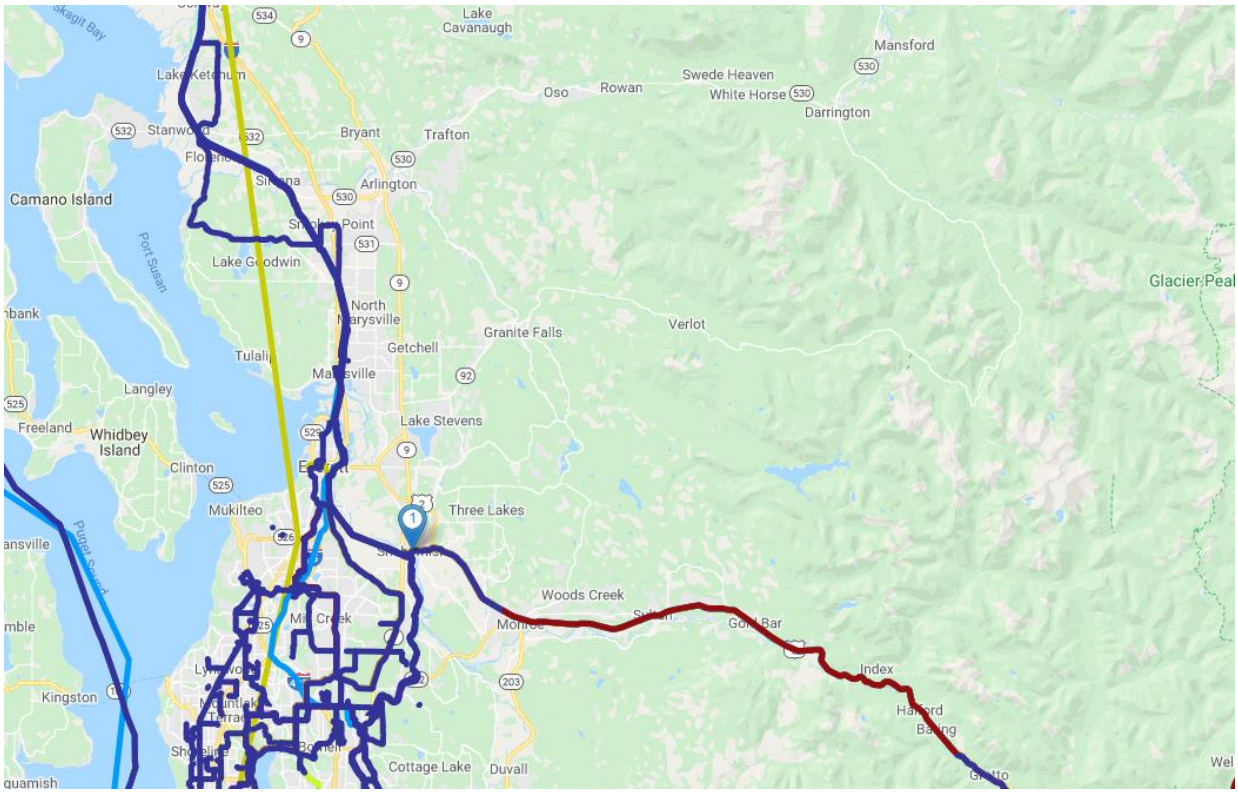


Figure 2-7. Long-Haul Fiber Routes in the Snohomish PUD Area[16]

[16] Source: FiberLocator, accessed August 2021.

3.Comparable Businesses

Magellan Advisors researched and analyzed the businesses comparable to Snohomish PUD that were selected by Snohomish PUD's broadband study team. The research focused on 4 key areas:

- Customer base served
- Infrastructure
- Services and Revenues
- Organization

This section compares and contrasts fiber and broadband operations of the select PUDs in Washington State. Magellan Advisors, with support of Snohomish PUD, spoke with other Washington State PUDs to understand their business models and internal staffing requirements and to learn from their experiences. At the recommendation of Snohomish PUD, the Washington PUDs shown in the map in Figure 3-1 were analyzed including:

- Benton PUD (Chris Folta)
- Chelan PUD (Bob Shane)
- Grant PUD (Russ Brethower)
- Gray's Harbor PUD (Rob Hanny)
- Kitsap PUD (no interview)
- Skagit PUD (Alistair Boudreaux)

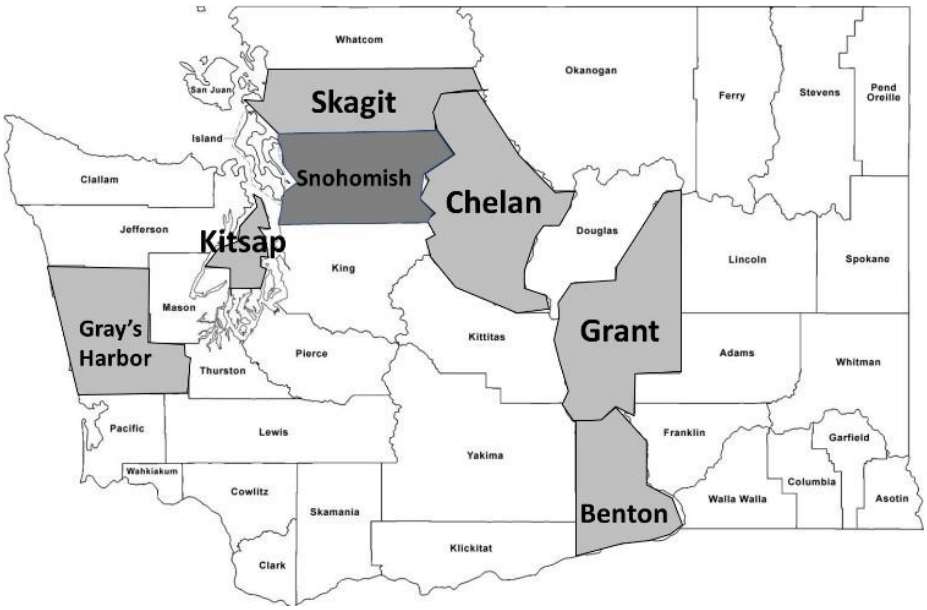


Figure 3-1. Locations of the PUDs Included in This Analysis

Washington State PUDs have implemented a wide range of telecommunication, fiber, and broadband business models. These range from leasing excess capacity (Gray's Harbor PUD)

to Fiber-to-the-Premises Lit Open Access wholesale operations (Grant PUD). No PUD offers retail services, and no PUD has indicated they plan to offer retail services even though they now can in underserved or unserved areas. Each PUD accounts for their fiber and broadband operations differently. This applies to accounting for the initial construction project as well as on-going operations. These accounting differences can make direct financial comparisons challenging.

In addition, the Kitsap PUD was included for reference as they have implemented a lit open access model in partnership with NoaNet. Magellan was unable to engage directly with Kitsap PUD after numerous attempts. We also interviewed several network service providers, including NoaNet, which is owned by a number of PUDs. NoaNet offers a range of services, but none of the PUDs we engaged used all of them.

A BROADBAND "STACK" MODEL

To understand the different ways Washington State PUDs participate in the fiber broadband business we use a simplified four-layer model shown in Figure 3-2.[17] The base layer is the *passive broadband infrastructure* consisting primarily of the unlit, or dark, fiber stands. Passive infrastructure can also include utility poles, conduit, and real estate. On top of this passive infrastructure is the active infrastructure. *Active infrastructure* is the electrical equipment used to transmit and route data packets to and from the residential and commercial endpoints and the local aggregation point. This is frequently based on the widely used Ethernet standard.

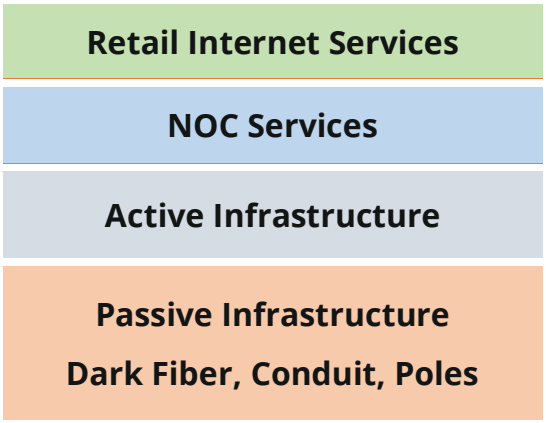


Figure 3-2. The Basic Broadband "Stack"

Network Operations Center (NOC) Services include the "back-end" operation support systems (OSS) and business support systems (BSS). This encompasses a wide range of

[17] This model is broadband specific version of the four lower layers of the extended tech stack model presented in section 1.

software systems to support functions including provisioning each customer, ensuring continuous operations, and billing. In this model, the retail internet service providers (ISPs) are responsible for routing and addressing packets through the global internet. In addition to providing access to the internet and the cloud, retail internet service providers are also responsible for marketing, customer service and in-home Wi-Fi. Large service providers such as Comcast and Ziply own and operate all layers.

WASHINGTON PUD BROADBAND MODELS

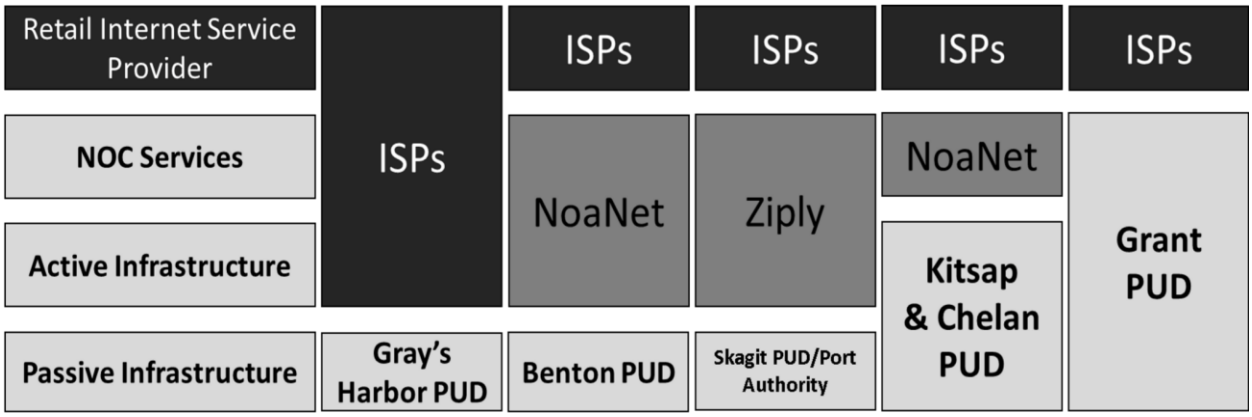


Figure 3-3. PUD Operating Models

The PUDs researched have implemented different models as illustrated in Figure 3-3. These models range from Grant PUD, which owns and operates a full Lit Open Access Network, to Gray's Harbor PUD, which leases extra dark fiber to service providers. In between these are Chelan and Kitsap PUD, which own the dark fiber and operate the active electronics and outsource the NOC functions to NoaNet. Benton PUD owns the dark fiber and outsources all the active components to NoaNet. The different models are summarized in Table 3-1 and discussed below.

Table 3-1. Broadband Model Summary of Comparable Businesses

PUD	Passive Infrastructure	Active Infrastructure	NOC Services	ISP
GRAY'S HARBOR PUD	PUD	Retail ISPs	Retail ISPs	Retail ISPs
BENTON PUD	PUD	Noanet	Noanet	Retail ISPs
GRANT PUD	PUD	PUD	PUD	Retail ISPs
KITSAP PUD	PUD	PUD	Noanet	Retail ISPs

PUD	Passive Infrastructure	Active Infrastructure	NOC Services	ISP
CHELAN PUD	PUD	PUD	Noanet	Retail ISPs
SKAGIT PUD	Port/PUD/ Petrichor	Ziply	Ziply	Retail ISPs

Benton PUD

Benton PUD entered the dark fiber leasing business in 2001 and currently has 500 miles of fiber. They are in the dark fiber wholesale business and NoaNet is their only customer. They deploy fiber to support their internal Information Technologies (IT) and Operational Technologies (OT) and include extra fiber to wholesale to service providers. In addition to their own needs, they deploy fiber to select anchor institutions and large commercial locations. They also provide fiber to over 75 cell towers.

Benton PUD wholesales dark fiber to Noanet, who then wholesales it to service providers and mobile network operators (MNOs) for their operations. When Noanet finds a customer to be served, they petition the PUD, who then evaluates the opportunity. If it passes evaluation, the PUD provides capital and NoaNet designs the network and manages the construction, work orders, and inspections. NoaNet holds all contractual relationships with the network service providers. They own the service orders and are responsible for billing. Benton PUD owns the resulting assets.

Benton PUD has a separate broadband business unit with one full time employee. Telecom makes up about 2-3% of revenues and is a minor note in their financial statements. It took ten years to achieve breakeven. In the last ten years they have generated over $4 million in positive cashflows. In 2020, gross revenues were $2.8 million and net cash flow was $700,000.

Chelan PUD

Chelan PUD operates a lit open access fiber network targeting residential subscribers. They also wholesale dark fiber to network service providers. The fiber business is operated as a stand-alone unit. The electric utility is responsible for all construction and the fiber group pays them for make-ready and pole attachments. Chelan PUD contracts NoaNet for NOC services and first line of support.

To date, they have invested over $100 million in fiber. The initial investment came from the utility side in the form of debt. The Board of the PUD decided to forgive the initial debt as a public benefit. They have 18,837 homes served with PUD fiber and are targeting passing 85-90% of all county homes in the next few years. Their revenues from external internet service providers in 2020 was $7.5 million.

Grant PUD

Grant PUD's stated mission is to provide electricity and fiber. They own and operate a lit open access fiber network to residential subscribers based on point-to-point Ethernet. They currently have 16 internet service provider customers providing residential services. They also lease capacity to six wholesale transport providers. They have one full time broadband employee and use other PUD resources as required.

Grant PUD began deploying fiber in 2000 with an initial focus on anchor institutions and dense population centers. As of 2018, they have passed 70% of all Grant County locations and are targeting 100% coverage by 2024. As of 2016, their total network construction costs exceeded $256 million. 2020 telecommunication revenues were over $10.6 million and had positive net earnings. Their original investment capital came from the electric utility operations. The fiber unit does not have to repay the initial construction money. It must, however, cover operating costs with current revenues.

Gray's Harbor PUD

Gray's Harbor PUD's fiber strategy is primarily an "excess capacity" model. The PUD wholesales excess dark fibers, Wave Division Multiplexing (WDM) circuits, space on radio towers, and space at co-location facilities to 26 service providers. The fiber unit is a subsidiary of the of the electric utility and has one full time employee. In 2020 it generated $560,000 in revenue and $245,000 in net cash flow.

Skagit PUD

Skagit PUD, a water utility, is focused on deploying fiber to their own facilities. When they do, they include excess fiber strands for wholesale purposes. This is primarily a wholesale middle mile dark fiber network. Skagit PUD created a joint venture with Port of Skagit called SkagitNet. SkagitNet owns dark fiber, and they are negotiating with Petrichor to manage it. NoaNet is also in discussions to provide maintenance and support.

Kitsap PUD

We attempted to connect with Kitsap PUD officials but were unable to meet with them. We've included them as an illustrative model of a water PUD that constructed a FTTP network. Additionally, they frequently discuss their open access architecture in public forums and we believe Lewis PUD has received funding for a similar architecture. The information below is from their website and their public appearances.

Kitsap PUD is a water utility. When the Washington State law passed in 1999 giving PUDs the ability to provide wholesale telecom services, Kitsap PUD began a county-wide fiber network project to connect all anchor institutions including schools, libraries, medical facilities, governmental offices, and naval bases. Today, these anchors have the capability

of 10 Gbps services. In 2015, residents in Kitsap County began to ask Kitsap PUD to expand their broadband network and provide residential services.

The Kitsap PUD residential network is a lit open access FTTP network that provides wholesale broadband services at 100Mbps or 1Gbps speeds. The outside plant architecture is point-to-point, and the lit network is based on Active Ethernet.

The fiber network has been funded by a property tax, federal funds, and long-term bonds. No Kitsap PUD water utility funds have been used. In 2018, total tax collection revenues were $2,329,556 of which 68%, or $1,584,000, went to telecommunications. Thus far, they have deployed over 250 miles of fiber including middle-mile and last-mile connections.

Kitsap PUD works with NoaNet, who offers retail services to anchors and businesses that include 10Mbps to 100Gbps transport, Dedicated Internet Access, VoIP, security and access control, system, and network monitoring.

AREAS OF FOCUS

The four areas of focus during our research are the target customer base, infrastructure, services & revenues, and organizational issue.

Customer Base

In 1999, Washington State passed a law that gave PUDs the option to enter the telecommunications market on a wholesale basis. Thus, the PUDs we researched all had wholesale operations and leased their assets and services to network service providers. These include ISPs that serve commercial and residential subscribers, 4G/5G Mobile Network Operators, Fixed Wireless ISPs and long-haul fiber providers.

A differentiator in PUD fiber strategies is on the end customer or end point served. Benton PUD focuses on serving community anchors (e.g., Government, Libraries, Medical), commercial locations and cell towers. They wholesale their excess dark fiber, via NoaNet, to ISPs and MNOs looking to connect a new end point or location. Benton has one customer, NoaNet, who maintains the network and the customer relationships with the service providers. Gray's Harbor PUD also focuses on wholesaling passive infrastructure including dark fiber, tower space and real estate for co- location. They have 26 network service provider customers.

Chelan, Grant, and Kitsap all have similar models. They operate a "lit" open access Fiber-to-the-Premises (FTTP) network for residential subscribers. They deploy the fiber, including the drop, to each single-family unit (SFU) served. They then deploy the active infrastructure and lease Ethernet Virtual Local Area Networks (VLANs) to the retail ISPs. The ISPs are responsible for customer acquisition and customer support. Today, Chelan serves 18,887 homes with lit wholesale connections and their stated goal is to pass 85-90% of all homes in the county over "the next several years". Grant PUD wholesales their active connections

to 16 retail ISPs. As previously stated, as of 2018, 70% of Grant County locations were passed by PUD fiber. They are targeting 100% coverage by 2024.

Grant PUD also sells wholesale capacity to six transport providers, and they have also constructed a wholesale wireless network to service a range of wireless services providers including MNOs and WISPs. Table 3-2 provides a summary of each PUD's customer base for comparison.

Table 3-2. Customer Base Summary Comparison

COMPANY	CUSTOMER BASE
BENTON PUD	Serve anchors, commercial buildings, and Cell Towers. NoaNet is their only direct customer.
CHELAN PUD	Serve residential market, 18,887 end user fiber connections.
GRANT PUD	Serve residential market with 16 Retail ISP customers and 6 wholesale transport customers.
GRAY'S HARBOR PUD	Serve 26 customers with dark fiber, co-location, and tower space.
KITSAP PUD	TBD
SKAGIT PUD	Through SkagitNet (PUD and Port)

Services And Revenues

PUD revenues are generated by leasing dark fiber or Ethernet VLANs to retail network service providers including ISPs and MNOs. The PUDs do not offer internet access, voice, or video/cable TV services.

Profitability is dependent on the accounting policies of each PUD. Each PUD accounts for their fiber and broadband costs and revenues differently. A primary factor in determining the profitability is how each PUD accounts for the construction costs. In some cases, such as Chelan PUD, the initial investment was written off as a public good. In other cases, revenues are offset with depreciation. Grant PUD, for example, depreciated $9.5 million of capitalized construction in 2020.

Chelan PUD's total operating revenues from telecom services were $10.5 million in 2020 with an operating loss of -$1.047 million. However, they had an operating profit of $2.5 million before $3.575 million in depreciation was deducted.

Grant PUD wholesale fiber revenues were $10.67 million, $9.43 million, and $8.26 million in 2020, 2019, and 2018, respectively. The gains are attributed to an increase in take rate, network expansion, and a slight wholesale price increase. Considering earning before depreciation, they were $8.4 million in 2020.

In 2020, Benton PUD generated $2.8 million in fiber revenues. Net cash flow after operating expenses ($1.2M) and Capital investments ($1 M) was $700,000. Gray's Harbor generated $700,000 in revenues in 2020 and had net cash flow of $400,000. Skagit doesn't call out telecom or fiber revenues but shows $568,000 in "Other" revenues which likely includes telecom revenues. Table 3-3 provides a summary of services and revenues for comparison.

Table 3-3. Services and Revenues Summary Comparison

Company	Services and Revenue
GRANT PUD	2020 Revenues of $10.6 million and net income of $8.4 million before depreciation.
CHELAN PUD	2020 Revenues of $10.56 million and net income of $2.5 million before depreciation.
BENTON PUD	2020 Revenues of $2.8 million and net cash flow of $700,000.
GRAY'S HARBOR PUD	2020 Revenue of $560,000 and $245,000 in net cash flow.
KITSAP PUD	TBD
SKAGIT PUD	Not Reported

Infrastructure

Chelan, Grant, and Kitsap are targeting wide-scale fiber deployment with their residential fiber strategy. These network architectures require that fiber be connected to each home or location in the service area or neighborhood. As expected, the level of investment from these PUDs is substantial.

Grant PUD invested $256 million in their network as of 2016. In 2020, they passed an additional 2,583 homes for a total of 35,732 homes passed. Their take rate is 63% or 23,225 homes served. Network expansion budgets for 2018, 2019, and 2020 were $8.2 million, $14.1 million, and $20.3 million, respectively. In 2021, they have budgeted $16.4 million for additional fiber design and construction. They are committed to 100% coverage of "all people of Grant County" by 2024.

Chelan PUD invested $103 million in fiber, funded by interfund transfers. This includes $5.1 million in 2020 and $1.9 million in 2019. Kitsap continues to expand their fiber network as well. They added 25 miles in 2019 and 48 miles in 2020, bringing their total to over 250 miles of fiber route miles.

