Community Broadband Access Framework

Increasing Economic Development Through Improved Broadband Access in Hillsdale, Jackson, Lenawee, Livingston, Monroe, and Washtenaw counties

Funded by:

greater ann arbor
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STUDENT LIFE
GINSBERG CENTER

POVERTY SOLUTIONS
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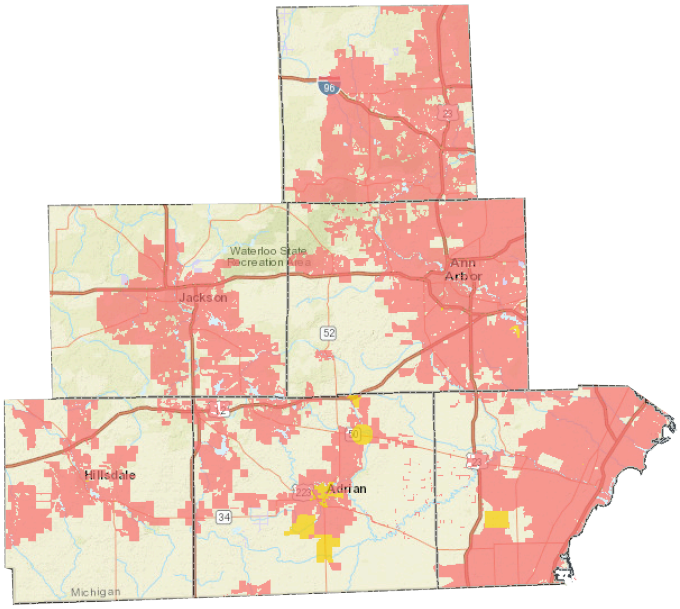
Introduction

Broadband is no longer a luxury in our society. Robust internet connectivity has become essential for information access and communication, not only where we work and learn, but also where we live. Access to broadband is not just about access to entertainment services – on the contrary, it has become the primary way we communicate with family and friends, consume and participate in educational resources, access medical and government services, and engage in commerce. Ubiquitous broadband access is foundational for the overall prosperity of any region. Residents with access to broadband can participate in online adult education and training, leverage online resources for job seeking, take jobs that require working from home, and engage in entrepreneurial activities.

Many residents in Michigan, and in Prosperity Region 9 specifically, are severely limited in these aspects of life due to a lack of adequate broadband service. This creates a serious equity disparity between areas with broadband and those without. This framework provides a toolset for municipalities to build an actionable broadband access plan.



Broadband Coverage in Prosperity Region 9 in red

Part One: Community Assessment

As shown on the above map, Region 9 has significant challenges when it comes to broadband coverage – only the areas shaded red have access to broadband as defined by the FCC as 25Mb download and 3Mb upload. But the conversation around broadband is much less quantitative – arguments are often made regarding the adequacy of internet access technologies that are slower, have data caps, or both. The best metric by which to gauge the need for community action is quantifying the qualitative opinions of area residents and their satisfaction or lack thereof with currently available internet services. Part one of this framework is a regional study to discover and document this community sentiment through surveying, with an extensible methodology that can be applied with greater granularity as needed. The Ginsberg Center at the University of Michigan led a comprehensive study for the region with a repeatable methodology. Both the methodology and outcomes of this study are included in this framework document, as well as examples of surveys completed independently by other communities in Region 9.

Part Two: Educational Equity Assessment

As the previous map shows, Region 9 has significant inequity when it comes to broadband coverage – only the areas shaded red have access to broadband as defined by the FCC as 25Mb download and 3Mb upload.

Talk to any parents and school administrators and you will find out that as early as Kindergarten, both public and private school students are routinely provided iPads, Chromebooks, or some other type of personal digital device for classroom instruction. The interviews conducted as a part of this framework begin to quantify the impact of home broadband access on educational outcomes for students, specifically whether students who live in areas without reliable broadband access are at a disadvantage.

The Ginsberg Center and the Washtenaw County Board of Commissioners Broadband Subcommittee conducted oral interviews with educators which have been summarized and included in this report.

Part Three: Economic Opportunity Assessment

We understand that there is a correlation between broadband availability in a region and the economic opportunities available in that region – this makes intuitive sense since broadband is required not only for basic information access and communication, but also to enable citizens to work from home, take jobs that require off hours availability, or engage in entrepreneurial activities.

As part of the report, the Poverty Solutions Center at the University of Michigan integrated broadband coverage data into the Washtenaw County Equity and Opportunity map. Additionally, work is underway at the Poverty Solutions Center to complete this work statewide such that all counties in the state will be able to access similar maps.

Finally, the Poverty Solutions Center conducted a project to discover, assess, and compile existing economic research that relates to the economic impact of broadband availability. This compilation is included, as if a policy brief by the Poverty Solutions Center that summarizes these findings.

Part Four: Legal Framework

As communities explore how best to improve broadband access within their borders, various competing models arise with different opportunities and challenges. Significant legal work is required for a municipality to understand their available options for building a municipal broadband solution or forming a public private partnership. A critical part of this framework is a step-by-step guide to assist municipalities in navigating through the process of establishing broadband internet access in their communities including providing guidance on the relevant statutes that apply.

Part Five: Feasibility Study

Once a municipality has determined that current broadband coverage is inadequate and that expansion by existing service providers to resolve the problem is not forthcoming, as well as determining that their residents are interested in the municipality engaging on the problem, the next tangible step is often conducting a feasibility study. Such a study will examine the attributes of a community and available assets against the goals that the community is seeking to

accomplish, then conduct pre-engineering and financial analysis to explore solutions and whether they might be financially feasible. This section discussed the process by which a municipality can pursue a feasibility study.

Part Six: Conclusions and Recommendations

While this framework document compiles a number of useful datasets, methodologies, and examples, the best path forward for any given community will be unique. This closing section provides some thoughts on how to approach the use of this framework to increase broadband access in your community.

Part One: Community Assessment

The first step for any community activity is to understand not only whether broadband challenges exist, but also resident sentiments regarding those challenges. The question of broadband coverage is quantitative, although the available data for Michigan has significant limitations. The best currently available data is maintained by Connect Michigan, a subsidiary of Connected Nation. This data is self-reported by service providers biannually (FCC Form 477) and indicates reported coverage on a census block level. One limitation is that census blocks can be large, and if even one household in the census block is served the entire block is reported as served, creating an overreported result. The second limitation is that self-reported coverage is not always accurate, especially when considering wireless services, so data is becoming increasingly skewed as wireless providers report coverage in areas where real world topography creates disparities between theoretical and actual coverage and speeds. With these limitations understood, the data from Connect Michigan is the best currently available data. Connect Michigan coverage maps for the counties in Region 9 are included in Appendix A. At a high level:

- Hillsdale County: 38.8% of households unserved (6,905 households)
- Jackson County: 23.5% of households unserved (14,269 households)
- Lenawee County: 19.6% of households unserved (7,356 households)
- Livingston County: 9.6% of households unserved (6,455 households)
- Monroe County: 6% of households unserved (3,482 households)
- Washtenaw County: 6.1% of households unserved (8,369 households)

In total for Region 9, about 12.4% of households do not have access to broadband, or 46,836 households. Given an average 2.58 people per household this yields about 120,838 people without broadband access in Region 9.

While broadband coverage is quantitative (does a home have access to broadband or not?), resident sentiment regarding broadband access is qualitative. It's important to understand if residents feel their internet connectivity needs are being met, and whether they are supportive of having their municipality engage in improving broadband access in their community. To understand this qualitative assessment, the Ginsberg Center at the University of Michigan worked with the Michigan Broadband Cooperative to design, execute and analyze a survey of the residents in Region 9. The survey and full results are included in Appendix B. Following is a summary of the most relevant data.

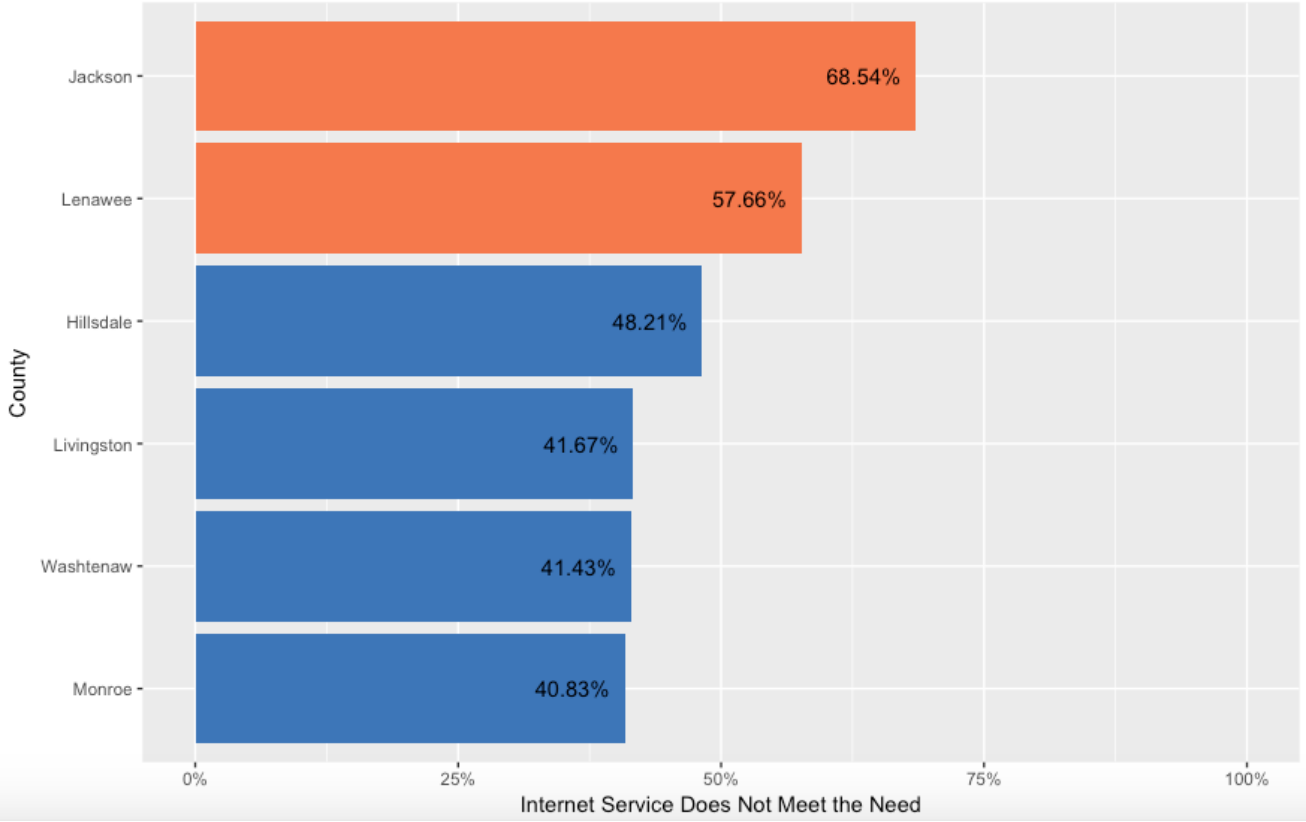
Survey Results for Region 9 Broadband Study

Data Set

7,685 surveys were sent out in total via USPS. Surveys were sent to randomized recipients across the six counties in Region 9 who live outside cites. Residents in cities were excluded from this study as it is understood that cities in Region 9 have comprehensive broadband coverage. Of the surveys sent out 818 were returned completed, yielding a 3.497% margin of error for the following results.

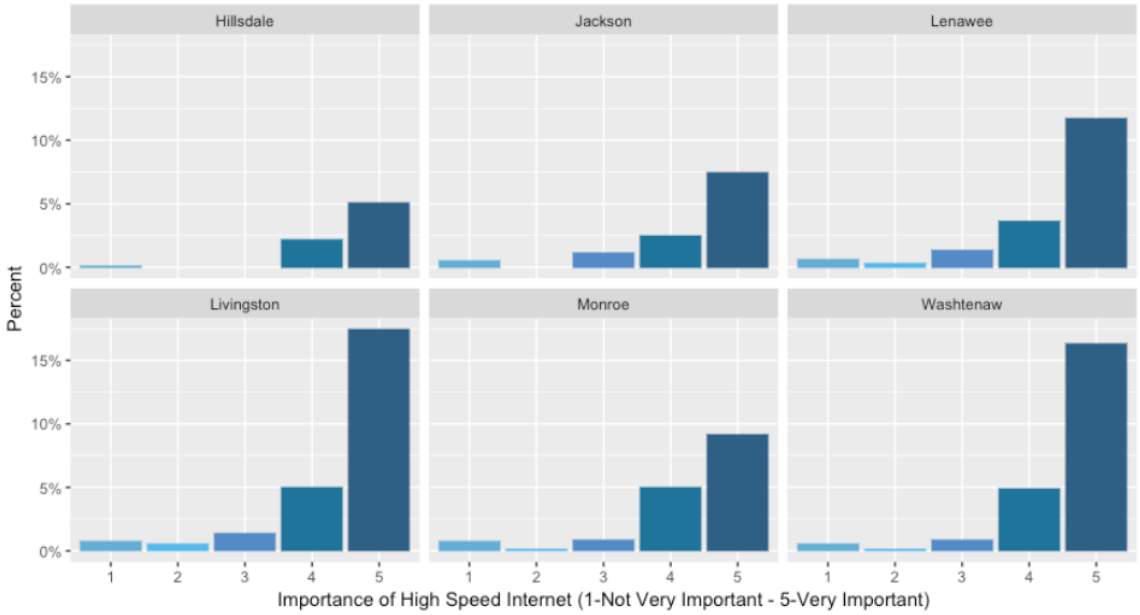
Current Internet Service Does Not Meet Need

Across Region 9, **47.88%** of all survey respondents do not have internet service that meets their needs. Jackson and Lenawee Counties reported the highest rates of internet service not meeting needs. Further, of respondents reporting that they do have access to high speed internet, **29.6%** indicated that their current high-speed internet service does not meet their needs.



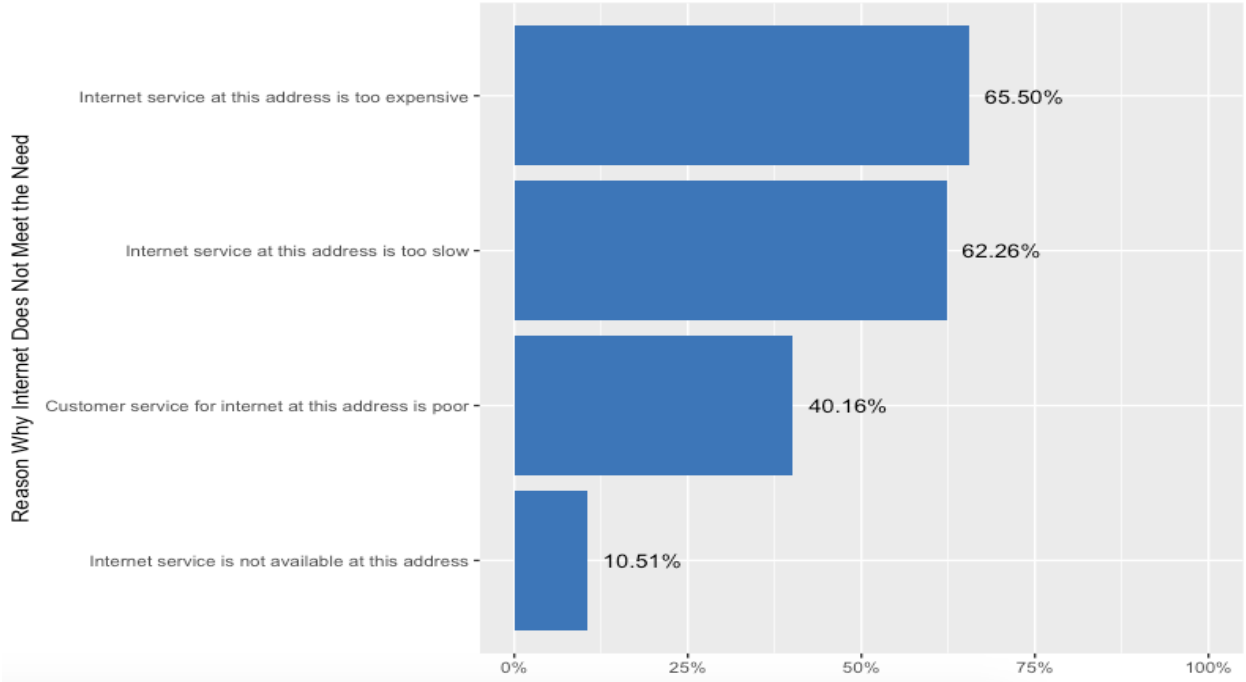
Importance of High Speed Internet

Most respondents ranked having access to high speed internet as "**Important**" or "**Very Important**". Of those surveyed, **Lenawee**, **Livingston** and **Washtenaw** counties had the highest number of people who thought high speed internet was **"Very Important".**



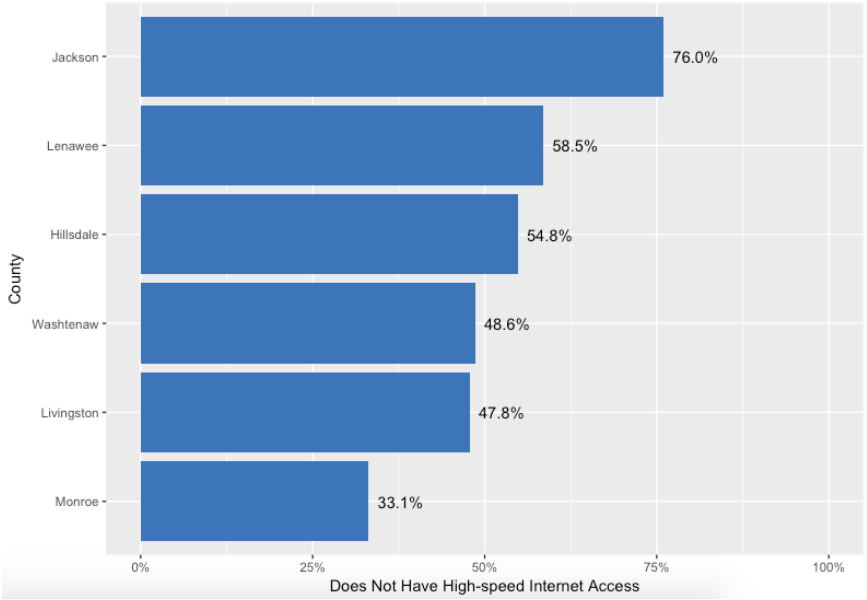
Current Needs Not Being Met

For the survey respondents with internet access reporting that their needs are not being met, the main complaints are related to #1 cost, #2 speed, and #3 customer service.



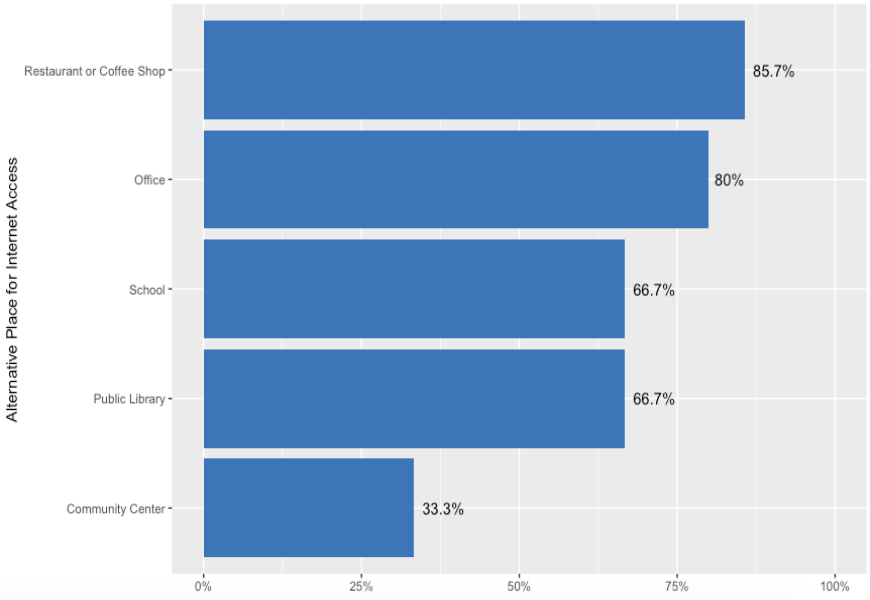
Reported Access to High Speed Internet

Across Region 9, only **14.50%** of survey respondents report they do not have high-speed internet access. Despite their report, a higher percentage of respondents actually **do not have high speed internet** at the nationally recognized threshold of 25Mb download and 3Mb upload. Based on reports of the specific kinds of internet access technology respondents are using, **50.84%** of survey respondents do not have high speed internet access. Jackson County was the highest with **76%** of respondents reporting not having access to high speed internet technologies. Monroe was the lowest at **33.1%**.



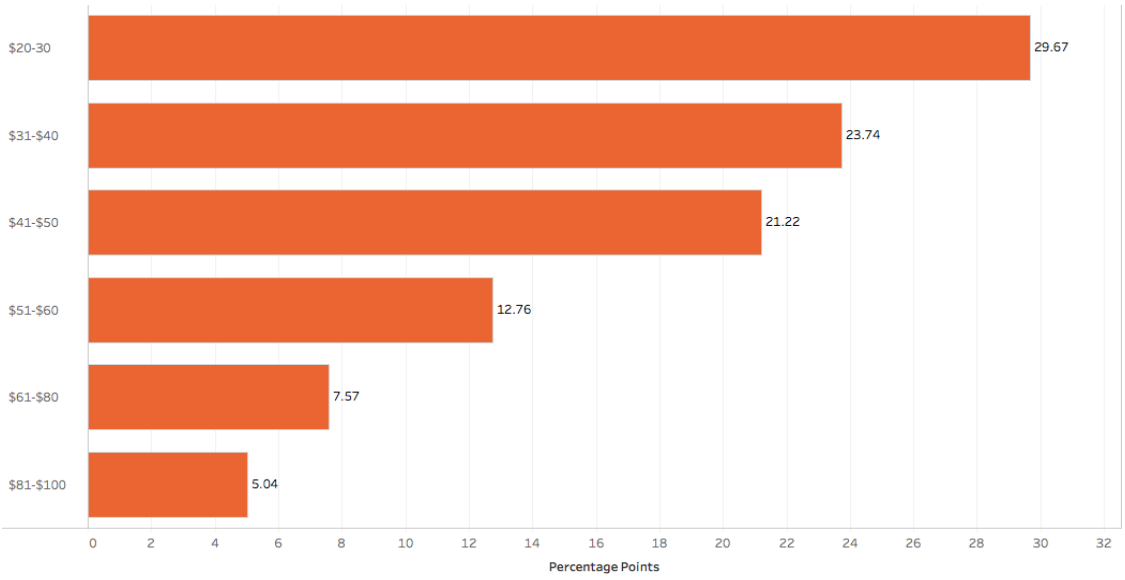
Workarounds to Access High Speed Internet

Survey respondents who do not have high speed internet access at home reported the most popular places to access internet include restaurants/coffee shops and offices.



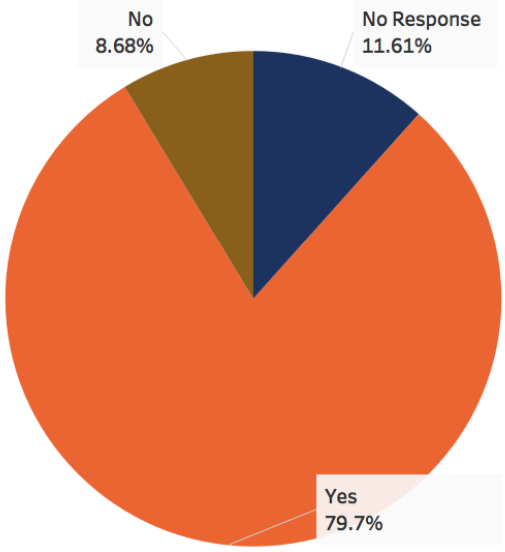
Willingness to Pay for High Speed Internet Access

Across Region 9, most respondents (**74.63%**) were willing to pay $50 or less for high speed internet access. The most popular price tier was $20-30, as **29.67%** of survey respondents reported they were willing to pay $20-30 for high-speed internet access. About a quarter of respondents (**25.37%**) indicated they would be willing to pay $51-100 for high speed internet access.



Interest in a Feasibility Study

Across Region 9, **79.7%** of respondents said they would support their municipality in conducting a feasibility study to improve broadband access in their area. Individually Livingston County had the highest support at **84.2%**, while Lenawee had the lowest at **73.2%.**



Please refer to Appendix B for the full results of this study.

Recommended Community Action

While this study gives a good overview of community sentiment regarding broadband at a county level in Region 9, any local municipality considering engaging with this issue should consider conducting a survey targeted specifically at their own residents. Municipalities have had success in the past in sending surveys along with tax bill mailings, which typically happen twice a year. A template version of the survey used in the above study is included in Appendix B. Additionally, two surveys completed by local townships (Manchester Township in Washtenaw County and Grass Lake Township in Jackson County) are included as examples in Appendix C.

Part Two: Educational Equity Assessment

One of the most consistently reported issues arising from lack of broadband access is challenges for students in completing homework and accessing educational resources at home. As part of this project, interviews were conducted with eight educators or school I.T. staff from across Region 9. Despite the modest size of the cohort, valuable insights were gleaned from the remarks and there was a consensus around both the challenges of disparate broadband access and the exciting potential impact of universal broadband access on both pedagogy and student performance.

General Observations:

- In school districts where digital devices are provided, student to device ratios range from 1:1 to 1:2+
- In the Saline School District (Washtenaw County) a BYOD (Bring Your Own Device) policy has been established.
- Typically, school provided devices are allowed to be taken home beginning in the 6^{th}-8^{th} grades, and continuing through graduation. Some schools allow students to purchase their devices upon graduation.
- Devices range from iPads and Chrome Books to laptop computers.
- In school districts where there is a disparity in broadband access at home, educators have resorted to inventing work-arounds and have had to troubleshoot compatibility issues in an attempt to achieve a degree of digital equity.
- In school districts where there is a disparity in broadband access at home, some educators report limiting or removing assignments that leverage online resources from their curriculum altogether.
- Use of broadband technology and the responsibility of coming up with alternative lessons for students is a tremendous burden on the teachers.
- An expectation for online parental involvement creates significant challenges where broadband or internet access is limited or unavailable at home. Teachers assume parents monitor their children's attendance, homework assignments and ongoing academic progress via the internet. Reliable access, data caps, bandwidth limitations, multiple logins and passwords and variance in digital literacy create barriers to parental engagement. As a result, both teachers and parents experience frustration and relationship discord.
- Text books are becoming an anachronism. Online content is limitless and hyperlinks expand the resources available. It was acknowledged that not all content is free, PDF capability is essential and the hyperlinks only work if you are online.

- Enriched online educational resources and collaborative learning are hindered by lack of universal broadband internet access; e.g. virtual field trips such as deep sea diving, visiting the Louvre in Paris or observing an autopsy.
- Online learning expands offerings for advanced placement classes, college credit courses and specific areas of study (such as Latin) that may not be available in smaller school districts.
- Broadband internet access enables students to engage in "credit recovery" for classes they have failed or missed.
- Online classes can maximize the utilization of educators and offer the flexibility for the teacher to be off-campus – a mile away or around the world.
- Extra-curricular activities compete with after school broadband internet access time.
- Students with broadband internet challenges have been observed to work on assignments for classes other than the one in which they are sitting.
- Email literacy has become an important skill. In this era of Facebook, Twitter and Instagram, phrasing for clarity, attention to tone, punctuation and grammar are areas that would benefit from intentional instruction.
- "Zero hour" has become a time before school where teachers are in the school and students can come in to work. This arrangement doesn't serve students that ride the bus or do not drive.
- A survey in the Chelsea High School (Washtenaw County) revealed that about half of the students had some sort of internet issue (no access, bad signal, lack of bandwidth).

Part Three: Economic Opportunity Assessment

It is intuitive that access to broadband should increase the economic opportunity of a given area. But what quantitative data is available, and what studies have been completed? For this framework, the Michigan Broadband Cooperative worked with the Poverty Solutions Center at the University of Michigan to both analyze current literature on the topic as well as forward some specific analysis for Region 9.

Regarding an analysis of existing literature, the Poverty Solutions Center identified and compiled twenty-one different studies relevant to the topic of the economic impact of community broadband. The studies fall into the following categories:

- Background information: six studies
- In favor of municipal broadband: ten studies
- Neutral, in favor of public-private partnership: two studies
- In opposition of municipal broadband: three studies

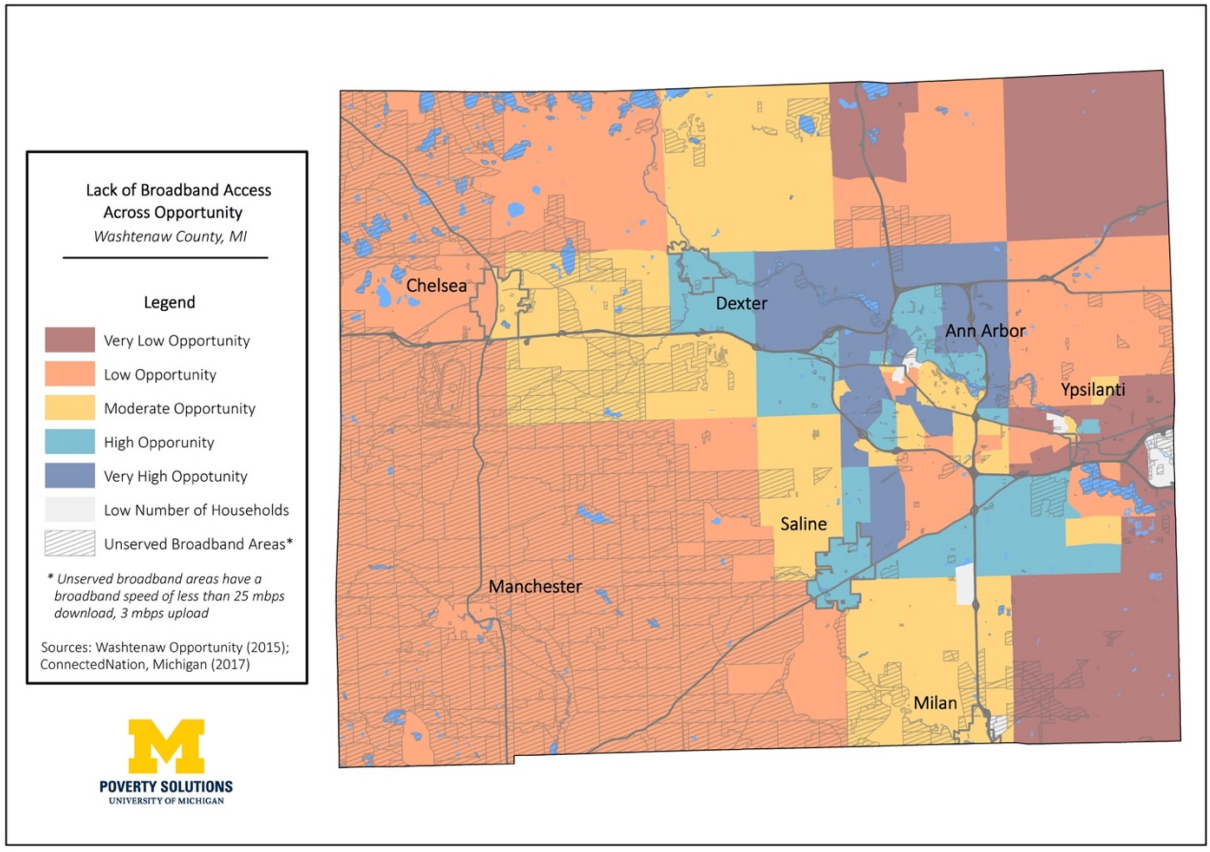
This full analysis is included in Appendix D.

The second more locally focused activity is focused around economic opportunity. In 2015, Washtenaw County's Office of Community and Economic Development (OCED) together with the Kirwan Institute for the Study of Race and Ethnicity completed a comprehensive

"opportunity index" for Washtenaw County which scores each census tract in the county according to data points or measurements in 5 categories:

- Health
- Job Access
- Economic Well-being
- Education and Training
- Neighborhood Safety and Stability

The Poverty Solutions Center has assumed responsibility for continuing work on the Washtenaw County opportunity index. As part of this project, the Poverty Solutions Center integrated broadband coverage data into the Washtenaw County opportunity index map:



As can be seen here, there is significant overlap between the areas of low opportunity and areas unserved by broadband.

The Poverty Solutions Center is currently working to expand the opportunity index framework such that all counties in Michigan can reproduce these maps for their own regions. This future framework will include broadband coverage data as one of the data sets.

Finally, the Poverty Solutions Center has prepared a policy brief summarizing the economic impact of broadband access, included here in Appendix E.

Part Four: Legal Framework

As municipalities begin to explore how they might address broadband coverage in their communities, it is important to understand Michigan's legal landscape regarding municipal broadband.

In March 2002, the Michigan legislature passed several laws to stimulate the availability of affordable high-speed internet connections such as broadband. Specifically, the Metropolitan Extension Telecommunications Rights-of-Way Oversight Act, PA 48 of 2002, MCL 484.3101 *et seq.* (the "METRO Act") created a telecommunication rights-of-way oversight authority and prescribed the powers and duties of municipalities to bring broadband to their communities. The Michigan Telecommunications Act was also amended in 2005 to explicitly allow public entities to provide telecommunication services within their boundaries. This has proven to be a particularly important step towards providing broadband access state-wide, particularly in rural communities where access is non-existent or limited.

Foster Swift is a Michigan law firm with 100 plus attorneys across the state, with a focus on municipal representation. Foster Swift has represented communities like Lyndon Township in their projects to build municipal broadband. For this framework, Foster Swift has prepared a step-by-step guide to assist municipalities in navigating through the process of establishing broadband internet access in their communities including providing guidance on the relevant statutes that apply. This guide is included in full in Appendix F.

Part Five: Feasibility Study

A broadband feasibility study examines the attributes of a community and available assets along with the goals that the community is seeking to accomplish, then conducts a pre-engineering study and financial analysis to explore solutions and whether they might be financially feasible. Before deciding to undertake a feasibility study, a municipality should have completed the following activities:

- Identified that the broadband services currently available are not meeting the needs of their residents
- Contacted incumbent providers and determined that there are no tangible plans to expand coverage such that it would meet the needs of the residents
- Determined that residents are supportive of the municipality conducting a broadband feasibility study.

From a funding perspective, these kinds of feasibility studies can range from around $10,000 to upwards of $70,000, depending on the deliverables of the study. It is a suggested best practice to select the firm to conduct the feasibility study by competitive bid. Of note, there is no state statute governing township procurement, so townships should reference their own records to understand self-imposed procurement rules. Often, townships have "qualifications based" bid selection capability versus a requirement to select a "low cost" bidder. If rules are in place requiring a township to award the contract to the low cost bidder, the RFP should be constructed carefully to ensure responses meet all township needs. Otherwise, the quality of the response can be used to determine the winning bidder during a bid evaluation process.

Several municipalities in Region 9 have conducted feasibility studies. Included in this framework are the following:

- An informal RFP and RFP evaluation framework to solicit bids for a broadband feasibility study (Appendix G)
- Example feasibility reports for Lyndon Township and Sharon Township (Washtenaw County) (Appendix H)

Part Six: Conclusions and Recommendations

Two things are clear: access to broadband is essential for participation in modern society, and a significant number of people living in Region 9 don't have it. How to extend broadband access to the unserved, and the extent to which a municipality should be involved, are questions with many different answers. This framework document provides an extensive foundation of information, but any individual community wishing to close their own broadband gap must undertake their own journey. In summary, the recommended process is this:

- Assessment: Understand what broadband solutions and unmet needs currently exist in your community, as well as the community sentiment regarding these solutions.
- Feasibility: What solutions are available, how much do they cost, and how might they be funded? A good feasibility study will explore not just the cost and revenue model of a single solution, but look at multiple options not only from a technology perspective, but also funding and partnership perspectives. Public-private partnerships can be great ways to accomplish capital projects that aren't viable for either the public sector or the private sector alone.
- Funding: Once a proposal is shown to be feasible, the next step is obtaining funding. For municipal projects that are tax funded this can be a voter initiated ballot question campaign – ballot question campaigns must be disconnected from municipal operations, and executing a campaign is out of scope for this framework. For municipal projects that are not millage funded, generally the decision is made by the municipal governing body.
- Building: Once the project is funded, it must be constructed. Constructing a large scale infrastructure project is complex and it is recommended that communities engage an outside consulting firm to manage the project. However, it is also critical for the community to have a representative from the community in a leadership role on the project – there must be a local champion.
- Operating: While some cities are well suited to operate municipal networks themselves, small rural communities are often better suited to partner with private operators. Public-private partnership structures should be explored in the feasibility study, with specific partners selected via competitive procurement (RFP or RFI).

It is conspicuous that this framework stops after the feasibility step. The reason that the funding, building, and operating steps are not addressed here is that once a community has progressed past the feasibility step they will have professional resources engaged to help with the other steps to come. Each new step brings with it new expert resources that can help guide a community to a successful outcome. But it is important for a community to not put all their trust in a single firm

or individual – to achieve the best outcome, communities should talk to many expert resources **and to each other** to learn from each other's mistakes, challenges, and successes.

In closing, bringing broadband access to people who don't currently have it is a difficult challenge – after all, if it were easy it would have been done already. But, this challenge is one that is worth undertaking because the stakes are increasingly high. While even a decade ago broadband was still a luxury, today it has become a necessity, and the consequence of not closing the broadband gap will be at the expense of our rural communities, for whom opportunities both economic and otherwise will continue to suffer. Now more than ever it is essential for community leaders to step forward and address the challenge of broadband equity head on.

Appendix A: Coverage Maps

Broadband Service Inventory by Platform

Advertised Speeds of at Least 25 Mbps Downstream and 3 Mbps Upstream

Hillsdale County

Michigan

Published September 27, 2017

N

CONNECT Michigan

Data displayed on this map is developed from a combination of direct provider outreach and data collection, FCC Form 477 filings, State Broadband Initiative datasets, and independent research conducted by Connect Michigan. As such, broadband availability at an exact address location cannot be guaranteed. Satellite broadband services may also be available.

Submit questions or recommended changes to: maps@connectmi.org

Symbology

In areas where multiple broadband providers offer service, this platform composite map stacks coverage display layers in the order presented below.

- Interstate
- US Road
- Local Road
- Municipal Boundary
- County Boundary
- Water
- National/State Land
- Fiber Broadband
- Cable Broadband
- DSL Broadband
- Fixed Wireless Broadband
- Mobile Wireless Broadband*
- Unserved Area

*This map is not a guarantee of coverage, contains areas with no service, and generally predicts where outdoor coverage is available. Equipment, topography and environment affect service.

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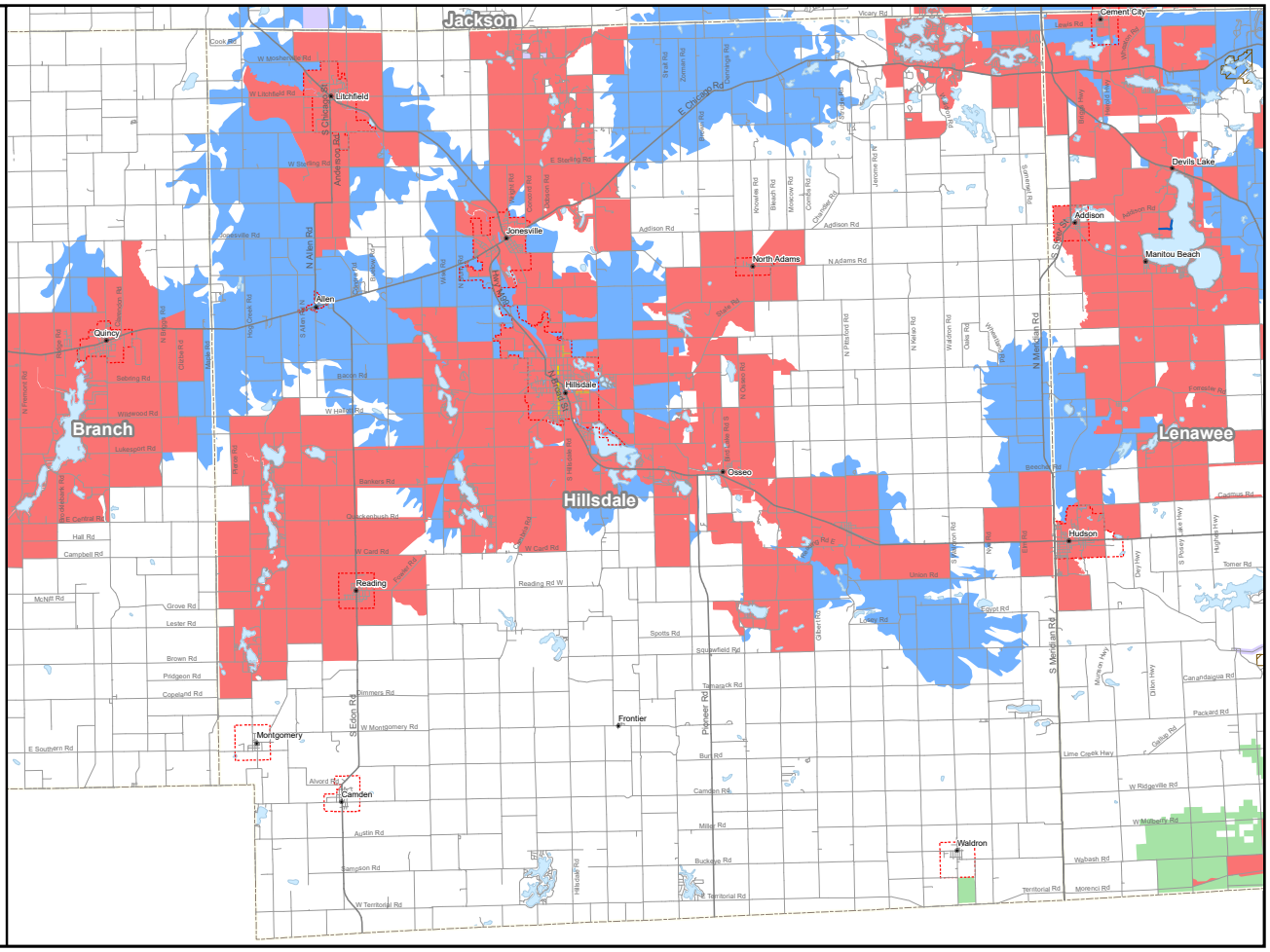

Broadband Service Inventory by Platform

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Jackson County

Michigan

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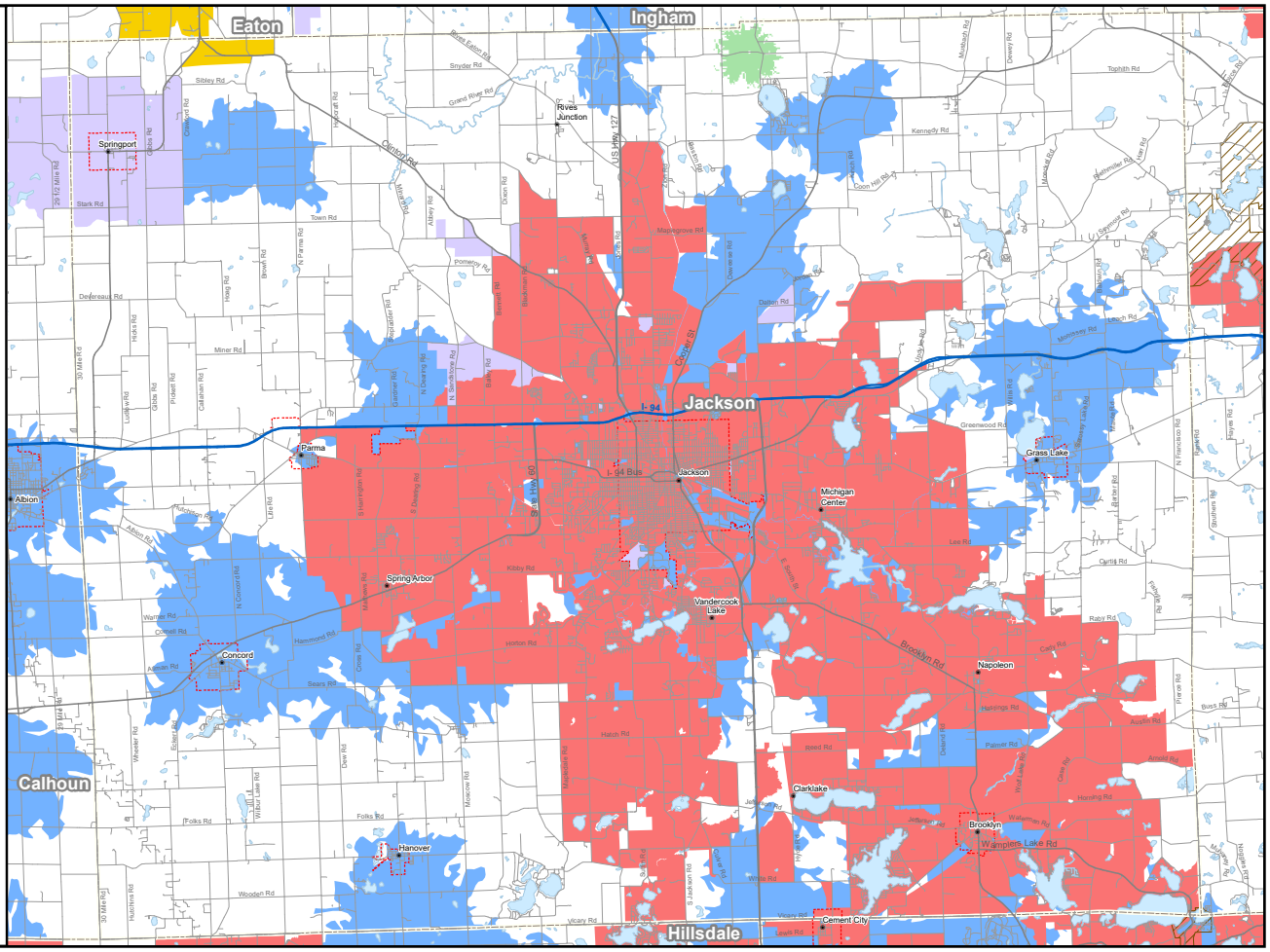

Broadband Service Inventory by Platform

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Lenawee County

Michigan

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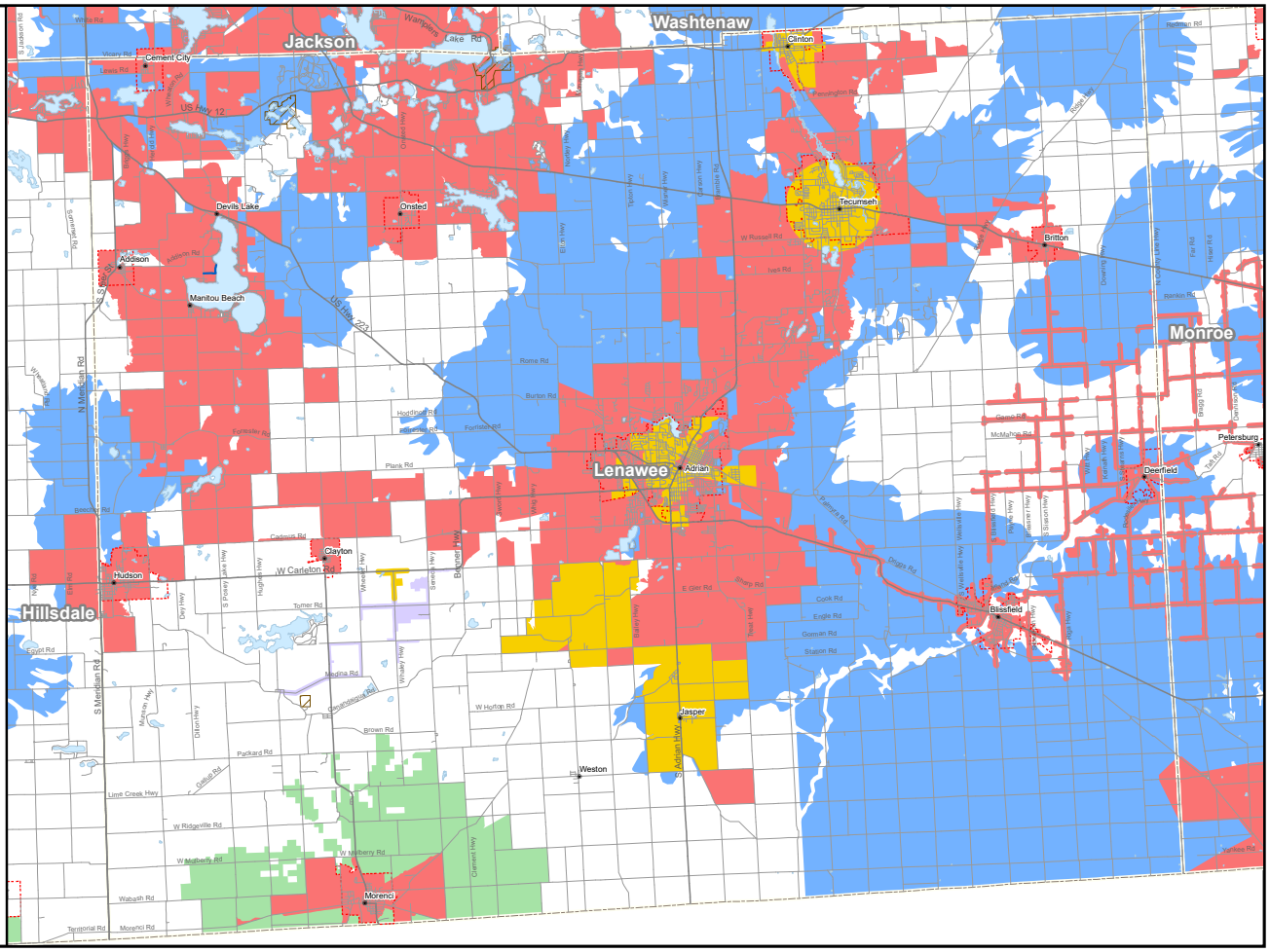

Broadband Service Inventory by Platform

Advertised Speeds of at Least 25 Mbps Downstream and 3 Mbps Upstream

Livingston County

Michigan

Published September 27, 2017

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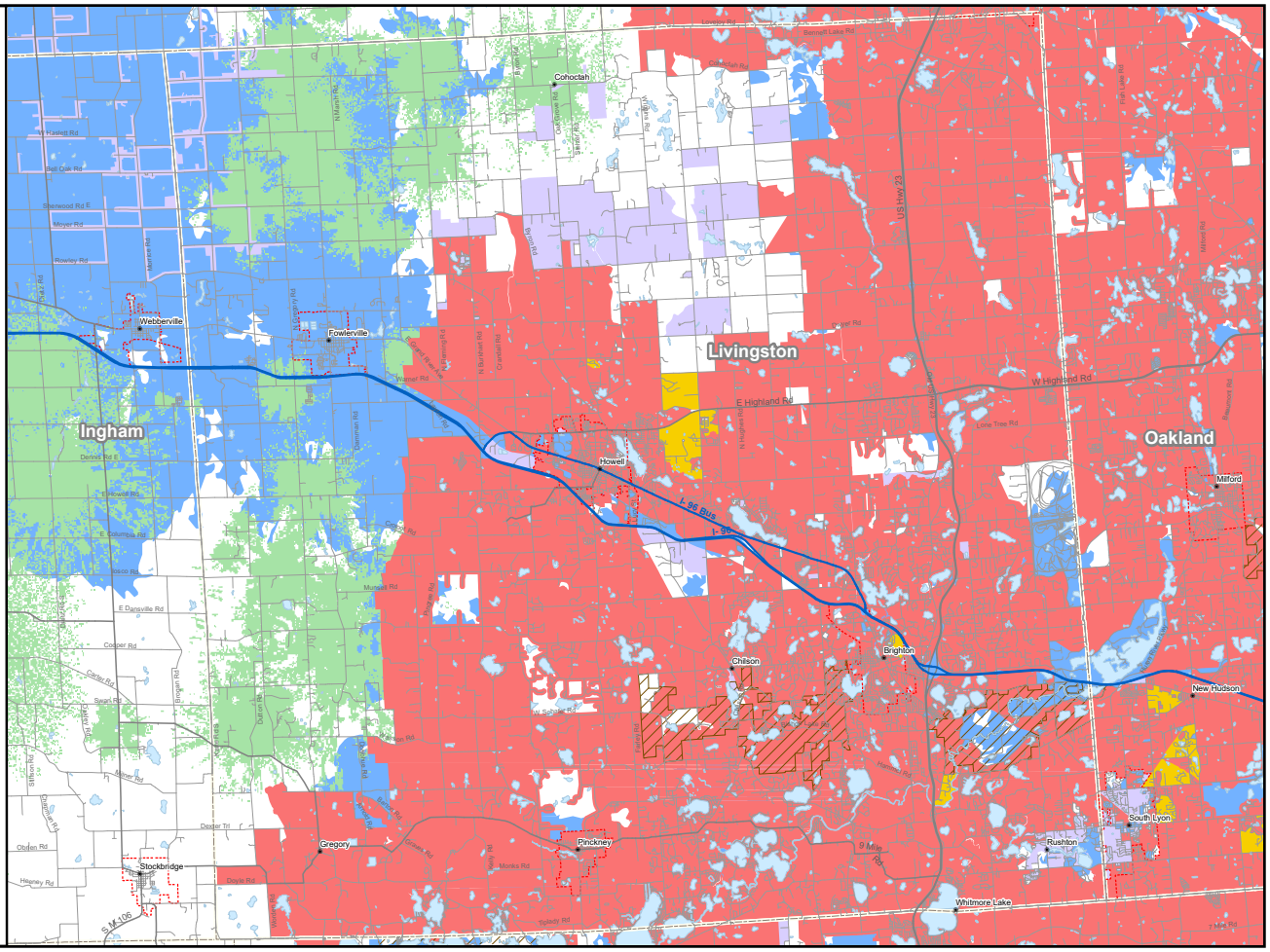

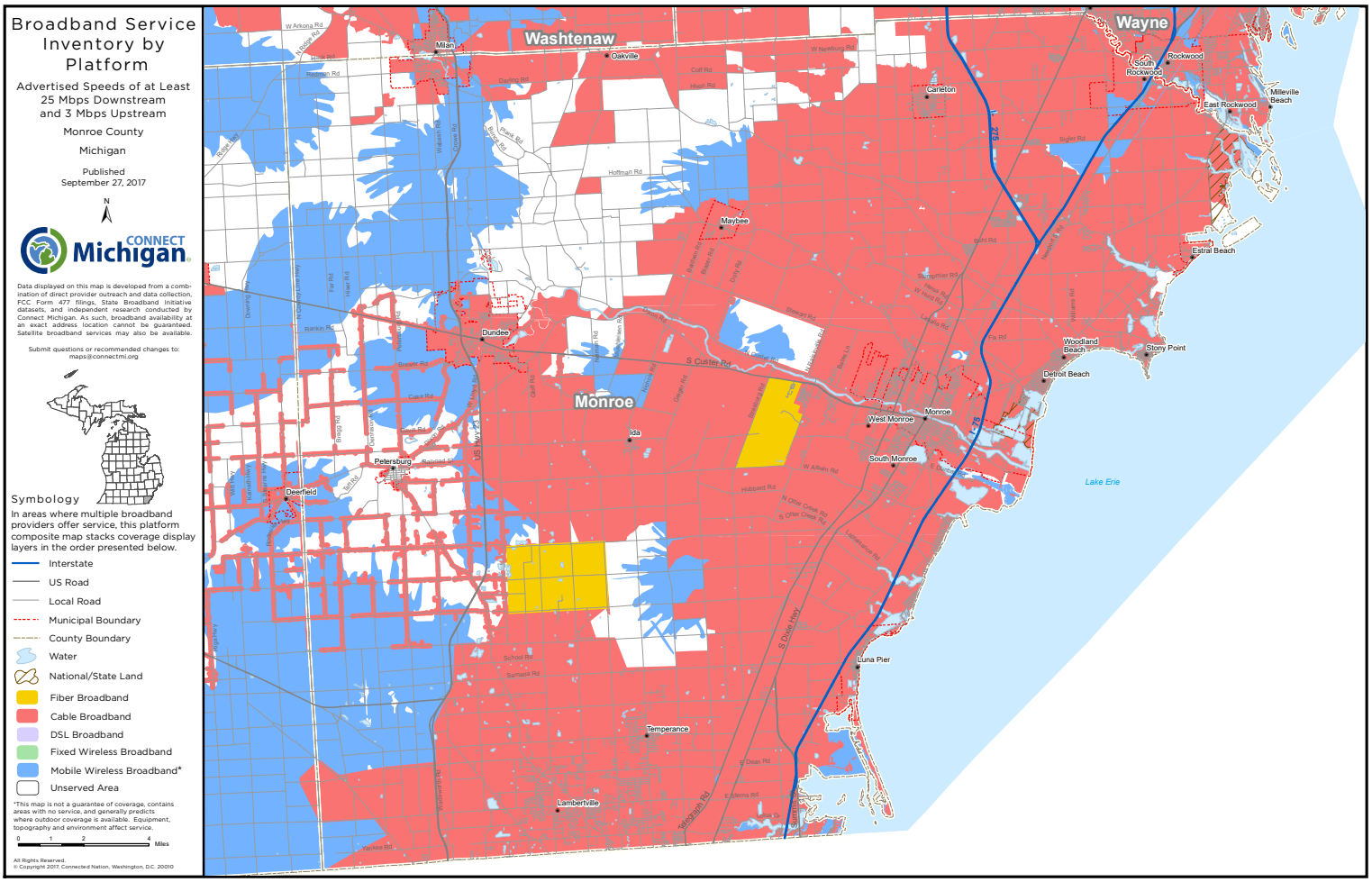
Broadband Service Inventory by Platform
Advertised Speeds of at Least 25 Mbps Downstream and 3 Mbps Upstream
Monroe County
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Interstate
US Road
Local Road
Municipal Boundary
County Boundary
Water
National/State Land
Fiber Broadband
Cable Broadband
DSL Broadband
Fixed Wireless Broadband
Mobile Wireless Broadband*
Unserved Area
*This map is not a guarantee of coverage, contains areas with no service, and generally predicts where outdoor coverage is available. Equipment, topography and environment affect service.
0 1 2 4 Miles
All Rights Reserved.
© Copyright 2017, Connected Nation, Washington, D.C. 20010
Washtenaw
Wayne
Monroe
Milan
Oakville
Carleton
Rockwood
South Rockwood
East Rockwood
Milleville Beach
Maybee
Estral Beach
Dundee
Woodland Beach
Stony Point
Detroit Beach
Monroe
West Monroe
South Monroe
Ida
Petersburg
Deerfield
Lake Erie
Luna Pier
Temperance
Lambertville
S Custer Rd
US Hwy 23
I-75
St Dixie Hwy

Broadband Service Inventory by Platform

Advertised Speeds of at Least 25 Mbps Downstream and 3 Mbps Upstream

Washtenaw County

Michigan

Published
September 27, 2017

Data displayed on this map is developed from a combination of direct provider outreach and data collection, FCC Form 477 filings, State Broadband Initiative datasets, and independent research conducted by Connect Michigan. As such, broadband availability at an exact address location cannot be guaranteed. Satellite broadband services may also be available.

Submit questions or recommended changes to:
maps@connectmi.org

Symbology

In areas where multiple broadband providers offer service, this platform composite map stacks coverage display layers in the order presented below.

