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Magellan
ADVISORS

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Final

PIERCE COUNTY

BROADBAND CONNECTIVITY & ACCESS EVALUATION

Acknowledgements

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1. Executive Summary

1.1 The Digital Imperative

The future of regional success is one of resiliency, diversity, sustainability, and connectedness built on an infrastructure that anticipates the current and future needs of populations. In our increasingly digital age, local governments are recognizing the need to mitigate the risks posed by the "digital divide[1]" by taking the opportunity to plan for initiatives that aim to improve quality of life, expand economic development, and equip governments with improved technologies.

Pierce County is well-positioned to realize substantial economic gains from targeted investments in broadband infrastructure. By linking its cities, natural assets, and rural areas with broadband, the County can attract investment, create economic opportunities, and operate more efficiently and effectively. Broadband and other digital technology directly enable transformation in business, education, health, transportation and other areas that make for great places, happy people, and vital enterprises. County government can be a catalyst for such transformation by making targeted investments in public infrastructure to reduce internal costs and improve operations. Such investment must align with and promote private investment, too. The keys to success are clear vision, committed leadership, and a solid plan.

1.2 Background

Broadband is essential, much like education, electricity, and water or sewer. It has become a primary enabler of economic mobility and prosperity, a "fourth utility" that is relied on by residents, businesses, and governments alike. Early in the digital revolution of the 1990s, communities realized they could not depend solely on private enterprise for internet access and began thinking forward about how to expand access to this new utility. Local governments like Pierce County now consider broadband a critical enabler of success in communities, playing a role in such issues as:

- **Attracting and retaining highly skilled talent**, particularly those in well-paid industries who can live most anywhere, with great quality of life that includes connectivity
- **Automating local government operations**, sharing applications among municipalities to reduce costs and increase impact
- **Monitoring and managing natural resources** while sustainably utilizing them for agriculture, industry, recreation, and utilities
- **Expanding value creation among existing businesses and developing new private enterprises**, especially those that fit the distinct character and resource base of the area, and create high-paying jobs
- **Improving skill development and housing mobility** as well as economic opportunities for residents

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[1] "Digital Divide" refers to the gap between populations with access to internet and those whose occupational, educational, and social opportunities are negatively affected by lack of access to the internet. The term is often associated with rural or lower income communities.

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- **Managing County resources, including buildings, parks, and vehicles**, and continually improving services to citizens and visitors.

The greatest broadband benefits come from building local economies, not just by reducing costs but by moving from consumption to production, and ultimately to innovation-based markets. Broadband is essential for traditional industrial recruitment but enables so much more. Even with ubiquitous reliable broadband, areas without innovators and digital producers risk becoming "digital bedroom communities" where consumers spend their time and money online rather than in the actual community. Technology creates the most value when it enables the new and improves the old: automating basic business functions with technology, university-industry research collaborations that develop revolutionary new technologies, and startup companies disrupting markets are all examples. However, realizing the benefits of broadband, especially in areas such as Pierce County that are looking to build innovative economic development strategies, depends on committed, visionary leadership.

1.3 About This Plan

Figure 1.1. Broadband Connectivity & Access Evaluation Project Overview

Stakeholder Outreach	Current and Future Fiber Mapping	Vertical Pole and Dark Fiber Assets	Governance and Policy Development	Action Plan and Report Compilation
June 2018-Dec 2018	*June 2018-August 2018*	*July 2018 - Nov 2018*	*July 2018 - Dec 2018*	*Nov 2018 - Feb 2019*
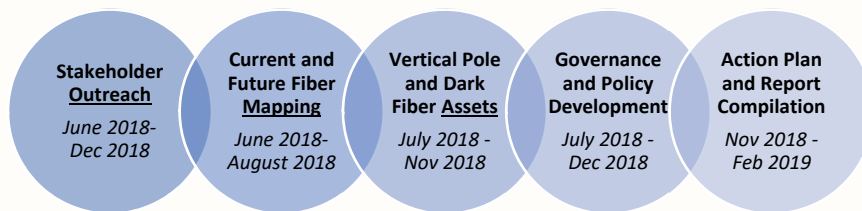
Methodology

To assess and evaluate broadband connectivity throughout Pierce County, Magellan Advisors worked with the County's team to gain an understanding of access to reliable, affordable service throughout the County's communities. Magellan's team used a process that has proven successful in communities around the country to engage with stakeholders including residents, businesses, service providers, utilities, and the County's internal team to assess broadband connectivity and access, measure gaps in service availability, and make recommendations about how to make high-speed internet more accessible for all.

This evaluation includes input from external and internal stakeholders—those who have an interest in broadband and/or the County. We assessed the availability, cost, and performance of broadband services and stakeholders' needs for bandwidth and connectivity in a series of conversations held throughout the County.

In addition to this outreach, Magellan Advisors surveyed households and organizations in a broad, county-wide survey. The Pierce County Broadband Survey of households and organizations had a total of 1,234 responses, 840 of which were complete. Most of these (820) were households. There was no sampling or selection process for respondents, so the results cannot confidently be said to represent the population. Instead, it provides an insight on the demand of and supply to key demographics.

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Respondents shared information about their internet needs and current service levels, business and household characteristics, and a variety of factors related to technology utilization. Most responses were from households, about two-thirds of which were complete[2]. Our team also conducted conversations among the County's internal team, regional partners, incumbent internet service providers (ISPs), and utilities in the County.

The conversations and survey responses were then weighed against Pierce County's current infrastructure and planned projects to assess how unmet needs might be addressed. Thus, the recommendations contained in this evaluation represent how community needs, the current market, future demand, and Pierce County's unique situation as a mixed urban-rural area converge to create opportunities for better broadband.

1.4 Findings and Conclusions

Magellan Advisors' research found that many communities within Pierce County—particularly areas outside its cities—do not have the broadband they need. Gaps exist due to non-aggregated markets, and existing internet service providers have not committed to addressing these gaps without significant incentives; basic economics keeps broadband out of many of the County's rural areas. This Broadband Connectivity and Access Evaluation identifies the role that the County government can play to ensure robust broadband is available and demand is fulfilled throughout the County, not just where it makes short-term profits for private telecommunications companies. The starting point is for Pierce County's leaders to decide that lack of broadband is more than a problem: it is a critical roadblock to solutions for numerous problems. The County should enable its communities to overcome this roadblock by playing a leadership role in not just increasing widespread availability, but in getting the greatest possible value from the technology.

An extensive consideration of opportunities for, issues with, and barriers to broadband development forms the core of this evaluation. It identifies various options and recommends tactics to increase broadband availability. A key decision for Pierce County leadership is role of the County in acting upon these tactics and recommendations for broadband development.

The evaluation found that generally, the urban and suburban centers of Pierce County seem to have satisfactory broadband. For instance, Comcast has indicated that wherever they have service, they can deliver 1Gbps broadband, depending on subscription level. Some of the smaller cities also have access to reasonable broadband within city limits from local providers. However, many community anchor institutions[3], businesses, and residents with broadband said they need more bandwidth and reliability, as well as lower costs.

The broadband gaps are largely between the urban cities and in more remote areas, but pockets within suburban areas also have reported issues. Like other rural areas throughout the United States, costs are too high, competition is too entrenched, or market demand is too low for providers serve rural areas without public support. Although Pierce County has numerous

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2 Surveys were categorized as "complete" if the respondent got all of the way through the survey and clicked "Submit."

3 For the purposes of this report, community anchor institutions include non-governmental organizations (NGOs) and non-profits, healthcare providers, educational institutions, libraries, and other key stakeholders who play a major role in the well-being of the County.

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providers, most locations have, at best, a choice between two (2) providers, a cable company or a telephone company.

Figure 1.2, below, displays a map of technologies reported by respondents to Magellan's Broadband Survey throughout the County. Magellan looked for state or federal supplied maps of services available for Pierce County, but much of the data was very old or unreliable, so it was not included here. In addition, we asked many of the providers to provide us with maps of their service areas along with options provided, but all declined siting competitive disadvantages to disclosing proprietary information.

As noted, the map below represents locations from the survey respondents and the technology they reported using. There are many areas that lack "robust" broadband within Pierce County. Through the survey we can conclude that the majority of broadband consumers are using low bandwidth DSL, cable and wireless services, indicated by yellow, green, or red dots, respectively. Fiber availability, represented by blue dots, is limited and there are a large number of residents without broadband connectivity. These results are indicative of non-investment by the existing service providers due to the lack of a competitive broadband environment.

Figure 1.2. Survey Respondents' Reported Technologies

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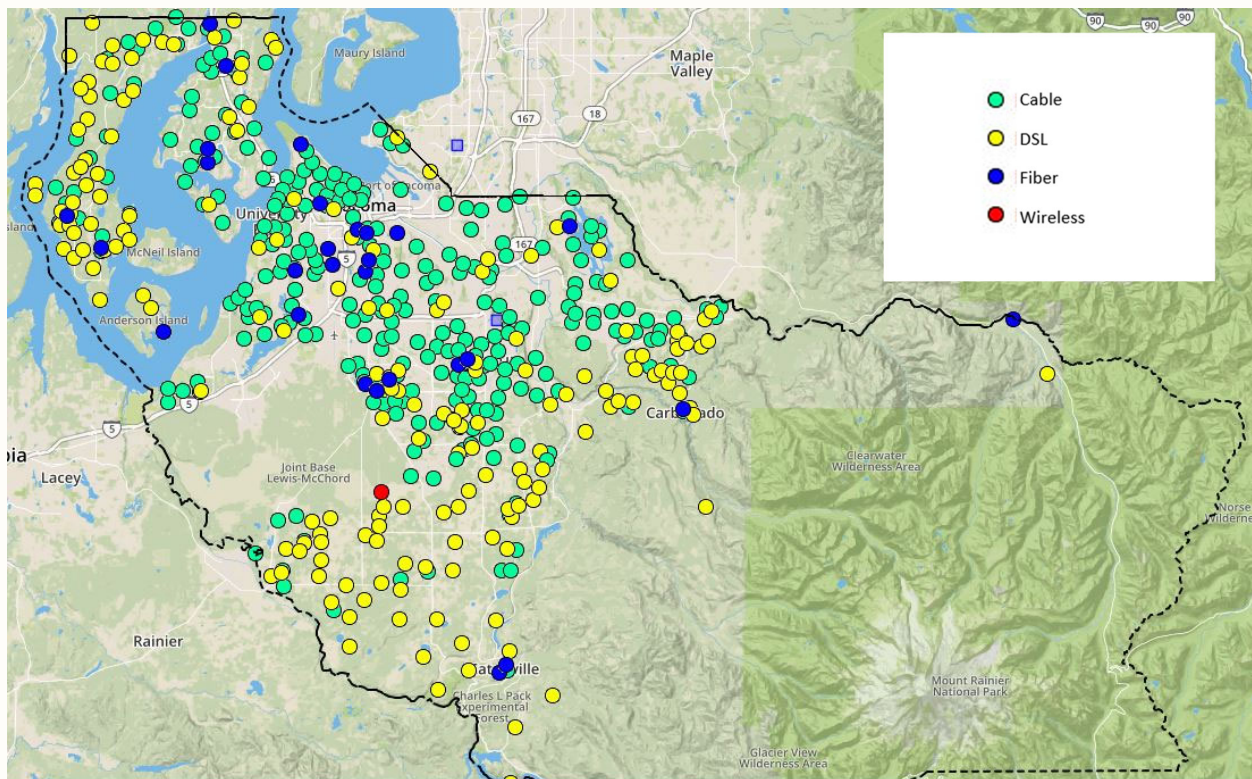
In addition to this information, Magellan's survey included a speed test[4] for respondents to gain an understanding of their internet service's performance. Our speed tests found:

- A large mix of Cable and DSL services, with some fiber[5]
- No service has upload speed over 100 Mbps

In general, our data shows bandwidth in the County to be between 1.5 Mbps to 25 Mbps (indicative of DSL service). Greater bandwidth at 25 Mbps to 50 Mbps (indicative of short haul DSL or cable service) is available in urban and suburban areas. Pockets of 50 Mbps to 100 Mbps and 100 Mbps to 1 Gbps (indicative of cable or fiber-based solutions) can be found in a few areas, typically around urban centers and suburban communities. Fiber is available from Rainier Connect and cable is available from Comcast, both offering 1Gbps service. Rainier Connect offers fiber in select "fiber-hoods" once enough homes pre-sign-up for service.

For many of the rural areas, including areas of Gig Harbor and the Key Peninsula and areas outside of the population centers, available speeds simply are not high enough to enable many functions needed for day-to-day household functions, much less for attracting key economic sectors. The County is in the unique position to address many of these issues by collaborating with stakeholders to figure out how to close the gaps. *Innovative approaches are required to get more, better broadband and maximize its benefits.* There are three key reasons for this.

First, new approaches make it more practical to deploy network infrastructure in both remote rural and dense urban core areas with various levels of public involvement. Smart policies supplemented by small, targeted public investments can speed network construction and greatly reduce deployment costs. New generations of existing broadband technologies and innovative use of under-utilized resources for broadband will profoundly impact availability and costs. Many communities across the world have found creative solutions to deploy next-generation networks.

Second, it is clear that *demand for connectivity will only increase due to new broadband applications and functions*. As sensors and the "Internet of Things" (IoT) are deployed in these areas, they will place new demands on infrastructure. Costs can easily soar out of control without capable technology leadership, both for local government and also for businesses and families. The very definition of governance is likely to change with broadband development, driven by cybersecurity, privacy, and social media concerns.

New applications and functions will enable Pierce County to be more flexible, lean, and responsive. At the same time, they fulfill an expectation of these attributes: People want local government to be online and digitally accessible because they've become accustomed to accessing such service easily, conveniently, and effectively through the internet. Pierce County's cities and anchor institutions are feeling the same pressures and are struggling to find and deploy effective systems without overwhelming their budgets. In much the same way as the County might facilitate broadband development, it can generate huge value by helping stakeholders evaluate, implement, and adopt strategies and policies that meet these needs and

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[4] Note: Results M-Labs speed test embedded within Magellan's Broadband Survey may be affected by respondents' use of wireless versus wired connections. Respondents were asked to use a wired connection for the most accurate results, but some may not have adhered to this request, causing results to show slower speeds.

[5] Details about broadband speeds and their capabilities can be found in Appendix C – Broadband Basics.

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work toward addressing larger community issues. The County should look to be more of a partner than a regulator when it comes to the deployment of future broadband.

Third, *innovation itself is a basic goal and core strategy in today's economy.* This third reason may be the most important, and must be addressed if broadband is to be truly beneficial. The challenge for Pierce County is to strengthen its traditional economic base— public services, precision manufacturing, port operations, recreation, etc.—with technology while helping residents upgrade their skills, digital and otherwise, to meet new demands. If local businesses and residents are not prepared, lack of adequate broadband may prove to be a huge vacuum sucking capital out of the local economy, or keeping potential businesses from locating to Pierce County.

Innovation creates wealth, and inclusive innovation creates broad-based wealth in a community. Connectivity is critical not just for today's innovators—most simply won't live where broadband is not available—but also for those who have the potential to *become* innovators solving pressing issues in existing and future industries. Thus, widespread, affordable broadband is essential to development. The diversity of Pierce County's economy and geography becomes valuable as local specialists or specialized assets are linked to each other to create synergy.

Broadband development makes the most sense when it is explicitly aligned with community, economic, and workforce development. Technology is not the one and only solution to social ills, but it is essential to solving modern economic and social problems. Access to broadband enables new, more effective, and cheaper solutions to these age-old problems. Specifically for Pierce County, broadband initiatives should be focused on addressing local issues, and meeting business, household, and internal needs. There are several growth areas, such as Fredrickson, that need to be targeted with broadband while building new infrastructure.

Pierce County can play a key role in the availability, impact, and use of broadband. The fundamental role of local government is to facilitate activities, development, and services, including generating public revenue and providing public services, to meet residents' needs. All aspects of this are likely to be profoundly impacted by technology. County governments have the opportunity to create additional value by working for, through, and with their municipalities and regional/state institutions; they are in the position to be connectors. Options for Pierce County in this context, summarized in Table 1.1, run from doing nothing to actively investing in broadband infrastructure or even becoming a broadband provider. *Magellan Advisors recommends a balanced approach in which the County acts as a catalyst for private infrastructure investment with smart policies and consistent, incremental, targeted public investment toward a broad, practical vision.*

Table 1.1. Range of County Roles for Broadband Development

		County Role		
	Traditional	User	Catalyst	Provider
Broadband Investment	None	Limited; inter-building	County-wide middle-mile backbone	County-wide carrier-class network
General Activity	Regulate development	Drive development (as a consumer)	Coordinate, facilitate, support development	Develop public broadband service
Goals	None; maintain status quo	Bandwidth and connectivity for internal purposes	Tech-enabled development and improvement	Universal broadband access
Key Documents	Broadband-friendly policies	County and departmental strategic plan	Network vision and stakeholder requirements	Broadband business plan
Key Stakeholders	Builders, providers, and utilities	Department leaders, internal users	Community anchors	Business and residential customers

There is no single right answer for Pierce County, and each target community might require a different approach depending on its unique needs and capabilities. Generally, ownership and control of the assets gives local governments tools to work on a variety issues, from economic development to environmental sustainability. This evaluation recommends Pierce County make incremental investments in public broadband assets and partner with telecommunications and utility companies to use those assets for deploying broadband.

1.5 Recommendations

Magellan Advisors recommends that the County help with funding, coordinate interested parties, and make County assets available for use in providing broadband services. There are three general areas and approaches we recommend for this. First, as new business corridors or districts get planned and created, the County has the opportunity to ensure that robust broadband solutions are made available through the inclusion of broadband policies. Second, the County should *partner with small cities, utilities, and internet service providers* to pursue opportunities for funding and take advantage of ongoing infrastructure projects that can be coupled with broadband expansion. Such partnerships are a key to success in finding innovative approaches to connect communities whose needs aren't currently being served. In the long-term, both of these strategies feed into a third approach, by which the County can play a *supporting role in development of a county-wide backbone network developed by in-kind contributions, Dig Once and Joint Trench policies.*

The County should focus on core community, economic, and workforce development objectives, particularly growing economic opportunities, promoting telecommuting and remote work, and supporting home-based and other small-scale businesses. Robust broadband is essential to

these goals; it makes these activities possible. The County could target the range of stakeholder groups to assess their requirements and aggregate demand, building on the survey results detailed in this report. Tactics include business incubation and other entrepreneur support, co-working, small business tech assistance, talent recruitment, and technology-focused activities, events, and sites. Programs that connect independent contractors and small businesses to major customers—including Pierce County—can be especially effective. All of this can be enabled, if not actually delivered, electronically via online meetings and social media.

The Pierce County Broadband Road Map

To move from the current situation of inconsistent and generally low-performing broadband services, Pierce County should invest incrementally in a methodical manner and in partnership with citizens, community anchors, and private providers. The general next steps are to get organized and build support among stakeholders. Getting organized means assigning responsibilities for broadband development activities to internal County personnel, and engaging external stakeholders on a Broadband Task Force. The Task Force will serve as the foundation for support-building activities.

Generally, the County should focus on higher-impact/lower-cost initiatives first, and use broadband policies such as dig once and joint trench to reduce buildout cost. Each initiative or project is likely to include network applications (automation, communications, monitoring, etc.), so stakeholders should be engaged as consumers/network users as well as collaborators. An overarching goal should be to aggregate demand to attract private investment. The County should organize to add conduit—and possibly fiber-optic cable and vertical assets such as poles—anywhere the right-of-way is disturbed along network routes or in targeted areas. This means establishing a system to track the ownership and utilization of these assets, as well as simply paying for them.

Regardless of whether a county-wide network ultimately results from this buildout, governance of the buildout activities is essential to keep such projects on track and aligned with County goals and priorities. This evaluation is a framework for broadband governance in the context of IT governance and eGovernance[6]. This evaluation also provides educational tools for Pierce County's stakeholders to learn and make sound decisions about broadband, telecommunications, and technology strategy.

1.6 Pierce County Broadband Action Plan

1. Develop internal capacity and engage external stakeholders
   - Prioritize broadband fiber deployment as a County strategy (potentially combine County needs into deployment plans)
   - Assign or acquire staff to facilitate broadband strategic plan for County across departments (governance structure)
   - Establish a Broadband Task Force comprised of internal and external stakeholder representatives as well as broadband and tech sector companies
   - Create long term potential buildout plan and budget cost estimates, timed to coincide with planned County and city investments in infrastructure

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[6] eGovernance refers to use of technology to open government to and increase involvement of citizens.

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- Identify public assets that can be used for broadband deployment
- Seek out funding and creative opportunities to get fiber in the ground (grants, CIPs, partnerships with state and federal governments)

2. Make County policy changes alongside providers that can be shared with cities
   - Extend offer to help localities use policy
   - Create and provide engineering standards for fiber-based infrastructure
   - Dig Once and Joint Trenching rules and guidelines to lower costs
   - Address rights-of-ways delay (Feedback received by Magellan indicates that the County is pretty easy to work with already)
   - All new developments require fiber broadband access and all processes and planning should incorporate broadband considerations

3. Seek private partners to co-invest
   - Add County-owned fiber and other assets to all projects, public and private

4. Two focus areas are ready for immediate attention
   - Address the lack of affordable and adequate broadband on the Key Peninsula. By enabling the strategies outlined in this Report, Pierce County can start to have an impact on the availability of broadband for the region.
   - Capitalize on infrastructure projects in Fredrickson. Pierce County has designated the Fredrickson area as a target for economic development. As new infrastructure is being established, the County has an opportunity to be influential in the broadband makeup of the area.

This study contains detailed information about each of these points, including how and why each of them should be addressed.

Why Now for Pierce County?

Pierce County should take action on this Plan now for several reasons:

- *The current status quo is not good enough*– technology is advancing rapidly and the County's residents and businesses need to keep up. The result of inaction is likely to be a continued impact of being left behind, already evident throughout the community. Not doing anything will yield the same issues the County is already grappling with today. Deployment of the new 5G infrastructure will require the County to be prepared and forward-looking with its policies and guidelines. While many of the population centers have access to broadband, many of the rural areas lack adequate service. The County can contribute assets and direction to help make a more reasonable business case for for-profit providers.
- *Political will is evident at all levels of government and there are multiple funding options.* Broadband initiatives are being undertaken across the country and within Washington itself, exemplifying that such endeavors are not only possible, but are sound investments for the futures of communities. The County should act upon the current environment of political will and funding opportunities now, while they are readily available.
- *Broadband development aligns with—indeed, is a critical enabler of—Pierce County's economic development goals and strategic plans.* Broadband can have a profound impact on out-commuting to Seattle and other parts of the region. Broadband makes telecommuting and remote work possible. Numerous web applications can be used to

encourage, grow, and support small-scale enterprises. Major employers require robust connectivity and a choice between multiple providers when selecting locations. And, of course, the internet is wide-open frontier for creative, tech-oriented entrepreneurs. Without fast, cheap, and pervasive broadband, the County is hamstrung when pursuing any of these goals. Pierce County is already seeking to build organizational capacity through collaboration between departments; adding a countywide broadband initiative to such processes as permitting will allow the County to further strengthen this collaboration. Business opportunities, natural resource innovation, and fostering a great place to live are other County goals that will be the beneficiaries of this Plan, which seeks to attract and enable economic development, eco-tourism, and new residents seeking excellent quality of life and quality of work.

- *Time-sensitive near-term opportunities are available to be capitalized upon now.* The capacity of incremental, opportunistic strategies such as this one are only as effective as the timeframe in which they are allowed to unfold. An earlier start means more opportunity, and new technologies such as 5G infrastructure expansion are current, readily available means to jumpstart this action plan. New economic development zones, such as Fredrickson, are also prime candidates for attention and will be discussed in more detail in the Report.

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2. Broadband Background

2.1 The Economy and Technology: Powerful Forces at the Global Cross-roads

One need only to glance around in any given place, at any given time to observe the intricate ways in which technology has become embedded into the global culture. From smartphones to social media, digital currency to smart infrastructure, our lives, on both an individual and a mass scale, have become inseparable from the devices and information that ensure a constant connection to those around us. Naturally, our economy has followed suit: virtualization has allowed for dynamic changes in the ways that we conduct business across every sector. With improved collaboration, open source information, expansive globalism, crowd sourcing, and a proliferation of start-up entrepreneurship, we find ourselves in a technology-based economy.

Inventory tracking for major retailers, digital platforms for major publications, and even livestock health monitoring for agriculture are just a few examples of the ways that this new economy is becoming digitized. Governments are no exception; in fact, with the coming of Fifth Generation ("5G")[7] technologies, municipalities large and small find themselves at the center of enabling changes in how people live, work, and play. As these changes play out, cities will be key players in ensuring the safety, efficacy, equality, and sustainability involved in these digital interactions. The actions, plans, and decisions made will have lasting effects on the economic, social, and ergonomic futures of regions around the globe.

> *"…It is the world's major cities that are the powerhouses of global growth. Teeming with industry and services, brimming with innovation, and home to a swelling and increasingly more skilled and diverse labour forces."8*

2.2 Digital Inclusion

Among the most important considerations in the digital, global economy is ensuring equal access to the opportunities brought about by these technologies. Because high-speed internet is necessary to employment opportunities, education, and identifying social resources, areas in which broadband is unaffordable or unreliable are at a distinct disadvantage. Many skilled jobs now require a level of digital literacy and availability, and increasingly, schools are incorporating online learning into their curriculums. Unserved or underserved populations are at risk of falling into a "digital divide," defined by a lack of equity in access to online information. Cities are increasingly taking note of these inequities and their economic and social consequences. To mitigate these pitfalls, many are commissioning plans such as this one, in which cities take action in ensuring the needs of all citizens are met through the use of policy, expansion of existing networks, and the creation of municipal infrastructure to fill those gaps.

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[7] See section 2.3 "Trends Affecting the Future of Fiber for more information on 5G.
[8] The Global 750: Forecasting the Urban World to 2030, Oxford Economics (http://www.oxfordeconomics.com/cities/report)

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2.3 The Demand for Bandwidth

As demand for larger amounts of data continues to grow, broadband technologies have evolved to meet the needs of users, enabling further advancements in online applications and a growth in the number of online devices. According to a report by Gartner,

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"As it becomes cheaper to fit sensors to consumer products, the number of smart devices in a typical home in developed countries could grow to over 500 by 2022, …. They expect that these smart devices, which make up the so-called Internet of Things (IoT), where wearables and sensors constantly exchange information, to be updated automatically with new features."[9]

These sensor-based products range from innovations in agriculture and health-tracking home applications to intelligent transportation and automated water metering. These technologies, further explored in this report's Smart City section, are already being deployed around the world, affecting demand for high speed bandwidth in unprecedented ways. As lifestyles, economies, and municipal operations become increasingly connected, predictions show that the demand for bandwidth will continue to rise.

Figure 2.1: IDC Predicts Huge Growth in the Number of Global Connections

Bandwidth is required for each of these new applications to function as intended. Trends over the last several years show that as the number of devices grows, significantly more bandwidth is needed to enable the plethora of applications performed. Figure 2.2 illustrates the bandwidth requirements of some common applications and how running multiple applications simultaneously affects bandwidth requirements.

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[9] http://www.techgoondu.com/2014/09/13/gartner-over-500-smart-devices-per-home-by-2022/

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Figure 2.2: Broadband Application Speed Requirements
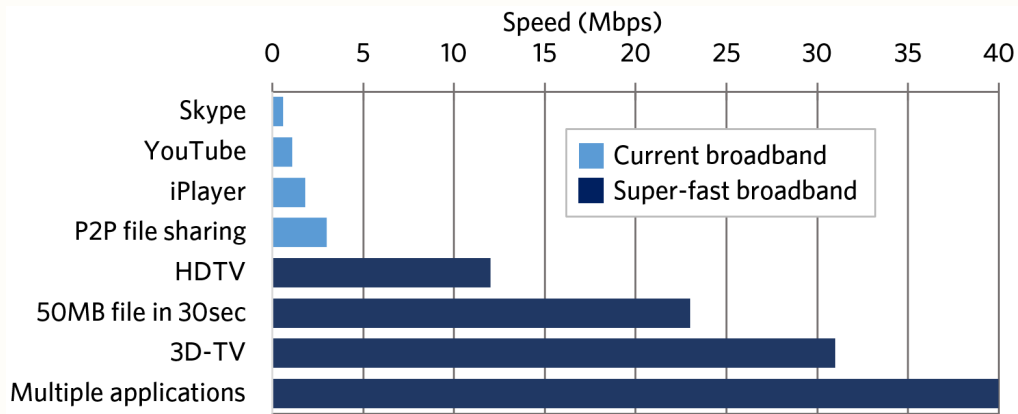
As the number of internet-enabled devices and applications continues to increase, demand for bandwidth will also continue to escalate. Figure 2.3 illustrates this trend as the usage of internet browsing, web hosting, e-commerce, virtual private network connectivity, and voice services becomes more frequent and widespread. Subscribers are also consuming more real-time video and streaming applications across all devices, requiring significant speeds, reliability, and performance.

Figure 2.3: Growth in Application Bandwidth Demand
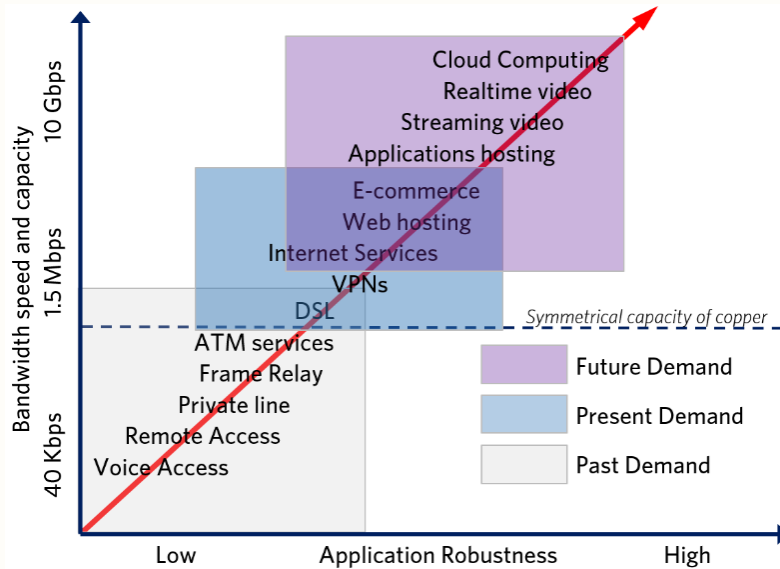
Although we are still early in the evolution of internet video applications, needs are expected to grow significantly over the next ten years as more users opt for video-based information over traditional text-based content. Cloud computing has also driven the need for more symmetrical[10] broadband as real time and cloud applications require additional bandwidth, both in download

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10 Symmetrical broadband connections provide equal download and upload speeds, such as 10 Mbps down, 10 Mbps up, instead of traditional asymmetrical broadband services that provide unequal speeds, such as 10 Mbps down and 2 Mbps up.

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speed and upload speed. As these applications continue to proliferate, reliable high-speed internet connections will become an even bigger necessity in daily life.

A 2012 study[11] demonstrated the amount of time the average user spends on each of their devices and how these users interact with multiple devices simultaneously. This study was designed to understand consumer media behavior over a 24-hour period, but an important implied finding revealed that users are spending significant amounts of time with broadband-enabled devices. More recently, a 2017 study revealed that individuals are spending an average of five hours a day across all devices for personal use, a 20% increase from fourth quarter 2015.[12]

Outside of personal use, many more devices are now connected to the internet to automate a variety of daily functions. Multimedia entertainment systems, thermostats, irrigation systems, food storage and preparation areas, and home security and monitoring systems are just some of the "smart home" innovations that have entered the scene. Each of these requires high speed connectivity to function, further increasing demand for broadband inside the home.

Figure 2.4: The Proliferation of Broadband-Connected Devices
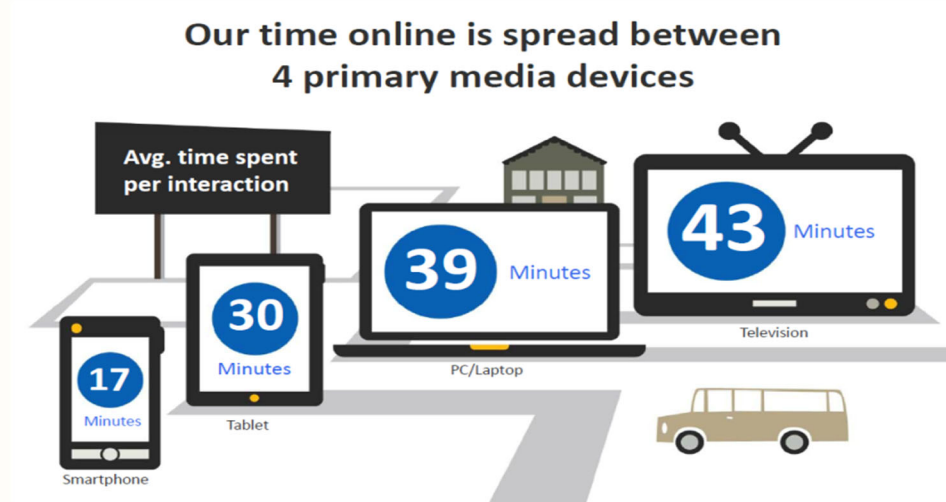
2.4 Overview of Broadband Technologies

The term "broadband" refers to high-speed internet services that provide users access to online content including websites, television shows, videoconferencing, cloud services, or voice conversations. These applications can be accessed and shared through a variety of technologies including personal computers, smartphones, tablets, and other connected devices. Although demands for this high-speed data are rapidly increasing, the Federal Communications Commission (FCC) defines broadband speeds as at least 25 Mbps downstream and 3 Mbps

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[11] The New Multi-Screen World. Understanding Cross-Platform Consumer Behavior" Google 2012. think.withgoogle.com/databoard/media/pdfs/the-new-multi-screen-world-study_research-studies.pdf
[12] Khalaf, S. (2017) U.S. Consumers Time-Spent on Mobile Crosses 5 Hours a Day. Flurry Analytics. http://flurrymobile.tumblr.com/post/157921590345/us-consumers-time-spent-on-mobile-crosses-5

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upstream. Cable, DSL, fiber, and wireless are the prime broadband delivery systems used to meet these demands by connecting users to the internet.

Fiber-optic cables (or just "fiber") are strands of glass the diameter of a human hair that carry waves of light. Unlike other connections that carry electrons across copper wire, fiber supports fast, reliable connections by using photons across glass, giving it the capacity to carry nearly unlimited amounts of data across long distances at spectacularly fast speeds. Because of this speed and reliability, fiber is considered the gold standard for supporting broadband across the full spectrum of devices and applications. Its usability and resiliency has brought fiber to the forefront of broadband, making it a highly desired asset for all entities, public and private, that own or control it. The availability of a reliable, cost-effective fiber connection creates opportunities for the communities it serves.

