



MENDOCINO COUNTY DIGITAL INFRASTRUCTURE PLAN: 2019-2025



Prepared by



This plan was prepared for the County of Mendocino by:

Economic Development and Financing Corporation

Heather Gurewitz, Executive Director

Diann Simmons, Program Director

175 E. Church St.

Ukiah, CA 95482

www.edfc.org

(707) 234-5705

info@edfc.org

Assistance, guidance, and support for this plan was provided by:

Tom West, Program Manager, North Bay North Coast Broadband Consortium

Trish Steel, former Broadband Coordinator for Mendocino County

Dan Hamburg, 5th District Supervisor, Mendocino County

Rick Ehlert, Coordinator, Mendocino County Office of Emergency Services

Greg Glavich, Communication Services Coordinator, Mendocino County

Jacob Turner, SeaKay Internet

Dave Smith, Director of Technology, Mendocino County Office of Education

Steven Blum, Tellus Venture Associates

Broadband Alliance of Mendocino County

CPUC data provided through California State University of Chico's Geographic Information Center

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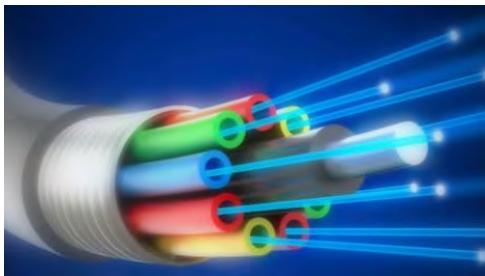


MENDOCINO COUNTY

DIGITAL INFRASTRUCTURE PLAN: 2019-2025

Prepared by
Economic Development and Financing Corporation
on behalf of the County of Mendocino

EXECUTIVE SUMMARY



Mendocino County’s goal is to develop the digital infrastructure needed to have available and affordable high-speed internet access for 98% of households by 2025. High-speed internet, for the purposes of this plan is defined as 100 megabits per second (mbps) download speed and 20 mbps upload speed. This is an ambitious goal, but critical for the economic future of Mendocino County and through advancements in technology, it is possible.¹

According to a recent study by Purdue University, for every dollar invested in “broadband” infrastructure, \$4 of economic activity is created.² Additionally, a study by the Broadband Association in 2016 showed that the Gross Domestic Product grew 1.1% faster in communities with fiber-optic cable networks than in communities without. Research has shown that when communities get connected to fiber optic networks, they see increases in home values by 3% and in rental properties by 8%.³ It is partially due to access to the service, but also because it brands a community as being technology oriented and forward thinking for the 21st century economy.⁴ In addition



¹ Monterey Bay Economic Partnership and Coast Broadband Consortium, White Paper: “Achieving Ubiquitous Broadband Coverage in the Monterey Bay Region”, Nov 2018;
https://tellusventure.com/downloads/mbep/mbep_ccbc_whitepaper_ubiquitous_broadband_30nov2018.pdf

² Grant, Alison, Wallace, Tyner, et al. “Broadband Benefit-Cost Analysis: A Case Study for the Tipmont REMC with Extrapolation to the State of Indiana”
Purdue Agriculture, August 2018.

³ Rosenberg, Nathan. “Financing Broadband Infrastructure” Webcast, November 20, 2018.
Council of Development Finance Agencies, BNY Mellon Webcast Series.
<https://www.cdfa.net/cdfa/cdfaweb.nsf/ordredirect.html?open=open&id=webcast104.html>

⁴ Ibid.

to the economic argument, the public safety component is extremely critical as has been demonstrated by recent wildfires and emergencies throughout Mendocino County.

According to the most recent California Public Utilities Commission (CPUC) data as of December 31 2018, only 73% of households in Mendocino County had access to what the CPUC considers high-speed internet access, 6 mbps download and 1 mbps upload. This does not address the complex affordability aspect. According to Dr. Jenna Burrell of UC Berkeley, \$70/month is considered relatively affordable for rural Mendocino County households.⁵ Delivering high-speed internet in Mendocino County’s rural and remote areas has many challenges and a strategic plan is critical for addressing them. The development of this strategic plan involved a significant amount of research into national and rural trends, CPUC data on connectivity, mapping, a survey of both residential and non-residential users and interviews with local governments, public institutions, and internet services providers. After collecting data, it was analyzed in a SWOT Analysis which assesses of the Strengths, Weaknesses, Opportunities, and Threats to developing high-speed internet access in Mendocino County.

<p style="text-align: center;">Strengths</p> <ul style="list-style-type: none"> • Local government leadership • Broadband Alliance of Mendocino County • Wireless Internet Service (WISPS) & Local Providers • Existing partnerships and consortiums • CPUC grant support • Existing dark fiber 	<p style="text-align: center;">Weaknesses</p> <ul style="list-style-type: none"> • Terrain and geology • Population density and market size • Economic capacity • Lack of equity in access • Socio-cultural context • Playing catch up • Lack of “lit” fiber and high cost of backhaul • Dead zones in the cellular network • Technology challenged households • Lack of resilience and outdated infrastructure
<p style="text-align: center;">Opportunities</p> <ul style="list-style-type: none"> • “Dig Once” policies • Collaboration between WISPS • Statewide partnerships and initiatives • Telecommuters and overpopulation in nearby urban areas • Government and private grant funding • Public-Private-Partnerships • Employment training programs and rural technology education 	<p style="text-align: center;">Threats</p> <ul style="list-style-type: none"> • Outside control of Mendocino County’s digital infrastructure • Power and influence of big telecommunication companies on national and state policies • Fires and natural disasters • Aging Infrastructure and deferred maintenance

Through this process, clear objectives and strategies emerged to support the countywide goal:

DEVELOP THE DIGITAL INFRASTRUCTURE NECESSARY TO HAVE AVAILABLE AND AFFORDABLE HIGH-SPEED INTERNET ACCESS FOR 98% OF HOUSEHOLDS IN MENDOCINO COUNTY BY 2025.

⁵ Burrell, Dr. Jenna. “The Value of Internet to Rural Populations: A case study from Mendocino County, CA.” Berkeley School of Information, 2016. Pg. 14

OBJECTIVE:
DEVELOP
PROJECTS TO
DEPLOY FIBER-
BASED AND FIXED
WIRELESS
TECHNOLOGY TO
REMOTE AND
RURAL AREAS OF
MENDOCINO
COUNTY.

- Collaborate with the other North Bay North Coast Broadband Consortium (NBNCBC) counties to access resources and implement infrastructure projects.
- Develop projects for “Middle Mile” and “Last Mile” fiber optic cable deployment
- Develop projects and find funding for relay tower deployment to connect remote households
- Assess potential for master lease agreements that allow the installation of broadband infrastructure on utility poles and light poles.
- Apply for grants that support rural projects.
- Develop collaboration between WISPs to work on efforts to reduce the cost of “backhaul,” access grant funds, and train a new workforce
- Seek funds to develop a project to help tech-challenged end users to maximize their existing bandwidth
- Research and develop local programs to help low income households get high-speed access and utilize it to improve their economic conditions

OBJECTIVE:
CREATE POLICIES
AT THE LOCAL
GOVERNMENT
LEVEL THAT
SUPPORT
IMPROVING THE
NETWORK

- Break down broadband funding silos by cooperative relationships and enhanced communications between anchor institutions (schools, colleges, libraries, and Health Care Facilities), communities, local governments, public safety, and providers.
- Work with cities and the county to help departments find opportunities to include high-speed internet access in future projects
- Work with local & state agencies to develop and implement “Dig Once” Policies
- Leverage existing cities’ and county’s assets for broadband or fixed wireless deployment
- Complete coastal streamline tower permitting
- Encourage cities and the county to adopt a unified broadband section in their legislative platforms
- Identify and secure match funding to support projects that deploy broadband
- Create public-private partnerships to develop broadband projects: 1) private investment, public facilitation, or 2) private execution, public funding, or 3) shared investment and risk

OBJECTIVE:
DEVELOP
PROGRAMS TO
IMPROVE EQUITY
AND
INCLUSIVENESS

- Work with foundations and programs focused on making education and learning equitable
- Leverage opportunities to provide home access for K-12 students (as promoted by the Mendocino County Office of Education to unlock 24/7 educational opportunities), and for college students, to enable online educational opportunities.
- Develop programs that help subsidize higher speed internet for lower income families in areas where Comcast and AT&T programs are not available.
- Provide incentives to low income individuals to encourage accessing distance education via the internet as a strategy to improve their economic capacity.
- Increase the number of public-access computers in county libraries and Wi-Fi hotspots in other public spaces throughout the county.
- Improve digital literacy and technology education programs in schools, libraries, and through non-profits.

OBJECTIVE:
DEVELOP
PROJECTS THAT
IMPROVE
RESILIENCY AND
REDUNDANCY IN
DIGITAL
INFRASTRUCTURE
SYSTEMS

- Develop projects that expand fiber optic routes to create network diversity and redundancy.
- Develop alternative sources of power for key sites to keep communications active during power outages
- Engage with the California Public Utilities Commission (CPUC) in proceedings addressing critical telecommunication outage issues.
- Request incumbent providers to share critical information with high-level county public safety officials on points of vulnerability in county networks, such as communities where facilities are non-redundant/diverse.
- Document any major telecommunication outages, and use such documentation to engage providers, CPUC and policy-makers at the local, state, and national level for corrective action.
- Ensure that telecommunications are disaster resilient and that they will not fail in an emergency

Planning and coordinating for improving access to high-speed internet in Mendocino County will continue to be a challenge. Our mountains, trees, and sparse rural populations are unlikely to change. However, the rapid changes in technology have improved the prospects. Through creativity, collaboration, and the necessary public and private investments, it is possible to develop the digital infrastructure needed to support a healthy community, strong economy, public safety and effective public institutions.

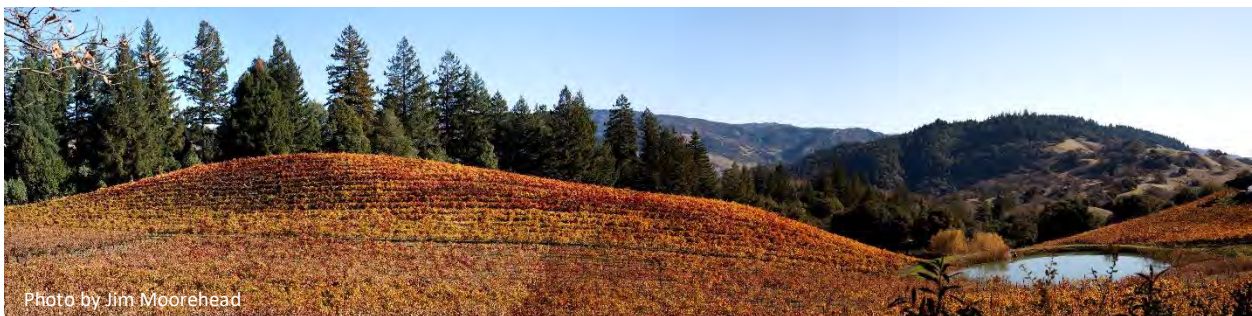


Photo by Jim Moorehead

INTRODUCTION

MENDOCINO COUNTY OVERVIEW



Mendocino County was one of the original counties of California, created in 1850 at the time of statehood. Located on the north coast of California, it is north of Sonoma County and south of Humboldt County, with Lake, Trinity, and Tehama Counties to the east.

According to the U.S. Census Bureau, Mendocino has a total area of 3,878 square miles (10,040 km²), of which 3,506 square miles (9,080 km²) is land and 372 square miles (960 km²) (9.6%) is water. Mendocino County's unique geography includes 130 miles of rugged Pacific Ocean coastline, coastal range mountains, and

ancient redwood trees with coastal populations centered in the incorporated cities of Fort Bragg (7,312)⁶ and Point Arena (453). The inland oak savannahs and rolling hills provide the backdrop for the incorporated cities of Ukiah (16,036),⁷ and Willits (4,875). The estimated population of all of Mendocino County for 2018 was 88,222.⁸

Along the coast, Highway 1 stretches for over 100 miles starting in Gualala and reconnects with Hwy 101 in the town of Leggett. Hwy 101 runs through inland Mendocino County, connecting the cities of Ukiah and Willits, and the towns of Hopland, Laytonville, and Leggett. Highway 20 is a major arterial route that runs from Fort Bragg on the coast, east across the county all the way to the border with Lake County. Large rural communities live off of Hwy 20 east in Redwood Valley and Potter Valley and at the end of Hwy 162 in Covelo/Round Valley. Another major route, Highway 128 runs northwest from Highway 101 in Cloverdale (Sonoma Co.) through the Anderson Valley to Albion to connect with Highway 1 on the coast.



According to the CPUC, there are an estimated 34,495 households in Mendocino County. This is slightly different from current Census estimates that estimate that there are 40,695 households and 41,107 housing units.⁹ For the purposes of this plan, we will use the estimate from the CPUC, although it is important to note the difference, as it likely means there are a number of households in the county that are not accounted for. Healthy Mendocino estimates that 3,234 households were below the poverty line, 2,549 of those households are families with children. According to their website, 73% of the county residents are white and 26% are Hispanic or Latino.¹⁰

⁶ US Census, American FactFinder, Community Facts, <https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkml>

⁷ US Census, Vintage Population Estimates, <https://www.census.gov/search-results.html?searchType=web&cssp=SERP&q=population%20of%20City%20of%20Ukiah>

⁸ Healthy Mendocino, <http://www.healthymendocino.org/demographicdata>

⁹ US Census, Mendocino County Quick Facts, <https://www.census.gov/quickfacts/mendocinocountycalifornia>

¹⁰ Ibid. <https://www.census.gov/quickfacts/mendocinocountycalifornia>

BUSINESSES AND INDUSTRY

The economy of Mendocino County is constantly evolving. Traditionally, Mendocino County has had an economy based on natural resources, including fishing, timber production, and farming. Both timber and fishing are still active in Mendocino County, but they do not have the same level of economic impact as they once had. Tourism, viticulture, wineries and cannabis production are some of the current major economic forces in the county. Additionally, small niche manufacturing is critical. An increasingly important part of the economy is the number of people who work remotely at home as contractors or for businesses and corporations located outside the county.

A unique aspect of the County's economic profile is the number of self-employed and small businesses. According to data provided by the California Employment Development Department's Labor Market Information System, there are over 5,000 employers in the county and over 80% have less than 10 employees and 99% have less than 100. Most major employers are the school districts, hospitals, and local governments.

The most visible of these small businesses are typical "mom & pop shops" providing services in the downtown areas. However, this is only a minor percentage of the small businesses in the county. Mendocino County is home to many professionals and artisans including everything from luthiers (guitar makers), potters, and basket weavers, to high-tech executives, project managers, and other professionals.

WHAT IS DIGITAL INFRASTRUCTURE?

Digital infrastructure refers to any type of underlying system that provides the transmission of internet services or digital data between users in Mendocino County and users anywhere else on the globe. The underlying infrastructure systems currently being used include: 1) fiber optic cable; 2) coaxial cable; 3) copper phone lines; 4) combinations of fiber, coaxial cable and/or copper phone lines; 5) fixed wireless microwave systems; 6) mobile wireless microwave systems; and, 7) satellite systems.

All of these types of systems are currently being used to connect end users to various points of presence on a middle-mile backbone. This is called "last mile" connectivity. The middle-mile backbone is the infrastructure system that transmits the data to the worldwide Internet. This is usually called the "Middle-Mile Backhaul" system. Today this underlying infrastructure system is mostly fiber optics, with some copper. Satellite systems are separate and because of the high cost and lack of reliability, are often not a technology included in developing access. However, as technology continues to change, what does not work now, may work in the future and it is important to keep monitoring the capacity of all technologies.



For "last mile" connectivity, all of these types of digital infrastructure are employed by private providers and may share resources. AT&T and Comcast are the main back-haul fiber providers, while the back-haul for one local fixed wireless provider comes from the transpacific fiber optic cable in Manchester, owned by US Cable. Frontier Communications is the owner of the copper line system in several of the northern communities, which can only provide dial-up or DSL services. Consequently, local "last mile" providers are dependent upon securing their backhaul capacity from AT&T or Comcast fiber or the US Cable fiber optic cable. Some providers can purchase access directly from AT&T and Comcast while others secure their needed backhaul capacity from Sonic which has special pricing from AT&T.

WHY IS DIGITAL INFRASTRUCTURE IMPORTANT & WHY PLAN?

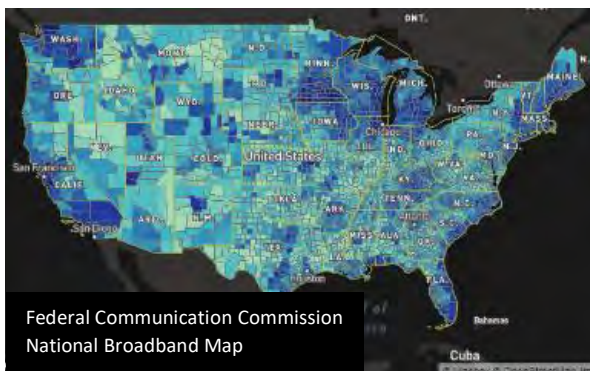
Digital infrastructure is crucial for economic growth, education, emergency communications, access to medical services, government services, etc. It is an essential part of Mendocino County's infrastructure. It allows our businesses to operate in the 21st century economy, provides access to training and education to improve the workforce, and provides jobs for rural residents. Cell phone and broadband services are also critical for public safety. As the county experienced in both the Redwood Valley/Lake Mendocino Complex Fire of 2017 and the Mendocino Complex Fire of 2018, resilient communication systems that inform residents in a timely manner and allow emergency response professionals to communicate, are absolutely critical for saving lives and protecting fire fighters.

Digital infrastructure is expensive and the return on investment (ROI) for big telecommunication companies in rural areas is low. This is the source of the digital divide. There is a public need for a service that private industry is either unable or unwilling to provide in an equitable manner.

This is why Mendocino County needs a strategic plan to ensure equitable and reliable high speed internet access.

NATIONAL TRENDS

Across the nation, internet is the backbone of the economy and the functions of daily life. Computers and the



internet have created a whole new culture by changing the ways we interact with our coworkers, families, friends, and even our public institutions and governments. Business operations, once requiring a physical presence in a specific location, can now operate from anywhere around the globe. More and more workers are being offered the option of telecommuting for jobs that can easily be done from remote locations.

