Broadband in Garrett County:
A Strategy for Expansion and Adoption

Prepared for:

Garrett County, Maryland

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1. Executive Summary

Like most of rural America and the Appalachian region, Garrett County, Maryland faces a challenging broadband ecosystem in which private sector investment has largely overlooked rural areas in favor of the greater potential Return on Investment (ROI) offered by metropolitan areas. The policy-makers of Garrett County seek to improve that ecosystem through a range of strategies—if necessary through public investment—that will expand broadband availability and use and might make the County a more attractive economic prospect for private sector broadband investment.

This Report presents a strategy for impacting that broadband ecosystem for the better—for expanding both broadband facilities and broadband use in Garrett County.

This Report was researched and prepared in the latter part of 2011 and early 2012 by Columbia Telecommunications Corporation (CTC).

1.1 Project Background and Goals

Garrett County has for a long time recognized broadband as an essential element of economic and community development. Indeed, the County's economic development strategy recognizes as a critical goal to "[i]ncrease non-satellite, broadband Internet availability to at least 90% of the addresses in the county by 2014."[1]

As a logical continuation of its years of efforts in this regard, the County sought, in July 2011, to develop a broadband feasibility study and network design, with a specific focus on maximizing the fiber backbone to be built by the One Maryland Broadband Network (OMBN) project and increasing broadband access for County residents, businesses, and visitors. The County's goal, simply stated, is to enable its residents to benefit from the same communications technology as do residents of metropolitan areas of the United States.

In keeping with the County's economic development strategic plan, the goal of the County's project is to evaluate the feasibility and establish a plan by which the County can encourage, facilitate, and incentivize deployment of broadband communications facilities to 90 percent of the County's residential addresses and as many business as possible. Where possible, the County also hopes to encourage competition in the broadband market, so that Garrett County residents and businesses benefit from the innovation and cost benefits that competition delivers.

The County's specific goals for this project are to:

1. Ensure the availability of a minimum of 768 Kbps broadband service to the outlying areas of the County that are not currently served;

[1] "Garrett County Economic Development Strategic Plan," February 2011. http://s3.amazonaws.com/zanran_storage/www.gcedonline.com/ContentPages/2522798777.pdf (accessed March 2, 2012)

2. Ensure the availability of 4 Mbps down/1 Mbps broadband service (representing the target speeds for broadband identified by the Federal Communications Commission in its 2009 National Broadband Plan[2]) in the populated areas of the County;

3. Support the County's efforts to recruit and develop technology businesses, because of its twin challenges around underemployment and declining population; and

4. Minimize public investment, if possible, in achieving those goals—and ensure that any required public investment is modest and appropriately aligned with the benefits to be produced by the investment.

The County is agnostic as to broadband technologies; while recognizing that some wireline facilities are frequently best able to deliver higher speeds, the County also recognizes that wireless services are essential for mobility and provide access to some residents who do not have wireline options at their homes. As a result, this Report's goals include encouraging the deployment of all forms of broadband services regardless of technology.

The County is also agnostic as to service provider. Given the enormous significance of broadband for economic and community life, the County believes that all potential partners should be part of the eventual solution and none should be excluded. As a result, this Report considers the potential to engage all parts of the public and private sectors (both commercial and non-profit, incumbent and competitive) to attempt to stitch together a broad patchwork of solutions in which many different entities play the role to which each is best suited, with all the varied pieces ideally coming together into a full solution.

1.2 CTC's Task

In the fall of 2011, the County engaged CTC to prepare this Report. The focus of the engagement was to provide recommendations and insights that would help the County to expand the availability of broadband services to residents, businesses, and visitors.

Over the course of the engagement, CTC performed the following general tasks:

1. Met with a large number of key County stakeholders, including representatives of the public, private, and non-profit sectors

2. Met with a range of potential private sector partners from both the incumbent and competitive sides of the telecommunications/broadband industries, as well as the electrical utility

3. Researched and evaluated the current *demand* for broadband communications products and services in the County through a range of efforts and methodologies, including:

[2] Federal Communications Commission, "Chapter 8: Availability," *National Broadband Plan*. http://www.broadband.gov/plan/8-availability/ (accessed March 19, 2012).

   a. Surveys of the business, residential, and agricultural sectors, using online (for business) and mail (for residences and farms) methodologies

   b. Extensive conversations with broadband users throughout the County

   c. Extensive conversations with broadband providers throughout the County regarding the demand for, and adoption of, their products

4. Researched and evaluated the current *supply* of broadband communications products and services in the County through a range of efforts and methodologies, including:

   a. Evaluation of the National Broadband Map data collected and published by the FCC and Department of Commerce

   b. Discussions with Salisbury University, the State of Maryland's agent for collecting broadband availability mapping data

   c. "Drive-outs" of portions of the County to evaluate the presence of wireline facilities and reach of wireless signals

   d. Research of available products and services in the Garrett County market, and their pricing

5. Developed recommendations regarding opportunities for the County to meet the demand for middle-mile network services

6. Developed an engineering and financial analysis of requirements for deploying a wireless broadband network across parts of the County that are currently largely unserved

7. Provided support and guidance in discussions between County staff and potential private-sector partners

8. Prepared maps and data to support County requests to private sector companies to build and operate broadband facilities in unserved parts of the County

9. Provided support and guidance in discussions between County staff and the State of Maryland with regard to potential joint strategic initiatives that build on the One Maryland Broadband Network (OMBN) program

10. Assisted County staff in the preparation of an Appalachian Regional Commission grant application for extending fiber optic infrastructure to key community anchor institutions and business parks (i.e., economic development zones) in the County

11. Researched and evaluated the full range of potential loan and grant opportunities available from the state and federal governments

1.3 Definitions and Terms

The American Recovery and Reinvestment Act of 2009 (ARRA) directed the Federal Communications Commission (FCC) to develop a national broadband plan "to ensure that all people of the United States have access to broadband capability and establish benchmarks for meeting that goal."[3]

The definition of broadband for purposes of national policy has tended to differ depending on the program and the agency at issue. The ARRA broadband funding programs offered a set of definitions for purposes of evaluating grant applications.[4] The FCC's 2009 National Broadband Plan defined "broadband" as "a*ctual* download speeds of at least 4 Mbps and *actual* upload speeds of at least 1 Mbps" in establishing targets for nationwide broadband availability.[5]

Perhaps most importantly for the purposes of this Report, in February 2011 the National Telecommunications and Information Administration (NTIA) and the FCC launched the National Broadband Map, a searchable online map of nationwide broadband availability.[6] The map is scheduled to be updated twice yearly with data gathered by a grantee in each state, territory, and the District of Columbia, under the auspices of the NTIA's State Broadband Data and Development Program. (In Maryland, the grantee is Salisbury University, working in partnership with the Maryland Broadband Cooperative, the state's designated agent for this work.)

The National Broadband Map purports to track the availability of broadband at a range of speeds, with a primary focus on download speeds of greater than 3 Mbps and upload speeds of greater than 768 Kbps.[7] This Report thus defines as "unserved" by broadband any community in which, according to the data underlying the National Broadband Map, speeds of 3 Mbps/768 Kbps are unavailable.

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[3] ARRA, §6001(k). The Act also included another significant provision related to broadband access: it allocated $7.2 billion in funding to promote broadband deployment and adoption nationwide. Those funds were distributed through the Broadband Technology Opportunities Program (BTOP) and Broadband Infrastructure Program (BIP).

[4] The guidance for BTOP and BIP grant applications defined "unserved" and "underserved" areas in terms of access to broadband service: In an unserved census block group or tract, "at least 90 percent of the households lack access to facilities-based, terrestrial broadband service, either fixed or mobile, at the minimum broadband transmission speed." Notice of Funds Availability for Broadband Initiatives Program and Broadband Technology Opportunities Program, 74 Fed. Reg. 33104 (July 9, 2009). An "underserved" area was defined as a census block group or tract that meets one or more of these factors: "(i) no more than 50 percent of the households…have access to facilities-based, terrestrial broadband service at greater than the minimum broadband transmission speed…; (ii) no fixed or mobile terrestrial broadband service provider advertises to residential end users broadband transmission speeds of at least [3 Mbps] downstream…; or (iii) the rate of terrestrial broadband subscribership for the…service area is 40 percent of households or less." Notice of Funds Availability for Broadband Initiatives Program and Broadband Technology Opportunities Program, 74 Fed. Reg. 33104 (July 9, 2009).

[5] "Box 8-1: National Broadband Availability Target," *National Broadband Plan*, Chapter 8, http://www.broadband.gov/plan/8-availability/?search=definition%252C%2bunserved (accessed August 9, 2011).

[6] "About National Broadband Map," http://www.broadbandmap.gov/about (accessed August 9, 2011).

[7] Customary shorthand for representing the relationship between download and upload speeds is to separate them with a slash and forgo including the "download" and "upload" language. Downstream speeds are always first in the relationship. Thus, for example, speeds of 3 Mbps download and 768 Kbps upstream would be represented as 3/768 or 3 Mbps/768 Kbps or 3 down/768 up.

1.4 Summary of Findings

Generally, we conclude that both broadband availability (supply) and use (demand) are high in Garrett County, compared with much of rural America, though still lagging metropolitan areas, particularly in Maryland. The level of interest and awareness in broadband Internet is high in the residential, agricultural, and business sectors, and the County's leaders, both public and private, are working together with uncommon commonality of purpose and commitment. Garrett County represents tremendous broadband leadership and is a model for much of rural America.

At the same time, Garrett County suffers from many of the same challenges as does the rest of the rural parts of the country—large unserved remote areas; relatively little competition in population centers; and high pricing that prevents consumers from fully benefiting from the networks where they do exist. These challenges are significant and of enormous importance in light of the County's clear understanding of the importance of broadband to community and economic development.

1.4.1 The Economics of Rural Broadband Deployment

It is important to understand the County's broadband challenges in light of the economics of broadband deployment in rural areas. Broadband infrastructure requires very high capital expenditures and expenditures in less densely populated areas can be exponentially more costly per potential customer (home or business passed) than in metropolitan areas. As a result, the economics of broadband deployment—in light of both capital costs and potential revenues—greatly favor densely populated areas where Return on Investment (ROI) is inevitably higher. Garrett County, like most rural jurisdictions in the United States, feels the effects of these economics in its relatively low level of deployment: Those in the private sector with the greatest resources for investment simply do not see the County as justifying the same level of investment as is the case in the metropolitan areas of Maryland.

At the same time, another larger dynamic is at work that is impacting broadband in Garrett County—and most of the rest of the nation as well. For a range of reasons, the incumbent broadband carriers (phone, cable, and wireless carriers) have dramatically slowed investment in wireline infrastructure in favor of mobile wireless, which is seeing exponential growth in use and very high ROI. The incumbent phone companies have therefore completely stopped residential wireline investment (FiOS in Verizon's case; U-Verse for AT&T) and are no longer upgrading their legacy copper networks to improve wireline services to homes (indeed, the phone companies are barely even sustaining their legacy DSL systems in some areas). And at the same time, the cable industry, whose networks in densely populated areas are already quite robust, is focusing its infrastructure investment on the enterprise market (generally, medium and large business; government; and institutions).

Ironically, this picture is not much improved by the presence in a community, as in Garrett County, of local competitive entrepreneurs. A large number of competitive providers emerged in the communications market in the wake of the Telecommunications Act of 1996, but, like the incumbents, they reasonably focused their investments in areas of greatest population density because the potential ROI justified the investment; as a result, these new market entrants have, in many places including Garrett County, not dramatically expanded the availability of broadband

even as they have introduced a welcome level of competition into areas where broadband is available. And, unfortunately, these competitors face steep odds that have led to countless failures around the country in the years since 1996: Simply put, these competitors faced all the capital costs of building a new network but their potential ROI was reduced because of the need to share a finite market with incumbents. The economics were not in their favor and many of the remaining competitors are not in strong financial positions.

As a result of all these dynamics, rural communities face a challenging void: Wireline investment in the residential market, which never really reached rural areas, has virtually stopped even in metropolitan areas; there is little likelihood of the cable or phone wireline broadband footprint expanding to unserved areas. Fortunately, the picture is not quite as bleak in the rural enterprise markets or for mobile broadband services.

1.4.2 The Potential of Broadband to Increase Economic Development in Garrett County

As challenging as broadband deployment can be, its importance is even greater. A significant body of economic literature, dating to the late 1990s, has demonstrated the clear link between the economic well-being of rural communities and even low-speed broadband. Dating from the very first of these studies, which was conducted by Carnegie Mellon University and MIT, the link has been clear.[8]

As new broadband platforms emerge, the same link has been apparent. And fortunately for rural areas that lack sufficient wireline infrastructure but may see upgrades in wireless broadband facilities, the link between wireless broadband and economic development has also been established. As the U.S. Department of Commerce noted in a recent report on competitiveness, wireless broadband—like wired broadband— "has the potential to transform many different areas of the American economy by providing a platform for new innovation."

The report notes that as broadband spreads, it is likely to bring with it increases in income and new business investment; and new, high-quality jobs. These jobs are likely to be created directly—through investments in infrastructure—as well as "indirectly through as yet unanticipated applications, services and more rapid innovation enabled by advanced wireless platforms."

The report also summarizes the existing economic scholarship linking broadband and economic development and concludes that, although it is difficult to quantify the economic effects of broadband, such effects "are likely to be substantial."[9]

[8] Gillett, Sharon E., et al., "Measuring the Economic Impact of Broadband Deployment," National Technical Assistance, Training, Research, and Evaluation Project #99-07-13829, February 28, 2006. http://cfp.mit.edu/publications/CFP_Papers/Measuring_bb_econ_impact-final.pdf (accessed March 30, 2012).

[9] "U.S. Competitiveness and Innovation Capacity," *Infrastructure for the 21st Century*, U.S. Department of Commerce (2011), p. 5-8 to 5-10.

1.4.3 Existing Broadband Facilities in Garrett County

Broadband deployment in Garrett County is quite high relative to other rural areas. This current state is the result of a number of factors:

- First, the County has made its own significant efforts to increase broadband deployment and to educate County residents about the benefits of broadband.

- Second, there exist in Garrett County a number of local entrepreneurs who have, in creative and innovative ways (and against tremendous odds), deployed broadband facilities and expanded the levels of competition in broadband in certain areas of the County.

- Third, recent upgrades made by the wireless telecommunications industry have dramatically increased the availability of broadband in most of the County.

A map illustrating the County's existing fiber optic infrastructure, as well as proposed fiber routes and sites, is illustrated in Section 1.5.1 and attached as Appendix A.

The broadband Internet services available to residents of Garrett County vary dramatically across the jurisdiction. In some locations residents have a choice among multiple wireline providers while other locations lack any such providers at all. Residents in the north have greater options than those living in the south, including DSL, cable, and fiber.

National wireless carriers provide mixed degrees of mobile broadband coverage, but we see important recent improvements in wireless services as both AT&T and U.S. Cellular have upgraded existing facilities to state-of-the-art technologies.

By virtue of the technology, national satellite providers operate in all parts of the County.

1.4.4 Existing Use of the Internet and Broadband in Garrett County

The data suggest that the Internet use rate in Garrett County is very high—nearly 80 percent—as is the *broadband* Internet use rate, which is likely well above 60 percent.

On the basis of several sets of data (CTC's own surveys of the residential, agricultural, and business sectors, as well as the availability data in the National Broadband Map that was gathered by Salisbury University), we estimate that 78 percent of Garrett County residences are currently paying for Internet service (both narrowband and broadband), demonstrating a strong Internet adoption rate. The Adoption Rate measures market demand as a proportion of supply, and is calculated using the formula: $\boldsymbol{a = d/s}$ where "*a*" is the Adoption Rate, "*d*" is the rate that the service is purchased (the demand metric), and "*s*" is the rate of a service's availability (the supply metric). For the supply metric, we rely on availability data from the National Broadband Map.[10] For the demand metric, we use the results of CTC's surveys in Garrett County.

[10] The National Broadband Map relies heavily on self-reporting from Internet service providers. Depending on the company and the technology, the map's coverage numbers are likely overstated. Since we use these metrics as the

Broadband adopters comprise 62.2 percent of total respondents to the residential survey.[11] The National Broadband Map reports 97.1 percent of Garrett residents have the option of purchasing broadband. If that number were reliable, the adoption rate for all broadband service in Garrett County (the rate of usage divided by the rate of availability) would be 64.1 percent (0.622 / 0.971 = 0.641). This number represents a big-picture estimate of broadband market demand; it indicates that a Garrett County resident has a 64.1 percent likelihood of purchasing broadband Internet service where available.

Frankly, we believe this number understates the actual adoption rate because the availability data sourced from the National Broadband Map overstate availability.

These strong demand data are supported by qualitative factors, particularly the level of interest and response we encountered in Garrett County. In our experience working in rural areas, we have seldom seen so much willing cooperation among public and private sectors and such strong alignment of goals among entities ranging from the County to the Chamber of Commerce to community non-profits. In addition, we have never—in 15 years of conducting survey work—seen so high a response rate as we encountered in this project, a strong sign of the level of interest and engagement throughout the community.

Adoption in the agricultural community is somewhat lower that in the residential market as a whole, and a small but significant minority reports that they do not even own a computer. These data suggest that the County can benefit economically from expanding digital literacy and broadband availability in this important economic sector.

1.5 Recommendations

In general, our recommendations focus on cost-effective initiatives that the County can pursue to reach its goals. While we suggest some ambitious plans in terms of financial commitment, the majority of our recommendations focus on strategies that can be undertaken with existing County staff and resources.

First and foremost, CTC recommends that the County focus public investment on middle-mile fiber infrastructure—a long-term investment that will open new opportunities for the private sector while serving public institutions. The County's pending Appalachian Regional Commission grant application provides one model to replicate with other funding sources. The State of Maryland's networkMaryland would be a strong partner for incremental construction whenever the County's rights-of-way are disrupted. And there may be opportunities, however limited, to facilitate private sector expansion of middle-mile infrastructure.

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denominator in calculating adoption rates, it is likely that true adoption rates are higher than those calculated in this report. This suggests that consumer demand for the broadband services predicted in this section are on the conservative side, and that true demand is likely higher.

[11] 78.1 percent of respondents said they have home Internet access. However, of total respondents, including those who have not purchased Internet service, those who reported using dial-up account for approximately 8.7 percent. Another 7.2 percent of respondents use a satellite service, another non-broadband technology. If we subtract the dial-up and satellite users from all home Internet users, we are left with 62.2 percent of respondents who have purchased broadband Internet service.

In addition, we propose a relatively modest wireless deployment, in partnership with Garrett County Community Action Committee or another private operator, that would fill many of the availability gaps—but such a network would almost certainly not be self-sustaining and would require annual public subsidy of about $250,000. This strategy may be worth delaying for one to three years to see if the availability gaps it seeks to fill are addressed by commercial deployment, and whether declining equipment costs makes the economics of this strategy more attractive.

To support small Internet service providers in Garrett County, we recommend that the County work with the Maryland Broadband Cooperative and Garrett County Community Action Committee to make available to local entrepreneurs cost-effective commodity Internet bandwidth that can enable affordable service in areas where none currently exists. On the demand side, we recommend that the County devote modest resources to demand-side education, with efforts targeted at a number of specific groups of users and potential users.

Specifically, we recommend the following:

1.5.1 Expand Middle-Mile Infrastructure to Serve Public Entities and Reduce Deployment Costs for Private Providers

The County's first priority should be to develop more middle-mile infrastructure to facilitate and support last-mile extensions to community anchor institutions, industrial/technology parks, and potentially to residential areas. Building fiber to developments such as McHenry Business Park, especially, would be significant for the County's economic development efforts. And projects such as these would pay dividends, too, in terms of expanding competition in the broadband marketplace.

The rationale for investing in the middle mile is clear: This is an area that is a logical way for the public sector to try to create private sector opportunity—and where the private sector has itself failed to meet the needs of the market. More specifically, *bridging the middle mile* represents a critical challenge to any community seeking to *expand last-mile availability*, as is noted in an Aspen Institute report by Blair Levin, the architect of the FCC's National Broadband Plan: "Numerous studies have demonstrated that the cost of middle-mile transport (which refers generally to the transport and transmission of data communications from the central office, cable head end or wireless switching station to an Internet point of presence or gateway) and the cost of second mile (transport from the remote terminal, cable node or base transceiver station to the central office, head end or mobile switching stations) often make it uneconomical for business to offer broadband in rural areas."

Levin notes that the challenge is concentrated around pricing—that high middle-mile costs make it "difficult for ISPs to offer an affordable service. Low density and demand in rural areas, coupled with the volume dependent middle mile cost structure, means that rural broadband

operators do not benefit from the same economies of scale that service providers in denser areas enjoy."[12]

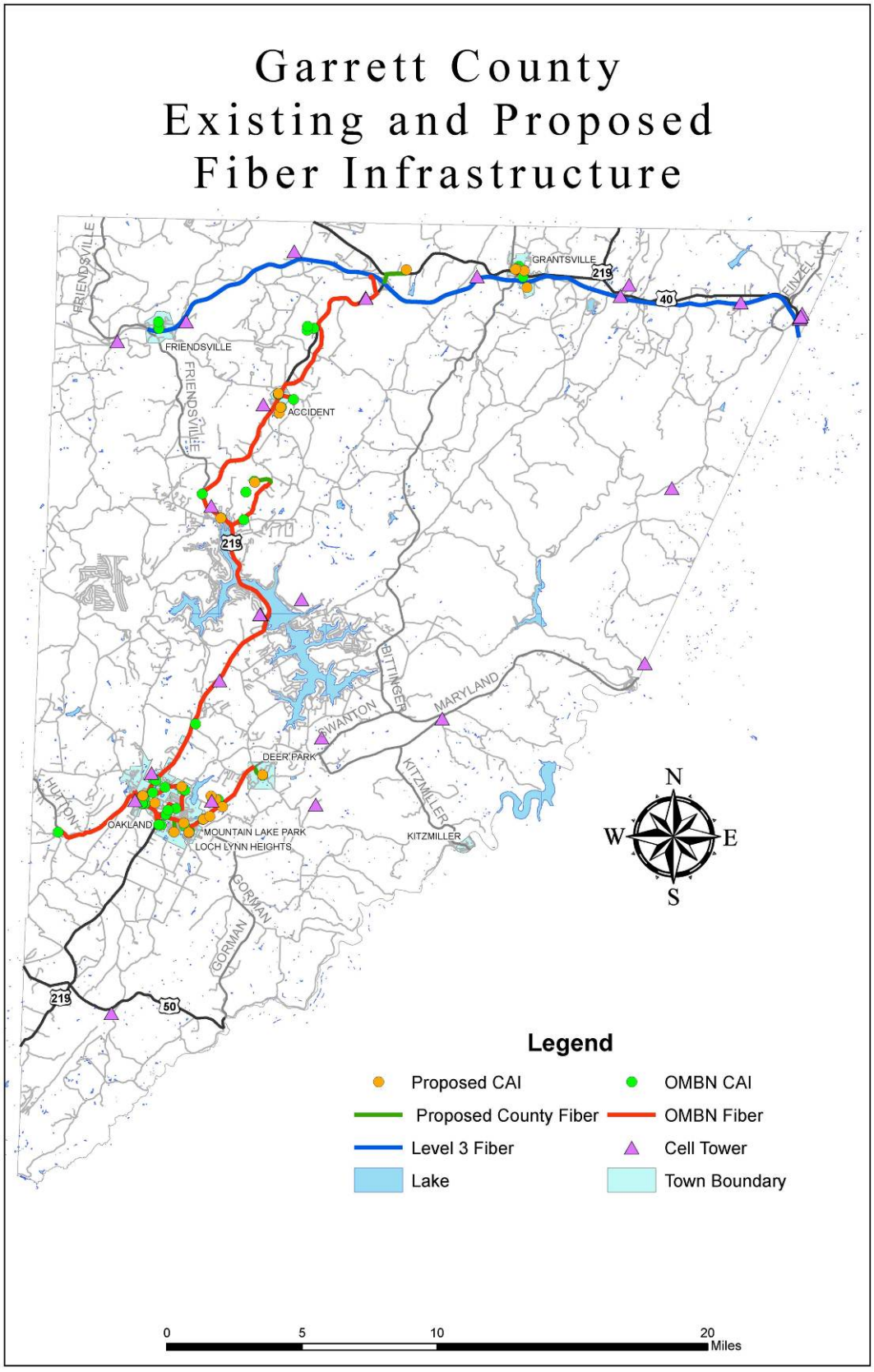
This is why the Broadband Technology Opportunities Program (BTOP)—the federal grant program that is funding the One Maryland Broadband Network (OMBN)—focuses on open access fiber infrastructure that makes the market more competitive in the middle mile. For the same reason, we believe the County will reap the greatest long-term rewards by focusing its resources on expanding middle-mile.

The County is wisely attempting to capitalize on OMBN with its March 2012 grant application to the Appalachian Regional Commission (ARC). In that application, which CTC helped to develop, the County proposes to extend its 50 miles of OMBN backbone fiber with 2.75 additional miles of fiber. The ARC grant would cover fiber and electronics to light 17 new sites—both community anchor institutions (e.g., Garrett College Oakland Outreach Center, Grantsville Outreach Center, and Grantsville Senior Center) and key economic development areas (e.g., Southern Garrett Industrial Park). The ARC grant would also fund electronics at 22 schools that are being connected with (dark) OMBN fiber.

A map illustrating the County's existing fiber optic infrastructure, as well as the proposed fiber routes and sites that would be funded by the ARC grant, is illustrated in Figure 1 below and attached as Appendix A.

[12] The Aspen Institute Communications and Society Program, *Universal Broadband: Targeting Investments to Deliver Broadband Services to All Americans*, Washington, D.C.: The Aspen Institute, September 2010.

Figure 1: Existing and Proposed Fiber Infrastructure



Following a similar approach, the County could identify additional economic development zones and a targeted list of CAIs that lack sufficient broadband service, then develop funding sources and timelines for installing fiber and electronics to connect those facilities. (See Section 1.5.7 for details on potential funding sources.)

We further recommend that the County continue to pursue partnerships with private sector entities to build middle-mile infrastructure. These partners could include First Energy and the Maryland Broadband Cooperative, both of which have short and long-term interests in building backbone fiber in Western Maryland. (The incumbent carriers do not plan any large-scale middle-mile installations.) To benefit the County, such installations should follow the open-access middle-mile fiber network model established by BTOP.

On a related note, the County should create a process by which private sector providers would notify the appropriate County departments (i.e., Information Technology, Economic Development) whenever they will be performing construction in the right-of-way. This is the same process that we have recommended to many counties with Institutional Networks to ensure that they can capitalize on private sector projects.

The rationale here is simple: Expanding broadband infrastructure to reach new buildings requires installing fiber optic cables, either on aerial lines or underground. As with any other public or private communications infrastructure project, the cost of construction—preparing the site, digging trenches, repairing roads that have been disrupted, and so on—is significantly higher than the cost of the actual fiber optic cable. By maintaining a constant awareness about upcoming capital improvement or construction projects in the public rights-of-way, the County may be able to take advantage of the efficiencies presented by that construction (e.g., by installing fiber at the same time that the right-of-way is being dug up for another purpose). In fact, "piggybacking" on other construction efforts in the County could make additional middle-mile connectivity feasible in places where it would otherwise be cost-prohibitive.[13]

The State, through networkMaryland, will provide free fiber to any locality that wants to install it—in exchange for some of the resulting fiber capacity. By taking the State up on its offer every time work is completed in the rights-of-way, the County would build up a critical mass of fiber at a relatively modest cost. This process will be incremental and slow—but it is an important long-term, strategic effort. (The County, of course, would also need to extensively and formally document the location of all fiber is so that it is usable over time.)

Taking this one step further, the County could also alert private sector providers whenever it will be working in the right-of-way. It is perhaps unlikely that an incumbent provider would choose to add plant, but such a notification would be easy to provide and could enable additional installation.

[13] For additional reference, see: "Brief Engineering Assessment: Efficiencies available through simultaneous construction and co-location of communications conduit and fiber," prepared by CTC for the National Association of Telecommunications Officers and Advisors (NATOA) and the City and County of San Francisco, 2009. http://www.ctcnet.us/2009%20CTC%20Coordinated%20Conduit%20Construction.pdf.

1.5.2 Bridge the Last Mile to Unserved Areas of the County by Investing in a Small Wireless Broadband Network

The most direct approach to meeting the County's broadband service goal is for the County to fund that service itself by building a network that will reach many of the unserved portions of the County. The private sector—left alone, or even with significant incentives—is unlikely to get the County to its 90 percent residential access goal. For that reason, we recommend that the County consider a potential strategy for building and operating a not-for-profit network that would make broadband service available to a portion of its unserved residents.

1.5.2.1 Technology Considerations

Section 2 of this Report presents a system-level design and high-level business model to support this recommendation. The network, illustrated in the map in Figure 2 below and in a full-size map in Appendix B, is designed to reach as many unserved homes as possible at the lowest possible capital cost. It thus focuses on unserved areas that have the densest possible development, which reduces capital costs and maximizes the number of homes reached with the public investment.

We recommend a wireless network that, to minimize costs and maximize reach, uses television white spaces (TVWS) technology, which is a promising option for small wireless Internet service providers (WISPs) to offer fixed wireless Internet services. For a variety of reasons, this is the most cost-effective way to build wireless without incurring the costs of licensed spectrum.

1.5.2.2 Financial Considerations

The County's annual cost to sustain the network and make service possible for nearly 3,000 homes will be approximately $250,000, including principal and interest payments on a capital cost of approximately $1.2 million, financed at 6 percent. This estimate assumes that 30 percent of the homes passed purchase services at $40 per month (our "base case" assumptions). If the County pays the initial $1.2 million capital cost upfront (e.g., out of general funds) rather than financing that expense, however, the network's balance sheet improves significantly: Using the same assumptions about take rate and monthly service fees, the network would end year 5 with a projected cash balance of $167,000. (For more analysis of network financial projections without principal and interest payments, see Section 2.1.)

Not surprisingly, the economics for the network deteriorate if the take rate is lower than our (conservative) 30 percent projection. Under the financing scenario, at 20 percent penetration, the County's annual outlay is around $370,000. Conversely, at a 45 percent take rate, the County's annual subsidy is closer to $160,000.

The network does sustain itself at a 68 percent take rate, assuming $40 per month service fees. If the fees increase to $50 per month, the network is self-sustaining at a 48 percent take rate. Thus, unless the take rate is far higher than our assumed 30 percent, the network is unlikely ever to sustain itself as a standalone entity and will require ongoing County subsidy.[14]

[14] We note that, while fiber-to-the-home is the state-of-the-art architecture, it is also exponentially more costly and would likely entail an annual deficit many times this size of the shortfall in a wireless scenario.

Because the proposed network is particularly designed to reach unserved, low-income areas, it may be eligible for a grant under the U.S. Department of Agriculture's Community Connect Grant program.[15] Community Connect is a modest-sized grant program for local governments and Native American tribes that focuses on targeted deployment to completely unserved, very low income areas. The 2012 program is expected to be announced imminently—in the spring of 2012.[16] This grant opportunity is discussed in more detail below, but we caution that this is a long-shot opportunity; while the grant's parameters change annually, in the past this program has targeted very low income areas with very high unemployment rates and Garrett County simply may not be sufficiently competitive for this opportunity. That said, much of the work necessary to apply for the grant has already been done and the materials in this Report can be relatively easily adapted into a grant application once the grant window opens. In the event that the County were successful in getting a grant, it may fund as much as 100 percent of the capital costs of the network, leaving a relatively modest annual cost for County subsidy; *with no upfront capital costs or financing charges, we project that the network would be self-sustaining at a 30 percent take rate for services at $40 per month*.

The TVWS technology has only recently become feasible (when the FCC made it legal to use that spectrum for such networks) and, as a result, equipment manufacturers have not yet achieved economies of scale. Over the next few years, as these technologies are more broadly deployed, both competition and scale will emerge in the TVWS equipment market and pricing is likely to decline. For that reason, this strategy may be more attractive in a year or two than it currently is.

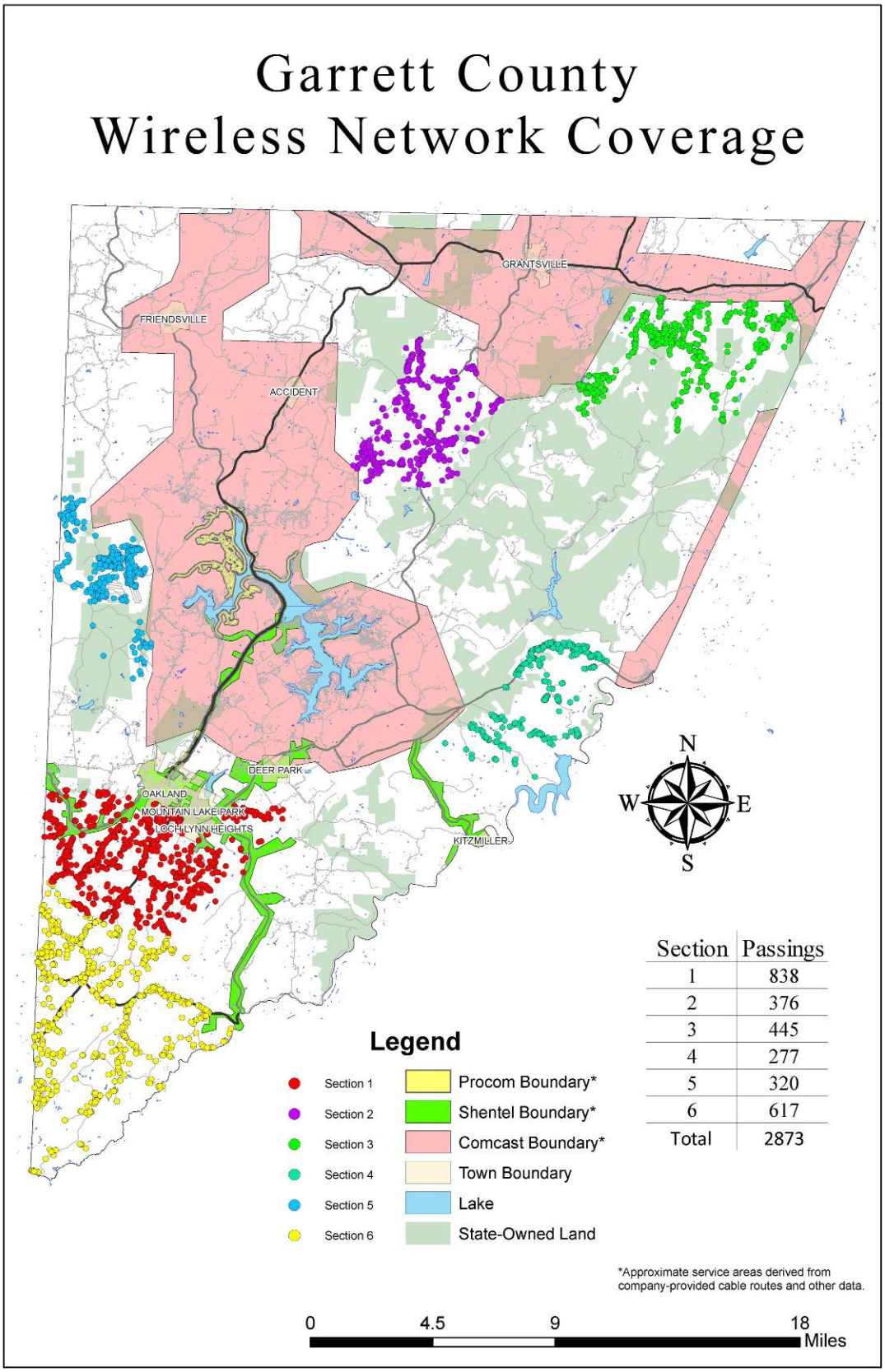
Equipment costs, however, comprise a relatively small part of the cost of the network; the bulk of the operating cost is for debt service and staffing costs. As discussed above, if the County does not need to finance the capital costs, the economics for the network improve. Staffing costs, however, cannot be reduced; on the positive side, those funds will create and sustain high-quality jobs in Garrett County, with all the associated economic benefits.

1.5.2.3 Governance and Operations Considerations

We recommend that the County work with Garrett County Community Action Committee (GCACC) on this strategy. GCACC, with its missions of economic development, education, and serving the unserved, is a logical partner to take operational responsibility for this network, and can also use the opportunity to provide technical and customer service training and skills as part of its workforce preparedness efforts. In addition, as a community non-profit, GCACC will look to the County to support network operations financially, but will not require that the County subsidize to the point of guaranteeing a profit, as a for-profit partner would. In this way, the County can avoid concerns about public subsidy for one for-profit entity over others—while at the same time investing to enable the benefits of broadband in some of the least served, lowest-income areas of the County.

[15] United States Department of Agriculture Rural Development, Rural Utilities Service, "About Community Connect Grants." http://www.rurdev.usda.gov/utp_commconnect.html (accessed March 21, 2012).
[16] E-mail from Janet Malaki, Senior Loan Specialist, Northern Operations Branch, Broadband Division, Rural Utilities Service, United States Department of Agriculture. March 20, 2012.

Figure 2: Map of Proposed TV White Spaces (TVWS) Network Coverage Areas



1.5.3 Encourage Carrier Expansion of Wireline Last-Mile Infrastructure

We recommend that the County also continue to take steps to directly support the construction of last-mile infrastructure by offering support to incumbent service providers. As we note in Section 4, CTC and the County have met with Shentel, Comcast, and others to discuss the County's goals and potential strategic partnerships. (Comcast and Shentel are currently evaluating maps of unserved areas that are contiguous with or close to their existing service footprints; the County and CTC provided the maps in March 2012 with a request to discuss the possibility that the companies would provide service to residents in those communities.)

While these efforts to reach out to the private sector to encourage construction of last-mile infrastructure have not led to the level of development that the County needs, we nonetheless see the effort as an important element of the County's long-term strategy. These efforts may well result in incremental improvements in residential access in the future.

Unfortunately, the improvements will, at best, be only incremental. As is discussed in some detail above, the economics of rural broadband deployment make highly unlikely significant investment to expand rural residential broadband footprints. And absent extremely costly public subsidy (as much as tens of thousands of dollars to reach some homes with wireline infrastructure), it is almost impossible for the public sector to dramatically change that economic calculus.

1.5.4 Facilitate Cost-Effective Commodity Bandwidth for Competitive Providers

Enabling and facilitating reduction in commodity Internet pricing in Garrett County is one area where the County can easily support private sector efforts. Specifically, the County can monitor and encourage the provision of cheaper commodity bandwidth in Western Maryland and can work with smaller Internet service providers to be sure they are able to benefit from potentially lower prices.

Commodity Internet bandwidth has traditionally been very expensive in rural areas. Pricing has dropped exponentially in recent years in the major cities where large carriers connect to each other, but the reduced pricing has not dropped proportionally in rural areas. But the backbone fiber to be constructed as part of the One Maryland Broadband Network (OMBN) will, ideally, open the market for commodity bandwidth in the County.

The OMBN's open access fulfillment partner is the Maryland Broadband Cooperative (MdBC). MdBC is a cooperative non-profit that will receive some dark fiber on OMBN routes. Under the terms of the OMBN grant from the federal government, that fiber will be open access as will the network MdBC operates with equipment purchased with grant funds.

The Coop will likely become the most cost-effective means by which private sector Internet service providers in Garrett County can purchase commodity bandwidth. More cost-effective bandwidth could be transformative for small, entrepreneurial Internet service providers in Garrett County such as ICEWEB. As is discussed in detail below, ICEWEB is currently paying more than $300 per megabit per month for commodity Internet bandwidth, thus dramatically limiting

the speeds it can afford to offer its customers and that they can afford to pay. At this high pricing, ICEWEB can purchase only about 3 megabits.

Given the Coop's tentative pricing for Western Maryland, we anticipate that ICEWEB would be able to reduce its costs for commodity bandwidth by a factor of eight to 10, and possibly by far more, depending on how much it can purchase, because pricing per megabit drops as the total number of megabits purchased increases.

For example, for 10 megabits per second, Coop pricing (for both "transport" and commodity bandwidth) is likely to average approximately $40 per megabit per month. However, for a buyer of 1 gigabit (1,000 megabits), per megabit pricing could drop as low as $8 to $10 per month. ICEWEB, however, may not be able to afford, and may not need, as much as a gigabit.

The County (or one of its partners or designees), therefore, potentially has an important role to play in facilitating aggregation of bandwidth needs and enabling groups of buyers to purchase collectively from the Coop, thus enabling all participants to benefit from the scale offered by large bulk purchasing. We therefore recommend that this is an area where the County should remain vigilant and deeply engaged—as it has been, to its credit, to date.

1.5.5 Create Governance Structures to Manage the Strategies Proposed Here

With an understanding of the existing institutional and organizational culture in Garrett County, CTC suggests the creation or use of two enabling governance mechanisms for purposes of achieving the operational recommendations noted here (obviously, our recommendations have to do with operational capacity—we recommend that the County also seek legal counsel with relevant expertise to address liability and other issues).

First, the County itself can focus on its core communications mission—serving the public sector. The obvious entity to meet the communications needs of the public sector in Garret County already exists in the form of the County's very capable IT department—which has demonstrated significant technical competence and capacity, as well as the appropriate sense of mission to manage the dark fiber the County will obtain from OMBN; light that fiber; and create an internal Garrett County intranet. This public and non-profit focused mission is appropriately narrow and very much in keeping with existing County structures and policies. It is appropriate, too, because it does not require substantial or any significant changes to existing structures.

This mechanism for public provision of services to the public and nonprofit sectors is also a tried-and-true public sector strategy at the county level throughout Maryland, and has proven itself over more than a decade in Allegany, Anne Arundel, Baltimore, Carroll, Frederick, Harford, Montgomery, and Prince George's counties. While it is also noteworthy that some public telecommunications projects focused on delivering services, particularly over fiber optics, to homes and business have encountered opposition around the country from incumbent telecommunications carriers, this institutional public/non-profit sector approach has been largely noncontroversial.

Second, we recommend that with respect to services to the home and business (specifically, the wireless network to serve unserved homes, as discussed above), a strong and established non-profit entity—the Garrett County Community Action Committee—take responsibility for network ownership, operations, and oversight. GCCAC has traditionally taken the role of supporting public interest initiatives in the County, and of bringing its organizational and management expertise to bear on facilitating new programs for the benefit of the community. In this case, GCCAC's management would be the mechanism to facilitate the County's goals to provide communications services where the private sector market has not had interest—and it would do so in a way that involves the non-profit private sector as a partner, both removing the County from the need to become a telecommunications utility to the public, and providing the County some insulation from day-to-day operations.

This nonprofit entity could also be the facilitator of bulk purchases of more cost-effective commodity bandwidth in order to support private sector entities within the County (particularly local entrepreneurs), as is discussed in the recommendation above.

1.5.6 Educate County Residents About Broadband

To capitalize on its efforts to expand broadband infrastructure and availability, the County would be wise to devote some resources to educating potential end users—or encouraging the private sector to educate their potential customers—about broadband. In this way, the County can attempt to influence *supply* side decision by private carriers by increasing *demand* and making investment more attractive.

1.5.6.1 Comcast Internet Essentials Provides Low-Cost Broadband

The Comcast Internet Essentials program offers "high-speed" Internet access[17] at $9.95 per month, with no installation, activation, or equipment charges. Participants can also purchase a "netbook-style laptop computer" for $149.99 when they enroll, and Comcast touts the availability of "free Internet training — online, in print and in person."

Internet Essentials was created when Comcast hoped to convince the Federal Communications Commission (FCC) to approve its proposed merger with NBC Universal, so it voluntarily made a nationwide commitment to providing low-cost Internet access to low-income residents in its existing service areas.

The program launched in September 2011, and is slated to last for three school years.[18]

Eligibility for the Internet Essentials program is limited to households with at least one child receiving free or reduced school lunches through the National School Lunch Program. Based on this criterion, Comcast has attempted to distribute information to eligible families through Garrett County Public Schools, but the Board of Education has declined the request to distribute

[17] "Download speeds of up to 1.5 Mbps and upload speeds of up to 384 Kbps" per "Internet Essentials FAQs." http://www.internetessentials.com/faq/index.html (accessed March 1, 2012).
[18] "FCC Chairman Genachowski Remarks at Comcast Internet Essentials Event," FCC, Sept. 20, 2011. http://www.fcc.gov/document/fcc-chairman-genachowski-remarks-comcast-internet-essentials-event (accessed March 1, 2012).

Comcast materials—stating, quite reasonably, that it cannot recommend a single vendor's product.

Other than this overture to the schools, we have not seen any significant efforts by Comcast to educate Garrett County consumers regarding Internet Essentials. We recommend that the County strongly encourage Comcast, whose obligation it is to publicize this product, to find alternative methods to inform potential Garrett County customers—whether through print and television advertising, public service announcements, or other means. Comcast has made a nationwide commitment; Garrett County consumers should hear about the opportunity, and should have access to their fair share of the benefit.

In a similar vein, if Shentel or other providers offer equivalent service through the recently announced "Connect to Compete" program,[19] we would recommend that the County ensure that residents are adequately informed of those opportunities. (As of the writing of this Report, Shentel is "monitoring the program" and evaluating whether to participate.)[20]

1.5.6.2 Consumers Can Aggregate Their Needs to Incent Carrier Construction to their Neighborhoods

The County, through its economic development department, can serve to assist consumers to aggregate their buying power and petition private carriers to build broadband facilities to serve their neighbors. This strategy is, frankly, a long-shot – carriers need compelling economics before they will build new facilities, but it is relatively low cost for the County and is more likely to bear fruit than if consumers do not have this assistance.

For example, Shentel, which is a regionally owned, flexible, and easy-to-work-with company, made significant efforts to frankly explain the circumstances under which they would expand their residential footprint. Shentel representatives told us that while the company has no immediate plans to expand its infrastructure, it would consider doing so in areas close to the existing plant where the density of homes supported the business case.

Shentel makes decisions about extending its residential plant based on a formula that includes the type of construction and the number of homes per mile. In a situation where construction has to be underground, it requires a minimum of 50 homes per mile of construction. In situations where construction can be aerial—which is less costly than underground—it requires a minimum of 30 homes per mile.

Shentel also commits that if it learns of neighborhoods with multiple consumers who live in close proximity and are willing to make an upfront commitment to purchase services, then it might be willing to expand its footprint to reach those residents even if the group represented a lower density of homes per mile than the construction formula typically requires. In other words, if consumers aggregate demand for service among their neighbors, they might create a critical mass of consumers, which would in turn create a far stronger business case for an investment in

[19] "Low-Cost Broadband, Computers for Millions of Students, Families," Official FCC Blog, Dec. 14, 2011. http://www.fcc.gov/blog/low-cost-broadband-computers-millions-students-families (accessed March 1, 2012).
[20] Personal e-mail between Joanne Hovis (President, CTC) and Christopher Kyle (Vice President of Industry Relations & Regulatory, Shentel), Feb. 29, 2012.

building broadband infrastructure.

(Comcast has not been willing to share its formula for expanding its residential footprint, if such a thing exists. And Comcast representatives have been candid that the company's investment strategy is focused on the enterprise market rather than the residential market. That said, there is no question that the company's rationale would be similar: if the business case exists, they will build. And the way to determine the business case and return on investment is to gauge demand.)

Based on this clear understanding of Shentel's model—and the assumption that Comcast has a similar formula—we recommend that the County educate residents in unserved areas about the potential opportunity to attract Shentel's construction. The County's Office of Economic Development could take on this task, and could use the same tools and strategies it uses to publicize other important programs or advice. It could, for example, "pitch the story" to the *Cumberland Times-News*, which has been extremely engaged in the topic of broadband, as have some of the local radio stations.

Further, if a group or groups of residents were interested in pursuing this opportunity, the County could play a role in facilitating at least initial discussions between the residents and the company. The County would have the standing and the leverage to bring company representatives to the table, and could assist the residents in at least the initial meeting.

We make this recommendation with a caveat: While the County should support its residents in this regard, it should be cautious about not overestimating the potential future availability of service. The County has absolutely no control over the investments that Shentel, Comcast, or any other private sector company might make; although the companies (especially Shentel) appear to have been amenable thus far, there are no guarantees that they will follow through. Thus, the County will likely need to temper consumer expectations.

1.5.6.3 Broadband Has Benefits that Justify Its Costs

A number of the County's broadband providers have identified that there are many consumers, both residential and small business, who do not understand the value of big bandwidth. This is a nationwide problem, not just an issue in Garrett County. We believe there is an opportunity for the County to have a positive impact here, and we recommend that the County devote resources to developing an ongoing community education effort related to broadband adoption.

For many potential broadband users, it is difficult to separate the value of broadband from its cost, because those concepts are so interrelated. Thus, it appears that there are many broadband customers in the County, particularly on the small business side, that are willing and able to pay for first-generation broadband products at lower speeds, but are unwilling or unable to pay for higher-quality broadband products. This appears to be the case for many customers of Procom—a very capable broadband network that includes state-of-the-art fiber-to-the-home infrastructure.

All of this suggests that there are many applications that are foundational for small business operations, including for home-based businesses and cottage industries, that many Garrett County business consumers are not using. Cloud-based services such as Google Docs, for example, provide applications at no or low cost, compared to the expense of purchasing software

that needs to be located locally on a user's device. Other cloud-based applications might include real-time data backup for security purposes or Web-based bookkeeping, paid on a monthly basis for access to the application rather than paying upfront for the software and maintaining it. For small professional businesses, such as accounting and law firms, Web-based timekeeping programs are also available.

To address this gap, the County could conduct occasional evening or lunchtime seminars at County facilities for small businesses to educate them about the kinds of applications that could increase their efficiencies and lower their costs on basic small business functions and applications. The County has the in-house expertise to teach these seminars, so this would be a low-cost endeavor. In addition, the County is also likely to find application and even hardware vendors that are willing to provide this type of education at no cost. (Vendors will always provide self-serving information, of course, but if a range of perspectives is offered, this would be a low-cost way for the County to help educate small businesses about the range of possibilities available to them.)

1.5.6.4 Coordination Among Real Estate Agents and Builders for Economic Development

According to a 2011 survey of building owners and property managers, broadband access is one of the most important decision factors for commercial real estate siting—after price, parking, and location.[21] Similarly, a national survey found that 77 percent of economic development professionals believe that to attract a new business, a community must have broadband of at least 100 Mbps;[22] in other words, they believe that economic development without broadband is essentially inconceivable.

While we believe that many real estate agents are aware of these trends, we strongly recommend that the County do what it can to ensure that all Garrett County real estate agents, both commercial and residential, understand that broadband is a unique asset—and, frankly, that Garrett County, by rural standards, has a high level of broadband service. This understanding should be part of how they market the County in general, and the particular properties that they represent.

In Garrett County, given the economic impact of tourism, this is an essential educational opportunity both in terms of real estate sales and the rental markets. The availability of broadband in all types of properties is essential to attracting renters, particularly information-economy workers from the Washington, D.C., Baltimore, and Pittsburgh areas, because many of them will require broadband to stay in touch with work during their vacations.

The survey data collected as part of this project support this analysis, in that the data show that second-home owners would spend more time in the County if they had better broadband. As noted in Section 5.1.3, more than one-third of second home owners said that access to a faster

[21] Joan Engebreston, "Comcast study: Broadband boosts real estate metrics," Connected Planet, Sept. 26, 2011. http://blog.connectedplanetonline.com/unfiltered/2011/09/26/comcast-study-broadband-boosts-real-estate-metrics/ (accessed March 12, 2012).

[22] Craig Settles, "After the Stimulus: Broadband and Economic Development," International Economic Development Council, October 2011. http://www.cjspeaks.com/msp/IEDC2011.pdf (accessed March 12, 2012).

Internet connection would allow them to occupy their second home more frequently. Approximately 18.2 percent said they would occupy it "much more frequently." Increased occupancy of second homes has the potential to increase economic activity in the region as part-time residents spend money locally.

We believe that educating commercial real estate agents in the County about the importance of broadband availability to commercial customers, and ensuring that they are in close coordination with the County's Department of Economic Development on this topic, will pay dividends in the long term.

Similarly, we recommend that the County consider requiring builders, contractors, or developers who are constructing new residential or commercial structures to install conduit to the curb and conduit along any roadway they build. This relatively minor requirement for builders will pay enormous dividends long term, in that it would remove a major impediment to providing last-mile telecommunications connectivity to those buildings.

1.5.7 Pursue Funding Opportunities

Early to mid-2012 is not a particularly good time to be looking for broadband grant funding, either public or private. Unfortunately, for a range of reasons including virtual paralysis in Congress and the challenging economic environment, resources are particularly low at the moment.

Programs that existed just two years ago do not now. The broadband funding in the American Recovery and Reinvestment Act of 2009—the Broadband Technology Opportunities Program (BTOP) and the Broadband Initiatives Program (BIP) —were very much one-time programs, and there is no appetite in Congress right now to reauthorize comparable programs.

In addition, the rather poisonous political atmosphere in Washington and upcoming election mean that very little legislation—particularly on the appropriations side—has been successful. In fact, all federal spending is being met with levels of suspicion that is unprecedented in our experience. In addition, with respect to foundations, grant sources are much lighter than they were just a few years ago, largely because of the deterioration of the economy and foundation endowments.

For these reasons, as of this writing, we see no immediate grant opportunities other than the pending Appalachian Regional Commission (ARC) grant on which the County Department of Economic Development and CTC collaborated.

That said, we recommend that the appropriate County staff subscribe to alerts of upcoming funding deadlines through www.grants.gov. And, given that the County has grant-writing capabilities on staff, we recommend that the County consider applying widely when opportunities present themselves. Each of these grant opportunities is something of a longshot—but the same was true of the BTOP-funded One Maryland Broadband Network (OMBN), and that longshot paid off.

We also recommend that the County closely monitor progress on the reauthorization of the Farm Bill (i.e., the Food, Conservation, and Energy Act of 2008).[23] The Farm Bill has traditionally been a vehicle by which rural broadband program are funded; it is likely to continue to be so, after the one-time shift to the ARRA. We have reason to hope that future iterations of the Farm Bill will include significant broadband funding, and that the current lack of such is a temporary sign of the times that will, presumably, change.

To help the County focus its future efforts in identifying funding options, we researched federal funding opportunities for Garrett County; we highlight in this section the County's most likely funding opportunities in the near term.

First, there are two relatively modest but very attractive grant opportunities on the horizon: the Community Connect program and the Distance Learning and Telemedicine program. We recommend that the County prepare for both when they emerge, on the assumption that both will be funded in the relative near-term. Both are important opportunities, and both will be highly competitive—but we feel they are worth dedication of resources because they are weighted on the grant side, rather than focused on loans, which would be much more costly.

Second, we include here details about the Universal Service Fund, which represents an ongoing source of funding for rural telecommunications infrastructure, and which has seen recent changes that could have an effect on broadband availability in Garrett County.

Finally, we note the availability of rural broadband loans—and the shortcomings of the existing program.

1.5.7.1 Community Connect Program Grants

The Community Connect Grant program[24] is a modest-sized grant program for local governments and tribes that focuses on targeted deployment to completely unserved, very low income areas. The 2012 program is expected to be announced imminently—in the spring of 2012.[25]

Community Connect grants are not necessarily a good fit for communities in this region, as priority is given to areas demonstrating "economic necessity." The application process is rigorous and competitive (with awards given to only 10 percent of applicants) and once awarded, program requirements are demanding (e.g., requiring last-mile service for all households in the service area). Awards are fairly modest.

Awards can be given to both public and private entities and eligible applicants include local governments and community nonprofits such as Garrett County Community Action Committee.

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[23] USDA, "Farm Bill 2008," http://www.usda.gov/wps/portal/usda/farmbill2008?navid=FARMBILL2008 (accessed March 21, 2012).
[24] United States Department of Agriculture Rural Development, Rural Utilities Service, "About Community Connect Grants." http://www.rurdev.usda.gov/utp_commconnect.html (accessed March 21, 2012).
[25] E-mail from Janet Malaki, Senior Loan Specialist, Northern Operations Branch, Broadband Division, Rural Utilities Service, United States Department of Agriculture. March 20, 2012.

The grants carry a modest (15 percent) match requirement that can be met with in kind contributions and awards range considerably in size from $50,000 to $1 million.

The grant window is likely to open very shortly and close 60 days later.

Community Connect funds approximately 15 projects annually (from an application pool of 150). Eligible projects must offer basic broadband transmission service to both residential and business customers within the proposed service area. Examples of eligible projects include deploying broadband transmission service to critical community facilities, rural residents, and rural businesses; constructing, acquiring or expanding a community center (but only 5 percent of grant or $100,000 can be used for this purpose); or building broadband infrastructure and establishing a community center with at least 10 computer access points, which offer free public access to broadband for two years.

While Community Connect has a fairly broad mission, funding is geographically limited to a single community with a population less than 20,000 that does not currently have Broadband Transmission Service (as determined by the FCC National Broadband Map). Grants cannot duplicate any existing broadband services, nor can applicants charge for services to any critical community facilities for at least two years from the grant award. Priority is given to areas that demonstrate "economic necessity." The grant process is very selective, with awards given to only 10 percent of applicants.

We recommend that the County chart an area within its unserved footprint, using the design we present in Section 2 for reaching unserved residences, and then target the lowest income portions of those areas in order to develop the most competitive grant application possible. The design and financial planning that we have completed for this Report should be relatively easy to quickly adapt for this grant application.

1.5.7.2 Distance Learning and Telemedicine Program Grants

The Distance Learning and Telemedicine (DLT) program[26] has historically provided both grants and loans, but appropriations have been limited to grants in recent years. Grants of $50,000 to $500,000 are given for equipment, rather than broadband facilities or service; however, this may provide a good way for the County to leverage a new broadband network (e.g., by helping finance video conferencing systems and medical units). As such, this could be a good supplement to other funding options.

Funds can be awarded to both public and private entities (including corporations or partnerships, tribes, state or local units of government, consortia, and private for-profit or not-for-profit corporations), assuming they provide the requisite services.

Grantees must provide education or medical care via telecommunications. Eligible entities must either directly operate a rural community facility or deliver distance learning or telemedicine services to entities that operate a rural community facility or to residents of rural areas. Among the grant scoring categories are innovativeness, benefits and needs (including economic need),

[26] United States Department of Agriculture, Rural Utilities Service, "About the DLT Program." http://www.rurdev.usda.gov/UTP_DLT.html (accessed March 21, 2012).

and availability of matching funds.

The strategy we recommend here would be to leverage the County's existing fiber to the greatest extent possible, to enable the education and health care sectors to maximize the value of their connectivity, both within the County and in connecting to peers and colleagues more broadly. In this kind of grant opportunity, Garrett County Community Action Committee, in particular, could serve as a key partner, given that it operates multiple facilities that share education and health care resources and its mission is entirely aligned with the purposes of the DLT grant program.

1.5.7.3 Universal Service Fund

The Universal Service Fund,[27] a creation of the Telecommunications Act of 1996, has traditionally been, along with RUS loans, the most significant source of telecommunications funding for rural America. There are four key programs within Universal Service, all of which are of note to Garrett County (although not all of which are useful by the County).