Generally, broadband is one of many services offered by telecommunications companies on multiple tiers of performance and cost. These services are divided into business and consumer users and are then offered at a subscription fee. The variety of services and technologies are increasing—exemplified by the explosion in smartphone apps —but the networks themselves are converging, so that any device operated by any user can potentially connect with vast amounts of information either inside or outside of the same network.

Broadband is deployed throughout communities as wired cables or wireless technologies that carry digital signals to and from users. The content comes into the local community from around the world via global, national and regional networks. The local infrastructure is built, connected and operated by internet and telecommunications companies that own the physical wires to each household. This started with telephone companies, which deployed twisted-pair copper telephone lines. The second wire came from television companies in the form of coaxial cable. Later satellite and wireless phone companies provided video and voice, with more flexibility to mobile and remote devices using radio waves. Beginning in the mid-1990s these companies repurposed their infrastructures to connect to the internet and carry digital content.

Figure 2.5. How Broadband Connects Us

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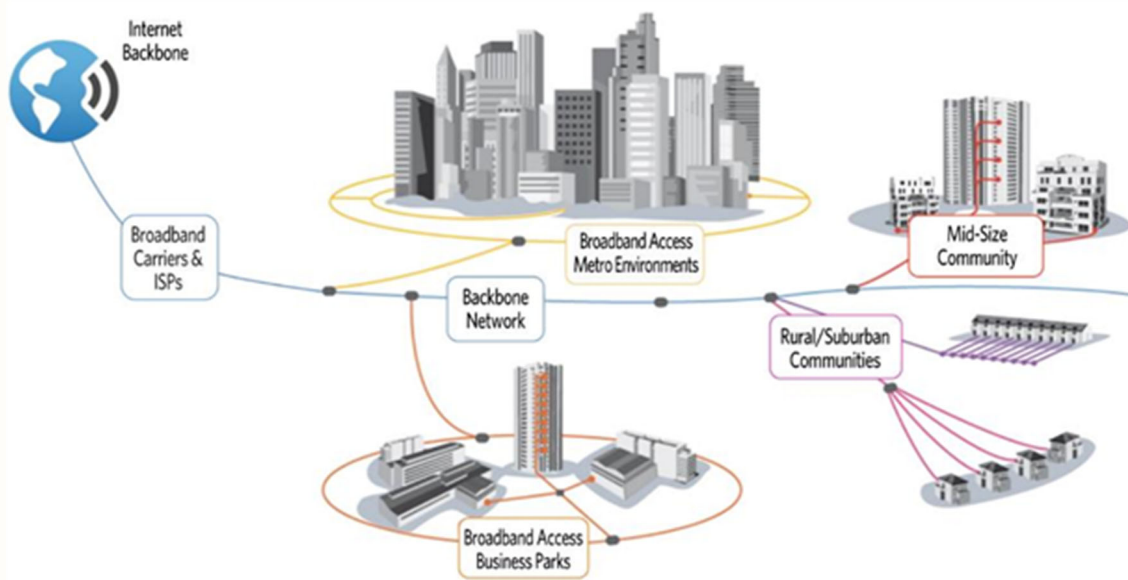
Infrastructure built on the older technologies described above is aging and results in slower, less reliable access to content. Capacity limits of this infrastructure of the infrastructure limit service providers' ability to reliably provide high speeds, and in turn, the amount of data consumers can use is also limited. Fiber provides the robust infrastructure that connect telephone, cable and internet infrastructure between communities and around the world. It was originally used by telecommunications for their core infrastructure, to connect their major switching centers, and was only available to their biggest corporate and institutional customers.

Today, fiber-optic networks serve homes and businesses throughout the world providing telephone and television as well as internet access services. The next section describes internet access technologies in more detail.

Dial-Up Access

Though not defined as a broadband technology due to speed and bandwidth limitations, dial-up access still exists. Dial-up internet access uses the public switched telephone network (PSTN) to establish an analog connection from a computer to an internet service provider (ISP). The computer connects via a modem by dialing a telephone number on a conventional telephone line and translating digital data into an analog signal.

Digital Subscriber Line (DSL)

DSL is a wireline technology uses high frequencies, which are not used by analog voice calls, to transmit digital data over traditional copper telephone lines faster than modems. DSL-based broadband provides transmission speeds ranging from several thousand bits per second (Kbps) to millions of bits per second (Mbps), generally ranging from 1.5 Kbps to 10 Mbps. DSL operates over the phone line—in parallel with voice traffic so calls are not affected—which plugs directly into a computer or router at the customer's site. The other end of the phone line connects to a DSL line card in the telephone company's central office or remote cabinet. Each user's data is multiplexed with their neighbors' over high-capacity fiber, transported to internet interconnection points, then routed over internet backbones to their online destinations.

There are different types of DSL:

> **Asymmetrical Digital Subscriber Line** (ADSL/ADSL2/ADSL2+) provides faster speed in the downstream direction than the upstream direction. This is fine for most customers who receive a lot of data but do not send much.

> **Symmetrical Digital Subscriber Line** (SDSL) – SDSL has the same speeds as ADSL and is used typically by businesses that generate online content or for services such as video conferencing, which need significant bandwidth both to and from the internet.

> **Very-high-bit-rate Digital Subscriber Line** (VDSL) – is a new generation of technology that provides up to 52/16 Mbps. It is more sensitive to line quality and requires a more expensive line card.

The availability and speed of DSL service depends on the distance from the customer to the closest telephone facility known as a central office. Telephone lines were optimized for voice communications and conditioned to eliminate high frequency noise. Consequently, some telephone lines cannot handle DSL, and others must be modified to support the service. Multiple DSL lines can be bonded to provide higher speeds, but the cost multiplies, too.

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Digital Carrier Systems

Most commonly known as T-1s, this is the digital telephone standard in the US and has been the mainstay of corporate telecom for years. This service uses a four-wire interface to deliver 1.5 Mbps, which can be subdivided into 24 channels when bonded together. While not falling within today's federal definition of broadband, this is the way many companies get internet access and connect their various facilities. T-1s are almost universally available from local service providers, although they may charge for mileage and other things that make the service rather expensive. The digital services hierarchy extends to multi-megabit services and fits with the even higher bandwidth optical carrier services.

Cable Modem

Cable operators provide broadband to subscribers using the same coaxial cable that has historically delivered content to televisions through a cable modem across the same "tree and branch" network used to distribute channelized broadcast television. Technically termed DOCSIS (Data Over Cable Service Interface Specification), cable broadband literally allocates channels for carrying data to and from customers instead of television. Most cable modems are external devices that have two connections: one to the cable wall outlet via coaxial cable that goes out to the internet, the other to a computer or router via Ethernet cable.

On the cable network, where the coaxial physically ends, a DOCSIS interface strips out the data and routes them all to their destinations via fiber optic cable. DOCSIS uses a "multiple access" approach to network in which every user's data is intermingled with others on the wire from the house to the router. Transmission speeds vary depending on the type of cable modem, cable network, and traffic load. Transmission speeds also vary among DOCSIS versions for example, with DOCSIS 3.1 Full Duplex supporting symmetrical speeds of 10 Gbps while DOCSIS 3.0 supports maximum download speeds of 1.2 Gbps and 200 Mbps upload speeds.

Copper Infrastructure

In response to growing consumer demand for bandwidth, DSL and cable network operators upgrade outdated or underperforming equipment following their revenue models and capital budget limitations to attempt to make the infrastructure faster and more reliable. However, several fundamental issues exist that pose long-term challenges to meeting the growing bandwidth demand through copper infrastructure:

- Broadband signals degrade significantly over copper as distances increase.
- Broadband signals over copper are susceptible to electrical interference and signal degradation, particularly as they age.
- The amount of bandwidth available on portions of broadband networks is often shared among multiple users, which can result in an uneven distribution of speed to users, and slower speeds to all as facilities become congested.

Fiber-Optics

As previously stated, fiber-optic network technology converts electrical signals carrying data into light and sends the light through transparent glass fibers about the diameter of a human hair. Fiber transmits data at speeds far exceeding copper, typically by hundreds of megabits per second. With fiber-optic broadband networks, speeds in the billions of bits per second range are

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possible. The fiber-optic network today operates at nearly 300 Terabits per second, which is so fast that a single fiber could carry all the traffic on the internet.

More commonly, fiber-optic networks provide between 100 Mbps and 10 Gbps to users. Fiber-optic networks can be designed to be highly reliable as well as fast. Fiber-optics are used extensively by major corporations and institutions and are beginning to be at the core of every telecom company's network. There are numerous standards for fiber optic networks. The two most common for broadband applications are Active Ethernet (AE) and Gigabit Passive Optical Network (GPON).

The actual speeds the customer experiences will vary depending on a variety of factors, such as how the network is structured, the hardware attached to the fiber-optics, and how the service provider configures the service. The same fiber that provides broadband internet can also simultaneously deliver voice (VoIP) and video services, including video on demand. Fiber operates synchronously, meaning the service is just as fast to download as to upload, which is increasingly important for households and businesses.

Dark fiber is a fiber-optic strand with no hardware attached to generate laser light signals across the fibers. From the business perspective, dark fibers are facilities—real estate—that are leased to customers. As with any real estate, the value of dark fiber depends on location, location, location: its end points and route. Dark fiber customers are large enterprises, including ISPs, that need to interconnect local area networks or "last mile" access network infrastructure.

The fiber must be "lit" to carry data between network nodes and provide network services. That equipment must be powered and connected to other network infrastructure, and must be housed in a building or cabinet. And, of course, all this infrastructure must be secured and maintained. Dark fiber lessors and lessees need to be thorough, clear, and in agreement about who is responsible for each portion of the infrastructure.

- **Fiber to the Node (FTTN)** brings high-capacity fiber-optic cables to communities and then connects to existing DSL and coaxial equipment. This is not an "all fiber" approach. Rather than bringing fiber-optic cables to every home or business, the fiber is connected to the existing copper network to increase its capacity. The copper-based "last mile" network that connects homes and businesses to the local nodes is still a bottleneck and results in subscribers not accessing the true speeds of fiber-optic connections.
- **Fiber to the Premise (FTTP)** provides internet access by running fiber-optic cable directly from an ISP to a customer's home or business. This approach is "all fiber" all the way to the customer. Fiber facilitates much faster speeds than copper wire, generally needs to

be serviced less, and is "future proof" because technology can increase the bandwidth of fiber-optic cables. AE and GPON are both FTTP technologies.

Figure 2.6 illustrates the relative difference between common internet connection methods, comparing access technologies from basic dial-up service through DSL, cable, and fiber. Whereas traditional broadband technologies have an upper limit of 300 Mbps, next-generation broadband that utilizes fiber-optic connections surpasses these limitations and can provide data throughputs of 1 Gbps and greater.

Figure 2.6. Physical Bandwidth Capacity Comparisons

Dial-Up – 56Kbps
- *Legacy Technology*
- *Shared Technology*

ADSL – 10Mbps
- *First Generation of DSL*
- *Shared Technology*

ADSL2 – 24Mbps
- *Second Generation DSL*
- *Shared Technology*

Cable – 150Mbps
- *Data Over Cable (DOCSIS 3.0)*
- *Shared Technology*

Next Generation Fiber – 1Gbps
- *Passive Optical, Active Ethernet*
- *Shared and Dedicated Technology*
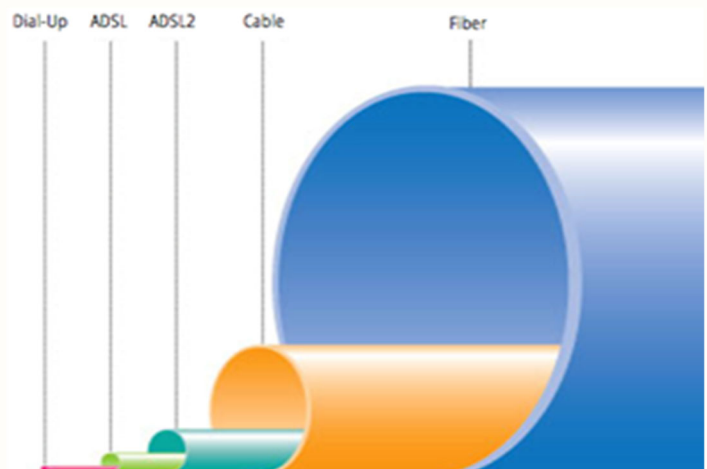
Wireless

Wireless broadband can operate as mobile, hotspot, or fixed. Wireless can also be used as "backhaul" to connect remote locations or sparsely populated areas, where DSL or cable service would not be economically feasible, via long-range directional antenna. Fixed wireless services allow consumers to access the internet from a fixed point while stationary, and often require an external antenna with direct line-of-sight between the wireless transmitter and receiver. Speeds are generally comparable to DSL and cable modem. These services have been offered using both licensed spectrum and unlicensed devices.

Hotspot wireless uses the Wi-Fi standard to provide connectivity for digital devices in an area via physical access points and a router, which interconnects wireless devices to the internet. Hotspots typically operate at 54 Mbps, but the actual bandwidth depends on the quality of the wireless signal and speed of backhaul to the internet. Wi-Fi is a multiple access technology, so bandwidth is shared with other users. While users can move around in the hotspot, they can't drive away: Wi-Fi does not provide a mobile connection. Wi-Fi is fast and robust, if limited in distance and susceptible to interference because it operates in open, unlicensed spectrum. Wi-Fi hotspots are common at hotels, restaurants, and public buildings for public access. It is used in many homes and businesses for private access. Many WISPs use Wi-Fi, and it is increasingly available from traditional telecoms (AT&T and Comcast have many branded hotspots). Wi-Fi complements cellular data via mobile wireless (users often use it to avoid cellular data caps and slow speeds), and is used in conjunction with wired broadband services—most hotspots connect to the internet via broadband.

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Wireless cellular data services, which borders on broadband speeds, are widely available from mobile phone companies. Typically referred to as either 3G or 4G (G for "generation"), mobile connections operate within cells that hand off signals from antenna to antenna as the device moves. 4G can move data at 12/5 Mbps, but speeds in the Kbps range are more common. Cellular data connections are most commonly used with smartphones, or with computers via cellular network interface card. Many smartphones can act as Wi-Fi hotspots or tether to computers via Bluetooth.

The next generation of wireless networks, 5G, are being designed and developed, with forecasted commercial availability in 2020 and an increased maturity of the network in approximately 2035. 5G networks operate multiple frequencies (i.e., 5-GHz, 60-GHz, 0.47-0.71 GHz) and will utilize millimeter wavelengths. 5G networks will operate on the IEEE 802.11ac, 802.11ad, and 802.11af standards, also known as Gigabit Wi-Fi and are expected to provide download/upload speeds up to 1 Gbps, which depends on the number of connections. The networks are designed to provide increased efficiencies while decreasing latency, and are designed for improving the performance of connected devices that define the IoT. In particular, network architectures with an emphasis on massive multiple input multiple output technologies (MIMO) and device-to-device (D2D) communications. For example, autonomous vehicles, healthcare technologies (such as blood glucose monitoring), ultra-high-definition video, virtual reality with many more network designs architectures and other applications. With 5G networks being heterogeneous, it must include macrocells, microcells, small cells and relays.

Satellite
Satellite internet uses licensed radio spectrum to send data from and to anywhere on Earth. The signals go on a 46,000-mile roundtrip from earth-bound devices through the atmosphere via the satellite and back to earth to another computing device. These radio signals have limited capacity and thus the connections tend to be slow. Because of the distance the signal must travel, satellite transmissions are susceptible to weather. Satellite should be considered a last resort for all but the most rural and remote areas. Areas with a high adoption of satellite generally indicates a need for better service. Today, the federal government finds that no satellite broadband service meets the 25/3 Mbps threshold of broadband.

Modern 21st Century Networks
Modern 21st century networks are comprised of a combination of technologies, not just one. Fiber is used in nearly all modern networks as it carries the most "data" and bandwidth when compared to other access technologies. Fiber is used not only for last mile access, but also as a middle-mile technology that carries data from cell towers, Wi-Fi hotspots, and other networks. Fiber is the backbone of the internet.

Wireless also plays a role in a modern network. Wireless access takes many forms including cellular, fixed wireless, Wi-Fi, Bluetooth, Zigbee, ZWave, and many others. Wireless offers a mobile or untethered experience that fiber cannot. However, the trade-off is less bandwidth when compared to fiber, but still may be appropriate for the desired mobile applications.

Wireless networks will nearly always need fiber for backhaul. So, having a robust fiber network is the anchor to any modern broadband network design. The combination of these network access technologies is what provides the foundation for the Internet-of-Things (IoT) that is discussed over, especially in respect to Smart City applications and technology.

2.4.1 Trends Affecting the Future of Fiber

Cloud Computing – An increasing demand for digital information has created a growing trend towards cloud computing, in which data is centralized and accessible to a number of users. Cloud computing allows pertinent files to be stored or backed up "in the cloud," rather than on traditional hardware, to enable verified users to access their information across a range of devices, anytime, anywhere. Businesses can share files, individuals can store digital photos, and media can be saved in online spaces rather than on physical CDs, DVDs, or thumb drives. The implication is more portable, less singular sources of information, media, and entertainment.

Data Transfer and Storage -- With a globalized economy, organizations are becoming larger and more widespread. Increasingly, data transfer is required over safe, secure networks for individuals to conduct daily business and maximize communication. This variety of data management allows for greater levels of collaboration within professional organizations, improved storage functionality without the need for new hardware, and a method of "backup" that ensures the longevity and infallibility of information.

IoT – Internet of Things -- The concept of the Internet of Things (IoT) refers to the networking of physical objects using embedded sensors and other wirelessly connected devices that collect and transmit information about a given object or subject. This includes public-sector innovations such as sensors for the optimization of traffic flow, commercial devices like radio-frequency identification tags for inventory tracking and fleet monitoring, as well as consumer products like smart appliances. Automation of this nature is becoming ubiquitous across all sectors.

Wireless & 5G Technologies – Fourth Generation or "4G" technology has been widely available for a number of years. Now, the next generation, "5G", is emerging, with forecasted commercial availability in 2020 and an increased maturity of the network in 2035[13]. These new networks are designed to provide increased efficiencies while decreasing latency, and are anticipated to improve the performance of connected devices, including the IoT. In particular, network architectures with an emphasis on massive multiple input multiple output technologies (MIMO) and device-to-device (D2D) communications. For example, autonomous vehicles, healthcare technologies (such as blood glucose monitoring), ultra-high-definition video, virtual reality with many more network designs architectures and other applications. 5G networks are distinguished from the present 4G technology by use of low power transmitters with coverage radius of approximately 400 feet; 5G thus requires the use of wireless technology for maximum usability, meaning close spacing and increased numbers of antennas.

SCADA – Supervisory Control and Data Acquisition (SCADA) is the latest in remote access technology. A type of industrial control system (ICS), SCADA is emerging across a variety of fields to allow for greater monitoring and control over industrial processes. Fourth generation IoT enabled SCADA systems rely on high-speed connections and wireless technologies to monitor and react to real-world data in the realms of utilities, energy consumption, manufacturing, HVAC controls, and a growing number of other industries.

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[13] Kinney, Sean. *Qualcomm SVP: New spectrum 'crucial' to 5G success*, RCR Wireless News, July 24, 2017. https://www.rcrwireless.com/20170724/5g/qualcomm-new-spectrum-5g-success-tag17, accessed December 5, 2017.

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3. Governance and Policy

Among the most important steps that a community can take to enable broader access to affordable, reliable broadband is ensuring that broadband-friendly governance and policies are in place to allow for the expansion of infrastructure while protecting the interests of the County. As a part of this evaluation, Magellan Advisors has examined Pierce County's relevant policies and guidelines to make recommendations based on known practices in similar regions as well as federal and state legislation.

3.1 Pierce County Telecommunications Franchises

Franchises are agreements between a city or county and a public or private utility provider which sets the terms for the utility's use of the public rights-of-way administered and managed by the city or county government. The franchise agreement covers a wide range of topics under which the utility is granted the right to use public rights-of-way for utility facilities needed to serve the public. For a telecommunications provider these facilities include poles, copper cable, fiber optic cable, coaxial cable, conduit, handholes and other means of access for underground facilities, wireless antennas, and equipment cabinets. These facilities are installed, maintained and repaired under the terms of a franchise agreement. The franchise agreement among other things recognizes the need for telecommunications infrastructure to be installed and maintained in the public rights-of-way without interfering with the public uses of streets and sidewalks for public travel.

Federal law and regulations impact what a city or county can accomplish in franchise agreements, particularly cable TV franchises, due to provisions of federal Cable Acts which are identified in the Pierce County Code at Chapter 12.34.020.B.

3.1.1 Pierce County Code Provisions

Under Chapter 36.55 RCW, the County Council may grant utility franchises for use of the public rights-of-way along county roads and bridges for construction and maintenance of utility facilities including telephone and cable TV. There are basic limitations on the grant of franchises including that they may not be exclusive, and requirements regarding restoration of roads and removal or relocation of facilities. Chapter 12.34 of the Pierce County Code addresses Right-of-Way Franchises specifically for "telecommunications users". The Chapter has multiple purposes:

A. Establish a local policy concerning telecommunications providers and services;
B. Establish clear and nondiscriminatory local guidelines, standards, and time frames for the exercise of local authority with respect to the regulation of the use of public rights-of way and/or public property by telecommunications providers;
C. Minimize unnecessary local regulation of telecommunications providers and services;
D. Encourage the provision of advanced and competitive telecommunications services on the widest possible basis to the businesses, institutions, and residents of the County;
E. Permit and manage reasonable access to the public rights-of-way of the County for telecommunications purposes on a competitively neutral basis;
F. Conserve the limited physical capacity of the public rights-of-way held in public trust by the County;

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G. Assure that the County's current and ongoing costs of granting and regulating private access to and use of the public rights-of-way are fully paid by the persons seeking such access and causing such costs;

H. Secure fair and reasonable compensation to the County and the residents of the County, consistent with 47 U.S.C. sec. 253, in a non-discriminatory manner, for permitting private use of the public rights-of-way and/or public property;

I. Assure that all telecommunications carriers placing facilities within the County rights of way comply with the ordinances, rules, and regulations of the County;

J. Assure that the County can continue to fairly and responsibly protect the public health, safety, and welfare; and

K. Enable the County to discharge its public trust consistent with rapidly evolving federal and state regulatory policies, industry competition, and technological development.

Specific definitions include defining what is a "telecommunications service". The Chapter was originally adopted in 1997 and is intended to have no effect on franchises in effect prior to that time until the expiration of that agreement or amendment of the agreement if one party does not agree to defer full compliance to a later date.

All franchises granted are to contain "substantially similar terms and conditions" for "similarly situated franchisees".[14] The franchisee must still secure "further easements, leases, permits or other approvals as may be required to lawfully occupy" the public rights of way.[15] Unless otherwise specified the franchise term may not exceed five years.[16]

The Code contains an "obligation to cure as a condition of renewal" regarding "any ongoing violations or defaults" which must be cured "or a plan detailing the corrective action to be taken by the franchisee has been approved by the County."[17] The Code contains various other conditions and provisions in Chapter 12.34.600 regarding:

- Damage to property;
- Repair and emergency work;
- Relocation of facilities;
- Restoration of public rights-of-way and restoration bonds;
- Insurance surety, and indemnification provisions;
- Assignment or transfer of franchises, and transactions affecting control; and,
- Notice and duty to cure, and revocation.

The Code contains various provisions regarding telecommunications facilities in the Public Rights-of-way in Chapter 12.34.600:

- Facilities may not unreasonably interfere with the use of the rights-of-way, and shall be moved temporarily or permanently as determined by the County;
- Facilities shall be maintained in a good and safe condition;
- Facilities shall be removed or relocated when determined by the County Engineer to be reasonably necessary;

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[14] Pierce County Code, Chapter 12.34.415
[15] Pierce County Code, Chapter 12.34.425
[16] Pierce County Code, Chapter 12.34.430
[17] Pierce County Code, Chapter 12.34.470

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- Unauthorized facilities shall be removed within 30 days of notice from the County Engineer. Facilities become unauthorized and subject to removal:
  - Upon expiration or termination of a franchise,
  - Upon abandonment of the facility,
  - If the facility was constructed without prior grant of franchise or permit, or at a location not permitted by the County Engineer,
  - And any other reasonable circumstance deemed necessary.

The Code specifies[18] certain duties to provide information such as providing accurate as-built maps, demonstration that the County's "Manual on Accommodating Utilities in Pierce County Rights-of-Way"[19] has been complied with, all fees due have been properly collected and paid, and that all books, records, maps and other documents are available for inspection at reasonable times and intervals. The Code requires all franchise grantees to cooperate with the County and with each other in accordance with the coordination provisions of the Manual.

The Code specifies requirements regarding construction in Chapter 12.34.700, including:

- Necessary utility right-of-way permits and applications, including detailed drawings, plans and specifications for the proposed construction;
- Construction codes and standards;
- Location of facilities including use of County conduit where possible, use of existing utility poles where possible, required undergrounding where all other existing utilities are underground;
- Encouraged shared occupancy of underground conduit to reduce excavation of the right-of-way; and,
- Required occupancy of County conduit and payment of a fee based on the cost that would have been expended to construct such a conduit.

3.2 Federal Communications Commission Actions and Federal Law

Federal law and Federal Communications Commission orders limit or seek to limit the jurisdiction of cities and counties regarding cable provider franchise agreements. Federal law caps the franchise fee that any city or county may charge to "not exceed 5 percent of … gross revenues derived … from the operation of the cable system to provide cable services."[20] Determination of the appropriate base of gross revenues is obviously important which suggests the basis for audit of the cable TV providers calculation of gross revenues to ensure that the franchising authority is being paid all it is due in franchise fees. It should be noted that gross revenues can be declining due to "cord cutting" (subscribers cancelling cable TV subscriptions in favor of "over-the-top" content such as Netflix, Hulu, Amazon Prime, etc.), "cord shaving" (subscribers reducing the channel options and packages), and demographic growth of "cord nevers" (consumers who have never subscribed to cable TV).

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[18] Pierce County Code, Chapter 12.34.624 and 626.
[19] Manual on Accommodating Utilities in Pierce County Rights-of-Way, 5th Edition, Prepared by the Office of the County Engineer Division, May 2016. ("The Manual on Accommodating Utilities" or "The Manual")
[20] 47 U.S.C. § 542(b).

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The FCC has an open rulemaking proceeding which proposes to further limit cities and counties by treating cable-related "in-kind" contributions as falling under the 5 percent cap, and by limiting the authority of cities or counties to include any provisions regarding other services such as broadband Internet access in franchise agreements.[21] This is an open rulemaking with no decision from the FCC on the near horizon, but the FCC direction is clear and cable TV providers may be expected to attempt to leverage these tentative conclusions in franchise agreement negotiations in the interim or perhaps delay conclusion of franchise agreements until the FCC has acted. This is the environment in which Pierce County will be negotiating franchise renewals with cable TV providers.

3.2.1 Pierce County Franchises

Magellan has reviewed the County's various cable and telecommunications franchise agreements, many of which have expired due to lack of a dedicated person managing and monitoring telecommunications franchises. With the passage of time some franchised entities have been acquired by other entities (i.e., Level 3/CenturyLink and YCom/FairPoint/ Consolidated Communications). Expired franchise agreements create urgency since the cable and telecommunications utilities require a current franchise agreement for construction and maintenance of facilities, and to be eligible to file applications and seek permits. This has been dealt with generally by starting with the telecom franchises that require renewal with the intent to move to cable providers next. This is a reasonable approach given the backlog of expired franchises.

The telecom review process has begun with Council approval of a new Franchise Agreement for MCI Metro/Verizon on December 5, 2018.[22] Among other provisions, that Franchise Agreement contains provisions for removal of facilities that are considered abandoned (either out of service for 180 consecutive days or more, or upon County determination and notice)[23], removal and relocation of facilities, provision of mapping of the facilities in the rights-of-way in electronic format compatible with the County's GIS databases, inspections, permits and construction standards, network planning, undergrounding of facilities, and acknowledgement that the franchise is subject to future ordinances. We recommend that the franchise provisions regarding network mapping and GIS data (e.g., 2.1.1 (a) and the referenced Exhibit 1, 12.1, and 14.1.2) be augmented to require provision and periodic update (e.g., annually) of network facilities mapped in electronic GIS shape file format including relevant attribute data such as type of fiber or facility, access points, conduit or structure type and size, manhole and handhole locations and elevation, pole locations, etc.

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[21] In the Matter of Implementation of Section 621(a)(1) of the Cable Communications Policy Act of 1984 as Amended by the Cable Television Protection and Competition Act of 1992; MB Docket No. 05-311; Second Further Notice of Proposed Rulemaking, released September 25, 2018 by the Federal Communications Commission; FCC 18-131.

[22] Ordinance No. 2018-97.

[23] Removal of abandoned facilities is a normal and important subject to include in ordinances and/or franchise agreements. Such provisions are consistent with if not required by a city or county's duties to manage public rights-of-way for the long-term public benefit.

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Table 3.1. Telecom Franchises

Franchisee	Expiration
CenturyLink	2011
Sprint (3 agreements)	2012
Click!	2014
Zayo	2015
Verizon Wireless/MCI	2015
White River School District	2016
Mashell Telecom dba Rainier Connect	2014 & 2016
AT&T Wireless	2019
T-Mobile	2019
Mobilitie	2021
Zayo--Wireless Franchise	2024
Fatbeam LLC	2024
YCom dba FairPoint (CCI)	2025
Unite Private Network	2025
Level 3 (acq. By CTL)	2028

Table 3.2 Cable Franchises

Franchisee	Expiration
YCom	2014
Wave	2015
Click!	2017
Comcast	2019
Mashell	2022

3.3 Discussion and Recommendations

3.3.1 Renewal Process

Clearly Pierce County must assign staffing and resources to manage and administer utility franchise agreements. Whether such staffing and resources are insourced or outsourced is a County decision, but there should be staff responsibility for utility franchise agreements at some level to manage and coordinate external staffing and resources. Such staffing and resources should be sufficient to address the backlog of expired and expiring franchise agreements in the shorter term, and to support a program of ongoing monitoring of franchise agreement compliance and preparation for subsequent expirations. This is a critical function since the county is the voice of the subscriber and the community in setting the terms by which utilities are allowed to access one of the most significant public resources that the County is responsible for: the public rights-of-way. Franchise agreement negotiations can take a long time, and therefore require planning and preparation. This in turn requires designation of responsible persons on staff to monitor and manage franchise agreements including planning for

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negotiations prior to franchise expirations. Such planning should be started long before expiration to allow for proper process and attention.

Preparation for renewal negotiations should include a compliance review of the franchisee's performance under the current franchise. A franchise fee audit may be advisable to ensure that franchise fees have been fully and properly paid. In the case of a cable provider, the compliance review should also include some level of technical review of the cable system to gain information on its performance and capabilities. Public input on the franchisee's performance is also important to gain through a variety of means including surveys, public outreach sessions and a public-facing web page. The web page could be a repository for public information related to the renewal process and other useful information such as FAQ (Frequently Asked Questions), process timeline and milestones, and opportunities for comment including calendar of public meetings and web comment forms. Among other things the public outreach should make clear the limited scope of authority the County has to ensure the public understands legal limitations.

Competition from overlapping service provider territories is fairly limited so needs assessments and public input on franchisee performance are important in the absence of facilities-based competition. For example, Comcast is the main cable TV provider in the County with some niche competitive providers such as Wave, Click! and Rainier Connect.

Public input should include a structured "Community Needs Assessment" including community focus groups, surveys (both online and telephone) with carefully crafted questions, inclusion of both subscribers and non-subscribers, stakeholder meetings, evaluation of current PEG[24] content, access equipment, facilities and services, culminating in public hearings. Customer service metrics to be addressed include telephone answering time, prompt confirmation of orders, accuracy of bills, ability of Customer Service Representatives to communicate in English, responsiveness, and the need for local offices. The activities and findings should be documented in a report with recommendations.

Pubic, educational and government access television (PEG) is an important subject to address both in seeking public input and ultimately in the franchise agreement. Video entertainment technology is changing, and PEG access should keep pace with those changes to the extent feasible. PEG access channels both upstream and downstream should be maintained at the same level of technical quality and reliability as the cable providers best commercial channels. Comcast provides High Definition PEG in cities adjacent to Pierce County including Seattle, Tacoma, Renton, Vancouver, and Portland Oregon. Other PEG considerations include whether the number of PEG channels should be increased, whether PEG channels should be located in a consecutive or near consecutive run, whether there should be PEG video-on-demand, whether PEG channels should be listed on the electronic program guide, and funding of PEG facilities and equipment.

The County may seek inclusion of fiber for its own internal use from cable TV providers where needed and appropriate to complete county fiber networking or INet for its own uses including intelligent traffic systems. A long view should be taken given the development of connected and autonomous vehicles.

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[24] Public, educational and government access.

3.3.2 Rates

Cities and counties may not regulate the rates of cable TV providers but certain policies may be specified in franchise agreements. These include specifying that the County has the authority and right to regulate rates to the extent permitted by law or applicable FCC rules and regulations; specification that a schedule of rates for all services, installations and equipment be published; requirement that all charges to subscribers be consistent with that published schedule; requirement that the cable TV provider shall not discriminate or grant any preference or advantage to any persons, although promotions and discounts are allowed so long as they are uniformly available; and, requirement to provide minimum notice (e.g., 30 days) of proposed changes in rates.

3.3.3 Dig Once

"Dig Once" can be defined as policies and/or practices that foster cooperation among entities that occupy public rights-of-way, to minimize the number and scale of excavations when installing telecommunications infrastructure in the rights-of-way. Dig Once has a number of substantial benefits, including promoting and supporting the placement of broadband infrastructure (e.g., fiber-optic cable and conduit); reducing the consequences and disruptions of repeated excavations (traffic disruption, road deterioration, service outages, and wasted resources), and enhancing service reliability and aesthetics. Dig Once accomplished the goal of minimizing costs of constructing separate trenches and facilities – via shared costs of construction. The cost savings are significant. The Federal Highway Administration estimates it is ten times more expensive to dig up and then repair an existing road to lay fiber, than to dig a channel for it when the road is being fixed or built. According to a study by the Government Accountability Office, "dig once" policies can save from 25-33% in construction costs in urban areas and approximately 16% in rural areas.[25] In addition, development of Dig Once standards and guidelines for deployment of conduit and fiber will facilitate economic development and growth, as it enables cost-effective staged or gradual deployment of broadband infrastructure.

