YUBA COUNTY STRATEGIC MASTER BROADBAND PLAN

Revision 2.1

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Prepared by Valley Vision

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Valley Vision is a civic leadership organization dedicated to improving the livability of the Sacramento region. Through research and action, Valley Vision collaborates on solutions that improve people's lives. It has been in the center of strategic efforts to improve broadband access and digital inclusion efforts in the Sacramento Region. https://www.valleyvision.org/.

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1 EXECUTIVE SUMMARY

The Yuba Water Agency partnered with Valley Vision on behalf of the Yuba County to develop this **Strategic Master Broadband Plan** to accelerate the deployment and adoption of reliable high-speed and affordable broadband internet. This **Broadband Plan** outlines Yuba County's broadband access and adoption gaps, identifies barriers and challenges, and provide recommendations to bring broadband internet service to residents, businesses and community anchor institutions. The recommendations focus on 1) expanding broadband infrastructure and services, 2) develop and implement policies to reduce barriers and accelerate broadband deployments, and 3) outlines strategies to improve broadband adoption in multiple fields to ensure sustainability of broadband investment.

This **Broadband Plan** is especially timely after the shelter-in-place order, due to the COVID-19 pandemic, highlighted the need for having appropriate broadband internet service in order to conduct most areas of our lives from home, including working, attending classes, healthcare appointments, carrying out purchases, and accessing other online services--on top of traditional entertainment usage of the internet. Both the COVID-19 pandemic and shelter-in-place orders laid bare the **"Digital Divide"**, actually revealing a **"Digital Cliff"**. Furthermore, businesses and community anchor institutions also had to rely on internet connectivity in order to continue operating and serving the community. This crisis and ongoing recovery efforts call for increased investment in broadband infrastructure and services, and immediate actions to accelerate deployment and adoption.

This **Broadband Plan** provides a strategic framework for local action to be led and implemented by the **Yuba County Broadband Task Force**. The plan will assist on its comprehensive approach and efforts to expand internet connectivity across the county.

The main findings and highlights from the Broadband Plan are listed below.

Broadband Landscape in Yuba County

- Based on latest 2020 California Public Utilities Commission (CPUC)'s **broadband availability data** (as of December 2019), the **top four largest** (by available service to households) residential internet service providers are **Comcast** (cable modem), 76% of households, **AT&T** (xDSL, fiber optics, and fixed wireless), 65% of households, **Digital Path** (fixed wireless), 16% of households, and, **Succeed.Net** (fixed wireless), 11% of households.
- **96.3% of households** have access to only **two or less ISPs**, which indicates a non-competitive broadband market.
- **6% of households** are unserved at the **FCC and New CA standard of 25/3 Mbps**, **23% of households** are unserved at the **CA Broadband Action Plan Goal of 100/20 Mbps**, and **97% of households** are unserved at the **FCC gigabit definition of 1000/500 Mbps**. Most unserved areas are located in the Central and Northeast parts of the County (foothills).[1]

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[1] All data included in the Broadband Landscape in Yuba County is based upon 2020 CPUC data reported by ISPs. Independent verification of this data is necessary to validate.

- **Mobile broadband** service, provided by 4G LTE (aggregated coverage of AT&T Mobility, Sprint, T-Mobile and Verizon), is **mostly available in the West part** of the County, while there are service gaps in the Northeast part of the County.
- Most **business broadband** service is available in the West and South parts of the County. **Most agricultural areas are unserved** at business broadband speeds of 100/20 Mbps and 1000/500 Mbps. There are also several **unserved commercial** and **industrial areas** across the county.
- There are **middle-mile fiber optics routes** mostly in the **West part of the County** along Highways 20, 65 and 70, and the Hammonton Smartsville road. It is also likely that there is an AT&T backbone reaching the Northeast part of the County.

Broadband Needs and Demand Analysis

- **Broadband Needs Assessment: Meetings/Interviews Findings**

  To identify and quantify broadband access and adoption needs, virtual meetings were conducted, working closely and in coordination with the Yuba County Broadband Task Force and the Yuba Water Agency, with the following sectors: **local governments** (Yuba County and City of Wheatland), **education** (school districts of Camptonville, Marysville, Wheatland, and Plumas Lake, and Yuba College), **business** (Yuba/Sutter Economic Development Corporation), **farming and agriculture** (UC Agriculture and Natural Resources Cooperative Extension for Rice) and **local broadband stakeholders** (Beale Air Force Base).

  - **Future housing and commercial developments** (i.e., Wheatland's new city limits) need to incorporate, from planning stage, broadband infrastructure and services along with other utility services.
  - Local or regional **infrastructure projects** (i.e., South Yuba Transportation Improvement Authority) in public-right-of-way (digging/trenching/excavating) need to **coordinate** with local governments, internet service providers, and telecom companies to install broadband infrastructure in a cost-effective and timely manner.
  - **Education facilities** have access to **high-speed and reliable broadband service** from connecting to the CENIC High-Speed Network (using E-Rate funding). This high-speed connectivity and infrastructure are not available for extending service for local residential use due to federal statutory restrictions[2]. **Major connectivity needs** are from **students at home in rural unserved areas**. Identified communities with connectivity issues include: Browns Valley, Challenge-Brownsville, Dobbins, Hallwood, Linda, Loma Rica, Marysville (North, West and heading up to the foothills), Olivehurst, Sierra Foothills, and Sutter borderline.