Lifeline Program

The Lifeline program for low-income citizens[28] has traditionally included two key programs: Lifeline and Link Up, which subsidize the telephone service and initial connection charges, respectively, for low-income Americans.

In brief summary, Lifeline has provided low-income households with a $9.25 per month subsidy on phone service, so long as they were purchasing service from participating telecommunications carriers. In the past year, Lifeline has been modestly reformed by the FCC. For purposes of this Report, the most significant change has been that the $9.25 subsidy can now be applied to bundled phone and Internet service, and is no longer limited to standalone phone service. While this change seems very modest, it is actually quite significant. The enabling legislation itself appears to be the barrier to allowing the subsidy to be used for standalone Internet service—hence the importance of the ability to bundle phone and Internet and still realize the benefit of the subsidy.

This program as it currently stands does not have implications for build-out of broadband facilities in Garrett County—but the availability of the subsidy is information that we think is worth including in the County's educational outreach to its residents. (See Section 1.5.6.)

The other significant aspect of Lifeline/Link Up reform for Garrett County is contained in a pending proceeding at the FCC, which has the potential to reallocate some of the Lifeline funding to libraries and possibly other public and nonprofit entities. Specifically, in a Further Notice of Proposed Rulemaking,[29] the Commission asks for comments on the prospects of

[27] "Universal Service," Federal Communications Commission. http://transition.fcc.gov/wcb/tapd/universal_service/ (accessed March 21, 2012). *See also:* Universal Service Administrative Company, http://www.usac.org (accessed March 21, 2012).
[28] "Lifeline Program for Low-Income Consumers," Federal Communications Commission. http://www.fcc.gov/encyclopedia/lifeline-program-low-income-consumers (accessed March 21, 2012).
[29] Further Notice of Proposed Rulemaking, "Lifeline and Link Up Reform and Modernization, Advancing

allocating some of the Lifeline reform savings to funding digital literacy efforts. Such allocation of funding would enable those entities to undertake digital literacy training. The Commission's focus has been on potentially using the E-rate mechanism to enable libraries to purchase digital literacy training services. There is a possibility that the program will be defined more broadly to make public entities such as local government, or non-profits like the Garrett County Community Action Committee, eligible for funding for such programs. This could be of real importance in low-income and less connected sectors of the Garrett County economy.

There is no way to predict at this stage how the proceeding will be resolved, but we believe it will be resolved during this calendar year and we will keep the County informed as we learn more.

High Cost and Connect America Funds

The Universal Service High-Cost program,[30] which has been the largest part of the Universal Service Fund (well in excess of $4 billion per year on an ongoing basis), has traditionally funded eligible telecommunications carriers (ETCs) to build and operate telecommunications (telephone) facilities in rural unserved areas. This program has been famously complex, bloated, and inefficient. The FCC undertook to reform the program over the past year, to mixed reviews.

For purposes of Garrett County's broadband future, the most significant change to note is that a part of the High Cost fund will be gradually transitioned over time into a new program, Connect America, which will subsidize the construction of broadband (data) facilities, rather than exclusively telephone services as in the past. Over time, the shift from telephone to data service will accelerate.

The key points for Garrett County are that, first, only eligible ETCs are able to leverage this funding. This is a private sector funding opportunity, and there is a right of first refusal by the incumbent telecommunications carriers in the community. As a result, this is really an opportunity for Verizon to build to the unserved parts of the County.

This program is also truly limited to the unserved parts of the County; at least as conceived by the FCC in the regulations, the fund will not pay for competitive facilities—it will only serve areas that are entirely unserved by broadband.

Because this and other changes in the High Cost program create certain financial threats or challenges for existing High Cost-funded telecommunications carriers, the program is, not surprisingly, subject to extensive litigation, and it is difficult currently to project when there will be clarity about the program's future. In addition, Garrett County is probably better served than many of the communities that are likely to be able to leverage the Connect America fund. But with time, we believe that the new Connect America program may be a long-term partial solution for parts of the County.

Broadband Availability Through Digital Literacy Training," WC Docket Nos. 11-42, 03-109, 12-23, and CC Docket No. 96-45; FCC 12-11, Federal Communications Commission, 47 CFR Part 54. http://www.gpo.gov/fdsys/pkg/FR-2012-03-02/html/2012-5142.htm (accessed March 21, 2012).

[30] "Universal Service Program for High Cost Areas," Federal Communications Commission. http://transition.fcc.gov/wcb/tapd/universal_service/highcost.html (accessed March 21, 2012).

Schools and Libraries (E-rate) Program

The Schools and Libraries Universal Service program[31]—typically referred to as the E-rate program—subsidizes the provision of broadband and telecommunications services to eligible K-12 schools and public libraries. It also covers such entities as Head Start programs, which is significant in Garrett County because one of the recipients is the Garrett County Community Action Committee.

Under this program, a range of providers can compete to provide services to schools and libraries. Through a structured program administered by the Universal Service Administrative Company (USAC), schools and libraries post their requests for proposals (RFP) and select the best bid, then cooperatively with the service provider apply to USAC for the subsidy amount. The funding flows directly from USAC to the provider.

Because of reforms to the E-rate program that were undertaken by the FCC in 2010 and implemented in 2011, public and non-profit entities now qualify as eligible providers. Thus, this program is potentially of significant importance to Garrett County; the County, as the operator of a public-sector anchor institution fiber network, could potentially serve schools and libraries that are eligible for the subsidy. At the very least, the County will have the opportunity to compete to provide the best possible, most cost-effective services to subsidy-eligible entities. The program also provides for subsidy of construction of some fiber to schools and libraries, which could present an opportunity to expand the reach of public interest fiber in the County.

Rural Health Care Program

The last component of the Universal Service Fund is the Rural Health Care program,[32] which partially funds telecommunications services for rural health care providers. We do not believe that this program represents an existing opportunity for Garrett County at this time.

1.5.7.4 RUS Broadband Loan Program

The other most extensive, long-term funding of rural broadband and telecommunications facilities construction has been the Rural Utilities Service (RUS) rural broadband loan program,[33] which is funded through the Farm Bill and administered through the RUS.

The program has financed, at competitive rates, broadband networks in rural areas throughout the United States. It gets a range of different kinds of reviews. The interest rates are generally considered to be extremely competitive, but the programs are quite famously very labor- and paperwork intensive.

Both public and private sector entities are eligible for the program. However, if the County were to undertake strategies requiring extensive financing, it is not clear to us that these loans would

[31] "Universal Service for Schools and Libraries," Federal Communications Commission. http://transition.fcc.gov/wcb/tapd/universal_service/schoolsandlibs.html (accessed March 21, 2012).
[32] "Rural Health Care Program," Federal Communications Commission. http://transition.fcc.gov/wcb/tapd/ruralhealth/welcome.html (accessed March 21, 2012).
[33] U.S. Department of Agriculture, "About the Farm Bill Loan Program," http://www.rurdev.usda.gov/utp_farmbill.html (accessed March 21, 2012).

be more advantageous than public bonds, especially given that there is no grant component.

We would recommend continuing to monitor this program in the hopes that there may, with time, be changes that make it more beneficial to the County. At the current time, however, we are not sure that it necessarily is worth pursuing.

1.6 Summary of Key Survey Findings

CTC conducted three surveys in Garrett County—mail surveys of the residential and agricultural sectors, and an online survey of businesses—to gather data about broadband availability, adoption, and issues in the County. The surveys aimed to help the County to understand both the potential unmet broadband needs in the community and ways in which improved communications services could benefit residents.

1.6.1 Residential Survey

We mailed a questionnaire to 600 randomly selected residences in Garrett County in November 2011. A total of 182 useable residential surveys were received by the cut-off date, providing a "gross" response rate of 30.3 percent—an extremely high response rate.

The survey was designed to obtain information about responding residents' use of communications services including Internet, television, and telephone. The survey also captured residents' opinions about communications services within Garrett County and identified ways in which those services may be improved to better meet residents' needs.

Key findings from the residential communications survey include:

- Seventy-eight percent of Garrett homes have Internet service, including 66.6 percent with high-speed (non-dial-up) service. The most prevalent connection type is cable, with a 43.2 percent market share among Internet subscribers (33.7 percent of all homes).
- Residents are generally satisfied with their Internet services. Fiber-optic subscribers are the most satisfied with most Internet service aspects, while satisfaction with dial-up and satellite lag other types in key service aspects.
- The largest Internet service "gap" (customers' importance minus their satisfaction) is the price paid for service, followed by speed and reliability.
- The strongest reason for residents to purchase very high-speed Internet is to download large data files, including photos and videos.
- Forty percent of respondents would consider switching to very fast Internet for a 20 percent price increase. This drops to 10 percent at a 40 percent price increase.
- Satellite has the largest television market share (48 percent) followed by cable (38 percent).
- Thirty-five percent of respondents have watched movies or television shows on their computer, 19 percent have purchased movies to watch on their television via the Internet, and 15 percent own game consoles connected to the Internet.

- Over 80 percent of Garrett homes have a land-line phone (traditional or cable), although only 69 percent use it as their primary service. Approximately 27 percent use their cell phone as their primary service. Six percent of homes use Internet-based phone services, but only 2.2 percent use it as their primary phone.
- Eight-seven percent of working respondents commute alone in their car. Telecommuting could provide substantial savings of gas and time.
- Approximately 22 percent of respondents were from second homes. One-third of second home respondents said they would occupy that dwelling more frequently if they had better Internet service.

1.6.2 Business Survey

We e-mailed a total of 458 survey invitations to key contacts at businesses located in Garrett County on October 24, 2011. The list of recipients was provided by County staff from the Chamber of Commerce databases. A total of 194 responses were completed by the cut-off date, providing an extremely high response rate of 42.4 percent.

The business Internet services survey was designed to capture information about Internet access and use among businesses in Garrett County. The survey questions also solicited opinions about current Internet service and their future Internet needs.

By its nature, this online survey was a sampling of businesses that are already online, not a sampling of all Garrett County businesses. This is in contrast to the residential survey, which was mailed to a random sampling of all residential addresses. Accordingly, the business survey results represent the opinions of businesses that have access to the Internet (broadband or otherwise) and have adopted it.

Key findings from the business Internet services survey include:

- Cable and DSL are the most prevalent Internet connection types among Garrett County businesses, with approximately 30 percent market share each.
- Larger companies are more likely to have fiber-optic or leased line Internet connections, while most small companies use cable or DSL.
- Ninety-one percent of businesses with Internet connections have a website. Approximately 50 percent use it for information only while 41 percent also use it for E-commerce.
- Primary support for company's Internet service is evenly split between the survey respondent, other employees, and outside IT service providers.
- Sharing images or photos was the most common business Internet activity.
- Over one-half of respondents believed their Internet speed was fast enough for their needs.

- Approximately 40 percent of respondents would pay 20 percent more for a faster Internet connection while 15 percent would pay 40 percent more. At price increases exceeding 40 percent, only a small share of respondents would consider switching to faster service.
- The lack of availability is the largest constraint on businesses' greater use of high-speed Internet.
- Businesses believe that use of high-speed Internet will become more important for their business over the next five years.

1.6.3 Agricultural Survey

In November 2011, we mailed questionnaires to 552 farms and farm-related businesses in Garrett County, Maryland. The list of recipients' names and addresses were provided by the University of Maryland Extension for Western Maryland. A total of 139 useable residential surveys were received by the cut-off date, providing a very high response rate of 25.2 percent.

The survey questions were designed to obtain information about farms' access to Internet services and their use of the Internet for farm-related activities. It also captured farm owners' opinions about Internet services within Garrett County and identified ways in which those services may be improved to better meet the needs of the County's agricultural community.

Key findings from the farm Internet Services Survey include:

- Approximately two-thirds of Garrett County farms have Internet access. The majority of farms without Internet service do not have computers, comprising 27 percent of all respondents.
- Of farms with Internet service, cable (25 percent) and satellite (24 percent) connections have the largest market share; DSL and dial-up have substantial shares (18 percent each).
- Aside from dial-up connections, cable is the least expensive ($44/mo.) and satellite is the most expensive ($75/mo.), on average.
- DSL ranks slightly higher than cable and non-satellite wireless for price, speed, and reliability satisfaction, although the differences are not statistically significant. Satellite ranks as the worst of non-dial-up services in these three satisfaction categories.
- The most common and important farm uses for the Internet are checking weather forecasts, researching farm issues, and purchasing farm products.
- There is some willingness to pay 20 to 40 percent more for faster Internet service, especially among current dial-up subscribers. Few respondents are willing to pay more than 40 percent extra for faster Internet service.
- Respondents generally thought that high-speed Internet was important to operational efficiency, interacting with suppliers, and other farm business aspects. They also believe that mobile Internet will become more important to their farming business over the next five years.
- There is little correlation between Internet connection types and the size of the farm. The connection type is likely determined primarily by location and availability.

2. System-Level Network Design and Business Model

Garrett County's most direct option for increasing the availability of broadband services to its currently unserved residents is to build and operate a broadband network, potentially in partnership with a community non-profit such as Garrett County Community Action Committee. In this section, we present a candidate network design and a corresponding financial analysis for constructing and operating a cost-effective wireless network using TV white spaces (TVWS) technology. While the financial analysis indicates that this network would require a substantial, ongoing County subsidy, we note that most of the County's funding would stay within the County. In other words, this network would create not just expanded access to broadband for currently unserved areas, but also new jobs in the County.

2.1 Proposed Technology

We considered a range of technologies to determine the most suitable and cost-effective approach to meeting Garrett County's needs. Point-to-multipoint WiFi would not work on this scale because it does not have the range that the County needs to cover; it is only effective over shorter distances. Licensed spectrum approaches would not be optimal because, if spectrum is available at all, the technology to operate it is typically very high cost.[34] A point-to-point network would also entail high costs—and it would require line-of-sight connections, which are virtually impossible over the terrain to be covered. (ICEWEB is facing the same difficulties in using this technology.)

In contrast, "TV white spaces" (TVWS) technology uses spectrum that does not require line-of-sight, and it can cover relatively long distances. It can also deliver connectivity at a level higher than available services; users would get typical download speeds of 3 Mbps and typical upload speeds of 1 Mbps. Finally, TVWS base station equipment is inexpensive relative to 3G, WiMAX and LTE technologies typically used in licensed spectrum.

"TV white spaces" are the unused buffer zone separating stations on the broadcast spectrum; the Federal Communications Commission (FCC) has made that portion of the spectrum available for unlicensed use because, with improvements and efficiencies in broadcast technology, the white space is no longer needed by the broadcasters to fully broadcast their signals. Even in urban areas where the broadcast spectrum is congested, there are white spaces available for other uses.

Content producers and the equipment manufacturing industry, led by Google and Microsoft, had lobbied the FCC for six to eight years to have the whitespaces made available as open, unlicensed spectrum, with the expectation that there would be the same kind of growth and development of use of that spectrum as there was in the unlicensed spectrum that WiFi utilizes.

They targeted this spectrum not just because the white space was available, but because it has excellent propagation characteristics—including indoors. It is able to penetrate physical obstructions that cannot be penetrated by the spectrum used for traditional WiFi—from exterior

[34] 3.6 GHz spectrum typically available for wireless ISPs is not available in Garrett County because of potential interference with a protected satellite link located across the West Virginia border.

building walls to broad-leaf trees and, in a limited way, larger physical obstructions such as hills.

An additional reason that TVWS technology may be a desirable approach relative to existing resources in Garrett County is the cost of carrier wireless services (i.e., U.S. Cellular and AT&T). These services are expensive on a monthly basis, and become even more costly if users have prepaid or non-contract usage or exceed their monthly data allowances (i.e., data caps)—meaning that heavy users (especially home-based businesses) are essentially unable to use AT&T or U.S. Cellular connections as their primary broadband connection.

That said, TVWS is in its infancy. The FCC only approved the strategy in the past few years and formalized the rules that will make it possible in the past year. So although there has been a lot of research and development, the earliest deployments will be by pioneers. In addition to the potential technical disadvantages of being an early adopter, launching a TVWS network has some financial disadvantages, as well: There has not yet been widespread adoption, so manufacturers have not yet realized economies of scale. There are few sources of equipment, and prices are not as low as they will be when scale has been achieved (as in the WiFi market).

2.2 Network Design and Coverage Area

The network we propose here is designed to provide service to currently unserved residences. We selected target areas for this implementation based on the County's customer surveys, input from the County's Economic Development Department, our knowledge of Procom's fiber routes, and the service areas reported by Comcast and Shentel. (The Comcast, Procom, and Shentel service areas are approximations based on the companies' input and other data; while the data lack the granularity required for a street-level design, they are sufficient for our purposes here.)[35]

We selected six discrete areas that, in total, include approximately 2,873 homes and businesses (i.e., passings), according to the County's GIS records. Given the County's approximately 20,100 residences, these areas represent 14.3 percent of the County's homes.

Within each service area, a TVWS base station would be installed on an existing structure or new tower on County-owned land. Each station would connect to the Internet backbone, either through County fiber or the State of Maryland's One Maryland Broadband Network (OMBN), using a direct fiber connection or a point-to-point wireless connection.

Each subscriber would need customer premises equipment (CPE) and potentially an external antenna to receive TVWS service. Within each home, connectivity to individual devices would be enabled by a wireless router, similar to the equipment commonly used with DSL or cable modem service. The design would support symmetrical speeds of up to 3 Mbps or 4 Mbps for each residence.

The proposed network coverage areas are illustrated in Figure 3, and in a full-size map in Appendix B. The TVWS network design process is illustrated in Figure 4. The TVWS network design is illustrated in Figure 5.

[35] We also note that we completed this design without the benefit of data detailing the availability of DSL, because that information is not available to us; thus, some of these homes may be eligible for DSL service.

Figure 3: Map of Proposed TV White Spaces (TVWS) Network Coverage Areas

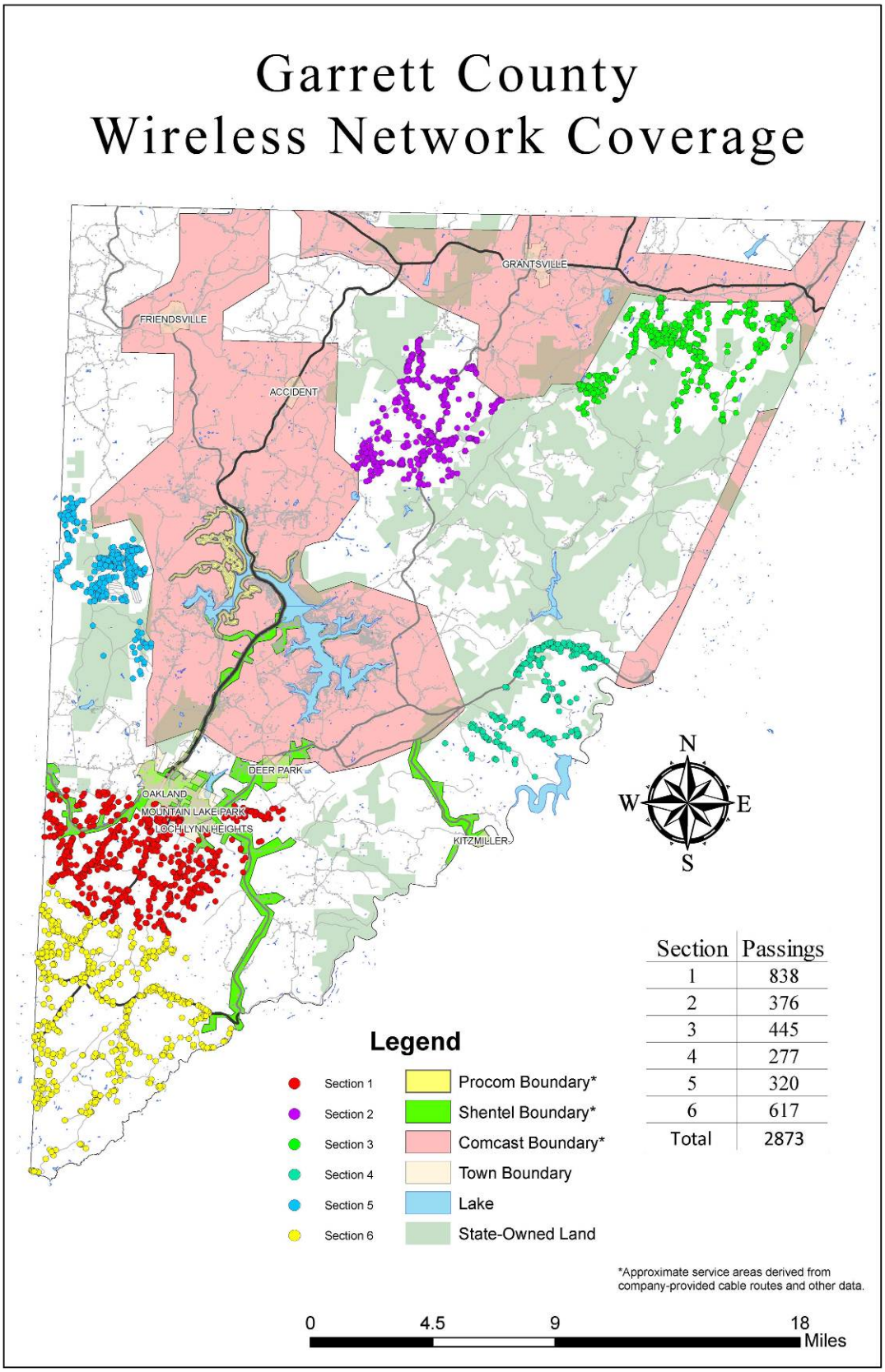
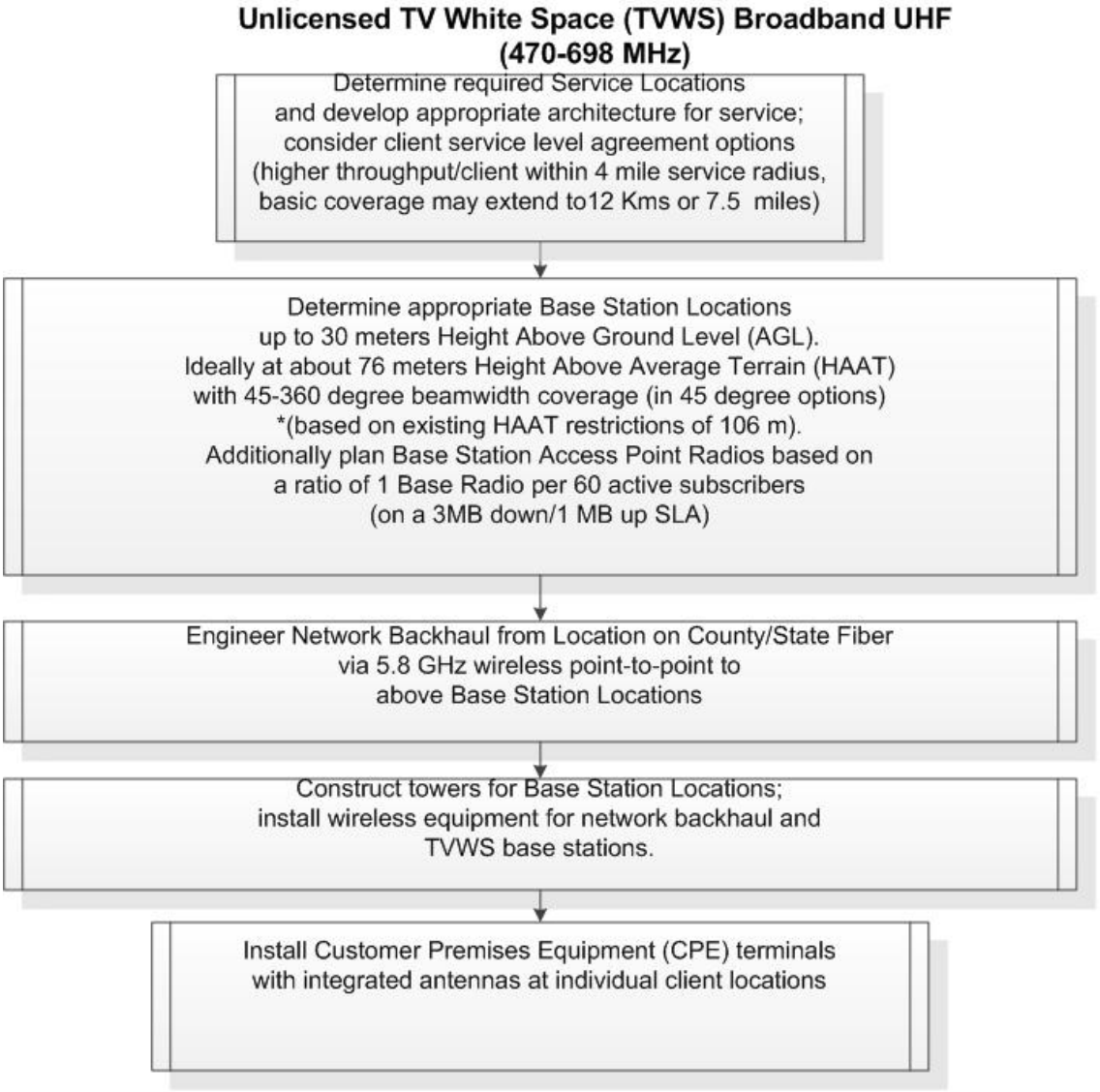
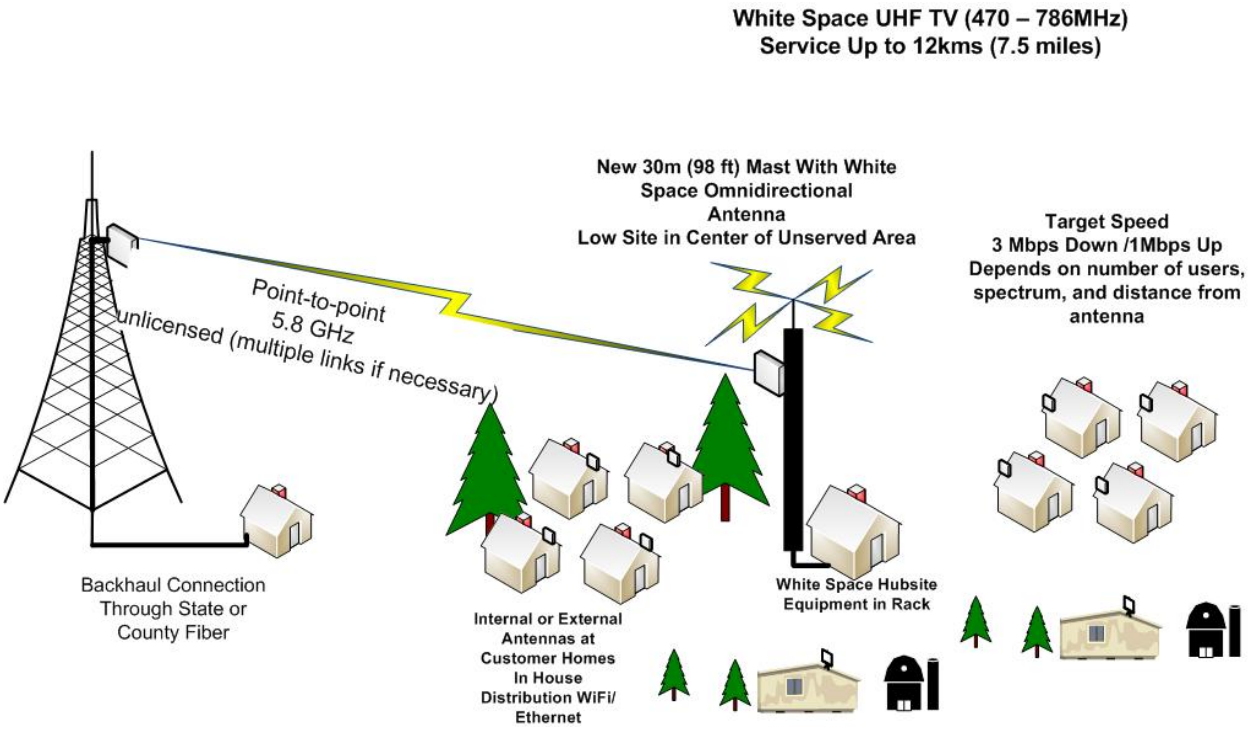


Figure 4: TV White Spaces Network Design Process



* If FCC final rules for the TVWS are amended to include a change in the HAAT restriction (as proposed to 250 m HAAT), existing taller towers (and water towers, mountain ridges, etc.) may be utilized such as the ASR #1264975, US Cellular Corp tower. This will also slim the number of necessary Base Station Locations since each station can cover a larger service area.

Figure 5: TV White Spaces Network Diagram



2.3 Business Model

The County would need to provide a subsidy of about $250,000 annually to pass all 2,873 homes in the identified areas and provide service to 30 percent of them based on relatively conservative assumptions. (Appendix C includes a complete set of pro forma financial statements for this network.) The financial picture improves if we assume more optimistic take rates or higher monthly customer fees—but unless adoption reaches levels of 60 to 70 percent (assuming monthly fees of $40 or so), the network would still require modest County subsidy to break even annually.

2.3.1 Overview of Network Costs with Financing

Under our base assumptions (i.e., 30 percent take rate, $40 per month), the proposed wireless network's annual revenue would exceed its operating expenses after year one. However after depreciation and interest expenses are added the net operation income shows a deficit of about $424,000 in year one, declining to a deficit of about $161,000 in year five.

Year	1	2	3	4	5
a. Revenues					
Wireless	138,000	310,320	413,760	413,760	413,760
Wireless Connection Fees (non-recuring)	56,350	28,126	-	-	-
Total	$ 194,350	$ 338,446	$ 413,760	$ 413,760	$ 413,760
b. Operating Expenses - Cash (not including taxes in line h)					
Operating Expenses	42,000	60,000	61,000	61,000	61,000
Salaries	307,410	257,410	257,410	257,410	257,410
Total	$ 349,410	$ 317,410	$ 318,412	$ 318,410	$ 318,410
c. Revenues less Cash Operating Expenses (a-b)	$ (155,060)	$ 21,036	$ 95,348	$ 95,350	$ 95,350
d. Operating Expenses - Non-Cash					
Depreciation	$ 196,788	$ 236,968	$ 236,968	$ 236,968	$ 236,968
e. Operating Income (d-c)	$ (351,848)	$ (215,932)	$ (141,620)	$ (141,618)	$ (141,618)
f. Non-Operating Income					
Interest Income	$ -	$ -	$ -	$ -	$ -
Investment Income	-	-	-	-	-
Interest Expense (Loan)	(72,000)	(72,000)	(55,541)	(38,095)	(19,602)
Total	$ (72,000)	$ (72,000)	$ (55,541)	$ (38,095)	$ (19,602)
g. Net Income	$ (423,848)	$ (287,932)	$ (197,161)	$ (179,713)	$ (161,220)

Net operating income does not reflect actual cash flow, however, because depreciation is a non-cash expense and the income statement does not include actual network deployment costs, principal payments on debt, or a depreciation reserve fund to replace the network equipment at the end of its five-year life expectancy.[36]

In order to fund the network equipment deployment and initial operating costs, we estimate the County will borrow[37] $1.2 million in year one. When loan principal and other cash transactions are added, the result is a requirement of a total subsidy of approximately $1.3 million over five years ("Unrestricted Cash Balance" below), averaging out to approximately $250,000 per year. This subsidy does not include a depreciation reserve fund to replace the network equipment at the end of its five-year life expectancy.

[36] Network electronics have a life expectancy and must be replaced on schedule, or the network risks performance and reliability problems; a depreciation reserve fund would be like a household's "rainy day" account, which covers the cost of a new furnace when the current one breaks.

[37] Assumes a five-year loan at 6 percent.

	Year	1	2	3	4	5
a. Net Income (From Income Statement)		$ (423,848)	$ (287,932)	$ (197,161)	$ (179,713)	$ (161,220)
b. Cash Outflows						
Capital Expenditures		$ (983,940)	$ (200,900)	$ -	$ -	$ -
	Total	$ (983,940)	$ (200,900)	$ -	$ -	$ -
c. Cash Inflows						
Loan		$ 1,200,000	$ -	$ -	$ -	$ -
	Total	$ 1,200,000	$ -	$ -	$ -	$ -
d. Total Cash Outflows and Inflows (b+c)		$ 216,060	$ (200,900)	$ -	$ -	$ -
e. Non-Cash Expenses - Depreciation		$ 196,788	$ 236,968	$ 236,968	$ 236,968	$ 236,968
f. Adjustments						
Proceeds from Additional Cash Flows		$ (1,200,000)	$ -	$ -	$ -	$ -
	Total	$ (1,200,000)	$ -	$ -	$ -	$ -
g. Adjusted Available Net Revenue		$ (1,211,000)	$ (251,864)	$ 39,807	$ 57,255	$ 75,748
h. Principal Payments on Debt						
Loan Principal		$ -	$ 274,310	$ 290,769	$ 308,215	$ 326,706
	Total	$ -	$ 274,310	$ 290,769	$ 308,215	$ 326,706
i. Net Cash		$ (11,000)	$ (526,174)	$ (250,962)	$ (250,960)	$ (250,958)
Cash Balance						
Unrestricted Cash Balance		$ (11,000)	$ (537,174)	$ (788,136)	$ (1,039,096)	$ (1,290,054)
Depreciation Operating Reserve		-	-	-	-	-
	Total Cash Balance	$ (11,000)	$ (537,174)	$ (788,136)	$ (1,039,096)	$ (1,290,054)
Debt Service Balance		$ 1,200,000	$ 925,690	$ 634,921	$ 326,706	$ -

Changing the key assumptions underpinning these projections naturally changes the bottom line. If the take rate were to drop to 20 percent, for example, the County's subsidy would increase to $1.6 million over five years. If the take rate were to double to 40 percent, the required subsidy would drop to about $960,000 over the same time period. (The change is not linear. In other words, a doubling of the take rate does not halve the subsidy required because, for each new customer signed up, the network incurs a $600 cost for the customer premises equipment.)

40 percent take rate, $40 per month service					
	Year				
	1	2	3	4	5
Net Income	$ (384,022)	$ (240,792)	$ (116,581)	$ (99,133)	$ (80,640)
Net Cash from Operations	$ (131,894)	$ (438,854)	$ (130,202)	$ (130,200)	$ (130,198)
Year End Cash Balance	$ (131,894)	$ (570,748)	$ (700,950)	$ (831,150)	$ (961,348)

If the monthly service fee were to increase to $75, the network would "cash flow"—that is, there would be no required County subsidy. However, at that price, we do not believe that the network could realistically assume a 30 percent take rate—so this scenario is unlikely. A better scenario involves fine-tuning the take rate, the monthly service fee (revenue) and the cost of customer premises equipment (expense). If penetration increases to 40 percent, customers pay $52 per month, and the CPE cost drops by half, to $300, the network would end year five with a cash balance of about $65,000. But again, assuming a higher monthly fee and a higher take rate may

be overly optimistic. (We do believe that equipment costs will come down as there is more adoption of white spaces devices—just as the cost of WiFi equipment dropped over time.)

2.3.2 Overview of Network Balance Sheet without Financing

We also analyzed how the proposed wireless network's costs and cash flow would change if the County were to pay the $1.2 million capital expense out of general funds, rather than financing it. Under our base assumptions (i.e., 30 percent take rate, $40 per month), the network's cash flow picture is significantly sunnier without principal and interest costs. Rather than the $250,000 annual subsidy required if the network were financed, the network would essentially cash flow. While it would likely require modest bridge funding from the County during years two and three, that would be recouped in subsequent years and the network would have a projected cash balance of $167,000 at the end of year five.

As with the financial projections under the financing scenario, the network balance sheet would change as take rate, service fee, and equipment cost sensitivities change. At a 20 percent take rate and $40 monthly service fee, for example, the net loss at the end of year five is a relatively modest $135,000. (We also believe that 20 percent is a low assumption, given the market.)

At a 25 percent take rate and $40 monthly fee, the network would have a net positive cash balance of $29,000 at the end of year five. At a 35 percent take rate, the year five cash balance grows to $333,000. At a 40 percent take rate, it would be $500,000.

The above scenarios assume a five-year lifecycle for the network equipment. If we instead assume that the equipment will last seven years rather than five, the network essentially cash flows over those seven years (again assuming our base assumptions of 30 percent take rate and $40 per month). In that event, an influx of new capital for replacement equipment would be necessary at the beginning of year eight—as it would be at the beginning of year six assuming a five-year lifecycle. (We assume that equipment costs will remain steady, meaning that the capital cost would again be $1.2 million.)

Because the cost of equipment will have a strong impact on the network's financial projections, we also considered what would happen in the event that some of the equipment costs—particularly the customer premises equipment (CPE), which are a substantial part of the cost—fall as a result of a growing TVWS device market and economies of scale for manufacturing. If CPE costs were reduced by 50 percent and we maintain our base case for take rate and fees, the network would end year five with a cash balance of more than $400,000.

Of course, if the CPE equipment costs do come down to this level, an alternative scenario would be to reduce service fees. If the fees were reduced to $30 per month, the network would cash flow at a 30 percent take rate. At a 40 percent take rate, service fees could be reduced to $26 per month—and it is relatively safe to assume that the lower the service fee, the higher the take rate is likely to be.

Note, however, that under none of these assumptions is the initial $1.2 million cash payment recouped in its entirety. As in the initial scenario, in which the network is financed and principal

and interest payments are made each year, full payback of the $1.2 million capital cost would be achieved at a take rate of about 65 percent.

2.3.3 Description of Assumptions

Our "base case" scenario is a projected 20 percent take rate in year one (i.e., 575 customers), and a 30 percent take rate (862 customers) in year two and beyond. We assume a monthly customer fee of $40 for 3 Mbps service and that customers will pay a $98 connection fee. The network would absorb a $600 cost per customer premises equipment (CPE) installed. Because subscribers would sign up periodically throughout the year, we recognize 50 percent of revenue in year one, 75 percent in year two, and 100 percent in years three and beyond. Revenue would plateau at about $414,000 annually, starting in year three.

Labor costs dominate the expense side of the equation. For planning purposes, we estimate that a County-operated TVWS network would require, at a bare minimum, the following staffing levels—which would cost an estimated $307,000 in year one and $257,000 in subsequent years (fully burdened labor rates):

Table 1: Staffing Requirements for Proposed TVWS Network

Position	Full-Time Equivalent (FTE)
Customer service representative	1.5
Installer	2.0 (year 1); 1.0 (year 2+)
Business manager	0.25
Sales manager/finance manager	0.25
Internet technician/engineer	0.25

To address the inevitable need for after-hours support, we have factored in an overtime fund to pay for on-call customer service and technician labor, as well as labor during off hours (including weekends and holidays).[38]

Our projections further assume that there would be no rental costs associated with placing the TVWS base stations, and that monthly power costs would total $450. We also estimate $1,000 in annual transportation costs and that billing software would cost $300 per year. We do not include any costs for sales, marketing, or insurance—under the assumption that the County's current operations could absorb any incremental expenses in those areas. Total non-labor operational costs would be $42,000 in year one, and would rise to about $60,000 in the following years.

On a per-customer basis, the network's annual operational costs would be approximately $600 in year one (i.e., $50 per month) and about $370 in years two and beyond (i.e., $30 monthly). And under the base case scenario, if the network were to be evaluated as an investment, it would be worth only about $46,000.

[38] The network's costs could come down significantly if existing County government staff could perform some of the necessary operational tasks. However, the network would still require significant levels of staffing for customer service roles. This is not just because staffing plays a key role in ensuring a network's success. The residents who would be served by this network do not currently have broadband, so they would likely need more "handholding" than customers who are more sophisticated in their understanding of broadband connectivity; the County should thus expect higher-than-average numbers of customer service phone calls and truck rolls to help its customers.

3. Current State of Broadband Technology

In this section, we summarize the broadband services available to residential and small business customers nationwide. In Section 4, we discuss the current state of broadband technology in Garrett County.

3.1 Wireline

The wireline component is typically the highest-speed portion of a network. Where it is part of a wireless/mobile network, wireline communications provide the backbone between key network locations and the interface with the wireless network (i.e., the base stations or cell sites). The majority of homes and businesses nationwide are connected via wireline communications, and the role of the wireline connection has evolved to provide users' most intensive needs—high-definition television, telecommuting applications, telemedicine, gaming, data backup, digital media storage and transport, and "cloud" applications.

There are three primary modes of wireline communications:

1) Fiber-to-the-premises (FTTP), adopted by Verizon in some markets, offered by Procom and QCOL in neighborhoods in Garrett County,[39]

2) Hybrid fiber-coaxial (HFC), used by Comcast, Shentel, and other cable operators, and

3) Digital subscriber line (DSL) used by Verizon over its copper telephone lines and by companies reselling access over the Verizon copper lines, such as ICEWEB, in parts of Garrett County.

3.1.1 Fiber-to-the-Premises (FTTP)

Since the early 1990s, telecommunications and broadband operators have deployed wireline networks consisting of their legacy infrastructures (copper or coaxial), and the core, backbone, and long-haul components using fiber optic technology. Over that time the providers have expanded the fiber component from the core, to reach closer to the home and business.

Fiber-to-the-premises (FTTP) provides the greatest capacity, reliability, and flexibility of all wireline solutions and is therefore the state-of-the-art wireline transport technology. Fiber itself provides a broad communications spectrum and has a theoretical capacity of hundreds of Gbps per fiber with off-the-shelf equipment; even low-priced equipment can provide 1 Gbps.

Because it contains no metal components, fiber is not susceptible to interference from outside signals or to corrosion. Fiber installed 20 years ago is not physically or technologically obsolete.

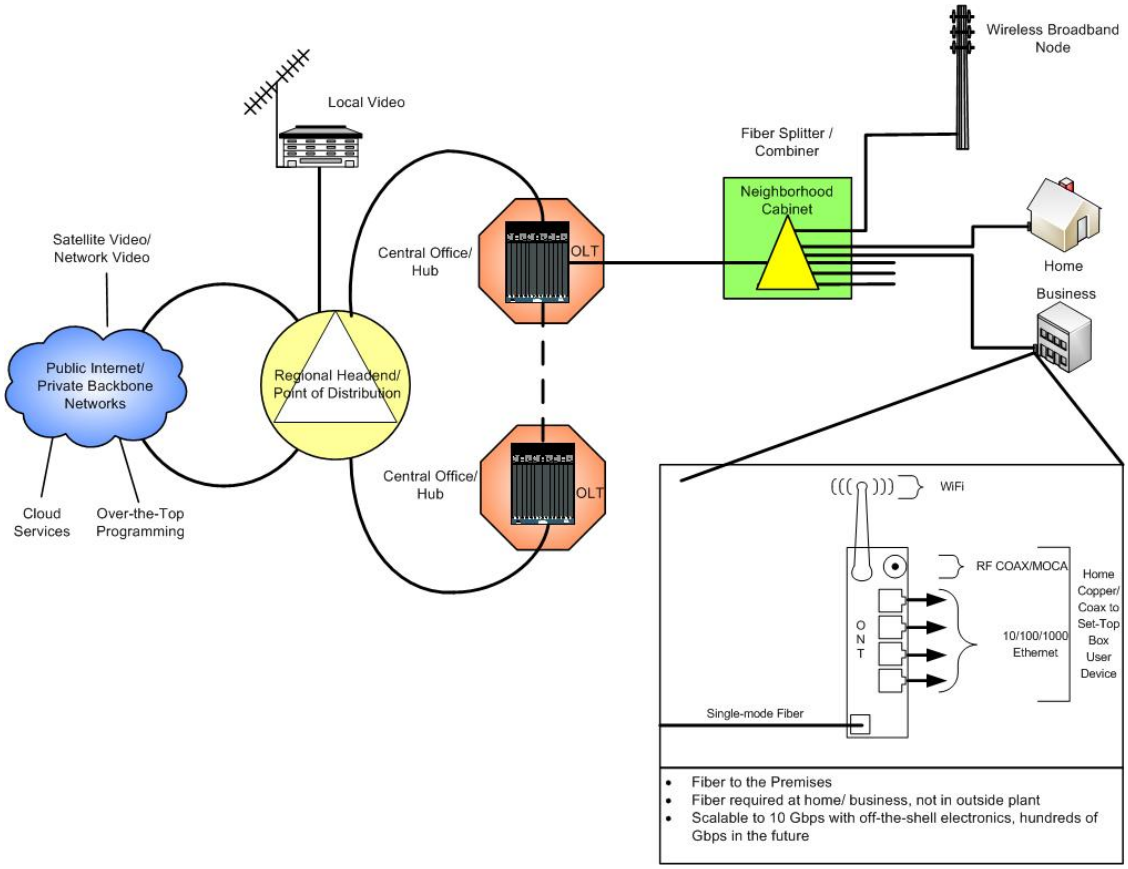
Fiber optic equipment generally has a range of 12 miles with standard passive optical network

[39] There are also custom fiber-to-the-premises services for "power" business and residential users; these include Metro Ethernet services from Cox and others.

(PON) electronics[40] and almost 50 miles with higher-powered electronics.[41] The range eliminates the need for electronics or powering in the middle of most networks, reducing the network's required staffing and maintenance and improving availability during storms or mass power outages.[42] Fiber can be continuously upgraded simply by replacing or upgrading the network electronics at the ends.

Figure 6 illustrates a sample FTTP network, demonstrating how high levels of capacity and reliability are brought directly to the premises—providing connectivity without a technical bottleneck to the Internet or other service providers, and providing a flexible, high-speed backbone for wireless services.

Figure 6: Sample FTTP Network



[40] ITU-T Recommendation G.984.2 Gigabit-capable Passive Optical Networks (GPON): Physical Media Dependent (PMD) layer spec., p. 10, Table 2a, http://www.itu.int/rec/T-REC-G.984.2-200303-I/en (accessed August 30, 2011).
[41] Cisco Small Form-Factor Pluggable Modules for Gigabit Ethernet, http://www.cisco.com/en/US/prod/collateral/modules/ps5455/ps6577/product_data_sheet0900aecd8033f885.pdf (accessed August 30, 2011).
[42] Powering is required at the central office facility (usually equipped with long-running generators) and at the user premises (requiring the user to have backup power, such as a battery or a home generator). In contrast, hybrid fiber–coaxial networks have power supplies in each neighborhood with a few hours of battery backup. Once the batteries are depleted, the cable operator must place a generator at each power supply location.

By the late 2000s, Verizon began constructing fiber optics all the way to homes and businesses in selected markets nationwide. This technology now reaches more than 15 million customers under the brand name FiOS.[43] In other parts of the United States, municipal operators and telephone cooperatives have also constructed FTTP networks. Internationally, FTTP is increasingly common, sometimes initiated by private sector companies, sometimes initiated or mandated by governments.

Verizon is providing data, video, and voice services with a maximum offered speed of 150 Mbps download, 35 Mbps upload.[44] However, the fiber in the Verizon FTTP network could scale to significantly higher speeds. With the Gigabit Passive Optical Network (GPON) electronics Verizon is currently deploying, each 36-user segment of the network shares 2.4 Gbps of downstream capacity and 1.2 Gbps of upstream capacity; assuming 50 percent penetration, this can provide a 133 Mbps average committed speed per user and 66 Mbps upstream—with burst capacity significantly higher. The next generation upgrade is 10G GPON technology (10 Gbps downstream, 2.4 Gbps upstream), which is under test by Verizon and deployed for trial users in the Singapore OpenNet.[45] When required by customer demand, the operator can activate the 10G GPON on the same fiber as the current GPON, requiring no new outside plant electronics and creating no disruption on the existing network.

Although Verizon offers the fastest mass-deployed service in some U.S. communities, it is moving considerably more slowly than the FTTP technology permits. Hong Kong Broadband Network (HKBN) and the electric utility's network in Chattanooga, Tennessee are offering 1 Gbps using FTTP technology.[46] Google plans to deploy 1 Gbps in its network under construction in Kansas City, Kansas and Kansas City, Missouri.[47] Verizon representatives have stated in private meetings that the company anticipates offering 1 Gbps service by 2017.[48]

In Garrett County, Procom is offering a variety of service levels, with speeds up to 16 Mbps down/32 Mbps up. While the fiber is capable of significantly higher speed, other parts of the infrastructure, including the connection to the Internet backbone, limit the speed available to the customer.

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[43] Previously the only premises to receive fiber optics were those receiving the highest-speed business services, such as DS3 (45 Mbps) or greater symmetrical services.

[44] "Experience the Fastest Internet in the U.S. and the Best Picture Quality," Verizon, http://offer.verizon.com/search?urlp.sem_adgr_id=1026_48627&urlp.google_ad_key=8178916593&google_kw_mt=e&google_kw_sid=1026_11474091&sem_kw_id=1026_46066&se=g&adc_visit=40aea437-1ebd-4cbc-9a59-6457de4f3aec&adc_visitor=1f1accb8-f507-4db7-8d80-e6b4695bd215m (accessed August 30, 2011).

[45] Other fiber technologies include WDM PON, which assigns separate wavelengths of light to separate users (a deployment is currently underway in South Korea), and point-to-point fiber networks, such as the Citynet in Amsterdam, with individual users each receiving separate dedicated fibers.

[46] HKBN bb1000 description, http://www.hkbn.net/2010/eng/en_service1_1a5.html, HKBN pricing from $27 Gigabit At Hong Kong Broadband, http://www.dslprime.com/fiber-news/175-d/2878-27-gigabit-at-hong-kong-broadband (accessed August 30, 2011); Your Gig is Here, http://www.chattanoogagig.com (accessed August 30, 2011); Chattanooga pricing at approximately $350, https://epbfi.com/you-pick/#/fi-tv-essential&fi-speed-internet-30 (accessed August 30, 2011).

[47] "Frequently Asked Questions: About Our Project," Google Ultra High-Speed Fiber Network, http://www.google.com/fiber/kansascity/faq.html (accessed August 31, 2011). See also: "Googlenet: A cure for America's lame and costly broadband?," *The Economist*, April 1, 2010, http://www.economist.com/node/15841658?story_id=15841658&fsrc=nwl (accessed August 30, 2010).

[48] As recounted by Joanne Hovis, President, CTC

3.1.2 Hybrid Fiber–Coaxial (HFC)

Cable operators, including Comcast, have extended fiber optics progressively closer to their subscribers' premises but have generally stopped about one mile from the premises, using coaxial cable for the last mile. Thus, their networks are a hybrid of fiber and coaxial infrastructure. Cox and Comcast typically only construct fiber optics to the premises of businesses that subscribe to Metro Ethernet and other advanced services (i.e., generally faster than 50 Mbps).

Cable operators have discussed constructing fiber optics to the premises, starting with new greenfield developments, but so far have generally not done so. They have typically opted instead to install new coaxial cables to new users, even though the construction cost to new premises is approximately the same.

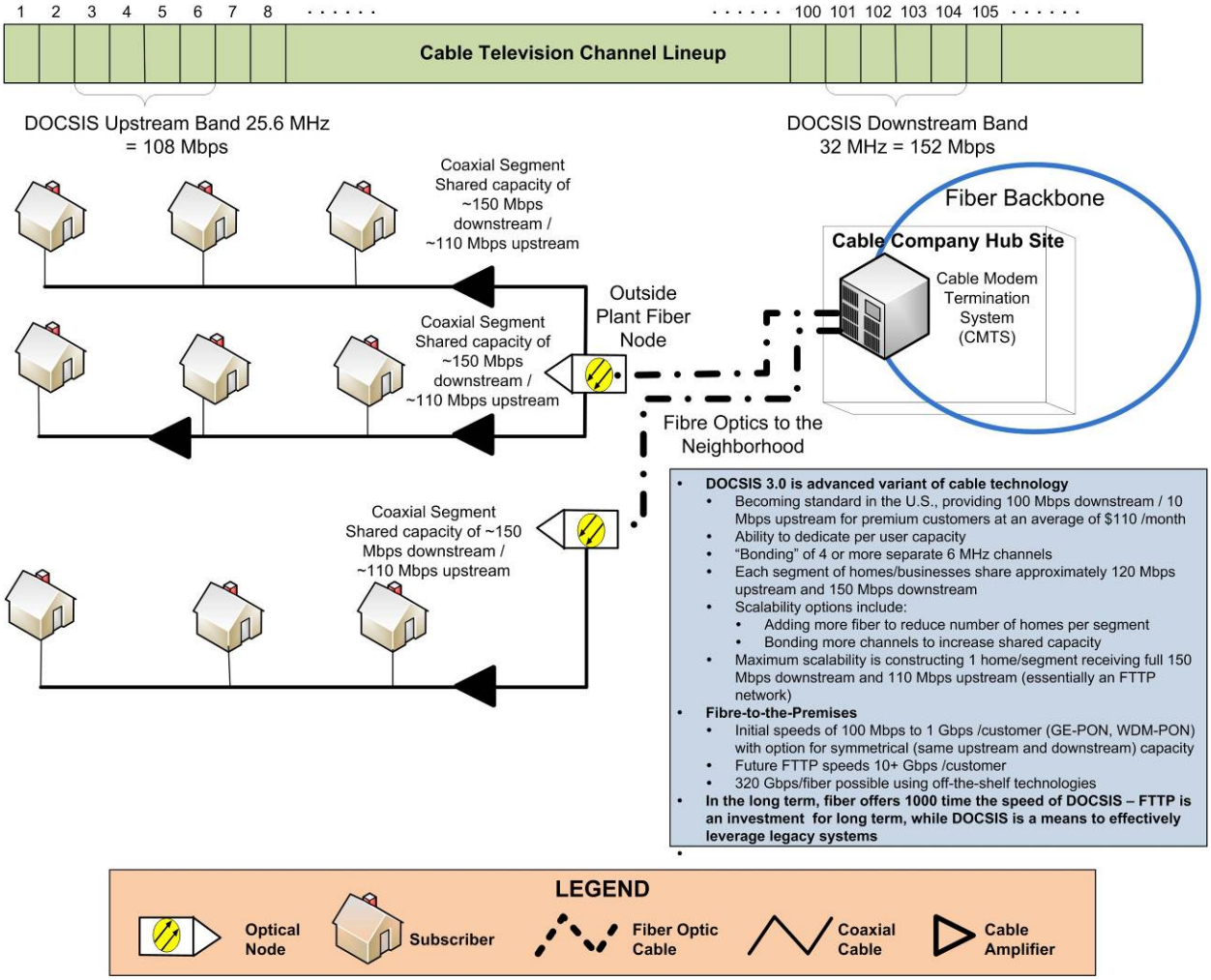
In Garrett County, Comcast and Shentel offer services using HFC technology. This is the dominant type of wireline broadband service in the County. Both companies are offering or are in the process of upgrading to the current leading cable technology for broadband, known as Data over Cable System Interface Specification version 3.0 (DOCSIS 3.0). DOCSIS 3.0 makes it possible for cable operators to increase capacity relative to earlier cable technologies by bonding multiple channels together. The DOCSIS 3.0 standard requires that cable modems bond at least four channels, for connection speeds of up to 200 Mbps downstream and 108 Mbps upstream (assuming use of four channels in each direction). A cable operator can carry more capacity by bonding more channels.

Theoretically, there is significant room for upgrading the speeds in a cable system, especially if there is access to high speed fiber optic backbone. For example, Virgin Mobile is offering 1.5 Gbps service in Britain over a cable network, presumably by bonding more than 30 channels.[49] It is critical to note that these are peak speeds, and that the capacity is shared by all customers on a particular segment of coaxial cable; this is typically hundreds of homes or businesses.

Figure 7 (below) illustrates a sample DOCSIS 3.0 network architecture.

[49] Speed is claimed in advertising but no independent verification is available. Also, there is no description of the burst vs. guaranteed speed or the symmetry (upstream/downstream) of the service.

Figure 7: Sample DOCSIS 3.0 Network



Ultimately, the maximum speed over an HFC network is limited by the physics of the cable plant; although an HFC network has fiber within certain portions of the network, the coaxial connection to the customer is generally limited to less than 1 GHz of usable spectrum in total. By comparison, the capacity of fiber optic cable is orders of magnitude greater and is limited, for all intents and purposes, only by the electronic equipment connected to it—allowing for virtually limitless scalability into the future by simply upgrading the network electronics.

3.1.3 Digital Subscriber Lines (DSL)

Copper "twisted-pair" telephone lines remain the main wireline communications medium globally, and considerable effort has gone into extending the capabilities and capacity of these lines. Digital Subscriber Line (DSL) technology expands the capacity of twisted-pair copper lines to provide higher-speed service.

Retail providers selling DSL services on copper lines deliver a maximum speed that depends on

the proximity of the central office or cabinet to the customer premises.[50]

In Garrett County, Verizon operates copper telephone lines that can be used for DSL services. Verizon offers the service directly and through resellers (including ICEWEB). The DSL service area is limited by the availability in the Verizon central offices (or remote cabinet), the condition of the copper wires, and the distance from the central office. The available speed varies on a case-by-case basis, depending on the above factors. Usually a DSL customer needs to be within three or four miles of a central office or cabinet.

In the United States, the most advanced widely available DSL platform is the U-verse network deployed by AT&T in its service areas (Garrett County is not an AT&T service area). U-verse constructs fiber to cabinets within approximately one-half mile of the home and uses the copper wires for the subscriber connection.[51] The maximum offered data speed of U-verse is 24 Mbps, with additional capacity for video traffic.[52] Video and voice are provided in Internet Protocol (IP) format, requiring IP set-top converters for all voice and video services. U-Verse is not available in Garrett County.

3.2 Wireless

With the improvement of the quality and speed of wireless communications, the public has become accustomed to using Internet services with wireless technologies, either on a communications link managed by a wireless service provider (i.e., a cellular data plan), on local infrastructure typically managed at a home or business (i.e., a WiFi hotspot), or through a mixture of those two approaches, in which an entity such as a service provider, municipality, landlord, or homeowners association operates a hotspot-oriented infrastructure.

It is critical to understand that wireless communications is limited and will always provide less capability and flexibility than the wireline technologies available at a given moment in time. Wireless is limited by over-the-air spectrum (i.e., the "channels" used for the signals), by range, and by line-of-sight. When an individual views images or videos on a device such as an iPad or a wireless Roku set-top converter, the communications link has traveled through a fiber optic backhaul connection to a service provider's base station (or to a home FTTP optical network terminal, cable modem, or DSL modem). From that point the signal travels either over a service provider network with careful signal and capacity modeling,[53] or from a hotspot located only a short distance from the user (and usually only serving the users in that premises).

That said, wireless technologies continue to improve and provide many of the services that homes and businesses need. Even if it is not, strictly speaking, a "third pipe" of fully competitive broadband to the home (after telephone and cable connections), it provides much of the value of

[50] The performance and maximum capacity of DSL on a copper telephone line depends on the frequency response of the individual line, which in turn depends on the condition and length of the line.
[51] AT&T's U-verse dissected, http://adslm.dohrenburg.net/uverse/ (accessed March 2, 2012).
[52] AT&T U-verse High Speed Internet, http://www.att.com/u-verse/explore/internet-landing.jsp?fbid=regRwrVqL4d (accessed March 2, 2012).
[53] Despite the dedicated spectrum (channel capacity), detailed engineering, and continuous upgrades in technology, wireless providers face significant challenges meeting the demand of users with laptop/tablet and smartphone devices, and have implemented bandwidth limits and other measures to control and ration usage.

one of those connections, and is currently the only one that follows users away from their homes or businesses.