- Interstate
- US Road
- Local Road
- Municipal Boundary
- County Boundary
- Water
- National/State Land
- Fiber Broadband
- Cable Broadband
- DSL Broadband
- Fixed Wireless Broadband
- Mobile Wireless Broadband*
- Unserved Area

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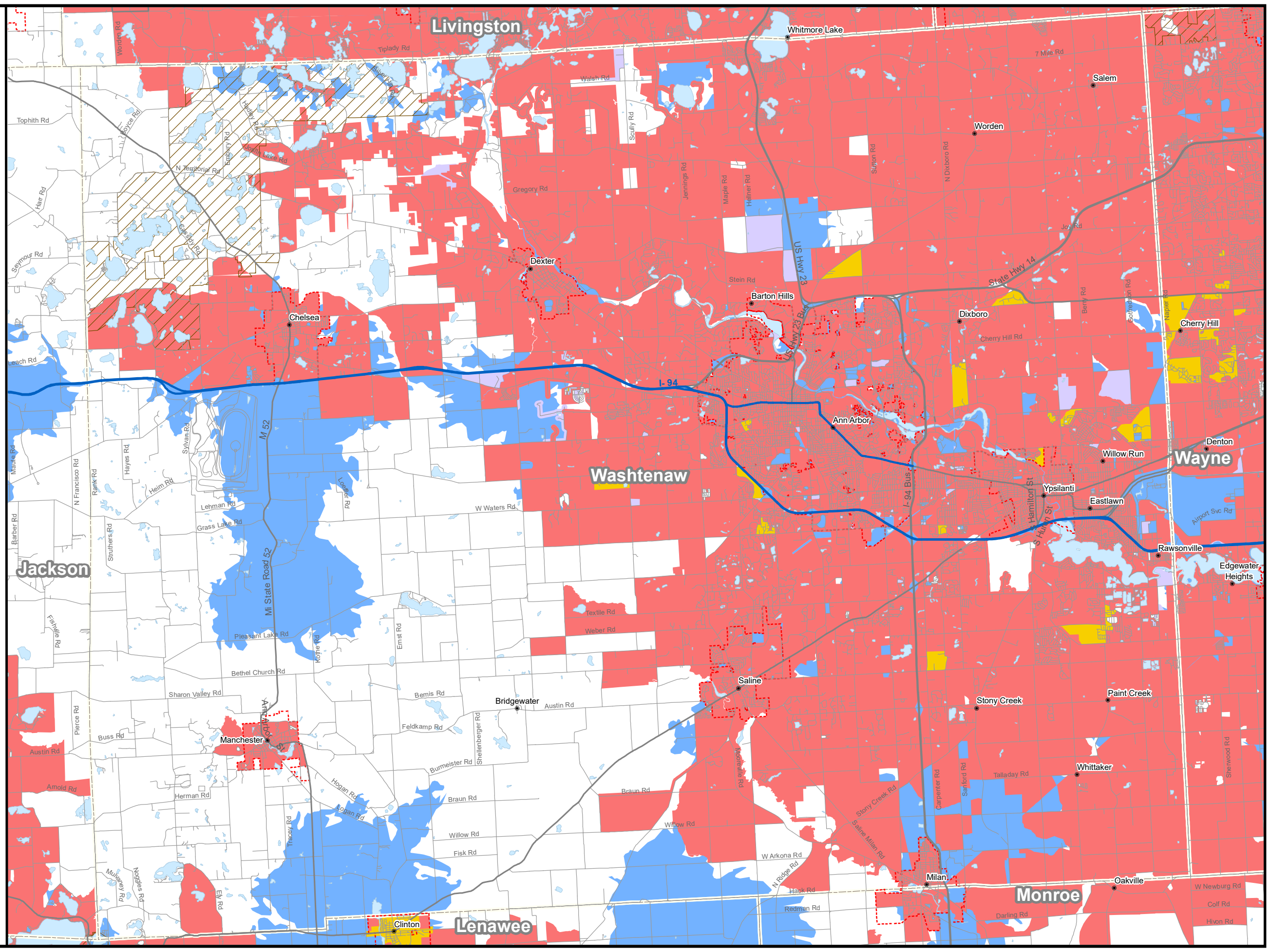
0 1 2 4 Miles



Appendix B: Broadband Survey and Results

MICHIGAN BROADBAND COOPERATIVE
www.mbcoop.org info@mbcoop.org (734) 436-1999

Dear <City> Resident:
<Address 1>
<Address 2>
<City>, <State> <Zip>

We need your help to determine where there is high speed Internet broadband service in your community. Will you kindly take 5 minutes to answer this short survey and return it to us promptly? Your household was chosen at random. Your responses will remain anonymous and a pre-addressed stamped envelope is provided to make mailing the survey back to us quick and easy! If you prefer to take the survey online please visit http://bit.ly/2jtQrx6

Who is conducting the survey? The Michigan Broadband Cooperative (MBCoop) and a team of graduate students and faculty from the University of Michigan are working together on this project. MBCoop is a not-for-profit organization formed by volunteers to achieve affordable and reliable high speed Internet broadband access for everyone in Michigan no matter where they live.

Why is the survey being conducted? MBCoop is working to expand affordable high speed Internet broadband access to everyone in Michigan, starting with the counties of Hillsdale, Jackson, Lenawee, Livingston, Monroe, and Washtenaw. The purpose of the project is to assess high-speed internet coverage and better understand unmet needs.

How is the survey being paid for? The survey is funded by a Greater Ann Arbor Region Prosperity Initiative grant that was awarded to the Michigan Broadband Cooperative. www.mbcoop.org

Who is working on the survey? A team of graduate students and faculty from the University of Michigan are partnering with us to administer the survey, analyze the results, and report back. Results will be made available on our website. www.mbcoop.org

Will my responses be kept confidential? Yes. Your household was randomly selected and we are not asking you to identify yourself. All of the survey responses will be reported together. Your responses will be kept confidential.

What will be done with the information? This information will be used to measure interest in affordable and reliable high-speed Internet broadband service. It is an important step toward making this essential infrastructure available to and affordable for everyone regardless of where they live. If you want to get involved, please email info@mbcoop.org or call (734) 436-1999.

Thank you in advance for your time and cooperation. Your responses are important to the success of this project and the efforts of MBCoop! If you prefer to take the survey online please visit http://bit.ly/2jtQrx6

Sincerely,

Ben Fineman, President
Michigan Broadband Cooperative

Enclosures.

Please use return envelope by April 1, 2018

Michigan Broadband Cooperative is working to better understand your access to the internet. Answering this survey does not obligate you to subscribe to any services. The survey results will be used to document current use and unmet need. Please complete one survey per household. Thank you for your time. If you prefer to take the survey online please visit http://bit.ly/2jtQrx6

1. **On a scale of 1 to 5 (1 being not important to 5 being extremely important) how important is high speed internet to you?** (Please check only one)

□ 1- Not Important □ 2 □ 3 □ 4 □ 5- Extremely Important

2. **Does your internet service meet your need?**

□ Yes □ No (skip to Q4)

3. **If yes, check any statements that are true for you:**

- □ The speed of the internet at this address meets my need
- □ The cost of the internet at this address meets my need
- □ Customer service for the internet meets my need

4. **If no, check any statements that are true for you:**

- □ I have no desire or see no value to use the internet from my home
- □ I have adequate access to the internet somewhere else (work, school, etc.)
- □ Internet service is not available at this address
- □ Internet service at this address is too slow
- □ Internet service at this address is too expensive
- □ Customer service for the internet at this address is poor

5. **Do you have high-speed internet access at this address?**

□ Yes □ No (skip to Q7)

6. **If Yes, what type of service is it? (check what applies)**

- □ Cable (eg. Comcast, etc.)
- □ DSL (eg. AT&T, Frontier, etc.)
- □ Satellite (eg. HughesNet, Exceed, etc.)
- □ Fixed Wireless (eg. Rural Ranch, AirAdvantage, etc.)
- □ Cellular (eg. Verizon, AT&T, etc.)
- □ I don't know
- □ I don't have internet access

7. **If you do not have high-speed internet, where do you go for internet access?**

- □ Community Center
- □ Public Library
- □ Restaurant or Coffee Shop
- □ School
- □ Work/Office
- □ Other (please write in):

8. **If a provider were going to install high-speed internet access at this address, how much would you be willing to pay per month?**

- □ $20-30 per month
- □ $31-$40
- □ $41-$50
- □ $51-$60
- □ $61-$80
- □ $81-$100

9. **Approximately how long is your driveway?**
_____ Feet

10. **Would you be supportive of your township board conducting a feasibility study to explore options for expanding broadband in your area?**

□ Yes □ No

11. **How many students living in the household need internet access from home?**
List number _____

12. **The address you received this survey at is a:**

□ Residence □ Residence with an in-home business □ Business

13. **Additional Comments:**
14.

Thank you for taking the time to complete this survey. Your feedback is valued and very much appreciated! Please share your number here if would you be interested in a phone interview to talk more about internet access: _(___ _)_____

CODE HERE: Insert Field <R> and <S>

Michigan Prosperity Initiative

Region 9 Broadband Access

2018 Survey Results

Michigan Broadband Cooperative Statement

Broadband is no longer a luxury in our society. In fact, internet connectivity has become essential for information access and communication.

Benefits of broadband access for residents:

- **communicate with family and friends**
- **consume and participate in educational resources**
- **access medical and government services**
- **engage in entrepreneurial activities**

Many residents in Michigan, and in Region 9 specifically, are severely limited in these aspects of life due to a lack of adequate broadband service. This creates a serious equity disparity between areas with broadband and those without.

-Fineman, 2017

The Edward Ginsberg Center & CTAC Collaboration

Project Team Coordinator:

Lisa Stadig Elliot - CTAC

Michigan Broadband Cooperative

- Ben Fineman, *President*
- Barb Fuller, *Board Member*
- Todd Anuskiewicz, *Board Member*

The Ginsberg Center

- Mary Jo Callan, *Director*
- Dave Waterhouse, *Associate Director*

UM Faculty Supervision

- Sue Ann Savas, *School of Social Work*
- Michael Elliott, *School of Public Health*

Community Technical Assistance Collaborative

Student Team (Fall 2017)

- Lauren Beriont, - *CTAC*
- Leslie Pittman - *CTAC*
- Mark Reid - *CTAC*

Student Team (Winter 2018)

- Lauren Beriont - *CTAC*
- Ina Conrado - *STATCOM*
- Chen Liang - *STATCOM*
- Ivy Wei - *CTAC*

Student Team (Spring/Summer 2018)

- Ina Conrado - *STATCOM*
- Alex Kime - *CTAC*
- Robin Kocher - *CTAC*
- Chen Liang - *STATCOM*
- Brenda Torres - *CTAC*

Michigan Prosperity Initiative Region 9: Survey Project Focus

- Capture residents' use of broadband in their homes and their barriers to access.

- Understand residents' sentiments about the mechanisms for closing the broadband **equity gap**.

Region 9

Hillsdale County

Jackson County

Lenawee County

Livingston County

Monroe County

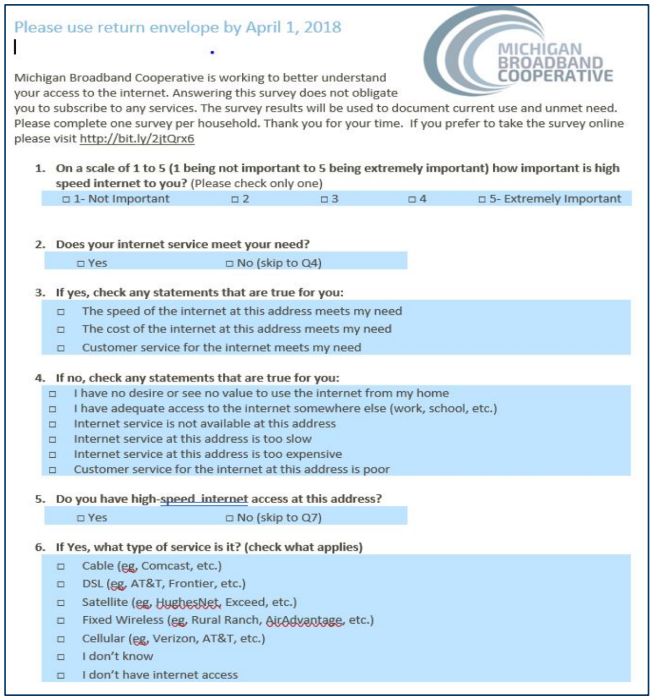
Washtenaw County

Phase One: Survey Development

2016. Michigan Broadband Cooperative (MBC) developed and tested a survey to gauge resident sentiment about broadband access.

Fall 2017. CTAC project team built on this work by reviewing the survey items, researching related scales, and revising items and response sets as needed.

Winter 2018. The two page paper survey was finalized along with the cover letter invitation to complete and a pre-paid return envelope.



Please use return envelope by April 1, 2018

MICHIGAN BROADBAND COOPERATIVE

Michigan Broadband Cooperative is working to better understand your access to the internet. Answering this survey does not obligate you to subscribe to any services. The survey results will be used to document current use and unmet need. Please complete one survey per household. Thank you for your time. If you prefer to take the survey online please visit http://bit.ly/2jtQrx6

1. **On a scale of 1 to 5 (1 being not important to 5 being extremely important) how important is high speed internet to you?** (Please check only one)
   □ 1- Not Important □ 2 □ 3 □ 4 □ 5- Extremely Important

2. **Does your internet service meet your need?**
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3. **If yes, check any statements that are true for you:**
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   - □ The cost of the internet at this address meets my need
   - □ Customer service for the internet meets my need

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   - □ Satellite (eg, HughesNet, Exceed, etc.)
   - □ Fixed Wireless (eg, Rural Ranch, AirAdvantage, etc.)
   - □ Cellular (eg, Verizon, AT&T, etc.)
   - □ I don't know
   - □ I don't have internet access

Phase Two: Collection, Analysis and Reporting

Regional Broadband Evaluation Timeline

ACTIVITY	ASSIGNED TO	PLAN DURATION
Secure 6-County Voter Registration List & Finalize Mailing List	Lisa E.	Three Weeks
Develop Data File - Voter List Survey Entry Protocol & Training	Ina C. & Chen L. Lisa E.	Two Weeks
Conduct 1st Mailing Wave	Dave W.	One month
Data Entry 1,537 surveys needed	Lisa E. CTAC Team Savas Students	Four Weeks (... up to six weeks if necessary)
Data Entry Determination - 2nd Wave	CTAC Team Savas Students STATCOM	One month *(if second wave for mailing & data entry)*
Data Analysis	STATCOM	Two month(s) - dependent upon # of waves needed
Key Informant Interviews - schools	Lisa E. & Ivy W.	One Month
Summarize Findings - Intvws	Lisa E. & Ivy W.	Two Weeks
Final Report & Mapping	STATCOM & CTAC	One month
Literature Review & Year 2 Recommendations	CTAC Team	One month
MBC Final Report	MBC Team	

PERIODS (-week increments)

January 1 - 15	January 16 - 31	February 1 - 15	February 16 - 28	March 1 - 15	March 16 - 31	April 1 - 15	April 16 - 30	May 1 - 15	May 16 - 31	June 1-15	June 16-30
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CTAC
STATCOM
MBC

STUDENT LIFE
EDWARD GINSBERG CENTER
UNIVERSITY OF MICHIGAN

MICHIGAN BROADBAND COOPERATIVE

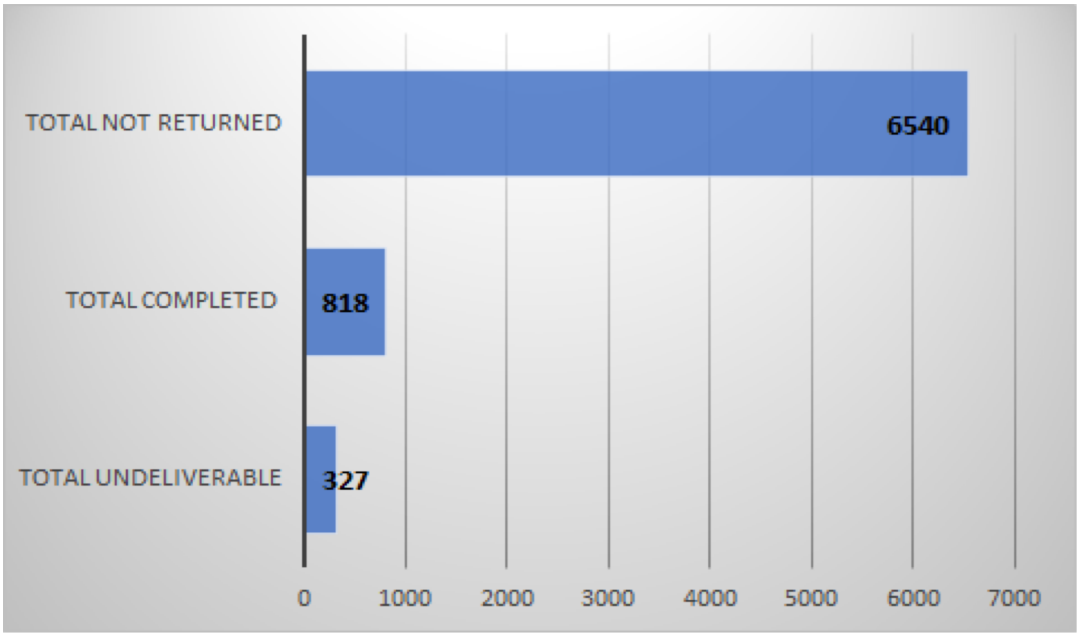
Sampling Strategy

Inclusion Criteria. Surveys were mailed to residents of Michigan's Region 9 counties who do **NOT** live in urbanized areas (those designated as 50,000 or more residents).

- The ***Voter Registration List*** was used to identify resident addresses.
- The random sample of surveys selected was proportional to the population in that county as determined by the 2010 US Census.
- A total of **7,685** surveys were mailed to residents in two waves.
    - **5,122 First Wave, March**
    - **2,563 Second Wave, April**

GOAL: 1,537 returned surveys were expected to establish a margin of error of 2.5%.

7,685 Surveys Mailed in Two Waves

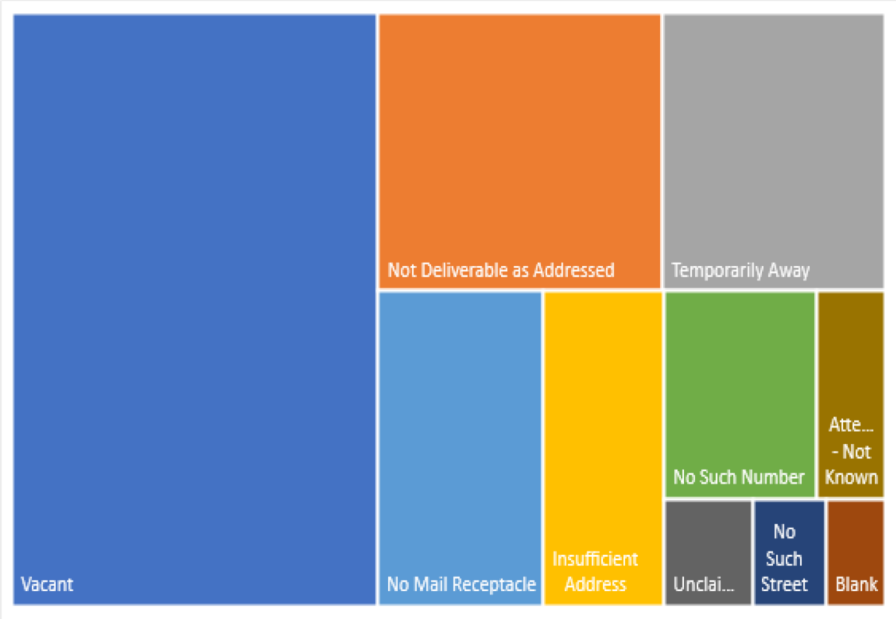


818 Surveys Completed

COUNTY	DESIRED RESPONSES	COMPLETED SURVEYS	COMPLETION RATE
HILLSDALE	132	62	9.41%
JACKSON	161	96	11.90%
LENAWEE	287	142	9.91%
LIVINGSTON	442	203	9.20%
MONROE	259	129	9.98%
WASHTENAW	257	186	14.47%
TOTAL		**818**	**10.6%**

327 Surveys Were Undeliverable

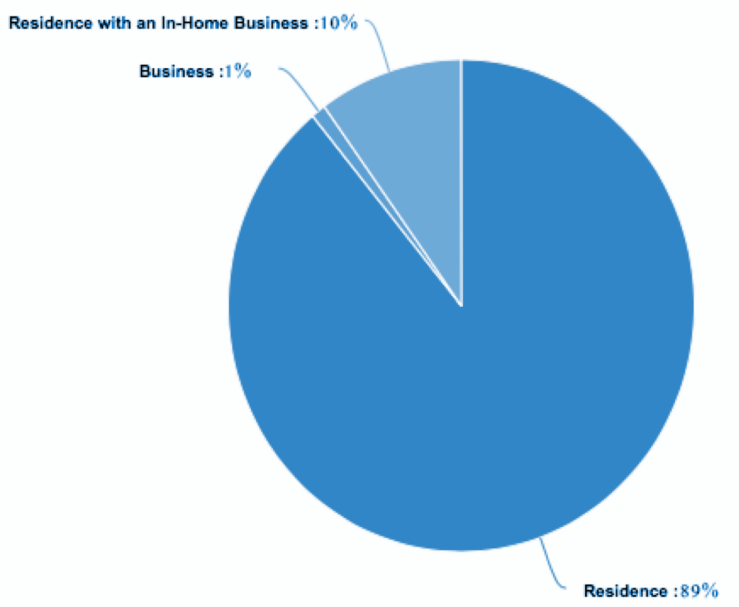
137	Vacant
50	Not Deliverable as Addressed
39	Temporarily Away
33	No Mail Receptacle
24	Insufficient Address
20	No Such Number
9	Attempted - Not Known
6	Unclaimed
5	No Such Street
4	Blank



Phase Two: Survey Analysis and Graphics

- Survey data was verified (i.e., omitted blank responses and outliers).
- Data was analyzed using R (open source analysis code).
- Graphics were generated using R and Tableau.
- Data visualization principles were used to facilitate interpretation of results.

Survey Results



Address Type

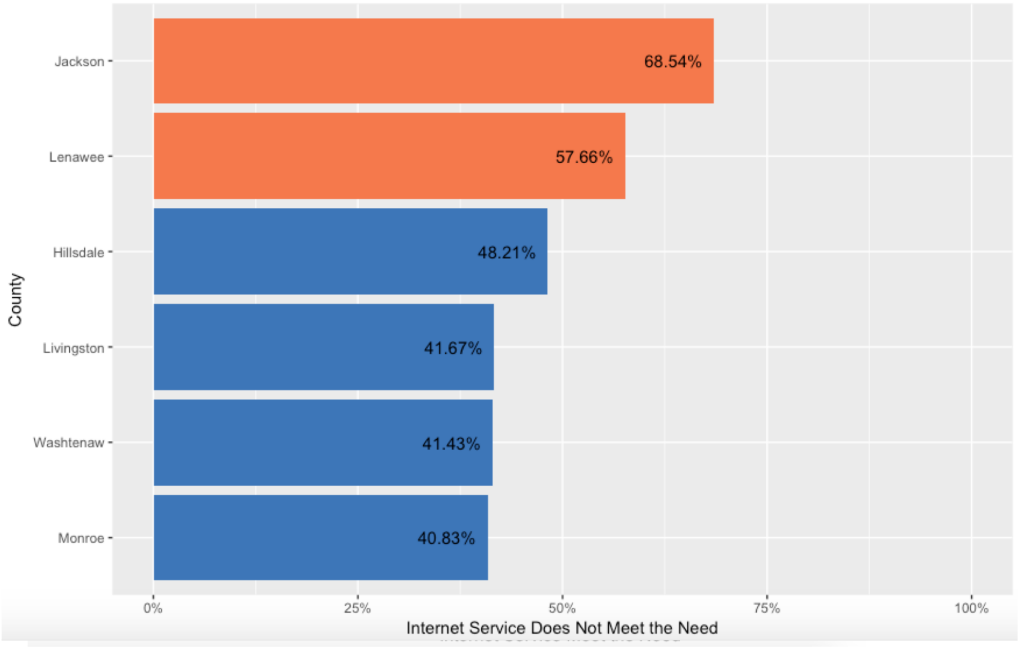
1. **89%** Residence
2. **10%** Residence with an in-home business
3. **1%** Business

Current Internet Service Does Not Meet Need

Across Region 9,

47.88% of survey respondents do not have internet service that meets their needs.

Jackson and Lenawee Counties reported the highest rates of internet service not meeting need.



Across Region 9

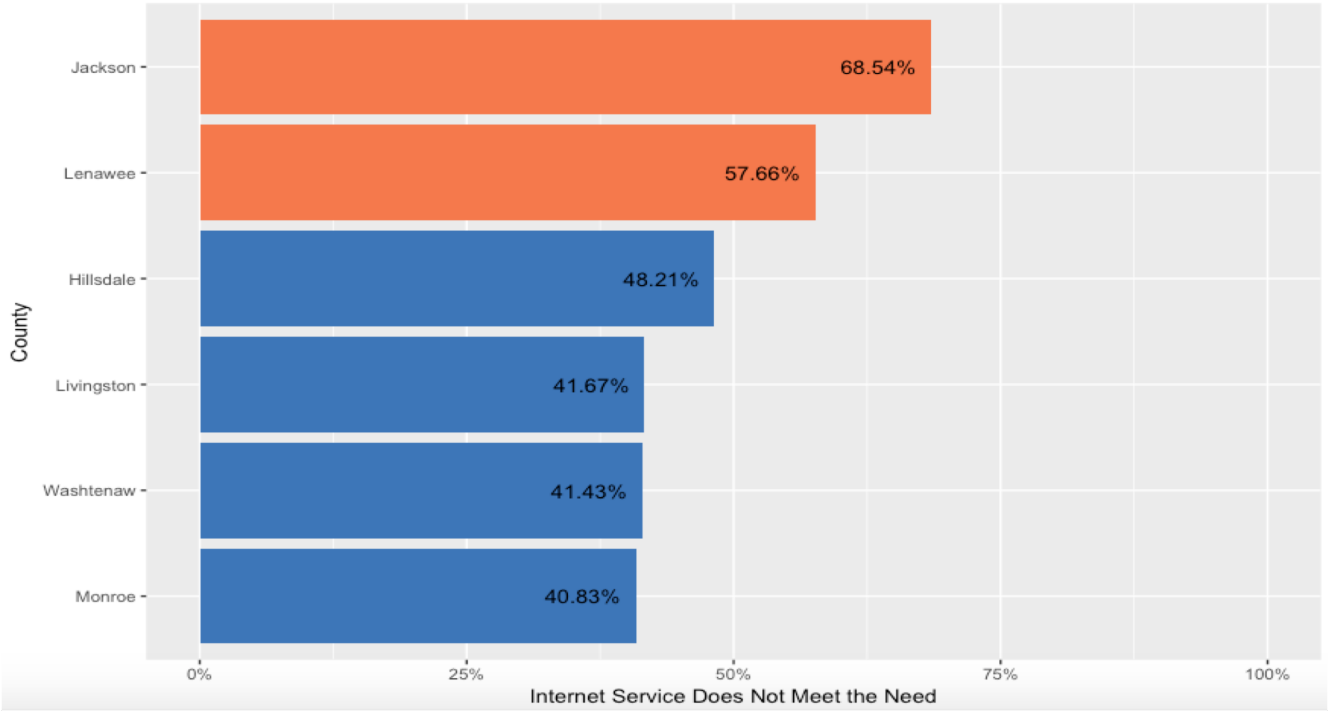
47.88%

of survey respondents do not have internet service that meets their needs, with a 3.497% margin of error.

Current Internet Service Does Not Meet Need

Jackson and **Lenawee** counties reported the **highest rates** of internet service **not meeting their needs**.

Current Internet Service Does Not Meet Need



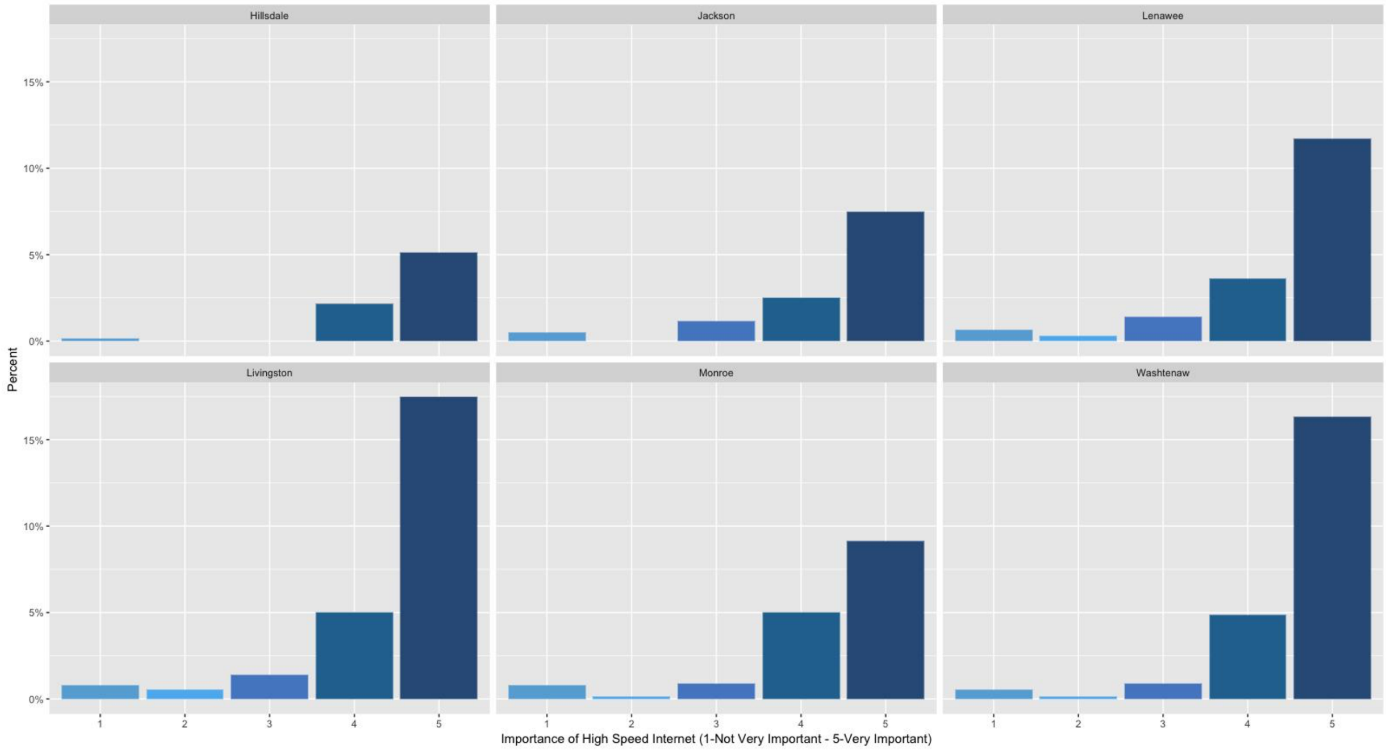
70.4%

Of respondents who have high speed internet indicated that their current internet service meets their needs.

Importance of High Speed Internet

Of those surveyed, **Lenawee**, **Livingston** and **Washtenaw** counties had the highest number of people who thought high speed internet was **“Very Important (5)”**

Importance of High Speed Internet

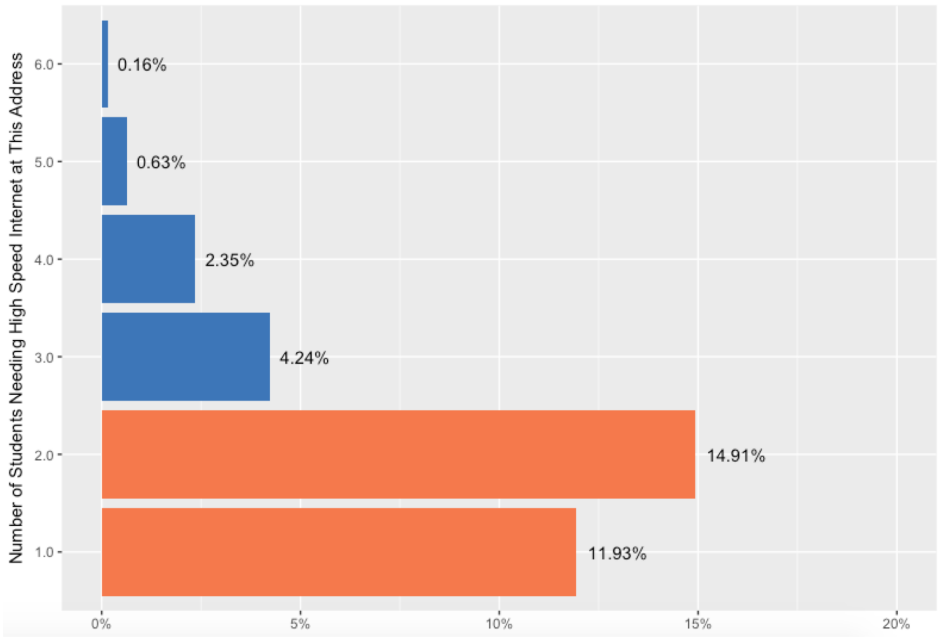


35.2%

of survey respondents reported having students in their household

Students Using High Speed Internet in a Residence

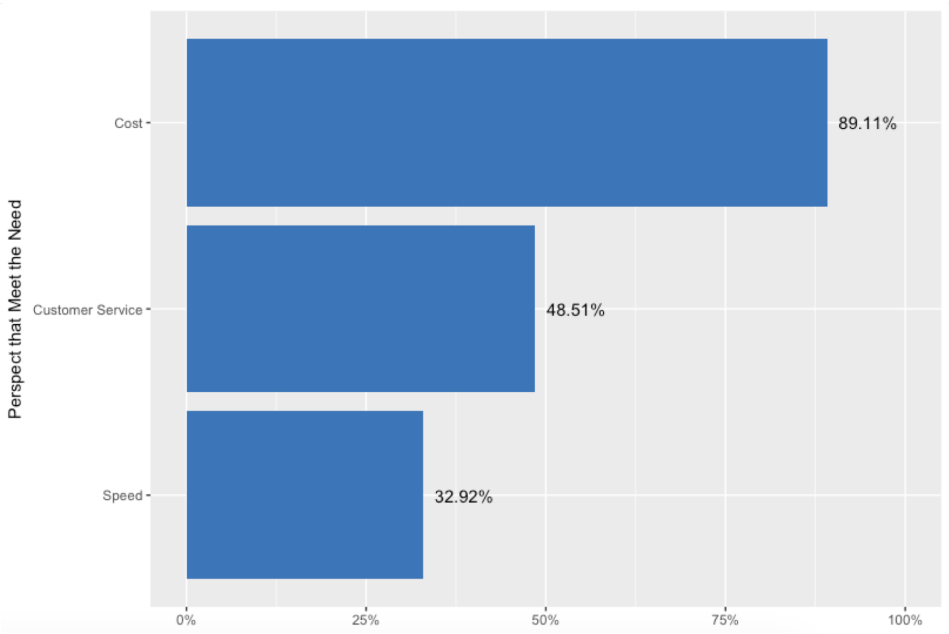
26.84% of survey respondents located in a residence reported **1 or 2 students** with high speed internet needs.



Satisfied With Current High Speed Internet Service

For those whose internet service meets their need,

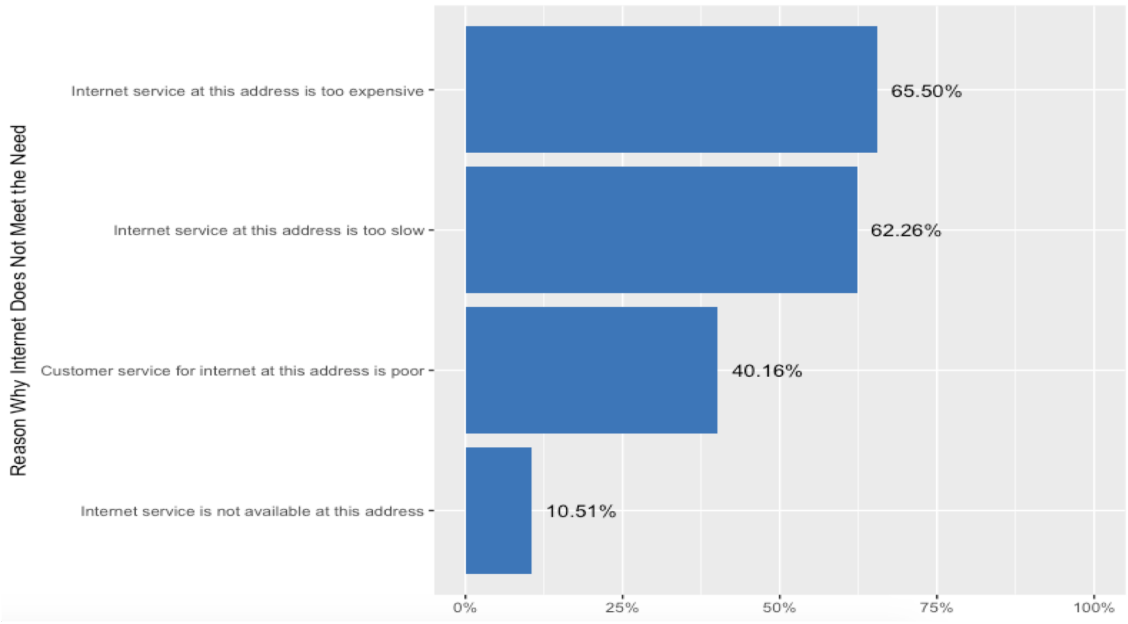
89% reported that the **cost of internet service also met their need.**



Current Service Does Not Meet Need

For those who have internet access that does *not* meet their need the **main complaints** are related to:

1. **Cost**
2. **Speed**
3. **Customer Service**

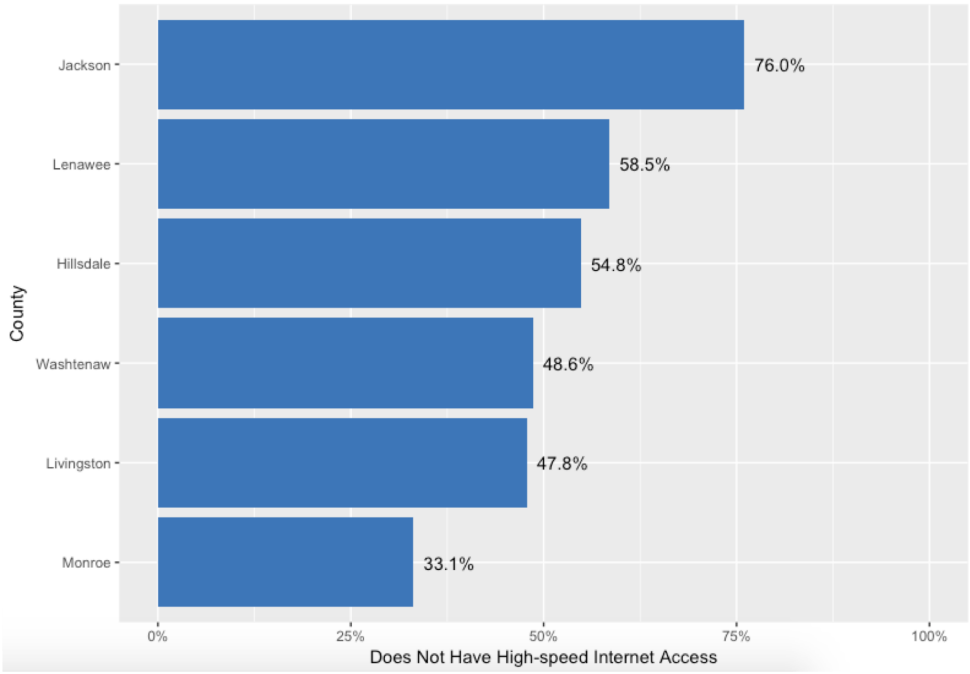


High Speed Internet Access

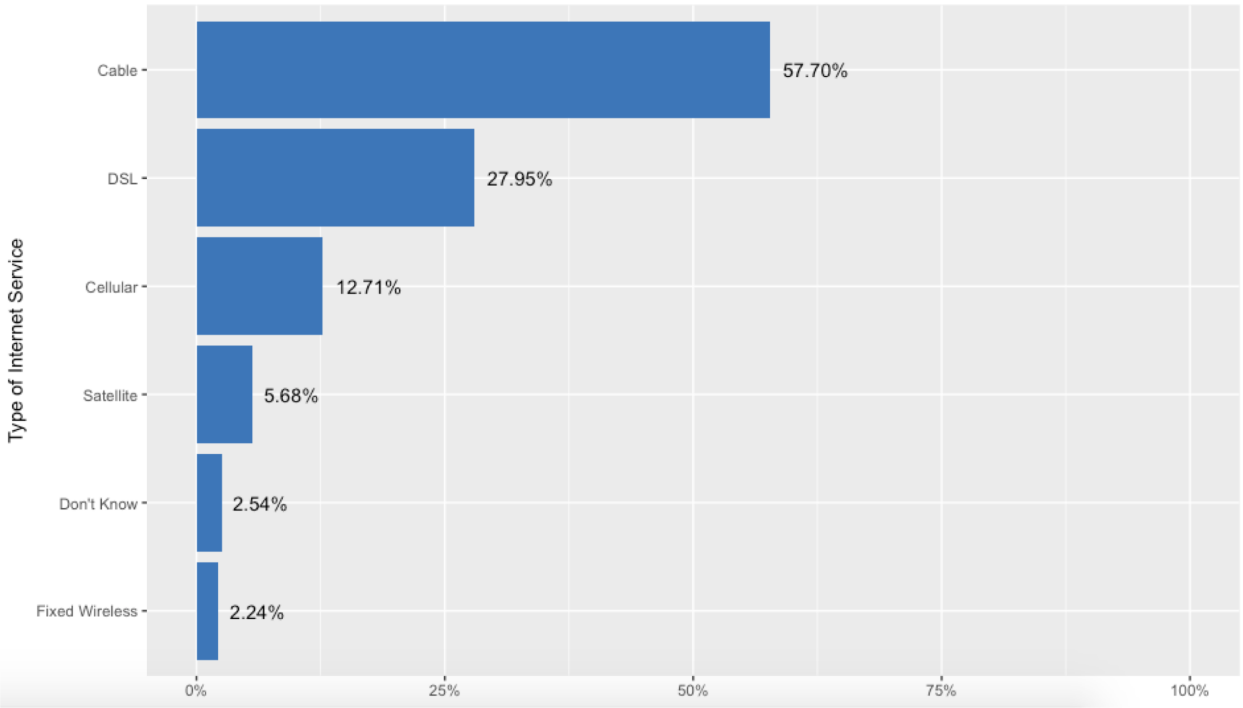
Across Region 9,

only **14.50%** of survey respondents report they **do not** have **high-speed internet access**.

Despite their report, a higher percentage of respondents **do not have high speed internet.**

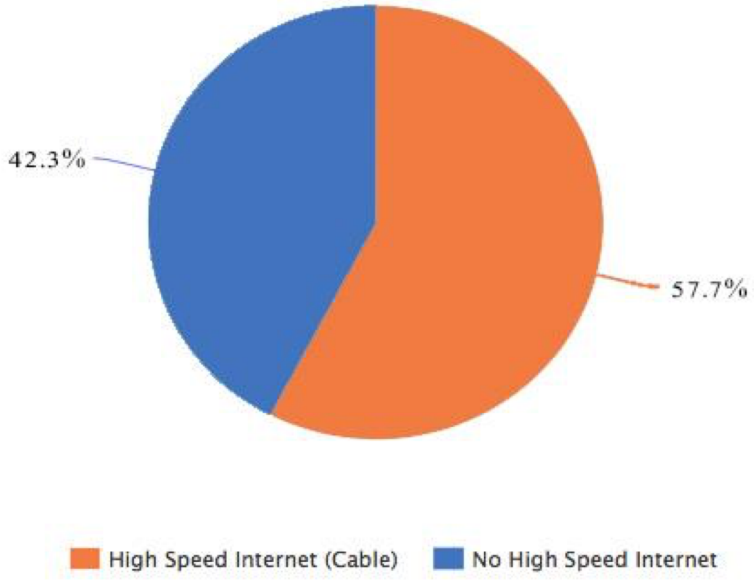


Type of Internet Service



High Speed Internet Access

For those who report having high-speed internet access at home, **57.50%** have **high-speed internet (Cable)**, while others do not.

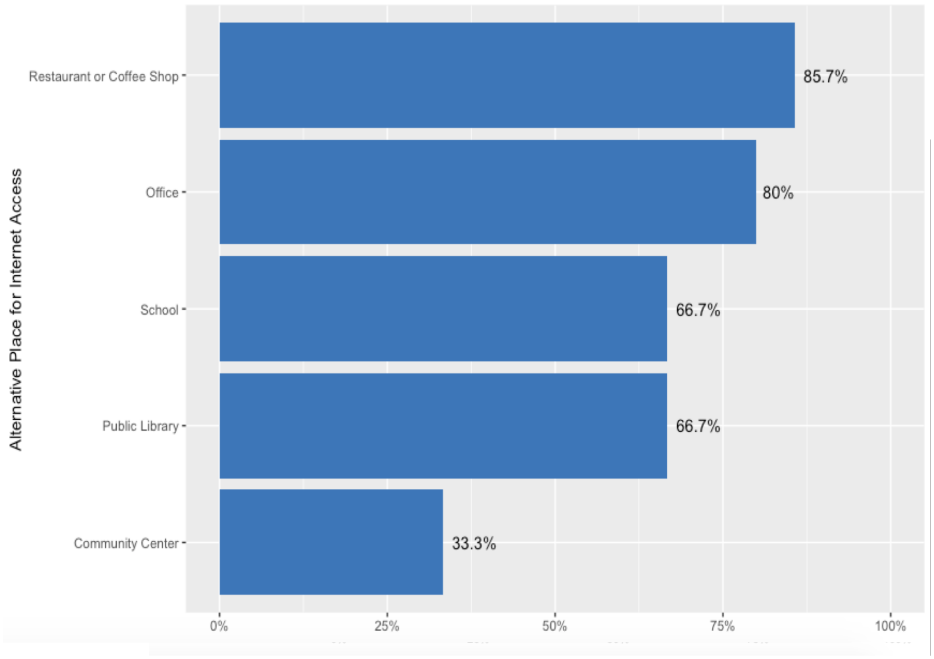


*Responses suggest that participants **do not know** if they **have high-speed internet service or not.**

Workarounds to Access High Speed Internet

Survey respondents who do not have high speed internet access at home reported the most popular places to access internet include:

1. **Restaurant or coffee shop**
2. **Office**
3. **School**

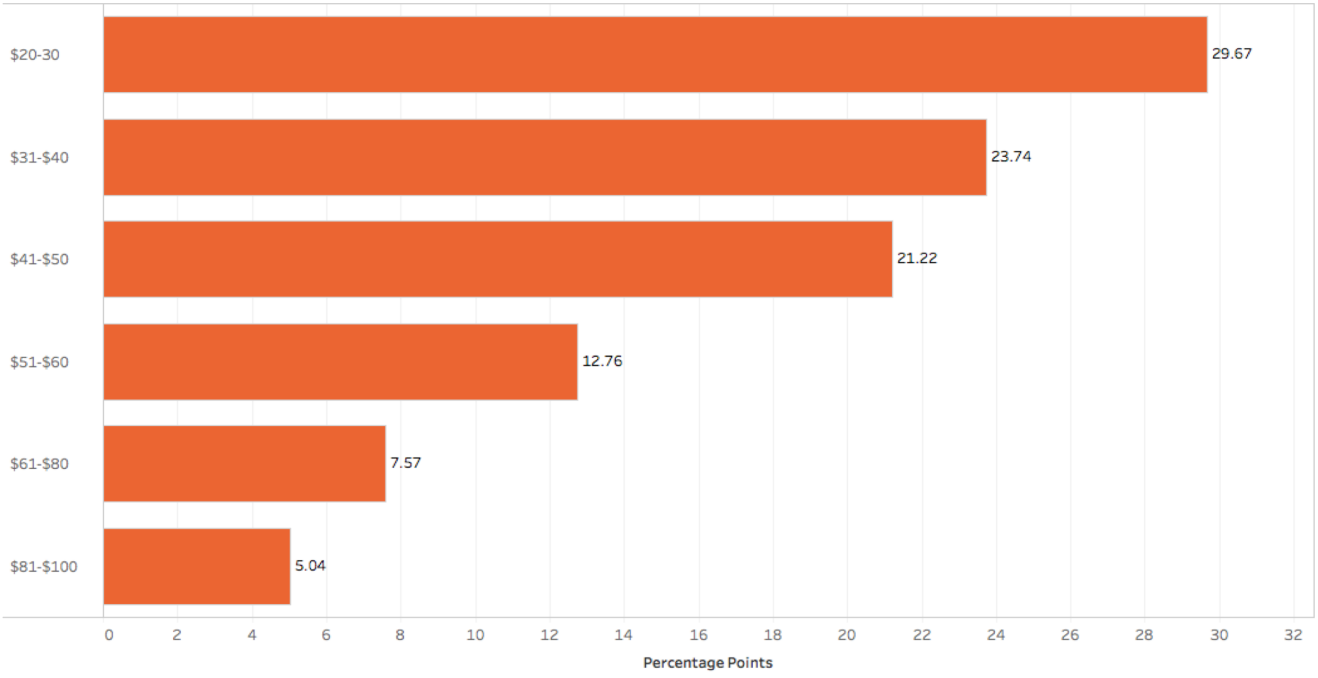


Across Region 9,

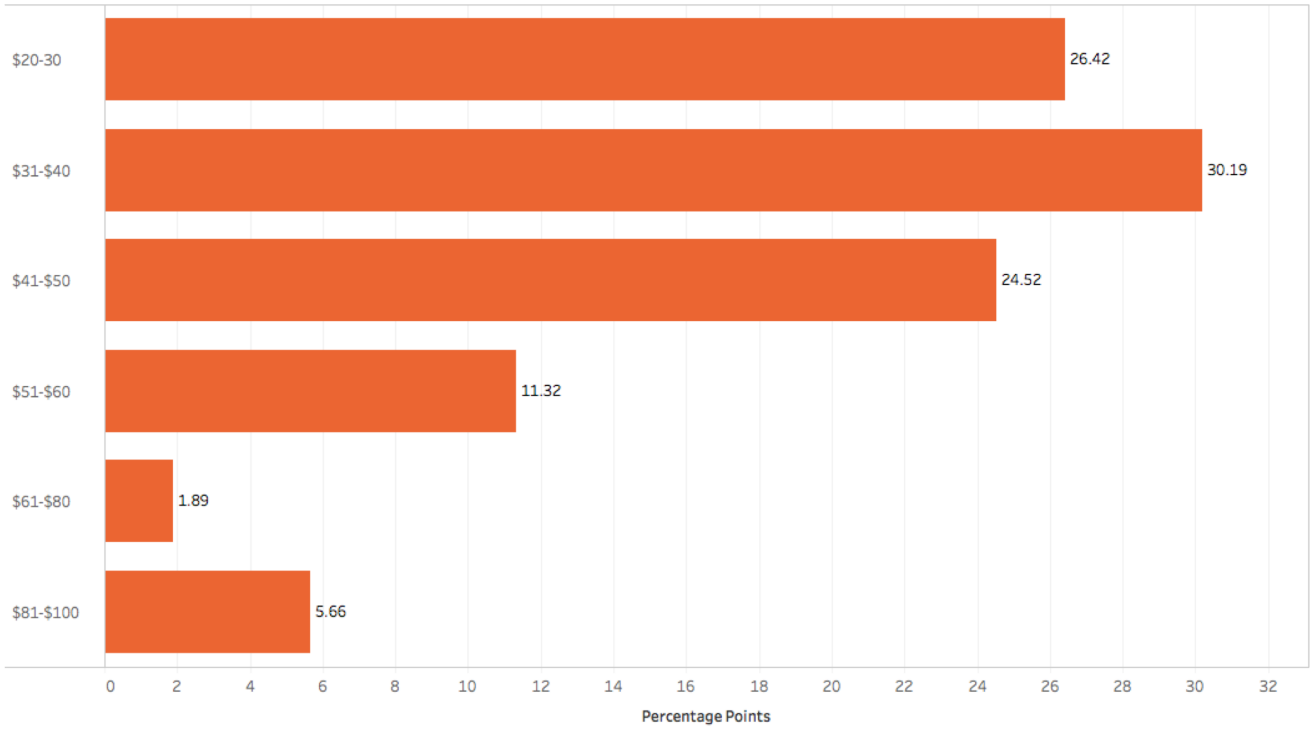
29.67%

of survey respondents reported they were willing to pay $20-30 for high-speed internet access

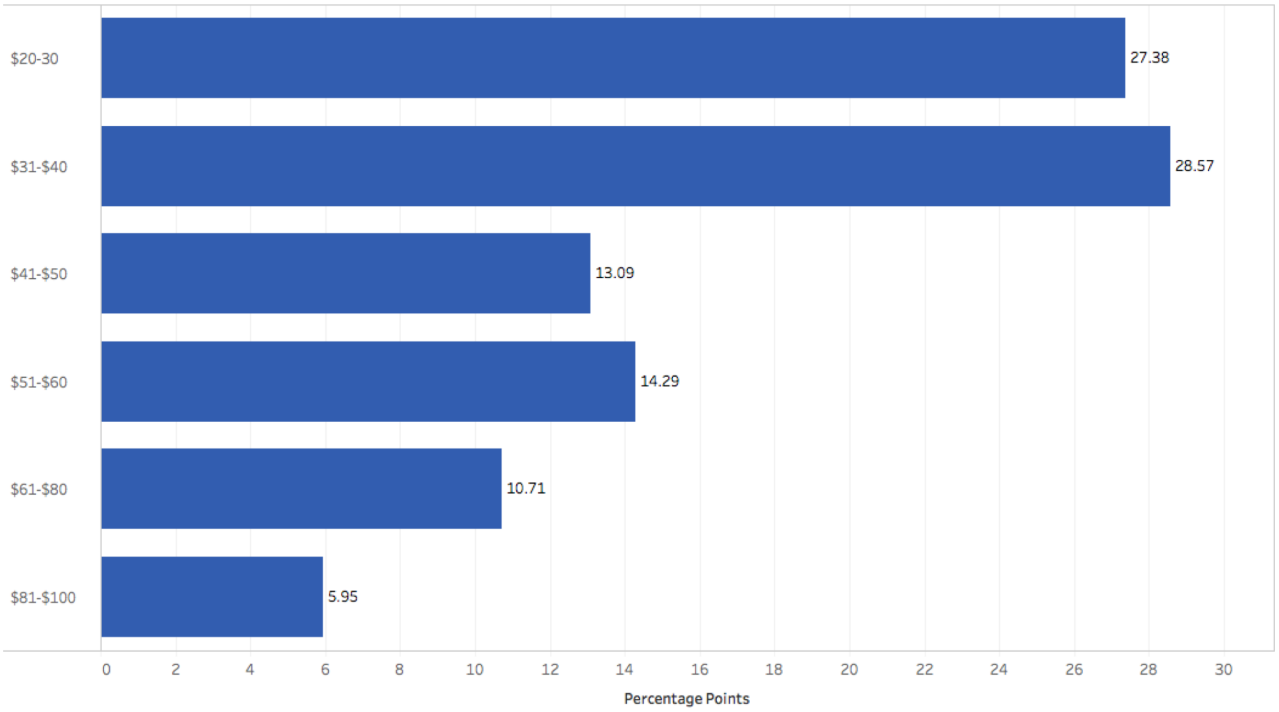
Region 9 Survey Respondents' Willingness to Pay for High Speed Internet



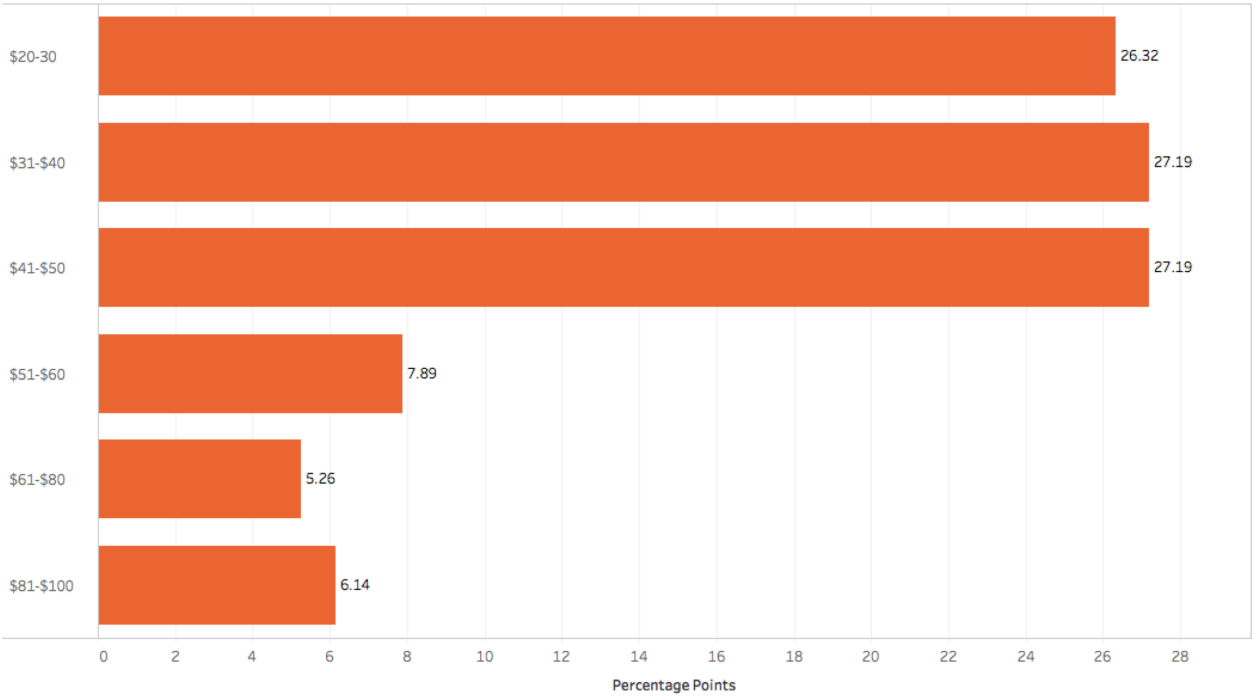
Hillsdale Survey Respondents' Willingness to Pay for High Speed Internet



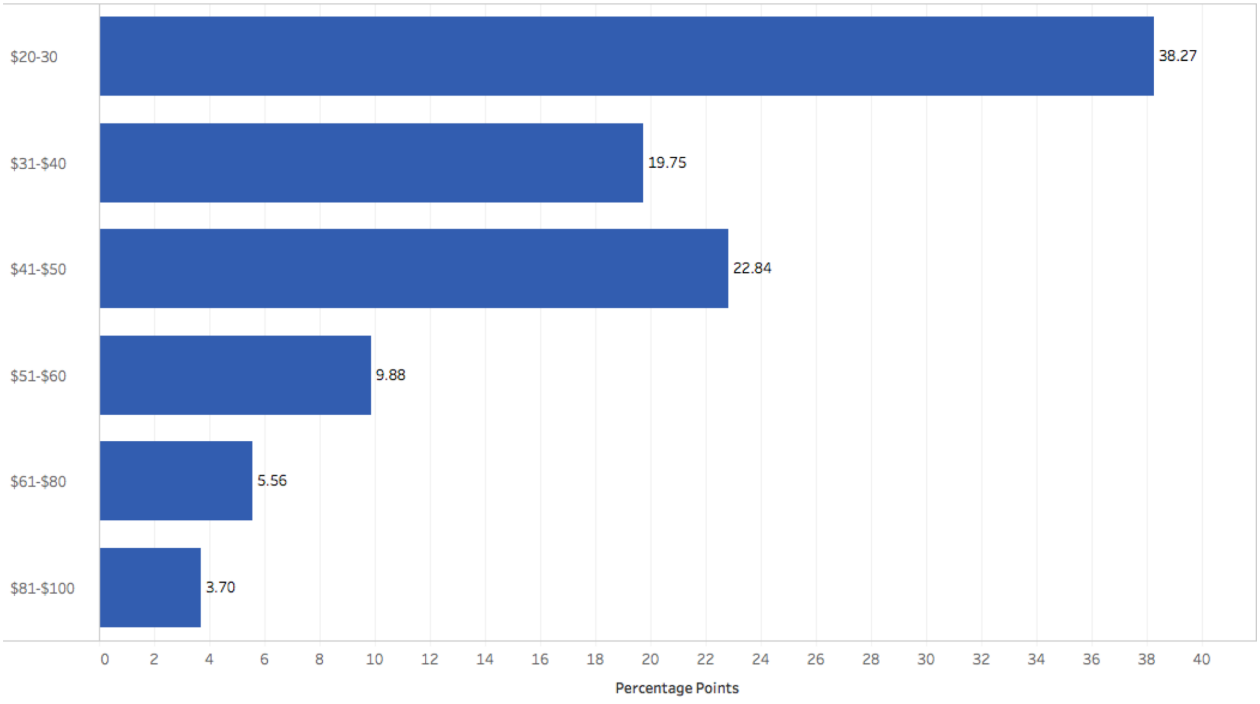
Jackson Survey Respondents' Willingness to Pay for High Speed Internet



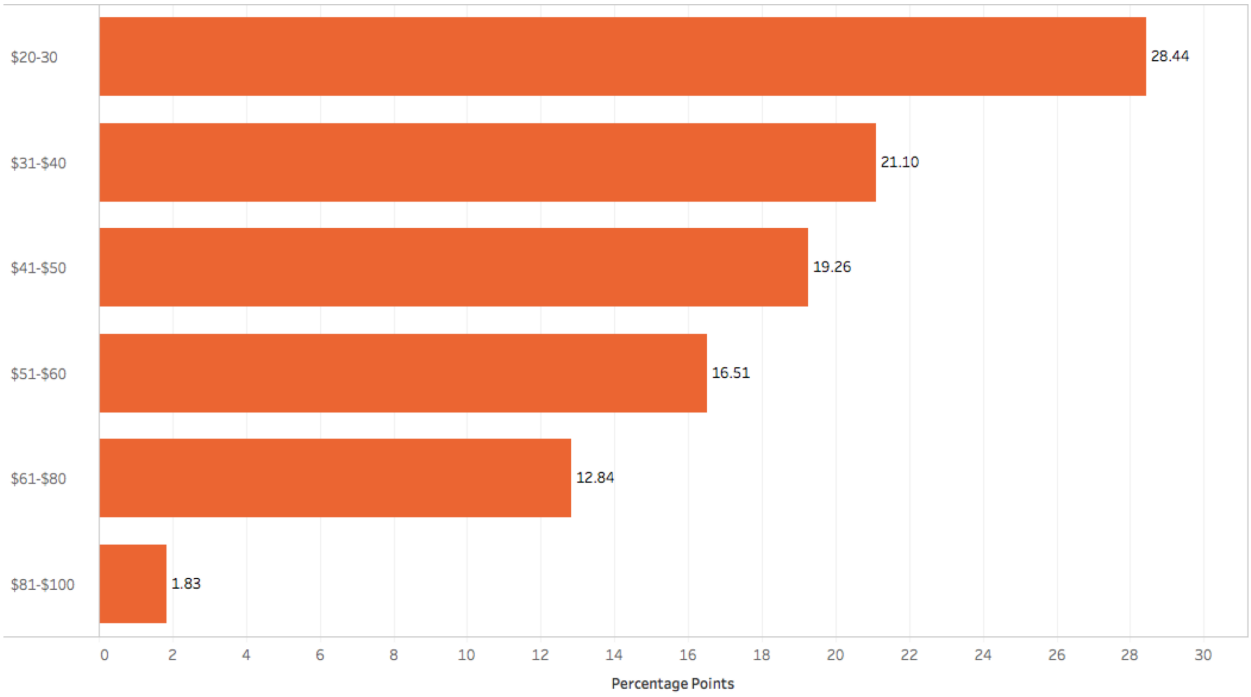
Lenawee Survey Respondents' Willingness to Pay for High Speed Internet



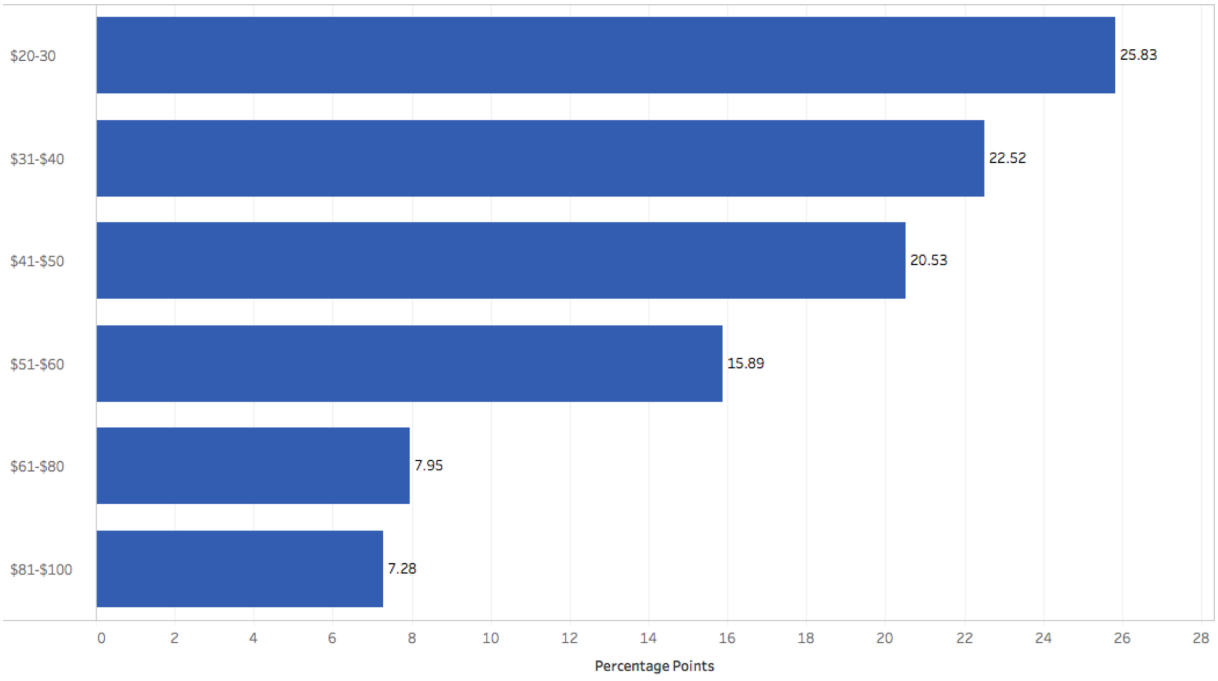
Livingston Survey Respondents' Willingness to Pay for High Speed Internet



Monroe Survey Respondents' Willingness to Pay for High Speed Internet



Washtenaw Survey Respondents' Willingness to Pay for High Speed Internet



Across Region 9,

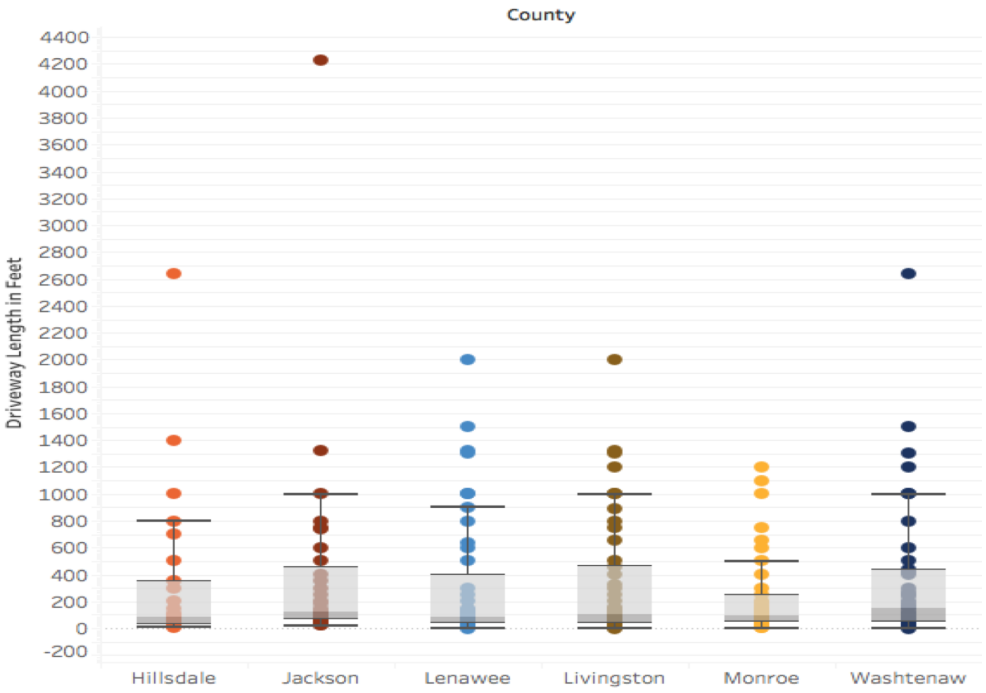
90%

of survey respondents reported a driveway length between **20** and **740** feet.