Dig Once policy discussions generally address the planning and coordination process for construction projects in the public rights-of-way. But the concept can also extend to required placement of conduit for fiber-optic conduits, as expressed in recent Congressional legislation. The Broadband Conduit Deployment Act of 2015 required the inclusion of broadband conduit during construction of any road receiving federal funding.[26]

Policy approaches also differ between detailing specific Dig Once processes in ordinances (e.g., San Francisco) or stating the policy direction to require coordination of projects in the roads and

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[25] https://eshoo.house.gov/issues/economy/eshoo-walden-introduce-dig-once-broadband-deployment-bill
[26] *Id*.

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rights-of-way, leaving specific implementation and management to designated city officials (e.g., Director of Public Works).

The Manual on Accommodating Utilities in the Pierce County Rights-of-Way incorporates many provisions and requirements that are supportive of "Dig Once" policies. The Manual applies to all franchises and permits issued to all public and private utilities for both overhead and underground services. The Manual states "the principal intent of Departmental right-of-way planning is to preserve right-of-way for future travel needs".[27] The Manual places responsibility on "the utilities to coordinate with other utilities…".[28] Additional provisions include:

- "Utilities shall work with the Engineer to provide as much lead time as possible in their needs for extending facilities and to accommodate the County's needs for upgrading the County's road system and maintenance programs."
- "Utilities shall coordinate the County's road, storm, and sanitary improvements with their own shot- and long-range development plans."[29]
- "Utilities should make use of [County planning documents] to take actions that will reduce or eliminate the need to cut new pavement during future utility projects."[30]
- "It is the responsibility of the utilities as practical, prior to construction, to notify all other public and private utility entities using the same right-of-way as the applicant's proposed construction. The utilities shall coordinate their activities to minimize work within County rights-of-way. For instance, utilities should make every effort to install their facilities in the same trench at the same time at road crossings. Utilities shall also coordinate with County projects to minimize cutting of newly surfaced roads."[31]

Magellan Advisors recommends that Pierce County explore extending the current sound basis for utility coordination in the Manual to encompass full "Dig Once" policies. Such coordination of projects in the rights-of-way would promote expansion of broadband infrastructure, reduce disruptive repeated excavations which cause traffic disruption, road deterioration, service disruptions and wasted resources. Additional requirements to be considered for addition to the Manual include:

- Requirement to coordinate installation, construction and maintenance work in the rights-of-way with the County, and with other utilities;
  - o Requirement of all occupants of the rights-of-way to submit plans quarterly for major excavation work in the next [12 months] to the County Engineer, in an acceptable format;
    - Recognize it is an estimate and plans do change;
    - Provide for protection of confidential business information;
  - o The plans of all occupants of the rights-of-way are reviewed by the County Engineer to identify conflicts and opportunities for coordination of activities.
- Notification of all providers of the opportunity to join the open trench and to coordinate efforts for multiple parties to join the dig;

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[27] The Manual on Accommodating Utilities, 2-1.1.1.
[28] Id., 2-1.2.2.
[29] Id., 2-7.
[30] Id., 4-1.
[31] Id., 4-3.

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- Provision for installation of public utility infrastructure (e.g., conduit, tube, duct or other structure for enclosing telecommunications fibers, wires, cables) in each excavation exceeding a set distance (e.g., 300 linear feet) (with exemption for good reason granted by the County Engineer);
- Provision of specified conduit space for the County for its use; and,
- Imposition of a moratorium on excavations affecting County roads for five years following new pavement.

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4. Pierce County Today

4.1 District Profiles

In November of 1980 Pierce County Council's current structure went into effect after a vote among its citizens approved the Home-Rule Charter. To fairly represent all areas, the 1,806 square miles of the County were split into seven districts of approximately equal populations. Each of these seven districts is represented by a County Councilmember who is elected to legislate on behalf of the constituents, while a County Executive oversees the executive branch.[32]

Each of these districts has unique demographics, geography, needs, and capabilities. Therefore, each will be profiled in the following section to contribute to a better understanding of broadband needs and accessibility.

4.1.2 District 1

District 1 covers 634 square miles in the eastern side of Pierce County that borders King County to the north and Yakima County to the east. This mostly rural area includes the cities of Bonney Lake, Buckley, Carbonado, Greenwater, Orting, South Hill, South Prairie, and Wilkeson. Mount Ranier National Park lies just to the south of District 1 and the eastern portion of the district is sparse in terms of population, with the majority of residents inhabiting the northwest cities of Bonnie Lake and Buckley.

Figure 4.1. Pierce County District 1

South Hill is the largest unincorporated residential area in the District, with a population of 55,194. This area is largely suburban and its top industries are manufacturing, construction, and retail trade[33]. Although it is a census-designated place within District 1, South Hill is often conflated with the City of Puyallup, which lies to its north. Many of the retail and healthcare facilities that serve residents of South Hill are located within Puyallup.

Bonney Lake has a population of 19,022 and a median household income of $85,975, well above that of county, state, and national incomes. Nearly 10,000 people are employed in Bonney Lake, mainly in wholesale trade, manufacturing, and construction. Although the City is mainly a suburban residential area, retail and wholesale businesses such as Walmart and

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[32] https://www.co.pierce.wa.us/1364/Council-Overview, accessed 6/28/2018.
[33] http://www.city-data.com/city/South-Hill-Washington.html

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Target are major employers[34]. With a large grocery outlet, an office plaza, and a medical center dominating the downtown area's economy, Bonney Lake's plans for economic development include expanding sewer services to the "Eastown" economic sector for increased opportunities[35].

Orting's population is approximately 7,254 and its largest industries are manufacturing, retail, and healthcare & social assistance[36]. The Voights Creek Hatchery, located just outside of Orting, draws sports fisherman to the area for salmon fishing. Orting also draws visitors to its numerous parks and forest areas.

Buckley has a population of about 4,516 people, many of whom are employed in agricultural and forestry jobs, educational services, and manufacturing[37]. The towns and cities of Carbonado (population 682), Greenwater (population 100), South Prairie (population 441), and Wilkeson (population 500) contain most of the remaining residents of District 1.

Although this area is appreciated for its scenery and its roots in agriculture and forestry, retail and manufacturing have begun to take shape throughout its populated regions.

4.1.3 District 2

At just over 75 square miles, District 2 is significantly smaller than District 1 in area. It's population, however, is comparable at 123,100. With a much denser population distribution, the District includes several larger urban and suburban pockets including Auburn, Browns Point, Dash Point, Edgewood, Fife, Lakeland, Milton, Northeast Tacoma, Puyallup, Sumner, and the Port of Tacoma.

Located deep within the heart of Puget Sound, District 2 is known for stunning marine-facing vistas on the western side. These views and the recreational activities associated with the Sound

Figure 4.2 Pierce County District 2

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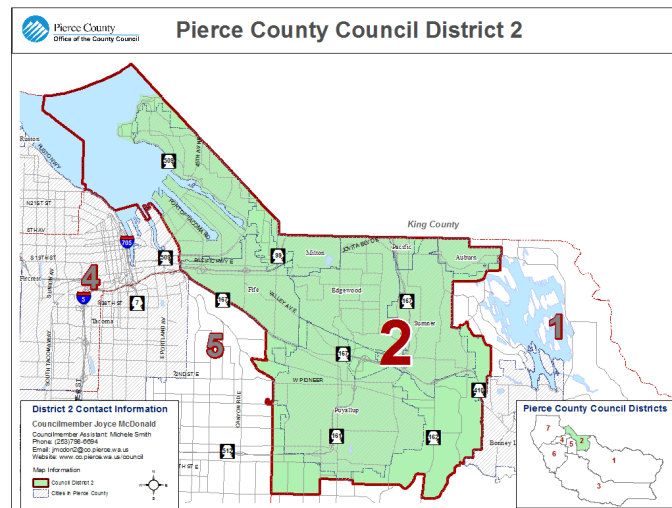
[34] City of Bonney Lake 2011=2012 Biennial Budget, http://www.ci.bonney-lake.wa.us/UserFiles/File/Business_Downloads/BL_Profile_2011-2012.pdf

[35] City of Bonney Lake Economic Development, http://www.ci.bonney-lake.wa.us/section_business/community_development/economic_development.shtml, accessed 6/28/2018

[36] https://datausa.io/profile/geo/orting-wa/ Accessed 6/28/2018

[37] https://datausa.io/profile/geo/buckley-wa/#economy Accessed 6/28/2018

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have attracted many visitors and residents to the District.

Perhaps most integral to the identity and economy of District 2, and indeed, to all of Pierce County, is the Port of Tacoma, which is shared with District 4 and serves as the heart of its economic prosperity. A major seaport and among the top 10 U.S. container ports, the Port of Tacoma ships and receives goods that support local, domestic, and international trade. According to a 2014 study performed by Martin Associates, the Port supports in excess of 29,000 jobs, and according to the Port's self-reported impact, "if the farmers and manufacturers who ship products through the Port of Tacoma were factored in, the port's activities reached 267,000 jobs overall in Washington."[38]

Much of the District relies upon the Port of Tacoma for its manufacturing and retail-heavy economic success. The Port is chaired by a five-member commission that holds regular public meetings and oversees a plethora of projects, including a plan to construct a liquified natural gas facility with the goal of improving air and water quality, as well as providing natural gas to local customers[39].

Figure 4.3. Major Shipping Routes from the Port of Tacoma[40]
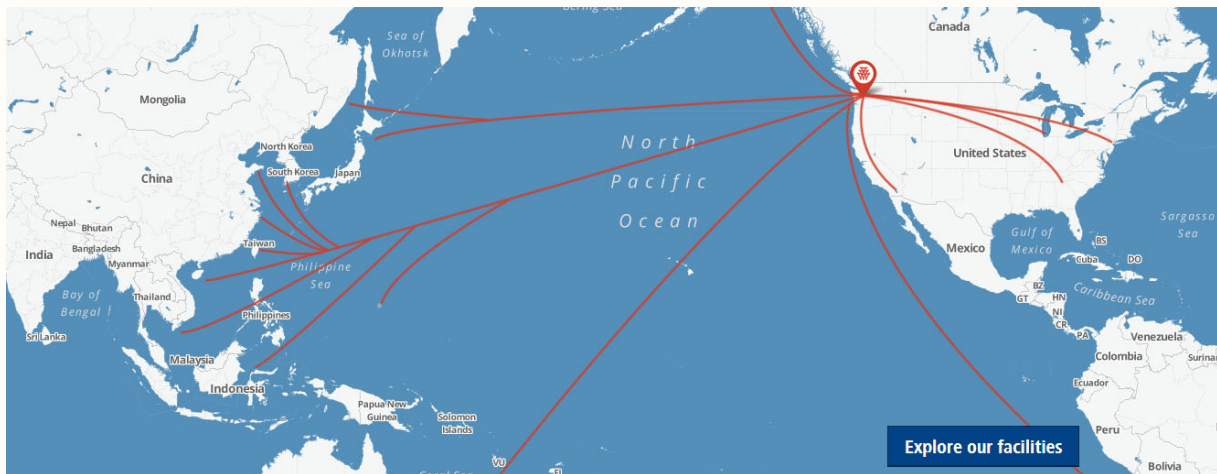
With approximately 40,000 residents Puyallup is the largest city in District 2. Originally an agricultural community built on the timber industry, the majority of the City's residents are now employed by the Puyallup School District or the Multicare Good Samaritan Hospital. Fred Meyer Distribution Center, Comcast Cable, Costco, and Walmart are also large employers in the City. Like much of District 2, Puyallup's economic makeup is positively impacted by its proximity to the Port of Tacoma. It is also the home of the Washington State Fair and Events Center, site of the sixth largest fair in the U.S. at more than one million visitors per year.[41] This influx has spurred the development of several large hotels in the area, while its desirable residential appeal has flourished with the construction of several major single-family residential projects.

The Browns Point and Dash Point communities, although technically separate, are linked geographically and often identify as a joint community known locally as "The Points." This area

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[38] https://www.portoftacoma.com/community/economic-impact, accessed 7/5/2018

[39] https://www.portoftacoma.com/puget-sound-energy-lng-facility

[40] https://www.portoftacoma.com/shipping accessed 7/6/2018

[41] http://www.ci.puyallup.wa.us/476/Business-Sectors

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is highly residential, with an emphasis on recreation and outdoor activities such as bicycling and water sports. A suburb of Tacoma and located within its urban service area, the Browns Point-Dash Point neighborhoods have little in the way of economic activity outside of small retail and service industries that serve residents. As a part of the 2008 Pierce County Comprehensive Plan, the Browns Point-Dash Point community created a vision for "preserving our established residential neighborhood character and strong independent community" and improvement of existing public facilities and services including pedestrian and bicycle safety and responsible development.[42]

The City of Edgewood has a population of just over 10,000 and covers close to 9 square miles in the northern central region of District 2. Its location just ten miles from the Port of Tacoma has resulted in an economy heavily concentrated in retail and wholesale trade, construction, and manufacturing.

Fife lies to the southwest of Edgewood and, with around 10,000 residents, is approximately equal to its neighbor in population. Although historically Fife was established as an agricultural community with its fertile land attracting a variety of nationalities from around the globe, it is now an economy based in warehousing, distribution and transportation, much like Edgewood, and thrives in large part due to its proximity to the port. Its major employers include Milgard Windows and Doors, Mission Foods, American Fast Freight, Continuant, and Costco. A vast number (approximately 85%) of Fife's residents work outside of the City, traveling an average of 25.1 minutes to their places of employment.[44]

The City of Milton, in the north of District 2, is slightly smaller than both Edgewood and Fife, with a population of approximately 8,230[45]. First established when a timber mill was built on the site in the early 1890s, the City's economy is now much like that of the neighboring cities in the District, with a concentration in retail and wholesale trade, manufacturing, and distribution. Similarly, the City of Sumner, with a population close to 10,000, has an economy built around these industries.

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[42] Browns-Point Dash-Point Community Plan, 2008, https://www.piercecountywa.org/DocumentCenter/View/38484/2015-40-BDP-only?bidId=

[44] http://cityoffife.org/city-departments/community-development/community-profile, accessed 7/5/2018

[45] 2016 US Census

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4.1.4 District 3

District 3 is the southernmost area of Pierce County, bordering Districts 1 and 6 to the south. Similar to District 1, District 3 is heavily rural, and its defining feature is the breathtaking Mt. Ranier, which lies in its eastern wing. District 3 includes a few areas of concentrated population, including Ashford, Eatonville, Elbe, Elk Plain, Frederickson, Graham, Roy, and Spanaway.

Ashford and Elbe are encompassed in a larger area known as the Upper Nisqually Valley, a rural region just outside the Nisqually entrance to Ranier National Park. According to

Figure 4.4 Pierce County District 3

the area's Community Plan, adopted in 1999, as much as 50% of the land is public, held by Federal, State, or local government as designated forest.[46] Little economic development occurs in these areas, as they are primarily used for recreational activities and wildlife conservation.

Elk Plain, part of the larger Graham community, describes itself as a vibrant, largely rural area with a country image, defined by its friendliness, safe neighborhoods, affordability, and natural beauty.[47] With a population of about 26,000, the major industries in Graham are construction, transportation & warehousing, and wholesale trade.

The population in Frederickson grew by more than 200% between 2000 and 2010. The area has braced itself for continued development by an ongoing update of its community plan. Previously a quiet, rural community, Frederickson has undergone transformation to become a largely suburban location, with a population of over 20,000. A Boeing manufacturing plant is one of the defining features of Frederickson's economy, whose major industries include manufacturing, construction, and retail.[48]

Spanaway, an unincorporated area of nearly 30,000, lies on the eastern edge of Joint Base Lewis-McChord military reservation. Like many of the surrounding areas, Spanaway's economy consists largely of retail trade and manufacturing. In community planning efforts, the area is often connected with Parkland and is a suburb of the Tacoma metropolitan area.

Roy lies in the westernmost segment of District 3 near Joint Base Lewis-McChord military reservation. About 800 people live

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[46] https://www.piercecountywa.org/948/Upper-Nisqually-Valley

[47] https://www.piercecountywa.org/939/Graham, accessed 7/5/2018

[48] https://datausa.io/profile/geo/frederickson-wa/, accessed 7/5/2018

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in Roy, many of whom are employed in the agriculture industry by major employers Silvaseed Tree and Seed Company and Wilcox Farms. The small town also hosts a rodeo twice a year, attracting visitors near and far and helping to preserve the area's rich history.[49]

The Town of Eatonville, in the southwest corner of the district, has just shy of 3,000 residents. As with many other rural locations in Pierce County, the dominant industries in these small towns are construction, manufacturing, agriculture, and retail.

4.1.5 District 4

Pierce County's District 4 encompasses large sections of the City of Tacoma and its surrounding area. This includes part of the Port of Tacoma (see above), the North and South End, Hilltop, and Downtown regions of the City of Tacoma, and the cities of Fircrest and University Place. Tucked snuggly between Districts 2, 5, 6, and 7, District 4 is one of the smallest in area, covering 33.1 square miles.

Although District 4 has roughly equal populations with the other districts, a notable difference is that its median household income falls significantly lower than those of Districts 1, 2, and 3. Much

Figure 4.5 Pierce County District 4

more densely populated and urban/suburban in nature than Districts 1 and 3, the primary economic drivers within District 4 include healthcare and social assistance, retail trade, and educational services.

The City of Tacoma itself has a significantly higher poverty rate than elsewhere in Pierce County, coming in at 17.9%[50]. However, Tacoma has a bustling commercial sector, the largest employers of which are Joint Base Lewis-McChord, Multicare Health System, and the State of Washington, including school boards.[51] Boeing also has a large presence in the City. Tacoma is the current county seat of Pierce County, and covers just over 62 square miles. The City is the third largest in the State of Washington, and boasts a booming economy centered in trade activities at its port, wholesale and local retail, and a variety of other businesses including Fred Meyer, State Farm, and the Multicare Health System. The City is home to The University of Washington's Tacoma campus, several parks (including one of the nation's largest urban parks at Point Defiance), and the famed Museum of Glass. The area is also served by Sound Transit, which has established Tacoma Link light rail for improved transportation, a thriving hydroelectric

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[49] https://www.cityofroywa.us/history.html, accessed 7/5/2018

[50] https://datausa.io/profile/geo/tacoma-wa/#economy

[51] https://www.cityoftacoma.org/government/city_departments/community_and_economic_development/economic_development_services/major_employers

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system run by Tacoma Power, and several hospitals administrated by Multicare Health System and Franciscan Health System.[52]

While Tacoma is mainly urban, Fircrest and University Place are more suburban. University Place is home to approximately 31,500 residents and is the fourth largest city in Pierce County. At approximately 8.56 square miles, much of its area lies along the waterfront of the Puget Sound, creating a haven for recreational activities. Like Tacoma, its economy consists largely of retail trade, healthcare and social assistance, and educational services, all of which contribute to quality of life among its residents.[53]

Fircrest is adjacent to University Place, separating it from the City of Tacoma. A much smaller community than either of its more populous neighbors, Fircrest is mostly residential and is famous for its chainsaw sculptures and parks, which have earned it the nickname of "The Jewel of Pierce County."

4.1.6 District 5

District 5 is slightly larger than District 4, covering just under 40 square miles of central Pierce County. The district includes the communities of Midland, North Clover Creek/Collins, Parkland, Spanaway, Summit Waller, and Summit View, as well as the Eastside and South End sections of the City of Tacoma. Its demographics are quite similar to those of District 4, with a significantly disparity in median household income compared with many of the other parts of Pierce County.

The Midland, Parkland, and Spanaway communities are close in proximity and have banded together to create the Parkland-Spanaway-Midland Land Use Advisory Commission, which consists of nine representatives and advises a variety of entities on land use matters. These include the County Executive, County Council, Hearing Examiner, Planning Commission, and the Planning and Land Services Department.[54] These communities have an array of distinctive features including suburban residential neighborhoods, historic urban communities, semi-rural residential areas, and major commercial zones. Midland, Parkland, and Spanaway also include several public parks and recreation centers, as well as Pacific Lutheran University. Much of its economy focuses on public sector jobs, such as in schools or government services, healthcare, and retail.

Figure 4.6 Pierce County District 5

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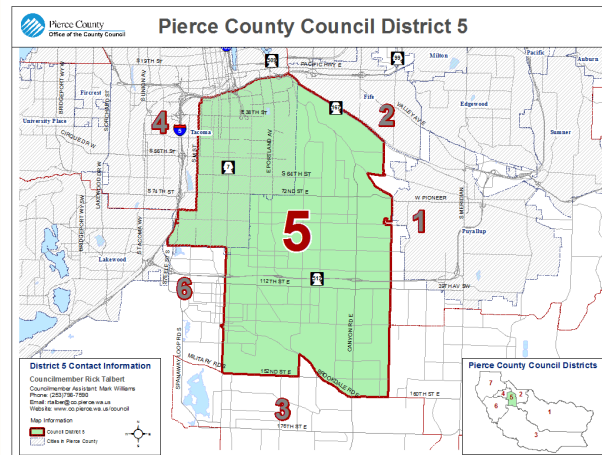
[52] https://en.wikipedia.org/wiki/Tacoma,_Washington, accessed 7/9/2018

[53] http://www.cityofup.com/

[54] https://www.piercecountywa.org/2087/Parkland-Spanaway-Midland-Advisory-Commi

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Summit-Waller, Summit View, and North Clover Creek/Collins are similarly bound together in a collective area known as Mid-County. As the name suggests, the region is near the geographic center of Pierce County and, although it does contain some urban and suburban sections, Mid-County is mostly rural. Although some of the County's major thoroughfares run through the Mid-County region, the economy mainly consists of small businesses and agriculture, and the area's community plan has maintained a commitment to protecting its natural landscape.[55]

The Eastside and South End sections of the City of Tacoma that lie within the boundaries of District 5 are generally less affluent, with median household incomes of $46,772 and $56,837 respectively. Both are affordable areas in which many residents are employed in low paid administrative, sales and office, and service industry jobs.[56]

4.1.7 District 6

The defining feature of District 6 is Joint Base Lewis-McChord, a U.S. military installation shared by the Army and the Air Force. The District also encompasses the communities of DuPont, Lakewood, Parkland, Steilacoom, Anderson Island, and Ketron Island. Thurston County borders District 6 to its south, and many of its western areas are coastal. Due to the presence of the Joint Base, the population is younger than the other districts of Pierce County, with a median age of 30.9 years. It's median household income is also the lowest among all seven districts, at $48,324.

Figure 4.7 Pierce County District 6
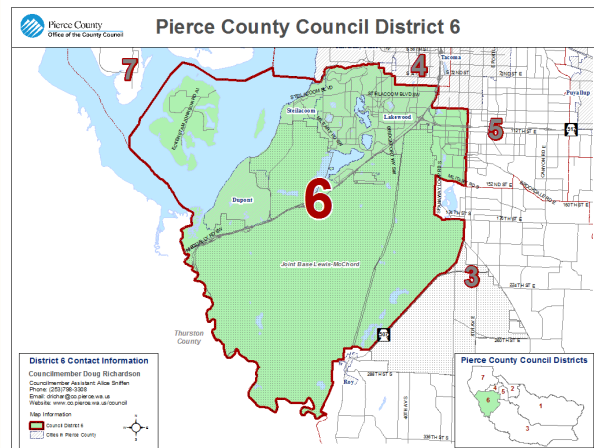
Joint Base Lewis-McChord (JBLM) was chosen for its strategic location near deep water ports along the western coast of the U.S. The Joint Base was created in 2010 when the Air Force's McChord Air Force Base merged with the Army's Fort Lewis, creating a prime location for training and mobilization. More than 45,000 service members and civilian employees operate at the base, which is the largest Army-led base in the country.[57] JBLM has produced substantial financial growth in the surrounding areas and is currently the third largest employer in the State of Washington.[58]

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[55] https://www.piercecountywa.org/942/Mid-County

[56] https://www.point2homes.com/US/Neighborhood/WA/Tacoma/West-End-Tacoma-Demographics.html, https://www.point2homes.com/US/Neighborhood/WA/Tacoma/Eastside-Tacoma-Demographics.html#IncomeFinancial, accessed 7/5/2018

[57] https://www.co.pierce.wa.us/618/Joint-Base-Lewis-McChord

[58] http://dupontwa.gov/index.aspx?NID=279

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The City of Dupont is home to approximately 8,200 people and covers about 5.86 square miles of District 6 on the western edge of JBLM. Its median household income is significantly higher than that of the District as a whole, and the area experienced a population increase of more than 200% between 2000 and 2010. DuPont was the site of an explosives factory beginning in 1906, which drew new residents *en masse*. The late 1980s and early 1990s saw an increase in new housing developments in Dupont with the development of its Northwest Landing. Today, the town still retains its Historic Village, and many of its residents are employed at JBLM.[59]

Lakewood lies just to the southwest of the City of Tacoma and is home to both Pierce College and Clover Park Technical College. The City has long been a hub for trade routes due to its location along major waterways, railways, and, most recently, highways. This area is noted for its vast amounts of park space, lakes, streams, and wetlands, which total about 600 acres within its 49.1 square miles. Lakewood is home to around 60,000 residents, many of whom work in healthcare, retail trade, or educational services. As Lakewood's recently adopted 2018 Strategic Plan points out, the area's extremely stratified income distribution indicates the absence of a middle class, and it poverty level of 20.3% is well above the average in the State of Washington.[60]

Steilacoom is the oldest established city or town in the State of Washington, first established in 1854. Today, the town is home to approximately 6,000 people, many of whom are employed at JBLM. Its rich history and small town charm distinguish Steilacoom from the surrounding areas, and, although major highways and interstates do not pass through it, it is the historic seat of Pierce County.[61]

The communities of Anderson Island and Ketron Island, though distinct from one another, are linked to each other in Pierce County's Comprehensive Plan. Anderson Island is approximately 8.1 square miles in area and mostly rural, although there are also a number of smaller residential lots. Much of the island is characterized by agriculture and forestry, and its residents are drawn to its quiet, remote ambience. Ketron Island is home to a few residents on its north end, but is primarily undeveloped and forested.[62]

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[59] http://dupontwa.gov/index.aspx?NID=35
[60] City of Lakewood 2018 Strategic Plan, pg 8.
[61] http://www.townofsteilacoom.com/
[62] Anderson-Ketron Islands Community Plan 2009, pg. B-6.

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4.1.8 District 7

The northwestern tip of Pierce County is designated as District 7 and encompasses a variety of communities along the Puget Sound including Gig Harbor, Key Peninsula, Fox Island, Ruston, and West and North Tacoma. Comparatively, the district is mid-sized, covering about 209 square miles, and its population is approximately 116,532. The median age in District 7 is the highest in the County, and median household incomes are also relatively high.[63]

Figure 4.8 Pierce County District 7

Gig Harbor is among the fastest growing communities in the County, with an average annual growth rate of 3.7% as of 2015[64].

The City's current population is 9,065, many of whom work in healthcare & social assistance, retail, or educational services.[65] Gig Harbor has become a popular tourist destination for its scenic views of the Sound, particularly in its historic waterfront area which thrives with local shops and fine dining. For the purposes of community planning, Fox Island is included in the Gig Harbor area.

The Key Peninsula is located just to the west of Gig Harbor and is composed mainly of small rural communities centered around agricultural and forestry uses. The population of the area is growing, currently estimated at well over 16,000. The peninsula is home to two state parks and many recreational activities draw residents and visitors alike. Many of its residents work in home-based businesses or local shops that cater to visitors, but the majority commute to areas outside of the peninsula for work[66].

Though the Town of Ruston has a small population, totaling approximately 797, it has much potential for commercial development in the area along its western boundary. Point Ruston is an area of ongoing waterfront development with about 1.5 million square feet of office, retail, entertainment, hotel, and restaurant space[67], and a plethora of new housing such as apartments and condominiums. The area prides itself as a prime location for up and coming projects with an aim to be a premier location for living, working, and visiting.[68]

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[63] https://www.co.pierce.wa.us/DocumentCenter/View/44982/District-7-Demographic-and-Income-Profile?bidId=, accessed 7/9/2018
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5. Broadband in Pierce County

The core of any plan consists of the goals and objectives of those involved or impacted, or its stakeholders. Citizens and consumers represent a major stakeholder group because they purchase and pay for the services for a variety of purposes. Their interests—and willingness to pay—should be foremost in the planning process and are best assessed via survey.

Anchor industries and institutions are important stakeholders, along with local government and support industries. Their needs often drive demand in communities. As they increase technology use, major stakeholders drive market supply and workforce skills. Internal County departments drive technology investment in alignment with and response to other stakeholders. Key stakeholders provide the context in which household and organization demand and market supply must be interpreted, are a primary concern for the County. Discussions and interviews are best for assessing the broadband needs and opportunities of key stakeholders.

As such, these processes were used as evaluative methods throughout Magellan's research. This section captures information learned in both the discussions, interviews, and surveys and present valuable information about broadband connectivity and access across the County.

5.1 Internal Pierce County Stakeholder Input

The various departments and divisions of Pierce County that do the public's work have differing technology requirements with core commonalities. Network access and throughput represent a common requirement. Our team spoke with an array of County departments about their technology needs and how broadband plays a role in the many ways Pierce County serves its citizens.

5.1.1 Communications

The Communications Department creates and disseminates public information about activities, decisions, programs, and projects for all three branches of Pierce County government. It operates Pierce County TV, manages the County's social media and website, does video production, and assists with education, outreach, and other media. Needless to say, Communications requires substantial bandwidth. Some locations in which they work have broadband including a 1 Gbps connection at the Communications office, which costs $1,200 a month.

Pierce County TV (PCTV) is a service of the Rainier Communications Commission (RCC), which assists with cable franchise development for Pierce County and seven cities— DuPont, Fife, Orting, Puyallup, Ruston, Sumner, and University Place. PCTV operates two government access cable channels, streams public meetings and other local events live online, produces public information videos for its jurisdictions, along with talk shows, video magazines, and special programs. PCTV content is hosted by a live and on-demand webcasting (streaming) platform in Olympia called Invintus Media. PCTV recently began offering live streaming for all of its members - on a variety of platforms - with options to go live on the PCTV cable channel, the web, and social media including YouTube, Facebook and Twitter. PCTV currently provides live YouTube streaming for the City of Sumner. Jurisdictions have had to pay more to increase their upload bandwidth because it requires a higher-than-standard upload speed. When the City of

Orting builds a new City Hall in 2019-2020, they must run new fiber for broadband because no high speed internet exists in that rural but quickly-suburbanizing area. In the past, RCC had difficulty sharing channel programming with cable carrier Rainier Connect because of its remote service areas in eastern Pierce County that lacked broadband. In the 2000's, they were still mailing them content on VHS tape.

It's important to note that cable TV service and broadband often go together, but they are separate services. While PCTV offers the live meeting service to all of its member cities, some locations do not have the necessary broadband connections. PCTV has to record live meetings and other productions and distribute/archive them later, due to a lack of high-speed data connections in the field. The department has a LiveU unit which uses bonded cellular for more remote broadcasting, but even then, cellular can be lacking in areas like Ashford, Orting, the Key Peninsula and Edgewood. In 2019, they have yet to fully test LiveU in all areas of Pierce County to know where it works and where it doesn't. Again, broadband and bonded cellular are different services. They have used this new technology a handful of times for in-district council meetings with success, but in locations that didn't truly test its capability.

The Communications Department reported hearing a lot about broadband and related issues. There are "haves" and "have nots," leaving a lot of people out. Gig Harbor is getting expensive, so more people are moving out to other areas—Vaughn, Fox Island, Anderson Island, Graham. Those areas have been growing quickly. There many home-based businesses: Ten percent (10%) of people work at home, and thirty percent (30%) telecommute. Traffic congestion has been a major issue.

Communications pointed out how important it is for all the County to have access to the information that is being posted. Currently, the residents' experiences vary considerably due to different levels of connectivity. As close as Frederickson is to urban areas, the County lost businesses there due to lack of broadband, and the County was hearing more from agriculture, particularly applications using satellite. They also emphasized that tribal groups have the worst broadband connectivity and availability.

5.1.2 Economic Development

Business attraction and expansion are a major focus of the Economic Development Department. It provides a range of data analysis, marketing, and tourism services, administers related commissions and host educational forums. Numerous regional partnerships—aerospace, environment, health, and workforce—are critical to the department. It had not seen many companies leaving Pierce County due to broadband, but it stated that this can be an issue for attracting and retaining business. The big problem cited by Economic Development was lack of visibility about where fiber exists; carriers seemed unwilling to share this information.

One example of issues with broadband connectivity occurred when a jewelry supply company with Comcast service had an internet-service outage. It was a residential connection, so it was not subject to restoration priority. Ninety-seven people worked there, and it was going to be down for weeks. A neighbor who works for Comcast interceded to get it fixed. CenturyLink's policy is that it will build infrastructure to connect a company, but it has very high monthly prices. Comcast is the other way around. It will build for very high installation costs.

There was a view that Pierce County should have connectivity as far and wide as possible. Many referenced Iowa Governor Brandstatter wiring the state in his first term. Iowa now rivals Connecticut in number of financial firms. The Economic Development team emphasized that broadband can be a marvelous tool for business and education. The preferable technology was not clear and risk of large investment in technology that is quickly outmoded. They also mentioned Tacoma's CLICK network and pointed out that something similar was needed along all arterials like those included in the Planning Department's Centers and Corridors Plan.

Economic Development was concerned about how to fund "last mile" connections, because it can be a barrier for business expansion and retention. Growth projections for unincorporated areas should make facilities investment desirable. Municipalities adjacent to each other need complementary overlapping policies and it is possible to drive through four cities in 15 minutes in Pierce County. Conduits are going to be going down the same roads and intelligent traffic system funding could be a money source for broadband expansion.

The department was working hard on bringing technology companies to Pierce County. It was reasonable in part since Seattle was built up and overflowing. The University of Washington Tacoma was moving to become a full blown research system and agriculture was becoming more technically sophisticated. Drones for crop monitoring were becoming common, and robotics too. There were lots of technical pieces. Pierce County didn't have the scale here for new agriculture applications. They were finding more smaller farms and greenhouses doing specialties for Seattle restaurants. The area is excellent for berries while animal farming is small.

Pierce County has diverse economic assets. The scenery has value in and of itself. Mt. Rainier attracts many tourists with its multitude of trails and outdoor sports. The County has a Life Science Incubator, 3D printing, and an Urban Waters Institute. Cybersecurity and prosthetics research are examples of local industry clusters and area toolmakers are phenomenal. Cold storage is particularly desirable in the region because Pierce County is a terminus for seafood from Alaska. The Port of Tacoma is equipped for the largest ships, and ranks third on West Coast, fifth in US for traffic.

The County has 12 Opportunity Zones, three in unincorporated areas. It owns two airports, one of which—Tacoma Narrows Airport—has potential for additional business. Joint Base Lewis-McChord has quite a few companies in maintenance, support, and systems contracts. It is a tremendous source of great employees, many with Master's degrees. Some 40-60% of those who separate stay in the area.