As the U.S. Department of Commerce noted in a recent report on competitiveness, wireless broadband—like wired broadband—is a platform for innovation and economic growth:

> "Broadband also can be provided wirelessly, and the rapid growth of mobile communications clearly shows how important this technology has become to the American way of life. Wireless broadband, like wired broadband, has the potential to transform many different areas of the American economy by providing a platform for new innovation. The spread of wireless broadband will increase the rate of growth in per capita income and will spur economic activity through new business investment. There is the potential for many new high-quality jobs to be created, both directly through investments in wireless infrastructure, and indirectly through as yet unanticipated applications, services and more rapid innovation enabled by advanced wireless platforms. Although these effects are difficult to quantify precisely, evidence from the economics literature suggests that they are likely to be substantial. Areas where innovations using wireless technologies are likely to have significant effects include consumer products and services; products to enhance business productivity, including business process re-engineering; health care, through products like patient-physician video conferencing, personal handheld biosensors to generate diagnostic information, and remote transmission of diagnostic information and images; education; and public safety, where a nationwide interoperable wireless broadband network for public safety will ensure that first-responders have real-time access to critical information in an emergency."[54]

3.2.1 Technology

As noted in the survey results, 3 percent of Garrett County residents report that "wireless paid" service is their main form of Internet service. While many of these residents may also receive wireline service to their homes or businesses, their primary contact with the Internet for those 3 percent is through their smartphone or wireless-equipped tablet or laptop computer. This indicates that paid wireless service is generally a supplementary and not a primary source of broadband service in Garrett County, either because of the cost or because of the functional limitations of the service.

Nationwide, wireless providers operate a mixture of third-generation (3G) and emerging fourth-generation (4G) technologies. The service providers typically provide devices (telephones, smartphones, air cards, tablet computers) bundled with 3G or 4G services. Typically devices are not portable from carrier to carrier, because they are "locked" into the carrier by software and/or because differences in the technologies used by the carriers limits compatibility of the devices (discussed below). Therefore, the purchase of a device is a de facto commitment to a particular service provider, as long as the user uses the device.

[54] "U.S. Competitiveness and Innovation Capacity," *Infrastructure for the 21st Century*, U.S. Department of Commerce (2011), p. 5-8 to 5-10.

Table 2: Typical Performance for Advertised 2G/3G/4G Services

Applications	Technology (Download/Upload Service Speeds)[55]		
	2G/2.5G–EDGE/GPRS, 1xRTT (128 Kbps–300 Kbps/ 70 Kbps–100 Kbps)	3G–EVDO Rev A, HSPA+ (600 Kbps–1.5 Mbps/500 Kbps–1.2 Mbps)	4G – WiMAX/ LTE (1.5 Mbps–6 Mbps/500 Kbps–1.2 Mbps)
Simple text e-mails without attachments (50 KB)	Good (2 seconds)	Good (1 second)	Good (1 second)
Web browsing	Good	Good	Good
E-mail with large attachments or graphics (500 KB)	OK (14 seconds)	Good (3 seconds)	Good (1 second)
Play MP3 music files (5 MB)	Bad (134 seconds)	OK (27 seconds)	Good (7 seconds)
Play video files (100 MB for a typical 10-min. YouTube video)	Bad (45 minutes)	OK (9 minutes)	Good (3 minutes)
Maps and GPS for smartphones	Bad	OK	Good
Internet for home	Bad	OK	Good

The strict definition of 4G from the International Telecommunications Union (ITU) was originally limited to networks capable of peak speeds of 100 Mbps to 1+ Gbps depending on the user environment;[56] according to that definition, 4G technologies[57] are not yet deployed.

In practice, a number of existing technologies (e.g., LTE, WiMAX) are called 4G and represent a speed increase over 3G technologies as well as a difference of architecture—more like a data cloud than a cellular telephone network overlaid with data services. Furthermore, a transition technology called HSPA+, an outgrowth of 3G GSM technology previously considered a 3G or 3.5G technology with less capability than LTE or WiMAX, has been marketed as "4G" by AT&T and T-Mobile, so the definition of 4G is now fairly diluted. The ITU and other expert groups have more or less accepted this.[58]

HSPA is the technology that AT&T currently operates in Garrett County. AT&T has declined to

[55] This data assumes a single user. For downloading small files up to 50 KB, it assumes that less than 5 seconds is good, 5-10 seconds is OK, and more than 10 seconds is bad. For downloading large files up to 500 KB, it assumes that less than 5 seconds is good, 5-15 seconds is OK, and more than 25 seconds is bad. For playing music, it assumes that less than 30 seconds is good, 30-60 seconds is OK, and more than 100 seconds is bad. For playing videos, it assumes that less than 5 minutes is good, 5-15 minutes is OK, and more than 15 minutes is bad.

[56] "Development of IMT-Advanced: The SMaRT approach," Stephen M. Blust, International Telecommunication Union, http://www.itu.int/itunews/manager/display.asp?lang=en&year=2008&issue=10&ipage=39&ext=html (accessed March 2, 2012).

[57] Such as LTE Advanced under development.

[58] "ITU softens on the definition of 4G mobile," *NetworkWorld*, December 17, 2010, http://www.networkworld.com/news/2010/121710-itu-softens-on-the-definition.html (accessed March 2, 2012).

disclose when it plans to upgrade its Garrett County network to LTE. U.S. Cellular, however, has announced publicly that it will be deploying LTE in Western Maryland; though the timing is indefinite, some locations in Garrett County may get the upgrade in 2012.

3.2.2 Limitations

Most businesses and residents will find that wireless broadband has technological limitations relative to wireline. These include:

1) *Lower speeds.* At their peaks, today's newest wireless technologies, WiMAX and LTE, provide only about one-tenth the speed available from FTTP and cable modems. In coming years LTE Advanced may be capable of offering Gbps speeds with optimum spectrum and a dense build-out of antennas—but even this will be shared with the users in a particular geographic area and can be surpassed by more advanced versions of wireline technologies (with Gbps speeds already provided by some FTTP providers today).

2) *More asymmetrical capacity, with uploads limited in speed.* As a result it is more difficult to share large files (e.g., video, data backup) over a wireless service, because these will take too long to transfer; it is also less feasible to use video conferencing or any other two-way real-time application that requires high bandwidth.

3) *Stricter bandwidth caps.* Most service providers limit usage more strictly than wireline services. Though wireless service providers may be able to increase these caps as their technologies improve, it is not clear whether the providers will keep ahead of demand. A recent *Washington Post* article about Apple's newly released iPad with 4G connectivity highlights the issue: "Users quickly are discovering the new iPad gobbles data from cellular networks at a monstrous rate. Some find their monthly allotment can be eaten up after watching a two-hour movie. That has left consumers with a dilemma: Pay up for more data or hold back on using the device's best features."[59]

4) *Limitations on applications.* For example, users of smartphones and some tablet computers are limited by service providers or device manufacturers to approved applications. Apple limits the applications that can operate on its iPhone and iPad devices. Although Android is an open platform, Verizon Wireless blocks uploads of video from Android wireless devices on its networks by disabling the feature unless the user is on a private WiFi network. The FCC has reiterated that wireless providers have almost unlimited latitude to manage usage on their networks, in effect applying network neutrality rules only to wired networks; service providers can therefore expand their "management" of applications beyond the devices they provide to blocking or slowing applications from users with aircard-equipped PCs or home networks. The 3GPP protocols underlying LTE and subsequent technologies are designed to enable service providers to manage capacity based on application type (i.e., to prioritize particular types of traffic and make others lower priority).

[59] Cecilia Kang, "New iPad users slowed by expensive 4G network rates," *Washington Post*, March 22, 2012. http://www.washingtonpost.com/business/economy/new-ipad-users-slowed-by-expensive-4g-network-rates/2012/03/22/gIQARLXYUS_story.html?hpid=z2 (accessed March 24, 2012).

4. Current State of Broadband in Garrett County

Broadband deployment in Garrett County is quite high relative to other rural areas. This current state is the result of a number of factors:

- First, the County has made its own significant efforts to increase broadband deployment and to educate county residents about the benefits of broadband.
- Second, there exist in Garrett County a number of local entrepreneurs who have, in creative and innovative ways, deployed broadband facilities and expanded the amount of broadband available throughout the County.
- Third, recent upgrades made by the wireless telecommunications industry have dramatically increased the availability of broadband countywide.

That said, it is important to understand the County's broadband deployment in light of the economics of broadband deployment in rural areas. Because broadband infrastructure requires high capital expenditures, the private sector favors deployments in densely populated areas that will produce enough revenue to merit an investment. Garrett County, like most rural jurisdictions in the United States, feels the effects of these economics in its relatively low level of deployment: The private sector simply does not see the County as worthy of significant investment.

This section of the Report provides a discussion of the types and quality of broadband available in the County, as well as an overview of broadband adoption. We begin with an overview of National Broadband Map (NBM) data pertaining to the County as a whole, and include analysis of the County's incumbent broadband providers, competitive/entrepreneurial broadband providers, and wireless broadband providers. For each broadband technology, we have also included specific NBM data. (We include the NBM data here because it is the primary source of statistics regarding broadband availability nationwide—but we include it with the caveat that the NBM data are widely regarded as inflating the actual availability of broadband nationwide.)

4.1 National Broadband Map Data

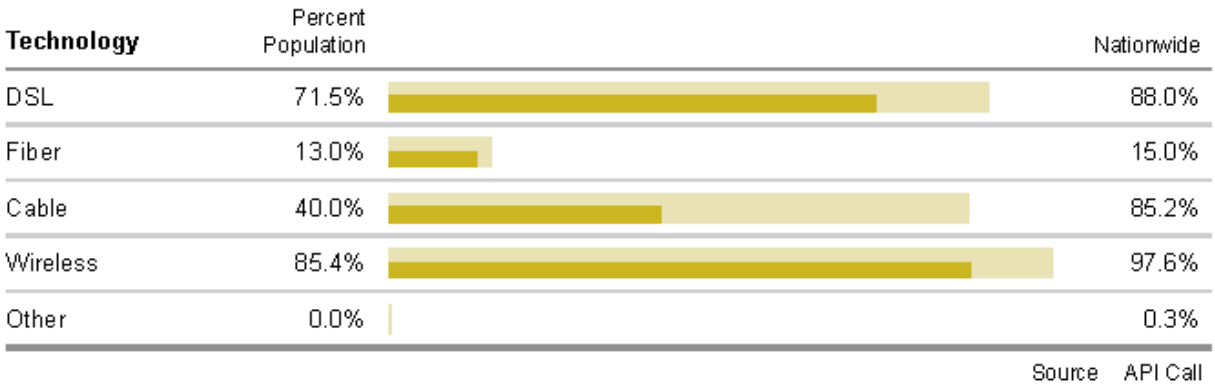
While National Broadband Map (NBM) data rank the County last in terms of overall connectivity among Maryland's 23 counties and Baltimore City, the NBM data still indicate that 96.2 percent of Garrett's population has access to broadband services of some kind.

Figure 8: National Broadband Map Data—Garrett County Connectivity

Rank	Name	Technology All	Speed Combo DL>3 UL>0.7	Speed Combo DL>.7 UL>.2	Demographics Info. Popul.
24	Garrett, MD	96.2% ±0.0	78.6% ±0.0	96.2% ±0.0	29,957

The most prevalent broadband technology available in Garrett County is wireless, reported at 85.4 percent, followed by DSL at 71.5 percent and cable at 40.0 percent. Only 13.0 percent of the population has access to fiber broadband.

Figure 9: National Broadband Map Data—Garrett County Technologies

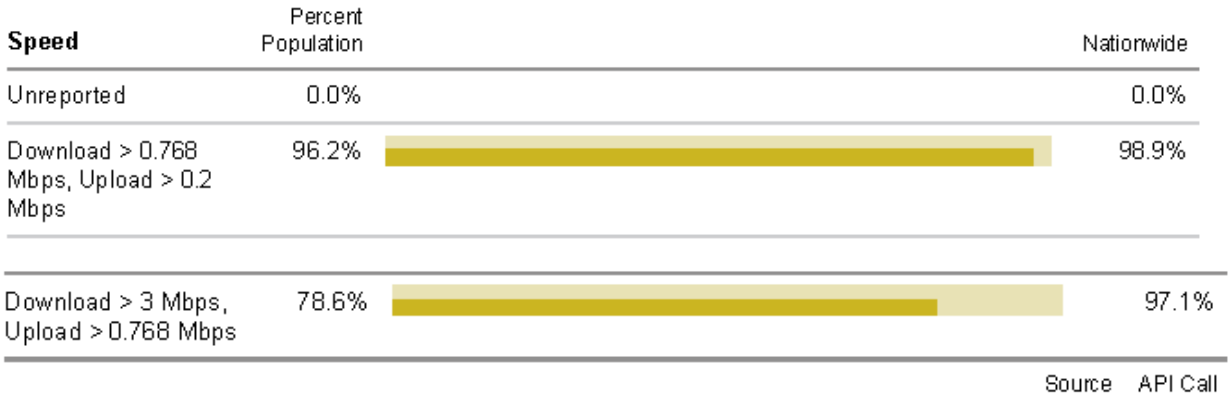


Technology	Percent Population	Nationwide
DSL	71.5%	88.0%
Fiber	13.0%	15.0%
Cable	40.0%	85.2%
Wireless	85.4%	97.6%
Other	0.0%	0.3%

Source API Call

The NBM reports that 96.2 percent of the population (i.e., everyone with broadband) has access to download/upload speeds greater than 0.768 Mbps/0.2 Mbps; almost 79 percent of the population is shown as having speeds greater than 3 Mbps/0.768 Mbps.

Figure 10: National Broadband Map Data—Percent of Population Connected



Speed	Percent Population	Nationwide
Unreported	0.0%	0.0%
Download > 0.768 Mbps, Upload > 0.2 Mbps	96.2%	98.9%
Download > 3 Mbps, Upload > 0.768 Mbps	78.6%	97.1%

Source API Call

The NBM also indicates that a majority of the County's community anchor institutions have broadband access.

Figure 11: National Broadband Map Data—Community Anchor Institutions Connected

Community Anchor Institutions	Total Number of Records	Subscribe to Broadband				Download Speed
		Yes	No	?	*	
Schools K through 12	24	21	0	3	17	
University, College, other post-secondary	5	5	0	0	4	
Libraries	4	4	0	0	1	
Medical / Healthcare	86	8	0	78	3	
Public Safety	27	13	7	7	1	
Community Centers - Government support	90	56	20	14	24	
Community Centers - Non-Government support	0	0	0	0	0	
Source API Call				Speeds provided *		

Given that the NBM data rely heavily on self-reporting by the commercial carriers, CTC's market research in Garrett County offers a means to evaluate the NBM's claims. Though some elements of CTC's market research appear to coincide with the NBM data, other measurements raise the concern that the NBM may significantly overstate the broadband coverage in the County.

According to CTC's survey results, 78 percent of County residents have Internet access in their homes, including 66.6 percent who have access to non-dial up broadband. The NBM reports 96.2 percent have access to broadband. This suggests one of the following possibilities: that the broadband map and the survey show contradictory data regarding coverage; that a significant proportion of the County chooses not to purchase broadband despite having access to it; or some combination of the two.

The largest market share of those served belongs to Comcast, at 43.2 percent, or 33.7 percent of all homes. This finding is quite close to the 35.8 percent of residents served by Comcast according to the NBM. However, if cable modem connections are in fact the largest portion of the broadband market, the real availability of DSL bears closer examination.

Data from the sample in the residential survey show a 24.4 percent market share for DSL in the County, or 19.1 percent of all homes. This is in contrast to 71.5 percent the NBM claims enjoy access to asymmetric DSL from Verizon. These numbers are highly discrepant, and suggest that either the availability of DSL is overstated by the NBM, or that the survey was not representative. However, since the site and the survey showed very close numbers for Comcast cable modem access, it is logically likely that the discrepancy has something to do with the specific provider's reported data rather than a problem with the sampling of the survey.

4.2 Broadband Adoption in the County

The Garrett County residential survey asked respondents whether they had a purchased an Internet connection in their home. (The survey was conducted via mail, so did not require an Internet connection to complete). A total of 78.1 percent replied "yes." This is the total Internet adoption rate for Garrett County—the rate at which Internet service is purchased where available. Most of this group reported using a broadband connection, but others reported using dial-up or satellite services. Respondents assessed their choice of home Internet service based on several considerations; they rated various components of service that are important to them, and indicated that reliability, speed and cost are all significant considerations. An Internet service's adoption rate is an indication of a population's willingness to pay for services based on what they consider to be important to them. If we can measure Internet service adoption, we can get a sense of a population's demand for the services in their community.

The adoption rate of a broadband service is the percentage of residents who purchase the service where it is available. The Adoption Rate measures market demand as a proportion of supply, and is calculated using the formula: ***a = d/s*** where "*a"* is the Adoption Rate, "*d"* is the rate at which the service is purchased (the demand metric), and *"s"* is the rate of a service's availability (the supply metric). For the supply metric, we rely on availability data from the National Broadband Map.[60] For the demand metric, we use the results of the Garrett County residential survey, which asked respondents whether they have Internet access in their homes, and if so what type. Further qualitative analysis is based on survey questions that assess the level of importance to consumers of components of Internet service, and their level of satisfaction with these components.

The survey began by asking respondents if they have purchased Internet access in their homes, to which 78.1 percent responded yes. This number is also the total Internet adoption rate, since availability of Internet access is 100 percent; anyone with a phone line can purchase dial-up Internet. Broadband users comprise 62.2 percent of total respondents.[61] The National Broadband Map reports 97.1 percent of Garrett residents have the option of purchasing broadband. **Therefore, the adoption rate for all broadband service in Garrett County, (the rate of usage divided by the rate of availability) is 64.1 percent (0.622 / 0.971 = 0.641).** This number represents a big-picture estimate of broadband market demand; it indicates that a Garrett County resident has a 64.1 percent likelihood of purchasing broadband Internet service where available. Frankly, we believe this number understates the actual adoption rate because the availability data sourced from the National Broadband Map overstate availability.

Below is a breakdown of the adoption rates of various types of Internet service that this adoption rate includes, as well as dial-up service.

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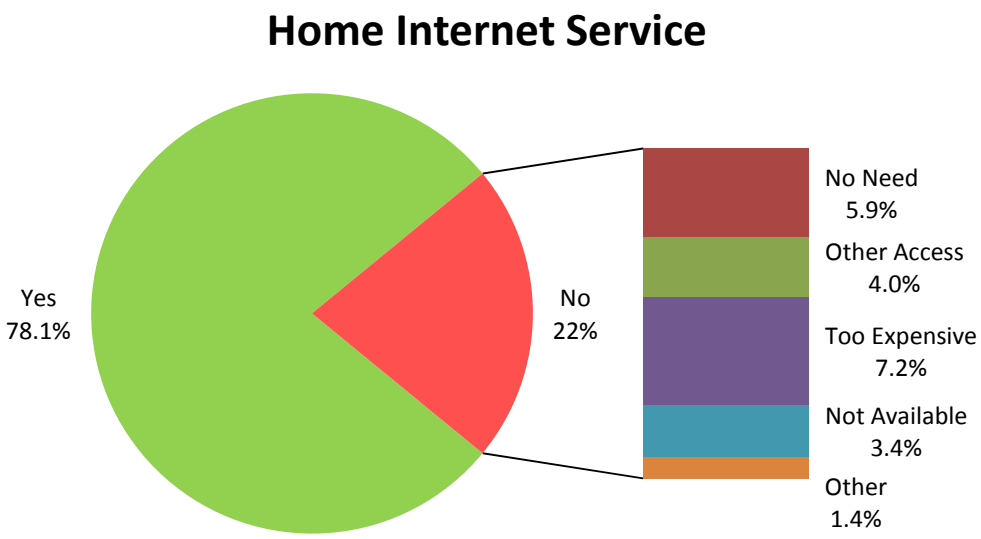
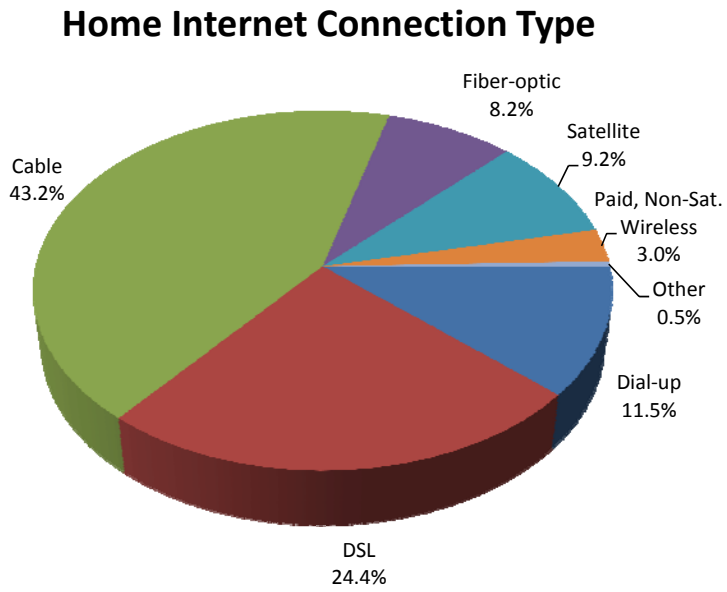
[60] The National Broadband Map relies heavily on self-reporting from Internet service providers. Depending on the company and the technology, the map's coverage numbers are likely overstated. Since we use these metrics as the denominator in calculating adoption rates, it is likely that true adoption rates are higher than those calculated in this report. This suggests that consumer demand for the broadband services predicted in this section are on the conservative side, and that true demand is likely higher.

[61] 78.1 percent of respondents said they have home Internet access. However, of total respondents, including those who have not purchased Internet service, those who reported using dial-up account for approximately 8.7 percent. Another 7.2 percent of respondents use a satellite service, another non-broadband technology. If we subtract the dial-up and satellite users from all home Internet users, we are left with 62.2 percent of respondents who have purchased broadband Internet service.



The most common Internet connection in Garrett County is cable modem, providing service to 43.2 percent of homes with Internet services (33.7 percent of all homes), followed by DSL with service to 24.4 percent of homes with Internet service (19.1 percent of all homes). Dial-up service has an 11.5 percent market share of residential Internet service, slightly higher than satellite (9.2 percent) and fiber-optic (8.2 percent) services.



We can estimate the adoption rate for each type of service by using the above data on what technologies respondents have purchased and comparing them with data on what is available to them.

4.2.1 Cable Modem

32.5 percent of all respondents adopted cable modem service. Data from the National Broadband Map reports 40 percent of the population has access to cable modem service in Garrett County. This leaves only 7.5 percent who have access to cable modem service and chose not to purchase it. According to this analysis, **the adoption rate of cable modem service in Garrett County (percentage of those with access to cable modem service who have purchased it) is 81.3 percent,** a high rate that reflects a high demand for this service. This service is relatively expensive, with an average monthly cost of $51 among respondents; cost was found to be the least satisfactory component this service, with an average rating of 2.75 (slightly dissatisfied) on a scale of 1 (very dissatisfied) to 5 (very satisfied). Nevertheless, these data show that residents are willing to pay for this service over less costly services where it is available, despite cost having been rated among the most important aspects of Internet service (4.6 out of 5) by respondents.

4.2.2 DSL

The second most popular service among respondents was DSL, at 18.4 percent, or 24.4 percent of home Internet users. The National Broadband Map shows 71.5 percent of residents have DSL access. However, as discussed in Section 4 of this Report, this number is likely overstated. If this number were correct, **the adoption rate for DSL would be 25.7 percent**, suggesting a far lower demand than exists for cable. This is consistent with the data gathered from respondents on satisfaction and importance of aspects of service. The only clear advantage a DSL user has over a cable user is cost; yet cost satisfaction among DSL users was 2.88, only slightly greater than that of cable users, and still in the slightly dissatisfied range. The data therefore suggest that DSL's availability exceeds its demand.

4.2.3 Dial-Up

A total of 8.7 percent of all respondents reported accessing the Internet via dial-up modem. Anyone with a working phone line has access to dial-up Internet, so we can assume that approximately 100 percent of residents have dial-up coverage, **making the adoption rate 8.7 percent.** Since dial-up service is widely available, it is highly unlikely there is a significant market demand beyond the current adoption rate. Dial-up satisfaction is rated poorly on every service metric, but receives more satisfactory ratings on cost and account metrics. At 3.2 out of 5 for cost satisfaction, dial-up beats cable and DSL, but still loses out to fiber-optic service.

4.2.4 Satellite

Like dial-up, satellite service is available to approximately 100 percent of residents. Satellite service speeds are significantly lower than those of broadband service, yet their costs are significantly higher, averaging $62 per month among respondents. Satellite only makes sense for customers who have no broadband options, and want a dedicated connection with speeds greater than dial-up. **Approximately 7.2 percent of all respondents** reported purchasing satellite service, making this the adoption rate. Respondents were dissatisfied with connection speed and price, and reliability was close to neutral. We can view this technology as an option for customers with no access to broadband, but not as a technology with demand beyond current

supply.

4.2.5 Fiber-Optic

Respondents reported using home fiber-optic service at a rate of 6.2 percent total, or 8.2 percent of Internet users. The National Broadband Map reports 13 percent of the population of Garrett County has access to fiber, **suggesting a 47.7 percent adoption rate**. Fiber beats every other technology on every satisfaction metric with the exception of reliability, in which cable modem outdoes fiber by 0.03 points. In addition, the average monthly cost for fiber Internet service is $43 per month, or 15.7 percent less than cable modem. With higher satisfaction ratings and lower cost, it stands to reason the fiber-optic market share has significant room for growth beyond its current 8.2 percent of Internet users.

4.3 Summary of Broadband Competition

This section provides a brief overview of the existing broadband landscape in Garrett County. Based on research conducted on the Internet and over the telephone, it appears that residents have a range of connectivity options that vary depending on where they live. Three separate addresses were used in this research to account for this geographical diversity.[62] These addresses were chosen after reviewing the Maryland Broadband Map[63] and Garrett County's Google fiber community application[64] to investigate existing provider footprints while also acknowledging geographical differences.

The following tables illustrate the wireline and wireless broadband service options for a sample residence and a sample small business in Garrett County. The County's incumbent wireline providers are Verizon Communications, Shentel, and Comcast Communications; competitive service providers include ICEWEB, Procom, QCOL, and Lumos.

Unless otherwise stated each price represents the monthly service cost. Connection speed represents the advertised maximum ("up to") download speed; actual download speeds will vary, and actual upload speeds will be slower for each service listed. For wireless service, 4G speed normally equates to a "burstable" (not guaranteed) download speed up to 10 Mbps and 3G tends to have up to four different advertised download speeds: 1 Mbps, 3 Mbps, 5 Mbps, and 7 Mbps. (3G and 4G speeds are "up to" and may not be consistently available.)

Table 3: Summary of Wireline Services Available at Sample Garrett County Addresses

Provider	Broadband Type	Residential service packages (monthly)	Small business service packages
Comcast	Cable	Performance: $29.99* 15 Mbps/3 Mbps	Starter: $59.90 12 Mbps/2 Mbps

[62] Residential addresses were: 143 Walnut Ave, Friendsville, MD; 1894 Glendale Rd, Swanton, MD; and 8895 Garret Highway, Oakland, MD.
[63] http://www.mdbroadbandmap.org/map/
[64] http://fiber.garrettcounty.org/map.php

Provider	Broadband Type	Residential service packages (monthly)	Small business service packages
		Economy: $38.95 1.5 Mbps/384 Kbps Performance Starter: $49.95 6 Mbps/1 Mbps Performance: $59.95 12 Mbps/2 Mbps Blast: $69.95 20 Mbps/4 Mbps Extreme 50: $114.95 50 Mbps/10 Mbps Extreme 105: $199.95 105 Mbps/10 Mbps *Price for six months; increases to $45 for remaining next six months, then to $45–$60.	Premium: $104.90 22 Mbps/5 Mbps Deluxe: $194.90 50 Mbps/10 Mbps Deluxe 100: $374.90 100 Mbps/10 Mbps
Comcast	Bundle (Triple Play)	Starter: $99.99 1st year $114.95 2nd year 12 Mbps/2 Mbps 80 channels Preferred: $119.99 1st year $134.99 2nd year 12 Mbps/2 Mbps 100 channels Preferred Plus: $139.99 1st year $154.99 2nd year 20 Mbps/4 Mbps 160 channels Premier: $159.99 1st year $174.99 2nd year 20 Mbps/4 Mbps 200 channels	None

Provider	Broadband Type	Residential service packages (monthly)	Small business service packages
Procom	Fiber	Economy: $20.99 400 Kbps/200 Kbps Standard: $49.99 1 Mbps/2 Mbps Express: $63.99 2 Mbps /4 Mbps Advanced: $91.99 8 Mbps/16 Mbps Expert: $154.99 16 Mbps/32 Mbps	Economy: $25.99 400 Kbps/200 Kbps Standard: $59.99 1 Mbps/2 Mbps Express: $89.99 2 Mbps /4 Mbps Advanced: $175 8 Mbps/16 Mbps Expert: $225 16 Mbps/32 Mbps
QCOL	Fiber	3 Mbps, $45 6 Mbps, $65 $50 activation fee. Dedicated connections available.	No commercial services
QCOL	Bundle (Triple Play)	Starter: $119.00 3 Mbps, 170 channels Preferred: $145.00 3 Mbps, 170 channels + premium subscription channels $50 activation fee Dedicated connections available.	None
Verizon	DSL[65]	High Speed: $24.99 0.5–1 Mbps/768 Kbps High Speed Enhanced: $39.99 7.1–15 Mbps/768 Kbps Prices for first 12 months	Starter: $34.98 1 Mbps/384 Kbps Quick: $47.99 3 Mbps/768 Kbps Fast: $64.99 5 Mbps/768kb Faster: $84.99 7.1 Mbps/768 Kbps

[65] Actual speed depends on the condition and availability of copper wires to the customer premises and its distance from the Verizon central office or remote cabinet.

Provider	Broadband Type	Residential service packages (monthly)	Small business service packages
			Fastest: $94.99 10-15 Mbps/1 Mbps All prices are for two-year contract, dynamic IP address, and subscribers without a Verizon business phone.
Verizon	DSL + DirecTV	High Speed: $64.99 0.5 – 1 Mbps / 768 Kbps High Speed Enhanced: $76.99 7.1 – 15 Mbps / 768 Kbps Each requires two-year contract with DirecTV	None

Of the major national mobile carriers, only AT&T and U.S. Cellular offer mobile broadband coverage. AT&T does not offer LTE service in the County yet; it does claim to provide substantial "mobile broadband" coverage, which is subsequently defined as 3G technologies.

U.S. Cellular offers 3G EVDO service, and may be the largest single provider in the County. It is beginning to offer 4G LTE services in other areas, and estimates that it will have LTE service available in Garrett County in April 2012.

T-Mobile provides service in the County. However, the coverage map they provide does not differentiate between their coverage area and roaming coverage. Nor do they make distinctions between 3G and 4G levels of service.

Verizon Wireless' coverage map indicates that no 3G or 4G services are offered anywhere in Garrett County. Additional searching reveals that Verizon claims to offer only 2G coverage, obtained through roaming on the U.S. Cellular network.

Satellite Internet access providers, by virtue of the characteristics of the technology, are able to offer services across the nation. The three major providers have similar speeds and pricing plans, with only HughesNet offering separate business services.

Table 4: Summary of Wireless and Satellite Services Available in Garrett County

Provider	Broadband Type	Residential service packages (monthly)	Small business service packages
AT&T	Wireless	DataConnect 5: $60 3G; 5 GB limit	None

Provider	Broadband Type	Residential service packages (monthly)	Small business service packages
		DataConnect 3: $35 3G; 3 GB limit	
T-Mobile	Wireless	Plus: $39.99 3G or 4G; 2 GB limit Premium: $49.99 3G or 4G; 5 GB limit Ultra: $79.99 3G or 4G; 10 GB limit Speeds slowed to 2G after data limits are reached.	Same as residential
U.S. Cellular	Wireless	Single Line: $39.99 *Voice*: 450 Min. *Message*: $0.25 per message, or $20 for unlimited messages *3G Data:* $30, 5 GB; $10, 100 MB Single Line Basic: $49.99 *Voice*: 700 Min. *Message*: $0.25 per message, or $20 for unlimited messages *3G Data*: $30, 5 GB; $10, 100 MB Single Line Essential: $69.99 *Voice*: 1000 Min. *Message*: Unlimited *3G Data*: $10, 100 MB Single Line Unlimited Basic: $69.99 *Voice*: Unlimited *Message*: $0.25 per *3G Data*: $30, 5 GB; $10, 100 MB	Same as residential

Provider	Broadband Type	Residential service packages (monthly)	Small business service packages
		Single Line Primary Plus: $79.99 *Voice*: 450 Min. *Message*: Unlimited *3G Data*: 5 GB included Single Line Essential Plus: $89.99 *Voice*: 1,200 Min. *Message*: Unlimited *3G Data*: 5 GB included Single Line Premium: $89.99 *Voice*: Unlimited *Message*: Unlimited *3G Data*: $10, 100 MB Single Line Premium Plus: $109.99 *Voice*: Unlimited *Message*: Unlimited *3G Data*: 5 GB included	
HughesNet	Satellite	Basic: $39.99 1 Mbps/200 Kbps (200 MB daily limit) Power 150: $59.99 1.5 Mbps/250 Kbps (300 MB daily limit) Power 200: $89.99 2 Mbps/300 Kbps (400 MB daily limit) Each plan requires a two-year contract	Express 200: $109.99 2 Mbps/300 Kbps (400 MB daily limit) Express 300: $199.99 3 Mbps/512 Kbps (800 MB daily limit) Express 500: $349.99 5 Mbps/1024 Kbps (800 MB daily limit) Each plan requires a two-year contract and one-time installation cost of $699 or $899 ($150 mail-in rebate available)

Provider	Broadband Type	Residential service packages (monthly)	Small business service packages
StarBand	Satellite	Nova500: $49.99 512 Kbps/100 Kbps Nova1000: $69.99 1 Mbps/128 Kbps Nova1500: $99.99 1.5 Mbps/256 Kbps Each requires a two-year contract and $150 install fee (waived with mail-in rebate)	None
WildBlue	Satellite	Value: $49.95 512 Kbps/128 Kbps 7.5 GB limit 2.3 GB upload cap Select: $69.95 1 Mbps/200 Kbps 12 GB data cap 3 GB upload cap Nova1500: $79.95 1.5 Mbps/256 Kbps 17 GB data cap 5,000 GB upload cap Each requires a two-year contract and one-time fees of $99.95 and $24.95.	None

Conclusion

The broadband Internet services available to residents of Garrett County vary dramatically across the jurisdiction. In some locations residents have a choice among multiple wireline providers while other locations lack any such providers at all. Residents in the north have greater options than those living in the south, including DSL, cable, and fiber. National wireless carriers provide mixed degrees of mobile broadband coverage. By virtue of the technology, national satellite providers operate in all parts of the County. However, it should be noted that these areas of competitive access are comparable to only average levels of service availability in an urban market.

4.4 Fiber

Fiber infrastructure in Garrett County includes fiber-to-the-home deployments and other fiber networks available to serve residential and small business subscribers, as well as a range of fiber networks owned by Lumos Networks and the State of Maryland. The County has also discussed with First Energy the possibility that it might construct open access fiber to link its substations.

4.4.1 Procom

Procom is a locally owned, entrepreneurial CLEC and ISP. It built a fiber-to-the-home (FTTH) network on Wisp Mountain and down Route 219 to Oakland on Marsh Hill Road, Lake Shore Drive, and Rock Lodge Road.[66] The company lit its fiber with an early generation of passive optical networking technologies, and has a very capable network. However, they face the same challenge that entrepreneurial overbuilders face throughout the United States: given how high the costs are to construct fiber optic facilities, and that the incumbent has been in the market for some time, it is extremely difficult to capture enough customers to realize the revenues needed to support the network. By its own account, Procom has had much greater success in the institutional and small business market than in the residential market. The company currently passes about 3,500 homes and has a penetration rate of less than 20 percent. To their credit, we note that Verizon, which has built FTTH in certain very densely populated high-income areas, averages approximately 20 percent penetration (and has the additional advantage of having been in those markets as a phone and DSL provider previously); so considering that it is an overbuilder, Procom has done quite well in marketing its services.

Procom provided an example of how challenging it is to expand its footprint in a rural area. To extend its network to eight recently constructed houses in McHenry (behind Browning's Foodland), the company incurred capital costs of $15,000 per home, not including certain equipment (e.g., ONT) and pole costs. Even assuming that 100 percent of those residences bought triple play service (a highly unlikely take rate), Procom's projected payback was seven years—about 3.5 times as long as the payback required by the incumbent providers. And those houses are relatively densely situated, and close to existing Procom plant; if the company had to bridge a rural area or build to low density homes, the expansion would have been even more spectacularly challenging.

4.4.2 QCOL

QCOL, like Procom is a regionally owned, entrepreneurial CLEC and ISP. It has built middle-mile fiber facilities into Garrett County as well as a fiber-to-the-home (FTTH) [67] network in some areas north of McHenry along and around Route 42 and in and around Friendsville. Like Procom, QCOL faces all the structural difficulties of a smaller company that does not have large scale and of an overbuilder forced to compete with a monopolist incumbent.

[66] http://www.4-procom.com/index.html
[67] http://www.qcol.net/

4.4.3 Lumos Networks

Lumos Networks is a CLEC serving Oakland but not the rest of the County. A large regional provider with holdings in western Maryland, Pennsylvania, Virginia, West Virginia, and the Midwest, Lumos entered the market when it bought FiberNet, which was another small CLEC.[68] It now has a direct fiber connection into Oakland from Morgantown, WV. It plans to develop additional fiber routes out of Oakland for redundancy, likely through some kind of partnership or business arrangement with the State of Maryland.

Although FiberNet did have limited service offerings for the residential market, Lumos does not serve that market in Oakland and has no residential rate plan. However, in the event that their system passes a residential address and that customer is willing to purchase business-class service, they will sell to a residence under their business class rate plan.

Lumos is also interested in selling commodity bandwidth in the enterprise market (e.g., larger businesses, institutional customers such as government, schools, libraries, and hospitals), and to other carriers.

The company does not have a Metro Ethernet ring in Oakland, but anticipates that it will be building such a ring in the next year or two. At that point, they will be able to sell Metro Ethernet products in the institutional and enterprise markets, competing with Comcast.

Lumos has no interest in the potential to expand its footprint to the residential market, which they do not serve. They are open to expanding their footprint in the small business and enterprise market, and are very open about their need for return on investment (ROI) within 36 months of any five-year term, or 24 months of a three-year term. In the event that they receive an expression of interest, they will send an engineer to estimate their cost—and a determination of what types of services they would need to sell to meet their ROI goals.

4.4.4 First Energy

First Energy's interest in connecting its substations with fiber presents a potential opportunity for the County to forge a beneficial partnership. CTC facilitated some discussions between the County and First Energy on this topic; further negotiations will depend on more concrete plans on both sides. First Energy was unable to make any commitments as of the date of this Report, despite very strong indications of interest. This is a pending partnership and collaboration that we are hopeful will come to fruition.

Assuming that First Energy were to include some open access fiber with the fiber it builds to connect its substations, private sector telecommunications providers would be able to cost-effectively reach whole sections of the community that lack sufficient broadband service.

For its part, the County could potentially offer a range of non-financial support, including:

[68] "Lumos Networks Fiber Map," Lumos Networks. http://www.lumosnetworks.com/content/fiber_map (accessed March 24, 2012).

- Facilitating the permitting process;
- Identifying available pieces of public property where First Energy could locate hubs for interconnection;
- Sharing market research and other information on carriers that might want to lease fiber;
- Introducing the Chamber of Commerce and other stakeholders to the concept;
- Participating in discussions with OMBN or the Maryland Broadband Cooperative; and
- Supporting First Energy in its bid to the Public Service Commission to include capital costs related to the fiber construction in its rate base.

4.4.5 One Maryland Broadband Network (OMBN)/Maryland Broadband Cooperative

The Maryland Broadband Cooperative (MdBC)[69] is the State's sub-recipient under the Broadband Technology Opportunities Program (BTOP) grant that is funding the One Maryland Broadband Network (OMBN). MdBC's charge and mission is to open up the middle-mile markets and bring cost-effective transport and commodity bandwidth to the rural western, southern, and eastern portions of the State. As such, MdBC is likely to provide services to its members in Garrett County by September 2013.

MdBC has obtained Resource Share Fiber from the State, as well as significant funding under the OMBN BTOP grant. Its huts (which will serve as local Points of Presence) are currently being manufactured to its specifications, and the backbone equipment purchased as part of the BTOP grant has been purchased and is awaiting installation once the huts are in place.

MdBC will place the huts (POPs) in the Keyser's Ridge area, Cumberland, Hagerstown, Frederick, and Rockville/College Park. This will allow MdBC to serve Western Maryland out of McLean, Virginia and Equinix in Ashburn, Virginia. Once the entire network is in place, MdBC will also be able to provide service out of other locations such as the carrier hotels at 300 Lexington and 111 Market in Baltimore.

The Coop's primary mission is to provide broadband to the rural areas by providing transport for last mile providers. To that end, MdBC pricing for transport (between any two points on its network) are as follows (note that an additional installation fee of $1,500 applies on a non-recurring basis):

10 Mbps:	$340 monthly recurring cost (MRC)
100 Mbps:	$1,275 MRC
1 Gbps:	$5,950 MRC
10 Gbps:	$12,900 MRC

Commodity Internet bandwidth is priced on a case by case basis and the prices vary widely, depending on the scale of bandwidth purchased (the unit cost per megabit decreases as the total number of megabits increases). The Coop is hoping to be able to offer commodity bandwidth in Garrett County (on top of the cost of transport) at a rate of $4 to $5 per megabit for its members.

[69] http://www.mdbc.us/

Coop members have the option of purchasing only transport from MdBC and then negotiating for commodity bandwidth at a major Point of Presence, or of buying through the Coop to leverage its scale.

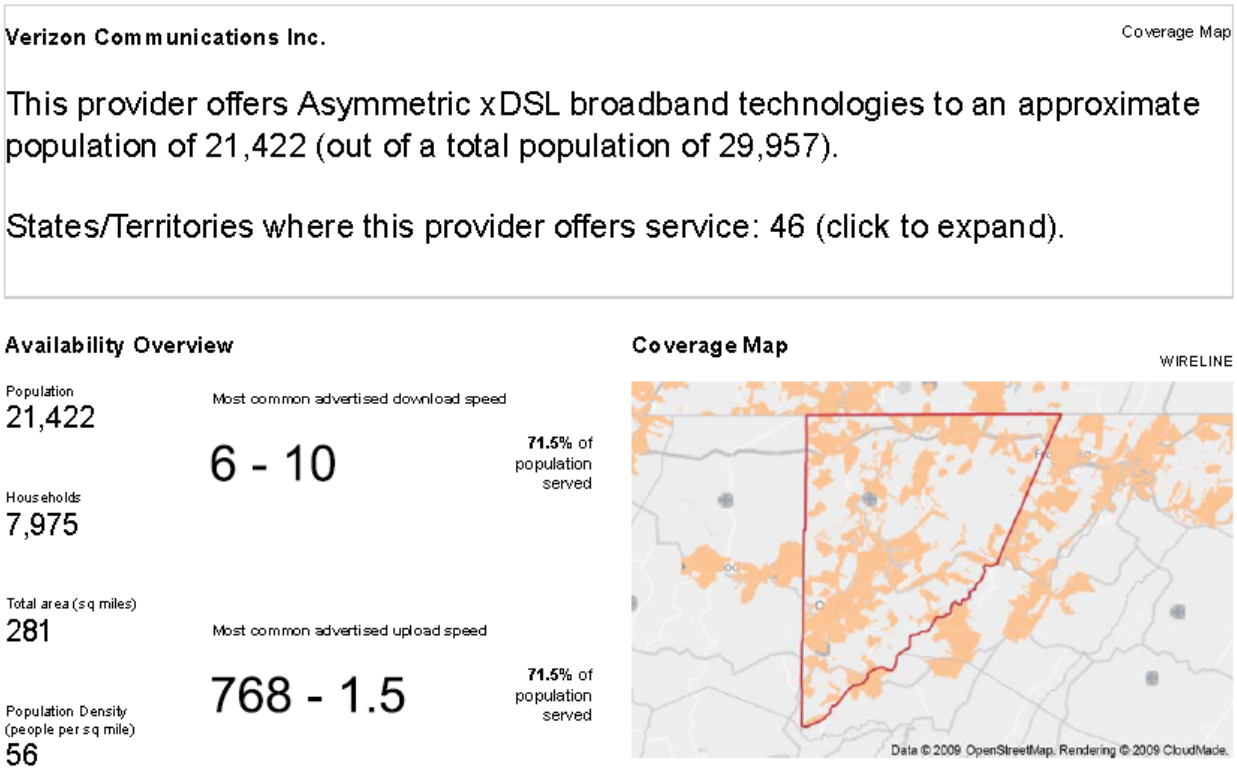
4.5 DSL

Verizon and its predecessors have operated a telephone network in much of the County for many decades. In recent years, Verizon upgraded some portions of that network to provide broadband DSL service. As is discussed in the technical section above, however, DSL has significant technical and distance limitations, and has never provided a solution for more than a significant fraction of County residents and businesses. In addition, Verizon has stopped investing in its rural wireline services in many parts of the country, and we believe that is the case in Garrett County.

4.5.1 Verizon

Verizon's own materials and the NBM purport to show that Verizon DSL is widely available in the County. The NBM, for example, indicates that 71.5 percent of residents have access to DSL service from Verizon:

Figure 12: National Broadband Map Data—Verizon DSL Coverage



However, it is the experience of many County residents and businesses that when they call Verizon to purchase services, they are denied; in other words, Verizon is refusing to add any additional customers. Most likely this is because of the limitations of its system to support additional customers, although it may also be purely a business decision not to focus on or market rural DSL services.

Based on all of these factors, the results of our survey work, and the County's own extensive observations and efforts, we therefore conclude that less than 25 percent of County residents and businesses could be served by Verizon DSL services.

4.5.2 ICEWEB

ICEWEB is a small, locally owned company that has been offering computer repair and sales since 1987 and has, since the advent of the commercial Internet, added Internet-related services such as Web hosting, Web development, networking, and reselling of dial-up, DSL, and satellite services, as well as some limited higher-end services as T1s.[70] It purchases commodity bandwidth at extremely high cost from Verizon. (While the company successfully carved out a niche rebranding and reselling Verizon DSL, but their business has been limited by Verizon's inability or unwillingness to lease them additional DSL circuits.)

In addition, ICEWEB has built a small wireless broadband network to sell services to the public in a range of areas, including parts of Oakland, Eagle Rock, and Grantsville. They use 802.11b technology, which is standards-based WiFi technology that is universally available on computers and devices sold on the existing market. They offer symmetrical data rate services ranging from 384 Kbps to 1 Mbps. They use the 5.8 GHz spectrum for backhaul.

ICEWEB's network is located on three radio station towers and two additional towers that they own. One of the challenges for expanding their footprint is access to towers. They report that the incumbent providers will not allow them to lease space on those providers' towers.

In our opinion, this is a very impressive local entrepreneurial effort that is delivering a fixed wireless product to residents who cannot access or afford other products. We note that they are currently paying $1,000 per month for about 3 Mbps of commodity bandwidth, which is a premium of about 800 percent above what their counterparts in large cities would be paying for bandwidth. Once the OMBN fiber has been built into Garrett County, and with the County's and the Maryland Broadband Cooperative's support, they will hopefully be able to significantly increase the amount of bandwidth they are purchasing for that price, and offer bigger bandwidth packages to their customers.

4.5.3 Lumos Networks

In addition to its fiber offerings (see Section 4.4.3), Lumos sells DSL service to the residential and small business markets. Lumos recently upgraded its Oakland DSL offering to a 6 Mbps down / 1 Mbps up product, which is available to locations within a three-mile radius of the

[70] http://www.iceweb.net/

central office (a typical limitation of DSL service). The company's 6/1 product is priced at $39.95 per month, which is very competitive. A phone line is an additional $28 per month, and unlimited long distance and local telephone service adds $20 more.

4.6 Hybrid Fiber-Coaxial (HFC) / Cable Modem

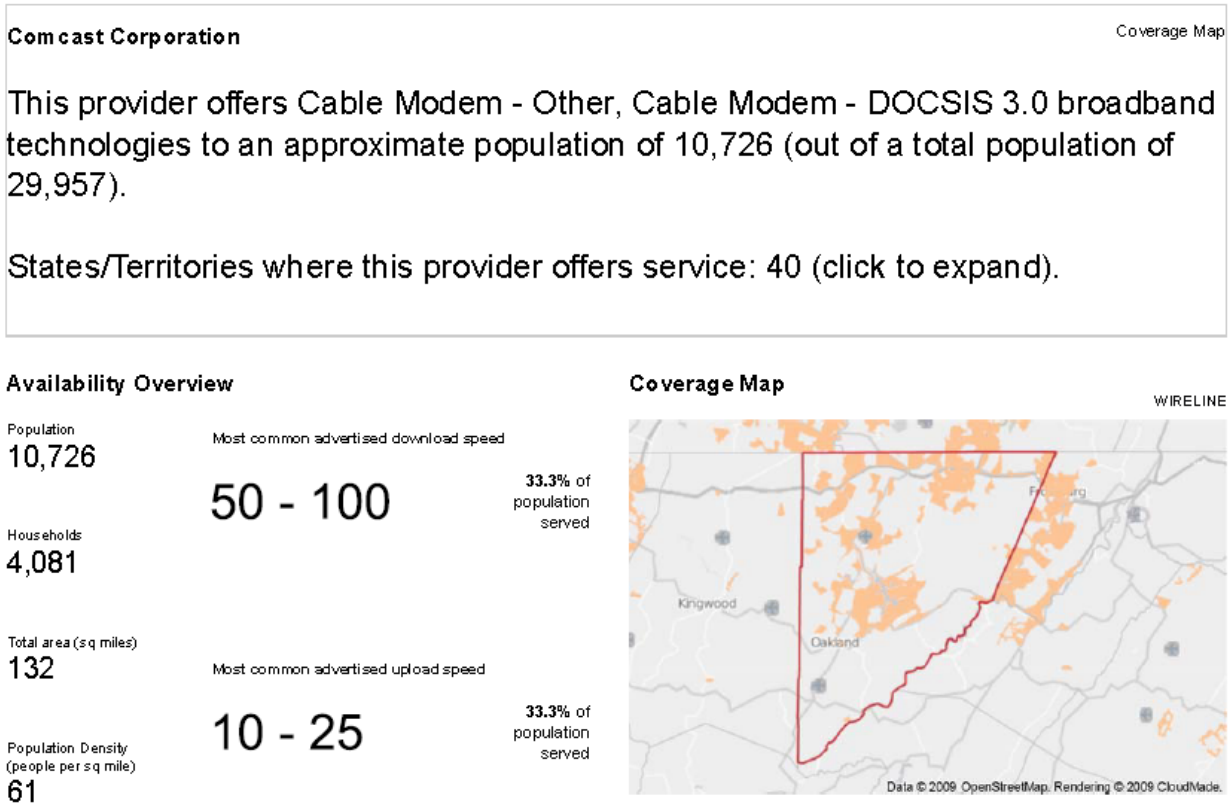
There are two incumbent cable providers in Garrett County. In the northern part of the County, in the areas around Deep Creek Lake and McHenry, and north to Grantsville, Comcast Communications operates a cable modem network that was purchased in 2006 from Adelphia Communications.

In the southern part of the County, from Oakland to Mountain Lake Park and Kitzmiller, Shenandoah Telecommunications (Shentel) has extensive cable assets that were recently purchased from Suddenlink Communications.

4.6.1 Comcast

According to the NBM, Comcast provides broadband via cable modem to 33.3 percent to 35.8 percent of County residents (the data are inconsistent):

Figure 13: National Broadband Map Data—Comcast Cable Modem Coverage



The Comcast system is state of the art or close to it for a cable modem network. Both in Garrett County and elsewhere, Comcast is known for investing in and supporting its facilities and maintaining them well. Most of the Comcast facilities in Garrett County have been upgraded to DOCSIS 3.0, the state of the art for cable modem technologies. And Comcast is offering services both to the residential and the business markets in Garrett County that are comparable to the services it offers in any metro area.

In addition, Comcast is open to investing extensively in Garrett County to provide business-class and enterprise-level services to Garrett County businesses and anchor institutions where the financial case supports that type of investment. Thus, assuming that there are interested customers, we anticipate that Comcast may invest further in Garrett County for purposes of serving the institutional market. On the other hand, however, while Comcast is supporting and upgrading its existing network to the business community, it is our impression that Comcast does not plan to expand its residential footprint other than perhaps in marginal ways if it is building to an institutional customer, and reaching a potential residential customer along that route entails only marginal additional investment.

We thus conclude that for purposes of the areas of Garrett County served by Comcast, the company's service areas is unlikely to grow for the residential market, and may grow if the business case develops in the institutional market.

As with Shentel, the County should continue to press Comcast to examine data indicating the existence of unserved and underserved residences near Comcast's existing facilities. The letter and map that the County sent to Comcast in March 2012 represent an important effort in this regard. It shows not just that there are underserved areas contiguous to Comcast's stated service footprint, but that there are residences within that stated area that are unserved.

4.6.2 Shentel

The cable provider in the southern part of the County is Shentel,[71] a regional provider based in Virginia that has holdings in Virginia, West Virginia and Maryland. It recently bought a range of small cable systems, including the Suddenlink network in Oakland. That network is dated and provides services that are in no way comparable to those of Comcast. However, Shentel's plan is to extensively upgrade its network in Garrett County in 2012 to a standard that, in our experience, is state of the art for cable networks.

The Shentel network reaches both business and residential customers, though Shentel's general business direction is focused primarily on the residential market.

Shentel has expressed some limited interest in expanding its residential footprint where the potential revenues justify the investment. It has been open about the formula under which it would be willing to offer additional services. Generally, Shentel's model is that it will absorb the cost of construction for up to 1,000 feet of cable construction if, in that 1,000 feet, it can reach a

[71] https://www.shentel.com/

minimum of six customers—though it may be willing to lower that number of minimum customers if the customers make a commitment in advance.

At a less granular level, this means that Shentel requires somewhere between 30 and 50 homes in each mile of plant construction to justify the capital investment—though it might be willing to build to somewhat lower density areas if customers have made commitments to purchase services in advance. We believe that Shentel's frankness and openness about its investment formula, as well as the interest it has expressed in working with the County and in serving the County's residents, potentially open the door to some modest expansion of the Shentel cable footprint in the County.

Based on the formula that Shentel has provided, we recommend that the County consider an educational campaign, or at least communications to dissatisfied citizens who are requesting better broadband in their neighborhoods, to consider organizing their neighbors and communities to make pre-construction commitments to purchase services; citizens could approach Shentel with those commitments, with the hope that a mass of potential customers in a relatively concentrated area would induce Shentel to build to their homes.

Given Shentel's ongoing interest in serving the County and expanding its footprint where such expansion makes good business sense, the County should also continue to provide research and data to Shentel to help it identify potential communities to serve. The County took a positive step in that direction by sending its Shentel contacts, in March 2012, a map identifying unserved and underserved parts of the County that are close to the Shentel footprint—and where market research suggests that there is a densely populated cluster of potential customers. Shentel responded that it would "begin putting together a plan to evaluate builds to these areas."[72]

We note in addition that Shentel's engineers told us quite frankly that, even once a Garrett County network is extensively upgraded, the challenge with increasing speeds in its service offering will relate to its lack of access to commodity Internet bandwidth, and the relative expense of bringing that bandwidth to the County. It is our expectation that once the OMBN is deployed and competitive providers are able to transport commodity bandwidth into the County, the price will drop for companies like Shentel—and they will have the opportunity to increase the speeds of their service offerings. The presence of OMBN fiber could additionally give Shentel the opportunity to cost-effectively contract for dark fiber and connect its Garrett County network to its other facilities in other parts of the state.

4.7 Mobile Wireless

Cellular broadband service is available in most of the denser parts of the County; unfortunately, the speed and reliability of the service varies sharply based on location and time of use, even in proximity to Deep Creek Lake. Areas that are not served by cellular voice service are also not served by these services—including along New Germany Road, in the Savage River valley, and in the Herrington and Swallow Falls Park areas.

[72] E-mail from Ed McKay, Vice President, Engineering and Planning, Shentel, March 28, 2012.

Where cellular broadband service does exist in the County, download speeds can reach 2 Mbps, although 1 Mbps is more typical. Upload speeds vary but are typically significantly lower. In addition, the performance is often not as consistent as with a wired connection for a range of technical reasons. And mobile wireless providers typically prevent mobile devices from sharing video and using other more bandwidth-intensive applications.

Cost is also a limiting factor, with basic service costing a set amount per month (usually requiring a multi-year service commitment), and additional charges if users exceed their monthly bandwidth cap.

Considering the cost and performance of the best mobile wireless services in Garrett County, those services currently are a step down from higher-quality cable modem and DSL services, sharply limiting the user's ability to do many things that are taken for granted on a wireline service. Customers cannot rely on the current mobile wireless service in the county to share large files (such as images, blueprints, video), operate two-way video, view on-demand video from Netflix and other sources, play interactive games, or use anything beyond the most rudimentary educational and telemedicine applications.