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[2] FCC's E-Rate Eligible Service List for Funding Year 2021. p 12. "Off-campus use, even if used for an educational purpose, is ineligible for support and must be cost allocated out of any funding request."
https://docs.fcc.gov/public/attachments/DA-20-1418A1.pdf

- There will be **growing need for additional high-capacity backbone** to the Beale Air Force Base and adjacent residential area, in addition to the broadband capacity needs of the upcoming University Affiliated Research Center (UARC).
- Identified areas of concern for **business internet access** are mostly in the **foothills**. **Access** and **reliability** of business tier internet service are main issues. Additionally, new commercial developments should include availability of broadband infrastructure from early planning stages.

- There is a **growing internet connectivity trend in Ag** for connected devices, sensors and vehicles in farm fields. Connectivity for offices in urban areas is expensive, and minimally-available in rural areas. Additional potential demand for commercial broadband connectivity comes from industrial facilities (i.e., rice mills and food processors).

- **Residential Broadband Service Market Analysis**

   This analysis is based on internet service **speed tests results** (2020-2021) using the CPUC's **CalSPEED application**, for both fixed and mobile service measurements, to assess (validate) actual levels of broadband coverage and speeds.

   - **Fixed Residential** Broadband Service: Speed test results indicate (from a total of 27) that the **Central and Northeast parts of the county** have speeds **below 25Mbps** and there is some discrepancy between the reported coverage (based on self-reported ISP data to the CPUC) and actual measurements. In the **Western side of the county**, in Marysville and Linda, there are **higher speeds available (above 100Mbps)**. The highest speed results are provided by AT&T and Comcast's service.

   - **Mobile Broadband** Service: Speed test results indicate (from a total of 49) that in the **Northeast part of the county**, in the edge of Loma Rica, Dobbins and Challenge-Brownsville, mobile broadband speeds are **below the CA standard (6/1 Mbps)**. In the same area, but **within town limits**, there are higher speeds (**6-25Mbps range**) provided by AT&T Mobility and Verizon. Speeds in the next speed range (**above 25Mbps**) are available in the **Western part of the county** (Marysville), and few locations in the Northeast (North of Dobbins). The highest speed range (**above 100Mbps**) is available in **Plumas Lake** by T-Mobile.

- **Business Broadband Service Market Research**

   In addition to the virtual meetings, two online surveys were conducted addressed to 1) the **business and commercial sector**, and 2) **farm and agricultural sector**. The business/commercial sector survey was distributed to businesses in the County in collaboration with Yuba County, Yuba-Sutter Chamber of Commerce, and the Yuba-Sutter Economic Development Corporation. The farms and agricultural sector survey was distributed to local farmers and growers in

collaboration with the University of California, Agricultural and Natural Resources (UCANR)-Cooperative Extension.

- o **Business Broadband Survey Results (35 respondents)**
    - **Contracted business ISPs:** AT&T (34.3% or 12), Comcast-Xfinity (34.3% or 12), Succeed.Net (17.1% or 6), Verizon (5.7% or 2), CalNet (2.9% or 1), other (2.9% or 1). 2.9% (1) did not have internet service.
    - **Broadband technology:** Cable modem (28.6% or 10), xDSL (17.1% or 6), fixed wireless (17.1% or 6), fiber optics (11.4% or 4), satellite (5.7% or 2), other technology (5.7% or 2), and mobile LTE/mobile hotspot (2.9% or 1). 8.6% (3) do not know the type of technology, and 2.9% (1) do not have the internet service.
    - **Measured (CalSPEED) speeds vs Contracted speeds**: download/upload speeds lower than contracted (37.5% or 9), around the same as contracted (45.8% or 11), and higher than contracted (0% or 0). Two do not have internet service, and 11 did not know. Two respondents did not answer this question.
    - **Service satisfaction:** Internet service is not good enough for business needs (51.4% or 18), internet service is good enough for business needs (42.9% or 15), and unsure (5.7% or 2)
    - **Service perception:** Not fast enough (12 or 66.7%), unreliable (10 or 55.6%), too expensive (7 or 38.9%), and insufficient customer service (5 or 27.8%). One (1 or 8.3%) respondent reported they do not have internet due to the cost of service.
    - **Internet usage:** General use (i.e., email, internet browsing, etc.) (85.3%), online payment processing (73.5%), online business applications (70.6%), online research and information (67.7%), access social media (64.7%), videoconferencing (64.7%), online banking (61.8%), data backup (55.9%), file sharing (50%), security monitoring (47.1%), web hosting (29.4%), agriculture & farming technologies (11.8%), and others (11.8%).