Pierce County also sees many residents in industries that allow them to work from home. Many are on urban outskirts in areas like Graham without broadband, so they are still commuting, adding to roadway congestion. Lack of mid-range housing is an issue, as is retraining the workforce for higher paying jobs. Availability of broadband is a long-term benefit of growth. Opportunities and requirements for new developments to install conduit and fiber are examples of where policies might help.

5.1.3 Emergency Management

The Department of Emergency Management works to create sustainable communities and enhance public safety by empowering all who work, govern, live in and visit Pierce County to

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prevent, mitigate, prepare for, respond to and recover from all types of hazards, emergencies and disasters. It is part of the Combined Communications Network Enterprise with Pierce Transit and the County, a joint venture to support the development, operation, and maintenance of a combined radio communications network for transit, public safety programs, other public agencies. In 2008, Pierce Transit built Next Gen P-25 network covering Puget Sound area. Pierce County entered a memorandum of understanding (MOU) with Pierce Transit to create single county wide network in 2010, and an Interlocal Agreement was completed the next year. In 2015, a 50/50 partnership joint venture known as the Combined Communications Network (CCN) was established, which Emergency Management now manages and oversees. South Sound 911 also uses and supports CCN. Pierce County is also partnering with the United States Geological Survey (USGS) on a system to detect and respond to massive volcanic mudflows or fast-moving gushes of mud and debris (lahars) that are likely at Mount Rainier.

The Single County Wide Communications Network that has resulted is a P25 TDMA network, with several layers of voice, and massive data. There were 21 sites on the network's backbone, with a 22nd site planned at Pierce County Jail, 96 different microwaves sites, and over two dozen sirens/siren sites. The microwave network also supports the City of Tacoma 800 Mhz, City of Puyallup 700/800 Mhz, Washington State Patrol, and Washington Department of Transportation (WDOT). There are seven layers in network: Microwave Network; 700 MHz, VHF Network, UHF data, 410 VHF overlay for fire station, Pierce County Jail DAS, and the Next Generation Integrated Lahar Warning System. Alerting and paging for search and rescue were almost ready for cutover and USGS/UW/foreign researchers are already connected to the network. Alert and lahar warning systems sent over 700 MHz.

The network also supports Pierce Transit's TRAX system, with 14 layers of systems necessary to run the busses. Numerous functions are at play to provide for status of vehicles in the field, monitor vehicle activity, and support operational, business and administrative capacities. In 2014, this was the third largest time division multiple access (TDMA) network, specified by Transit and supported by a $6M investment. It enabled fire and police agencies, providing voice services but not data. Ensuring sustainability of such a large network is an ongoing challenge to which operations and maintenance are critical, as is a replacement fund.

Some CCN sites are leased, some are County-owned, with varied height, and a few are monopoles. All sites have three layers of power and a hut. Some have commercial colocations, also City of Tacoma, with room and rate schedules for more. CCN uses a 3-loop system for resiliency. The microwave could be expanded to provide additional revenue to support O&M. Data connectivity is the emerging concern. FirstNet was seen as a longer-term opportunity that would not meet short term needs. Funding is difficult, particularly startup money; national funding of $8 billion cannot go very far toward the vision of a true single system, leveraging infrastructure from both systems, and providing 100% coverage. JPEGs and video can be lifesaving, but getting it from Point A to Point B is the imperative. Commercial use of the network may be critical to help pay for First Net.

The County has some fiber assets, as does the City of Tacoma. The Port has radios, including ship to shore, and its own security force. Emergency Management is working with Joint Base Lewis-McChord on coverage and required security. There are also three major tribes in the area. The Lahar System and projects like drainage monitoring equipment opens the door to collaboration with tribal communities. The County is working on Next Generation 911, which will

have three primary PSAPs after consolidation. Cybersecurity and hacking represent a huge issue. Systems are under attack constantly, and Emergency Management is aware of the impact elsewhere. The department is focused on funding, a sustainable business model, and opportunities for fiber investment to generate revenues, add capabilities, and cut costs.

5.1.4 Finance and Information Technology

Pierce County has very well-developed spatial data system to support Land Use Planning, Public Works, Property Assessors, etc. in a centralized geographic information system (GIS). However, telecommunications metadata is very limited to just spatial location, and does not include fiber count and other details. After 25 years of investment in conduit, Pierce County has four strands in an older fiber ring in the metro area, all of which is underground, with nodes at the County Administration building, fire stations, and the Health Department. The fiber doesn't extend into the main Pierce County service area. Thus, the County depends on carriers to connect County facility locations and meet bandwidth needs.

Pierce County gets to the internet at one of the nodes, CenturyLink. From the Administration Building, they connect to the CLICK network, and use Optic Fusion as a redundant path. The County can get up to 1 GB at additional cost.

The County's award-winning planning and land use system, Planning and Land Services (PALS and PALS+) was purposely built by staff for the Planning Department. Body cameras could potentially be put into use at a later date, and the Sheriff's budget priority is for more deputies to deal with very rapid growth. Community security cameras were not an issue.

Microwave point-to-point was on a couple of nearby buildings. The technology was selected for the ease and because it is unlicensed, was being explored for further use. The County was also exploring sewer utility conduit for fiber. It crosses the County in ways that roads don't, and it gets by north/south barriers such as the Narrows, I-5, and rivers. Anything that crosses east to west is very valuable. There was a tendency for sewer expansion rather than allowing further septic tanks, with expansion on the horizon. The County does its own network and system engineering with centralized provision of telecom in IT. Integrating Public Works ITS into the County systems is a challenge.

The County has heavy dependence on Verizon. The connectivity challenge was not at the core, it was at the remote sites, in keeping up with new remote sites. Streaming video from remote sites was particularly a challenge. The County has CMF, Office 365, and Amazon web services, which were great at the core but bandwidth out to the remote sites is limited. Tacoma Public Utilities (TPU) has separate water, sewer, electric and broadband utilities, and none of the territories are in coalignment. All extend beyond city limits and into the County.

Pierce County is more complex than King County. Almost 50% of population is in unincorporated areas here, versus just 10% in King County. Canyon Road is very a high growth area with 4 lanes in each direction. Unincorporated does not necessarily mean rural. There are three primary fire districts for most of the County and a patchwork of small districts in the remainder. There are 3,300 fire districts in the state of Washington.

5.1.5 Parks and Recreation

Parks and Recreation has many locations. Administrative locations are a challenge, and connectivity is a huge challenge. The department needs better connections at North Lake Tapps Park, Frontier Park, Pierce County Fair, and the maintenance office. Costs can be very high: better connection for the Sprinker Maintenance Office would cost $90,000 by Comcast. Cross Park in Frederickson is going to be up and running in two years and will also need connectivity.

The department's point-of-sale (POS) system is web based, and has to be secured and PCI compliant. It is used at the Ice Rink, Equestrian Center, and Heritage Recreation Center. Supervisors, who will switch maintenance to tablets next year, communicate with maintenance via cell phone. The County runs community centers, summer camps, leisure programs, and special needs programs. They use Activenet for registration and Civic Plus for publishing content. There are no cameras in parks, but there are some cameras in community centers, around buildings. Security cameras are low down on the priority list but Wi-Fi is a common request. The Community Centers should have it first—it's an important aspect of special events, including a lot of weddings. Meridian, Frontier Park, Spanaway, North Lake Tapps, and Chambers Creek Regional Park are all high priorities for Wi-Fi, while ball fields are a close second.

Parking is a big issue at some of the trailheads. There is a lot of street lighting in parking lots for ball fields. Collaboration is important because there are numerous districts: for example, Tacoma Metro Park District, Peninsula Metro Park District, Lakewood Park District, as well as US Parks at Mt. Rainier. There may be a transit center coming in the future and Mt. Rainier may be prohibiting personal vehicles as traffic into national parks is increasing. Mt. Rainier is a very affordable destination and gets a lot of use from military families.

5.1.6 Planning and Land Services

The County's regulation and zoning approach is to try to help, not hinder, broadband deployment. The County owns no utility poles, has few streetlights and sidewalks, and on the peninsulas, some utilities are underground. Pierce County has a large urban area compared to most Washington counties. Planning and Public Works tend to focus energy in most populous areas for efficiency.

Planning deals with private land and has developed an award-winning database system and iPad app that inspectors use with air cards. A fiber loop connects all the County buildings.

The last new cell tower application was a 150' monopole in June 2016, which was approved one month later. There were 32 permits in 2017 involving a cell tower; most were antenna replacements. The policy approach was to make it easy to add antennas. Policy comes into play for new poles over 60 feet, which must go through a public hearing. They try to expedite permits that require public hearing. There has been some discussion of "Dig Once" policies.

Urban growth areas are unincorporated land but planned for annexation. There may need to be plans that bridge the many different boundaries to foster investment since the many boundaries create uncertainty and inability to plan. Formal adoption of regulations via ordinance and design requirements might be important to get ahead of the development curve.

5.1.7 Public Works and Utilities

Pierce County owns substantial amounts of vacant land and much of a levee that crosses most of the County. Public Works handles roads and traffic and is planning for "Complete Streets" and innovative mobility options. They have cameras controlling traffic signals and movement, not capturing any images. Dig Once requires coordination. The County had made the first big step coordinating internally and there was a Utility Coordination meeting every year. The Department used to have utility coordinating layer on GIS with all planning and permitting activity but it was removed because it was too onerous to manage and required too much maintenance.

There has been a push by the Department to underground utilities. Peninsula Light has done so, the operational principle being that as electric systems age out, they go underground. Some partners on poles still wanted to hang cable. Consequently, problems related to maintenance, repair, and weather were expected to continue to create costs. Some stakeholders don't believe the County has a right to impose obligations via franchise.

The Department had been getting a fair amount of applications for ROW access, some for large towers. The County spends millions on ROW acquisition. Any compensation or trade-out should be equitable. The County owns some street lights, which were being upgraded to LED, and poles. There was no rhyme or reason as to where street lights were located; it was based on specific illumination projects and developer dependent, with no street light plan and policy. The $25k annual O&M budget grew to $350k.

Traffic signaling allowed for preemption by police but not hold-the-green for the fire departments. Pierce Transit, which operates local public buses, had not requested hold-the-green for buses. There was not much communications or coordination between the two agencies.

Sewer and Storm Water, which includes a regional wastewater treatment facility, thousands of miles of infrastructure and 15,000 manholes, is part of the department. There was very little abandoned pipe, since in sewer system terms, it is a very young system. They were open to putting conduit into pipes. Pierce County is not a water purveyor, although it had the largest number of water purveyors in the state and the most franchisees. Thurston County PUD was purchasing several small water companies in PC, which could improve the sector. "Purple pipe" reclaimed water was not an issue.

The County Transportation Improvement Program (TIP) is for six years with $11M of state and federal grants in 2018, focused on standard transportation improvement, above ground. Every time a signal was serviced, it would be upgraded to newest technology. There was no budget line item for "fiber improvements" and more of this was in the O&M budget than capital improvement. The work was done independent of IT due to security concerns and has a transportation purpose due to statutes as part of "County Road Fund." IT had no role on traffic technology. There was "miscellaneous" bucket for opportunistic builds in TIP.

The overall budget was $72M, including about $25M for capital improvements. "Complete Streets" were part of planning and the County thought it necessary to prepare for connected and autonomous vehicles today. The County has 1520 centerline miles of road with lane miles total

quite a bit higher. The County has 7 lane roads, many 3 lane and 5 lane roads, and 80 intersections. They were building 3 to 5 intersections a year.

Congestion efforts dealt with concurrency but fell behind the intersection work. Not all signals were connected. So, a lot of signal work was expected for the future, prioritized by traffic pattern and fatalities data. All traffic work, construction, etc., was done in-house. The department had a van with splice table, two Fujikura fiber-optic splicers, other tools, tents, a backup van, and inventory of fiber in warehouse.

5.1.8 South Sound 911

South Sound 911 operates under an interlocal agreement, dispatching all 41 police and fire agencies in the County, except for Joint Base Lewis-McChord and the Puyallup Tribe. South Sound 911 currently operates out of four facilities, including two recently consolidated dispatch centers. Since its inception in 2011, South Sound 911 has implemented a unified Computer Aided Dispatch (CAD) system, upgraded 911 phone system technology and continues to host the law enforcement records management system (RMS). All of which require high-speed connectivity to the current four facilities as well as to the agencies it serves. The connectivity challenges are resiliency and redundancy, although high speeds are critical.

South Sound 911 connects to the public safety agencies in a variety of ways, including using the older fiber ring in Tacoma as well as a variety of commercial vendors. South Sound 911 is transitioning internet services from CenturyLink to Optic Fusion. The 911 phone systems are now connected to the new state ESInet via NoaNet. As plans for the new Public Safety Communications Center are underway to consolidate, South Sound 911 is also planning for redundancy with its current facility on 35th Street that currently houses the data center. South Sound 911 is looking for high speed (10 Gpbs connections) with redundancy between the two buildings. High speed connectivity to other regional partners such as Valley Communications, JBLM and jails is important for booking photo projects and disaster recovery initiatives. The agency is on track for a new, fully consolidated facility in 2021.

Radio systems are managed by other entities (Pierce County and Tacoma) with the need for connectivity to utilize the public safety radio systems from both facilities. Public safety users utilize a variety of means to connect to South Sound 911 for their mobile CAD and RMS capabilities using wireless air cards from vendors such as Verizon, Sprint and AT&T typically using Netmotion to securely connect to the South Sound 911 systems.

5.1.9 Authorities and Cities

Magellan Advisors interviewed representatives of many cities or towns in Pierce County—including Eatonville, Puyallup, and Sumner—and the Pierce County Transit Authority. The Town of Eatonville is a rural community of approximately 3,000 residents, located in Pierce County roughly 60 miles south of Seattle and 30 miles southeast of Tacoma, nestled among the foothills of Mt. Rainier. The Town provides electric power, water, wastewater, stormwater, garbage, and recycling utilities. They purchase power through BPA. They have limited SCADA systems with their water solution, but not for power.

One million cars a year pass through Eatonville on their way to Mt Rainier. The Visitor Center offers Wi-Fi, but the City does not offer it anywhere. The Police Department is contracted

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through the sheriff's office. Schools are the largest employer, with elementary, one middle, and one high school. The community does not have any real industrial areas. It is mostly a bedroom community with a few store front businesses.

Rainier Connect provides fiber broadband to the City of Eatonville but will only build to certain areas where enough people pre-sign up for service. Rainier Connect got an American Recovery and Reinvestment Act (ARRA) Grant to build fiber to area homes and business. Comcast and CenturyLink also provide services. In town, most have access to broadband, but just outside town, in the unincorporated communities, broadband availability tapers off quickly. Cell service for the City is provided by Verizon. Coverage was pretty good inside the city, but less so outside city boundaries.

The City of Puyallup, home to about 40,000 people, is located just southeast of Tacoma. It had been contracting with UPN Fiber (United Private Network Fiber) for six and twelve strands of fiber in a few areas of the city. Most sites were connected via city-owned fiber with UPN for outlying areas. Two-inch conduit was required for all new construction. The City uses Wi-Fi and Office 360, internally. It managed 52 traffic signals and had a few PTZ cameras for traffic. Traffic Signaling systems were radio-based, but the City was moving to fiber solutions. New fiber for traffic signal had handholds every 300'. The Police Department used NetMotion for mobile connectivity with AirCards from Verizon. There were two cameras in the jail, and ALPR in two units, but no body cameras. The City was implementing a new jail system for cameras, booking etc. The Puyallup Technology Park has a 50,000 sq. ft. data center used by Wave.

Sumner has about 10,000 residents, however the daytime population is much higher because there is a fairly large industrial/commercial base in the City, including several Fortune 100-500 companies. There are more jobs in Sumner than people, which is a good problem to have. Wave recognized the need for broadband in the industrial areas, so they built a fiber network to provide robust broadband. The City was not sure exactly what was available, but heard it is pretty good (there had not been any complaints for specific areas). Zayo provided an extensive fiber network as well, which the City used to connect some facilities. Zayo has both underground and aerial assets serving many businesses. Comcast offered coax-based residential broadband up to about 200 Mbps. CenturyLink used DSL, so speeds were much slower. Residents were frustrated because they did not have any alternatives to Comcast or CenturyLink.

Sumner was considering a Dig Once policy. A broadband/fiber consortium in King County, called C3, was established to address county-wide fiber. Sumner was interested in participating in something similar for Pierce County. Sumner had not done much on Smart City initiatives and did not own any fiber. The City was very interested in some joint trench opportunities and wanted the County to coordinate any interagency opportunities.

The City Police Department has no body or car cameras. Sumner's IT group managed all the police communications, data, and devices. They used Verizon for mobile connections, South Sound 911 for dispatch, and Integraph and NetMotion for wants and warrants. They had no handheld devices and were not using ALPR or other license plate readers. Most of the City's 20 to 30 signals traffic signals, except for the DOT, connected via copper-based infrastructure. Sumner was mostly using Comcast for their connectivity, along with some leased fiber, and

seemed to have enough bandwidth. One or two smaller facilities were using DSL (Centurylink), but the City planned to upgrade.

Sumner's permitting process was not yet online, although it would be soon. Inspections were to be online/mobile soon as well. Sumner Parks and Recreation offered computer classes at a senior center. Their internet connection is DSL, so it is very slow. The City was hoping to get better access to that facility soon. Comcast quoted $10K to connect, which was cost prohibitive. The City has a data center onsite and was slowly moving to the cloud (Azure) over time. They were interested in the data center being built in Puyallup as a colocation facility.

Pierce Transit has its own police personnel who work in conjunction with the Sheriff. The Pierce Transit Police had roughly 23 emergency vehicles, including patrol cars, equipped with a Verizon Aircard for data access with laptops in each vehicle. Coverage was pretty good although it was limited some of the more rural areas. They had docking stations in cars that attach to external antennas for better coverage. FirstNet had not approached them for services. They did not use body or in-car cameras due to onerous records request requirements by the State. There were 144 cameras in eight locations (transit centers, etc.) with video sent via Comcast to a location near the Tacoma Dome for storage.

Sound Transit coaches have cameras with video and audio that allow the police to do a live look-in to see what is happening. All cameras are cellular based. The Transit Police cars had Opticom for holding the green, but it was not used widely. SouthSound911 provided all their facial recognition; pictures must be taken and sent to SS911 for determination. Fingerprints and wants & warrants were available in each car and would soon be available via handheld devices carried by the officers. Radio communications was via LTE-capable Motorola radios. They were in the process of upgrading some of those systems and were looking into grants for drone usage for traffic and 3D scanning.

5.1.10 Schools and Libraries

The Bethel School District covers over 200 square miles in southeast Pierce County. It was the 16th largest district in the state with an estimated enrollment of over 20,000 students in 16 elementary schools (K-5), six middle schools (6-8), three comprehensive senior high schools (9-12), an alternative high school (9-12), an elementary online academy, a school of choice (K-7), and the Pierce County Skills Center. The K-20 network provided 5 to 10 service to each school, and Rainier Connect provided some of the last mile connections

The district had 1:1 device policy for the students, including over 23,000 iPads to all students grades 6-12, and 100+ T-Mobile hot spots for those who could not afford service at home. Teachers all had iPads and laptops. There was Wi-Fi in all buildings and classrooms, and it was planned for the outdoor areas. The iPads were locked down for security. A local tech levy provided the funds and E-rate covered much of the internet access costs. Four schools had cameras, though none had access for the police. The district's 200 buses had a Stop Camera with ticketing system for non-stopping cars and cameras in the buses with local recording only. The schools used Nortel VoIP PBX and Destiny library asset management. There were backup generators at each school.

Puyallup School District had about 25,000 students. It was using Windows 10 platform and moving to 1:1 for notebooks. They were concerned about a digital divide because of affordability

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and availability. Some students only had cell phones to access the internet, which was not seen as a good solution. The teachers were being trained on teaching with technology, although some are still not convinced it was effective. They provided online education for about 500 students, including home-schoolers.

They have about 1000 security cameras in the schools with 7-day video retention, that the local police could directly access. There were no cameras in classrooms with video retention. Administrators could automatically and remotely lock/unlock doors. They used Avaya VoIP and Skype for Business for voice communications, and OneDrive and Azure for storage. The main site had 10 Gbps service and was upgrading to 20Gbps. Each elementary school had a 1Gbps connection. K-20 was a provider. The school's Wi-Fi supported two connections per student. They had 185 buses with cameras, front and rear audio, and fleet tracking.

White River School District had 3700 students, mostly suburban with some rural areas, with 1:1 Chromebooks for each student middle school and above. Kindergarten and first grades have iPads, and grades 2 through 5 had computer carts in their classrooms. Most schools had 1 Gbps connections from K-20 Network, although one had Comcast 100 Mbps service. All classrooms had Wi-Fi access. Some students did not have service at home, either due to affordability or availability. For affordability issues, the district provided T-Mobile "Hot Spot" ($10 per month) internet access with 2GB per month data caps, and the schools offered open Wi-Fi access.

Pierce County Libraries have 20 branch locations, which seemed to have plenty of bandwidth. Comcast and Wave provided gigabit broadband to each branch except the one on Anderson Island. E-Rate paid about 80% of the connectivity costs, which allowed the libraries to provide many technology resources. They offered free Wi-Fi in all their libraries during library hours, but they turned off Wi-Fi after hours because too many people were hanging around the library and neighbors did not feel secure. Wi-Fi was being used by some of the neighbors in lieu of their own broadband plans. They might implement a registration system to address the issue. The libraries used Polaris Check-out system and had no POS systems.

Libraries all offered laptops for use within the facility and to take home, just like a book, and had desktops and laptop labs used for training. They were a Microsoft shop, moving away from Chromebooks, and did not offer iPads. Children's computers for early education were controlled with limited access. They provided prints and copies for a nominal fee, e-Books through 10 different sources, and a range of subscription-type services (for car repair manuals, for example). One facility (Gig Harbor) had just started using a Law Library content solution. Most facilities had employment content, classes (resume writing, etc.) and job match functions. Most branches offered computers in English, Spanish and Korean. The branches had meeting rooms, auditoriums and tech to support meetings.

The libraries were integrated with some school districts so students can check out books, e-books, and computers with their student IDs. They worked with Senior Center programs, had Book Mobiles and Summer Reading programs, all of which were using tech. The Libraries were concerned about the Digital Millennium Copyright Act as they have been getting notices that some users on their network download copyrighted content. They were working to close that loop, but that's tough in a hands-off policy environment.

5.2 Broadband Survey: Introduction

Magellan Advisors surveyed households and organizations in Pierce County, WA, about broadband. The survey gathered information about demand for and supply of high-speed internet access services—broadband—in the area. Given that broadband is physically limited to access points, this is fundamentally a survey of locations. Respondents were asked whether their home or work location had broadband. If so, we asked about the service and about key factors in their use of and willingness to pay for broadband. Basic demographic information, paralleling data gathered by the U.S. Census Bureau, was also included in the survey. Organizational respondents were asked similar questions for business.

The survey was open to the public and promoted via local associations, government, media, and schools. As a non-systematic "convenience" survey, it is not possible to say respondents represented the population or even make meaningful statements about overall response rates. Some demographic types and geographic areas responded at higher rates than others. There may be systematic reasons some people did not respond. Specifically, we should assume that persons who distrust the government, surveys, and/or technology did not respond. For these reasons, while we report numbers and statistics, the analysis uses approximate language about respondents (not the population) and conclusions are qualified as suggestions about demand. Conclusions about supply will have varied resolution due to differing response rates across areas in the County.

5.3 Survey Response Overview

The survey resulted in over 1,200 useable responses, about two-thirds of which were complete (i.e., the respondent went all the way through the survey instrument but not necessarily responded to all items). As of 2017, Pierce County had around 300,000 households and more than 17,500 establishments in 2016.[69] Based on these numbers, approximately 0.4% of households responded, and 0.3% of organizations.

Table 5.1 Survey Response Overview

Survey Responses	All	Partial	Complete	
Total	1,234	394	840	68%
Household	1,188	368	820	69%
Organization	46	26	20	43%

The Census Bureau estimates that 83.5% of households in Pierce County had some type of broadband, 7.6% had low-speed connections only, and 13.9% had no Internet access.[70] Survey responses, shown in Table 5.5.2, in contrast, were more likely to be from households with low-speed connections. Even if internet access increased since 2017, responses seem to include

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[69] Source: U.S. Census Bureau, American FactFinder, Community Facts, https://factfinder.census.gov/faces/nav/jsf/pages/community_facts.xhtml

[70] Source: U.S. Census Bureau, American FactFinder, *2013-2017 American Community Survey 5-Year Estimates, Presence and Types of Internet Subscriptions in Household,* https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?pid=ACS_17_5YR_B28002&prodType=table

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10% fewer "no broadband" households than the population. The practical implication is that we must assume any conclusions about household access are "best case." The Census Bureau does not collect data about organizations' internet access but it is reasonable assume that a larger percentage of organizations have internet access than households, which is what we see in survey results.

Table 5.2 Internet Access by Household and Organization Respondents

Type	All	Internet Access		
		High-speed Broadband	Low-speed	None
Total	1,234	978	217	39
	100.0%	79.3%	17.6%	3.2%
Household	1,188	937	213	38
	96.3%	78.9%	17.9%	3.2%
Organization	46	41	4	1
	3.7%	89.1%	8.7%	2.2%

Some areas of Pierce County had relatively higher response rate than percentage of population, detailed in Table 5.3. Relatively large numbers of responses came from cities around and outside of Tacoma in the eastern portions of the County. While 14% of responses came from Tacoma, it accounts for a quarter of the County's population. Gig Harbor, Ruston, Roy, Buckley, Eatonville, and Puyallup all contributed heavily to the results. Carbonado also responded more than would be expected. Residents of Tacoma, Auburn, Lakewood, and University Place may be under-represented in the results.

Table 5.3 Survey Responses by City

City	2016 Population	Percent County	Percent Responses	Difference
Gig Harbor	9,110	1.1%	10.8%	9.7%
Ruston	816	0.1%	9.4%	9.3%
Roy	822	0.1%	9.4%	9.3%
Buckley	4,682	0.6%	9.5%	8.9%
Eatonville	2,959	0.4%	4.9%	4.5%
Carbonado	663	0.1%	2.6%	2.6%
Puyallup	40,640	4.9%	7.1%	2.2%
Orting	7,693	0.9%	2.3%	1.4%
Wilkeson	492	0.1%	1.0%	1.0%
South Prairie	435	0.1%	0.4%	0.4%
Bonney Lake	20,310	2.4%	2.8%	0.4%
Steilacoom	6,309	0.8%	0.7%	-0.1%
Edgewood	10,734	1.3%	0.6%	-0.7%
DuPont	9,497	1.1%	0.5%	-0.6%
Milton	7,970	1.0%	0.3%	-0.7%
Fircrest	6,780	0.8%	0.1%	-0.7%
Pacific	7,122	0.9%	0.0%	-0.9%
Sumner	9,969	1.2%	0.3%	-0.9%

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City	2016 Population	Percent County	Percent Responses	Difference
Fife	10,103	1.2%	0.0%	-1.2%
Enumclaw	11,654	1.4%	0.2%	-1.2%
University Place	33,288	4.0%	1.5%	-2.5%
Lakewood	60,665	7.3%	2.6%	-4.6%
Auburn	77,472	9.3%	0.9%	-8.4%
Tacoma	211,277	25.4%	14.4%	-11.0%
County Total	832,896			

5.4 Households

The average size of respondent household was just over 3 persons, the maximum size was 8, the median size was 3, suggesting an equal number of responding households had between 1 and 3, and between 3 and 8. The most common size of responding households was 2 persons. The average household size for all of Pierce County was 2.6 persons and the average family size was 3.1, according to the Census Bureau. The median age of the youngest person in responding households was 24 and mode, or most common, age was 12. For the oldest, the median was 55, the mode 65, and the max was 98. The calculated median age was 29, whereas the Census Bureau estimated the median age of the county population to be 36 in 2017. Therefore, responding households tended to be smaller and younger than the population overall.

Figure 5.1 Survey Respondents Compared to the Population
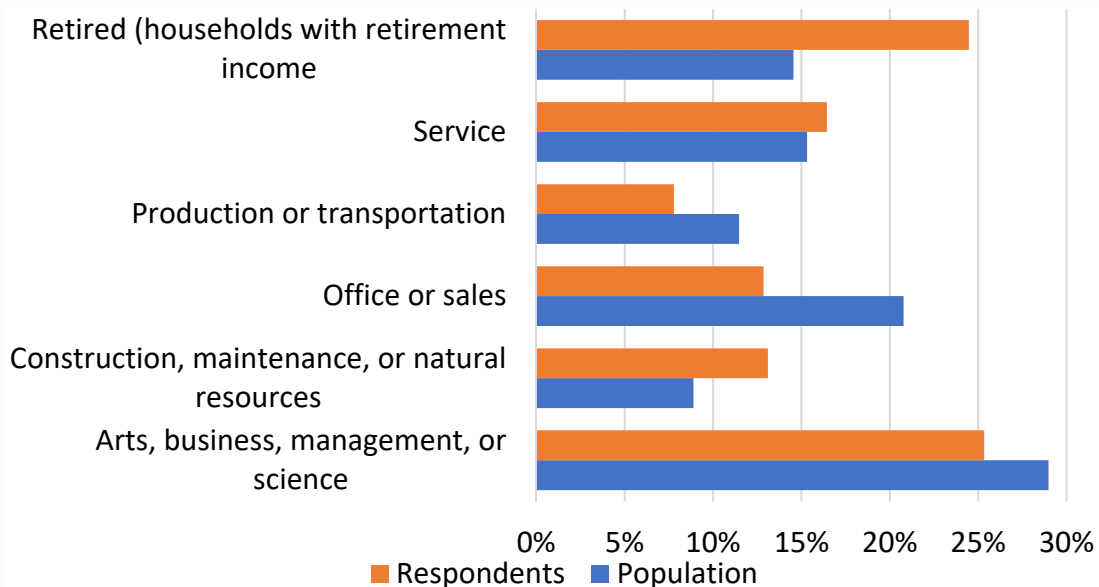
At the same time, as illustrated in Figure 5.1, respondents tended to be retired, in construction or related fields more than the population. Persons in service industries responded at slightly higher rates than in the population. The survey had relatively fewer responses from persons in

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sales, production, and management occupations. Respondents also had relatively higher levels of educational achievement than the population. Over a quarter of respondents had graduate degrees and over a third had bachelor degrees, compared to less than 10% and less than 20% in the population. Households led by persons with less than a college degree responded at a lower rate than would be expected by their percentage of population.

Figure 5.2 Educational Achievement of Respondents and Population Compared
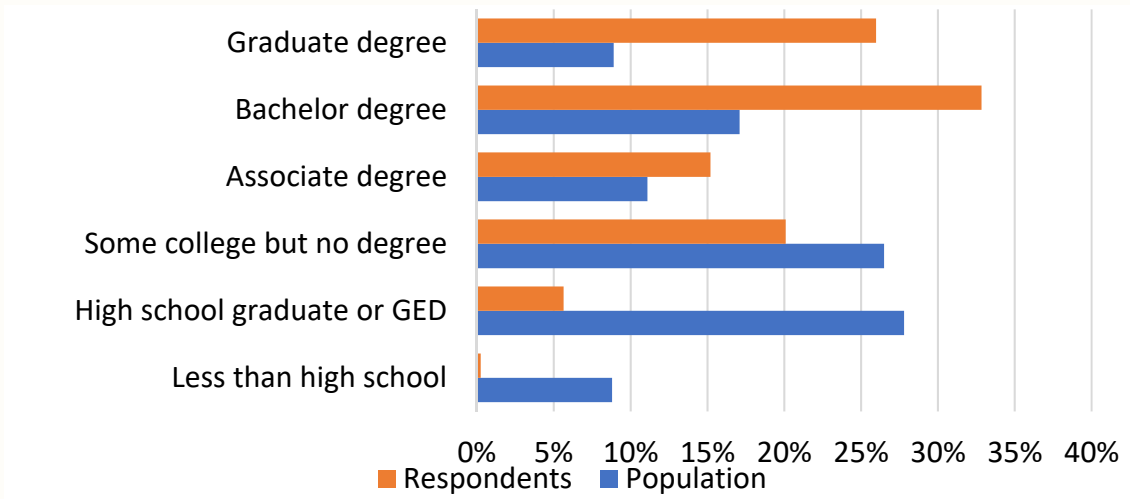
There are important caveats when comparing survey responses to the population. The survey was of *households*, whereas most Census statistics are for *individuals*. The survey asked for highest level of educational achievement and occupation of the primary breadwinner. Thus, educational achievement will naturally be higher for survey results. Most households have persons in various occupations, so our results under-count occupations. Household age and size statistics are approximations calculated from ranges in survey results with limited details about people within households. The results do provide clear and useful input from over 1,200 households, from across Pierce County, representing the experience, interests, and views of their neighbors.

5.4.1 Household Broadband Demand

General activities within a household indicate latent or potential demand for broadband. School work or training was the most common activity of the four included in the survey among respondents. Working from home was the next most common activity. Both of these were reported by a higher percentage of respondents without broadband than by all respondents. Households without broadband tended to have fewer home-based business and health monitoring activities. The largest relative gap between households with and without broadband was for home-based businesses, followed by schoolwork. Respondents with broadband had an average of 8 connected devices, and those without had 6.5.

Figure 5.3 Online Activities in Households
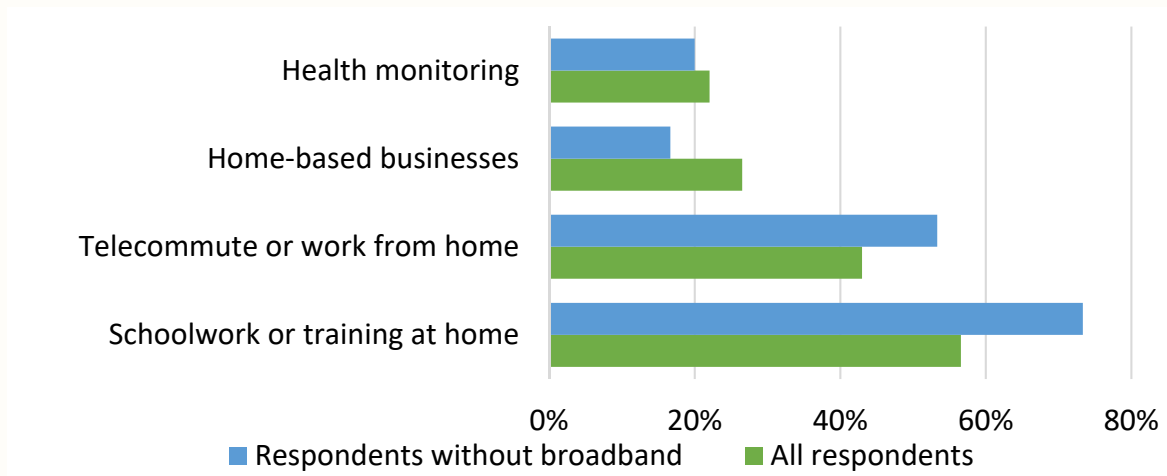
Interpersonal communication was overwhelmingly the most common online activity, followed by general interest research, which about two-thirds of households do on a daily basis. Eighty (80%) percent of respondents' households get entertainment only at least once a week. Home business is by far the least common activity, which about two-thirds of responding households never do. About half of respondents never or rarely work from home. Gaming and learning are mixed, with bifurcated results: Some households do them regularly while others do them rarely. Buying and selling online are mirror images of each other. About a two-thirds of households regularly buy online and two-thirds rarely sell online. A larger percent indicate frequently selling online than indicated never buying online.