4.7.1 AT&T and U.S. Cellular

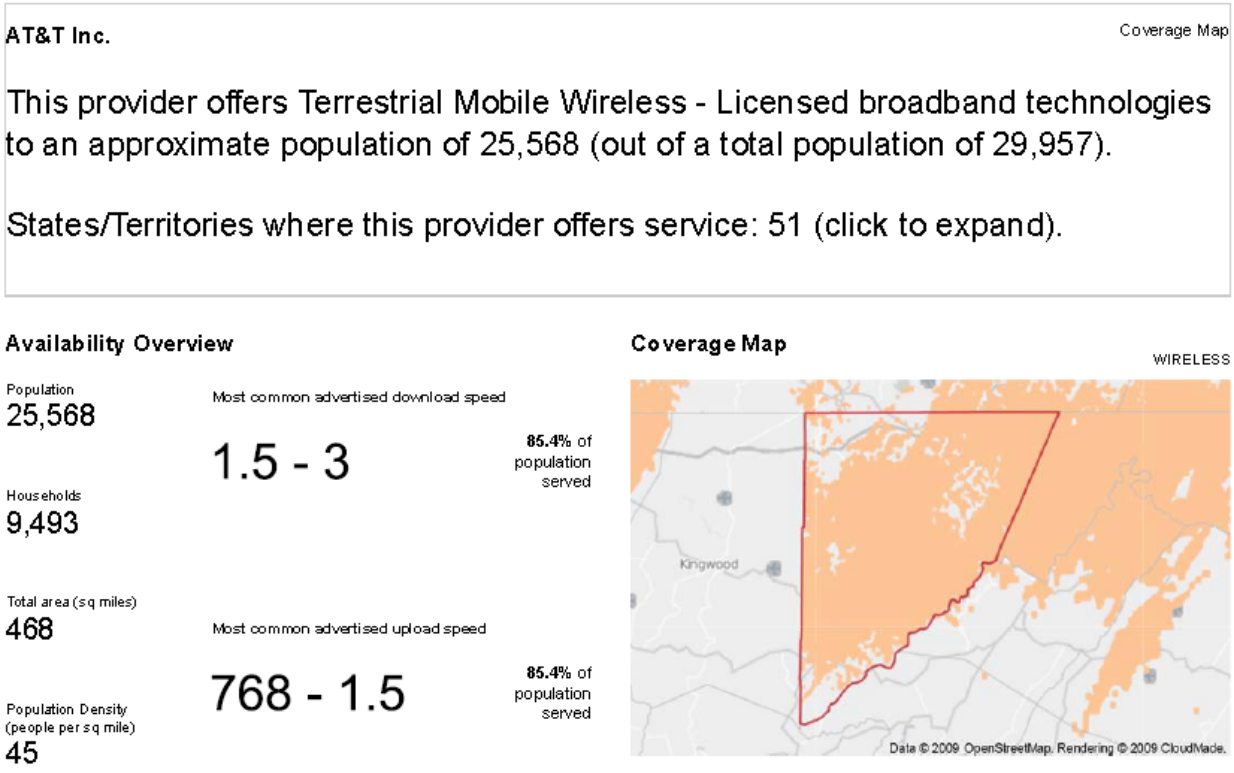
AT&T is offering HSPA+ (generally considered to be a 3G or 3.5G) and U.S. Cellular is offering EVDO (3G) mobile wireless services within the County. These services have been upgraded in recent years and can be expected to improve further, as newer technologies are developed and network performance improves nationwide.

AT&T has upgraded from HSPA to more capable LTE in many metropolitan areas, including the Washington, D.C. region, but has not yet deployed that technology in Garrett County. When we inquired about their timeline, they responded that under no circumstances do they disclose upgrade paths or timelines. We note, however, that even without LTE deployment, the AT&T product currently deployed in the County will reliably deliver more than the 768 Kbps in remote areas that the County had targeted—although it is unlikely to deliver 4 Mbps down as the County had targeted for its population centers.

In the case of U.S. Cellular, the company has been very public about its plans to upgrade western Maryland to LTE from EVDO over the next year or so. While we have no specifics as to their build-out timeline, we note that in late April 2012, U.S. Cellular notified the County that it would be building three new cellular towers in Garrett County. This is a very strong and encouraging sign that they are investing in higher quality mobile bb in the County. The LTE product will deliver higher, more reliable speeds than the existing EVDO network, though we note that (as U.S. Cellular itself has explicitly stated) this mobile product is not an exact substitute for a wireline or point-to-point service—in part because commercial mobile products are capped as to total bandwidth available per month.

AT&T offers only mobile wireless access in Garrett County. The NBM shows that this wireless service covers most of the County, both in terms of geography and population:

Figure 14: National Broadband Map Data—AT&T Mobile Wireless Coverage



The NBM does not list U.S. Cellular as a broadband provider in Garrett County, so no benchmark data are available.

It should also be noted that Sprint and Verizon Wireless do not have infrastructure in Garrett County and do not have plans to serve the County; customers of those companies roam to U.S. Cellular's network. In the case of Verizon Wireless, subscribers are only allowed to connect to U.S. Cellular's 2G 1xRTT service with significantly lower reliability and typical download speeds in the 100 Kbps range (and slower uploads)—comparable to dial-up services.

T-Mobile operates in the County under a roaming agreement with AT&T.

4.7.2 Clear

Clear does not offer services in Garrett County even though it holds a license for a large block of spectrum. Its closest active area is near Baltimore[73] and it has not announced plans to activate service in Garrett County.

[73] Clear, "Check Coverage," http://www.clear.com/coverage (accessed March 19, 2012).

5. Survey Data and Analysis

On the County's behalf, we conducted surveys of residents, businesses, and the agricultural sector in Garrett County. The surveys aimed to collect data that would allow the County to understand both the potential unmet broadband needs in the community and ways in which improved communications services could benefit residents.[74]

5.1 Residential Survey Summary

We mailed a questionnaire to 600 randomly selected residences in Garrett County in November 2011. To encourage participation, the survey was printed as a booklet, which enhances the readability of the survey, and was enclosed in a non-standard-sized envelope to make it stand out. A written survey was chosen over a telephone survey because the increase of cellular-only households means that telephone surveys omit a growing and important residential segment. The survey was estimated to take 12 to 15 minutes to complete.

The survey was designed to obtain information about responding residents' use of communications services including Internet, television, and telephone. The survey also captured residents' opinions about communications services within Garrett County and identified ways in which those services may be improved to better meet residents' needs.

The following sections discuss the survey objectives, process, and results.

5.1.1 Background and Objectives

The residential communications survey was designed to capture substantial information about residents' use of, and satisfaction with, Internet and related services of communications providers in Garrett County. This information was intended to help the County evaluate market needs and demand for communication services. To meet those objectives, residents were asked about their:

- Internet use, satisfaction, and opinions about their service
- Television and video services, satisfaction, and opinions about their service
- Telephone services and satisfaction levels
- Internet-based television and telephone use
- The potential impact of improved Internet service on the use of second homes
- General household information

This information is being used to assess the current state of communications services in Garrett County and to identify ways in which the County may be able to support improvements in those services to better meet the needs of its residents.

[74] CTC was responsible for all project communications, coordination, methodologies, and reporting of results. CTC also managed the work of contractors involved in survey printing, mailing, and processing. County staff and stakeholders provided feedback on the draft survey instruments and reviewed preliminary study findings.

5.1.2 Survey Process

5.1.2.1 Mailing and Response

A total of 600 questionnaires were mailed to randomly-selected Garrett County residents in November 2011. The survey forms were mailed first-class and included a postage-paid envelope to return the completed survey. Completed forms were returned to the survey processor for verification and data entry.

A total of 182 useable residential surveys were received by the cut-off date, providing a "gross" response rate of 30.3 percent.[75] Based on approximately 12,800 households[76] in Garrett County, the results are available with a precision level of ±7.2 percent at the 95 percent probability level for aggregate responses. That is, 19 times out of 20, one would expect the survey results to be within ±7.2 percent of the actual value across the entire population.

The data from completed surveys were entered into a database format for analysis.

5.1.2.2 Data Analysis

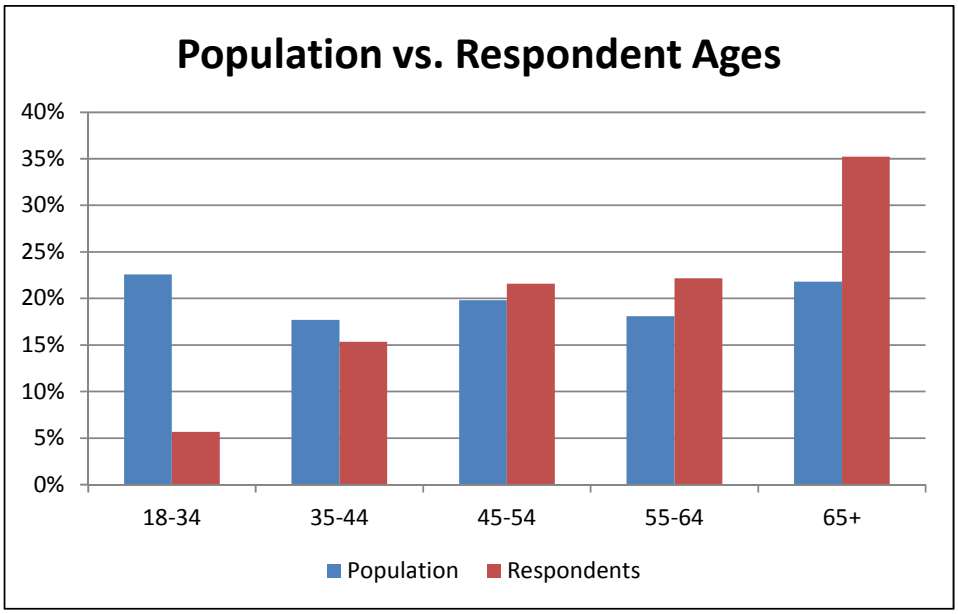
Survey data was coded, labeled, cleaned, and verified with IBM SPSS[77] software. Survey data was evaluated using techniques in SPSS including frequency tables, cross-tabulations, and means functions.

Survey results were weighted based on the age of the survey respondent to help adjust for the fact that younger residents are much less likely to respond to a survey than older residents. To the extent that younger residents use different technologies, subscribe to different services, or have different opinions, the survey results would be biased and would misrepresent the population as a whole if weighting were not performed. Weighting survey data by the age of the respondent helps correct for any inherent biases in survey response rates by age. The weighting calculation uses population data from the 2009 Census Bureau estimate (2010 Census data by detailed age cohort not yet available) and is calculated in the following manner:

Survey Response Weighting			
Age of Respondent	Percent of Population	Percent of Respondents	Weight
18-34	22.6%	5.7%	3.98
35-44	17.7%	15.3%	1.15
45-54	19.8%	21.6%	0.92
55-64	18.1%	22.2%	0.82
65+	21.8%	35.2%	0.62
Total	100.0%	100.0%	

In this manner, the weighted results are more representative of the Garrett County population as a whole.

[75] Excluding 15 undeliverable surveys, the "net" response rate was 31.1%. In addition, at least eight surveys were received after the cut-off date.
[76] Source: U.S. Census Bureau, 2009 data, http://quickfacts.census.gov/qfd/states/24/24023.html
[77] IBM Statistical Package for the Social Scientist, www.spss.com



The following sections of this Report summarize the survey results and highlight key findings.

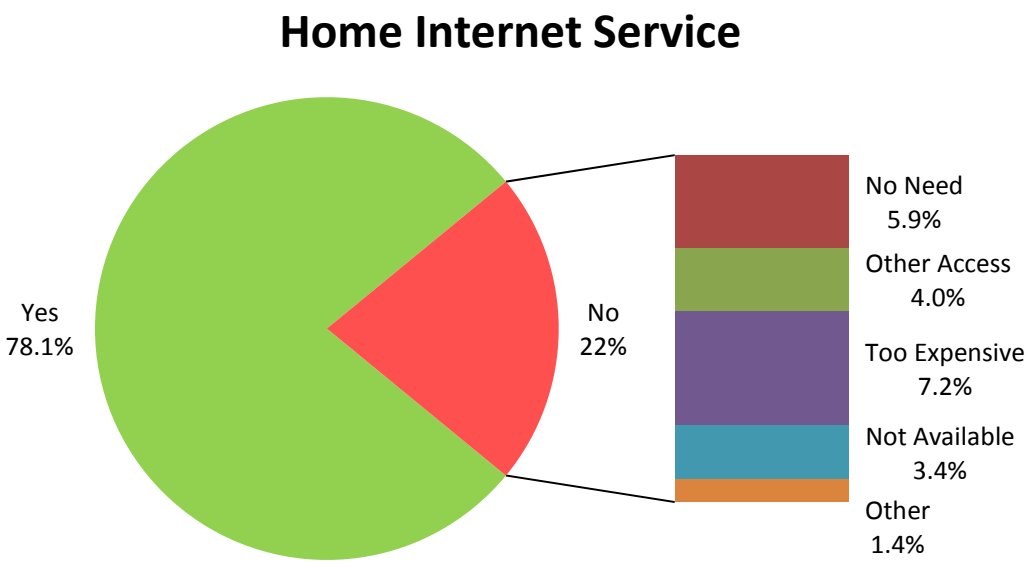
5.1.3 Residential Survey Results

The residential survey results are presented and discussed in the following sections. In addition, comparisons or cross-tabulations of responses based on demographics or services types are included to evaluate key correlations or distinctions among major subgroups of service types or other characteristics.

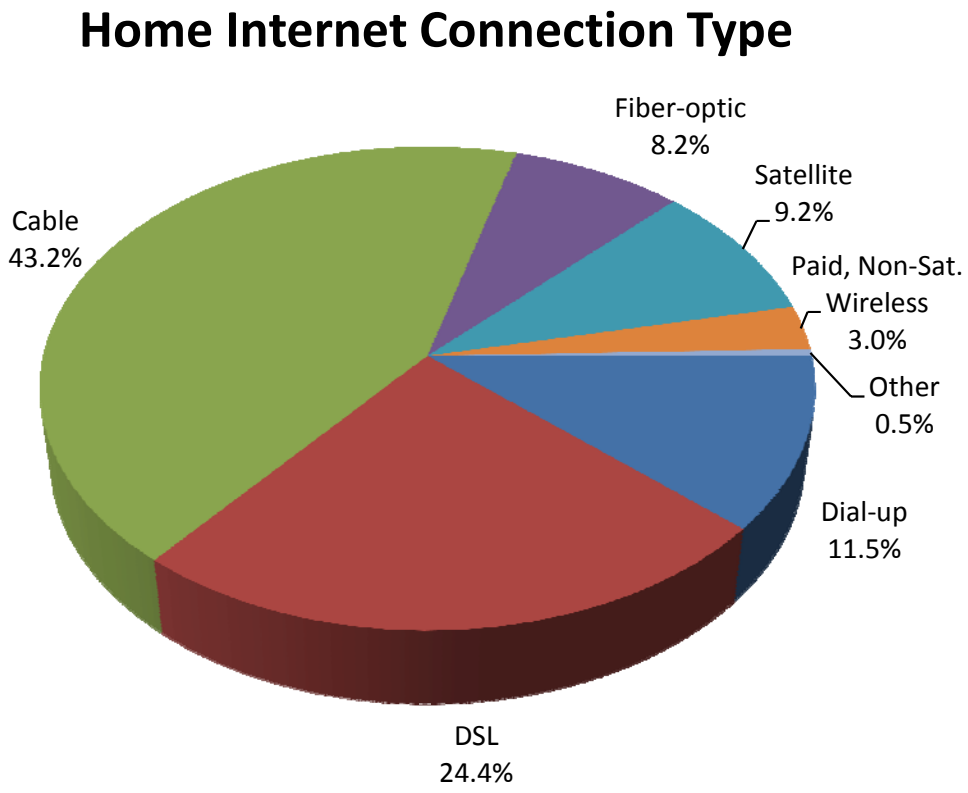
It should be noted that statements referring to "Garrett County" households refer to the 182 respondents to the survey, which are representative of the larger population within the statistical parameters discussed previously. All of the results discussed in subsequent sections represent "age-weighted" data unless otherwise specified.

5.1.3.1 Internet Service

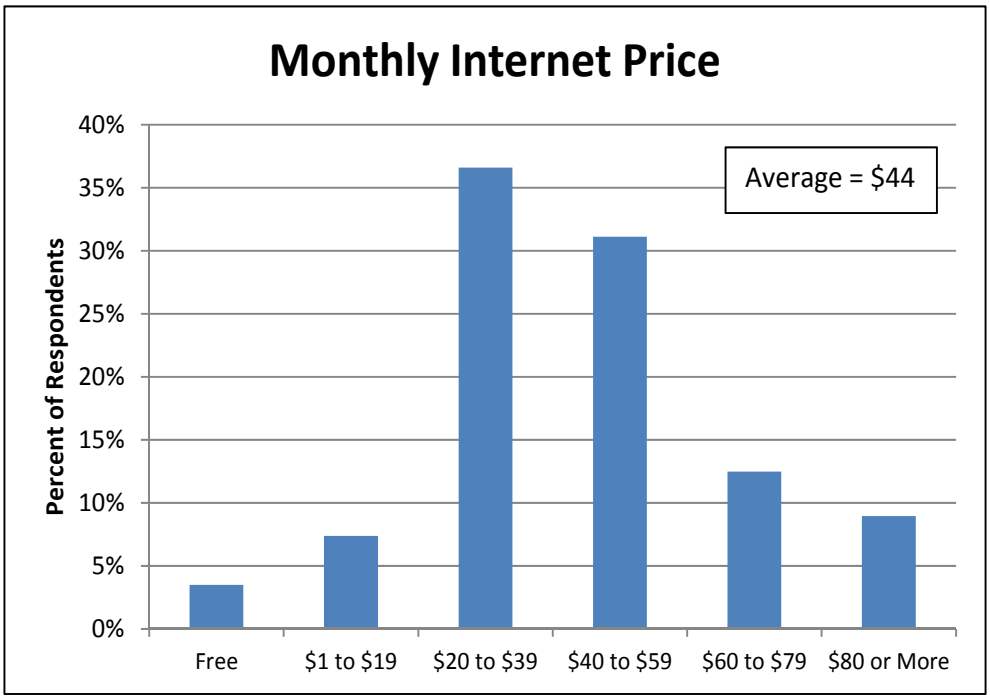
Approximately 78.1 percent of respondents have home Internet service, including 69.1 percent with high-speed (non-dial-up) service. The most common reason for not having Internet service was the expense, followed by lack of need and the ability to access the Internet at another location.



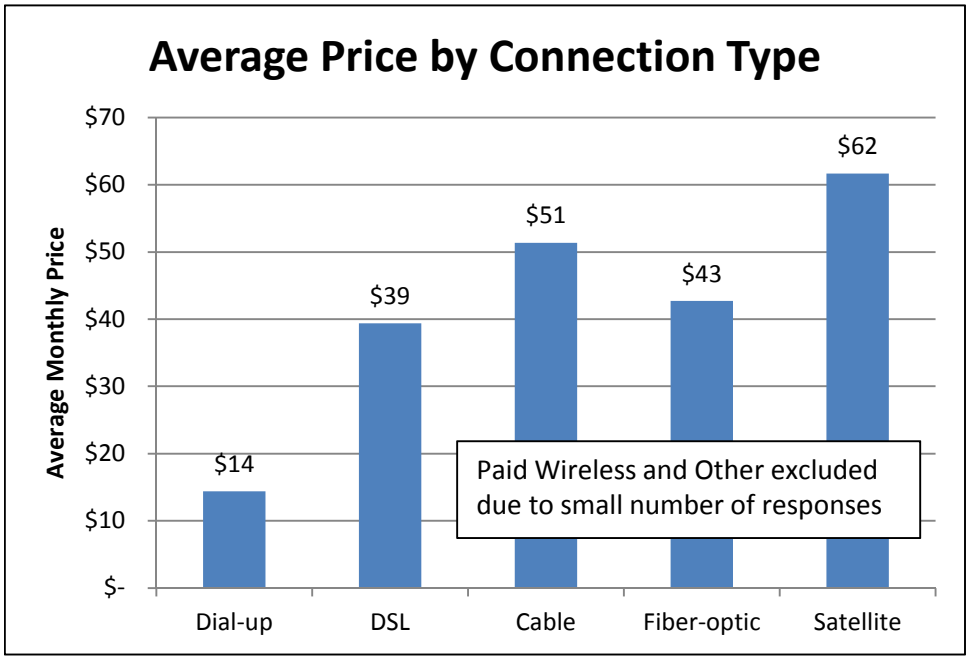
The most common Internet connection is cable modem, providing service to 43.2 percent of homes with Internet services (33.7 percent of all homes), followed by DSL with service to 24.4 percent of homes with Internet service (19.1 percent of all homes). Dial-up service has an 11.5 percent market share of residential Internet service, slightly higher than satellite (9.2 percent) and fiber-optic (8.2 percent) services.



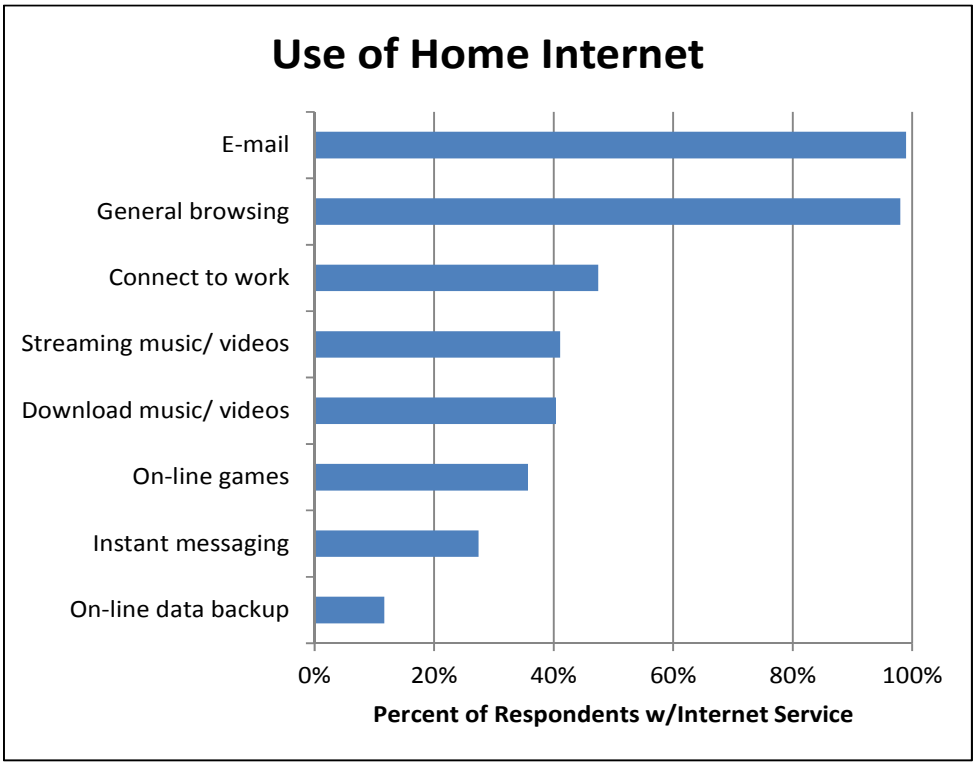
On average, Garrett County residents pay $44 per month for Internet service, with two-thirds paying between $20 and $59 per month.



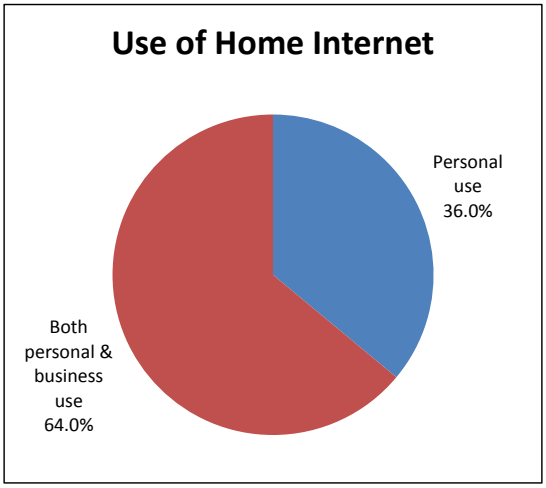
The price paid varies across different connection types. Dial-up subscribers pay the least, on average, while satellite subscribers pay the most.



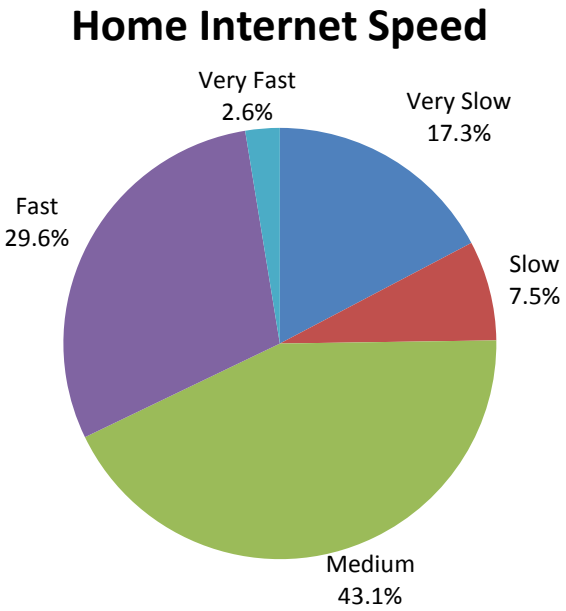
Garrett County residents use their home Internet connection for a variety of purposes. Nearly all use it for e-mail and for general Internet browsing. Nearly one-half also use it to connect to work computers or servers, indicating the potential for increased telecommuting if connection speeds are sufficient.



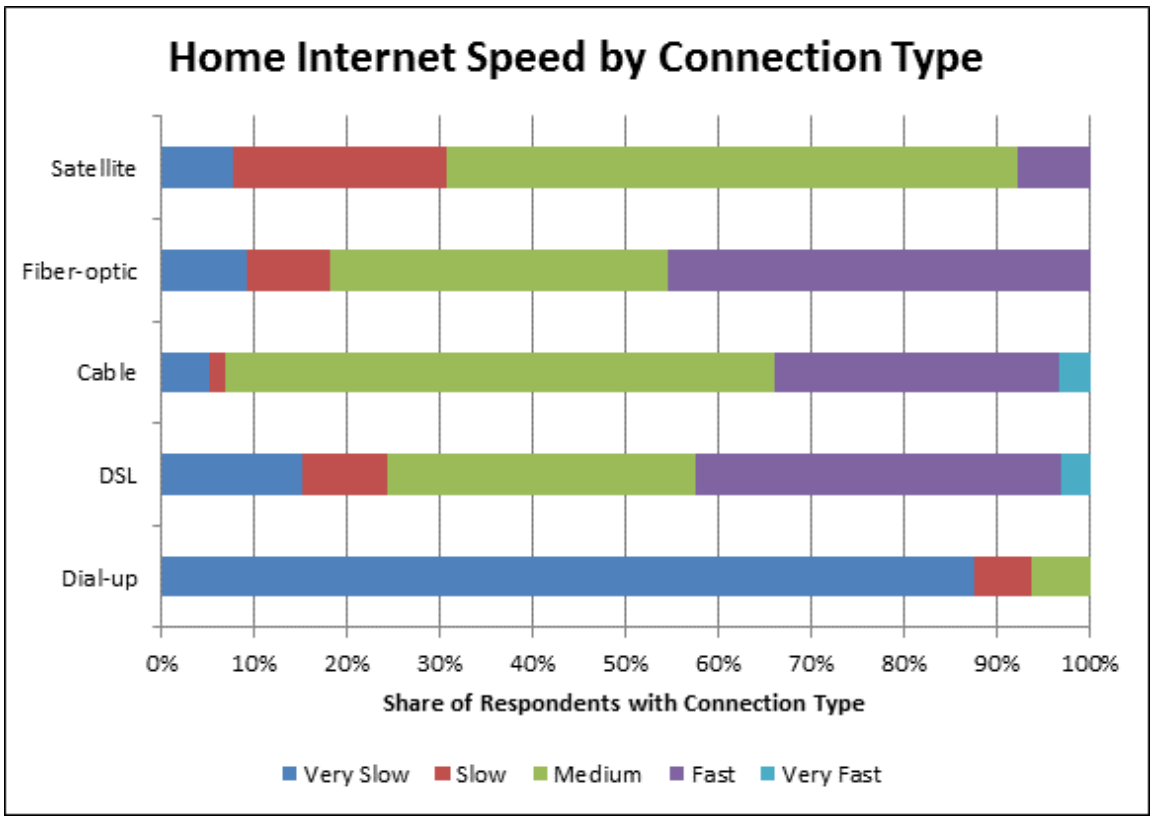
In a separate question, nearly two-thirds of respondents indicated that they used their home Internet connection at least partly for work-related purposes. This may include connecting to work computers, information gathering for work-related activities, checking work e-mail, or for other work-related purposes. This may also indicate the potential for increased telecommuting if Internet speeds are sufficient to support work-related functions. Telecommuting is discussed in more detail later in this section.



Respondents were asked to describe the speed of their home Internet connection. Nearly one-third of respondents indicated that their connection speed was "fast" or "very fast," while one-fourth percent described their speed as "slow" or "very slow."



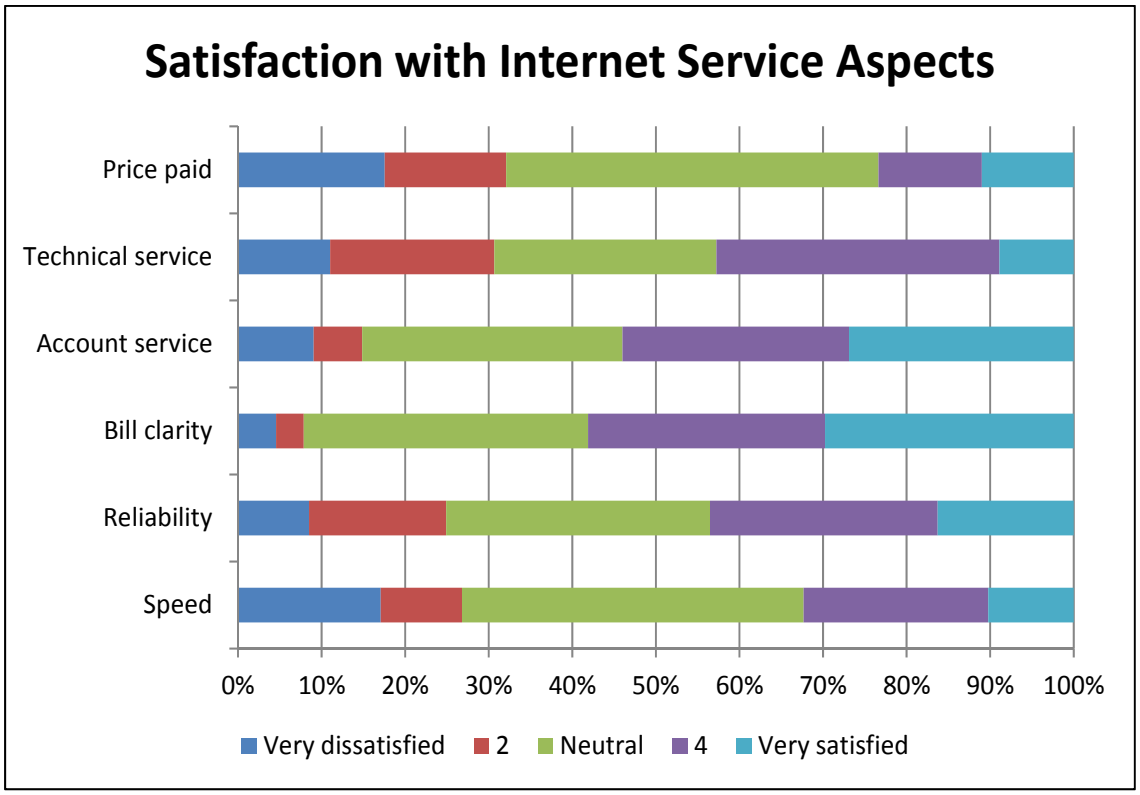
Respondents' descriptions of their Internet connection speed varied by connection type. Nearly all dial-up subscribers had slow or very slow connection speeds. In general, cable, fiber-optic, and DSL subscribers all described their connection speed as somewhat fast, and within a fairly close range of each other.

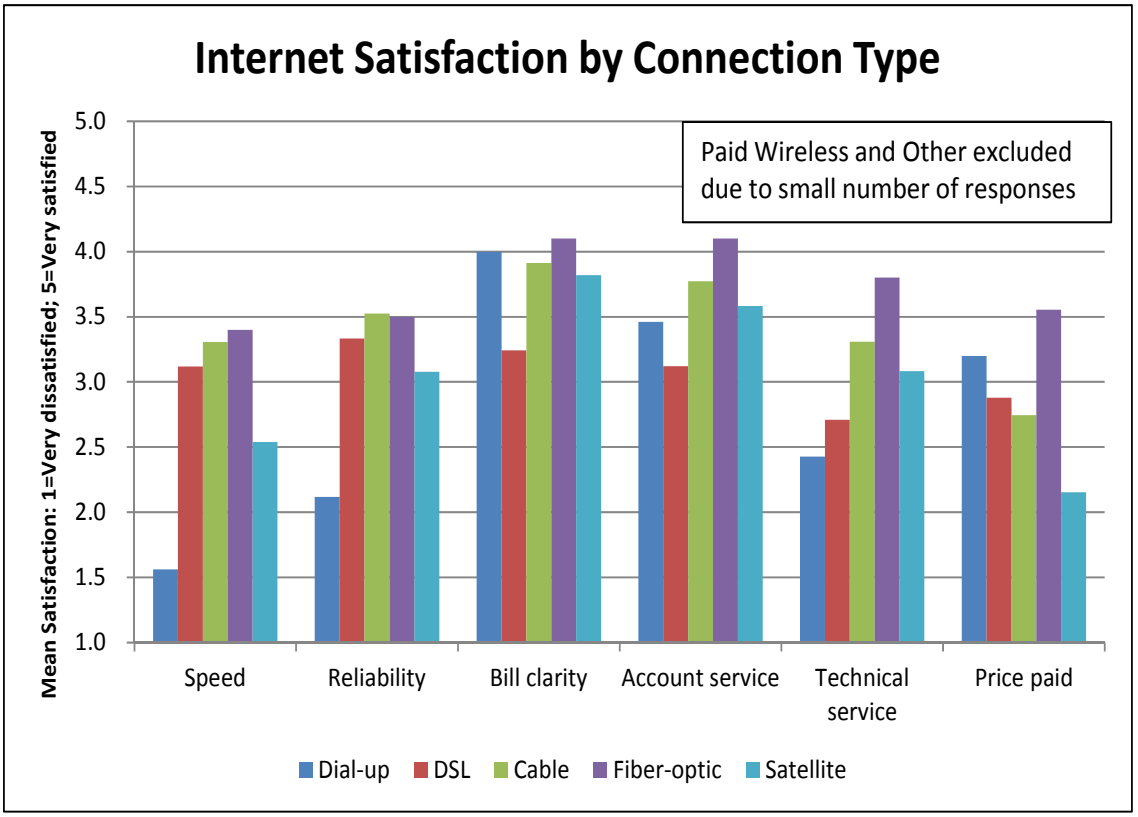


5.1.3.2 Internet Satisfaction and Importance Levels

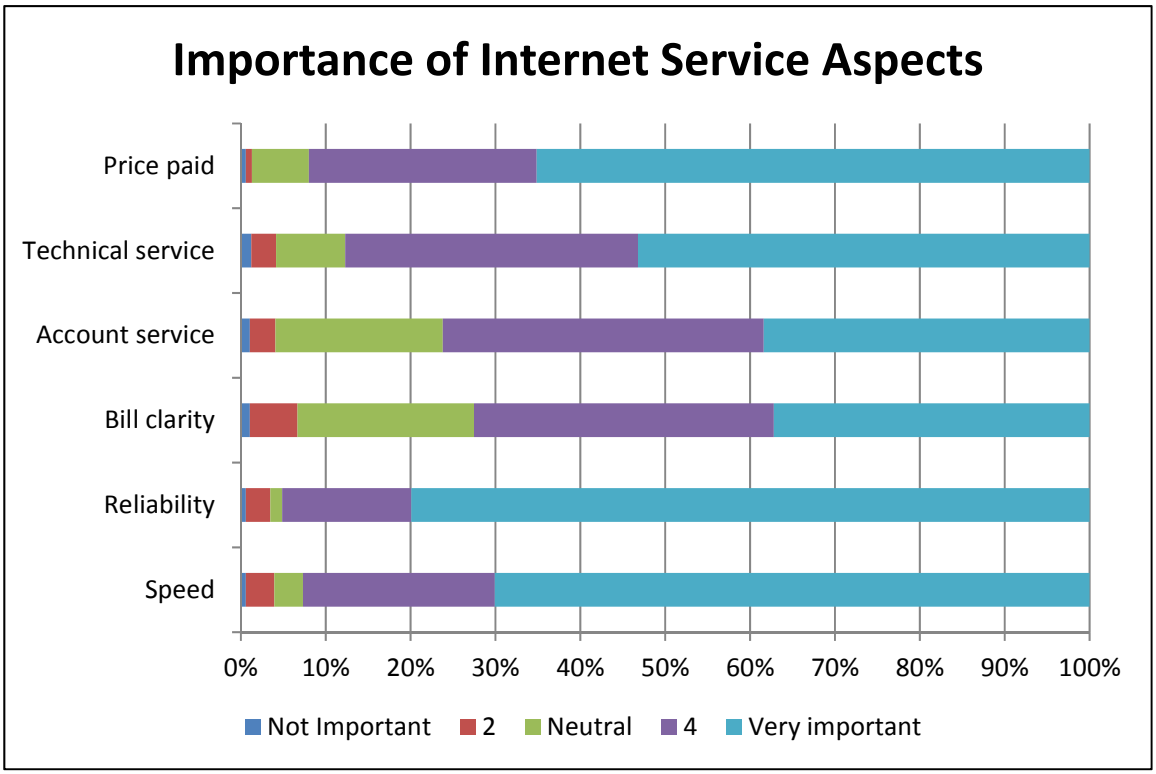
Respondents were asked about the importance of, and their satisfaction with, a number of aspects with their home Internet service.

On average, residents were most satisfied with their bill clarity and account service, and were the least satisfied with the price paid. Dial-up subscribers were the least satisfied with connection speed, reliability, and technical service. Cable, DSL, and fiber-optic subscribers rated their speed and reliability satisfaction as relatively high, and in a fairly narrow range. However, fiber-optic subscribers rated their satisfaction with the price paid as higher than any other connection type.

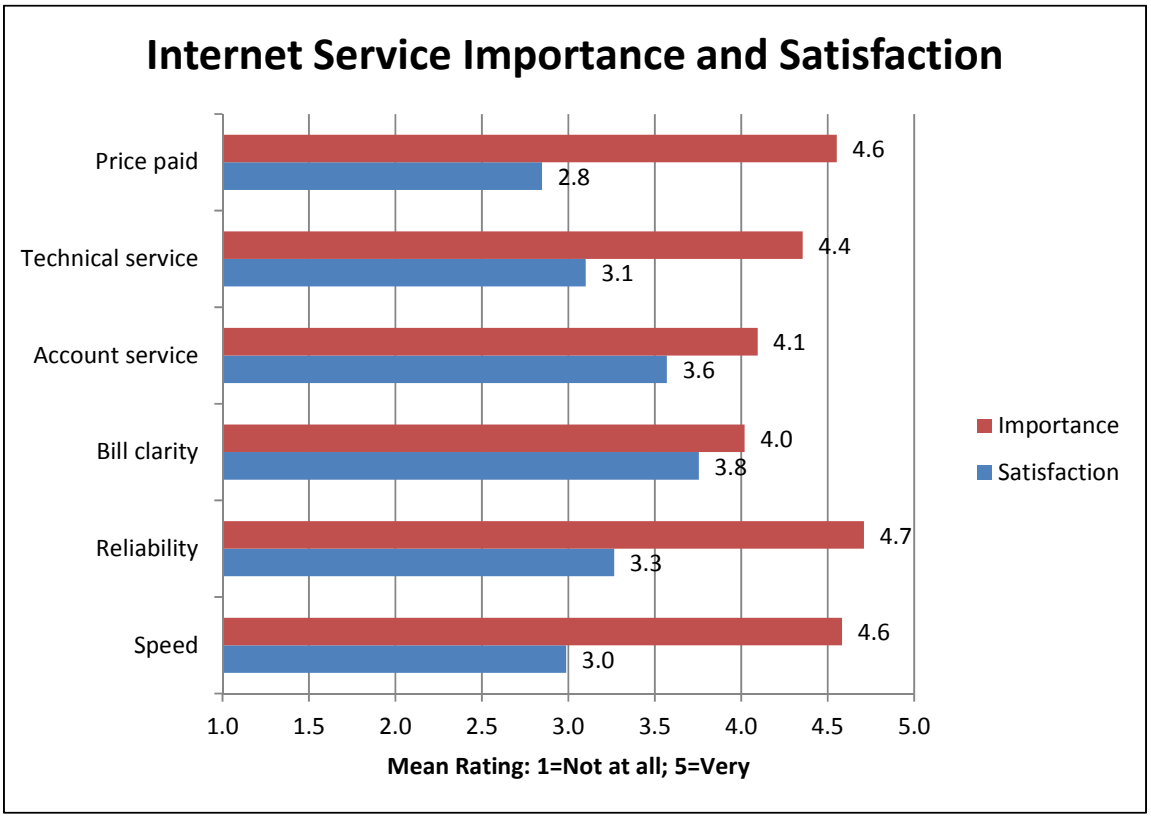

Satisfaction with Internet Service Aspects
Price paid
Technical service
Account service
Bill clarity
Reliability
Speed
0%
10%
20%
30%
40%
50%
60%
70%
80%
90%
100%
Very dissatisfied
2
Neutral
4
Very satisfied


Internet Satisfaction by Connection Type
Mean Satisfaction: 1=Very dissatisfied; 5=Very satisfied
5.0
4.5
4.0
3.5
3.0
2.5
2.0
1.5
1.0
Paid Wireless and Other excluded due to small number of responses
Speed
Reliability
Bill clarity
Account service
Technical service
Price paid
Dial-up
DSL
Cable
Fiber-optic
Satellite

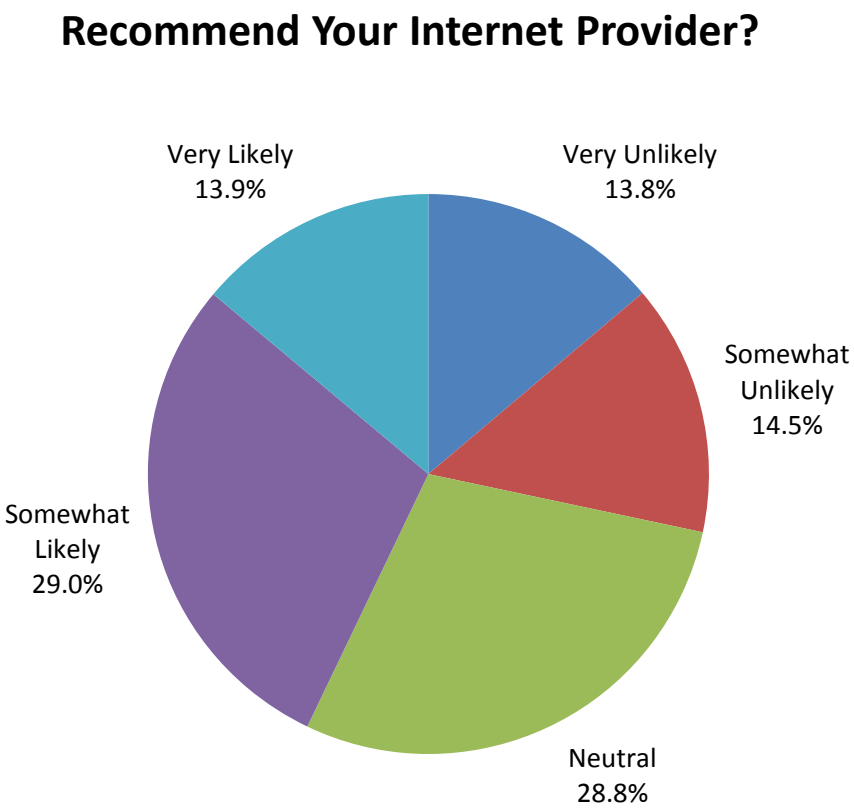
Respondents were also asked to rate the importance of those same Internet service aspects. Respondents ranked reliability as the most important aspect, closely followed by speed and the price paid.

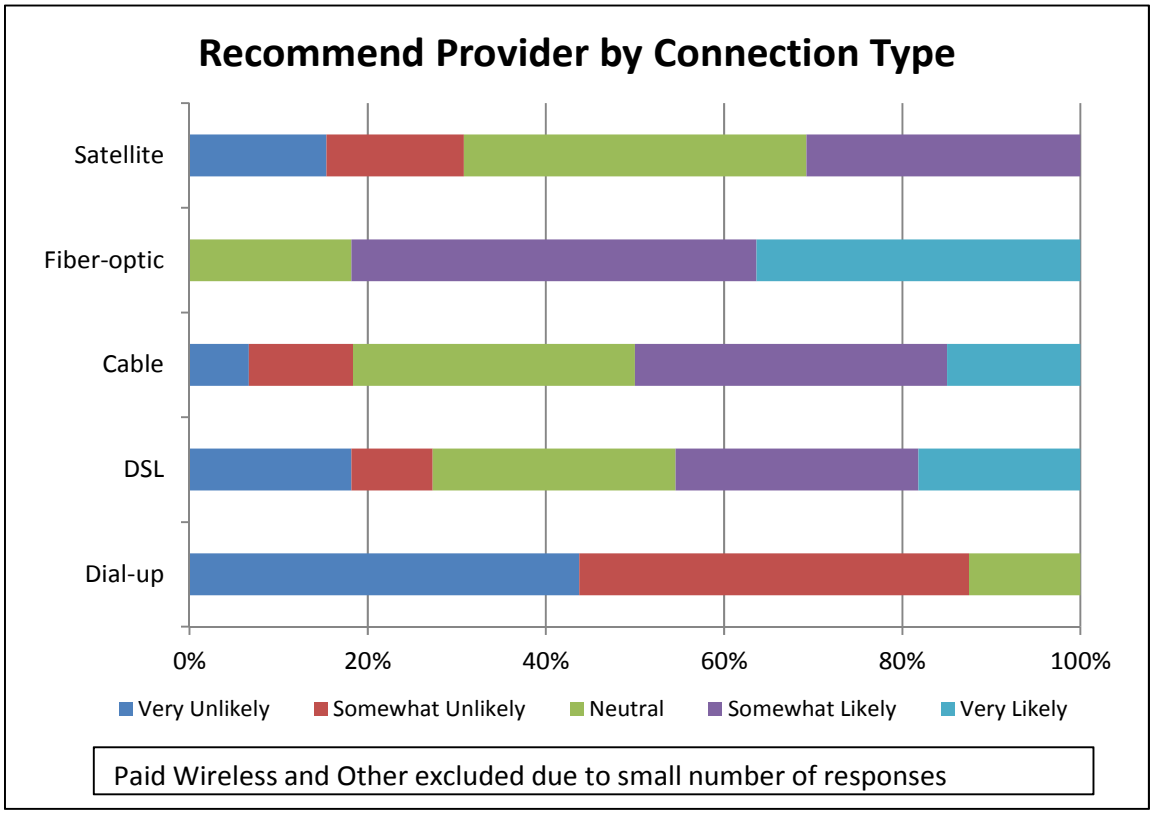


Respondents' satisfaction with, and importance of, the Internet aspects were compared. The "gap" between residents' importance and their satisfaction level helps identify areas where service providers are not fully meeting the desire of the market. The largest service "gap" was the price paid (mean importance less mean satisfaction = 1.8), followed by speed and reliability. The gaps for these aspects are partially driven by the relatively high importance place on these three aspects by respondents. At the same time, these gaps identify aspects where Internet service can be improved in Garrett County.

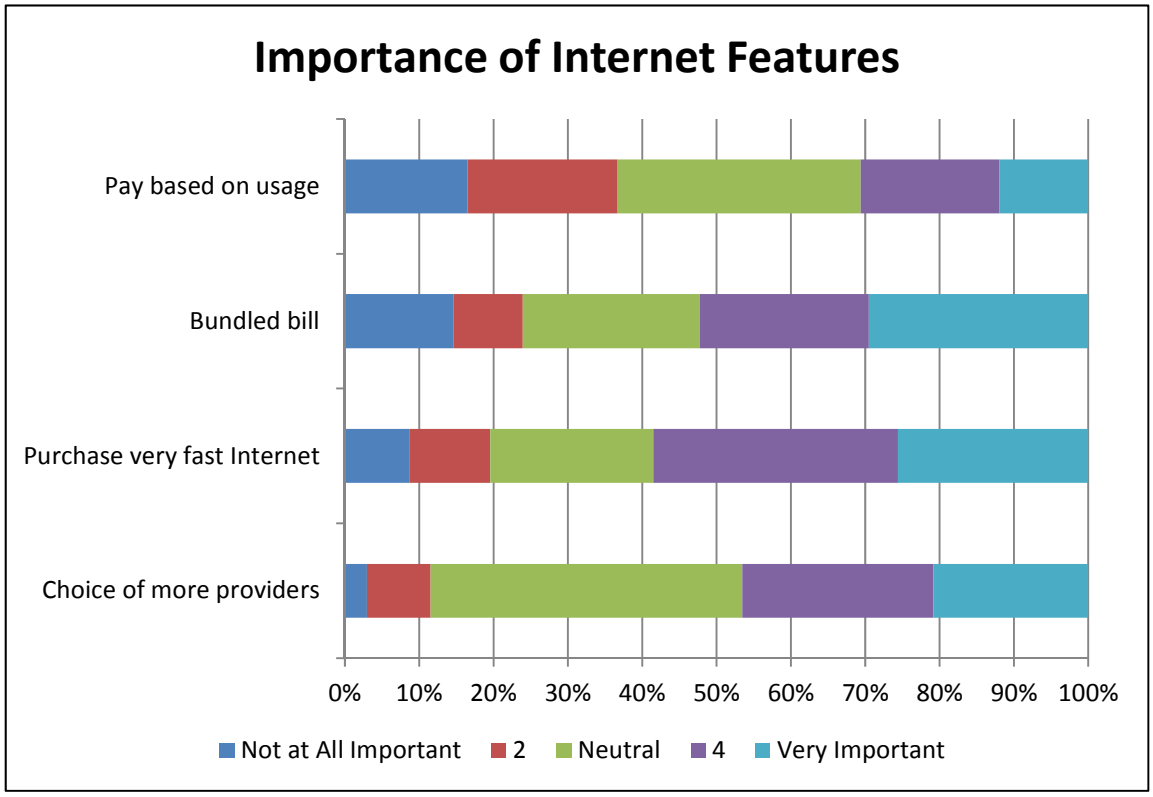


One typical means of assessing satisfaction with a product or service is to ask the customer if they would recommend it to family or a friend. Data reveals that customers are somewhat more likely than unlikely to recommend their current Internet service provider. Approximately 43 percent were somewhat or very likely to recommend their provider, while only 28 percent were somewhat or very unlikely to recommend their provider. This varies greatly by connection type, with fiber-optic subscribers much more likely than average to recommend their provider, and dial-up subscribers much less likely to recommend their provider. In fact, no fiber-optic respondent would be unlikely to recommend their provider, while no dial-up respondent would be likely to recommend their provider. It should again be noted that sub-segment analyses are based on a very limited number of responses.

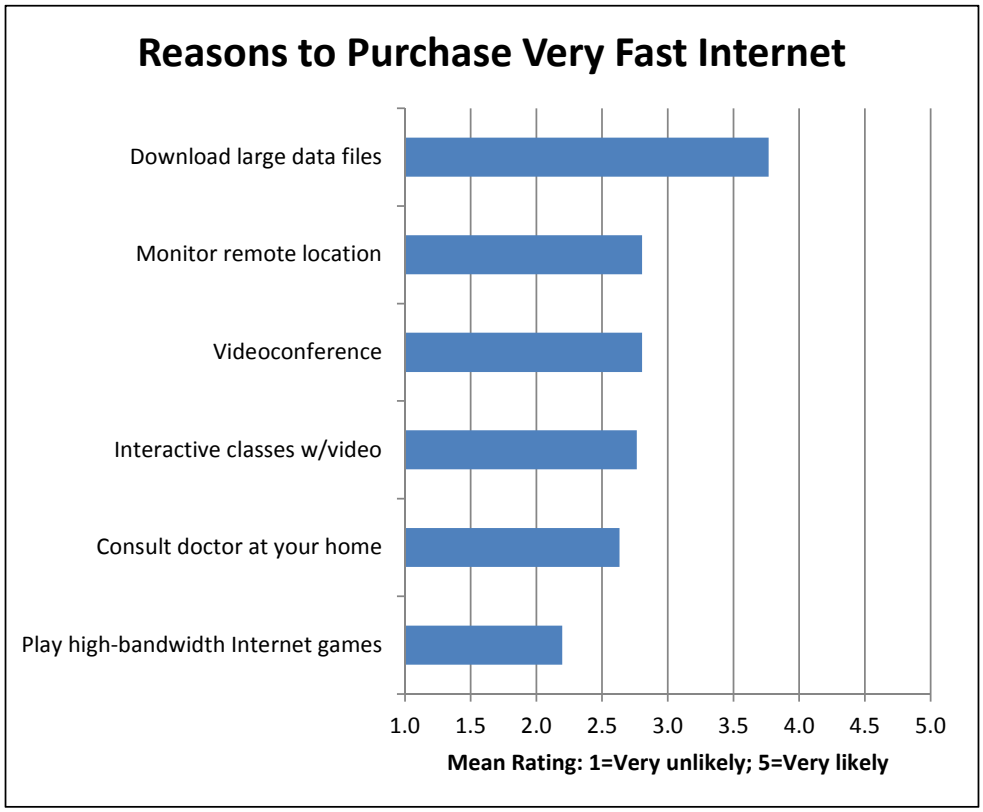

Recommend Your Internet Provider?
Very Likely
13.9%
Very Unlikely
13.8%
Somewhat
Unlikely
14.5%
Somewhat
Likely
29.0%
Neutral
28.8%


Recommend Provider by Connection Type
Satellite
Fiber-optic
Cable
DSL
Dial-up
0%
20%
40%
60%
80%
100%
Very Unlikely
Somewhat Unlikely
Neutral
Somewhat Likely
Very Likely
Paid Wireless and Other excluded due to small number of responses

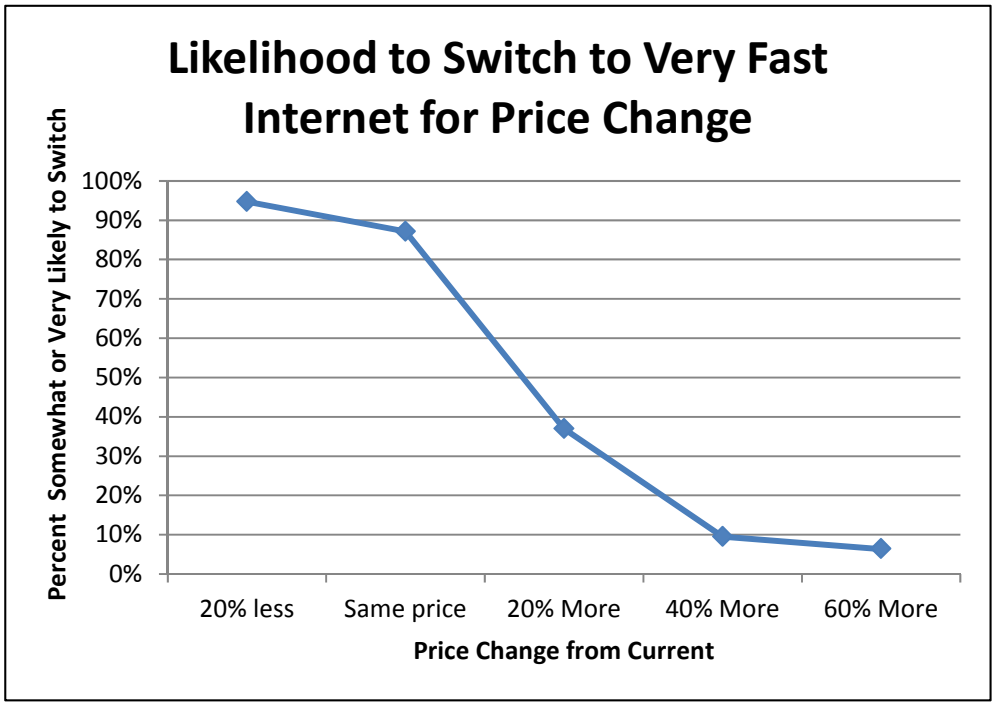
Respondents were asked their opinions about several Internet service features, including a choice of more providers, the option to purchase very fast Internet (10 to 100 times cable or DSL speeds), the ability to bundle phone and Internet bills, and the ability to pay for Internet based on the amount of data used. The mean importance ratings for choice of more providers, the option to purchase very fast Internet, and bill bundling were in a very narrow range and were statistically equivalent. The ability to pay based on the amount of data used was less important than the other features.



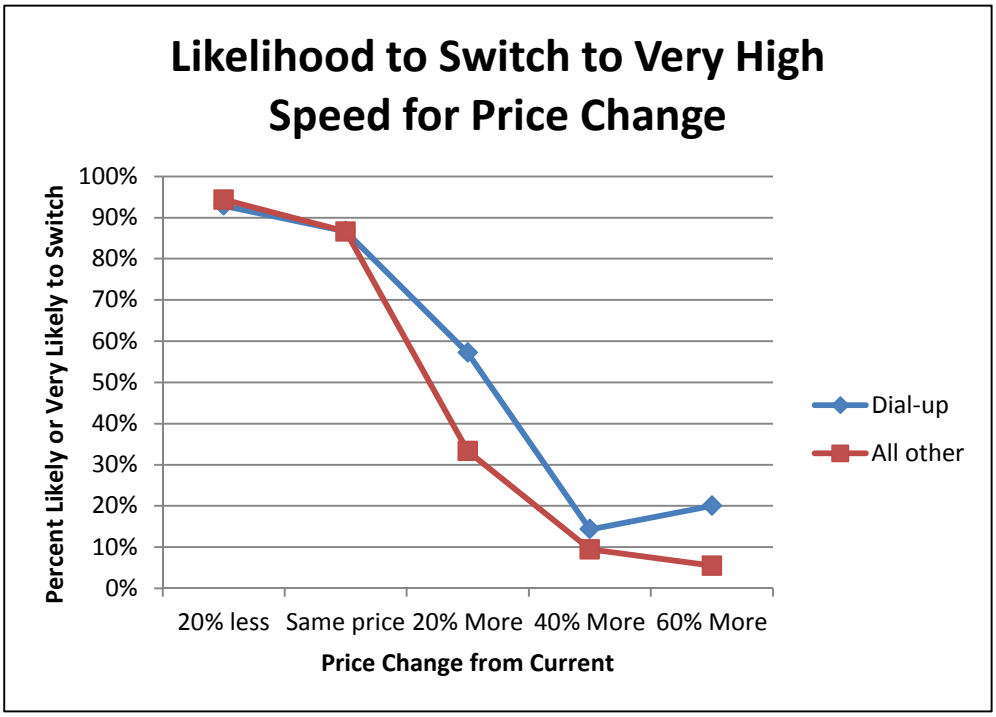
Respondents were asked about key reasons that they may wish to purchase very fast Internet service. The ability to download or upload large data files or photos/video ranked as the strongest reason for purchasing very fast Internet. Of the reasons provided, the ability to play high-bandwidth video games ranked as the weakest reason that respondents would purchase very high-speed Internet.



Respondents were asked if they were willing to pay a higher price for very fast Internet service. Slightly over one-third of respondents were somewhat or very likely to pay 20 percent more for very fast Internet, However, likelihood to switch to very fast Internet dropped to 10 percent for a price increase of 40 percent.