Benton, Gray's Harbor, and Skagit PUD have more limited strategies and thus lower investments. They are each deploying fiber for their own needs and wholesale extra capacity. Benton PUD has invested over $25 million in middle mile fiber since its inception in 2001. They do not disclose what percentages are used for internal and wholesales operations.

Gray's Harbor PUD's fiber operation is expected to grow substantially in the next few years. They currently are reviewing over 25 requests by customers to deploy fiber in unserved and underserved areas in accordance with the PUD's business model. They are also taking a more active approach in seeking both state and federal funding. Skagit PUD plans to continue to focus on connecting their facilities and are open to working with private fiber providers for dark and lit fiber services and joint construction opportunities. Table 3-4 provides a summary of infrastructure for comparison.

Table 3-4. Infrastructure/Network Summary Comparison

COMPANY	INFRASTRUCTURE
BENTON PUD	Dark fiber for ISPs and MNOs
CHELAN PUD	Dark fiber and open access lit fiber for retail ISPs
GRANT PUD	lit open access FTTP for retail ISPs. Wholesale wireless network
GRAY'S HARBOR PUD	Wholesale dark fiber to range of SPs. Mostly PON,[18] some Active Ethernet
KITSAP PUD	Lit open access FTTP for retail ISPs
SKAGIT PUD	Wholesale dark fiber co-owned with Port to Ziply

Organization

All PUDs have a dedicated fiber unit. Whether they are wholesaling excess capacity or have a substantial fiber operation, each PUD separates the fiber unit from the utility since electric and fiber are different businesses and have different operating cultures. The

[18] "PON" stands for passive optical network, which is a standard for gigabit speed fiber-based retail broadband infrastructure.

degree of separation varies. Benton and Chelan PUD's have separate fiber units with separate budgets and Benton PUD's fiber operation has one full time employee.

Grant and Gray's Harbor PUDs have a separate broadband unit that falls under the electrical organization. Their revenues and expenses are 'rolled-up' with the electric unit. Grant PUD has one full time employee and uses applicable PUD resources when required. Gray's Harbor PUD is similar. It has one full time employee, and three utility employees are assigned to the fiber unit part time. Table 3-5 provides a summary of organizational structures for comparison.

Table 3-5. Organization Summary Comparison

COMPANY	ORGANIZATIONAL STRUCTURE
BENTON PUD	Separate Fiber unit with one full time employee
CHELAN PUD	Stand-alone fiber group with separate budget
GRANT PUD	Broadband unit is under electrical unit. Separate expenses that are rolled-up with Electric. One full time employee and use PUD resources when required.
GRAY'S HARBOR PUD	Part of Electric unit. One full time and 3 part time employees
KITSAP PUD	TBD
SKAGIT PUD	Separate unit called SkagitNet, co-owned by PUD and Port.

4. Partnership Opportunities

Snohomish PUD has many opportunities for partnerships to invest in broadband. The largest set of prospective partners consists of Snohomish PUD's current public-sector customers, which are commonly referred to as "community anchor institutions" in broadband planning. Broadband would be an opportunity to expand these relationships. This would mean working together to attract network service providers as customers. Under this approach, Snohomish PUD could jointly invest and, to the extent acceptable by PUD leadership and allowable by statute, share risk with these customers, manage the infrastructure, and "sell" providers on the area. The other approach would be to partner with the providers to reduce their cost of doing business, particularly in more rural areas. Of course, any such "partnership" would require Snohomish PUD to be fully compensated for the value of any assets, so this approach is essentially a wholesale business model.

Generally, the former approach is more likely to drive investment in infrastructure for under-served areas and to meet community priorities. Snohomish PUD could work with local partners to attract wholesale customers—internet service providers—from outside the community and/or grow local ones. The local partners would have primary responsibility for where infrastructure is deployed and who gets served. The other, latter approach would not involve any real relationship with community anchor institutions. The provider "partners" would simply serve the community anchors as customers and would decide where to invest based on corporate goals and expectations for shareholder value.

COMMUNITY ANCHOR INSTITUTIONS

This section focuses on opportunities to partner with Snohomish PUD's community anchor institutions. To fully assess these opportunities, Magellan Advisors conducted interviews with 25 representatives of 15 organizations, representing the range of community anchor institutions. This group of stakeholders—entities who may have an interest in the outcomes from this study—included local governments, educational institutions, libraries, and economic development. The stakeholder representatives were identified by Snohomish PUD personnel, and interviews were arranged and conducted by Magellan Advisors.

We asked about their current connectivity, short-term plans, long-term goals, and major trends impacting them. We covered both internal requirements and external stakeholder needs and opportunities. For example, we discussed students' connectivity issues along with school districts' goals and plan. The fact that residents— individuals, families, and enterprises—are stakeholders for both Snohomish PUD and for community anchors can be a foundation for partnerships.

Current Connectivity

All the institutions we engaged had adequate connectivity. Some, especially schools and libraries, had excellent connectivity. Generally, and not surprisingly, those stakeholders located near the Interstate 5 corridor tended to have the best connectivity. Many of the institutions with multiple sites had connectivity via "legacy" fiber infrastructure built by Black Rock Cable in the 2000s. Some cities, the county, libraries, school districts, and tribes provided easements and/or funding for Black Rock's build. In return, they got dark fiber to many of their sites. Typically, these institutions use the fiber for 1 to 10 Gbps connections to their sites in a star configuration with all sites homed to each institution's data center or headquarters. Wave Broadband, which acquired Black Rock in 2012, now manages that infrastructure. Snohomish County is something of a hub, with fiber from almost 20 districts in a "meet-me" cabinet in the county's data center and two strands of fiber connecting to the Seattle Internet Exchange at 10 Gbps.

The libraries and schools also purchased managed services from the K-20 Education Network, which was established by the State of Washington in the late 1990s. K-20 has bulk service agreements from multiple providers. This, along with E-Rate funding, enables educational institutions to have high performance connections, including secondary connections, at relatively low costs. They have extended this connectivity throughout their facilities with Wi-Fi. In Darrington, the City Hall is co-located next to the library but still has issues with connectivity. The libraries and schools also extended connectivity by providing cellular Wi-Fi hotspots, which can be quite costly— approximately $8K per month for the Arlington School District, for example, which handed out as many as 350 of these devices. Of course, these tactics were in response to the pandemic-related restrictions on people attending these institutions in-person, which were easing at the time of this report.

Anchor institutions that did not partner with Black Rock, particularly those with locations outside the Interstate 5 corridor, had more modest connectivity. The City of Sultan, for example, has "moderate" broadband from Comcast. It has no connectivity between buildings. Comcast reportedly said it would cost tens of thousands of dollars to connect three of the city's sites. At the same time, residents complain about speeds and the company will not build out into unincorporated areas. We heard similar issues for Camano Island, Darrington, Stanwood, and the Tulalip Tribes. There was essentially no broadband service outside population centers. Where broadband was available, interviewees indicated it was relatively expensive. In contrast, Comcast provides complementary connectivity to Snohomish County's fire stations.

While Camano Island and areas in eastern Snohomish County seemed have the poorest connectivity, areas between Arlington and Marysville and in northwest Snohomish County also had issues. The Cascade Industrial Center and areas around the Arlington Municipal Airport lacked network infrastructure, according to interviewees. Providers were "charging a lot for build out" in the area. Tribes in the area generally have good internal connectivity, but representatives noted problems getting broadband to residential locations. Many

stakeholder representatives identified gaps in cellular service, including on the Port of Everett waterfront. A significant number of residents who got cellular Wi-Fi hotspots from schools and libraries could not use them due to coverage limitations.

Planned Improvement and Upgrades

The City of Everett has extensive fiber for traffic, including Black Rock dark fiber, and has been incrementally expanding fiber when it has opportunities. Generally, broadband availability in the Everett area and south is not an issue, except possibly in multi-dwelling units with outdated internal wiring. The City of Everett planned to replace connections they buy with City-owned infrastructure. To these ends, they are looking at implementing a "Dig Once" policy and a partnership with Mox to test a new way of laying fiber. The City of Marysville was deploying dark fiber for sites currently connected with Comcast I-Net, which the company was phasing out. The Tulalip Tribes planned to replace portions of their Salish Networks provided by Ziply but it was not clear how they intended to do this.

Smaller cities and towns like Darrington and Sultan have considered doing the same. They noted various opportunities, such as downtown street scaping, but don't seem to have staff capacity to aggressively pursue these opportunities. Island County has an active broadband planning initiative in partnership with Port of Coupeville focused on central Whidbey Island. Island County is also focused on the area near the Camano Island Airfield, along State Route 532. It was noted that NoaNet has unused fiber on Camano Island. Snohomish County was in the initial phases of a broadband planning effort. It had formed a broadband action team and was planning to study broadband gaps, focusing on affordability.

Beyond these items, stakeholders had few plans to expand or extend connectivity at the time of this assessment. The schools and libraries were doing some refresh and upgrades of their Wi-Fi infrastructure, which could result in expanded connectivity. They also planned to continue their programs to loan out cellular Wi-Fi hotspots. Stakeholders had plans related to their core purpose, generally driven by or otherwise related to growth in the region. For example, the Port of Everett had plans to develop more commercial and mixed-use facilities. Plans generally related to demand for industrial and residential properties, primarily transit and transportation upgrades. While such plans were most evident for the eastern portion of the county, they extended throughout the area, particularly in the eastern communities. It was apparent that some plans and planning as a process had been derailed by need to respond to the COVID-19 pandemic. Stakeholders clearly expected to continue dealing with that for the next year or so.

Long-term Goals

Stakeholders' long-term goals were generally related to revitalization and growth. Few related directly to network infrastructure and services. The clear exception was Island County. Specifically, the county and its broadband action team sought to get broadband across the islands. Camano seems to have the largest gaps and fewest options for closing

them. Stakeholders had general goals to close connectivity gaps in other areas, particularly along the US 2 and SR 530 corridors and along the eastern coast of Port Susan/Puget Sound, from Tulalip to Stanwood.

Several stakeholders noted a need for redundant north-south fiber routes under the river and its sloughs, on both sides of Interstate 5. There were also general goals to improve cellular connectivity, particularly 5G coverage in key core economic areas, specifically downtown Everett, the Port of Everett, and the area between Arlington and Marysville including the Cascades Industrial Center. We heard no specific goals to meet these needs or even general plans to address them.

General Issues and Major Trends

The two general issues for all stakeholders were the COVID-19 pandemic and industrial and residential growth. Both issues were intertwined with broadband demand. The libraries and schools, for example, were facing substantial costs to keep their patrons and students connected. They also faced operational disruptions and staffing challenges related to the pandemic. There was a general trend to more online, virtual activities. This was especially true in education—although they were bringing students back into the classrooms—but more broadly evident in many jobs as people needed to work from home.

At the same time, there appear to be growth opportunities and pressures across the region. While growth was most evident in the southeastern area, it clearly reached into the east county and north into Skagit County. Relative to the recent past, the more rural areas east of Interstate 5 were seeing the most development. Effectively all of the stakeholders in these areas noted new businesses moving in and new residential units being developed. While interviewees noted development opportunities along the sound north of Everett and on Camano Island, those areas did not have as much evident demand for real estate as east county.

Part of the residential growth impetus was related to work changes driven by the pandemic. Employers were more open to remote work, which meant people could move to more remote rural locations without having to face long commutes. The growth pressures were also apparently from excess demand and over-development of the Seattle area. Companies and people were generally moving north due to high costs in King County. This was driving demand for infrastructure—transportation and water/sewer even more so than broadband—but also driving economic vitality.

Another general issue that was implicit in almost all stakeholder discussions—and explicit in some—was the need for network redundancy and more resilient infrastructure. Most stakeholders had network architectures that left them exposed to risk due to failures or other incidents at critical facilities. Cyber security and threat mitigation also seemed to be a general but unaddressed issue. There was only limited planning and no active efforts to address these issues, particularly in a comprehensive, inclusive manner. Generally, cities and institutions in east county seemed to be well-financed due to local consumer spending.

Several stakeholders noted available funding sources and on-going investments related to growth and infrastructure. Island County was actively seeking funding to improve broadband on Camano Island, along with its other areas.

SERVICE PROVIDERS

Magellan discussed potential partnership and co-investment interests with service providers in the county and state to explore the level of interest and type of business arrangement the service providers would propose in working with Snohomish PUD. The focus of the discussions was on unserved and underserved communities and the types of arrangements possible between Snohomish PUD and the service provider.

Meetings were held with five providers: Comcast, Ziply Fiber, AT&T, NoaNet, and Petrichor. Comcast and Ziply Fiber are incumbent last-mile retail service providers. Comcast is the incumbent cable TV company and Ziply Fiber is the incumbent local exchange carrier (ILEC), or telephone company. AT&T operates in Washington as a Mobile Network Operator (MNO) and as a provider of private fiber for the large enterprise market. NoaNet and Petrichor are wholesale services providers that were both created by legislative authority. NoaNet was created by the PUDs and Petrichor by the Port Authorities. They serve similar roles and work together in some cases. Both last-mile providers, Comcast and Ziply, would be interested in working with the PUD to obtain government grants and overbuild targeted areas with fiber-to-the-premises. They differ greatly in how they would envision the partnership. Whereas Comcast will not share assets and will not operate a network in any open access fashion, Ziply would co-own assets and would be willing to operate the network on an open access basis.

AT&T currently has access to PUD sites and facilities throughout the county. They currently have 12 macro cell sites at PUD Locations. They are interested in maintaining this relationship and exploring ways to expand it to improve 4G/5G and FirstNet coverage. FirstNet is a national public safety network operated by AT&T and funded, in part, by the U.S. Government. The wholesale providers, NoaNet and Petrichor, are both interested in exploring partnerships with Snohomish PUD. They are both service organizations who work with asset owners in varying capacities.

AT&T

AT&T is a global telecommunications company with primary operations in the US and Latin America. In 2021 is generated approximately $170 billion in revenue. AT&T is, in reality, Southwestern Bell Corporation (SBC), which bought AT&T Long Distance years ago and kept the well-known AT&T brand name. SBC also bought fellow ILECs Pacific Bell, Ameritech and Bell South resulting in their huge footprint. They also have a nationwide mobile network and are deploying a lot of fiber to support towers and small cells as they expand their 5G coverage.

In Washington, AT&T operates as a mobile network operator (MNO) and a private fiber provider to Fortune 500 enterprises. Their main assets in Washington are cellular antennas and radios. AT&T is also the operator of FirstNet, which is a national first responder network with dedicated radio spectrum. To connect their cell sites, AT&T will lease local fiber from any available "3rd Party LEC (Local Exchange Carrier) including Zayo, Comcast, Ziply Fiber and NoaNet." Their main concern with third party assets is the stability of the investment with 25-year contracts desired.

AT&T has a long-standing relationship with Snohomish PUD including agreements on pole attachments and leasing PUD assets to support 12 macro cellular sites. They are interested in maintaining these sites and in many cases, they want to work with Snohomish PUD to add additional antennas. They are also interested in working with Snohomish PUD to find locations for additional macro-sites. AT&T is interested in working with Snohomish PUD to identify key locations for new "vertical assets" such as towers and would lease space on them.

Since AT&T is not an ILEC, they rely on third party LECs for fiber connecting their cell sites. As noted, they will lease local fiber from any available, reliable, and cost-effective resource. If, in the future, Snohomish PUD has excess dark fiber in key locations, AT&T would include Snohomish PUD in the bidding process.

AT&T expressed interest in working with Snohomish PUD's Key Accounts Department to prioritize restorations during extreme weather events. This group works with key customers and the Snohomish PUD operations team to prioritize fixes during outages. They also expressed interest in partnering with Snohomish PUD on a new wireless technology called "AirGIG". This technology is designed to send data along electric powerlines and has potential use cases in remote locations. However, at this time, these technologies and products are nascent and are not ready for production deployment.

Comcast

Comcast is a multinational telecommunications and media conglomerate and is the largest cable TV company and the largest internet provider in the U.S. with over 29 million residential subscribers and 2.2 million business customers across 40 states. Total annual revenues exceed $100 billion with approximately 65% from Cable and Telecommunication services. The rest is split between NBCUniversal and Sky (UK). Net income in 2020 was over $10 billion.

Comcast has substantial assets and operations in Washington State and in Snohomish County. As a legacy FCC Title VI Cable TV company, they are required to obtain franchise agreements in every area they operate. Currently, they have a franchise agreement with Snohomish County which gives them the ability to deploy anywhere in the County. In general, Comcast would be willing to work with Snohomish PUD to serve under and unserved areas in the County.

Historically, Comcast has internally funded their entire network. With the amount of federal and state funding available for broadband, Comcast could be opportunistic and seek grants to make rural deployments meet their financial models. In Washington, the State Broadband Office has mandated that any entity receiving money from the State must operate the network in an open access model. This condition is a deal breaker for Comcast, although they can still be a retail operator. Comcast is challenging the open access requirement at the state level. They claim the broadband authority cannot mandate a business model on local communities and note that the federal NTIA broadband grants do not mandate the open access business model. If the open access requirement were removed, Comcast's preferred model would be for both parties (Comcast and a public entity) to apply for the broadband grant money. Comcast would then co-fund the construction of the network and would own and operate it. They have no interest in co-owning assets for any length of time or in leasing conduit or dark fiber. Their preferred model is to buy the asset. The new network would be operated as they do with all their cable networks and offer their traditional triple play of voice, cable TV and internet. For new builds, they would deploy fiber-to-the premises using passive optical network architectures.

If the open access requirement remains, Snohomish PUD and Comcast could potentially negotiate an agreement in which Snohomish PUD provides the upfront grant money and allows Comcast to own the assets, provided adequate consideration were included. In this case, there is no federal money provided by the State Broadband Office and thus there would not be the open access mandate.

In general, there is a good day-to-day working relationship between Snohomish PUD and Comcast. They already partner on pole attachments, over lash agreements, and joint trenching. They also work with Snohomish PUD on new housing developments. We recommend the Snohomish PUD ensure on-going timely communications with Comcast and all service providers in the county.

NoaNet

NoaNet was founded and is owned by participating Washington State Public Utility Districts (PUDs) in 2000, with a mission to bring high-speed telecommunication services to unserved and underserved communities. They are a public-benefit, non-profit wholesale telecommunications organization that provides solutions and resources for all aspects of broadband projects in the state. They describe themselves as "Washington State's Wholesale Broadband Solutions Provider" and view themselves as a middle-mile operator.

The original intent of NoaNet was to enable the PUDs to focus on passive asset construction and maintenance. NoaNet was founded to provide expertise and economies of scale to all participating PUDs in the active portion of broadband delivery. Their offerings include owning and operating the electronic equipment needed to deliver data packets over the fiber and the network operations center (NOC) to monitor the network and assure service delivery.

Their NOC is based in Spokane and operates on a 24x7x365 basis. They noted that this is an expensive and complex endeavor. There are many expensive software solutions required to manage the network and customer relationships. Additionally, running the NOC 24 hours per day requires at least six employees. Their value proposition for smaller PUDs it to let them manage the complexity of the NOC and let the PUDs focus on their local infrastructure.

A new law gives them the authority to be a retail service provider. However, they prefer the wholesale open access model. Their incorporating charters enables them to operate in other states and they have begun operations in Oregon and expect more out-of-state activity.

While NoaNet offers a range of services, no PUD uses all of them. Thus, they are inherently flexible in how they could work with Snohomish PUD. They noted repeatedly that rural broadband will never be cash flow positive and referenced the decades old U.S. FCC Universal Service Fund (USF) for voice service where urban and suburban voice customers subsidized rural customers. To address this issue, their preferred method would be for Snohomish PUD and NoaNet to jointly apply for grants. The upfront grant funds would reduce the financial services obligations and thereby the monthly breakeven requirements. This should enable retail service providers to offer services at affordable rates. NoaNet's goal is to minimize (not *eliminate*) any on-going subsidies from the electric utility.

NoaNet would entertain a small or pilot project and is willing to work with Ziply Fiber and/or Wave in some suitable arrangement. They also mentioned that they are interested in exploring wireless technologies and business models to serve the hard-to-reach locations.

Petrichor

Petrichor was founded as a *dark fiber management entity* for Washington State Port Authorities the same year as the PUDs received their authority for wholesale broadband operations. The ports own the fiber assets and Petrichor maintains them and manages the transactions with the service providers. The Port of Whitman was their first engagement. They can now work with anyone, and not just Port Authorities.

In Skagit County, Skagit PUD and Port Authority of Bellingham created SkagitNet which owns the dark fiber and Petrichor manages it. Petrichor outsources NOC services to NoaNet. There is an arrangement with Ziply in Skagit County that has yet to be finalized. Petrichor's role in that deal has not been determined.

Their preferred model is one in which the Port Authority, or other entity, funds the deployment of fiber and retains ownership of the assets. Petrichor maintains the dark fiber network and acts as a broker to retail service providers. Petrichor currently works with 20 service providers across the state. In addition to dark fiber management services, they offer design, construction oversight, strand mapping, and grant writing services and perform

advocacy work. They also use NoaNet NOC services and NoaNet leases dark fiber from them.

Petrichor would be willing to work with Snohomish PUD to jointly apply for grants. They envision Snohomish PUD's role as limited to funding, asset ownership, and promoting the open access model. This approach would require no investment of specific capital or infrastructure by Snohomish PUD, only collaboration on planning and proposals. Snohomish PUD would continue to maintain the poles and collect attachment fees. Petrichor would then manage the dark fiber network and relationship with the service providers. In one model, they envision working with Ziply Fiber and structuring an arrangement whereby Ziply would operate the network as a lit open access provider.