A growing number of government agencies now provide quick and easy access to resources and information through online services, from the California DMV to Social Security. And already, a large number of government agencies require compliance information to be submitted online only, with paper submittal no longer an option.

While there is a huge entertainment industry focused around the internet including Netflix, Amazon Prime, Hulu, and YouTube, entertainment is not the motivation for publicly supported high-speed internet. The driving needs for high-speed internet are our economy, education, emergency services and health care.

The internet is now engrained in education for schools across the country. As the nation continues to promote Science Technology, Engineering, and Mathematics (STEM) programs, internet access is a critical component of learning. Even statewide and national tests for students have moved to an online platform.

Over the last 10 years, wireless internet has seen exponentially high levels of growth through fixed wireless networks. As engineers and researchers find ways to pack more and more data into radio waves, internet access via cellular phone data and fixed wireless networks are



gaining capacity and becoming more reliable. Fixed Wireless is now an accepted method of delivering “broadband” internet. However, cell phone databased internet still lacks the speed and reliability needed to be considered “broadband.”

CHALLENGES TO RURAL DIGITAL INFRASTRUCTURE DEPLOYMENT

In August 2009, USDA issued an Economic Research Report recognizing the importance of high-speed internet for rural economies and noting the lack there of.¹¹ Since that official federal government recognition, the challenges of deploying rural broadband have not gotten easier and the speeds required to participate in a 21st century economy have increased exponentially.



Rural digital infrastructure deployment faces challenges across the nation due in part to the low density of populations in relation to the high operating costs for service. Installing infrastructure in urban areas has a very high return on investment (ROI), quickly recovering infrastructure costs and the ongoing service costs, which meets the corporate bottom-line. Rural areas do not offer that level of return.

According to Dr. Jenna Burrell of UC Berkeley who studies rural internet access, “People living in rural areas are frequently left with few (if any) options for Internet

connectivity. The Internet services that are available often impose data caps, may be unreliable, often do not provide service at speeds that qualify as ‘broadband,’ and/or are disproportionately expensive when compared to Internet services available in urban areas.”¹²

CURRENT STATUS OF DIGITAL INFRASTRUCTURE IN MENDOCINO COUNTY

Mendocino County’s goal is to have available and affordable high-speed internet access to 98% of households by 2025. According to the State of California, Public Utility Commission data from December 31, 2016, 80% of Mendocino County households have access to high-speed internet which is currently defined as 6 mbps download speed and 1 mbps upload speed. These numbers do not include the households connected through several providers that do not report to the CPUC which may account for more than 3,000 additional households. If those numbers are added in and assumed to be served and not underserved, connectivity is closer to 88%.

However, data from the Census and Healthy Mendocino indicate that there are over 40,000 households in the county which is significantly more than what is recognized by the CPUC. The CPUC reports annually on the “availability” of



¹¹ Sternberg, Peter, Mitch Morehart, Stephen Vogel, John Cromartie, Vince Breneman, and Dennis Brown. “Broadband Internet’s Value for Rural America.”

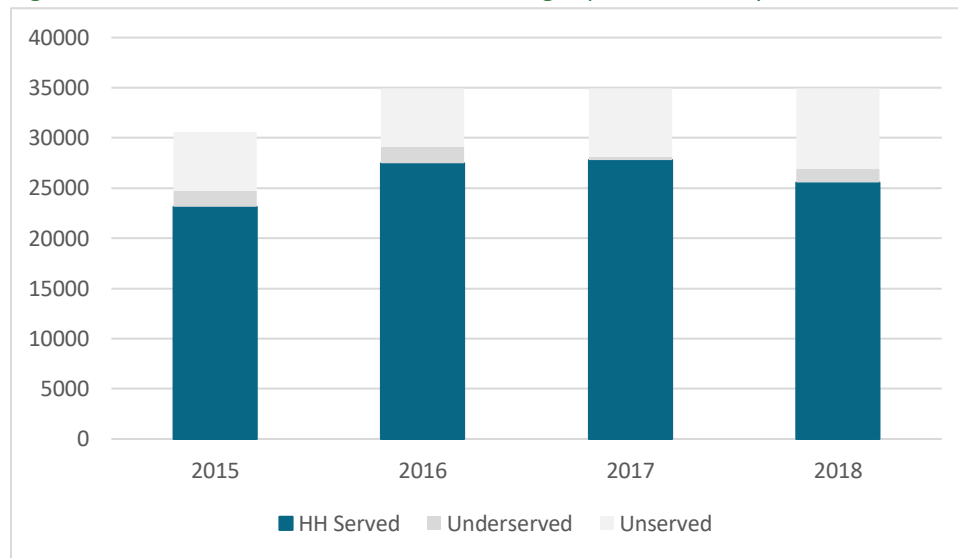
US Department of Agriculture, Economic Research Report No. 78, August, 2009.

¹² Burrell, Dr. Jenna. “The Value of Internet to Rural Populations: A case study from Mendocino County, CA.” Berkeley School of Information, 2016.

internet by census block. If one household is served in the block, then it is counted as served. In Mendocino County, because of our rural population, a census block may be fairly large geographically, and very often a block that is designated as served is only partially served and could have as low as one household with access. Using this data to plan is somewhat difficult and the reason that EDFC conducted a separate survey.

CPUC data can be used to get rough estimates and must be viewed as an overestimation. With that caveat, the following chart shows the number of served v. unserved and underserved households in Mendocino County based on CPUC data. “Served” means households that have at least 6mbps download and 1 mbps upload speeds “available.”

Figure 1: California Public Utilities Commission High Speed Availability Data 2015-2018



It is worth noting that according to the available data, there was no change in service between 2015 and 2016 and that there was only a slight change in service between 2016 and 2017. It is not clear at this time why there is a significant sharp decline in connectivity in 2018. Note that the years on the chart reflect the year after the end date on the calendar year. So, 2015 data is actually current based on December 31, 2014 and 2016 data reflects availability that was current on December 31, 2015. It is possible that homes lost in the Redwood Valley/Lake Mendocino Complex Fire were removed from census tracts served as of December 31, 2017. However, the CPUC is still using the 2010 Census count of households, so, if households were lost in 2017 due to the Redwood Valley/Lake Mendocino Complex Fire, this would show up as a reduced number of households served and not a reduction in total households. This would result in a reduced percentage of households served. Again, in the last five years, there has been huge growth among wireless internet service providers (WISPs). Based on the survey conducted by EDFC in October of 2018, a conservative estimate is that 3,000 households have been connected with wireless service over the last five years.

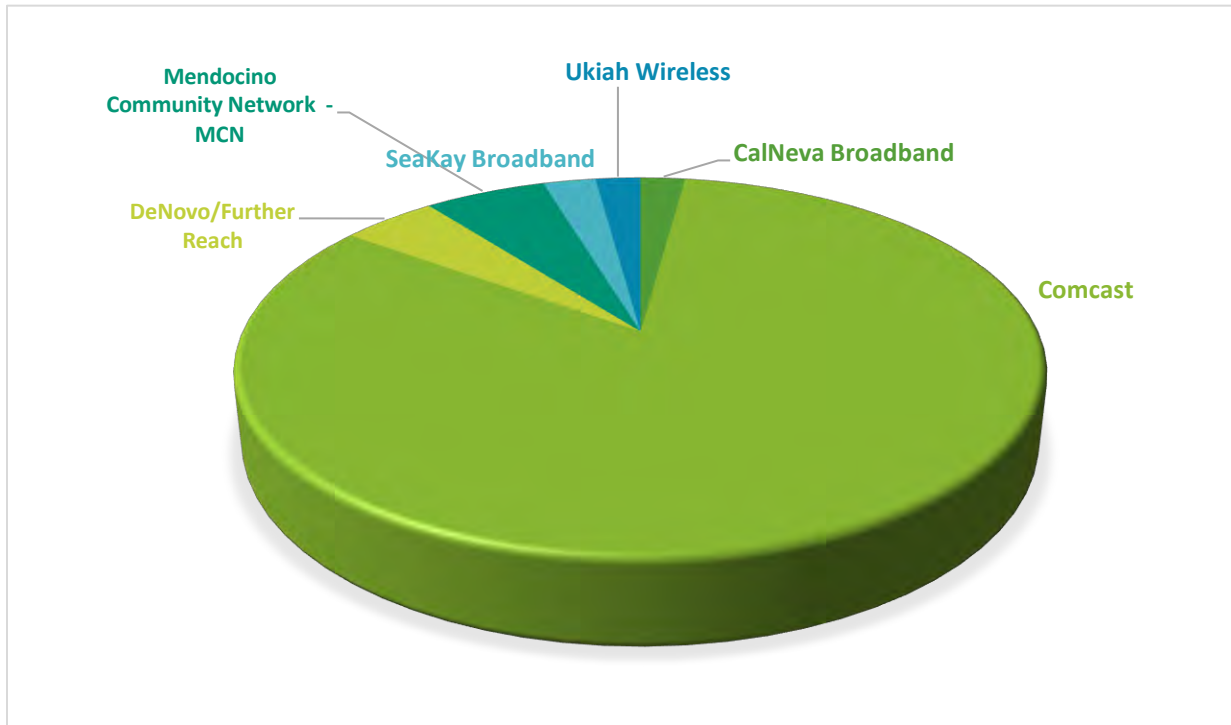
In October of 2018, EDFC conducted three surveys; a residential broadband access survey, a non-residential broadband access survey (businesses, community and anchor institutions), and a survey of internet service providers in Mendocino County. The results of the surveys were used to develop this plan, to create a better understanding of the current level of access, and to develop target areas for future projects.

SERVICE PROVIDERS

There are at least 14 different internet service providers in Mendocino County providing fiber optic cable internet, DSL, fixed wireless, dial-up, and satellite internet. While the goal to provide affordable high-speed internet access to 98% of the households in Mendocino County typically refers to either fiber optic cable known as broadband or fixed wireless technology, in a county the size of Mendocino, it is unlikely that we will be able to provide that percentage without other types of service. Technology continues to grow and change, and it is critical to monitor all options to determine if they will become affordable and reliable methods of delivering high-speed internet to rural and remote areas of the County.

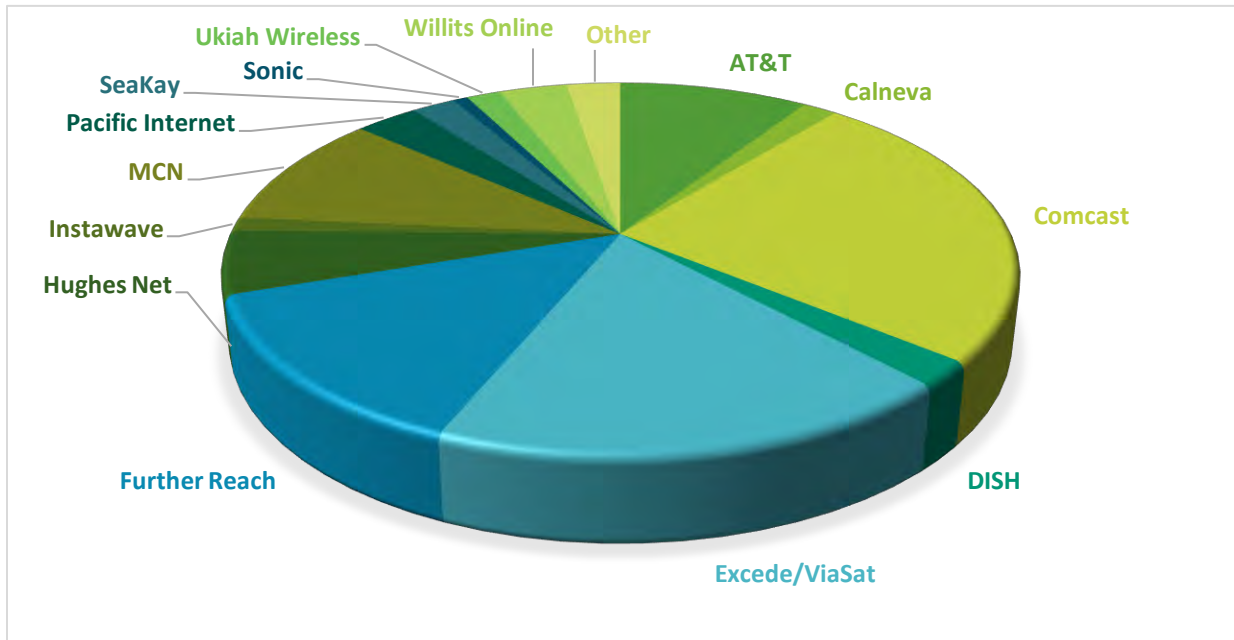
The two largest providers of fiber optic cable internet service in Mendocino County are AT&T and Comcast. In the more concentrated population areas, these companies provide mostly reliable high-speed service, though affordability is still a challenge. In addition to these corporations, there are several small wireless internet service providers and community internet service providers. These include Willits Online, Further Reach, SeaKay Broadband, and Ukiah Wireless. Mendocino Community Network provides ADSL and dial-up services. In the survey ISPs were asked how many customers they serve. Figure 2 below shows the results.

Figure 2: Service as Reported to EDFC by Internet Service Providers, Total HH Served: 32,620



It is important to note, that there was no response from AT&T in this survey so it is not possible to use this data for estimating the number of people served. Respondents to the residential survey were asked who their provider is. The results are shown in Figure 3 below.

Figure 3: Residential Survey Results Provider of Service



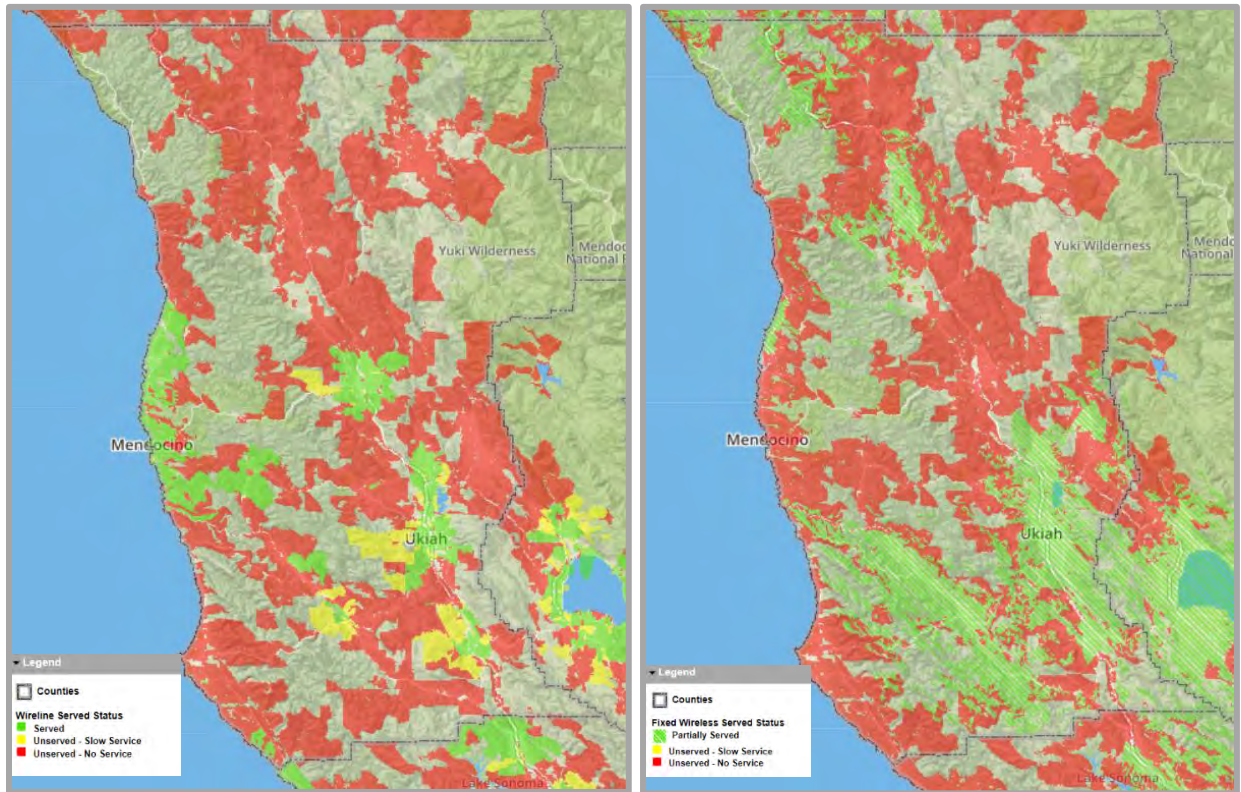
This data cannot be compared directly to the CPUC data, as the CPUC data shows availability only and there is overlap which is seen in the table below and if added together would total 88,899 with access to high speed internet service:

Table 1: CPUC – Number of Households Served by Provider

Provider	Households w/Availability
101 Netlink	12,914
AT&T California	13,228
CalNeva Broadband	208
Comcast	22,104
DigitalPath, Inc	13,894
North Coast Internet	13,674
Sonic.net	12,568
Valley Internet	309

The CPUC does provide an online mapping tool that shows availability by census block. The following maps show the availability of both wireline and fixed wireless access in Mendocino County. Larger versions of these maps and additional detailed maps can be found in the Maps section.