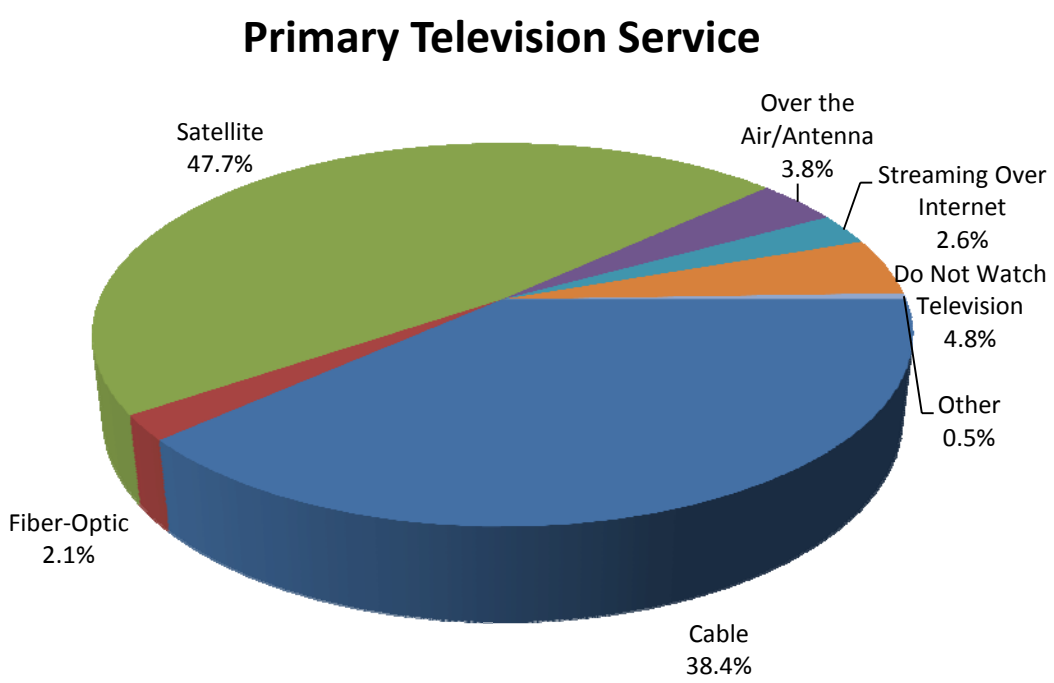
Residents' willingness to pay for very fast Internet varied somewhat by the Internet connection type. Dial-up users were slightly more willing to pay extra for very fast Internet service. This result is likely due to a combination of greater dissatisfaction with connection speed by dial-up users and the fact that dial-up users pay less, on average, than others and therefore the percent increase means a smaller dollar value.



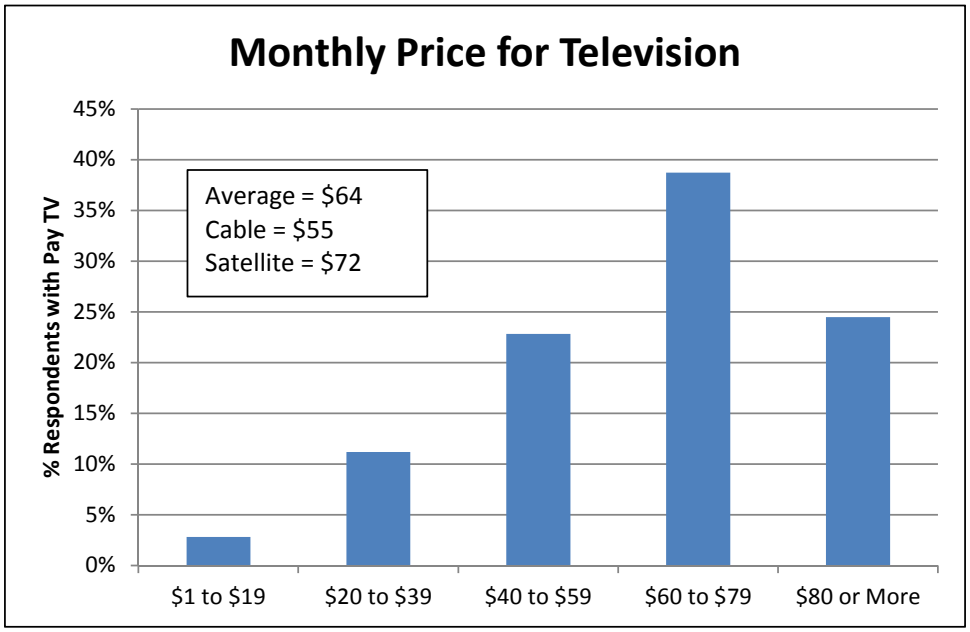
5.1.3.3 Television Service

The residential survey asked a limited number of questions about residents' television service, including questions that related to Internet video services.

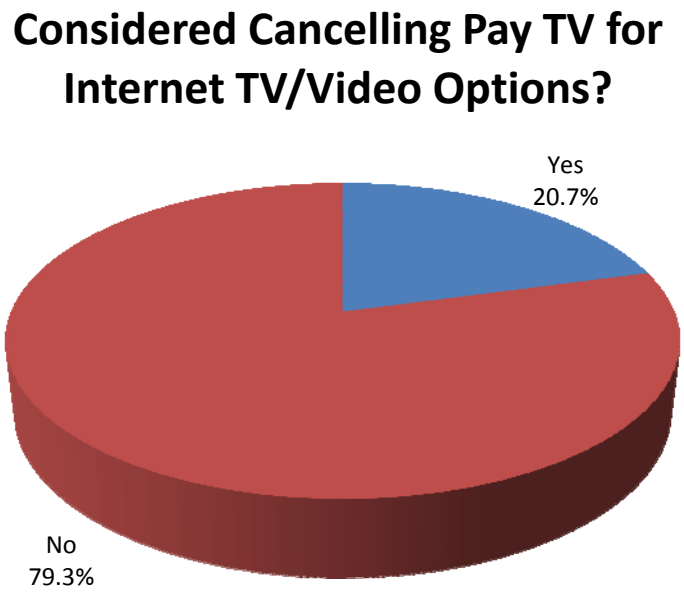
Satellite television service is the most prevalent among Garrett County residences, with service to 47.7 percent of all homes. Approximately 38.4 percent of homes subscribe to cable television service. Homes do not watch television, receive TV over the air, through fiber-optic service, or streaming over the Internet comprise less than five percent of the market, each.



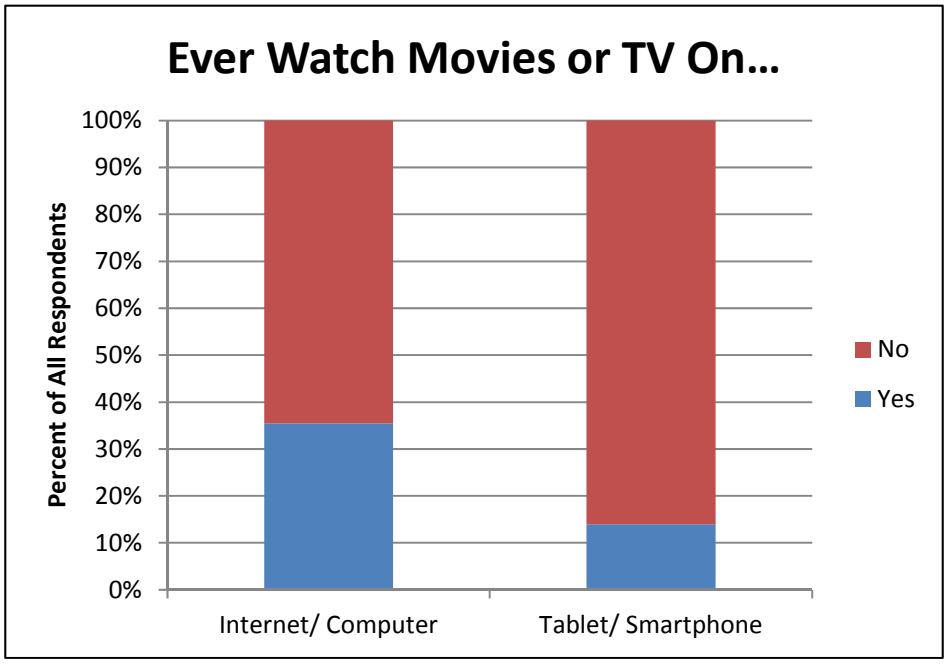
Of those with pay television service, the average monthly bill is approximately $64. This is a combination of satellite subscribers who pay $72 per month and cable subscribers who pay $55 per month, on average. The number of fiber-optic television respondents was very limited and does not provide a reliable average price.



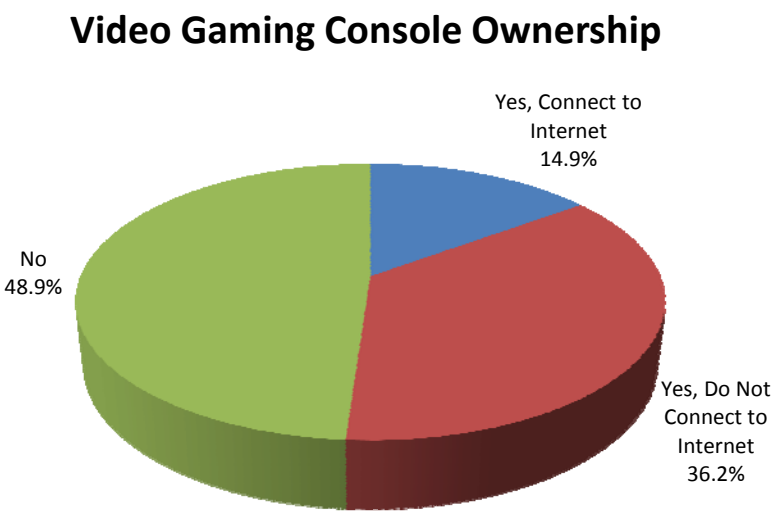
Those with pay television service were asked if they have considered cancelling their subscription television service in favor of video options available over the Internet. Slightly more than 20 percent had considered this option. This response was slightly higher for cable subscribers (27 percent) than satellite subscribers (16 percent).



Over one-third of respondents ever watch movies or television shows via the Internet on their computer. A much smaller share, approximately 14 percent, watch movies or television over their tablet computer or smartphone. In addition, 19 percent of respondents had ever purchased a movie for streaming via the Internet to their television or computer. This information indicates the potential demand for higher-speed Internet connections to support expanded television viewership options.



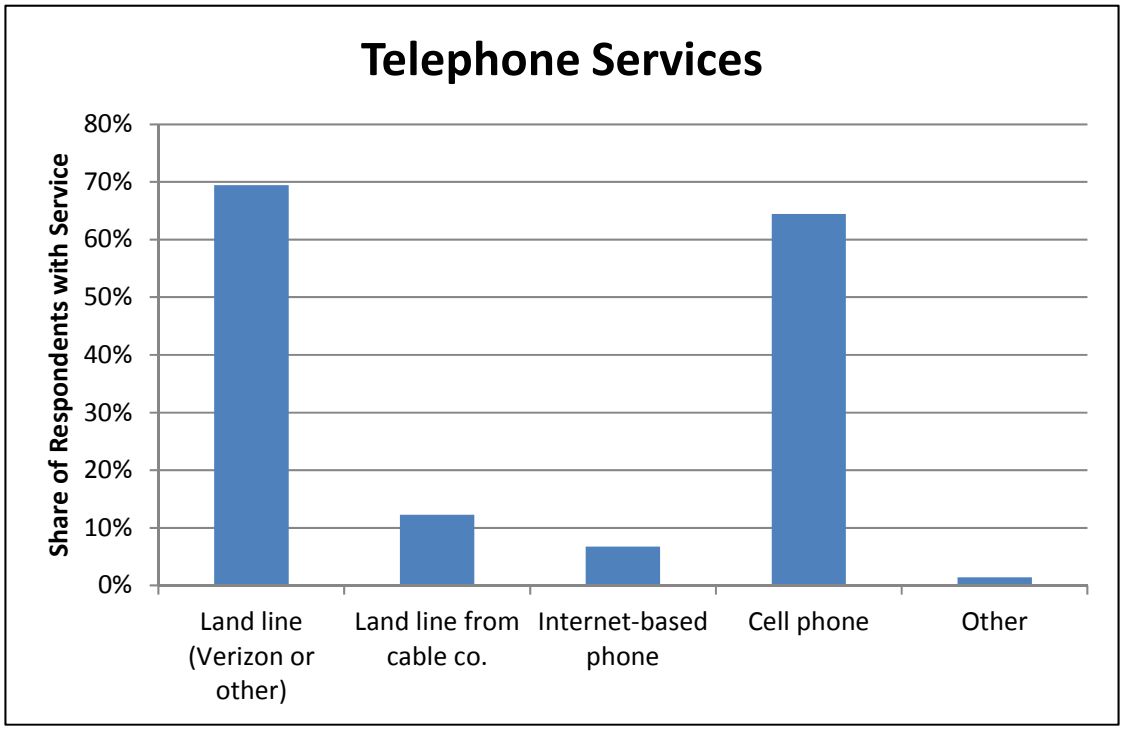
Over one-half of respondents own a video gaming console, and 15 percent connect that console to the Internet. This is another emerging driver of the need for higher-speed Internet net connections.



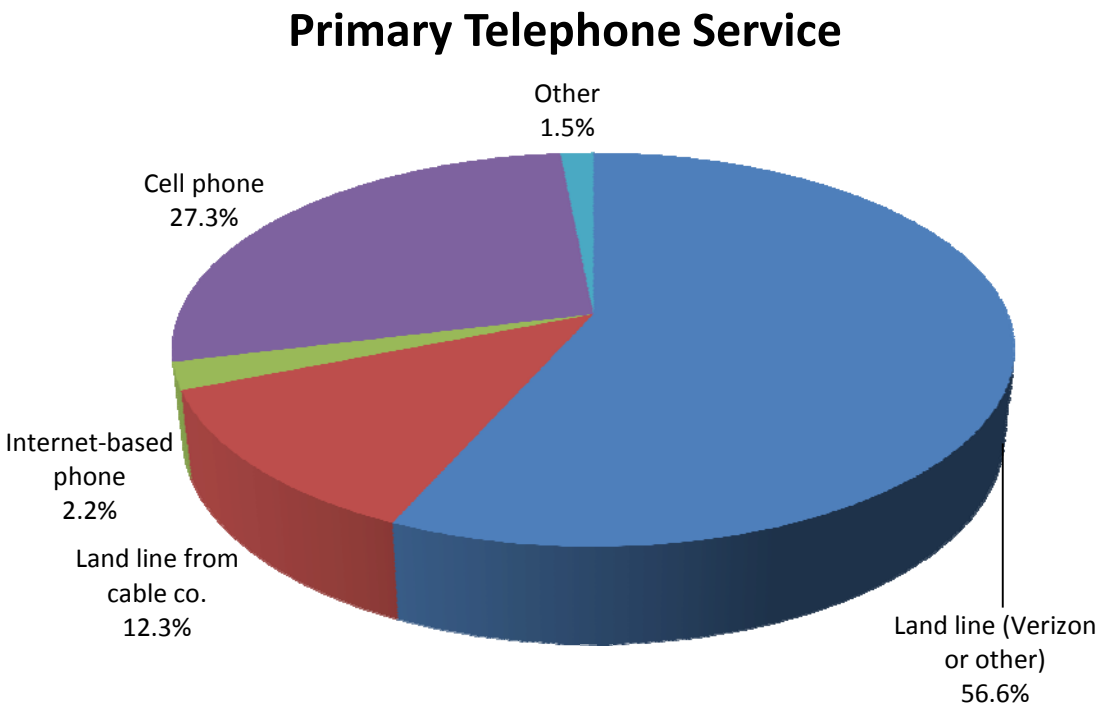
5.1.3.4 Telephone Service

Survey respondents were also asked a few questions about their telephone service, including migration toward increasing use of Internet phone and cell phone services.

Approximately 81.7 percent of homes have land-line telephone service either from their incumbent local provider (mostly Verizon) or their cable company. In addition, 6.8 percent of homes use an Internet-based phone service, although only 2.2 percent use this as their primary service. This implies that approximately 16 percent of Garrett County homes have cell phone service only.

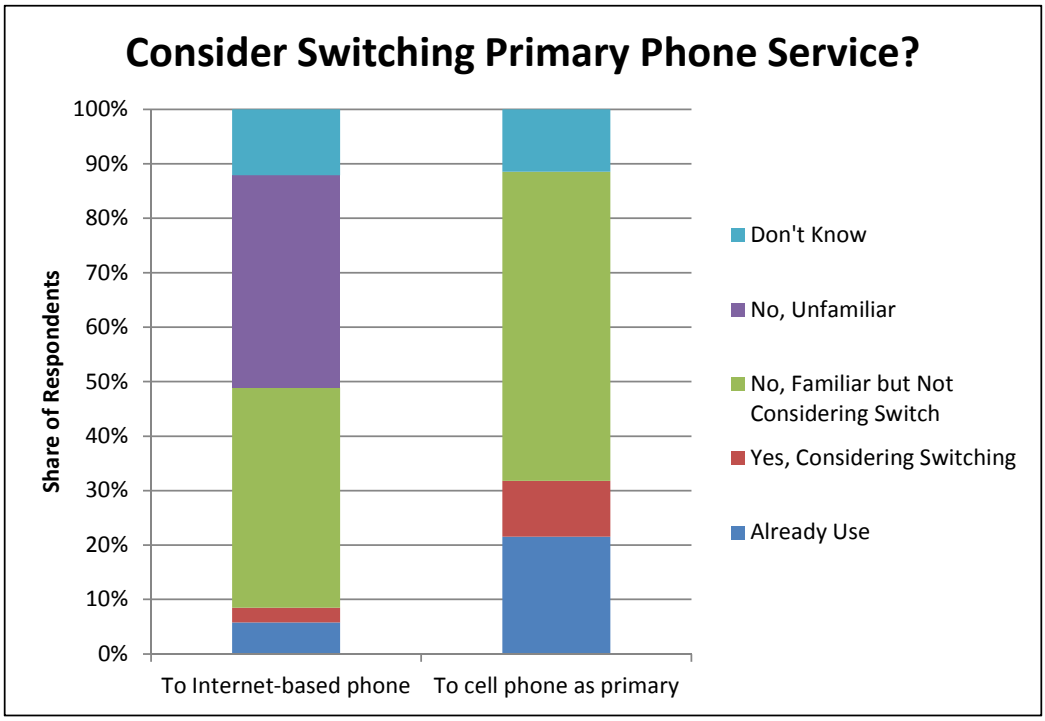


Over one-half of homes use their traditional land-line telephone (typically from Verizon) as their primary phone service, while 27.3 percent of respondents indicated that their cell phone was their primary phone service and 12.3 percent reported that they used their cable telephone service as their primary phone.



Only a small percent of respondents already have Internet-based telephone service and 2.7 percent are considering switching their service to Internet-based options in the next year. Nearly 40 percent are unfamiliar with this technology, and more than 10 percent are yet undecided on use of this technology.

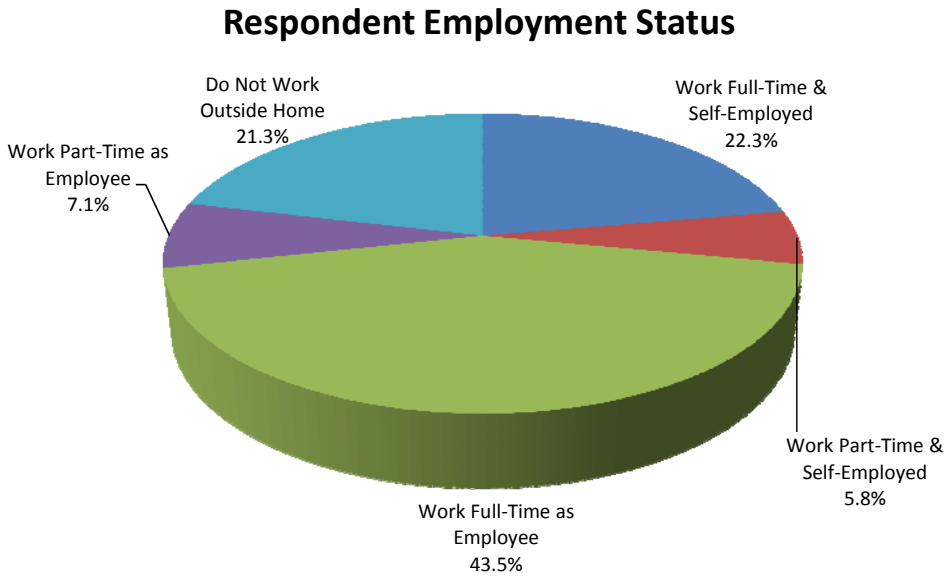
Conversely, 21.5 percent of homes currently use their cell phone as their primary service and another 10.3 percent indicated that they are considering switching to cell phone as their primary service in the next year. An additional 11.5 percent is undecided. This reflects the nation-wide trend toward more cell phone-only homes, and shows the potential for a continuation of that trend.



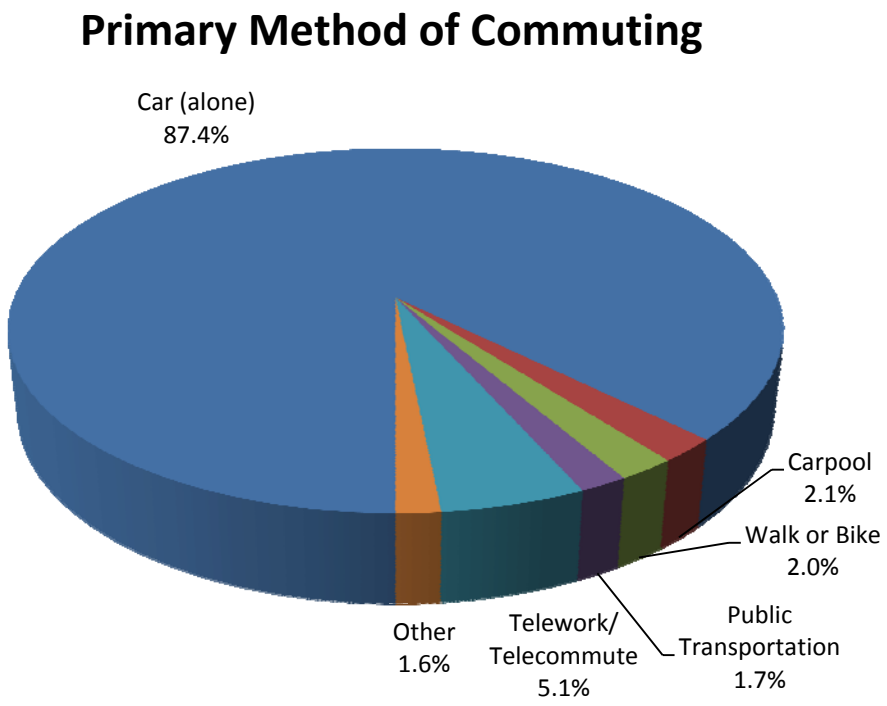
5.1.3.5 Telecommuting

In addition to questions about their use of communications services, respondents were asked about their employment status, commuting patterns, and their use of the Internet for telecommuting.

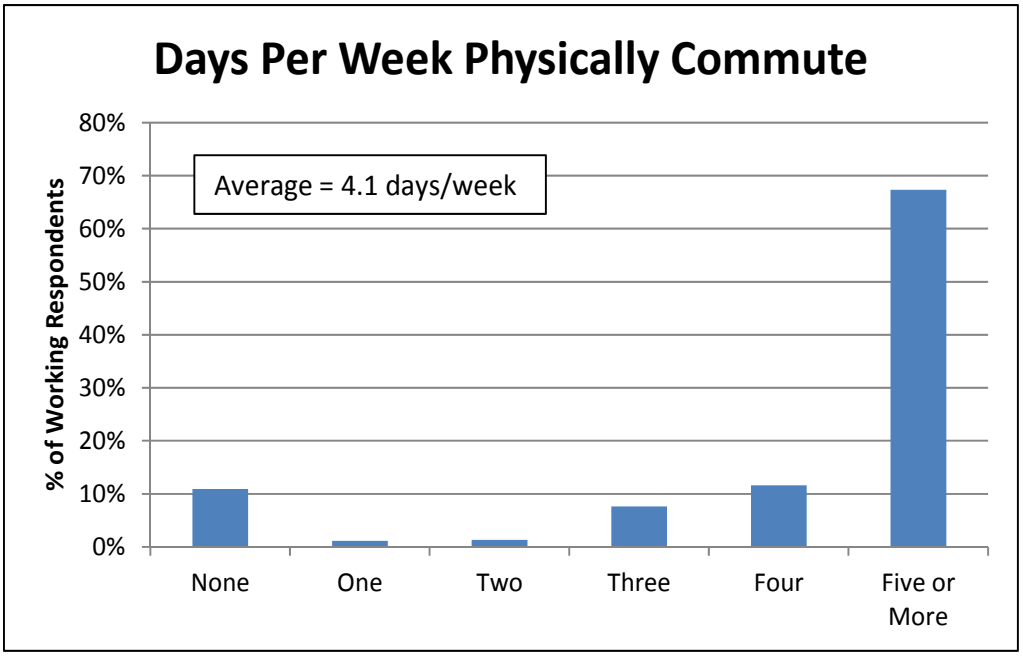
Nearly 80 percent of survey respondents are employed, with 12.9 percent working part-time and 65.8 percent working full-time. Over one-fourth of respondents indicated that they were self-employed.



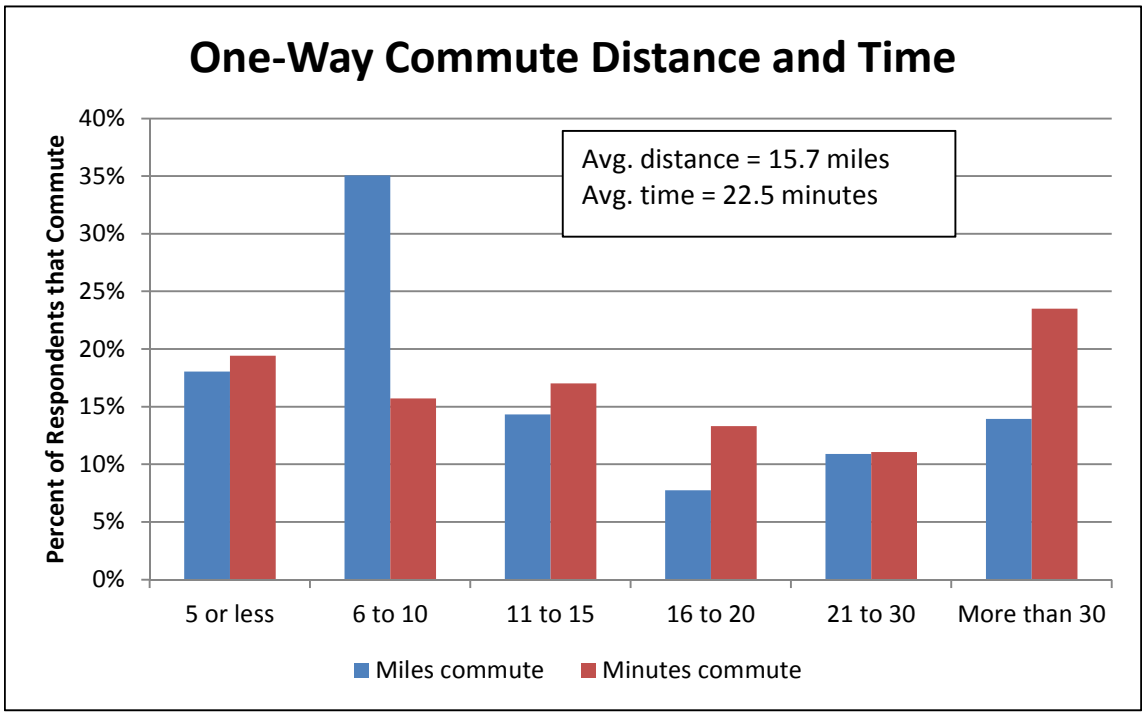
Of those respondents who were employed, the overwhelming majority (87.4 percent) commuted by car, alone. Approximately 5.1 percent primarily telecommuted.



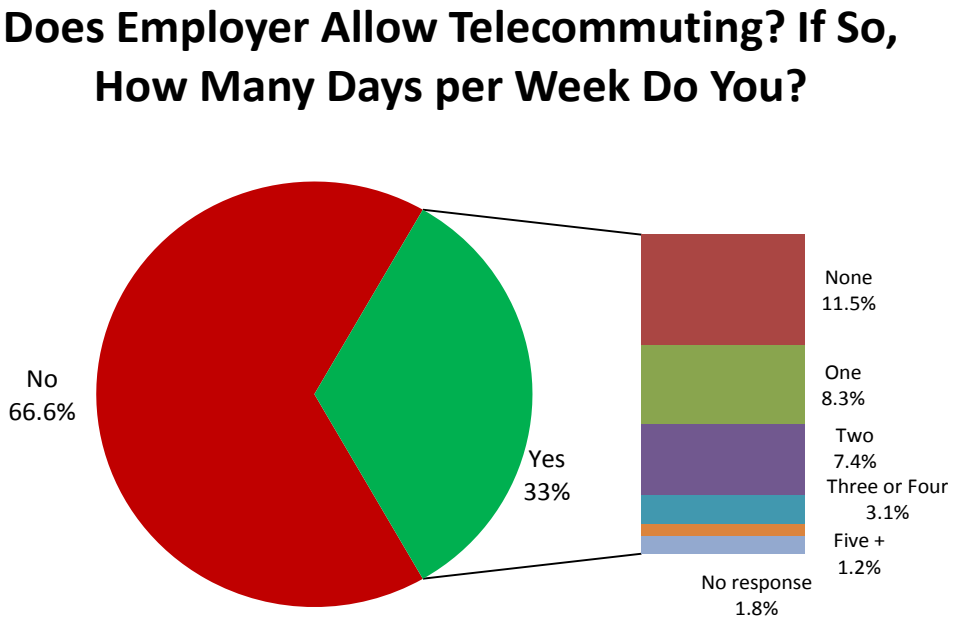
Approximately two-thirds of employed persons commute five or more days per week. The average employed respondent physically commutes to work 4.1 days per week.



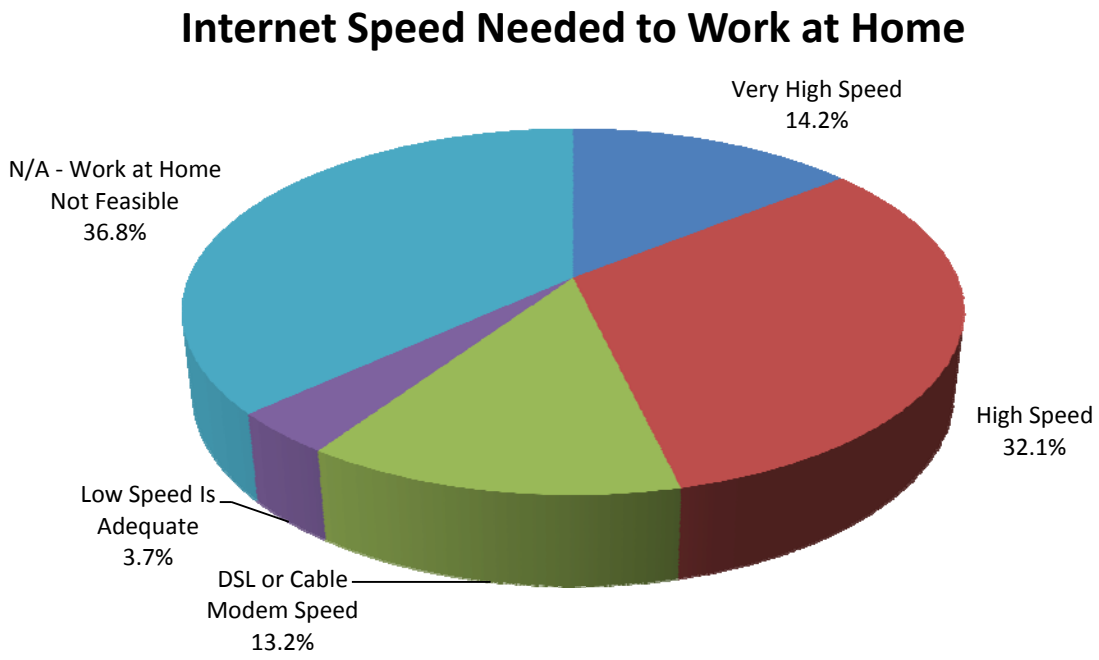
On average, employed respondents commute 15.7 miles and 22.5 minutes to work each way.



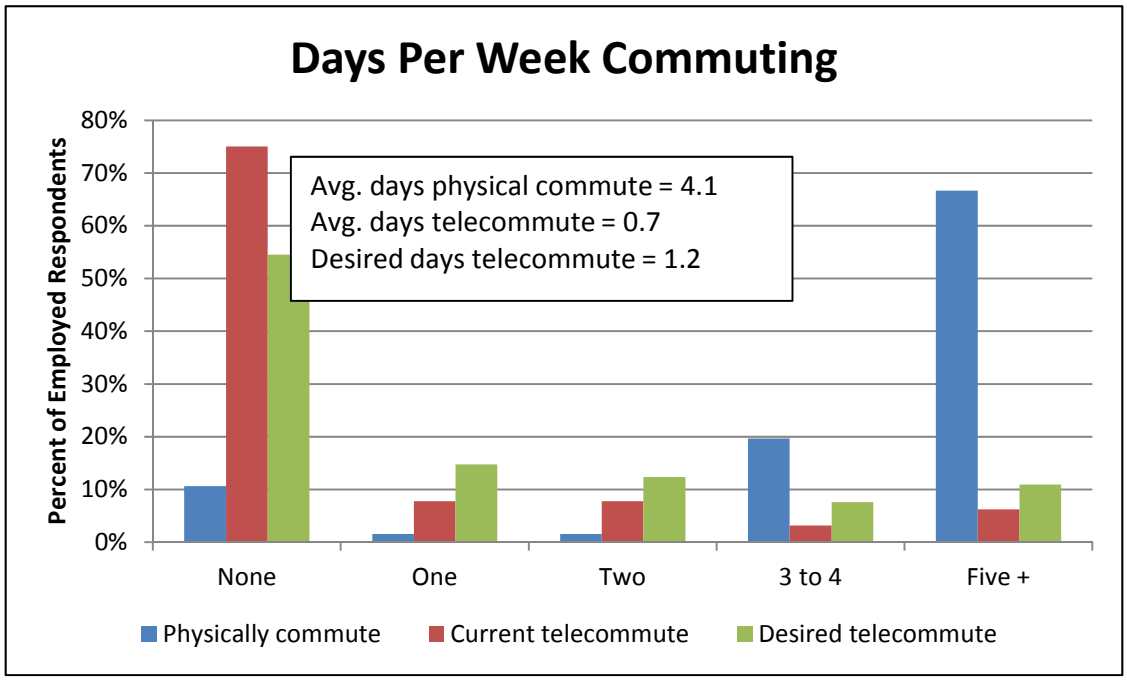
About one-third of workers are allowed to telecommute by their employer, and approximately 22 percent take advantage of telecommuting. Most only telecommute one or two days a week, although 1.2 percent of respondents telecommute five days per week. On average, the typical respondent telecommutes 0.7 days per week.



Nearly one-half of workers said that they would need high-speed or very high-speed Internet connections to enable them to work at home. For this question, "very high speed" was defined as 100 Mbps or faster, and "high speed" was defined as 10 to 100 Mbps.



Respondents indicated that they would be more likely to work at home if their Internet connection had sufficient speed and capacity to enable it. On average, respondents indicated that they would like to work from home 1.2 days per week, compared to the current average of 0.7 days per week.



Combining this information with the average commuting distances and times, and other Garrett County-specific data, some benefits from telecommuting can be estimated. The following estimates assume 12,279 working adults in Garrett County (17,542 adults aged 18 to 65, and roughly 70 percent employed, from Census data). It is estimated that increasing telecommuting to the level desired by survey respondents could annually save Garrett County residents:

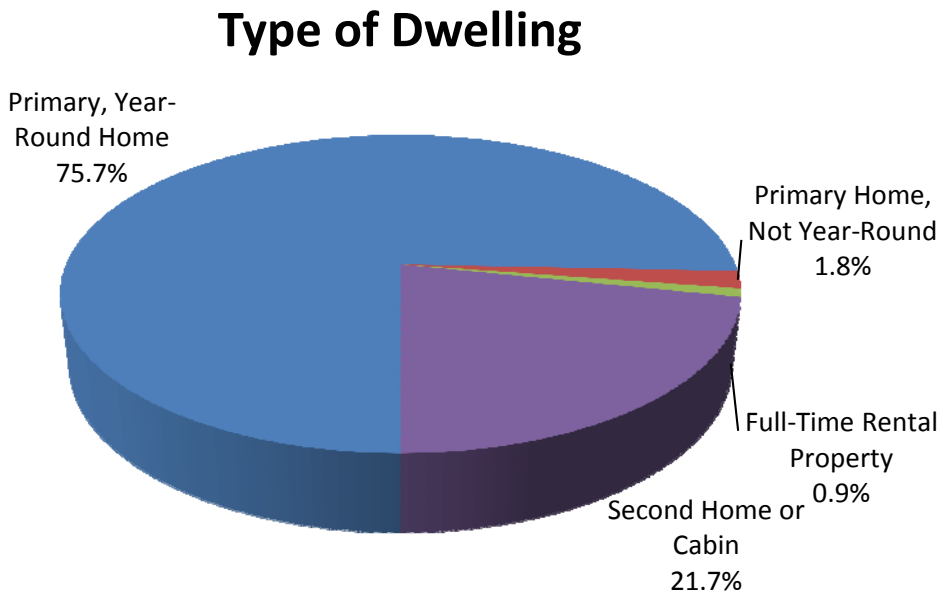
- 317,000 person-days of commuting
- 9.9 million miles driven
- 400,000 gallons of gas (@25 mpg)
- $1.3 million annually on gas (@ $3.25/gal.)
- 14.3 million minutes of commute time (238,000 hours)

In addition to the direct (gas) cost savings and time savings, increased telecommuting could potentially provide benefits from reduced road congestion and use, reduced vehicle maintenance costs, reduced emissions and other environmental damage, and other benefits.

5.1.3.6 Household Characteristics

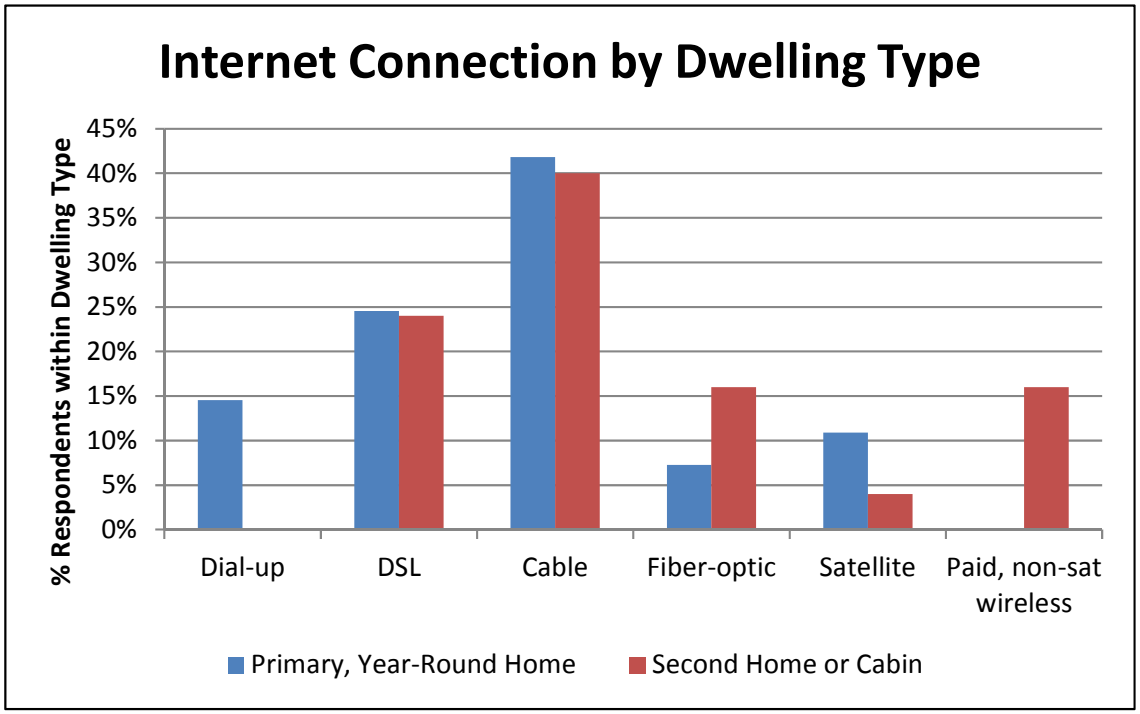
Information about each respondent's home, age, education, income, and other characteristics was also gathered to help define the respondent group and to investigate correlations between these characteristics and responses to other questions.

Over three-fourths of respondents' dwellings were their primary, year-round home, while 21.7 percent were second homes and 1.8 percent were primary homes not occupied year-round.

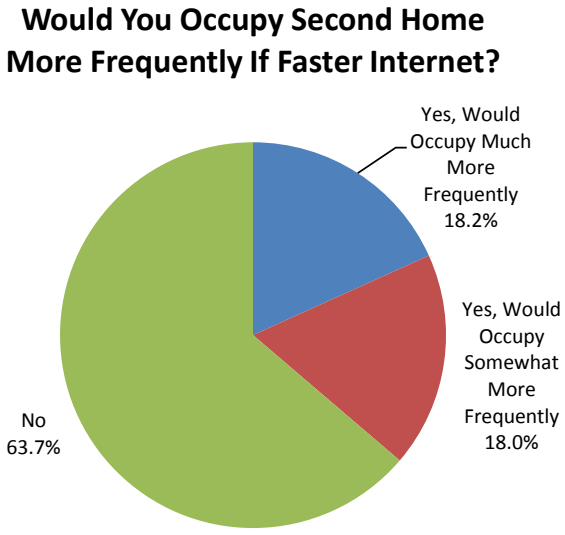


DSL and cable connections were prevalent at both year-round and second homes in roughly equal shares. However, second homes were more likely to have paid, non-satellite wireless

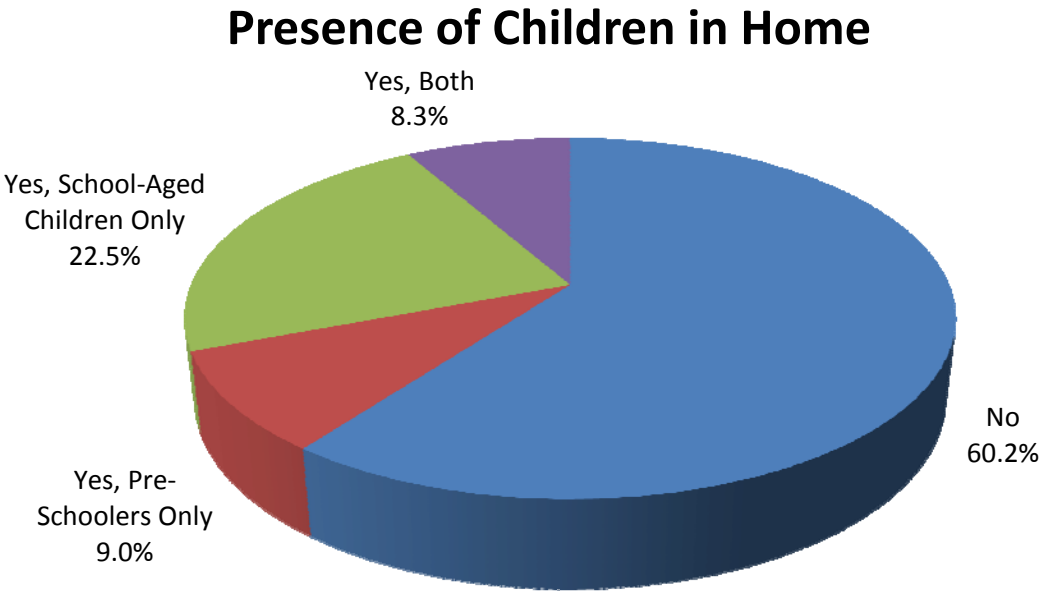
Internet service (likely via cell towers) while primary, year-round homes were more likely to have dial-up service.

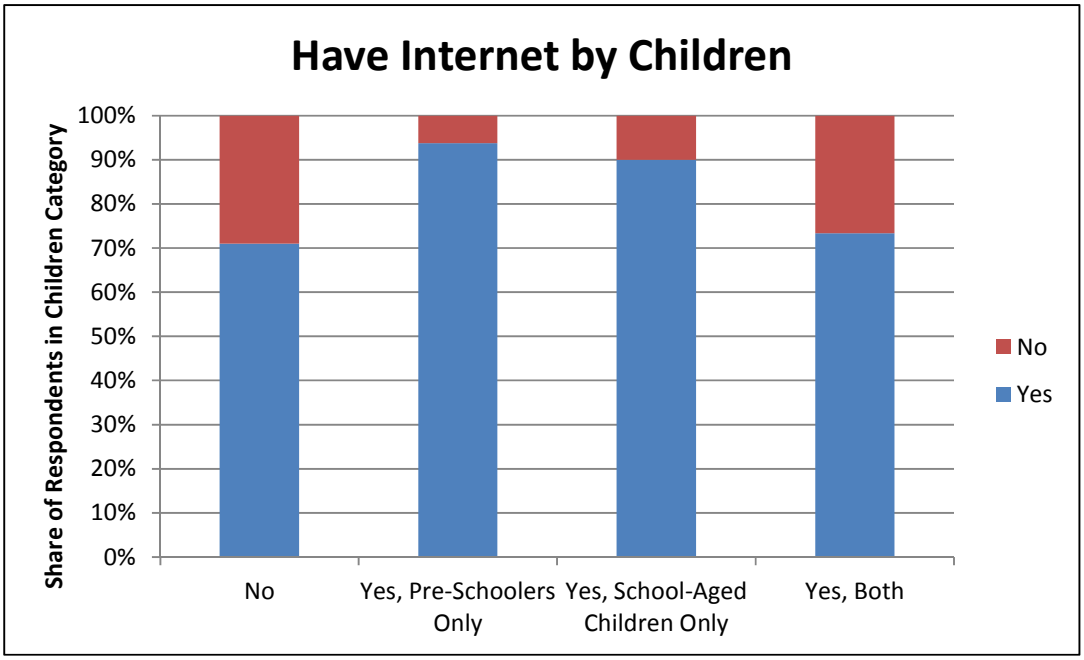


More than one-third of second home owners said that access to a faster Internet connection would allow them to occupy their second home more frequently. Approximately 18.2 percent said they would occupy it "much more frequently." Increased occupancy of second homes has the potential to increase economic activity in the region as part-time residents spend money locally.



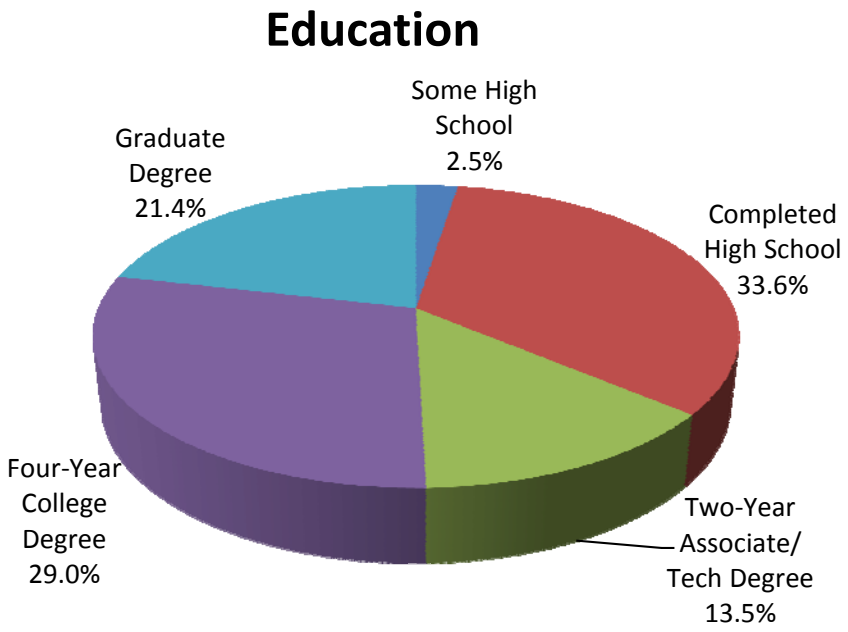
Approximately 40 percent of respondents had children living in the home, with 31 percent having school-aged children. Homes with school-aged children are more likely to have home Internet service than are homes with no children.



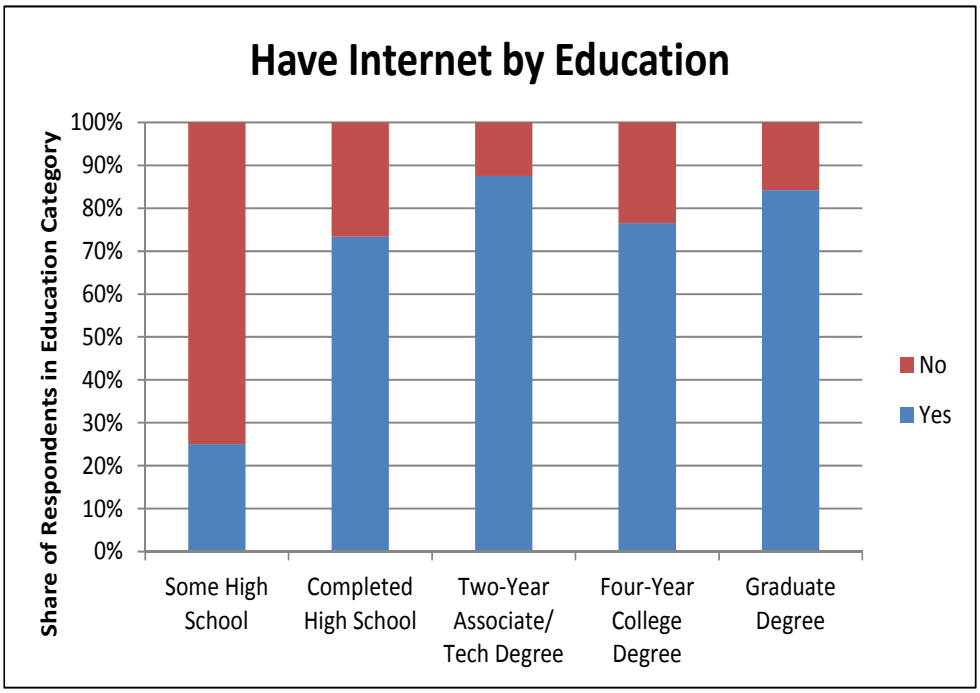


There were no substantial trends between the type of Internet connection and the presence of children.

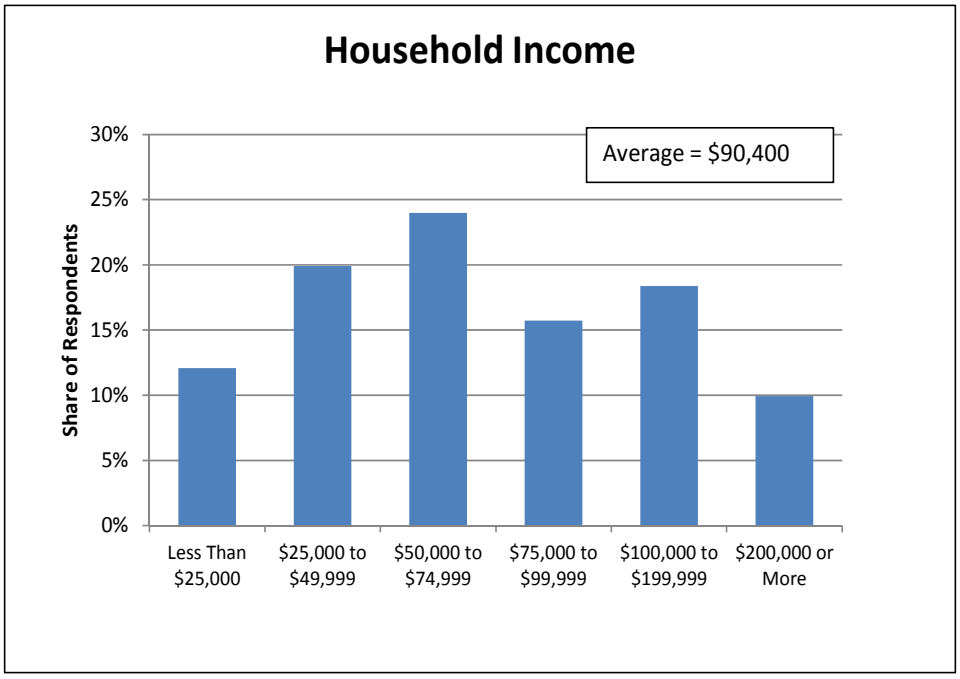
Respondents were also asked about the highest level of education attained. Over one-half of respondents had completed either a four-year college degree or a graduate degree.



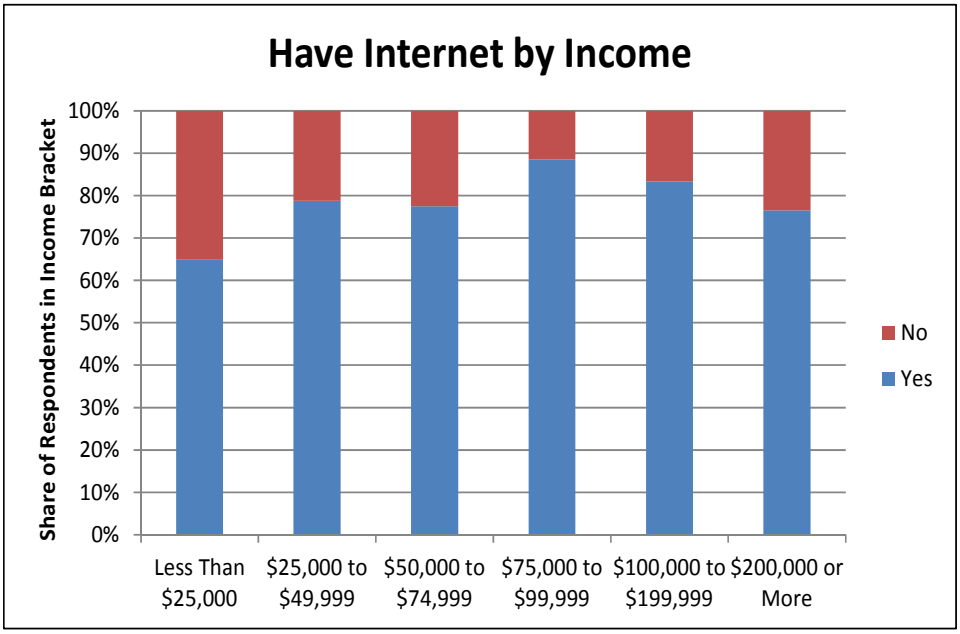
Those respondents that did not complete high school are less likely to have home Internet service. However, it is unclear whether this is directly due to education level or whether it is more related to income, age, or other factors.



The average household income of survey respondents was approximately $90,000. Ten percent of respondents had household incomes in excess of $200,000.



Income plays a significant role in purchasing power for goods and services. Homes with incomes less than $25,000 are less likely to have home Internet service than other homes.

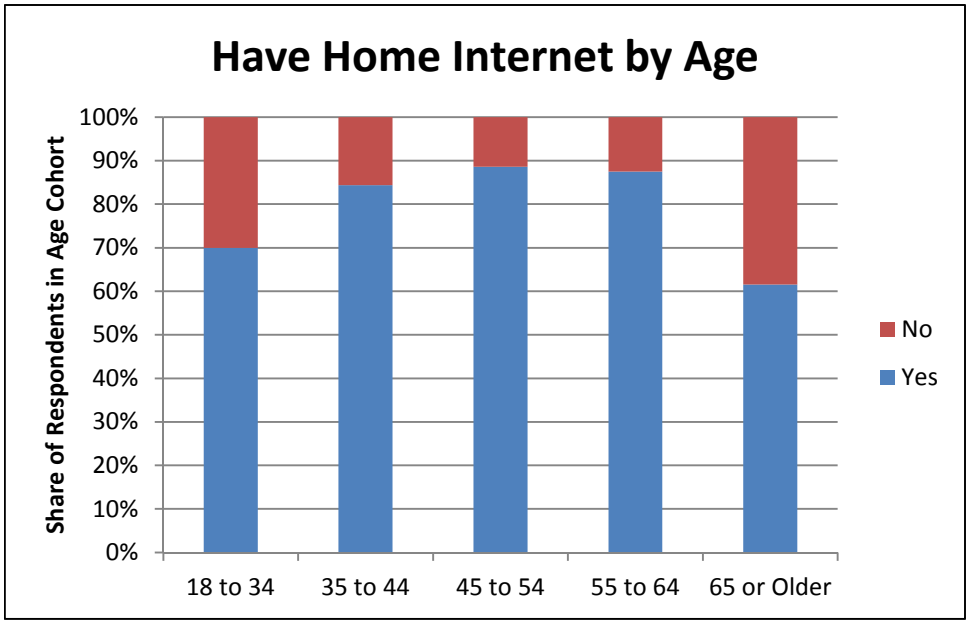


No significant correlations were observed between income and the type of Internet connection used, the type of television service used, or the type of primary phone service.

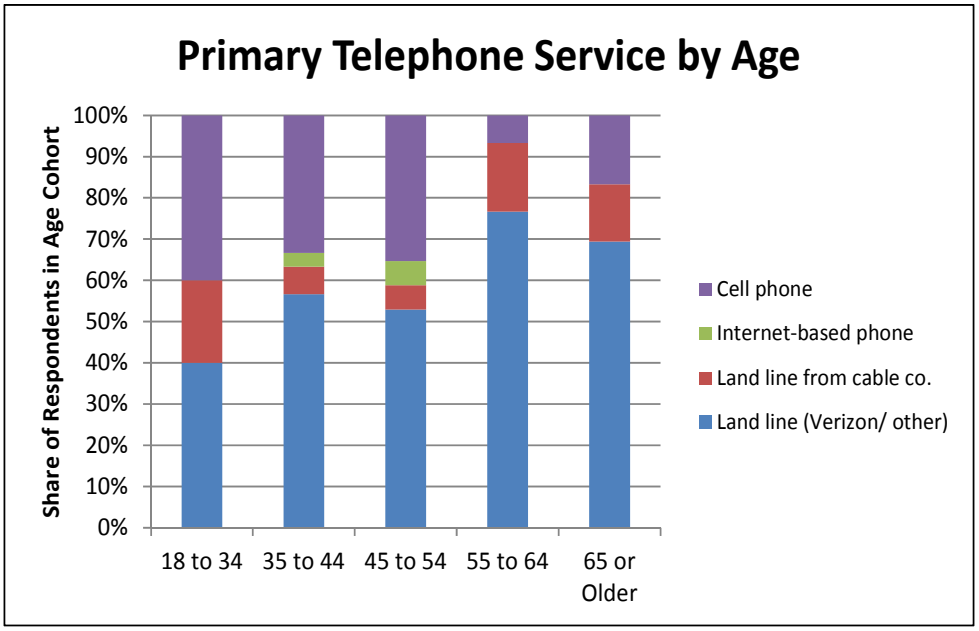
The ages of survey respondents, Census data, and the data weighting calculation were discussed

earlier in this section. There were a number of correlations observed between age and the types of communications services used.