Figure 5.4 Frequency of Online Activities

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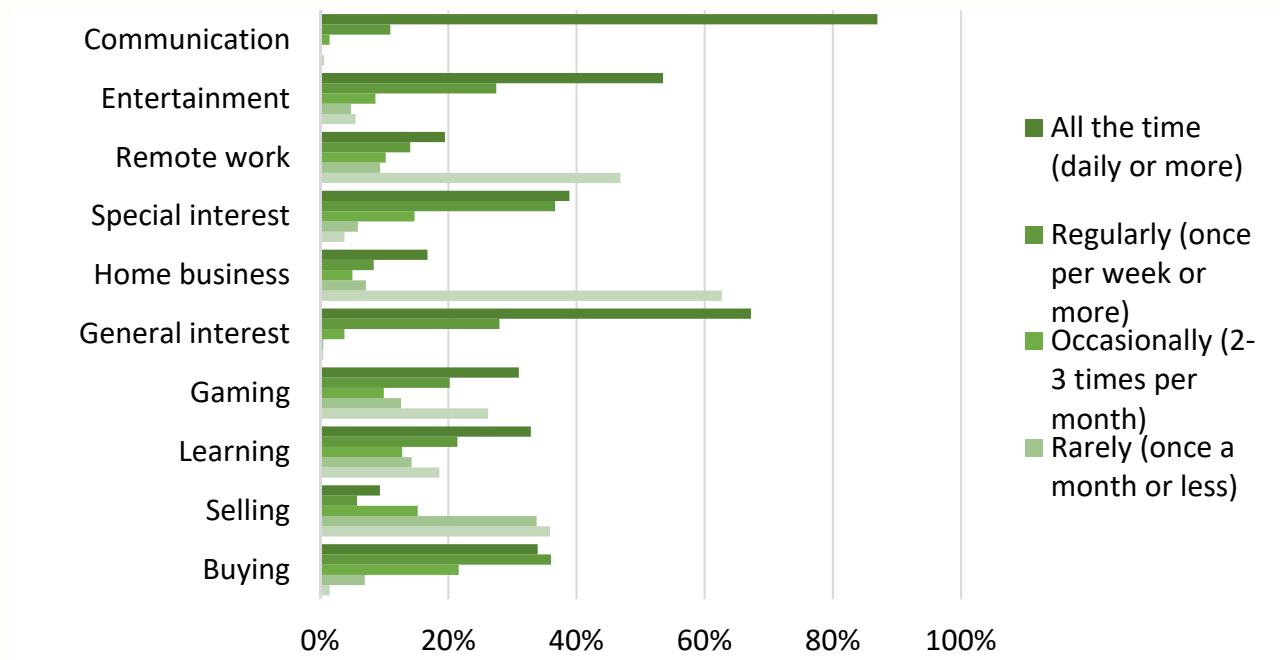
Nearly a quarter of responding households watch no traditional broadcast or cable television, while about a seventh watch no streaming video. Just over a third each of households are primarily streamers, traditional viewers, and hybrids. Generally, respondents were more likely to be traditional broadcast television viewers than streamers.

Figure 5.5 Percent of Responses by Level of Traditional Television Viewing Versus Streaming
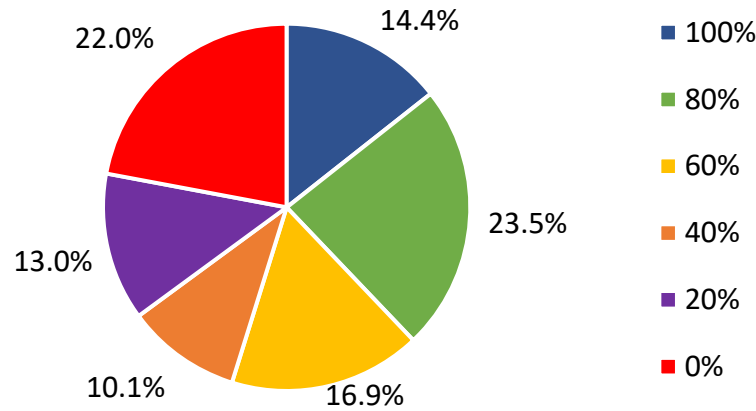
Respondents overwhelmingly indicated that internet access is either critical or very important. They rated reliability even more highly. Almost two-thirds indicated that speed was very important while less than a third said it was critical. Price was similar although less: A quarter of respondents indicated it was somewhat important. Customer and technical support was the attribute most often cited as somewhat important.

Figure 5.6 Importance of Broadband Attributes
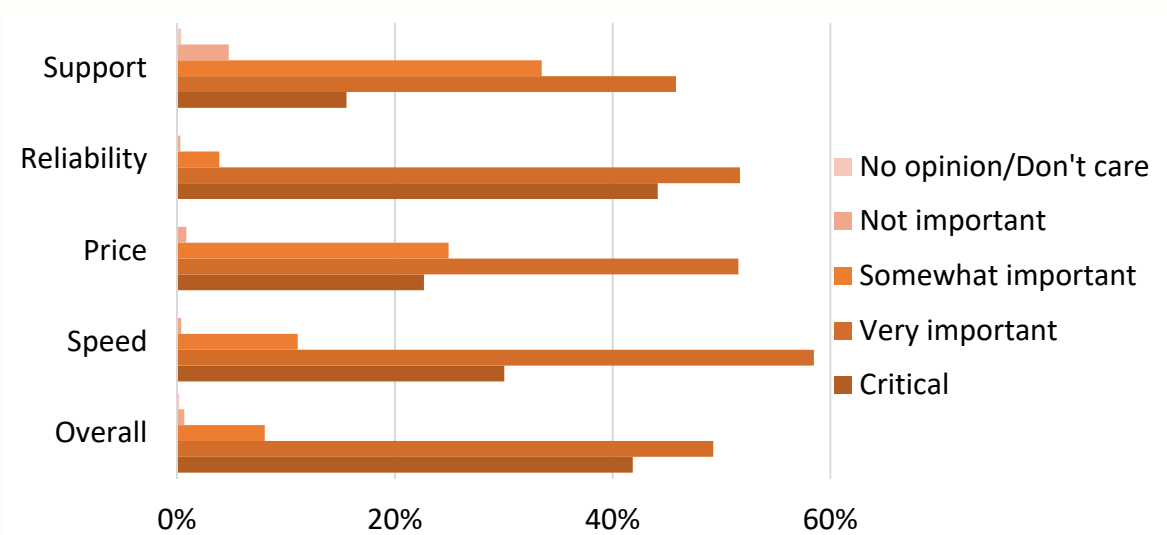
Lack of available services was respondents most frequent (over 70%) number one reason for not having broadband, as seen in Figure 5.7. The second most cited reason was available services were too slow, which over half of respondents ranked as the number two reason. The cost of broadband was the third most highly rated reason, followed by having access elsewhere.

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Respondents clearly saw a need for broadband, although about a third of respondents seemed to feel their smart phones met their internet access needs.

Figure 5.7 Reasons for Not Having Broadband Ranked
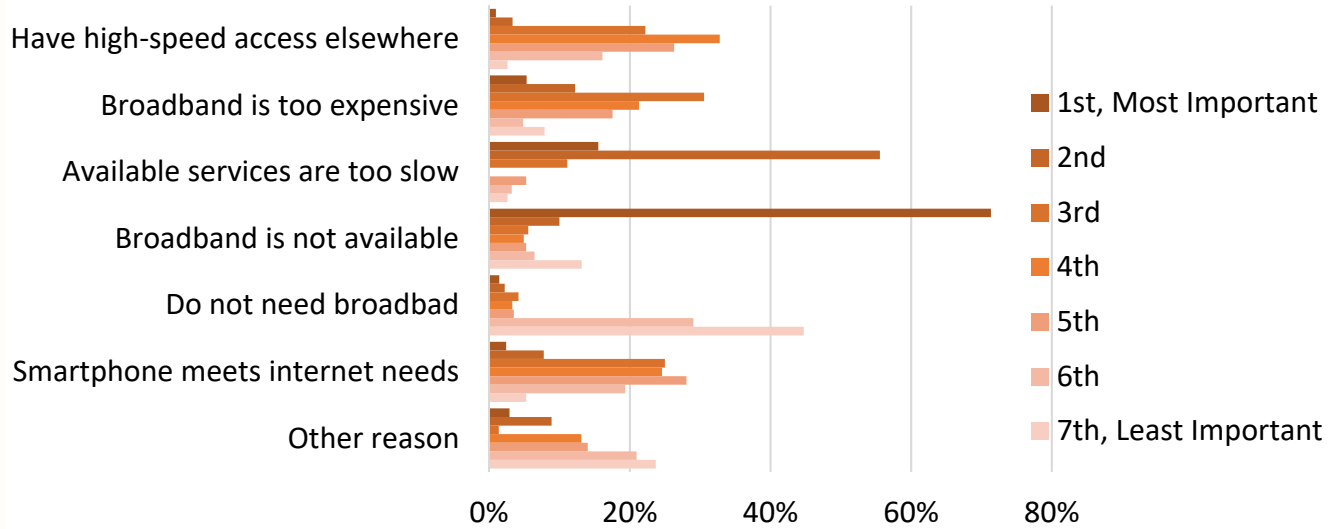
Respondents were generally willing to pay about $25 per month for basic broadband, which equates to about $1.00 per 1 Mbps per month. Figure 5.8 shows approximately how much respondents would be willing to pay for various speeds. Two-fifths would not pay anything for broadband that did not meet the 25 Mbps downstream and 3 Mbps upstream criteria. Around $80 would be acceptable for about half of respondents to pay for 100/20 broadband. About two-fifths would pay in the $100 per month range for gigabit service, and a quarter would clearly pay more.

Figure 5.8 Willingness to Pay for Broadband Services of Various Speeds
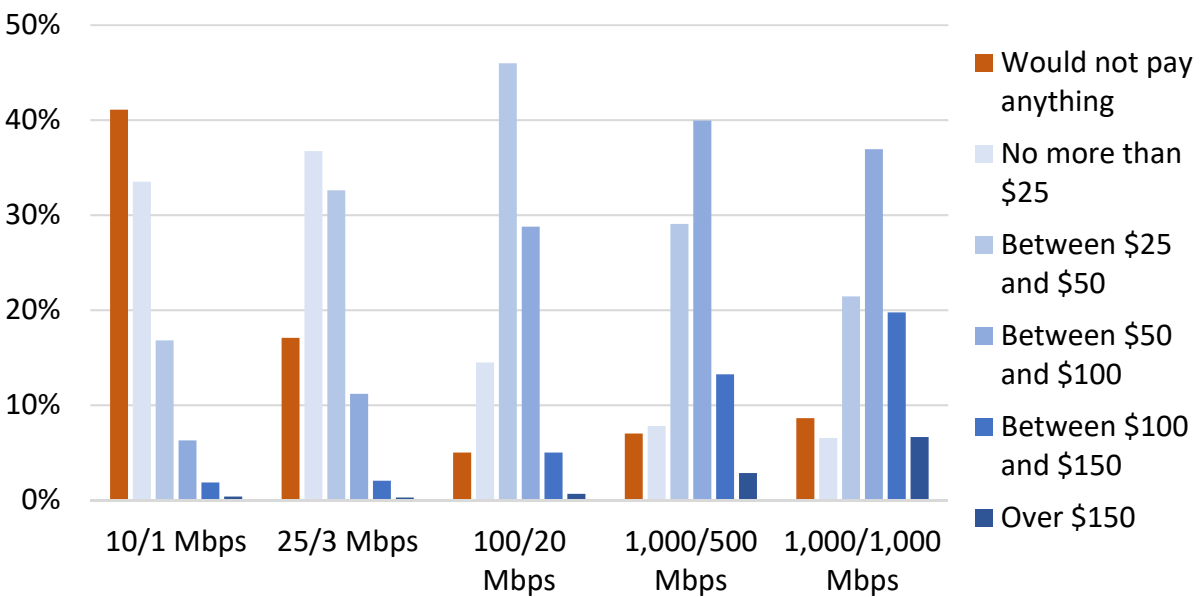
The difference between percentage of respondents willing to pay for services with terrible customer service and technical support is shown in Figure 5.9. Across the board, poor service increased respondents' unwillingness to pay anything by 15%. Poor service especially impacted willingness for higher speed services, reducing willingness to pay a typical low price—between $50 and $100—for 100 Mbps or faster—by about 10%. Respondents' willingness to pay common prices for basic service decreased over 10% with poor service. Note that this is stated willingness to pay rather than demonstrated.

Figure 5.9 Impact of Service and Support Quality on Willingness to Pay
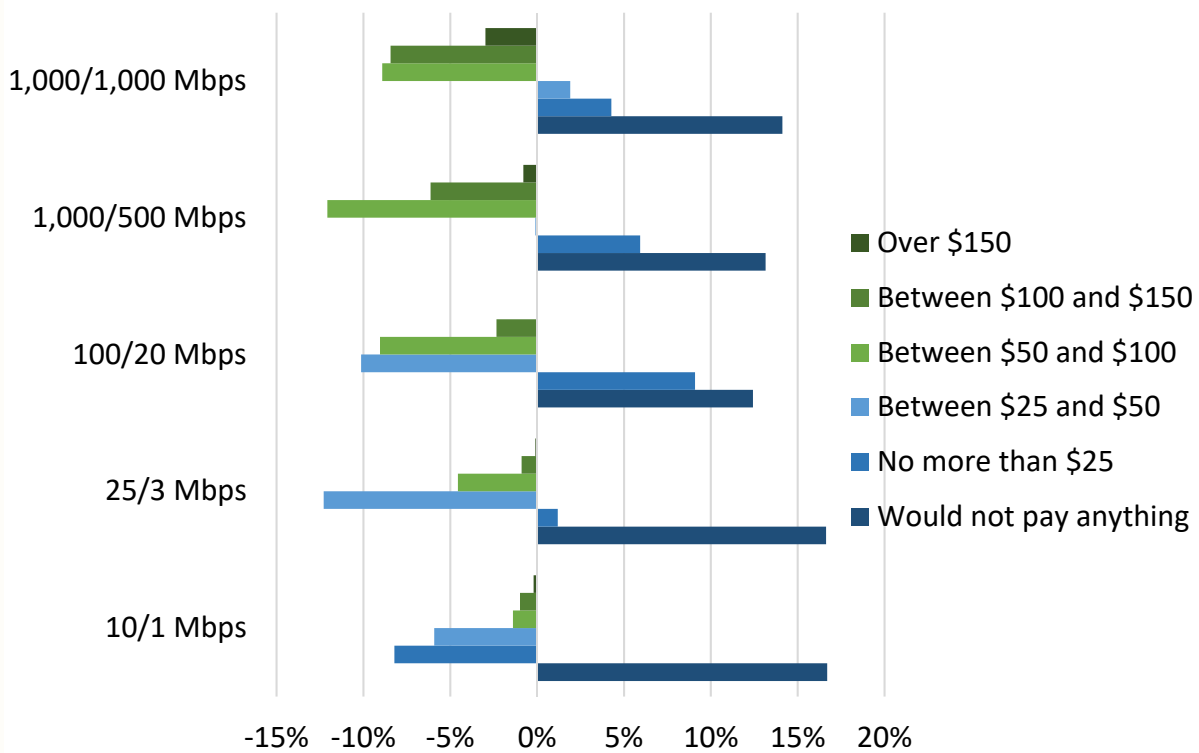
5.5 Organizations

Organizations were a small fraction of all responses (less than 4%), and they responded at lower relative rate than household. Organizations also varied more than household in key characteristics such as purpose and size. Therefore, a detailed analysis of their responses would not be meaningful. Regardless, they should be considered and may offer some hints into how broadband impacts business in Pierce County.

A third of organization responses came from manufacturers, around 15% were in construction and related industries, and about a tenth were from education. One response each came from seven different sectors related to higher-skill, higher-pay services such as healthcare and utilities. On average respondents had just over 2 locations in Pierce County, and 95% were headquartered in the area. Respondents' average size was 32 employees in the area, the median size was 4.5, and the mode was 2. These statistics tell us the majority of respondents were much smaller than average. One respondent had 300 employees locally.

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Half of respondents generally indicated technology to be critical across all business functions. General administration, purchasing, and customer support were the most dependent on technology for respondents, and outbound logistics appeared to be the least technologically dependent function. Customer expectations was the strongest driver of technology investment, followed by cost savings and new revenue opportunities. Competitive pressures were also important. Lack of available solutions was by far the biggest barrier to respondents' tech investment. Personnel acceptance of technology, uncertainty about benefits, and leadership support were not seen as barriers by most respondents. A quarter saw getting IT expertise to be a problem, and a fifth had a problem finding workers with basic digital skills. Half and two-fifths of respondents, respectively, did not have these problems.

Generally, organizations' responses about broadband services and issues paralleled those of households. Organizations reported higher committed rates from providers, but had similar actual speeds to households. Internet is generally even more important to organizations than households, and they rated reliability, speed, and support more highly, too. Price is less of an issue. Organizations reported more connected devices, higher spending, and higher costs for broadband than households.

Figure 5.10 Likelihood of Respondents' Organizations Moving for Better Broadband
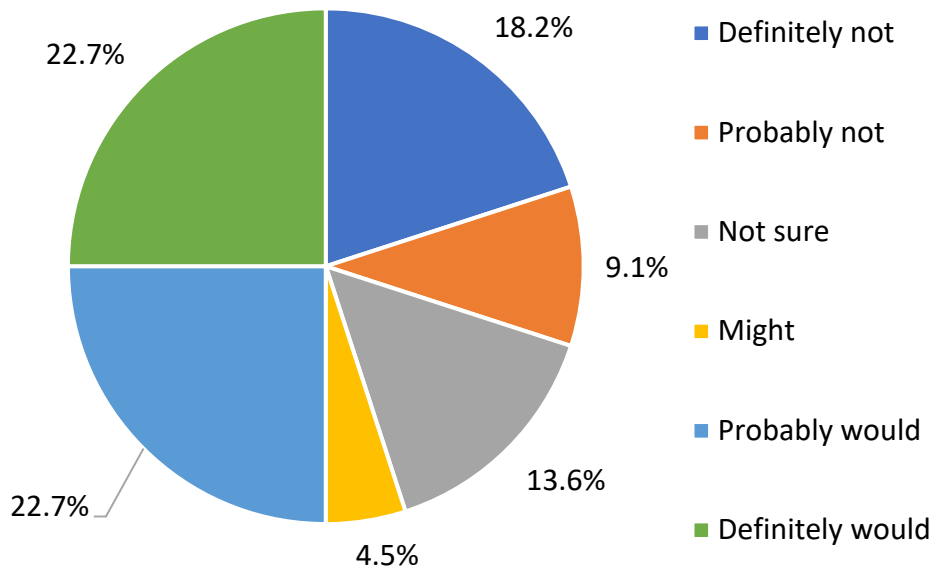
A key issue for organizations is location, and availability of broadband, especially fiber-based services, can directly influence location decisions. Increasingly, organizations are virtual with fewer geographic market ties and physical assets that might limit their mobility. They can work wherever they have connectivity. About half of responding organizations said they definitely or probably would relocate for better, cheaper, and faster connectivity. Less than a fifth said they definitely would not, only slightly more than the percent that were unsure.

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5.6 FCC Reported Broadband Supply

5.6.1 U.S. Baseline Coverage

On December 12, 2018 OOKLA released U.S. fixed broadband speed test data for Q2 – Q3 2018.

Nationwide, the average Internet download speed was 97.25 Mbps, and average upload speed was 32.88 Mbps. Mean download speed increased by nearly 36% from 2017, and upload speed by 22%, driven in part by the expansion of gigabit service across the U.S. At a global level, the U.S. ranked 7th seventh for download speed and 27th for upload speed.

Washington state ranked 9th in the Country, with an average download speed of 106.65 Mbps and upload speed of 25.76 Mbps. The fastest ISP in the Washington was Xfinity.

Kansas City, Mo. was the fastest city overall with downloads of 159.19 Mbps, and its top provider for speed was Google Fiber. Seattle averaged download speeds of 119.89 Mbps. Wave G was cited as the fastest ISP.

5.6.2 FCC Baseline Data for Pierce County

The FCC's most recent fixed broadband availability map as of January 31, 2019, shown below, is based on data self-reported by Internet Service Providers as of June, 2017. (The FCC will update the map with December 2017 data in the near future.)

Darker shading indicates a higher number of Internet Service Providers offering speeds of at least 25 Mbps downstream and 3 Mbps upstream. Black shading represents 12 or more providers. The light green color on the map indicates only 1 or 2 providers of broadband service, but data includes higher latency satellite service that affects usability for interactive applications such as gaming and voice calls. In addition, like mobile broadband providers, satellite service providers often cap the amount of Internet data that can be downloaded and uploaded each month, imposing additional charges for data overages.

Figure 5.11 FCC Fixed Broadband Availability Map – Pierce County, WA, as of June 2017

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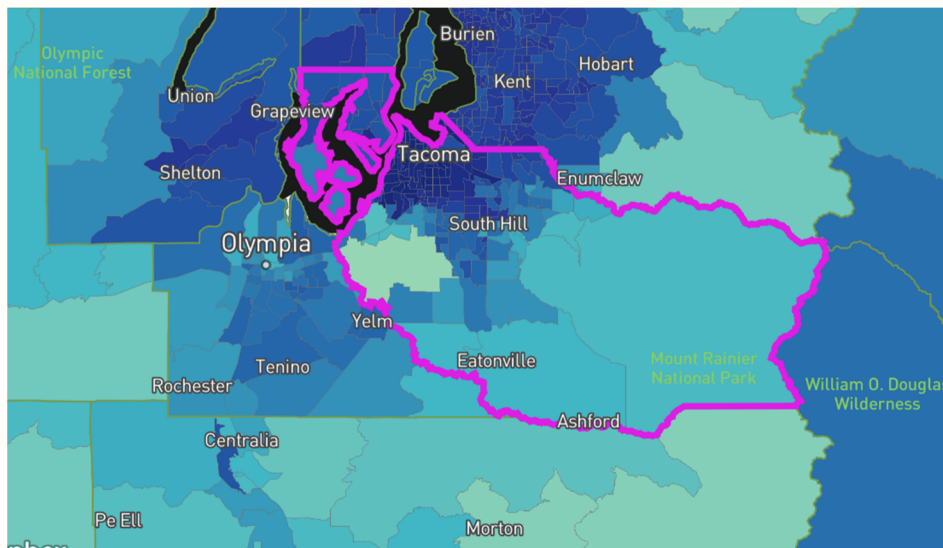
At a meeting with Pierce County representatives in 2018, a high priority target area for acceleration of broadband service was Frederickson – a major industrial area for the County reporting loss of customers due to lack of broadband access. Data reported to the FCC as of June, 2017 in the map of the Frederickson area below showed that there were census blocks in the area (depicted in light green) with only one provider offering 25/3 Mbps service.   A closer examination of these census blocks revealed that only DishNet, a satellite service provider, offered 25/3 Mbps service.   Wireline copper-based service speeds from CenturyLink ranged from 1.5 to 20 Mbps per second. Cable service was unavailable in the census blocks as of June, 2017.

Figure 5.12 FCC Fixed Broadband Availability Map – Fredrickson, WA, as of June 2017
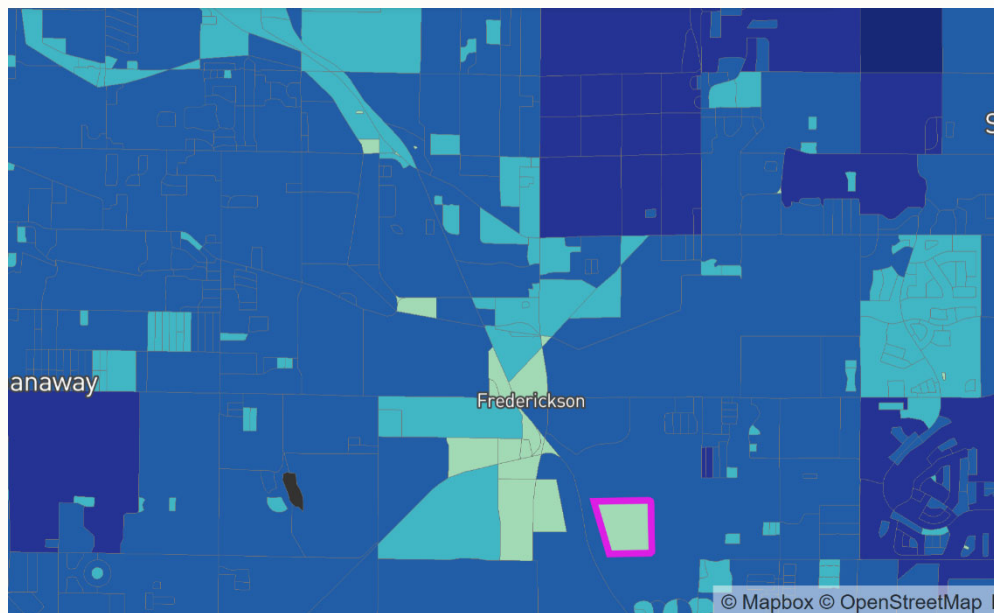
In the turquoise and blue blocks, Comcast and/or Century Link offered broadband service.

Comcast's data report to the FCC as of June, 2017 also stated that the company could provide 100% of its serving area in the map below with an Internet download speed of 100 Mbps and an upload speed of 10 Mbps. However, not all locations in the same census block may be able to access the same level of service.

5.6.3 Service Provider Infrastructure Expansion

In January, 2018 Comcast announced deployment of new Gigabit service, which would be available in most areas of unincorporated Pierce County, and throughout the following cities: Bonney Lake, Buckley, Carbonado, DuPont, Eatonville, Edgewood, Fife, Fircrest, Gig Harbor, Joint Base Lewis-McChord, Lakewood, Milton, Orting, Puyallup, Roy, Ruston, South Prairie, Steilacoom, Sumner, Tacoma, University Place and Wilkeson. Comcast stated that it would deploy the new service in phases, with completion of phases beginning at the end of 2018.

Comcast noted that the service would not be available in all areas, and actual speeds could vary based on several factors including modem capabilities.

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At completion of Comcast's 1 Gigabit service rollout, there will still be areas of Pierce County that remain unserved with 1 Gigabit service, or even terrestrial 25/3 Mbps service. The last frontier of the Digital Divide will be outside the town limits in the lowest density census blocks and areas with difficult terrain.

5.7 Magellan's Supply Findings

Magellan Advisors analyzed broadband offerings in the area to compare with survey results. There are nominally about 20 companies providing internet access in Pierce County, 17 of which have some form of retail offering. Magellan Advisors identified a total of 74 different offerings—varying by price and speed—for the area. There are 67 zip codes that make up the area, one of which (98405) had 26 different offerings available. The average offering, though, was only available in fewer than 4 zip codes.

Table 5.4 Number and Costs of Offerings of Providers Compared

Provider	Offerings	Average MRC		Per Mbps	
		Business	Residential	Business	Residential
Advanced Stream	12	$93.78	$65.95	$3.44	$2.41
Wave	11	$118.15	$72.13	$1.01	$0.89
CenturyLink	10	$132.83	$57.50	$1.01	$0.80
Comcast	10	$201.95	$66.16	$1.14	$1.64
Rainier Connect	9	$65.62	$59.14	$1.93	$0.86
Click!	5	$54.97	$54.97	$1.36	$1.36
Consolidated	4	$70.80	$70.80	$10.68	$10.68
MegaPath	4	$123.33	NA	$6.21	NA

Offered speeds varied from 3 Mbps downstream and 0.768 Mbps upstream, which does not qualify as broadband, up to 1 Gbps symmetrical, which was available for businesses in only three zip codes (98329, 98349, and 98405) and four zip codes for residential (98329, 98349, 98405, and 98413). Comcast did indicate that wherever they offer residential service, they can provide 1Gbps broadband. Comcast gigabit service had the highest price—$500 per month for asymmetrical service (120 Mbps upstream)—of all offerings.

The average offering was across all providers was 170/71 Mbps for $90 a month, whereas the median speeds and price were 35/7 Mbps for $70 a month. This means that most offerings were substantially slower and less expensive than the average. The average monthly cost per Mbps of throughput (download and upload combined) was $2.21, which varied from a low of $0.04 to a maximum of $16.75, with a median of $1.46. The most common price was $70 per month, which will purchase between 28 and 55 Mbps of throughput, depending on the provider.

5.7.1 Providers

Advanced Stream (http://advancedstream.com) is a local Internet Service Provider that provides service via Click! fiber infrastructure and point-to-point wireless.

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CenturyLink (https://www.centurylink.com/) is a publicly traded old-line telephone company—originally founded as the Oak Ridge (Louisiana) Telephone Company in 1930—headquartered in Monroe, LA, that now provides telecommunications service in 37 states. Its current state is the result of numerous acquisitions, including former "Baby Bell" Qwest (2011) and Level 3 (2016). CenturyLink does provide service to many parts of Pierce County, but has been slow in upgrading their aging systems in many parts to support 21st century broadband. CenturyLink indicated it may be some time before they have any plans for upgrades that they can release publicly. They are focused on their integration with Level 3 and are planning to upgrade their old DSL service (their dominant technology in Pierce County) to a more competitive fiber-based solution.

Click! (http://clickcabletv.com/) is an open access fiber-optic network owned by the City of Tacoma and Tacoma Public Utilities Board. The network owners don't provide service, instead they sell wholesale connectivity to retail providers Advanced Stream and Rainier Connect. The networks owners are currently evaluating fundamental changes to Click!'s business model.

Click! is in the midst of some potential changes that will affect the delivery of broadband to their service area. While Magellan did not do an extensive review of their company or business practices, or provide them any guidance, we do know they are struggling to stay profitable for many reasons. They are investigating options to help them move the business forward in a more positive fashion including being in talks with potential suitors. In March of 2019, Click announced they have selected Rainier Connect as a potential partner in running and managing this network. Details and contract negotiations are ongoing. There was a lot of public comments at various public meetings expressing concern by the community of including a for-profit company in the management and ownership mix of Click!, s0omething the Board will have to weigh carefully.

Time will ultimately tell what could have been done differently with the whole business model for Click and why it has struggled to find its way.

Click has a lot of valuable fiber-based assets that today are underutilized, hence the struggle to be profitable.

Comcast Xfinity (https://corporate.comcast.com/) is part of a communications conglomerate that includes NBC and Universal Pictures. Originally a cable television system operator, it grew through acquisitions including Time Warner Cable in 2014. It is headquartered in Philadelphia, PA, and now provides a full range of telecommunications, including enterprise network services and voice services. Comcast indicated that anywhere they provide services, they can deliver 1Gbps broadband. Their service is mainly available in the more densely populated areas and limited in rural communities.

Consolidated Communications (http://consolidated.com) was originally a local independent telephone company in Mattoon, IL. It now provides broadband and business technology solutions in 23 states.

MegaPath (https://www.megapath.com/) is a subsidiary of Fusion, Inc., a national tech services company that started in Pleasanton, CA, and is now based in New York, NY. It provides broadband, business internet, and a range of enterprise network services in 14 states, particularly Mid-Atlantic, Midwest, New England, and West Coast markets.

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Rainier Connect (http://rainierconnect.com) is a subsidiary of Mashell Telecom, Inc., a local independent telephone company serving Centralia, Eatonville, and Tacoma. Rainier Connect provides fiber-to-the-home via Click! in some communities and provides cable (DOCSIS) broadband. Rainier Connect also received some federal funding to help build fiber to Eatonville and a few neighboring communities. Their current offers requires a certain number of pre-subscribers before deploying their fiber based services. Rainer Connect (Mashell) also receives some Universal Service Funding and as such has some carrier-of-last-resort obligations.

Wave Broadband (http://wavebroadband.com/) is a regional telecommunications company, serving California, Oregon, and Washington. It was founded in 2003 with acquisitions of three cable systems and is headquartered in Kirkland, WA. Wave has since grown by acquiring other, typically small and financially distressed, systems in the region. It was purchased by TPG Capital in 2017, which owns other regional providers in New England and Texas. Wave is very interested in expanding their operations in the Tacoma, Pierce County area.

5.7.2 Long-haul and Middle-mile and Long-haul Networks

There is extensive long-haul and metropolitan, middle-mile network infrastructure in and around Pierce County. Long-haul networks, illustrated in Figure 5.13 and Figure 5.15, interconnect network service providers key sites. Figure 5.14 shows middle-mile networks, which are regional backbone networks that interconnect major sites and local access networks.[71] Selected network assets, based on data provided by Pierce County and/or the providers is included in Figure 5.16.

The notable features of all of these maps are (a) how extensive the network infrastructure is, and (b) how concentrated it is in the population centers. Many companies have fiber-optic routes and other network infrastructure in and around Pierce County, including cities and other counties. Some private infrastructure is allocated for public use, specifically the Wave network shown in Figure 5.16. A new network is being built, notably by United Private Networks, which also has infrastructure in 20 other states. And, Pierce County has a rare non-profit network, NiceNet, although it seems to be basically defunct.

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[71] Data on long-haul and middle-mile networks is from FiberLocator (https://www.fiberlocator.com/).