Figure 4 & 5: Wireline Availability and Fixed Wireless Availability in Mendocino County as of 12/31/2016

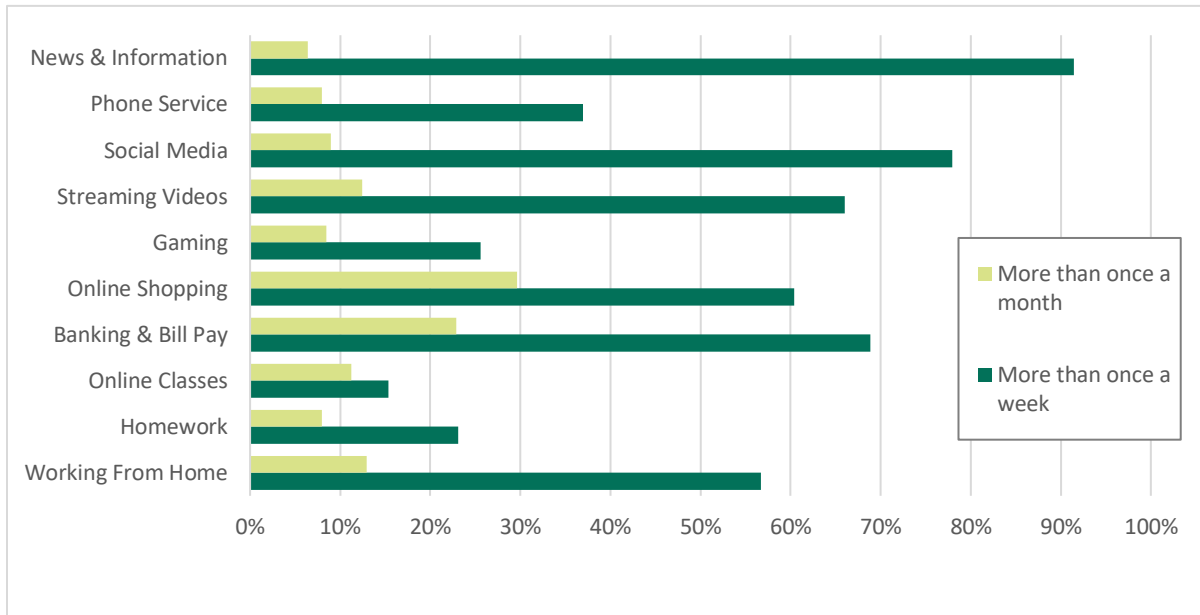


By combining and analyzing all of this data, there is a starting point to identify problem areas and begin creating a plan.

RESIDENTIAL USAGE

In a county where self-employment and telecommuting are extremely high, it is very difficult to parse out residential use from business use. There were over 500 responses to the residential internet access survey conducted by EDFC. The survey asked residents if they had internet, how they used it, how much it cost, and whether it was sufficient for their needs. Of the individuals who responded to how they use the internet (421), almost 60% said that they work from home more than once a week. A very high percentage of residential users also indicated that they are regularly paying bills, managing their households, accessing goods and services, and getting news and information via the internet. Unfortunately, in response to the sufficiency of internet access, less than 30% of respondents with access said that their service was always sufficient or better. (see Figure 6 below.)

Figure 6: Residential Survey Results: Use of Internet in Mendocino County by Frequency



CONNECT AMERICA FUNDS IN MENDOCINO COUNTY



Photo by Mendocino Sports Plus, Paul McCarthy

In August of 2015, AT&T received \$428 Million of Connect America funds to develop broadband access for 2.2 million households across the United States. They accepted over \$60 Million to connect over 140,000 households in rural California.¹³ In a presentation on March 27, 2018, they told the Mendocino County Board of Supervisors that their goal is to serve up to 2,200 households in Mendocino County.

In their presentation, AT&T informed the board that they met the requirement for their Connect America grant for 2017 of 40% completion (state-wide percentages, not county) using existing towers, and said that for 2018 through 2020, they are working on installation of about 18 towers in Mendocino County, to bring remaining planned service to homes and businesses. The actual number they will serve in Mendocino County is unknown. All final percentages and numbers are state-wide. As of the March report to the board, the 18 towers were in various states of planning.

The roadblocks they face include: the terrain, finding sites that work with owners who are willing to have a tower on their property, and finding sites where the owner *and* the neighbors are willing. AT&T said they will complete the installations of the towers and new services by the end of 2020. All of the services included in this project are in hard-to-serve areas of the County. However, there are extremely-hard-to-serve areas that are not being addressed with these funds.

¹³ <https://www.fcc.gov/document/att-accepts-428-m-connect-america-fund-rural-broadband>

BUSINESS & INDUSTRY

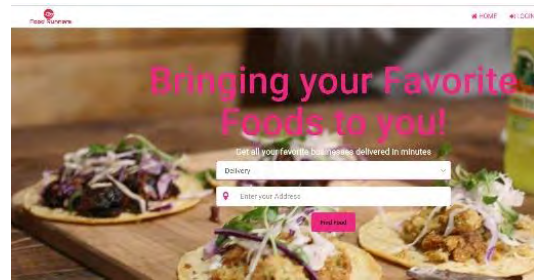


Photo by Jim Moorehead Photography

There is no question that access to high-speed internet is fundamental to the economic prosperity of Mendocino County. Internet is integrated into almost every aspect of business from purchasing supplies and inventory to internal and external communications, to marketing and outreach. Our agriculture industry, which contributed \$268,692,700 to the county economy in 2017, relies more and more on broadband for marketing, communication, reporting and precision agriculture. In EDFC's Non-Residential Broadband Survey, there were approximately 50 responses from businesses, local governments, and non-profit organizations. Eighty Percent of the respondents said that it was

crucial to their operation. The remainder said that they could run without it, but it would be a hardship or that they could run but could not perform all of their functions. Not a single respondent said that it was unimportant to their business operation.

There is some self-selection involved with who responds to a survey about internet access, so it is reasonable to assume that there are businesses in the county that operate and do not use the internet or feel they need it. In fact, many small retailers see the internet as a threat to their business as the prevalence of online shopping continues to grow. Locally that is borne out by the 60% of respondents to the residential survey who said they shop online more than once a week.



Improving high-speed internet access through the deployment of reliable technologies is essential for economic growth in Mendocino County. As noted in the introduction, studies show that for every dollar invested into high-speed internet infrastructure, there is an estimated \$4 economic impact.

TECHNOLOGY IN ANCHOR INSTITUTIONS & LOCAL GOVERNMENTS

High-speed internet access is critical for all types of anchor institutions and local governments. From fire departments to public libraries and health care providers, high-speed internet is now critical infrastructure.

LOCAL GOVERNMENTS

Almost all local governments are considering the importance of technology in their plans for both internal operations and to serve their constituencies.

The County of Mendocino has been working on a plan for improving their use of technology. On November 6th the Board of Supervisors accepted a Technology Master Plan. *"The objective of the Master Plan includes developing and articulating a vision for the effective use of technology to support the work of the County. The master plan*

identifies information technology strategies that have a positive return on investment and improve public safety or resident service.”¹⁴

These efficiencies are critical for all local governments as they struggle with staffing, budgets, and timing. However, improving their services through technology also requires that both the local governments and the residents who interact with these systems have the bandwidth necessary to operate.

The City of Ukiah Strategic Priorities for Information Technology include developing a prioritized plan for public infrastructure, employing sound planning principles in the City and greater valley, promoting and strengthening economic development, and improving the organizational workplace environment.¹⁵

The City of Fort Bragg set a goal of improved access to technology in their Economic Development Strategy for 2014 – 2019:

“Adequate and consistent broadband access has become a basic necessity for successful business. Although most areas inside [Fort Bragg] City limits have access to basic broadband services, the City lacks reasonably-priced access to high-capacity T1 service lines for the general business population. In addition, some areas located just outside City limits lack internet service except via satellite or dial-up. Finally, there is little access to wireless internet in Fort Bragg for the visitor population.”

The City of Willits currently does not have a broadband plan, but they were able to work with Caltrans to get 4” conduit installed under the sidewalks on both sides of Main St. from the Hwy. 20 intersection to the Sherwood Rd. intersection during the recent reconstruction. Willits is hoping to work with a provider in the future to establish some type of public/private approach to utilizing the new infrastructure to provide high-speed internet for free Wi-Fi downtown along with improving service for businesses, schools and City Hall. They hope to develop a broadband plan in the near future that would include extending conduit into side streets.

The City of Point Arena does not currently have a broadband plan. Historically they have been extremely underserved, but with the advent of the small non-profit Further Reach initiating service on the south coast, there has been improvement in access through fixed wireless for City facilities, residents, and businesses. An important and immediate improvement for 2019 will be fixed wireless access at the Point Arena Pier. Additionally AT&T has fiber along Hwy 1 that serves the schools, the County library branch and the County Sheriff’s office. The City of Point Arena is looking for opportunities to access service from this AT&T fiber.

County of Mendocino’s Microwave System

The County of Mendocino has a network of Microwave Towers. Overall, the County's capacity is significantly less than is needed for current and future County needs, and doesn't have the capacity to serve residential use. There are two extremely limiting factors:

1. Terrain – a high percentage of the county is mountainous with dense foliage with elevations ranging from sea level to nearly 7000'

¹⁴ ClientFirst Technology Consulting, “Technology Master Plan.” Mendocino County, October 29, 2018.

¹⁵ City of Ukiah, Annual Budget, Fiscal Year 2018-2019. Pg. 169-172.

2. Lack of available fiber for high capacity back-haul required to provide the general public with acceptable broadband throughput.

The County’s back-haul provider is Sonic.net, a CLEC out of Santa Rosa, that purchases back-haul from AT&T. The County currently owns several communications towers and leases equipment/tower space on several state and commercially owned towers. Each tower has multiple microwave links/dishes creating a network throughout the County for county data as well as for all public safety radio communications. The towers are anywhere between 6 to 28 miles apart which limits network speed/throughput due to RF propagation losses which are the means through which radio signals travel. Radio Signals are affected by the medium in which they travel and this can affect the radio propagation or RF and the distances over which the signals can propagate. These longer path distances reduce microwave signal strength substantially which reduces available throughput. The county is just beginning feasibility studies and engineering to increase the capacity of the County microwave system to as much as 300 megabits.

The current microwave system serves the County administration buildings in Ukiah, Willits and Fort Bragg with 75 megabits data capacity. The public libraries (5 branches) share a wireless 100 megabit circuit from Sonic.

LIBRARIES

The 5 public libraries in Mendocino County provide both public access Wi-Fi and computers. They do not track the use of Wi-Fi, nor daily users who are set up with their laptops, but they do track usage of the public access computers. It is important to note, that since these computers can only be used for a short period of time, it is unlikely anyone is using the public access computers to run a business or telecommute. However, it shows the critical nature of these machines, especially for some of Mendocino County’s most vulnerable populations who have no other source of internet access:



Table 2: Monthly Usage of Public Library Public Access Computers

Branch	Monthly Computer Hours of Use
Ukiah	1,181
Fort Bragg	1,042
Willits	656
Coast	424
Round Valley	295

While there is no formal data on the use of the library for telecommuting, informal discussions with branch librarians indicate that there can be 5-10 people daily in individual libraries that set their laptops up and conduct business.

HEALTH CARE



There are three major hospitals in Mendocino County, all of which report sufficient high-speed internet access. However, many of the small rural health clinics that serve as the main providers of care for rural populations lack sufficient service.

There are many medical providers outside of the hospital that rely on access to the internet for the mandatory electronic patient care reporting and billing. Slow speeds for health care often means wasted time for doctors, nurses, and medical professionals in a county where these providers are in short supply.

Additionally, telemedicine provides access to doctors and specialists that are frequently inaccessible in rural and remote areas and this requires a very high-speed secure wireline service.

EDUCATION

The Mendocino County Office of Education (MCOE) is currently the service provider/ISP for the County school districts with a system through AT&T – Advance Switch Ethernet with a 10 Gig limit. Dave Smith, MCOE Director of Technology, reports that total usage has not yet reached 5 Gigs. There are two outlying schools and one school district that cannot be reached by the fiber system including Round Valley Unified, Whale Gulch School in the Leggett District and Sherwood Elementary School in the Willits District. They are all connected to the MCOE system through fixed wireless, with service that is just adequate but needs improvement. Laytonville Unified currently has a contract with Frontier Communications but will utilize the MCOE system when that contract is up.

Generally, the districts that are utilizing the MCOE service report that they are adequately served, but there are areas that are experiencing slow speeds mostly on the south coast. An immediate issue for school districts being able to improve bandwidth is the legal requirement for a filter to secure internet service. MCOE needs to come up with \$100k in funding to double the capacity of the current 5-gig filter.

The Charter Schools in the County have a range of access, from utilizing the MCOE system to service from local providers, including fixed wireless. For the schools not in the MCOE system, service is less adequate, with cost and availability as the limiting issues.

One of the most significant challenge for education in the county is the number of students who do not have access to internet at home. Most Mendocino County School Districts provide a laptop/Chromebook for each student and many schools now utilize online systems for homework assignments and grades notification. Many students who live outside of our cities, have poor or no internet access at home. In order to do their homework, they must download homework related documents before leaving school and are not able to do any research or online learning at home.



“The homework gap, or the barriers students face when working on homework assignments without a reliable Internet source at home, ... has widened as an increasing number of schools incorporate Internet-based learning into daily curriculum. Approximately 70% [nationally] of teachers assign homework requiring access to broadband. In addition, about 65% of students used

the Internet at home to complete their homework, which could include submitting assignments, connecting with teachers and other students through group discussion boards, working on shared documents as part of a group project and doing online research for a school paper. Parents rely on the Internet as well to be fully-informed on their child's academic performance, with many schools turning to online grading systems.”¹⁶

EMERGENCY SERVICES AND RESILIENCY

The internet and cellular networks are critical infrastructure for public safety and the networks need to be redundant and resilient. Over 90% of survey respondents said that they use the internet to get news and information more than once a week and 45% said they are using the internet for their phone service. This is important for public emergencies and natural disasters. It is also important when there are telecommunication outages.



In August 2014 a 45-hour outage severely impacted 8 communities along the Mendocino Coast. Internet and most phone systems weren't working, and because of the system set up, Laytonville, which was experiencing a nearby wildfire at the time, was also not getting cell phone or internet service.

These outages are extremely crippling to communities and economies, as was demonstrated by a major telecommunications outage in 2015. On September 3, 2015

at 9:55 a.m., fiber cable owned by AT&T located in a remote area of Mendocino County was cut by vandals, resulting in a widespread telecommunications network failure across the 3-county region of Mendocino, Humboldt and Del Norte counties. The lack of redundancy and diversity in AT&T's infrastructure and the dependence of other providers on AT&T's fiber, caused a loss of services for 24 hours across Mendocino County.

The 2015 outage impacted services including Internet, mobile telephone, landline telephone, business processes such as fax and credit card processing. Most critically, it resulted in the loss of 9-1-1 services from seven Public Safety Answering Points (PSAPs).

A survey was done at the time with results showing that:

- 96% of respondents lost some or all forms of communication
- 96.5% of the 364 non-residential respondents indicated that they were impacted, ranging from reduced capacity to function, to having to close their doors
- 47% of businesses/organizations reported loss of income.



¹⁶ The Homework Gap: The 'Cruellest Part of the Digital Divide' by Clare McLaughlin, <http://neatoday.org/2016/04/20/the-homework-gap/>

AT&T has reported back to Mendocino County that they have addressed issues with redundancy in the network, and except for countywide power outages and burning of aerial fiber related to wildfires, there have not been any mass telecommunications outages reported. Any future deployment of fiber optic cable or line extensions needs to address resiliency and redundancy for emergencies and natural disasters.

It is also critical to make sure there are back up power systems to run telecommunications. Wildfire season has become extremely dangerous in California, and the loss of telecommunications due to a power outage or a power shut-off to prevent fires, could be deadly for people who expect notifications that would be delivered through reverse 911.

SWOT ANALYSIS OF DIGITAL INFRASTRUCTURE IN MENDOCINO COUNTY

In order to develop strategies to reach the goal of 98% connectivity in Mendocino County, this plan first looks at the Strengths, Weaknesses, Opportunities, and Threats (SWOT) Analysis.

STRENGTHS

LOCAL GOVERNMENT LEADERSHIP

- Almost all local governments recognize the importance of high speed internet access
- Mendocino County has had active engagement from members of the Board of Supervisors who understand the need for improving high-speed internet access and are willing to be involved in the effort to make improvements.
- Mendocino County is a member of the North Bay North Coast Broadband Consortium (NBNCBC).
- The Executive Office of Mendocino County has supported broadband work by creating the contractual position of a County Broadband Coordinator and County Manager for the NBNCBC.

BROADBAND ALLIANCE OF MENDOCINO COUNTY

The BAMC is a grassroots community group that was first formed as the Mendocino Coast Broadband Alliance by citizens who recognized the importance of broadband access for our local economy and community. The group expanded and became the Broadband Alliance of Mendocino County with representation and support from the County of Mendocino, the Community Foundation of Mendocino County, and Economic Development and Financing Corporation. This group provides a forum for exchange of information and collaboration between partners, as well as advocacy for legislation and policies to improve rural broadband deployment.

WISPS AND LOCAL PROVIDERS

Local providers, who are themselves local residents that care about the community and provide internet access for their family, friends, and neighbors, are a major strength. Mendocino County has a lot of talent and WISPs that are also local businesses that create local jobs by hiring local people. While they still need a return on their investment, they are not trapped by a corporate model and have more flexibility and capacity for collaboration.

EXISTING PARTNERSHIPS AND CONSORTIUMS

- The collaboration of the North Bay North Coast Broadband Consortium (NBNCBC) which includes the Counties of Napa, Sonoma, Marin, and Mendocino, has provided an important foundation for digital infrastructure development.

- Relationships forged with organizations such as the California Emerging Technology Fund (CETF) and The Utility Reform Network (TURN) have provided important support in this very technical field.

CPUC GRANT SUPPORT

The California Public Utilities Commission has provided funding through the North Bay North Coast Broadband Consortium to support the County of Mendocino’s Broadband Coordinator and to develop this strategic plan. The NBNCBC is in the process of preparing an application for the coming three years to continue important efforts in the county.

EXISTING DARK FIBER

There are reports that AT&T has “dark” or inactive fiber-optic cable throughout Mendocino County. However, any information about the network, dark or lit, is proprietary and AT&T will not share information about it. However, if there is actually dark fiber, as demand grows, this fiber may be ready and available to increase capacity of service.

WEAKNESSES

Deploying high-speed internet in Mendocino County is not without many challenges. These obstacles are what necessitate having a strategic plan.

TERRAIN AND GEOLOGY

Mendocino County is a beautiful place with a mountainous terrain, redwood forests, and oak covered hills. Unfortunately, while the terrain shapes our rural lifestyle, it creates serious challenges for the deployment of all kinds of infrastructure. County residents are familiar with the constant road work on Hwy 101 in between Willits and Ukiah, where the ground continually shifts. Two major landslides on Highway 101 and Highway 1 shutdown the highways and severely affected communities in northern areas of the county.



The majestic redwood trees that characterize many parts of the county often create obstacles for fixed wireless systems which require “line-of-sight” from one tower to the next.

POPULATION DENSITY/MARKET SIZE

Mendocino County is home to approximately 89,000 people spread over 3,800 square miles. As identified by the ISPs that responded to our survey, low population density is a major issue in a for-profit business model.