Ziply Fiber

Ziply Fiber is owned by Northwest Fiber and is the Incumbent Local Exchange Carrier (ILEC) for all of Snohomish County. Northwest Fiber also owns Wholesale Networks which operates as a Competitive Local Exchange Carrier (CLEC) in areas outside their ILEC footprint. The ILEC designation puts many rules and regulations on Ziply. One such requirement is for the ILEC to wholesale their "Unbundled Network Elements" (UNE) to CLECs. These elements include individual copper telephone wires as well as colocation space in central offices to house the CLECs equipment.

Ziply claims this unbundling requirement makes them an open access provider. A significant difference with this definition and municipal open access networks is Ziply is also a retail provider on the network. Most municipal open access providers offer their lit and dark (unlit) network elements purely on a wholesale basis and they do not offer competing retail services. Ziply, like other ILECs, are primarily retail providers with the wholesale UNE requirement overlayed on top of them. Thus, while this is technically "open access", the CLECs are often at an economic disadvantage competing against the retail ILEC. CLEC purchase UNE's at a wholesale discount and are often competing for the same customers. This is one reason why the CLEC market, as originally envisioned in the 1996 Telecom Act, has not been widely successful.

Ziply has expressed interest in partnering with cities and towns in Washington. One partnership model they have suggested is for the public entity (e.g., city, county, PUD, or port) to pay for part of the initial construction of the fiber network. They suggest the public entity pay for 40% of these costs; Ziply would pay the remaining 60% as well as the other substantial cost of designing and engineering the network and maintaining the network. In return for their upfront investment, the public entity would receive part of the network, dark and/or lit, for their own internal uses. Ziply, as an ILEC, would bring open access competition from CLECs to the new area. Though, as noted, CLEC competition is spotty across the USA. Even without CLEC competition, this arrangement would still bring fiber to the targeted communities.

Ziply has entered two partnerships relevant to Snohomish PUD, one with Snohomish County and one in Skagit County involving the Skagit PUD. Both are in the process of being finalized. The project in Snohomish County involved Ziply and Snohomish County. They were recently awarded $16.7 million from the Washington State Broadband Office as part of a federal grant allotment. The County is the project administrator, and it was "shovel ready" at the time of the grant application. The project will connect 4,500 locations in Darington and Arlington and along the Route 530 corridor. It will be an FTTP network based on the 10Gbps XGS-PON FTTP architecture. The middle-mile network along Route 530 will also provide the county with 4-6 fiber strands for its own use. Ziply will operate the network as both a lit, and dark, open access network and will also compete at the retail level. As part of the open access agreement, Ziply will offer co-location space at central offices as well as in outside plant cabinets.

The Ziply partnership in Skagit County has operational similarities but it is a bit more complex. Ziply funded the construction of the network. The Port of Skagit applied for grants and loans and will pay Ziply a one-time amount for a 20-25-year Irrefutable Right to Use (IRU) covering Ziply's initial investment. The port will then own the fiber assets for the duration of the IRU. In return for the payment, Ziply will maintain the network and operate the network in a dark fiber open access model. They will also provide retail services over the fiber. At the end of the IRU, Ziply takes full ownership of the assets.

Ziply would be open to exploring a range of models with Snohomish PUD, including seeking state broadband grants with Snohomish PUD as the public entity sponsor. This would be similar to their project with Snohomish County. They are also receptive to co-ownership of assets by which each entity would own a percentage based on their funding and in-kind investments. This would apply to both last-mile and middle-mile assets.

Ziply is interested in joint competitive overbuilds, including in areas where Ziply is the copper-based DSL ILEC and competes with an incumbent cable company. This would include denser urban and suburban communities. These areas are not unserved and are not likely to be considered underserved since the cable companies offer up to a gigabit service so it is unlikely any grant funds could be used for new broadband. In these areas, Ziply faces the same financial and business decisions as in rural areas, namely ensuring the expected take rate and monthly service fees meet their financial objectives and obligations. In these areas, there is the added challenge of competing with a well-entrenched and cash-rich incumbent cable company.

Theoretically, Snohomish PUD could deem communities that have a single gigabit provider as underserved and work with Ziply to overbuild their copper networks with fiber. Do not expect any state grant money to be awarded for this so other financial means would be necessary to fully compensate the PUD as required. The arrangement could range from joint ownership and joint operations to grants to reduce Ziply's capital requirements in rural areas. In denser areas, the fiber should have a sustainable, revenue positive cash flow with 30-35% take rate. In this scenario, the question becomes whether a new entrant can get one third of the incumbent cable company's customers. Also, this arrangement would

be subject to federal and state regulations covering both ILECs and public utilities, particularly regulations against use of public assets for private profits.

5. Legislation and Regulation

Magellan Advisors conducted an opportunities and threats analysis of the current legislative environment including local, state, and federal broadband policy. This includes evaluating state legislative items (such as House Bill 1336), federal and state agency regulatory policies regarding broadband, and Congressional action to provide infrastructure funding for broadband projects. This memo describes findings of this analysis and relates it to Snohomish PUD's potential broadband infrastructure deployment.[19]

State and federal policy is now very supportive of broadband infrastructure to address the "digital divide" and provide higher internet access speeds. This in turn supports enabling increased competition, which tends to put downward pressure on the price of broadband services and upward pressure on service quality. Broadband infrastructure deployment will allow more affordable, reliable high-speed broadband options for the area's residents, businesses, and anchor institutions.

BROADBAND SERVICE

Technically, broadband refers to a communications circuit that is split into multiple, separate channels. Broadband has evolved to mean "always on" high-speed internet access. Since January 2015, the Federal Communications Commission (FCC) defines "broadband" as a minimum of 25 megabits per second (Mbps) download speed and 3 Mbps upload speed (or "25/3") which it deemed adequate for a single user engaged in telecommuting or student activity. The FCC reaffirmed this definition in January 2018, but the General Accountability Office in July 2021 called for the FCC to analyze small business speed needs stating "[m]uch of the literature GAO reviewed suggests that FCC's current broadband minimum benchmark speeds … are likely too slow to meet many small business speed needs".[20] Notably, the Infrastructure Investment and Jobs Act sets the floor for broadband speed at 100 Mbps download and 20 Mbps upload for projects eligible for IIJA funding (below), as did recent State of Washington legislation.

Most current broadband services are asymmetrical, with faster download than upload, and providers commonly only advertise download speeds. However, the need for symmetrical broadband speeds is growing. Relatively slow upload speeds in the region limit uses that

[19] The following discussion does not constitute a legal opinion and should not be construed as such. Questions about interpretation or applicability of these or other provisions of federal or Washington law should be referred to legal counsel.

[20] Broadband: FCC Should Analyze Small Business Speed Needs"; Report to Congressional Addressees, GAO 21-494, July 2021, U.S. Government Accountability Office.

involve sending data into the internet such as content creation, distance learning, gaming, telehealth, and telecommuting. As demand for these applications increase, demand for faster upload speeds and symmetric services will accelerate.

Our market assessment ("Snohomish Broadband Market Analysis," above) finds much of Snohomish PUD territory underserved—lacking 25/3 Mbps broadband service—especially to the north and east. A small portion of Snohomish PUD's area—the southwest corner, closest to Seattle—has multiple options for fast relatively inexpensive broadband. Snohomish PUD provides electricity to these underserved areas, and state and federal legislation provides the opportunity for it to expand broadband infrastructure to address the lack of broadband service – on a wholesale or retail basis.

The Infrastructure Investment and Jobs Act (IIJA, discussed in detail in the "Federal Funding" section, below) recognizes consumers' need for increased broadband speeds by increasing the minimum speed threshold to 100 Mbps download and 20 Mbps upload, over the FCC 25/3 Mbps definition. For planning purposes, Snohomish PUD should use this higher speed threshold as a baseline for its considerations.

The IIJA distributes billions in funding to states for carriers, public-private partnerships, co-ops, or local governments to use to build broadband infrastructure in unserved areas. This funding will become available following a rule-making process anticipated to last six months (to mid-May, 2022). Snohomish PUD could evaluate this grant funding or consider partnering with other parties seeking the grant funding to extend and expand broadband infrastructure. Stakeholder feedback indicates many of the infrastructure needs and opportunities may be wireless-related including fixed broadband and backhaul for fixed and mobile broadband traffic. Furthermore, there appear to be real needs and opportunities for intergovernmental relationships to support regional networking. Snohomish PUD could consider various partnership possibilities including support for wireless backhaul and interconnection of cities, neighboring counties, and local tribes. However, the FCC has recently funded construction of broadband facilities in certain unserved areas through its Rural Digital Opportunity Fund (RDOF). Snohomish PUD should avoid broadband investments in these areas absent an interested partner with a sound business case.

The IIJA includes further funding for deployment of technologies to enhance electric grid flexibility, with $3 billion in additional funding for the Smart Grid Investment Matching Grant Program at Department of Energy. Snohomish PUD could consider this funding for extending fiber optic cable further into the electric grid to the extent such need exists – especially if it also supports broadband opportunities. The IIJA also funds many transportation programs. This may provide opportunity for Snohomish PUD to coordinate fiber projects during highway construction and other infrastructure projects. Ongoing communication with the Washington State Department of Transportation and the State Broadband Office could be useful to consider these opportunities at an early stage.

Part of this effort at the federal level will include long-needed improvements to broadband availability mapping to remedy substantial known inaccuracies in today's maps. These more accurate maps should be available by mid-to late 2022 to enable Snohomish PUD to make decisions about extending broadband facilities with more granular, accurate information.

INFRASTRUCTURE AND BROADBAND LEGISLATION IN CONGRESS

Recent federal funding commitments could make network expansion or increased resilience economically possible. Too often the capital expense of construction impedes otherwise viable projects. Of course, infrastructure must be maintained and should be used, which is the point of the planning process, but these funds make planning a meaningful endeavor. Most of these opportunities give preference to public-private collaboration, some require it. The additional infrastructure and development activity make it imperative for the public rights of way and other shared assets to be managed in a comprehensive manner. Consideration of network infrastructure should be integrated into the range of planning activities and pains must be taken to ensure all potentially impacted parties have a voice. This will ensure broadband is deployed economically but also equitably.

Infrastructure Investment and Jobs Act

President Biden signed the Infrastructure Investment and Jobs Act ("IIJA") into law on November 15, 2021. According to the Executive Order issued that day on IIJA implementation, the IIJA "will help rebuild America's roads, bridges, and rails; expand access to clean drinking water; work to ensure access to high-speed internet throughout the Nation; tackle the climate crisis; advance environmental justice; and invest in communities that have too often been left behind".[21] The IIJA provides $65 billion in funding for broadband deployment but there is a six-month federal (NTIA) rulemaking process before the funds can be disbursed. A few key points:

1. Funding includes $42.45 billion for grants to states for broadband infrastructure deployment. All funding decisions will be made by the National Telecommunications and Information Administration (NTIA) and the states as well as state legislatures who decide how state funds will be distributed. Local communities should start speaking to their state agencies and legislators now about how the funds will be distributed once awarded.

[21] *Executive Order on Implementation of the Infrastructure Investment and Jobs Act*, November 15, 2021. https://www.whitehouse.gov/briefing-room/presidential-actions/2021/11/15/executive-order-on-implementation-of-the-infrastructure-investmentand-jobs-act/

2. The NTIA rulemaking process will take 6 months from the date of enactment. Then, states will have 3 months to submit applications. Earliest funding awards may not be issued until Q1 2023.
3. The IIJA also funded many transportation programs. This will provide the opportunity for communities to coordinate fiber projects during highway construction and other infrastructure projects.
4. The IIJA includes further funding for deployment of technologies to enhance grid flexibility, with $3 billion in additional funding for the Smart Grid Investment Matching Grant Program at Department of Energy. Now included are Smart Grid investments that provide flexibility and help quickly rebalance the electrical system, facilitate the aggregation or integration of distributed energy resources, provide energy storage to meet fluctuating demand, provide voltage support, integrate intermittent generation sources, increase the network's operational transfer capacity, and anticipate and mitigate impacts of extreme weather events or natural disasters on grid resilience. Title I of Division D – Energy contains several other provisions to support and improve grid infrastructure and resiliency. IIJA provisions include $65 billion for broadband deployment to "address our nation's digital divide":
    - $2.75 billion for the Digital Equity Act to promote digital inclusion and equity where skills, technology and support is lacking to take advantage of broadband connections. Digital literacy training, workforce development, device access programs and other digital inclusion measures.
    - $14.2 billion for Affordable Connectivity Benefit (ACB) to ensure low income families can access the internet ($30 per month voucher), building on the Emergency Broadband Benefit (EBB). ACB funding is less than the EBB benefit ($30 per month vs. $50 EBB benefit) but eligibility is expanded to households at 200% of the poverty level. NTIA rulemaking could make participation in this program a condition for infrastructure grants.
    - $42.45 billion in grants to states for broadband deployment. This inaugurates a new Department of Commerce (NTIA) program to provide broadband infrastructure grants to states. Each state will run its own competitive grant process with subgrantees (broadband providers) that may include carriers, public-private partnerships, coops, or local governments.
    - Other provisions direct the remainder of funding to programs for middle mile deployment ($1 billion grant program), $2 billion for broadband deployment in rural areas through the ReConnect Program administered by Rural Utilities Service (RUS), tribal grants for broadband deployment, and private activity bonds.

The rulemaking process must be completed by NTIA within 6 months from enactment (November 15, 2021) and Notice of Funding Availability released. Then funds will be disbursed based on a competitive grant process administered by each state under these

federal rules. *But* new FCC mapping of broadband availability must be completed before proposals will be accepted. FCC maps are expected mid to late-2022. Priorities and specific allowed uses of funds are, first, infrastructure for areas without 25/3 Mbps service, infrastructure for areas without 100/20 Mbps service second, then eligible community anchor institutions. Installing internet and Wi-Fi infrastructure or providing reduced-cost broadband within a multifamily residential building, prioritizing those with a substantial share of qualified low-income households. Programs for broadband adoption including provision of affordable internet-capable devices and broadband data collection, broadband mapping and planning are all eligible activities.

Project requirements for funding:

- Speeds of at least 100/20 Mbps with low latency. Higher speeds will receive priority.
- 25% match required from non-federal sources, such as in-kind contributions, unspent COVID relief funds or provider investment.
- Projects prioritized based on higher speed, greater scalability, faster buildout and service coverage for high poverty areas.
- Projects must be completed within four years.
- Projects must offer at least one low-cost broadband option (rates are not regulated, but determined by state, approved by NTIA).
- Additional requirements included regarding service quality, reliability, cyber rules, prohibition on using gear manufactured in China, required technical and operational capacity for the subgrantees.

Additional provisions:

- "Digital discrimination" (as defined by FCC and DOJ) is prohibited.
- Consumer broadband labels are required, e.g., whether an offered price is an introductory price and if so, what is the full price. ○ Initiates cyber response and recovery fund under DHS for significant breaches of public and private networks.
- Initiates FEMA grants for cybersecurity.

THE BROADBAND DATA ACT AND FCC BROADBAND MAPPING

The Broadband Deployment Accuracy and Technological Availability Act ("Broadband DATA Act") was signed into law on March 23, 2020. The Act is intended to strengthen the process for collecting broadband availability data and thereby improve the accuracy of the FCC's broadband availability maps. As noted in Magellan's Market Analysis memo, the FCC's maps

are based on provider-provided data that is input into a methodology "that has been widely criticized for its overstatement of service offerings".[22] Current broadband mapping counts a census block as "served" with broadband if a service-provider reports serving one premise in that census block. The FCC notes this "may therefore over-estimate broadband coverage, particularly in areas with large census blocks."[23]

One objective of the Broadband DATA Act is to create a common dataset of all locations in the US where fixed broadband internet access service can be installed. This will establish the "Broadband Serviceable Location Fabric" of geocoded information for each location as a foundation for all data on broadband availability (speed, price, availability, reliability, and providers), to be updated every six months. The Broadband DATA Act contains a challenge process where the accuracy of data submitted by providers may be challenged. The IIJA adds a deadline for the FCC to resolve any such challenges – 90 days after response by the provider to the challenge.

The FCC shall use this data to create three Broadband Maps: one which depicts broadband availability without regard to fixed or mobile wireless technology – and the areas which remain unserved – as well as separate mapping for fixed and mobile broadband availability. The FCC is to use audits and crowdsourcing on an ongoing basis to improve data accuracy. Crucially, IIJA broadband funding will not be available until the new maps have been produced. The IIJA states "on or after the date on which the broadband DATA maps are made public" the NTIA shall provide notice and invitation to submit proposals for grant funding.

FEDERAL AND STATE BROADBAND AND WIRELESS REGULATION

Federal (FCC) and State (WUTC) Regulatory Jurisdictions

Federal and state statutes divide telecommunications regulation between state and federal jurisdictions. The Federal Communications Commission (FCC) has jurisdiction over national policies, subject areas where Congress has explicitly preempted state regulation, and other subjects which cannot be rationally regulated by the various states – such as management

[22] Magellan Advisors Broadband Market Analysis Technical Memo to the Snohomish Public Utility District, dated September 2021, at page 3 citing Broadband Communities: "Broadband Mapping is a Mess. No One Knows What to Do About It"; https://www.bbcmag.com/law-and-policy/broadband-mapping-is-a-mess-no-one-knowswhat-to-do-about-it ("Broadband Market Analysis Memo")

[23] "Fixed Broadband Deployment", https://broadbandmap.fcc.gov/#/about

and licensing of the radio spectrum. Individual states use utility regulatory commissions – such as the Washington Utilities and Transportation Commission (WUTC) – under state statutes[24] to regulate telecommunications providers. Telecommunications prices – including broadband – are no longer regulated by state or federal regulators given the emergence of numerous telecommunications providers in the marketplace.

State of Washington Policy and Legislation

Public Utility District Regulation

PUDs are governed by separate provisions of the Revised Code of Washington – Title 54. Under Title 54 "PUDs are governed by a nonpartisan, locally elected board of commissioners. Commissioners are responsible for setting rates that meet statutory limitations and for overseeing the operation of the PUDs. They meet in open session where members of the public can observe and participate in the decision-making process."

Washington Legislative Developments

Governor Inslee signed "the Public Broadband Act" (HB 1336, or "the Act") on May 13, 2021. The Public Broadband Act removes restrictions on public utility districts (such as Snohomish PUD), port districts, counties, small cities and towns which had prevented them from offering retail telecommunications services – under prior statutes *only wholesale services* could be offered by PUDs. Now these entities are allowed to provide retail telecommunications services in unserved areas with certain requirements for an initial report to their governing bodies and the State Broadband Office. Furthermore, the Act allows a PUD to provide retail telecommunications services by contract with any federally recognized tribe in Washington.

The Act adds provisions to R.C.W. Title 54 to allow PUDs to provide retail telecommunications services within the district and outside the district by contract, expands the area in which a PUD may provide wholesale services beyond the PUD district to include defined adjoining areas, and updates provisions for payments in lieu of property taxes. The Act requires that prior to providing retail services a PUD must report to its governing Commission and the State Broadband Office specified information:

- An assessment of the current availability of broadband infrastructure and its adequacy to provide high-speed internet access,
- The area in which retail telecommunications services is to be provided,
- Evidence that the area is unserved ("unserved" defined as lacking access to service with minimum 100 Mbps download/20 Mbps upload speeds – *note* that this definition is consistent with the IIJA),

[24] Title 80 of the Revised Code of Washington.

- Expected costs of providing retail telecommunications services,
- Evidence that the proposed infrastructure is capable of scaling to greater upload and download speeds to meet state broadband goals,
- Sources of funding for the project, and,
- A strategic plan to maintain long-term operations and expected rates and charges.

The Governor also signed HB 1064, which requires disclosure of high-speed internet access availability by a seller of improved residential real property for all real estate transactions on or after January 1, 2022. Current law mandates a seller disclosure statement which is amended by HB 1064 to add a required "yes/no/don't know" answer to "does the property currently have internet service?", and if yes, who is the provider. Broadband availability has been demonstrated to increase home values and this disclosure requirement will clearly foster consumer choice and increased home values for residential properties with internet service. The converse is also true, home values for residences in unserved areas will be relatively less which has clear implications for the Snohomish County tax base.

Washington State Broadband Office

The State Broadband Office (SBO) was created in 2019 with the key mandate to foster high-speed internet access for all by 2024, and 150 Mbps symmetrical services by 2028. Copper wire telephone infrastructure cannot scale to these speeds and performance requirements. so more scalable infrastructure such as fiber is required to achieve this goal. The SBO found that federal broadband maps "are woefully misleading and inaccurate"[25] for identifying areas unserved with broadband, so the SBO sponsored its own statewide survey and speed testing results map.

The SBO data reveals that sub-broadband speed service is prevalent across the Snohomish PUD area. The SBO is supporting Broadband Action Teams to centralize discussion of broadband connectivity and accessibility needs and provide a direct link to the SBO. Snohomish County took a step forward on broadband with the inaugural meeting earlier this year of the Snohomish County Broadband Action Team with many partners and stakeholders including Snohomish PUD. Snohomish PUD also participates in Snohomish County Tomorrow, an inter-jurisdictional forum of the county, cities and the Tulalip Tribes working together for the betterment of all citizens of Snohomish County.

Washington Public Works Board

The Public Works Board (PWB) was established and funded by the Washington State Legislature to meet local government financing needs for infrastructure on a reliable and sustainable basis. PWB financing programs were originally oriented to perhaps more traditional infrastructure such as water, sewer, roads and streets, bridges, solid waste and

[25] State Broadband Office 2020 Report to the Legislature, January 2021, page 2.

recycling. Broadband infrastructure financing was added to the original infrastructure programs (water, sewer, roads, bridges, etc.) in 2019 to recognize the criticality of broadband services to the State.

The PWB is authorized under R.C.W. 43.155.160 to loan and grant money to local governments and other entities including public utility districts for purposes of expanding broadband access to unserved areas. The purpose of the PWB's Broadband Program is to fund low-interest loans and grants for the acquisition, construction and installation of broadband facilities. Evidence of the *unserved* (not underserved) status of the proposed project area must be documented in the application to establish that the project area lacks broadband at 25 Mbps download/3 Mbps upload speeds.