- o **Farm and Agriculture Broadband Survey Results (18 respondents) – Coverage in the Farm Fields**
    - **Contracted business ISPs:** AT&T (50% or 9), Succeed.Net (22.2% or 4), Verizon (11.1% or 2), T-Mobile (5.6% or 1), and Hughes (5.6% or 1). 11.1% (2) did not have internet service in the field.
    - **Broadband technology:** mobile LTE/mobile hotspot (35.3% or 6), fixed wireless (23.5% or 4), Satellite (5.9% or 1), xDSL (5.9% or 1), fiber optics (5.9% or 1). 23.5% (4) do not have internet in the field. One respondent did not answer this question.
    - **Service satisfaction:** Internet service is not good enough for business needs (16.7% or 3), internet service is good enough for business needs (83.3% or 15).
    - **Service perception:** Not fast enough (80% or 12), unreliable (73.3% or 11), too expensive (46.7% or 7), and insufficient customer service (13.3% or 2).

- ▪ **Potential improvements by better internet:** remote control and monitoring (14 or 82.4%), usage of soil and crop sensors (10 or 58.8%), storage and analysis of soil, crop, animal, or other data (9 or 52.9%), aerial monitoring and farming activities via drones (4 or 23.5%), usage of autonomous or remote farming equipment (4 or 23.5%), usage of autonomous or remote farming equipment (1 or 5.9%), Six (36%) added marketing produce and livestock (2), monitoring and emergency alarms (2), security (1), information on their industry (1).

RECOMMENDATIONS TO EXPAND/UPGRADE BROADBAND INFRASTRUCTURE AND SERVICES

- The plan presents recommendations, strategies, and approaches to proactively accelerate expansion and upgrade of broadband infrastructure and services in Yuba County. The **Yuba County Broadband Task Force** should lead the countywide broadband efforts in partnership with broadband stakeholders including State and local agencies, community anchor institutions, community-based organizations, business organizations, internet service providers and telecommunications companies, among others.
- The recommendations address the **needs, findings, results and gaps identified** in this plan.
- The recommendations include the following:
    - ○ **Setting future-proof broadband performance standards for the County:** Set a **near-term goal (1-5 years)** aligned to the recent 100 Mbps downstream standard of the California Broadband Action Plan. **For the long-term (5-10 years)**, set a gigabit county standard to ensure deploying future-proof infrastructure to handle the growing internet usage for all residents and businesses.
    Businesses and community anchor institutions require higher speeds than residential service users, including higher reliability and consistency. For these commercial users, it is recommended to set standards in the range of hundreds of Mbps and up, including symmetrical downstream and upstream speeds.
    - **Selecting priority areas for broadband expansion and upgrades:** The needs and demand analysis provided the following list of areas and communities in need of improved broadband service: Browns Valley, Challenge-Brownsville, Dobbins, Hallwood, Linda, Loma Rica, Marysville (North, West and heading up to the foothills), Olivehurst, Sierra Foothills, Sutter borderline, Wheatland (new city limits). It is important to identify unserved areas at different broadband standards (25/3 Mbps, 100/20 Mbps, and 1000/500 Mbps) within and nearby these communities. Priority areas also include unserved (at a minimum of 100/20 Mbps) agricultural, commercial and industrial areas.
    - **Validating broadband coverage and speeds:** Conduct validation and ground truth of actual broadband coverage and speeds; especially in priority areas or areas that residents and/or broadband stakeholders widely report issues regarding lack of internet access, or poor and unreliable connectivity. As the CPUC gathers data from providers (supply side of the internet service market) on an annual basis (scaling back from twice a

year), the county, in partnership with a coalition of broadband stakeholders, should carry out annual or bi-annual broadband service (coverage and speed) validation campaigns for internet users (demand side of the internet service market).

- **Expanding broadband infrastructure and services to priority areas:** It includes expanding middle-mile and last-mile infrastructure to unserved areas, mostly located in the Central and Northeast parts of the County. This plan presents estimated costs to expand connectivity to unserved areas and households.
- **Developing strategic partnerships for cost-effective broadband deployments:** Including partnership with local jurisdictions and local government agencies and departments, broadband infrastructure providers, Caltrans, CENIC, community anchor institutions, among others.
- **Applying to Federal and State broadband infrastructure and services programs/grants:** The plan presents a comprehensive list of Federal and State broadband infrastructure grants and programs, including from the California Advanced Services Fund (CASF), the US Department of Agriculture (USDA), National Telecommunications and Information Administration (NTIA), Economic Development Administration (EDA), among others.