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Figure 5.13 Overview of Long Haul Networks
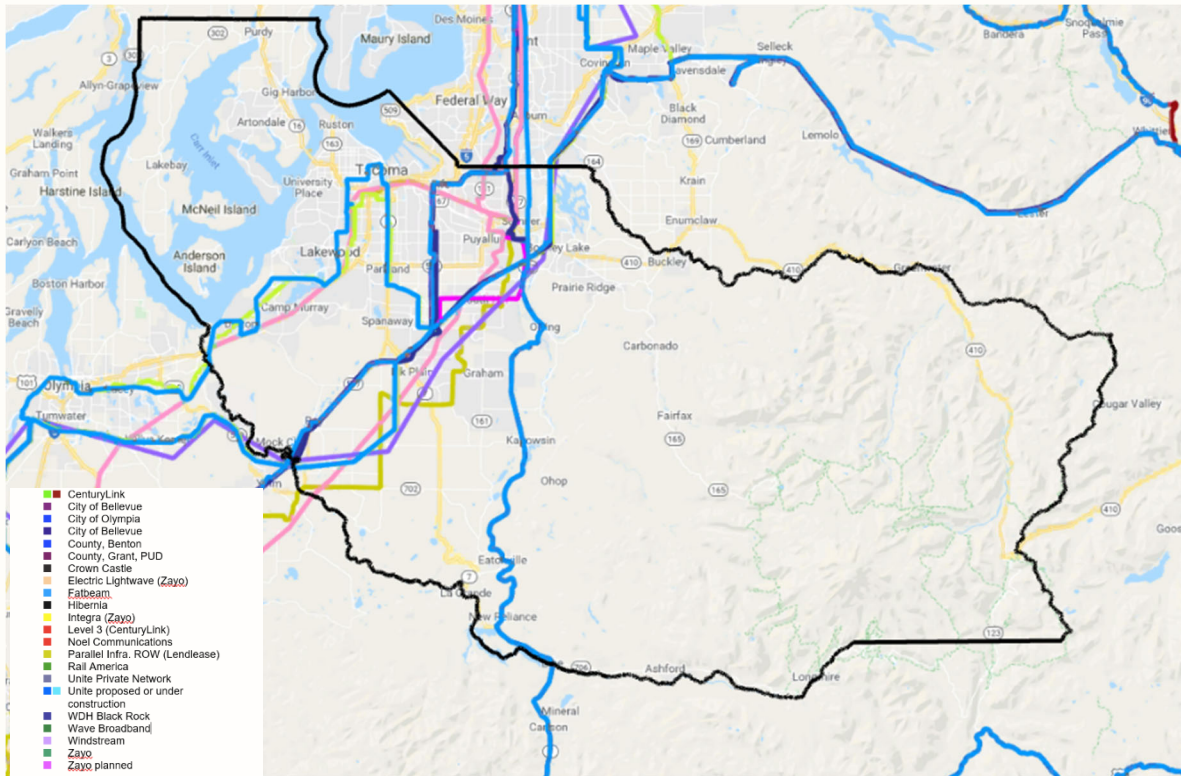
Figure 5.14 Overview of Metro Networks

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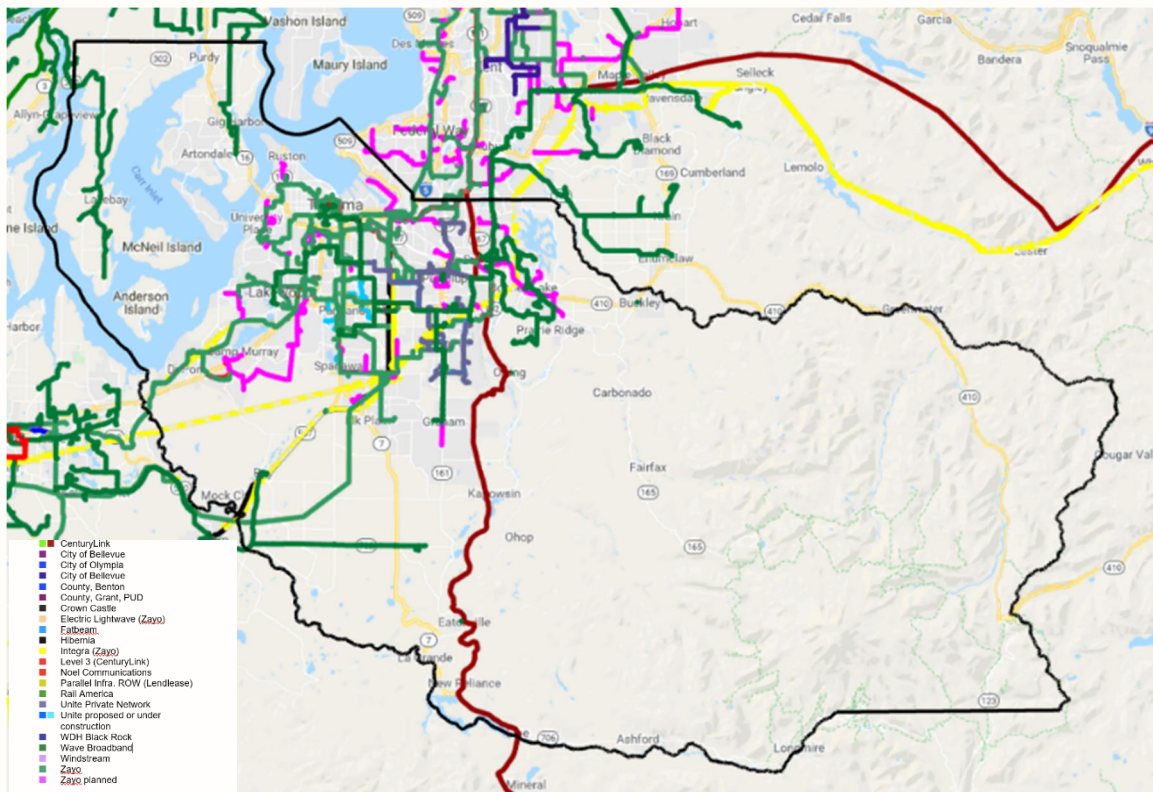
Figure 5.15 Detailed View of Networks

Metro Networks
- CenturyLink Metro
- CenturyLink Metro Leased
- City of Bellevue, WA
- City of Olympia, WA
- City of Renton, WA
- County - Benton, WA
- County - Grant, WA - PUD
- Crown Castle
- Electric Lightwave (Integra)
- Fatbeam
- Hibernia
- Integra
- Level3 Metro
- Noel Communications
- Parallel Infrastructure ROW
- Rail America (ROW)
- Unite Private Network
- Unite Private Network - Proposed
- Unite Private Network - UC
- WDH Black Rock
- Wave Broadband
- Windstream
- Zayo Metro
- Zayo Planned Routes

Figure 5.16 Additional Information on Selected Network Assets

- Nice Net
- Wave
- Unite Private Network

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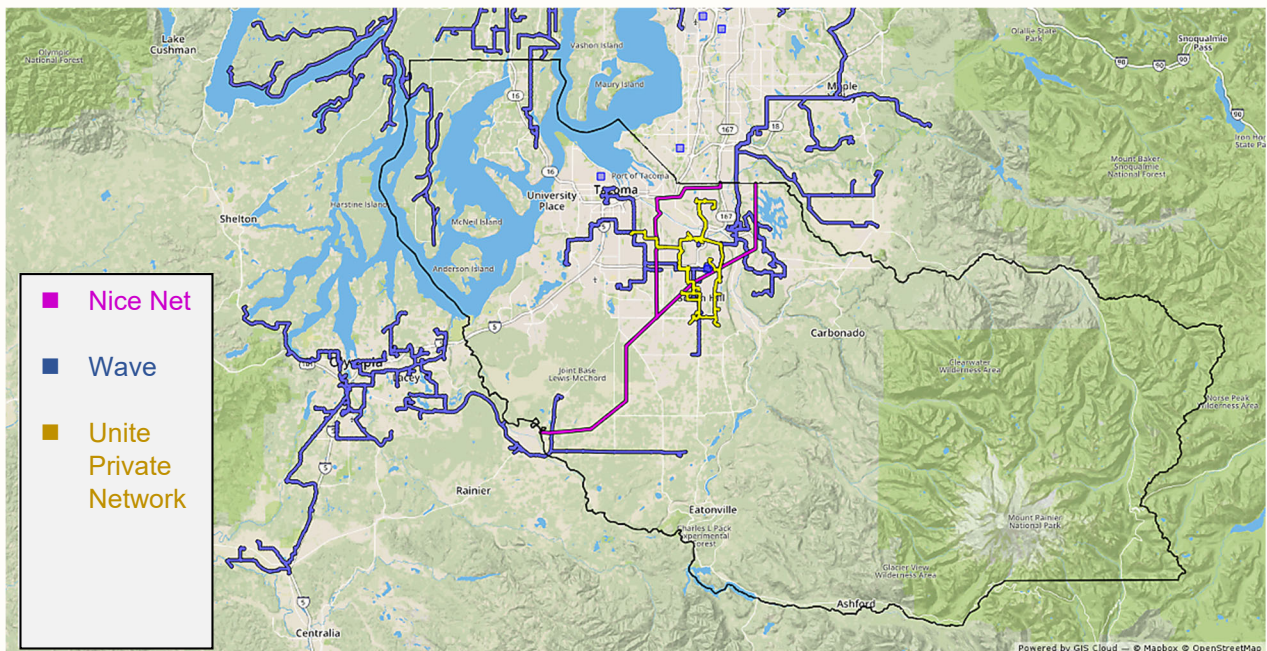
5.7.3 Survey Results

Responses identified over seven broadband service providers in Pierce County, as opposed to the 17 that nominally serve the area. Two companies appear to dominate the market: Comcast/Xfinity served effectively half of respondents and Century Link served about a third. Other providers served fewer than a tenth of respondents, most less than 5%, and less than a quarter of respondents had all other providers combined.

Figure 5.17 Provider (689 responses)
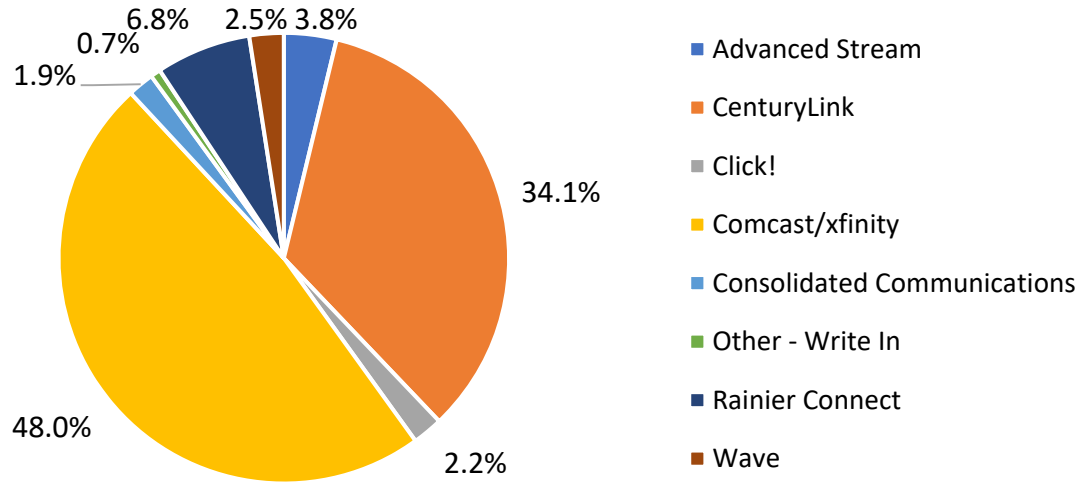
Figure 5.18 Response Locations by Provider

Pierce County, WA
Broadband Connectivity and Access Evaluation
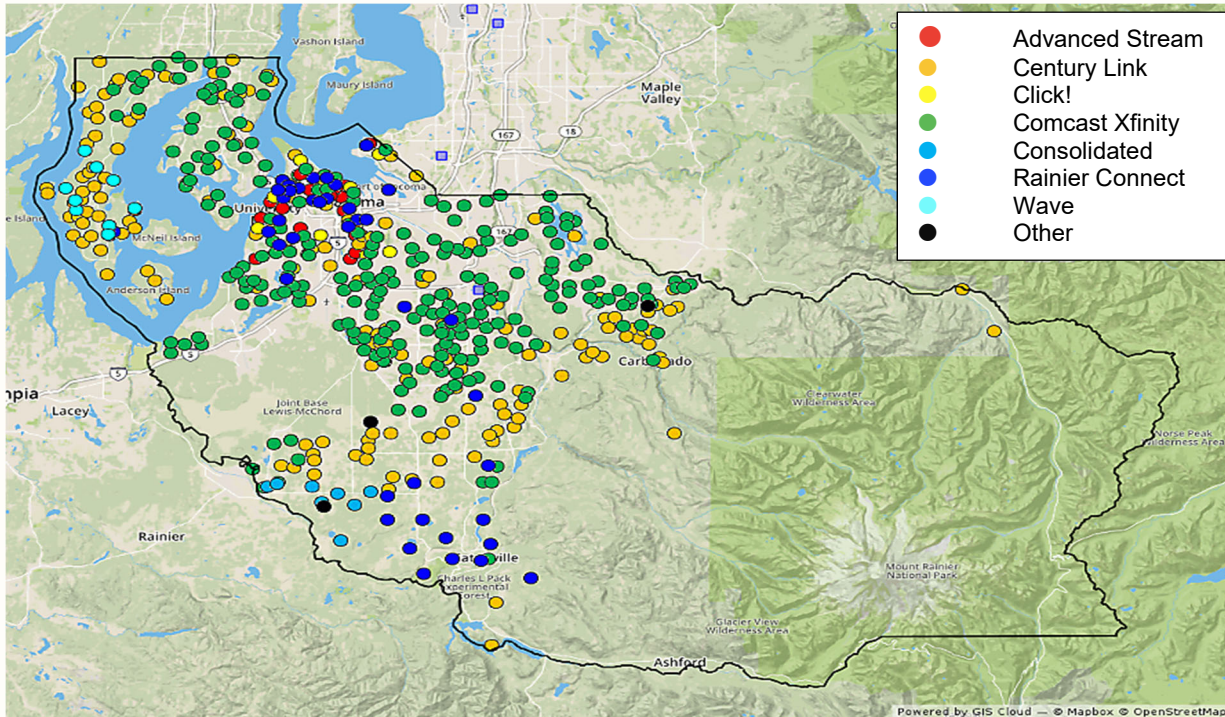
Pierce County, particularly the Tacoma area, appears to have abundant providers in urban core areas (see Figure 5.18). The central area of the County is thoroughly served by Comcast Xfinity and CenturyLink. Rainier Connect has a substantial presence in the south-central portion of the County and in Tacoma. Advanced Stream and Click! are basically limited to the City of Tacoma. Wave serves only a small part of the county on the west side of the Sound, around Lakebay, where Comcast does *not* have a presence. Consolidated Communications serves a small area south central Pierce County, adjacent to areas served by Century Link and Rainier Connect. In contrast to Tacoma, areas in south central Pierce County appear to be served by only one provider. The central portion of the County is thoroughly covered by CenturyLink and Comcast Xfinity. Rainier Connect appears to serve a limited corridor through the middle of the County. CenturyLink is the only provider in the eastern areas of the County.

A speed test was built into the survey.[72] Comcast connections were the fastest on average and the most economical, averaging 72 Mbps total throughput (downstream and upstream combined), for about $1.10 per Mbps per month. Results show Century Link to be about one fifth as fast for about three times more per Mbps per month. Consolidated Communications' services were both the slowest and most expensive for the throughput, according to survey responses.

Table 5.5 Average Provider Throughput and Costs Compared

Provider	Percent Responses	Mean Throughput	Cost per Mbps/Month
Advanced Stream	3.8%	15.88	$2.83
CenturyLink	34.1%	15.30	$3.88
Click!	2.2%	56.21	$0.85
Comcast/xfinity	48.0%	72.47	$1.10
Consolidated	1.9%	6.09	$11.31
Other - Write In	0.7%	4.60	$14.73
Rainier Connect	6.8%	21.27	$2.59
Wave	2.5%	93.78	$0.76

The results are similar for connection types. Comcast provides cable connections and Century Link uses Digital Subscriber Line (DSL). Less than a twentieth of respondents had fiber optic broadband.

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[72] Magellan Advisors uses the Measurement Lab's Network Diagnostic Tool (NDT) for speed tests. Unlike other speed tests, NDT tests speeds to the core internet, where most content is located. Most other speed tests only test speed to the edge of the provider's network. For this reason, NDT provides more meaningful and valid, but significantly different results compared to other speed tests. For more information visit https://www.measurementlab.net/tests/ndt/.

Figure 5.19 Connection Type (686 responses)
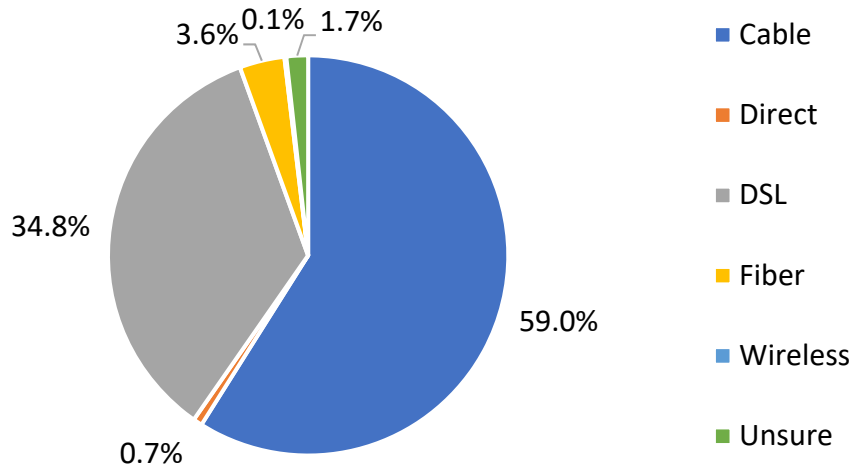
The best overall performance and lowest per Mbps costs were reported for cable connections (see Table 5.6 Average Connection Performance and Costs Compared

DSL provided much less throughput for about the monthly costs, which means it was about five times more expensive per Mbps per month. Fiber optic services were relatively slow and costly, especially when compared to industry norms—it is usually much faster and more economical than other connections (see Table 5.6, below). Given the small percentage of responses, it is possible that the twenty-five people who indicated they had fiber connections were simply mistaken, which would mean there were effectively no fiber-based broadband services available to respondents.

Figure 5.20 Responses by Type of Broadband Connections, Including None Available

Pierce County, WA
Broadband Connectivity and Access Evaluation
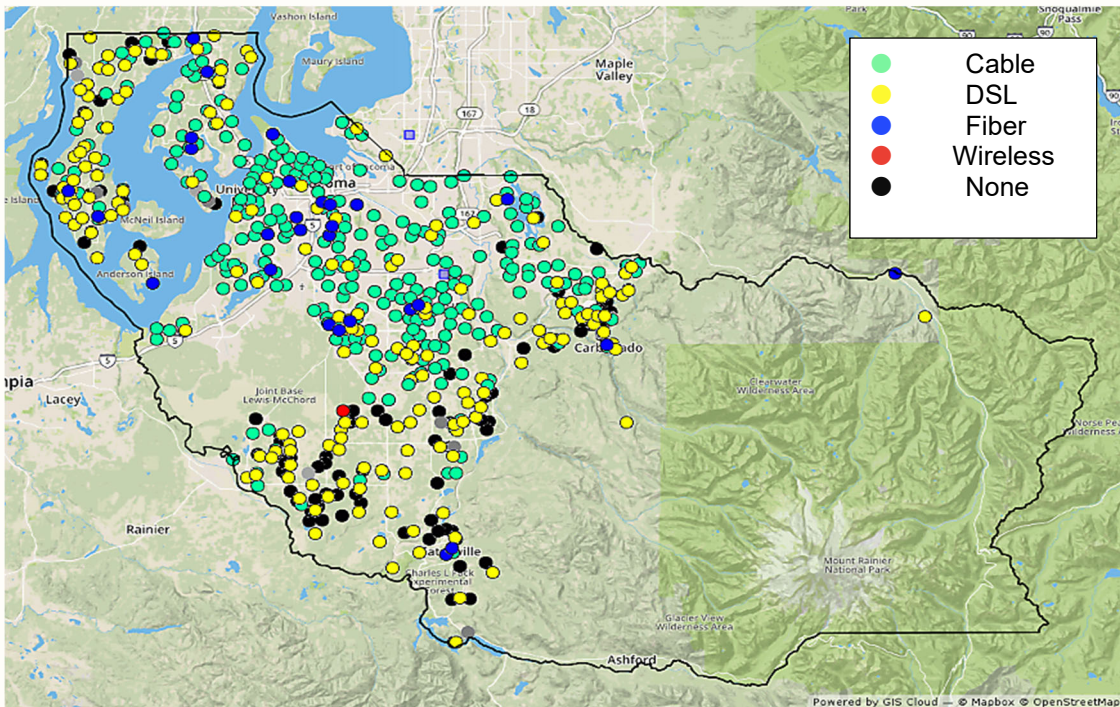
As shown in Figure 5.20, most respondents in urban core areas of Pierce County had cable broadband services. Areas to the west, across Puget Sound, and to the east were less likely to report cable or fiber, and more likely to have DSL. While there were a few geographic outliers that reporting having fiber connections, relatively few respondents had fiber and those who did were concentrated within Tacoma and adjacent cities. Some of these responses, such as the one in the Greenwater area, were likely misreported by the respondent, considering that service was provided by CenturyLink, which does not provide fiber broadband in the County.

Respondents without broadband were asked the reason. In Figure 5.20, these responses are represented by black circles, which indicates "no broadband services are available" as the top reason out of seven. Levels of grey indicate lack of availability was ranked second, third, and fourth of seven (anything more than fourth being considered a non-reason). Note the co-location of black and dark grey with DSL services, to the far east and west of the county. These appear to be areas with marginal internet services.

The far east of the County is park land and wilderness area with almost no population, let alone wired infrastructure. The area in the southwest portion with no response is Joint Base Lewis-McCord, which has no public civilian areas.

Figure 5.21 Response Locations by Total Broadband Throughput
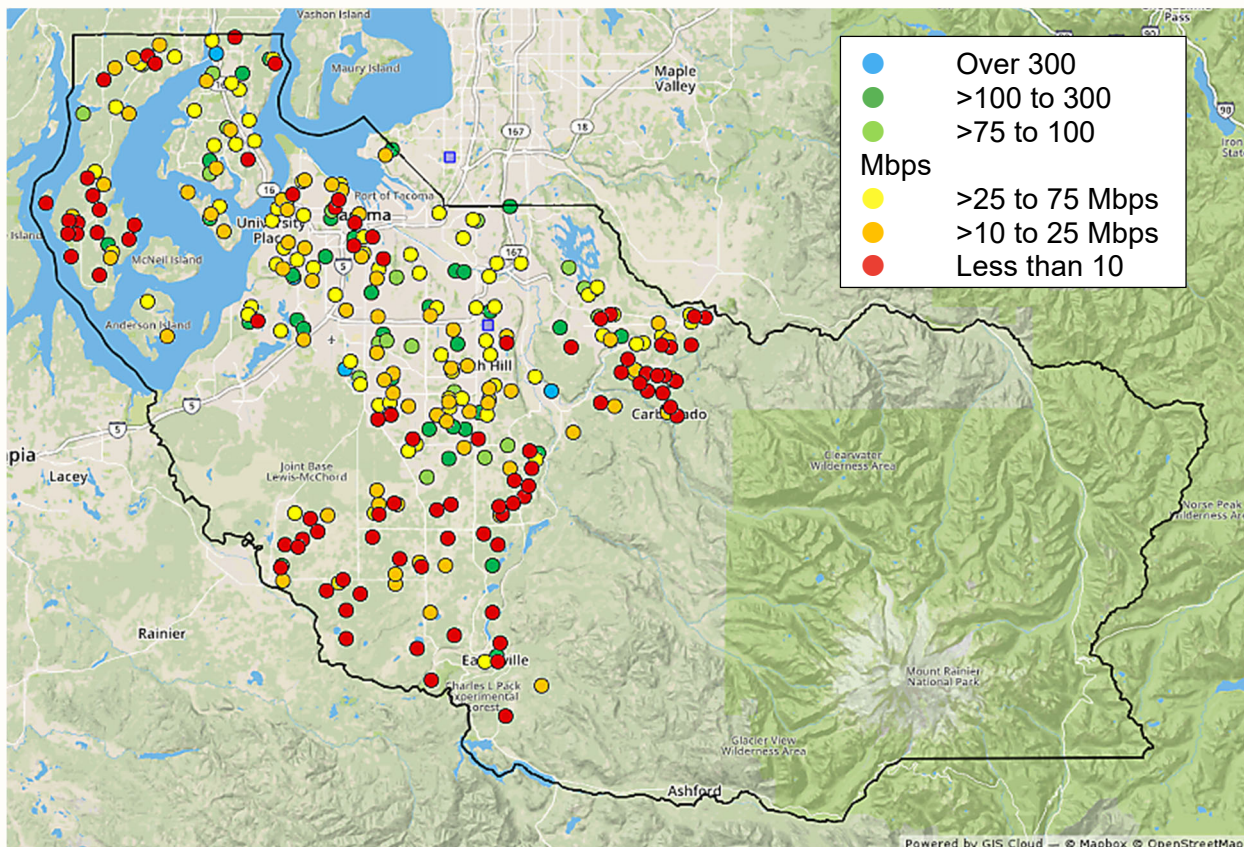
The farther a location from Tacoma, the slower its broadband services seem to be, as shown in Figure 5.21, although there are clearly exceptions. Much of central and western Pierce County has "broadband" that does not meet the technical threshold of at least 25 Mbps downstream

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and 3 Mbps upstream (or an aggregate total throughput of 28 Mbps). This is true for a substantial portion of western Pierce County, and locations in the center of Tacoma. Higher speed services appear throughout the central part of the County

Table 5.6 Average Connection Performance and Costs Compared

	Percent	Mean Throughput	Mean Mbps/Mon/$
Cable	59.0%	62.65	$0.72
Direct	0.7%	48.70	$1.22
DSL	34.8%	12.72	$3.77
Fiber	3.6%	94.54	$0.84
Wireless	0.1%	13.67	$5.04
Unsure	1.7%	53.91	$1.31

The maximum contracted speed—that provider committed to deliver—reported was 1,000 Mbps (or 1 Gbps), which can only practically be delivered via fiber-optic connection. Average contracted speeds were typically 100/50, and the median was 30/10. Maximum speed test results were less than 500 Mbps downstream and just over 200 Mbps upstream. The average actual speed was much lower: 37.2 Mbps down and 6.4 Mbps up. These average speeds meet the current FCC definition of broadband, which calls for at least 25 Mbps downstream, but are only about a quarter of what respondents felt they were paying for.

Table 5.7 Overall Speed Test Statistics

	Responses	Maximum Speed	Mean Speed
Download	679	489.43 Mbps	37.24 Mbps
Upload	679	208.25 Mbps	6.44 Mbps

As illustrated in Figure5.22, most responses were between 10 and 25 Mbps total throughput. More responses were between 3 and 10 Mbps than between 25 and 50. And, more respondents had connections with less than 3 Mbps throughput than had between 100 and 300 Mbps.

Figure 5.22 Distribution of Respondents' Throughput

Pierce County, WA
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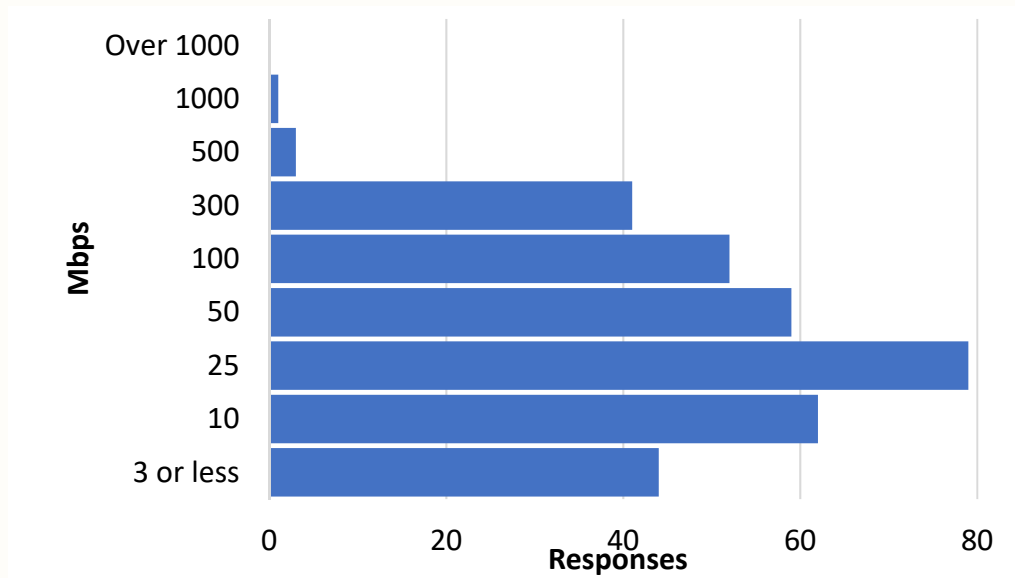
The maximum speeds suggest some respondents did have fiber-optic connections, but those connections were not operating up to their potential. The average speeds show that most respondents have much slower service that is only nominally broadband. It should be noted that the Network Diagnostic Tool measures throughput to the internet's core networks rather than to the edge of providers' networks as many speed tests do. Therefore, the constrained speeds could be the result of oversubscribed backhaul connections between providers' access networks and their tier 1 internet connections.

Just under a third of respondents took only internet from their provider. The majority of respondents—about two-thirds—only one other service, and about a quarter took one or two other services. The most common service was telephony (two-fifths of respondents), followed by basic television (a third). Premium and high-definition television were also common services.

Table 5.8 Monthly Recurring Costs for All Services and Estimated Costs for Broadband Only

	Responses	Max	Mean	Median	Mode	Min
All services	682	$475.00	$116.05	$100.00	$100.00	$1.00
Broadband only	681	$295.00	$68.57	$60.00	$50.00	$1.00

Table 5.8 contains statistics for costs among respondents. The median costs are less than the mean costs, suggesting that most respondents are paying more than average. The minimum of $1.00 suggests that some respondents under-reported their costs, thus actual costs statistics are likely higher than these results.

Figure 5.23 illustrates how often respondents perceived problems with their broadband services. About 5% reported their connection never slowed, while almost a third felt their service slowed every day. A similar percentage said their service went out briefly every few months, and under a tenth of respondents experienced outages on both daily and weekly bases. Two-hour outages were yearly events for about a quarter of respondents, but never occurred for about 14%. Service was out for multiple hours every few months for 15% of respondents, and about once a year for 22%. About three tenths experienced these less than annually. Less than half of respondents said they never experience day-long outages.

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Figure 5.23 Reported Reliability
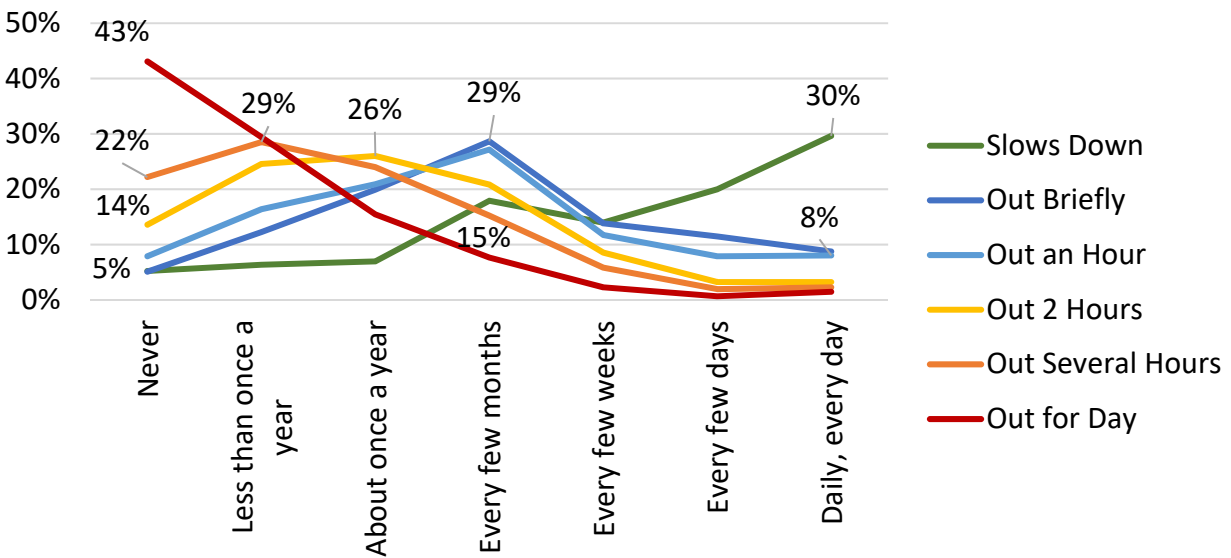
As can be seen in Figure 5.24, about half of respondents were either very or somewhat satisfied with their broadband. Just over two-fifths were either very or somewhat dissatisfied, in general. Price and speed were the least satisfactory attributes: Nearly two-thirds were dissatisfied with price, and well over half were dissatisfied with speed. Reliability had the highest relative levels of satisfaction, with over half indicating satisfaction and less than 40% dissatisfied with reliability. Around a tenth were unsure about these attributes. Responses were more evenly distributed regarding support, with about a fifth of responses for each satisfaction level.

Figure 5.24 Satisfaction with Broadband Attributes
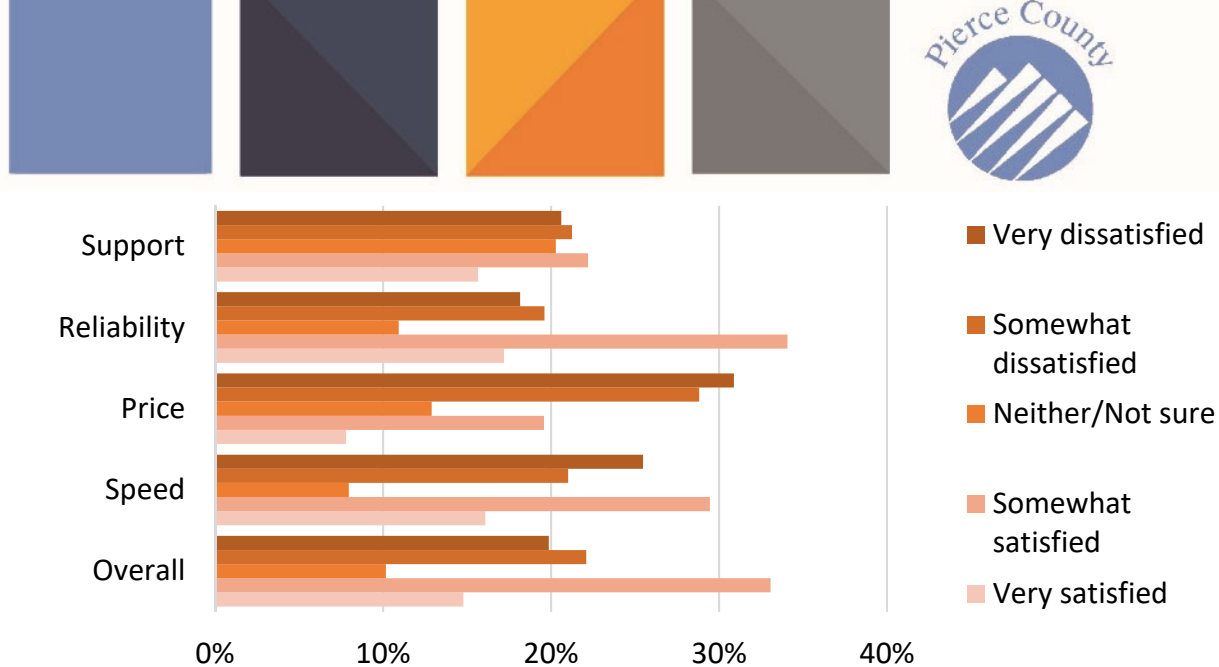
5.7.4 Broadband Supply Assessment

Broadband service in Pierce County could be better. With only about half of respondents satisfied, even if we assume people responded to the survey because they were unhappy about broadband, there is clearly room for improvement. Reliability was rated as more important than speed and price by respondents, yet price and speed were the attributes with which they were least satisfied, in spite of respondents experiencing regular slowing and periodic outages.