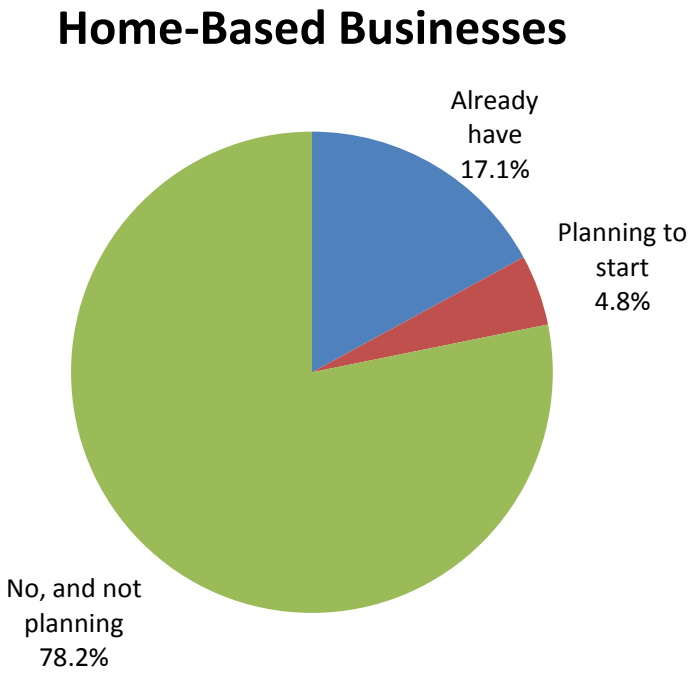
Older and younger respondents are less likely to have home Internet service than are other age groups.

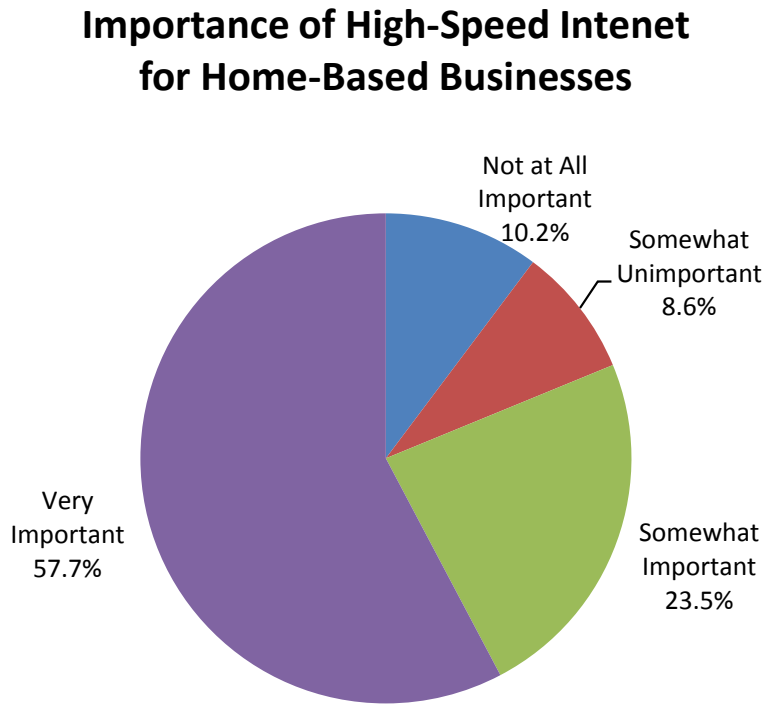


The type of primary telephone service is also correlated with the age of the respondent. Younger respondents are more likely to use their cell phone as their primary service, while the share with traditional land lines increases with the respondent's age.



Approximately 17 percent of respondents indicated that they already had a home-based business, and another 4.8 percent intend to start one in the next one to three years. Over one-half of those with a home-based business or planning to start one said that high-speed Internet service is "very important" to that business.





5.2 Business Survey Summary

In October 2011, 458 invitations were e-mailed to businesses in Garrett County, soliciting their response to an online survey about their Internet service and use. The survey questions were designed to obtain information about business' access to the Internet, services purchased, and their use of the Internet for their business activities. The survey also captured opinions about Internet services within Garrett County and identified ways in which those services may be improved to better meet the needs of the County's business community.

Because this survey was conducted online, and invitations were sent via e-mail, the respondents all have e-mail addresses and, thus, some access to Internet service. In other words, the survey was a sampling of businesses that are already online, not a sampling of all businesses. A small percentage of respondents (less than 5 percent) indicated that their businesses do not have Internet access, but these results should be viewed in light of the survey methodology.

The following sections discuss the survey objectives, process, and results.

5.2.1 Background and Objectives

The business Internet services survey was designed to capture information about Internet access and use among businesses in Garrett County. The survey questions also solicited opinions about current Internet service and their future Internet needs. To meet those objectives, survey recipients were asked about their:

- Internet connections and availability
- Internet use for a variety of business-related activities
- Satisfaction with, and importance of, Internet service aspects
- Opinions about Internet services available to businesses

This information is being used to assess the current state of Internet services in Garrett County's business community and to identify ways in which the County could support improvements in those services to better meet the needs of its businesses.

5.2.2 Business Survey Process

This section describes the processes for project coordination, survey development and implementation, data analysis, and presentation of results.

5.2.2.1 Survey Solicitation and Response

A total of 458 invitations[78] were e-mailed to key contacts at businesses located in Garrett County on October 24, 2011. The list of recipients' names and addresses were provided by County staff from the Chamber of Commerce databases. Two reminders were e-mailed to survey recipients on November 2 and November 16. Respondents completed the electronic questionnaire through Survey Monkey online survey software, and results were formatted into Excel and SPSS databases for analysis.

A total of 194 responses were completed by the cut-off date, providing a response rate of 42.4

[78] 461 surveys were e-mailed, but three were sent to invalid e-mail addresses

percent. Given the total number of businesses in the target community (458 to which the survey was sent), the results are available with a precision level of ±5.4 percent at the 95 percent probability level for aggregate responses. That is, 19 times out of 20, one would expect the survey results to be within ±5.4 percent of the actual value across the entire population.

5.2.2.2 Data Analysis

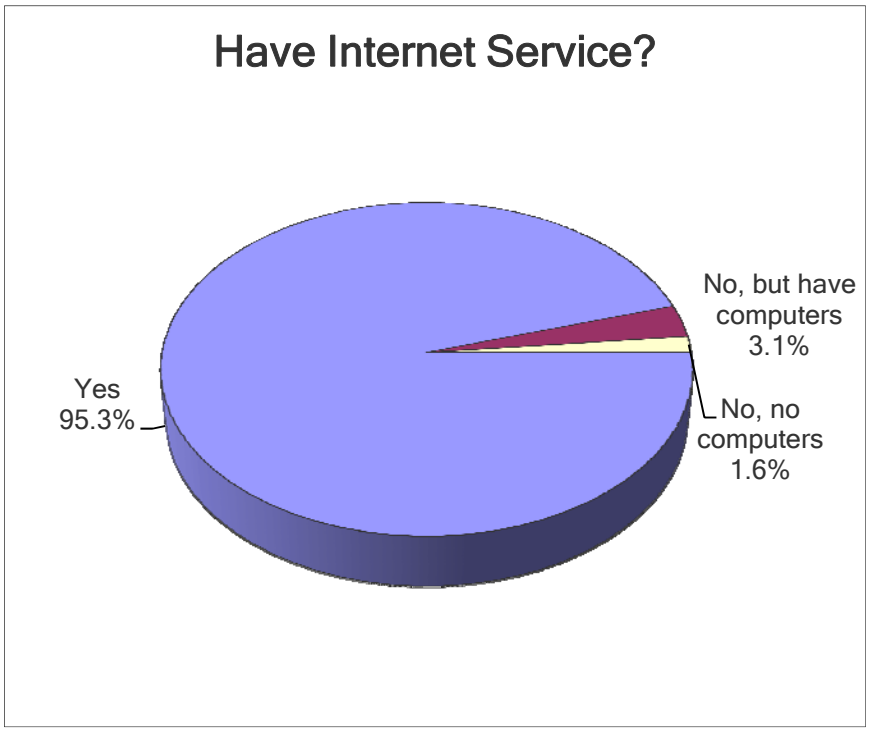
Survey data was entered in IBM SPSS[79] software, and was evaluated using techniques in SPSS including frequency tables, cross-tabulations, and means functions. Survey results were exported to Microsoft Excel software for additional analysis, summary, and graphing purposes. The illustrations in this Report were created in Excel.

5.2.3 Business Survey Results

The following sections present and discuss the business survey results. It should be noted that there were 194 total respondents to the survey and the confidence interval is ±5.4 percent for aggregate results. Analyses of sub-sections of the responses will have broader confidence intervals.

5.2.3.1 Computers and Internet Service

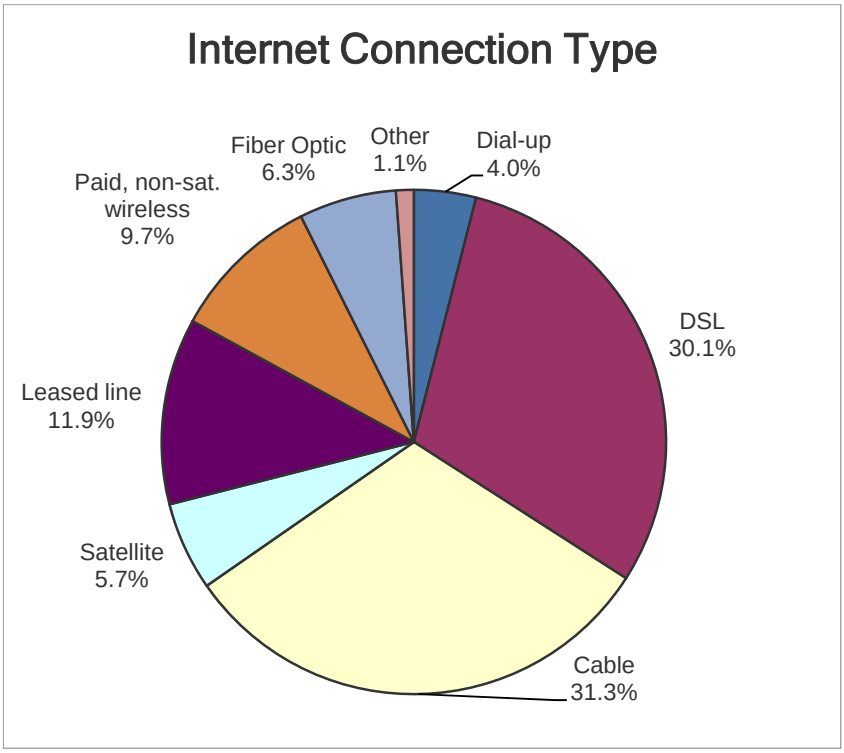
Over 95 percent of Garrett businesses have Internet service. The few without Internet service either had no computers or had computers but no Internet connection.



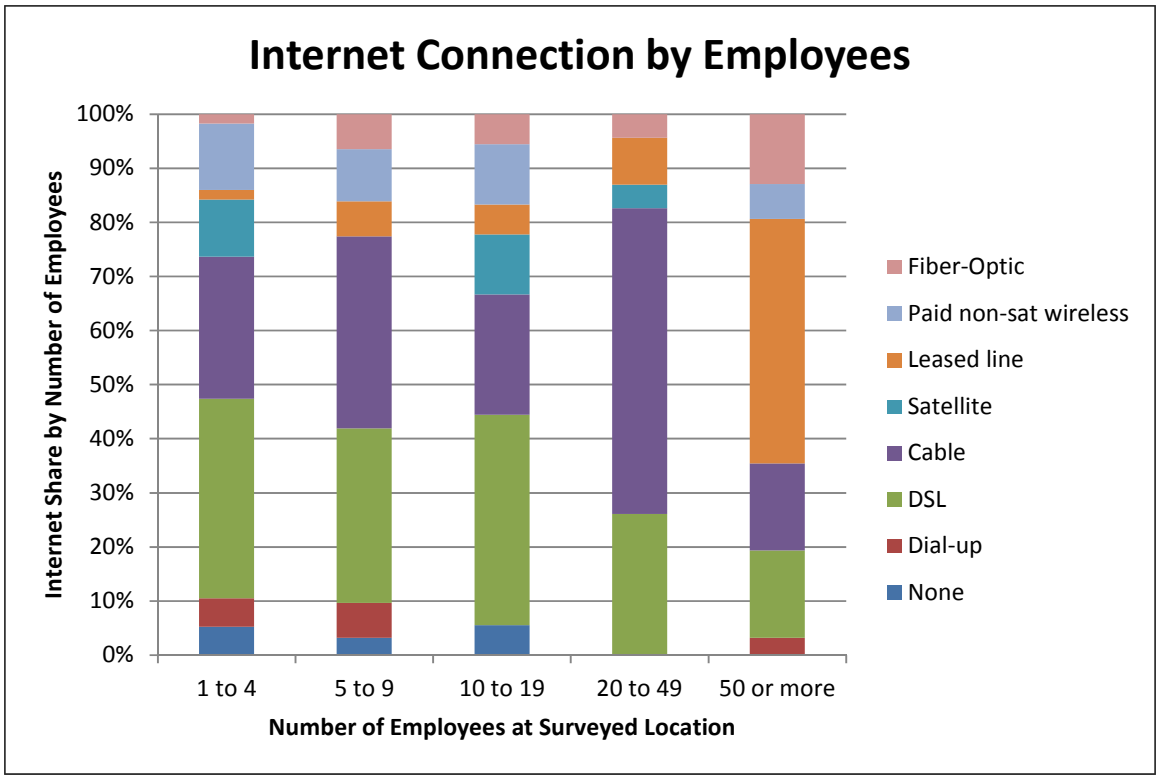
Cable and DSL are the most common types of business Internet connections, comprising approximately 30 percent of the market, each. Leased line and paid, non-satellite wireless are

[79] IBM Statistical Package for the Social Scientist, www.spss.com

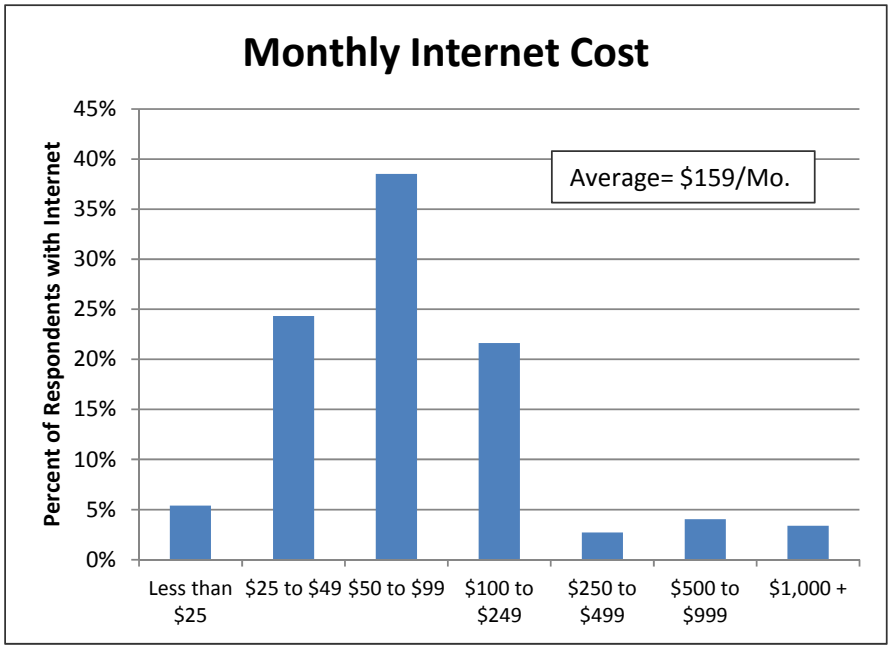
less prevalent with 12 and 10 percent of the market, respectively. Much smaller shares of businesses have fiber-optic, satellite, or dial-up Internet connections.



Over one-half of larger businesses have leased line or fiber-optic Internet connections, compared to smaller companies that are more likely to have cable or DSL connections.

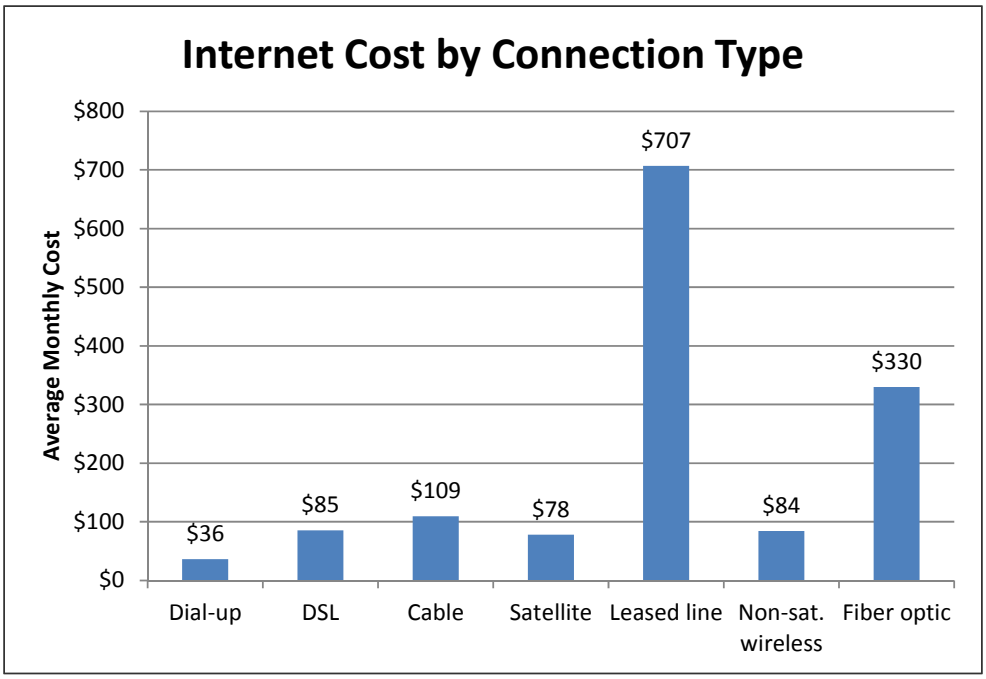


On average, Garrett County businesses pay $159 per month for Internet service. The most common monthly cost is between $50 and $99. Only 10.1 percent of businesses pay $250 or more per month for Internet service.

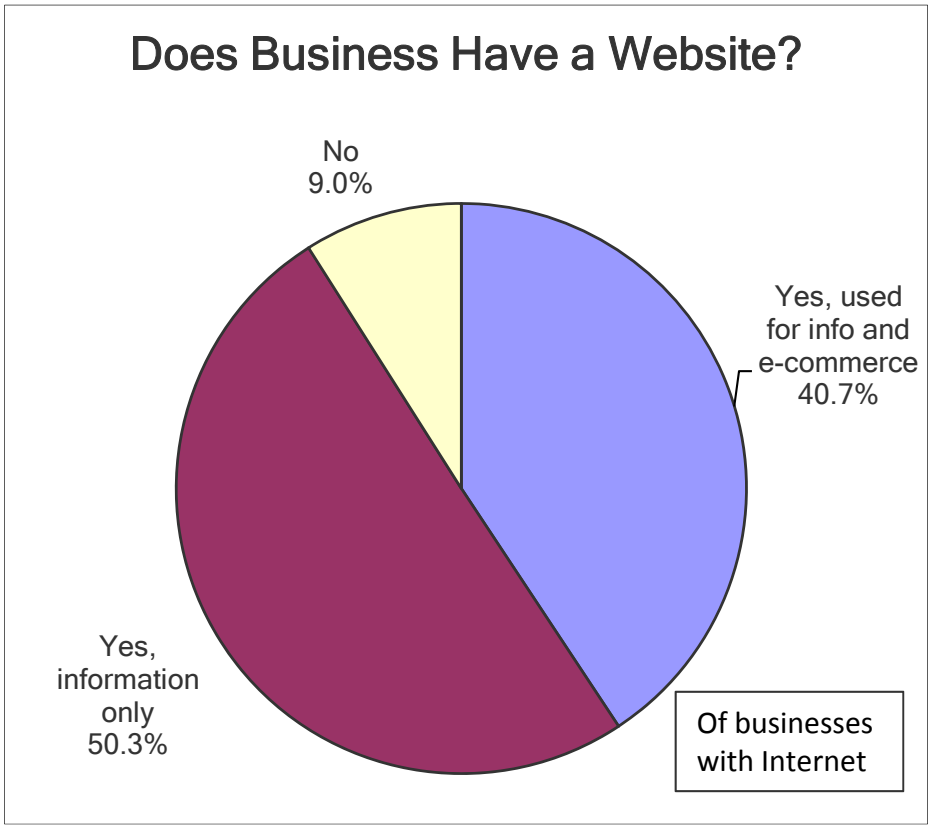


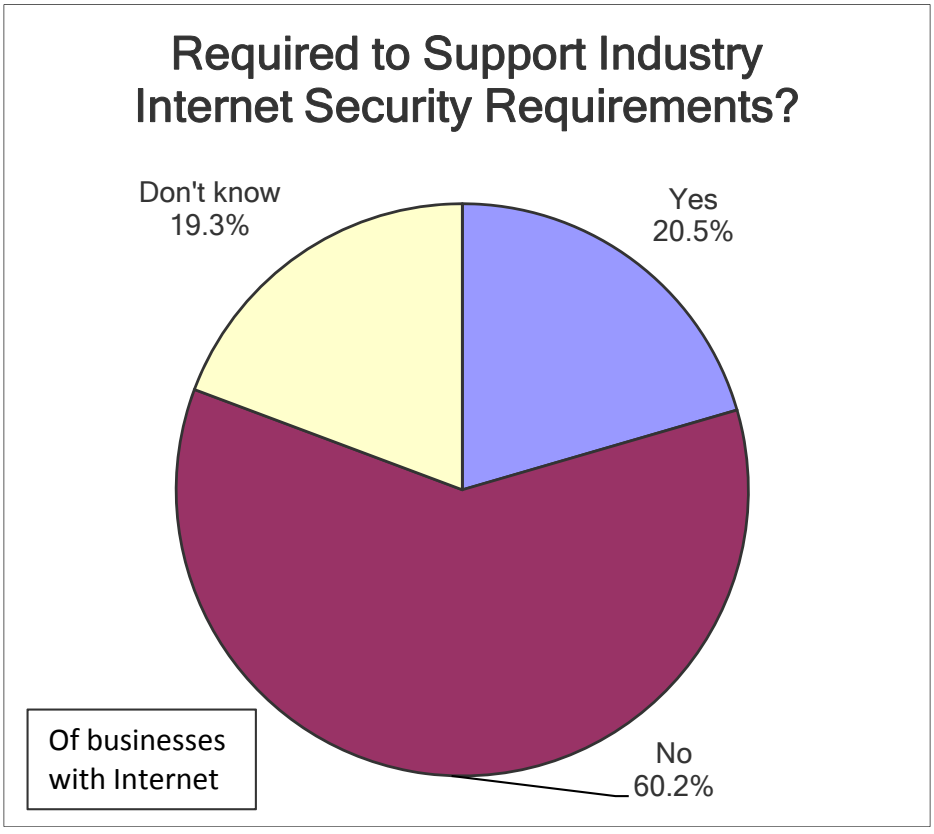
The amount varies significantly based on the Internet connection type. As one would expect, leased line connections are the most expensive, and dial-up connections are the least expensive. Satellite, non-satellite wireless, DSL, and cable connections all have monthly prices in a very

tight range, averaging between $78 and $110 per month. It should be noted that some of these averages are derived from categories with very few responses, thus they will naturally have a relatively broad confidence interval.

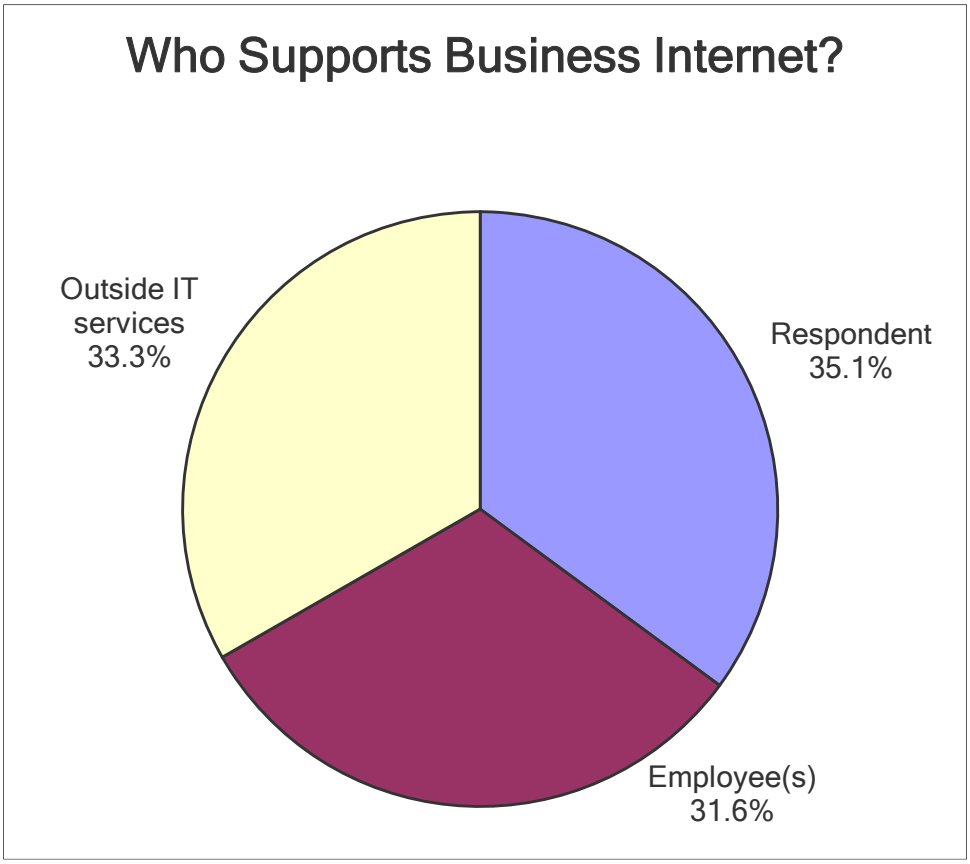


Approximately 91.0 percent of Garrett County businesses with Internet connections have a website, and nearly one-half use their Website for e-commerce. At least 20.5 percent of businesses with Internet are required to support some form of industry Internet security requirements, and another 19.3 percent of respondents were unsure.

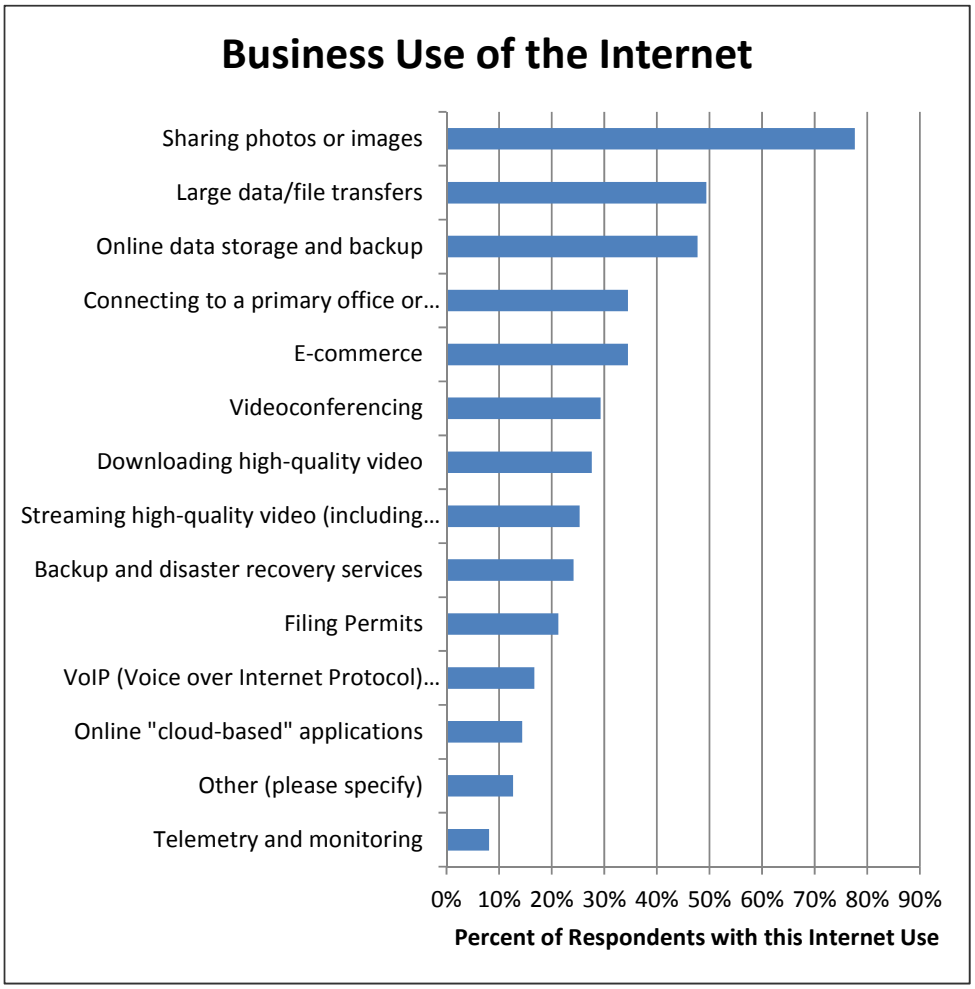

Does Business Have a Website?
No
9.0%
Yes, used for info and e-commerce
40.7%
Yes, information only
50.3%
Of businesses with Internet


Required to Support Industry Internet Security Requirements?
Don't know
19.3%
Yes
20.5%
No
60.2%
Of businesses with Internet

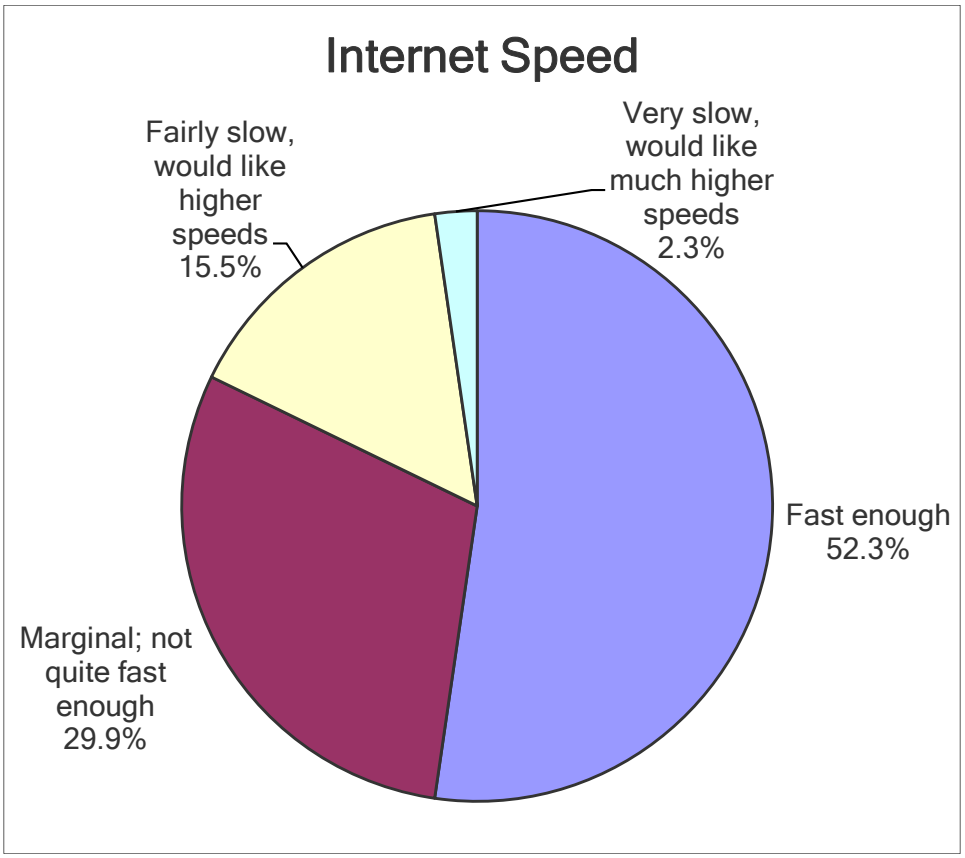
The responsibility for supporting company Internet connections are nearly evenly split between the respondent, another employee(s) within the business, or an outside IT services provider.

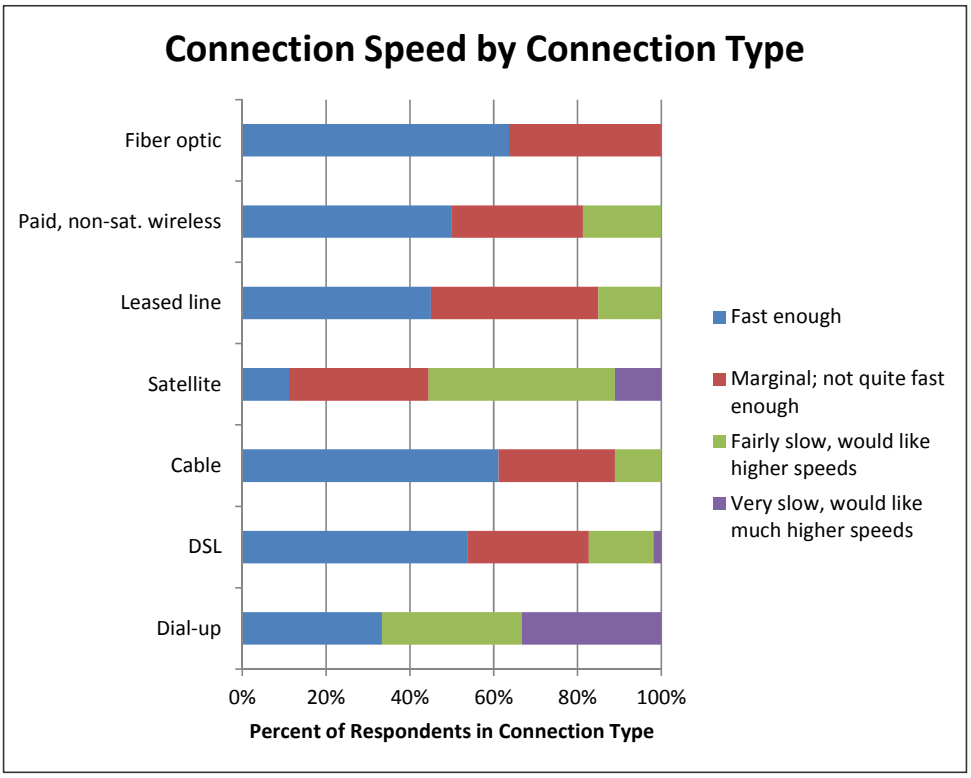


Businesses use the Internet for a variety of purposes. Sharing photos or images was by far the most common business Internet use, with nearly 80 percent of respondents indicating that they used the Internet for this purpose. Transferring large data or files and on-line data storage and backup also ranked high, and are being used by nearly one-half of businesses.



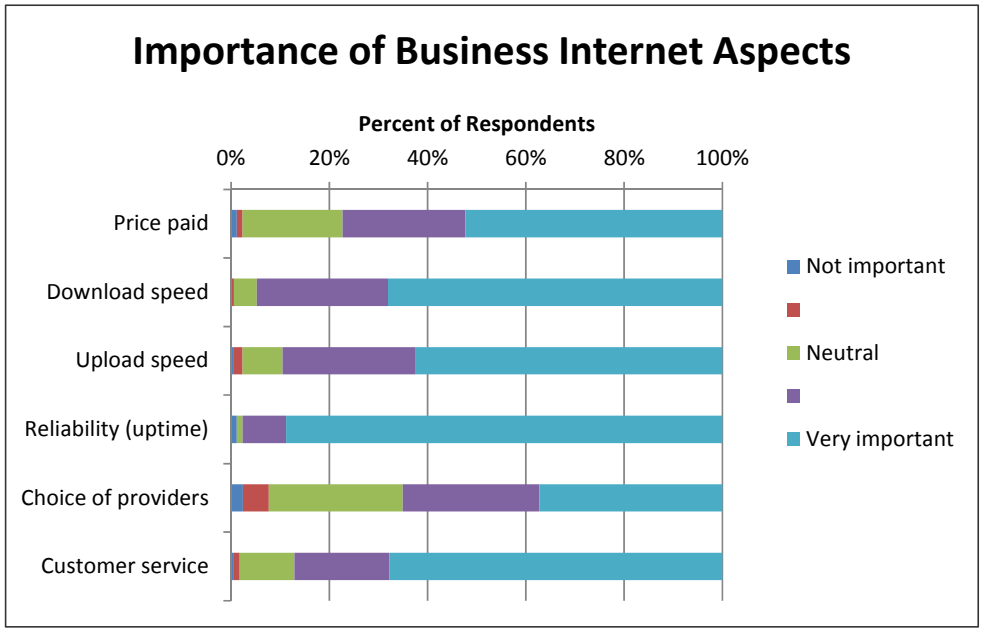
Respondents were asked to rate the speed of their Internet connection. More than one-half indicated that their Internet connection was fast enough for their needs, while less than 20 percent indicated that their connection was "fairly slow" or "very slow." Opinions about Internet speed varied by connection type. Dial-up users were most likely to rate their speed as "very slow," while more than one-half of fiber optic, cable, and DSL subscribers ranked their speed as "fast enough."


Internet Speed
Very slow, would like much higher speeds 2.3%
Fairly slow, would like higher speeds 15.5%
Fast enough 52.3%
Marginal; not quite fast enough 29.9%

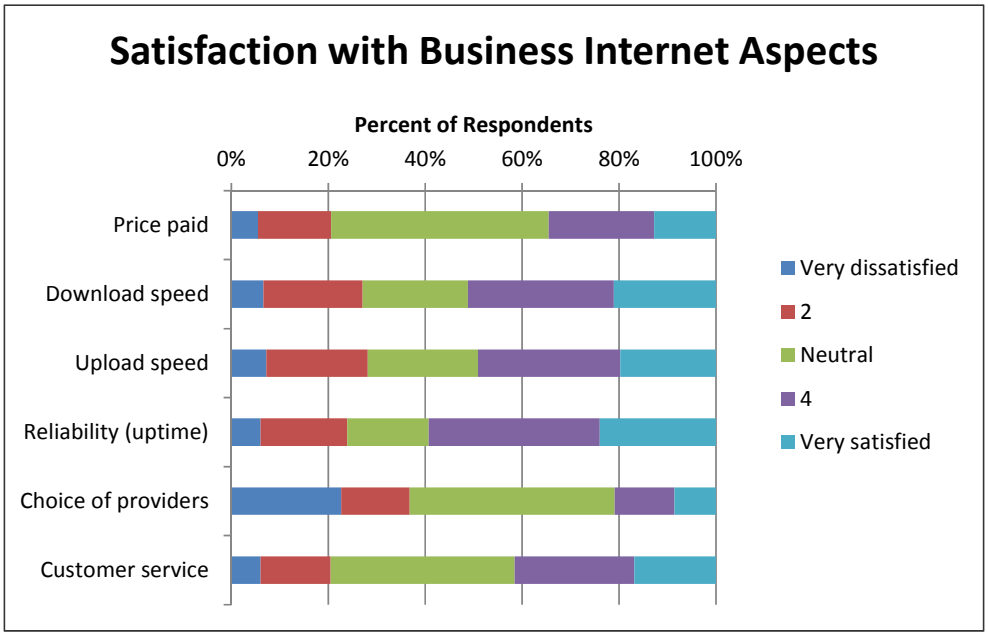

Connection Speed by Connection Type
Fiber optic
Paid, non-sat. wireless
Leased line
Satellite
Cable
DSL
Dial-up
0%
20%
40%
60%
80%
100%
Percent of Respondents in Connection Type
Fast enough
Marginal; not quite fast enough
Fairly slow, would like higher speeds
Very slow, would like much higher speeds

5.2.3.2 Internet Importance and Satisfaction

Respondents were asked about the importance of several aspects of their Internet service. Internet connection reliability ranked as the most important aspect, with 89 percent of respondents rating it as "very important." Speed and service ranked somewhat lower than reliability. The ability to choose among competing providers ranked as the least important among the six Internet aspects included in the question.



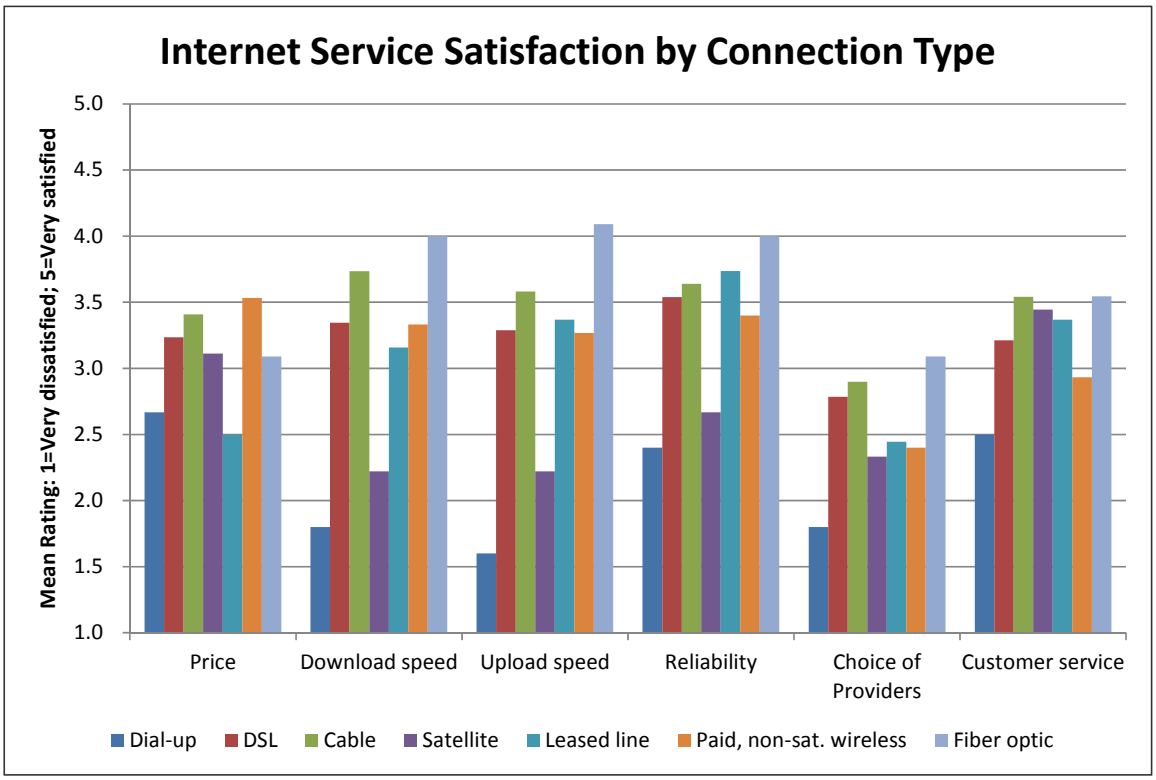
Satisfaction levels were the greatest for reliability and speed, while respondents were the least satisfied with the ability to choose among providers.



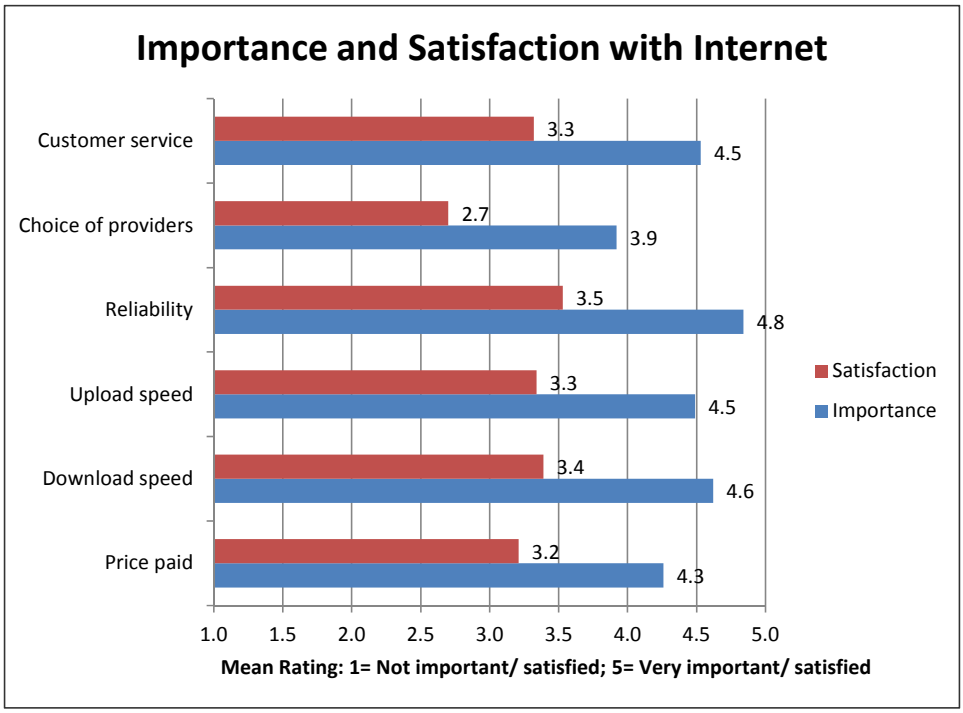
Satisfaction with some Internet aspects varies by the Internet connection type. As one would expect, dial-up users are the least satisfied with speed and reliability. They are also the least satisfied with customer service and the choice of providers.

Fiber optic Internet users are the most satisfied with speed, reliability, and customer services.

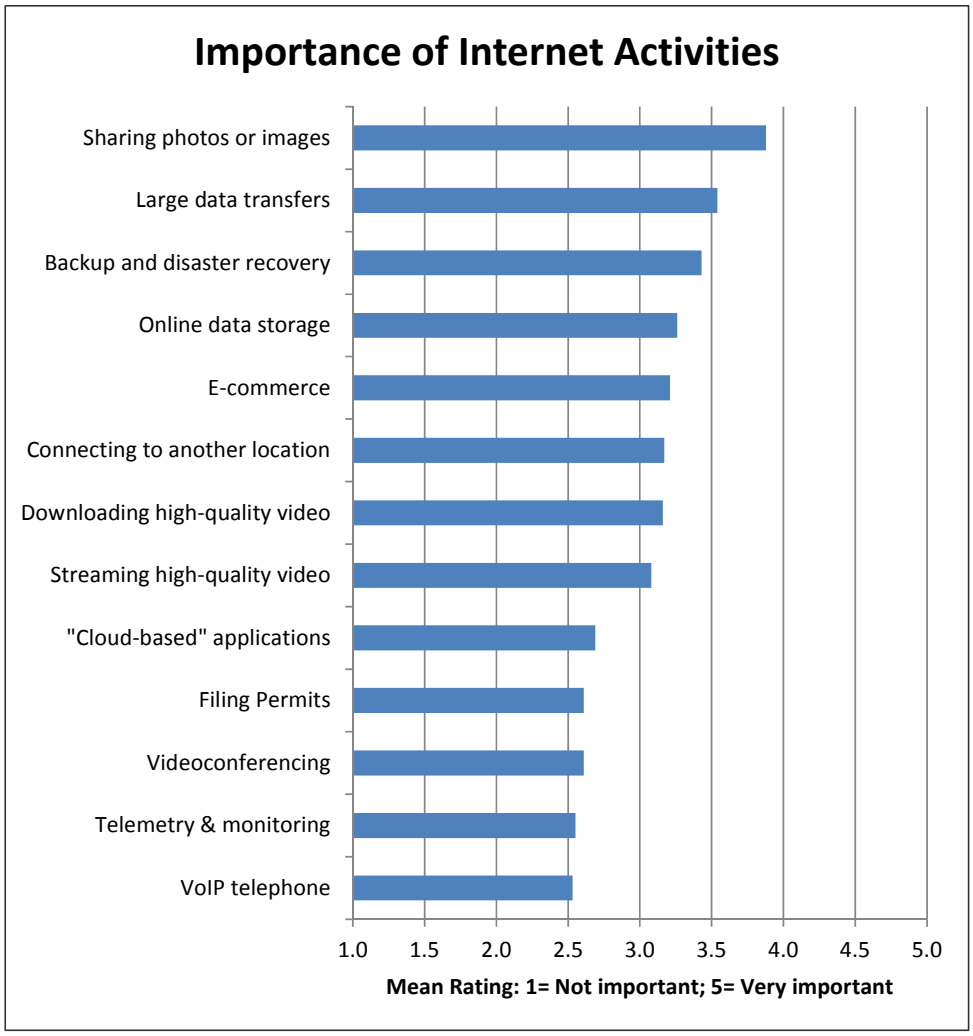
It should again be noted that due to the relatively small sample size, the confidence around results for sub-segments is relatively large and most differences are not statistically significant at the 95 percent confidence level.



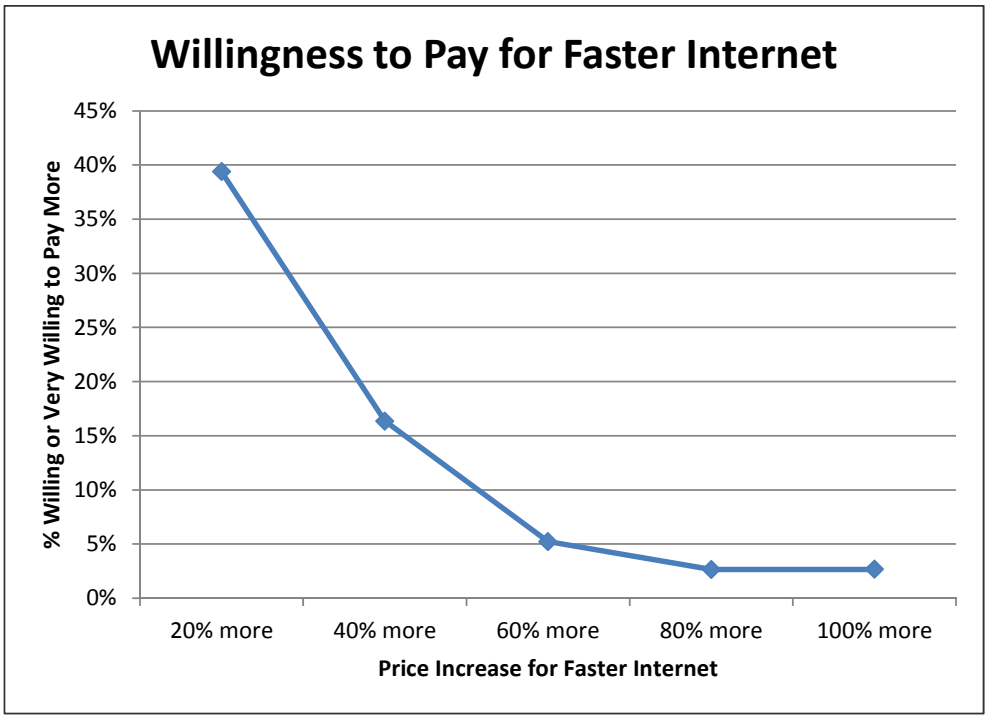
The "gap" between the importance of Internet aspects and the customer satisfaction with those aspects can indicate the areas in which efforts should be focused for improvement. Even though reliability ranked as the aspect with which businesses were most satisfied, it also had the highest "gap" between importance and satisfaction (mean importance minus mean satisfaction = 1.3). This reflects the very high level of importance that businesses place on reliability. The service "gap" for speed, choice of providers, and customer service was slightly smaller than the gap for reliability. The smallest service gap was for the price paid.



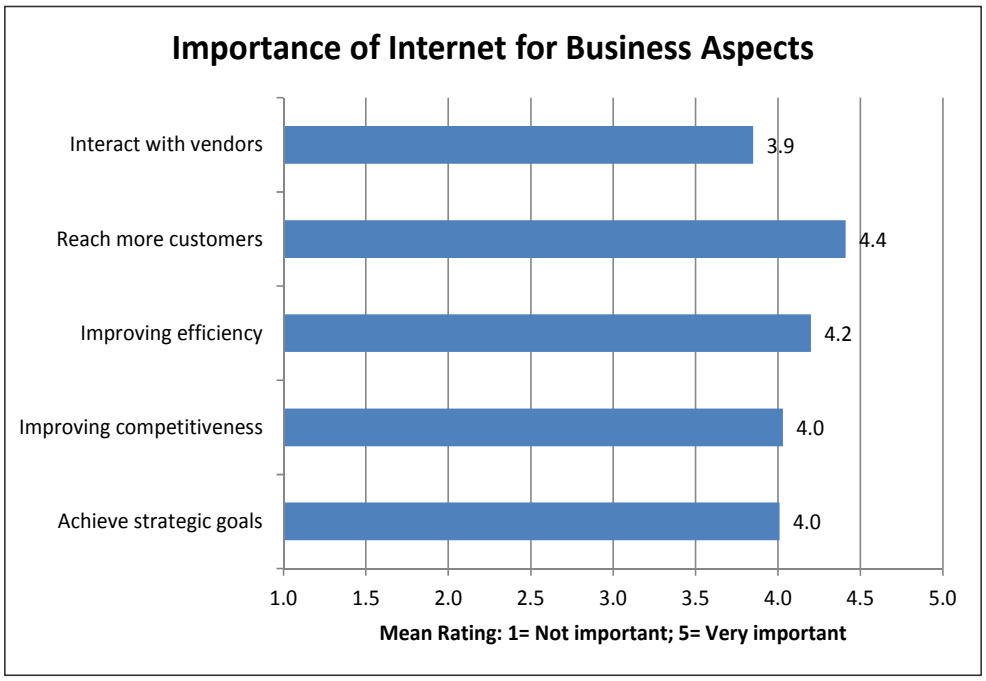
Respondents were asked to rank the importance of several Internet uses for their business. Sharing large photos or images, large data transfers, and backup & disaster recovery rank as the most important aspects. Videoconferencing, telemetry & monitoring, and VoIP telephone were the least important, although it is unclear if Internet speed is limiting those uses or if there is less need for those applications by businesses.



Respondents were asked if they were willing to pay more for faster Internet service to better take advantage of the uses mentioned in the previous question. Nearly 40 percent of businesses would be somewhat or very willing to pay 20 percent more for faster Internet service and 15 percent said they would be somewhat or very willing to pay 40 percent more. Only a small portion of businesses are willing to pay 60 percent more for faster Internet.

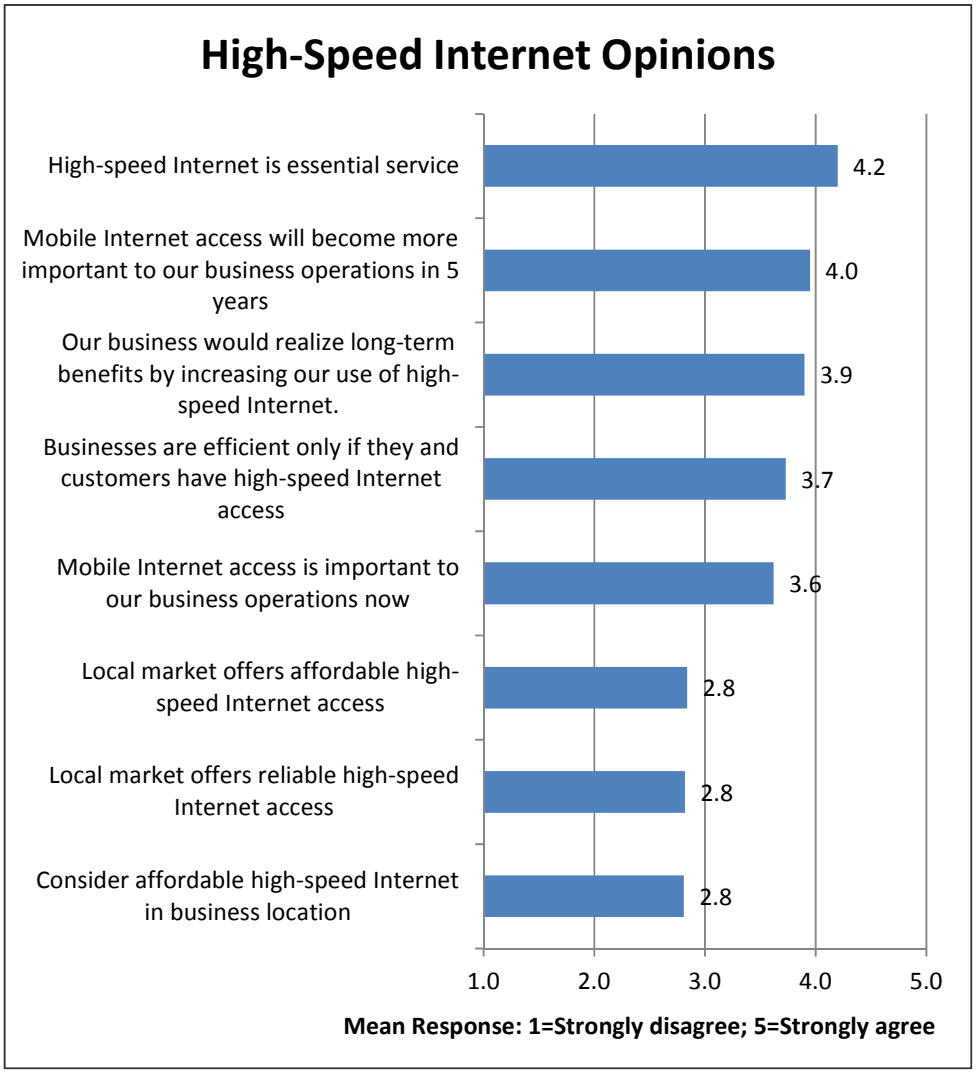


Among several business aspects, respondents ranked the ability to reach more customers as the most important aspect enabled by high-speed Internet. All business aspects ranked relatively high and in a narrow range of importance from use of high-speed Internet.