ECONOMIC CAPACITY

Mendocino County has a significantly lower median income (\$43,510) than the State of California (\$63,783). The economy is now inextricably linked to the internet. In large urban areas, \$70/month typically provides fast broadband speeds. But, in Mendocino County, where cost of service is higher, it may only provide for minimal basic service.

LACK OF EQUITY IN ACCESS TO HIGH-SPEED

For low-income households, \$70/month is likely to be a significant burden on the household budget. This includes the 3,234 households that are below the poverty line, 2,549 of which have children that need high-speed internet for school homework. AT&T and Comcast have low income programs, but there are not programs for individuals served by WISPs or satellite which are typically the providers serving the most rural areas of the county.

SOCIO-CULTURAL CONTEXT

In the past, there was a significant constituency in the county that was actively opposed to expanding technology. Many people perceived it as a detriment to our rural community lifestyle. While most people in the county now understand its importance to preserving our rural lifestyle, the anti-technology attitude still exists in some communities and prevents the development and implementation of projects.

There are also individuals that believe fixed wireless and microwave technology have negative health impacts. While there is no conclusive evidence, there are enough people who believe they are sensitive to microwaves that makes it worth monitoring research for future planning.

PLAYING CATCH UP

Mendocino is behind in connectivity. Even if the number of households reported as served by the CPUC was accurate, their estimate for the county is still far behind the California State goal. As technology is changing and getting faster, it is difficult to catch up to the old goals while new moving targets are being created.

HIGH COST OF BACKHAUL

Several WISPs are interested in providing faster service but note that the cost of backhaul is too expensive.

DEAD ZONES ON THE CELLULAR NETWORK

Mendocino County has a lot of dead zones on our cellular network. These are not just in remote areas of the county, but on major routes. The lack of cell service presents public safety risks for motorists and emergency services. The following is an emergency services identified list of “dead zones” on main roadways in the county:

Name of Hwy/Road	Type	Locations/Miles
Highway 101	Principal Arterial	<ul style="list-style-type: none">• MP 36 – 43: Ridgewood Grade to South of Willits• N. or Willits beginning at Reynolds Hwy. to Long Valley and the 162 intersection• N. of Leggett from Jitney Gulch Bridge to Standish Hickey state park and north to the County line
Highway 20 West	Minor Arterial	<ul style="list-style-type: none">• From Irmulco Rd. to Camp 20• Past Camp 20 to McGuire pond – go 3-4 miles before pick up a signal again
Highway 253	Minor Arterial	<ul style="list-style-type: none">• 5 miles west of Hwy 101 to Boonville

Highway 1	Minor Arterial	<ul style="list-style-type: none"> • From Hales Grove to Rockport very spotty • Rockport to Soldier Frank Point – no connection
Highway 162	Major Collector	<ul style="list-style-type: none"> • No connection 4 – 6 miles in from 101/Longvale (depending on server); becomes spotty closer to the Valley
Branscomb Road (Rd. 429)	Major Collector	<ul style="list-style-type: none"> • Past the summit going west for a mile
Laytonville Dos Rios Rd. (Rd. 322)	Minor Collector	<ul style="list-style-type: none"> • Half way going east at Hamburger through Dos Rios
Potter Valley Rd.		<ul style="list-style-type: none"> • Significant areas with no connection

AGING INFRASTRUCTURE

A significant portion of the telecommunications infrastructure in Mendocino County is old and needs maintenance. This includes both copper wiring for land-line phone service and older fiberoptic cable networks. This has resulted in two major issues. 1) Phone systems are unreliable and, in many cases, don't work at all and 2) there are failures in critical communication systems, particularly during emergencies as the outdated infrastructure cannot handle the large amounts of usage needed during emergency situations. This has led to data throttling on emergency alerts which delays and slows alerts and information.

OPPORTUNITIES FOR DIGITAL INFRASTRUCTURE DEPLOYMENT IN MENDOCINO COUNTY

“DIG ONCE” POLICIES

A “Dig Once” Policy is an important tool that can be utilized to maximize the efficiency and lower the cost of public works and infrastructure projects through combining efforts. For example, during road construction, installing conduit or conduit with fiber, at the same time as other trenching, reduces the cost of installing fiber and means that the road won't have to be torn up to install it at a later date. This tactic can be used around any kind of sewer, water, or electrical infrastructure work.

COLLABORATION OF WIRELESS INTERNET SERVICE PROVIDERS

The most efficient and effective way to support this growth is through collaboration. It is possible to leverage local funds to access grant funding, purchase backhaul at lower costs, increase capacity, and develop a workforce.

While fiber optic networks cost millions to deploy, wireless systems can be deployed for significantly less. Relay towers can be in the range of \$30,000, and in rural and remote Mendocino County, that may serve as few as 5 households. Some of the local WISPs report that infrastructure cost typically takes 5-years for a return on the investment which is functional for a small business with a minimum of 20 customers per tower, but does not work for less. Finding ways to help offset the cost to the most remote sites can improve the ability of small local businesses to serve these areas.



STATEWIDE PARTNERSHIPS AND INITIATIVES

We are part of a big state that has a number of entities working on broadband and fixed wireless technologies. If Mendocino County taps into these networks there may be opportunities:

- Corporation for Education Network Initiatives in California (CENIC - nonprofit)
- California Telehealth Network (CTN)
- California Broadband Council (CBC – a state agency)
- Rural County Representatives of California (RCRC)

TELECOMMUTERS AND THE RURAL LIFESTYLE

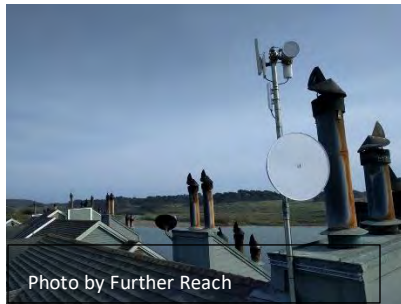


Photo by Further Reach

Mendocino County, depending on the destination, is a 2 - 3.5 hour drive to the Bay Area, an easy distance from some of the world's leading high tech companies. While the county is not a prime location for a major corporate office, many of these companies are trending toward a more dispersed workforce with individuals telecommuting from home. As the population of the Bay Area continues to grow and housing becomes even more expensive, Mendocino County offers rural landscapes and rugged coastal bluffs that provide a friendly backdrop for a more laid-back lifestyle. Over 230 of the 477 respondents to the residential broadband survey conducted

by EDFC said that they telecommute more than once a week. Growing demand from this group of high-wage workers can help provide the customer base necessary for Internet Service Providers to expand high-speed internet options with a return on investment.

GRANT FUNDING

There are several sources of grant funds for deploying digital infrastructure projects. These include:

USDA Rural Economic Development Loan and Grant (REDLG) Program

This program supports rural projects through local utility organizations. USDA provides zero- interest loans to utilities which they, in turn, pass through to local businesses (ultimate recipients) for projects that will create and retain employment in rural areas. The maximum loan is \$2 million and the maximum grant is \$300,000.

USDA RD Community Connect Grant

This program funds broadband deployment into rural communities where it is not yet economically viable for private sector providers to deliver service. Matching funds of at least 15% from non-federal sources are required and can be used for operating costs.

USDA Rural Broadband Access Loan and Loan Guarantee Program

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 service at the "broadband speed" in eligible rural areas.

Economic Development Administration (EDA) Public Works Program

EDA Public Works Program investments help facilitate the transition of communities from being distressed to becoming competitive by developing key public infrastructure, such as technology-based facilities that utilize

distance learning networks, smart rooms, and smart buildings; multi-tenant manufacturing and other facilities; business and industrial parks with fiber optic cable; and telecommunications and development facilities.

California Advanced Services Fund (CASF) Infrastructure Grant

CASF grants are designed to assist in the building and/or upgrading of broadband infrastructure in areas that are unserved by existing broadband providers. AB 1665 provides the commission the authority to award grants to fund all or a portion of construction costs for projects in unserved areas. AB 1665 allows the commission to determine, on a case-by-case basis, the level of funding to be provided for a project and directs the commission to consider factors including, but not limited to, the location and accessibility of the area, the existence of communication facilities that may be upgraded to deploy broadband, and whether the project makes a significant contribution to achievement of the program goal.

Microsoft Airband Initiative

The MAI supports businesses working to increase internet and energy access and makes it more affordable. Partnerships include co-investment, and access to resources like technology, digital skills, and reseller programs.

While these funds are all “broadband” specific, there are many other funds that could potentially be used. These include funds to support connectivity for emergency services, or technology in agriculture, inclusive economic development, or even education.

PUBLIC-PRIVATE PARTNERSHIPS

- Cities and counties alone do not have the capacity, expertise, or the capital to develop fiber optic networks without engaging in partnerships with private entities. However, they can play an important role in making sure that private dollars are invested in ways that provide access in an equitable manner.
- Local governments and other public agencies, including special districts, can play a critical role in serving their communities with high-speed internet access. In addition to the ability to apply for grants, they can also leverage “Dig Once” policies to make it possible for private entities to deploy fiber. Additionally, public right of ways and other publicly owned land and facilities can be used to support creative solutions.
- The “dark fiber model”, in which local government directly deploys a fiber to the home (FTTH) network and provides a private partner with a license to use the government-owned fiber, is another option. Another similar option is when the partner “lights” the fiber and offers services to end users.

EMPLOYMENT TRAINING PROGRAMS & RURAL TECHNOLOGY

Young people who are interested in technology often feel they need to leave Mendocino County to begin a high-tech career. There is an opportunity to work with Mendocino College and other career education programs to develop and implement more programs focused around jobs in deploying and maintaining high-speed digital infrastructure systems. This can also be a strategy to help train a workforce in higher wage job opportunities.

THREATS TO DIGITAL INFRASTRUCTURE DEVELOPMENT IN MENDOCINO COUNTY

OUTSIDE CONTROL OF MENDOCINO COUNTY’S DIGITAL INFRASTRUCTURE

AT&T owns the majority of Mendocino County’s fiber optic cable and has not shown interest in collaborating with local governments. While some work has been done through Connect America Funds, AT&T has not committed to

providing any specific amount of service to Mendocino County, only to the number of households in rural California.

POWER AND INFLUENCE OF BIG TELECOMMUNICATION COMPANIES ON NATIONAL AND STATE POLICIES

- Attempts to improve policy and legislation to make it easier to expand digital infrastructure in rural areas have been thwarted by large corporate telecommunication companies.
- The removal of Net Neutrality provisions and issues with data throttling pose a threat to high-speed access in Mendocino County.
- Grant programs available through the state and federal government are often complex and difficult for local providers to access. This means that funding for large projects, such as the Connect America Funds, typically go to big telecommunication companies like AT&T.

FIRES AND OTHER NATURAL DISASTERS

Mendocino County has now been impacted by two major wild fires two years in a row. This not only impacts the network on a ground level when infrastructure is destroyed, but also on a government financial level as these events are expensive and divert funding from other projects.

VISION & GOAL FOR CONNECTING MENDOCINO COUNTY

Mendocino County envisions a vibrant connected community that has the digital infrastructure necessary to support our economy, education, health care, emergency services and the 21st century rural lifestyle.

Goal: Affordable High-Speed Internet Access Available to 98% of Households in Mendocino County by 2025.

The goal for Mendocino County is to have affordable (\$70/month) high-speed internet access (100 mbps download and 20 upload) available to 98% of households in the county by 2025. Currently the California Public Utilities Commission defines “Broadband” speeds as 6 Mbps download and 1 mbps upload. The FCC and USDA are currently using 25 mbps download and 10 mbps upload speeds. According to the FCC, the current minimum speeds needed for telecommuters and students is 25 mbps download speeds.¹⁷ However, that is right now, and we have seen speeds change drastically over the last five years. Based on current changes to technology we expect that the demands of high speed in the future will be 100 mbps download and 20 mbps upload.¹⁸ While this is an ambitious goal, it is important to aim for this speed which is already becoming the new standard of service in urban areas.

In order to reach this goal, there are four main objectives that will utilize several strategies.

¹⁷ FCC Broadband Speed Guide, <https://www.fcc.gov/reports-research/guides/broadband-speed-guide>, accessed December 20, 2018.

¹⁸Monterey Bay Economic Partnership and Central Coast Broadband Consortium. “Achieving Ubiquitous Broadband Coverage in the Monterey Bay Region”

OBJECTIVE 1: DEVELOP PROJECTS TO DEPLOY FIBER-BASED AND FIXED WIRELESS TECHNOLOGY TO REMOTE AND RURAL AREAS OF MENDOCINO COUNTY.

Strategies:

- Collaborate with the other North Bay North Coast Broadband Consortium (NBNCBC) counties to access resources and implement infrastructure projects.
- Develop projects for “Middle Mile” and “Last Mile” fiber optic cable deployment
- Develop projects and find funding for relay tower deployment to connect remote households and businesses
- Assess potential for master lease agreements that allow the installation of broadband infrastructure on utility poles and light poles.
- Apply for grants to support rural deployment projects.
- Develop collaboration between WISPs to work on efforts to reduce the cost of “backhaul,” to access grant funds, and train and to grow the workforce
- Seek funds to develop a project to help end users with maximizing their bandwidth
- Research and develop local programs to help low income households get high-speed access and utilize it to improve their economic conditions

OBJECTIVE 2: CREATE POLICIES AT THE LOCAL GOVERNMENT LEVEL THAT SUPPORT IMPROVING THE NETWORK

Strategies:

- Break down broadband funding silos by cooperative relationships and enhanced communications between anchor institutions (schools, colleges, libraries, and health care facilities), communities, local governments, public safety, and providers.
- Work with cities and the county to work with departments to help include any high-speed internet access opportunities in future projects
- Work with local & state agencies to develop and implement “Dig Once” Policies
- Leverage existing cities’ and county’s assets for broadband or fixed wireless deployment
- Complete the coastal streamlined wireless tower permit ordinance (inland already adopted)
- Encourage all cities and the county to include broadband in their legislative platforms
- Identify and secure match funding to support projects that deploy broadband
- Create public-private partnerships to develop broadband projects: 1) private investment, public facilitation, or 2) private execution, public funding, or 3) shared investment and risk

OBJECTIVE 3: DEVELOP PROGRAMS TO IMPROVE EQUITY AND INCLUSIVENESS

Strategies:

- Work with foundations and programs focused on making education and learning equitable
- Leverage opportunities to provide home access for K-12 students (as promoted by the Mendocino County Office of Education to unlock 24/7 educational opportunities), and for college students to enable online educational opportunities.
- Develop programs that help subsidize higher speed internet for lower income families in areas where Comcast and AT&T are not available.

- Provide incentives to low income individuals to encourage accessing distance education via the internet as a strategy to improve their economic capacity.
- Increase the number of public-access computers in county libraries and Wi-Fi hotspots in other public spaces throughout the county.
- Improve digital literacy and technology education programs in schools, libraries, and through non-profits.

OBJECTIVE 4: DEVELOP PROJECTS THAT PROVIDE RELIABLE AND RESILIENT DIGITAL INFRASTRUCTURE SYSTEMS

Mendocino County needs digital infrastructure that not only supports the daily operations of businesses, local governments, and institutions, but more than that, it needs to be reliable and resilient in case of emergencies. Additionally, dead zones in the networks present a hazard and impediment to emergency service workers throughout the county. It is important that Mendocino County have a layered and redundant network that supports the county in all situations.

Strategies:

- Develop projects that expand fiber optic routes to create network diversity and redundancy.
- Develop alternative sources of power for key sites to keep communications active during power outages
- Advocate for an increase in the power back up requirements for towers from 2-3 hours to 24 hours.
- Engage with the California Public Utilities Commission (CPUC) in proceedings addressing critical telecommunication outage issues.
- Request incumbent providers to share critical information with high-level county public safety officials on points of vulnerability in county networks.
- Document any major telecommunication outages, and use such documentation to engage providers, the CPUC and policy-makers at the local, state, and national level for corrective action.

DIGITAL INFRASTRUCTURE PROJECT IMPLEMENTATION & TIMELINE

The timeline to implement this plan is 6 years. While that seems like a long time, the goals are extremely ambitious given the challenges Mendocino County faces. The County will need to continue to work with the North Bay North Coast Broadband Consortium to access CPUC funding which gives the county the capacity to coordinate and implement projects.