Federal Policy and Legislation

FCC Federal Universal Service Fund

The FCC currently administers over $9.5 billion annually[26] in federal subsidies to support broadband access to schools, hospitals, libraries, commercial and non-profit broadband providers as well as low-income consumers including those on federally recognized tribal lands. FCC subsidies are managed and administered by the Universal Service Administrative Company (USAC), which is authorized by Congress to operate under FCC oversight.

Eligible Telecommunications Carrier Designation

"Eligible Telecommunications Carrier" (ETC) is a term defined in the Federal Telecommunications Act of 1996. ETC designation that is required to be obtained by a service provider from the state utility commission or the FCC before the service provider is eligible to receive federal universal service support funds, such as lifeline assistance, or high-cost assistance. To receive the ETC designation a telecommunications provider must demonstrate it will offer the services supported by the universal service fund throughout its designated service area. A provider wishing to offer Lifeline broadband services would need to apply for ETC designation and demonstrate that it can and will offer voice and broadband service throughout its designated service area which meet minimum service standards established annually by the FCC. As Snohomish PUD is only authorized to provide retail service in unserved areas, it is unlikely to qualify as an ETC.

FCC Lifeline

The federal Lifeline program provides monthly support to eligible consumers who qualify based on their enrollment or eligibility in several federal social service support programs or

[26] "USF Proposed 4th Quarter Contribution Factor is 29.1 Percent"; https://www.fcc.gov/document/usf-proposed-4th-quarter-contribution-factor-291-percent

based on their income thresholds. The monthly support per customer is provided to participating service providers who then pass the discount to the end user customer. The discount is $9.25 per month off voice or broadband internet service offerings[27] or $34.25 per month for those who live on federally recognized tribal lands in rural areas for service delivered in the home or via mobile phone. While Snohomish PUD would not qualify to offer these services, the Lifeline program could help providers defray the cost of doing business, including possibly leasing infrastructure from a PUD.

To qualify, applicants must provide documentation that they participate or are eligible for any one of the following programs: Supplemental Nutrition Assistance Program (SNAP), Supplemental Security Income (SSI), Medicaid, Federal Public Housing Assistance administered by the US Department of Housing and Urban Development (HUD), and the Veterans Pension and Survivors Program administered by the Veterans Affairs Administration. Applicants may also qualify by demonstrating their income is at or below 135% of the federal poverty guidelines. The FCC regulations include substantial administrative and compliance requirements for participation in the Lifeline program (including ETC designation) which should be evaluated before deciding to participate including obtaining study area code and FCC registration number and maintaining an approved compliance plan.

FCC E-Rate

The E-rate program helps schools and libraries obtain affordable broadband connectivity. Discounts for broadband network services used by the school or library depend on the level of poverty and the urban/rural status of the population served, but typically range from 20 percent to 90 percent of the costs of eligible services. Program participants must engage in a competitive bidding process to select the most cost-effective service provider for their business. Snohomish PUD may be able to participate in these bids. Schools may request funding for wireless or wireline broadband services, as well as for unbundled services including leased fiber, as follows:

- Dark Fiber Leasing
- Lit Fiber Leasing
- Dark and Lit Fiber Leasing
- Self-provisioned Services and Services provided over Third party Networks
- Transport Only
- Internet Access Only

Schools and libraries have the flexibility to lease dark and provision their own broadband services, allowing for opportunities to share fiber-optic cable with fiber owners in the area.

[27] Lifeline; Universal Service Administrative Co.; https://www.usac.org/lifeline/

Rural Digital Opportunity Fund (RDOF)

The FCC has awarded RDOF Phase I funding based on winning auction bids. The results for Snohomish County are shown in the map[28] in Figure 5-1 with two winning bidders: Frontier Communications Northwest (Green) and Space Exploration Technologies Corp. or SpaceX (Red). The winning bidders must build out service to all locations within the awarded area based on milestones, beginning with 40% of the locations served by the end of the third year of support payments by the FCC. For planning purposes, Snohomish PUD would need to avoid proposing facilities in these areas for broadband service unless it were done in coordination with the winning bidders.

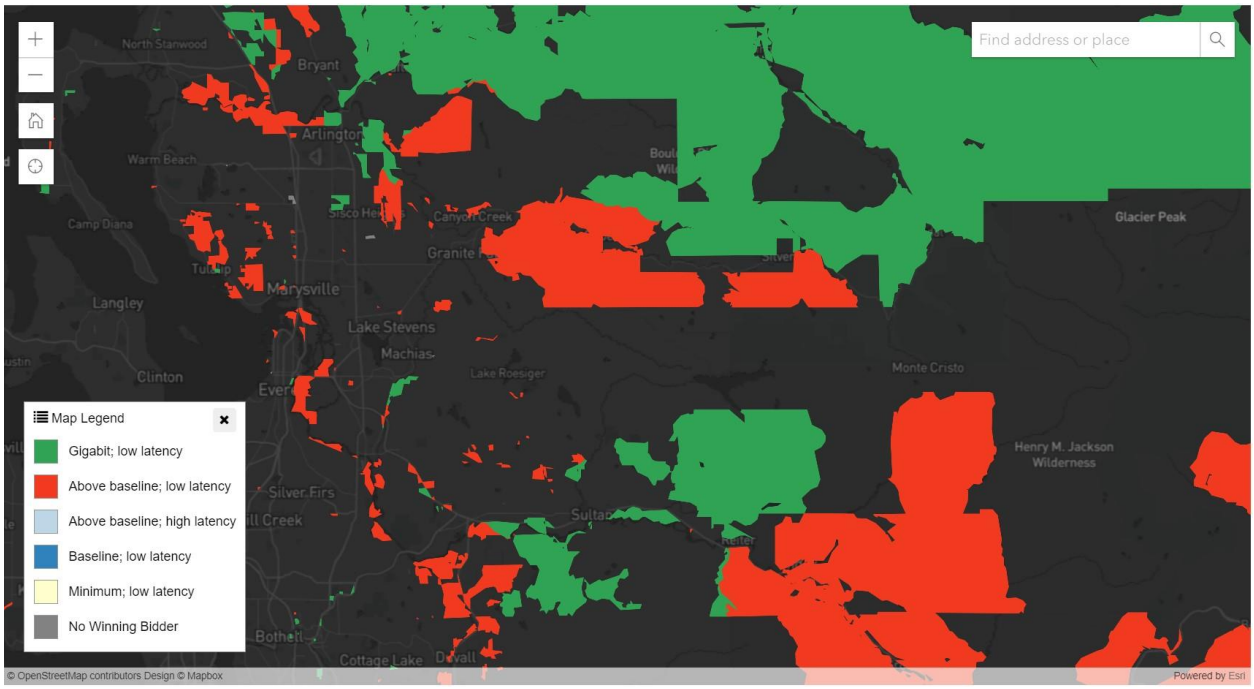


Figure 5-1. Snohomish PUD Service Area RDOF Map

5G Wireless Antenna Placement and Fiber Backhaul

Local authorities and the Federal Communications Commission have been in an ongoing jurisdictional battle over siting practices and requirements for wireless facilities for at least the past two decades. At the center of the jurisdictional battle today is 5G wireless service – which requires antenna densification with closely spaced smaller antennas covering a radius of approximately 400 feet. These antennas require fiber optic connections to the network, belying the common public misconception that "wireless service" is indeed fully wireless, end-to-end.

[28] https://www.fcc.gov/reports-research/maps/rdof-phase-i-dec-2020/

In the past two decades the Federal Communications Commission (and Congress) has preempted the authority of state and local jurisdictions, including its 2018 "Small Cell Order".[29] The Order limits local authority in many areas including fees (imposing a requirement for a strict cost based fee, or $270 per pole, if the provider does not want to perform the cost analysis), requirements and criteria that may be used for evaluating applications, time frames, aesthetic requirements, and provisions of state laws where the FCC claims the ability to preempt local authority. The Order was broadly challenged on appeal and the Ninth Circuit Court of Appeals largely upheld the FCC except for FCC preemption of local authority over aesthetic requirements associated with placement of 5G antennas and supporting equipment – local authorities retain jurisdiction over aesthetic matters.

The FCC also implemented provisions of the Spectrum Act[30] by tightening the application of "shot clock" timelines and requiring local jurisdictions to approve certain collocations and modifications to existing wireless communications facilities under shortened explicit deadlines defined as an "eligible facilities request". The Snohomish County Code is up to date including provisions that comply with these matters at Chapter 30.28A, Development Standards and Siting Process for Personal Wireless Service Facilities. The FCC "shot clock" pertains to approvals by local authorities (municipalities, counties) of public right of way encroachments and requests to attach to city owned structures in the PROW such as streetlights.

The FCC has authority for pole attachment regulation where a state has NOT exercised "reverse preemption" and implemented the state's own regulatory regime. The FCC regulates pole attachments in 30 states, and 20 states have exercised "reverse preemption" and implemented their own laws and regulations—this includes Washington. Washington State has implemented its own regulations on pole attachments which appear to have specific regulations for public utility districts based on statute passed in 2008: RCW 54.04.045, "Locally regulated utilities – attachments to poles – rates – contracting", where "locally regulated utility" means a public utility district. See attached.

a. The statute requires the PUD to respond to an application within 45 days to indicate if it is complete or not; and,

b. To notify applicant within 60 days of that notice whether the application is accepted or rejected.

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[29] Declaratory Ruling and Third Report and Order; In the Matter of Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment; WT Docket No. 17-79; In the Matter of Accelerating Wireline Broadband Deployment by Removing Barriers to infrastructure Investment; WC Docket No. 17-84; Released by the Federal Communications Commission, September 27, 2018. ("Small Cell Order" or "Order".)

[30] See Middle Class Tax Relief and Job Creation Act of 2012, Pub. L. No. 112-96, 126 Stat. 156, § 6409(a) (2012) ("Spectrum Act"), codified at 47 U.S.C. § 1455(a).

As part of the whole small cell hubbub at the FCC there was an effort to set stringent requirements for "One-touch Make Ready". A Notice of Inquiry for proposed rulemaking was issued by the FCC in 2018, but no action has been taken yet by FCC. At any rate, this would not apply in Washington due to its exercise of "reverse preemption" on pole attachments. See attached 2018 statement from Washington PUD Association for more on this subject.

Radio Frequency Radiation

"The phenomenon of radio waves and microwaves moving through space is described as 'RF radiation'".[31] Congress preempted local authority over inclusion of RF radiation in their consideration of siting of cell towers and antennas. Congress assigned complete regulatory jurisdiction to the FCC under the 1996 Telecommunications Act which preempted local regulation of RF safety standards in favor of uniform national RF safety standards[32] under FCC jurisdiction. Local authorities can require compliance with these FCC RF standards be demonstrated as part of the evaluation of 5G siting applications. Local authorities may not however deny wireless communications facilities siting applications based on RF radiation – Congress has preempted local authority on this subject and placed jurisdiction in the hands of the FCC.

The FCC last updated its standards and limits for RF exposure in 1996. The FCC issued a "notice of inquiry" in 2013 to consider updating these limits with new information and study, but in 2019 the FCC terminated the inquiry by "declining to undertake any of the changes contemplated in the notice of inquiry".[32] The DC Court of Appeals RF Remand Opinion sends the matter back to the FCC with instruction that the FCC must provide reasoned explanations for its decisions that no changes to the RF standards and limits are required.[33] While the issue of RF standards is under study on remand from the court existing RF standards remain in effect. It is not known when an FCC decision will be made, or what the resulting RF standards will be.

But in the meantime, the FCC has a very useful "Consumer Guide for Wireless Devices and Health Concerns"[34] that was updated in October 2020. The Consumer Guide is a comprehensive summary of the FCC's standard setting efforts regarding safe levels of exposure to radiofrequency (RF) radiation and the different federal health and safety

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[31] Environmental Health Trust, et al. v. Federal Communications Commission and United States of America; No. 20-1025, Opinion, US Court of Appeals for the District of Columbia, decided August 13, 2021, at page 3. ("RF Remand Opinion")

[32] See, "A Local Government Official's Guide to Transmitting Antenna RF Emission Safety: Rules, Procedures, and Practical Guidance"; Local and State Government Advisory Committee, Federal Communications Commission, June 2, 2000. Available at https://wireless.fcc.gov/siting/FCC_LSGAC_RF_Guide.pdf 36 RF Remand Opinion, page 7.

[33] RF Remand Opinion, pages 30-31.

[34] "FCC Consumer Guide: Wireless Devices and Health Concerns," https://www.fcc.gov/sites/default/files/wireless_devices_and_health_concerns.pdf

agencies (such as OSHA and FDA), and expert non-governmental organizations (such as IEEE) that the FCC coordinates with and relies upon for setting FCC guidelines and rules. Snohomish PUD could provide this Guide to its members if they contact Snohomish PUD with questions regarding health and safety concerns.

6. Technology Options and Funding Opportunities

Snohomish PUD requested a conceptual network design to assess at a high level the costs and timelines for potential broadband infrastructure deployment. Snohomish PUD also sought information about technology options for last-mile connectivity as well as strategies for the middle-mile connectivity and interconnection points. High-level cost estimates for deploying the infrastructure based on potential routes and technologies options were also requested. This information is included in Appendix 2. The essential technology for Snohomish PUD is fiber. Exactly what, if any, assets would be deployed are to be determined. Much of the technology investment will be with other parties—especially broadband service providers—but the PUD may want to consider the larger universe of options and costs when deciding its course of action.

Local public agencies and institutions now have access to unprecedented funding opportunities for broadband development. The sources directly relevant to Snohomish PUD are Washington State's Public Works Board and the federal Broadband Equity, Access, and Deployment (BEAD) and Enabling Middle-Mile Broadband Infrastructure programs being administered by the National Telecommunications and Information Administration (NTIA). Several other opportunities may be meaningful for Snohomish PUD but would require close collaboration with providers and/or other public entities. These are described in detail in Appendix 3.

The WSBO Fall 2021 Broadband Acceleration Grant awards totaled over $145M for thirteen projects, averaging $11.2M each. Six of these proposals were led by counties, three were tribes, two were ports, and one each for an association of providers and a PUD (Jefferson County PUD). Snohomish County was awarded $16.7, which will be paid to Ziply to construct fiber along SR 530 to Darrington. It is not clear at this date to what level this program will be funded in the future or what the priorities may be.

The BEAD funds will be administered by the states. It funds data gathering and planning as well as grants for new broadband deployment to unserved areas, service to all locations in underserved areas, and connecting eligible community anchor institutions. The Washington State Broadband Office will undoubtedly administer these funds, likely via the Broadband Acceleration Grant program, but has yet to issue specific guidelines for applications and projects.

The Middle Mile funds will be administered directly by NTIA with input from the states. These will be competitive grants for the construction, improvement, or acquisition of middle mile broadband infrastructure. Funding will be awarded on a technology-neutral and competitive basis. The federal share cannot exceed 70 % of total project costs. Snohomish PUD is an eligible applicant but joint application with other entities will likely result in a stronger proposal. Specifics on this program have not yet been released.

7. Broadband Opportunities, Risks, and Threats

The purpose of this study was to analyze the business case for Snohomish PUD to provide broadband service. The study was intentionally broad, so broad as to make specific identification of risks, opportunities, and threats difficult to pinpoint. In order to balance the study's objective, it is important to note that there are numerous reasons and risks for Snohomish PUD not to provide broadband. Those reasons vary with the extent and type of broadband services being offered. Generally, the more extensive the service area and offerings are, the greater the risk is. The reasons for providing broadband also vary but come down to the PUD's capabilities and demand among customers. The PUD is nominally well positioned to meet the latter due to the former but there are many factors that weaken the business case.

In the business case context, an "opportunity" is a situation in which costs are relatively low and/or revenues (or other basic success metrics) are likely to be relatively high. Having poles, wires, engineers, linemen, and customer service associates, for example, seems to be a situation that allows for deploying broadband services a relatively low cost. Conversely, a threat is an entity or situation that may increase costs and reduce revenues. "Risk" is some measure of the likelihood of an opportunity not being realized or a threat impacting the business.

A fundamental question for opportunity, risk, and threat assessment is, "What are you trying to achieve?" There are numerous opportunities for Snohomish PUD related to providing broadband services, as detailed in this report. What does it mean?

A basic uncertainty in this study is the extent to which PUD assets might be used for broadband. Information from the PUD indicates that very few of its assets would be available for broadband. Another issue is how it capitalizes on assets. Clearly Snohomish PUD must recoup all costs and it should share in profits generated by other entities from use of its assets. This is the fundamental reason for doing business, and it is required by statute. But it is unclear to us the extent to which Snohomish PUD can practically work with other entities to generate value from its assets. Staff indicated the PUD is reticent to allow access by, coinvest with, or take on any risk for other entities, public or private.

The greatest threat to any new entrant to the broadband market is response by incumbents. While physical sabotage is not unheard of, the greatest threat is predatory pricing, which is quite common. One or both incumbents drastically reduce prices, which undermines consumer interest and cash flow for the new entrant, choking it before it can get established. Consumer apathy is another threat: Although they may complain, consumers won't necessarily switch to a new option even if it is cheaper. There are various tactics to mitigate these risks, but they require resources and persistence, which of course increases costs and weakens the business case.

Further study is needed, particularly the extent to which existing PUD assets might be used and how they might be used by other entities, to determine the broadband opportunities for Snohomish PUD. Assumptions about components and technical characteristics need to be tested. Various ways of deploying infrastructure, both over time and physically, should be explored. Revenue opportunities must be specified and verified, ideally in the form of a letter of intent, purchase order, or other commitment to buy. Threats to increase costs or undermine revenue should be analyzed in more depth and detail.

The overarching question that must be answered is, "What is Snohomish PUD able and willing to do?" We saw a clear desire by Snohomish PUD to understand the risks associated with entering a new line of business. It was unclear how the PUD would collaborate with partners, particularly to achieve objectives that are not core to the PUD's mission such as greater availability of cheaper, faster broadband. Political issues may impede collaboration, but it remains unclear whether and to what extent. All of these things fundamentally limit the potential ability to recover cost.

The benefits of external research and analysis depend on internal clarity. Magellan Advisors recommend Snohomish PUD determine what it is able and willing to do about broadband in terms of infrastructure deployment, line of business, and working with other entities before studying the topic in more detail. Full analysis of the business case, evaluation of opportunities, risks, and threats, and understanding of how to tap the former while avoiding the latter will require a clear benchmark, which depends on goals and purpose. Therefore, any additional study should start with exactly what Snohomish PUD is able and willing to do regarding broadband.

POTENTIAL STRATEGIC FOCUS

Magellan Advisors recommends that, if Snohomish PUD decides to move forward, it develop a framework or suite of components for broadband development that can flexibly apply to specific opportunities. The starting point would be Snohomish PUD's core competencies, which are basically building and operating wired infrastructure. Such a framework might consist of:

- Assistance with permitting and other local regulations
- Break fix and other maintenance services
- Facilities and outside plant services, such as conduit proofing, pole make-ready, restoration, site preparation, etc.
- Strategic decision making and direction for an optimal business model
- Marketing support for retail providers/wholesale customers
- Financial oversight for grants and other funding
- Operational systems and support, particularly billing

Snohomish PUD has intimate knowledge of supporting assets—conduits, poles, etc.—and geographic barriers, but may be strategically disinclined to become a broadband provider.

It may, therefore, make sense for Snohomish PUD to focus on middle mile infrastructure and transport services to backhaul providers' traffic and interconnecting major sites. A focus on building backbone infrastructure to and through areas where additional, diverse backhaul is needed would be an initial or minimal version of this approach.

Appendix 1. Interviewees

Arlington School District

- • Mark Ehrhardt, Director of Technology

Bonneville Power Authority (BPA)

- Adelle Harris
- Christopher Witthaus

Town of Darrington

- Dan Rankin, Mayor
- Bo (unknown surname and role)

Economic Alliance of Snohomish County

- Terrie Battuello, Vice President of Economic Development,
- Misha Lujan, Government Relations Manager

City of Everett

- Nick Harper, Deputy Mayor
- Steven Hellyer, Chief Technology Officer

Port of Everett

- Bob Marion, Controller

Island County

- Janet St. Claire, Commissioner, Island County Commission District 3

City of Marysville

- Worth Norton, Information Services Manager
- Brian Tuley, IT Supervisor

City of Sultan

- Will Ibershof, City Administrator

Snohomish County

- Josh Dugan, Chief of Staff, County Executive
- Randy Blair, Public Works
- Brook Chesterfield, Public Works
- Viggo Forde, Chief Information Officer

Sno-Isle Libraries

- Jason Latham, Acting Assistant Director, Information Technology

Stanwood-Camano School District

- Kyle White, Technology Specialist

Stillaguamish Tribe

- Jon Carrier, Director of Information Technology

Tulalip Tribes

- Kevin Jones, kjones@tulaliptribes-nsn.gov
- Laini Jones, lainijones@salishnetworks.com

Washington State University Everett Campus

- Paul Pitre, Chancellor
- Marshall Fryberger, Manager of IT and Operations

Service Providers

- Hans Hechtman and Carla Carrell, Comcast
- Jessica Epley, Ziply Fiber
- Robert Bass and Wayne Wooten, AT&T
- Chris Walker and Mike Henson, NoaNet
- Joe Poire and Kara Riebold, Petrichor

All parties who Magellan and Snohomish PUD reached out to during this project participated in discussions, with the exception of Kitsap PUD.