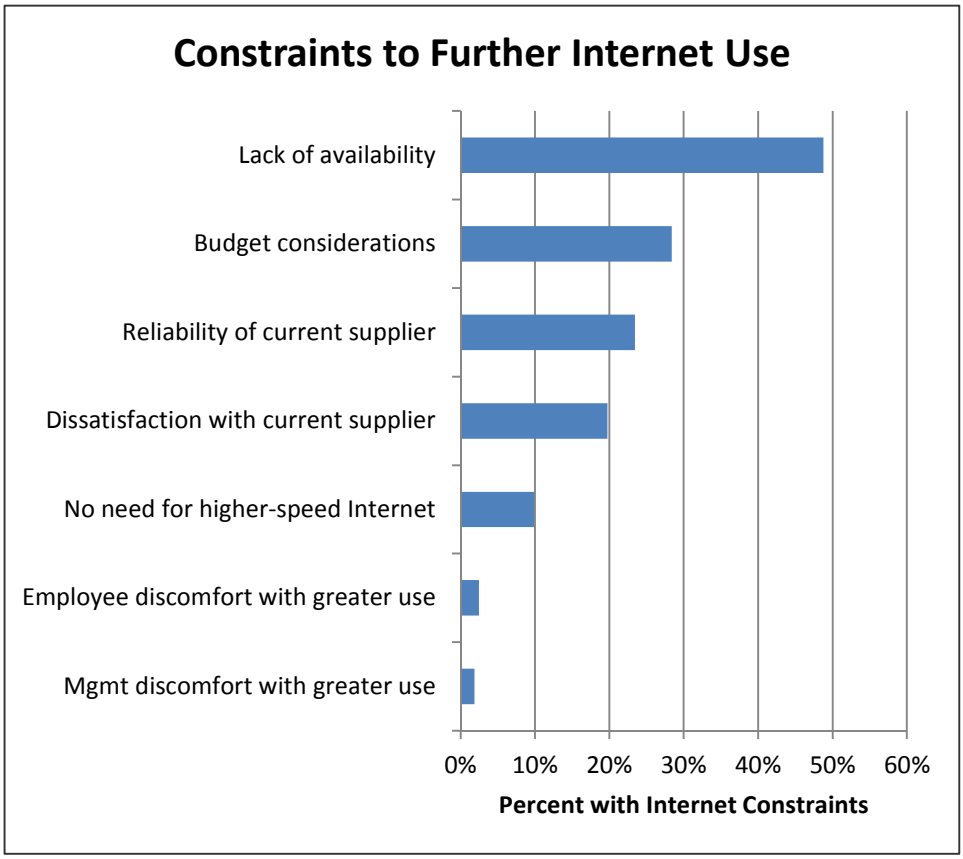


Respondents were also asked about their opinions regarding high-speed Internet access and value. Most agreed that high-speed Internet is an essential service, similar to other utilities. They largely agreed that mobile Internet would become more important in five years and that their

business would realize long-term benefits by increasing their use of high-speed Internet. The least agreement among the opinions solicited were that their business would consider affordable high-speed Internet in business location decisions, and that the local market offers reliable and affordable high-speed Internet access.



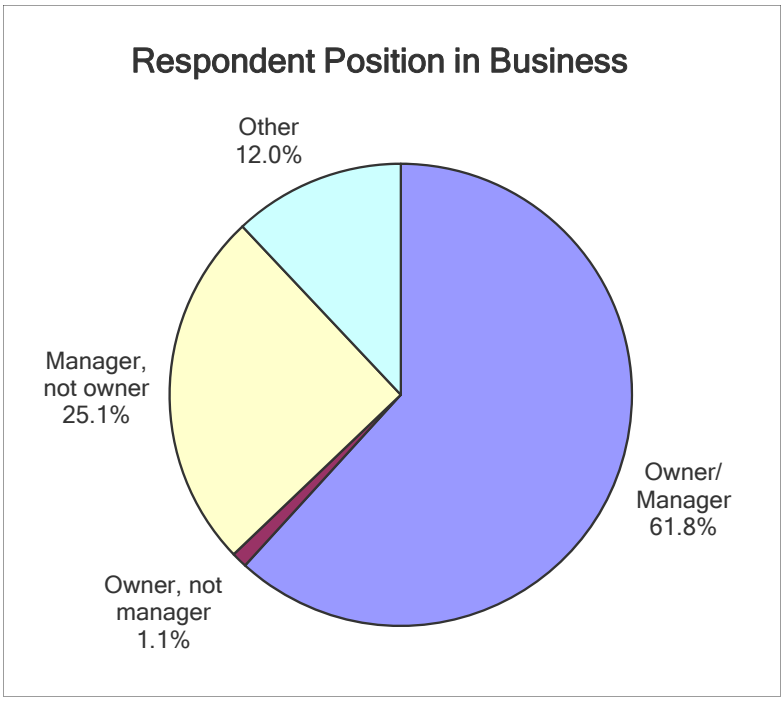
By far, the largest constraint to further use of high-speed Internet was the lack of availability. Budget, reliability, and dissatisfaction with providers ranked much lower as constraints to further Internet use.



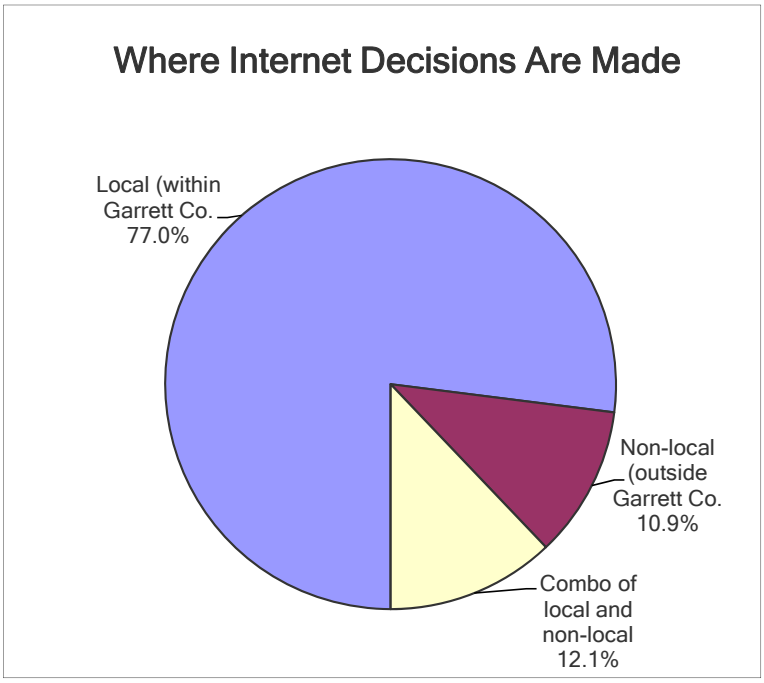
5.2.3.3 Business Characteristics and Information

In addition to information and opinions about Internet service, businesses were asked about their business size, type, and other characteristics. This information is used to characterize the business community and to correlate various survey data to business characteristics.

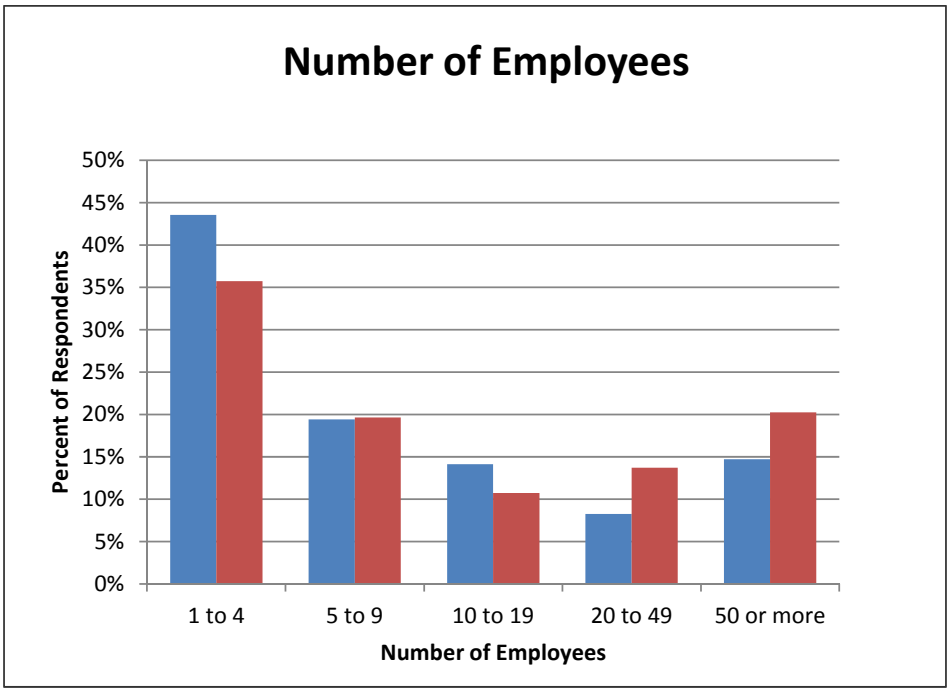
Approximately 62 percent of respondents were the owner and manager of the business, while 25 percent were the manager, but not the owner.



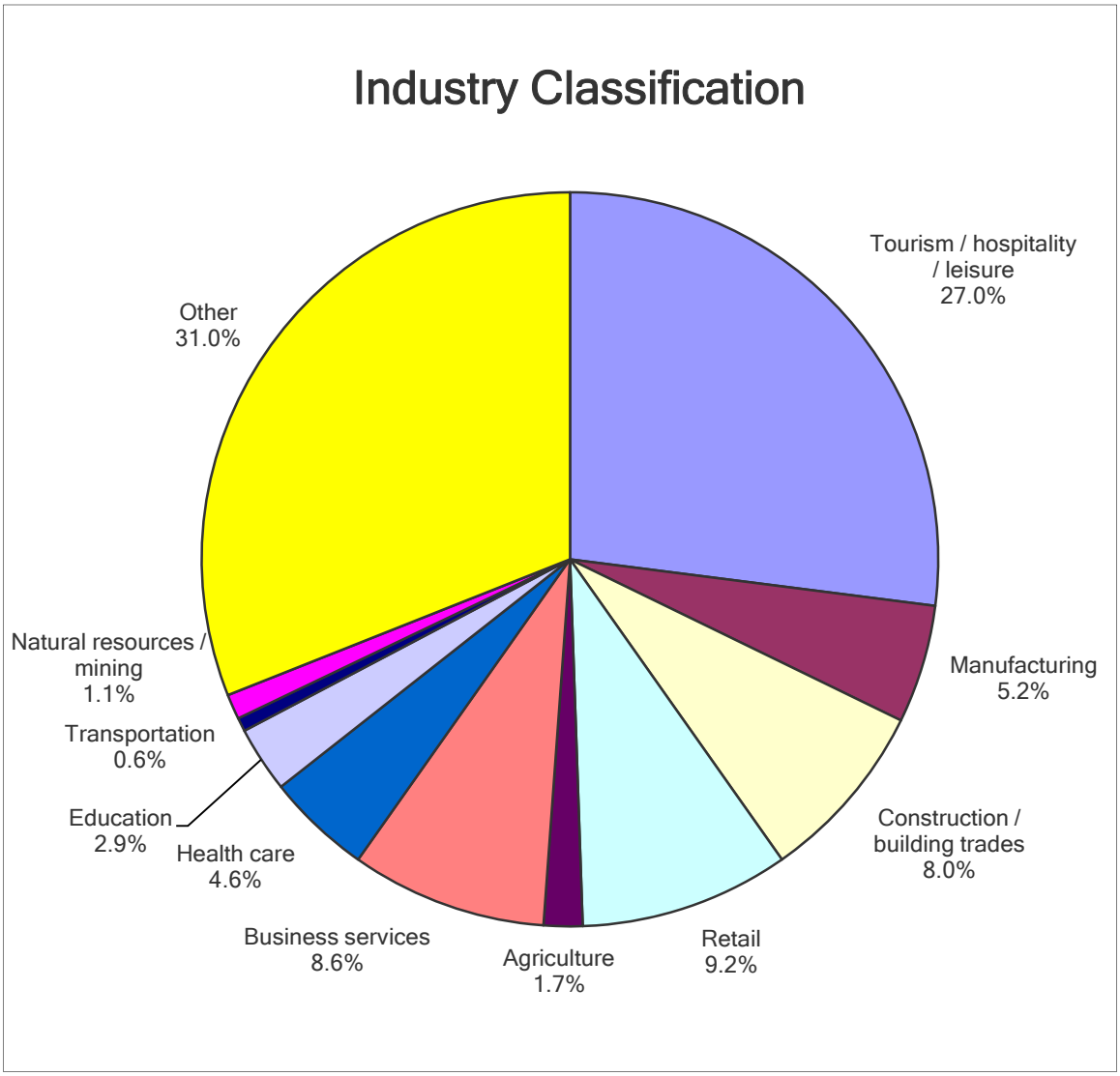
Approximately 77 percent of business respondents make Internet decisions exclusively in Garrett County, while an additional 12 percent share this responsibility between Garrett County and outside locations.



Approximately 63 percent of businesses have fewer than ten employees at the surveyed location, and 55 percent of businesses have fewer than ten employees at all locations. Only 15 percent of respondents have 50 or more employees at this location, while 20 percent had 50 or more employees at all locations.



The largest industry segment responding to the survey was the tourism/ hospitality/ leisure industry, comprising 27.0 percent of respondents. The next largest segments were considerably smaller, including retail (9.2 percent), business services (8.6 percent), and construction (8.0 percent). In addition, 31.0 percent of respondents classified their business in another category outside the ten options provided in the survey question.



5.3 Agricultural Survey Summary

In November 2011, 552 questionnaires were mailed to farms and farm-related businesses in Garrett County, Maryland. The survey questions were designed to obtain information about farms' access to Internet services and their use of the Internet for farm-related activities. It also captured farm owners' opinions about Internet services within Garrett County and identified ways in which those services may be improved to better meet the needs of the County's agricultural community.

The following sections discuss the survey objectives, process, and results.

5.3.1 Farm Survey Background and Objectives

The farm Internet Services Survey was designed to capture substantial information about Internet access and use among farms and farm-related businesses in Garrett County. The survey questions

also solicited opinions about current Internet service and their Internet needs in the future. To meet those objectives, survey recipients were asked about their:

- Internet connections and availability
- Internet use for a variety of farm-related activities
- Satisfaction with, and importance of, Internet service aspects
- Opinions about Internet services for farms
- General farm-related information

This information is being used to assess the current state of Internet services in Garrett County's agricultural community and to identify ways in which the County may be able to support improvements in those services to better meet the needs of its farms.

5.3.2 Farm Survey Process

This section describes the processes for project coordination, survey development and implementation, data analysis, and presentation of results.

5.3.2.1 Survey Mailing and Response

A total of 552 questionnaires were mailed to Garrett County farms and farm-related businesses in November 2011. The list of recipients' names and addresses were provided by University of Maryland Extension for Western Maryland. The survey forms were mailed first-class and included a postage-paid envelope to return the completed survey. Completed forms were returned to the survey processor for verification and data entry.

A total of 139 useable residential surveys were received by the cut-off date, providing a response rate of 25.2 percent.[80] Given the number of farms and the response rate, the results are available with a precision level of ±7.2 percent at the 95 percent probability level for aggregate responses. That is, 19 times out of 20, one would expect the survey results to be within ±7.2 percent of the actual value across the entire population.

The data from completed surveys were entered into a database format for analysis.

5.3.2.2 Data Analysis

Survey data was coded, labeled, cleaned, and verified with IBM SPSS[81] software.

Survey data was evaluated using techniques in SPSS including frequency tables, cross-tabulations, and means functions. Survey results were exported to Microsoft Excel software for additional analysis, summary, and graphing purposes. The illustrations in this Report were created in Excel.

5.3.3 Farm Survey Results

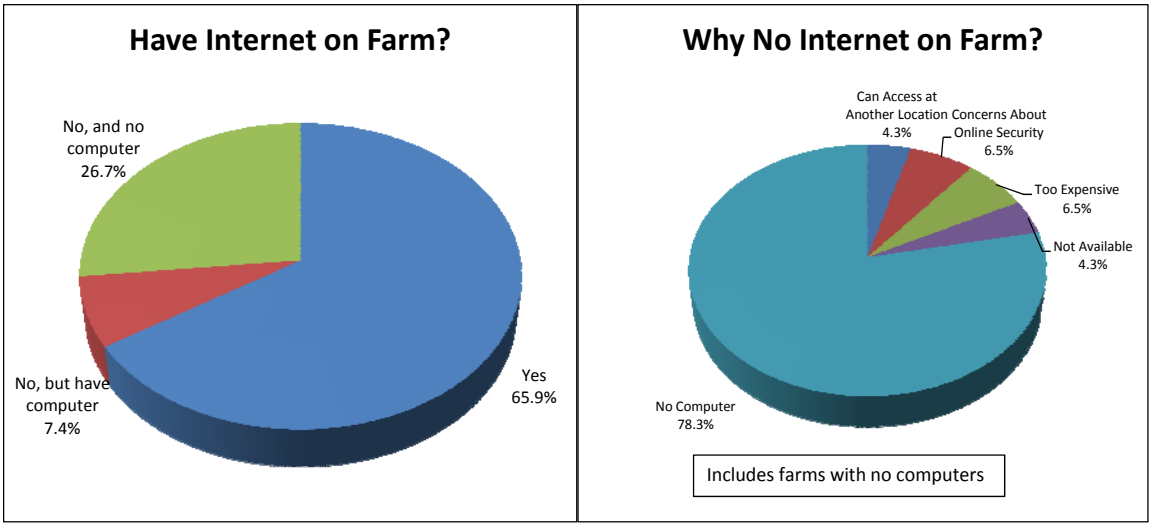
The following sections present and discuss the farm survey results. Although some surveys were sent to farm-related businesses, the general term "farms" is used in describing the group of

[80] In addition, at least 12 surveys were received late and three noted that they no longer farmed.
[81] IBM Statistical Package for the Social Scientist, www.spss.com

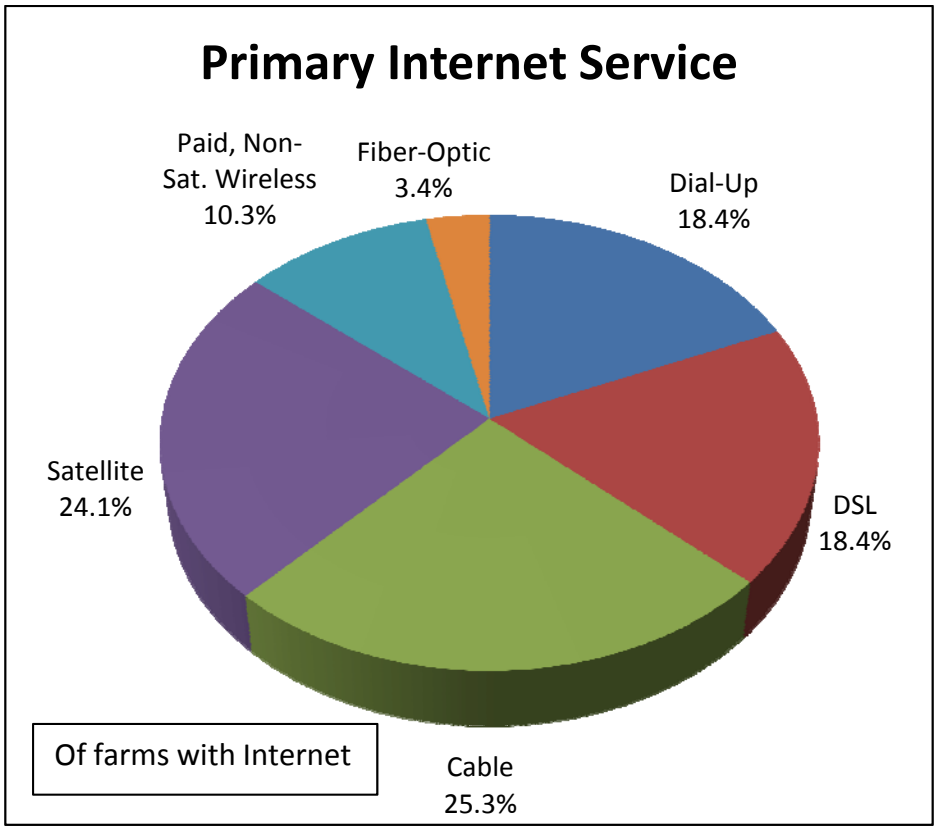
respondents. It should be again noted that there were only 139 total respondents to the survey and the confidence interval is ±7.2 percent.

5.3.3.1 Computers and Internet Service

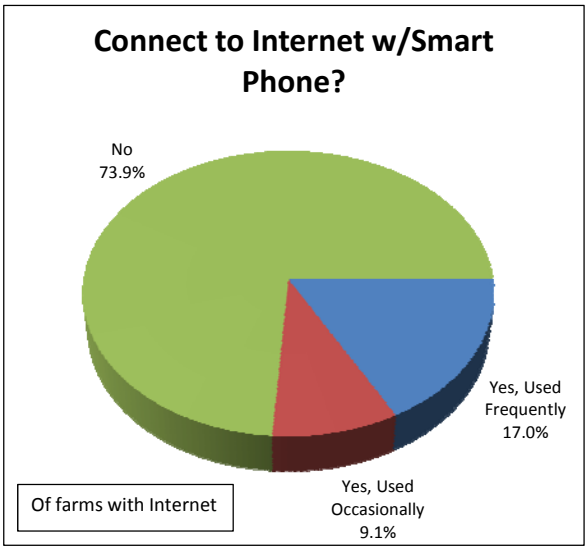
Nearly two-thirds of Garrett County farms have Internet service. Of those without Internet service, the vast majority simply do not have computers, comprising 27 percent of all respondents.



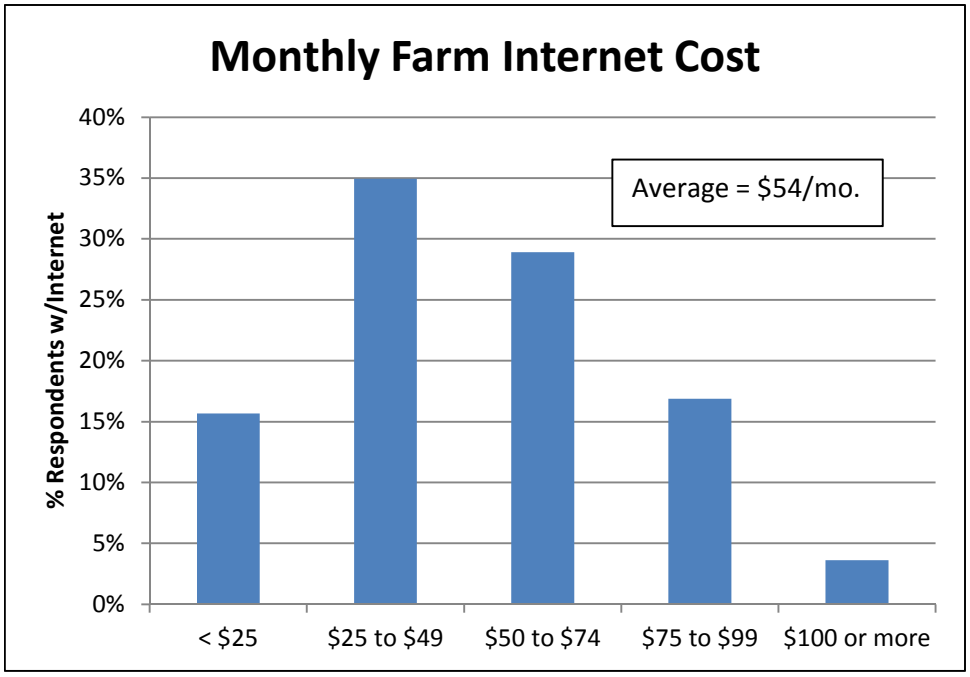
Among farms with Internet service, cable and satellite connections are the most prevalent, comprising 25 and 24 percent market shares, respectively. DSL and dial-up Internet services are also common among farms, comprising 18 percent of the market each. A smaller portion of farms have paid, non-satellite wireless or fiber-optic Internet service. The type of Internet connection may enhance or limit the ability of farms to fully utilize the Internet in their farming operations.

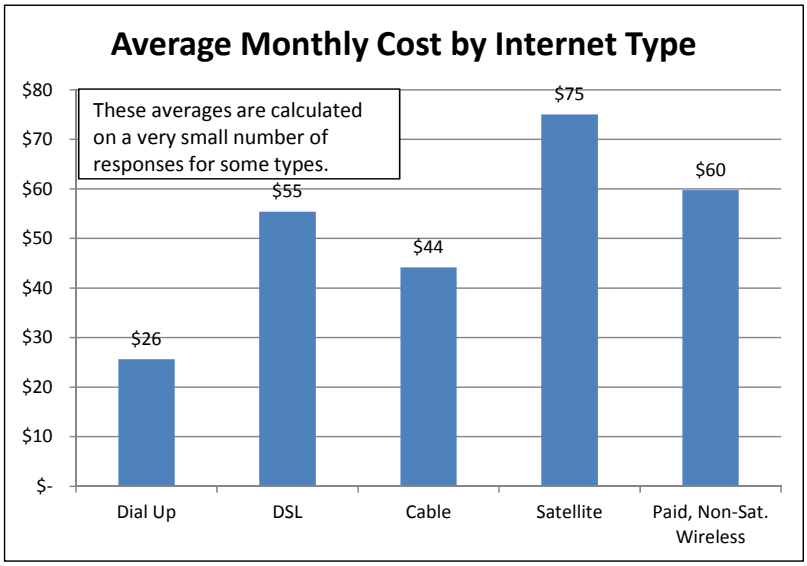


More than one-fourth of farms with Internet service also connect to the Internet with smartphones. Approximately 17.0 percent use their smartphones frequently to connect to the Internet, while another 9.1 percent connect occasionally. Although a minority of farms connect to the Internet using smartphones today, the advantages of mobile Internet connections may prove increasingly valuable to farms in the future, and are discussed later in this Report.

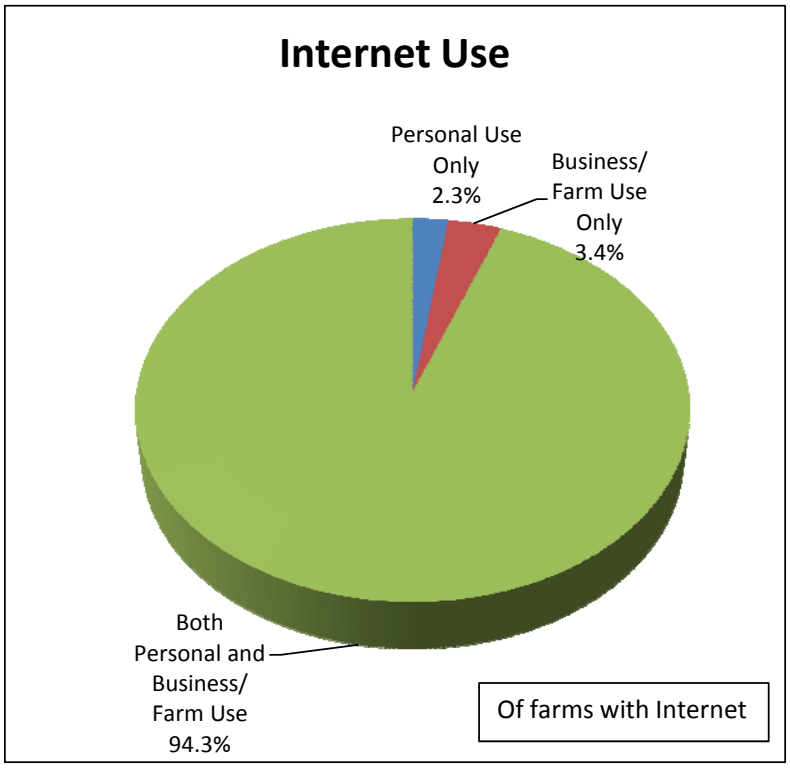


The average Internet cost for Garrett County farms is approximately $54 per month. This varies widely across connection types, with dial-up being the cheapest and satellite being the most expensive.

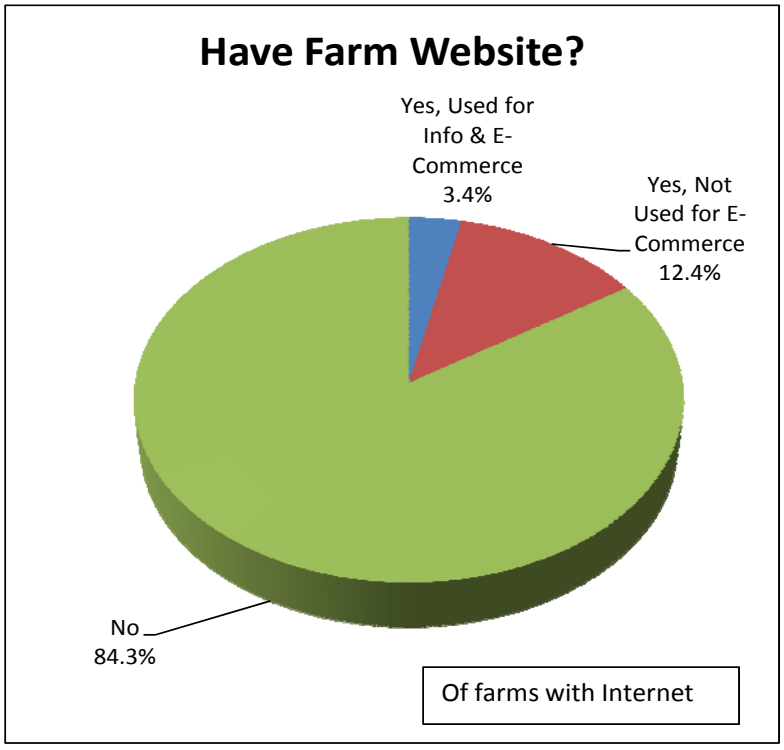




Most respondents use their Internet connection for both personal and business/farm uses, reflecting the family farm characteristics in the area. For this reason, the Internet uses, needs, and opinions are likely to more closely resemble rural residential customers rather than business customers.

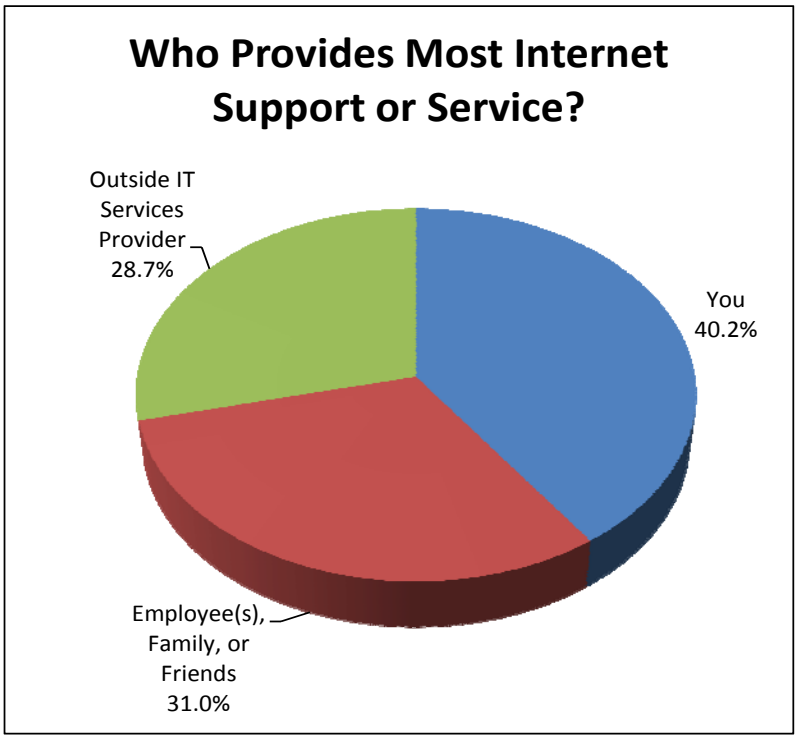


Slightly more than 15 percent of farms have a website, and 3.4 percent use their website for E-commerce (selling products).



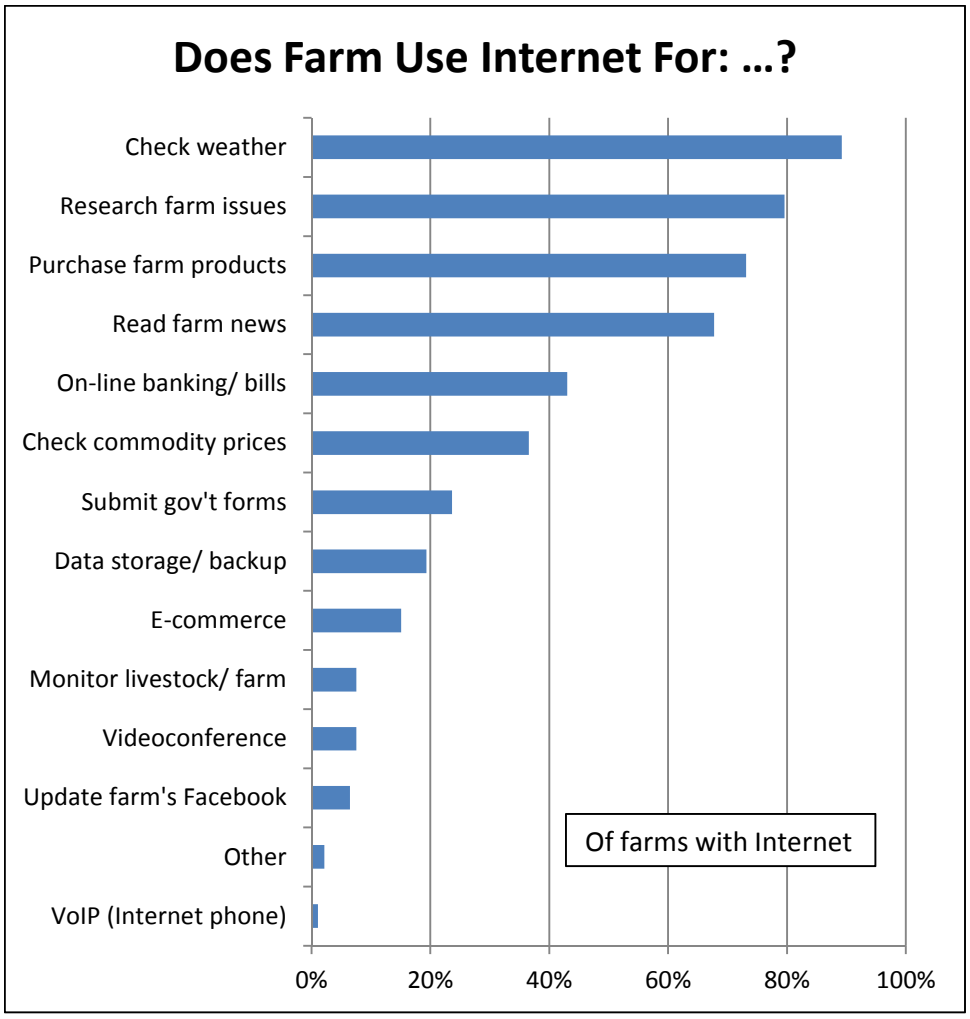
Technical support for farm Internet connections are either provided by the respondent,

employees or family, or an outside IT services providers. Over 70 percent of the primary Internet support is provided by the respondent or someone related or working for the farmer, while outside IT service providers support less than 30 percent of farm Internet services.



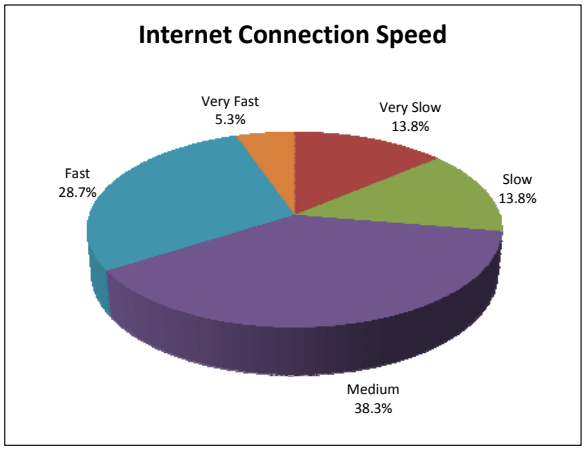
5.3.3.2 Farm Internet Uses and Satisfaction

Farms use the Internet for a variety of purposes related to their farming operations. The most common farm Internet use is checking weather conditions and weather forecasts, indicated by nearly 90 percent of respondents with Internet service. Researching farm issues, purchasing farm products, and reading farm news were done by more than 60 percent of respondents. Using Voice over Internet Protocol (VoIP), updating the farm's Facebook page, videoconferencing, or remotely monitoring livestock or the farm are the least common Internet uses. Each of these comprised less than 10 percent of farms with Internet service.

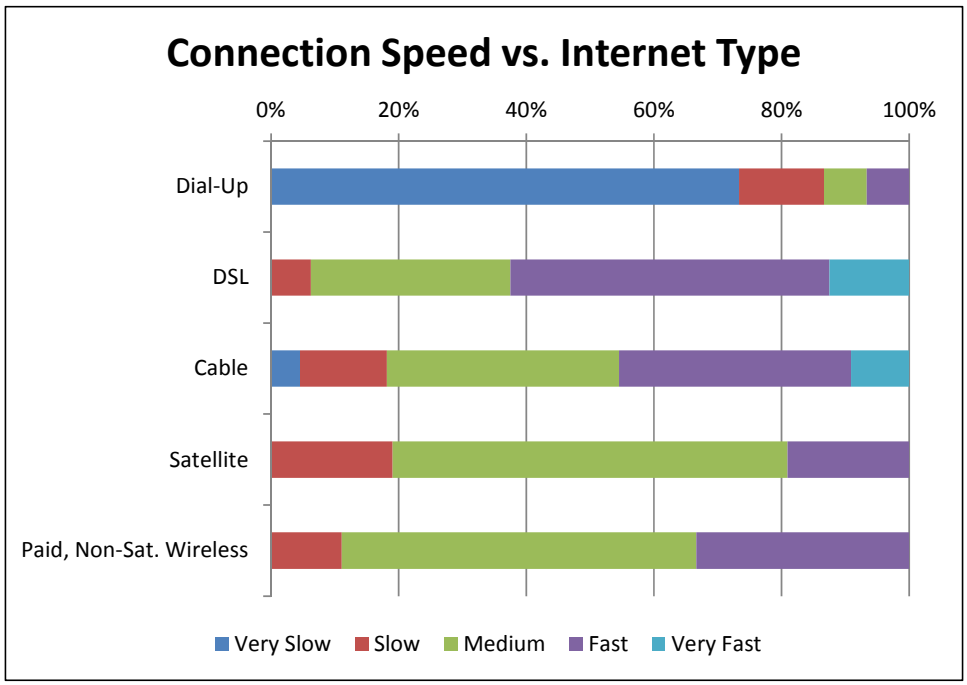


Additional investigation of farm uses revealed few significant correlations between farm Internet uses and connection types. However, these analyses are done on relatively small sub-sets of the data, and it is therefore difficult to draw firm conclusions from them.

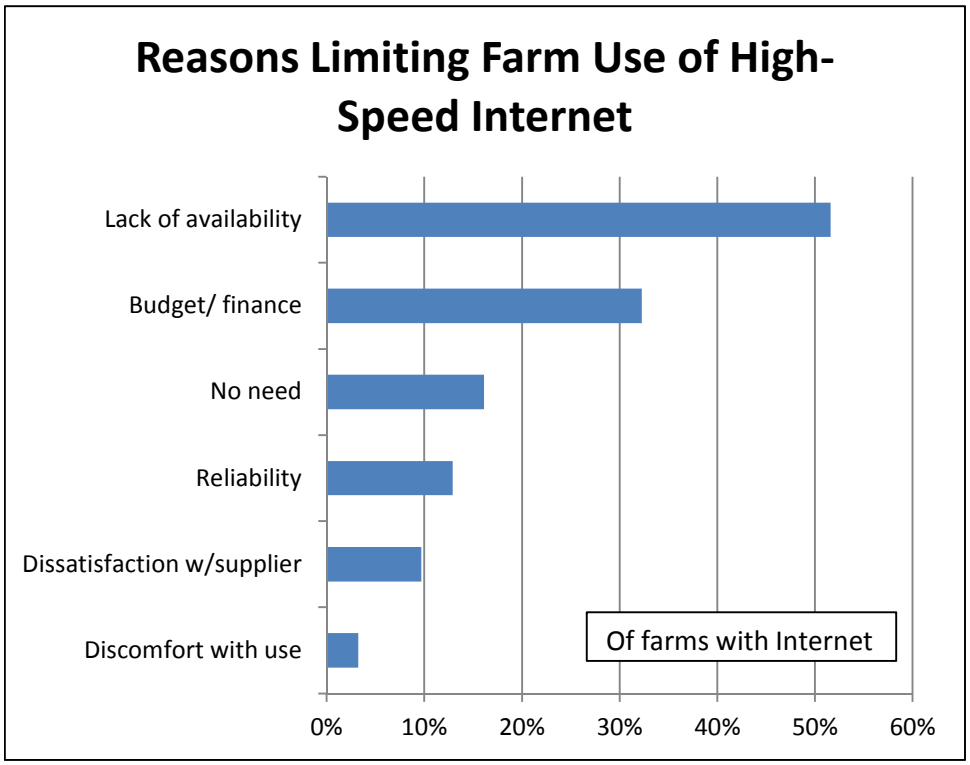
Respondents were asked to describe the speed of their Internet connection. Over one-third of respondents described their Internet speed as "fast" or "very fast," while an additional 38.3 percent described it as "medium." Over one-fourth of respondents described their connection as "slow" or "very slow," indicating a substantial portion of customers with inferior speeds and desiring a faster Internet connection. These responses differ substantially across connection types.



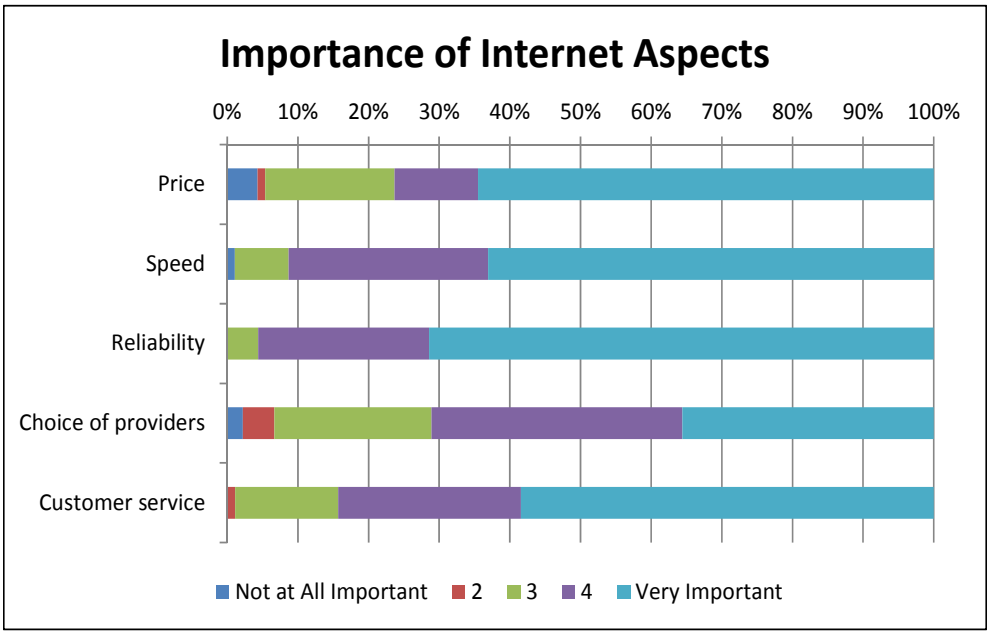
Opinions about current Internet speeds were compared to the connection types used. Approximately 87 percent of dial-up users described their connection as "slow" or "very slow." This compares to less than 20 percent of respondents with other connection types. DSL users ranked their connection as the fastest, with nearly two-thirds indicating "fast" or "very fast" Internet speeds, although other connection types also ranked close to DSL in speed.



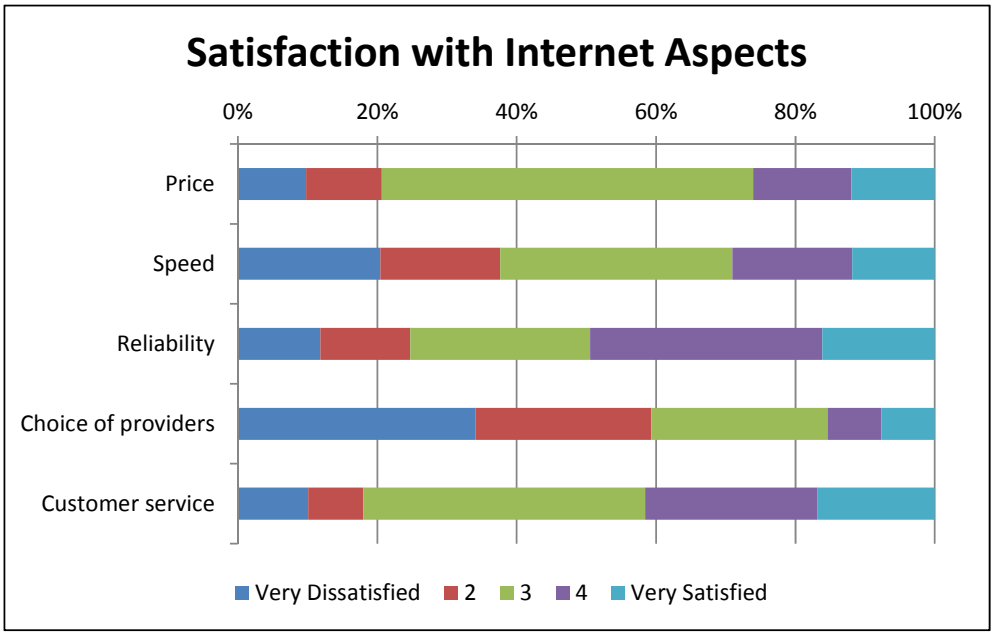
The largest reason limiting farms' use of high-speed Internet is the lack of availability, as indicated by more than one-half of survey respondents. Budget and finance reasons were the second most prevalent reason limiting further use of high-speed Internet.



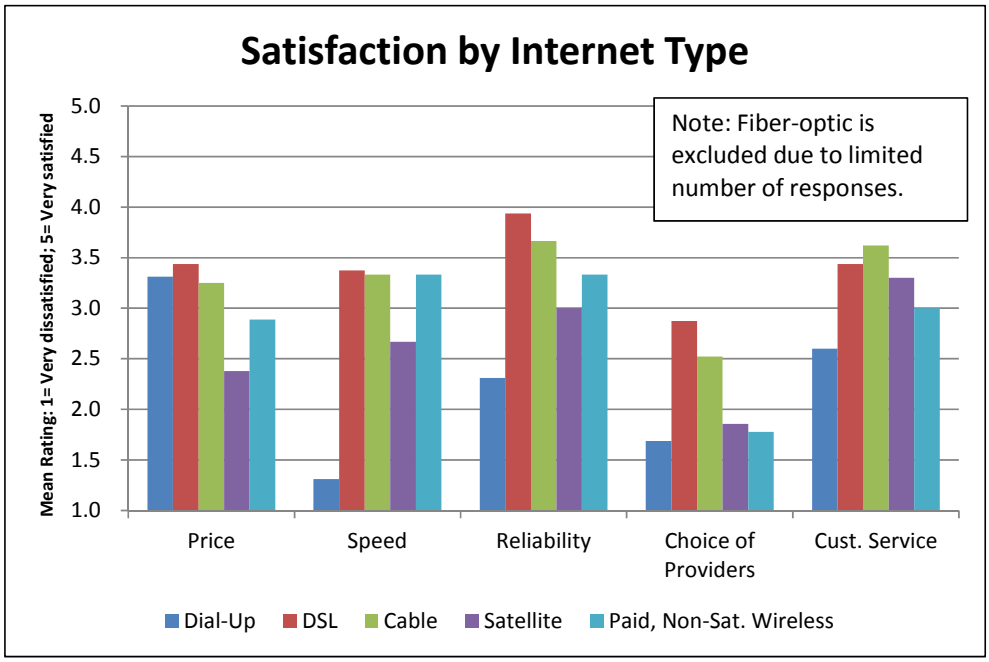
Respondents were asked about the importance of several aspects of their Internet service. Reliability ranked as the most important, with more than 90 percent of respondents indicating that is was important or very important. Price, speed, and customer service all ranked somewhat lower than reliability. The ability to choose among competing providers ranked as the least important, although 71 percent of respondents still ranked it as important or very important.



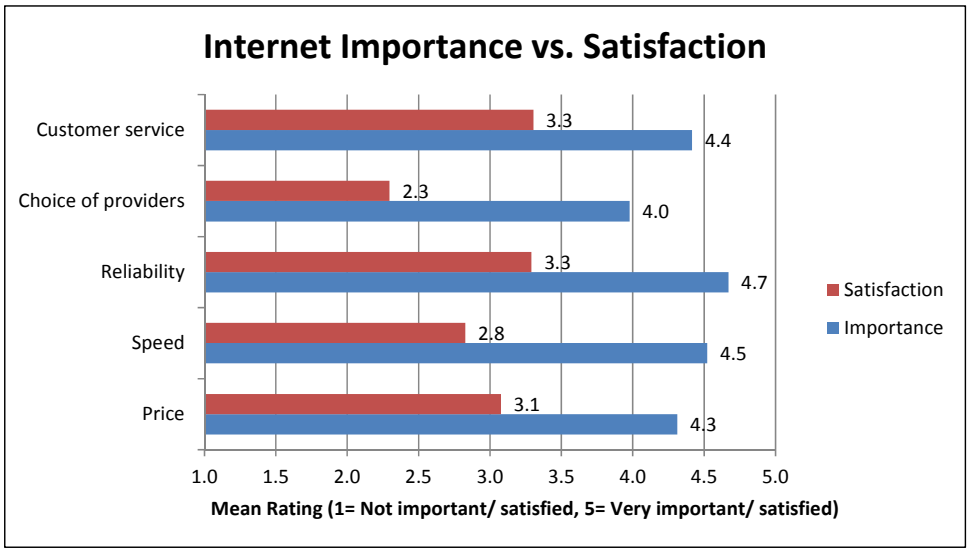
Respondents were asked about their level of satisfaction with Internet service aspects. In general, respondents were most satisfied with reliability and customer service, and were the least satisfied with the ability to choose among competing providers.



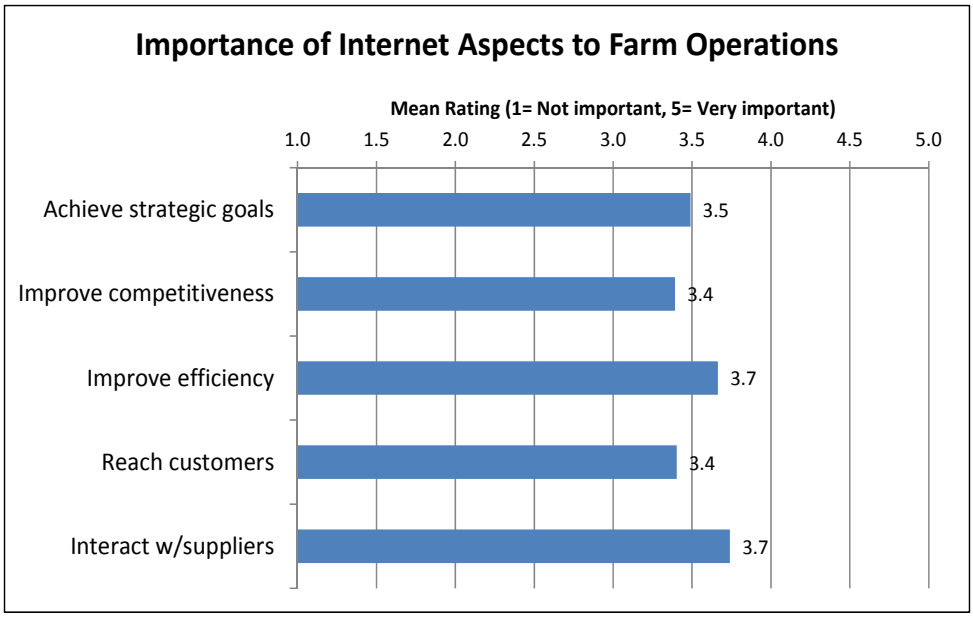
The level of satisfaction varied among respondents with different Internet connection types. DSL and cable subscribers are generally the most satisfied with Internet service. Dial-up customers are the least satisfied with all aspects except price paid. Satellite subscribers are the least satisfied with the price paid for their Internet service. Satellite subscribers pay the most for service, as discussed previously.



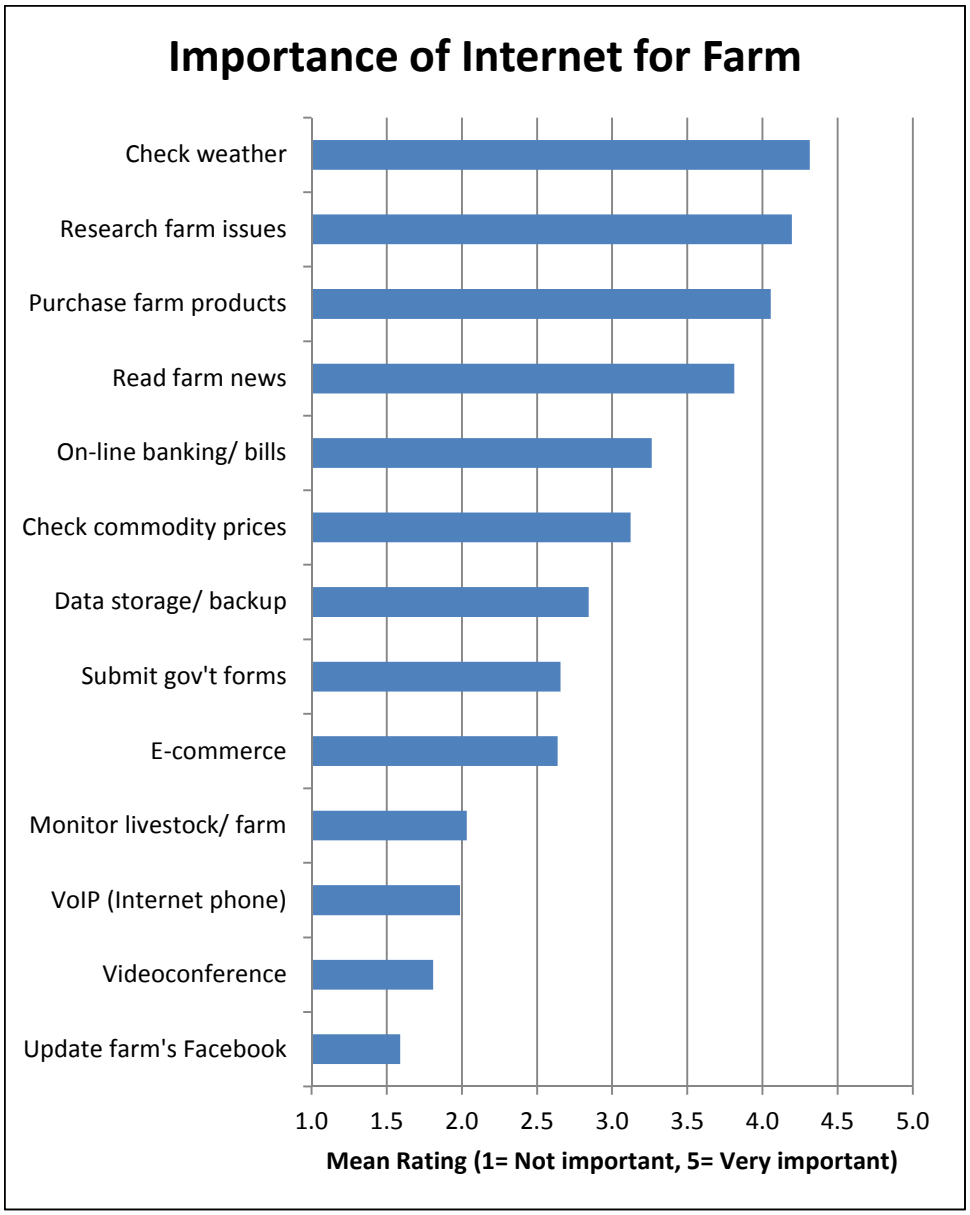
Comparisons of the importance of Internet service aspects and customers' satisfaction with those services reveal "gaps" between importance and satisfaction. These gaps are areas where Internet providers are not fully meeting the needs of the market in some service aspects. The largest gaps are speed and the ability to choose among competing providers, each with a mean rating gap of 1.7 (importance minus satisfaction). These are two areas that merit a focus for improving Internet services to Garrett County farms. Gaps for other service aspects are also relatively large, and should not be ignored.



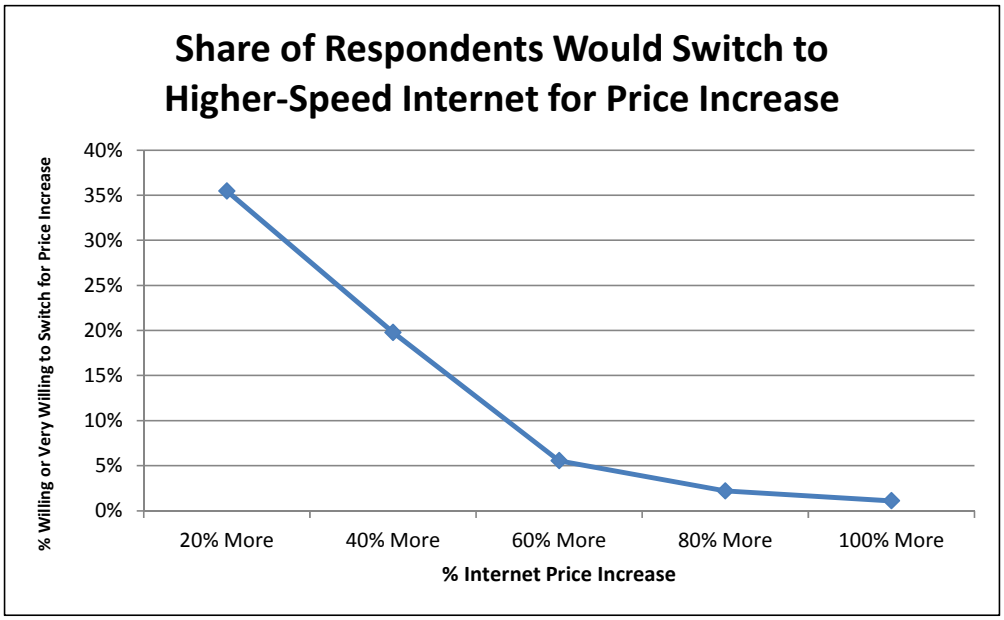
Farm respondents indicated that the Internet was moderately important for several aspects of their farming operations. The highest ranking aspects were improving operational efficiency and interacting with suppliers, although all aspects ranked within a fairly narrow range of importance to farmers.