Jackson County reported the longest average driveway length at **321.93 feet**.

Driveway Length

90% of survey respondents reported a driveway length between **20** and **740** feet.



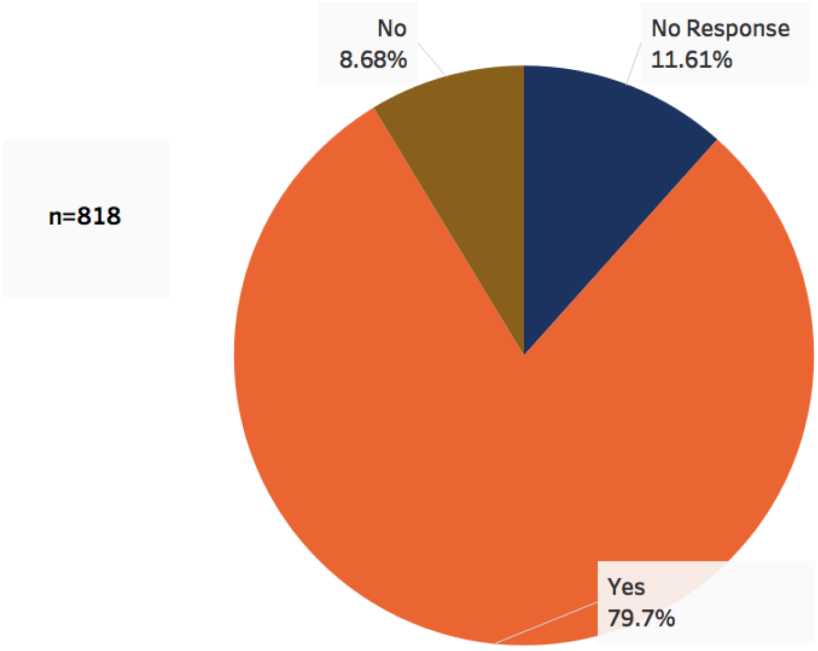
Driveway Length

Though standard deviations are high,

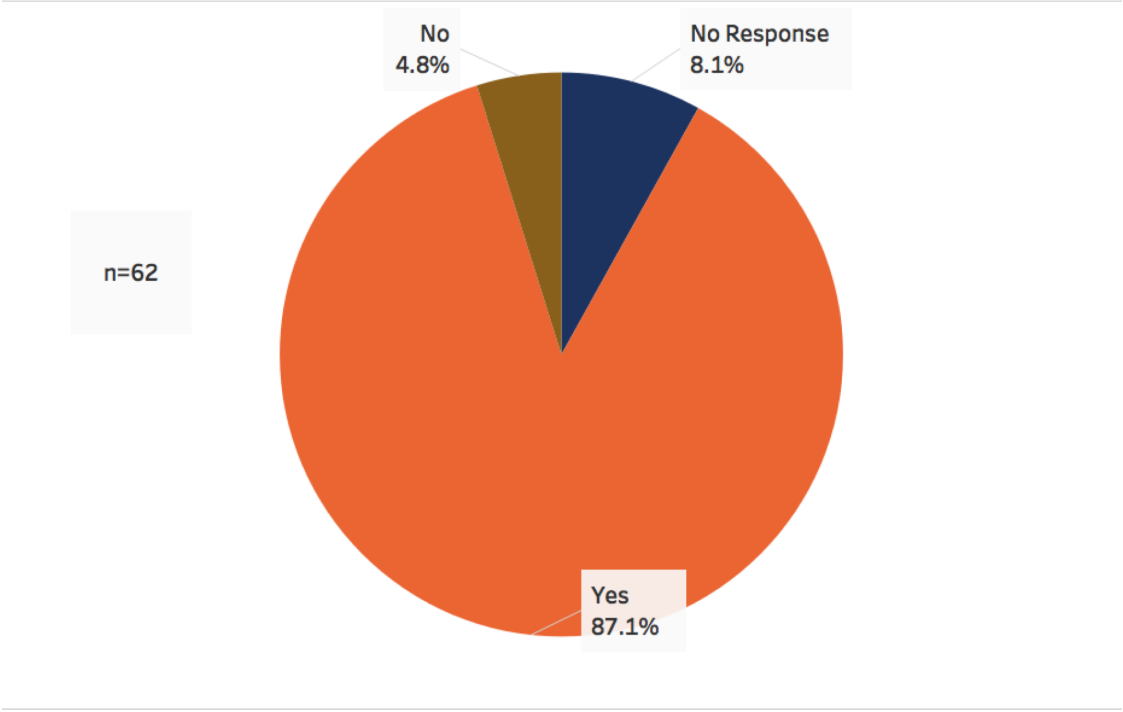
Jackson County reported the **longest driveway on average**.

County	Mean Length	Avg. Cost to Install Fiber	Standard Deviation	Counts	Min	Max
Hillsdale	304.89	$914.67	533.9750	61	10	2640
Jackson	**321.93**	**$965.79**	528.3330	95	25	4224
Lenawee	313.89	$941.67	416.2588	142	0	2000
Livingston	239.41	$718.23	355.6464	201	0	2000
Monroe	239.68	$719.04	342.5577	126	8	1200
Washtenaw	227.30	$681.90	417.5793	184	0	2640

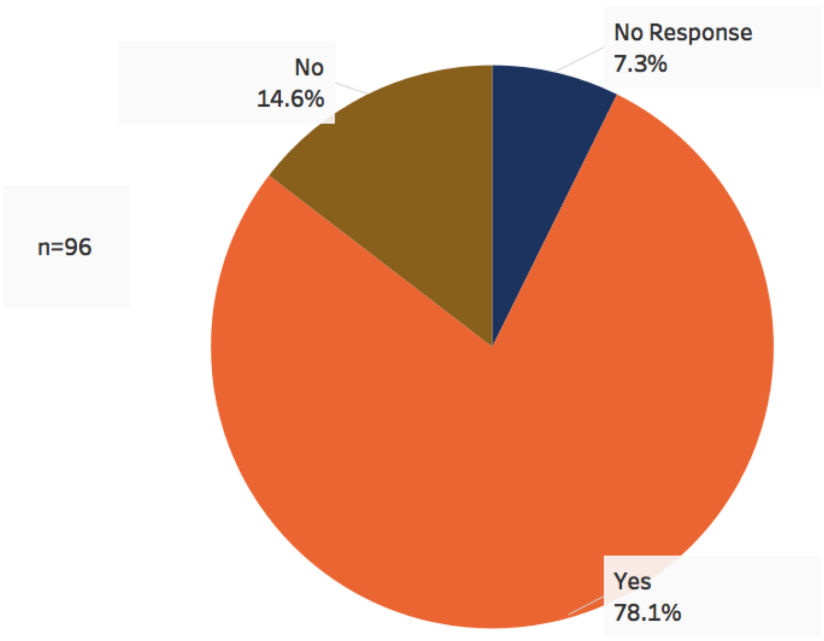
Interest in a Broadband Feasibility Study in Region 9



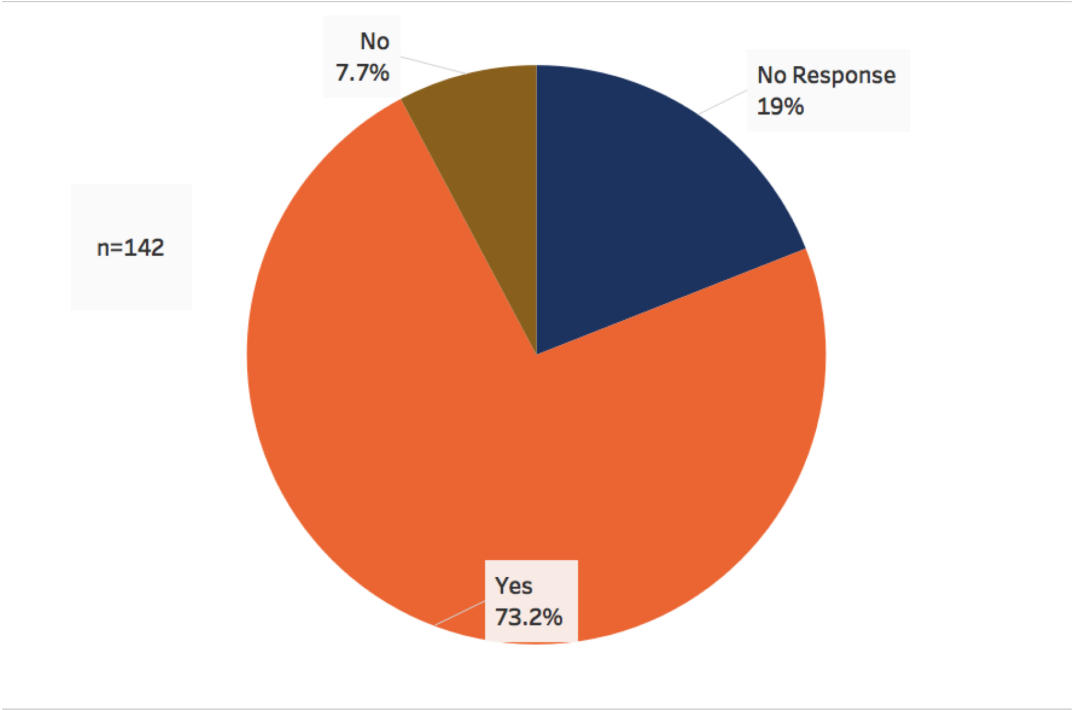
Interest in a Broadband Feasibility Study in Hillsdale



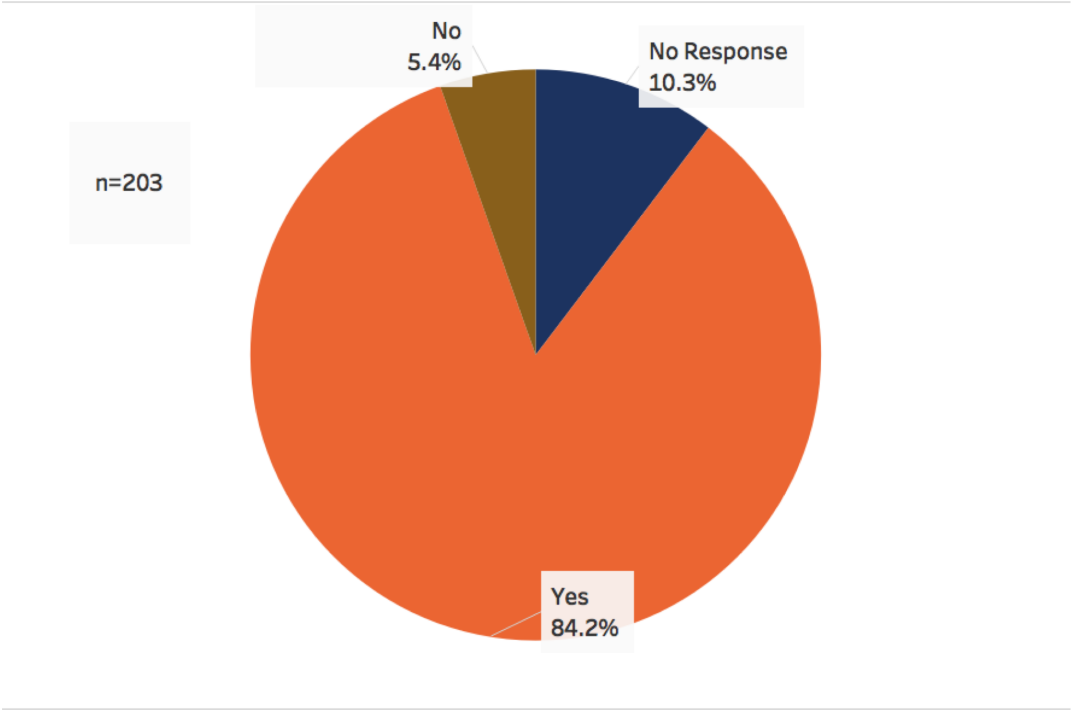
Interest in a Broadband Feasibility Study in Jackson



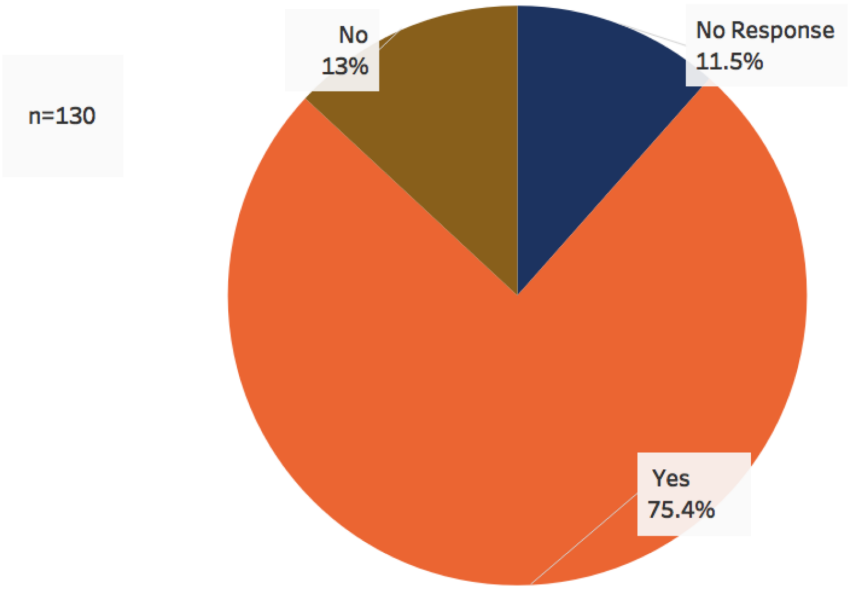
Interest in a Broadband Feasibility Study in Lenawee



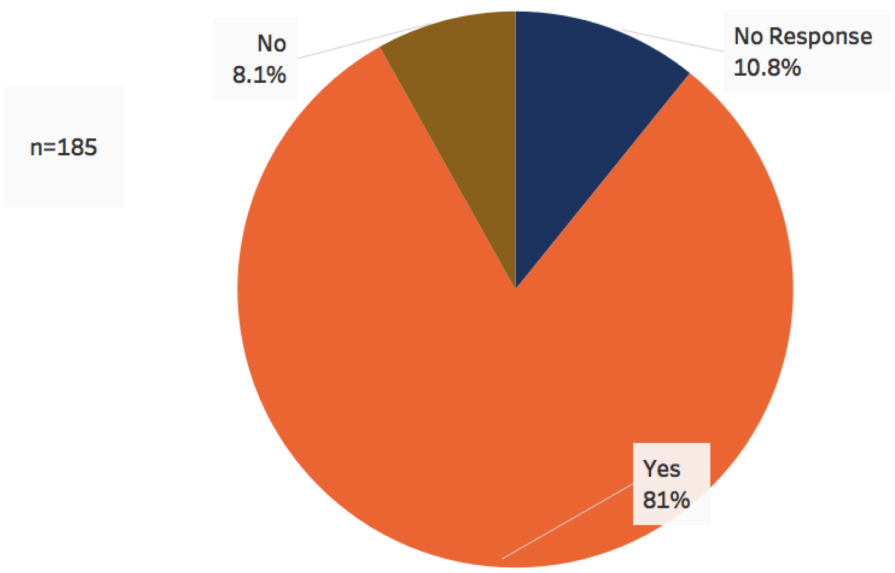
Interest in a Broadband Feasibility Study in Livingston



Interest in a Broadband Feasibility Study in Monroe



Interest in a Broadband Feasibility Study in Washtenaw



Acknowledging Potential Sources of Error

Some data entries included:

- Question marks
- Numeric ranges (that were averaged)
- A number of 99’s on a question where 999 was the “no response” option
- Numerical questions answered with “yes” when asked about the number of students needing access from this location
- Numerical responses in the thousands as a response to the length of driveway and other outliers (a business supporting 642 students, for example)

Key Informant Interviews

Phase Two: Key Informant Interviews

To better understand...

- how differences in broadband access impact how educational instruction is provided
- whether full student participation is dependent upon internet access at home
- what extent they believe educational outcomes are affected by access to broadband

Key Informant Teacher Interviews were planned.
Project Team developed:

- Outreach Letter
- Key Informant Interview Protocol

Key Informant Interviews

Goal: Conduct two teacher interviews per county for a total of 12 interviews.

Outreach to recruit teachers: Six teacher contacts were provided by the Washtenaw County ISD. Snowball sampling used to recruit additional teachers was unsuccessful.

Result: 3 of 12 key informant interviews completed.

Jackson County 1 interview was completed.

Washtenaw County 2 interviews were completed.

Appendix C: Additional Example Survey Results from Local Townships

Dexter Township Broadband (Internet) Survey

Property I.D. D-04-___ ___ - ___ ___ ___ - ___ ___ ___ (as shown on your tax bill)

Property Address _____, _____, MI _____
City Zip Code

Contact Info _____, (_____)_____
Email Phone Number

Property Type

- ☐ Residential
- ☐ Commercial
- ☐ Vacant lot

Survey Return Options – Please Return NO LATER THAN September 14, 2017

- Return in envelope with your tax payment
- Return to Dexter Township Dropbox (Blue Box by Township Hall Entrance)
- Mail to Supervisor, Dexter Township, 6880 Dexter-Pinckney Rd, Dexter 48130
- Scan and email to broadband@dextertownship.org
- This form can be downloaded online @ http://www.dexterrtownship.org

We value your privacy. We will only use your Email or Phone if we need additional information. We will not give or sell this info to anyone.

1) Do you have Internet Access at your address?

- ☐ Yes
- ☐ No (skip to question #6)
- ☐ I don't know

2) If you have Internet Access at your address, what type service is it?

- ☐ Cable Internet
- ☐ DSL Internet
- ☐ Dedicated T-1 Line
- ☐ Satellite-based Internet
- ☐ Dial-Up Internet
- ☐ Cellphone-based Internet
- ☐ Wireless Internet
- ☐ I don't know

3) If you have Internet Access at your address, who is your provider?

- ☐ Charter Spectrum
- ☐ AT&T
- ☐ Dish Network
- ☐ Direct TV
- ☐ Verizon
- ☐ Sprint
- ☐ Rural Reach
- ☐ Air Advantage
- ☐ Provide Net
- ☐ Wild Blue
- ☐ Hughes Net
- ☐ I don't know
- ☐ Other _____
  Name of provider=

4) How much do you currently pay for Internet each month?

- ☐ $20-$30
- ☐ $31-$50
- ☐ $51-70
- ☐ $71-90
- ☐ More than $90
- ☐ I don't know

5) Does your internet service meet your needs?

- ☐ Yes
- ☐ No
- ☐ Not applicable

6) If you do not subscribe to broadband, why not?

- ☐ No value to using the internet
- ☐ Adequate access elsewhere
- ☐ Broadband is not available
- ☐ Too slow or data caps
- ☐ Other _____

_____

_____

7) How important is Broadband (high speed internet) Access to you?

- ☐ Very Important
- ☐ Somewhat Important
- ☐ No preference
- ☐ Not Very Important
- ☐ Not Important At All

8) If you don't have internet access at home, where do you go to use it?

- ☐ Library
- ☐ Coffee Shop/Restaurant
- ☐ Community Center
- ☐ Other
- ☐ I do without

9) How much are you willing to pay for Internet each month?

- ☐ $20-$30
- ☐ $31-$50
- ☐ $51-70
- ☐ $71-90
- ☐ More than $90

10) If you have high speed internet access at home, how fast is it?

- ☐ Dial up
- ☐ 5Mbps
- ☐ 10Mbps
- ☐ 60 Mbps
- ☐ 100Mbps
- ☐ I don't know

11) Are you interested in alternate choices?

- ☐ Yes
- ☐ No

Dexter Township Resident,

July 01, 2017

The Dexter Township Board of Trustees is attempting to accurately determine the extent of availability of true High-Speed Broadband (Internet) in Dexter Township. We have studied the service area in broad terms, but we don't have accurate information on each property in the Township.

We have formed a Broadband Research Committee to gather detailed information on Broadband accessibility. If you would be interested in serving on this committee, please contact Trustee Mike Compton mcompton@dextertownship.org, or Supervisor Harley Rider supervisor@dextertownship.org

To help us gather accurate information, we are asking all Dexter Townships property owners to complete the enclosed survey. This survey will help us determine the extent of the areas in Dexter Township that have High-Speed Broadband and those that don't have access.

If you would like more information on this survey, please contact any Dexter Township official.

Please return your completed survey with your tax payment, Dexter Township Dropbox (Blue Box by Township Hall Entrance), or mail to *Dexter Township Broadband, 6880 Dexter-Pinckney Rd, Dexter 48130*

Please return your survey as soon as possible, but no later than September 14, 2017.

Sincerely,

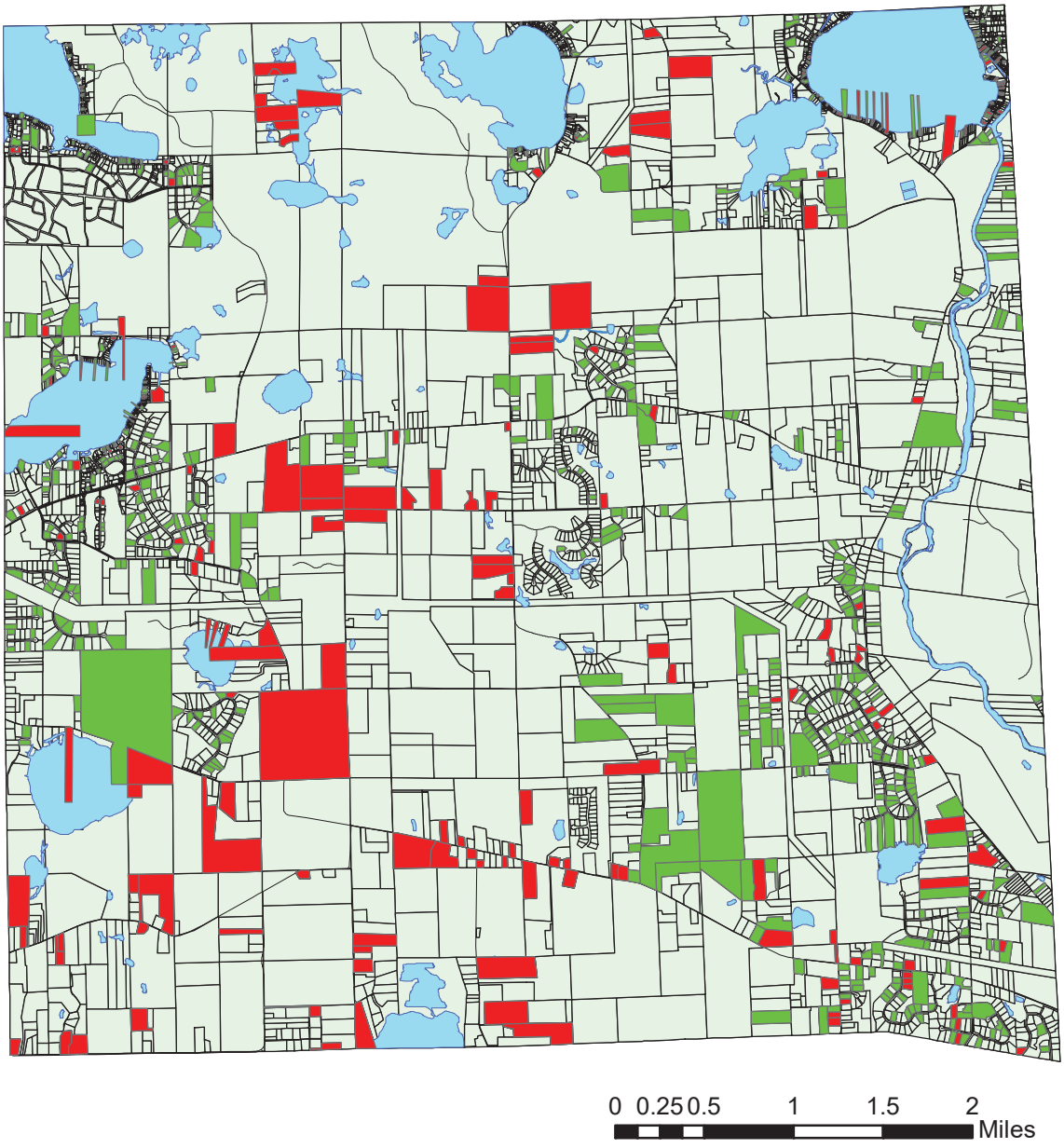
Michael J Compton | Trustee | mcompton@dextertownship.org
Harley Rider | Supervisor | supervisor@dextertownship.org
Dexter Township Broadband Committee | broadband@dextertownship.org

Dexter Township
6880 Dexter-Pinckney Rd
Dexter 48130
Phone: (734) 426-3767
Fax: (734) 426-3833

Office Hours: Monday-Friday
8:30 a.m. - 4:30 p.m.

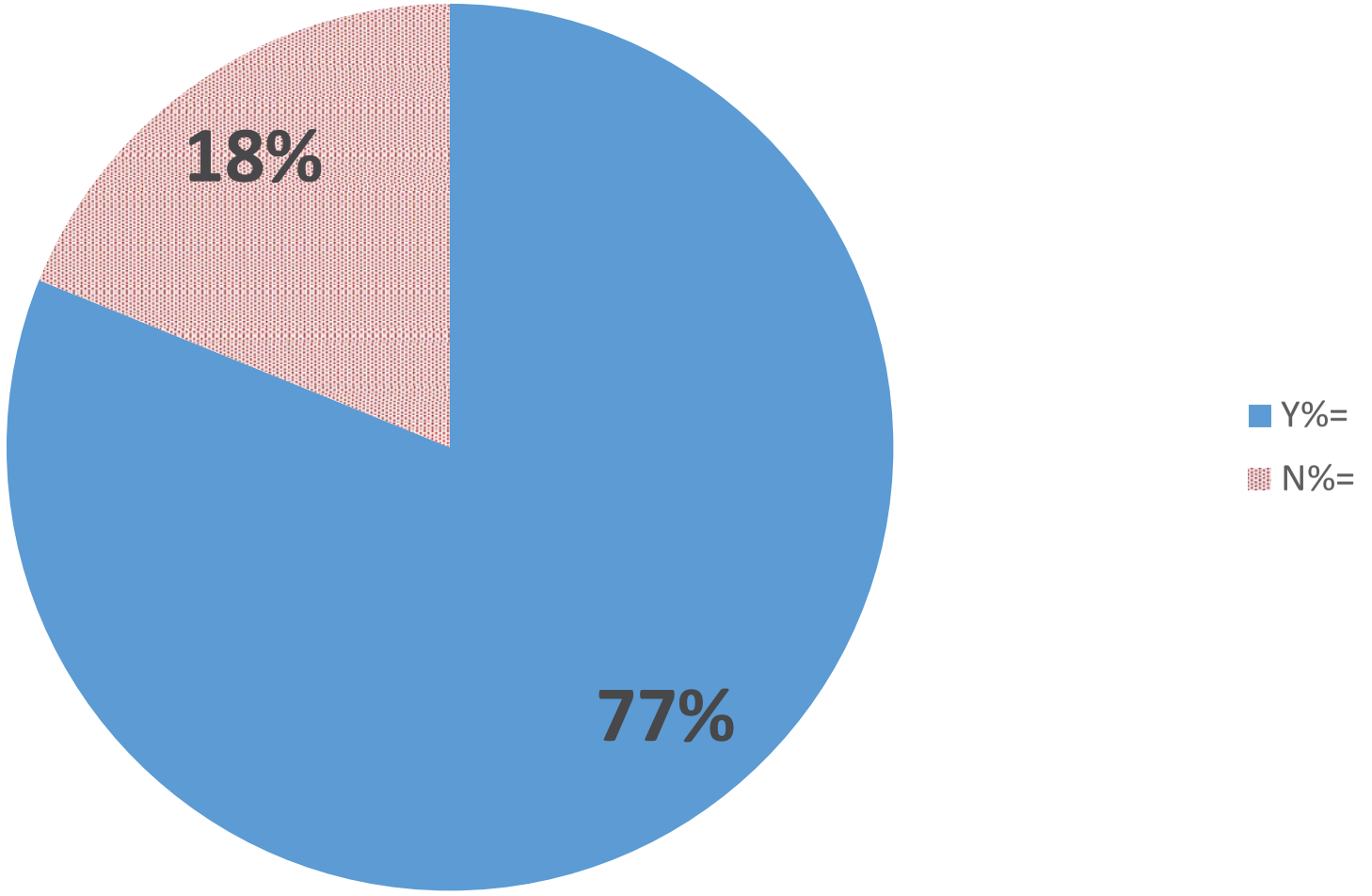
Notes/Comments:

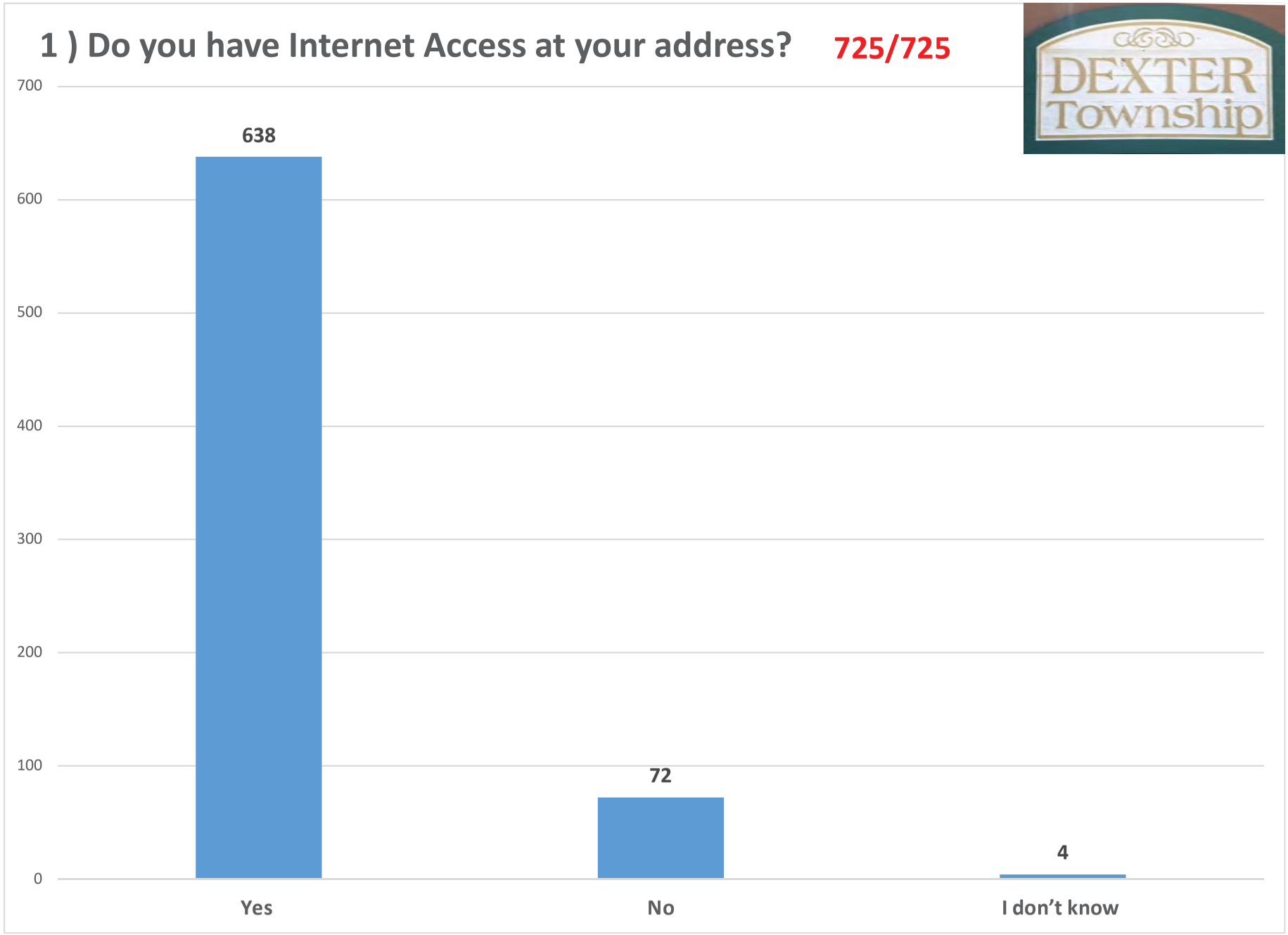
Broadband or No Broadband?
Dexter Township
2017



Dexter Township Households with access to broadband?

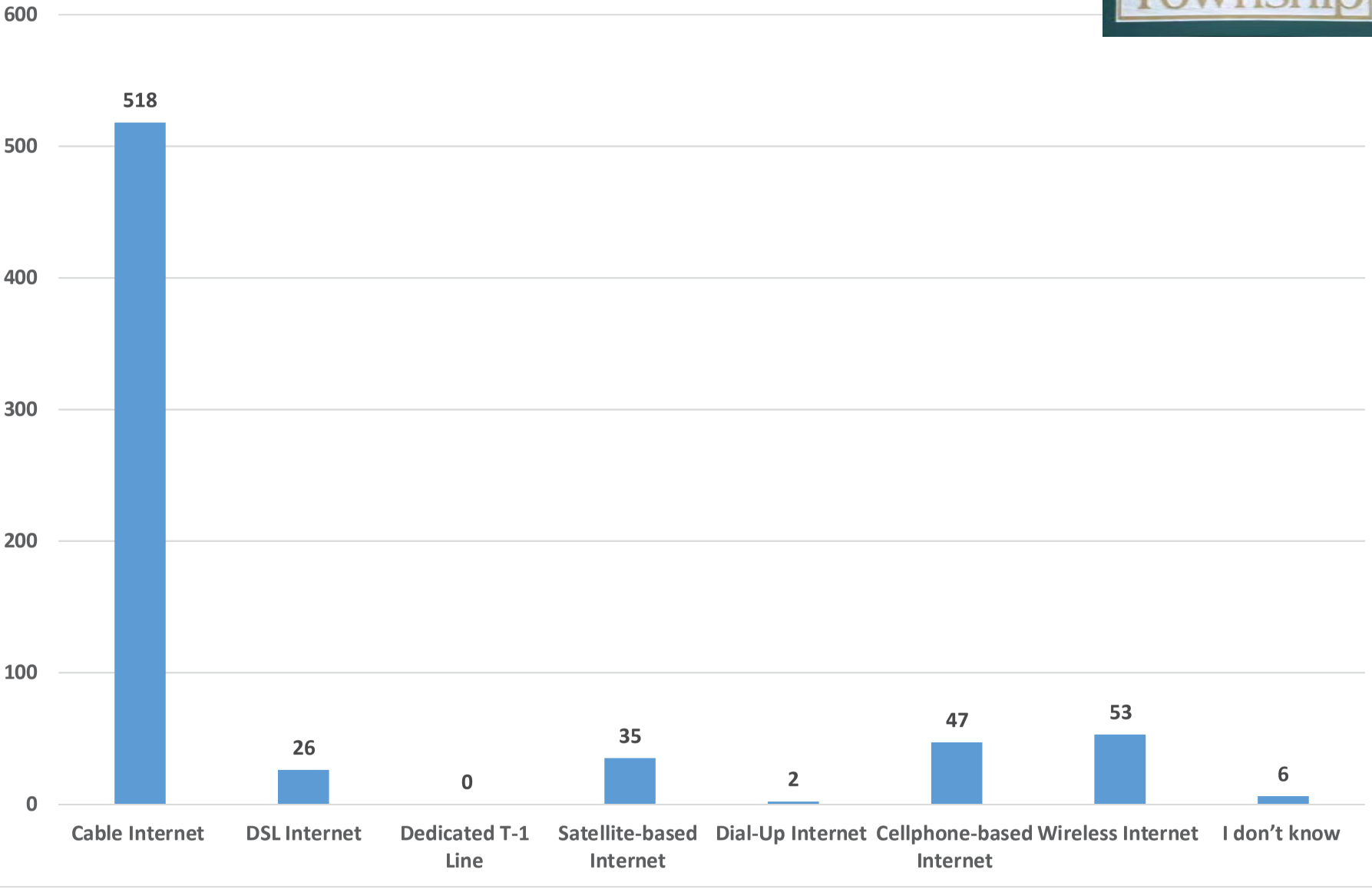
Our Data 725/725




1) Do you have Internet Access at your address?
725/725
DEXTER Township
700
600
500
400
300
200
100
0
638
72
4
Yes
No
I don't know

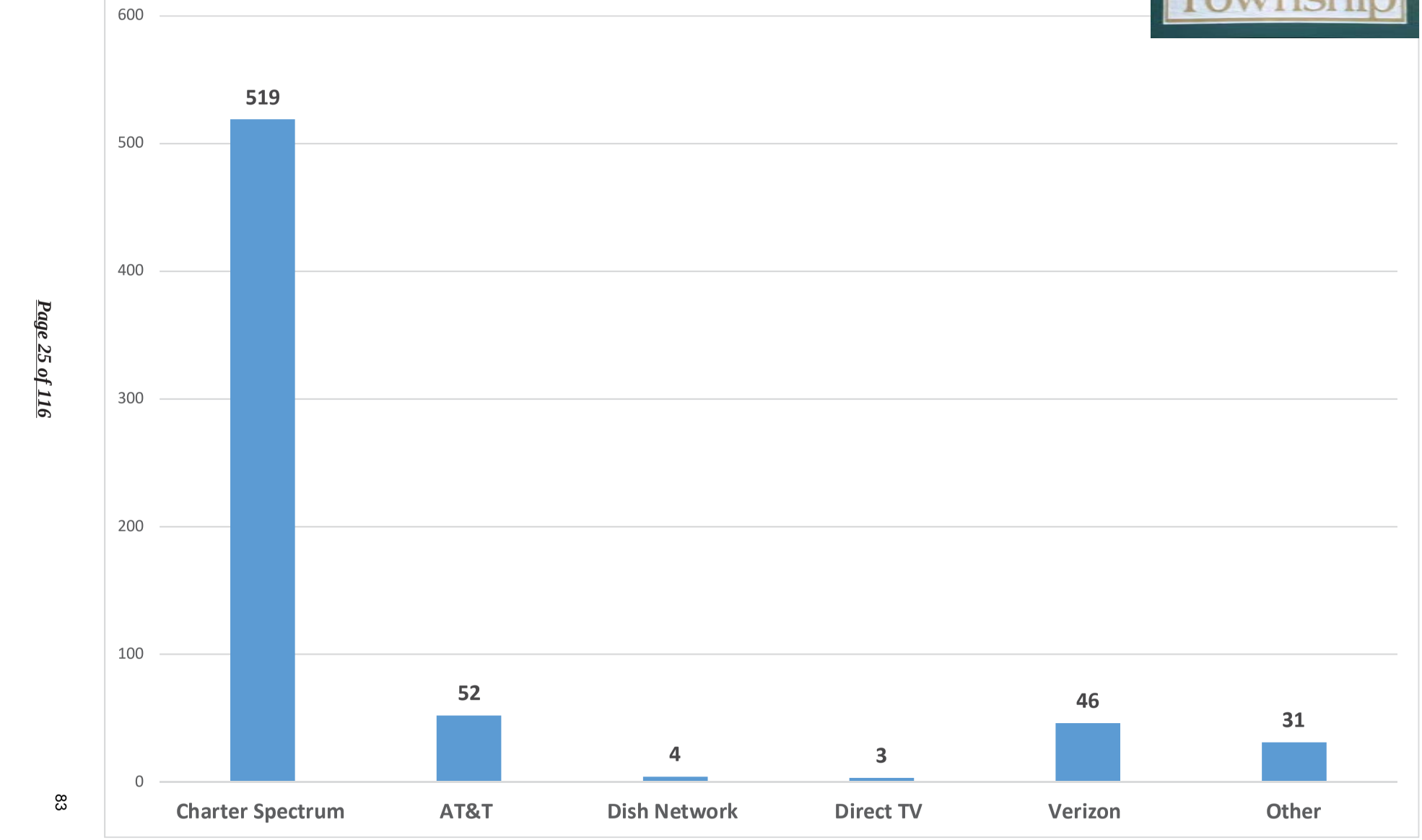
2) If you have Internet Access at your address, what type service is it?

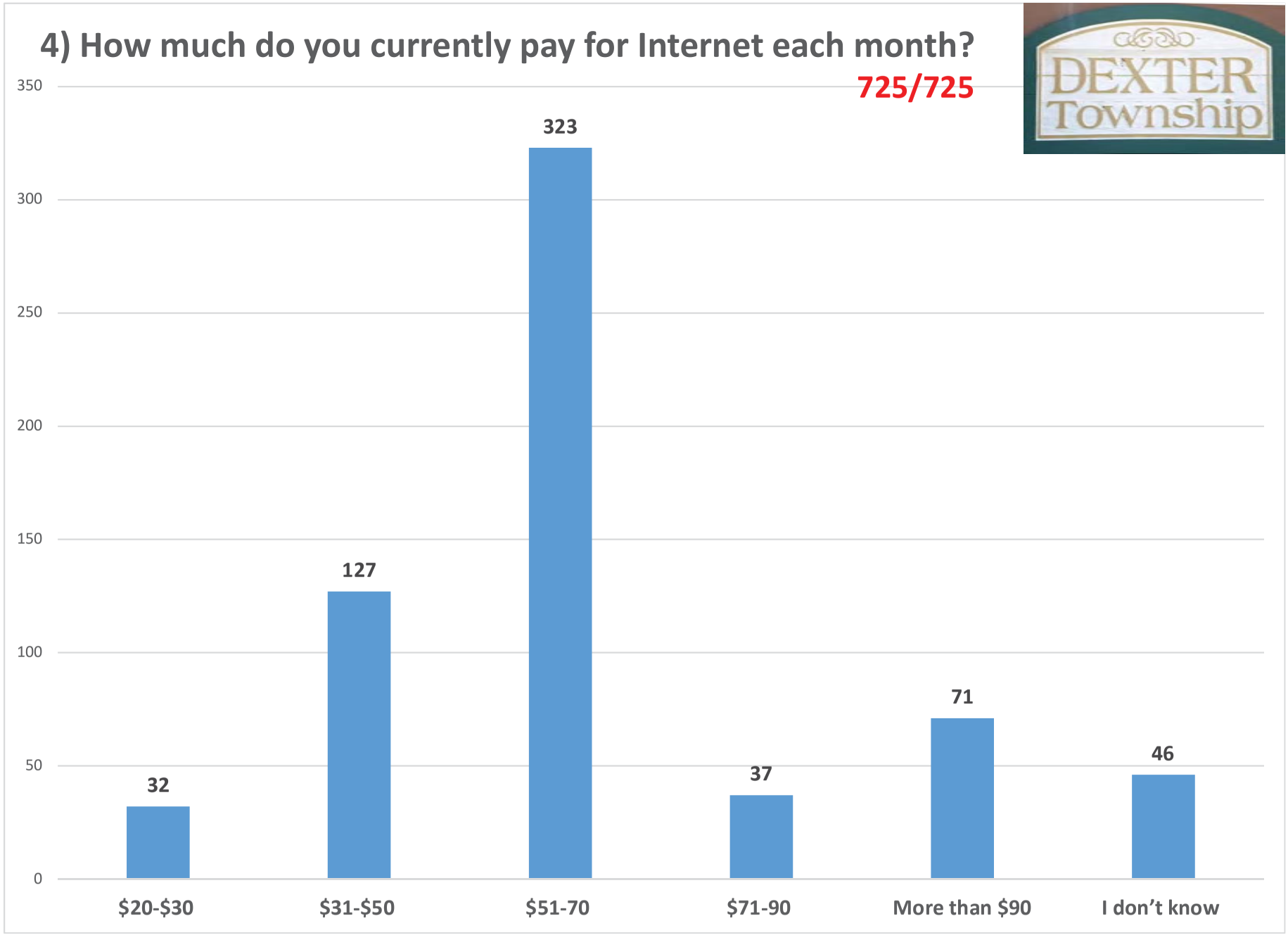
725/725

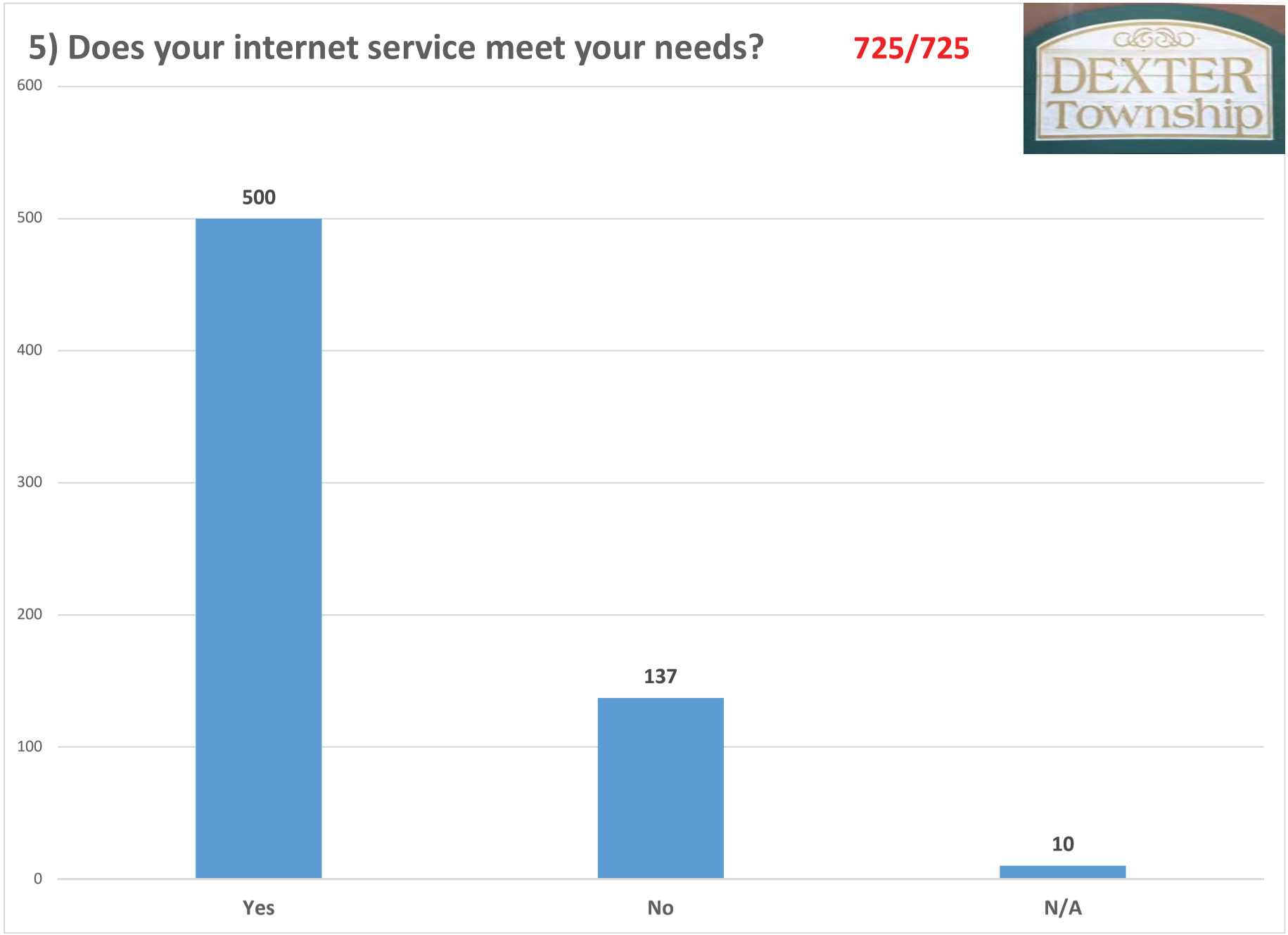


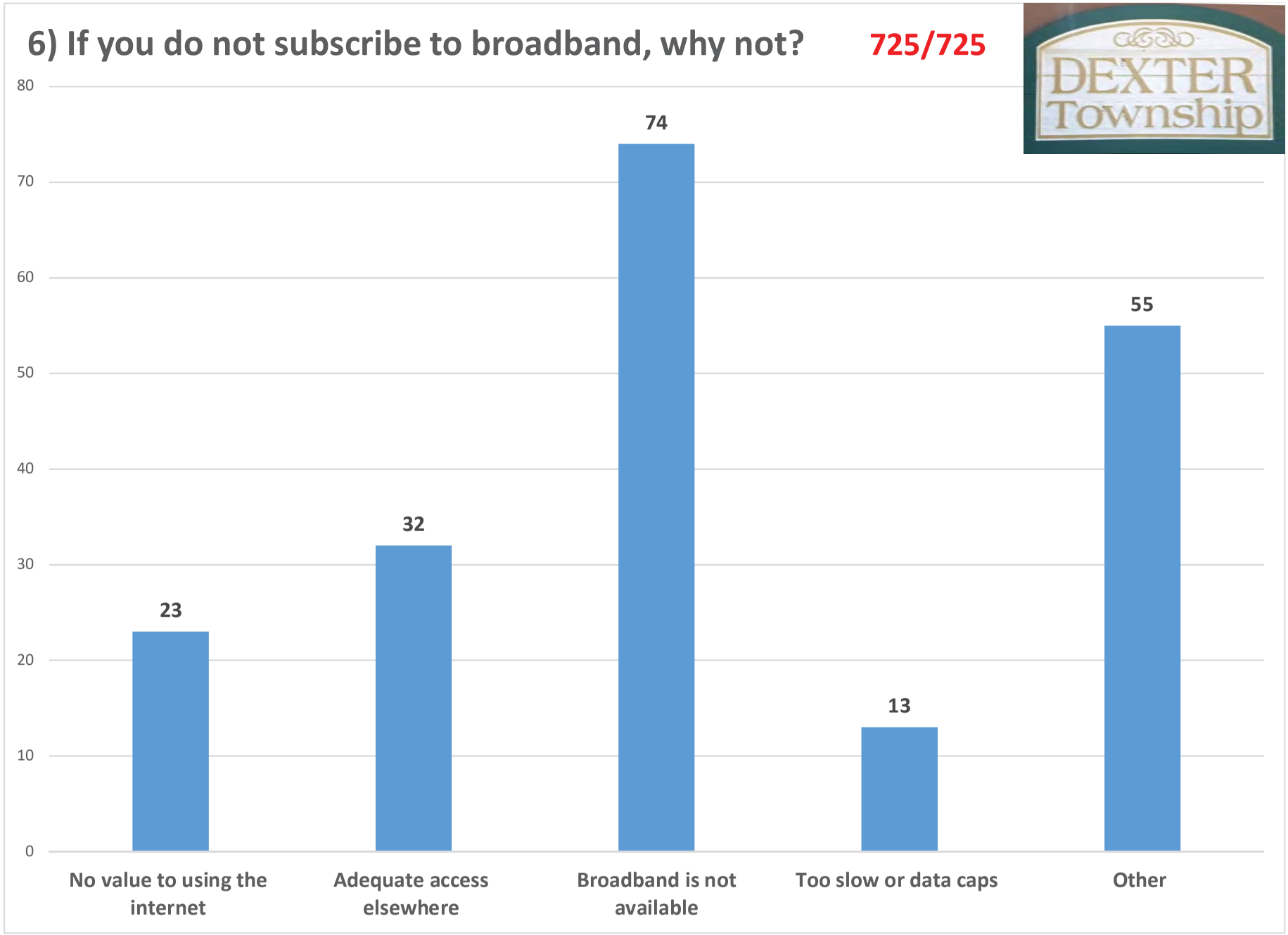
3) If you have Internet Access at your address, who is your provider?