Appendix 2. Technology Options and Costs[35]

To estimate costs, Magellan Advisors developed a conceptual network design, an analytical tool for capital budgeting and strategic planning rather than a "recommendation." Decision makers could use the conceptual design to understand options to meet connectivity requirements, what the costs components are, and how those components relate to options and their benefits. The conceptual design supports the range of broadband business models. It accommodates retail broadband with "last mile" distribution infrastructure but can also serve as "middle-mile" fiber for broadband providers and major enterprises. While we note coverage statistics for components of the design and relevant service offerings, we do not estimate revenues or address other "top line" aspects of various business models.

The conceptual design is for a near-total over-build of Snohomish PUD's existing fiber infrastructure because staff indicated that all but a small section was not useable. Partnership opportunities and current and projected needs throughout Snohomish County and Camano Island were considered. Stakeholder input identified a range of connectivity needs and opportunities across the Snohomish PUD area. While we did not gather detailed data, general opportunities were for additional coverage of both industrial and rural areas. Stakeholders stated specific needs for targeted investments in additional backhaul or more resilient infrastructure, as discussed in the "Partnership Opportunities" section, above. Stakeholders indicated that general areas of the Snohomish PUD area, such as Camano Island and the area around Arlington Airport and Cascade Industrial Center, lacked broadband options.

BUSINESS MODEL CONSIDERATIONS

The conceptual design depends on the types of services to be provided as well as the area to be covered. Snohomish PUD has made no determination regarding what, if any, services it might offer with network infrastructure. Therefore, a network concept should accommodate either a dark fiber or an open access business model. A dark fiber approach involves simply leasing out a real asset—strands of fiber-optic cable. Open access involves additional equipment, lighting the network, and providing services. Neither necessarily involves access infrastructure for retail broadband, which requires major investments in operations and staff.

[35] Cost estimates are from Magellan Advisors' financial model that includes local prevailing wages for labor rates and vendor-sourced materials costs for the conceptual design as described, including assumptions.

Under these wholesale broadband business models, the customers are network service providers and major enterprises or institutions, including Snohomish PUD itself. The broadband utility develops, maintains, and manages backbone infrastructure. Distribution and access infrastructure are generally handled by the wholesale customer. Customers use the backbone for their core and feeder networks and possibly as distribution infrastructure. The network will handle numerous wholesale customers, especially if it is carefully managed: A conduit can be leased to a single customer or, on the other extreme, portions of a backbone cable could be leased to hundreds of customers.

The design allows the network to be extended by others to serve the community. A large, multi-site enterprise customer, for example, could lease fiber strands and attach its own equipment. Or a provider could build fiber or radio access infrastructure in particular areas or locations, interconnected via the backbone. Conceptually, customers pay to connect their assets via the infrastructure. Lit services would make this much easier and valuable to most prospective customers but would require capital and operating expenditures and expertise. In this design, the physical network and facilities can be securely shared among multiple customers/users, controlled by Snohomish PUD, but does not necessarily require lighting the network.

This study does not include a full analysis of broadband businesses models for Snohomish PUD. It provides cost and coverage estimates based on the conceptual design for the following components:

- Fiber backbone infrastructure to all areas of the Snohomish PUD service area, reaching all substations
- Network equipment for a data center and huts at substations with distribution lines to provide transport services across the backbone
- Distribution and access infrastructure—fiber and radio/wireless—to all electric customers in the Snohomish PUD service area

Each of these components enable different services. The fiber backbone only allows for dark fiber leasing. Transport isn't practical as a retail service. Distribution and access infrastructure directly support the full range of network services, except mobile (although that could be added to these components at substantial additional capital expense that is beyond the scope of this study). Snohomish PUD could use these estimates along with internally generated estimates of uptake and revenue for particular service offerings in specific areas to evaluate business models. For example, Snohomish PUD could evaluate an open access model with multiple wholesale customers—either fixed lease or revenue share—verses full retail. We recommend Snohomish PUD consider specific services for specific customers/partners in specific areas, building on the results of this study.

CONCEPTUAL NETWORK DESIGN

The objective of the conceptual network design is to demonstrate interconnection of distributed wholesale customers' (retail ISPs') access equipment, commercial data centers, major industry, and institutional sites. It uses ring topology to minimize impact of an equipment failure or fiber cut. Backbone routes follow major thoroughfares, as well as some secondary streets, where appropriate, to complete a ring. The rings are interconnected throughout the Snohomish PUD service area. Spurs extend into remote areas where it is not practical to complete a ring.

The routes were selected to connect as many Snohomish PUD and community assets as practical with this architecture. The conceptual design accommodates providing service to as much of the Snohomish PUD service area as possible, but does not include access and distribution infrastructure to the consumer. Therefore, the conceptual design, illustrated in Figure A-1, is for a high-strand count backbone network infrastructure to provide wholesale broadband throughout the Snohomish PUD. This design is not a recommendation. It is simply a means of estimating the costs of broadband infrastructure. We provide an overview of access technology options and estimates the costs for that infrastructure.

Fiber Backbone

The conceptual design features backbone network infrastructure to interconnect multiple other networks and sites. It consists of high strand count (e.g., 288-strand) fiber cable deployed overhead and underground, based on Snohomish PUD's power infrastructure (i.e., overhead where there are poles). Underground also tends to be more aesthetically acceptable**.** The design includes two separate conduits with shared access points (hand holes) at regular intervals and hubs at each of Snohomish PUD's electric substations.

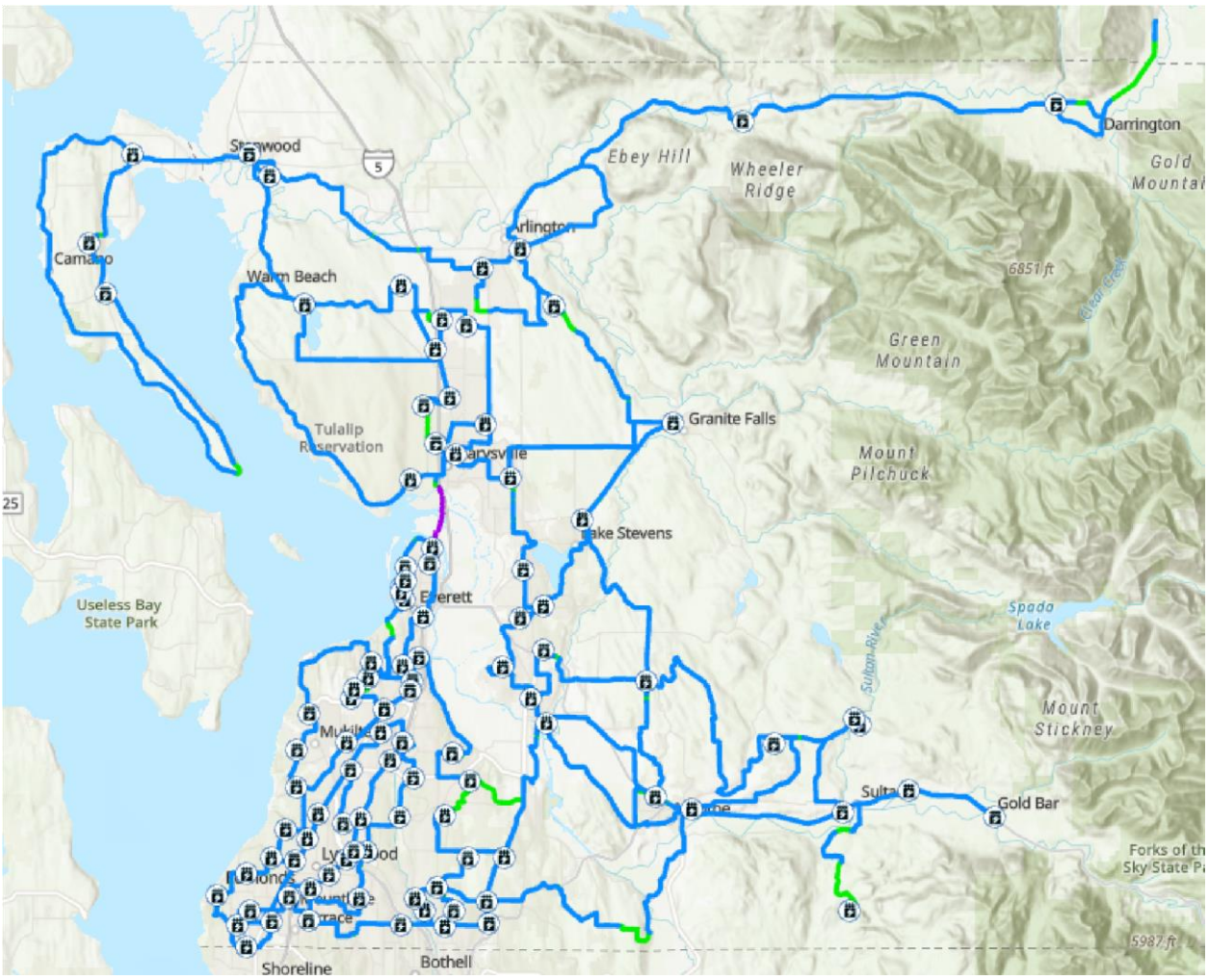

Figure A-1. Snohomish County PUD Wholesale Broadband Utility Backbone Conceptual Design

This backbone network is over 219K strand miles, more than 500 miles of 432-strand fiber cable, with 101 interconnecting points at electrical substations. Most of the backbone—460 miles—is overhead, based on the placement of Snohomish PUD's electric plant. Overhead fiber may be all-dialectic self-supporting (ADSS) cable or it may be lashed (e.g., "strand and lash") to existing cable. Strand and lash cable is more expensive—an estimated $22.40 versus $20.84 per foot—but does not require separate pole attachment and involves less make ready.[36] Given concerns about space on poles and reasonableness of cost estimates, the design assumes overhead construction to be strand and lash. All of this is new, over-build infrastructure except for a short section of 288-strand fiber under the Snohomish River.

[36] It is beyond the scope of this study to estimate make ready costs or evaluate aerial fiber deployment methods.

Table A-1. Estimated Backbone Network Infrastructure Capital Expenses

COMPONENT	OVERHEAD	UNDERGROUND	TOTAL
Labor	$43,843,143	$35,494,835	$79,337,978
Materials	$10,376,753	$2,255,401	$12,632,154
Contingency Cost @ 20%	$10,843,979	$7,550,047	$18,394,026
Engineering and Management	$3,677,209	$392,058	$4,069,267
TOTAL	**$68,741,084**	**$45,692,341**	**$114,433,426**

The total estimated cost to build the backbone is $114M, or $218K per mile, including 20% contingency on construction (labor and materials), as shown in Table A-1. Labor, based on local rates, is the largest cost component, particularly for underground. While underground is less than 10% of the backbone, the labor represents a third of the total costs. In total, the overhead infrastructure is less than two-thirds the overall total costs. The estimated costs without contingency are $96M, which may be considered the lowest possible cost before value engineering. Thus, Snohomish PUD can expect to spend approximately $100M to build a backbone network based on this conceptual design. Some form of backbone is essential to any broadband business model, although few scenarios would necessitate the full build backbone of the conceptual design.

Transport Network Equipment

Typically, broadband networks have a core network that forms a ring between a few key core sites, also known as “central offices” or “headend” facilities. Core sites contain the most powerful equipment to connect the local network to the global network. They must be secure, with high reliability power, and preferably centrally located. At least one, ideally two, sites must connect to high-capacity dedicated internet services, ideally via different providers with fiber following separate routes, for bulk IP. While the specific locations of core sites are not defined in the conceptual design, we include cost estimates—not including real estate acquisition costs—for them.

The network equipment required to deliver broadband services to customers, under any business model, is comprised of several functional groups and multiple components within each group. Each functional group and a brief overview of how it is used to deliver service to the end customer follows below. Retail ISPs may operate a mix of access networks consisting of both passive optical network (PON) and Active Ethernet services. The diagram below demonstrates the functional components of the network and how customers connect to the network to receive services.

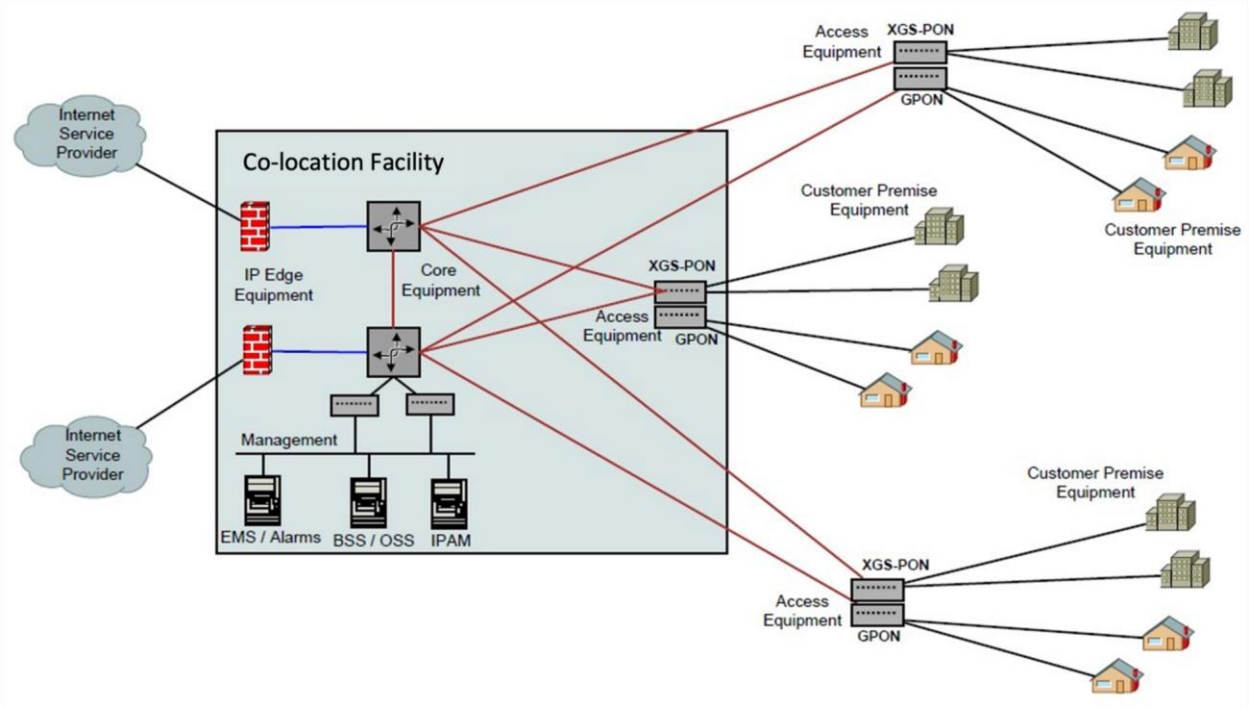

Figure A-2. Passive Optical Network (PON) Broadband Model

Core Equipment

The core equipment aggregates traffic from all access equipment, connecting customers and routing their data to and from the IP edge equipment or other end-point destinations. Standard network protocols provide link redundancy and dynamic traffic re-routing in the event of an equipment failure or fiber cut. Core equipment can easily support thousands of customers and hundreds of gigabits of traffic throughput at deployment and will accommodate future system growth through the addition of service modules, optical interfaces, and/or software licenses. Figure A-2 shows the key components and how they are integrated into a broadband system.

Optical Network Terminal

An Optical Network Unit (ONU), sometimes called an Optical Network Terminal (ONT), serves as the demarcation point between the retail ISP's fiber network and the router or firewall connecting to the customer's local area network (LAN). There are two general methods for installing ONTs. The first method involves mounting an outdoor rated ONT on an exterior wall of the structure and extending service wiring inside the premise. The second method involves extending the fiber into the premise and installing an indoor-rated ONU inside. In either case, the ONT is typically installed somewhere near the fiber entrance and an AC power source. The ONT terminates the fiber-based PON signals and provides customer access to their services through traditional copper interfaces. XGS-PON ONT's

supporting greater than 1 Gbps data service may also support optical small form-factor pluggable (SFP) interfaces for connection to enterprise-class LAN equipment.

Internet Protocol Edge (IP Edge) Equipment

Separate from the core switches, the network must maintain an "internet perimeter." The internet perimeter will include internet routers and internet firewalls to be used to manage routing throughout the network. Firewalls will be utilized to protect critical back-office systems, including provisioning, network management, data storage, and other information. The two core switches will be interconnected to two internet routers providing redundancy for internet services in the event of a single interface or equipment failure. As mentioned above, bulk IP should be acquired from at least two providers using diverse paths, one of which should be a Tier 1 provider.

Estimated Costs

The estimated capital investment for equipment and services to establish a transport network is approximately $2.2M, as shown in Table A-2, below. This includes a primary "central office" and a backup or secondary site, creating a dual-home core network. It does not include any distribution or access equipment. Budget 20% of capital expenses for professional services to design and build the transport network. Plan to spend approximately $500K to build out a data center to house this equipment, not including property acquisition or construction costs.

Table A-2. Estimated Capital Expense for Transport Network Components

COMPONENT	DESCRIPTION	UNIT COST	QTY	TOTAL
Edge Routing	2 meet points with BGP and 100G circuits	$150,000	2	$300,000
Core Routing	Routing and BNG for 375K subscribers; uplinks for only one access POP	$250,000	2	$500,000
Security	Firewall appliance / cloud service	$100,000	2	$200,000
Management	Server, element, and back-office network software	$150,000	2	$300,000
IP Services	DHCP, DNS, IPAM, AAA	$50,000	2	$100,000
Professional Services	20% of capital expenses			$280,000
Data center	Outfit an existing building with fire suppression, power, rack space, etc.			$500,000
			Transport Network Estimated Capital Expense	**$2,180,000**

Such a network could create at least $250K per year in operating expenses, regardless of business model. Capital and operating expenses associated with transport network equipment increases with access network size/number of subscribers. Specifically, each distribution hub (GPON POP, as described below), serving 2,250 subscribers, adds $325K in capital costs to the transport network because each requires five OLTs in the CO for that many connections.

Fiber Distribution Infrastructure

The backbone would traverse the utility service area to connect distributed wholesale customer access equipment at hubs. Snohomish PUD's substations were used as hubs in the conceptual design.[37] Feeder lines, which are also typically deployed in rings, connect a few core sites to distribution hubs. The core and feeder networks and hubs comprise the "transport" network. The distribution network branches out from the hubs. Multiple access lines drop off the distribution lines—hence the term "fiber drops"—from splitters into customer premises. Major sites can be directly connected to the core. These lines are referred to as "laterals" rather than feeders. The backbone fiber may be used for a feeder network and/or laterals, as well as core network. The particular use of specific fiber strands is a matter of how they are spliced together and where they terminate.

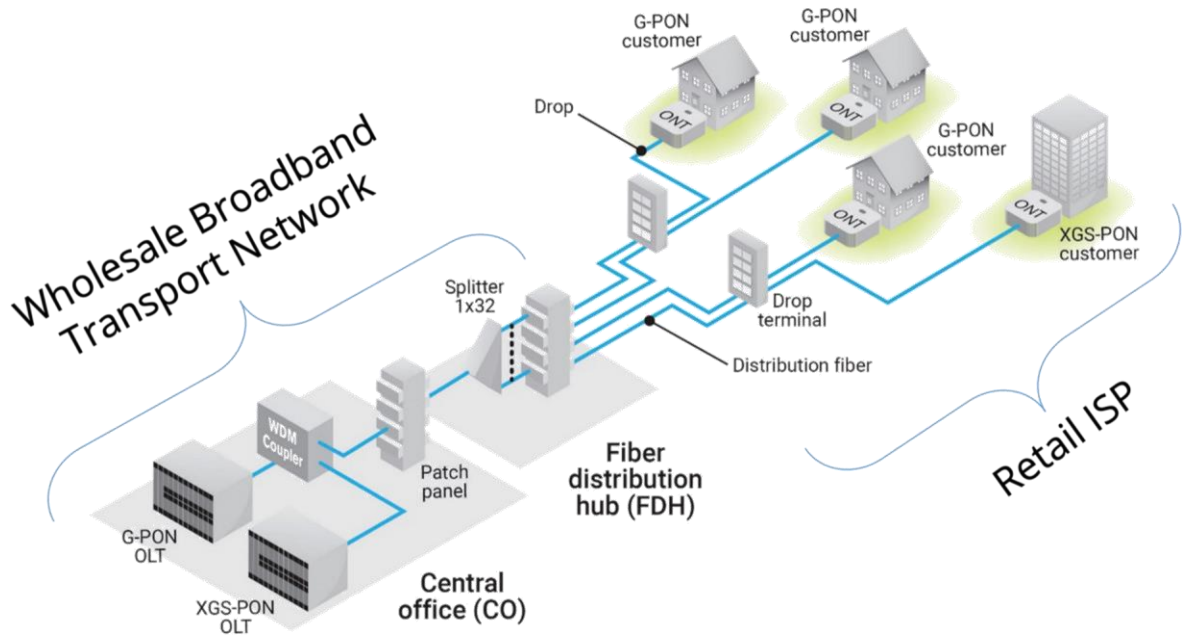

Figure A-3. Conceptual Design for Wholesale Passive Optical Network (PON)

[37] Current substations were used to estimate infrastructure costs. It is beyond the scope of this study to identify actual hub locations or estimate costs to acquire real estate for them.

Under a strictly wholesale business model, retail ISPs could be responsible for distribution infrastructure, as shown in Figure A-3. This includes deploying points of presence (POPs) at hubs. ISP POPs may use powered cabinets, prefabricated shelters, or existing structures with sufficient space for equipment racks and other components. The conceptual design can connect retail ISPs' POPs anywhere in the Snohomish PUD area with backhaul via diverse routes to multiple upstream service providers for maximum fault protection. In practice, a distribution infrastructure can and should be built in a phased manner in response to consumer demand and/or as workforce capacity allows. The assumptions used for these cost estimates are stated in Table A-3 and can be applied to any relevant broadband business model.