Policy Recommendations to Support Broadband Infrastructure Deployment and to Reduce Entry Barriers

- The Yuba County Municipal Code includes several provisions on the standards for wireless communication facilities and the design review process. These provisions **apply broadly to telecommunications** infrastructure. There are **no provisions in the Code that deal specifically with broadband** infrastructure, although there are numerous provisions that deal with the conduit required for operating a cable television franchise.
- Broadband-specific infrastructure regulations serve to streamline infrastructure deployment processes, including lowering costs and maximizing efficiency and wait times — all critical to making the County investment-ready.
- Based on the assessment of existing telecommunications and broadband-related policies and ordinances, the following are recommended policy approaches that would encourage and facilitate investment in broadband infrastructure deployment:
  - o **Future-Ready Broadband Planning:** The County should support deployment of broadband infrastructure and services by including broadband facilities in planning for all public buildings, major transportation and all public works projects. Including new housing and commercial developments.
  - o **Permitting, Licensing and Other Regulations**: It includes 1) streamlining the process around deployment (particularly permitting), 2) updating ordinances, 3) creating clear permit application processes and efficient online tools, 4) developing an asset inventory, and 5) adopting a standard master license agreement for broadband infrastructure deployment.

- o **Dig Once/"Dig Smart" Policy:** This policy promotes the placement of fiber or conduit in the ground any time there are digging, trenching or excavation projects in the public-right-of-way, especially transportation, public works or utility projects.
  - o **Adopt Innovative Policies and Technology:** It includes: 1) microtrenching, 2) policies that support high-capacity fiber backbone, 3) adopt the Digital Equity Bill of Rights, 4) adopt a broadband access policy or a policy to bring broadband to unserved communities, and 5) 5G deployment.
  - o **Coordination with Stakeholders:** The County should ensure clear and consistent lines of communication with ISPs, telecom companies, broadband infrastructure providers, and critical broadband stakeholders including state agencies, public utilities, and community anchor institutions.
  - o **Allocate Staff Resources: Increasing staff capacity at the County level will help ensure a coordinated, focused** approach to advance broadband priorities.
  - o **Conduct Broadband Coverage and Speed Data Gathering:** The County should continue conducting broadband coverage validation County and supporting State efforts, which includes widespread use of the CalSPEED (or other similar professional-level testing tools) app by residents and businesses.
- Review best policy practices and resources provided in this plan.

Recommendations to Improve Broadband Adoption

- **Broadband Adoption (subscription rates):** Based on **CPUC broadband adoption data** (as of December 2019), **32% of housing units do not have connections** at least at the CA standard of **6/1 Mbps**, **48% of housing units** do not have connections at least at the FCC and New CA standard of **25/3 Mbps**, **65% of housing units** do not have connections at least at the CA Broadband Action Plan Goal of **100 Mbps download**.
- Currently **AT&T** and **Comcast** (two largest ISPs by number of households) **offer affordable plans** for low-income or qualifying households. Digital Path (third largest provider do not offer affordable (discounted) plans.
- **Digital Skills and Digital Literacy Programs** are currently offered by the **Yuba County Library**, **Yuba County One Stop Center**, **E Center**, **Area on Aging 4**, and **Comcast RISE**.
- Based on data from the **American Community Survey (ACS) 2019**, **80% to 100% of households** in the County has at least **one or more computational device**.
- **Affordable Hardware Devices** are provided by the **E Center** (as long funding allows), and during the pandemic, **Yuba College** offered for check out **Wi-Fi hotspots** and **laptops**.
- During the pandemic, **school districts** (Camptonville, Marysville, Plumas Lake, and Wheatland) continued working based on **online platforms** and **distance education**.
- There is a **need for telehealth** in the County as there is **low number of health care professionals**. For example, the ratio of primary care physicians to population in Yuba County is 1: 4,340. There are currently some telehealth services offered by local health care providers.
- **Recommendations to improve broadband adoption** and subscribership are the following:

- Yuba County could **develop a portal** that links to websites or internet services provider **websites listing affordable plans**.
- Local digital skills programs have traditionally been under-resourced in the local region. By **providing digital skill building activities**, the county and organizations, especially educational institutions, the Library and nonprofits can **uplift residents to be more technologically educated**. The County Broadband Task Force could provide **updated resource lists** along as part of its ongoing activities, and could explore a framework for developing a digital equity skills curriculum.
- Supporting **development of a technology navigation center** that would provide a space for free Wi-Fi and access to computing devices in each town; especially to reach the rural areas in the county.
- **Distance education** should also be supported by **hardware devices** and **digital skills/literacy training**. These could be supported through schools along with internet services providers that provide low-income and affordable devices including hotspots.
- Maintaining the **increased access to telehealth services** after the COVID-19 pandemic will be important to provide access for those living in rural parts of the county, as well as those who are unable to leave their home for health or scheduling conflicts.
- **Work collaboratively and support** a wide range of community anchor institutions (i.e., education, health care, workforce, and economic development), community-based organizations and community centers to **apply for Federal and State broadband adoption funding**. This plan provides a comprehensive list of Federal and State funding opportunities.