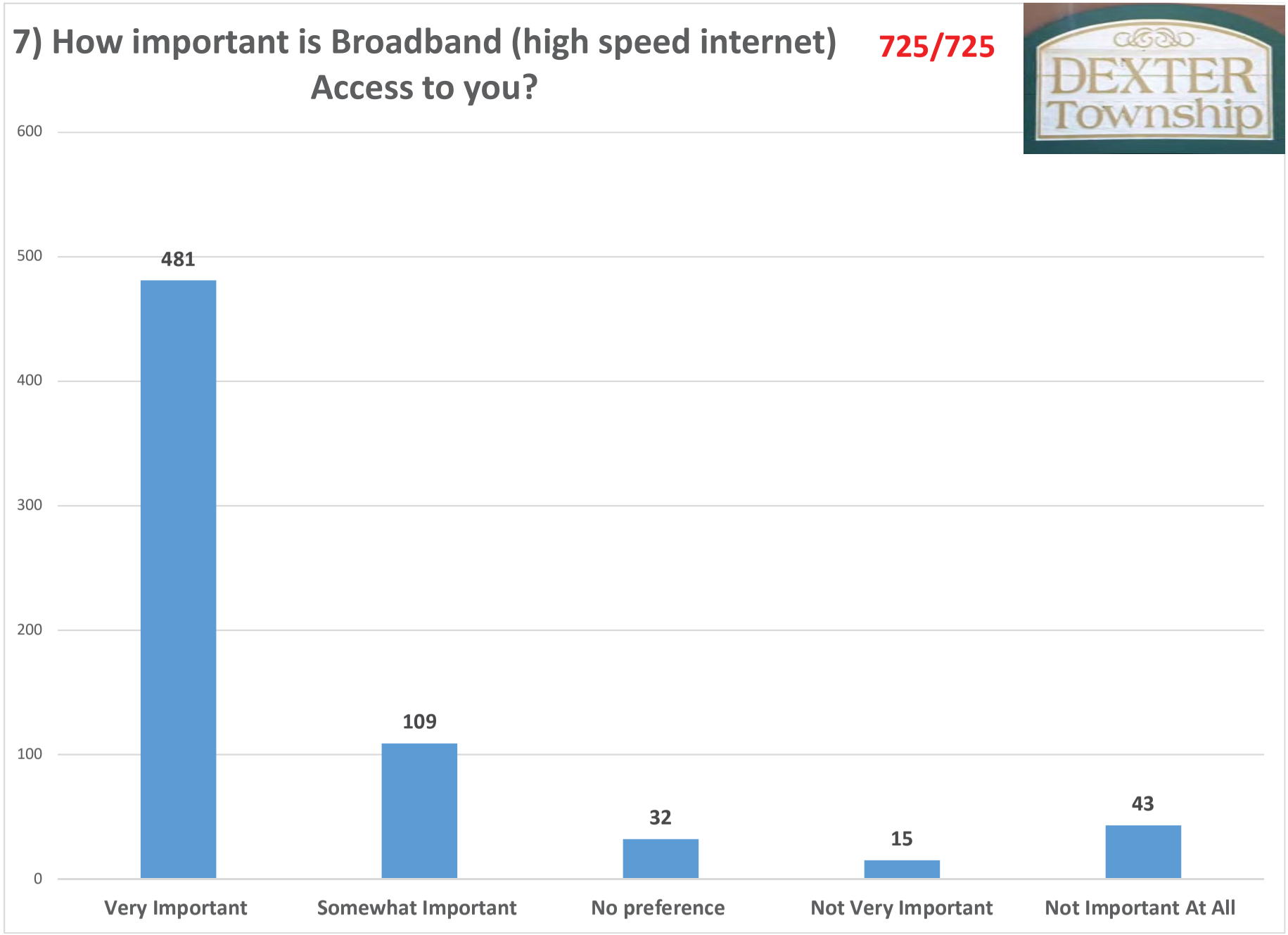
725/725




4) How much do you currently pay for Internet each month?
725/725
DEXTER Township
350
300
250
200
150
100
50
0
323
127
32
37
71
46
$20-$30
$31-$50
$51-70
$71-90
More than $90
I don't know

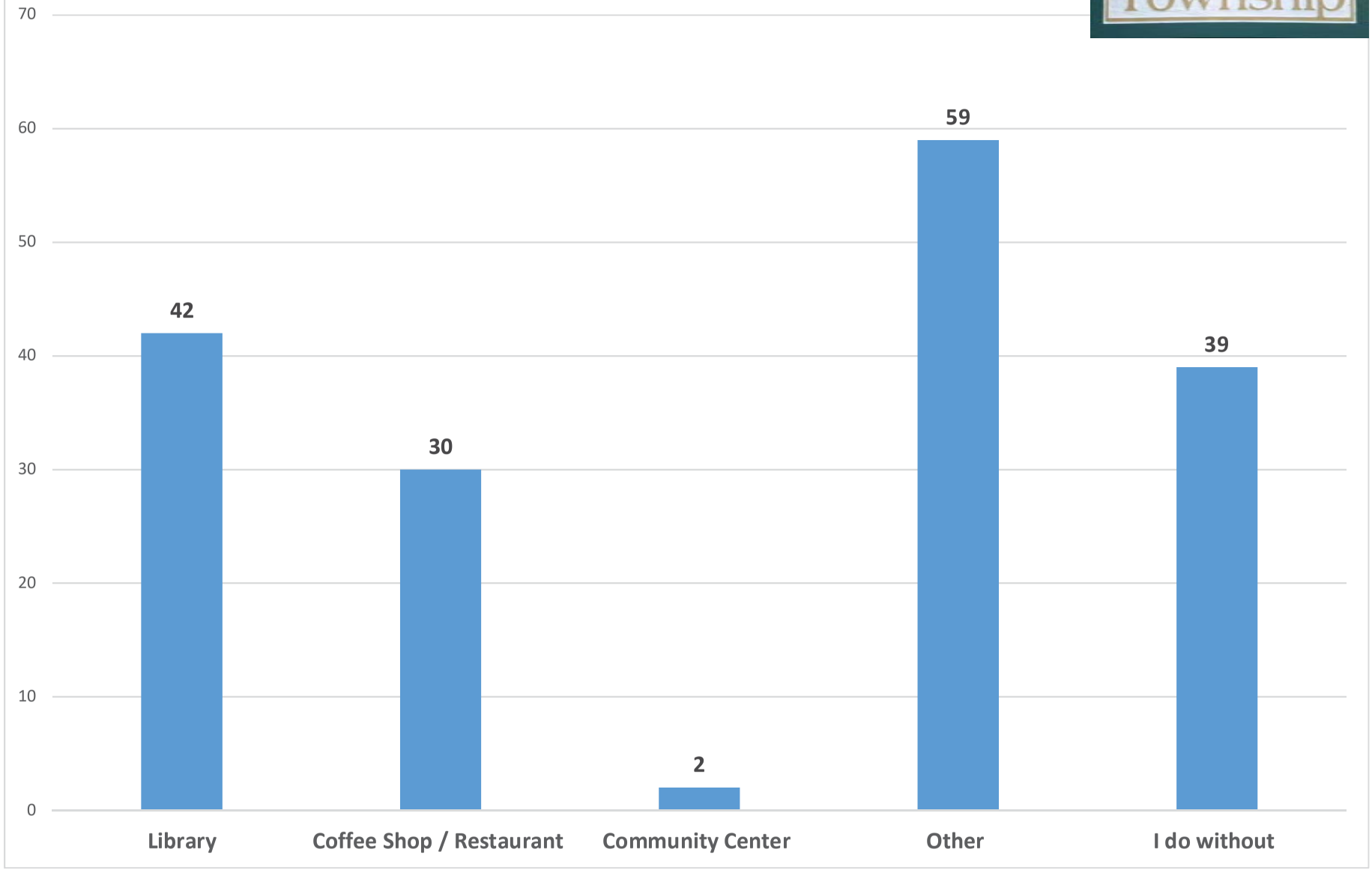

5) Does your internet service meet your needs?
725/725
DEXTER Township
600
500
400
300
200
100
0
500
137
10
Yes
No
N/A

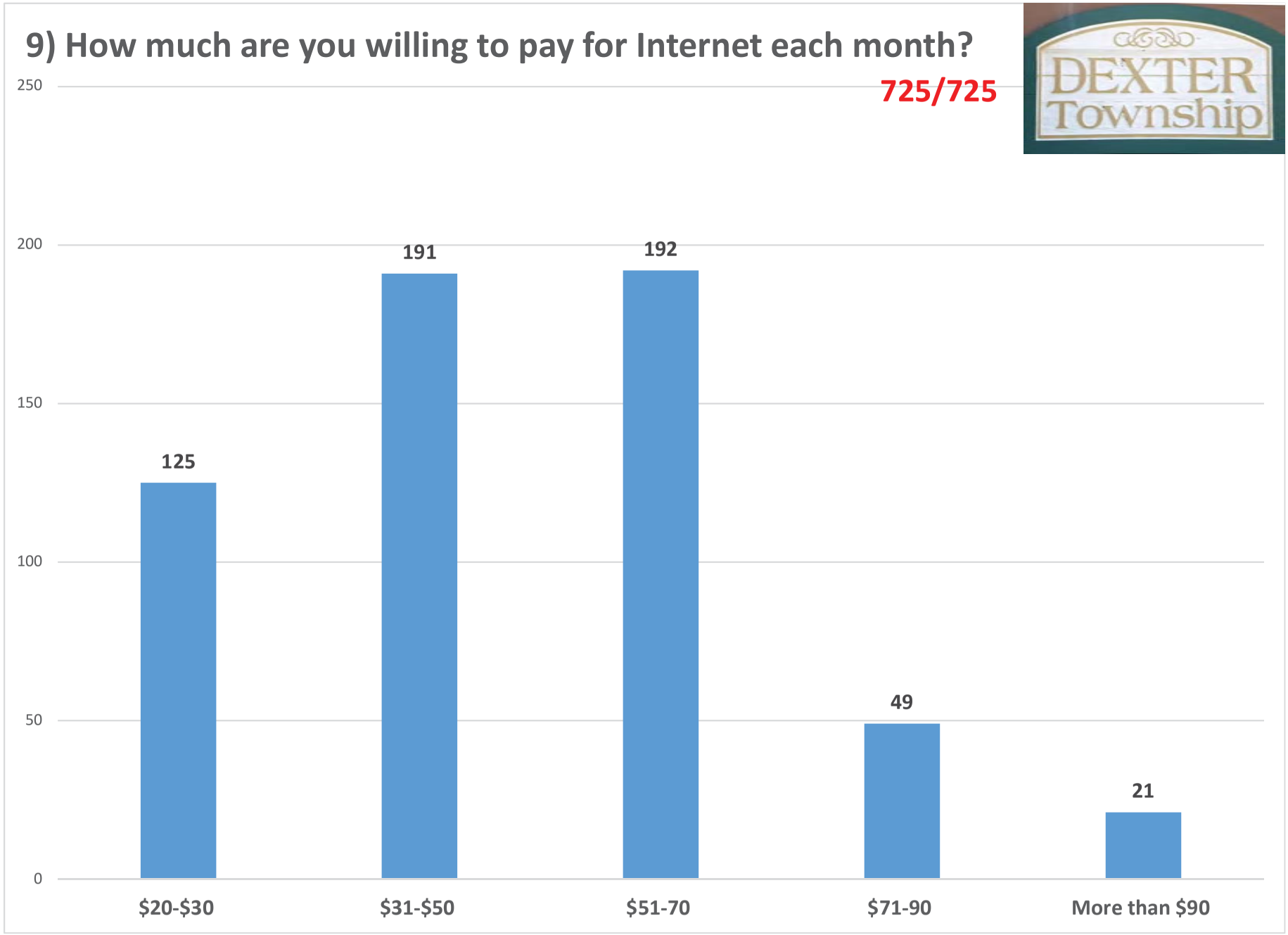

6) If you do not subscribe to broadband, why not?
725/725
DEXTER Township
80
70
60
50
40
30
20
10
0
23
32
74
13
55
No value to using the internet
Adequate access elsewhere
Broadband is not available
Too slow or data caps
Other


7) How important is Broadband (high speed internet) Access to you?
725/725
DEXTER Township
600
500
400
300
200
100
0
481
109
32
15
43
Very Important
Somewhat Important
No preference
Not Very Important
Not Important At All

8) If you don't have internet access at home, where do you go to use it?

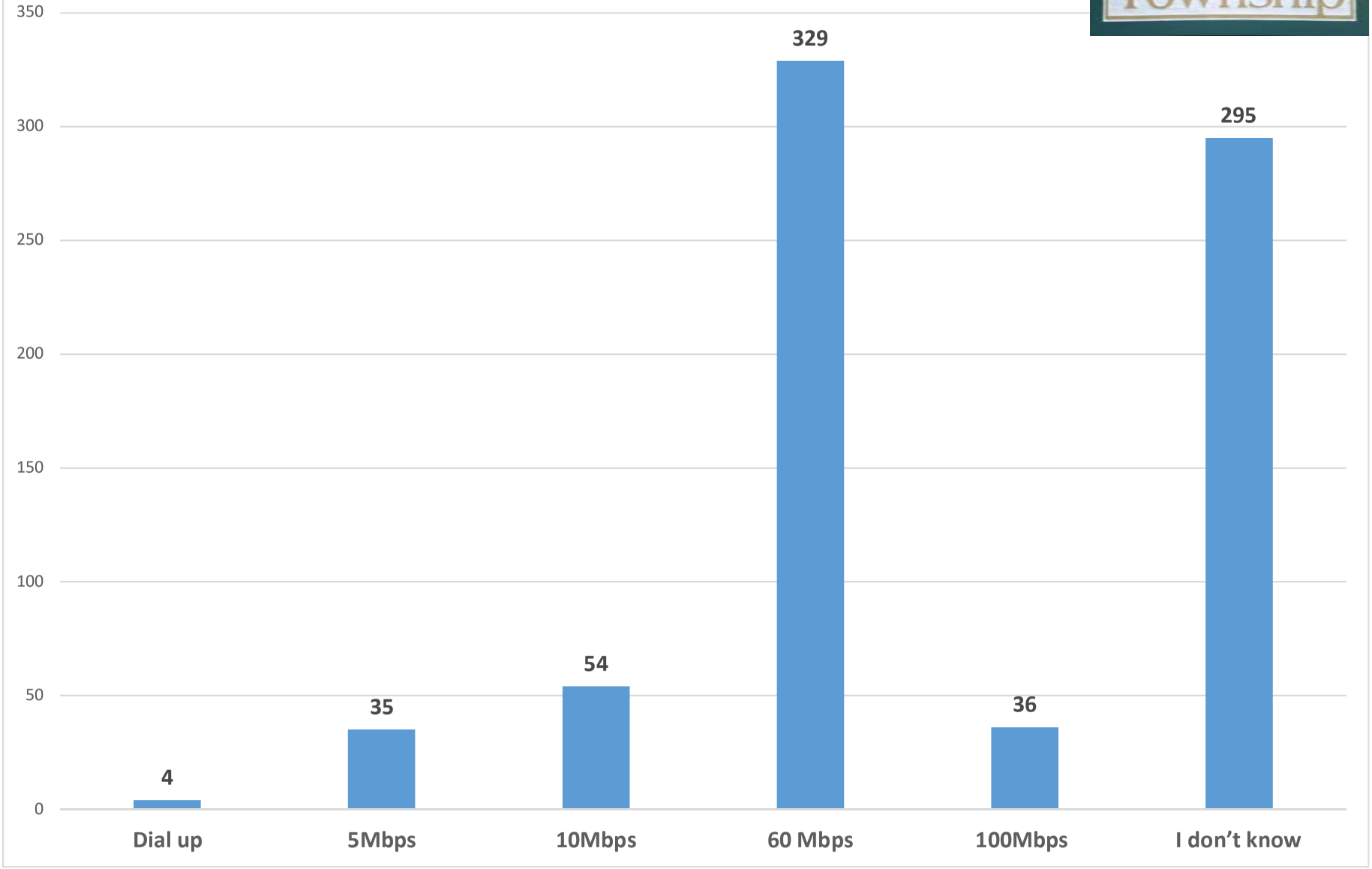
725/725

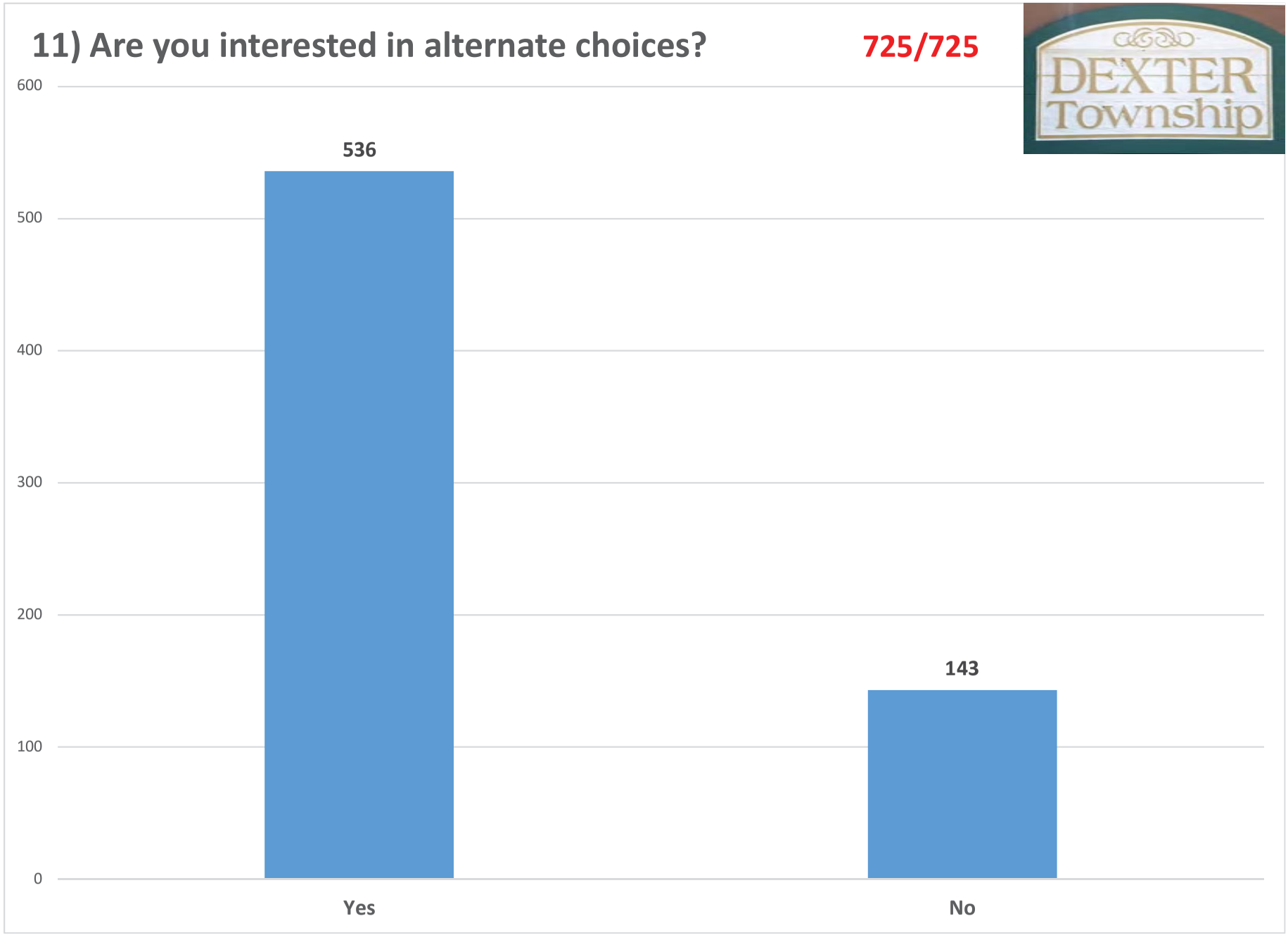


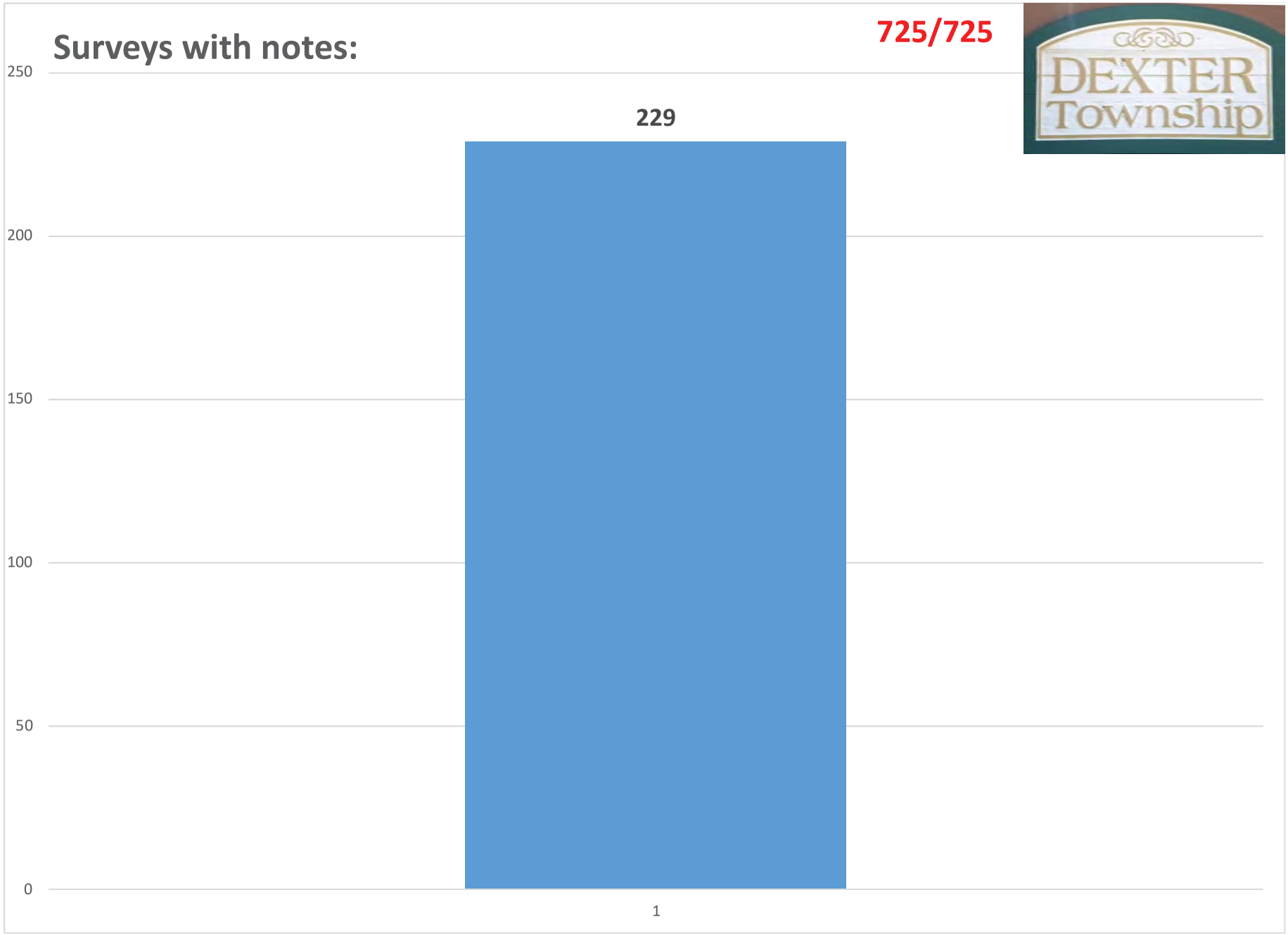

9) How much are you willing to pay for Internet each month?
725/725
DEXTER Township
250
200
150
100
50
0
125
191
192
49
21
$20-$30
$31-$50
$51-70
$71-90
More than $90

10) If you have high speed internet access at home, how fast is it?

725/725

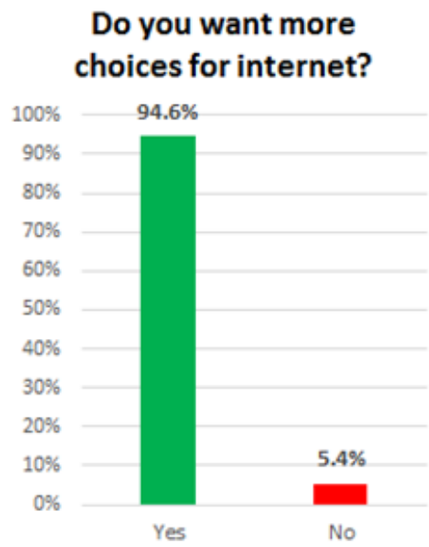


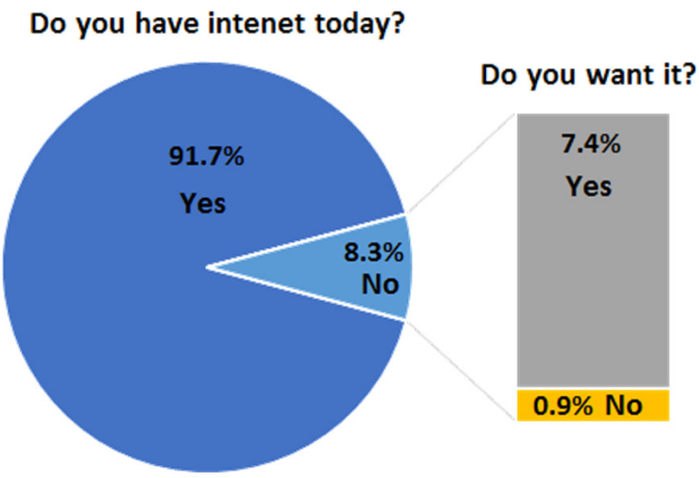

11) Are you interested in alternate choices?
725/725
DEXTER Township
600
500
400
300
200
100
0
536
143
Yes
No

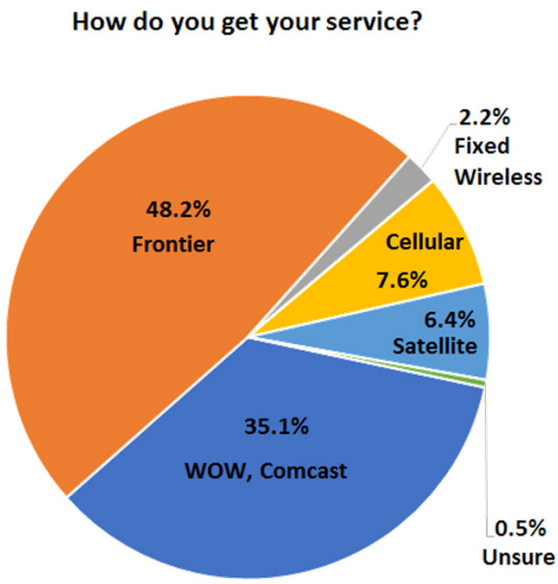

Surveys with notes:
725/725
DEXTER Township
250
200
150
100
50
0
229
1

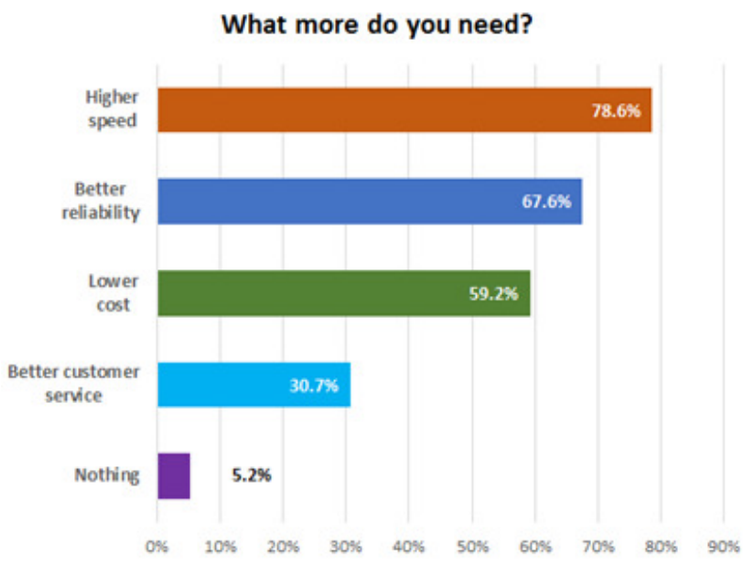
Grass Lake Internet Survey Results

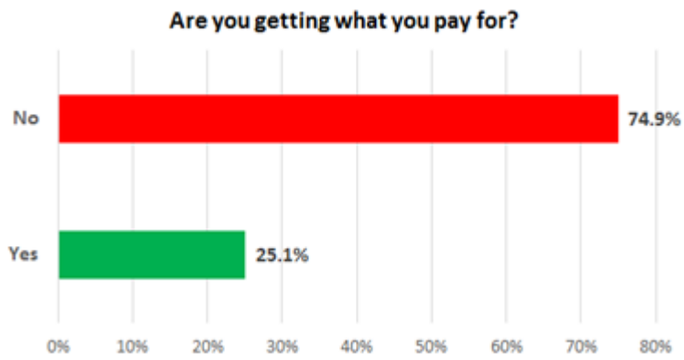
499	responses within Township
20%	of households responding
100%	match for ratio of Village to township residents
93%	are registered voters
61	volunteers

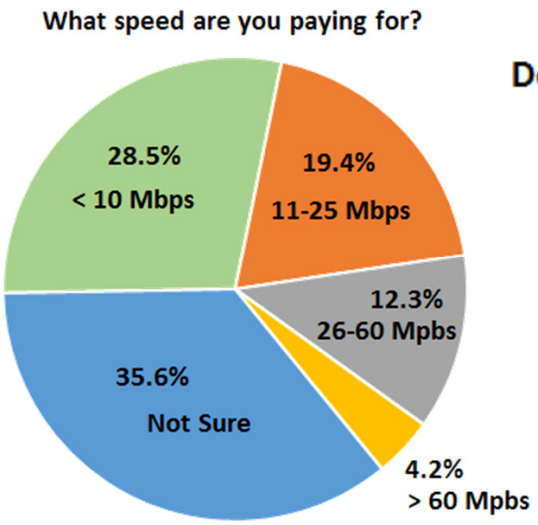


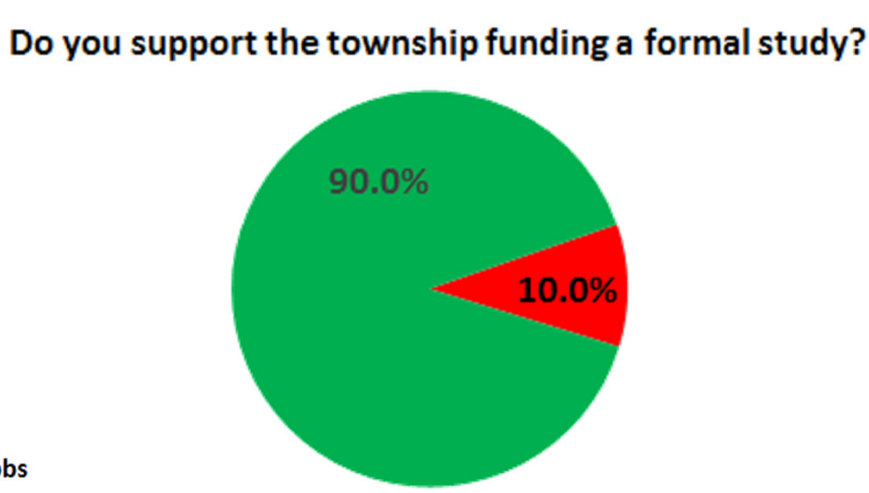






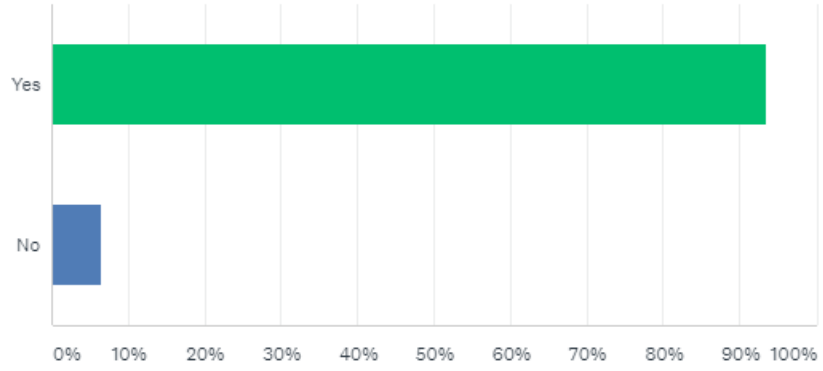




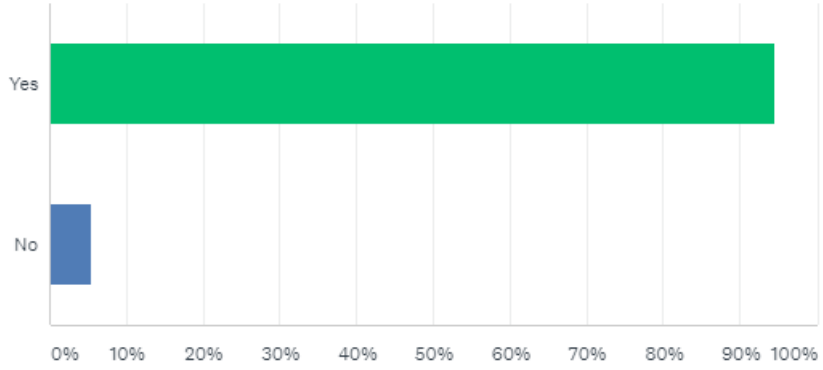


Grass Lake Township Internet Survey Results

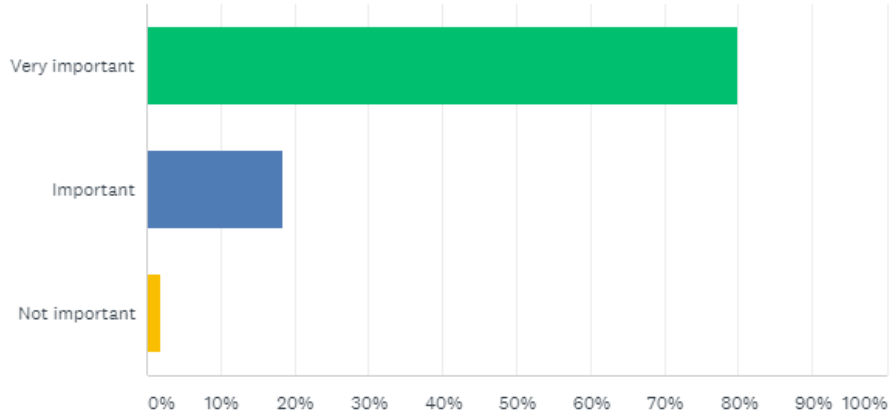
Are you a registered voter in Grass Lake Charter Township?



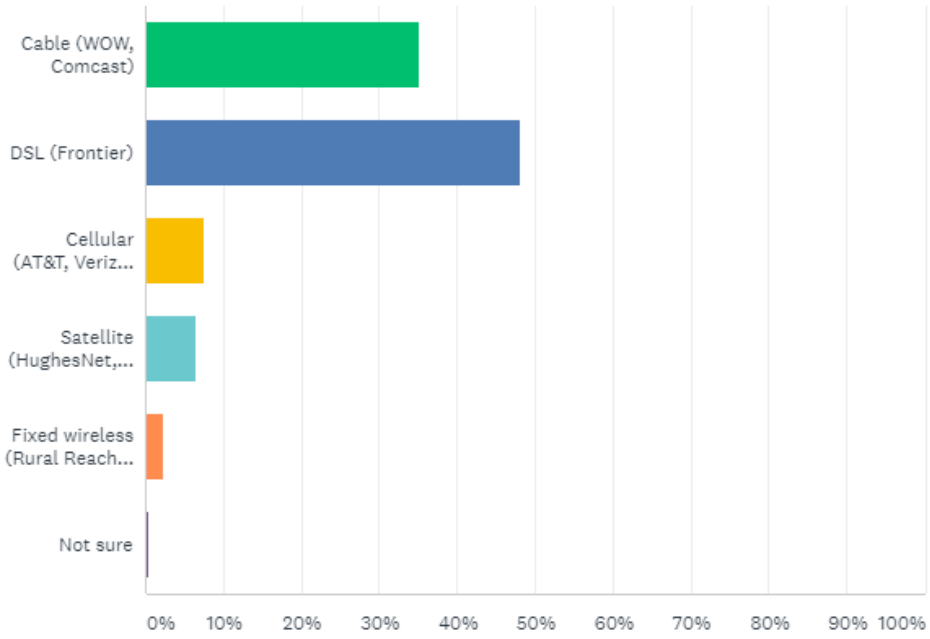
Do you want more choices of internet service available to you?



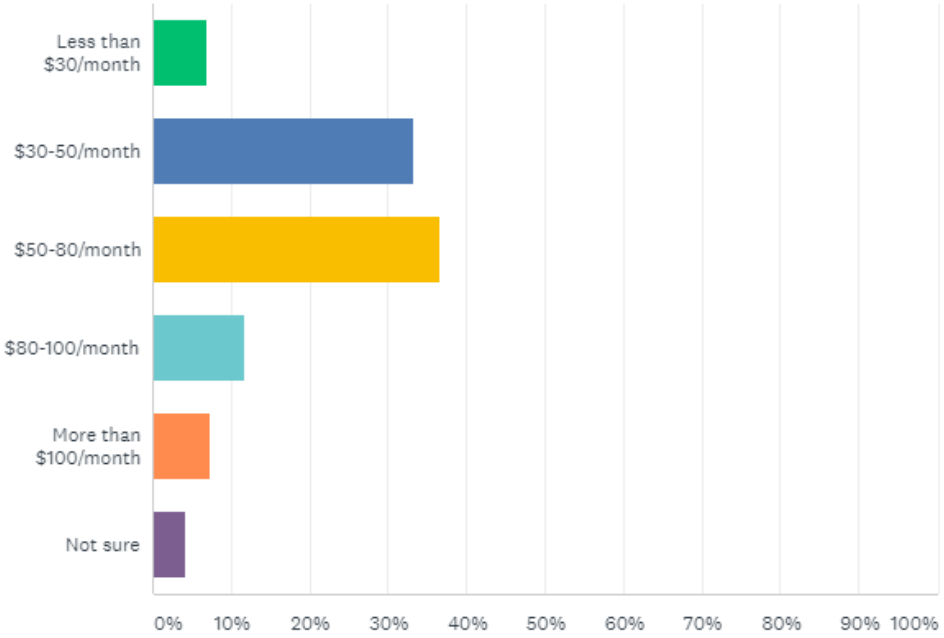
How important is it to have fast, reliable internet service?



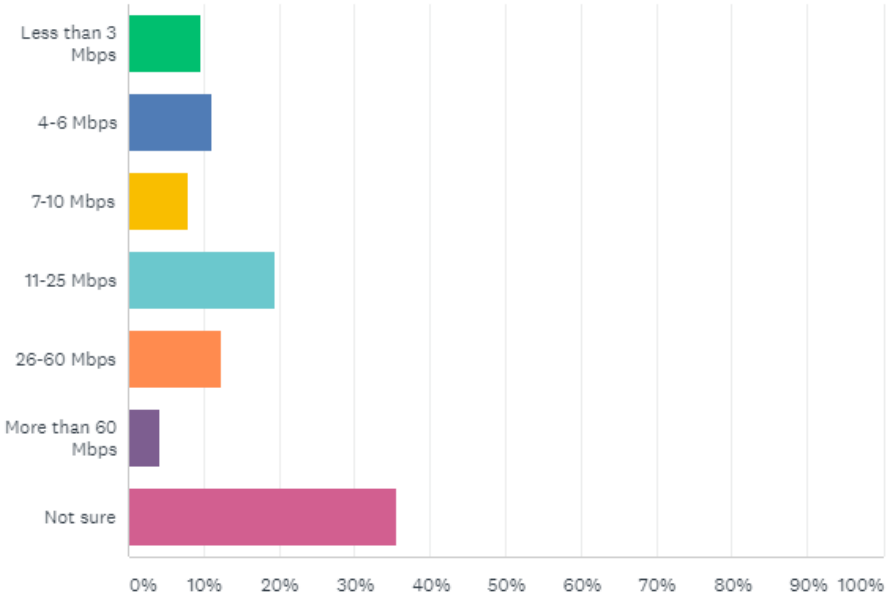
How do you currently receive your internet service?



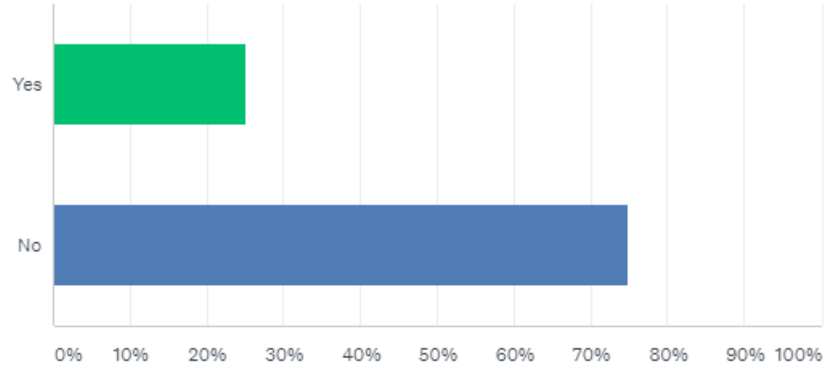
How much are you paying for your service?



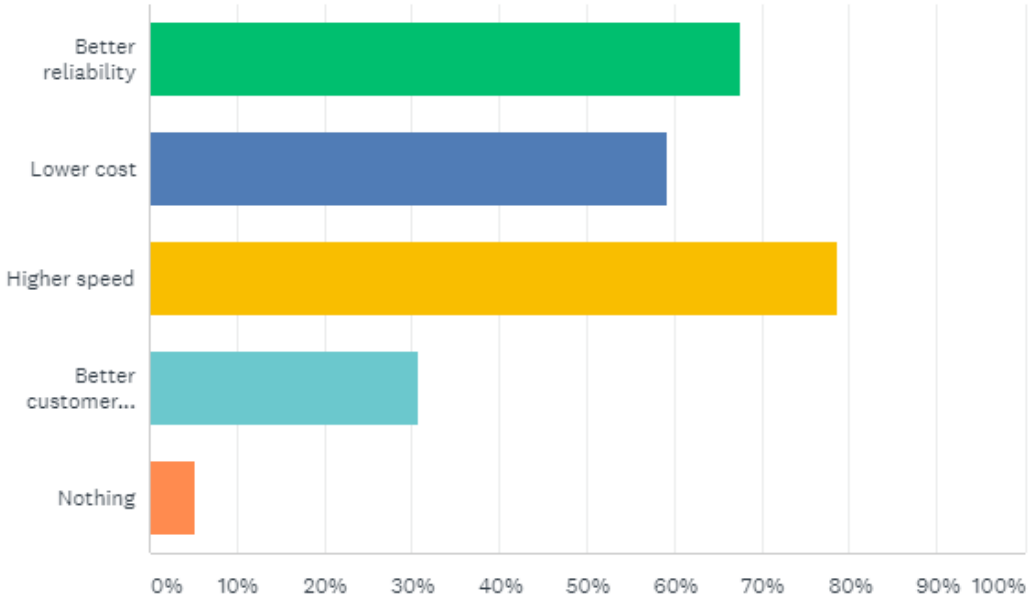
What speed are you paying for?



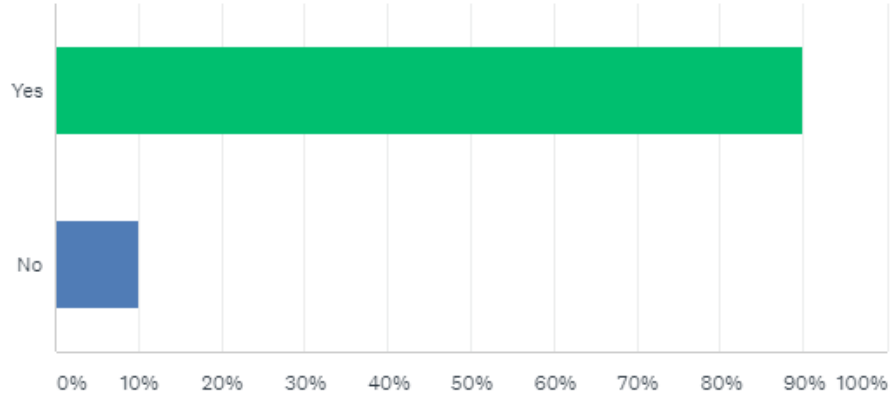
Do you feel like you get what you are paying for?



What more do you need from your internet service?



Do you support the Township funding a formal study so we can discover our options?



Responses from within Township: 499, representing 20% of households.
20% of responses were from the Village, representing the actual ratio of population.

Appendix D: Literature Review, Economic Impacts of Municipal Broadband

Making The Case for Municipal Broadband

Michigan Broadband Cooperative

Table of Contents

7. Community-Owned Fiber Networks: Value Leaders in America
   Berkman Klein Center for Internet and Society at Harvard University (2018)
   Summary: Municipal broadband leads to lower market prices; cited widely
8. Municipal Broadband: History's Guide
   Journal of Law and Policy for the Information Society – Student-Run Law Journal (2013)
   Summary: Case Studies – Successful cases include Bristol, VA; Corpus Christi, TX; and Santa Monica, CA; and unsuccessful cases include Philadelphia, PA and St. Cloud, FL.
9. The Return on Investment from Broadband Infrastructure and Utilization Initiatives
   Strategic Networks Group, Inc (2014)
   Summary: Suggests that expanding broadband access to communities yields a positive return on investment, where the leverage effect is anticipated to be 10 to 1 ($1 investment, $10 return in direct and spinoff impacts to the local economy
10. Socioeconomic Effects of Broadband Speed
    Ericsson, Arthur D. Little, and Chalmers University of Technology (2013)
    Summary: Doubling the broadband speed for an economy increases GDP by 0.3%.
11. Public Investment in Broadband Infrastructure: Lessons from the U.S. and Abroad
    Technology Policy Institute (2017)
    Summary: Large literature review of municipal FTTH networks, by a Washington DC non-profit think tank
12. A Policymaker's Guide to Rural Broadband Infrastructure
    Information Technology & Innovation Foundation (2017)
    Summary: Robust resource for context and background information on rural broadband
13. Do Municipal Broadband Networks Stimulate or Crowd Out Private Investment? An Empirical Analysis of Employment Effects
    Hal J. Singer (2018)
    Summary: Study suggests that there is a small benefit to employment through a public muni network, though not as much as the private network.
14. The Digital Divide and Economic Benefits of Broadband Access
    Council of Economic Advisers – Obama Administration (2016)
    Summary: Quantitative measure of the problem and benefits to broadband access
15. Development of High Speed Networks and the Role of Municipal Networks
    Organization for Economic Cooperation and Development (2015)
    Summary: Features successful municipal broadband example – Chattanooga, TN

16. Reevaluating the Broadband Bonus: Evidence from Neighborhood Access to Fiber and United States Housing Prices
    Gabor Molnar, Scott J. Savage, Douglas C. Sicker (2015)
    Summary: Estimates from a hedonic housing price model suggest that fiber-delivered Internet service may be beneficial to households in terms of increased speed and reliability of service and may be associated with about a $5,437 increase in the typical home's value.

Studies on Economic Impact:

17. Communities can't afford to wait for the federal government to obtain next gen broadband
    Brookings Institute (2018)
    Summary: Support the theory that each community should study and emulate the models that clearly improve the math for investment in next-generation networks, regardless of the public or private delineation.. Offer evidence that communities that have organized themselves to improve the math for investment have often succeeded in seeing that investment follow. Communities should take the initiative to move these efforts forward.
18. The Role of Communication Infrastructure Investment in Economic Recovery
    Organization for Economic Cooperation and Development (2009)
    Summary: Suggests that there should be public investment of telecommunication infrastructure within communities and investment in broadband communication platforms should by undertaken and led by the private sector.

Studies on Economic Impact:

19. Municipal Fiber in the United States: An Empirical Assessment of Financial Performance
    Center for Technology, Innovation and Competition at Penn Law School (2017)
    Summary: UPenn Study - municipal fiber has a negative cash flow; Cited widely
    *Critiques of report included in notes
20. Economic Impact: A Difference-in-Differences, Micro-Data Assessment of Automobile Manufacturing and Municipal Broadband in Tennessee
    George S. Ford, Alan Seals, Lawrence J. Spiwak (March 2018)
    Summary: Study finds no increase in employment outcome in Hamilton County attributable to the municipal broadband network.

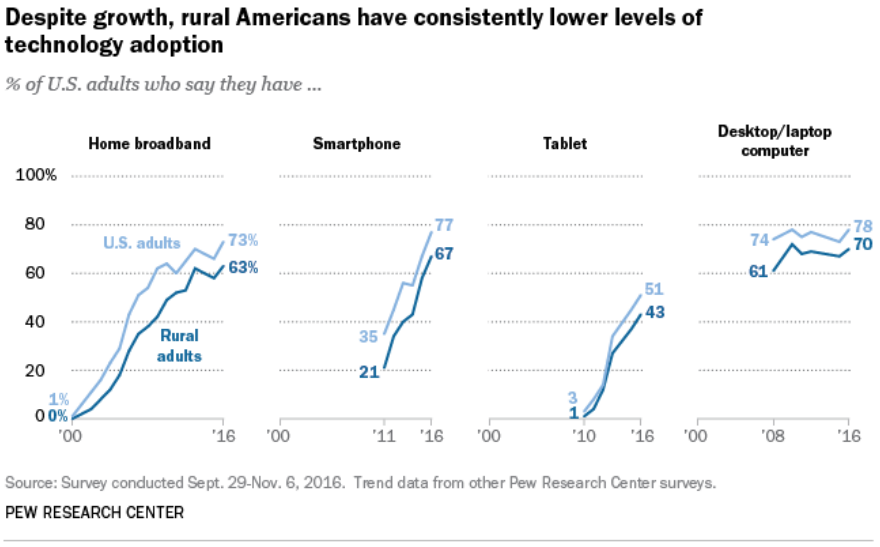
21. The Impact of Government-Owned Broadband Networks on Private Investment and Consumer Welfare
    Dr. George S. Ford – State Government Leadership Foundation (2016)
    Summary: Suggests that municipal government will become a monopoly and would be subject to anti-trust litigation. Draws on economic theory to suggest that subsidies should be given to existing private companies and not municipal governments to have the most efficient use of dollars. Supports laws that limit municipal broadband entry.

Background

1. 2018 Broadband Progress Report
   Federal Communications Commission (2018)
   Summary: With respect to fixed 25 Mbps/3 Mbps and 10 Mbps/3 Mbps LTE services, 85.3% of all Americans have access to such services, including 61% in evaluated rural areas and 89.8% in evaluated urban areas.
   Source: https://www.fcc.gov/reports-research/reports/broadband-progress-reports/2018-broadband-deployment-report

2. American Mobility – Paid for by Comcast
   The Atlantic (2017)
   Summary: Nearly half of American households with incomes below $30,000 lack broadband service, and a nearly equal percentage have no laptop or computer. In a 2015 study, the Census Bureau found that cost was not the major barrier to adoption; rather, 55.2 percent of households that don't have broadband cite a lack of need or lack of interest as the main reason for non-adoption.
   Source: https://www.theatlantic.com/sponsored/comcast-2017/limits-of-mobile-only-internet-access/1491/

3. Digital gap between rural and nonrural America persists
   Pew Research Center (2017)
   Summary: Quantitative measures based on PEW survey data
   Source: http://www.pewresearch.org/fact-tank/2017/05/19/digital-gap-between-rural-and-nonrural-america-persists/

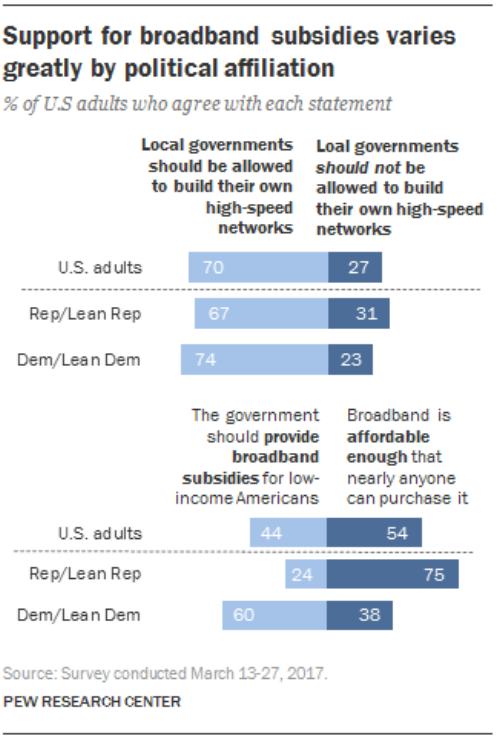


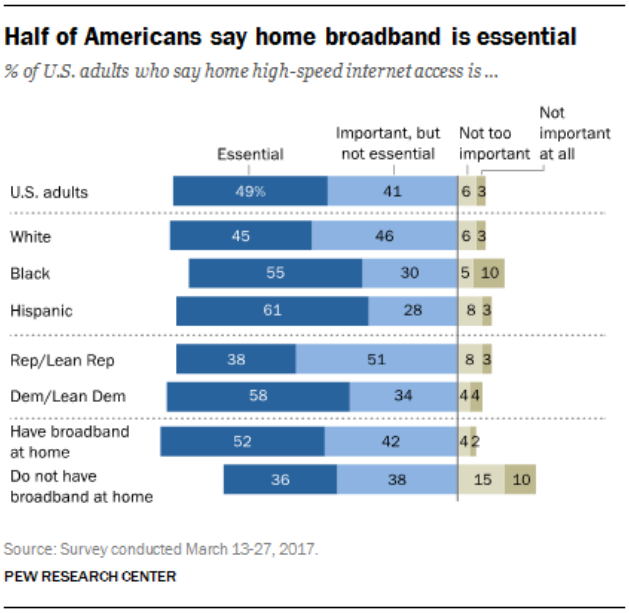
4. Americans have mixed views on policies encouraging broadband adoption

Pew Research Center (2017)

Summary: Quantitative measures based on PEW survey data

Source: *http://www.pewresearch.org/fact-tank/2017/04/10/americans-have-mixed-views-on-policies-encouraging-broadband-adoption/*





5. Internet/Broadband Fact Sheet

Pew Research Center (2018)

Summary: Graphs and data representing changes over the past 20 years in internet use over time, who uses the internet, home broadband use over time, who has home broadband, among others.

Source: http://www.pewinternet.org/fact-sheet/internet-broadband/

6. Bipartisan Bill Aims to Prove the Value of Broadband Access for All

Wired (February 2018)

Summary: Understanding the context for a lack of comprehensive research on the impact of broadband - "Still, according to Nicol Turner-Lee, a fellow at the Center for Technology Innovation at Brookings Institute, it's been about a decade since the last nationwide report on the impact of broadband was released as part of the National Broadband Plan"

Source: https://www.wired.com/story/broadband-access-impact-bill/

Arguments

- Due to recent FCC Legislation, there is a decrease in the subsidization of broadband for low-income Americans and will further limit the opportunities for rural and low-income Americans to have access to the internet. As such, broadband in rural areas is a needed service that municipal governments can step in to supplement.
- Market Failure: There is a failure in the market where private broadband corporations find that the investment of building broadband infrastructure in rural areas is not worth the gain. As such, broadband in rural areas is a needed service that municipal governments can step in to supplement.
- One can argue that broadband should be treated as a public good because it is a service that all Americans need in order to complete important personal documentation like taxes, paying bills, government assistant, educational applications, and job applications. If high-speed broadband is considered a public good, than a high cost for building infrastructure and maintenance is justified as municipal governments are not profit-maximizing entities.

Studies on the Economic Impact of Municipal / Rural Broadband: In Favor of Municipal Broadband

7. Community-Owned Fiber Networks: Value Leaders in America

Author: David Talbot, Kira Hessekiel, Danielle Kehl
Berkman Klein Center for Internet and Society at Harvard University
Year: January 2018
Summary: Harvard Study – municipal broadband leads to lower market prices; cited often

Summary Quotes:

"We found that most community-owned FTTH networks charged less and offered prices that were clear and unchanging, whereas private ISPs typically charged initial low promotional or "teaser" rates that later sharply rose, usually after 12 months. We were able to make comparisons in 27 communities. We found that in 23 cases, the community-owned FTTH providers' pricing was lower when averaged over four years. (Using a three year-average changed this fraction to 22 out of 27.)"

"By one recent estimate, about 9.2 percent of Americans, or almost 30 million people, lack access to wired home broadband service, which the FCC defines as an Internet access connection providing speeds of at least 25 Mbps download and 3 Mbps upload. Even where home broadband is available, high prices inhibit adoption; in one national survey, 33 percent of non-subscribers cited cost of service as the primary barrier. Municipally and other community-owned networks have been proposed as a driver of competition and resulting better service and prices."

Source:
https://cyber.harvard.edu/sites/cyber.harvard.edu/files/2018-01-10-Pricing.Study .pdf
https://cyber.harvard.edu/research/municipalfiber

8. Municipal Broadband: History's Guide

Author: Eric Null, J.D.
Journal of Law and Policy for the Information Society (Student-Run Law Journal)
The Ohio State University
Year: 2013
Summary: Case Studies – Successful cases include Bristol, VA; Corpus Christi, TX; and Santa Monica, CA; and unsuccessful cases include Philadelphia, PA and St. Cloud, FL.

- "While these issues (and others) present challenges to municipalities, empirical data show that municipalities can be very successful Internet providers. While some have met with problems, many have overcome them… this article will discuss the important lessons learned

from these networks, including what they teach about business models and how to properly build-out the network. ”

Successful Cases:

Bristol, VA

- “The city originally invested $21 million in the network through bonds and federal grants. It is expected to pay for itself in twelve to fifteen years. 26 Bristol has already seen significant direct benefits.27 Large companies, including Northrop Grumman and CGI, have moved to nearby Lebanon, Va., in part because of BVU’s one gigabit-per-second service. 28 These two companies alone brought 700 high-paying jobs to southwestern Virginia, with thirty percent of those positions being filled by local residents.29 Moreover, BVU’s services have been instrumental in business retention. The coal giant, Alpha Natural Resources, stayed in Bristol partially because of BVU’s service.30”
- “Increasing the number of jobs and the median pay in the area is a tremendous economic benefit, but social benefits abound as well. ” (Health system)
- “BVU employs local citizens.”
- “BVU’s CEO, Wes Rosenbalm, attributes its success to fulfilling a community need rather than seeking novelty.44 Because private companies were not likely to build high-speed Internet infrastructure in Bristol of their own volition, the primary viable actor available to meet that community need was the municipality itself.45 Success did not come without a fight. BVU was subject to numerous legal battles.”

Corpus Christi, TX

- In 2002, the city invested $7.1 million in a 147-square-mile mesh Wi-Fi network.
- City > “Earth Link” > City = vastly improved network
- It was designed to increase efficiency by improving services and cutting costs by “migrating time- and paper-intensive work to a wireless network.” In other words, it was designed to avoid dog bites.
- The city wanted to align agency interests (police, fire, education, and licensing) such that a single network could meet their business needs.
- To ensure the network would be used in the public interest, the city founded the Corpus Christi Digital Community Development Corporation (CCDCDC), a non-profit group
- Long term city costs have been reduced, effectively, by fifty million over the next twenty years.

Santa Monica, CA

- “A piecemeal build-out approach worked well for Santa Monica. After the city built the I-net, it immediately noticed annual savings of $400,000. The new system increased government

efficiency by allowing for remote tasks such as "traffic surveillance, traffic signal synchronization, real-time parking advisories, real-time mass transit signs and security cameras."85 Within a few years, the savings grew to $500,000 per year. The city then reinvested $500,000 into building its own ten gigabit-per-second fiber-optic network. Because the city owned the fiber and had built more capacity than it needed, it began leasing its dark fiber. This created a new revenue stream for the city while giving local businesses more, and cheaper, options."

- "As a result of Santa Monica's service, competitors were forced to lower prices. Prices have dropped twenty percent or more for independent service providers (that is, service providers not using the city's open access network)."
- "In addition, the low-cost fiber is a draw for businesses when high rents would otherwise deter them. High-speed Internet is a selling point even for the Fairmont Hotel Santa Monica, a luxury hotel providing 100 megabit-per-second connections to its patrons."
- "Like Bristol's OptiNet, City Net has been nationally recognized with awards from the Public Technology Institute and Harvard's Kennedy School of Government."
- "Other cities seeking to emulate the program have consulted Santa Monica; though Wolf says that his program is most likely to succeed "in cities whose municipal buildings are located reasonably close to one another and that are within about 50 miles of global data centers with access to competitive broadband options." Therefore, before adopting Santa Monica's plan, a municipality must make the determination that the plan will work for it. In addition, a city must "forecast savings based upon implementation of an advanced fiber optic infrastructure, complete a cost/benefit analysis and build infrastructure where financials net zero or a greater return."

Unsuccessful attempts:

Philadelphia, PA

- Summary: "Philadelphia's wireless program was described as a failure of municipal wireless, generally attributable to some inherent inability of municipalities to provide Internet access. Contrary to that assertion, and as discussed above, municipal wireless networks can be, and often are, successful. This could indicate that Philadelphia's plan was the cause of the failure, and that private ownership is not sufficient. This was one particular attempt that did not succeed at first—an attempt with inadequate planning, too many restrictions on the private entity, and not enough public understanding or input."
- "Executive committee recommended a public-private partnership. However, the city ultimately ignored the suggestion. It decided to pursue a purely private model largely because EarthLink agreed to build and maintain the network at its own expense."
- Earth link > Private Company Take Over > City
- Restrictive Agreement > "Each additional restriction made it slightly more difficult for EarthLink to realize a profit"

- "At the time, the project was thirty percent over budget, and a functional wireless system required double the access points per square mile as was predicted. In addition, reception was spotty. Problems got worse as EarthLink laid off more than fifty percent of its workforce toward the end of the program."
- "Once complete, the network will be for government use only, though the city plans to expand it for public use in public spaces. The city may eventually use it to increase revenue by partnering with government agencies and educational institutions. However, the altruistic plan of maximum digital inclusion is no longer the primary goal."

St. Cloud, FL

- Confusing results: "Some thought the service provided was "so far below the industry standard that citizens would rather pay the higher price than suffer through government mismanagement." Others said this was an example of "government incompetence" because of the government's inability to adequately plan such a complex network. Hewlett-Packard, St. Cloud's customer service provider, told a different story. HP said out of more than 50,000 user sessions in the first forty-five days, only 842 help-line calls were received. Others have indicated success as well: "[t]he St. Cloud Cyber Spot has had tremendous success, attracting 77 percent of its residents to use the network 6 months after its launch date. . . . Coverage is so reliable that some residents have decided to cancel their wired broadband service"

Source: http://moritzlaw.osu.edu/students/groups/is/files/2013/08/6-Null.pdf

9. The Return on Investment from Broadband Infrastructure and Utilization Initiatives

Author: Strategic Networks Group, Inc (Funded by Blandin Foundation)
Year: 2014

Summary: Third Party Economic Analysis – Minnesota State Example funded by a Private Foundation. Study suggests that expanding broadband access to communities yields a positive return on investment, where the leverage effect is anticipated to be 10 to 1 ($1 investment, $10 return in direct and spinoff impacts to the local economy). Conclusions were drawn for two different communities – one with high broadband coverage where expanded use among existing users was encouraged and one with low broadband coverage where expanded use among existing users was encouraged along with non-users becoming new adopters of broadband.

- "To help illustrate the in-state impacts of increased investments in broadband access and utilization we looked at Lac qui Parle and Kanabec Counties. For Lac qui Parle, which already enjoying 100% coverage, the impacts we estimated are based on increasing eSolutions among existing broadband users. For Kanabec County, with 27% coverage, the

impacts we estimated are based on combined impacts of increasing utilization of eSolutions among existing broadband users, and encouraging non-users to become new adopters of broadband. The comparison between the two counties shows the impact potential of influencing both new utilization and expanding eSolutions utilization among existing broadband subscribers.

- Our analysis shows that the potential return from an investment in broadband in the counties of Lac qui Parle and Kanabec, within the scenarios considered, are illustrative of and on par with findings from SNG's research into actual experiences in other jurisdictions. From past SNG research, the required investment to achieve measureable results is on the order of $120,000 to $145,000 for La qui Parle and $175,000 to $225,000 for Kanabec. This level of investment would provide sufficient resources to mobilize an effective outreach, awareness, and utilization program that would be targeted to expanding effective and efficient use of eSolutions.
- At this level of investment, a leverage effect of as much as 10 to 1 can be anticipated, so that for a $1 investment, $10 is returned in direct and spinoff impacts to the local economy.
- When there is an existing broadband network, the Tax Effect from driving broadband utilization would be net positive, with a ratio of 1.03 to 1.25 greater returns in tax revenues than the public investment made. "From past SNG research, the required investment to achieve measureable results is on the order of $120,000 to $145,000 for La qui Parle and $175,000 to $225,000 for Kanabec. This level of investment would provide sufficient resources to mobilize an effective outreach, awareness, and utilization program that would be targeted to expanding effective and efficient use of eSolutions.
- At this level of investment, a leverage effect of as much as 10 to 1 can be anticipated, so that for a $1 investment, $10 is returned in direct and spinoff impacts to the local economy.
- Furthermore, when there is an existing broadband network, the Tax Effect from driving broadband utilization would be net positive, with a ratio of 1.03 to 1.25 greater returns in tax revenues than the public investment made.

Source: https://blandinfoundation.org/content/uploads/vy/SNG--ROI_from_Broadband_Infrastructure_and_Utilization--01-31-14.pdf

10. Socioeconomic Effects of Broadband Speed

Author: Ericsson, Arthur D. Little, and Chalmers University of Technology
Year: 2013
Summary: Doubling the broadband speed for an economy increases GDP by 0.3%.

- Research conducted by Ericsson, Arthur D. Little and Chalmers University of Technology confirms that increased broadband speed contributes significantly to economic growth
- Positive effects come from automated and simplified processes, increased productivity as well as better access to basic services such as education and health

Source: http://nova.ilsole24ore.com/wordpress/wp-content/uploads/2014/02/Ericsson.pdf

11. Public Investment in Broadband Infrastructure: Lessons from the U.S. and Abroad

Authors: Scott Wallsten, Lucia Gamboa

Technology Policy Institute (Washington DC – Non-profit think tank)

Year: June 2017

Summary: Large literature review of municipal FTTH networks

- "Financing models can include public-private partnerships, cooperatives, and outright government ownership. In the U.S. about 500 municipalities have undertaken some form of municipal broadband including 89 communities with publicly owned FTTH networks."