Table A-3. Conceptual Network Design Assumptions

DESIGN INPUT	ASSUMPTION
Customer Premises Served per Hub	4500
Prospective Customer Take Rate	50%[38]
Total Subscribers (Drops) per Hub	2,250
Video Subscribers	0
Data Centers	1
Hubs Used/Retail Provider PoPs	84
Split ratio	1:32

Feeder and Distribution Fiber

Feeder fiber extends from the POPs to neighborhoods and business districts. Of Snohomish PUDs' nearly 360K customer premises, just over 73K are within drop distance of the conceptual backbone. The backbone is designed with 432-strand fiber, but a dozen should be adequate for the core and feeder networks. Therefore, at least a couple hundred strands would be available for use as distribution. A more detailed design would be necessary to determine how much this would reduce the need for distribution fiber so it is not included in the cost estimates.

The estimated costs are based on the miles of overhead and underground distribution plant—3,267 miles and 2,863 miles, respectively. The cost estimates for such a build are summarized in Table A-4. Feeder fibers are sized based on the demand forecast and sizing of each enclosure to ensure that each service area is well equipped for broadband services. These details are addressed in design engineering to get optimal coverage for the least practical costs.

For cost estimating purposes, we assume an immediate full build out of the distribution network (i.e., reaching all Snohomish PUD's electric customers) using a combination of 144-

[38] Take rate in the context is used to estimate costs only, not revenues, and is set to a level intended to result in conservative cost estimates.

and 96-strand cables, for a total of 6,130 miles of cable with 60K vaults for underground and 35K snowshoes overhead. Fiber distribution network infrastructure for gigabit broadband to all Snohomish PUD customers would cost approximately $2.7B to build, in addition to the costs for backbone network infrastructure and transport equipment discussed above. The combined infrastructure would be suitable for full retail broadband services under open access, sole provider, or other business models.

Table A-4. Estimated Snohomish PUD Full-build Access and Distribution Infrastructure Costs

COMPONENT	COST
Labor	$1,835,385,983
Materials	$128,691,524
Contingency Cost @ 20%	$392,815,502
Engineering and Management	$49,173,620
Total	**$2,406,066,629**

Feeder fiber connects OLT ports to passive splitters located in outdoor cabinet enclosures called fiber distribution hubs (FDHs), placed strategically throughout the service area. Splitters may also be located within the access POP itself. In areas where aerial fiber deployment may be used, FDHs may be placed aerially or transitioned from the aerial pole to a ground mounted FDH.

There are five OLTs per POP in the CO because each OLT serves 512 subscribers at a 1:32 split. Therefore, 5 OLTs are required to serve the 2,250 subscribers, the average number of assumed subscribers per hub based on Snohomish PUD's customers/meters per substation. The number of POPs and OLTs per POP depends on the number subscribers. The conceptual design includes OLT and backhaul hardware necessary to connect each POP to the core routers. In an actual design/implementation, each OLT would not need backhaul hardware, two line cards, 16 optical interfaces, etc. However, for a conceptual design we have to assume worst case to ensure the entire hardware/software cost is captured in budgetary estimates. Estimated PON access capital expenses are shown in Table A-5, below.

Table A-5. Estimated PON Access Capital Expense per Hub/POP[39]

COMPONENT	DESCRIPTION	UNIT COST
Cabinet/Hut	Prefabricated shelter, 10x12	$125,000
Switching	Aggregation switch	$7,500
Access Network	XGS-PON OLT for 2,250 subscribers	$325,000
	TOTAL	**$457,500**

[39] Not including real estate acquisition costs.

Distribution fiber extends from the splitters in the FDHs to network access points (NAPs), or drop terminals, which connect individual fibers entering customers' premises. NAPs may be attached to aerial strand, located in ground level pedestals or placed in underground vaults or hand holes located near the sidewalk or curb in residential neighborhoods or business districts. NAPs are costed as an integral component of the distribution infrastructure estimates. Fiber distribution to NAPs will be sized based on the service area density to provide service to between 8-12 premises per NAP.

Fiber Service Drops

Fiber drops connect from each NAP to the customer premise equipment that delivers broadband service. At the customer premise, the drop cable terminates in a protective "clamshell" enclosure attached to a home or building for storage of slack and connection to the home equipment. Drop fiber may be installed aerially or underground, typically for a flat fee. Providers may charge additional drop costs for special circumstances such as burying fiber through difficult landscapes or under driveways. The estimated average cost of a fiber drop in Snohomish County at the time of this study, including all of these components and labor and recognizing that drops can vary greatly in complexity and distance, is $1,350.

Wireless Access Infrastructure

While Snohomish PUD would not deploy or operate radio access network or other wireless infrastructure under the model in this study, it is important to consider this infrastructure in the design to accommodate cellular and fixed wireless ISPs and capitalize on the assets. Wireless broadband can operate as mobile or fixed service. Although cellular connections can approach broadband speeds, mobile wireless broadband is still in its infancy, as discussed below. Fixed wireless can be used to connect remote locations or sparsely populated areas (see Figure A-4), where DSL or cable service would not be economically feasible, via long-range directional microwave antennas. As discussed below, most of these connections are built on proprietary technologies, although they generally extend Wi-Fi and similar standards.

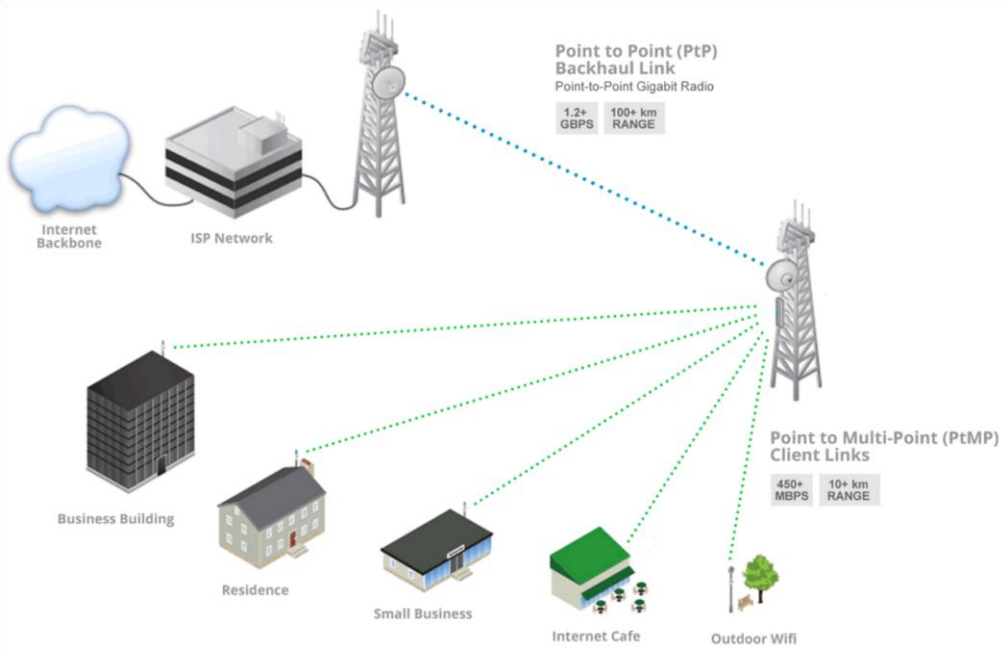

Figure A-4. How Wireless Networks Connect Communities

Coverage and speed are an intrinsic trade-off for wireless technologies. The farther a signal travels, the less information it can carry. High frequency signals, which have inherently high capacity, travel shorter distances than lower frequency signals (at the same power level). Lower frequency signals cover terrain and penetrate physical objects more effectively than high frequency signals. Spectrum in the lower frequency ranges offer better non-line-of-sight solutions, whereas the higher spectrum ranges need a more line-of-sight solution. Line-of-sight requires the transmitting antenna to be able to "see" the receiving antenna with limited trees and buildings in the way to be effective.

Terrain, then, plays an important role in the network design. Radio signals do not get over mountains or hills very well, nor does certain spectrum do very well in penetrating through buildings, foliage, or water, including rain and snow. The farther away the transmitter and the receiver are from each other, the less bandwidth is available. Transmitter sites need a means of connecting to the network, whether via fiber or microwave, to another site where it then transitions to a wireline fiber network. Fiber can be costly to install in remote locations. Electrical power, security and access are also considerations when locating appropriate tower sites. A propagation analysis to determine appropriate tower locations for Snohomish PUD's specific terrain would be part of a wireless high-level design to be conducted in the future.

Cellular Mobile Wireless

Mobile wireless connections operate from antennas on towers that create wireless cells across a geographic area. Connectivity is maintained as devices move from wireless cell to wireless cell. The base of each tower site is connected to other tower sites and the internet,

optimally via fiber optic cables. Today, 4G transmits data at around 12/5 Mbps.[40] With each new generation, more wireless applications become possible as more data can be carried across the airwaves.

5G networks operate multiple frequencies using millimeter wavelengths to offer anticipated download/upload speeds of 1 Gbps. The networks are designed to provide increased efficiencies while decreasing latency and to improve the performance of connected devices that define the Internet of Things (IoT), including autonomous vehicles, healthcare monitoring technologies, ultra-high-definition video, virtual reality, and many more applications ripe for development.

With limits in return on investment and physics, it is unlikely that 5G will be an all-encompassing broadband solution. While the big three cellular providers have nominally launched 5G nationwide, a mature 5G network will take time and continued investment by carriers. The full extent of 5G rollout is speculative, but if the investments in current infrastructure are any indicator, areas like rural Snohomish County should expect a long wait. Two keys to full 5G deployment are spectrum—all of which is effectively owned by AT&T, T-Mobile, and Verizon—and vertical assets with fiber connections.

Fixed Wireless

Fixed wireless services allow consumers to access the internet from a fixed point while stationary, and typically requires an external antenna with direct line-of-sight between the distant wireless transmitter and the customer building-mounted receiver. Speeds are generally comparable to DSL and cable modem. These services have been offered using both licensed spectrum and unlicensed devices. There are numerous small ISPs using fixed wireless to serve remote, sparsely populated areas, and several focused on more dense, urban areas.

Fixed wireless can be deployed as point-to-point (PtP) or point-to-multipoint (PtMP). PtP involves a one-to-one relationship between antennas at different locations. It is typically used for interconnecting sites, such as a headquarters or main buildings, to a remote facility. Fiber has much greater capacity and is more reliable, so internet service providers typically use this approach for connecting to customer locations where they do not have wired infrastructure. End-users typically use it as a backup or secondary connection or for non-critical or remote sites. PtMP involves multiple—even hundreds of—users' antennas connecting to a single, central base station.

As illustrated in Figure A-4, PtP and PtMP are complementary technologies. PtP can be used to interconnect PtMP base stations as well as for remote sites (although fiber is preferable due to its capacity and reliability). The networks require line-of-sight or near line-of-sight to operate. As implied by the term, fixed wireless does not allow for mobile use. The systems

[40] Several providers have announced they will discontinue 3G services in 2022.

utilize proprietary protocols and specialized devices to achieve the long ranges and high throughputs. Different vendors' products may not interoperate with each other.

Citizens' Broadband Radio Service (CBRS)

The FCC set aside the 3550-3700 MHz (3.5 GHz) spectrum in 2015 under a new, shared spectrum approach. There are three tiers of CBRS users, diagrammed in Figure A-5. Current, incumbent, tier 1 spectrum users, which include US military, fixed satellite stations, and, for a limited time, wireless internet services providers (WISPs) are protected from interference by other users. Ten Priority Access Licenses (PAL) for 10 MHz channels between 3550 and 3650 MHz in each US county was auctioned off by the FCC in July 2020. These licensees are protected from interference by other users but may not interfere with incumbent users. A licensee may aggregate up to 4 PALs. Any portion of the spectrum may be used without a license for General Authorized Access (GAA), but this may not interfere with incumbent or PAL users.

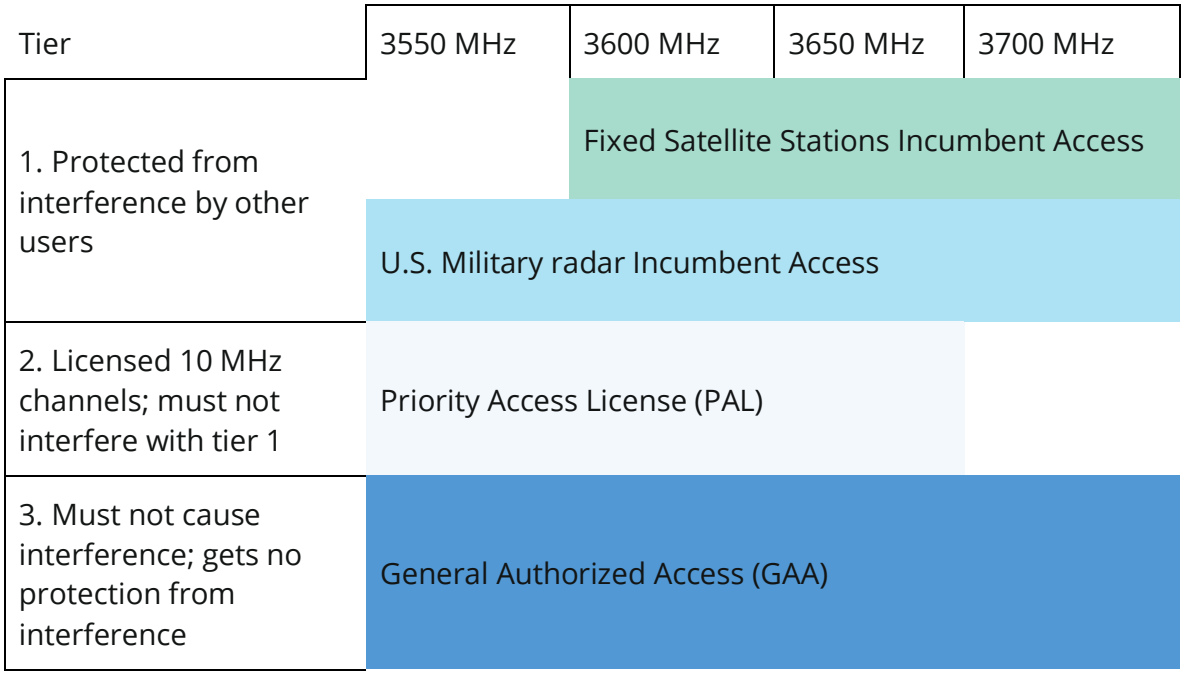

Figure A-5. CBRS User Tiers

CBRS use is managed by a Spectrum Access System (SAS) with which all Citizen Broadband Service Device (CBSD) base stations must be registered. There are two classes of CBSD. Class A base stations, which can transmit at 1 watt of power, are meant for smaller-scale indoor, enterprise, or campus use. Class B base stations can transmit at 50 watts, giving them much greater range. Strategically placed radio signal sensors will ensure that uses do not interfere with each other, particularly military radar.

Another important characteristic of CBRS is the Long-Term Evolution (LTE) protocol is commonly used with the spectrum. LTE is also used for 4G cellular data service, so it is

widely implemented in user equipment. CBRS involves different spectrum, but some smartphones have antennas that operate in the CBRS bands. It is reasonably easy and economical to add CBRS/LTE to devices without changing their operating characteristics or systems. Therefore, there are few barriers to end user adoption.

The combination of CBRS/LTE in base stations and user equipment is a radio access network (RAN). A RAN has a network core (an Evolved Packet Core or EPC) that authenticates and authorizes user equipment and manages connections to multiple base stations. This allows for mobile roaming from base station to base station without loss of connectivity and makes RANs very secure. The downside of a CBRS/LTE RAN is that some entity must operate EPC and the SAS. These are relatively inexpensive services that can be purchased from vendors or operated on private servers.

Low-Power Wide Area Networks (LPWAN)

Although not broadband, LPWAN technology should be considered in any network infrastructure plans. It is generally used to connect many small devices over a large geographic area. Water meter reading is a prime example of a LPWAN application. These are message-based networks, meaning end devices send small packets of information to an LPWAN gateway that then sends the data via a wired network to monitoring or tracking software. Real-time control of the devices is very limited but other, similar technologies exist that allow for remote control.

There are numerous standards for LPWAN with varying degrees of openness and propriety. The proprietary technologies were first to develop and currently have the largest installed bases. The open standards for LPWAN are still evolving. The major open standards are extensions of other standards, specifically 5G and Wi-Fi. The costs and flexibility of open standard based systems tend to be much better than proprietary technologies, although proprietary technologies may perform better in the short-term.

Wi-Fi

Wi-Fi, which was originally termed “Wireless Fidelity,” is an open standard that was developed to connect computers to a local area network (LAN) via unlicensed radio spectrum (the same frequencies used for cordless phones, garage door openers, and other non-network wireless devices). Generally, Wi-Fi is a PtMP technology: Wi-Fi access points connect multiple devices within limited range, typically no more than 150 feet indoors and up to 1,500 feet outdoors. There are multiple standards or versions of Wi-Fi. Some can provide up to 1 Gbps of throughput. Other new Wi-Fi standards are intended to cover large areas with minimal power requirements.

Wi-Fi coverage and speed depends on multiple factors such as buildings, foliage, and other physical barriers, interference from other spectrum users, radio spectrum used, transmission power, type of antenna(s), and weather. New versions of the Wi-Fi protocol

operate at greater distances and/or speeds. It can be deployed PtP to interconnect sites and is being adapted for LPWAN applications.

Wi-Fi access points are often integrated into routers that interconnect the Wi-Fi network (also called a service set identifier or "SSID") to other networks, including a broadband connection to the internet. This is typically referred to as a "hotspot" or Wi-Fi zone. Multiple access points can be interconnected to each other as well as a router to cover a larger area. A Wi-Fi network can even be extended over multiple otherwise independent routers via a centralized server to create "community" Wi-Fi. The latest version, Wi-Fi 6, improves these functions as well as expands the spectrum and increases speeds for Wi-Fi connections.

Today, many organizations use Wi-Fi to provide wireless connectivity throughout a building or campus. Many cities and counties have deployed public Wi-Fi in zones that extend into parks, other public spaces, and even throughout the community. Wi-Fi hotspots are common at hotels, restaurants, and public buildings for public access, and are widely used in homes and businesses for private access. The conceptual network is designed to accommodate Wi-Fi as well as other wireless technologies but does not include them. While Snohomish PUD could potentially offer public Wi-Fi, we assume any such equipment would be provided separately by Snohomish PUD or other entity.

Radio Access Network model

The Radio Access Network (RAN) model, diagrammed in Figure A-6, accommodates all the above forms of wireless connectivity, and thereby maximize the number, types, and value of wireless providers as customers. Under this model, Snohomish PUD could lease co-location facilities, fiber backbone, poles, towers, and other assets to private companies to deploy and operate RANs. The particular type of RAN would depend on the equipment providers deploy.

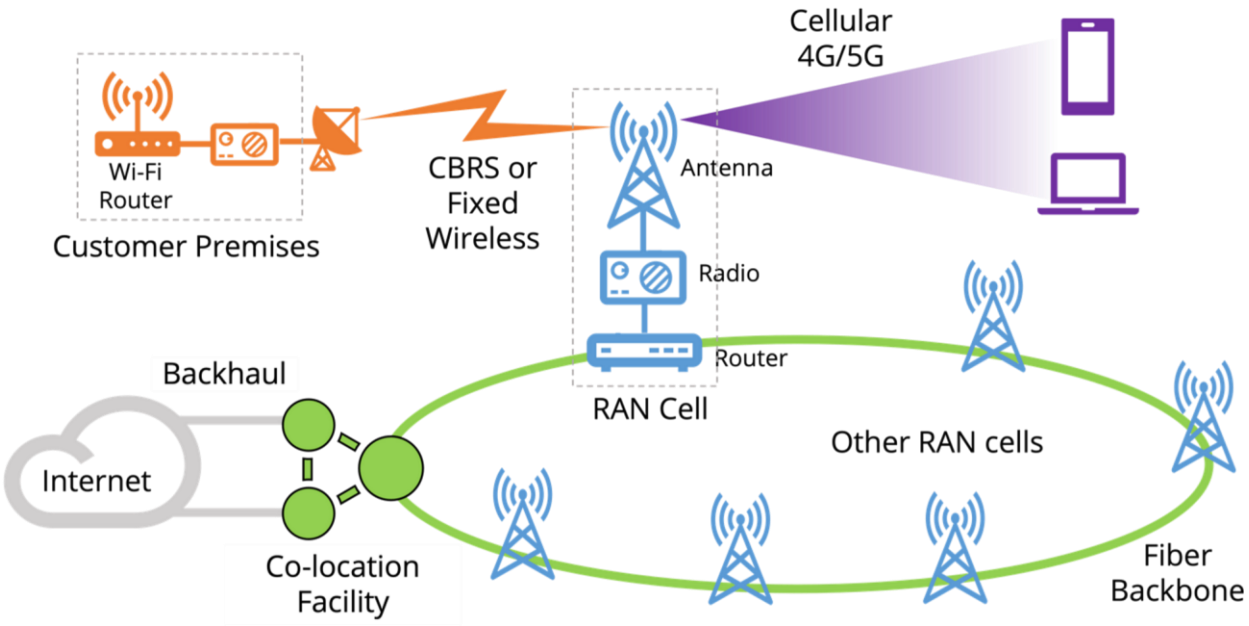

Figure A-6. The Radio Access Network (RAN) Model

The key issue for Snohomish PUD is how and whether to develop assets and facilities to accommodate RANs. The conceptual network design incorporates poles, but that doesn't mean they can be used for RAN infrastructure. Fiber must be physically accessible at poles and towers to connect cells. Poles would need to be assessed and possibly upgraded to support small cell infrastructure. Tower sites would need secure, multi-tenant huts for providers to deploy their gear (these huts may also serve as fiber hubs, depending on location). Providers may need the backbone to route to their points-of-presence and will definitely need interconnection to their regional/national networks.