PRIORITY AREAS FOR MENDOCINO COUNTY DIGITAL INFRASTRUCTURE PROJECTS

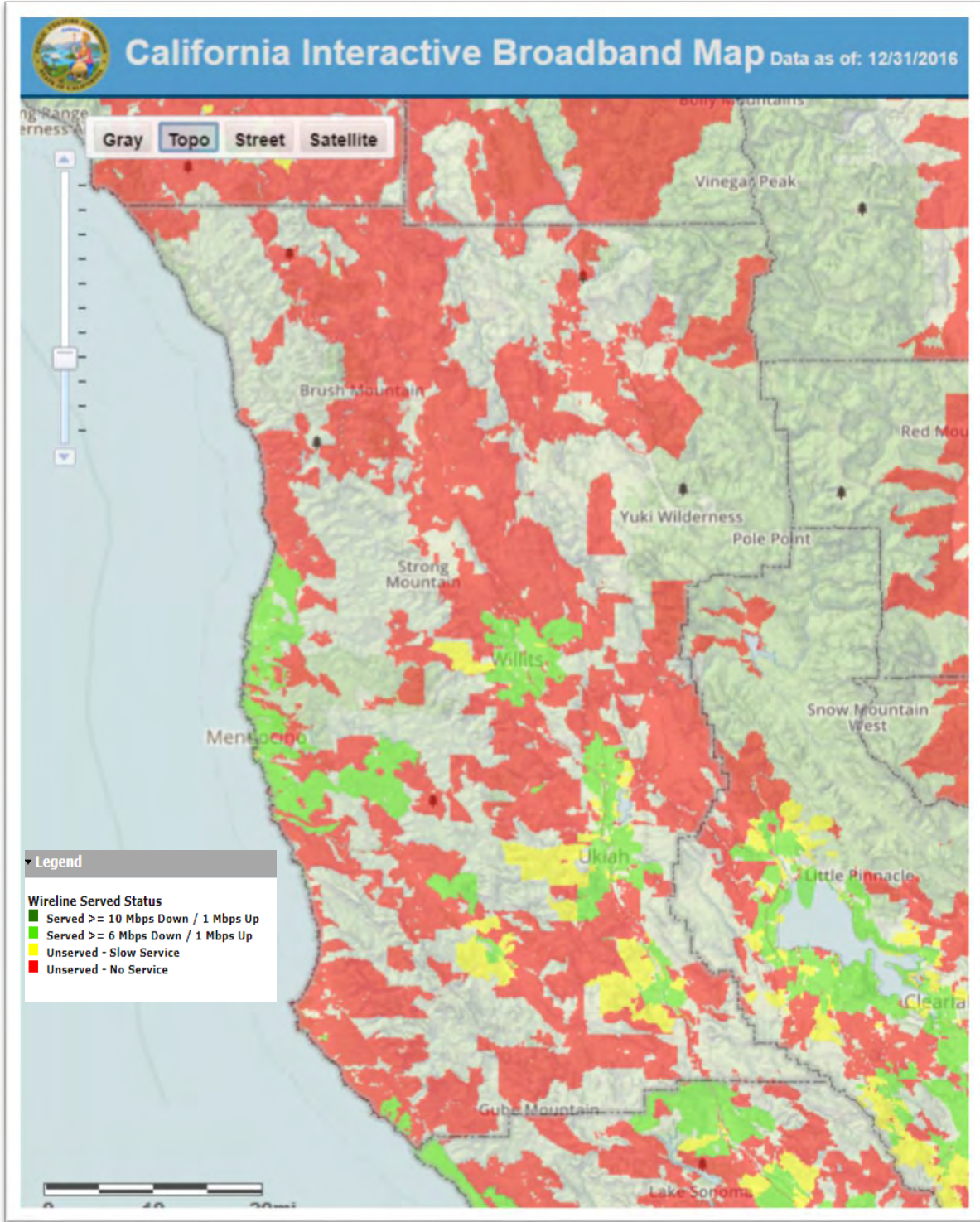
In 2015, there were 14 priority areas in the County identified by the Geographical Information Center through California State University of Chico. A map of these areas is available in the Map Section of the plan. These areas include (from north to south) in Mendocino County:

- | | |
|--|---|
| <ul style="list-style-type: none"> • Angelo Wilderness/Jack of Hearts Road and Branscomb Road west of Laytonville • Laytonville • Ocean Meadow Drive (north of Inglenook) • Brooktrails: Sherwood Road and Willow Brook (north of Willits) • Boice Lane (south of Fort Bragg) • Caspar and Prairie Way | <ul style="list-style-type: none"> • Road 408 in Mendocino • Pacific Reefs and Navarro Ridge Road • Rancho Navarro • Elk • Irish Beach • Manchester • Point Arena • Gualala |
|--|---|

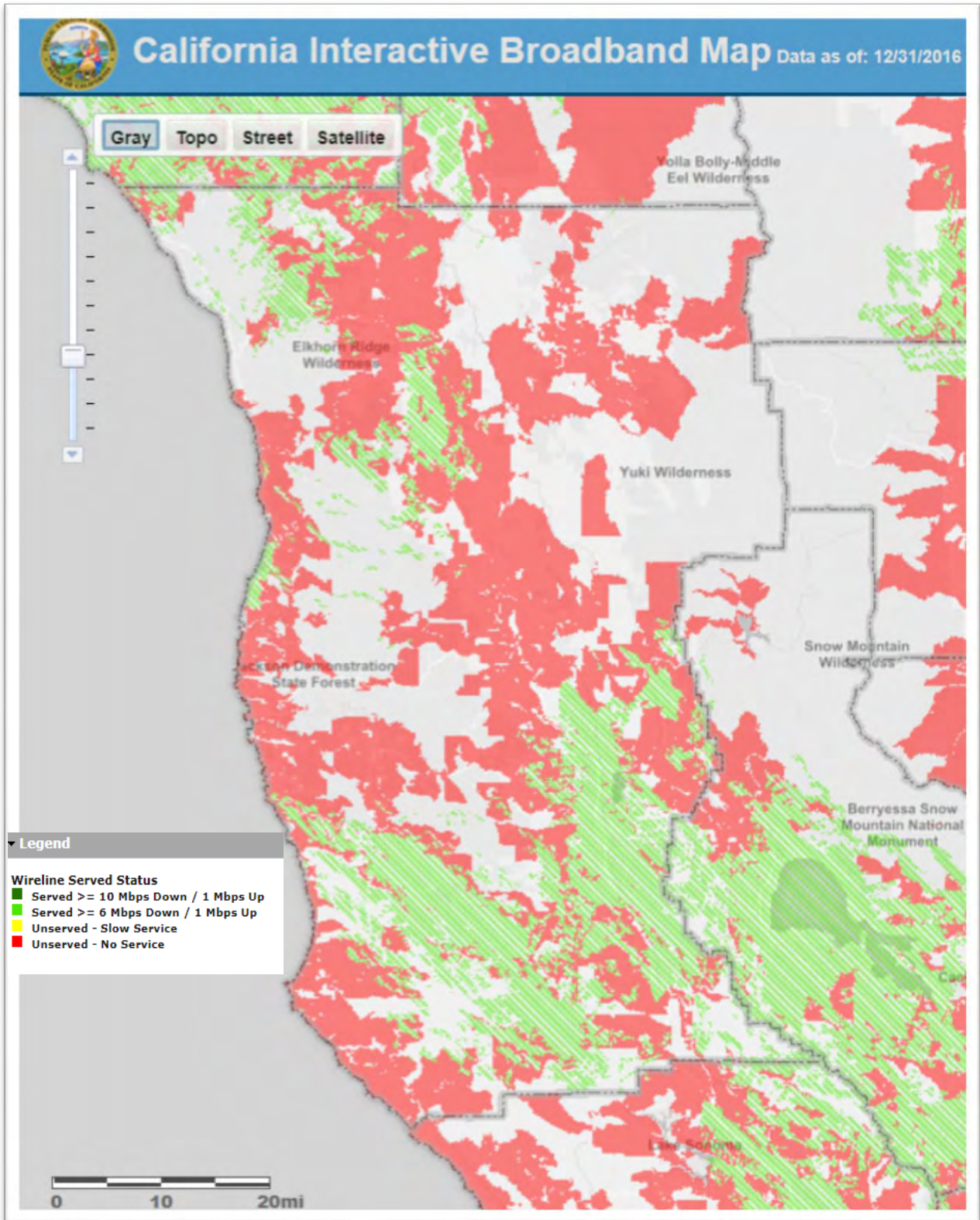
This design will be used as a baseline for planning and project development for fiber-optic cable projects over the next 6 years. It is likely this design will be amended and updated to reflect progress or alternative route options. For example, the Skunk Train railroad right of way may serve as a better alternative to the identified Highway 20 fiber route.

Planning and coordinating for improved access to high-speed internet in Mendocino County will continue to be a challenge. Our mountains, trees, and sparse rural populations are unlikely to change. However, through creativity, collaboration, and the necessary public and private investments, it is possible to develop the digital infrastructure needed to support a healthy community, strong economy, and effective public institutions.

MENDOCINO BROADBAND MAP WIRELINE SERVED V. UNSERVED, 12/31/2016

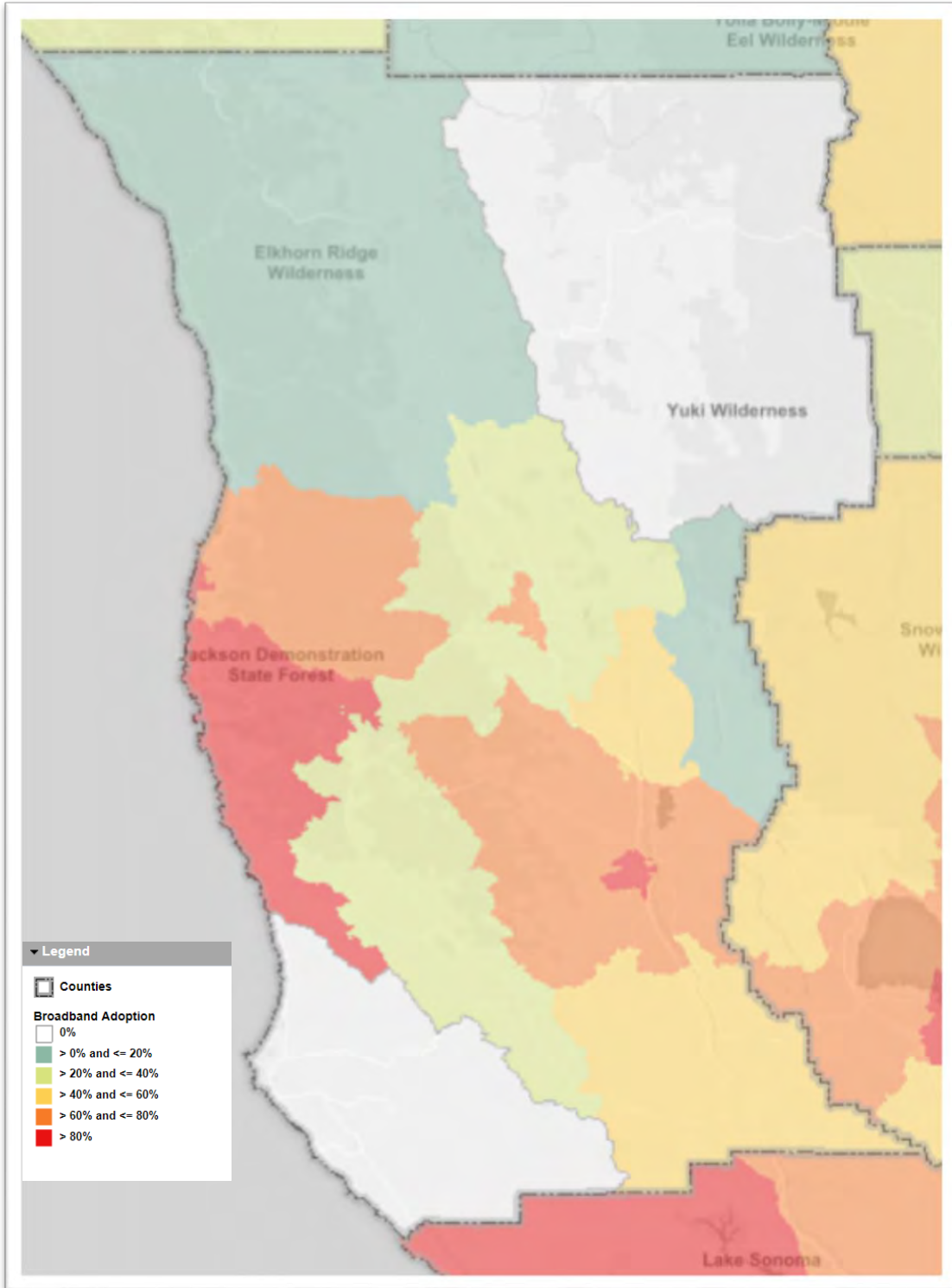


MENDOCINO COUNTY BROADBAND FIXED WIRELESS SERVED V. UNSERVED, DECEMBER 31, 2016



BROADBAND ADOPTION IN MENDOCINO COUNTY

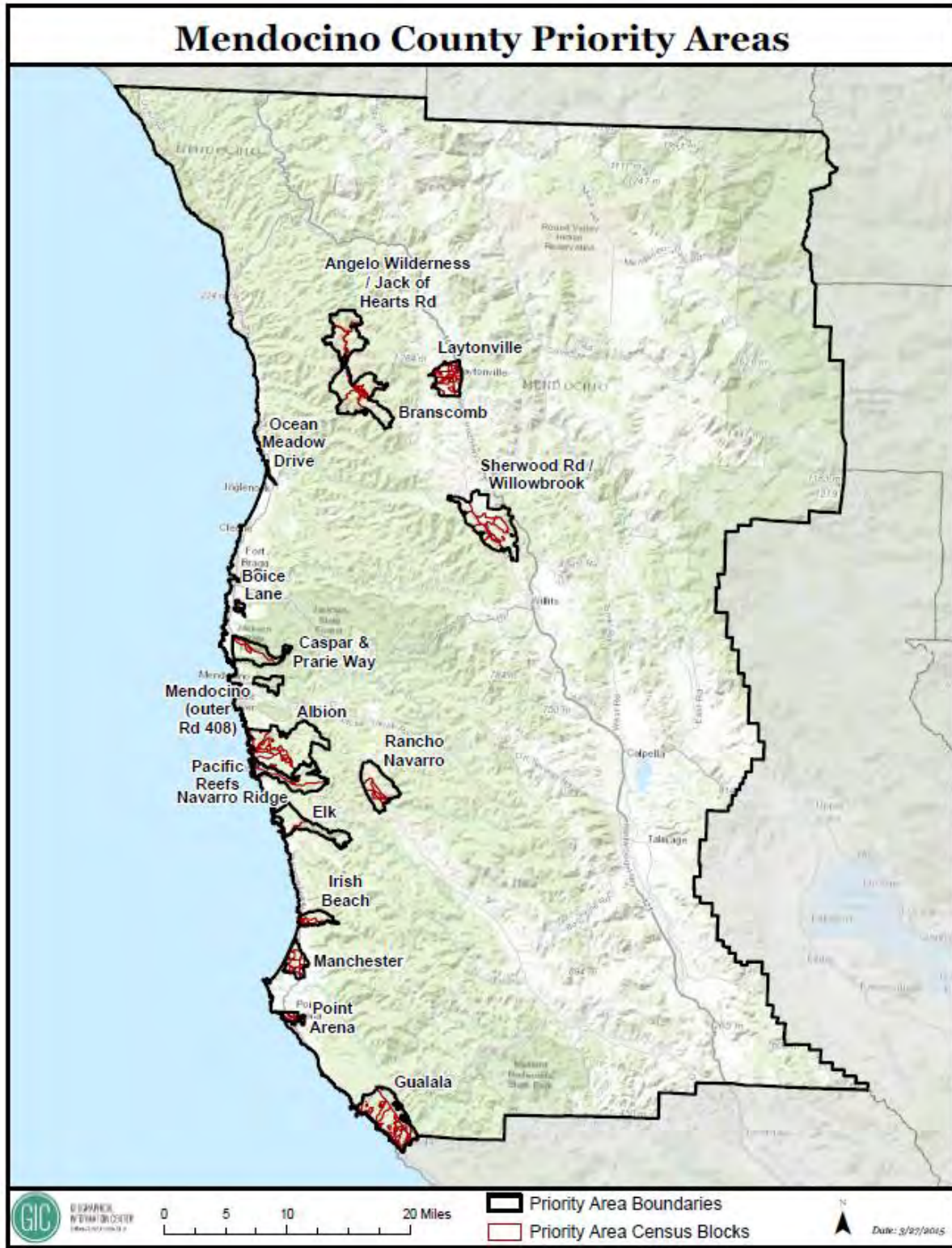
Broadband Adoption is defined as the percentage of residential fixed internet access connections per total households with broadband deployment. CPUC Interactive Broadband Map, Data as of 12/31/2016



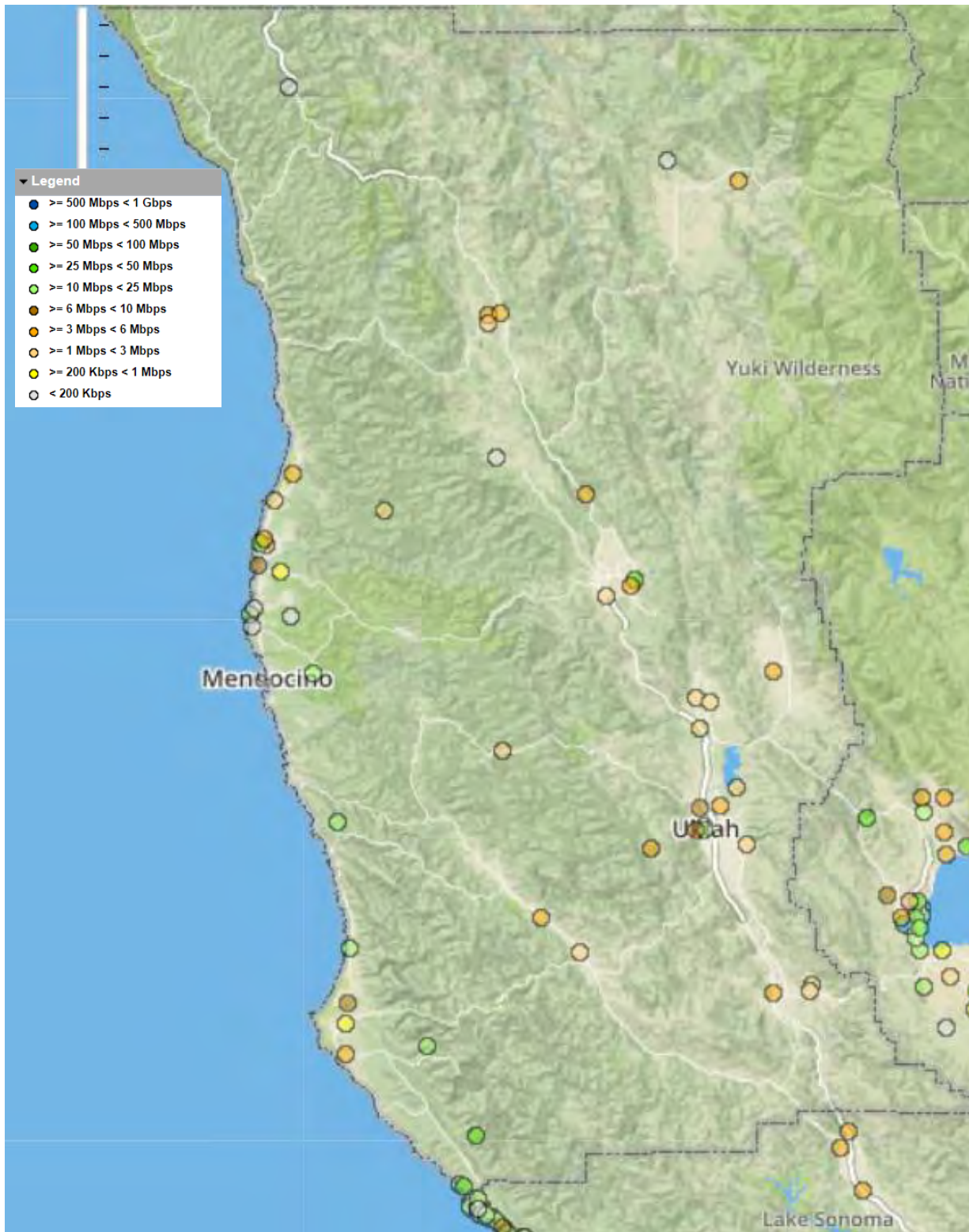
CONCEPTUAL DESIGN FOR MENDOCINO COUNTY FIBER-OPTIC CABLE "BACKBONE"



Source: California State University of Chico Geographic Information Center, May 31, 2016.