2 INTRODUCTION

This introductory section presents a brief demographic and economic profile of Yuba County. Following is an overview of current and relevant fields were broadband has become a critical element to support prosperity and economic development for the County, including public digital services (or "Smart Jurisdiction"), equity and education, clean air and clean economy, future-ready workforce, food and agriculture technology, and emergency preparedness and response. This section also introduces current Federal and State broadband standards (based on speed) used to define status of "served" or "unserved" areas. Additionally, it describes broadband technologies used to deliver internet services to the population, households and businesses, including wireline, fixed wireless, and mobile wireless technologies. Finally, this section presents main broadband demand drivers and trends, including household broadband needs, and most common applications that drive internet usage.

2.1 Demographic and Economic Profile for Yuba County

This demographic and economic profile presents an overview of the population, environment, and industry indicators in Yuba County. These indicators contribute to an understanding of the County's broadband gaps and help inform the recommendations of the Broadband Plan to ensure that they are appropriate and effective for the size and characteristics of the County and its communities.

Yuba County is located in the California's Central Valley Region (see location and map in Figure 1) along the Feather River. The most recent Census Bureau data available[3] indicates that Yuba County has a population of 78,668 people; among those, 12,476 and 3,810[4] live in the cities of Maryland and Wheatland respectively. In terms of race and ethnicity, seventy-eight percent of the population identify as White alone; seven percent as Asian alone; four percent as Black or African-American alone; and twenty-nine percent as Hispanic or Latino.

The bulk of Yuba County's population is clustered along the State Route 70 and 65 corridors between Marysville, Plumas Lake, and Wheatland with significant additional clusters around the towns of Loma Rica, Challenge-Brownsville, and Dobbins. Interviews conducted with local elected officials during the outreach and engagement process of this Plan found that a majority of the County's population resides on the valley floor, most within a few miles of the river. The County is mostly suburban, with some rural areas, and large swathes of agricultural land.

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[3] Yuba County Quick Facts, US Census Bureau https://www.census.gov/quickfacts/yubacountycalifornia
[4] Wheatland, CA profile, Census Reporter https://censusreporter.org/profiles/16000US0685012-wheatland-ca/
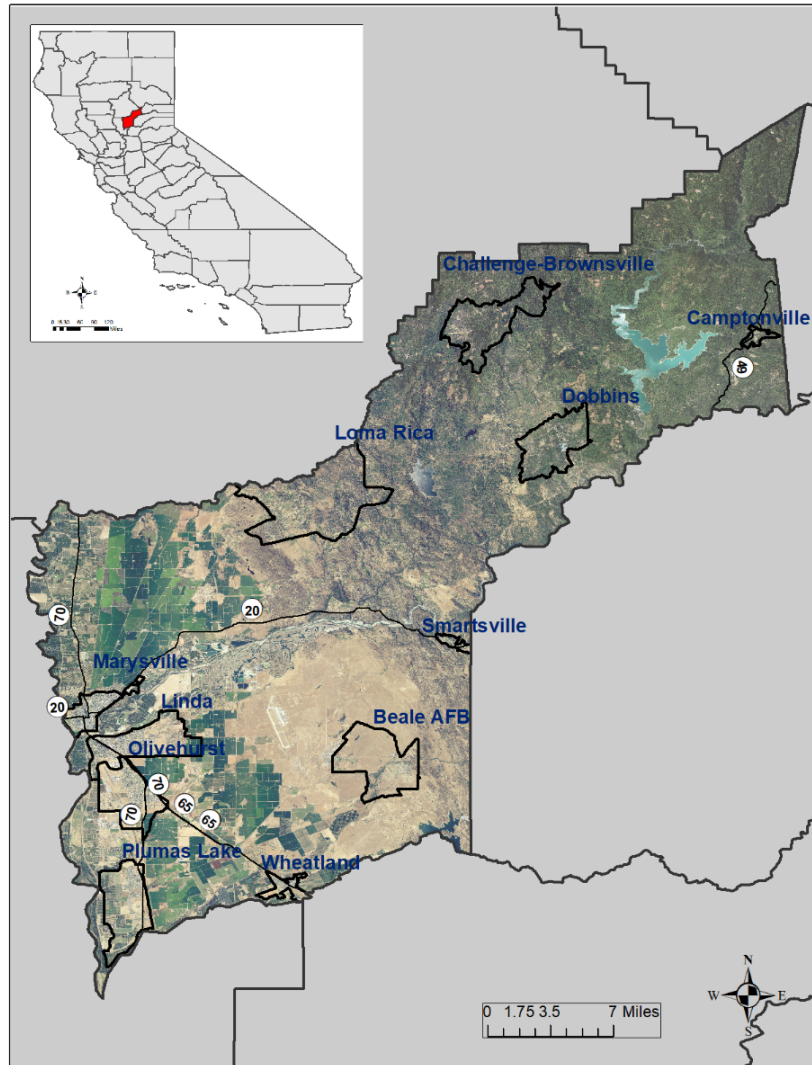
Figure 1. Yuba County Map.