RANs are much less costly that fiber networks.[41] They are more flexible, too, but have much less capacity and lower reliability. Mounting facilities can be the largest cost for RAN because antennas need to be above the surrounding terrain. Aesthetics is also an important issue because, as boxes on poles and towers, cell sites are not particularly attractive. People want connectivity but may object to cell towers in their neighborhood.

Wireless Broadband Cost Estimates

For cost purposes, we assume that any wireless solution must qualify as broadband, ideally meeting the State of Washington's new standard of 100 Mbps download and 20 Mbps upload. CBRS is the best technology for economically meeting these criteria. A CBRS cell with full coverage would have four sectors, each with an antenna and base stations which may come as an integrated unit. Each cell requires a router with fiber interface, power, and

[41] The active components of a RAN will need refreshed in 5 years at most. Historical trends suggest the costs of those components can be expect to drop substantially in that time.

an equipment hut, which may be shared with other network infrastructure such as a GPON POP. It also requires a tower, which would typically be a 50 to 150 feet tall monopole but can be most any tower suitable for antenna mounting.

Such a cell would accommodate 2,000 subscribers—500 subscribers per base station—with 200 Mbps throughput per base station, divided among all users in that sector. Users should generally get 50 Mbps to 100 Mbps throughput, depending on the number of other simultaneous users. A CBRS cell would nominally provide 60 Mbps download at a 10-mile radius in "ideal" circumstances, including no foliage or terrain. The practical range is around 3 miles.

Each 4-sector cell requires four 65-degree, 4-port antennas and base stations, which may come as an integrated unit, one per sector. Antennas are mounted on towers and a hut is generally required for other network equipment. A router is required to connect the cell to the fiber network for backhaul. The total estimated cost for generic CBRS RAN cell, not including property acquisition and costs, is less than $260k, as shown in Table A-6. A RAN with 80 cells, one at each major distribution substations, would require about $21M in capital.

Table A-6. CBRS Radio Area Network Costs

COMPONENT	UNIT COST	QUANTITY	COST
Antenna, base station, installation, wiring, and network management software license, per sector[42]	$12,500	4	$50,000
150-foot direct embed monopole, shipping and installation	$110,000	1	$110,000
Equipment hut, generator/battery backup and AC	$65,000	1	$65,000
Router with fiber interface	$1,000	1	$1,000
Construction, engineering, and project management services		15%	$33,900
		Total per CBRS cell	**$259,900**

Each customer premise will need equipment that consists of an CBRS LTE antenna and base station with integrated router and Wi-FI access point. Installation cost is approximately $200, and each customer initialization involves a $35 fee for EPC. Together, as detailed in Table A-7, each customer involves about $750 in capital expenses. There is also a monthly recurring cost of $2.25 per customer.

[42] Based on Telrad equipment (see https://telrad.com/products/breezecompact-1000/). There are multiple vendors of CBRS RAN equipment. Magellan Advisors does not endorse or recommend a particular solution or vendor.

Table A-7. Customer Premise Equipment Cost Estimate

COMPONENT	COST
CBRS CPE cost ($356 equipment, $350 labor)	$706
EPC Access Fee Per CPE (One Time Fee)	$35
Total per customer premise	**$741**

Since RAN operators are prospective customers, Snohomish PUD would need to address cell site costs and issues and facilitate RAN development. Identifying sites that may support wireless and conditioning them with fiber may be an applicable tactic. For the purposes of this analysis, we presume substations would be used for this purpose. Snohomish PUD may want to extend the network to reach existing cell sites, too, as these represent business opportunities.

Co-Location Facility and Core Network

Modern, carrier-class networks are typically structured in a hierarchical manner, with a core network interconnected a few key sites. Core network sites are key to operations and reliability as they feed major sites. The broadband utility would need a CO, data center, or headend facility to provide an interconnection hub for retail ISPs. The CO would house core and edge equipment for ISPs serving customers within the area. Other carriers could be co-located in these sites so circuits and traffic could be connected and routed to the rest of the world.

Two of these sites, including the CO, should have dedicated internet access to different providers using separate network routes out of the area, ideally to both Seattle and Bellingham. Equipment and facilities requirements are reasonably modest—primarily separate, secure cages for providers and major network users to place equipment, along with environmental controls and clean, reliable power. The costs of a data center build out, including power systems—approximately $500K—are included in the transport network portion of the conceptual design.

Staffing and Workforce

Substantial human capital is required to build and operate a broadband system. While a salary survey or staffing plan would be premature and beyond the scope of this study, it is important to note staffing as a cost component. Broadband managers typically make $150K - $200K annually. Network engineers can be even more costly. An operations manager and possibly technicians will be needed, along with customer care, financial, and marketing professionals. At the same time, the available workforce for the reasonably specialized broadband sector is constrained by general economic trends (the “Great Resignation”), growth within the sector, and relatively few training programs. This analysis is limited to the “hard” capital costs for equipment and infrastructure. It does not include any workforce

requirements or payroll cost estimates, nor does it include buildings, vehicles, software, and other supporting assets.

OVERALL CAPITAL EXPENSE ESTIMATES

The major components of broadband infrastructure are backbone fiber, transport equipment, which together comprise the "core" network, and access/distribution network, which can be either fiber (PON) or wireless (CBRS). Both forms of access require a core network. Costs for these components, detailed above and summarized in Table A-8, do not include operating expenses or real estate acquisition.

Table A-8. Total Cost Estimates for Major Broadband Network Components

COMPONENT	EACH	QUANTITY	AMOUNT
Core Network			
Backbone Infrastructure			$114,433,426
Transport Equipment			$2,180,000
		Total	**$116,613,426**
PON Fiber Access Network			
Distribution Infrastructure			$2,406,066,629
Hub/PoP	$38,430,000	84	$38,430,000
CPE, including drop fiber	$255,150,000	189,000	$255,150,000
		Total	**$2,699,646,629**
CBRS Radio Access Network			
CBRS cells	$259,900	84	$21,831,600
CBRS CPE	$741	189,000	$140,049,000
		Total	**$161,880,600**
Total Fiber Broadband Cost (FTTH + Core)			**$2,816,260,055**
Total Wireless Broadband Cost (RAN + Core)			**$278,494,026**

Core network infrastructure for the entire Snohomish PUD area would cost approximately $117M to construct. This is all new build except for a short section under the river. PON fiber access to all customer premises in the Snohomish PUD area, with a 50% take rate, would cost a total of $2.8B to construct, including customer equipment and fiber drops as well as the core network. CBRS radio access would cost approximately $278M, including core network and CPE. These estimates are for "full-build" to all areas and customer premises of Snohomish PUD. Estimates are based on Snohomish PUD's electric infrastructure.

Magellan Advisors does not recommend building this infrastructure and provides the cost estimates as an illustrative reference point. Capital expenses can be reduced to a fraction of these estimates by partnering, focusing on specific areas, and careful engineering. Construction of any scale will necessarily be phased and investment will be in several tranches. The cost of money can be a major expense, and can be reduced with an incremental, focused approach.

A fiber broadband network for the entire Snohomish PUD area, reaching all customer premises, would cost approximately $2.8B to build, shown in Table A-9. Wireless infrastructure—which could either complement or substitute for the fiber-based access components—with comparable coverage would involve an estimated $278M in capital investment. The core network, including district-wide fiber backbone with the necessary transport equipment, which could directly connect 63K residential customers and nearly 10K commercial sites, would cost approximately $117M. The backbone alone would cost $114M. All estimates are before the cost of non-network assets, payroll, and other important factors, as discussed in detail in this report.

Table A-9. Fiber Broadband Full Build-out Cost Estimate for the Snohomish County PUD

COMPONENT	COST
CORE NETWORK TOTAL (BACKBONE AND TRANSPORT)	$116,613,426
PON FIBER-TO-THE-HOME (FTTH) ACCESS NETWORK TOTAL	$2,699,646,629
CBRS RADIO ACCESS NETWORK (RAN) TOTAL	$161,880,600
TOTAL FIBER BROADBAND COST (FTTH + CORE)	$2,816,260,055
TOTAL WIRELESS BROADBAND COST (RAN + CORE)	$278,494,026

These cost estimates are for a conceptual design based on and fully overbuilding Snohomish PUD's existing infrastructure except the section under the river. Snohomish PUD could build only a portion of the infrastructure or focus investment in particular areas. A high-level design would be necessary to determine costs for projects based on this approach. An engineering design would be needed to optimize routing and infrastructure placement for construction. The actual cost of any such development will be less than this "full build" estimate.

Appendix 3. Funding Opportunities

STATE FUNDING

The State of Washington Community Economic Revitalization Board (CERB) and Public Works Board (PWB) in consultation with the State Broadband Office (WSBO) provided funding for broadband projects. Broadband is considered an essential service for which the WSBO is funding broadband projects in underserved areas. Funding effectively requires partnership with a local government entity, including a PUD. An ISP of other for-profit entity cannot directly apply for this funding.

Washington Public Works Board

The Public Works Board (PWB) was established and funded by the Washington State Legislature to meet local government financing needs for infrastructure on a reliable and sustainable basis. PWB financing programs were originally oriented to perhaps more traditional infrastructure such as water, sewer, roads and streets, bridges, solid waste and recycling. Broadband infrastructure financing was added in 2019 to recognize the criticality of broadband services to the State. Assets or infrastructure developed with PWB funding must be maintained for public use for at least fifteen years ensure it benefits the taxpayers.

The PWB is authorized under RCW 43.155.160 to loan and grant money to local governments and other entities including Public Utility Districts for purposes of expanding broadband access to unserved areas. The purpose of the PWB's Broadband Program is to fund low-interest loans and grants for the acquisition, construction and installation of broadband facilities. Evidence of the unserved (not underserved) status of the proposed project area must be documented in the application to establish that the project area lacks broadband at 25 Mbps download/3 Mbps upload speeds. Eligible applicants include public entities:

- Cities and Towns
- Cooperative Associations
- Counties
- Nonprofit Organizations
- Other Special Purpose Districts
- Public Port Districts
- Public Utility Districts
- Quasi-Municipal Corporation
- Tribes Private Entities:
- Incorporated businesses or partnerships
- Limited liability corporations organized for the purpose of expanding broadband access

Funding Availability

The PWB may fund all or part of a proposed project up to 50% of the total cost and $2 million dollars, except additional funding may be available in defined "distressed areas" or "Indian country" (up to 90% and $5 million dollars – the cost share/match is $555,555). Areas that qualify as "distressed" under the statutory definition (RCW 43.168.020 (3)) receive special considerations. Areas in the "severely distressed" class get interest rates 25% of the standard interest rate.[43]

Community Economic Revitalization Board

The Community Economic Revitalization Board (CERB) has three funding programs. Generally, CERB may not finance projects for retail development or gambling, or that are outside the applicant's jurisdiction. Jobs created can't displace jobs from one part of the state to another. Funding cannot be used for a public entity to provide retail telecommunications services or services that not authorized by statute or for the sake of creating competitive, publicly owned telecommunication network infrastructure.

Rural Broadband Program

CERB provides low-interest loan/grant packages to local governments and federally recognized Indian tribes, financing for construction and planning of infrastructure to provide high-speed, open access broadband service for the purpose of community economic development. Funding is only available to rural communities and counties, which makes Snohomish County and Snohomish PUD ineligible. A federally recognized tribe within the county could be eligible. Therefore, we include information about this funding.

Eligible Activities

Eligible broadband projects either drive job creation, promote innovation, and expand markets for local businesses. Or they serve the ongoing and growing needs of local education systems, health care systems, public safety systems, industries and businesses, governmental operations, and citizens. They must improve accessibility for underserved communities and populations and meet minimum speed requirements using eligible infrastructure listed in Table A-10.

Table A-10. Eligible Infrastructure Types and Speeds

BROADBAND MEDIUM	SPEED DOWN/UP
CABLE MODEM	100 Mbps / 20 Mbps

[43] PWB Broadband Construction Policies Handbook Version 1.0, page 3.

BROADBAND MEDIUM	SPEED DOWN/UP
FIBER	1 Gbps / 1 Gbps
WIRELESS (FIXED WIRELESS, WIFI)	50 Mbps / 10 Mbps
4G MOBILE WIRELESS	25 Mbps / 5 Mbps
BROADBAND OVER POWERLINES (BPL)	100 Mbps / 100 Mbps
MICROWAVE	100 Mbps / 20 Mbps

Funding Availability

CERB offers loans at $2 million maximum per project at 1-3% interest rate up to 20 years. Grants are available up to 50% of the total award, determined by the underwriting process and debt service coverage ratio (DSCR). Applicants must demonstrate feasibility with a supporting study and provide a cash match of 20% of the total project cost.

Committed Private Partner Program

The Committed Private Partner (CPP) Program provides loans and grants for construction of public infrastructure necessary for private business expansion. It requires a private business commitment to create jobs as part of the application. Applicants must provide evidence that a private development or expansion is ready to occur contingent upon the approval of CERB funds. The project must either create a significant number of permanent jobs at a cost per job of no more than $30K and/or private capital investment that exceeds the CERB investment. Jobs must also pay more than the county median hourly wage. Applicants must also demonstrate CERB assistance is needed as no other source of funding is available in time.

Eligible Activities

Planning, acquisition, construction, repair, reconstruction, replacement, rehabilitation, or improvement of eligible systems, which include telecommunications. They also cover research, testing, training, and incubation facilities in designated Innovation Partnership Zones (IPZs) authorized under RCW 4.330.270.

Funding Availability

CPP offers loans at $3 million maximum per project at 1-3% interest for up to 20 years. Grants are available up to 25% of the total award, determined by the underwriting process and debt service coverage ratio (DSCR). Applicants must provide a cash match of 20% of the total project cost.

Prospective Development Program

The Prospective Development (PD) program funds planning, acquisition, construction, repair, reconstruction, replacement, rehabilitation, or improvement of infrastructure including telecommunications for rural communities and counties. Applicants must demonstrate that private business development is likely to occur as a result of the public improvements. Only a federally recognized Indian Tribe in Snohomish County would be eligible for these funds. Funding availability is similar to CPP.

FEDERAL FUNDING

The American Rescue Plan Act under the Final Rule Released by Treasury on January 5, 2022

On March 11, 2021, the American Rescue Plan Act (ARPA) was signed into law which provided $350 billion in direct federal funding to states, territories, tribal and local governments to address the social and economic challenges communities have faced in response to the COVID-19 public health emergency.

ARPA recognized the need for improved broadband infrastructure and faster speeds, especially to underserved households and businesses impacted by the COVID-19. ARPA also made funds eligible for "government services" which include any service or program traditionally provided by a municipal government. This includes the construction of roads, buildings, middle-mile and last-mile broadband networks, and other critical infrastructure and equipment to support the provision of public safety and other services, as well as health care delivery and educational services to households impacted by COVID-19.

ARPA provides government agencies with a significant opportunity to fund broadband construction, planning, engineering, deployment and adoption goals over the next five years. Other funding sources funded under ARPA as well as the Consolidated Appropriations Act of 2020 (outlined further below) could also be leveraged to maximize funding resources that best meet the connectivity needs and eligibility requirements for County residential consumers and businesses. Estimated allocations within Snohomish County for ARPA for all government services included the following amounts for the County and cities:

- Snohomish County: $159,679,985.00
- City of Everett: $20,695,570.00
- Snohomish City: $2,834,468.00
- City of Marysville: $9,417,568.00

Smaller towns likely were also allocated funding, although the amount will vary based on population. Snohomish County and its towns and cities can allocate a portion of ARPA funds towards broadband network planning, engineering, construction, digital literacy

training and outreach to increase participation in several of the programs discussed below. The ARPA rules allow for project funds to be obligated no later than December 31, 2024 and finalized by December 31, 2026. This window provides recipients a five-year window to sufficiently build and deploy network infrastructure. Snohomish PUD could engage with these local governments to explore the possibility of partnering on the use of ARPA funds.

ARPA Project Eligibility Criteria

The Treasury Departments Final Rule (FR) released on January 5, 2022, contains a non-exclusive list of eligible costs for funding in response to the pandemic as well as considerations for evaluating other potential uses of Fiscal Recovery Funds not explicitly listed. The FR also provides maximum flexibility for recipients to use Fiscal Recovery Funds (FRF) for programs and/or services that are not identified on these non-exclusive lists but which meet the objectives of the statute by responding to the pandemic and its negative economic impacts.

The FR provides broad latitude to use these funds for the provision of "government services" which can include, but are not limited to, maintenance of infrastructure or pay-go spending for building new infrastructure, including roads; modernization of cybersecurity, hardware, software, equipment, devices, the protection of critical infrastructure; and the provision of police, fire, and other public safety services. ARPA funds under the "revenue loss" eligible use category can also be used as a match for non-federal match requirements for other federal grant programs other than those administered by NTIA.[44] In other words, Treasury provides authority to ARPA fund recipients or subrecipients to use these funds for non-federal match requirements from USDA, EDA, and other federal grant management agencies unless otherwise prohibited from that agency.[45]

Broadband Provisions in the U.S. Treasury's Final Rule (FR)

Treasury authorized the use of ARPA funds for eligible broadband projects that reliably deliver up to 100 Mbps down and 20 Mbps up in areas where it is impracticable due to geography, topography, or financial cost. Projects must also be designed to serve unserved or underserved households and businesses, defined as those that are not currently served by a wireline connection that reliably delivers at least 100 Mbps download and 20 Mbps upload speeds. For broadband investments, recipients can also use their funds to support digital literacy training and other adoption programs that promote access to the Internet. Recipients may also use funds for modernization of cybersecurity, including hardware,

[44] SLFRF-Final-Rule-Overview.pdf (treasury.gov)

[45] SLFRF-Final-Rule.pdf (treasury.gov) (Page 269-270)

software, and protection of critical infrastructure, as part of provision of government services up to the amount of revenue lost due to the public health emergency.

Funds may also be used for both last-mile and middle-mile projects so long as the middle-mile facilities provide connectivity to last-mile entrants. The Final Rule does not specify a specific technology but encourages recipients to build networks that are "future proof," which indicates a proclivity towards fiber. The FR also provides recipients with significant discretion as to how they will assess whether the project itself has been designed to provide households and businesses with broadband services that meet, or even exceed, the speed thresholds. It is important to note that ARPA funds cannot be used in areas funded by another federal or state grant or loan program. Any area funded by the FCC's Rural Digital Opportunities Program (RDOF) may not be eligible for funds under ARPA. We caution local and County governments to carefully identify the specific areas it wishes to build broadband network facilities to ensure it is in alignment with the Final Rule.

Key broadband provisions in the FR:

- Recipients (states, local and county governments) are encouraged to fund projects to serve locations without access to reliable wireline broadband with speeds of 100 Mbps down, 20 Mbps up and in areas with a specific identified need for broadband investment.
- Recipients are permitted to define "need" in their community however they wish. Examples of need could include:
    - Lack of access to a reliable high-speed broadband connection
    - Lack of affordable broadband and/or reliable service
- Projects that achieve last-mile connections with fiber are encouraged
- Funds may also be used to modernize cybersecurity for existing and new broadband infrastructure
- Projects funded and built by local governments, coops and or nonprofits are encouraged
- Recipients using ARPA funds to build broadband networks must also:
    - Participate in the FCC's Affordable Connectivity Program (ACP)
    - Provide access to a broad-based affordability program to low income consumers similar to ACP
    - Include at least one low-cost option without data caps at speeds to support households with multiple users to telework and engage in remote learning

Snohomish PUD might work with local government agencies in Snohomish County to leverage these provisions to construct network infrastructure for affordable broadband services to low-income and disadvantaged households and businesses, including last-mile

connections to public housing and skilled nursing facilities as well as to schools, hospitals and libraries. Last-mile investments of these funds should focus on areas of immediate need such as opportunity zones and local businesses with significant revenue loss due to the pandemic because those are the purposes of ARPA.

Competitive grant programs funded outside of ARPA could also be considered, such as the Community Connect grant program administered by the U.S Department of Agriculture's (USDA) Rural Utilities Service (RUS) as well as the National Telecommunications and Information Administration (NTIA) Tribal Infrastructure grant program.

Broadband provisions in the Infrastructure Investment and Jobs Act of 2021 (IIJA)

President Biden signed the Infrastructure Investment and Jobs Act (IIJA) into law November 15, 2021, which directs that NTIA will administer $42.5 billion to establish a new program called the Broadband Equity, Access, and Deployment (BEAD) program. This program will provide formula-based grants and technical assistance to states to develop broadband plans, and issue funds to subgrantees to construct and deploy infrastructure in unserved and underserved communities. Each state is designated to receive a minimum of $100 million each. The BEAD program requires states or its subgrantees to provide a 25% match for total project costs. Matching funds can be derived from ARPA allocations as well.

NTIA will also administer two new digital inclusion programs – the State Digital Equity Capacity Grant Program and the Digital Equity Competitive Grant Program which will issue $2.75 billion nationally to build state capacity and award grants to promote the achievement of digital equity, support digital inclusion activities, support state efforts relating to the adoption of broadband by residents of those states, and make competitive grants directly to entities involved in advancing digital inclusion and digital equity.

NTIA will also administer a new Middle Mile competitive grant program that will provide $1 billion nationally to encourage the expansion and extension of middle mile infrastructure to reduce the cost of connecting unserved and underserved areas to internet backbone networks. These grants will promote broadband connection resiliency through the creation of alternative network connection paths to prevent single points of failure on a broadband network. We expect the final rules for these programs to be issued sometime towards the end of Q2, 2022 and application windows likely to open sometime in Q3, 2022. The BEAD program rules are also dependent on the completion of the

FCC's revised Broadband Locations Map directed by the Broadband Data Act of 2021 and the Bipartisan Infrastructure Act[46]. As of the date of this report, the FCC has been delayed in revising its mapping layers due to pending litigation over its procurement of Cost Quest

[46] BILLS-117hr3684enr.pdf (page 778)

as the agency's vendor for this project. Therefore, the timing of the release of the BEAD grants may be delayed due to pending litigation at the FCC.