Source: https://techpolicyinstitute.org/wp-content/uploads/2017/06/Public-Investment-in-Broadband-Infrastructure.pdf

12. A Policymaker's Guide to Rural Broadband Infrastructure

Authors: Doug Brake

Information Technology & Innovation Foundation

Year: April 2017

Summary: Good resource for context and background information on rural broadband

- "Adoption: At a high level, the ultimate policy goal is not just deployment, but adoption and use. We want to encourage the transition to all-digital communications systems, where various social institutions—such as communications and distribution to information—and economic functions—such as banking or health care—can be either provided entirely or dramatically improved through access to robust broadband. This requires both that broadband networks be available, and that people take advantage of the broadband networks that exist. In addition to being intuitive, more and more evidence indicates it is the adoption of broadband that matters far more than the simple existence of network infrastructure. A regression analysis of data from 2008 to 2011 found that "simply obtaining increases in broadband availability (not adoption) over this time has no statistical impact on either jobs or income."30 A similar analysis of economic measurements and data from the National Broadband Map led researchers to concluded that "broadband adoption in rural areas positively (and potentially causally) impacted income growth," but "[b]roadband availability measures (as opposed to adoption) demonstrate only limited impacts, suggesting that future broadband policies should be more demand-oriented."31 In a follow-up study, the same academics analyzed data on adoption rates of rural and urban users, finding that a lack of interest was the dominant reason for non-adoption, and surfaced more often in rural areas than urban.32 This survey gave the authors "some preliminary evidence that it is the demand for broadband (and

not supply) that is driving the gap."

Source: http://www2.itif.org/2017-rural-broadband-infrastructure.pdf

13. Do Municipal Broadband Networks Stimulate or Crowd Out Private Investment? An Empirical Analysis of Employment Effects

Author: Hal J. Singer

Year: 2018

Summary: Muni networks do not appear to generate the same private-sector employment effects as privately owned networks, municipalities cannot cite private employment gains as a benefit of government provision. The finding here is consistent with prior findings in the literature, and consistent with the crowding-out hypothesis that muni networks, which by construction are not profit-maximizing, discourage privately owned networks. Study suggests that there is a small benefit to employment through a public muni network, though not as much as the private network.

- "As noted by Ford, the root cause of any underinvestment in broadband infrastructure is the existence of a positive externality (not captured by ISPs or broadband consumers). ISPs will not deploy to neighborhoods where the private return does not exceed the cost of capital, even when the social return does. More competition in the form of muni-broadband does not treat the problem of underinvestment. To increase the private return, the solution should involve a subsidy to any willing provider, an issue to which I return in Part III"
- "Relative to the socially optimal level of broadband investment, the private sector will likely underinvest in the presence of positive externalities, as implied by the significant spillovers. Accordingly, a subsidy on buildout costs (for example, a tax credit for fiber) or a demand-based subsidy (for example, covering the expense of broadband for low-income households) is in order. Barring ISPs from participating in the value created for edge providers, by setting the price of interconnection and paid priority to zero, perversely exacerbates underinvestment caused by externalities.
- With respect to the wisdom of government ownership, because muni networks do not appear to generate the same private-sector employment effects as privately owned networks, municipalities cannot cite private employment gains as a benefit of government provision. The finding here is consistent with prior findings in the literature, and consistent with the crowding-out hypothesis that muni networks, which by construction are not profit-maximizing, discourage privately owned networks.
- This is not to say that there are no benefits of muni networks. In the absence of any network, a muni network could stimulate economic development and permit residents to develop valuable skills. And there is evidence that muni networks stimulate public employment; some public employment is better than no public employment. Yet public employment can also be stimulated through roads and bridges. Thus, the relevant policy

question is how best to spend public resources. Economics counsels that public resources should be allocated to, among other things, public good, such as national defense or lighthouses, which will be under-provided by private parties due to their non-excludable nature. But because broadband (like satellite television) is excludable via a pricing mechanism, including congestion pricing, broadband is closer to a club good, which can be profitably provided albeit at significant markups over marginal cost (to cover the large upfront costs). Again, a subsidy that moves broadband adoption toward the socially optimal level (accounting for the positive externalities) is the best course under these circumstances.

- Finally, statewide obstacles to funding muni networks could serve as a way for cities to temper their demand for new networks, in the same way that states would prefer that cities temper their demand for new sports stadiums. Muni-broadband should be a last resort for municipalities that cannot be served profitably by private ISP."

Source: https://link.springer.com/content/pdf/10.1007%2F978-3-319-78420-5_15.pdf

14. The Digital Divide and Economic Benefits of Broadband Access

Author: Council of Economic Advisers – Obama Administration
Year: 2016
Summary: Quantitative measure of the problem and benefits to broadband access

Main Findings:

- The number of U.S. households subscribing to the Internet has risen 50 percent from 2001 to 2014, and three-quarters of American households currently subscribe;
- A digital divide remains, however, with just under half of households in the bottom income quintile using the Internet at home, compared to 95 percent of households in the top quintile;
- Supply-side factors may also have an important influence on the rate of broadband subscription: areas with more wireline providers have higher Internet subscription rates;
- Broadband provides numerous socio-economic benefits to communities and individuals, improving labor market outcomes for subscribers, increasing economic growth, providing access to better health care, and enhancing civic participation;
- Academic research shows that using online job search leads to better labor market outcomes, including faster re-employment for unemployed individuals, yet because of a digital divide, low-income households are less able to use these tools than high-income households;
- Unemployed workers in households with Internet were 4 percentage points more likely to be employed one month in the future than those in households without Internet. This difference persists over time.

Source:
https://obamawhitehouse.archives.gov/sites/default/files/page/files/20160308_broadband_cea_issue_brief.pdf

15. Development of High Speed Networks and the Role of Municipal Networks

Author: Organization for Economic Cooperation and Development (2015)

Summary: Features successful municipal broadband example – Chattanooga, TN

- One important element of this decision was the fibre already in place, laid along power lines, which was used to manage the energy grid. As a result of the fibre, for example, outages could be restored in seconds rather than days
- In recent years there has been increased economic activity in Chattanooga and the broadband network is prominently cited as being one of the main contributors to that development.285 In 2011, for example, both Amazon and Volkswagen opened major facilities and there were a growing number of smaller firms and start-ups.
- Lobo et al (2008) indicated that household broadband expenditures over the period 2001-2005 supported 548 jobs and contributed USD 110 million in income and taxes to Hamilton County. It concluded that Hamilton County would benefit from the investment of a fibre network technology as it would result in income and taxes exceeding USD 352 million while creating over 2 600 new jobs.

Source:
http://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=DSTI/ICCP/CISP%282015%291/FINAL&docLanguage=En

16. Reevaluating the Broadband Bonus: Evidence from Neighborhood Access to Fiber and United States Housing Prices

Authors: Gabor Molnar, Scott J. Savage, Douglas C. Sicker

Year: June 2015

Summary: Estimates from a hedonic housing price model suggest that fiber-delivered Internet service may be beneficial to households in terms of increased speed and reliability of service and may be associated with about a $5,437 increase in the typical home's value.

Source:
https://www.lightwaveonline.com/content/dam/lw/documents/FTTH_Report_06_26_2015.pdf

Studies on the Economic Impact of Municipal / Rural Broadband: Neutral - In Favor of Public-Private Partnership

17. Communities can't afford to wait for the federal government to obtain next gen broadband

Author: Blair Levin, Nonresident Senior Fellow – Metropolitan Policy Program
Brookings Institute

Year: February 2018

Summary: Support the theory that each community should study and emulate the models that clearly improve the math for investment in next-generation networks, regardless of the public or private delineation.. Offer evidence that communities that have organized themselves to improve the math for investment have often succeeded in seeing that investment follow. Communities should take the initiative to move these efforts forward.

- Evidence: "Various studies have concluded that next generation broadband networks result in improved property values, improved economic performance, and lower broadband prices—benefits shared across the general community. "
- "Every initiative has to determine how to approach designing, financing, constructing, and equipping a network; and creating, marketing, and servicing the product for the customer. The models differ in which of these functions are handled by the public and which are left to the private sector. Indeed, a number of models, such as those pioneered by the North Carolina Research Triangle Park communities, leave most of those functions to the private sector. Others, like Lincoln, Nebraska, have used a dark fiber model that enables private sector carriers to more rapidly and efficiently roll out next-generation services. Still others, like rural electric co-ops, take on the full responsibility for the network and the service.
- Communities should study and emulate the models that clearly improve the math for investment in next-generation networks, regardless of the public or private delineation. Yet choosing an upgrade model will not be simple; communities should reflect their preferences between certain trade-offs, from control and risk to scale through aggregation or local control. Yet the multitude of new alternatives creates the best opportunity yet for communities to control their gigabit destiny.
- As is always true with local economic development, help begins with self-help. Communities that have organized themselves to improve the math for investment have often succeeded in seeing that investment follow."
- Others, like Lincoln, Nebraska, have used a dark fiber model that enables private sector carriers to more rapidly and efficiently roll out next-generation services. Still others, like rural electric co-ops, take on the full responsibility for the network and the service.

Source: https://www.brookings.edu/blog/the-avenue/2018/02/16/communities-cant-afford-to-wait-for-the-federal-government-to-obtain-next-gen-broadband/

18. The Role of Communication Infrastructure Investment in Economic Recovery

Author: Taylor Reynolds

Organization for Economic Cooperation and Development (OECD)

Year: 2009

Summary: There should be public investment of telecommunication infrastructure within communities and investment in broadband communication platforms should by undertaken and led by the private sector.

- "This paper argues that policy makers need to evaluate the costs and benefits of any public investment in telecommunication infrastructure and select projects which can deliver both strong immediate aggregate demand effects, such as through the employment created by rolling out the networks, and strong longer-term aggregate supply-side effects, which can improve the productive capacity of the entire economy as an improved foundation for commerce and communication. Governments generally do best when they help facilitate environments that support an innovative and robust participation by the private sector…With that in mind it is understandable that some governments, through their stimulus packages, wish to address areas of potential market failure (e.g. reaching underserved areas) or more broadly stimulate investment in the provision of national broadband networks faster than might otherwise be the case… It can also be noted that all national plans involving public investment also specify a leading role for the private sector in ownership and operation of the networks receiving public investment."

Source: http://dx.doi.org/10.1787/222432403368

19. Municipal Fiber in the United States: An Empirical Assessment of Financial Performance

Author: Christopher S. Yoo, Timothy Pfenninger
Center for Technology, Innovation and Competition at Penn Law School
Year: March 2017
Summary: UPenn - concludes municipal fiber has a negative cash flow; Cited widely

- "An examination of the NPV covering the five-year period from 2010 to 2014 reveals that of the 20 municipal projects that report the financial results of their broadband operations separately, generated negative cash flow. Unless these projects substantially improve their performance, they will not be able to cover the costs of current operations, let alone generate sufficient cash to retire the debt incurred to build the project.
- For the nine projects that are cash-flow positive, seven would need more than sixty years to break even. Only two generated sufficient cash to be on track to pay off the debt incurred within the estimated useful life of a broadband network, which is typically projected to be 30 to 40 years. One of the two success stories is an industrial city with few residents that is unlikely to serve as a model for other cities to emulate. Regression models based on the data and the case studies of individual projects underscore the difficulty that municipal fiber projects face in becoming financially viable.
- These results suggest that municipal leaders should carefully consider all of the relevant costs and risks before moving forward with a municipal fiber program. Underperforming projects have caused numerous municipalities to face defaults, bond rating reductions, and direct payments from the public coffers. In addition, troubled municipal broadband ventures take a toll on community leaders in terms of personal turmoil and distraction from other matters important to citizens. Although some claim that investing in fiber serves a necessary function of future-proofing a municipality's infrastructure, evidence shows little current need for such high broadband speeds. Sound fiscal policy favors timing capital investments so that they coincide with expected revenue, otherwise a city will be forced to pay interest on an investment that is not yet creating any benefits."

Critiques of Report:

- https://www.brookings.edu/blog/the-avenue/2017/06/29/new-report-swings-and-misses-on-communities-and-next-generation-broadband/
- https://www.newamerica.org/oti/blog/christopher-yoos-municipal-broadband-report-misleads-viability-success-municipal-fiber-networks/
- https://muninetworks.org/sites/www.muninetworks.org/files/fiber-fallacy-upenn-yoo.pdf

Source:
https://www.law.upenn.edu/live/files/6611-report-municipal-fiber-in-the-united-states-an

20. Economic Impact: A Difference-in-Differences, Micro-Data Assessment of Automobile Manufacturing and Municipal Broadband in Tennessee

Authors: George S. Ford, Alan Seals, Lawrence J. Spiwak

Year: March 2018

Summary: Advocacy for municipal broadband systems claims the city-owned fiber optic networks creates jobs and increases wages. In this paper, we use publicly-available data and the difference-in-differences statistical procedure to look for wage and job gains in Hamilton County, Tennessee. We compare the effects of the municipal broadband network on employment outcomes in the IT sector with the effects on the automobile sector of the contemporaneous opening of an automobile plant. While the impacts of the automobile plant are strong and easily identified, we find no increase in employment outcome in Hamilton County attributable to the municipal broadband network.

Source: https://ssrn.com/abstract=3138871

21. The Impact of Government-Owned Broadband Networks on Private Investment and Consumer Welfare

Authors: Dr. George S. Ford

State Government Leadership Foundation

Year: April 2016

Summary: Very critical of municipal level government and its ability to be able to serve people. Arguments insinuate that municipal government will become a monopoly and would be subject to anti-trust litigation. Draws on economic theory to suggest that subsidies should be given to existing companies and not municipal governments to have the most efficient use of dollars. Supports laws that limit municipal broadband entry. Foundation is a very conservative, right-wing think tank.

Source:
http://sglf.org/wp-content/uploads/sites/2/2016/04/SGLF-Muni-Broadband-Study-1.pdf
https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2973274

Appendix E: Legal Framework for Municipal Broadband

LEGAL FRAMEWORK FOR BROADBAND INTERNET ACCESS:
How to Get Your Community Connected to Broadband

High speed internet access has become a 21st century necessity. In March 2002, the Michigan legislature passed several laws to stimulate the availability of affordable high-speed internet connections such as broadband. Specifically, the Metropolitan Extension Telecommunications Rights-of-Way Oversight Act, PA 48 of 2002, MCL 484.3101 *et seq.* (the "METRO Act") created a telecommunication rights-of-way oversight authority and prescribed the powers and duties of municipalities to bring broadband to their communities. The Michigan Telecommunications Act (the "Act") was also amended in 2005 to explicitly allow public entities to provide telecommunication services within their boundaries. This has proven to be a particularly important step towards providing broadband access state-wide, particularly in rural communities where access is non-existent or limited. While private companies are successful in providing broadband to areas where it will be most profitable, other communities are more often needing to look to their local governments to assist with providing access to and funding broadband infrastructure without state assistance.

Below is a step-by-step guide to assist municipalities in navigating through the process of establishing broadband internet access in their communities including providing guidance on the relevant statutes that apply.

I. Public Engagement

The first step is to identify a need in your community. Local governments should conduct community assessments to determine whether locally funded broadband infrastructure is either necessary or prudent for its citizens. There are several ways to begin opening a dialogue with your community to determine if broadband is right for your area and, if so, what type of broadband will work best.

- Surveys
    - Distribute a survey to residents regarding strategies for improving broadband service. Surveys can be created online or sent out to residents in the mail (i.e. with utility or tax bills).
    - Types of issues to focus on:
        - How important is it to have high speed internet at your residence?
        - How likely are you to pay $X for monthly broadband service?
        - How much would you be willing to pay for fast internet connection?

        - How likely are you to support a millage for broadband service?

- Township Hall-style meetings
    - Public hearings to seek community input.
- Study sessions
    - Educational-style sessions with expert panels to provide information regarding broadband, projected costs, etc.
    - These may include presentations and opportunities for community members and local officials to ask questions before voting on the issue.
- Pilot project
    - If an option, some communities may be able to initiate pilot projects to test feasibility and equipment that could be used in homes or small businesses. This helps communities get an idea of real-world usage.
    - *Example*: The City of Holland initiated a 90-day pilot project that hooked up three multi-tenant buildings (simulating a neighborhood) with the same equipment from two different vendors to determine what residents liked and what worked best.

II. Feasibility Study

Another way to gauge whether broadband is right for your community, before initiating the financing and legislative processes, is to conduct a feasibility study to determine long-term viability of the project. Fiber optic contractors and consultants are the most commonly used companies to conduct such studies. In an RFP for a feasibility study, the local unit may want to consider asking for the following deliverables:

- Investigating local bandwidth providers and obtain quotes for appropriate levels of service.
- Recommending an approach to be used for access to rights –of-way, pole structure, fiber layout, impact of active and passive networks, central hub equipment location, and other pertinent decision points.
- Analysis of all costs for design, implementation, and maintenance of infrastructure build to each improved property in the local unit.
- A summary map depicting proposed routes and fiber optic cable sizes.

- A financial model that takes into account project costs and projected rates to determine overall project feasibility.

The feasibility study may coincide with or precede the municipality conducting public engagement techniques.

III. Identify Funding Sources

Once the local unit has determined that a broadband project is necessary, desired and feasible, the next step is to identify, based on the projected financial model, from where the municipality will obtain funding for the project. Given that these projects are often costly, securing a revenue source is a top priority early on. There are generally two primary ways to fund broadband infrastructure:

- Bond by Millage

If the project will be substantially costly, the main way local units may finance broadband projects is with a bond issue to be funded by a millage. This often can be explored during the public engagement process as the municipality begins to gauge how residents feel about broadband and whether or not a millage proposal will pass.

Below is a brief outline of the bond by millage process:

1. *Draft ballot language.* (*see samples below*)

Ex. #1 Shall (municipality) borrow the principal sum of not to exceed $_____ and issue its general obligation unlimited tax bonds, in one or more series, payable in not to exceed _____ years from the date of issue of each series, for the purpose of paying the cost to acquire, construct, furnish, and equip capital improvements consisting generally of a fiber optic infrastructure to provide broadband internet service in the (municipality) including, but not limited to, fiber optic backbone, service lines, necessary electronics, rights-of-way, accessories and attachments thereto and any other related component, equipment or cost necessary to place the improvements into service?

Yes.

No.

Ex. #2 Shall (municipality) borrow the principal sum of not to exceed $_____ and issue its general obligation unlimited tax bonds, in one or more series, payable in not to exceed _____ years from the date of issuance of each series, for the purpose of paying the cost to acquire, construct, furnish, and equip a broadband provisioning system to provide broadband internet service in the (municipality), including high-speed fiber optic infrastructure, service lines, and necessary electronic equipment and building improvements, together with necessary interests in land, rights-of-way, appurtenances and attachments thereto?

Yes.

No.

The estimated millage to be levied in (year) is (#) mills and the estimated simple average annual millage rate required to retire the bonds is (#) mills.

2. *Approve ballot language by resolution.* (*See attached sample Resolution* ***Appendix A)***

3. *Conduct a regular or special election in accordance with the Michigan Election Law, PA 116 of 1954 and the General Property Tax Act, PA 206 of 1893 (requires majority vote of electors).*

- Revenue Bond

Another option would be to utilize a revenue bond if the broadband infrastructure is likely to be self-supporting through the imposition of use or service charges. Although revenue bonds may be authorized by a number of acts, the most frequently used authority for the issuance of these bonds is the Revenue Bond Act of 1933, MCL 141.101 *et seq.* Generally, the bonds are payable solely and only from the revenues generated by the system. However, if more than 25% of the cost will be defrayed by federal or state grants, the local unit may pledge its limited full faith and credit. The Revenue Bond Act provides the standard process for issuing negotiable revenue bonds, such as publishing a notice of intent to issue bonds, which confers referendum rights.

The availability of this option will depend on the estimated costs and marketability of the project.

- General Fund + User Fees

Some local units may be able to finance the project from their general fund, and defray those costs from user charges or subscription revenues. Calculation of fees/charges must include at least: (1) all capital costs attributable to the provision of the service; (2) all costs to the provision of the service that would be eliminated if the service was discontinued; and (3) the proportionate share of costs identified with the provision of 2 or more county or municipal services including telecommunication services. MCL 484.3114(d). Charges may also include operation and maintenance expenses, and depreciation.

The availability of this option will depend on estimated costs, the scope of the project, and the size of the local unit's general fund.

- Special Assessment

Some local units have explored the option of utilizing a special assessment to fund broadband projects. In fact, a bill was introduced in the state legislature in February 2017 that would have amended PA 188 of 1954 ("Act 188") to explicitly add "the construction, improvement, and

maintenance of communications infrastructure, including broadband and high-speed internet" as a permissible "improvement" that a township may fund through an Act 188 special assessment. (HB 4162). While the bill was referred to the House Committee on Communications and Technology, no further action has been taken since February 2017. This may signal that the legislature does not intend to allow the funding of local broadband through special assessments.

Further, there are other challenges associated with attempting to fund broadband by a special assessment district because the amount of the assessment for each parcel would need to be proportionate to the value of the benefit conferred on that property. These valuations would be difficult to calculate in advance, before property owners make the decision to connect or utilize available municipal broadband services.

IV. Conduct RFPs

The Act requires a public entity to issue a request for competitive sealed bids *before* it can provide telecommunication services within its boundaries under the METRO Act:

- The public entity must receive *less than three* qualified bids from private providers before it can choose to provide its own services. MCL 484.2252(1)(b). If it receives three or more qualified bids, it may not provide its own services.
- The RFP must be issued at least *60 days* before the public entity can initiate providing telecommunications services itself. MCL 484.2252(1)(c).
- The Act does not mandate particular publication requirements for the RFP. It simply requires the municipality to issue a "request for competitive sealed bids." MCL 484.2252(1)(a). Thus, notice of the RFP should be reasonable.
- The Act also does not specifically speak to acceptance or rejection of bids, but generally, an RFP would include language reserving the public entity's right to reject any and all bids/proposals and would set forth specific criteria for reviewing and evaluating bids.

Once the RFP has been conducted as outlined above, and less than three qualified bids are received, the public entity can provide telecommunication services within its boundaries *as long as the services it provides are under the same terms and conditions that the public entity set forth in the RFP*. MCL 484.2252(1)(d). Thus, local units should be careful about how they draft RFP requirements for bidders to ensure that the local unit is also able to comply with those minimum requirements.

Joint RFPs Allowed: Two or more public entities may jointly request bids and provide telecommunication services if all participating public entities meet the above requirements. If a

public entity does not receive *any* qualified bids, it may also contract with another public entity to receive telecommunication services. MCL 484.2252(3).

V. Cost-Benefit Analysis

The METRO Act requires the municipality to conduct a three-year cost-benefit analysis before it adopts an ordinance or resolution authorizing the municipality to construct broadband facilities. MCL 484.3114(1)(b). The analysis must be completed at least 30 days prior to the hearing required in the following section VI. The cost-benefit projections must be "reasonable" and must identify and disclose the total projected direct costs of and the revenues to be derived from constructing the telecommunication facilities and providing the service. The costs must be determined using accounting standards developed under the Uniform Budgeting and Accounting Act; PA 2 of 1968; MCL 141.421 – MCL 141.440a.

VI. Conduct Public Hearing

At least 30 days after the cost-benefit analysis is complete, the municipality must conduct at least one public hearing before it adopts an ordinance or resolution authorizing the municipality to construct broadband facilities. The municipality is required to publish a notice of the public hearing "as required by law." MCL 484.3114(1)(a). While the METRO Act does not state the required content of the notice or the required timeframe in which to publish and post it, notice should be published in a newspaper of general circulation in the municipality as soon as possible, but no later than 15 days before the public hearing and posted no later than 18 hours before the public hearing (per the Open Meetings Act), unless a City's Charter provides earlier. (*See attached sample Notice **Appendix B**)*.

The municipality should have a draft Broadband Ordinance available for public inspection and review in advance of the public hearing, when notice is posted. (*See attached sample Ordinance **Appendix C**)*. Under the METRO Act, the Broadband Ordinance may not:

- Unduly discriminate against another person providing the same service (this does not include establishing rates that are different from those of another person providing the same service);
- Employ terms more favorable or less burdensome than those imposed by the municipality upon other providers of the same service within its jurisdiction concerning access to public rights-of-way;

- Impose or enforce against a provider any local regulation with respect to public rights-of-way that is not also applicable to the municipality in its provision of a telecommunication or cable modem service provided through a broadband internet access transport service; or

- Employ terms more favorable or less burdensome than those imposed by the municipality upon other providers of the same service within its jurisdiction concerning access to and rates for pole attachments.

VII. Ordinance Adoption

Following the public hearing, the public body may adopt a Broadband Ordinance. As with all ordinance adoptions, this should be done by Resolution and the publication of a Notice of Adoption/Summary of Ordinance. (*See attached sample Resolution* ***Appendix D*** *&* *Notice* ***Appendix E****)*.

The municipality should adopt the ordinance per its normal procedure for ordinance adoptions under applicable laws. Below is a brief summary of those processes:

- Cities
    - Adopt per charter provisions
- Charter Townships
    - Introduction/First Reading
    - Publish and Post Notice of Proposed Ordinance
    - Second Reading/Adopt Resolution
    - Publish Notice of Adoption/Summary or Complete Ordinance within 30 days after adoption
- General Law Township
    - Introduction/Adopt Resolution
    - Publish Notice of Adoption/Summary or Complete Ordinance within 30 days after adoption
- Village
    - Introduction/Adopt Resolution

- Publish Notice of Adoption/Summary or Complete Ordinance within 15 days after adoption.

VIII. Other Considerations

- Consent

It is possible that the broadband infrastructure may need to cross into other adjacent municipalities in order to connect the system. If that is the case, the local unit will need to obtain consent from the adjacent municipality before commencing construction. This can be obtained by a resolution of the adjacent municipality governing body granting the local unit the authority and consent to install broadband infrastructure within the municipality and a franchise agreement. Further, the local unit may also need a franchise if it intends to transact business in the adjacent municipality. (*See attached sample Consent Resolution* ***Appendix F****; sample Consent and Franchise Agreement see* ***Appendix G****).*

- Adjacent Municipality Connections

It is also possible that an adjacent municipality will want to connect to the local unit's broadband infrastructure to serve customers within its own jurisdiction. The Act provides that "a public entity shall not provide telecommunication services outside its boundaries," unless two or more public entities jointly request bids. MCL 484.2252(2). However, this prohibition against providing service outside of municipal boundaries may be preempted by Section 706 of the Federal Telecommunications Act of 1996, which directs the Federal Communications Commission (FCC) to take action to remove barriers to broadband investment and competition. The FCC has deemed similar statutory provisions in other states to be preempted. See, e.g. In re City of Wilson, NC, WC Docket Nos. 14-115 & 14-116 (February 26, 2015) (https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-25A1.pdf.

In any event, the adjacent municipality would likely need to go through a similar process as the first local unit as set forth in sections I through VII above. This process would be different depending on how the two municipalities decide to structure the arrangement and sharing of broadband services/infrastructure. There are two primary ways in which the arrangement could be structured:

- Interlocal Agreement – the two municipalities may enter into an interlocal agreement whereby the originating broadband local unit maintains ownership and responsibility for the infrastructure and provides broadband services to the adjacent municipality for a fee and under certain terms. (*See attached sample Agreement* ***Appendix G****).*

- Formation of a Separate Authority – the adjacent municipality buys into the broadband system and the two local units jointly form a new authority to maintain and be responsible for the system and provision of services to both jurisdictions. This would likely require resolutions of both municipalities and other agreements/documents to form and govern the joint authority.

Each municipality will want to consider which option makes the most sense economically, practically and politically in their community.

LEGAL FRAMEWORK APPENDIX A

RESOLUTION NO. _____

RESOLUTION SUBMITTING BROADBAND INTERNET BOND PROPOSAL AT ELECTION TO BE HELD ON_____

A meeting of _____, was held on the ____ day of _____, _____, at _____at __:00 PM.

PRESENT:_____

ABSENT:_____

The following preamble and resolution were offered by _____ and supported by _____.

WHEREAS, the (MUNICIPALITY) has determined that it is in the best interest of the residents and property owners of the (MUNICIPALITY) that the (MUNICIPALITY) acquire, construct, furnish, and equip capital improvements consisting generally of a fiber optic infrastructure to provide broadband internet service in the (MUNICIPALITY) including, but not limited to, fiber optic backbone, service lines, necessary electronics, rights-of-way, accessories and attachments thereto and any other related component, equipment or cost necessary to place the improvements into service (the "Project"); and

WHEREAS, the (MUNICIPALITY) has determined that the (MUNICIPALITY) should borrow money in a principal amount not to exceed $_____ and issue general obligation unlimited tax bonds of the (MUNICIPALITY) in such amount, in one or more series, for the purpose of paying all or part of the cost of the Project; and

WHEREAS, it is necessary to submit the proposed issuance of the bonds to the qualified electors of the (MUNICIPALITY) for a vote.

NOW, THEREFORE, BE IT RESOLVED THAT:

1. The following bond proposal shall be submitted to a vote of the qualified electors of the (MUNICIPALITY), at the election to be held on _____:

Broadband Internet Bond Proposal

Shall (municipality) borrow the principal sum of not to exceed $_____ and issue its general obligation unlimited tax bonds, in one or more series, payable in not to exceed _____ years from the date of issue of each series, for the purpose of paying the cost to acquire, construct, furnish, and equip capital improvements consisting generally of a fiber optic infrastructure to provide broadband internet service in the (municipality) including, but not limited to, fiber optic backbone, service lines, necessary electronics, rights-of-way, accessories and attachments thereto and any other related component, equipment or cost necessary to place the improvements into service?

Yes.

No.

If approved, the estimated millage to be levied in ___ is _____ mills and for the remaining __ years the estimated simple average annual millage rate required to retire the bonds is _____ mills.

2. The ballot wording of the bond proposal is hereby certified to the (MUNICIPALITY) Clerk and to the Clerk of _____ (COUNTY) (the "County Clerk"). The (MUNICIPALITY) Clerk is hereby authorized and directed to file this Resolution and/or

complete and file any of such forms, certificates or documents as may be required by the County Clerk to evidence the foregoing certification and/or submission by no later than _____.

3. The (MUNICIPALITY) Clerk and the County Clerk are hereby directed to (a) post and publish notice of the last day of registration and notice of election as required by the Michigan Election Law; and (b) have prepared and printed, as provided by the Michigan Election Law, ballots for submitting the bond proposal at the election, which ballots shall contain the proposal appearing herein, or the proposition shall be stated as a proposal on the voting machines, which ballots may include other matters presented to the electorate on the same date.

4. The (MUNICIPALITY) hereby confirms the retention of (ATTORNEY) as bond counsel with respect to the bond proposal.

5. Any resolutions in conflict with this Resolution are repealed, but only to the extent necessary to give this Resolution full force and effect.

Upon Roll Call Vote, the following voted "Aye":

_____

The following voted "Nay":

_____

CERTIFICATION

I, _____, the undersigned (MUNICIPALITY) Clerk of the (MUNICIPALITY), hereby certify that the foregoing resolution is a true and complete copy of a resolution adopted at a regular meeting of the (MUNICIPALITY) held on __ day of ___, _____, the original of which is on file in my office, and that notice of such meeting was given, and the meeting was conducted, pursuant to and in compliance with the Act No. 267, Michigan Public Acts of 1976, as amended.

_____

LEGAL FRAMEWORK APPENDIX B

(MUNICIPALITY)

NOTICE OF PUBLIC HEARING

DATE: _____

NOTICE IS HEREBY GIVEN that the (MUNICIPALITY), will hold a Public Hearing on **_____, _____, at _____** at a meeting of the (MUNICIPALITY) at the _____.

At this meeting, the (MUNICIPALITY) will consider and hold a public hearing on the proposed Municipal Broadband Ordinance. The purpose of the Broadband Ordinance is to authorize the construction of telecommunication facilities or provide a telecommunication or cable modem service through a broadband internet access transport service and establish regulations governing access to and use of the Township's broadband internet access transport services for the benefit of the residents of the Township.

Any person may appear and be heard at said Public Hearing. The (MUNICIPALITY) is receiving written comments concerning the proposed Ordinance at _____. Written comments must be received by the (MUNICIPALITY) prior to the start of the Public Hearing on _____.

The required 3-year Cost Benefit Analysis was completed on _____, in accordance with applicable law. The Ordinance and the Cost Benefit Analysis are available for inspection at the Clerk's Office.

This notice is being published and posted in compliance with the Open Meetings Act, 1976 PA 267, the Americans with Disabilities Act, and in accordance with the Metropolitan Extension Telecommunications Rights-of-Way Oversight Act, Act 48 of 2002.

(MUNICIPALITY) will provide necessary reasonable auxiliary aids and services, such as signers for the hearing impaired and audio tapes of printed materials being considered at the meeting to individuals with disabilities at the meeting/hearing upon seven (7) days' notice to (MUNICIPALITY) by writing or calling the following: _____.

A copy of this notice is on file in the office of the Clerk.

LEGAL FRAMEWORK APPENDIX C

ORDINANCE NO. _____

MUNICIPAL BROADBAND ORDINANCE

An Ordinance to protect the public health, safety, and welfare by establishing regulations governing access to and use of the (MUNICIPALITY)'s broadband internet access transport services, as defined in the Metropolitan Extension Telecommunications Rights-Of-Way Oversight Act, Public Act No. 48 of 2002, MCL 484.3101 et seq. (the "METRO Act"), and in accordance with the Michigan Telecommunications Act, Public Act 179 of 1991, MCL 484.2101, et seq.

THE (MUNICIPALITY) ORDAINS:

Section I. Title.

This Ordinance is known and cited as the "(MUNICIPALITY) Municipal Broadband Ordinance."

Section II. Purpose and Preamble.

1. The (MUNICIPALITY) desires to construct infrastructure within the public rights-of-way and outside of the public rights-of-way with consent of the owner(s) of the property for the provision of broadband internet access transport services for the benefit of the residents of the(MUNICIPALITY), in accordance with the METRO Act and the Michigan Telecommunications Act.

2. The (MUNICIPALITY) properly noticed and conducted a public hearing in accordance with MCL 484.3114(1)(a).

3. The (MUNICIPALITY) prepared reasonable projections of at least a 3-year cost-benefit analysis as required by MCL 484.3114(1)(b).

Section III. Approval of Cost-Benefit Analysis.

In accordance with the METRO Act, the (MUNICIPALITY) prepared reasonable projections of at least a 3-year cost-benefit analysis identifying and disclosing the total projected direct costs of and the revenues to be derived from constructing the infrastructure for the provision of broadband internet access transport services to its customers.

Section IV. Operation of Broadband Internet Access Service.

The (MUNICIPALITY) shall operate its broadband services, including but not limited to dark fiber leasing, active Ethernet, passive optical network connectivity, and internet access for wholesale or retail to customers.

1. Applications for the use of the (MUNICIPALITY)'s broadband service shall be submitted by the property owner to the (MUNICIPALITY)'s internet service provider on forms or online as directed by the (MUNICIPALITY) or the internet service provider.

2. Prior to providing broadband service to a customer, proof evidencing ownership or a present possessory right (e.g. rental or lease agreement) of the property to be serviced must be submitted to the (MUNICIPALITY). If new service is requested by a customer who is not the owner of the property, the customer shall obtain, and provide the (MUNICIPALITY) evidence satisfactory to the (MUNICIPALITY) of the property owner's consent to the provision of services.

3. It shall be unlawful for a person or firm to obtain or use the broadband service over or through the (MUNICIPALITY)'s broadband without the (MUNICIPALITY)'s approval of an application for service, and paying all necessary user charges, costs and fees in accordance with this Ordinance.

Section V. Rates and Fees.

1. User charges shall be used to defray the costs of capital, operation, maintenance, and replacement of the broadband services, and to the extent permitted by law, may also be used for debt retirement.

2. The (MUNICIPALITY) may establish by resolution a fee schedule setting forth the charges, fees and costs for the provision of broadband services in accordance with MCL 484.3114, including but not limited to:

    a. Application fees;

    b. Usage charges;

    c. Fees for discontinuing broadband services to a customer;

    d. Fees for monitoring, inspection and surveillance procedures including the cost of reviewing monitoring reports;

    e. Other fees and charges the (MUNICIPALITY) may deem necessary to carry out the requirements of this Ordinance.

Section VI. Compliance with the METRO Act.

The (MUNICIPALITY) shall comply in all respects with the requirements of the METRO Act and the Michigan Telecommunications Act, Public Act 179 of 1991, and shall not do any of the following:

1. Adopt an ordinance, rules or a policy that unduly discriminates against another person providing the same service provided, however, that subject to other requirements of the METRO Act, this paragraph shall not be construed as precluding the (MUNICIPALITY) from establishing rates different from those of another person providing the same service or providing introductory or special rates.

2. Employ terms more favorable or less burdensome than those imposed by the (MUNICIPALITY) upon other providers of the same service within its jurisdiction concerning access to public rights-of-way.

3. Impose or enforce against a provider any local regulation with respect to public rights-of-way that is not applicable to the (MUNICIPALITY) in its provision of a telecommunication service provided through broadband services.

Section VII. Penalty.

Any person who violates any of the provisions of this Ordinance shall be deemed responsible for a municipal civil infraction. Any person who violates any of the provisions of this Ordinance shall also be subject to a civil action seeking appropriate injunctive or other relief as allowable by law. For violation of any provision of this Ordinance, the violator shall pay costs, which shall include all direct or indirect expenses, including attorney fees reasonably and actually incurred, engineering fees and costs, and the (MUNICIPALITY)'s administrative salaries and costs, to which the (MUNICIPALITY) has been put in connection with the violation. A violator of this Ordinance shall also be subject to such additional sanctions, remedies, and judicial orders as are authorized under Michigan law. Each day a violation of this Ordinance continues to exist constitutes a separate violation. Any person or other entity that violates any provision of this Ordinance is responsible for a municipal civil infraction as defined by Michigan law and subject to a civil fine determined in accordance with the following schedule:

1st violation within 3-year period* $ 50.00

2nd violation within 3-year period* $100.00

3rd violation within 3-year period* $200.00

4th or subsequent violation within 3-year period* $500.00

*determined on the basis of the date of violation(s).

Section VIII. Severability.

If any part of this Ordinance is declared invalid, that invalidation will not affect the remainder of this Ordinance.

Section IX. Repealer.

All ordinances or parts of ordinances which conflict with this Ordinance are repealed to the extent necessary to give this Ordinance full force and effect.

Section X. Effective Date.

This Ordinance is effective 30 days after it (or a summary of it) is published in a newspaper of general circulation within the (MUNICIPALITY).

LEGAL FRAMEWORK APPENDIX D

RESOLUTION NO. _____

RESOLUTION TO ADOPT ORDINANCE NO. _____, MUNICIPAL BROADBAND ORDINANCE

A meeting of _____, was held on the ____ day of _____, _____, at _____at __:00 PM.

PRESENT:_____

ABSENT:_____

The following preamble and resolution were offered by _____ and supported by _____.

WHEREAS, the (MUNICIPALITY) desires to construct infrastructure within the public rights-of-way and outside of the public rights-of-way with consent of the owner(s) of the property for the provision of broadband internet access transport services for the benefit of the residents of the (MUNICIPALITY), in accordance with the Michigan Telecommunications Act, Act 179 of 1991, MCL 484.2101 *et seq*. and the Metropolitan Extension Telecommunications Right-Of-Way Act, Act 48 of 2002, MCL 484.3101 *et seq*. (the "Acts"); and

WHEREAS, the (MUNICIPALITY) properly noticed and conducted a public hearing in accordance with MCL 484.3114(1)(a); and

WHEREAS, in accordance with MCL 484.3114(1)(b), the (MUNICIPALITY) prepared reasonable projections of at least a 3-year cost-benefit analysis identifying and disclosing the total projected direct costs of and the revenues to be derived from constructing the infrastructure for the provision of broadband internet access transport services to its customers; and

WHEREAS, the Acts authorize the (MUNICIPALITY) to adopt ordinances regulating the public health, safety, and general welfare of persons and property by establishing regulations governing access to and use of the (MUNICIPALITY)'s broadband internet access transport services; and

WHEREAS, the (MUNICIPALITY) has considered a proposed Ordinance (the "Ordinance") accordingly and has determined that it is in the best interests of the public health, safety and welfare to adopt the Ordinance.

NOW, THEREFORE, BE IT RESOLVED THAT:

1. Ordinance No. ____, "Municipal Broadband Ordinance," attached as **Exhibit A**, is hereby adopted.

2. The Ordinance shall be filed with the (MUNICIPALITY) Clerk.

3. The (MUNICIPALITY) Clerk shall publish a Notice of Adoption with a summary of the ordinance, in a newspaper of general circulation in the (MUNICIPALITY) within 30 days after adoption.

4. Any and all resolutions that are in conflict with this Resolution are hereby repealed upon the effective date of the Ordinance, but only to the extent necessary to give this Resolution full force and effect.

Upon Roll Call Vote, the following voted "Aye":

_____

The following voted "Nay":

_____

CERTIFICATION

I, _____, the undersigned (MUNICIPALITY) Clerk of the (MUNICIPALITY), hereby certify that the foregoing resolution is a true and complete copy of a resolution adopted at a regular meeting of the (MUNICIPALITY) held on __ day of ___, _____, the original of which is on file in my office, and that notice of such meeting was given, and the meeting was conducted, pursuant to and in compliance with the Act No. 267, Michigan Public Acts of 1976, as amended.

_____

LEGAL FRAMEWORK APPENDIX E

NOTICE OF ADOPTION: MUNICIPAL BROADBAND ORDINANCE

To the residents and property owners of the (MUNICIPALITY), and all other interested persons:

On _____, _____, the (MUNICIPALITY) adopted a Municipal Broadband Ordinance ("Ordinance"). A summary of the Ordinance is provided below. A true copy of the Ordinance, including any exhibits, is available for inspection at _____.

ORDINANCE NO. ___
MUNICIPAL BROADBAND ORDINANCE

Section 1. This section states the title of the Ordinance.

Section 2. This section states the purpose and preamble of the Ordinance.

Section 3. This section states that the (MUNICIPALITY) has prepared reasonable projections of at least a 3-year cost-benefit analysis identifying and disclosing the total projected direct costs of and the revenues to be derived from constructing the infrastructure for the provision of broadband internet access transport services to its customers.

Section 4. This section states the process and procedure for use and operation of the (MUNICIPALITY)'s broadband service.

Section 5. This section states that the (MUNICIPALITY) may establish by resolution a fee schedule setting forth the charges, fees and costs for the provision of broadband services in accordance with MCL 484.3114.

Section 6. This section states that the (MUNICIPALITY) shall comply with the requirements of the METRO Act, Public Act No. 48 of 2002, MCL 484.3101 et seq. and the Michigan Telecommunications Act, Public Act 179 of 1991, MCL 484.2101, et seq.

Section 7. This section states the penalties for violations of the Ordinance.

Section 8. This section provides that any portion of the Ordinance found invalid for any reason, such holding shall not be construed as affecting the validity of the remaining portions of this Ordinance.

Section 9. This section provides that if any ordinances or parts of ordinances in conflict herewith are hereby repealed only to the extent necessary to give this Ordinance full force and effect.

Section 10. This section provides that the Ordinance shall take effect 30 days after it (or a summary of it) is published in a newspaper of general circulation within the (MUNICIPALITY).

LEGAL FRAMEWORK APPENDIX F

RESOLUTION NO. _____

RESOLUTION GRANTING AUTHORITY AND CONSENT TO INSTALL FIBER OPTIC LINES IN (MUNICIPALITY)

A meeting of _____, was held on the ____ day of _____, _____, at _____at __:00 PM.

PRESENT:_____

ABSENT:_____

The following preamble and resolution were offered by _____ and supported by _____.

WHEREAS, the (MUNICIPALITY) has been asked to grant to (BROADBAND MUNICIPALITY), a Michigan municipal corporation, authorization and consent to install, construct, repair, reconstruct, maintain, replace, operate and/or remove communications utilities (including fiber optic lines and cables) and related devices, fixtures, pipes, conduit, wires, equipment, marker posts, and appurtenances that may from time to time be appropriate, some of which may be above or below ground, within (MUNICIPALITY); and

WHEREAS, (MUNICIPALITY) deems it to be in the best interests of (MUNICIPALITY) to grant such authorization and consent to (BROADBAND MUNICIPALITY); and

WHEREAS, such authorization and consent will benefit the health, safety and welfare of the citizens of (MUNICIPALITY) and others.

NOW, THEREFORE, it is hereby resolved as follows:

1. (MUNICIPALITY) approves, authorizes, and grants consent to (BROADBAND MUNICIPALITY) to install, construct, repair, reconstruct, maintain, replace, operate and/or remove communications utilities (including fiber optic lines and cables) and related devices, fixtures, pipes, conduit, wires, equipment, marker posts, and appurtenances that may from time to time be appropriate, some of which may be above or below ground, within (MUNICIPALITY).

2. This authorization shall also constitute consent pursuant to Article VII, Section 29, of the Michigan Constitution of 1963.

3. The Supervisor and Clerk of the (MUNICIPALITY) are authorized to take any and all other actions, and to execute such other documents, as may be necessary or appropriate in order to implement the consent and authorization described herein.

4. All resolutions and parts of resolutions insofar as they conflict with the provisions of this Resolution are hereby rescinded.

Upon Roll Call Vote, the following voted "Aye":

_____

The following voted "Nay":

_____

CERTIFICATION

I, _____, the undersigned (MUNICIPALITY) Clerk of the (MUNICIPALITY), hereby certify that the foregoing resolution is a true and complete copy of a resolution adopted at a regular meeting of the (MUNICIPALITY) held on __ day of ___, _____, the original of which is on file in my office, and that notice of such meeting was given, and the meeting was

conducted, pursuant to and in compliance with the Act No. 267, Michigan Public Acts of 1976, as amended.

LEGAL FRAMEWORK APPENDIX G

CONSENT AND FRANCHISE AGREEMENT FOR BROADBAND INTERNET SERVICE

This Agreement is made on the ____ day of _____, 20__, by and between (BROADBAND MUNICIPALITY), a Michigan municipal corporation, and (MUNICIPALITY), a Michigan municipal corporation.

WHEREAS, the (BROADBAND MUNICIPALITY) owns and operates a broadband internet access transport system (the "System"); and

WHEREAS, the (BROADBAND MUNICIPALITY) has extended the System into (MUNICIPALITY) and may need to further extend the System and infrastructure adjacent to, along, under or within the road right-of-way located in the (MUNICIPALITY) and the limited service area (hereinafter the "Service Area") as legally described in Exhibit A, attached hereto; and

WHEREAS, pursuant to Article VII, section 29 of the Michigan Constitution of 1963, a public utility may not use the streets, highways or other public rights-of-way within the (MUNICIPALITY) for public utility facilities without the (MUNICIPALITY)'s consent, and may not provide utility services within the (MUNICIPALITY) without first obtaining a franchise from the (MUNICIPALITY); and

WHEREAS, the (MUNICIPALITY) is amendable to providing its consent and a franchise as limited by this Agreement.

NOW, THEREFORE, it is hereby agreed by and between the (BROADBAND MUNICIPALITY) and the (MUNICIPALITY) as follows:

1. Consent. Subject to the terms and conditions of this Agreement, the (MUNICIPALITY) grants to the (BROADBAND MUNICIPALITY) consent, permission, right and authority to lay, construct, maintain, locate, repair, rebuild, operate, use and replace broadband internet access transport system systems, including equipment necessary to extend the System in and through the Services Area. This Agreement also grants to the (BROADBAND MUNICIPALITY) any right to serve property within the Service Area. This Agreement does not grant to the (BROADBAND MUNICIPALITY) any right to serve any property within the (MUNICIPALITY) outside of the Service Area, or to place utilities in any other place within the (MUNICIPALITY) without first obtaining specific written authorization and approval from the (MUNICIPALITY). This Agreement does not provide any rights to use any (MUNICIPALITY) -owned property.

2. Consent Not Exclusive. The rights, powers, and authorities granted by this Agreement are not exclusive, and the (MUNICIPALITY) may grant similar rights, and powers to any other person or entity.

3. Franchise. Subject to the terms and conditions of this Agreement, the (MUNICIPALITY) grants to the (BROADBAND MUNICIPALITY) a franchise to operate its System within the Service Area. The following conditions shall apply to the franchise granted by this Agreement:

(a) Construction Plans. The Construction of broadband facilities within the Service Area shall be constructed in accordance with the plans prepared by a certified public engineer, and a copy of such plans will be filed with the (MUNICIPALITY).

(b) Maintenance and Repair. The (BROADBAND MUNICIPALITY) shall have the right to conduct ordinary and routine maintenance, repair and replacement work on the System constructed or maintained pursuant to this Agreement.

(c) During the term of this Agreement, the (BROADBAND MUNICIPALITY) shall charge and bill users rates, fees and charges as permitted by law for Service in the Service Area as may be approved from time to time by formal action of the (BROADBAND MUNICIPALITY).

4. No Cost to the (MUNICIPALITY). The (MUNICIPALITY) shall have no duties or responsibilities with regard to the System constructed and maintained pursuant to this Agreement and the (MUNICIPALITY) shall not be responsible for any cost or expenses associated with them.

5. No Basis for Annexation. During the term of this Agreement, the (BROADBAND MUNICIPALITY) shall not use the existence of the System constructed pursuant to this Agreement to justify or support any annexation of property from the (MUNICIPALITY) to the (BROADBAND MUNICIPALITY), no matter who initiates the annexation effort. Furthermore, the parties agree that any body (including the County Board of Commissioners, State Boundary Commission or their successors) should view any such annexation effort as if the System constructed pursuant to the Agreement does not exist. Notwithstanding any provision of this Agreement to the contrary, in the event the (BROADBAND MUNICIPALITY) initiates or supports annexation of any portion of the Service Area from the (MUNICIPALITY) to the (BROADBAND MUNICIPALITY), the consent and franchise granted by this Agreement shall be immediately revocable by the (MUNICIPALITY).

6. No Liability. Neither the (MUNICIPALITY) nor its officers, agents, employees, or contractors shall be liable to the (BROADBAND MUNICIPALITY) for any interference with or disruption in the operation of the System constructed pursuant to this Agreement, except for the sole negligence or willful misconduct of the (MUNICIPALITY), its agents, officers, employees or contractors. The (BROADBAND MUNICIPALITY), to the extent permitted by law, shall indemnify and hold the (MUNICIPALITY) harmless from any claims, demands, actions, suits or judgments of any kind or nature arising from or related to the System within the Service Area, except for the sole negligence or willful misconduct of the (MUNICIPALITY), its agents, officers, employees or contractors.

7. **Non-Assignment**. The parties shall not assign, transfer or convey this Agreement, or any of the rights or obligations conveyed or imposed by this Agreement, to any other person, firm, or corporation without the prior written approval of the other party.

8. **Interpretation**. Nothing in this Agreement shall be construed to convey any title or interest in or to any highway, street, alley, or other public place. Nothing in this Agreement shall be construed in any manner as a surrender by the (MUNICIPALITY) of its legislative power with respect to the subject matter of this Agreement or with respect to any other matter or in any manner limiting the right of the (MUNICIPALITY) to lawfully regulate the use of any public rights-of-way.

9. **Compliance with Laws**. The (BROADBAND MUNICIPALITY) shall comply with all applicable laws, statutes, ordinances, rules and regulations regarding the installation, construction, operation, maintenance, repair, replacement, ownership or use of the System constructed pursuant to this Agreement. The (BROADBAND MUNICIPALITY) shall secure all necessary permits, licenses, and approvals from all governmental officials, agencies or entities of competent jurisdiction.

10. **Term**.

(a) This Agreement is for thirty (30) years.

(b) Termination Date. This Agreement shall continue in full force and effect until 11:59 p.m., _____, _____.

(c) Continued Term. If either party desires to terminate this Agreement, it shall, six (6) months prior to the termination date, give written notice of termination. If neither party shall give notice of termination, as hereinafter provided, or if each party giving notice of termination withdraws the same prior to termination date, this Agreement shall be renewed for an additional term of thirty (30) years, subject to notice of termination by either party, on six (6) months written notice prior to the renewed agreement's new termination date.

11. **Termination; Rescission**. This Agreement may be terminated by mutual written agreement of the parties. However, the franchise granted by this Agreement is revocable at will by the (MUNICIPALITY) upon six (6) months prior written notice to the (BROADBAND MUNICIPALITY) and after an opportunity for the (BROADBAND MUNICIPALITY) and Service Area representatives to address the (MUNICIPALITY) before any revocation decision is made.

12. **Amendments and Contract Execution**. This Agreement may be amended or modified only in a writing signed by the appropriate (MUNICIPALITY) and (BROADBAND MUNICIPALITY) officials after approval of such amendment by the (MUNICIPALITY) and (BROADBAND MUNICIPALITY). This Agreement and amendments thereto shall be in writing and executed in multiple copies. Each copy shall be deemed an original, but all copies together shall constitute one and the same instrument.

13. **Successors**. This Agreement shall be binding on and inure to the benefit of the parties and their successors.

14. **Certification**. The persons signing this Agreement on behalf of the (MUNICIPALITY) and the (BROADBAND MUNICIPALITY) certify by their signatures that they are duly authorized to sign on behalf of said parties and that this Agreement has been authorized by said parties.

IN WITNESS WHEREOF, the parties have executed this Agreement as of the date first above written.

WITNESSES: **(MUNICIPALITY)**

(BROADBAND MUNICIPALITY)

_____

85381:00001:3699599-8

85381:00001:3699599-8

Appendix F: Template Feasibility Study RFP and Evaluation Matrix

Informal Request for Proposal: [Municipality] Broadband Feasibility Study

Responses Due: [date]

[Municipality] is a rural municipality in [location] with a population of about [population]. This area is significantly unserved in terms of broadband access – a minority of households have access to DSL or fixed wireless, but no households have access to cable or other infrastructure cable of providing broadband speeds. This request is seeking informal proposals to conduct a feasibility study to provide broadband to all households in [municipality].

1.0 Project Description

1.1 **Required Actions.**

- **Stakeholder kickoff meeting.** Conduct a meeting, preferably in person, with project stakeholders discussing goals and decision points for the project.
- **On-site Plant Review.** Conduct on-site review and analysis of proposed service area to determine relevant location details that may inform wireline vs wireless viability, aerial vs underground viability, boring vs trenching viability, property density, potential make ready costs, etc.
- **Stakeholder consultation meeting.** Conduct a meeting with project stakeholders discussing preliminary findings to enable final report to effectively meet community goals.
- **Stakeholder report presentation.** Conduct a meeting to present the findings of the report to the stakeholders, and field any questions.

1.2 **Required Deliverables.**

- **Design narrative.** Discussion regarding the recommended approach to be used for access to rights of way, pole structure, outside plant fiber layout, impact of active versus passive networks, central hub equipment location, wireline vs wireless, and other pertinent decision points.
- **Detailed project costs.** Analysis of all costs for design, implementation, and maintenance of broadband infrastructure build to serve each improved property in [municipality].
- **Infrastructure map.** A summary map depicting proposed fiber routes, sizes, and towers/antennas (if applicable).
- **Bandwidth analysis.** Investigate local bandwidth providers and obtain quotes for appropriate levels of service.
- **Assumptions.** Enumerate assumptions and known unknowns including justifications for assumptions.

- **Financial model.** A model that takes into account project costs and projected take rates to determine overall project feasibility.
- **Funding analysis.** An analysis that compares various available funding options including loans, grants, taxes, and public/private partnerships.

2.0 Qualifications and Experience

2.0 **Experience and expertise.** Applicants will be evaluated based upon prior experience and expertise. Please include the following with your proposal:

- A list of three (3) instances of your firm's work that best reflect your capabilities and their relevancy to this project.
- Current references for three (3) current or former clients.
- Briefly describe your firm's organizational capacity to complete this study (e.g. staff, equipment, software, physical space, office location, etc)
- An accurate, realistic time frame for completion of the study.

3.0 Submissions

3.1 **Price quote.** Submissions shall include a price quote to deliver the items in section 1.0.

3.2 **Submission.** Responses to this informal RFP shall be submitted by end of day on [date] via email to [email].

3.3 **Questions.** Questions should be directed to [email] or [phone].

Firm	Contact	Has responded to Region 9 bid?	Completed Region 9 work?
Aspen Wirelss	jim@aspenwireless.net		
CCG	blackbean2@ccgcomm.com	X	Sharon Twp feasibility, Mancheseter Twp feasibility, Lyndon Twp project mgmt
CTC	jhovis@ctcnet.us	X	Ann Arbor Twp feasibility
DCS Technology Design	clscharrer@dcstechnology.com	X	Sylvan Twp community group (non-municipal)
Design Nine	info@designnine.com	X	
Finly Engineering	m.mrla@fecinc.com	X	Lyndon Twp Engineering
Inteleconnect	smayo@inteleconnect.com	X	
Lookout Point Communications	info@lookoutpt.com	X	
NEO Connect	info@NEOconnect.us		
Pulse Broadband	rudy@pulsebroadband.net	X	Lyndon/Dexter/Webster Township Feasibility
Vantage Point	Lori.Sherwood@vantagepnt.com	X	
Yates	bbretsch@yesrus.com	X	
Wideband Group	rsigns@widebandgroup.com	X	Conway Twp feasibility

Proposal Evaluation Matrix

Step 1: Review each proposal. Grade the various criteria outlined in the proposal. Assign points based on the range recommended.

	Proposal Criteria	Points	Vendor A	Vendor B	Vendor C	Vendor D	Vendor E
1.0	**Response to requirements (Entire proposal)**	**30 points max**					
1.1	Provides a quality and complete proposal in accordance with the instructions stated in the RFP	0-5					
1.2	Includes client contact information / references for at least three recent projects of similar scope and with municipalities and government entities	0-5					
1.3	Clearly and comprehensively articulates an understanding the scope of work of the project and the requirements contained within the RFP	0-5					
1.4	Demonstrates mastery of the process necessary to manage projects and complete tasks	0-5					
1.5	Clearly and comprehensively explains plans and approaches in a manner that is understandable to both technical and non-technical audiences	0-5					
1.6	Aligns with and understands Manchester Township's goals	0-5					
		30	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
2.0	**Qualifications (Sections 1 and 2)**	**30 points max**					
2.1	Demonstrates significant expertise and experience in completing similar consulting projects	0-5					
2.2	Demonstrates a track record of success in completing projects of similar size and scope within the scheduled timeline and budget	0-5					
2.3	Demonstrates expert knowledge of all broadband technologies, standards, and protocols	0-5					
2.4	Demonstrates significant expertise and experience with municipalities and government entities	0-5					
2.5	Demonstrates significant expertise and experience with RFP preparation	0-5					
2.6	Demonstrates experience working with key stakeholders	0-5					
		30	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
3.0	**Project Staffing (Sections 3 and 4)**	**20 points max**					
3.1	Is clear in identifying project team members (including subcontractors), their roles, and time commitments	0-5					
3.2	Demonstrates appropriate skills, education, qualifications and certifications of all project team members	0-5					
3.3	Demonstrates recent relevant experience of all project team members in implementing a similarly complex project	0-5					
3.4	Demonstrates convincingly that the proposed staffing level is sufficient to meet project requirements within the schedule timeline	0-5					
		20	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
4.0	**Project and Implementation Plan (Section 4)**	**10 points max**					
4.1	Provides a comprehensive, well-conceived project plan with logical steps and realistic timeframes	0-10					
		10	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
5.0	**Price (Section 5)**	**10 points max**					
5.1	Provides rates and hours for all personnel assigned to the project plus any non-labor costs	0-5					
5.2	Provides total project costs and "not-to-exceed" total budget for the project	0-5					
		10	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**
	Total Points	**100**	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

Step 2: Discuss individual evaluations
Step 3: Contact references of preferred vendor
Step 4: Summarize the individual evaluations into a Committee evaluation to document the Committee's decision to recommer

Appendix G: Example Feasibility Study Reports from Local Townships

PULSE BROADBAND, LLC

FTTH FEASIBILITY STUDY REPORT

LYNDON TOWNSHIP, MI

April 29, 2016

Pulse Broadband LLC has been engaged by Lyndon Township to complete a detailed feasibility study for building a fiber-to-the-home network and offering double play telecom services (Internet and VoIP Telephone) offered to its entire area.

Pulse completed an on-site field review by Pulse technical outside plant staff. We utilized this visit to evaluate some of the initial assumptions built into the model and review the condition of the plant. We completed a bandwidth analysis to determine the availability of internet hand-off points and pricing. We conducted a thorough field assessment, analyzed aerial and underground construction, defined cost differences, and determined real-world costs for Lyndon's footprint. Finally, we completed detailed financial modeling to evaluate economic feasibility. It is our pleasure to provide the results of this independent feasibility study.

The feasibility study provides details for all of our calculations, but the highlights include:

1. Fiber plant miles. We received PDF maps provided by Consumers Energy and cross referenced the calculated miles with Washtenaw Road Commissions shape files. We calculated 64.6 miles for your fiber plant. This figure was discussed with the Broadband Cooperative and some roads were removed to bring the final assumption to 62.8 miles. This mileage was used in both construction method models.
2. Aerial construction using Consumers Energy poles. The cost of construction to Lyndon Township (not including ISP costs) is $5,931,816. This includes $107,765 of pole assessment fees to Consumers Energy and $2,682,354 make ready estimates based on preliminary information from Consumers Energy. Final make ready costs can only be determined by Consumers Energy. Pulse Broadband used its best efforts at estimating those costs based on a conversation with Consumers energy.
3. 100% underground construction. If Lyndon Township decides to bypass Consumers Energy and builds all underground, then the total cost of construction increases to $6,295,086.
4. ISP partner. Our model projects $659,214 as startup costs for the ISP. Based on $46.50 core offer prices, we believe the ISP can operate at breakeven. Lyndon Township might have a tough time generating interest with only 600 estimated customers. We suggest vetting ISP's as part of next steps.