CPUC SPEED TESTS MAP

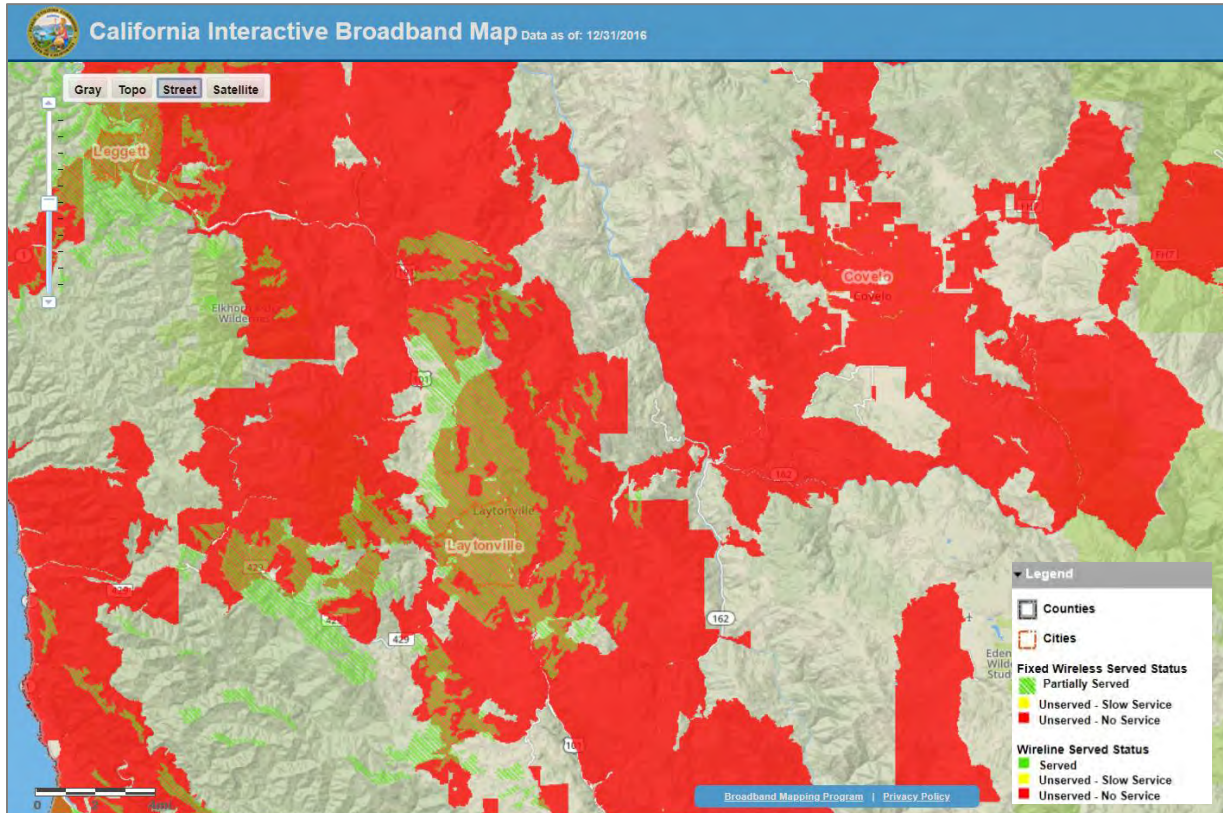


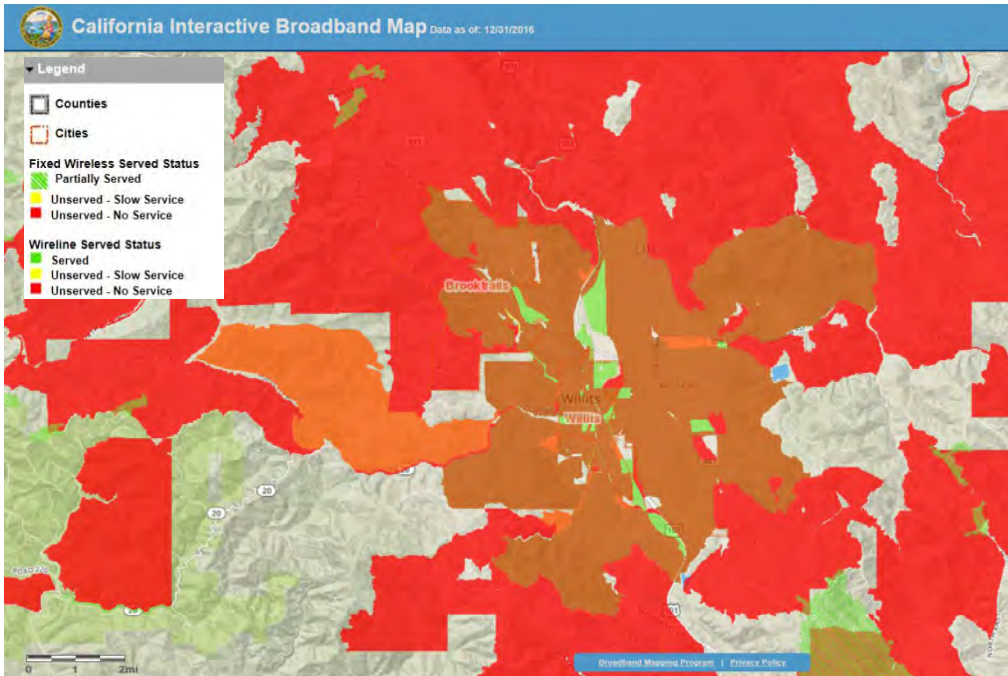
Source: CPUC Interactive Broadband Map, <http://www.broadbandmap.ca.gov/> Fall 2017 and 2016 CalSpeed Tests

CENSUS BLOCKS UNSERVED BY WIRELINE OR WIRELESS AS DETERMINED BY THE CPUC

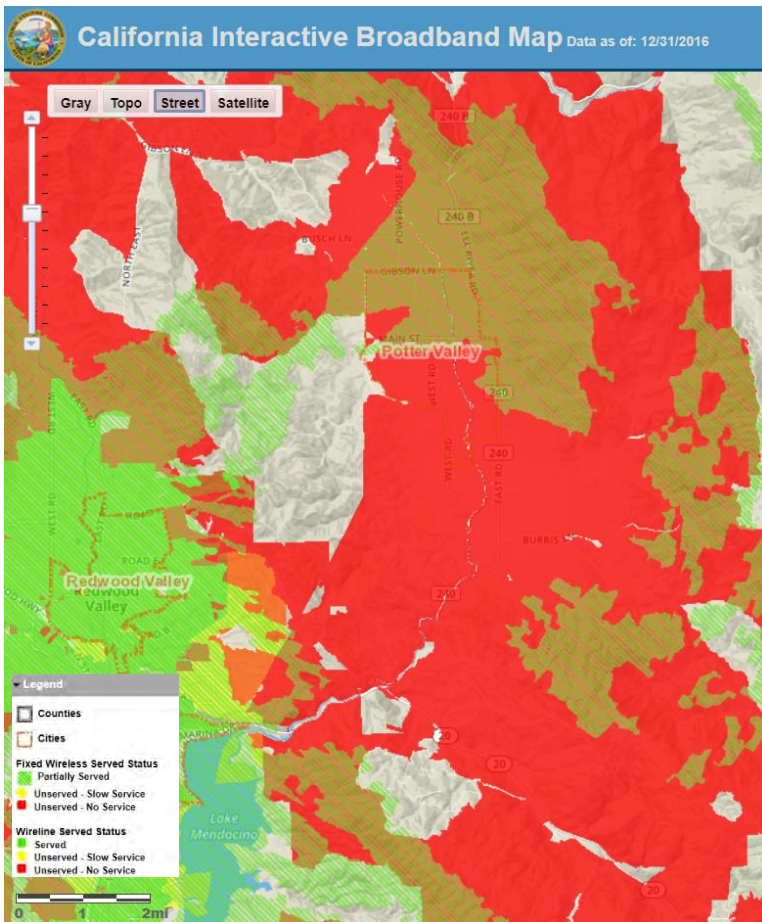
The following maps are all generated using the California Interactive Broadband Map available from the California Public Utilities Commission. It is certain that these maps lack all the data necessary to make them completely accurate, however, they provide an important starting point. The wireline and wireless data are combined, so areas that have a mix of green and red may be covered by some form of service whereas areas that are completely red are considered as not being covered by anything. Again, this does not include the data that shows households served by non-reporting WISPs.