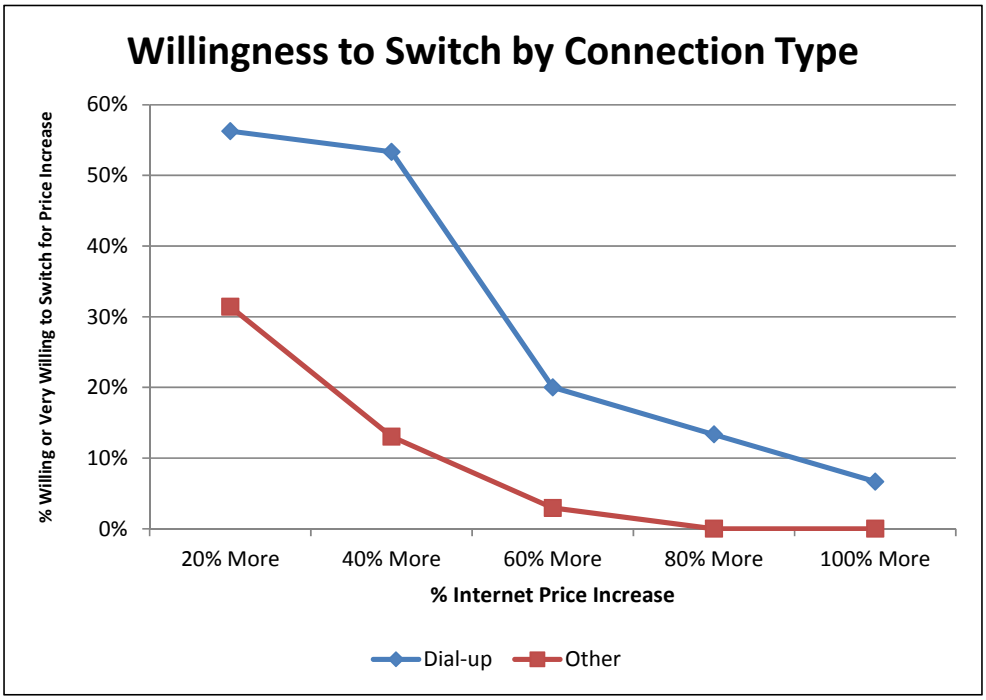
Farm respondents were also asked what Internet uses were the most important for their farm business operations. Checking weather forecasts, researching farm issues, and purchasing farm products ranked as the most important. As noted previously, these are also the most frequent uses of the Internet for farms. Therefore, there is no evidence of impedance of Internet activities by current Internet service aspects, although it is possible that farms could make greater use of these activities with higher-speed or more reliable Internet connections.



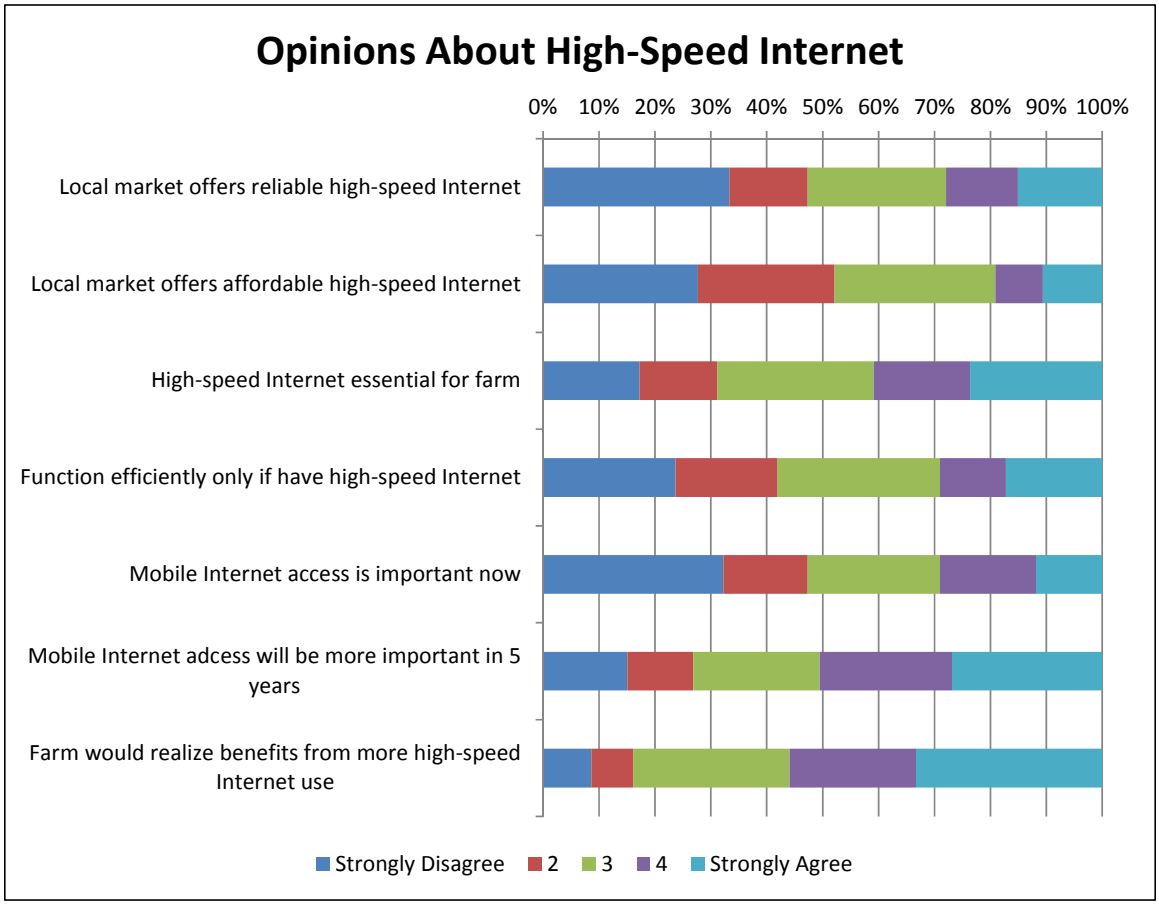
Respondents were asked about their willingness to pay a higher price for an Internet service that allowed their farm business to more quickly and efficiently perform the activities mentioned in the previous question (importance of Internet activities). More than one-third of respondents were willing to pay 20 percent more for better Internet service, and 20 percent of respondents were willing to pay 40 percent more better Internet. Only a small portion of respondents were willing to switch for better Internet service at price levels 60 percent or higher compared to their current price.



It should be noted that dial-up users are much more likely to switch than are users with other Internet connection types. Over one-half of dial-up users would switch to better Internet service for a price increase of up to 40 percent. This is likely influenced by lower satisfaction with speed and reliability, combined with the fact that dial-up users pay the lowest price and therefore the price increase would mean fewer dollars compared to respondents with other Internet connection types.



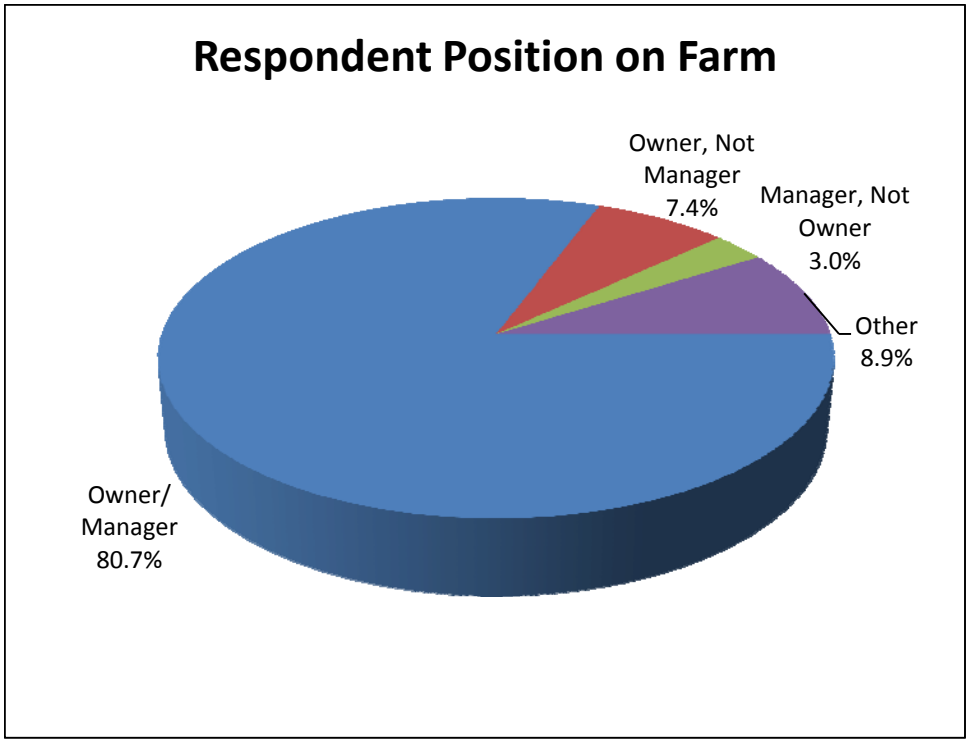
Respondents were asked their opinions about several statements regarding their Internet use, access, and benefits. The strongest agreement was that farms would realize benefits from more high-speed Internet use. The strongest disagreement was that the local market currently offers reliable high-speed Internet access.



5.3.3.3 Farm Business Information

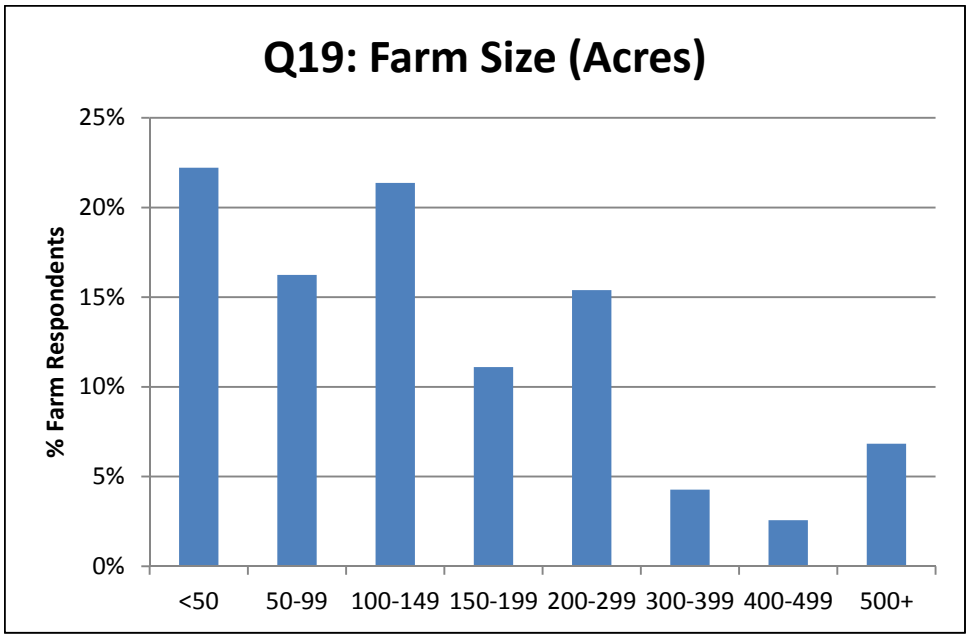
The farm survey also captured various pieces of information about the respondent and the farm to which the survey was sent. This information is used to characterize the farm community and to identify correlations between farm characteristics and other responses.

Over 80 percent of the survey respondents were the owners and managers of the farm business. Much smaller shares were owners or managers (but not both) or held some other position on the farm or farm-related business.

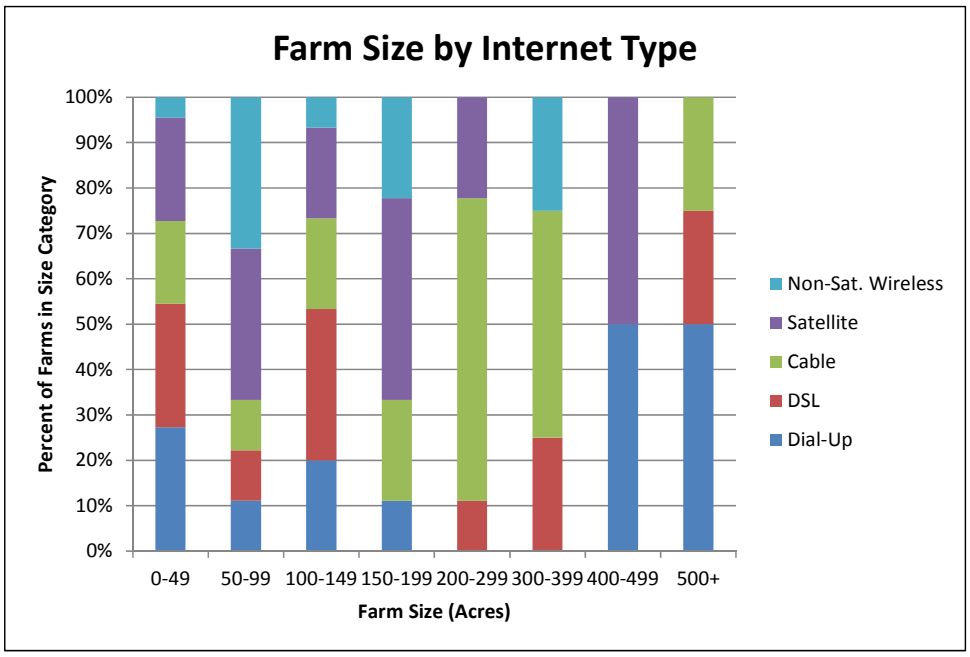


The average farm size of survey respondents was 155 acres. This is only slightly larger than the 141 acres reported in the 2007 Census of Agriculture conducted by the United States Department of Agriculture[82], and indicates that the survey respondents are relatively representative of all Garrett County farms, based on this metric. Approximately 38 percent of farms were less than 100 acres while 6.8 percent were 500 acres or larger.

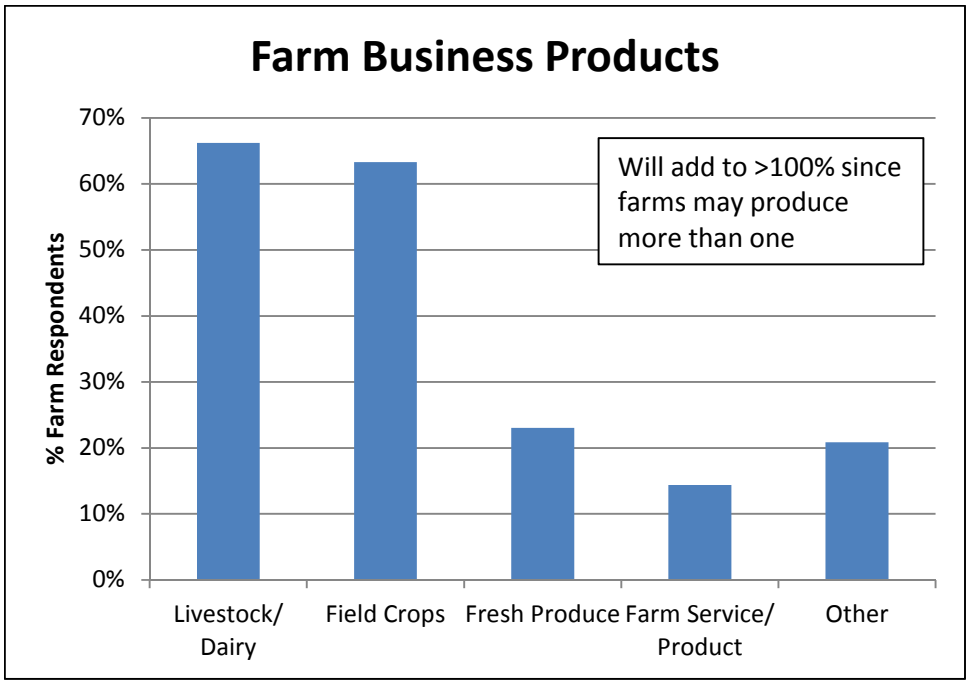
[82] www.agcensus.usda.gov



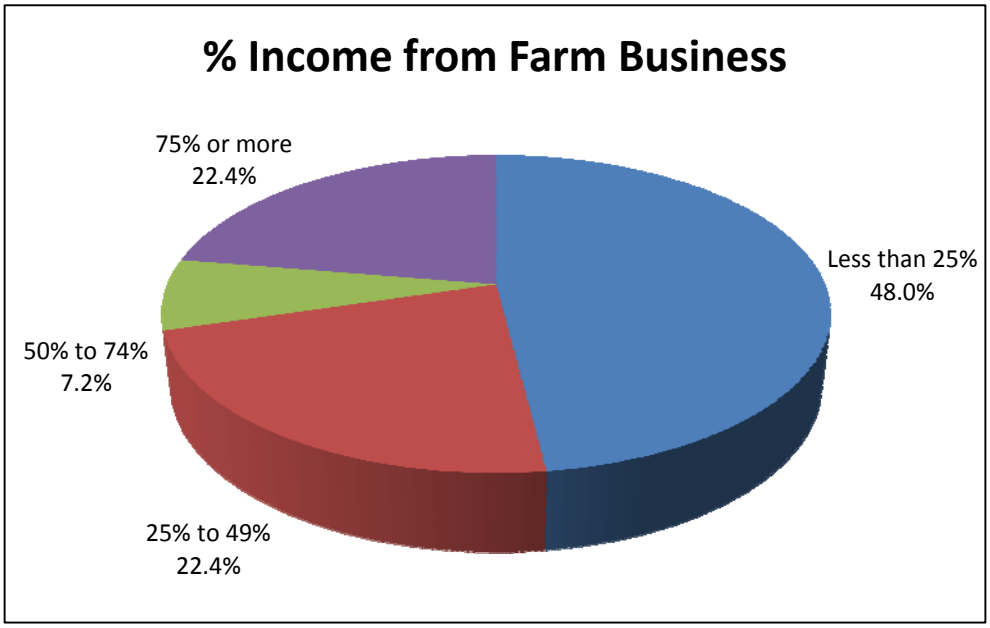
There are no clear correlations between the size of the farm and the Internet connection type. Thus, the connection type may be determined more by the location of the farm than the size and use of the Internet. It should be noted that results for each sub-segment are based on relatively few responses.



Approximately two-thirds of Garrett County farms have livestock and/or field crops. Smaller shares grow fresh produce or other farm products and services.



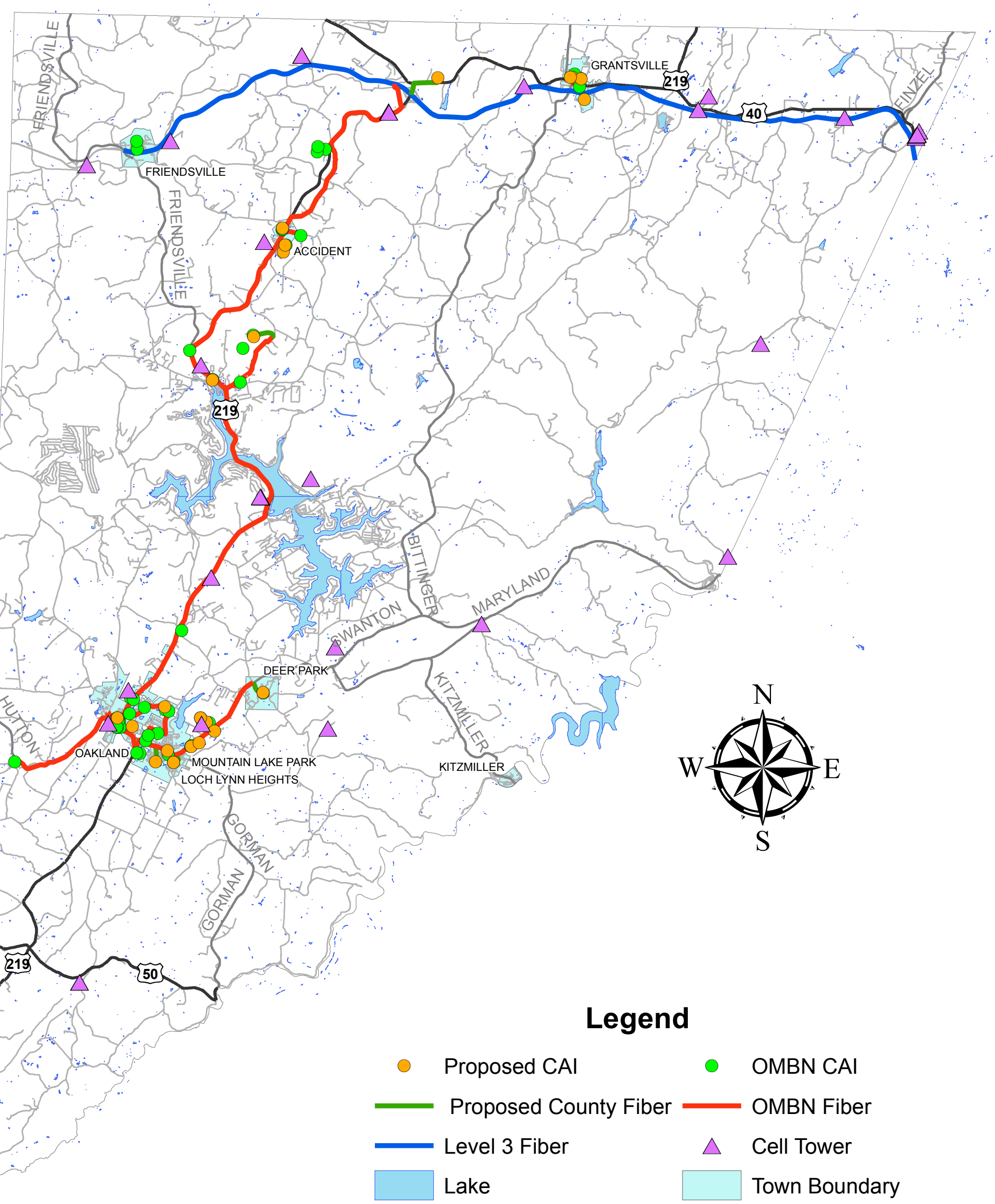
Nearly one-fourth of respondents derive most of their household income from farming operations, while nearly one-half derive less than 25 percent of their income from farming.



The vast majority of respondents have between one and four employees working on the farm, including the main operator. This reinforces the notion that the Garrett County farm sector is largely comprised of small to medium-sized family farms.

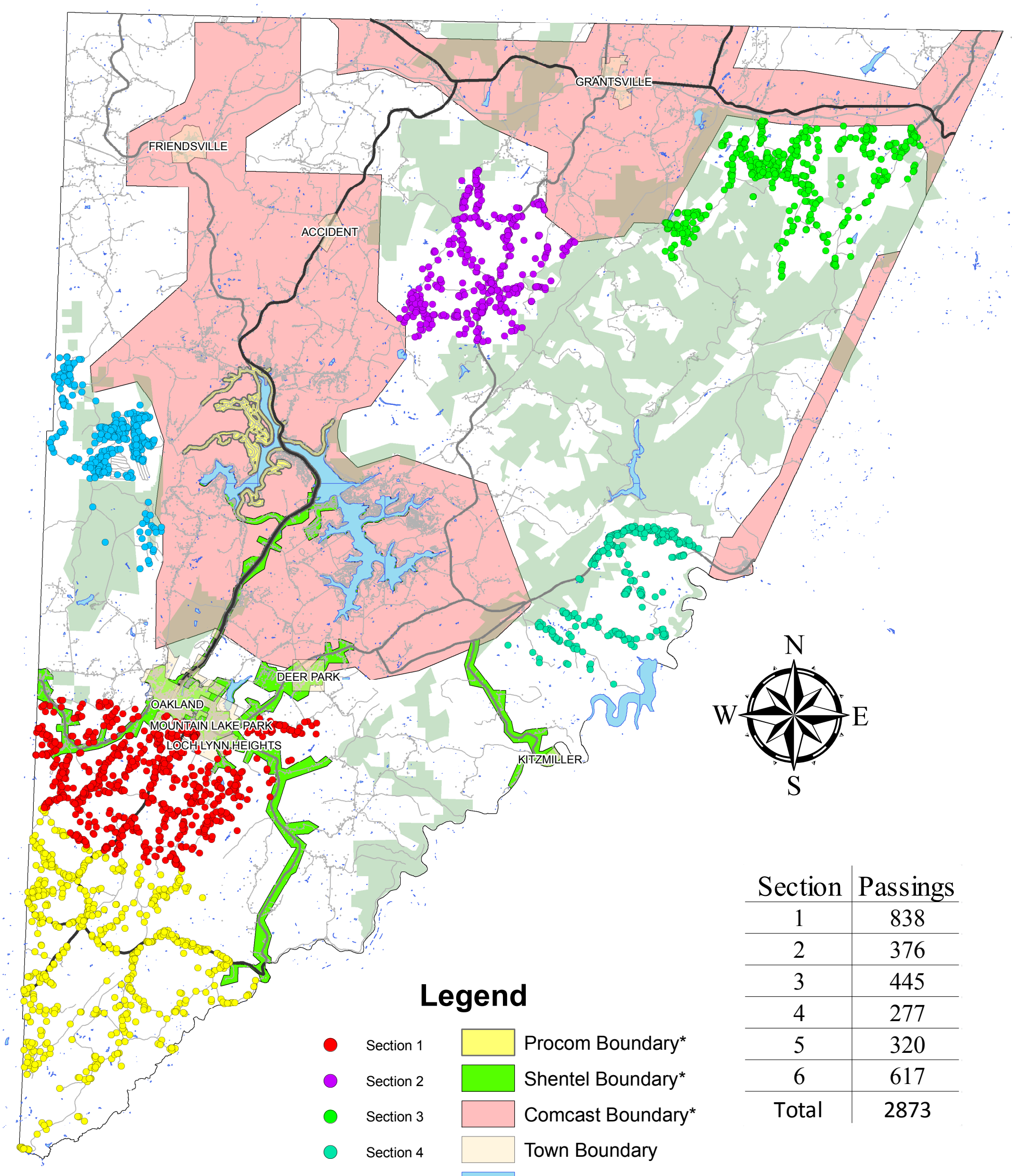
Appendix A: Existing and Proposed Broadband Infrastructure in Garrett County

Garrett County
Existing and Proposed
Fiber Infrastructure



Appendix B: Proposed TVWS Network Coverage Map

Garrett County
Wireless Network Coverage



Section	Passings
1	838
2	376
3	445
4	277
5	320
6	617
Total	2873

Legend

- Section 1
- Section 2
- Section 3
- Section 4
- Section 5
- Section 6
- Procom Boundary*
- Shentel Boundary*
- Comcast Boundary*
- Town Boundary
- Lake
- State-Owned Land

*Approximate service areas derived from company-provided cable routes and other data.

0 4.5 9 18 Miles

Appendix C: Financial Projections for Proposed TVWS Network

Scenario 1: County finances capital expense

Project Assumptions

Page Title Information

Organization	Garrett County Maryland
Plan Name	Financial Projections Wireless Internet Base Case Rev 5
Date	March 26, 2012

Financial Assumptions

Finance Requirements

	Year 1	2	3	4	5	
Loan	1,200,000	-	-	-	-	
Total	$ 1,200,000	$ -	$ -	$ -	$ -	$ 1,200,000

40 linked to b417 (monthly service fee)

Cash Start	$ -

	Year 1	2	3	4	5	6	7	8	9	10
Depreciation Operating Reserve	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

	Year 1	2	3	4	5	6	7	8	9	10
Capital Exp Funded by Depreciation Reserve	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Unrestricted Cash Balance	$ (11,000)	$ (537,174)	$ (788,136)	$ (1,039,096)	$ (1,290,054)	$ (1,152,441)	$ (1,035,996)	$ (940,646)	$ (845,296)	$ (749,946)
Depreciation Operating Reserve	$ -	$ -	$ -	$ -	$ -	$ (883,315)	$ (1,033,990)	$ (1,033,990)	$ (1,033,990)	$ (1,033,990)
Debt Service Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Cash Balance	$ (11,000)	$ (537,174)	$ (788,136)	$ (1,039,096)	$ (1,290,054)	$ (2,035,756)	$ (2,069,986)	$ (1,974,636)	$ (1,879,286)	$ (1,783,936)

Loan

	Year 1	2	3	4	5
Finance Rate	6.00%	7.50%	7.50%	7.50%	7.50%
Period (Years)	5	5	5	5	5
Principal Repayment Period Start	2	2	2	2	2
Defer Interest Payments? By year - year 1 loan	no	no	no	no	no
Defer Interest Payments? By year - year 2 loan	no	no	no	no	no
Defer Interest Payments? By year - year 3 loan	no	no	no	no	no
Bond/Loan Issuance Cost	0.00%	0.00%	0.00%	0.00%	0.00%
Debt Service Reserve	0.00%	0.00%	0.00%	0.00%	0.00%
Interest Reserve	no	no	no	no	no

Interest Reserve Year 1 Financing	$ -	$ -				
Interest Reserve Year 2 Financing		$ -	$ -			
Interest Reserve Year 3 Financing			$ -	$ -		
Interest Reserve Year 4 Financing				$ -	$ -	
Interest Reserve Year 5 Financing					$ -	$ -
Total	$ -	$ -	$ -	$ -	$ -	$ -

Interest Earned on Available Cash	0.00%

Customer Assumptions

Wireless Customers

Service	Year 1	2	3	4	5 plus
Residential	575	862	862	862	862
Commercial	-	-	-	-	-
Farms	-	-	-	-	-
Total	575	862	862	862	862

Market Size

	1	2	3	4	5
Beginning of Year	-	2,873	2,873	2,873	2,873
Area 1	838	-	-	-	-
Area 2	376	-	-	-	-
Area 3	445	-	-	-	-
Area 4	277	-	-	-	-
Area 5	320	-	-	-	-
Area 6	617	-	-	-	-
Total Residences	2,873	2,873	2,873	2,873	2,873
Total Commercial	-	-	-	-	-
Total Farms	-	-	-	-	-

By Area		Include in Year?
1	838	1
2	376	1
3	445	1
4	277	1
5	320	1
6	617	1

Market Share (end of year)	1	2	3	4	5 plus
Residential	20.00%	30.00%	30.00%	30.00%	30.00%
Commercial	0.00%	0.00%	0.00%	0.00%	0.00%
Farms	0.00%	0.00%	0.00%	0.00%	0.00%

Revenue Recognition

Residential	50.00%	75.00%	100.00%	100.00%	100.00%
Commercial	50.00%	75.00%	100.00%	100.00%	100.00%
Farms	50.00%	75.00%	100.00%	100.00%	100.00%

Calculation of Average Speed per Customer

Enter in speed (Mbps) of each service under year one	1	2	3	4	5 plus
Wireless - Residential	3.0	3.0	3.0	3.0	3.0
Wireless - Business	3.0	3.0	3.0	3.0	3.0
Wireless - Farm	3.0	3.0	3.0	3.0	3.0
Average Mbps	3.00	3.00	3.00	3.00	3.00
Total Mbps	1,725	2,586	2,586	2,586	2,586

Revenue Assumptions

Wireless Subscriber Fee (Monthly)

Service	Year 1	2	3	4	5 plus
Residential	40	40	40	40	40
Commercial	40	40	40	40	40
Farms	40	40	40	40	40

Operation & Maintenance Expense Assumptions

Annual Operating Expense

Education and Training	0.00%	percent of total labor expense
Allowance for Bad Debts	1.00%	percentage of non-institutional revenues

	Year 1	Year 2	Year 3	Year 4	Year 5+	
Internet Connection Fee	$ 31,000	$ 47,000	$ 47,000	$ 47,000	$ 47,000	
	$ 15.00					per Mbps per month
	10					oversubscription ratio

Attachment Fees	0	attachments at	$ -	per year	- attachments
					100.00% owned by other

	Year 1	Year 2	Year 3	Year 4	Year 5+	
Insurance (incremental)	$ -	$ -	$ -	$ -	$ -	annual
Sales & Marketing	$ -	$ -	$ -	$ -	$ -	annual
TBD	$ -	$ -	$ -	$ -	$ -	annual
Site Rental & Power						
Rental cost per site (monthly)	$ -	$ -	$ -	$ -	$ -	per month
Total Sites	9	9	9	9	9	
Total Site Rental (Annual)	$ -	$ -	$ -	$ -	$ -	annual
Power cost per site (monthy	$ 50	$ 50	$ 50	$ 50	$ 50	per month
Power Cost	$ 5,400	$ 5,400	$ 5,400	$ 5,400	$ 5,400	annual
Transportation (Annual Maintanance)	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	annual
Billing Software	$ 300	$ 300	$ 300	$ 300	$ 300	per month

Wireless Labor

Salary Escalations	0.00%	
Overhead	0.00%	of base salary

Incremental Employees	Year 1	Year 2	Year 3+	Labor Cost		
Business Manager	0.25	0.25	0.25	90,000		
Sales Manager/Finance Manager	0.25	0.25	0.25	90,000		
Internet Technician/Engineer	0.25	0.25	0.25	90,000		
CSR	1.50	1.50	1.50	50,000	Customers per Employee	Number of Shifts
Customer Service Representative/Help Desk	-	-	-	-	2500	0
Service Technicians/Installers	-	-	-	-	2500	0
Sales and Marketing Representative	-	-	-	-		10
						CSR's per sales person
Installer	2.00	1.00	1.00	50,000		
TBD	-	-	-	-		
Total Wireless Staff	4	3	3			
Overtime	50,000	50,000	50,000			
On-Call						

	Daily Rate	Quanity	
Weekdays	$ 30.00	249	$ 7,470
Weekend Days	$ 60.00	104	$ 6,240
Holidays	$ 100.00	12	$ 1,200

Capital Requirement Assumptions

Implementation Costs

Deployment by Area (5 year depreciation)

	1	2	3	4	5		Include in Year?	
Area One	$ 131,330	$ -	$ -	$ -	$ -		1	$ 131,330
Area Two	95,680	-	-	-	-		1	$ 95,680
Area Three	95,680	-	-	-	-		1	$ 95,680
Area Four	88,665	-	-	-	-		1	$ 88,665
Area Five	88,665	-	-	-	-		1	$ 88,665
Area Six	81,420	-	-	-	-		1	$ 81,420
Total	$ 581,440	$ -	$ -	$ -	$ -	100%	after 5 years	

Deployment by Area (7 year depreciation)

Area One	$ -	$ -	$ -	$ -	$ -		1	$ -
Area Two	-	-	-	-	-		1	$ -
Area Three	-	-	-	-	-		1	$ -
Area Four	-	-	-	-	-		1	$ -
Area Five	-	-	-	-	-		1	$ -
Area Six	-	-	-	-	-		1	$ -
Total	$ -	$ -	$ -	$ -	$ -	100%	after 7 years	

Deployment by Area (10 year depreciation)

Area One	$ -	$ -	$ -	$ -	$ -		1	$ -
Area Two	-	-	-	-	-		1	$ -
Area Three	-	-	-	-	-		1	$ -
Area Four	-	-	-	-	-		1	$ -
Area Five	-	-	-	-	-		1	$ -
Area Six	-	-	-	-	-		1	$ -
Total	$ -	$ -	$ -	$ -	$ -			

Wireless Customer Connection Costs

CPE & Installation Support

		Percent	Replacement		CPE	Installation
Indoor	600	0.00%			600	0
Outdoor	700	100.00%			600	100
Blended	700		75%	5 year depreciation		

Incremental by Year

	1	2	3	4	5
Residential	575	287	-	-	-
Commercial	-	-	-	-	-
Farms	-	-	-	-	-

Connection fee charge to wireless customer	14.00%	of CPE cost	98		14
Additions (starting in year 4)	$ -	per year			

1. Base Case

30 percent take rate, $40 per month service 20/30

	Year 1	2	3	4	5
Net Income	$ (423,848)	$ (287,932)	$ (197,161)	$ (179,713)	$ (161,220)
Net Cash from Operations	$ (11,000)	$ (526,174)	$ (250,962)	$ (250,960)	$ (250,958)
Year End Cash Balance	$ (11,000)	$ (537,174)	$ (788,136)	$ (1,039,096)	$ (1,290,054)

2. Take Rate Sensitivity from Base Case

20 percent take rate, $40 per month service 15/20

	Year 1	2	3	4	5
Net Income	$ (444,360)	$ (348,086)	$ (277,741)	$ (260,293)	$ (241,800)
Net Cash from Operations	$ 49,128	$ (526,408)	$ (371,722)	$ (371,720)	$ (371,718)
Year End Cash Balance	$ 49,128	$ (477,280)	$ (849,002)	$ (1,220,722)	$ (1,592,440)

3. Take Rate Sensitivity from Base Case

25 percent take rate, $40 per month service 20/25

	Year 1	2	3	4	5
Net Income	$ (423,848)	$ (325,724)	$ (237,121)	$ (219,673)	$ (201,180)
Net Cash from Operations	$ (11,000)	$ (483,326)	$ (311,082)	$ (311,080)	$ (311,078)
Year End Cash Balance	$ (11,000)	$ (494,326)	$ (805,408)	$ (1,116,488)	$ (1,427,566)

4. Take Rate Sensitivity from Base Case

35 percent take rate, $40 per month service 25/35

	Year 1	2	3	4	5
Net Income	$ (404,534)	$ (264,154)	$ (156,201)	$ (138,753)	$ (120,260)
Net Cash from Operations	$ (71,766)	$ (482,936)	$ (189,842)	$ (189,840)	$ (189,838)
Year End Cash Balance	$ (71,766)	$ (554,702)	$ (744,544)	$ (934,384)	$ (1,124,222)

5. Take Rate Sensitivity from Base Case

40 percent take rate, $40 per month service 30/40

	Year 1	2	3	4	5
Net Income	$ (384,022)	$ (240,792)	$ (116,581)	$ (99,133)	$ (80,640)
Net Cash from Operations	$ (131,894)	$ (438,854)	$ (130,202)	$ (130,200)	$ (130,198)
Year End Cash Balance	$ (131,894)	$ (570,748)	$ (700,950)	$ (831,150)	$ (961,348)

6. Take Rate Sensitivity from Base Case

45 percent take rate, $40 per month service 35/45

	Year 1	2	3	4	5
Net Income	$ (362,510)	$ (218,112)	$ (75,621)	$ (58,173)	$ (39,680)
Net Cash from Operations	$ (191,022)	$ (396,014)	$ (69,082)	$ (69,080)	$ (69,078)
Year End Cash Balance	$ (191,022)	$ (587,036)	$ (656,118)	$ (725,198)	$ (794,276)

7. Price Sensitivity from Base Case

30 percent take rate, what per month service fee required to cash flow?

Service Fee $ 75 per Month

	Year 1	2	3	4	5
Net Income	$ (305,098)	$ (19,402)	$ 160,879	$ 178,327	$ 196,820
Net Cash from Operations	$ 107,750	$ (257,644)	$ 107,078	$ 107,080	$ 107,082
Year End Cash Balance	$ 107,750	$ (149,894)	$ (42,816)	$ 64,264	$ 171,346

8. Wireless Life Sensitivity from Base Case (5 Years all vs, 5 Years CPE and 7 Year Infrastructure)

30 percent take rate, $40 per month service

change to 7 year loan

	Year 1	2	3	4	5	6	7
Net Income	$ (390,623)	$ (254,707)	$ (170,073)	$ (159,129)	$ (147,532)	$ (72,850)	$ (70,941)
Net Cash from Operations	$ (11,000)	$ (423,899)	$ (148,687)	$ (148,685)	$ (148,685)	$ (408,297)	$ (278,266)
Year End Cash Balance	$ (11,000)	$ (434,899)	$ (583,586)	$ (732,271)	$ (880,956)	$ (1,289,253)	$ (1,567,519)

9. Wireless Life and Price Sensitivity from Base Case (5 Years all vs, 5 Years CPE and 7 Year Infrastructure)

30 percent take rate, what per month service fee required to cash flow?

Service Fee $ 65 per Month

change to 7 year loan

	Year 1	2	3	4	5	6	7
Net Income	$ (305,373)	$ (62,757)	$ 85,527	$ 96,471	$ 108,068	$ 182,750	$ 184,659
Net Cash from Operations	$ 74,250	$ (231,949)	$ 106,913	$ 106,915	$ 106,915	$ (152,697)	$ (22,666)
Year End Cash Balance	$ 74,250	$ (157,699)	$ (50,786)	$ 56,129	$ 163,044	$ 10,347	$ (12,319)

10. CPE Cost Sensitivity from Base Case

30 percent take rate with CPE cost reduced 50 percent ($600 to $300)

CPE payment to 25% (From 14%)

	Year 1	2	3	4	5
Net Income	$ (388,198)	$ (235,638)	$ (145,441)	$ (127,993)	$ (109,500)
Net Cash from Operations	$ 162,650	$ (439,500)	$ (250,962)	$ (250,960)	$ (250,958)
Year End Cash Balance	$ 162,650	$ (276,850)	$ (527,812)	$ (778,772)	$ (1,029,730)

11. CPE Cost and Service Fee Sensitivity from Base Case

30 percent take rate, what per month service fee required to cash flow? CPE Cost reduced 50 percent ($600 to $300)

Service Fee $ 65 per Month

	Year 1	2	3	4	5
Net Income	$ (302,948)	$ (43,688)	$ 110,159	$ 127,607	$ 146,100
Net Cash from Operations	$ 247,900	$ (247,550)	$ 4,638	$ 4,640	$ 4,642
Year End Cash Balance	$ 247,900	$ 350	$ 4,988	$ 9,628	$ 14,270

12. CPE Cost and Service Fee Sensitivity from Base Case

40 percent take rate, what per month service fee required to cash flow? CPE Cost reduced 50 percent ($600 to $300) 30/40

Service Fee $ 52 per Month

	Year 1	2	3	4	5
Net Income	$ (269,514)	$ (48,186)	$ 116,815	$ 134,263	$ 152,756
Net Cash from Operations	$ 189,494	$ (229,088)	$ 34,254	$ 34,256	$ 34,258
Year End Cash Balance	$ 189,494	$ (39,594)	$ (5,340)	$ 28,916	$ 63,174

Garrett County Maryland
Financial Projections Wireless Internet Base Case Rev 5
March 26, 2012

Income Statement

	Year	1	2	3	4	5
a. Revenues						
Wireless		138,000	310,320	413,760	413,760	413,760
Wireless Connection Fees (non-recuring)		56,350	28,126	-	-	-
	Total	$ 194,350	$ 338,446	$ 413,760	$ 413,760	$ 413,760
b. Operating Expenses - Cash (not including taxes in line h)						
Operating Expenses		42,000	60,000	61,000	61,000	61,000
Salaries		307,410	257,410	257,410	257,410	257,410
	Total	$ 349,410	$ 317,410	$ 318,412	$ 318,410	$ 318,410
c. Revenues less Cash Operating Expenses (a-b)		$ (155,060)	$ 21,036	$ 95,348	$ 95,350	$ 95,350
d. Operating Expenses - Non-Cash						
Depreciation		$ 196,788	$ 236,968	$ 236,968	$ 236,968	$ 236,968
e. Operating Income (d-c)		$ (351,848)	$ (215,932)	$ (141,620)	$ (141,618)	$ (141,618)
f. Non-Operating Income						
Interest Income		$ -	$ -	$ -	$ -	$ -
Investment Income		-	-	-	-	-
Interest Expense (Loan)		(72,000)	(72,000)	(55,541)	(38,095)	(19,602)
	Total	$ (72,000)	$ (72,000)	$ (55,541)	$ (38,095)	$ (19,602)
g. Net Income		$ (423,848)	$ (287,932)	$ (197,161)	$ (179,713)	$ (161,220)
h. Taxes (non-member services and dark fiber)		$ -	$ -	$ -	$ -	$ -
i. Net Income After Fees & In Lieu Taxes		$ (423,848)	$ (287,932)	$ (197,161)	$ (179,713)	$ (161,220)

Garrett County Maryland
Financial Projections Wireless Internet Base Case Rev 5
March 26, 2012

Cash Flow Statement

	Year	1	2	3	4	5
a. Net Income (From Income Statement)		$ (423,848)	$ (287,932)	$ (197,161)	$ (179,713)	$ (161,220)
b. Cash Outflows						
Debt Service Reserve		$ -	$ -	$ -	$ -	$ -
Interest Reserve		-	-	-	-	-
Depreciation Operating Reserve		-	-	-	-	-
Financing		-	-	-	-	-
Capital Expenditures		(983,940)	(200,900)	-	-	-
	Total	$ (983,940)	$ (200,900)	$ -	$ -	$ -
c. Cash Inflows						
Interest Reserve		$ -	$ -	$ -	$ -	$ -
Depreciation Operating Reserve		-	-	-	-	-
Debt Service Reserve		-	-	-	-	-
Cash Start		-	-	-	-	-
Loan		1,200,000	-	-	-	-
	Total	$ 1,200,000	$ -	$ -	$ -	$ -
d. Total Cash Outflows and Inflows (b+c)		$ 216,060	$ (200,900)	$ -	$ -	$ -
e. Non-Cash Expenses - Depreciation		$ 196,788	$ 236,968	$ 236,968	$ 236,968	$ 236,968
f. Adjustments						
Proceeds from Additional Cash Flows		$ (1,200,000)	$ -	$ -	$ -	$ -
	Total	$ (1,200,000)	$ -	$ -	$ -	$ -
g. Adjusted Available Net Revenue		$ (1,211,000)	$ (251,864)	$ 39,807	$ 57,255	$ 75,748
h. Principal Payments on Debt						
Loan Principal		$ -	$ 274,310	$ 290,769	$ 308,215	$ 326,706
	Total	$ -	$ 274,310	$ 290,769	$ 308,215	$ 326,706
i. Net Cash		$ (11,000)	$ (526,174)	$ (250,962)	$ (250,960)	$ (250,958)
Cash Balance						
Unrestricted Cash Balance		$ (11,000)	$ (537,174)	$ (788,136)	$ (1,039,096)	$ (1,290,054)
Depreciation Operating Reserve		-	-	-	-	-
Debt Service Reserve		-	-	-	-	-
	Total Cash Balance	$ (11,000)	$ (537,174)	$ (788,136)	$ (1,039,096)	$ (1,290,054)
Debt Service Balance		$ 1,200,000	$ 925,690	$ 634,921	$ 326,706	$ -

Garrett County Maryland
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Capital Additions

	Year	1	2	3	4	5
Wireless Network Cost						
Site Deployment (5 year depreciation)		$ 581,440	$ -	$ -	$ -	$ -
Site Deployment (7 year depreciation)		-	-	-	-	-
Site Deployment (10 year depreciation)		-	-	-	-	-
	Total	$ 581,440	$ -	$ -	$ -	$ -
Wireless Customer Connection Cost (5 year depreciation)						
CPE		$ 402,500	$ 200,900	$ -	$ -	$ -
	Total	$ 402,500	$ 200,900	$ -	$ -	$ -
	Total Capital	$ 983,940	$ 200,900	$ -	$ -	$ -

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Depreciation

	Year	1	2	3	4	5
20 Year Capital Expenditures		$ -	$ -	$ -	$ -	$ -
10 Year Capital Expenditures		-	-	-	-	-
7 Year Capital Expenditures		-	-	-	-	-
5 Year Capital Expenditures		983,940	200,900	-	-	-
	Total	$ 983,940	$ 200,900	$ -	$ -	$ -

	Year	1	2	3	4	5
Depreciation Total		$ 196,788	$ 236,968	$ 236,968	$ 236,968	$ 236,968

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Principal and Interest Payments (Year 1 Financing)

	Payment Year	1	2	3	4	5
Loan						
	Principal	$ -	$ 274,310	$ 290,769	$ 308,215	$ 326,706
	Interest Paid	72,000	72,000	55,541	38,095	19,602
	Total	$ 72,000	$ 346,310	$ 346,310	$ 346,310	$ 346,308
	Interest Deferred	$ -	$ -	$ -	$ -	$ -
	Payment	$ 346,310	$ 346,310	$ 346,310	$ 346,310	$ 346,310
	Loan Amount/Balance (beginning of year)	$ 1,200,000	1,200,000	925,690	634,921	326,706
	Loan Amount/Balance (end of year)	$ 1,200,000	925,690	634,921	326,706	-
	Payment Start	2				
	Term (years)	5				
	Interest	6.00%				
	Defer Interest Payments?	no	no	no	no	no

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Expenses

Year	1	2	3	4	5
Operating Expenses					
Attachment Fees	$ -	$ -	$ -	$ -	$ -
Education and Training	-	-	-	-	-
Allowance for Bad Debts	1,000	3,000	4,000	4,000	4,000
Internet Connection Fee	31,000	47,000	47,000	47,000	47,000
Insurance (incremental)	-	-	-	-	-
Sales & Marketing	-	-	-	-	-
TBD	-	-	-	-	-
Total Site Rental (Annual)	-	-	-	-	-
Power Cost	5,400	5,400	5,400	5,400	5,400
Transportation (Annual Maintanance)	1,000	1,000	1,000	1,000	1,000
Billing Software	3,600	3,600	3,600	3,600	3,600
Total	42,000	60,000	61,000	61,000	61,000
Wireless Labor					
Business Manager	$ 22,500	$ 22,500	$ 22,500	$ 22,500	$ 22,500
Sales Manager/Finance Manager	22,500	22,500	22,500	22,500	22,500
Internet Technician/Engineer	22,500	22,500	22,500	22,500	22,500
CSR	75,000	75,000	75,000	75,000	75,000
Installer	100,000	50,000	50,000	50,000	50,000
On-call	14,910	14,910	14,910	14,910	14,910
Overtime	50,000	50,000	50,000	50,000	50,000
Total Wireless Staff	$ 307,410	$ 257,410	$ 257,410	$ 257,410	$ 257,410
Labor Multiplier	1.00	1.00	1.00	1.00	1.00

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Revenues

	Year	1	2	3	4	5
Wireless						
	Residential	$ 138,000	$ 310,320	$ 413,760	$ 413,760	$ 413,760
	Commercial	-	-	-	-	-
	Farms	-	-	-	-	-
	Total	$ 138,000	$ 310,320	$ 413,760	$ 413,760	$ 413,760
	Total	$ 138,000	$ 310,320	$ 413,760	$ 413,760	$ 413,760

Scenario 2: County funds capital expense

Project Assumptions

Page Title Information

Organization	Garrett County Maryland
Plan Name	Financial Projections Wireless Internet Base Case Rev 5 - Cash Financing
Date	April 22, 2012

Financial Assumptions

Finance Requirements

	Year 1	2	3	4	5						
Loan	-	-	-	-	-					40	linked to b417 (monthly service fee)
Total	$ -	$ -	$ -	$ -	$ -	$ -					

Cash Start	$ 1,200,000

	Year 1	2	3	4	5	6	7	8	9	10
Depreciation Operating Reserve	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%	0.00%

	Year 1	2	3	4	5	6	7	8	9	10
Capital Exp Funded by Depreciation Reserve	0.00%	0.00%	0.00%	0.00%	100.00%	100.00%	100.00%	100.00%	100.00%	100.00%
Unrestricted Cash Balance	$ 61,000	$ (118,864)	$ (23,516)	$ 71,834	$ 167,184	$ 304,797	$ 421,242	$ 516,592	$ 611,942	$ 707,292
Depreciation Operating Reserve	$ -	$ -	$ -	$ -	$ -	$ (883,315)	$ (1,033,990)	$ (1,033,990)	$ (1,033,990)	$ (1,033,990)
Debt Service Reserve	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Cash Balance	$ 61,000	$ (118,864)	$ (23,516)	$ 71,834	$ 167,184	$ (578,518)	$ (612,748)	$ (517,398)	$ (422,048)	$ (326,698)

Loan

	Year 1	2	3	4	5
Finance Rate	6.00%	7.50%	7.50%	7.50%	7.50%
Period (Years)	5	5	5	5	5
Principal Repayment Period Start	2	2	2	2	2
Defer Interest Payments? By year - year 1 loan	no	no	no	no	no
Defer Interest Payments? By year - year 2 loan	no	no	no	no	no
Defer Interest Payments? By year - year 3 loan	no	no	no	no	no
Bond/Loan Issuance Cost	0.00%	0.00%	0.00%	0.00%	0.00%
Debt Service Reserve	0.00%	0.00%	0.00%	0.00%	0.00%
Interest Reserve	no	no	no	no	no
Interest Reserve Year 1 Financing	$ -	$ -			
Interest Reserve Year 2 Financing		$ -	$ -		
Interest Reserve Year 3 Financing			$ -	$ -	
Interest Reserve Year 4 Financing				$ -	$ -
Interest Reserve Year 5 Financing					$ -
Total	$ -	$ -	$ -	$ -	$ -

Interest Earned on Available Cash	0.00%

Customer Assumptions

Wireless Customers

		Year				
Service		1	2	3	4	5 plus
Residential		575	862	862	862	862
Commercial		-	-	-	-	-
Farms		-	-	-	-	-
	Total	575	862	862	862	862

Market Size

	1	2	3	4	5	By Area		Include in Year?
Beginning of Year	-	2,873	2,873	2,873	2,873			
Area 1	838	-	-	-	-	1	838	1
Area 2	376	-	-	-	-	2	376	1
Area 3	445	-	-	-	-	3	445	1
Area 4	277	-	-	-	-	4	277	1
Area 5	320	-	-	-	-	5	320	1
Area 6	617	-	-	-	-	6	617	1
Total Residences	2,873	2,873	2,873	2,873	2,873			
Total Commercial	-	-	-	-	-			
Total Farms	-	-	-	-	-			

Market Share (end of year)	1	2	3	4	5 plus	20/30	base
Residential	20.00%	30.00%	30.00%	30.00%	30.00%		
Commercial	0.00%	0.00%	0.00%	0.00%	0.00%		
Farms	0.00%	0.00%	0.00%	0.00%	0.00%		

Revenue Recognition

Residential	50.00%	75.00%	100.00%	100.00%	100.00%
Commercial	50.00%	75.00%	100.00%	100.00%	100.00%
Farms	50.00%	75.00%	100.00%	100.00%	100.00%

Calculation of Average Speed per Customer

Enter in speed (Mbps) of each service under year one	1	2	3	4	5 plus
Wireless - Residential	3.0	3.0	3.0	3.0	3.0
Wireless - Business	3.0	3.0	3.0	3.0	3.0
Wireless - Farm	3.0	3.0	3.0	3.0	3.0
Average Mbps	3.00	3.00	3.00	3.00	3.00
Total Mbps	1,725	2,586	2,586	2,586	2,586

Revenue Assumptions

Wireless Subscriber Fee (Monthly)

	Year				
Service	1	2	3	4	5 plus
Residential	40	40	40	40	40
Commercial	40	40	40	40	40
Farms	40	40	40	40	40

Operation & Maintenance Expense Assumptions

Annual Operating Expense

Education and Training	0.00%	percent of total labor expense
Allowance for Bad Debts	1.00%	percentage of non-institutional revenues

	Year 1	Year 2	Year 3	Year 4	Year 5+	
Internet Connection Fee	$ 31,000	$ 47,000	$ 47,000	$ 47,000	$ 47,000	
	$ 15.00					per Mbps per month
	10					oversubscription ratio

Attachment Fees	0	attachments at	$ -	per year	- attachments
					100.00% owned by other

	Year 1	Year 2	Year 3	Year 4	Year 5+	
Insurance (incremental)	$ -	$ -	$ -	$ -	$ -	annual
Sales & Marketing	$ -	$ -	$ -	$ -	$ -	annual
TBD	$ -	$ -	$ -	$ -	$ -	annual
Site Rental & Power						
Rental cost per site (monthly)	$ -	$ -	$ -	$ -	$ -	per month
Total Sites	9	9	9	9	9	
Total Site Rental (Annual)	$ -	$ -	$ -	$ -	$ -	annual
Power cost per site (monthy	$ 50	$ 50	$ 50	$ 50	$ 50	per month
Power Cost	$ 5,400	$ 5,400	$ 5,400	$ 5,400	$ 5,400	annual
Transportation (Annual Maintanance)	$ 1,000	$ 1,000	$ 1,000	$ 1,000	$ 1,000	annual
Billing Software	$ 300	$ 300	$ 300	$ 300	$ 300	per month

Wireless Labor

Salary Escalations	0.00%	
Overhead	0.00%	of base salary

Incremental Employees	Year 1	Year 2	Year 3+	Labor Cost	Customers per Employee	Number of Shifts
Business Manager	0.25	0.25	0.25	90,000		
Sales Manager/Finance Manager	0.25	0.25	0.25	90,000		
Internet Technician/Engineer	0.25	0.25	0.25	90,000		
CSR	1.50	1.50	1.50	50,000		
Customer Service Representative/Help Desk	-	-	-	-	2500	0
Service Technicians/Installers	-	-	-	-	2500	0
Sales and Marketing Representative	-	-	-	-		10
						CSR's per sales person
Installer	2.00	1.00	1.00	50,000		
TBD	-	-	-	-		
Total Wireless Staff	4	3	3			
Overtime	50,000	50,000	50,000			
On-Call						

	Daily Rate	Quanity	
Weekdays	$ 30.00	249	$ 7,470
Weekend Days	$ 60.00	104	$ 6,240
Holidays	$ 100.00	12	$ 1,200

Capital Requirement Assumptions

Implementation Costs

Deployment by Area (5 year depreciation)

	1	2	3	4	5		Include in Year?	
Area One	$ 131,330	$ -	$ -	$ -	$ -		1	$ 131,330
Area Two	95,680	-	-	-	-		1	$ 95,680
Area Three	95,680	-	-	-	-		1	$ 95,680
Area Four	88,665	-	-	-	-		1	$ 88,665
Area Five	88,665	-	-	-	-		1	$ 88,665
Area Six	81,420	-	-	-	-		1	$ 81,420
Total	$ 581,440	$ -	$ -	$ -	$ -	100%	after 5 years	

Deployment by Area (7 year depreciation)

Area One	$ -	$ -	$ -	$ -	$ -	1	$ -
Area Two	-	-	-	-	-	1	$ -
Area Three	-	-	-	-	-	1	$ -
Area Four	-	-	-	-	-	1	$ -
Area Five	-	-	-	-	-	1	$ -
Area Six	-	-	-	-	-	1	$ -
Total	$ -	$ -	$ -	$ -	$ -	100% after 7 years	

Deployment by Area (10 year depreciation)

Area One	$ -	$ -	$ -	$ -	$ -	1	$ -
Area Two	-	-	-	-	-	1	$ -
Area Three	-	-	-	-	-	1	$ -
Area Four	-	-	-	-	-	1	$ -
Area Five	-	-	-	-	-	1	$ -
Area Six	-	-	-	-	-	1	$ -
Total	$ -	$ -	$ -	$ -	$ -		

Wireless Customer Connection Costs

CPE & Installation Support

		Percent	Replacement		CPE	Installation
Indoor	600	0.00%			600	0
Outdoor	700	100.00%			600	100
Blended	700		75%	5 year depreciation		

Incremental by Year

	1	2	3	4	5
Residential	575	287	-	-	-
Commercial	-	-	-	-	-
Farms	-	-	-	-	-

Connection fee charge to wireless customer	14.00%	of CPE cost	98		14	14
Additions (starting in year 4)	$ -	per year				