We look forward to working with Lyndon Township on this important strategic, regional infrastructure project which will bring the capability of gigabit broadband access to your residents and communities. We've included a paragraph at the beginning of the report to provide credibility for any reader unfamiliar with Pulse. Please free to distribute our report for any required business purposes and include my contact information as needed.

Sincerely,

Eric Freesmeier, CEO
eric@pulsebroadband.net
(314) 324-7347

CONTENTS

About Pulse Broadband

Pulse was formed with the sole purpose of partnering with rural America to bring fiber technology to underserved areas. Since our formation in 2008, we have partnered with electric cooperatives, municipal entities, and private groups to build over 5,000 miles in successful FTTH projects. In addition to our fiber design and construction management expertise, we offer a full suite of telecom services, from feasibility studies of a new network to back office support services for existing companies. This 360° view of the industry, along with our years of hands-on experience, give Pulse the distinction of being one of the true leaders in the rural Fiber-to-the-Home industry.

There is no project too small, or too large, which is outside the scope of our expertise. Our projects have ranged in size from 25 miles with 900 passings to 1,800 miles with 26,500 passings. Each project has been unique and our collaborative approach with every owner has brought a customized solution. The variations and complexities of each project have given us invaluable real-world experience. These experiences enable us to take a deep-dive with each new client to ask the right questions, inspect critical areas, and discover hidden problems to ensure our studies, models, and designs produce the most accurate outcomes.

Pulse Broadband is a full-service firm offering feasibility studies, financial modeling, fiber design, technology selection, construction management, vendor (bandwidth, VoIP, video and network management) negotiations, and back office support. Our working knowledge in each of these critical areas allows us to make more informed decisions. Whichever service our clients need; this holistic approach gives them the confidence that they are setup for success.

Bandwidth Analysis

Analysis of Providers

Terie Hannay, our VP of Planning and Integration, conducted a thorough investigation of all local providers. She gathered their initial pricing, terms and connection points. Terie is happy to report that bandwidth is readily available at competitive prices.

The below quotes were received for the Township Hall at 17751 N. Territorial Road. We have requested additional quotes for the Dexter fire station at 12088 N. Territorial Road and also the Chelsea Library at 221 S. Main Street. Based on preliminary responses from vendors the pricing and availability for these two alternative locations will be the same or similar to the schedule below.

The top quote received for the Lyndon Township is from Birch Communications, a strong mid-tier provider. Their pricing for a 500MB circuit is $2,199 and a 1GB is $2,499. The ISP model reflects $3,300 so the ISP has flexibility to choose their provider. Refer to the chart below outlining the available carriers and their preliminary pricing and terms (3 years).

Summary of Provider Offerings				
Provider	**500 MB**	**1 GB**	**Installation**	**Term**
Cogent	$3,287	$5,035	$2,000	3 yrs.
ATT	$3,144	$4,336	$0	3 yrs.
XO Communications	$4,107	$8,633	$0	3 yrs.
Level 3	$4,873	$6,000	$0	3 yrs.
Birch	$2,199	$2,499	$0	3 yrs.
ACC	$2,944	$4,136	$1,500	3 yrs.
US Signal	$3,665	$5,554	$0	3 yrs.
123.Net	$3,639	$4,999	$0	3 yrs.
TelNet WW	$2,545	$3,945	$0	3 yrs.
Century Link	$6,086	$8,569	$0	3 yrs.
ComLink	$3,285	$4,630	$0	3 yrs.

Conclusion

Multiple providers have provided reasonable quotes and guidance that other locations would be similar. Bandwidth pricing could be negotiated further. We are confident that the ISP can provide adequate service with these prices.

Electric Plant Data

Consumers Energy supplied Pulse Broadband with information about the electric plant in Lyndon Township's footprint. Consumers Energy supplied 36 PDF prints of the electric plant. These maps visually showed the layout of the plant and pole locations. These maps, however, were lacking critical pieces of data:

- Total number of poles
- Span lengths for aerial and underground
- Defined scale
- All prints drawn to the same scale

In order to determine the number of utility poles in Lyndon's footprint, Pulse manually added the number of poles from the 36 PDF files. The number of calculated utility poles is 1,936. Since there was no scale, nor were prints drawn to the same apparent scale, Pulse estimated a scale for each print. This was accomplished by taking each individual print, finding a scaled map of the same real-world location, and transferring this scale to the print. The lengths of electric spans were then measured and totaled for each print.

Consumers Energy Map Calculation

The number of utility poles (1,936) used for aerial construction were calculated as described above. The proposed path for aerial construction utilized the path of Consumers Energy's electric plant. The path and maps (36 PDF prints) were supplied by Consumers Energy. The length of aerial spans was calculated using the following steps:

- Identify scale on each map, reference point on Google Earth
- Define sections of Consumers Energy plant used for construction
- Measure each line on each map
- Sum spans on each map
- Sum total spans from 36 prints

The path for underground construction was determined by a combination of Alan's on-site visit, Consumers Energy's plant, and Washtenaw Road Commission data. The path and length of underground construction was calculated using the following steps:

- Identify scale on each map, reference point on Google Earth
- Define possible path along roads following power
- Identify path along roads that do not follow power
- Measure each line on each map
- Sum underground path on each map
- Sum underground path from 36 prints

The following tables summarizes the estimated data:

Data calculated using Consumers Energy maps	
Number of Utility Poles	1,936
Total Calculated Miles	65

The following map illustrates the proposed path for the fiber network based on Consumers Energy PDF maps:

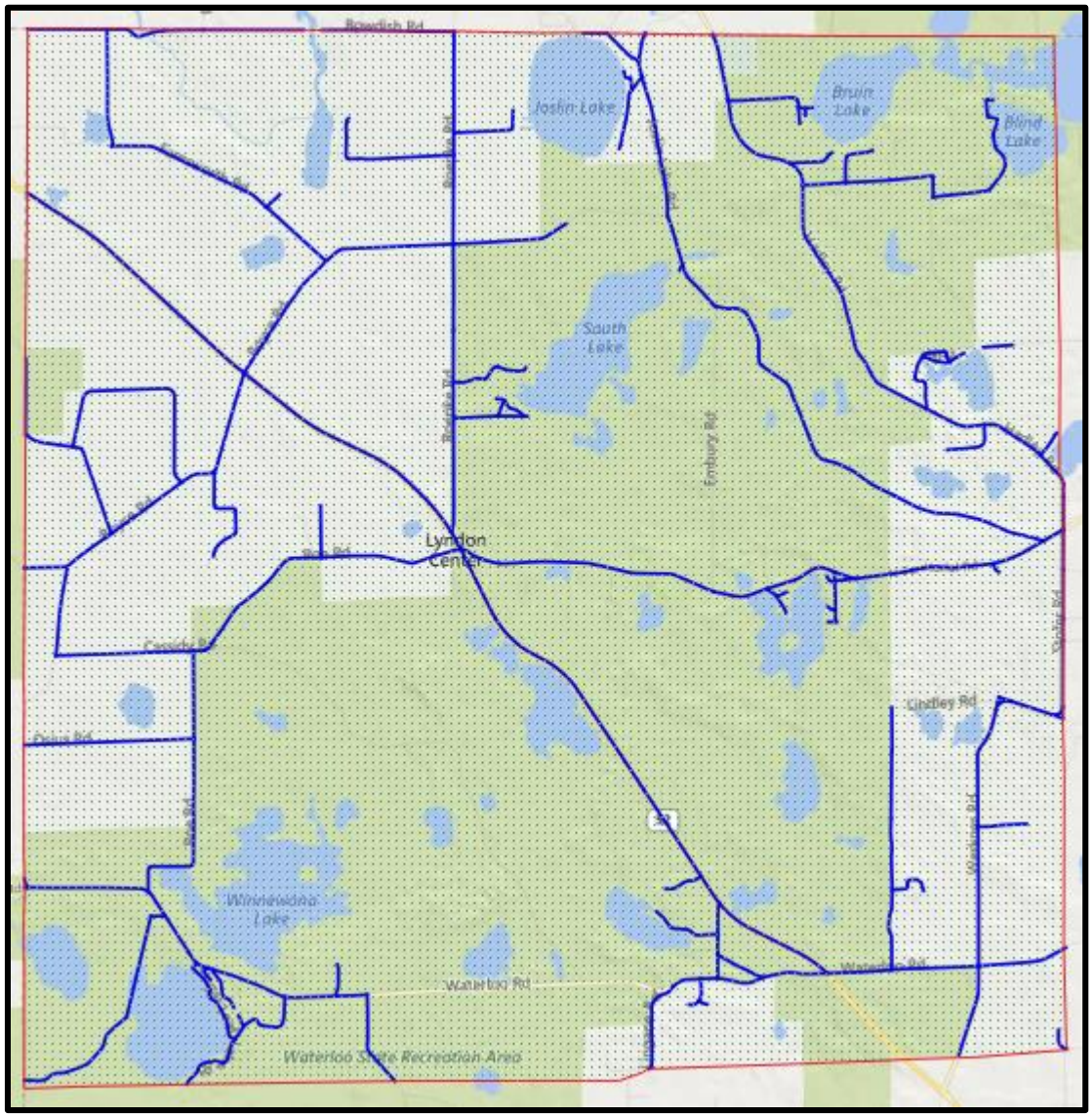


Figure 1. Map Illustrating Proposed Path for Fiber

VERIFY MILEAGE

In order to verify the mileage, Pulse referenced the data supplied by Washtenaw Road Commission. Pulse was provided the road data shapefile for Lyndon Township from the Washtenaw Road Commission. This data provided all roads within Lyndon Township's footprint, regardless if they would be within the path of the broadband network. Pulse completed the following steps to determine a more accurate count of road miles used for construction of the broadband network:

1. Tally road miles from the Washtenaw Road Commission shapefile
2. Identify roads that would not be within the path of construction
3. Subtract these roads from the shapefile
4. Tally all remaining road miles representing the proposed path of construction

The following pictures depict the roads contained within the Washtenaw Road Commission shapefile and suggested roads to remove from the fiber network:

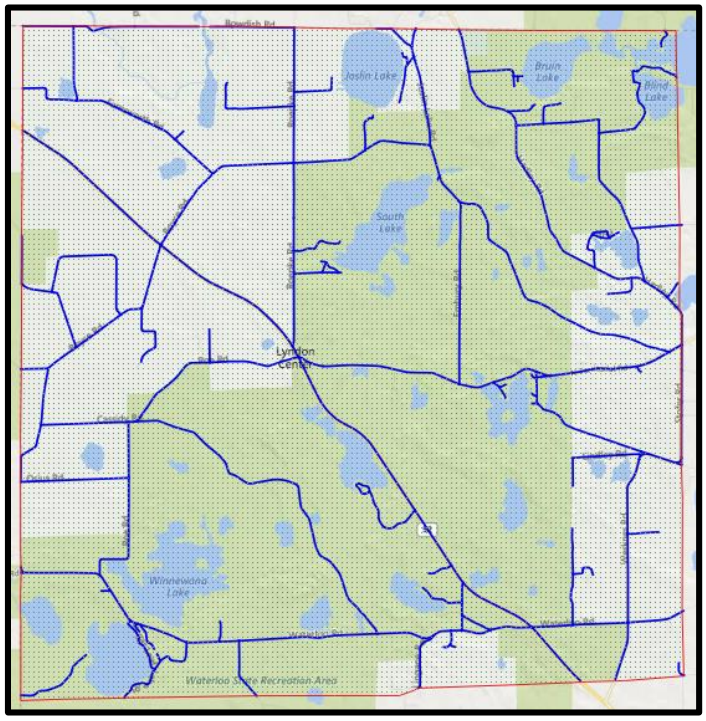


Figure 2. Map depicting Washtenaw Road Commission Shapefile

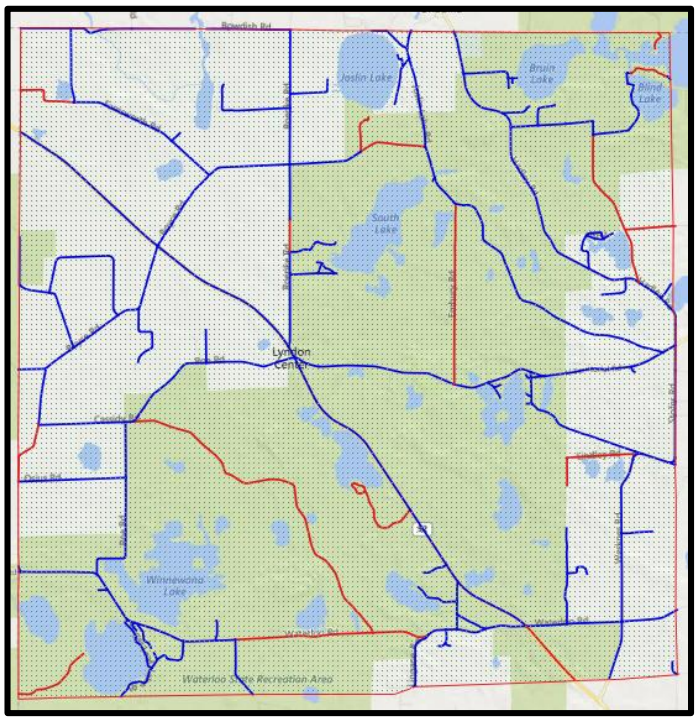


Figure 3. Map depicting roads (highlighted in RED) removed.

The following picture depicts the actual roads used in the calculation of road miles to be compared to the figure from the Consumers Energy calculation:

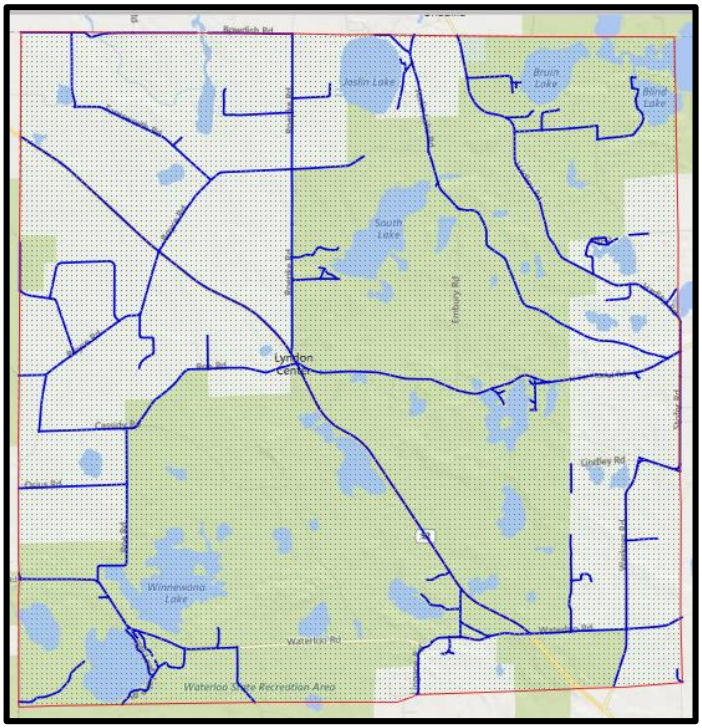


Figure 4. Map depicting net road miles used for calculation.

Comparison of two methods	
Consumers Energy	65
Washtenaw Road Commission	64.6

Core Business Model Assumptions

Our financial models make the following assumptions for both construction methods:

1. Distributed Split Architecture
2. GPON Technology
3. ISP will run operations
    a. Headend costs will be removed from network cost estimate
    b. GPON ONT will be removed from network cost estimate
    c. Installation will be removed from network cost estimate
    d. Base monthly service rate of $46.50 will be required to cover above costs plus the operation expenses to run their business
4. Lyndon Township needs total upfront amount to build network
5. Pulse estimates 50% of homes will take service and Lyndon Township will pay the construction of the drop. The assumed drop length is 600 ft. in the model. The township could reduce costs by requiring home owners with drop lengths (which includes some footage back to the terminal along the main pole line) over 300 ft. to cover their own additional costs. Aerial model savings would be $410,000 and underground model savings would be $735,000.

Construction Comparison: Aerial vs. Underground

The majority of broadband networks will incorporate a hybrid design utilizing both aerial and underground construction. The selection of preferred construction will be based upon such factors as ease of construction, reduction in make-ready costs, environmental, and permitting. When an entity does not own the poles, this adds another layer for decision making. Pulse's financial model incorporates the costs of all factors and produces results to assist in determining the preferred construction method. Consumers Energy is the local provider of electricity and owns the poles within Lyndon's footprint. Lyndon Township, with the assistance of Michigan Broadband Cooperative and Pulse Broadband, has obtained various costs associated with aerial construction utilizing Consumers Energy's utility poles. The following table summarizes the additional costs:

Estimated Costs to Consumers Energy			
	Price	**Units**	**Total Cost**
Pole Assessment	$57.25/pole	1,882	$107,765
Pole Replacement	$3,000/pole	565	$1,694,118
Make-Ready Construction	$750/pole	1,317	$988,236
Total Additional Aerial Construction			**$2,790,119**

In addition to the upfront costs incurred during construction, Lyndon Township will be required to pay annual pole rent and maintenance fees to Consumers Energy. The following table shows the value of the annual pole rent:

Simple Present Value Annual Ongoing Operating Costs			
	Price	**Units**	**Total Cost**
Pole Attachment Fee	$8.50/pole	1,882	$16,000
Annual Maintenance Fee	$3.50/pole	1,882	$6,588
Total Annual Ongoing Costs			$22,588
X 20 years			**$451,765**

The below table shows the model for aerial construction costs:

Total Project Costs – Aerial Model	
Pole Assessment	$107,765
Pole Replacement	$1,694,118
Other Make Ready	$988,236
Aerial Construction	$1,453,761
UG Construction	$328,303
Permits	$1,800
Drop Construction	$906,068
Simple PV Pole Rent/Maintenance	$451,765
Total	**$5,931,816**

At the on-site field review, Alan Van Buskirk and Rudy Tober were made aware of Lyndon Township's desire to explore the option for 100% underground construction. A critical factor driving the need for underground construction is Lyndon Township does not own the utility poles. Lyndon Township wants to compare the upfront cost of underground construction versus the upfront and on-going costs of aerial construction. Lyndon Township also desires to have the most advanced broadband network, which they believe involves underground construction. An underground network is also more protected from weather.

The following table shows the model for 100% underground construction costs:

Total Project Costs – Underground Model	
Pole Assessment	$0
Pole Replacement	$0
Other Make Ready	$0
Aerial Construction	$0
UG Construction	$4,708,554
Permits	$36,000
Drop Construction	$1,550,532
Simple PV Pole Rent/Maintenance	$0
Total	**$6,295,086**

Construction Model Comparison

The following table compares the costs for the two models:

Total Project Costs – Model Comparison		
	Aerial/UG	**Underground**
Pole Assessment	$107,765	$0
Pole Replacement	$1,694,118	$0
Other Make Ready	$988,236	$0
Aerial Construction	$1,453,761	$0
UG Construction	$328,303	$4,708,554
Permits	$1,800	$36,000
Drop Construction	$906,068	$1,550,532
Simple PV Pole Rent/Maintenance	$451,765	$0
Total	**$5,931,816**	**$6,295,086**

Detail Project Costs – Aerial Model

Capital Budget Assumptions

Capital costs to construct the network will be approximately $6,000,000. The timeline anticipated for the build is 12 months based on achievable milestones plus the construction preparation time. The following assumptions were made in the capital projections for the financial model:

- Outside Plant Construction:
  - 62.8 miles of distribution plant will be constructed over the course of 12 months. Construction is assumed to begin in Month 4 and to be completed by Month 16.
  - The cost of aerial construction is estimated at $69,319 per mile. Make ready costs for Consumers Energy is $42,707 per mile. Total aerial labor excluding make ready is $11,302 (plant labor less make ready plus technical labor). Materials cost per mile is $8,239. We have assumed a majority (60%) of fiber will be 96 count fiber. The $69,319 referenced above includes professional services discussed below.
  - The cost of underground construction is estimated at $104,542 per mile. The model assumes a fixed number of pedestals based on homes passed. This causes higher than anticipated cost per mile when a low number of underground miles are assumed in the model. The $104,542 referenced above includes professional services discussed below.
- Drop Construction:
  - 579 homes are expected to sign up for services over the course of two years.
  - The cost of drop construction is $1,565 per home. Labor is $1,380 and materials are $147. Aerial pole line is utilized and 30% underground for drops is assumed. Conduit is not utilized unless boring (driveways and sidewalks) is required.
  - Drop length of 600 feet is assumed per home.
  - Inside the home installation including ONT electronics will be the responsibility of the ISP partner.
- Professional Services:
  - The mapping of the outside plant is required to create the fiber design. This will require an estimated 754 hours over the course of six months to complete. The design of the outside plant is estimated at 356 hours over the course of six months to complete.
  - Project management for project planning, inspection of contractors and invoice approval/reconciliation is estimated to require a crew of two over the course of 12 months for a total of 3,780 hours.
  - Drop surveys to provide the fiber route from the distributed split to the side of the house for contractors is estimated at 261 hours to map and draft. These will be completed over the course of a year.

CAPITAL BUDGET

		Township		
PROJECT: **FTTH Network**	**SERVICE AREA:** **Lyndon Township, MI**	**Unit Cost**	**No. of Units**	**Total Costs**
OUTSIDE PLANT LABOR				
Pre-Construction	Complete Make Ready Construction	$ 42,707.20	59.7	**$ 2,548,236**
	Pole Assessment	$ 150	-	**$ -**
Aerial	PM99 (Move Pole Facilities)	$ 72.00	188	**$ 13,553**
	CO12(6M) [Hang stranded fiber]	$ 0.95	31,504	**$ 29,929**
	CO24(6M) [Hang stranded fiber]	$ 0.95	31,504	**$ 29,929**
	CO48(6M) [Hang stranded fiber]	$ 0.95	31,504	**$ 29,929**
	CO96(6M) [Hang stranded fiber]	$ 0.95	189,027	**$ 179,576**
	CO144(6M) [Hang stranded fiber]	$ 1.05	31,504	**$ 33,080**
	PM2A [Aerial Bond]	$ 4.50	376	**$ 1,694**
	PF3-3 [Place Screw Anchor]	$ 40.00	179	**$ 7,160**
	PE1-3 [Place down guy]	$ 24.00	179	**$ 4,296**
	PF3-AUX [Install auxiliary eye]	$ 8.00	119	**$ 955**
	PM69 [Place fiber storage loop]	$ 50.00	119	**$ 5,967**
Underground	BMUDT [Trench Conduit]	$ 5.50	13,265	**$ 72,958**
	BMUDD [Bore Conduit]	$ 12.00	3,316	**$ 39,795**
	BFO12 [Pull Fiber]	$ 0.90	1,658	**$ 1,492**
	BFO24 [Pull Fiber]	$ 0.90	1,658	**$ 1,492**
	BFO48 [Pull Fiber]	$ 0.90	1,658	**$ 1,492**
	BFO96 [Pull Fiber]	$ 0.90	9,949	**$ 8,954**
	BFO144 [Pull Fiber]	$ 0.90	1,658	**$ 1,492**
	BM71 [Rock Adder]	$ 10.00	829	**$ 8,291**
	BD5 [Pedestals]	$ 60.00	579	**$ 34,740**
	BM2-A [Grounding]	$ 40.00	579	**$ 23,160**
	BM80 [Risers]	$ 50.00	66	**$ 3,316**
	BM53 [Markers]	$ 20.00	99	**$ 1,990**
	BHF [Handholes]	$ 300.00	33	**$ 9,949**
Technical	SPL [Install Splitter]	$ 50.00	21	**$ 1,034**
	SPL-CBN [Install Splitter Cabinet]	$ 1,000.00	5	**$ 5,147**
	HACO12 [Splice Enclosures for 12 ct]	$ 125.00	66	**$ 8,291**
	HACO24 [Splice Enclosures for 24 ct]	$ 125.00	66	**$ 8,291**
	HACO48 [Splice Enclosures for 48 ct]	$ 135.00	66	**$ 8,954**
	HACO96 [Splice Enclosures for 96 ct]	$ 150.00	50	**$ 7,500**
	HACO144 [Splice Enclosures for 144 ct]	$ 150.00	66	**$ 9,949**
	TERM	$ 150.00	290	**$ 43,425**
	HO1 [Splicing with bi-directional testing]	$ 25.00	10,540	**$ 263,502**
			Total	**$ 3,449,517**

		Township		
PROJECT: **FTTH Network**	**SERVICE AREA:** **Lyndon Township, MI**	**Unit Cost**	**No. of Units**	**Total Costs**
OUTSIDE PLANT MATERIALS				
Fiber	12 ct. Loose Tube Fiber	$ 0.30	37,207	**$ 11,162**
	24 ct. Loose Tube Fiber	$ 0.35	37,207	**$ 13,023**
	48 ct. Loose Tube Fiber	$ 0.45	37,207	**$ 16,743**
	96 ct. Loose Tube Fiber	$ 0.70	223,245	**$ 156,271**
	144 ct. Loose Tube Fiber	$ 1.00	37,207	**$ 37,207**
Aerial	1/4" EHS Strand	$ 0.14	319,520	**$ 44,733**
	Lashing wire 0.038" Type 302 1,600' Roll	$ 24.00	282	**$ 6,758**
	Weaver(Bonding Clamp)	$ 1.75	555	**$ 972**
	#6 Bare Copper Ground Wire	$ 0.34	989	**$ 336**
	Anchor 8" Helix	$ 26.89	179	**$ 4,813**
	Sno-Shoe (pair)	$ 39.95	119	**$ 4,767**
	Stainless Steel Strap	$ 0.20	4,003	**$ 801**
	1/2" Spacer	$ 0.12	4,003	**$ 480**
	Guy Guards	$ 3.08	179	**$ 551**
	Auxilliary Eye	$ 14.39	119	**$ 1,717**
Stranded Hardware	#4 Split Bolt	$ 0.81	376	**$ 305**
	Preformed Deadend 1/4" Strand	$ 3.21	1,111	**$ 3,566**
	12" x 5/8" Machine Bolt w/ Nut	$ 1.07	941	**$ 1,007**
	2"x1/8" Flat Square Washer	$ 0.30	2,240	**$ 672**
	5/8"-11 Square Nut	$ 0.22	1,497	**$ 329**
	3 Bolt Clamp	$ 4.38	1,129	**$ 4,947**
	3 Bolt Clamp Curved	$ 5.48	376	**$ 2,063**
	5/8"Thimble Eye Bolt	$ 3.90	179	**$ 698**
	Bug nut(D Lash Clamp)	$ 0.30	4,003	**$ 1,201**
	Guy Hook - Ram's Head	$ 3.01	179	**$ 539**
Underground	Arnco 1.25" HDPE Conduit	$ 0.52	16,581	**$ 8,622**
	Channell 24x36x24 Handhole	$ 193.40	33	**$ 6,414**
	Channell Pedestal	$ 55.00	579	**$ 31,845**
	Pedestal Stickers	$ 0.70	579	**$ 405**
	0.75" Flex Conduit - 20'	$ 9.70	133	**$ 1,287**
	Screw Lags	$ 0.25	1,327	**$ 332**
	5/8" x 8' Copper Ground Rod	$ 10.31	612	**$ 6,311**
	Ground Rod Clamp	$ 0.90	612	**$ 551**
	Warning Marker	$ 14.60	99	**$ 1,453**
Technical	"A" Splice Enclosure	$ 220.00	133	**$ 29,183**
	"C" Splice Enclosure	$ 250.00	116	**$ 29,081**
	"D" Splice Enclosure	$ 285.00	66	**$ 18,903**
	Splice Trays for A Enclosure	$ 20.00	265	**$ 5,306**
	Splice Trays for C Enclosure	$ 22.00	399	**$ 8,777**
	Splice Trays for D Enclosure	$ 25.00	398	**$ 9,949**
	Aerial Clamps for FOSC 450	$ 25.82	315	**$ 8,141**
	Splitter Cabinets	$ 5,000.00	5	**$ 25,733**
	Splitters	$ 800.00	21	**$ 16,543**
	AirFOSC	$ 150.00	290	**$ 43,425**
	Splice Protector (sleeves)	$ 0.27	10,540	**$ 2,846**
			Total	**$ 570,770**

		Township		
PROJECT: **FTTH Network**	**SERVICE AREA:** **Lyndon Township, MI**	**Unit Cost**	**No. of Units**	**Total Costs**
DROP TO THE HOME				
Labor	CO2(6M) [Hang stranded fiber]	$ 0.90	208,440	**$ 187,596**
	BMUDT [Trench No Conduit]	$ 2.00	125,064	**$ 250,128**
	BMUDD [Bore Conduit]	$ 12.00	13,896	**$ 166,752**
	BFO2 [Pull Fiber]	$ 1.00	138,960	**$ 138,960**
	BM83 [Drop Riser Guard]	$ 25.00	232	**$ 5,790**
	BM(0.75) [House Cane]	$ 13.00	232	**$ 3,011**
	PM2A [Aerial Bond]	$ 4.50	347	**$ 1,563**
	BM2-A [Grounding]	$ 40.00	347	**$ 13,896**
	NID [Place NID Housing]	$ 25.00	579	**$ 14,475**
	HO1 [Splicing]	$ 25.00	579	**$ 14,475**
	HO1T [Testing]	$ 4.00	579	**$ 2,316**
Materials	2 Ct. Loose Tube Fiber	$ 0.20	347,400	**$ 69,480**
	Lashing wire 0.038" Type 302 1,600' Roll	$ 24.00	156	**$ 3,752**
	0.75" Flex Conduit - 20'	$ 9.70	232	**$ 2,247**
	Arnco 0.75" HDPE Conduit	$ 0.30	13,896	**$ 4,169**
	Weaver(Bonding Clamp)	$ 1.84	347	**$ 640**
	#6 Bare Copper Ground Wire	$ 0.38	347	**$ 130**
	#4 Split Bolt	$ 1.33	347	**$ 462**
	5/8" x 8' Copper Ground Rod	$ 10.31	347	**$ 3,582**
	Ground Rod Clamp	$ 0.90	347	**$ 313**
	Splice Protector (sleeves)	$ 0.27	695	**$ 185**
	Calix 700 Series ONT Enclosure	$ -	579	**$ -**
			Total	**$ 1,051,831**
PROFESSIONAL SERVICES				
Plant Design/Mgmt	OSP Field Verification/GPS Mapping	$ 86.11	754	**$ 64,902**
	OSP Drafting/Design	$ 83.53	356	**$ 29,729**
	OSP Project Management/Inspection	$ 92.46	3,780	**$ 349,500**
Drop Design/Mgmt	Service Entrance Mapping/Drafting	$ 85.00	261	**$ 22,147**
	Service Entrance Mgmt/Inspection	$ -	-	**$ -**
				$ -
			Total	**$ 466,277**

GRAND TOTAL **$ 5,628,396**

MODEL ASSUMPTIONS AND OUTPUT

The below inputs drive the 20-year Pulse financial model created for Lyndon Township.

Plant Statistics:		**Construction Statistics:**		
Homes Passed	1,158	Make Ready Per Aerial Mile	$42,707	
Small Bus Passed	0	Aerial Production	75	miles per month
Large Commercial	0	UG Production	5	miles per month
Total Miles	62.8	Avg. Length of Drop fiber along main	400.0	
UG %	5.0%	Avg. Length of Drop fiber from main to	200.0	
Do you own the poles?	No	UG Drop %	40.0%	
Pole Condition	Good	Avg. Feet between splices	500.0	
Underground Construction Conditions	Good			
Number of Substations	0			

Capital Expenditures

Summary of Total Capital Required

Construction Costs	$5,370,486
Ongoing Capital Costs at Launch	$561,330
Total Project Capital Costs	$5,931,816

Construction Costs

	Unit Cost	x Quantity	=	Total
Headend/Office Space	$204,722	0		$0
Cabinet Equipment	$89,722	0		$0
Aerial Construction (A)	$69,319	59.7		$4,136,116
Underground Construction (B)	$104,542	3.1		$328,303
Drop Construction (C)	$1,565	579		$906,068
Total Construction				**$5,370,486**

Details for construction costs above:

(A) Aerial Cost Per Mile		(B) Underground Cost Per Mile		(C) Drop Cost Per Home	
Plant Labor (inc. Make Ready)	$48,340	Plant Labor	$66,591	Plant Labor	$1,326
Technical Labor	$5,670	Technical Labor	$5,670	Tech. Labor	$54
Fiber	$3,732	Fiber	$3,732	Fiber	$120
Aerial Materials	$1,356	UG Materials	$18,327	Materials	$27
Technical Mat.	$3,151	Technical Mat.	$3,151	NID Enclosure	$0
Design	$1,507	Design	$1,507	Design	$38
Constr. Mgmt	$5,565	Constr. Mgmt	$5,565	Constr. Mgmt	$0
Total Aerial	$69,319	Total UG	$104,542	Total Drop	$1,565

Ongoing Capital Costs at Launch

	Cost	x Quantity	=	Total
Pole Assessment	$57	1,882		$107,765
Permits	$1,200	1.5		$1,800
Simple PV of Pole Rent (20 yrs)	$22,588	20		$451,765
Plant Maintenance Materials	$0	0		$0
				$561,330

Detail Project Costs – Underground Model

Capital Budget Assumptions

Capital costs to construct the network will be approximately $6,300,000. The timeline anticipated for the build is 15 months based on achievable milestones plus the construction preparation time. The following assumptions were made in the capital projections for the financial model:

- Outside Plant Construction:
  - 62.8 miles of distribution plant will be constructed over the course of 15 months. Construction is assumed to begin in Month 4 and to be completed by Month 19.
  - The cost of aerial construction is $0.
  - The cost of underground construction is estimated at $74,967 per mile. Labor is $53,689 per mile including both plant and technical (splicing). Materials are $12,636 per mile which includes fiber, conduit, splitters, splice enclosures and other underground materials. The $74,967 referenced above includes professional services discussed below.
- Drop Construction:
  - 579 homes are expected to sign up for services over the course of two years.
  - The cost of drop construction is $2,678 per home at 100% underground. Labor is $2,492 (all underground) and materials are $148. Drops do not include conduit unless boring (driveways and sidewalks) is required.
  - Drop length of 600 feet is assumed per home.
  - Inside the home installation including ONT electronics will be the responsibility of the ISP partner.
- Professional Services:
  - The mapping of the outside plant is required to create the fiber design. This will require an estimated 754 hours over the course of six months to complete. The design of the outside plant is estimated at 356 hours over the course of six months to complete.
  - Project management for project planning, inspection of contractors and invoice approval/reconciliation is estimated to require a crew of two over the course of 15 months for a total of 4,860 hours.
  - Drop surveys to provide the fiber route from the distributed split to the side of the house for contractors is estimated at 261 hours to map and draft. These will be completed over the course of a year.

CAPITAL BUDGET

		Township		
PROJECT: FTTH Network	**SERVICE AREA: Lyndon Township, MI**	**Unit Cost**	**No. of Units**	**Total Costs**
OUTSIDE PLANT LABOR				
Pre-Construction	Complete Make Ready Construction	$ 0.00	0.0	**$ 0**
	Pole Assessment	$ 150	-	**$ -**
Aerial	PM99 (Move Pole Facilities)	$ 72.00	0	**$ 0**
	CO12(6M) [Hang stranded fiber]	$ 0.95	0	**$ 0**
	CO24(6M) [Hang stranded fiber]	$ 0.95	0	**$ 0**
	CO48(6M) [Hang stranded fiber]	$ 0.95	0	**$ 0**
	CO96(6M) [Hang stranded fiber]	$ 0.95	0	**$ 0**
	CO144(6M) [Hang stranded fiber]	$ 1.05	0	**$ 0**
	PM2A [Aerial Bond]	$ 4.50	0	**$ 0**
	PF3-3 [Place Screw Anchor]	$ 40.00	0	**$ 0**
	PE1-3 [Place down guy]	$ 24.00	0	**$ 0**
	PF3-AUX [Install auxiliary eye]	$ 8.00	0	**$ 0**
	PM69 [Place fiber storage loop]	$ 50.00	0	**$ 0**
Underground	BMUDT [Trench Conduit]	$ 5.50	265,301	**$ 1,459,155**
	BMUDD [Bore Conduit]	$ 12.00	66,325	**$ 795,903**
	BFO12 [Pull Fiber]	$ 0.90	33,163	**$ 29,846**
	BFO24 [Pull Fiber]	$ 0.90	33,163	**$ 29,846**
	BFO48 [Pull Fiber]	$ 0.90	33,163	**$ 29,846**
	BFO96 [Pull Fiber]	$ 0.90	198,976	**$ 179,078**
	BFO144 [Pull Fiber]	$ 0.90	33,163	**$ 29,846**
	BM71 [Rock Adder]	$ 10.00	16,581	**$ 165,813**
	BD5 [Pedestals]	$ 60.00	579	**$ 34,740**
	BM2-A [Grounding]	$ 40.00	579	**$ 23,160**
	BM80 [Risers]	$ 50.00	-	**$ -**
	BM53 [Markers]	$ 20.00	1,990	**$ 39,795**
	BHF [Handholes]	$ 300.00	663	**$ 198,976**
Technical	SPL [Install Splitter]	$ 50.00	21	**$ 1,034**
	SPL-CBN [Install Splitter Cabinet]	$ 1,000.00	5	**$ 5,147**
	HACO12 [Splice Enclosures for 12 ct]	$ 125.00	66	**$ 8,291**
	HACO24 [Splice Enclosures for 24 ct]	$ 125.00	66	**$ 8,291**
	HACO48 [Splice Enclosures for 48 ct]	$ 135.00	66	**$ 8,954**
	HACO96 [Splice Enclosures for 96 ct]	$ 150.00	50	**$ 7,500**
	HACO144 [Splice Enclosures for 144 ct]	$ 150.00	66	**$ 9,949**
	TERM	$ 150.00	290	**$ 43,425**
	HO1 [Splicing with bi-directional testing]	$ 25.00	10,540	**$ 263,502**
			Total	**$ 3,372,098**

		Township		
PROJECT: **FTTH Network**	**SERVICE AREA:** **Lyndon Township, MI**	**Unit Cost**	**No. of Units**	**Total Costs**
OUTSIDE PLANT MATERIALS				
Fiber	12 ct. Loose Tube Fiber	$ 0.30	34,821	**$ 10,446**
	24 ct. Loose Tube Fiber	$ 0.35	34,821	**$ 12,187**
	48 ct. Loose Tube Fiber	$ 0.45	34,821	**$ 15,669**
	96 ct. Loose Tube Fiber	$ 0.70	208,925	**$ 146,247**
	144 ct. Loose Tube Fiber	$ 1.00	34,821	**$ 34,821**
Aerial	1/4" EHS Strand	$ 0.14	0	**$ 0**
	Lashing wire 0.038" Type 302 1,600' Roll	$ 24.00	0	**$ 0**
	Weaver(Bonding Clamp)	$ 1.75	0	**$ 0**
	#6 Bare Copper Ground Wire	$ 0.34	1,242	**$ 422**
	Anchor 8" Helix	$ 26.89	0	**$ 0**
	Sno-Shoe (pair)	$ 39.95	0	**$ 0**
	Stainless Steel Strap	$ 0.20	0	**$ 0**
	1/2" Spacer	$ 0.12	0	**$ 0**
	Guy Guards	$ 3.08	0	**$ 0**
	Auxilliary Eye	$ 14.39	0	**$ 0**
Stranded Hardware	#4 Split Bolt	$ 0.81	0	**$ 0**
	Preformed Deadend 1/4" Strand	$ 3.21	0	**$ 0**
	12" x 5/8" Machine Bolt w/ Nut	$ 1.07	0	**$ 0**
	2"x1/8" Flat Square Washer	$ 0.30	0	**$ 0**
	5/8"-11 Square Nut	$ 0.22	0	**$ 0**
	3 Bolt Clamp	$ 4.38	0	**$ 0**
	3 Bolt Clamp Curved	$ 5.48	0	**$ 0**
	5/8"Thimble Eye Bolt	$ 3.90	0	**$ 0**
	Bug nut(D Lash Clamp)	$ 0.30	0	**$ 0**
	Guy Hook - Ram's Head	$ 3.01	0	**$ 0**
Underground	Arnco 1.25" HDPE Conduit	$ 0.52	331,626	**$ 172,446**
	Channell 24x36x24 Handhole	$ 193.40	663	**$ 128,273**
	Channell Pedestal	$ 55.00	579	**$ 31,845**
	Pedestal Stickers	$ 0.70	579	**$ 405**
	0.75" Flex Conduit - 20'	$ 9.70	-	**$ -**
	Screw Lags	$ 0.25	-	**$ -**
	5/8" x 8' Copper Ground Rod	$ 10.31	1,242	**$ 12,808**
	Ground Rod Clamp	$ 0.90	1,242	**$ 1,118**
	Warning Marker	$ 14.60	1,990	**$ 29,050**
Technical	"A" Splice Enclosure	$ 220.00	133	**$ 29,183**
	"C" Splice Enclosure	$ 250.00	116	**$ 29,081**
	"D" Splice Enclosure	$ 285.00	66	**$ 18,903**
	Splice Trays for A Enclosure	$ 20.00	265	**$ 5,306**
	Splice Trays for C Enclosure	$ 22.00	399	**$ 8,777**
	Splice Trays for D Enclosure	$ 25.00	398	**$ 9,949**
	Aerial Clamps for FOSC 450	$ 25.82	315	**$ 8,141**
	Splitter Cabinets	$ 5,000.00	5	**$ 25,733**
	Splitters	$ 800.00	21	**$ 16,543**
	AirFOSC	$ 150.00	290	**$ 43,425**
	Splice Protector (sleeves)	$ 0.27	10,540	**$ 2,846**
			Total	**$ 793,626**

		Township		
PROJECT: **FTTH Network**	**SERVICE AREA:** **Lyndon Township, MI**	**Unit Cost**	**No. of Units**	**Total Costs**
DROP TO THE HOME				
Labor	CO2(6M) [Hang stranded fiber]	$ 0.90	0	**$ 0**
	BMUDT [Trench No Conduit]	$ 2.00	312,660	**$ 625,319**
	BMUDD [Bore Conduit]	$ 12.00	34,740	**$ 416,880**
	BFO2 [Pull Fiber]	$ 1.00	347,400	**$ 347,400**
	BM83 [Drop Riser Guard]	$ 25.00	579	**$ 14,475**
	BM(0.75) [House Cane]	$ 13.00	579	**$ 7,527**
	PM2A [Aerial Bond]	$ 4.50	0	**$ 0**
	BM2-A [Grounding]	$ 40.00	0	**$ 0**
	NID [Place NID Housing]	$ 25.00	579	**$ 14,475**
	HO1 [Splicing]	$ 25.00	579	**$ 14,475**
	HO1T [Testing]	$ 4.00	579	**$ 2,316**
Materials	2 Ct. Loose Tube Fiber	$ 0.20	347,400	**$ 69,480**
	Lashing wire 0.038" Type 302 1,600' Roll	$ 24.00	0	**$ 0**
	0.75" Flex Conduit - 20'	$ 9.70	579	**$ 5,616**
	Arnco 0.75" HDPE Conduit	$ 0.30	34,740	**$ 10,422**
	Weaver(Bonding Clamp)	$ 1.84	0	**$ 0**
	#6 Bare Copper Ground Wire	$ 0.38	0	**$ 0**
	#4 Split Bolt	$ 1.33	0	**$ 0**
	5/8" x 8' Copper Ground Rod	$ 10.31	0	**$ 0**
	Ground Rod Clamp	$ 0.90	0	**$ 0**
	Splice Protector (sleeves)	$ 0.27	0	**$ 0**
	Calix 700 Series ONT Enclosure	$ -	579	**$ -**
			Total	**$ 1,696,295**
PROFESSIONAL SERVICES				
Plant Design/Mgmt	OSP Field Verification/GPS Mapping	$ 86.11	754	**$ 64,902**
	OSP Drafting/Design	$ 83.53	356	**$ 29,729**
	OSP Project Management/Inspection	$ 92.22	4,860	**$ 448,200**
Drop Design/Mgmt	Service Entrance Mapping/Drafting	$ 85.00	261	**$ 22,147**
	Service Entrance Mgmt/Inspection	$ -	-	**$ -**
				$ -
			Total	**$ 564,977**

GRAND TOTAL **$ 6,516,996**

MODEL ASSUMPTIONS AND OUTPUT

The below inputs drive the 20-year Pulse financial model created for Lyndon Township.

Plant Statistics:		**Construction Statistics:**		
Homes Passed	1,158	Make Ready Per Aerial Mile	$0	
Small Bus Passed	0	Aerial Production	75	miles per month
Large Commercial	0	UG Production	5	miles per month
Total Miles	62.8	Avg. Length of Drop fiber along main	400.0	
UG %	100.0%	Avg. Length of Drop fiber from main to	200.0	
Do you own the poles?	No	UG Drop %	100.0%	
Pole Condition	Good	Avg. Feet between splices	500.0	
Underground Construction Conditions	Good			
Number of Substations	0			

Capital Expenditures

Summary of Total Capital Required

Construction Costs	$6,259,086
Ongoing Capital Costs at Launch	$36,000
Total Project Capital Costs	$6,295,086

Construction Costs

	Unit Cost	x Quantity	=	Total
Headend/Office Space	$204,722	0		$0
Cabinet Equipment	$89,722	0		$0
Aerial Construction (A)	$27,944	0.0		$0
Underground Construction (B)	$74,967	62.8		$4,708,554
Drop Construction (C)	$2,678	579		$1,550,532
Total Construction				**$6,259,086**

Details for construction costs above:

(A) Aerial Cost Per Mile

Plant Labor (inc. Make Ready)	$5,632
Technical Labor	$5,670
Fiber	$3,493
Aerial Materials	$1,356
Technical Mat.	$3,151
Design	$1,507
Constr. Mgmt	$7,136
Total Aerial	$27,944

(B) Underground Cost Per Mile

Plant Labor	$48,019
Technical Labor	$5,670
Fiber	$3,493
UG Materials	$5,992
Technical Mat.	$3,151
Design	$1,507
Constr. Mgmt	$7,136
Total UG	$74,967

(C) Drop Cost Per Home

Plant Labor	$2,438
Tech. Labor	$54
Fiber	$120
Materials	$28
NID Enclosure	$0
Design	$38
Constr. Mgmt	$0
Total Drop	$2,678

Ongoing Capital Costs at Launch

	Cost	x Quantity	=	Total
Pole Assessment	$57	0		$0
Permits	$1,200	30.0		$36,000
Simple PV of Pole Rent (20 yrs)	$0	20		$0
Plant Maintenance Materials	$0	0		$0
				$36,000

Detail Project Costs – ISP

Capital Budget Assumptions

Capital costs to operate the network will be approximately $472,000. The following assumptions were made in the capital projections for the financial model:

- Network Equipment:
  - An ISP will build a headend to house the GPON network gear and router. Pulse recommends using reliable, proven network equipment. The Calix E7 Series 10GE has been modeled and include 10GE transceivers and Ethernet cards. The router housed in the headend is assumed to be a Cisco ASR-1000 router or something equivalent. The total cost of the headend is $204,722. This cost is required at the beginning of the project.
- In-Home Installation:
  - Inside the home installation/service calls will be handled by an internal technician, but won't be able to install all customers initially. The ISP will need to hire 3rd party technicians to fulfill the excess demand at the time of launch. The 3rd party help is assumed at $125 per home.
  - The assumed Calix 700 Series ONT is installed inside the home and transmits a wireless signal to devices in the home. Each ONT costs $275 for the equipment. Only homes that sign up for service will have an ONT installed.
  - The $30 ONT enclosure is split in our model (total price of $275 + $30 = $305) installed at time of drop.
- Equipment
  - Trucks have been included in the budget for the inside the home technician. We have assumed a cost of $35,000 per truck.
  - Fiber testing equipment will be required for troubleshooting after construction. We have assumed of each of the three basic equipment for a total of $18,000.
  - Computers and iPads for the new staff are in the budget for $1,500.

CAPITAL BUDGET

		ISP		
PROJECT: **FTTH Network**	**SERVICE AREA:** **Lyndon Township, MI**	**Unit Cost**	**No. of Units**	**Total Costs**
NETWORK AND ACCESS EQUIPMENT				
Main Office	Headend Room Build to Suit	$ 65,000.00	1	**$ 65,000**
	Cisco ASR-1000 Routers	$ 50,000.00	1	**$ 50,000**
	E7-2 Package Chassis	$ 696.50	2	**$ 1,393**
	Battery String Kit, Heater and Connectors	$ 2,239.00	1	**$ 2,239**
	10GE SFP+ Transceiver 20Km, 1310nm	$ 2,096.50	3	**$ 6,290**
	GPON SFP OIM, Class B+ 1490/1310nm	$ 1,200.00	21	**$ 24,814**
	E7-2 10GE-4 Ethernet Card	$ 5,596.50	1	**$ 5,597**
	Fiber Management	$ 5,000.00	4	**$ 20,000**
	E7-2 8 Card PON unit	$ 9,796.50	3	**$ 29,390**
			Total	**$ 204,722**
DROP TO THE HOME				
Installation	Contracted Installation Labor	$ 125.00	220	**$ 27,506**
	Calix 700 Series ONT Electronics	$ 275.00	579	**$ 159,225**
	Miscellaneous Materials	$ 30.00	579	**$ 17,370**
	Miscellaneous Materials	$15	579	**$ 8,685**
			Total	**$ 212,786**
EQUIPMENT				
Devices	Trimble Units	$ 3,500	-	**$ -**
	Computers, iPads	$ 500	3	**$ 1,500**
	OTDR	$ 15,000	1	**$ 15,000**
	Power Meter	$ 1,000	1	**$ 1,000**
	Light Source	$ 2,000	1	**$ 2,000**
Vehicles	Pickup Trucks	$ 35,000	1	**$ 35,000**
	Bucket Trucks	$ 40,000	-	**$ -**
	Trailer	$ 10,000	-	**$ -**
	Trench Machine	$ 75,000	-	**$ -**
	Bore Machine	$ 125,000	-	**$ -**
	Wenches, tool boxes, etc.	$ 10,000	-	**$ -**
	ATV's	$ 5,000	-	**$ -**
Plant Maintenance	Materials	$ -	-	**$ -**
			Total	**$ 54,500**

Does not include operating resources or cash cushion

GRAND TOTAL **$ 472,008**

MODEL ASSUMPTIONS

The below inputs drive the 20-year Pulse financial model created for Lyndon Township's ISP partner.

Plant Statistics:		
Homes Passed	1,158	
Small Bus Passed	0	
Large Commercial	0	
Total Miles	65	
Ongoing Capital Costs:		
External Installation	$125	per install
ONT (plus $30 enclosure)	$275	each
Installation Materials	$15	per internal install
Plant Maintenance Materials	$20	per mile
Customer Metrics:		
Res Customer Take Rate	50%	
Small Bus Customer Take Rate	30%	
Commercial Take Rate	50%	
Timeline to Launch Services	8	Months
Customer Ramp	12	Months
Data Only - Low Tier	$46.46	
Data Only - High Tier	$56.46	
Data Only Upsell to High Tier	25%	
VoIP Only	$39.95	
VoIP Federal Line Charge	$3.95	
Bundle Discount - Double Play	$5.00	
% order for Double Play - Data/VoIP	30%	
Installation revenue	$0.00	
Small Bus Pricing	$69.95	
Commercial Pricing	$1,200.00	
Cell Tower Opportunities	0	
Cell Tower Pricing	$2,250.00	
FCC CAF or Other Revenue from Grants	$0	Annual revenue
Average Retail Price Increase	0.5%	
Future Community Dev. from Fiber	1.0%	After Year 5

Operating Costs:		
Bandwidth	$3,300	Monthly
VoIP	$13.00	Per Line
Customer Care	$10.00	Per Sub
Network Management	$4.00	Per Sub
Admin/Marketing Resource	1	
Admin/Marketing Resource	$50,000	Base salary
Maintenance Technicians	0	
Maintenance Technicians	$50,000	Base salary
Installation Technicians	1	
Installation Technicians	$40,000	Base salary
Internal installs	4.0	Per day per tech
Benefits	50.0%	
Bad Debt Expense	1.0%	
Vehicle Repairs and Fuel	$600	monthly
Facilities Rent	$0	
Facilities Utilities	$500	
Property Tax Expense	1.0%	as a percent of assets
Marketing cost per connect	$50	
Other expenses	2.0%	percent of revenue
Average Expense Cost Increase	2.0%	
Balance Sheet Items:		
Loan Term	8.3	years
Interest Rate	3.8%	
Plant Depreciable Life	8.3	years

FINANCIAL HIGHLIGHTS

The highlights below come from the Management Dashboard tab from the Pulse financial model. These were chosen as important indicators for Lyndon Township to share with interested parties. A few very important notes to show financial feasibility of the project include:

- $604,000 loan assumed for first year which includes $82,000 operating runway
- Positive monthly cash flow after debt service
- Simple payback period for the project of 4.5 years is better than 8-year loan term

Balance Sheet Overview

	Year 1	Year 2	Year 3	Year 4	Year 5	Total ($ 000's)	Per Passing	Per Customer
Total Miles constructed	0	0	0	0	0			
Homes passed	1,158	1,158	1,158	1,158	1,158			
Take Rate	50.0%	50.0%	50.0%	50.0%	50.0%			
Residential Customers	579	579	579	579	579			
Network Equipment ($ 000's)	$205	$0	$0	$0	$0	$205	$177	$354
In-Home Capital Expenditures ($ 000's)	$250	$0	$0	$0	$0	$250	$216	$432
Op. Exp. and Cash Cushion ($000's)	$149	$55	$0	$0	$0	$205	$177	$353
Total Capital Expenditures ($ 000's)	$604	$55	$0	$0	$0	$659	$569	$1,139
Grants Received ($ 000's)	$0	$0	$0	$0	$0	$0	$0	$0
Debt Incurred ($ 000's)	$604	$55	$0	$0	$0	$1,081	$934	$1,868

Income Statement Overview

All financial drivers stated per customer at end of year

	Year 1	Year 2	Year 3	Year 4	Year 5
Revenue	$60.63	$60.76	$61.06	$61.37	$61.67
Variable Costs	$23.60	$23.80	$24.27	$24.74	$25.21
Customer Margin	$37.03	$36.96	$36.79	$36.63	$36.46
Operating Costs	$13.20	$23.49	$23.90	$24.33	$24.77
Total EBITDA	$23.84	$13.48	$12.89	$12.29	$11.69
Debt Service	$12.21	$13.33	$13.33	$13.33	$13.33
Monthly Cash Flow	$11.63	$0.15	($0.44)	($1.03)	($1.64)

Key Project Viability Indicators

	Year 1	Year 2	Year 3	Year 4	Year 5
EBITDA per Customer	$23.84	$13.48	$12.89	$12.29	$11.69
Equity to Assets %	-15.1%	-11.4%	-9.2%	-6.8%	-3.9%
TIER	5.37	1.91	1.98	2.09	2.28

Simple Payback	7.0 years	Project IRR	0.0%
Loan Term	8.3 years	Loan Interest Rate	3.8%

Lyndon Township, MI
Projected Income Statement

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Mileage and Homes Passed:										
Aerial Miles	0	0	0	0	0	0	0	0	0	0
UG Miles	0	0	0	0	0	0	0	0	0	0
Miles	0	0	0	0	0	0	0	0	0	0
Homes passed	1,158	1,158	1,158	1,158	1,158	1,158	1,158	1,170	1,181	1,193
Businesses passed	0	0	0	0	0	0	0	0	0	0
Large businesses passed	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Customer Statistics:										
Res customer take rate	50.0%	50.0%	50.0%	50.0%	50.0%	54.6%	54.6%	54.6%	54.6%	54.6%
Bus customer take rate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Large Bus customer take rate	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
Res customers	579	579	579	579	579	632	632	638	645	651
Bus customers	0	0	0	0	0	0	0	0	0	0
Large bus customers	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
New Installs	579	0	0	0	0	53	0	6	6	6
Projected Income Statement:										
Revenue:										
Data only	$63,288	$238,261	$239,278	$240,469	$241,659	$257,528	$266,395	$269,150	$273,174	$277,251
Double Play - Data/VoIP	$48,672	$183,237	$184,019	$184,935	$185,851	$198,055	$204,874	$206,993	$210,087	$213,223
Double Play - Data/Video	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Triple Play	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Small Business	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Large Commercial	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Installation Fees Collected	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cell Towers	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
FCC or Other Grants	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Total revenue	**$111,960**	**$421,498**	**$423,297**	**$425,404**	**$427,510**	**$455,582**	**$471,269**	**$476,143**	**$483,261**	**$490,475**

Lyndon Township, MI

Projected Income Statement

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Bad debt	$769	$4,214	$4,231	$4,252	$4,273	$4,521	$4,711	$4,756	$4,827	$4,899
Admin/marketing wages	$25,000	$50,000	$51,000	$52,020	$53,060	$54,122	$55,204	$56,308	$57,434	$58,583
Maintenance tech wages	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Installation tech wages	$20,000	$40,000	$40,800	$41,616	$42,448	$43,297	$44,163	$45,046	$45,947	$46,866
Capitalized portion of install wages	($28,488)	$0	$0	$0	$0	($4,556)	$0	($567)	($585)	($602)
Payroll taxes and benefits	$8,256	$45,000	$45,900	$46,818	$47,754	$46,431	$49,684	$50,394	$51,399	$52,423
Vehicle repairs and fuel	$3,600	$7,344	$7,491	$7,641	$7,794	$7,949	$8,108	$8,271	$8,436	$8,605
Facilities rent	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Utilities	$6,000	$6,120	$6,120	$6,120	$6,120	$6,120	$6,120	$6,120	$6,120	$6,120
Plant Maintenance Materials	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Property tax expense	$0	$2,047	$2,047	$2,047	$2,047	$2,047	$2,047	$2,047	$2,559	$4,094
Pole rental	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Marketing sales	$28,950	$0	$0	$0	$0	$2,652	$0	$317	$321	$324
Other operating expense	$2,239	$8,430	$8,466	$8,508	$8,550	$9,112	$9,425	$9,523	$9,665	$9,809
Total operating expenses	**$66,326**	**$163,155**	**$166,055**	**$169,022**	**$172,047**	**$171,695**	**$179,463**	**$182,214**	**$186,123**	**$191,122**
EBITDA	**($17,118)**	**$94,032**	**$90,130**	**$85,990**	**$81,792**	**$98,810**	**$99,055**	**$96,842**	**$94,968**	**$92,027**
EBITDA Margin	*-15.3%*	*22.3%*	*21.3%*	*20.2%*	*19.1%*	*21.7%*	*21.0%*	*20.3%*	*19.7%*	*18.8%*
Interest Expense	$21,567	$21,128	$18,401	$15,570	$12,631	$9,580	$6,412	$10,822	$14,391	$12,082
Depreciation	$35,085	$55,610	$55,610	$55,610	$55,610	$57,010	$57,733	$57,870	$58,126	$58,384
Net income	**($73,770)**	**$17,295**	**$16,120**	**$14,811**	**$13,551**	**$32,221**	**$34,909**	**$28,149**	**$22,451**	**$21,561**

Average Customer Statistics:										
Revenue Per Customer	$38.67	$60.66	$60.92	$61.23	$61.53	$60.07	$62.14	$62.15	$62.46	$62.76
Direct Variable Cost	$21.68	$23.65	$24.05	$24.52	$25.00	$24.40	$25.41	$25.73	$26.13	$26.53
Direct Margin Per Customer	$17.00	$37.02	$36.87	$36.70	$36.53	$35.67	$36.72	$36.43	$36.33	$36.23
Indirect Operating Cost	$22.91	$23.48	$23.90	$24.33	$24.76	$22.64	$23.66	$23.79	$24.05	$24.45
Total Margin per Customer	($5.91)	$13.53	$12.97	$12.38	$11.77	$13.03	$13.06	$12.64	$12.27	$11.78

Lyndon Township, MI

Projected Statement of Cash Flows and Balance Sheet

Projected Statement of Cash Flows:

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Net income	($73,770)	$17,295	$16,120	$14,811	$13,551	$32,221	$34,909	$28,149	$22,451	$21,561
Add: depreciation	$35,085	$55,610	$55,610	$55,610	$55,610	$57,010	$57,733	$57,870	$58,126	$58,384
Change in receivables	($35,107)	($73)	($176)	($176)	($176)	($3,462)	($192)	($589)	($597)	($605)
Change in payables	$21,306	$6,070	$516	$521	$525	$1,662	$555	$655	$880	$721
Cash flow to/from operations	**($52,486)**	**$78,901**	**$72,069**	**$70,765**	**$69,511**	**$87,430**	**$93,005**	**$86,086**	**$80,860**	**$80,062**
Capital expenditures	($454,638)	$0	$0	$0	$0	($15,381)	$0	($215,566)	($206,582)	($1,879)
Cash flows to investing	**($454,638)**	**$0**	**$0**	**$0**	**$0**	**($15,381)**	**$0**	**($215,566)**	**($206,582)**	**($1,879)**
Proceeds from senior debt financing	$603,918	$55,296	$0	$0	$0	$0	$0	$215,566	$206,582	$0
Principal payments on senior debt	($63,269)	($71,476)	($74,203)	($77,034)	($79,973)	($83,024)	($86,191)	($112,063)	($88,027)	($50,456)
Non-FCC Grant contributions	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Equity contributions	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Equity distributions	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Cash flows to/from financing	**$540,649**	**($16,180)**	**($74,203)**	**($77,034)**	**($79,973)**	**($83,024)**	**($86,191)**	**$103,503**	**$118,555**	**($50,456)**
Ending cash balance	**$33,525**	**$96,245**	**$94,112**	**$87,843**	**$77,381**	**$66,407**	**$73,221**	**$47,244**	**$40,077**	**$67,804**

Projected Balance Sheet:

	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8	Year 9	Year 10
Cash	$33,525	$96,245	$94,112	$87,843	$77,381	$66,407	$73,221	$47,244	$40,077	$67,804
Receivables	$35,107	$35,180	$35,355	$35,531	$35,706	$39,169	$39,360	$39,949	$40,546	$41,151
Total current assets	$68,631	$131,425	$129,467	$123,374	$113,088	$105,576	$112,581	$87,193	$80,623	$108,955
Property	$454,638	$454,638	$454,638	$454,638	$454,638	$470,019	$470,019	$685,585	$892,167	$894,045
Depreciation	($35,085)	($90,694)	($146,304)	($201,913)	($257,523)	($314,533)	($372,266)	($430,136)	($488,262)	($546,646)
Total assets	$488,185	$495,369	$437,801	$376,099	$310,203	$261,062	$210,334	$342,642	$484,528	$456,354
Payables and deferred revenue	$21,306	$27,376	$27,892	$28,412	$28,938	$30,600	$31,154	$31,810	$32,690	$33,411
Bank debt	$540,649	$524,469	$450,266	$373,232	$293,259	$210,235	$124,044	$227,547	$346,102	$295,645
Total liabilities	$561,955	$551,844	$478,157	$401,644	$322,197	$240,835	$155,198	$259,356	$378,791	$329,056
Contributed equity	$0	$0	$0	$0	$0	$0	$0	$0	$0	$0
Accumulated income/loss	($73,770)	($56,475)	($40,356)	($25,545)	($11,994)	$20,227	$55,136	$83,286	$105,737	$127,298
Total Equity	($73,770)	($56,475)	($40,356)	($25,545)	($11,994)	$20,227	$55,136	$83,286	$105,737	$127,298
Total Liabilities and Equity	$488,185	$495,369	$437,801	$376,099	$310,203	$261,062	$210,334	$342,642	$484,528	$456,354

NEXT STEPS AND CONSIDERATIONS

Based on the results of our on-site visit, cost and business structure breakdown, and financial analysis we have identified additional considerations for the township. The following list for the township should be discussed:

1. **Network Maintenance.** We have identified the potential hard construction costs of the network, but there will also be on-going maintenance costs. We have outlined these projected costs and expressed them in the ISP model. There will be a need to either hire technical staff or contract these services through a third party. It will be important to think through how this aspect of the network will function and how the relationship between the ISP function and Township owned network will operate.
2. **Fiber Drop Costs and Assumptions.** In the model we have assumed that 50% of Lyndon Township residents and businesses will take fiber service. This is consistent with national averages, but is an unknown at this point. The model accounts for 50% of homes and businesses requiring drop construction at an average cost of $1,565 - $2,678 per drop depending on the construction method chosen. If the drop count increases beyond 50% in the future, those drops and their associated costs would be incremental to the model. In other words, they would need to be paid for either by the entity requesting drop installation (residents), additional millage or paid for through the on-going revenues generated by the ISP. In any case, this should be considered as the current model is reviewed. The model can be changed to reflect any number of drops desired (including 100%), but cost estimates for the network would need to be increased accordingly.
3. **ISP Services Provider.** A challenge in presenting this model is that an ISP provider has not yet been identified and there is no way to know what level of interest might exist from 3rd parties, or if Lyndon Township will have the ability to partner with other communities to provide these kinds of services. The ISP model presented in the Feasibility Study assumes a "stand alone" scenario. This is the least efficient version, due to the small size of the network (600 projected subscribers) and the associated inability to gain any economy of scale. Given that there are on-going costs to maintain the network, provide service and generate reserves for future capital improvements, the efficiency of the ISP and its ability to generate positive cash flow will be critical not only in providing needed monies for on-going costs, but also to help keep monthly subscription fees reasonable for subscribers to the network. Once the details of the ISP relationship can be determined a more accurate long term financial model can be developed.
4. **Key Unknowns in the Model.** Given the short time frame of the study and the difficulty in obtaining quality data from Consumers Power Company the aerial model contains significant unknowns that can only be resolved with Consumers Power Company information. The maps provided by Consumers lacked critical information (span lengths etc.) and our discussion with Consumers Power regarding "Make Ready" costs provided extremely general information (which we have used in our preliminary Make Ready cost calculation). This information is not precise and could vary considerably. The only way to obtain accurate information is to pay consumers power their required $57.25 per pole analysis fee. Given that we estimate that there are approximately 1,900 poles in Lyndon Township this fee could easily exceed $100K or more. If Lyndon Twp. were to consider a primarily aerial construction approach utilizing pole attachments to Consumers Power infrastructure, we would strongly advise that the first step in such a process would be to identify the precise Consumers Power Make Ready cost.