The speed test results show average speeds that are about a third of what providers said they would deliver, which means consumers are getting much less throughput than they're paying for. Many are getting service that they said they wouldn't pay for, and generally they are paying about twice what they feel broadband is worth. Only a small percentage could not get broadband service, but a substantial proportion of those with high-speed access were not actually getting broadband speeds. It should also be noted that the survey does not require the responder to connect via Ethernet directly to the modem, so some results may show the speed of their Wi-Fi connections instead.

There are nominally numerous providers, but most serve only a few customers. The two dominant providers are either higher speed cable or lower speed DSL. Those who choose DSL generally do not have cable available, otherwise they would go with the faster, more economical service. The general conclusion is that consumers really have no choice of broadband provider and must put up with poor performance and high prices. Several parts of the County, most notably the south-central area, have effectively no competitors and only one actual service provider.

Survey results suggest strong demand for better broadband. The economic potential behind that demand seems strong, too. Home-based businesses, remote work and telecommuting, and selling online were much less common than purely consumer activities. Persons with limited technology resources appear to be even more inclined to these activities than those with good access. Given that our respondents were young, more educated, and more likely to be out of the workforce or in non-technical occupations, survey results likely under-represent interest in these activities.

Bandwidth and connectivity are essential enablers of economic activity. Lack of choice, low speeds, and relatively high costs appear to be barriers to expanding economic opportunity in Pierce County. These conclusions from household respondents are reinforced by organizations' responses. Pierce County is poised to use technology to grow if it had better options. A significant portion of the lack of availability is from some of the more rural parts of the County.

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6. Findings and Opportunities

Overall, our findings indicate that the current status of broadband access is adequate in some areas but is not good enough in others, especially in the rural communities. Technology is advancing rapidly and the County's residents and businesses are struggling to keep up. The result of inaction is likely to be a continued feeling of being left behind. Not taking action to improve access will worsen the already present digital divide and exacerbate many of the same issues the County is already grappling with today. The County has options to help address the issue of both availability and affordability in the areas that have expressed needs.

From a broadband perspective, Pierce County has a number of strengths, which include strong and progressive leadership at the city and County levels that recognizes the growing importance of broadband infrastructure. Both the cities and the County are making support for broadband infrastructure a key priority. Pierce County has proximity to Seattle and a tech savvy talent pool.

Political will is evident at all levels of government and there are multiple *funding options.* Broadband initiatives are being undertaken across the country and within Washington itself, exemplifying that such endeavors are not only possible, but are sound investments for the futures of communities. The County should act upon the current environment of political will and funding opportunities now, while they are readily available.

Broadband development aligns with—indeed, is a critical enabler of—Pierce County's economic development goals and strategic plans. Pierce County is already seeking to build organizational capacity through collaboration between departments; adding a countywide broadband initiative to such processes as permitting will allow the County to further strengthen this collaboration. Strategic use of land is also among the County's strategies, including building strategic infrastructure, which is precisely the goal of the incremental, opportunistic approach described in this Plan. Business opportunities, natural resource innovation, and fostering a great place to live are other County goals that will be the beneficiaries of this Plan, which seeks to attract and enable economic development and new residents seeking excellent quality of life and quality of work.

Opportunities from broadband infrastructure are vast and derive significantly from connected devices and the Internet of Things. *Pierce County's geographic location and talent pool can be the fuel for leveraging technology developments including applications supported by 5G wireless deployment including sensor networks, Smart City applications, and autonomous and connected vehicles.* Broadband infrastructure will support Pierce County's human infrastructure, including connectivity for education and personal improvement and advancement, and health care to support "aging in place." To enable this support, some key principles can guide the County: Strategic collaboration, innovation and creativity, supporting industry, and ensuring equitable access.

Pierce County, WA
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6.1 Strategic Collaboration

6.1.1 Leverage City/County Infrastructure and Purchasing Power

Currently, Pierce County and the cities within it lease substantial broadband capacity at retail rates from various service providers. The County and the cities also operate and maintain fiber-optic network facilities of their own to interconnect city and County buildings and for other purposes including traffic management. Thus, the cities and the County have experience with fiber networking. The cities and County could use this experience with fiber-optic network operation to place their own conduit/fiber facilities and achieve significant lifetime savings, compared to paying continued annual or monthly lease payments to current providers. Investment in long term assets will reduce monthly costs and budgets. The conduit/dark fiber could also be used by other parties to expand broadband availability and affordability. Leveraging County and city purchasing power as an anchor tenant on a fiber network would drive widespread deployment of dark fiber in the long term to catalyze economic development. Diverse paths and redundancy would be created over time as well.

Infrastructure owned or managed by the city or County could potentially be utilized to support broadband. For example, the County has projects on the horizon that provide opportunity for conduit and fiber placement. Public Works also may have some infrastructure on bridges or public rights-of-way. There also may be an opportunity to place wireless towers and antennas at County and city facilities to expand broadband, serving hundreds from locations such as rooftops of rural fire stations. However, fiber backhaul to County buildings in more rural areas is needed to support wireless deployment. While these are large potential opportunities, they would need to be vetted with stakeholders and for compliance with historic foundation requirements.

Cooperation and coordination among both public and private entities are crucial to supporting opportunities. Related policy steps include implementation of "Dig Once" practices both at the County and city levels, along with placement of conduit that can be made available using the presence and purchasing power of the cities and County as anchor tenants to catalyze development. Coordination among cities and the County is also crucial for "Smart Cities" readiness, and this could start with the County and cities coordinating on Capital Improvement Plans to that end.

6.1.2 Partnership with Pierce County Cities and Towns

The interests of underserved Pierce County cities and towns are aligned with the interests of the County with respect to broadband infrastructure deployment because the infrastructure must travel through the towns and the County to an upstream interconnection point with a wholesale broadband service provider. The County and local governments should work together to develop uniform policies that lower barriers to broadband infrastructure investment by the private sector, such as streamlined, low-cost access to rights of way, as well as to adopt a Dig Once policy that treats underground conduit as a valuable commodity.

When underground trenching is required for any purpose, whether water, wastewater, electricity, road construction or any other purpose, local governments should ensure that conduits are installed for their use. Conduits locations should be mapped and tracked, and all departments of the towns, cities and county should contribute to and have access to the conduit

maps so that informed decisions can be made about placement of new conduits.   By installing conduit strategically over time in this way, the County and local governments can save as much as 80% of the cost of fiber-optic deployment through joint use of the trench and can provide valuable access to underground conduit to broadband service providers to install fiber-optic cable.

Towns and Cities should also coordinate with the County to apply for broadband infrastructure funding, and/or to support a service provider partner willing to invest its own capital and/or apply for a grant or loan in return for the aggregated demand of the local governments, and use of Town and County rights of way and conduits to serve households and businesses along the route.

The Towns and Cities should quantify potential savings from ownership of their own fiber-optic cable and consider investing that amount into expansion of existing fiber-optic cable and facilities and conduit that could be interconnected/leased to a service provider to offer broadband service along the route, including fiber for 5G cellular service.

Today's investments in telecommunications assets would enable and support the local communities for the next 50 years, given the proper installation and maintenance. Not only will Pierce County's telecom spend stay local, but it will permanently reduce Pierce County's operating costs for decades to come, while expanding opportunities, and investing in locally owned and controlled broadband assets. These assets can be used to support community-based innovation, to support local industries and network/content providers, while generating other positive community benefits, and potential new revenue streams. The County would have the ability to make excess capacity available to the market, to support the broader goals of this Broadband Strategic Plan.

6.1.3 Electric Utilities

Collaboration to provide broadband internet access in Pierce County with the several electric utility companies also presents an opportunity. *Local power companies are investing and need network infrastructure.* As is common to all electric utilities, many have constructed fiber networking throughout electric distribution networks for operational support purposes. Tacoma Power is an investor in and owner of Click! which demonstrates a utility companies' interest in broadband. In neighboring Kitsap County, the local utility provider is offering broadband services to its subscribers under a special provision from the State. Magellan Advisors recommends the State revisit their rules regarding the prohibition of public utilities districts (PUD) and municipalities providing retail broadband services. Many states are finding that municipal entities and utility providers that offer retail broadband have the effect of increasing competition, lowering overall costs, and in many instances, are able to provide broadband to areas where typical for-profit entities do not. Utility providers have the organizational and physical structures to make broadband more available and affordable. For-profit providers have fought giving the right to "public" agencies, including PUDs, to offer potentially competing broadband services. However, the status quo indicates that if nothing changes, these for-profit providers will not offer services in the most hard-to-reach locations and as such, the broadband divide will continue.

Figure 6.1 Pierce County Utilities Providers
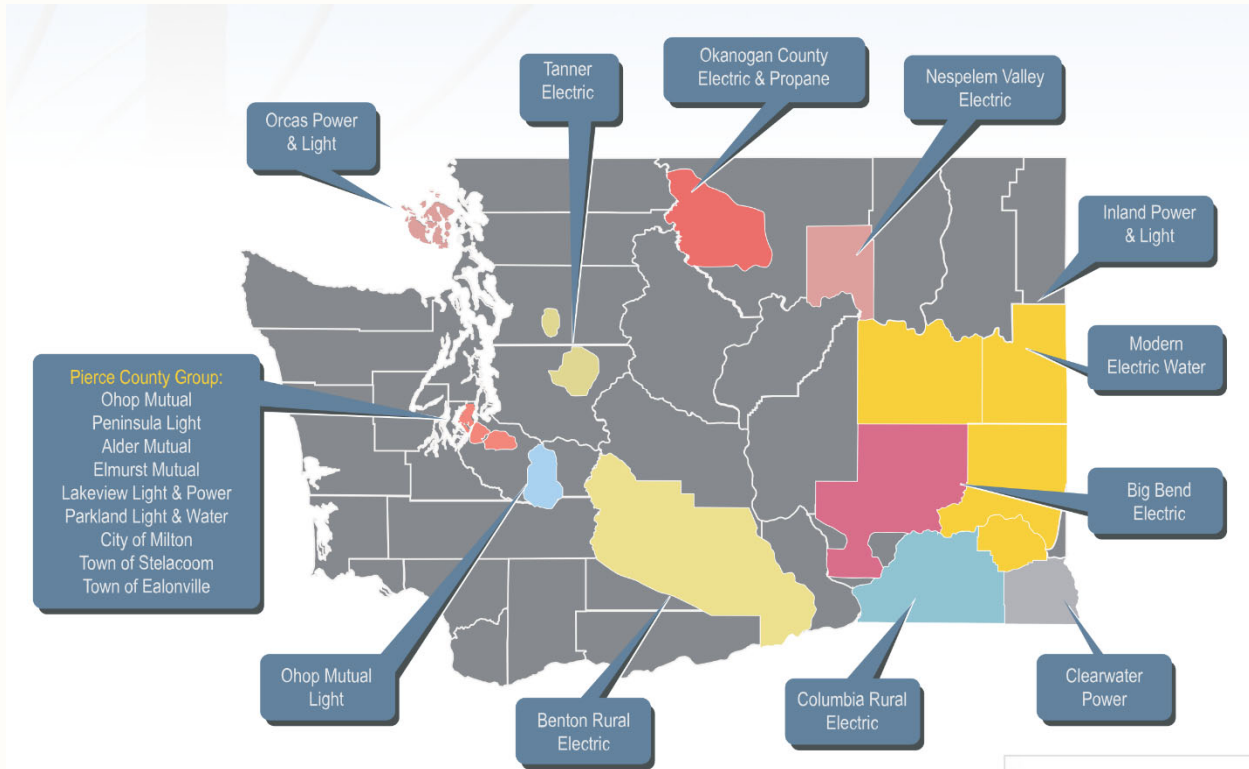
Pierce County is home to six electric mutual and cooperatives that have a long history of successful utility operation in rural small towns.   One strategy is for the County to coordinate with Pierce County cooperatives to develop a joint broadband needs assessment in their communities and develop a collaborative plan to attract federal funding.

The USDA-RUS Electric Program provides low cost federal cost of money loans to deploy fiber-optic Smart Grid networks to the meter.   RUS allows the use of the Smart Grid network to provision Broadband service to electric customers. USDA-RUS encourages its electric borrowers to leverage their Smart Grid networks to offer broadband service in rural areas.

USDA-RUS receives $5 billion a year in appropriation funding for electric system loans. There are no requirements to serve broadband only to unserved census blocks in the electric serving area, and no cap on loan size. The loans have a fixed interest rate for a 30 to 35-year maturity. The interest rate is pegged to the constant maturity rate ("CMT") of the 30-year Treasury bond each time funds are drawn for deployment. The CMT rate fluctuates, but rates have ranged from less than 2% to over 3% in the last year. RUS will allow borrowers to defer principal payment during construction.

Debt service for a RUS loan compared to debt service on municipal bonds for a $22 million Smart Grid network can save over $11 million in debt service payments over a 20-year period, and make the difference between sustainability and infeasibility in a rural broadband business plan.

RUS will also allow for a "short option" maturity, for example a 30-day maturity, with a lower rate than the 30-year CMT.   A 30-day loan will automatically roll over at the end of the 30-day term

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at no charge.   By choosing a short option maturity, a borrower can continue to roll over the note every 30 days at no charge, significantly lowering the interest rate below the 30-year CMT, but the borrower may fix the interest rate at the then current 30-year CMT at the end of any 30-day rollover period.

Where allowable by state law, electric cooperatives and electric cities around the U.S. are tapping into Electric Program loans for Smart Grid networks for load management and outage management of their electric distributions systems, and at the same time offering broadband services to diversify and increase their electric service revenue base. Their customers can receive symmetrical 100 Mbps to Gigabit Service and higher, and the system will attract new businesses to the area to increase economic development. Customers have the added advantage of controlling their energy usage remotely and/or automatically through Internet-enabled apps for energy management.

6.1.4 Special Note on State Provided Broadband Middle Mile Network

State Government/University Partnership

To better achieve their public policy and institutional missions, the State of Washington has supported several middle-mile broadband projects including K-20, which provides services to schools, universities and other anchor institutions. NoaNet is another not-for-profit network covering the State with hundreds of miles of backbone.

Figure 6.2 NoaNet Network

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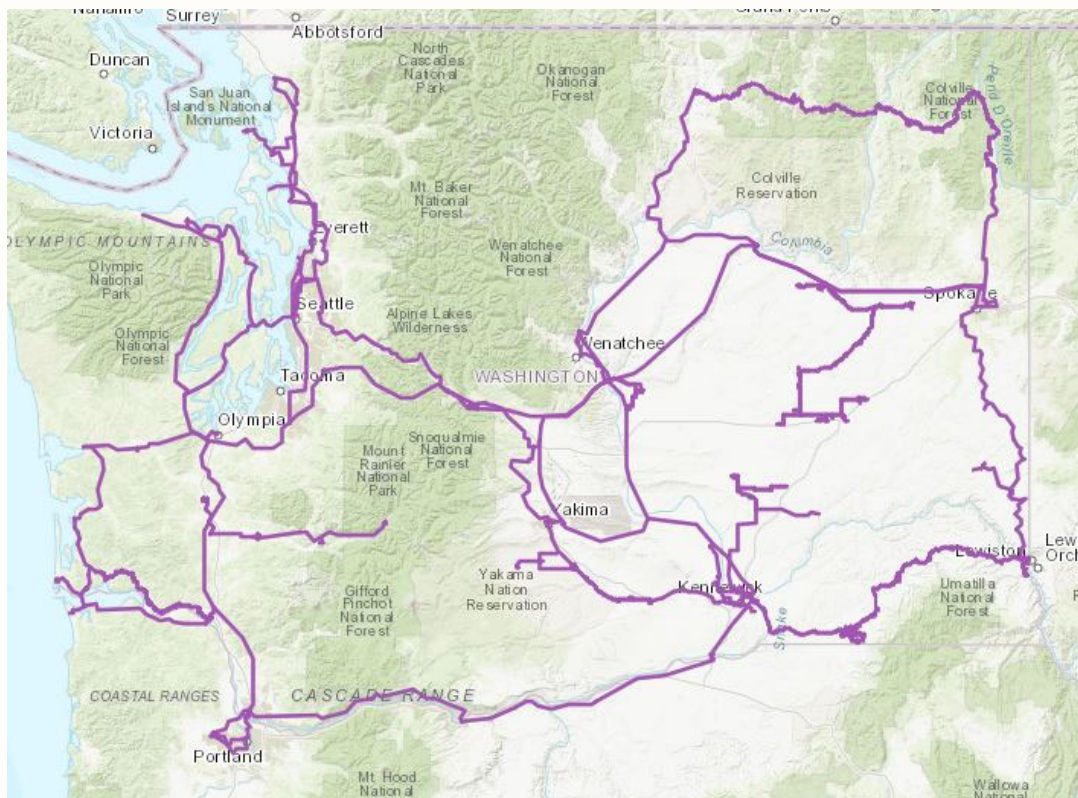
6.2 Supporting Industry

The data suggest that workforce is a major issue in Pierce County. Unemployment is very low, there is strong employment growth in key sectors, and wages are rising. An aging population exacerbates this issue as people leave the workforce and demand additional services. The general opportunity, therefore, is to increase worker productivity in existing industries within Pierce County. At the same time, out-commuting is a major environmental, quality of life, and transportation issue. These workers are drawn by jobs and pay. So there is another general opportunity to connect these persons with local employers.

Service industries are important in terms of employment. Knowledge and relationship-intensive service sectors such as education, health, professional, scientific, social, and technical are growing strongest. Additionally, these sectors are seeing strong wage growth. Health and social services are also on the entrepreneurial and enterprise vanguard of more, smaller establishments. Manufacturing remains a core part of the County's economy due to its employment and productivity, especially because most of this is exported, which brings capital into the area. Military and the associated support operations are a large industry in Pierce County.

Port Operations including ships, drayage, rail and trucking/shipping operations are also rather large industries that are on the cusp of real technological advances to improve automation, logistics and safety. Having a robust broadband ecosystem would support the growing advances in this very important industry.

Manufacturing also stands to benefit from opportunities to improve processes and outputs with technology. *Key product innovations can be enabled by digital design and production technologies.* Large Fortune 500 companies currently reside in Pierce County including Amazon and others. They are constantly looking for an educated and connected workforce, as well as broadband to support improved internal operations. By ensuring this ecosystem is robust, Pierce County will create an environment that will continue to attract these job creators to the region.

The economy has dual trends of consolidation in maturing industries and diffusion in emerging and stagnant sectors. Health, retail, and technology—specifically, network services—are all prime examples. Mergers and acquisitions in these sectors are resulting in a relatively few major companies. At the same time, there are new spaces and possibilities emerging for small, flexible yet specialized companies. Broadband and related technologies are driving and enabling these changes.

6.3 Ensuring Equal Access

Outreach to stakeholders in Pierce County presents clear evidence of a growing digital divide among its rural populations. With the technologies available today, some rural homes may not, for the foreseeable future, get robust broadband because the cost to deliver those services is simply too great for any one person, company or organization to provide. There may be some within Pierce County that do not get affordable broadband comparable with what is offered in urban communities in the near future, if left to the for-profit providers alone. Instead, they will rely on satellite services or other slower forms of broadband.

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However, rural broadband in Pierce County is far from a lost cause. Through dedicated planning, realistic expectations, and sustained effort, there are means by which the County can help ensure equitable access. Additionally, there are several best practices to enhance these efforts, some of which Pierce County and local organizations including the schools are already engaging in. These include working with local internet service providers to promote affordable home-based broadband for lower income families, sponsoring Youth Tech programs that aim to increase students' digital literacy, and offering free Wi-Fi in schools, parks, and other public areas.

These best practices should continue to be encouraged, further developed, and publicized. Many times, getting the word out is half of the battle, as in today's society word is spread through social media and the internet, which may not be the most effective tool in reaching those that are living in "the divide." To address these issues, the County and its partners must meet citizens where they live through outreach such as community meetings and other non-digitized mediums.

6.4 A Business Model that Fits

There is no single right answer when communities consider their role in broadband development; each community might take a different approach depending on its unique needs and capabilities. Generally, ownership and control of public assets gives local governments tools to work on a variety issues, from economic development to environmental sustainability.

While the private sector will always have a role in providing the next-generation broadband experience, the buildout of strategic assets such as conduit/fiber middle-mile networks may ultimately lie with local government. This evaluation finds that there are key issues in Pierce County caused by lack of access and availability of broadband assets and infrastructure, even as rural Pierce projects are being built on the backs of investment by residents/taxpayers, and state/federal funding programs.

Business models for local government to address such issues vary widely (see Appendix A for a full examination of available business models and case studies). The table below illustrates some of these options, ranging from low-risk, low-reward models on the left to higher risk, high-impact models on the right.

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Table 6.1 Range of County Roles for Broadband Development

	Traditional	User	Catalyst	Provider
			County Role	
Broadband Investment	None	Limited; inter-building	County-wide middle-mile backbone	County-wide carrier-class network
General Activity	Regulate development	Drive development (as a consumer)	Coordinate, facilitate, support development	Develop public broadband service
Goals	None; maintain status quo	Bandwidth and connectivity for internal purposes	Tech-enabled development and improvement	Universal broadband access
Key Documents	Broadband-friendly policies	County and departmental strategic plan	Network vision and stakeholder requirements	Broadband business plan
Key Stakeholders	Builders, providers, and utilities	Department leaders, internal users	Community anchors	Business and residential customers

The fundamental role of local government is to facilitate activities, development, and services, including generating public revenue and providing public services, to meet residents' needs. All aspects of this are likely to be profoundly impacted by technology. County governments have the opportunity to create additional value by working for, through, and with their municipalities and regional/state institutions; they are in the position to be connectors. *With this in mind, Magellan Advisors recommends a balanced approach in which the County acts as a catalyst for private infrastructure investment with smart policies and consistent, incremental, targeted public investment toward a broad, practical vision.* This evaluation recommends Pierce County make incremental investments in public broadband assets and partner with telecommunications and utility companies to use those assets for deploying broadband.

6.4.1 What is a Public-Private-Partnership?

A broadband public-private-partnership (P3) is a negotiated contract between a public and private entity to fulfill certain obligations to expand broadband services in a given area. NoaNet and CityNet are examples of P3 partnerships within the County. P3s have been increasingly implemented as more local governments employ public broadband and utility infrastructure in conjunction with private broadband providers. P3s leverage public broadband assets, such as fiber, conduit, poles and towers, buildings and other facilities with private broadband provider assets, and expertise to increase the availability and access to broadband services. Local governments forgo "getting into the business" of providing retail services and instead, make targeted investments in their broadband infrastructure, and make it available to private broadband providers with the goal of enhancing their communities.

A P3 would provide a competitive provider with access to a new market that otherwise would be inaccessible for various reasons, such as the capital requirements to construct. Pierce's residents would benefit through access to a new fiber-based service offering in which local decision makers have the ability to influence how the community is served. Finally, the County could negotiate a revenue share based on total revenues generated from the network or a simple fee for use model. This revenue would be used to maintain and expand the network as needed and can be earmarked for other community improvements as identified by County leadership.

6.5 Funding Opportunities:

6.5.1 USDA-RUS Reconnect Loan and Grant Program

The $600 million USDA-RUS Reconnect grant and loan funding opportunity, announced in December 2018, targets funding to the lowest density rural communities in the U.S., and prioritizes awards in states with a broadband plan updated within the last five years and policies that promote streamlined, low-cost access to rights of way.

Funding is available only for rural communities where at least 90% of the serving area is unserved with 10/1 Mbps broadband, and only in communities not previously funded by an RUS broadband loan, state broadband award, or an FCC Connect America Fund reverse auction subsidy – unless the awardee of the funding is the applicant. Only Viasat received an FCC reverse auction award in 2018, and only for satellite broadband service.

Pierce County communities adjacent to the Seattle-Tacoma-Bellevue Metropolitan Statistical Area will not meet the eligibility test for rurality established by USDA-RUS. Communities with a population of greater than 20,000, or adjacent to a town with a population of 50,000, are ineligible.

Rural area census blocks of Pierce County that are at least 90% unserved with 10/1 Mbps service today would be eligible for funding, but it would be necessary to identify the exact locations of these census blocks and ensure that they meet all of the eligibility requirements.

The program's scoring criteria awards 25 points for proposed serving areas with a population density of 6 or less, calculated by dividing total population by square mileage of the proposed serving area.   Points are also awarded for the numbers of farms, businesses, schools, rural healthcare providers/pharmacies, and critical community facilities in eligible areas that pre-commit to broadband service subscriptions.

Pierce County, on its own, could not apply for Reconnect funding to own, maintain and operate a broadband system because it has no history of operating a broadband, telephone, cable or electric utility, which is a requirement for a ReConnect award. Pierce County may be able to apply if an experienced service provider partner entered into a binding commitment with the County to provide the required services.   The partner would have to be able to make a sustainable business case with revenues from the unserved census blocks, which would most like be located outside the towns already served by Comcast, CenturyLink and the satellite broadband providers.

The Reconnect 100% Loan Program is not competitive, and loan terms are highly attractive at 2% fixed rate interest over a 20-year or higher maturity, but the first eligible loan applications to be submitted will be the first awarded.

Ideally, Pierce County should identify potential applicants for the Reconnect funding, if any, who propose to offer Fiber to the Home and affordable high capacity symmetrical broadband service and support their applications; however time is very short. Additional funding opportunities have also been announced by the FCC and Congress and may be more suited to Pierce County's implementation timeframes.

6.5.2 Other Funding Sources:

Most federal broadband infrastructure grant and loan funding available today is authorized to USDA Rural Development and Rural Utilities Service programs. Assuming a business case can be made, there are smaller grant opportunities of $2 million per award to connect an unserved rural community.

Funds are authorized to the Department of Commerce Economic Development Administration for communities affected by sudden events such as a natural disaster, a military base closing, or loss of a major employer, but the funding available is less than the amount authorized to the USDA programs, and there are restrictions on where infrastructure may be placed.   For example, for a county applicant, infrastructure must be placed only in County rights of way. Additional funding would have to be found to deploy fiber from the county's right of way to the premise.

Areas affected by natural disasters such as hurricanes and wildfires have access to funding for infrastructure resiliency, to bury electric and communications lines, but these funds have primarily been available through the Economic Development Administration.   Community Development Block Grants from the Department of Housing and Urban Development have been targeted to housing for displaced residents in disaster affected communities.

6.5.2.1 Tax Advantaged Investment Funding

Pierce County may also have access to Tax advantaged Investment funding created by state law, which could be used for broadband infrastructure investment.   Investment in Pierce County Opportunity Zones would offer tax incentives to investors, which can be "stacked" on top of incentives provided by other tax advantaged investments.

6.5.3 Policy Changes Needed at the Federal Level

The FCC's and federal agencies' focus on the 10/1 Mbps benchmark speed as the threshold for broadband funding does little to ensure that communities can successfully compete with Gigabit communities for jobs and investment. Instead it continues to reward service providers who offer the minimum level of service.   In the words of the Director of the National Telephone Cooperative Association, it represents a "race to the bottom" for rural areas.

6.5.4 Potential for Washington State Funding for Broadband Infrastructure

Without forward looking policies and greater investment in infrastructure grant and loan funding by the federal government, state and local governments must look to their own resources, innovative partnerships and policy support to promote Gigabit service for all.

Governor Inslee's proposed budget for the 2019-2021 fiscal cycle includes a $1.2 million plan to create an office devoted to building out broadband internet access across the state. The office would have the authority to set statewide policy and promote private investment and would add Washington to a growing list of states with offices dedicated to expanding internet availability.

Governor Inslee's budget proposal also calls for $25 million in bonds and grants for broadband infrastructure upgrades in rural parts of Washington, to be administered by the state's Public Works Board.

6.5.5 Partnerships with Incumbent Cable Company and 5G Wireless Providers

As previously noted, in January, 2018 Comcast announced its intention to deploy 1 Gbps broadband service in Pierce County, including portions of unincorporated areas between the towns.   Pierce County could engage Comcast to identify the cost of building out to all areas of Pierce County not currently planned by Comcast, and work collaboratively to provide pre-commitments and/or support a Comcast funding application to cover the additional cost of infrastructure construction.

The County and towns should work together to remove every possible barrier to fiber-optic broadband Network construction, including fiber densification required for 5G deployment, which may include access to County and local government vertical assets.

6.5.6 Target Fredrickson Area for Broadband Inclusion

Fredrickson has been targeted by the Economic Development Board as a strategic development region for increased focus and attention to new infrastructure that will attract new businesses to the area.

Pierce County, by implementing the recommendations outlined in this Report, can have an immediate impact on the broadband availability of this region.

Any new potential business entrants into a market require specific infrastructure before they will consider setting up operations. They require adequate and affordable commercial space, housing, desirable communities for their employees and all other utilities required for their type of business including power, water, rail etc. Broadband is now a critical utility that businesses require before considering a new space. To build the Fredrickson area as competitive, Pierce County needs to ensure adequate and affordable broadband to the region.

Pierce County, through Economic Development, Planning and Public Works and the new potential Broadband Task Force, should develop and enforce broadband build guidelines and practices that developers must adhere to when building. These include, at a minimum, conduit of sufficient size stretching from a handhold at the curb to each building, conduit installed in all new road projects and in accordance with standards and guidelines put forth by the County, and to adhere to a Dig Once policy where interested carriers can place their own conduit while the streets are

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open. Further, the County, once a business plan is agreed to and developed internally, could offer fiber assets that have been or will be placed by the County from their own Dig Once policy or through their excess capacity as the result of any traffic signal upgrades being done in the region. This would demonstrate the County's ability to make County assets available for public use to encourage the cost-effective deployment of broadband.

Key Peninsula Broadband

It was noted that the Key Peninsula, in many places, lacks adequate broadband for both the residents and businesses.

What is the County's role in driving the development of more robust broadband to the region?

What's the issue? Why is broadband lacking in this region?

In our estimation, there are several reasons that broadband is inadequate in many portions of the Key Peninsula. First, CenturyLink is the incumbent provider and has not upgraded their last mile connections to fiber and is still relying on older twist pair wires, which cannot carry a lot of data (by today's standards) using DSL technology. DSL is inherently difficult to provide broadband because it uses this copper-based medium that degrades over distance – the further away from the generating signal you are, the worse service becomes.

CenturyLink is a for-profit company and has to get a return-on-investment for any endeavor they take on. Given the rural nature of much of the peninsula, there is not a lot of incentive to spend capital funds for a limited ROI especially given a lack of competition. CenturyLink, as with most carriers, has limited capital and will thus prioritize profitable areas over less profitable ones. So unless they deem the peninsula a profitable region, or anticipate competition, they may not upgrade as their limited funds might be better spent elsewhere across the US (not just the region).

The County, through implementation of this practices and strategies outlined in this Report, can have a long-term impact on the availability and affordability of broadband to the Key Peninsula. This strategy will take some time, but over time, it will have an impact.

1. The County must develop a Broadband Plan for this region. This Plan can be created in part, by the potential broadband manager for the County (as recommended by this Plan) who would oversee the development and implementation of the Plan.
2. Develop political will for the development of new broadband for the region. This will drive resources, attention and planning to make this area a priority for broadband.
3. Make County assets available (as part of the Plan) to assist in reducing the overall costs of deployment, making it more attractive to a for-profit provider.
4. Align with the new State Broadband Office in collaborative efforts and potential state funding resources made available to broadband.
5. Develop community engagement where citizens can have a voice and help provide communities a unified voice when approaching the carriers for solutions.
6. Implement Dig Once and Joint Trench policies designed to reduce the cost of broadband deployment over time.
7. Build opportunistically as scenarios present themselves. The County must be prepared to identify and react to these opportunities through their broadband plans.

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7. Broadband Strategic Initiatives and Recommendations

This evaluation is meant to identify opportunities which the County can consider and execute to incentivize additional broadband investment throughout Pierce County either through direct public investment, and/or in developing key partnerships with industry.

Pierce County has several opportunities improve broadband in the County and to prepare the County for future broadband growth and economic opportunities. The County should take a lead role in directing, encouraging, facilitating and championing the projects/opportunities identified below.

A grassroots movement to secure broadband is not a short-term, overnight effort. It does require a coordinated, consistent and motivated plan. It will take time. Windows are often open when broadband efforts can make progress, including advances in new technologies, new grant funds becoming available, new construction projects happening, natural catastrophes highlighting the negative impacts of lack of broadband, or changes in the political environment. Smart planners should look for these windows and be ready to act when these opportunities present themselves.

Pierce County should have staff (current or future) assigned to rural and municipal broadband coordination efforts. The staff would be responsible for identifying potential communities that need broadband and then coordinating internal and external efforts to help drive everything required to get broadband for that community. These staff members should know how to navigate the political and commercial environment on behalf of the community in getting the appropriate broadband for their needs. In many instances, a Broadband Program Manager has been identified within the organization to manage aspects of this plan, executing key initiatives. This manager will sometimes reside within the IT department or may report through Public Works. Wherever this position resides, it also needs to work very closely with Economic Development.

Just as the broadband assets are long-lived, broadband should be a long-term program within Pierce County and its partner's local government operations. The area, through development of this Broadband Strategic Plan, can take a more holistic view of the community's needs, and through execution of this Plan, can begin to build and manage this very important infrastructure.

While several cities within Pierce County are working to establish goals in their municipal planning documents to expand their fiber infrastructure, the County and others seem to take a more *ad hoc* approach. To support long-term development, it is advised to invest incrementally, in a planned, methodical manner. Develop a 5-year, or 10-year plan, and begin to incrementally and opportunistically invest in phases, focusing on the greatest impact first, and using broadband policies such as dig-once and joint trench to build out planned routes early, and at a much-reduced cost.