North County

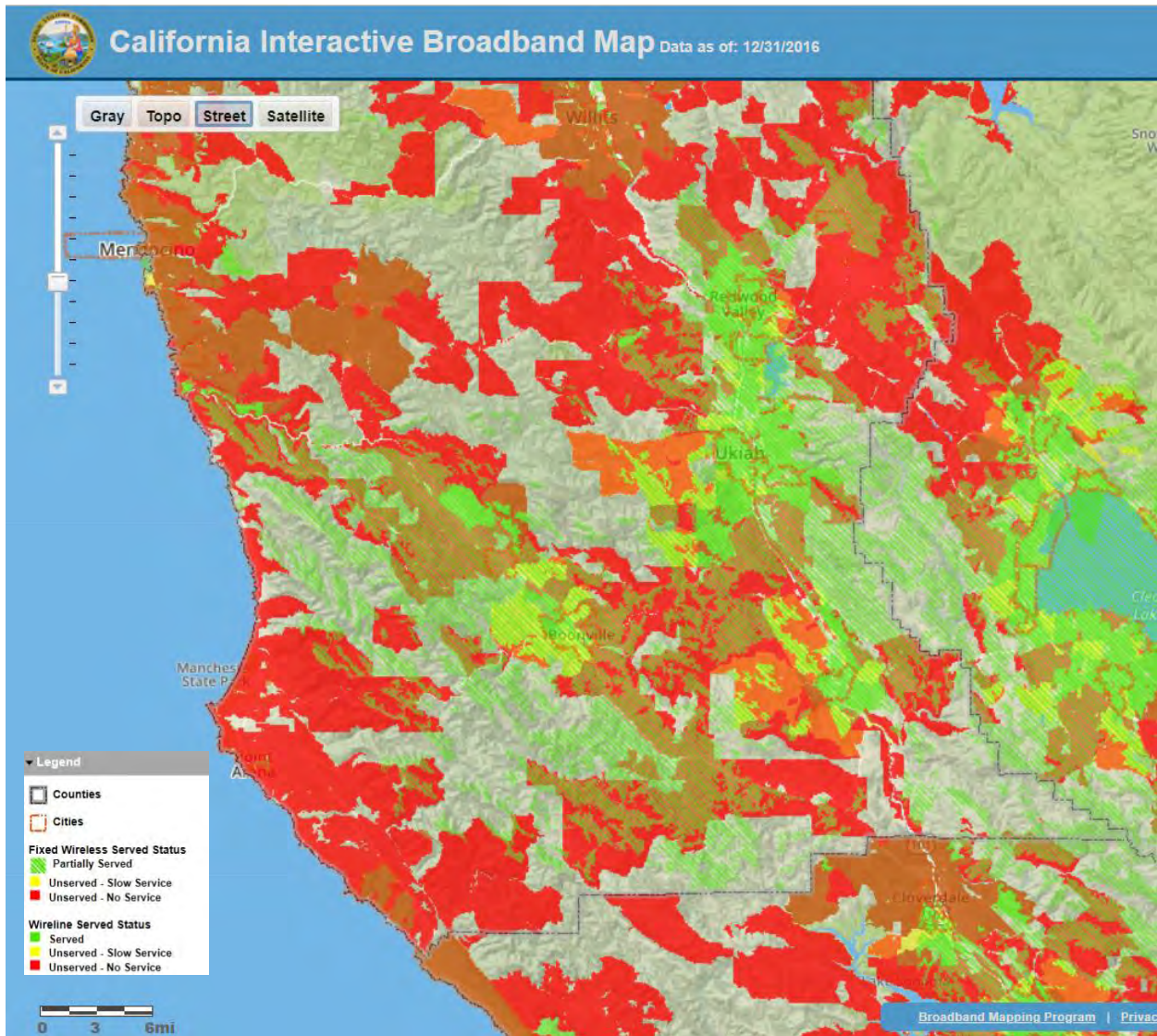




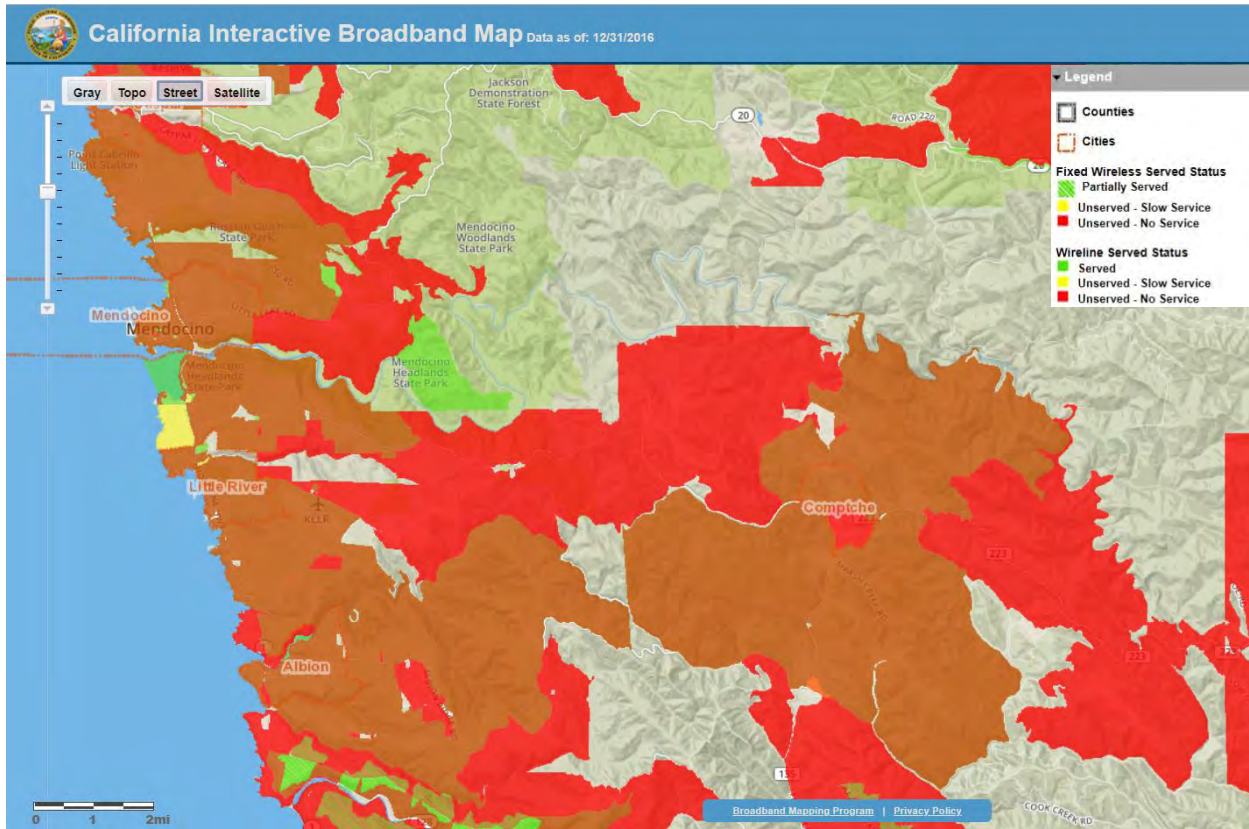
Redwood Valley and Potter Valley



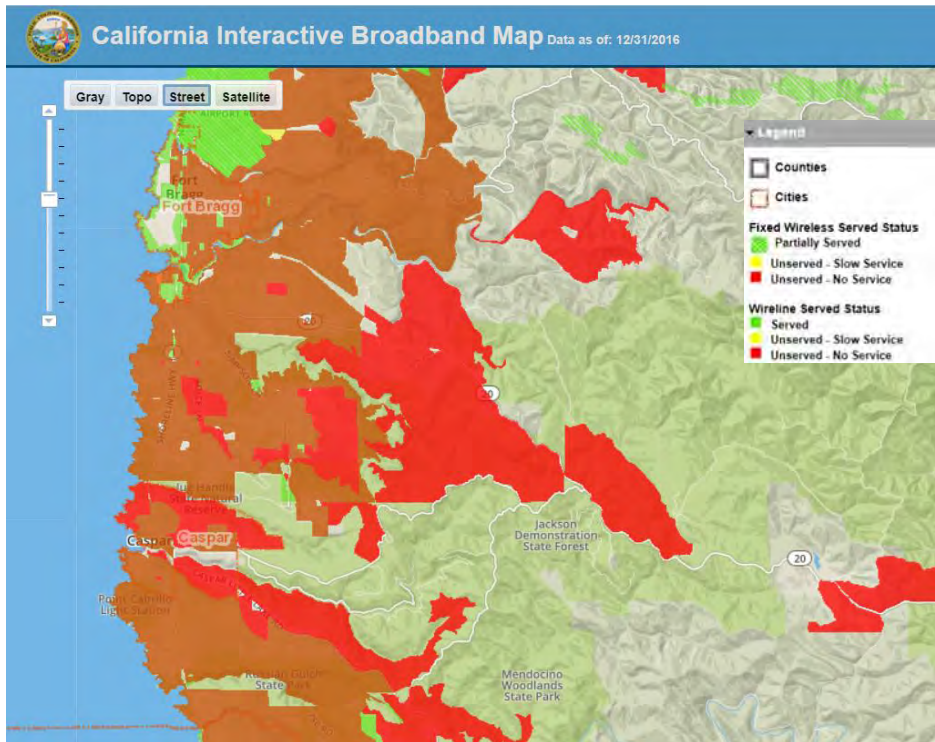
Southern Mendocino County



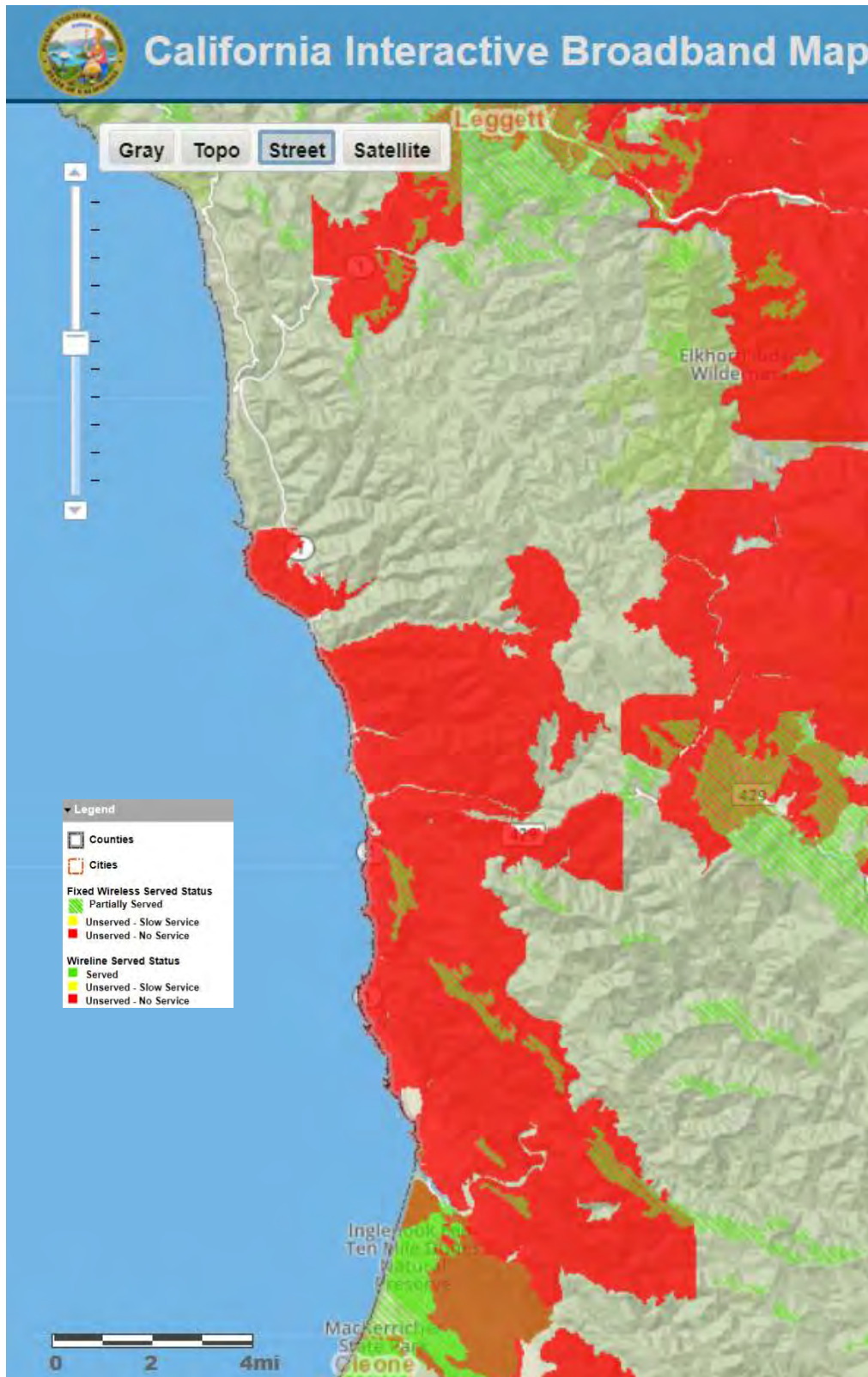
Mendocino, Little River, & Comptche



Caspar- Fort Bragg



North of Fort Bragg to Westport



APPENDICES

APPENDIX I: TYPES OF DIGITAL INFRASTRUCTURE

BROADBAND/FIBER OPTIC CABLE

Broadband is wide bandwidth data transmission which transports multiple signals and traffic types. The medium can be coaxial cable, optical fiber radio or twisted pair. As opposed to fixed wireless, broadband actually travels on a fiber line from one point to another. While broadband remains the fastest and most reliable way to connect to the internet, it is the most difficult to deploy in large rural counties with mountains and forests, such as Mendocino County. Additionally, broadband internet is provided through large tele-communications corporations that base their service on a profit model that is frequently not rural-friendly. Cable internet is a type of broadband and is the most common access for residential broadband. Based on current technology, broadband carriers say they can deliver up to 10Gbps download speeds. A long-term goal is to expand the fiber network throughout Mendocino County.

FIXED WIRELESS

This rapidly growing approach to providing internet service uses radio frequency bands to “beam” information from one point to another without a hard line. Technology in the wireless realm has moved at a rapid pace and with each generation of wireless, engineers are finding ways to pack more and more data into a single frequency. Additionally, because the equipment is relatively inexpensive and can be placed on top of existing features, fixed wireless is connecting areas of the county that have never been connected before with higher speeds than ever possible. Further Reach, which serves the South Coast and parts of the Anderson Valley, is providing service as fast as 100mbps up and down. While fiber is ideal, because of the rugged terrain that characterizes Mendocino County, this is one of the most widely available and feasible options. Wireless internet service providers (WISPs) have been starting up across the county and not only provide a crucial service but also important economic opportunities in the local community.

DSL & T1 LINES

DSL, which stands for Digital Subscriber Line, uses existing 2-wire copper telephone line connected to the home to deliver service at the same time as landline telephone service. AT&T reports on their website that the fastest possible speed for DSL is 6mbps down and 0.5 mbps up. That said, speeds vary greatly on DSL as they may be entirely on copper-based connections or may have a fiber connection. A drawback for copper-based DSL service is that it can only be delivered to residences within 2 – 3 miles of a switching station, due to degradation of the signal over copper. MCN Fusion says they can deliver up to 50mbps in certain areas of Mendocino County.¹⁹ T1s are known for having a steady maximum speed of 1.54 mbps download, however new technology has greatly increased DSL speeds.

¹⁹ Mendocino Community Network, www.mcn.org. Accessed on October 30, 2018.

CELLULAR DATA & HOTSPOTS

Cellular technology, like fixed wireless, has grown significantly over the last 10 years. As phones are surpassing LTE and moving into 5G, cell networks have the capacity to deliver more data at faster speeds. That said, it relies on major carriers installing the necessary infrastructure to increase the network. While some customers are able to rely on cellular network-based internet through a mobile phone, many areas are still in the dark or have aged technology, which severely limits speeds. Many cell phone and smartphone providers offer voice plans with internet access. New advances in cellular data technology are projected to provide download speeds as high as 500mbps, though it is uncertain when Mendocino County cellular networks will be upgraded to match those speeds. While this is not currently viable for providing ubiquitous high-speed internet, developing this network is critical for public safety and emergency services.

SATELLITE

Satellite is the most widely available means of connecting to the internet as it operates from signals to satellites 22,000 miles away, orbiting the earth, theoretically at the same rotation as the earth to maintain a constant signal. Common in areas where there is no access to hardline or fixed wireless, satellite is faster than dial-up but has been widely criticized as being unreliable and also typically has data caps, limiting use. Hughes Net is the most common satellite connection and speed capacity is as follows, “The HughesNet Gen5 service plans are designed to deliver download speeds of 25 Mbps and upload speeds of 3 Mbps, but individual customers may experience different speeds at different times of the day. Speeds and uninterrupted use are not guaranteed and may vary based on a variety of factors including: the configuration of your computer, the number of concurrent users, network or Internet congestion, the capabilities and content of the websites you are accessing, network management practices as deemed necessary, and other factors.”

Based on the results of the survey, Satellite is unreliable and delivers inferior service at a very high cost. That said, in many cases it is an important back-up system for businesses or other essential services that cannot afford to lose all connection to the internet when systems fail or the power goes out. With a generator and satellite, a business or individual can stay connected regardless of surrounding conditions.

DIAL-UP

The original method of connection, dial-up connects your computer via a standard land-line telephone cord to the regular copper phone connection. The user then dials in through the computers’ modem to the internet service provider to connect to the internet. According to Wikipedia, “Modern dial-up modems typically have a maximum theoretical transfer speed of 56 kbps.” In most areas of the United States, dial-up is considered antiquated technology with no relevance to today’s technology. Our goal is to improve infrastructure to remove any need for dial-up.

APPENDIX II: INTERNET SERVICE PROVIDERS IN MENDOCINO

There are at least 11 different companies providing high-speed internet access in Mendocino County (not including satellite providers). As high-speed internet has become recognized as an essential tool and not a luxury, that should be accessible to all, it is important to note that private businesses will continue to be the main driver of delivery of service. Local government cannot act with the speed necessary to keep up with technology or provide it in a cost effective manner.

NATIONAL CARRIERS

Comcast

According to information provided by Comcast, they provide internet service to an estimated 27,000 households in Mendocino County in the communities of Albion, Brooktrails, Calpella, Caspar, Cleone, Comptche, Fort Bragg, Inglenook, Little River, Mendocino, Navarro, Redwood Valley, Ukiah, and Willits. Based on the results on the broadband needs assessment, they are likely the largest provider of services in the county. Twenty-five percent of survey respondents said that have access to the internet through Comcast. Speeds for Comcast range from 15 mbps to 250 mbps down and 5 mbps -7 mbps up. However, they have recently launched a newer service which has the capacity to offer speeds up to 1000 gbps up and down. While this may seem like overkill right now, at the speed technology is moving, this could be the new standard in 5 years' time. Comcast does not report a growth in the geography they serve over the last five years, nor a significant change in the number of households served over the last five years. Comcast says that the major barriers to expanding the network are the market size and the lack of density in our rural areas. They expressed interest in partnering with local governments to extend service.

AT&T

Despite many promises, AT&T was not willing to provide direct information about the actual service that they provide. Instead, they referred the process back to the "availability" data from the CPUC, which has proven to be inaccurate many times over. Instead, we can make some very rough projections about AT&T based on the broadband survey. Less than 10% of respondents said that they received internet service through AT&T. If this data is compared with previous surveys, the trends are consistent that Comcast serves more households than AT&T. However, without AT&T being willing to say how many households and businesses receive internet through their services, it is impossible to guess. We can determine that it is significantly less than 27,000 based on the ISP and residential survey results. This is extremely simplified as the picture gets more complex as we consider households that are served by CLECs such as Sonic, which uses AT&T infrastructure to deliver internet to households in Mendocino County. If you include those households, this number goes up significantly as Mendocino Community Network, which is a billing agent for Sonic that serves only parts of the Mendocino Coast, serves an estimated 1,500 households.

Verizon

Several respondents to the broadband access survey noted that their internet service provider was Verizon, but Verizon is not an ISP in Mendocino County. That said, they do have an extensive cellular network throughout the county providing LTE data service. While this is all some people have access to, based on the definitions, it does not constitute high-speed internet access, and these households are considered unserved.

US Cellular

US Cellular also provides only cellular data service in Mendocino County. They have the most extensive network in the most remote and rural parts of the county and are looking to expand. While this technology is still not ideal, it is continuously changing and will continually need to be re-evaluated to determine whether it provides a service that meets the high-speed definition (100 mbps/20mbps).

WIRELESS INTERNET SERVICE PROVIDERS (WISPS) AND COMPETITIVE LOCAL EXCHANGE CARRIERS (CLECS)

The planning process has identified at least 9 independent fixed wireless providers working throughout Mendocino County. These providers do not necessarily report back to the CPUC and so their service does not show up on CPUC maps that estimate service areas. Based on the ISP survey, it is clear that there are over 3,000 households connected through fixed wireless that are not counted by the CPUC. In addition to our WISPs, there are several ISPs that are classified as CLECs or billing agents of CLECs.

“CLECs are wireline carriers that are authorized under CPUC and FCC rules to compete with ILECs to provide local telephone services. They often package their local service offerings with local toll, long distance, international, Internet access, cable and/or video services. Under policies adopted by the CPUC, the FCC and the telecommunications Act of 1996 (1996 Act), CLECs are not required to duplicate ILEC local service offerings. They can choose which customers to serve (business, residential or both) and what services to offer.”²⁰

As we look at the future of connectivity, the largest area of growth for remote and rural areas is through WISPs and CLECs. The main reason is that the cost of deploying wireless infrastructure is significantly less than deploying fiber optic cable. Additionally, the networks are managed by small local businesses and while they still need a certain market size to create a viable business, their models are less restricted than large corporations with national ROI standards that don't work for many parts of Mendocino County.

Willits Online

This local company is a CLEC and a Competitive Local Reseller (CLR) and serves a significant portion of northern Mendocino County. Speeds and service vary based on the type of service, either DSL Dry Loop or Wireless Broadband. In some areas, WOL is offering their “MEGA*Link” service. Speeds from WOL range based on location and service type, and how much a customer is willing to pay. The lowest amount available is 1.5 Mbps download and as high as 40 mbps down and 5 Mbps up. The higher speed services are available in Willits, Boonville, Ukiah, and Potter Valley, but the service available to Laytonville, Covelo, and Redwood Valley only goes up to a maximum of 4.5mbps download, which does not meet the CPUC guidelines for high-speed internet.

Mendocino Community Network and Sonic

Mendocino Community Network (MCN) is a billing agent for Sonic, which is based in Santa Rosa, California and is a CLEC that serves Mendocino County. MCN serves 1,900 households on the coast with dial-up, DSL, and high-speed DSL.

²⁰ CPUC,

http://www.cpuc.ca.gov/uploadedfiles/cpuc_public_website/content/utilities_and_industries/communications_-_telecommunications_and_broadband/reports_and_presentations/46428_d0505013_bbreport_3of9.pdf

Sonic offers a variety of products at a range of price points. Products offered are based on geographical availability at the service address. Sonic, through MCN, serves a very significant population in Mendocino County. According to the CPUC Availability Data, Sonic serves an estimated 12,568 households in Mendocino County. As a CLEC, the IP Broadband services utilize AT&T infrastructure for service delivery in Mendocino County.

Pacific Internet

Pacific Internet is a fixed line provider in Ukiah that was recently bought by an organization affiliated with Willits Online. Pacific provides DSL/ADSL2 services. Their back-haul is provided by Sonic.

Wireless Internet Service Providers

Further Reach, SeaKay Wireless, and Ukiah Wireless serve a total estimated 3,000 households in Mendocino County through Fixed Wireless/Microwave technology. They provide service to many areas that are completely unserved by other providers including the south coast, Redwood and Potter Valleys.

Based on the residential survey, it is clear that Digital Path, Instawave, 101 Netlinks, and several other small WISPs provide service in Mendocino County. Instawave does not report to the CPUC (unless it is owned by another provider) and did not respond to the survey. DigitalPath, 101 Netlinks, and Northcoast Internet all report to the CPUC that they are serving an estimated 12,000 each (not total) however, based on responses to the survey, this seems to be a very high estimation.

APPENDIX III: MENDOCINO COUNTY HIGH-SPEED INTERNET ACCESS NEEDS ASSESSMENT

EDFC conducted two public surveys, one for residential internet access and one for businesses and institutions. We received over 500 responses to the residential survey, 477 of which were valid. We also received 49 responses to the non-residential survey of which 46 were valid. Validity is based on the respondent answering at least one question and providing a location in Mendocino County.

EDFC also conducted interviews with local governments, critical institutions including schools and health care, and internet service providers. EDFC also conducted outreach and solicited feedback and information from the Broadband Alliance of Mendocino County, local government leaders, non-profit organizations and partners, and the community. The following are the results of the needs assessment.

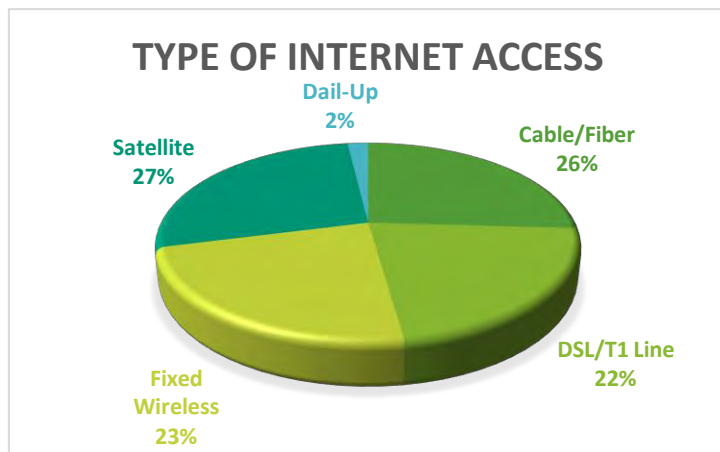
RESIDENTIAL SURVEY RESULTS

There were 477 unique household responses to the Residential Use Broadband Survey. One of the most interesting pieces of information that came out of this survey is that 56% of respondents use the internet to work from home or telecommute more than once a week. This ties back to the importance of internet access to our local economy. Another interesting finding from the survey is that 40% of respondents had access from a wireless internet service provider or through a CLEC. The growth of WISPs is tremendous and the findings from this survey provide important insight about the value and potential they have for Mendocino County.

Access

Out of the 477 completed surveys, 89% of respondents said they have access to internet and 11% said they did not have access or only had access through their cell phone. The CPUC does not count Satellite nor Dial-Up as having access. Given those standards, the total without access is 35%. The CPUC’s calculation is that 80% of households are served by high speed internet service providers.

Type of Connection	Number of Responses
Cable/Fiber	109
DSL/T1 Line	92
Fixed Wireless	98
Satellite	114
Dail-Up	8
Total	421



Satellite internet makes up a 27% of access for respondents surveyed. This type of access has been noted for being expensive and unreliable. This was confirmed in the survey as 41% percent of respondents who have satellite said it is never sufficient and 49% said that it is sufficient sometimes but not all the time, and 60% of satellite users are paying upwards of \$80/month, including over 40% paying more than \$100/month, which is well beyond what is considered affordable.