DISCLAIMER

These forward-looking statements reflect Pulse's best professional judgment based on currently known factors but involve significant risks and uncertainties. We are confident in our abilities to project the fiber and telecommunications industries, but actual results could vary materially dependent on changes in the market conditions.

Sharon Township
Options for a Broadband Network

February 10, 2017

Doug Dawson
President
CCG Consulting

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I. Scope of Work

This report is the result of an informal RFP issued by Sharon Township looking for a consultant to help them look at broadband issues. That RFP asked for the following deliverable products:

- **Design narrative.** Discussion regarding the recommended approach to be used for access to rights of way, pole structure, outside plant fiber layout, impact of active versus passive networks, central hub equipment location, and other pertinent decision points.
- **Detailed project costs.** Analysis of all costs for design, implementation, and maintenance of fiber optic cable infrastructure build from a head end to each improved property in Sharon Township.
- **Route map.** A summary map depicting proposed routes and fiber sizes. (This was delivered separately from this report).
- **Bandwidth analysis.** Investigate local bandwidth providers and obtain quotes for appropriate levels of service.
- **Assumptions.** Enumerate assumptions and known unknowns including justifications for assumptions.
- **Financial model.** A model that takes into account project costs and projected take rates to determine overall project feasibility.

This report represents the results of the study done by CCG Consulting to meet the stated goals. This report contains the following:

- A description of the engineering analysis done and the results obtained. CCG considered several different design options to try to find the most affordable network alternative for the design.
- A description of the financial analysis done in looking for the most affordable way to pay for a fiber network. CCG considered numerous options including:
    - Different network designs.
    - Different business plans, notably open access (meaning partnering with one or more commercial ISPs) versus doing this through a cooperative effort with other townships. We also looked at the option of the township forming a small ISP.
    - The effect of key variables like the number of customers (penetration rate), interest rates, and the term of the bond.
- A look at a few key industry issues that are most relevant to this effort. This includes:
    - Issues associated with having an open access network.
    - Various threats or external issues to consider.
- An analysis of the study results. We looked to see what options make the most sense for the citizens in the township. We highlight the findings that we think are the most important results of our analysis.
- Specific recommendations and next steps. The report makes specific recommendations of what should come next after this analysis.

II. Executive Summary

Sharon Township hired CCG Consulting to look at options for funding and bringing broadband to the township. While we've done hundreds of similar studies over the years this is one of the smallest communities we've ever studied. We knew it was going to take some creative solutions to make this work.

Before hiring us the township had already come to understand that it was going to require some increases in property taxes in the township to make this possibility financially feasible. Thus, one option we studied was to finance a bond with property tax increases and then to allow one or more ISPs inexpensive access to your network. Such a plan can finance fiber. And one would expect ISPs to offer low broadband rates if they don't have to pay for a network. However, we spotted a few downsides to this concept. First, the ISPs are likely to make considerable profits working on your network for free – and yet none of those profits would flow back to help defray the costs of the bonds. Second, the ISPs are going to serve households that buy products from them, but ideally since everybody in the township is paying for the network then every household ought to get connected and get some benefit from it.

One thing the analysis gave us is a set of numbers to understand the cost of the network. In the open access scenario just mentioned you would need a bond issue of $4.6 million, which would mean an average property tax increase of $43.26 per month for twenty years. That number could be lower if you could get an interest rate on the bonds lower than the 5% assumed in the analysis.

We also looked to see if there were other ideas that might work. One idea was to look at a more traditional open access network where the township charged some fee to ISPs to get access to customers. Those revenues could be used to lower the property tax payments. There are a few problems with this idea. First, the ISPs are likely to pass all fees charged to them on to customers, making broadband more expensive. We know from experience that as broadband costs rise that ISPs engage more in what we call cherry picking – meaning they tend to only pursue customers with the largest profit margins. We would expect that if you charge more to the ISPs that fewer homes would buy broadband. We've seen that open access networks that charge $30, for example, don't seem to get more than 50% of the customers on the network. From a financial perspective this looks to be the worst option.

We then went in another direction and asked if there was a way for the township to start their own ISP. Frankly, we expected this to look terrible, and were surprised when it didn't. The township is small with only 700 homes, but an ISP using a fiber network would not require a huge amount of effort. It's possible today to outsource the most technical aspects of being an ISP, making it possible to take care of a network and customers with only two part-time local employees. We looked at several options for this scenario. The good news of this option is that you could charge a low broadband fee of $35 and still make a profit as an ISP. Those profits could then be used to offset some of the annual bond costs, or to pay the bonds off early. This scenario has the added advantage in that you could give free broadband to every home at some minimal speed to allow them to save money on cellphone data or to use modern services like the Amazon Echo or smart home technologies.

Finally, we look at a scenario where the township partnered with other townships to create a larger ISP. If you only partnered with a few townships then the results are similar to having your own standalone ISP. But there are economies of scale if you can gather a larger number of townships into a partnership. For example, if you could put together a consortium with nine times the homes in Sharon, then an ISP selling at the same $35 rate would generate enough cash to cover about one-fourth of the bond issue.

While the financial numbers are important, there are other issues to consider. The report looks at a variety of other issues that you should take into consideration before choosing the option that best suits the township. This would require feedback from homeowners, feedback from other townships about the potential for partnering, and some legal analysis looking at the best corporate structure and asking if a cooperative is the best structure for a joint government enterprise.

Below I have also made specific recommendations for the logical next steps that ought to be taken after you digest this report.

If I was asked to rank the alternatives from a financial perspective, the option I most favor is partnering with multiple townships to create a large ISP. This would provide a big enough company to attract and keep the needed technical talent and it would allow you to meet social goals like providing some level of broadband to every home, even those not willing or able to pay for faster broadband. This option can also provide significant cash to help offset bond costs.

My next choice would be to operate your own small ISP. This might seem intimidating, but it would be a tiny business with only a few part-time employees. It would allow you to retain the profits from the ISP business to defray the cost of the bonds. And you would be able to dictate that there be quality customer service.

My last choice is the one that we started with, which is to pay for the network entirely out of property taxes and to allow commercial ISPs to operate on the network (open access). This option is the most expensive for homeowners overall since the profits of the business all goes to ISPs and not back to the network.

But before you choose any option you will need to do more research into legal restrictions of operating in the various scenarios. But I think there is a wide enough number of viable options that I feel certain there is one that will work for the Township.

III. Next Steps

Here I address the steps that I think come next after the township digests this report.

Some Legal Research Needed.

The financial analysis shows that there are several options that can work – and for two of those options you need to make certain that you can meet all of the legal requirements.

One of the ideas that looks financially feasible is for the Township to become your own ISP. Michigan has legal roadblock against municipal broadband as follows:

> *Michigan permits public entities to provide telecommunications services only if they have first requested bids for the services at issue, have received less than three qualified bids from private entities to provide such services, and have subjected themselves to the same terms and conditions as those specified in their request for proposals. (Mich. Comp. Laws Ann. § 484.2252)*

I recommend that you get legal advice from a regulatory lawyer to fully understand what this means. On the surface this doesn't look like a terrible hurdle to overcome since it seems likely that nobody would respond to an RFP to bring broadband to the township. But you should find out if any other communities have tried this before and if they encountered issues or were unable to overcome this barrier for some reason.

The other viable idea is to band together with other townships to form a larger ISP. That primary benefit of that option is that the ISP can make profits that could be returned to the township to offset bond costs. And so you want a legal structure for such a jointly owned ISP that is able to return profits to you as earned. There are probably a number of ways this could be done but the two primary ideas that come to mind are to join with the other townships as part of an Authority. In that case you would face the same legal roadblock discussed above.

The other way to structure a jointly-owned ISP is through the Cooperative that already has been formed for this basis. But there are a number of issues that must be understood before you adopt the cooperative model:

- First, cooperatives are generally owned by the customers that buy services from the coop. If that means that the end-user customers own the coop then this would not meet your financial goals. That would mean that profits of the coop would accrue to customers and could not be returned to the townships to help pay for the bonds. The ideal structure would be a coop with the members being each township. I don't know if such a thing is possible, and if not, then the cooperative model is not the right structure for this venture.
- Even if the townships can own the cooperative, would cooperative law in Michigan allow the coop to pay out most of its profits each year back to the owners? I know that in some states there are limits on how much earned profits can be paid out each year. If it turns out that cash would accumulate in the coop and would not be available to the townships, then that also means that a cooperative is probably not the right business structure.

If there are problems with doing this as either a coop or as a government entity through an Authority, then you will have to explore other alternatives. But man of them will also face restrictions. For example, this could be structured as an LLC or other kind of corporation, but many states have restrictions against government entities owning corporations.

It might also be possible to structure this as a non-profit corporation. But the major issue with that structure is that profits are supposed to be used for social good and you might not be able to use any profits to repay debt.

There are more esoteric structures that have been used in other communities. For example, there is a groups of communities in Minnesota that created a cooperative called RS Fiber. That cooperative is owned by the end-user customers. The government entities supplied the funding for part of the cost of the network through economic development bonds that are backed by property taxes. Those bond proceeds were 'loaned' to the cooperative and the cooperative is expected to make the payments on the bonds. The bonds provided enough cash to allow the cooperative to borrow the rest of the funding from traditional banking sources. However, that structure does not look easily feasible here. You really couldn't launch this until all of the member townships were ready to fund the cooperative. But the bigger issue is that it doesn't look like a cooperative in the townships can make enough money to fully cover the cost of debt – and that means they would be unable to borrow the money needed to finish the network from banks.

I see this structure issue to be the first thing that needs to be resolved. There doesn't appear to be any automatically easy business structure that works. But research might show one or more of these alternatives to be viable.

Bond Research.

With this study in hand you should now be able to have a conversation with bond sellers about the term (number of years) and the interest rates you might be able to get from the bond assumed in here. To the extent that result is different than the assumptions I've made I would be glad to provide a new set of numbers that incorporates the best estimates. My hope is that you can get a lower interest rate than I've assumed at 5%.

Socialize This with Other Townships.

Since one of the best financial options is to create an ISP between multiple townships, the process of spreading that word and looking for other interested townships needs to be undertaken.

I have always found that having these discussions is far easier when there is a concrete proposal to suggest. I know there has been a lot of discussion with other townships generically on the issue. But I think you can use this study to demonstrate that working together is a superior solution for your homeowners than building an open access network.

And obviously, if not enough other townships are interested, or if there are a few but they are geographically scattered, then this idea can't work.

Get Feedback from Citizens.

This study allows you to talk concrete numbers with homeowners. You now have an estimate of the size of the bond and how much that will cost homeowners each month in terms of bond payments.

Investigate what it Means to be An ISP

You are probably intimidated by the concept of operating your own ISP. This is something that CCG has done many time and we would be glad to help you understand your options.

Choose the Best Option.

After all the above research and feedback you can start to choose one of these options as the one you want to pursue. Again, remember that you want to consider both financial and social issues. For example, the idea of giving everybody free broadband if you do this with your own ISP is an idea that might gather a lot of public support.

Pledge Drive.

At any point where you want to get serious about pursuing a specific option you need to undertake a pledge drive. This would involve getting every homeowner in the township to tell you if they would be willing to pledge to buy broadband on the network. That pledge is needed so that you can understand the expected financial performance of the business. You would want to undertake this pledge drive even if the City is going to be the ISP. It's vital to understand the revenue stream that will be generated by the business.

IV. Engineering Analysis

In this section we will look at the engineering analysis performed as part of this study. The purpose of our engineering estimate was to determine the best network configuration to bring fiber to everybody in the township. We also explored network design options that resulted in the most affordable network. Derrel Duplechin of CCG made a trip to the township to look at local conditions that affect network costs.

A. Primary Engineering Assumptions

Following are the primary assumptions made in designing and determining the price of the fiber network.

Passings

In the telecom industry we use the term passing to mean any home or business that is near enough to the network to be a potential customer. The township provided a count of passings and showed us that there are 711 buildings in the township that might be customers of a fiber network.

Aerial versus Buried Fiber

In many places in the country a fiber network would follow the existing utilities, and most existing utilities follow existing roads.

But we found Sharon Township to be nonstandard. The existing electric network often does not follow roads. It's frequently built across lots or parallels a road at some distance from the road. In terms of our industry, this means that the existing electric pole network is built partly on private rights-of-way rather than on public rights-of-way. The government automatically assumes they own a public right-of-way along any named and maintained road. Such right-of-way was probably acquired when the road was first built or else taken by eminent domain.

But the same is not true for the power poles that don't follow the roads. At some point in time when those poles were built the electric company obtained the right-of-way from the landowners at the time.

In our design we considered both a buried fiber network and one placed on the existing poles. It looks to us that it would be exceedingly expensive to place fiber onto some of the existing poles. Many cut through wooded areas or take paths that would not allow easy vehicle access. Aerial fiber construction is done by trucks that contain large reels of fiber and it's mandatory that these large trucks have easy access to poles (which almost always means they must be on a road surface).

We also saw that some of the poles in the township would require additional work before the township could place fiber on them. This extra work is called 'make-ready' in the telecom industry. FCC rules say that it is the financial responsibility of a new attacher to a pole to pay for any work needed to move or rearrange the existing wires on a pole. We noted poles that were short and that in some cases didn't have enough clearance to add fiber and stay within dictated safety parameters. This means that the township would have to pay to 'move' existing electric wires that might not meet FCC safety or clearance standards. The township would also have to pay for any cost of tree trimming needed to enable construction. We note that AT&T largely has buried their telephone network and we are sure that they came to the same conclusion as us many years ago when they built their network.

After looking at the number of places where construction on the poles would be a problem, we determined that burying the network will be the lowest cost option. That's a bit unusual since it's generally less costly to string fiber on poles – but in Sharon using poles would be a costly issue.

Further, burying the fiber means considerably lower costs to maintain the network over time along with fewer outages. We understand that there are often power outages in the area due to limbs falling onto electric wires. Such problems would be avoided with a buried fiber network. This is

not to say that there can't be problems with underground fiber networks. For instance, somebody with a backhoe can dig up and cut fiber. But such outages are generally far less frequent for underground networks.

We used electronic mapping records provided by the county that show there are 69.64 miles of 'named' roads in the township. Many of these roads are considered as 'private' roads in the township. We included all roads needed to reach all of the existing homes the township. It might be possible with a detailed construction design to builder fewer miles of roads to avoid any long stretches of roads that contain no potential customers.

In terms of relative density, this means that there are 8.5 homes in the township per mile of fiber. That is less dense than small towns which generally have 15 or more homes per mile, but the township is still more densely populated than true rural areas with farms that can be anywhere under 5 homes per mile.

B. Fiber Network Design Parameters

We looked at a fiber network design in two ways. First, we looked at what we call a carrier class design. This is the design that a regulated telephone company might use when building a network. Such a network would utilize building techniques that would add a large amount of future potential capacity to a network. But building to the carrier class standard is expensive, and telcos are often accused of building 'gold-plated' networks to the detriment of their rate payers. So we also designed a leaner and more cost-effective network that we still think meets all of the requirements today, and will continue to meet those requirements into the future of the township.

Here are the characteristics of the carrier class fiber network that affect design cost:

- A carrier class network 'right-sizes' the fiber and will put a fiber on each route that anticipates all of the needs of that fiber both today and into the future.
- A carrier class network would put all of the buried fiber into conduit. This requires that first an empty conduit is buried into the ground. In the kind of soil around Sharon Township that will involve a significant amount of backhoe work to get the conduit deep enough.

  Once the conduit is in place fiber is then pulled or pushed through the conduit. In the ideal carrier class network two conduits are placed into the ground at the same time, with one being a spare in case something ever happens to the first one. Generally there is room inside of a conduit to pull multiple strands of fiber.
- A carrier class network would use boring to cross roads. Boring is the process of digging a deep hole on both sides of a road and then using a machine to bore a hole across the road for inserting a conduit. Fiber is then passed through the conduit. Fiber networks require many road crossings. For example, a fiber built on the east side of a road would require a crossing to get to every home on the west side of the road.
- A carrier class network will place devices or access points along the fiber to have access to every existing home, but will also place access points where there might be future homes. A good analogy for this is when you see fire hydrants sitting in an unbuilt part of a new subdivision. It's cheaper up front to add the fiber access points while constructing the fiber than it is to add them later.

We estimated the cost of a network built to these carrier class standards, which will be summarized below. But then we also looked at a more affordable network that considered the following different design parameters.

- We designed the network using only two sizes of fibers. We used a 72-count fiber for the main backbone of the network that connects across the township. Everywhere else is designed with a 48-count fiber. It may seem counterintuitive, but it's cheaper to design a network with the same count of fiber almost everywhere than it is to exactly right-size the fiber on each street. And that is due to the fiber construction process. First, the contractor needs to procure and bring different sizes of cable to the township. When constructing with different sizes of fibers the contractor then needs to swap out cable reels during the construction process to get the right sized fiber for each street. It's more efficient to use the same size everywhere which simplifies the construction process and also the ordering process. While larger strands of fiber cost a little more than smaller ones, the vast majority of cost in building fiber is labor, and so anything that reduces labor can save overall cost.
- In the lower cost design the network in neighborhoods is not placed in conduits. With the 10-acre lot minimum in the township it's easy upfront to know the potential long-term demand for fiber in any portion of the network. Building with all 48-count fibers basically assures a lot of space capacity everywhere in the neighborhood networks, thus eliminating the need for conduits. Many commercial overbuilders would also directly bury fiber in these kinds of neighborhoods; this is not a unique design parameter. Our design would still place a single conduit along Highway 52.
- Whenever possible, we assumed that road crossings would be trenched and not bored. Many of the roads deep in the neighborhoods are dirt or gravel and it would be extravagant on such roads to go through the extra cost of boring to reach customers on both sides of the road. Instead, a narrow trench would be dug across the road and the dirt and gravel replaced once the fiber was placed.
- Our design does assume placing multiple handholes or other types of access in locations where there might be future homes or businesses.

The cost of the two kinds of construction are as follows for the fiber:

	Lower Cost	Carrier Class
Fiber Construction	$2.77 M	$3.19 M
Engineering	$0.13 M	$0.15 M
Construction Management	$0.15 M	$0.17 M
Permitting	$0.04 M	$0.04 M
Total	$3.09 M	$3.55 M

The township is free to choose between the two designs, but we strongly favor the less expensive build – not only because it costs less, but because it still satisfies all of the needs of the township. In your semirural area there is no way to justify spending nearly a half million extra for things like burying two conduits on dirt roads that are serving only a few customers.

We also note that the study includes an option for building 4.8 miles of fiber to Chelsea to get access to Internet bandwidth. A quote for wholesale bandwidth was obtained if the connection could be made at or near to the Chelsea Library where you could meet a carrier with fiber to the internet. This construction is shown as optional because if one of the townships around you also builds fiber then this construction would not be needed. You can very inexpensively connect two fiber networks at the edge where the two networks are close to each other.

Active versus Passive Electronics

One of the first decisions to be made when looking at a fiber network is determining if it is better to use active or passive fiber electronics.

An Active Optical Network (AON) dedicates a fiber for each user between the customer location and the electronics hub. This means each customer has a dedicated path to the electronics and does not share bandwidth directly with another customer in the neighborhood. An AON network has many more field lasers than a passive network since there are two lasers for each customer at the two ends of the network.

In an AON network, everything is encoded as data between the electronics and the customer. This means all services must be digitized and delivered as an IP data stream to the user. The AON uses only 2 wavelengths on each fiber—one for transmission of data to the users and one for transmission of data from the users.

The vendors currently making Active Optical Network equipment include Enablence, Calix, and PacketFront.

The other choice is to build a Passive Optical Network (PON) which uses passive hardware to "split" the signals so that a single high-powered laser can be shared by up to 64 customers (more typically for 32 customers). This technology requires less fiber than an AON since many customers in an area share the same single fiber over which the information carried on the fiber is “split” into 32 individual fiber drop paths for delivery to homes or businesses. In construction, one feeder fiber “feeds” a passive splitter that takes the information that is transmitted onto the feeder fiber and distributes it across 32 or 64 individual fiber drops similar to the way water in a single pipe can be sent to 32 individual locations by placing a 1-to-multiple pipe junction on a single feeder water pipe.

PON technology uses bandwidth on the fiber differently than the AON. The PON electronics divide up the optical wavelengths on the fiber to allow 1 wavelength to transmit data and voice to the users, another wavelength to receive data and voice from the users, and a third optional wavelength to transmit RF video (like traditional broadcast Cable TV video on a cable network) to the users over one fiber strand. In this manner, the PON network can transport both analog signals and digital signals into the home.

Vendors for PON equipment include Alcatel-Lucent, Adtran, Zhone, Huawei, Calix, and Enablence.

Today passive optical networks use the GPON (Gigabit Passive Optical Network) technology. This technology uses Ethernet signaling for the customer delivery path. In a GPON system there is still the capability for three separate data streams—one for cable TV and two more for downstream and upstream data. The currently available GPON technology can deliver 2.4 Gbps of downstream data and 1.2 Gbps of upstream.

A new PON standard called 10-GPON will enable 10 Gbps downstream and 2.5 Gbps upstream to be shared among 32 customers. This technology is being designed to coexist with current GPON technology which holds great potential for future upgrades in network capacity. This technology is just now becoming available in the market.

There is now also a variation of GPON called WDM PON which uses a different color or laser light to each of the customers. This brings some of the best characteristics of an active network into the PON network since this makes it possible to deliver different amounts, and even dedicated amounts, of bandwidth to each customer.

FTTP technology is expected to continue to grow in available bandwidth as volume sales of the technology decrease laser costs. The limiting factor is the development of these cheaper lasers. Already in the lab are systems that will deliver a terabyte of download speed and such technology upgrades will be introduced as laser prices drop.

In this study we have calculated the cost of the network using passive electronics. But on a scale as small as the township the cost difference between the two technologies is negligible; you could choose either technology

Normally you would have to choose one of the electronics technologies to match the fiber design since active fiber requires more pairs of fibers in the field. However, in your case, since we have designed the network using the same-sized fiber throughout, there are sufficient fiber pairs in the design to accommodate active fiber, or you could choose passive fiber.

One of the recommendations elsewhere in this study is that you work together with other townships to achieve economy of scale savings, and in doing so it would make sense for any townships involved to use the same type and brand of electronics. The network design we have given you provides the flexibility to handle any electronics alternative chosen.

PON Network Design

In designing a PON network there are several different network architectures in use in various systems around the world. The first design issue to consider is whether to centralize or distribute the electronics in the network. The second design issue looks at using a star versus a ring topology. A third issue in the design is to determine whether to use distributed splitter locations or local convergence points for splitter locations.

Large communities need to use distributed PON huts where PON electronics are housed. In a larger community, a design will place huts in several locations about town that will contain PON electronics which will light the fibers that will be split and assigned to each home. However, in a

small community like the township all of the PON electronics can be placed at the core with no requirement for remote huts. We have assumed that these electronics would be placed at the Township building. But they could optionally be placed into a small hut.

In a PON network, even when the electronics are in the core, there is a need to have small field cabinets where the fibers are split. These are where one feeder fiber is connected to the fiber to serve up to 32 homes. There are two possible designs for splitter location design: a) distributed splitter locations where PON fiber is split at several locations and thus splitters are distributed along the PON fiber, and b) local convergence point splitter locations where all PON splitters feeding a certain geographic area are located at the same cabinet.

Our design uses a "local convergence point" splitter architecture. This type of architecture ensures that the splitters that serve a general geographic area are all located within the same splitter cabinet. This design also makes it easier to make sure that a given splitter cabinet isn't overloaded. This is important if there is ever a need to upgrade the core electronics. The local conversion point also ensures that the FTTH common electronics are most efficiently utilized—thus saving money on optics and electronics.

In our model design, we estimated the placement of 5 splitter locations using a 288-count splitter cabinet for PON distribution. This would provide 5 X 288, or 1,440 potential customer locations within the township, making the design ready to handle significant future growth. The most heavily-loaded cabinet covers only 152 passings, meaning it uses 53% of capacity. This design can serve twice as many homes than are in the township today.

Customer Assets

There are several assets needed to connect a customer to the network. This includes fiber electronics, a fiber drop, and any equipment to be placed inside of customer homes.

Customer electronics in the industry are referred to as an ONT (Optic Network Terminal). This device converts light from the fiber network into the signals needed to provide the triple-play services. There are several different options for ONTs. First, ONTs can be external, meaning placed outside on the side of the building, or internal and placed inside like is done with cable modems. If the ONT is external, it has an optional battery that can keep the ONT running during a power failure.

Since there is a possibility that the network will partner with one or more ISPs to provide service, we elected to use external ONTs in the study. The two types of ONTs cost very nearly the same. But in the long run it's smarter to put the ONT inside to keep it out of weather. The decision to place ONTs inside or outside can't really be determined until you decide who will be serving customers.

ONTs come with an option for battery back-up. However, most of our clients have stopped providing batteries. The batteries were historically installed to operate phones in the case of a power outage at the home. However, there are fewer and fewer phones in existence that are powered from the phone line and most phones must be plugged into an electric outlet. So when

such a phone loses power it can't be powered by the battery. These are small UPS units and also are unable to power laptops or any other electronics for more than a short time. We have not included a battery in our design, but you might offer it as an option for a customer who really wanted it.

Fiber drops are the wires that connect directly to a home or business from the outside fiber network. We estimated the cost of drops in your network using an average length of 350 feet. This distance was obtained by looking at the homes in the townships using google Earth. We note that this is one of the highest average drop lengths we have seen. We have assumed that all of the drops will be buried. But there may be some homes where it would be easier to string them on an existing power pole, so there is that potential to save some money. Drops are not buried as deeply as the fiber alongside roads and can generally be plowed into the ground using a specialty hand-guided plow that looks something like a snowblower.

Today most, but not all, ISPs provide a WiFi router for their customers. They have found that when customers have service complaints that it's more often about the quality and performance of the WiFi router and not about the fiber network. Providing a high quality WiFi router can eliminate a lot of the problems that come with cheap routers that customers might purchase on their own. Our study assumes that routers will be supplied, but it's not mandatory.

Other Assets

There are other assets required to support an operating fiber network. Following is a list of such assets. Most of these assets would be provided by the ISP. In most of the scenarios we considered that somebody other than the township would provide these assets – but if you were the ISP you would have to provide these assets.

- Building. We don't think that the township needs to construct a building. We have assumed that you will house the needed electronics in Township Hall. The electronics require two racks that need only a few square feet of floor space in a locked room or closet. If you wanted a building there are many used ones available today due to the cellular companies centralizing electrics at cellphone towers. You could have one of these in place for somewhere between $10,000 and $25,000.

- Data Routers. The ISP must provide various servers and routers to handle the ISP functions. This would include providing email, security, IP addresses, web storage, and other functions normally provided by an ISP. We've assumed that this equipment will be provided for at the core site of the ISP and not inside the township.

- Telephone Service. The operating ISP might also want to provide telephone service. While not everybody wants it, about 50% of homes nationwide still have a home phone. Again, the equipment needed to provide voice service would be at the ISP location.

- Cable TV. If the ISP you are partnered with already offers cable TV they could deliver this over the fiber network. However, this would require them to buy an additional gigabit data connection back to their headend. Any ISP not already providing cable TV is not likely to

consider it since the product has a low margin today and households are starting to abandon the product. We have not assumed a cable TV product in the analysis. It would also possibly be possible to bring cable TV eventually if

- Other Assets. The business plan also includes the other assets needed to operate an ISP. This would include a vehicle for an outside technician. The business plan assumes the need for computers, furniture, and office equipment.

C. Network Costs

Our estimated costs for the required assets were estimated as follows:

Fiber**.** We based the estimated cost of fiber based upon conversations we had with several fiber construction companies that have recently built fiber in Michigan and in terrain similar to the township. Fiber costs vary significantly nationwide due to factors such as labor costs, terrain, and local construction methods.

There are two different ways that municipalities build fiber. One is called design/build where the same construction company designs and then builds the network. This practice is not allowed by law in many states because there are too many examples where a design/build allowed a contractor to cut corners to the detriment of the municipality. Commercial ISPs often use design/build because they have the expertise to keep an eye on the contractor to make sure they are delivering what was promised, at the price promised.

The more normal construction method for municipalities is to hire an engineering firm to both design the network and to also then inspect the build to ensure that it is being built correctly. We have chosen this method in our pricing since most municipal networks are built this way. It would be possible to save as much as $100k to $150k if you were allowed to use design/build and could find a contractor you trusted.

We estimated construction costs for the various types of fiber as follows:

Buried Fiber in Conduit	$42,000 per mile
Buried Fiber Without Conduit	$37,980 per mile

These prices include $12,500 per mile for fiber and other materials with the rest of the cost being labor.

However, these prices reflect the cost of building fiber straight down one side of the road and not stopping for customers. However, in a FTTP deployment the fiber has to serve customers on both sides of the road and the fiber needs to be spliced to numerous handholes. These are small devices buried in the ground that give technicians access to the fiber that goes to each home. There are several different ways to design the network to cover both sides of the road. The most expensive is to build one side of the road and then bore under the road at each home on the other side. A slightly less expensive method, particularly where there are some dirt and gravel roads, is to cross the fiber as needed from one side of the road to the other, trenching where possible and boring

when not possible. We chose this second method and it adds an additional 20% to the cost of the fiber routes to cover the trenching, boring, handholes, and splicing.

These costs do not include engineering, construction inspection, or permitting. We've estimated that the engineering and inspection will cost 10% of the cost of the construction, a price range we see often. The permitting fees would be paid to the township and this is something you might waive in order to hold down the price of the network. We've estimated such fees at $35,000. Note that if you waived them for your own fiber construction then you might have to forego such fees for anybody else that wants to build in the township.

Electronics. We priced the FTTH electronics in this study based upon recent prices we got from Calix. Calix is one of several FTTP vendors and we feel safe in using their prices because the equipment from all of the vendors has a similar cost. CCG is vendor neutral and we are not suggesting that you use Calix. Rather, our experience is that the cost of the FTTP electronics is similar between vendors and thus using a recent quote from any of the vendors is sufficient for predicting the cost of the network electronics. Calix just happened to be the most recent bid we had in hand.

There are two major components of fiber electronics. First is the core. The core 'lights' the fiber and transmits the signal to customers. Calix calls this component an Optical Line Terminal (OLT). The other major component, mentioned earlier, are the ONTS that sit at each home and that are used to receive the light signal and translate it back into an electronic signal for inside the home or business.

We've assumed that the core electronics cost around $73,000. We have assumed that each ONT at the customer premises costs $450, which includes the cost of installation.

There are more expensive ONTs that can be used for larger customers. There are no businesses in the township today that would need the more expensive electronics. Even if one was built, the cost for the electronics for a large business is, at most, a few thousand dollars more expensive than a standard customer connection.

As noted above, the overall price of using active electronics is similar, and so our business plan provides a reasonable estimate for either type of network.

Fiber Drops. Drops are estimated to cost $423 including materials and labor. We assume an average drop length of 350 feet.

Connecting All Customers. The models all assume that you would provide drops and ONTs to all of the potential customers in the township. While there may be a few homes that don't want to be connected, our thoughts are that if citizens are paying for the network from property taxes then everybody should be offered the chance to connect to the network. It's cheaper to connect everybody during the construction process than it would be to come back later and connect them one-by-one as they take service.

Other Costs. We've assumed a cost of $30,000 to upgrade and install the needed racks and power equipment in Township Hall. We've assumed an inexpensive router costing $10,000 that would be used to connect the network to one or more ISPs.

Construction Contingency. A contingency is essentially a fudge factor. When borrowing money to build a fiber network it is routine to borrow a little extra to protect against price overruns. A contingency is not needed if you have first done a detailed network design before hiring a contractor. We've included a 5% contingency to the cost of fiber. This could be set higher if you wanted more safety. We don't normally add a contingency to electronics since it's easier to make a good estimate of those cots.

Summary of Network Costs

Following are the low and high cost estimates of expected network costs. These costs are for network assets only and don't include assets like vehicles that are probably going to be owned by the ISP(s) that operate on your network.

	Lower Cost	Carrier Class
Upgrade to Township Hall	$ 30,000	$ 30,000
ISP Router	$ 10,000	$ 45,000
Splitters	$ 49,750	$ 49,750
Electronic Core	$ 72,910	$ 72,910
Fiber Core	$ 58,032	$ 58,032
Fiber	$2,765,920	$3,190,320
Engineering	$ 134,371	$ 154,318
Construction Management	$ 151,524	$ 174,018
Permitting	$ 35,000	$ 35,000
Drops	$ 300,398	$ 300,950
ONTs	$ 319,950	$ 319,950
Subtotal	$3,927,855	$4,430,247
Optional Route to Chelsea	$ 221,760	$ 221,760
Total	**$4,149,615**	**$4,652,007**

Note that the drop and ONT prices assume that a connection is built to every customer. This will be discussed more when discussing possible business models.

V. Business Structure

This section will first look at the possible business structures that the township can consider. It will then look at a few key segments of the fiber industry today that have the most bearing on the choices the township is considering.

A. Business Structure

There are several possible operating models for the township to consider. Each option has significantly different results and consequences. The two options are:

> Open Access. In this option the township would build the model and then would allow one or more ISPs to offer service on the network.
>
> Township as the ISP. In this option the township would form and operate your own ISP.
>
> Partnering with Other Townships. In this option multiple townships would come together to operate the fiber businesses.

There is a more detailed discussion of this issue in the Next Steps section above. Determining the structure of the business is the first step to take and the ideal structure will be one that allows the profits made from the ISP business to help offset the cost of the bonds.

B. The Open Access Market

Let's first look at how the existing open access market operates today. It is an interesting and fairly limited marketplace. The most common open access structure is that ISPs buy access from network owners to get access to customers. That structure is identical whether there is one or multiple ISPs providing service. There are many more open access networks that provide wholesale access on a more limited basis, mostly to serve business customers.

The Full Open Access Market

Most open access networks operate in states where this business structure has been mandated by legislation or regulation.

- The PUDs (Public Utility Districts – rural electric companies) in Washington are restricted to being wholesale providers due to legislation passed a number of years ago. There are numerous different open access models being tried at various PUDs, with the largest being Chelan PUD, Grant PUD and Douglas PUD.
- Utah has a similar law that applies to municipalities. This led to the creation of an open access fiber business in Provo and another in a collective of small towns operating as Utopia. Provo subsequently sold their network to Google Fiber. Utopia is still operating a wholesale business.
    - Utopia doesn't charge ISPs to get onto the network. Instead, when a household joins Utopia, a customer accept a lien on their home, and have the option to pay $300 down and $30 per month for 10 years, nothing down and $25 per month for 20 years, or a flat payment of $2,750. This allows ISPs to offer services like 250 Mbps fiber for $35 per month.
- A similar law was passed in Virginia after Bristol Virginia Utilities (BVU) built a retail fiber network. The legislation grandfathers BVU as a retail provider but only allows other

cities to operate open access networks. So far the wholesale model has been adopted by a small number of cities, the largest being Roanoke on a limited basis.

There are a few other municipal entities that have elected a wholesale business structure, even though it was not mandated by law. This includes the following situations:

- Tacoma, Washington chose a wholesale model where the city is the retail provider of cable TV, but connections to the network for telephone and broadband are sold wholesale to ISPs. The city recently announced that it is considering changing to a full retail model for all services.
- Ashland, Oregon operates an open access network, but the city also operates as a retail ISP on the network and competes against a few local ISPs that sell on the network.
- There is a network in Urbana and Champaign Illinois that purports to be open access operating under the name UC2B. The backbone network for this project was built from the Broadband Stimulus Grants that were awarded a few years back. The network is owned jointly by the two cities plus the University of Illinois. UC2B has not yet built a citywide fiber network, but works with various ISPs to add fiber one neighborhood at a time to the network. So rather than being open access, it's more like negotiated deals with different ISPs to operate in different parts of the city.
- There are a number of municipal networks that have built fiber rings and which are promoting "open access" to carriers. But these networks have largely not built to reach residential customers. I would put these networks into the open access wannabes, and with financing and the right partners they might eventually become open access networks. An example of this is AXcess Ontario in Ontario County, NY.
- Other communities have tried to build open access networks but then were unable to find any ISP partners. For example, Longmont, Colorado sought funding as an open access network, but since they were unable to find ISP partners they now offer full retail services directly to residents.
- Ammon, Idaho is just now starting an open access network. This is an interesting model in that the network is being financed through liens placed upon customers' homes plus a monthly 'utility fee' charged to homeowners. The plan is for these fees to pay for the network so that the ISPs will not be charged for using the network.
- There are other cities that are considering open access networks. The largest of these is San Francisco, which would pay for the plan through a 'utility fee' charged by the city to every electric customer in the city.

Overall, it is a very tiny universe of US networks that operating with open access and that include residential customers.

Problems with Full Open Access Networks

There are several problems faced by all full open access networks in the US:

- Quality of ISPs. Europe has seen some large success with open access networks because a significant number of the large ISPs there are willing to operate on a network operated by somebody else. This came about due to the formation of the European Union. All of the

state-owned telecoms and ISPs found themselves in competition with each other, and as a whole they embraced open access. There are huge open access networks in places like Amsterdam and Paris as well as hundreds scattered in smaller towns and cities. The big networks have over a hundred ISPs competing for customers—many of the ISPs with niche businesses going after a very specific tiny slice of the market.

But that hasn't happened in the US. There is not one example in this country of a large telco or cable company agreeing to operate to any significant extent on somebody else's network. These large ISPs will lease the occasional connection to serve a large business customer outside their footprint, but they won't buy large-scale connections.

This means that open access networks in the US have to rely on small ISPs. These small ISPs are generally local and mostly undercapitalized. They are often family businesses. The small ISPs have all of the problems inherent with small businesses. They often don't have the money or expertise to market well. They often have cash flow issues that put restraints on their growth. And many of them don't last a long time, which is typical of small businesses in general. This can be seen in a few of the open access networks in the US. In Chelan County, one ISP has almost 98% of the residential customers. There were originally almost a dozen ISPs, but over the years they either folded or were purchased by the remaining ISP. The danger faced by Chelan PUD is that they would have no provider if the one ISP fails or goes out of business. These kinds of businesses, for example, often don't survive the death of the owner-operator.

In Provo, before the network was sold, there were only two ISPs on the network. They originally had eight ISPs on the network. It's hard to make an argument that a network with so few choices is really open access—because the whole purpose behind open access is to provide customer choice.

- Cherry Picking. The wholesale model tends to lead to cherry picking. That is the phenomenon where the ISPs only want to sell to the most lucrative customers in the market—those with the highest monthly bills. This cherry picking is driven to a large degree by the wholesale arrangement between a network owner and ISP. Most existing wholesale networks sell connection to ISPs at some fixed price. This price varies between $25 and $33 per customer on the various networks mentioned above.

  This kind of pricing makes it impossible for the ISPs to develop profitable products to sell to smaller users or low-income homes. An ISP can't pay $30 for a connection and then create a $25 to $40 data product—the math just doesn't work. And this is unfortunate because every one of these open access networks had an original goal to bring broadband to as many customers as possible.

  The open access networks generally have customer penetration rates far lower than similar municipal networks that are directly operated by the municipality as the ISP. I don't think any of the networks mentioned above have customer penetration rates greater than 50%. This means the networks benefit less than half of the customers in the market. That is

perceived as a disaster for a municipal provider since everybody in the municipality is paying for the network.

- Making the Numbers Work. Almost by definition, an open access network owner has a big challenge in making the numbers work. Consider the difference between a network owner that is in the retail business and one that operates an open access network. A retail provider today that offers the triple play of cable TV, broadband, and telephone probably has an average customer bill higher than $120 per month. Compare that to an open access network provider that might charge between $25 and $30 per month for the wholesale connections. The biggest expense to recover in any network is the cost of the physical network, and the networks for the two business plans are nearly identical. The retail provider might have extra network costs for assets like a cable TV headend, cable settop boxes, or cable modems—but the big cost of building fiber to reach each customer is the same for both businesses cases.

  Since the margins are so thin for open access, the business often requires a high customer take rate just to break even (meaning to cover operating costs). It can be difficult, or even impossible, to create an open access business plan that will cover operating expenses as well as pay for the network.

- Stranded Investments. One problem that plagues all fiber networks is that the cost to connect the customer to the network is high compared to competing technologies. Both telcos and cable companies can bring a fairly inexpensive drop wire to a customer home without needing any electronics. But fiber networks require a significant investment, an average of around $1,000, to connect a customer—and if that customer leaves the network before spending enough to recover the installation cost, then that investment is "stranded," meaning it is not generating any revenue. Over time it's not unusual for a fiber network to accumulate a significant number of these stranded customer connections.

What This Means for Sharon Township

Sharon Township can't consider the "normal" open access network structure because you would never be able to repay the cost of building the network. This is easy to demonstrate. As is shown elsewhere in this report, the cost of the network and the costs to finance it, when spread across all customers, equates to a required revenue stream of roughly $43 per month, depending upon different variables like the exact network design and the interest rate on debt. If Sharon tried to charge $43 monthly to ISPs for each customer on the network the ISPs would have to charge a high rate for broadband, perhaps $80 per month for a basic connection. With that rate probably less than half of the homes would buy broadband. And that would mean that the shortfall would have to be spread to just the households that buy a wholesale connection. This leads into what is called a death spiral in economics because it's a problem with no solution. There is no price that customers are willing to pay that will generate enough revenue to pay off the cost of building the network. And so far, none of the cities that have built wholesale networks has been able to recover that initial cost. All of these other cities have electric utilities and those utilities covered the costs of the fiber network (and basically passed it on in higher electric rates). That's not a viable option for Sharon Township.

The township already understood the basic dilemma of pure open access, and so you have anticipated that you will cover the cost of the network through some other mechanism. In my analysis I have assumed that the cost of the network will be covered with property taxes. In the township that is the only viable option. But other cities have considered other sources like sales tax. For example, Cook County Minnesota funded about half of the cost of their network through a sales tax—something that was viable there because they are a resort area on Lake Superior.

So the network option in Sharon Township is to pledge an increase in property taxes to pay for the network. When the network is built you will invite one or more ISPs to operate on the network. In my business plans I have assumed that you will still charge the ISPs a small fee per customer per month—I've assumed $5. The township will own the network and you need to maintain a rainy day fund to cover the cost of network repairs or of adding additional new homes to the network. But the township business plan is simple. Your only revenues are from the property taxes and from whatever small fee you charge to the ISP(s). For that fee your role is to pay for the original network plus whatever other additional future costs are negotiated between the parties.

Issues with Working with ISPs

Even though the township is paying for the original network there are still concerns with working with ISPs in an open access environment. You still run some of the same risks that are mentioned above. I particularly would be concerned about:

- The Viability of the ISPs on the Network. The township is small and so it is unlikely that you are going to attract multiple ISPs unless a number of other townships also build open access fiber networks.

  Large networks like Chelan County (over 25,000 customers) and Provo (over 20,000 customers) had a very difficult time finding and keeping viable ISPs on their network. Small ISPs are not generally strong companies and they also tend to be sole proprietorships that fold when the owner can't sustain financial viability or else just decides to do something different.

  It's a real possibility that you build a fiber network and get only one ISP serving. And then sometime in the future that ISP folds shop and your customers are stranded with no viable ISP option. As mentioned, that is the fear today in Chelan County where they have 25,000 customers and one ISP.

- You Have Little Negotiating Power. At the end of the day the tiny number of potential customers is not going to be enough customers to give you any leverage to get concessions out of an ISP. It's likely that you beg somebody to serve on your network as opposed to being able to influence how they operate in terms of prices, service, etc.

  This means that even if you charge very little to the ISP they might still charge high prices. There is really nothing you can do to stop them from doing that. In your case your citizens will be paying the equivalent of over $40 per month more in property taxes. And for that

contribution they are going to want significantly lower retail rates for the broadband and other products.

But the ISP(s) on your network either might be so tiny as to have no economy of sale, or they might just be greedy and want to charge high prices. Or, as mentioned earlier, they could just decide to cherry pick and only serve those households willing to pay a high price for broadband. It's been my experience that you will have little or no power to influence their behavior.

- ISP Profits. The ISP can make a significant amount of profits over time. There is nothing wrong with that, but the ISP profits are due in a large part to the fact that you are providing them with a free (or very cheap) network. They could never do as well financially in your market if they had to build a network or had to pay you what it's worth to use it.

  In effect you have subsidized the ISP(s) and any profits they make come out of the pockets of your citizens who are also paying over $40 per month in tax revenues for the network.

Is There Another Alternative?

The other alternative is to form your own ISP, either just for the township of in partnership with multiple townships. If you limit the product line on the fiber network to basic broadband, and perhaps to resell telephone service, it's not a complicated business to operate. It is possible to create a functional ISP at this small scale.

There are a number of upsides to this concept:

- First, you could now serve every home. Since everybody is paying for the network then you could put a minimal data product—say 5 Mbps download—for free into every residence. Even people that don't use computer would benefit by having WiFi to save money on their cellular data plans. All but a tiny few homes would not benefit from ubiquitous service.
- Any profits can be rolled back to benefit your citizens. This could either be structured as direct reductions in the retail prices of the products sold on the network, or else profits could be used to make some of the bond payments, thus reducing the property tax millage you would need to charge. The second idea is probably the fairest answer since it saves money for all taxpayers equally.
- You eliminate the risk of having a poorly performing ISP or one that disappear and strands your customers.
- You can control the customer service experience. We know from working with many municipal businesses that they provide superior customer service compared to almost all commercial providers. This is just in the general nature of what municipalities do and is why citizens tend to love municipal electric and water companies compared to commercial ones.
- Doing business as a cooperative or some other form of commercial entity might bypass state restrictions on municipalities offering broadband.

I've created financial models for this scenario that will be covered below. I've created models with a Sharon-only ISP and one also working in a cooperative that shows financial viability. I've always felt that numbers tell the best story, so in the next section of the report I look at the results of the financial analysis and the story that those numbers tell us.

VI. Results of the Financial Analysis

One of the tasks undertaken in this study was to examine various business plan alternatives to see which business structure and financing ideas work for the township. Following is a discussion of the major assumptions used in creating the studies and the results of the analysis.

All studies looked out over a 20-year future period. While that is a long time over which to make financial projections, the goal was to match the study period with the anticipated financing period of 20 years.

A. Studies Considered

I considered a number of different business plans as follows.

Standalone ISP. I looked at the financial impact of the township directly operating and acting as the ISP. In this case the township would use revenues from the ISP business to try to pay the bond and then would use property taxes to make up the difference. I looked at several different options:

> **ISP at Market $35 Basic Broadband Rate**. This scenario set the price of the primary broadband product at $35. In my study I have assumed this would be for 100 Mbps with a higher price for gigabit service. I chose the $35 price since when it's added to the increase in property taxes the average cost per broadband subscriber would be just under $80 per month. But note that there is nothing magic about the $35 number and you could set a price higher or lower than that depending on the goals you are trying to achieve. Depending upon the number of customers on the network, this scenario generates some positive cash flow that could be used to help offset bond costs.
>
> **ISP with Market Rates**. I also looked at a scenario where the basic rate was increased to $55, which is a representative rate in larger communities in the state for basic broadband. The major purpose of this look was to see how much extra cash this would generate, which could be used to offset the cost of the bonds.

Open Access Models. Following are the open access models considered. The models are the same from a financial perspective if there is one or multiple ISPs operating on the network.

> **Base Model**. I always create one 'base' model which is then used to compare the effect of changes in other assumptions. In this case the base open access model assumes the following:

- The township pays for building the fiber network. This includes the cost of fiber drops and ONTs to connect to customer locations. The township would also be responsible for future capital such as connecting to new homes built in the township, or needed repairs to the network (such as when somebody cuts the fiber network).
- The townships pays for the network by using a bond funded by an increase in the millage on property taxes.
- The ISPs take care of any capital costs inside of homes, like WiFi modems. The ISPs then operate the business. They bill and collect revenues from customers and these revenues belong to the ISP. The ISPs cover all operating expenses like employees, software, vehicles, customer service, marketing, etc.
- I've assumed the township would charge a small fee to the ISPs for using the network—assumed in the model at $8 per customer per month. This is to establish the 'rainy day fund' that would be used to pay for future capital and repair needs. The rate is set low so that the ISPs can profitably set low rates for customers.
- The base model assumes that 70% of the customers in the township buy services from the fiber network. At this early stage we can't know how many homes will want broadband. But in working around the country, we are seeing relatively high customer take rates of broadband in rural areas – generally between 70% to 85%. This tells me that using 70% as the starting base penetration does not feel out of line as a moderate penetration goal.
- From a network cost perspective the base model assumes that the township will have to build fiber to Chelsea to get access to affordable bandwidth. It is assumed that the fiber construction will follow our "low-cost" construction ideas.

Base Model at a 60% Penetration. Same as the base study except that only 60% of residents buy broadband from the fiber network.

Base Model at an 80% Penetration. Same as the base study except that 80% of residents buy broadband from the fiber network.

Traditional Open Access Model. Same as the base model except that the township charges $25 each month to ISPs for each customer on the network.

Effect of Interest Rate Increase. Same as the base model but with interest rates on the bond set 1% higher.

Lowest Possible Capital Costs. Same as the base model but excludes the fiber route to Chelsea (assumes some township nearby meets you at a border.

High Capital Costs. Same as the base model but uses "carrier class" construction methods to design the network.

Higher Capital Contingency Costs. Same as the base model but assumes a higher contingency reserve to protect against construction cost overruns.

Partner with Other Townships. The other concept explored was partnering with other townships. This means that the townships would join together to fund an ISP as a cooperative (or as some other business structure) to operate the network.

This model works basically the same as the open access network, but with several exceptions:

- The townships would have to fund the startup costs to launch the jointly run ISP.
- We've assumed that the township would pay for all initial capital, including the cost of the electronics inside the home (WiFi router).
- The jointly operated business needs to have the ability to return profits to the township. The major reason to consider this option is to see if there is economy of scale from acting as a group – and to then take advantage of any profits to offset bond cots.
- Because the business is operated by the townships, through the cooperative, I've assumed that you would provide a free data connection at some minimal speeds like 5 Mbps to every home. Even those that don't use a computer would be able to save money through WiFi on their cellular data plans. There is no incentive for an ISP to offer this kind of service in an open access environment. You just have to be careful that so many people don't opt for the 'free' option that the ISP does not cash flow. This is why I am strongly recommending holding a pledge drive before funding or building the network to find out the products customers are willing to pay for.

I looked at two scenarios:

Partnering with 3 Other Townships. In this scenario three other townships roughly the same size as Sharon go together and form an ISP as a co-op to provide services.

Partnering with 9 Other Townships. This scenario looked at economy of scale and considered a customer base that is 9 times larger than Sharon. This could be 9 small townships or a smaller number of larger townships.

In all of these studies I create two separate set of financial statements—one for the township and one for the ISP. That lets me look in detail at how the ISP might perform—which is essential in understanding

B. Business Plan Assumptions

Customer Revenue Assumptions

In an open access or cooperative environment the goal is to generate enough cash for the Township to maintain a rainy day fund, but to otherwise hold down charges for using the network so that the ISPs can offer the lowest rates possible. My models assume a charge to the ISP(s) of $8 per customer per month.

Even though you won't charge much to get onto the network we still have to recognize that the Township is a small market for broadband. The ISP will have incremental costs to serve it and will still want to make a profit. In my models I estimate those costs and look at setting prices that will derive the margins that I think ISPs will look for.

In my model I've assumed two sets of products—broadband and telephone using VoIP. Most ISPs serving on fiber networks offer the two products. Even if the ISP does not own a voice switch, there are numerous options for them to buy wholesale voice to resell to your citizens.

But there is nothing stopping ISPs from offering additional products. For instance, if they provide cable TV elsewhere they might also want to provide it in the township. The issue for them will be if the cost of getting the cable signal to the township (requires about a gigabit of data speed) is too costly to support the product. ISPs are also offering other products around the country like smart home services (smart thermostats, door locks, security systems, watering systems, etc).

But for purposes of this modeling I've kept the product line simple. Unless noted, the models assume the following products and prices for the ISPs:

100 Mbps broadband	$35
1 Gbps broadband	$60
Basic phone line	$20
Phone line with unlimited long distance	$30

We've assumed no hook-up fees for customers

Note that in an open access environment that an ISP might charge more than the above rates. The Township probably does not have any market power to force ISPs to a preferred set of rates. This is one of the primary reasons to consider your own ISP if that can be made to work – because then you control the pricing. All of the profits in an open access environment go to the ISPs and so they could charge more than the suggested $35 and pocket the profits. Unfortunately their rates don't benefit you, but if their rates get too high there will be fewer customers buying broadband.

Township Revenue Assumptions

The township has two revenue sources. The first is the property tax revenues that are set to be adequate to make the annual payment on the bonds.

Second, I show the township charging $8 per month for each customer to the ISPs (or to the co-op). The purpose of this revenue is to fund a 'rainy day fund' to enable the township to fund adding new homes to the network or to make the occasional repairs to the network.

Expense Assumptions

It's important to note that this analysis looks at "incremental" expenses—those are new expenses that are incurred as a result of launching the township fiber business. This analysis does not include some allocated share of existing expenses.

Let me give an example of what that means. An ISP will already have an owner/manager who operates the business and collects a salary. I have not accounted for any of that salary in the analysis because the ISP is already paying that salary today.

Without knowing the specific ISPs that might be involved we also can't know the specific incremental costs of the ISP for taking on provision of service in the township. And so I have made my best estimate based upon the experience of working with hundreds of small ISPs. But they don't do everything the same. For example, on ISP might do the 'help desk' function with staff while another might outsource it to an external vendor. The help desk function is the technical support function at the ISP that answers questions about broadband and that troubleshoots and fixes technical issues.

ISP Expenses

Following are the various major expense assumptions used in the models.

Inflation. I assumed that expenses will increase 2.5% per year for inflation.

Employees: Labor is always one of the major expenses for offering broadband services. We estimate the following labor costs needed to support broadband in the township.

- **Field Technicians**. A field technician is somebody in a truck that does maintenance on the network and that fixes problems in the field. The standard industry metric for small ISPs is that one field technician can take care of an area covering 1,600 customers. In the case of the township that would add about 1/3 of a new technician in workload to an existing ISP.
- **Customer Service**. The ISP will also need additional resources for customer service. These are the employees that take orders, receive and process bill payments and answer customer questions. The metric is similar to that for field technicians and a small ISP generally has one customer service representative for every 1,500 customers. That also equates to roughly 1/3 of a representative assignable to the township business.
- **Benefits and Taxes**. We assume that the ISP's benefits and taxes add 30% to the cost of the base salary.

Internet Help Desk. These are the people in an ISP that handle technical support. This means that they take technical questions from customers, fix any problems that can be done remotely through the electronics, and maintain 24-hour monitoring of the network. While some small ISPs do this function in-house, the more common method is to hire an external company to handle this function. This function today costs roughly $4.00 per customer per month.

Bandwidth. The ISP must buy wholesale bandwidth to the Internet. In the forecasts we used a price of $1,800 per month for a gigabit of Internet bandwidth. That should be adequate for the number of homes in the market today. But that price was quoted for getting access to bandwidth in Chelsea, if the ISP has connections in larger towns they probably will be able to get a better price than this.

Other ISP Operating Costs. There are a number of other incremental costs for the ISP to serve new customers, as follows:

- **Wholesale voice and long distance**. If an ISP does not own their own voice switch then they must buy wholesale telephone lines. We've assumed the purchase of wholesale lines, which cost a little more generally than providing this in-house.
- **General asset-based expenses**. This would include things like the gas and insurance for the vehicle used to serve the township. It would include computer expenses for the employees that work in the township. It would include the electric bill for powering the fiber electronics.
- **Advertising**. There will be some advertising costs at the beginning of the business to sign up new customers.
- **Billing**. There are costs to create, mail, and collect payments for billing. Some customers are going to want paper bills. Others will want to pay by credit cards.
- **Software**. Most ISPs maintain software that they pay for by the number of customers they have. This might include mapping software and OSS/BSS software (the recordkeeping, customer service, and billing software).

Not Included. Again, my study looks at incremental costs—which means new costs that the ISP must take on in order to serve the township. This means that there is no assignment of costs for such things as accounting or the salary of the owner of the ISP. I've assumed that those costs would be covered by the "profits" generated by the business in the township.

Township Expenses

Fiber Maintenance. Since the township owns the fiber network I have assumed that you will be responsible for the cost of fixing the network when something breaks. This could be a cut fiber or a customer card that goes bad. The actual maintenance work may be handled by the ISP, but I've assumed that as the network owner these costs would be borne by the township.

Rights-of-Way Expenses. In Michigan there is a proscribed fee that must be paid each year for access to public rights-if-way. This is covered in the METRO Act as follows:

> *Section 8 (4) Except as otherwise provided under subsection (6), for each year after the initial period provided for under subsection (3), a provider shall pay the authority an annual maintenance fee of 5 cents per each linear foot of public right-of-way occupied by the provider's facilities within a metropolitan area.*

To be conservative I've estimated that this would apply to all state, county and township roads. It would not apply to private roads. There are approximately 56 miles of roads that might incur this fee which results in an annual expense of about $15,000. It's possible that the Township could waive the fees on Township-owned roads or else perhaps use any such revenue to offset the cost of the bonds. But that is going to require legal research.

Start-up Costs. There are one-time costs for getting into this business. These include things like this study, legal fees, and other similar costs.

Capital Assumptions in the Study

Above I talked about the cost of the fiber network. But there are other assets needed to operate the business. My assumptions for this additional capital are as follows:

Township Capital. I've assumed that the township would cover the capital cost in the future of adding new customers to the network as homes are built. I've assumed the township would pay for replacement of electronics or for fixing fiber if it's damaged.