Having a plan for where the network will be built will allow the County and its partners to take advantage of opportunities that arise where the right-of-way along these planned routes may be disturbed. These practices can reduce the long-term capital projections of any planned network buildout. Whereas building fiber networks in an urban environment can cost anywhere from $50 - $140 per foot, joint trenching or placing conduit into existing construction projects can reduce costs by over 80%.

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Finally, all long-term capital programs require appropriate funding. Fiber assets have a 25-year financial life, while their useable life can exceed 50 years given the proper installation and maintenance. When funding these projects, local governments have the ability to accept a longer payback period than most incumbent, or even competitive, providers can since governments focus on the well-being, education, and welfare of residents, rather than on creating shareholder value and increasing profits.

Fiber Expansion and Investment Initiatives are complex issues that require various levels of approvals and very tight coordination between the participating agencies and partners. Further, these initiatives require real monetary investments, further complicating plans. For this reason, this portion of the Roadmap and Action Plan relates to *EXECUTING* the Broadband Strategic Plan as it relates to direct investment and expansion of broadband assets throughout the County.

During the stakeholder outreach efforts, we met with the consortium of utility providers (sewer, water, power) and expressed the need to also include coordination of broadband efforts into their construction planning processes. They were very welcoming to having the County help coordinate these efforts and to work closely for the common good to get conduit/fiber planned as part of their interconnection construction projects.

The County should assign staff to be responsible for driving broadband efforts. This person would be responsible for:

- Identifying and coordinating all broadband efforts and opportunities, especially focused on the rural communities;
- Understanding, driving, and applying for grant funding opportunities;
- Educating local representatives on issues of broadband to develop political will;
- Ensuring public policies are in place to encourage broadband providers and ensure they have what they need to deliver broadband;
- Being a champion at all levels within the community for broadband and its benefits;
- Being the expert on technology solutions available for use in broadband;
- Being a liaison between the broadband providers and the community to help identify and drive solutions;
- Keeping broadband efforts in the public mindset; and,
- Working with government agencies to identify and map gaps in critical communications services and working to fill those gaps.

While these recommendations call for a 5- to 10-year period, the ultimate timeline will be dictated by the lead organization chosen to oversee and execute this Plan, and more so by the budgets and resources dedicated to this Program.

The recommendations will focus on a few general areas that have been identified by the planning team and focus on overall broadband direction and plans, irrespective of other specific projects. Broadband planning will focus on establishing broadband throughout the County and is not yet specific to any one location or project.

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7.1 Support Cities and Economic Development Areas in Broadband Policies

Political will is critical to rural broadband. Political will is the ability of the government organizations, local vocal community organizations and other prominent entities like first responders, politicians, hospitals and large businesses to speak out about their lack of services and adverse effects on the life and economy of those that live and work in these rural areas. Part of political will means being vocal and public about the lack of adequate broadband and its effect on the community.

Political will also involves government agencies taking steps to create an environment for the carriers to be able to provide broadband services. This includes:

- Having fair permitting policies and procedures;
- Making County/City sites available for co-location of assets by the carriers;
- Proper broadband planning considerations included in all construction projects by the city, county, state or federal agencies (such as dig once or joint trench);
- Organizing/facilitating/overseeing grassroot efforts of selected interested communities looking for broadband;
- Investing in broadband assets directly when a clear business case is presented; and;
- Assisting on funding by applying for available grants when opportunities are identified

The County should work with cities to ensure that political will, including permitting practices and strategic collaborative efforts, reflects broadband as a utility. By combining resources, the cities and County can form partnerships to expand access using an incremental approach that capitalizes on shared interests.

7.2 Pierce County Backbone Network

Lack of competition in retail providers is influenced greatly by the availability of infrastructure or lack thereof, and by the enormous cost to build infrastructure. Many competitive regional or national providers will not take the risk of using their own capital to overbuild current incumbent networks, when the outcome may be to only capture a small portion of the market. Rather, providers will often times accept federal dollars in forms of grants or loans to buildout high-cost or underserved areas – relying on tax payer subsidies. This fact further negates the argument for fair competition as it relates to tax payer funded or "government owned networks," when most providers will only build into "areas that don't make the business case" when they're using other sources of capital. Competing with a subsidized carrier does not always make a lot of financial sense.

The business case or justification for buildout throughout Pierce County, under the "Internet is a utility" model, should necessitate local investments into furthering the access of next-generation broadband for all. With that being said, last-mile investments cannot be solely placed upon Pierce County, but should have buy-in from the local communities to be served.

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7.3 Detailed Recommendations

Recommendation 1: Continue to Work Collaboratively with and to Encourage Providers to Expand Infrastructure to Serve Rural and Underserved Pierce County, including new designated Economic Development Areas

Pierce County and its telecommunications partners have a vested interest in furthering the buildout and delivery of next-generation broadband services to the region's users. Unfortunately for areas like Pierce County, the vast rural nature of the area makes this a challenge. And, as is evident with current rural projects, they <u>require</u> government funding and subsidies in order to happen.

Communications between the providers, and the local communities is not great. Upgrade plans are not public and are therefore not discussed openly. Expectations cannot be met when they are not clearly defined and communicated. The lack of transparency around these upgrades greatly contributes to the problem.

Pierce County should work to ensure that its local government peers and industry partners/providers are at the table regularly to discuss the region's roadmap for deploying broadband. Pierce County should require regular quarterly updates on upgrade plans, and results for newly upgraded areas. (See Franchise Agreements Section.)

In addition, Pierce County should push for fiber connectivity. Often providers that accept rural upgrade dollars will invest in upgrading the existing copper plant to a newer standard or upgraded specification, thereby providing minimal upgrades to the services offered. While these upgrades are welcomed, they still position the area to lag others. These incremental upgrades provided by the area providers will no doubt have to occur again, and again – until they adopt a future-proof wireline technology such as fiber.

To help encourage broadband deployment by the carriers, the County should open its assets for use with broadband deployments, thus reducing some of the financial barriers these carriers may face.

Recommendation 2: Consider Formation of Special Districts to Provide Structure and Fund Broadband Expansion[73]

In many cases, rural communities can organize to support investment for next-generation broadband services. Local raising of capital by the potential subscribers or homeowners is one way to entice broadband providers to serve their areas. Homeowners associations (HOAs) are well suited for this as they are able to levy assessments for development improvements.

Unfortunately for much of rural Pierce County residents, they do not live in "organized" neighborhoods, where an overarching HOA is available to manage these types of infrastructure projects, leaving most residents to fend for themselves. But special taxing districts have been used in many states and should be considered for Pierce County.

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[73] The following analysis should not be considered to be a legal opinion. The analysis is based on a plain reading of the cited statutes and other materials.

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Recommendation 3: Establish a Broadband Infrastructure Program (BIP)

Magellan recommends the County consider leveraging existing public assets to support expanded broadband deployment. Collectively, Pierce County's local and state government offices have extensive assets which can support the efficient delivery of broadband services. Conduit, fiber, towers (water, fire or public safety communications), street light poles, and strategically located buildings can all be used to support the deployment of broadband infrastructure. This inventory of assets can be utilized through a Pierce County Broadband Infrastructure Program (or BIP), whereby community assets are leased to service providers for the provision of broadband or wireless services. These assets not only expedite deployment but can be utilized to generate revenue to cover maintenance and operations costs of the network assets, and to fund network expansion.

It is recommended the County consider completing an asset inventory of all sites and facilities that are approved for an alternate use of supporting provision of commercially available broadband services. The County would also determine which assets could be used for co-location of broadband facilities. Some of these assets have already been captured and included in the GIS database provided by Magellan.

Further, various segments of conduit and fiber exist, and are being expanded regularly in local jurisdictions. The County and its partners should ensure that additional fiber and conduit capacity is included within these projects and that fiber allocations are dedicated to a greater Pierce County project. These expansions should be supported by joint trench/dig-once practices.

Recommendation 4: Formalize a BIP to Make Use of Broadband Related Assets

Pierce County should begin to formalize its BIP, focused on meeting telecommunications needs and demands of government agencies and community anchors, while bringing value to the greater community, and monetizing any County assets that are made available. Counties and cities across the United States are developing these types of infrastructure programs to drive new revenues to local government, and to support long-term sustainability in their communities – including in bridging the digital divide. The County should work in conjunction with local cities and governments to facilitate a program of leasing assets for the use with broadband.

Furthermore, a BIP, when equipped with adequate assets, can negate the need for additional buildout in key areas, making community assets available to providers, instead of requiring them to build their own. For many local governments, this allows for greater control and management of ROW access, including during underground construction which can severely impact major transportation corridors, and can sometimes be impacted through underground construction moratoriums.

There are several tasks required in order for Pierce County to formalize this program, including:

- Document and maintain an inventory of available assets;
- Develop and standardize agreements for fiber, conduit, and pole/tower leasing;
- Develop pricing policies for fiber, conduit, and pole/tower leasing;
- Publish non-discriminatory rates and terms;
- Create an enterprise fund to maintain proper budgets, cost accounting, and to track

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expenses and revenues of the program; and,

- Create a capital fund to cover costs of building infrastructure.

It is recommended the County be prepared to incrementally grow its program as outlined in these recommendations. This progression will allow Pierce to take measured steps to deploying broadband throughout the County, enabling Pierce to expand its network as opportunities and community needs present themselves. This will also allow the County to support business and community anchor needs, as well as underserved/unserved residents, through the use of these community assets, and in partnership with local service providers who require access to the County's infrastructure.

Recommendation 5: Develop RFI and Seek Strategic Partnerships in Meeting Stated Goals

Pierce County is a large complex region and its Broadband Plan should be multi-faceted in its approach. To that end, the County should seek partners that can help in meeting this Plan's stated goals, with an eye toward delivering next-generation broadband services throughout Pierce County. Over the next 10 years, the cost to deliver broadband in the most rural areas will come down in cost or will be delivered through more effective means; in the meantime, however, speeds and services should continue to be upgraded and improved. The County should take advantage of working with the proposed new State Broadband Office.

Recommendation 6: Adopt Broadband Infrastructure and Fiber-Optic Standards

Pierce County should adopt broadband infrastructure and fiber-optic standards from which it will plan, construct, and expand its network. In addition, it should incorporate these standards into all planning and expansion projects, including joint trench/dig-once requirements.

Recommendation 7: Equip Economic Development Areas with Fiber Connectivity

Economic development areas should include any areas within the County that have been identified, marketed, or developed as a key area capable of driving additional economic value within the County and the greater region. Pierce County should strive to ensure proper next-generation broadband infrastructure, and leading services are readily available when companies decide to move into that area. (See section on driving broadband into Fredrickson.)

Taking a proactive approach to planning for telecommunications and technology in each area will ensure the necessary services are readily available from day one. As previously stated, Pierce County should adopt development standards for telecommunications infrastructure, and should enforce those standards, ensuring the project is designed and constructed with this infrastructure. Pierce County should not wait for the telecom providers to lay the necessary infrastructure, as they will not typically deploy until potential customers have been identified. For Pierce County, and its economic development partners, this issue can create a "chicken and egg" scenario, whereby the infrastructure is not readily available when site selectors and companies begin their search for the optimal location. It is usually too late at this point.

The County can take several steps to ensure its existing and planned areas are properly prepared, they include:

- Adopt appropriate development standards, conditioning next-generation fiber-based telecommunications infrastructure.

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Pierce County and its cities have the ability to condition development, whereby the approvals for development are contingent upon the necessary broadband infrastructure being installed as part of <u>initial</u> site development.

- Ensure Pierce County's downtown areas have the necessary capacity.

    Small businesses and entrepreneurs are locating in more urban downtown areas where industry networking occurs more frequently, and where they can engage in a more collaborative setting. Maker spaces, co-working facilities and collaboration studios are becoming more of a norm, as communities begin to focus their attention on attracting talent. These facilities require high-speed connectivity and can usually take a focal point in establishing these types of professional ecosystems. Most of the larger cities within Pierce County already have robust broadband, while other communities on Gig Harbor could use some improvement.

- Ensure connectivity to Economic Development Areas.

    In addition to the last-mile connectivity within the areas, middle-mile connectivity, connecting the site to the Internet, and major data center facilities are a necessary pieces of the overall solution. Pierce County should design appropriate handhole/vault configuration to enable easy interconnect as the County middle-mile network is expanded.

Recommendation 8: Implement Smart Community Technologies and Innovation Districts

Smart communities use sensors to provide real-time analytics such vehicle/pedestrian counts, environmental quality (pollutants, temperature, humidity, etc.), public safety, and other concerns. The data and network allow local government to automate services, inform the public, plan better, and track performance. Open data can spur additional, independent development, particularly of software but also in more traditional aspect of a jurisdiction—business development, land/real estate development, program development, etc. Santa Monica, CA was able to use its real-time parking systems and data to spawn a startup focused on routing vehicles to open parking spaces. This technology is now integrated into BMW, Mercedes and Audi vehicles.

For Pierce County, there is an opportunity to support and incubate local technologies that impact agriculture, as described herein, and other Pierce County industries. Sometimes all that is needed to spur innovation is to connect home-based entrepreneurs, inventors, researchers and software development professionals, and coordinate them around a common problem. Innovation Districts can facilitate this kind of economic development activity, creating local solutions to industries which are currently in the midst of major positive transformations through automation.

Innovation districts, smart city applications, and similar tactics rely on connectivity. Sustainable development, in which Pierce County can grow without negatively impacting prospects for future citizens, is an underlying goal. These tactics create new opportunities by bringing diverse persons together with critical resources. The assets—including buildings and people as well as network infrastructure—are essential but they don't do anything without activities. Pierce County should sponsor a range of innovation activities, particularly ones that capitalize on its

geographic character and natural assets. Make connectivity and network assets central to these activities to maximize the impact of broadband on economic growth and opportunities.

> "The trend is to nurture living, breathing communities rather than sterile, remote compounds of research silos."
>
> -Pete Engardio, "Research Parks for the Knowledge Economy." Bloomberg Businessweek

The County and its partners should look for key areas that could be fruitful grounds for an innovation designation. According to the Brookings Institute "a new complementary urban model is now emerging, giving rise to what we and others are calling 'innovation districts.'" These districts, by our definition, are geographic areas where leading-edge anchor institutions and companies cluster and connect with start-ups, business incubators, and accelerators. They are also physically compact, transit-accessible, technically-wired and offer mixed-use housing, office, and retail."

Further,

> *"Innovation districts are the manifestation of mega-trends altering the location preference of people and firms and, in the process, reconceiving the very link between economy shaping, place and social networking. Our most creative institutions, firms and workers crave proximity so that ideas and knowledge can be transferred more quickly and seamlessly. Our "open innovation" economy rewards collaboration, transforming how buildings and entire districts are designed and spatially arrayed. Our diverse population demands more and better choices of where to live, work and play, fueling demand for more walkable neighborhoods where housing, jobs and amenities intermix."[74]*

As this recommendation is focused on urban cities, the County would serve a supporting role, rather than lead.

Pierce County should:

- Use its public network assets as a platform for innovation;
- Support and incubate technologies,
- Define and identify prime urban locations, including supporting industries
    - Downtowns, specific parks and areas, redevelopment areas.
- Showcase technology, through strategic partnerships where possible.

The Recommendations listed above depend on organizational and technology governance capabilities. They provide a basis for collaboration and partnerships. While these recommendations are geared toward the greater Pierce County Broadband Plan, each municipality has a role to play in ensuring their communities are served, and that they have a seat at the table when it comes to the greater broadband discussion. Several cities are already involved in actively planning for broadband infrastructure. Others simply don't have the

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[74] https://www.brookings.edu/essay/rise-of-innovation-districts/

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resources, or haven't yet identified the need. Greater collaboration and more regional leadership can help to drive these improvements into every corner of the County.

7.4 Conclusions and Next Steps

Pierce County, with a lot of rural area, suffers a broadband gap primarily related to a funding gap. Like other rural areas throughout the United States, it is dependent on competitive service providers' willingness to buildout rural fiber routes and communities based upon grant and subsidized loan programs. Leadership at the County level can soften this dependency by creating mutually beneficial models for deploying the necessary infrastructure to all portions of Pierce County.

Pierce County should consider organizing itself in order to accomplish the goals and initiatives documented in this Plan. Additionally, Pierce County should build consensus amongst the community and potential partners to move broadband forward throughout the region.

Pierce's Broadband Strategic Plan's Roadmap and Action Plan include the following recommendations and prioritizations:

Pierce's Broadband Strategic Plan's Immediate Action Plan includes:

Action 1: Establish a Broadband Task Force

Action 2: Assign or acquire staff to facilitate broadband strategic plan

Action 3: Make broadband fiber deployment a county-wide strategy

Action 4: Formalize Broadband Friendly Policies and Standards

Immediate Focus Areas: Fredrickson and Key Peninsula

These Actions are short-term in nature and should be accomplished within the first 12-18 months of this evaluation's adoption. The next steps Magellan Advisors is recommending for Pierce County to follow over the next 10 years are intended to be incremental. By setting a 10-year timeline, the incremental steps are feasible and realistic for Pierce County to pursue, allowing adequate time to ease into the recommended model.

Initializing the recommended model should be viewed similarly to the original creation of other county departments in the past, in the sense that public demand for better telecommunications is gradually increasing; and, Pierce County should consider the opportunities to effectively meet the public demand in the next 10-year horizon and onward. Pierce County will continue to update the action items over time as new data becomes available and projects are completed.

Appendix A. Municipal Broadband Case Studies

As municipalities across the nation begin to make adjustments for next-generation broadband services in support of the future of their communities, a variety of approaches have come into play. The benefits of broadband services have been shown to positively impact communities both economically and socially including increasing economic competitiveness, workforce deployment, educational capabilities, municipal operations, and Smart City applications.

City and county governments have an array of options to choose from when selecting the right broadband business model to effectively meet the specific needs of their communities. Knowledge of the competitive market factors in the locality, needs of residents, businesses and internal stakeholders, and organizational and operational capabilities of local government should be carefully considered. The following section will discuss many of the available options in detail, as well as providing examples of cities who have found success in the adoption of each model.

Public Policy Only

The municipality utilizes its public policy tools to influence how broadband services are likely to develop in its community. Public policies are shaped to streamline the processes of designing, constructing, and managing broadband infrastructure in a local government's jurisdiction. Focus areas include right-of-way access, permitting processes and costs, construction practices and placement methods, and franchises and utility fee assessments. Examples of policies and standards include: joint trenching and dig once policies, utility relocations, and funding mechanisms for design, labor, and materials. This option is not considered a true business model per se, but does impact the local broadband environment and is therefore included as one municipal broadband option.

Public Policy Only Example: Santa Cruz County, California

In 2013, the board of supervisors approved an overhaul of broadband infrastructure plans and regulations. Specific areas of focus include permitting fee reductions and a proposed dig once ordinance that would make it easier to install fiber-optic cables during other work on area roads or utilities lanes.

Zach Friend, Santa Cruz County Supervisor, said, "Many regions throughout the country face a situation similar to ours: deemed too rural for real capital investment by the Internet Service Providers but urban enough that this lack of investment really puts us at an economic and community disadvantage. To have these policies recognized at a national level shows their applicability and value throughout the country."

The initiatives were crafted into a comprehensive set of policies:

- A dig once process that requires notification and an opportunity for broadband companies to join in whenever a street is open.
- Development of master lease agreements (MLAs) to simplify access to county facilities.
- Including conduit as part of public works projects, new developments, and land divisions.

The key challenges to policy development and implementation relate to internal departments working together and communicating the shortcomings in current practices and policies. With a

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better understanding of interdependent responsibilities, policies can be improved. In addition, changes often come with an associated cost, so the municipality will need to establish a fund to financially assist the early adoption of certain policies.

Public Services Provider

Public services providers utilize fiber and broadband resources to interconnect multiple public organizations with fiber or wireless connectivity. These organizations are generally limited to the community anchors within their jurisdiction, including local governments, school districts, higher educational institutions, public safety organizations, utilities, and healthcare providers. The majority of these anchors require substantial connectivity and often, the local government's network can provide higher capacity at lower costs than these organizations are able to obtain in the commercial market.

Public Services Provider Example: Seminole County, Florida

Seminole County owns and operates a 450-mile fiber-optic network that was installed over the past 20 years primarily to serve the needs of transportation. The county's Traffic Engineering Group initially developed the network by connecting traffic signals to fiber in the early 1990s to provide enhanced communications and better reliability. What was originally conceived to be a network used exclusively for transportation became a resource that connected public organizations across the county.

To date, the county's Traffic Engineering Department has connected 26 fire stations, 58 county buildings, 44 schools, 4 Seminole State College campuses, 41 city buildings, and 17 water treatment plants. In addition, the department maintains over 375 traffic signals, 148 school flashers at 73 locations, 46 beacons and flashers, and 29 variable message signs. The fiber network consists of different types of cables and strand counts: single mode, multi-mode, and hybrid. This results in approximately 1,246 active strand pair miles of fiber.

Seminole County's network has saved the public organizations millions of dollars and has enabled the county and its cities to:

- Share resources between the county, cities, schools and community colleges;
- Aggregate demand for public procurements to attain volume purchasing power;
- Provide inter-jurisdictional public safety communications between the county and cities;
- Reduce public organizations' spend on communications services on a countywide basis; and,
- Future-proof the communications needs of all organizations connected to the network.

Significant challenges were identified in certain portions of the County's network, resulting from the commingling of fiber assets with the Florida Department of Transportation (FDOT). The restricted use of the FDOT's assets limited the County's opportunities to utilize this fiber in commercial transactions. However, the County was still able to utilize these assets for its own purposes as well as other public organizations connected to the network.

Open-Access Provider

Local governments that adopt open-access generally own substantial fiber-optic networks in their communities. Open-access allows these local governments to "light" the fiber and equip

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the network with the electronics necessary to establish a "transport service" or "circuit" to service providers interconnecting with the local network.

The concept of open-access enables competition among service providers across a network that is owned by the local government. The municipality remains neutral and non-discriminatory with providers who deliver services over the network. Service providers lease access to the network based on the amount of bandwidth required by the end customer and establishes a standard rate structure and terms of service. They generally charge wholesale rates to retail broadband providers to use their networks. They publish rates to competitive service providers, charging a monthly recurring fee based on bandwidth of the service utilized or a flat fixed fee per month. Services offered may include Internet, telephone, data connectivity (transport), and dark fiber.

Open-Access Provider Example: The City of Palm Coast, Florida

In 2006, the Palm Coast City Council approved a five-year fiber-optic deployment project funded at $500,000 annually for a total investment of $2.5 million. The network was developed to support growing municipal technology needs across all public organizations including city, county, public safety, and education. The city utilized a phased approach to build its network using cost-reducing opportunities to invest in new fiber-optic infrastructure. As each phase was constructed, the city connected its own facilities and coordinated with other public organizations to connect them, incrementally reducing costs for all organizations connected to the broadband network. Through deployment of this network, the city has realized a savings of nearly $2 million since 2007 and projects further annual operating savings of $350,000. The network provides valuable new capabilities that enhance its mission of serving the residents and businesses of the community, while generating over $500,000 annually in new outside revenue from use of the network.

In a market where local fiber was scarce and unaffordable for all but the largest businesses, Palm Coast FiberNet now provides cost-effective fiber access for as little as $50 per month for a 10Mbps connection. Service providers utilize the network to deliver internet and business communications services for significantly lower costs than were previously available. FiberNet has reduced the costs of business internet services across the city by 30%. The city has enabled new competition and introduced a competitively priced fiber product into the wholesale market within Palm Coast.

Palm Coast struggles with decisions of whether to build out to customers in line with city's overall goals of supporting local economic development whether that be opting to not build the connections; proceeding with these connections; or declining to build where these connections are infeasible. Under most conditions, the city has been successful at building out these connections; however, this has been a recurring issue facing FiberNet and several other municipally owned networks.

Infrastructure Provider

Cities that provide conduit and dark fiber services to local organizations are generally considered infrastructure providers. They lease these assets to community organizations, businesses, and broadband providers. These organizations use municipal fiber to connect to one another and to data centers to reach the internet, cloud services, and other content

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networks. Many municipal providers who have deployed these services began by building their own fiber networks to serve purely municipal functions. As their networks grew, they realized that these networks could provide access to local organizations needing fiber connectivity.

Dark fiber is the core product of most infrastructure providers and is generally utilized by businesses, community anchor organizations, and in a few cases residents. Commonly, dark fiber strands are leased using a simple mileage-based price calculation to the end user. However, customers may require new construction to reach their facilities, resulting in construction costs to be incurred by the municipality and which will be charged back to customers to allow the municipality to recoup its investment.

Infrastructure Provider Example: The City of Santa Monica, California

In 2002, Santa Monica renewed its franchise with the local cable provider; it also included a lease of fiber-optic network capacity to connect various schools and community college sites. The city paid construction costs of $530,000 and shared the ongoing costs with the schools and community colleges saving a combined $400,000 in annual telecommunications costs which grew to $500,000 over several years. The savings were used as seed capital for the development of the city's own fiber-optic network.

Today, 126 businesses are connected to CityNet and approximately five are added monthly. The network covers approximately eight square miles and soon will be delivering up to 100Gbps of symmetrical broadband access. Prices for services are negotiated for each business customer individually.

Santa Monica's CityNet fiber network was able to achieve the following goals for the community:

- Lower costs of internet access for the city and schools;
- Establish free Wi-Fi in 35 public hot zones as well as distribute 375 computers in kiosks and libraries in town for free access;
- Nurture existing businesses, attract new businesses, support startups, VCs, and incubators; and
- Create an environment for other incumbents to invest in city infrastructure. The city has no plans to provide residential service.

As demand for high-speed internet services grew over the past five years, small and medium businesses desired an affordable internet solution that was enabled by a single provider. The struggle Santa Monica faced was maintaining lean operations and a "hands off" approach while still serving a range of business customers. Retail was a new business model that Santa Monica had not encountered yet which required a "change in thinking" to have true impact in the local market. The decision was made to offer direct internet services as part of its portfolio of services.

Municipal Retail Provider – Business Only

A common goal for municipalities that deploy broadband networks is to support local economic development needs. Local governments equip their business and industrial districts with fiber infrastructure through which they can provide cost effective, high-speed internet, and other services to local customers.

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Municipal business providers offer competitively priced internet and communication services that are generally very competitive in the small and medium business market against other provider offerings. They compete on both price and quality, generally focused on the following value proposition, all at a lower monthly cost:

- Higher bandwidth, scalable to Gigabit speeds
- Symmetrical service, the same upload and download speeds
- Higher quality fiber connections with less downtime and a stronger service level agreement
- Responsive local customer service

Municipal Retail Provider Example: The City of Hudson, Ohio

Similar to other communities that have recently decided to invest in municipal networks, Hudson's focus is only on internet access and voice. The gigabit network will be deployed incrementally by Hudson Public Power focusing on downtown and areas of high demand. Through the reinvestment of service fees from customers, the city plans to grow the network as a self-sustaining venture.

Hudson's municipal network is marketed under the name Velocity Broadband and the city is one of the first cities in the Midwest to offer gigabit connectivity. Hudson is actively signing on business customers while the network is being deployed. The city has no definite plans to serve residents but once business services are in place, they will consider a residential service offering.

Municipal Retail Provider – Residential

Municipalities that provide end user services to residential and business customers are considered retail service providers. Most commonly, local governments offer triple-play services consisting of phone, television, and internet services. As a retail provider, the organization is responsible for a significant number of operational functions, including management of retail services, network operations, billing, provisioning, network construction, and general management.

Perhaps the most important decision when evaluating a retail business case is whether the municipality should provide linear television services. Television is the "glue" that holds the triple-play service bundle together, and without television, many networks fail to achieve strong market share above 30%.

Costs vary among municipal retail providers. Therefore, it becomes difficult to set benchmarks consistently as each provider has a cost structure that differs from its peers. We do not advise that a city rely on the performance of other municipal providers to forecast its own expected performance.

Municipal Retail Provider – Residential Example: The City of Morristown, Tennessee

At the time of Morristown's initial deployment in 2004, fiber-to-the-home was not a common practice. However, once the city realized that fiber was a way to secure the network investment for the future, it was an easy decision. Nearly a decade later the upgrade to gigabit capability did not have to touch the fiber network – the electronics were simply changed on either end.

Morristown Utility System (MUS) FiberNet started signing up customers in 2006, and by 2008 had a take rate of 33%, with take rates in 2015 over 44% of homes passed, and a greater percentage of businesses. Out of the four broadband service providers present in Morristown, 80% of residents have availability to choose from at least two of those providers[75] and 100% of Morristown households have access to broadband internet.

FiberNet's strong financial performance resulted in:

- Cash flow positive two years after launch
- Net income positive after five years
- Revenues of $8.6 and $8.9 million in 2013 and 2014, respectively
- Businesses and residents saving $3.4 million annually
- $840,000 in savings from a smart meter program
- $20,000 in savings due MUS's dedicated network specialists.

MUS FiberNet's impact on economic development:

Oddello Industries, a contract furniture manufacturer that relies on FiberNet for its communications, announced a $4 million expansion resulting in 228 new jobs.

Molecular Pathology Laboratory Network (MPLN), a global leader in personalized laboratory medicine located its primary backup facility in Morristown.

While many benefits that outweigh the challenges, MUS admits that broadband and telecommunications is tough for a small community, due primarily to the economies of scale. The challenge for Morristown leaders was to gain the political will to be successful, battle the telecom lobby and the Tennessee legislature, and make good business decisions with vendors. MUS leadership acknowledges that it takes determination to make this model successful.

Public-Private Partnerships

Public-private partnerships (P3s) are an emerging business model that provides an innovative solution to an ongoing municipal broadband issue: How does a local government invest in municipal broadband without operating a broadband network?

Generally, P3s bring a local government and one or more private organizations into a partnership to plan, fund, build, and maintain a broadband network within the municipality's jurisdiction. In many cases, P3s are still in development as there are few cases of networks today permanently using this model.

The key to P3s is to find the right alignment between the public and private partner. Each organization must align on aspects of the P3 to make it successful, including:

- Who has rights to access the network and is the P3 exclusive or non-exclusive?
- What are the public and private partners' goals and how are they incentivized?
- What roles and responsibilities does the public and private partner have in the P3?
- What assets are financed through the public and private partner?
- What revenue model is used by the public and private partner to recoup their

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75 http://www.musfiber.net

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investment?

- What requirements must the private partner meet, in terms of service availability, speed, price, locations, and timeframes?
- How will the partners determine future buildouts and who pays for them?

Public-Private Partnership Example: Ontario, Rancho Cucamonga, and Vallejo, CA

The cities of Ontario, Rancho Cucamonga, and Vallejo, California have all contracted with Inyo Networks in P3 agreements for Inyo to function as the network operator and retail provider of business and residential fiber services. The cities will receive a percentage of gross revenues generated from the network assets, and in turn will be responsible for all capital costs associated with fiber expansion, as well as operations and maintenance of all conduit and fiber assets.

Under this agreement, Inyo will own all end-user customers and will be responsible for providing an excellent customer experience. Inyo provides a full suite of IP-enabled services including cable TV, phone and high-speed internet services. In Rancho Cucamonga, a 1 Gbps residential service starts at $69 per month, and a 1 Gbps business service at $250 per month.

Other Community Benchmarks and Lessons Learned

Riverside County, CA – RIVCOConnect

RIVCOConnect is a Riverside County, CA initiative, supported by the County Board of Supervisors and Executive Office and led by Riverside County Information Technology, that seeks to invite the private sector, either incumbent vendors or business entities new to the county, to work in a cooperative fashion and create partnerships to deliver broadband services countywide at speeds of 1 Gbps and above.

The main objective of RIVCOConnect is to encourage development and reduce restrictions on private entities to entice fiber network builds throughout the county. The strategies RIVCO is utilizing center around:

- Open Data Portals;
- Streamlining and reduction of costs regarding applications, permits, inspections, etc.;
- Seeking grants to minimize costs;
- Creating opportunities for providers to secure revenues after build-outs; and,
- Encouraging innovations that create demand.

Monroe County, NY

Over the course of the previous two decades, Monroe County spent millions of dollars installing fiber and conduit as part of sewer maintenance projects and an emergency communications systems project. As a result, the County has over 350 miles of fiber throughout the area with approximately 18% of the fiber strands being utilized to date. The network was constructed to initially connect county facilities with no plans by the County to compete with private providers. Furthermore, Monroe County provides network access to the City of Rochester, and other municipalities throughout the County.

Monroe County is now exploring opportunities to connect its network into regional data centers, and New York State education and research networks.

Columbia County, GA

The C³BU network currently offers 20 Gigabits bandwidth and is scalable to several hundred Gigabits. The Dense Wave Division Multiplex (DWDM) platform is Metro Ethernet Forum (MEF) 2.0 certified to provide true carrier-class performance to their customers. The C³BU Software Defined Network (SDN) also provides carrier-class packet optical transport services to other service providers.

C³BU directly serves Community Anchor Institutions (CAI) which consist of government, education, public safety, and non-profit facilities. C³BU currently partners with multiple providers for commercial and residential services. C³BU serves over 180 facilities through the network (excluding residential customers), and five service providers collocated in the point of presence facility.

C³BU seeks to use their technology investments to achieve the following goals:

- Stimulate demand for broadband, economic growth, and job creation by expanding the availability of affordable broadband Internet access for all people, businesses and community organizations.
- Promote the use of broadband to improve the quality and availability of health care, education and government services.
- Enable Intelligent Traffic System (ITS) to increase traffic management efficiency, thus reducing carbon emission impact.
- Support Supervisory Control and Data Acquisition (SCADA) migration from radio-based transport to Ethernet.
- Provide bandwidth to next generation applications such as Software As A Service (SAAS), public safety cameras, E-Health records, disaster recovery, automatic utility meter readings and distance learning.
- Provide public safety agency radio interoperability facilitated by new tower construction.
- Develop the C3BU into a hub access point for the region.[76]

City of Newport and Newport Utilities, TN

Newport Utilities is located in rural Cocke County, TN and provides electric, water, and waste water services to the residents in Newport, TN. This rural area is underserved and unserved in many areas of NU's footprint.

In December of 2015, Newport Utilities (NU) conducted a feasibility study regarding creation of a broadband network – overwhelming the response was positive from residents and businesses. By September of 2016, NU embarked on developing a formal implementation plan. In December of 2016, the NU Board unanimously approved the Phase 1 Business Plan.

The fiber network will be completed in a phased approach, with Phase 1 connecting 7,000 residential customers and nearly 1,200 businesses. Phase 1 is expected to take 12 to 18

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76 http://www.columbiacountyga.gov/government/departments-a-c/broadband-utility/about-broadband

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months, with Phase 2 beginning shortly after. Early in March 2018, NU connected its first pilot customer, who was very excited to have gigabit connectivity to the home in Cocke County.[77]

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77 http://www.newportutilities.com/fiber/index.shtml

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