$42.5 Billion BEAD Program Overview

According to the IIJA, BEAD program funding will be dispersed to states in three phases.

1. The first phase allows states to access up to $5 million each to support planning efforts, including building capacity in state broadband offices and to fund outreach and coordination activities with local communities and stakeholders.
2. The second phase requires states to submit an initial broadband plan to NTIA. These plans must be informed by collaboration with local and regional entities and will lay out how each respective state and territory will use the BEAD funding and other funds to bring reliable, affordable, high-speed broadband to all residents.
3. Once NTIA approves the initial plan, states can access additional funds from their BEAD allocation based on the number of unserved and underserved locations proportional to the national average. States and territories will be able to access the remaining funds upon review and approval of a final plan they must submit to NTIA. Each state will receive a minimum of $100 million.

Service Area Definitions

Unserved areas are defined as having no access to a minimum of 25/3 Mbps service and underserved areas are those that have no access to a minimum of 100/20 Mbps service. States may distribute funds to subgrantees (local governments, non-profit or commercial entities). Grantees must also offer a low-cost service option, which will be defined by the states and then approved by NTIA. All projects must achieve at least 100/20 Mbps speeds, serve the entire area, be completed within 4 years, and must not experience network outages that last, on average, 48 hours in a one-year period. "Unserved Service Projects" are those for which at least 80% of proposed locations are unserved, while "Underserved Service Projects" are those for which at least 80 % of proposed locations are either unserved or underserved.

Eligible uses for BEAD funds

- Creation of a new, or fund operations for, a statewide Broadband Office including staffing support, consultants and training
- Broadband data collection efforts for mapping
- Provide grants for new broadband deployment, with the following priorities:
- Unserved service projects
- Underserved service projects, once eligible entities certify that all unserved locations will have service provided
- Connecting eligible community anchor institutions
- Develop preliminary budgets for pre-planning activities

- Publications, outreach, and communications support • Technical assistance, including workshops and events • Preferential rankings will be based on: ○ Deploying to persistent poverty counties or high-poverty areas
- Speed of proposed broadband service ○ Expediency of proposed project plan
- Demonstrated record of compliance with Federal labor and employment laws
- Installation of Wi-Fi and internet infrastructure in multi-family dwellings that are unserved and in locations where the percentage of individuals with a household income is at or below 150 percent of the poverty line

Limits on eligible entity spending include a 5% expenditure limit on pre-deployment planning and 2% on administrative expenses.

BEAD Program Requirements for States

State grantees must submit a 5-year action plan that details the level of local, regional and municipal collaboration as well as their investment priorities and associated costs; alignment of planned spending with economic development, telehealth, and related connectivity efforts. States must also address local and regional needs for broadband connectivity supported by data analysis and how those needs could be met with partnerships with non-profits, local governments and or cooperatives.

$1 Billion Enabling Middle Mile Broadband Infrastructure Program

NTIA has also been directed under the IIJA to establish a new competitive grant program to support middle mile infrastructure projects in unserved and underserved areas. Competitive grant funds may be used for the construction, improvement, or acquisition of middle mile broadband infrastructure. Funding will be awarded on a technology-neutral and competitive basis. *The federal share cannot exceed 70 % of total project costs.* Eligible entities include state, local or tribal governments, technology companies, utilities, cooperatives, public utility districts, commercial broadband or cooperative providers, nonprofit, regional planning counsels, Native entity, or economic development authorities, or partnerships of such entities. Program purpose is to encourage the expansion of middle mile infrastructure to reduce the cost of connecting unserved and underserved areas (lacking 25/3 Mbps or 100/20 Mbps) and to promote "broadband connection resiliency through the creation of alternative network connection paths."

State Digital Equity Act programs

The Digital Equity Act provides $2.75 billion to establish three grant programs that promote digital equity and inclusion. They aim to ensure that all people and communities have the skills, technology, and capacity needed to reap the full benefits of our digital economy. These funds will be awarded via and administered by the states:

- State Digital Equity Planning Grant Program: A $60 million grant program for states and territories to develop digital equity plans.

- State Digital Equity Capacity Grant Program: A $1.44 billion grant program for states and territories. It will fund an annual grant program for five years in support of digital equity projects and the implementation of digital equity plans.
- Digital Equity Competitive Grant Program: A $1.25 billion grant program. It will fund annual grant programs for five years to implement digital equity projects.

Other Broadband Funding Opportunities in the IIJA

Broadband Deployment Locations Map for All Federal Programs Administered by the FCC

The IIJA also directs $10 million to the FCC to create a map of the geographic footprint of all broadband infrastructure deployment projects funded by the federal government. The map must include the program title, type of broadband network, company name, project duration timeline, and upload and download speeds. The FCC must post the map on its website with periodic updates. This map will serve as the "centralized, authoritative source of federal funding for broadband infrastructure deployment." The IIJA statute requires all broadband providers to provide the FCC with any information, in the format, type, or specification to augment the collection of data under the form 477 data collection program. It also authorizes the FCC to give providers 60 days (instead of 6 months) to file the new mapping data and resolve challenges within 90 days after receiving a response from the challenged provider. The US Census must provide the FCC with housing unit data from the most recent census and the FCC must publish the broadband maps on the internet.

Changes to the Universal Service Fund (USF) Programs Under IIJA and ARPA

The FCC administers over $9 billion annually in federal subsidies to support broadband access to schools, hospitals, libraries, commercial and non-profit broadband providers as well as low-income consumers including those on federally recognized tribal lands. FCC subsidies are managed and administered by the Universal Service Administrative Company (USAC), which is the program administrator to the FCC. Below is an overview of the most relevant subsidy programs authorized under ARPA, IIJA and the Consolidated Appropriations Act of 2020.

Affordable Connectivity Program (ACP), $14.2 Billion Administered by the FCC

The IIJA created the Affordable Connectivity Program (ACP) which extends the framework of the Emergency Broadband Benefit Program (EBB) by making the monthly subsidy permanent to qualifying low-income households impacted by COVID-19. The newly established ACP benefit provides monthly subsidies to qualifying households at $30 per month, down from $50 per month authorized under the EBB.

Monthly benefits to eligible households will continue to be distributed through participating mobile or fixed broadband providers who are reimbursed by USAC for the costs of providing discounted monthly service to eligible low-income customers. Participating providers must establish they provide broadband services to participate in the ACP.

Nontraditional providers like wireless Internet service providers, electric cooperatives and municipal governments are permitted to participate.

The ACP benefit applies to all broadband services offered by participating providers. The program prohibits participating providers from using credit checks as a condition of receiving the benefit. Participating providers must notify existing customers and must publicly advertise the program in coordination with state agencies and non-profit groups. The program also establishes a dedicated complaint process for consumers and adopt rules that prevent "inappropriate" upselling or down selling, extension of contracts, or restrictions on switching service offerings.

The IIJA expands program eligibility to those with incomes that are within 200% of the poverty level (up from 135%) and to all Women Infants and Children (WIC) program participants. Applicants must provide documentation that they participate or are eligible for any one of the following programs:[47]

- The National School Lunch (Free and Reduced price) or breakfast program
- Federal Pell grant program
- Supplemental Nutrition Assistance Program (SNAP),
- Supplemental Security Income (SSI),
- Medicaid, Federal Public Housing Assistance administered by the US Department of Housing and Urban Development (HUD).
- Veterans Pension and Survivors Program administered by the Veterans Affairs Administration

The ACP, like the EBB program, also provides reimbursement to participating service providers to supply an eligible household with a connected device (laptop, desktop or tablet) of not more than $100. Participating service providers may not seek reimbursement for more than one connected device per household.

FCC's Emergency Connectivity Fund (ECF)

The ARPA authorized another new program within the FCC to provide over $7.17 billion to fund the costs of eligible equipment and services that can be provided to students, teachers, and library patrons who lack connected devices such as laptop or tablet computers and/or lack broadband access during the pandemic. Tribal libraries are eligible for support under the Library Services and Technology Act. Schools and libraries do not need to be current E-Rate participants. The following types of equipment purchased for off-campus use by students, school staff, and library patrons who lack sufficient connectivity to engage in remote learning are:

- Laptop and tablet computers
- Wi-Fi hotspots

[47] Affordable Connectivity Program | Federal Communications Commission (fcc.gov)

- Modems (including air cards)
- Routers
- Devices that combine a modem and router

Eligibility:

- Applicants can be reimbursed up to $400 for each laptop or tablet, and a maximum of $250 for Wi-Fi hotpots
- For other eligible equipment and services, the FCC and USAC will review costs to ensure they are reasonable
- Equipment and devices paid for under ARP are not reimbursable under ECF
- Connectivity funded under Emergency Broadband Benefit Program and a connected device through the Emergency Connectivity Fund Program are permissible **Key dates:**
- Eligible schools, libraries, and consortia of eligible schools and libraries can submit requests for funding to purchase eligible equipment and services between July 1, 2021, and June 30, 2022.
- Interested schools and libraries can find more information and apply at emergencyconnectivityfund.org

Rural Utilities Service (RUS)

Originally authorized in 2018 as a pilot program, the Rural Utilities Service (RUS) Loan and Grant program is the largest U.S. Department of Agriculture (USDA) funding source for broadband infrastructure in underserved rural and tribal areas lacking broadband service at a minimum speed of 100 Mbps download and 20 Mbps upload. The RUS has over $1.15 billion funding for broadband projects in FY 2022 under its third Funding Opportunity Announcement (FOA) which was published on October 25, 2021.

Applications under FOA 3 are due on February 22, 2022. Loan awards are made on a first come first serve basis. Grant and loan/grant awards will be issued starting in July/August 2022. The IIJA authorizes an additional $2 billion to the ReConnect program and will likely be made available under a fourth FOA which may not open until Q4, 2022 at the earliest.

ReConnect Eligibility

Eligible projects must be located in communities with a population of 20,000 or less. Eligible entities for ReConnect funds include cooperatives, for profit entities, state and local governments or tribal nations (as defined in section 4 of the Indian Self-Determination and Education Assistance Act (25 U.S.C. § 450b)).

Speed Tier Eligibility

- Projects must provide 100 Mbps symmetrical service to every premise in the proposed funded service area (PFSA).

- All premises in the PFSA must be able to receive this service at the same time at this speed.

Eligible service areas

- Rural areas where at least 90% of the households in the PFSA lack sufficient access to broadband of at least 100/20. Applicants must submit evidence of the lack of sufficient broadband access.
- Applicants must identify all existing providers in the PFSA and indicate what level of service is being provided. If these areas are found to have sufficient service, the application will be rejected.
- Areas served by existing RUS borrowers who are without sufficient access to broadband (100/20).
- Areas receiving or designated to receive RDOF that are without sufficient access to 100/20.
- Applicants receiving or pending to receive federal broadband grants or loans for the PFSA, must explain how ReConnect funds will complement and not duplicate other federal funding sources. **Key priorities for applicants**
- Assisting rural communities to recover economically from the impacts of the COVID-19 pandemic, particularly disadvantaged communities.
- Ensuring all rural residents have equitable access to RD programs and benefits.
- Reducing climate pollution and increasing resilience to the impacts of climate change through economic support to rural communities.

Key programmatic requirements

- Projects must be completely built out within 5 years from the date funds are first released.
- Projects must be technically feasible.
- All project costs can be fully funded or accounted for.

The following entities are eligible to apply

- Corporations, limited liability companies and limited liability partnerships
- Cooperative or mutual organizations
- States or local governments or political subdivision, or US territory
- Indian tribes
- Individuals and legal general partnerships formed with individuals are not eligible

- One entity must take the lead on submitting an application. Intercompany agreements can be used to account for revenues and expenses on the applicant's financial projections.

ReConnect fund eligibility in RDOF funded areas

- Service areas of existing RUS borrowers without sufficient access to broadband (100/20) are eligible. This includes areas receiving or under consideration for RDOF because RDOF funds both operational expenses and capital expenses, while ReConnect funds only capital expenses.
- Applicants seeking funds for RDOF funded areas must explain why RUS should provide additional funding and how the application may provide service to households faster, etc.
- ReConnect applicants who are under consideration for or who have received RDOF funding must submit a statement certifying that the ReConnect funds have not been and will not be reimbursed by RDOF. Funds can only be used for complementary purposes.
- If two applicants seeking ReConnect funds for the same area and score the same points, the applicant who is the RDOF awardee will receive preference over the non-RDOF applicant.

Award categories

- 100% Loan @ 2% interest rate with a 3-year payment deferral. Applications will be processed and awarded on a rolling basis. Maximum loan amount: $50,000,000
- **50% Loan/50% Grant Combination**: Loan rate is at the treasury rate of interest with a 3-year payment deferral. Applicants may offer cash for the loan component at the time of application; all funds must be deposited into the applicant's operating accounts at the closing of the award. Maximum loan/grant amounts are $25,000,000 for both. No match contribution is required.
- **100% Grant**: requires a 25% cash match contribution: Maximum award is $25,000,000.
- **100% Grant for Tribal Governments and Socially Vulnerable Communities**: Maximum grant amount is $25,000,00 with no matching requirement; could qualify for funding requests up to $35,000,000 if they can demonstrate that the PFSA(s) is comprised of 100% of locations within areas classified by the USDA Economic Research Service as FAR Level 4. A GIS layer of FAR Level 4 areas can be found at https://www.usda.gov/reconnect
- If at least 75% of the PFSA(s) consists of Socially Vulnerable Communities, no matching fund requirement and applicants may apply for grant funds to construct the broadband facilities.

Scoring Criteria

- Rurality of PFSA (25 Points)
    - Points will be awarded for serving the least dense rural areas as measured by the population of the PFSA per square mile or if the PFSA is located at least one hundred miles from a city or town that has a population of greater than 50,000 inhabitants.
    - If multiple service areas are proposed, the density calculation will be made on the combined areas as if they were a single area and not the average densities.
    - Population densities of 6 or less or if the PFSA is located 100 miles from a city or town of 50,000.
    - Applicants do not need to use FCC Form 477 data; they are permitted to use another data sets.
- Level of existing service (25 Points)
    - Projects that propose to build in areas that are not receiving service of at least 25/3 will receive 25 points, with points awarded based on the number of households lacking such service that the project will serve.
    - Applicants must provide supporting evidence that 25/3 service does not exist for those households.
    - To the extent possible, applicants must identify all existing providers in the PFSA and indicate what level of service is actually being provided.
    - Applicants are not required to treat the publicly available FCC current Form 477 data as dispositive of what speed service currently exists.
- Economic need of the community (20 Points)
    - Economic need is based on the county poverty percentage of the PFSA in the application. The percentages must be determined by utilizing the Census Small Area Income and Poverty Estimates (SAIPE) Program.
    - For applications where 75% of the PFSA(s) are proposing to serve communities with a SAIPE score of 20% or more, 20 points will be awarded.
    - PFSA's located in geographic areas for which no SAIPE data exist will be determined to have an economic need.
- Affordability (20 Points) - Applicants should demonstrate that they will:
    - Offer affordable rates in their target markets and provide information about the pricing and speed tiers they intend to offer

  - Offer at least one low -income tier for households with multiple users to simultaneously telework and engage in remote learning
  - Commit to applying for the Lifeline or EBB programs.
- Labor Standards (20 points)
  - Applicants should describe how the project will incorporate strong labor standards, including whether workers (including contractors and subcontractors) will be paid wages at or above the prevailing rate;
  - 20 points to applicants that commit to strong labor standards, consistent with Tribal Laws and follow Tribal Laws such as TERO in compliance with Davis-Bacon Act"
- Tribal government or tribal entity applicants (15 points)
  - If at a minimum, 50% of the geographic area of the PFSA(s) is on tribal lands based on the GIS layer in the RUS mapping tool.
- Non-tribal entities (10 points)
  - If at least 50% of the geographic area of the PFSA(s) is to provide service on tribal lands.
- Local governments, non-profits or cooperatives (15 points)
  - This includes projects involving public-private partnerships where the local government, non-profit, or cooperative is the applicant.
- Socially Vulnerable Communities (15 points)
  - At least 75% of the PFSA(s) encompass Socially Vulnerable Communities
- Net neutrality (10 points)
  - A board resolution or its equivalent must be submitted in the application committing that the applicant's networks shall not;
    - Block lawful content, applications, services, or non-harmful devices, subject to reasonable network management
    - Impair or degrade lawful Internet traffic based on content, application, or service, or use of a non-harmful device, subject to reasonable network management
- Wholesale broadband services (10 points)
  - Recipients that commit to offering wholesale broadband services at rates and terms that are reasonable and nondiscriminatory.

Steps to prepare for a ReConnect application

1. Review the RUS ReConnect Mapping tool and other data to determine:

a. Geographic area you wish to serve and whether 90% of it is not served with 100/20 service;

b. Whether the PFSA is funded by an existing RUS customer and/or an RDOF awardee or both.

2. If the PFSA is classified as socially vulnerable and has a score of at least 20% under the Census Small Area Income/ Poverty Estimates (SAIPE) Program
3. Download the FOA and bookmark the RUS ReConnect page to become familiar with all requirements

Community Connect Grant Program

The Community Connect Grant program is a smaller and simpler version of the ReConnect program. Community Connect provides up to $3 million in awards to eligible applicants to deploy either fixed or mobile broadband services throughout rural and underserved communities with a population size of 20,000 or less. Eligible entities include federally recognized tribes, state or local governments, non-profit cooperatives and for-profit entities. Applicants must provide a matching contribution of 15% of the total award amount. Matching funds must be made in cash, which will be used to fund the operations of the project.

Eligible applicants must have the legal capacity to own and operate a broadband network. Under the FY 2021 FOA, eligible areas must be unserved with broadband at a speed of 10 Mbps download and 1Mbps upload however we expect this will change under this year's program. Applicants are typically required to provide broadband service at speeds of at least 25 Mbps download and 3 Mbps upload that must also be made available to every residential and business customer in the proposed funded service area (PFSA) in the application. Funds can be used to support the construction, acquisition or leasing of facilities, spectrum, land or buildings used to deploy broadband services throughout the PFSA.

Awardees must provide free broadband service at the minimum broadband grant speed to all essential community facilities for two years. These facilities include public schools, fire stations, public libraries and other publicly held anchor institutions.

Distance Learning and Telemedicine (DLT) Grant program

The RUS Distance Learning Telemedicine (DLT) program provides 100% grant funding to rural communities and tribal areas with a population of 20,000 or less to provide distance learning and telehealth services. The maximum award is $1 million, and the minimum is $50,000. DLT only covers technology and equipment costs. It does not cover network deployment costs. Allowable costs for eligible capital assets under DLT include:

- Broadband facilities
- Audio, video and interactive video equipment

- Terminal and data terminal equipment
- Computer hardware, network components and software
- Inside wiring and similar infrastructure that further DLT services
- Acquisition of instructional programming that is a capital asset
- Acquisition of technical assistance and instruction for using eligible equipment

The application window for this program will likely open in Q2, 2022 for a sixty-day window. Awards will likely be announced in January 2023.

Community Facilities Loan and Grant program

This program is the most inclusive of all the USDA Rural Development funding sources and can support a wide variety of funding needs of a rural community including tribal nations located in rural areas with a population of 20,000 or less. The Community Facilities program (known as "CF") funds any essential community facility for the development of that community. Awardees are eligible for low interest loans, grants, or a combination of both depending on the project and funds available from the applicant. Funds are administered by the State RD office which receives an allocation for projects from the National Office in Washington, D.C.

Eligible entities include local, state or federally recognized tribal governments and funds can be used to purchase, construct and or improve any essential community facility including the purchase of equipment. Typical projects include the construction and inside wiring costs of a health clinic, school, community or childcare center. It may also be used to fund public safety services such as fire departments, police stations, prisons, fire trucks, police vehicles, radios, towers, and other devices, fire trucks and public works vehicles. The Community Facilities program is open year-round.

Public Works and Economic Adjustment Grant Program

U.S. Department of Commerce, Economic Development Administration (EDA) Public Works program helps economically distressed communities revitalize, expand, and upgrade their physical infrastructure. It also enables communities to attract new industry; encourage business expansion; diversify local economies; and generate or retain long-term, private-sector jobs and investment through the acquisition or development of land and infrastructure improvements needed to expand industrial or commercial enterprises.

EDA Public Works program investments also help facilitate the transition of communities from being economically distressed to becoming competitive by developing key public infrastructure, such as technology-based facilities that utilize distance learning networks, smart rooms, and smart buildings; multi-tenant manufacturing and other facilities; business and industrial parks with fiber-optic cable; and telecommunications and development facilities. In addition, EDA invests in traditional public works projects, including water and sewer systems improvements, industrial parks, business incubator

facilities, skills-training facilities, and broadband networks. There is no population density criteria for EDA funds.

Eligibility Criteria

- The project must align with at least one of EDA's current investment priorities listed on its website at www.eda.gov.
- The project must increase the capacity of the community or region to promote job creation and private investment in the regional economy. Job creation is a very high priority focus for EDA. Therefore, applicants must demonstrate how the project will create new or retain existing jobs.
- The likelihood that the project will achieve its projected outcomes.
- The ability of the applicant to successfully implement the project, including the applicant's financial and management capacity and its ability to secure the support of key public and private sector stakeholders.

Funding Availability

Projects are scored and awarded on a rolling basis throughout the year. Grant awards range from $100,000 to $4 million with matching requirements anywhere between 20% to 50% of the total project costs. Matching can either be made in cash or in kind depending on the project and financial status of the applicant. Applicants are encouraged to contact their regional EDA office first to discuss project scope and goals with EDA officials to determine feasibility. ARPA authorized an additional $3 billion in supplemental appropriation funds for economic development projects including middle mile broadband network projects.