ISP Capital. I've assumed the ISP would take care of the following capital costs:

- **Equipment Inside Customer Premise**. The most common such equipment would be a WiFi router. But if the ISP provides cable TV service this also would include settop boxes.
- **Operational Assets**. The ISP would also be required for any assets needed to operate their side of the business. This could include things like vehicles, computers, furniture, tools, and anything else they need to be a functional ISP. The ISP would also own any of the electronics needed to provide broadband, telephone, or cable TV products.

Financing Costs.

One of the biggest costs for the township is the debt payments on the bond. I have assumed that the bonds would be for twenty years with steady payments throughout. Like all loans there is both a principal and an interest component of each debt payment. The study assumed that property taxes will be increased by enough to cover the cost of the debt.

C. Summary of Financial Findings

The financial studies I have created are complex and produce sets of financial projections for the township as well as for the partner ISPs or for the partner cooperative. I've found it's overwhelming to copy all of the detailed results of these studies into a written report.

So instead, I will focus on the summary results of the studies. There are a few key facts about each study that I think are the most important:

- How much the township has to borrow in a bond, and how much that bond costs each taxpayer per month during the bonding period.
- How much cash is generated by the township.
- How much cash is generated by the ISP partners or the cooperative partners.
- The net impact on the taxpayers in the township for all of these items.

Township Acting as the ISP

I looked at six different alternatives for this scenario. I looked at setting rates starting at $35 and I also considered using 'market rates' starting at $55. I then looked at the two alternatives at a 60%, 70% and 80% customer penetration rate. The financial results are as follows:

60% - $35 Rate	Total	Per Customer
Bond Needed	$4,925,000	$46.32 / Month
Township Cash after 20 Years	$1,450,726	($ 8.50) / Month
Higher Customer Prices		$ 0.00 / Month
Net Impact on Township Households		$37.82 / Month

60% - Market Rate	Total	Per Customer
Bond Needed	$4,925,000	$46.32 / Month
Township Cash after 20 Years	$3,837,589	($22.49) / Month
Higher Customer Prices		$20.00 / Month
Net Impact on Township Households		$43.83 / Month

70% - $35 Rate	Total	Per Customer
Bond Needed	$4,925,000	$46.32 / Month
Township Cash after 20 Years	$2,086,368	($12.23) / Month
Higher Customer Prices		$ 0.00 / Month
Net Impact on Township Households		$34.09 / Month

70% - Market Rate	Total	Per Customer
Bond Needed	$4,925,000	$46.32 / Month
Township Cash after 20 Years	$4,880,018	($28.60) / Month
Higher Customer Prices		$20.00 / Month
Net Impact on Township Households		$37.72 / Month

80% - $35 Rate	Total	Per Customer
Bond Needed	$4,925,000	$46.32 / Month
Township Cash after 20 Years	$2,660,445	($15.59) / Month
Higher Customer Prices		$ 0.00 / Month
Net Impact on Township Households		$30.73 / Month

80% - Market Rate	Total	Per Customer
Bond Needed	$4,925,000	$46.32 / Month
Township Cash after 20 Years	$5,819,076	($34.10) / Month
Higher Customer Prices		$20.00 / Month
Net Impact on Township Households		$32.22 / Month

Here is what these results tell me:

- First, there is 'profit' to be made by being your own ISP. While you can't make enough profit as an ISP to fully cover the costs of the bond, you can generate excess cash that could be used to either make some of the bond payments each year (and reducing the millage rate that year), or else you could pay off the bonds early. One of the big upsides of this idea is that after the bond payments are finished this would return a positive new cash flow to the Township that could be used for other things.
- It's obvious that the number of customers that buy ISP services makes a significant difference. This makes it vital that you undertake a pledge drive before seeking financing

or launching your own ISP so that you can have a good idea of what the finances will look like.

- The version where I look at 'market rates' was done to see the impact or raising customer rates and then using the profits to somehow cover bond expenses. You have a philosophical issue to answer when choosing rates. These results show that excess profits can result in lower overall costs to everybody in the market, even those that don't buy broadband. So you could increase rates so as to lower the cost for everybody (and by charging more to those that want broadband). There is no right or wrong answer when setting rates and the two rates I've suggested aren't the only options. But these results show that the more you charge, the more cash is generated by your own ISP that can be used to cover bond costs.
- All of these versions are superior to an open access scenario where all of the profits accrue to an external ISP rather than to the Township.

Open Access Scenarios

In this scenario the Township pays for the network through property taxes. You would only charge $8 per month to the ISPs to use your network – that fee to maintain a rainy day fund to pay for repairs. In this scenario all of the profits accrue to the ISPs. The results of this scenario are the same in you have one or multiple ISPs.

60% Penetration	Total	Per Customer
Bond Needed	$4,600,000	$43.26 / Month
Township Cash after 20 Years	$ 241,283	
Equity Needed by ISP	$ 188,923	
ISP Cash after 20 Years	$1,495,617	$ 8.76 / Month
Net Impact on Township Households		$43.26 / Month

70% Penetration	Total	Per Customer
Bond Needed	$4,600,000	$43.26 / Month
Township Cash after 20 Years	$ 352,211	
Equity Needed by ISP	$ 199,955	
ISP Cash after 20 Years	$1,914,832	$11.22 / Month
Net Impact on Township Households		$43.26 / Month

80% Penetration	Total	Per Customer
Bond Needed	$4,600,000	$43.26 / Month
Township Cash after 20 Years	$ 479,427	
Equity Needed by ISP	$ 210,959	
ISP Cash after 20 Years	$2,396,510	$14.04 / Month
Net Impact on Township Households		$43.26 / Month

These results tell me:

- In this scenario your citizens always pay the full cost of the bond issue through property tax. There are no profits generated to offset those costs or to pay the bonds off early. The expected property tax assessment is an average of $43.26 per month per household for 20 years.
- The number of customers on the network doesn't make a big different to the township. However, you want the ISPs to do well so that they continue to serve on the network.
- The primary downside of this scenario is that ISPs are free to charge whatever the want. The above figures assume a $35 rate, but they could charge more than that to increase their profits.
- The big risk of this scenario is that you might someday not have an ISP willing to serve your customers. The best example I have of this, which is described elsewhere in this report is in Chelan County Washington where they have been reduced to having one ISP who is serving over 20,000 customers. And there is no guarantee that ISP will always be there to serve.

Effect of Interest Rate Increase

70% Penetration	Total	Per Customer
Bond Needed	$4,600,000	$47.01 / Month
Township Cash after 20 Years	$ 649,751	
Equity Needed by ISP	$ 199,955	
ISP Cash after 20 Years	$1,914,832	$11.22 / Month
Net Impact on Township Households		$47.01 / Month

An increase (or decrease) in interest rates only really affects the homeowners since they must cover the bond payments with property taxes. This shows that a full 1% higher interest rate changes the impact to a household by $3.74 per month for the 20 years. While interest rates are in a state of flux right now, a full 1% swing in interest rates would be extraordinary. But none of us has a crystal ball to predict the future.

Effect of 15-Year Bond Term (shorter)

70% Penetration	Total	Per Customer
Bond Needed	$4,600,000	$51.94 / Month
Township Cash after 20 Years	$ 382,290	
Equity Needed by ISP	$ 199,955	
ISP Cash after 20 Years	$1,914,832	$11.22 / Month
Net Impact on Township Households		$51.94 / Month

It's clearly going to be an easier sell to homeowners if the property tax increase is smaller. Shortening the bond term to 15 years raises the monthly increase in property taxes to $51.94. This actually is a savings for homeowners and it costs less to make these larger payments for 15 years than the smaller payments for 20 years. But this feels like an increase that many homeowners

might object to. The term of bonds generally follows the life of the assets being financed. I generally see fiber bonds with lives between 20 and 25 years.

Lowest Possible Capital Costs

70% Penetration	Total	Per Customer
Bond Needed	$4,350,000	$40.91 / Month
Township Cash after 20 Years	$ 362,515	
Equity Needed by ISP	$ 199,955	
ISP Cash after 20 Years	$1,914,832	$11.22 / Month
Net Impact on Township Households		$40.91 / Month

This shows that changes in the capital costs to build the network flow through straight to homeowners. This means it's important to choose construction options that provide for a great network without overbuilding them.

High Capital Costs

70% Penetration	Total	Per Customer
Bond Needed	$5,100,000	$47.96 / Month
Township Cash after 20 Years	$ 280,111	
Equity Needed by ISP	$ 199,955	
ISP Cash after 20 Years	$1,914,832	$11.22 / Month
Net Impact on Township Households		$47.96 / Month

This shows that higher capital costs hurt the homeowners in the same manner that low ones benefit them.

Higher Capital Contingency Costs

70% Penetration	Total	Per Customer
Bond Needed	$4,775,000	$44.91 / Month
Equity Needed by ISP	$ 199,955	
Township Cash after 20 Years	$ 362,603	
ISP Cash after 20 Years	$1,914,832	$11.22 / Month
Net Impact on Township Households		$44.91 / Month

The contingency represents borrowing extra money to cover any cost overruns in constructing the network. This shows that it would be wise to seek fixed price bids to build the network before you get funded, which would pin down the construction costs and would eliminate the need for extra contingency.

Traditional Open Access Model

50% Penetration	Total	Per Customer
Bond Needed	$4,600,000	$43.26 / Month
Township Cash after 20 Years	$1,398,624	
Township Reduced Property Taxes	($1,200,000)	($ 7.03) / Month
ISP Cash after 20 Years	$1,248,800	$ 7.32 / Month
Customer Price Increase		$20.00 / Month
Net Impact on Township Households		
For those buying broadband		$56.23 / Month
For those not buying broadband		$36.23 / Month

This scenario has the township charging $25 per month per customer to use the network. This is likely to mean fewer customers on the network since the ISPs will pass along your fees in higher rates. For this example I've assumed that the scenario reduces the penetration rate to 50%.

The results of this scenario have a different impact on customers that buy or don't buy broadband on the network. I've assumed that the township would use a lot of the cash it generates in this scenario to cover bond payments.

This scenario doesn't make much sense for the township. It forces rates to be higher, meaning that there are fewer customers who will use the network. The customers that use the network have already paid for bonds in their property taxes and will also pay high rates for broadband in this scenario.

Partnering with 3 Other Townships – 70% Penetration

In this scenario the township would partner with two other townships and create a broadband cooperative to operate the business and act as the ISP. The big difference between this and the open access scenario is that any profits from the cooperative could be used to benefit customers. This will be discussed in more detail below. This benefit could come either through reductions in retail prices or by lowering the cost of bond payments.

70% Penetration	Total	Per Customer
Bond Needed	$4,875,000	$45.85 / Month
Township Cash after 20 Years	$ 311,340	
Coop Profits after 20 Years	$ 520,098	($ 3.05) / Month
Net Impact on Township Households		$42.80 / Month

8**0% Penetration**	Total	Per Customer
Bond Needed	$4,875,000	$45.85 / Month
Township Cash after 20 Years	$ 442,591	
Coop Profits after 20 Years	$ 993,215	($ 5.82) / Month

Net Impact on Township Households	$40.03 / Month

There is one additional benefit to this concept which is that it would allow you to provide a minimal free broadband connection to every home, even if they don't buy traditional broadband. They could use the WiFi, for example, to reduce the data costs for their cellular plans or to use Internet of Things devices like Amazon Echo, smart thermostats, or IP burglar alarms.

This shows that there is a modest savings available to customers from creating a cooperative between a few townships.

These bonds are a little larger than in the open access model since I've assumed that the township would kick in a share of the cost to launch the ISP. But there are issues with using bond money for anything other than capital, so a way needs to be found to fund the money needed to start the ISP. For example, it might be possible for the ISP to obtain bank loans to start the business. But the easiest path would be for each township to kick in a share of funding to jumpstart the new ISP.

Partnering with 9 Other Townships – 70% Penetration

70% Penetration	Total	Per Customer
Bond Needed	$4,775,000	$44.91 / Month
Township Cash after 20 Years	$ 319,156	
Coop Profits after 20 Years	$ 1,422,647	($ 8.34) / Month
Net Impact on Township Households		$36.57 / Month

80% Penetration	Total	Per Customer
Bond Needed	$4,775,000	$44.91 / Month
Township Cash after 20 Years	$ 450,250	
Coop Profits after 20 Years	$1,895,700	($11.11) / Month
Net Impact on Township Households		$33.80 / Month

This shows that there is a big benefit to making the cooperative larger. There is an economy of scale at the jointly-created ISP from having more customers. And with more townships the cost for each one to fund the new ISP become smaller. Finally, this demonstrates that even with a larger cooperative there is great incentive to get as many customers on the cooperative networks as possible.

A Few Other Revenues to Consider

The business plan I have created is a little conservative on the revenue projections. There are other potential revenues that could help to pay for the network:

- Business Revenues. I've included no business revenues. Some ISPs (not all) charge a premium price to business customers for broadband. There are only a few businesses in the township today, so recognizing these extra revenues won't make much different to the business plan analysis. But there is the potential for some extra revenue.

- Home Run Revenues. There are a few opportunities for what I call home run revenues – meaning significant revenues from a single customer. For example, there are a few cell towers within the township and it is possible over time that you could provide bandwidth to these towers. But I've not included this revenue in the forecasts because it's not an easy revenue to get – cellular companies prefer to buy connections in bulk from wholesale providers and it could be difficult to displace whoever is serving these towers today.
- Future Products. It's likely that ISPs will find future revenues that are not reflected in these projections. We are already seeing the large cable companies offer products like home security, energy management, home automation, etc. It's possible over time that even small ISPs will be able to make some positive margins by reselling these products.

D. What These Results Tell Us

The township has some interesting options to consider. There are viable scenarios that work under three different business models:

- The township acts as the ISP. If enough households would subscribe the excess cash generated can be used to help offset bond costs.
- The township finances the entire network through property taxes. You then make it available for one or more ISPs to bring services. It turns out this is the financially least attractive option because it requires the township to pay for the network and you don't gain any benefits from the profits made from operating on the network. This comes with the risk that the ISPs might charge higher rates than you would with your own ISP. And there is a huge risk that someday you might have no ISP who wants to operate on the network.
- The township can partner with other townships to create an ISP that would operate on the network. If you can gain economy of scale by getting enough townships to work together, this can return significant cash profits to each township to help offset bond costs.

Following considers the pros and cons of each of these ideas. This is important because the decision should not be made entirely based upon finances.

Township Operating Your Own ISP

Note that this would have to be a very simple and stripped down ISP. I would envision perhaps two part-time employees to operate the ISP. So this would mean "small-town service," but it would also be local service and these employees should be able to satisfy everybody. But most of the services needed by an ISP can be purchased from vendors—meaning that the local employees would take care of local maintenance issues, bill customers, and answer customer questions.

Pros

- Any revenues generated above operating costs can be used to offset the bond payments. As long as the business is run efficiently it can generate positive margins.
- This can work really well if households agree to pay broadband rates higher than market. In nearby towns like Ann Arbor a household can get a decent broadband connection for $55. If your households would agree to pay something higher than my suggested $35, then that extra cash can cover a significant amount of the bonds. It's worth noting that a lot of rural broadband cooperatives charge rates between $70 and $100.

- Because the township owns and operates the ISP, you could also provide a free or low-cost broadband connection to every household. Such a connection might be set at a low speed like 5 Mbps—but this would be sufficient to allow home usage of data for cellphones and for Internet of Things devices (Amazon Echo, burglar alarms, smart thermostats, etc.). The big danger here, though, is that too many people elect the free option.
- One of the biggest benefits goes to homes that don't use broadband. The revenues from customers paying for broadband pay more towards the debt than homes that don't. But it looks like there will always be some property tax assessment each year to pay for the network.

Cons

- The township is taking all of the risk of operating the ISP. If you operate inefficiently and let costs get out of control, then this could cost more to households than a straight-up property tax financing.
- There is an administrative state barrier that makes it harder for a municipality to serve broadband than other kinds of business entities. The specific language of this restriction is included in the Next Steps section of the report. It doesn't appear to be a hurdle you can't overcome, but you need to get legal advice on the issue.

Open Access Network

In this scenario the township would secure financing directly with a property tax increase. The network would then be opened to one or more ISPs to provide service.

Pros:

- Customers should hopefully get lower prices since the ISPS are paying almost nothing to use the network (I am recommending you charge them $8 per customer per month). This might mean that customers can get a 100 Mbps connection for something like $35. But there is no guarantee that the ISPs will price it that low and the township is going to have almost no control over what ISPs choose to sell on the network and what they charge for products.
- The township does not have to be in the ISP business. You build the network and then open your doors to ISPs. This is the simplest option for the township in that you set the property tax surcharge each year and make bond payments and have to do very little else.
- It's possible that if you get multiple ISPs that you might get some competition for broadband. However, there is no guarantee of this and in other open access markets we've seen the ISPs all charge basically the same rates.

Cons:

- Households will pay the full cost of financing the network from property taxes. I've estimated that to be in the range of $43 per household per month for 20 years. This fee is charged to everybody—homes that want broadband and those that don't. If this is charged on assessment values, then more expensive homes will pay even more for the broadband surcharge.
- None of the profits from selling broadband is used to help pay for the network. The ISPs will make a profit while homeowners always pay the bond payments.

- My analysis shows that traditional open access is the most costly option for citizens. If you want to charge any substantial fees to the ISPs, they will both pass those fees on to customers and they will also cherry-pick, meaning they will seek to only serve homes willing to commit to a high monthly bill. My analysis shows that if the township charges $25 per month for each customer connection that the overall impact to customers is the worst of any scenario. This is because customers will pay high prices, and there will also likely be fewer households on the network.
- You always run the risk that at some time in the future there might be no ISP willing to operate on the network. We've seen an example in both Chelan County WA and Provo UT where an open access network started with multiple ISPs and then dwindled to one. And there is no guarantee that even one ISP will want to serve you. In such a circumstance your network would go dark but you'd still have to make the bond payments.

Partnering With Other Townships

In this scenario you would partner with other townships to create an ISP to operate on all of your networks. The goal is to take advantage of economy of scale such that the more townships that band together, the better the financial result for everybody.

Such an ISP probably would have to be more complex than the simple stripped-down one you could operate by yourself.

Pros:

- This has the potential to being the best financial scenario for homeowners.
- The biggest benefit from this scenario is that all profits from operating the network would flow back to help reduce the burden on customers. This could be done either by reducing broadband rates (benefitting just broadband customers) or by flowing profits back to the townships to help cover bond payments (benefitting all homeowners).
- The analysis shows there is a major economy of scale. The bigger this joint effort becomes, the bigger the benefit to every member township and their citizens. There is not much benefit from doing this for just a few townships (unless you run the ISP as stripped-down as the one I've recommended if you do this yourself). But there are significant profits to be made as the township-ISP gets larger.

Cons:

- You won't get competition from multiple ISPs on the networks. But this perhaps ought to be listed as a benefit, because if the ISP is owned and operated by the townships it is likely to provide great customer service and low prices.
- There is a lot of work needed to put together this kind of coalition and to make it work. You need firm buy-in from township partners before the first township can feel safe to launch. There is a bit of a chicken and egg phenomenon—townships might want to see this work before joining, but without enough of them joining it's difficult to get started. The township could launch first with your own ISP and add other townships into the business over time.
- It's not necessarily a negative, but there is research needed to understand the best legal structure for such a joint business. The primary issue is to find a structure that would let

the profits from the business flow back to the townships. For now you've created a cooperative, but it may turn out that is not the best structure. For instance, can governments be owners of a cooperative? This might also work as something an Authority arrangement between government entities. But then there are the legal risks associated with operating directly as a government entity—meaning any restrictions on municipal broadband providers could kick in.

E. Conclusions/Recommendations

In my first conversation with the township broadband committee I heard that concept that was most in favor is to use property taxes to pay for the network and then open up the network to open access.

But I've always said that numbers ought to tell the story. It turns out that an open access network is the most expensive option for the township homeowners. If a way can be found to somehow form a government-run ISP, then the profits from that business can help to offset some of the bond fees and can provide the lowest overall cost to homeowners.

Another big upside to have the township, or a group of townships, operate the network is that you could provide broadband to every home, even for those that don't have computers or want traditional broadband. Such households could be given a free low-speed connection that could be used to supply data to cellphones or to operate devices that need WiFi such as smart appliances, burglar alarms, etc. It seems like this will be an easier sell to the public if everybody gets something for their property tax increase.

The numbers tell me that capturing some of the profits from operating the ISP is the best idea. This can be done by the township operating a minimalist and stripped-down ISP or it could be done by partnering with other townships to operate a more robust ISP.

One thing to keep in mind in looking at all of these options is that households will be paying a lot for broadband—either directly or through property taxes. For example, in the open access scenario households will be paying $43 for property taxes and probably at least $35 per month for broadband. That means a total increase to households of $78 per month for twenty years—although they do get great fiber broadband for that price.

With all of that said, here are my specific findings and recommendations:

Forming an ISP is the Best Financial Option

This is the opposite of what I expected to find, which is why I let the numbers tell the story. The number cut through issues and paint the bottom-line picture of what various options cost your homeowners.

There are two possible ways of doing this, and there are pros and cons of each.

- The township could create a small and simple ISP to serve your homes.

- You can partner with other townships to create an ISP. This could be a little more robust of an ISP than doing it yourself, and could, for example, afford to hire an experienced general manager. There is significant economy of scale with such a business and the more townships that come together, the bigger the benefit to customers.

Consider More Than Only Dollars

There are generally reasons other than a pure dollar comparison when making these kind of choices. I call these social considerations.

Free Broadband For Everybody. One of the most intriguing possibilities is that if you somehow operate this with your own ISP that you can then provide free, or very cheap, broadband to every home. That is something that is not likely to work in an open access environment as an ISP is not going to want to service customers who aren't paying for broadband. But you could provide every home with a small amount of broadband to use for cellphone data or for the many new uses for broadband such as using an Amazon Echo, having an IP security system, or operating smart home devices (something that is going to be in big demand within a few years).

Rate Fairness. There are some negative social issues to paying for the network from property taxes. First, homes with a higher assessed property value will pay more than others. But more importantly, homes that don't want to have broadband are going to be paying for those that do. Some of the options I am recommending recover a significant amount of the money needed to make bond payments from broadband customers. Generally municipal businesses adhere to a principal that cost causers ought to pay for service. That's why homes that use more water or more electricity pay more than those who use less. A structure that generates some of the bond payments from broadband customers is fairer than one that only uses property taxes.

Quality of Customer Service. There is always the possibility in an open access environment that the ISPs on your network won't do a good job. A small ISP might maximize profits by being slow to answer customer calls or to make repairs. They might be bad at billing customers. The problem with a low-quality ISP on an open access network is that you will have almost no ability to replace them or offer an alternative. The township can control customer service better if you control the ISP, either through direct ownership or through partnering with other townships.

How Hard Is it to Be an ISP? If you want to consider one of the options other than open access, you will have to wrestle with the question of how comfortable you are with operating an ISP. My opinion is that this is probably a lot easier than you think and it is certainly a lot easier than it was a few years ago. There are numerous small ISPs around the country that would be of a similar size of yours at 500 – 600 customers. Here are the primary functions the ISP would have to handle:

- Providing the Data Product. This used to be quite technical, but today this entire function can be outsourced to high-quality vendors for a reasonable monthly cost per customer. The outside vendor will route Internet traffic, check for viruses,

protect the network against malicious software attacks, etc. This vendor would also answer customers' technical questions and would also have the ability to effectuate simple repairs for you remotely.

- Maintain the Network. For a fiber network this small there is a not going to be a lot of maintenance required. You can hire a part-time technician to make any needed repairs and to maintain the fiber and electronics. You can contract with other carriers to come in and handle major repairs (such as when somebody cuts a fiber).
- Backoffice Functions. This involves things like taking orders, preparing bills, and collecting payments. For a company this small this can easily be a part time position that perhaps works only in mornings, or else a few days per week.

This gets a little more complicated if you were to operate a larger ISP across multiple townships. In that case I would recommend that the ISP be staffed with a general manager who would oversee all of the above functions. But otherwise, even a larger ISP only has to cover the basic functions. One thing we've learned is that the one product that requires a lot of staff effort is cable television, and as long as you don't offer that, then an ISP can be a pretty simple business. Obviously you will want to have a technician who is competent, but this kind of talent seems to be reasonably available almost anywhere.

Consider Risk

There are a few risks to consider for each of the options that should also be part of the decision-making process of choosing the best operating model. The following are the biggest risks I foresee:

What if no ISP Wants to Serve? One of the dangers of the open access model is that you might eventually end up with a situation where no ISP is willing to serve on your network. The kinds of companies that will operate on an open access network are small, undercapitalized, and are generally sole-proprietorships or family businesses. You are looking at probably financing the network from 15 to 20 years, and that is a long time to count on somebody to be willing to operate on the network. If you end up with only one ISP (and this has happened to other open access networks), then you will live in fear of that ISP folding or the company owner/operator dying. It is not inconceivable that your network could go dark if there is no ISP available or willing to serve.

Broadband Alternatives. There are two possible competitors to any broadband network you build that must be considered.

- CAF II Broadband. The FCC has provided subsidies to AT&T and Frontier, both of whom serve part of the township, to upgrade their rural broadband. This is likely to result in faster cellular broadband from AT&T and faster DSL from Frontier. The FCC requirement is that these upgrades deliver at least 10 Mbps download – speeds that are faster than what is available in the township today. The risk is slight from this competition, but there will be households that find these upgrades to be adequate and who would rather stay with these providers than pay for a fiber network.
- Elon Musk Satellite Broadband. Elon Musk, the owner of other innovative businesses like Telsa Motors and SpaceX, is trying to raise $10 billion which he says will enable him to blanket the globe with faster satellite broadband. He's

talking about putting up over 4,000 satellites at low altitudes and might be able to offer broadband of 100 Mbps or faster. Of course, this is still just an idea on the drawing board, but he has been able to make his other wild-sounding plans come to fruition. If this network is built it could provide a significant competitor to your own network (and every other rural broadband network). The risk is building your own network and then his satellite network is built and can do what he promises and undercuts demand for your network versus him never making this work. This is a really hard risk to judge.

Build Only to Success

If you end up being the ISP, then I strongly recommend that you only build to success. By that, I mean that you should have some sort of pledge drive and sign-up all of the customers in the township before getting the network financed. If you adopt one of the business options that counts on customer revenues to help pay for the network, then getting customer buy-in before you start is essential.

F. FINANCING OPTIONS

The township has already found the most likely financing option for a project this small. A lot of 'normal' financing options are not going to be easily available to you. But let me highlight a few that could be. Following is a discussion of some of the primary ways this project could be financed. We will look at the options for financing it both as a municipal venture and as a private venture.

Public Financing Options

The two primary mechanisms used for public financing are revenue bonds and general obligation bonds. There are some major benefits of using bond financing. First, the term of the bond can match the expected life of the assets and it is not unusual to find bonds for fiber projects that stretch out for 25 to 30 years. Second, you can finance a project completely with bonds, meaning that no cash or equity needs to be put into the business up front.

Revenue Bonds: The primary historic source of money to finance this sort of telecommunications system is through the issuance of municipal tax-exempt bonds. Most of the municipal fiber networks that have been built have been financed through revenue bonds. Revenue bond are backed by the revenues and the assets of the fiber network and the associated business. With a pure revenue bond the county would not be directly responsible for repaying a revenue bond should the project go into default. With that said, having a default would be a financial black-eye that might make it hard to finance future projects. So to some degree the county would still be on the hook for the success of revenue bonds, at least tangentially.

However, it is getting harder to finance a project with revenue bonds due to some failures on the part of other municipal networks. Among these are Monticello, MN; Crawfordsville, IN; and Alameda, CA. These kinds of failures have made investors leery about buying

bonds that are only backed by the business. This reluctance has made financing with revenue bonds more expensive.

The cost of a bond issue cannot be judged only by the interest paid. In fact, the other financing costs of bonds can outweigh the interest rate in the effect on the bottom line cost of repaying a bond issue. Because of market reluctance to buy revenue bonds, they often have higher interest rates than general obligation bonds, but they also can incur the following costs:

> Debt Service Reserve Fund (DSRF): Many revenue bonds require borrowing additional funds to be kept in escrow as a hedge against missing future payments. The DSRF is often set to equal a year's worth of principle and interest payments. This money is put into escrow and is not available to operate the business.
>
> Capitalized Interest: Bonds begin accruing interest from the day the money is borrowed. Since fiber businesses take a number of years to generate enough cash to make bond payments, the bondholders require capitalized interest that is used to make the interest payments for up to the first five years of the project. Basically, the project must borrow the amounts needed to make debt payments which can add a significant amount to the size of the bond issue.
>
> Bond Insurance: Bond insurance is an up-front fee paid to an insurance company that will then pay one year of bond payments to bond holders in case of a default. We've seen bonds issued that have required both a debt service reserve fund and bond insurance.

The difference between bond interest rates and commercial interest rates both change over time; that difference is referred to in the industry as the 'spread.' Sometimes the spread favors bonds and at other times it favors commercial borrowing. In the scenarios used in the study the commercial loans produce better results. But in some of the scenarios studied above the business had a hard time covering the debt payments on the commercial loans in the early years, and in those cases municipal financing would be safer.

Interest rates are not the same for all kinds of bonds. For instance, the interest rate for revenue bonds can be considerably higher than general obligation bonds due to the perceived higher risk. In the last few years the difference between the two types of bonds has not been too great, with general obligation bonds between 4% and 5% and revenue bonds between 6% and 7%. But this changes over time and there have been historic times when one of the two types of bonds would be a better option.

The revenues from this project are not going to be strong enough to support a pure revenue bond. However, that does not mean that the revenues from the business can't be used to help pay for other kinds of financing.

General Obligation Bonds (GO Bonds): If revenue bonds aren't an option then the next typical alternative is general obligation bonds. General obligation bonds are backed by the

tax revenues of the entity issuing the bonds. This backing can be in the form of various government revenues such as sales taxes, property taxes, or the general coffers of a government doing the borrowing.

In the case of the Township, this is the most likely financing option, and one you have already realized. In your case you can issue revenue bonds backed by property tax revenues. But again, this does not mean that only property taxes can be used to repay the bonds and it looks like the best option includes using some of the revenues generated by the business to help cover some of the bond costs.

Private Financing Options

One of the problems of launching the business through a cooperative is that you might not be able to use bond proceeds to start the cooperative ISP. This might mean looking for a small secondary source of funding. The traditional way for commercial ventures to get financed is through bank loans. The interest rates on such loans are generally a lot higher than bonds. Still, there are some ways to mitigate the financing costs so that a project doesn't have to rely on only bank loans. Here are some thoughts on financing the fiber business if it is a non-municipal venture:

Equity: Most forms of private financing require some equity. Equity means that the borrowing entity brings some sort of cash or cash equivalent to the business as part of the financing package. The amount of equity required will vary according to the perceived risk of the venture by the lender. The higher the risk, the more equity required.

Equity can take a number of different forms:

- Cash: Cash is the preferred kind of equity and lenders like to see cash infused into a new business that can't be taken back out or that doesn't earn an interest rate.
- Preferred Equity: For a stock organization (like an LLC or other type of corporation) the business can issue some form of preferred stock that then acts as equity. Preferred equity usually gets some sort of interest rate return, but the payments are not usually guaranteed like they are for bank loans. If the business gets into a cash crunch they must pay bank loans and other forms of debt before they pay preferred equity interest.
- Assets: It's possible to contribute assets as equity. For example, a new fiber venture might be seeded by having one of the partners contribute an existing fiber route or other valuable asset to the business. In such a case the contributed asset generally has to be assigned a market value by an independent appraiser.
- Non-recourse Cash: Non-recourse cash would be taking cash in an obligation that is not guaranteed to be paid back. To give an example, in Sibley and Renville counties, a fiber business was recently launched in the form of a cooperative. The local government provided an economic development bond to the business as a non-recourse loan. This means that the new fiber business will make their best effort to make the bond payments, but if they are short of cash then the government entities who issued the bonds would have to make bond payments. The other sources of financing for that project looked upon these bonds as a form of equity.

In your case, the only likely form of equity would be a cash payment, up front by each home owner. There is no reasonable way to require homeowners to do this, which creates its own set of issues. But a bank loan is likely to require equity.

Bank Loans: While there are around 150 municipal fiber ventures in the country that largely have been financed through bonds, the vast majority of other fiber projects in the country have been financed with commercial lending sources. Most fiber projects have been built by for-profit communications companies or by cooperatives.

The banking industry as a whole does not like to finance long-term infrastructure projects. This is the primary reason why the country has such an infrastructure deficit. Historically banks would fund things like power plants, electric and water networks, and other long-term revenue-generating assets. But various changes in banking laws which have required banks to maintain larger cash reserves along with a general desire to go after higher interest rate projects mean that banks have largely stopped doing this kind of lending. It's not impossible to finance an infrastructure project at a traditional bank, but the general parameters of bank loans make it a challenge.

Most banks prefer not to make loans with a term much longer than 12–15 years, and very few telecom projects can generate enough cash in that time period to pay for the original investment. Bank loan rates are generally a few percentage points higher than bond rates, which also makes it harder to prove feasible.

Also, bankers generally expect a significant amount of equity from the borrower. The banking industry has gotten much more conservative over the last decade and they now might require 40% equity where a decade ago for a similar project they might have required 20% equity. Since fiber projects are relatively expensive, it's difficult to raise the kind of equity needed to make a project work.

There are exceptions. A few of the large banks like Key Bank and Bank of America have divisions that will make bank loans to municipal ventures that look a lot like bonds. These loans will have long payment terms of 20 years or more and reasonable interest rates. However, most of these loans go for things like power generation plants and other projects that have a really strong guaranteed revenue stream. These banks have done a tiny handful of telecom projects, but they view most of them to be too risky. Banks are also somewhat adverse to start-ups and prefer to make these kinds of loans to existing businesses that already have a proven revenue stream.

There is one unique banking resource available to companies who want to build fiber projects. This is CoBank, a boutique bank. This bank has financed hundreds of telecom projects, mostly for independent telephone companies. CoBank is a relatively small bank and has strict requirements for financing a project. They are leery of start-ups and we can't think of a start-up they have financed recently. They also expect significant equity to be infused into a new venture. They tend to have somewhat high interest rates and somewhat short loan terms of 10–12 years.

The final source of bank financing is local banks. Historically local banks were the source in many communities for car and home loans. But over the last few decades those loan portfolios have migrated to other lenders and local banks have been struggling for a decade to find worthwhile projects in their regions. We know of many commercial projects for small telcos that have been financed by local banks.

One of the issues of borrowing from a local bank is that they are going to have a relatively small lending limit. Most local banks won't make an individual loan for more than one or two million dollars. That obviously doesn't go far in a fiber project. However, local banks have become adept at working in consortiums of multiple banks to make larger loans. This spreads the risk of any one loan across many banks. Banks who do this usually take part in consortium loans for a number of projects. These smaller banks see this as a way to make loans to quality projects and quality customers that they could not loan to on their own.

To make this work you generally must start with a bank that is local to the project and let them help you put together the consortium. They essentially become the sponsor of the deal. This approach takes some extra work to put together, but there are many examples of this working for financing good projects.

Loan Guarantees: One way to make banks more amenable to loaning money to fiber projects is through federal or state loan guarantee programs. A loan guarantee is just what it sounds like. Some state or federal agency will provide a loan guarantee, which is very much like getting a co-signer on a personal loan. These programs guarantee to make the payments in the case of a default and thus greatly lower the risk for a lending bank. In return for the lower risk, the banks offer lower interest rates.

These guarantees are not free. There is an application process to get a loan guarantee in much the same manner as applying for a bank loan or a grant, meaning lots of paperwork. And then the agency making the guarantee will generally want a fee equal to several interest 'points' up front. To some extent, this process works like insurance and the agency keeps these fees to cover some of the cost of defaults. If they issue enough loan guarantees, then the up-front fees can cover eventual losses if the default rates are low. These points are a payment to the agency for issuing the guarantee and are not refundable.

There are several state and federal agencies that might be willing to make loan guarantees for telecom projects. The following agencies are worth considering:

> HUD 108 Program: The Department of Housing and Urban Development has a loan and loan guarantee program that is allotted for economic development. There is both federal money under this program as well as money from this program given to the state to administer. While these loans and loan guarantees generally are housing related, the agency has made loan guarantees for other economic development projects that can be shown to benefit low- or moderate-income households. If enough of a fiber project can be said to benefit low-income residents, then these loans can theoretically be used for a fiber project.

Small Business Administration 504 Loan Program: This program by the SBA provides loans or loan guarantees to small start-up businesses. These loans or loan guarantees must be made in conjunction with a bank, with the bank providing some loan funds directly and with the SBA loaning or guaranteeing up to 50% of the total loan.

USDA Business and Industry Guaranteed Loans (B&I): The Department of Agriculture provides loan guarantees through the B&I program to assist rural communities with projects that spur economic development. Such a project must, among other things, provide employment and improve the economic or environmental climate in a rural area. These loan guarantees are available to start-up businesses. The program can guarantee up to 60% of a loan over $10 million or greater percentages of smaller loans.

Rural Utility Service (RUS): This is a part of the Department of Agriculture. We cover their loan program in detail a little bit below in this report. They also can provide loan guarantees. These come with the same sorts of issues associated with the loans. These loans and loan guarantees can only be used in communities of that do not include cities of 20,000 population or greater, which would not be an issue in Nobles County.

Rural Utility Service (RUS) Loans: The Rural Broadband Access Loan and Loan Guarantee Program (Broadband Program) furnishes loans and loan guarantees to provide funds for the costs of construction, improvement, or acquisition of facilities and equipment needed to provide broadband in eligible rural areas. These loans can't be used for any town with a population over 20,000.

RUS makes broadband loans and loan guarantees to:

- Finance the construction, improvement, and acquisition of facilities required to provide broadband including facilities required for providing other services over the same facilities.
- Finance the cost of leasing facilities that are required to provide broadband if the lease qualifies as a capital lease under Generally Acceptable Accounting Procedures (GAAP). The financing of such a lease will be limited to the first three years of the loan amortization period.
- Finance the acquisition of facilities, portions of an existing system, and/or another company by an eligible entity, where acquisition is used in the applicant's business plan for furnishing or improving broadband. The acquisition costs cannot exceed 50 percent of the broadband loan amount, and the purchase must provide the applicant with a controlling majority interest in the equity acquired.
- Finance pre-loan expenses, i.e. any expenses associated with the preparation of a loan application, such as obtaining market surveys, accountant/consultant costs for preparing the application, and supporting information. The pre-loan expenses cannot exceed 5 percent of the broadband loan excluding any amount requested to refinance outstanding telecommunication loans. Pre-loan expenses may be

reimbursed only if they are incurred prior to the date on which notification of a complete application is issued.

RUS is allowed to make loans to a wide range of entities. Borrowers can be either nonprofit or for-profit and can be one of the following: corporation; limited liability company (LLC); cooperative or mutual organization; Indian tribe or tribal organization as defined in 25 U.S.C. 450b; or state or local government, including any agency, subdivision, or instrumentality thereof. Individuals or partnerships are not eligible entities.

To be eligible to receive a loan under this program, the entity must:

- Submit a loan application. We note that the loan application requires a lot of work including such things as pre-engineering, surveys, mapping, financial business plan models, environmental impact studies, and other things which make the application expensive to get prepared externally;
- Agree to complete the build-out of the broadband system described in the loan application within three years from the date the borrower is notified that loan funds are available;
- Demonstrate an ability to furnish, improve, or extend broadband in rural areas;
- Demonstrate an equity position equal to at least 10 percent of the amount of the loan requested in the application; and
- Provide additional security if it is necessary to ensure financial feasibility as determined by the Administrator.

In practical terms here is how the RUS loans have been administered over the past few decades:

- The rules say that a project needs at least 10% equity, but in reality this is often expanded to be anywhere from 20% to 40% at the discretion of the RUS. In effect, the RUS acts as a bank and they will require enough equity that the project can adequately cover debt payments. In comparing the RUS to other banks, we would classify them as conservative.
- The loan terms are generally in the range of 12 years, sometimes up to 15 years for fiber projects. This is much shorter than the terms available on bond financing, meaning the annual payment would be higher under an RUS loan than with a bond.
- It is exceedingly hard to get a project funded for a start-up business. When one takes an RUS loan they essentially want the whole company as collateral. Thus, the bigger and the more successful the existing company, the easier to meet their loan requirements.
- Their collateral requirements are overreaching in other ways that make them hard to work with for municipal projects. For example, if your project was going to share fiber with some existing network, such as one built by a school system, they would want that asset as collateral. This is generally not possible.

This makes the RUS a very unlikely funding source for a municipal venture or for any start-up venture. To the best of our knowledge, they have never yet successfully funded a municipal venture and they rarely approve a project for a start-up business unless it is extremely well funded by a demonstrably successful company.

The other big drawback of these loans is that they take a long time to process. They often have a backlog of loan applications at the RUS of 12–18 months, meaning you have to wait a long time after application to find out if they will fund your project. Very few existing companies are willing to wait that long unless they are certain they will be funded. And if you are coordinating these loans with other forms of financing this wait is not practical.

The loans are granted by using a very detailed checklist and rating system. This system gives a big preference to making new loans to existing RUS borrowers.

However, the loan fund is really large and is currently at nearly $1 billion. Congress generally has been adding additional funds to the RUS pot each year. The RUS also has some discretion and they have it within their power to make a grant as part of the loan. This is something that can't be counted on, but we know of projects where the borrower only had to pay back 80% of what they borrowed. The interest rates can be lower than market in some cases, but for the last several years, with low interest rates everywhere, the RUS loan rates were not much cheaper than commercial loans.

These loans also require a significant paperwork process to drawdown funds along with significant annual reporting requirements.

There is a low likelihood that RUS would be a funding source for a project in the county.

New Markets Tax Credit: The New Markets Tax Credit (NMTC) Program was established in 2000 as part of the Community Tax Relief Act of 2000. The goal of the program is to spur revitalization efforts of low-income and impoverished communities across the United States and Territories. Eligibility of the county to use these funds would depend upon meeting the earnings test. However, much of rural America meets this test if you earmark the funds for the rural parts of a project.

The NMTC Program works by giving big tax credits to investors that are willing to invest in infrastructure projects in qualifying communities. The tax credits are so lucrative that often the other terms for accepting the funding are modest. The tax credit equals 39% of the investment paid out—5% in each of the first three years, then 6% in the final four years, for a total of 39%.

The Community Development Financial Institutions (SDFI) Fund and the Department of the Treasury administer the program. The process of how the Treasury allots credits is a complicated one and we won't cover it, but in the end there are entities who end up each year with some amounts of New Markets Tax Credits that they must invest to gain the tax credits. The credits are often purchased by the large national banks or other firms that invest in infrastructure.

Generally in practice, these funds act like a mix of loans and credits to the recipient. For instance, a community that received these funds might have to pay some modest amount of interest during the seven years of the tax credit, and at the end would have a balloon for

the principal. However, often some or even all of the principal will be excused, making this also look like a grant.

Because the entities that get the credits change each year, and because you apply with the entities that hold the credits, and not with the federal government, the processes for applying for this money are somewhat fluid. However, there are entities and consultants who help find New Market Tax Credits and who can help you through the maze of requirements.

These funds are not likely to fund a whole, or even a large percentage, of a fiber project, but they might be used to find 5% to 10% of the needed funds of a project and can be a very affordable piece of a funding package. In some cases the terms for getting these credits are so good that other pieces of the financing might look at the tax credit money as equity.

Creative Sources of Loans: We've seen entities get very creative in finding sources of financing:

- Loans from Individuals: We've seen small fiber businesses gain equity through non-recourse loans from people and businesses in the area. These loans had loan contracts and covenants like any other loans. The money borrowed in this manner reduces the amounts that have to be borrowed from the larger external sources, and generally these loans avoid the large fees associated with external financing.
- Loans from Other Cooperatives: If you borrow through the cooperative, it's possible to get low or even zero-interest loans from other cooperatives in the area. Cooperatives are a unique type of business that is required by law to either invest their profits back into the business or else return it as dividends to members. Because the amount of dividends are limited by law, cooperatives often find themselves with large cash reserves. They are allowed to loan out these cash reserves, but only to other cooperatives.

While it's possible to pursue non-bond financing, the process to so can be expensive. And there is no guarantees of getting funding from traditional lending sources like banks or the federal government.

G. OPTIONS FOR BUSINESS STRUCTURE

This report is recommending that you find a business structure that can somehow funnel some of the profits of the business back into paying for financing costs. However, this is not a straightforward process. There are several business structures that might work for this, and there are issues with each:

- Direct Ownership of the Business by the Township. The problem with this idea is that you would be operating a tiny ISP. This is possible and I know successful ISPs that are as small as this. But there is a lot more safety in finding a way to instead partner with other townships in order to form a larger ISP. On the plus side, the township would control everything. The revenues from the ISP could be used to directly offset some of the bond costs.

- Township Ownership, Operation by the Cooperative. This alternative is more attractive in that several townships could go together to form an ISP. That gains economy of scale and would allow an ISP that can offer better service. But the downside of this is that it might be challenging for Cooperative to flow money back to the township to help pay for financing costs. Cooperatives have rigid rules that dictate how much they can pay out of profits and when. There are two alternative ways to structure ownership by the Cooperative to be considered.
    - First, all of the customers could be owners of the Cooperative. In that case, the Cooperative would not be contributing to bond payments. But it might be able to pass money back to customers in the form of rate reductions. However, there might even be limits on that.
    - It might be possible for the Cooperative to be owned directly by the Townships with the townships as the only members. However, that is a nuance of coop law that will have to be explored. In that option the coop could make payments back to each township to help defray bond costs. But even then there might be legal restrictions on how much and how fast the Cooperative could make such payments.
- Township Ownership, Operated by some other business structure. It may turn out that a cooperative is not the best structure for multiple townships to own an ISP. Perhaps this would best be done as some sort of joint powers agency owned by the various participating townships. It might even be possible to form this as an LLC or as a direct non-profit corporation – depending on what is legal for townships to do in Michigan. The big upside to this kind of structure is that profits could probably be flowed immediately each year to help pay for bond costs.
- Township Ownership, Open Access to ISPs. This is the least attractive option from a financial perspective because all of the profits of the business go to the ISPs, meaning that homeowners pay the full cost of the bond financing.

In my recommendations I suggest that the Township take a hard look at these options. A lot of the choice is going to boil down to what is allowable to Townships under Michigan law. For example, you might not be able to be an owner of a cooperative or for-profit corporation.

I know you have already formed a cooperative, but that is not necessarily the right or the best structure to make this work to everybody's best interest. The ideal arrangement looks to be where the Township owns the network, services ae provided by an ISP owned by one or more townships, and profits from the business used to defray some of the bond costs. Any structure that does not allow for all of that is not the best one.

VII. Other Issues

A. Connect America Fund

In the fall of 2015, both Frontier Communications and AT&T accepted funding from the FCC to improve rural broadband in Washtenaw County. There is a map attached as an addendum that shows the areas that are covered. Sharon Township is included in these upgrade areas.

This funding comes from the Connect America Fund, which is part of the FCC's Universal Service Fund. This particular program is referred to as CAF II, meaning that it was the second round of such funding awards, with the first round being much smaller.

The Universal Service Fund today is funded primarily from surcharges on telephony revenues. Originally, the USF was funded by surcharges on landline telephones and special access circuits only, but eventually a surcharge was also placed on cellphones. The fund has the purpose of promoting broadband around the country and has four primary components:

- High Cost Fund. These are payments made to rural providers for building networks. This was historically given to support rural telephony but is being shifted to support rural broadband.
- Lifeline. This program provides a $9.25 monthly subsidy for either a telephone line or a data connection for qualifying low-income households.
- Rural Healthcare. This provides for data connections to rural hospitals and clinics.
- Schools and Libraries. This subsidizes fast broadband connections to schools and libraries, where the national goal is to bring gigabit speeds to these facilities.

The Connect America Fund (CAF) is a component of the High Cost Fund. The FCC set aside $1.7 billion per year for the six years starting with 2016 to build or upgrade rural broadband. These funds were mostly made available to Census blocks that have little or no broadband today.

The funding was available to the largest telcos automatically. Both AT&T and Frontier elected to take this funding for Washtenaw County. The CAF II awards for the County are as follows:

- AT&T accepted $435,687 per year to bring service to 1,617 rural customers.
- Frontier accepted $119,570 per year to bring service to 441 rural customers.
- Together the two companies are getting $3.3 million to improve rural broadband in the county.

The amount of the awards are based upon nationwide cost models that have been developed to estimate the cost of upgrading rural areas to broadband.

The township is mostly served by AT&T, although there are a few customers in the township served by Frontier.

Now that these two companies have accepted the funds they must use the money to increase rural data speeds. All of the customers in those rural areas must be upgraded to data speeds of at least 10 Mbps download and 1 Mbps upload. The companies have six years to make the needed

upgrades, with 2016 being the first year. Note that those speeds are far slower than the FCC's own definition of broadband—25 Mbps download and 3 Mbps upload.

The companies can use the money to implement any broadband technology that will achieve the desired speeds. Frontier has said that they will use the money to upgrade or add DSL. In order to implement the DSL, they will have to extend fiber deeper into the rural areas to support the DSLAMs (DSL transmitters).

But AT&T is likely to use the money in a very different way. I have not yet seen any announcements made for Michigan, but in other states AT&T says they will use the money to expand 4G cellular wireless coverage and will use that to satisfy the FCC requirement. We also know that AT&T badly wants to get rid of their copper networks and they have started the process in many states of tearing down their copper. I expect them to do this everywhere that gets the CAF II upgrades to cellular service.

This means that AT&T is likely to be offering a faster cellular data service than they do today. But note that the fastest speeds available on 4G are about 14 Mbps—and to get that speed you need to be right next to a cell tower. It's likely that data speeds in the township today for cellular data are slower than the goal of at least 10 Mbps. We think it's likely that AT&T will offer a "fixed" cellular data product at homes where they will put a small dish on the outside of the home and will deliver data to a WiFi modem like other ISPs. It's also worth noting that the CAF II build-out allows ISPs to impose stingy data caps. The FCC suggests that data caps can be as small as 100 Gigabytes per month in total download. For a household that watches video over broadband that is a tiny data caps these days. As an example, my household doesn't have traditional TV and we watch all video over the Internet. With three family members (and a home-based business) we generally use about 700 Gigabytes per month.

These upgrades are something for Sharon Township to consider. While the 10/1 Mbps broadband is not very fast, even by today's standards, it might be welcomed by some of your citizens who only have the option today of dial-up or satellite broadband. Some of your citizens might be happy with this small broadband and not want to participate in fiber.

B. Faster Satellite Data

Late last year Elon Musk announced that his SpaceX company is moving forward with attempting to launch low earth orbit (LEO) satellites to bring better satellite broadband to the world. His proposal to the FCC would put 4,425 satellites around the globe at altitudes between 715 and 823 miles. This contrasts significantly with the current HughesNet satellite network that is 22,000 feet above the earth. Each satellite would be roughly the size of a refrigerator and would be powered by a solar array.

This idea has been around a long time and I remember a proposal to do something similar twenty years ago. But like many technologies, this really hasn't been commercially feasible in the past and it took improvements to the underlying technologies to make this possible. Twenty years ago they could not have packed enough processing power into a satellite to do what Musk is proposing. But Moore's Law suggests that the chips and routers today are at least 500 times

faster than two decades ago. And these satellites will also be power hungry and providing them enough energy wasn't possible until modern solar power cells were created. This kind of network also requires the ability to make huge numbers of rocket launches—something that was impractical and incredibly expensive twenty years ago. But if this venture works it would provide lucrative revenue for SpaceX, and Elon Musk seems to be good at finding synergies between his companies.

Musk's proposal has some major benefits over existing satellite broadband. By being significantly closer to the earth the data transmitted from satellites would have a latency of between 25 and 35 milliseconds. This is much better than the 600 microsecond delays achieved by current satellites and would match the latency achieved by many ISPs. Current satellite broadband has too much latency to support VoIP, video streaming, or any other live Internet connections like Skype or distance learning.

The satellites would use frequencies between 10GHz and 30GHz, in the Ku and Ka bands. Musk says that SpaceX is designing every component from the satellites to earth gateways and customer receivers. The large number of satellites would provide broadband capability to a large number of customers, while also blanketing the globe and bringing broadband to many places that don't have it today. The specifications say that each satellite will have an aggregate capacity of between 17 and 23 Gbps, meaning each satellite could theoretically process that much data at the same time.

The specifications say that the network could produce gigabit links to customers, although that would require making simultaneous connections from several satellites to one single customer. And while each satellite has a lot of capacity, using them to provide gigabit links would chew up the available bandwidth in a hurry and would mean serving far fewer customers. It's more likely that the network will be used to provide speeds such as 50 Mbps to 100 Mbps.

But those speeds could be revolutionary for rural America. The FCC and their CAF II program is currently spending $9 billion to bring faster DSL or cellular service to rural America with speeds that must be at least 10/1 Mbps. Musk says this whole venture will cost about $10 billion and could bring faster Internet not only to the US, but to the world.

It's an intriguing idea, and if it was offered by anybody else other than Elon Musk it might sound more like a pipe dream than a serious idea. But Musk has shown the ability to launch cutting-edge ventures before. There is always a ways to go between concept and reality and like any new technology there will be bugs in the first version of the technology. But assuming that Musk can raise the money, and assuming that the technology really works as promised, this could change broadband around the world.

C. Recommendations

Following are my recommendations. Some of these are explained in more detail in the executive summary and the nest steps at the beginning of the report.

Form Your Own ISP

The numbers say that it makes more financial sense to form your own ISP, either alone or with other townships. This is preferable to open access since it allows you to use any generated profits to offset the cost of financing. This also allows you to set prices and to make sure that you get good customer service.

Some Legal Research Needed.

There are a few areas that require more legal research.

First is to understand the existing Michigan rules for a municipality to offer broadband. At first glance this looks like a roadblock that can be overcome. But you need advice on how this has worked with other cities and if there are issues that are not apparent in the code language.

There are also issues to investigate before you use a cooperative to form an ISP. The primary one is to find a structure that allows you to flow excess cash back to help offset bond costs. That might be a real challenge with a cooperative.

Bond Research.

With this study in hand you should now be able to have a conversation with bond sellers about the term (number of years) and the interest rates you might be able to get from the bond assumed in here. To the extent that result is different than the assumptions I've made I would be glad to provide a new set of numbers that incorporates the best estimates. My hope is that you can get a lower interest rate than I've assumed at 5%. You also need to understand things like the ability to pay a bond off early. Finally, there is the issue of being able to use bond money to start an ISP – particular an ISP that would be operated by an external cooperative.

Socialize This with Other Townships.

Since one of the best financial options is to create an ISP between multiple townships, the process of spreading that word and looking for other interested townships needs to be undertaken.

I have always found that having these discussions is far easier when there is a concrete proposal to suggest. I know there has been a lot of discussion with other townships generically on the issue. But I think you can use this study to demonstrate that working together is a superior solution for your homeowners than building an open access network.

And obviously, if not enough other townships are interested, or if there are a few but they are geographically scattered, then this idea can't work.

Get Feedback from Citizens.

This study allows you to talk concrete numbers with homeowners. You now have an estimate of the size of the bond and how much that will cost homeowners each month in terms of bond payments.

Investigate what it Means to be An ISP

You are probably intimidated by the concept of operating your own ISP. This is something that CCG has done many time and we would be glad to help you understand your options.

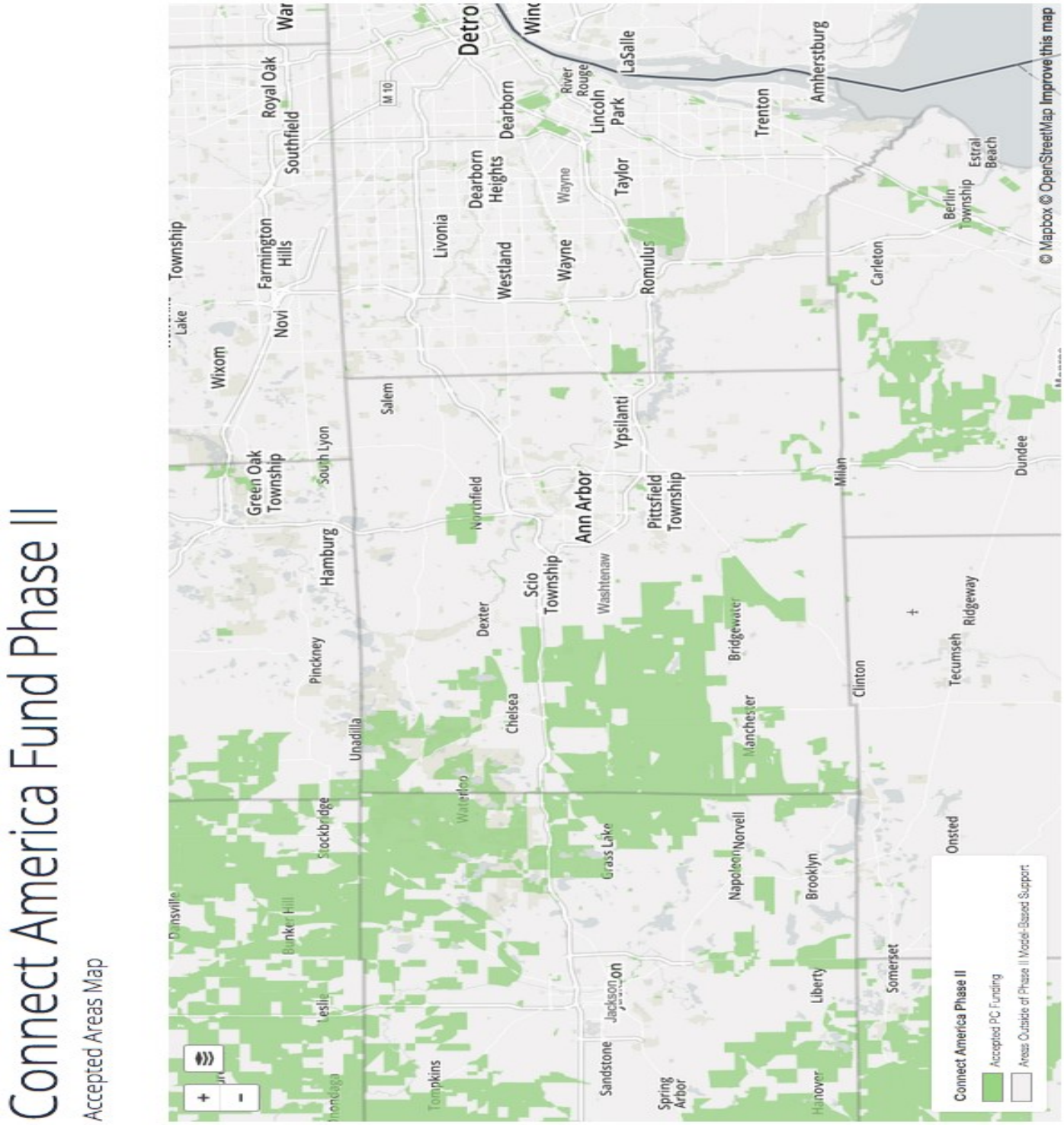
Choose the Best Option.

After all the above research and feedback you can start to choose one of these options as the one you want to pursue. Again, remember that you want to consider both financial and social issues. For example, the idea of giving everybody free broadband if you do this with your own ISP is an idea that might gather a lot of public support.

Pledge Drive.

At any point where you want to get serious about pursuing a specific option you need to undertake a pledge drive. This would involve getting every homeowner in the township to tell you if they would be willing to pledge to buy broadband on the network. That pledge is needed so that you can understand the expected financial performance of the business. You would want to undertake this pledge drive even if the City is going to be the ISP. It's vital to understand the revenue stream that will be generated by the business.

VIII. Appendix: Map of Washtenaw County



Appendix H: Project Participants

Greater Ann Arbor Prosperity Initiative - Region 9
Regional Broadband Access
Participants

- **Michigan Broadband Cooperative**
  Ben Fineman, President
  Barb Fuller, Vice-President
  Todd Anuskiewicz, Board Member

- **Edward Ginsberg Center, University of Michigan Faculty and Staff**
  Mary Jo Callan, Director
  Dave Waterhouse, Associate Director
  Sue Ann Savas, Assistant Professor, School of Social Work
  Michael Elliott, Professor of Biostatistics, School of Public Health

- **Edward Ginsberg Center, University of Michigan Students**
  Lauren Beriont, Masters in Social Work Candidate and CTAC Coordinator (Community Technical Assistance Collaborative)
  Chen Liang, 2nd Year Masters Degree Student, STATCOM (Statistics in the Community at Michigan)
  Ina Conrado, 1st year Masters Degree Student STATCOM (Statistics in the Community at Michigan)
  Ivy Wei, Masters in Business Administration Candidate
  Lisa Stadig Elliot, Masters in Social Work Candidate
  Leslie Pittman, Masters in Social Work Candidate
  Mark Reid, Masters in Social Work Candidate
  Aroosa Ahmed, Masters in Social Work Candidate
  Kevin Liao, Masters in Biostatistics Candidate STATCOM (Statistics in the Community at Michigan)
  Brenda Torres, Masters in Social Work Candidate

- **Poverty Solutions, Gerald R. Ford School of Public Policy, University of Michigan**
  Kate Naranjo, Masters in Public Policy, Strategic Projects Manager
  Sruthi Naraharisetti, MPP/MSW Candidate

- **Foster, Swift, Collins & Smith PC**
  Michael D. Homier, Shareholder

- **Specialized Expert Resources**

  Mary Jo Callan, Director, Edward G. Ginsberg Center for Community Service & Learning, University of Michigan

  Teresa Gillotti, Interim Director, Washtenaw County Office of Community & Economic Development

  Susan Lackey, former President, Washtenaw Development Council

  Scott Menzel, Ph.D., Superintendent, Washtenaw Intermediate School District

  Michael J. Watza, Attorney at Law, Kitch Drutchas Wagner Valitutti & Sherbrook, PC