Sixty respondents to the survey said that they use satellite to telecommute from home more than once a week. Of those, twenty-three people said their internet service was never sufficient and 35 said it was sufficient sometimes but not all the time. This indicates that the lack of broadband access in rural areas of the county does create an economic hardship.

Respondents by Area

Region	Responses
North Coast	190
South Coast	88
Anderson Valley & Comptche	25
Inland Mendocino County	95
North County	79
Total	477

Location	Number of Responses
Albion	18
Boonville	3
Branscomb	2
Caspar	5
Comptche	9
Covelo	7
Elk	21
Fort Bragg	92
Gualala	28
Hopland	3
Laytonville	12
Leggett	1
Little River	17
Manchester	18
Mendocino	53
Navarro	5
Philo	8
Point arena	21
Potter Valley	10
Redwood Valley	19
Ukiah	63
Westport	5
Willits	57
Total	477

Sufficiency of Access

418 respondents answered that they had internet access and told us about its sufficiency. Of the total number that responded to the question, 72% said that their internet was either sometimes sufficient for their needs, but not all the time or never sufficient. Of those, 60% said that better service was not available.

By comparing the data through pivot tables, we were able to look at respondents who work from home more than once a week and analyze the sufficiency of their service by type of access. The results were as follows:

Type of Access	Never sufficient	Sufficient sometimes but not all the time	Always sufficient or better
Cable	10%	53%	37%
Dial-up (phone line)	80%	20%	0%
DSL (phone line)	21%	54%	25%
Satellite Internet	38%	57%	5%

Sufficiency of Internet Access for Respondents Who Use the Internet for Homework

Type of Access	Never sufficient	Sufficient sometimes but not all the time	Always sufficient or better
Cable	7%	52%	40%
DSL	18%	62%	20%
Fixed Wireless	11%	45%	43%
Satellite	41%	49%	10%
Dial-Up	67%	22%	11%

Sufficiency of Internet for Respondents Who Use the Internet for Online Classes More than Once a Week

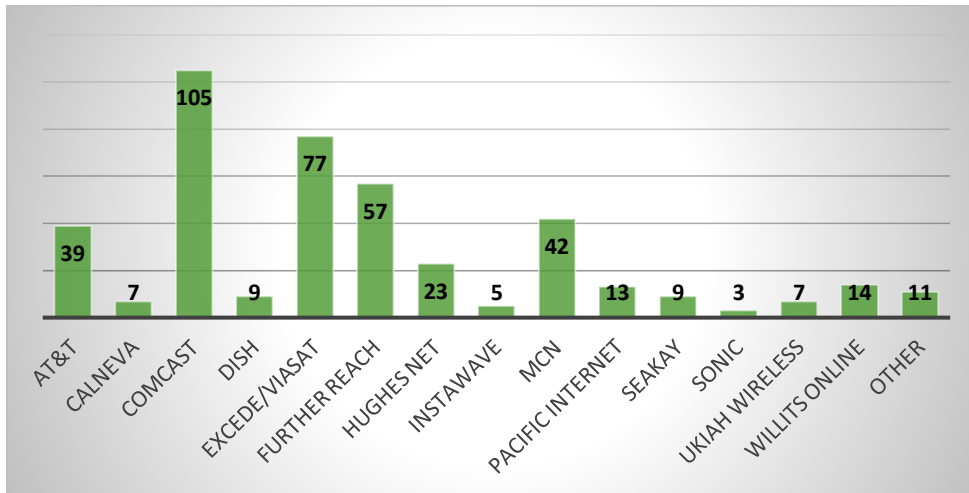
Type of Access	Never sufficient	Sufficient sometimes but not all the time	Always sufficient or better
Cable	8%	58%	33%
Dial-up (phone line)	67%	33%	0%
DSL (phone line)	24%	65%	12%
Fixed Wireless	13%	56%	31%
Satellite Internet	50%	50%	0%

Providers

Through the survey, we identified more than 15 internet service providers in the county. These include the two major telecommunication corporations, AT&T and Comcast. It includes three satellite providers, Dish, Hughes Net,

and Exede. The remaining 10+ providers are WISPs and local ILECs and CLECs. This does not include internet providers through cellular service.

The graph below shows the distribution of respondents by provider:



Activities & Usage

The top three activities that respondents are engaging in on the most frequent basis (more than once a week) were:

1. Getting news and information (91%)
2. Social Media (78%)
3. Paying bills, banking and household management (69%)

It is also important to note that while streaming videos came in 4th at 66%, and 56% of respondents use the internet to work from home more than once a week. Only 23% of individuals indicated using the internet for homework more than once a week. Similarly, only 15% of individuals said they take online classes more than once a week. This may be a function of the age of our population and the people who had time to take the survey but based on discussions with Mendocino College staff, this seems low.

Only 60% of respondents said they used the internet for online shopping more than once a week, but over 90% of respondents shop online more than once a month.

37% of respondents said that they use the internet for phone service more than once a week, which is important because in some areas where the phone line has decayed, this can be the only method of reliable phone service. However, this number likely includes many people who chose Voice Over Internet Phone (VOIP) because it is lower cost than a standard phone line. This is problematic in the case of a natural disaster or other public safety emergency because the phone does not work without electricity and residents can miss critical information.

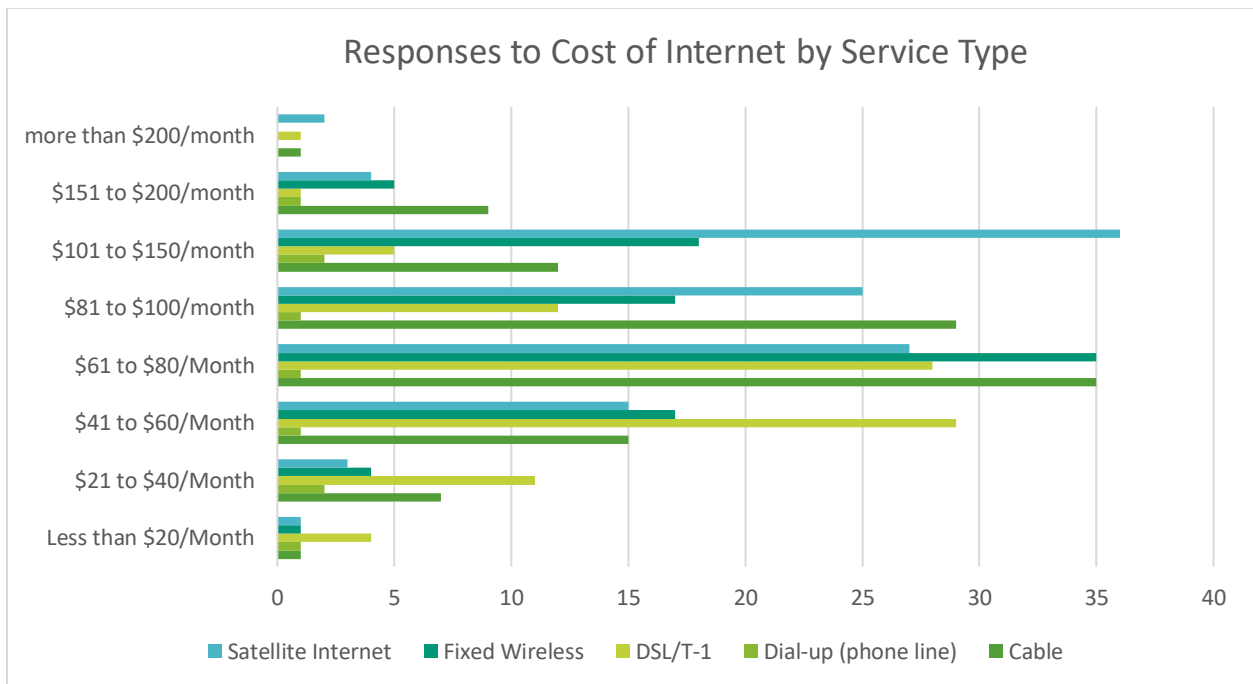
Economics and the Internet

The cost of internet is often a sticking point. National carriers often say that they are not able to serve rural areas because of low population and that people want better speeds but are not willing to pay for it.

The survey conducted shows that 57% of respondents pay less than \$80/month which should be considered as affordable for households that are above the median income. That said, cost and speed are not always equal, this does not ensure people are paying less than \$80/month for the speeds necessary to participate in the modern economy or education system. The chart below shows the distribution of the 428 responses who shared the cost of their internet:

Cost of Internet	Number of Responses	Percentage of Responses
Less than \$20/Month	9	2%
\$21 to \$40/Month	27	6%
\$41 to \$60/Month	80	19%
\$61 to \$80/Month	128	30%
\$81 to \$100/month	86	20%
\$101 to \$150/month	73	17%
\$151 to \$200/month	20	5%
more than \$200/month	5	1%

It is also important to break down the cost of internet by the type of service:



Reliability

EDFC asked respondents to tell us how regularly their internet fails. They were given a variety of options that have been condensed. Almost never or only when the electricity goes out makes up one category. The fails regularly category includes responses that said the internet failed monthly, weekly, and daily. 37% of respondents who have fiber optic cable internet say their internet fails regularly. While no service seems to be supplying flawless

coverage, 45% of respondents who have fixed wireless said it almost never fails, and 33% said it fails regularly. This is still a problematically high percentage of households lacking reliable service. Satellite has even higher rates of failure, with only 24% of respondents saying it almost never fails and 59% saying it fails regularly.

Type	Almost never fails	Fails Regularly
Cable	40%	37%
DSL	30%	42%
Fixed Wireless	45%	33%
Satellite	24%	59%

Lack of Service

We asked respondents to provide a geographical location. Pivot tables were used to look at the availability of service based on location. This data shows the street and town and number of households on that street that reported no access to internet:

Albion	7	Jade Court	1
Albion Ridge Rd.	7	Little Valley Rd.	1
Boonville	1	N Franklin St.	1
Vista Ranch Rd.	1	N Hwy 1	1
Branscomb	2	Shane Dr.	1
Branscomb Rd.	1	Thomas Lane	2
Kenny Creek Rd.	1	N Hwy 1	1
Caspar	3	Ward Ave.	.1
Caspar Orchard Rd.	1	Gualala	10
Pacifica Dr.	2	Bourns Gulch Rd.	1
Comptche	1	Iversen Rd.	6
Flynn Creek Rd.	1	Ocean Ridge	1
Covelo	6	South Hwy 1	1
Hill Rd.	1	South Hwy 1	1
Hulls Valley Rd.	1	Laytonville	10
Mendocino Pass Rd.	3	Branscomb Rd.	1
Rifle Range Rd.	1	Cedar Creek Rd.	1
Elk	7	Davidson Lane	1
Cameron Rd.	2	Davidson Rd.	1
Greenwood Rd.	4	Foster Ave.	1
Philo Greenwood Rd.	1	N Hwy 101	2
Fort Bragg	17	Oak Drive	2
Atkins Way	1	Lakeview Ave.	1
Boice Lane	1	Little River	6
Brush Creek Rd.	1	Frog Pond Rd.	1
George's Ln.	1	Little River Airport	4
Harbor Ave.	1	Road 18	1
Hwy 20	3	Manchester	8

Forest View Rd.	2	E Bobbi St.	1
Irish Beach Drive	1	E. Gobbi St.	1
Mountain View Rd.	2	Knoxville Rd.	1
Navarro Rd.	1	Orr Springs Rd.	2
O'Rorey's Place	2	Parducci Rd.	1
Mendocino	20	Pepperwood Place	1
Comptche Ukiah Rd.	9	Pine Ridge Rd.	1
Little Lake Rd.	2	Bisby Ave.	1
Lori Lane	1	Pinoleville Rd.	1
Outlaw Springs Rd.	2	Westport	2
Road 409	5	Howard Creek Rd.	1
Warner Lane	1	Wages Creek Rd.	1
Navarro	3	Willits	34
Appian Way	1	3rd gate Rd.	1
Hwy 128	1	Bear Dr.	1
Wendling St.	1	Blackhawk Dr.	1
Philo	6	Blue Lake Rd.	1
Greenwood Rd.	1	Buckeye Pl.	1
Hwy 128	3	Buckeye Rd.	1
Scott Homestead Rd.	2	Condor Rd.	1
Point Arena	6	Fort Bragg Rd.	1
Eureka Hill Rd.	2	Hearst Post Office	1
Main St.	1	Hearst-Willits Rd.	1
School St.	1	Locust St.	1
Schooner Gulch Rd.	1	North Highway 101	3
Tenmile Cutoff Rd.	1	Pineview Dr.	1
Potter Valley	6	Poppy Dr.	2
Burris Lane	3	Ridgeview Rd.	1
East Rd.	2	Sawyers Lane	1
Powerhouse Rd.	1	Sherwood Rancheria Rd.	1
Redwood Valley	5	Sherwood Rd.	6
Meadow Dr.	1	South Lenore Ave.	1
Road B	1	Tulip Lane	1
Tomki Rd.	2	Walter Rd	1
Webb Ranch Rd.	1	S. Main	1
Ukiah	12	Chinquapin Dr.	1
Boonville Rd.	1	N Main St.	1
Burke Hill Dr.	1	Poppy Lane	1
		Rose Terr.	1

NON-RESIDENTIAL SURVEY RESULTS

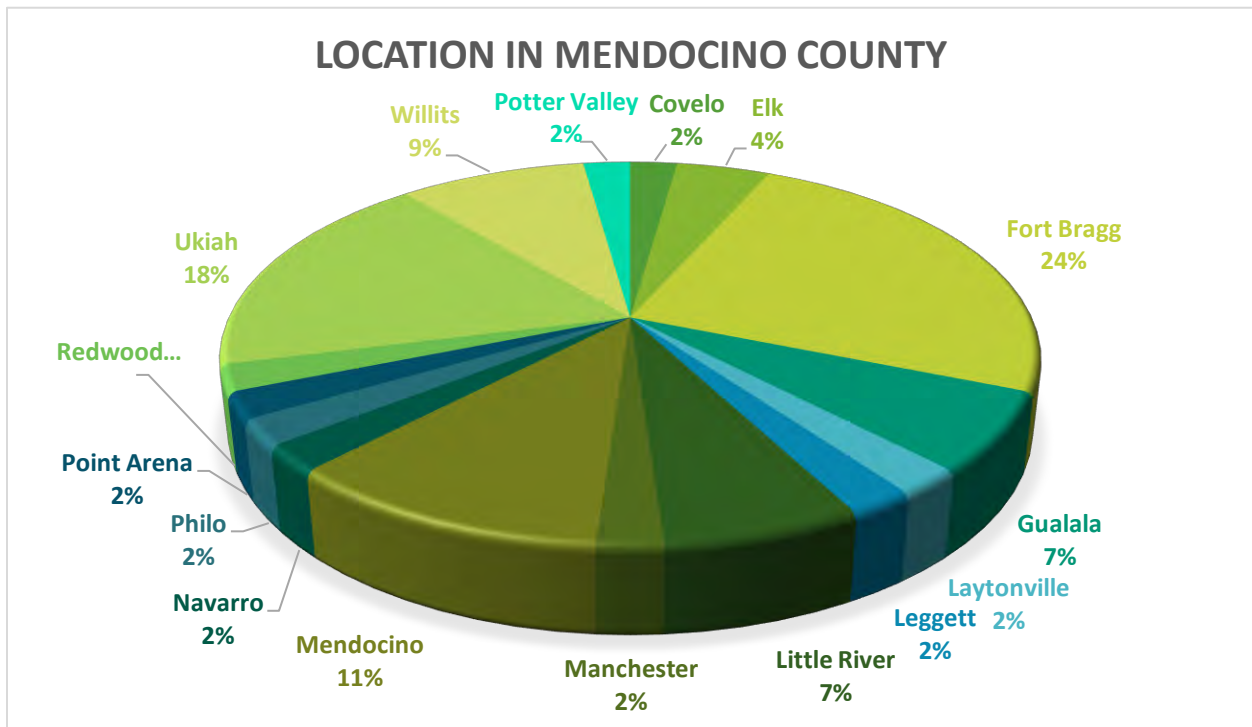
There are several components to non-residential internet use. It includes businesses, non-profit organizations, public institutions, local governments, health care, and other community services. The results of this survey are

not meant to be statistically relevant, but rather to provide insight into usage and identify issues that need to be addressed. The majority of respondents to the survey were self-employed individuals:

Access

Do you have internet access?	# of Responses
No	1
Yes	39
Yes, but only through cell/mobile devices	4

Respondents by area



Importance of Access to Business

How important is the internet to your business?	# of Responses	% of Responses
Crucial to our operation and existence	33	79%
We could not perform all our functions without it	6	14%
We could manage without, but it would be a hardship	3	7%

Type of access

How do you access the internet?	# of Responses	% of Responses
Dial Up	1	2%

DSL	12	23%
Cable	11	21%
Fixed Wireless	11	21%
Satellite	6	11%
T-1	4	8%
Cell Phone Only	8	15%

Sufficiency of access

How often is the internet service you have sufficient for your business?	# of Responses
Never sufficient	6
Sufficient sometimes but not all the time	19
Sufficient all the time	13
Always sufficient and sometimes more than sufficient	3
Always more than sufficient	1

Provider

Who is your ISP?	# of Responses
AT&T	6
CalNeva	1
Comcast	9
Exede	4
Further Reach	7
Mendocino Community Network	7
SeaKay	4
Willits Online	1
Total	39

Activities/Usage

How do you use the internet for your business?	% of Respondents
Sales	59%
Advertising and marketing	84%
Bookkeeping and financial management	80%
Staff communications	84%

Purchasing supplies and inventory	82%
Managing operations	80%
Telephone Service	41%
Customer Use	57%

Other uses indicated by survey respondents:

- Accessing Web based trading & CRM sites
- File sharing & uploading work products
- Cloud-based design
- Bidding tools
- Emergency broadcast provider
- Everyday operations
- News, Information, Apps
- Online donor database
- Online GPS
- Online stewardship work
- Grant writing
- Training, education, professional development
- Telecommuting
- Reporting to Gov't Agencies & Private Donors/Grantors
- Networking
- Research
- Security cameras
- Technology exhibits in our Science Center
- Telemedicine

OTHER RESEARCH

In addition to the CPUC data analysis and the three online surveys, EDFC conducted interviews with school districts, MCOE, County libraries, local governments, fire departments, internet service providers, individual Mendocino County residents, and community service organizations. More information on this research is available upon request.