There are 29,049 housing units and 26,354 households, with 2.84 persons per household. Of these households, 90.5% have a computer, and 83.1% have an internet subscription. Urban and suburban areas generally have access to broadband internet and a few providers to choose from, including fiber to the home. However, for lower-income residents there are not enough affordable and reliable options for connectivity. The further away from the city centers, the more options for connectivity are limited. When these options do exist, they are often at slower speeds. In the foothills, even mobile coverage is limited, which makes communications challenging for ongoing economic activities and day to day life, and particularly more challenging during wildfire season when it is most needed.

The median household income is $58,054, and fifteen percent of the population lives in poverty. Between 2008 and 2017, Yuba County maintained a higher percentage of students enrolled in free and

reduced meal programs than the statewide average. These two data points in particular underscore the need for affordable Internet subscriptions and programs.

The primary industries in the County[5] are government and government enterprises (37% of county jobs), healthcare and social assistance (12.5% of county jobs), and retail trade (7.4% of county jobs). Farm employment also makes up a significant percent of county jobs (4%).

2.2   Broadband Importance for Communities, Economic Development and Prosperity in Yuba County

Broadband availability and adoption are critical to the County's economic development and overall livability. Specifically, it would put the County and its cities on the path to becoming "smart" jurisdictions, as well as facilitate advancements towards equity in education, a clean economy, a future-ready workforce, cutting-edge food and agriculture technology, improved emergency preparedness and response, among other areas.

2.1.1.   The Path to Becoming a "Smart" Jurisdiction

Depending on the source, there are many different interpretations of what makes a city "smart" — for example, using digital technology and the Internet to make certain processes more efficient (e.g., transitioning the various permitting applications and approvals to an online format, instead of in-person). Broadly, the notion of a "smart" city refers to any jurisdiction that "uses information and communications technology (ICT) to enhance its livability, workability and sustainability" (the Smart Cities Council[6]). Even if this definition is vague, there are many specific examples of how it can be operationalized (the McKinsey Global Institute[7]):

1. In the transportation space, mobile applications can provide relevant and real time traffic or public transport updates to commuters, whether they are driving their own cars or taking public transport.
2. In the telehealth space, non-emergency consultations with healthcare providers can be conducted via videoconference; digital devices that take vital signs readings and forward the results to doctors can be used to remotely monitor those with certain medical conditions, such as diabetes or cardiovascular disease. This would be especially relevant in areas where residents need to travel to a different city to visit their healthcare provider (e.g., in Wheatland, where many residents travel to the Kaiser Permanente in Lincoln).

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[5] 2018 Yuba Economic & Demographics Profile.
https://www.rcrcnet.org/sites/default/files/useruploads/Documents/Advocacy/Economic_Development/County_Profiles/2018%20Yuba%20Economic%20&%20Demographic%20Profile.pdf
[6] The Smart Cities Council. https://rg.smartcitiescouncil.com/readiness-guide/article/definition-definition-smart-city
[7] What makes a city smart? https://www.mckinsey.com/business-functions/operations/our-insights/smart-cities-digital-solutions-for-a-more-livable-future#part1

3. In the civic engagement space, mobile applications can provide easy access to city services, or an additional venue for communicating securely with county or city staff and participating in public-facing meetings, such as Boards of Supervisors or City Council meetings.

2.1.2. Broadband and Equity in Education

The Digital Divide that existed even prior to the pandemic has, in the past year, revealed itself to be a "Digital Cliff" as more Californians fell off into deeper poverty and greater isolation. In Yuba County, as in many other parts of the region, this was especially evident in the education space, where many K-12 and college-level students did not have sufficient Internet access to be able to transition to remote learning. These gaps in broadband availability and adoption, discussed in greater detail throughout this Plan, cannot be fully addressed by the education sector alone. Although the County's school districts and colleges have implemented numerous successful stop-gap measures to enable remote learning — loaning hotspots and Chromebooks to students, working with Internet Service Providers to arrange low-cost Internet plans, Wi-Fi hotspot buses, extending campus Wi-Fi to parking lots, among others — these are not sustainable, because they do not address the infrastructure gaps or provide a long-term solution to affordability and adoption. They are tactical solutions; what is needed is a strategic approach.

2.1.3. Broadband, Cleaner Air, and the Clean Economy

Broadband availability and adoption are critical to monitoring and improving the air quality of the County, as well advancing its clean economy goals.

In terms of air quality, the six-county Capital Region, which includes Yuba County, is home to 2.5 million people, and ground zero for toxic air quality from increasingly catastrophic wildfires. Air monitoring technology is often dependent on reliable broadband infrastructure. For example: The Community Air Protection Program[8], created in 2017 by Assembly Bill 617, empowers California's most polluted communities to monitor their air quality and guide investments to reduce carbon emissions and improve public health in frontline neighborhoods. Through this program, Sacramento's Old North Sacramento/Norwood and Oak Park neighborhoods were given a grant to monitor their air, understand how air quality impacts health, and develop a plan to reduce exposure to air pollution. The program relies on Clarity Node-S air monitors[9], which use mobile broadband 2G/3G/4G for their device-to-cloud communication. This technology requires a high-capacity and reliable backbone. Improving broadband infrastructure in the County would enable it to deploy and use this and similar types of technology, which are especially critical in the areas prone to wildfires. The Feather River Air Quality Management District[10] — a bi-county District that was formed in 1991 to administer local, state, and federal air quality

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[8] The Community Air Protection Program. https://www.valleyvision.org/projects/community-air-protection/
[9] Clarity Node-S air monitors technical specifications. https://click.clarity.io/hubfs/Marketing%20Assets%20-%20PDFs/Product%20and%20Specification%20Sheets/Node%20S%20Specifications%20Sheet.pdf?_ga=2.147404543.955058625.1621441166-551749316.1621441166
[10] Feather River Air Quality Management District. https://www.fraqmd.org/

management programs for Yuba and Sutter counties — has taken several actions[11] to further air quality monitoring and improvement. Improved broadband infrastructure in the County could be leveraged by the District in furthering these efforts.

In terms of the clean economy, the six-county Capital Region does not meet the health-based National Ambient Air Quality Standards, mainly due to emissions from the transportation sector. Regionally, efforts are underway[12] to address this issue, including transitions to zero-emission buses, expansion to climate-friendly commuter rail, among others. The benefits of these and other similar advancements would be maximized if future-ready broadband infrastructure was present in the County. For example, the use of mobile applications would provide relevant and real time traffic or public transport updates to commuters.

2.1.4. Broadband and a Future-Ready Workforce

Broadband availability and adoption are critical to ensuring that the County's residents and communities are ready for the future of work, including transformations in workforce and the workplace. As noted by the National Skills Coalition "Digital Literacy, or the ability to use information and communication technologies to find, evaluate, create and communicate information, is an increasingly critical skill in a changing economy"[13].

A 2020 report[14] on the automation risk for jobs in the six-county Capital Region found that fifty percent of all workers are concentrated in six industry sectors in the region, and three of those sectors have an above average risk of automation: retail trade, accommodations and food services, and construction. These three sectors contained about 300,000 jobs in 2018 and are projected to grow by 7.9%, adding another 23,500 jobs by 2023. These data points indicate the need for a future-ready workforce that is able to adapt to the changes that artificial intelligence and automation will bring. There is a need to upskill (teach additional skills to enhance capabilities) and reskill (train in a new occupation) residents into positions paying similar or higher wages, while reducing overall job loss risk due to technological advancement. This includes, among other things, investment in digital skills education, training and digital access, particularly targeting underserved communities to ensure participation in the new economy by all residents. Addressing digital skills acquisition is a foundational priority in the Region's Prosperity Strategy[15].

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[11] Community Air Protection Program Survey. https://www.fraqmd.org/community-air-protection-program
[12] Federal Clean Air Advocacy Materials (April 2021). https://www.valleyvision.org/resources/federal-clean-air-advocacy-policy-papers-april-2021/
[13] Digital Fluency for a Resilient Economy, National Skills Coalition. https://software.org/blog/digital-fluency-for-a-resilient-economy/
[14] Automation Risk for Jobs in the Capital Region. https://www.valleyvision.org/wp-content/uploads/Automation-Risk-for-Jobs-in-the-Sacramento-Capital-Region_COE_VV_FOW_FINAL.pdf
[15] Greater Sacramento Comprehensive Economic Development Strategy. https://www.valleyvision.org/wp-content/uploads/Greater-Sacramento-CEDS-May-2020.pdf

A poll conducted by Valley Vision in partnership with California State University of Sacramento in 2021 on the impact of the COVID-19 pandemic[16] on individuals and communities in the region found that the percent of people who work from home either part or full time shot up from thirty-eight percent prior to the pandemic to seventy percent during the pandemic. By a wide margin, most respondents (78%) said they want to continue to work at home at least one day a week, even when restrictions are lifted, and twenty-eight percent said that they want to continue to work at home full time. It's clear that, even when restrictions are lifted, there will be no "return to normal" in terms of where and how people work.

Broadband availability and affordability are indispensable for students and workers to obtain, practice, and use digital skills, as well as transition to working from home for those whose jobs can be done remotely. Likewise, businesses and employers need reliable broadband in order to be adaptable to these trends. Improved broadband infrastructure in the County would enable its residents and communities to keep pace with these fundamental shifts in the workforce and workplace.

2.1.5. Broadband and Food & Ag Technology

Agriculture has become increasingly reliant on technology for water and energy conservation, reduction of chemical inputs, and increased productivity. Most of this technology requires broadband access, yet many rural areas do not have access to technology-neutral, high-speed Internet access from both wired and wireless infrastructure.

A 2020 regional AgTech workforce assessment[17], conducted by Valley Vision and Los Rios Community College, asked employers in the region about their future automation and technology plans. All predicted their facilities would continue to become more automated and technologically advanced. The rate of technology inclusion and implementation varied for each employer, but all were exploring ways they could further increase the sophistication of their processes. When asked about their top three concerns for the future of AgTech in the Sacramento Region and nationally, employers identified limited broadband connectivity. Without access to broadband, farmers and ranchers are unable to adopt new technologies necessary to stay economically viable.

Broadband is critical for the adoption of Ag technologies (precision agriculture); food technologies in processing, packaging and distribution; R&D; rural business development; and access to vital services. COVID-19 has exposed even more deeply the region's Digital Divide and disparities between urban and rural areas.

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[16] Valley Vision's Resilience Poll 2021. https://www.valleyvision.org/wp-content/uploads/VV_Resilience-Poll-3_5-2021.pdf
[17] Greater Sacramento Region's Food & Ag Cluster AgTech Workforce Assessment: Skills for the 21st Century Digitalization Era. https://www.valleyvision.org/wp-content/uploads/Ag-Tech-Industry-Final-FINAL-Report-8-24-20.pdf

2.1.6. Broadband and Emergency Preparedness and Response

In the event of an emergency, Listos California[18] and other emergency preparedness programs recommend as many accessible mediums as possible – phone alerts, text alerts, announcements over radio and TV, and availability of real time information through the Internet are vitally important as situations are emerging and as disasters are underway. The redundancy of mediums is needed in case systems fail (e.g. electricity goes out, phone lines are damaged, etc.).

Valley Vision conducted polling throughout the Listos campaign to learn about people's preferences and experiences with natural disasters and preparedness. When asked where they had previously heard about preparing for natural disasters, 71% identified the Internet, email, or social media as the place that they had previously heard about preparing for natural disasters. The next highest percentage was 59%, who reported Television. So, internet is the place where people had most frequently received prior information about emergency preparedness. When asked which sources they would use for information in a natural disaster, 47% reported the internet (which was exceeded by TV news (at 52%) and radio (at 57%). But it was still one of the leading sources people would want to turn to get information about how to respond in a disaster. The Internet is also critical for economic recovery and long-term resilience.

2.3   Broadband Definitions and Speed Standards

The Federal Communications Commission (FCC) and the California Public Utilities Commission (CPUC) define advanced telecommunications capability (broadband) primarily in terms of downstream and upstream speeds. This is a particularly useful metric for analyzing the deployment and performance of broadband services. In the 2015 Broadband Progress Report[19], the FCC updated the definition of broadband to 25 megabits per second (Mbps) downstream and 3 Mbps upstream (previously defined as 4 Mbps downstream and 1 Mbps upstream). In 2017, the California legislature changed the definition of unserved areas to areas where broadband is offered at slower speeds than 6 Mbps downstream and 1 Mbps upstream[20]. Recently, in July 2021, the California broadband standard was increased to 25 Mbps downstream and 3 Mbps upstream, matching the FCC standard. The following are current broadband standards and definitions used in Federal and State broadband programs:

- **6/1 Mbps[21]:** Speeds of 6 Mbps downstream and 1 Mbps upstream. Previous California standard (AB 1665, 2017).
- **25/3 Mbps:** Federal Communications Commission (FCC) and New CA (2021) broadband standard.

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[18] Listos California. https://www.listoscalifornia.org/
[19] Federal Communications Commission (FCC). (2015, January). *2015 Broadband Progress Report.* Retrieved June 2017. https://apps.fcc.gov/edocs_public/attachmatch/FCC-15-10A1.pdf
[20] California Legislative Information (CALEG). (2017, October). AB-1665 Telecommunications: California Advanced Services Fund. Retrieved Dec 2017.
https://leginfo.legislature.ca.gov/faces/billNavClient.xhtml?bill_id=201720180AB1665
[21] Megabits per second.

- **100 Mbps:** 100 Mbps downstream is the speed goal set in the Governor's Executive Order (August 2020) and the California Broadband for All Action Plan (December 2020).
- **1Gbps/500Mbps:** FCC's Gigabit-level service definition.

Section 3 Current Broadband Landscape in Yuba County describes broadband coverage at these broadband speed standards in the County.

The FCC or CPUC currently do not adopt non-speed performance metrics in progress reports due to a current lack of comprehensive data on factors other than speed. However, they recognize the importance of low latency and high consistency in providing advanced telecomm capability (broadband). The following are supplemental broadband benchmarks described in the FCC's 2016 Broadband Progress Report[22], which in the future will help evaluating broadband service in a more comprehensive manner.

- **Latency (milliseconds or ms):** Latency is defined as a measurement of the time it takes a data packet to travel through the network. It significantly impacts the performance of interactive, real-time applications, including VoIP, online gaming, videoconferencing, and VPN platforms. In practical terms, latency is perceived as a delay in the data transmission, for example a delay from the time a user clicks to download a file to the time the downloading process begins, or a voice/videoconference call being out of sync requiring participants wait periods between exchanges.
- **Consistency (or reliability):** Consistency has the potential to significantly impact whether a service delivers broadband to consumers with meaningful access to interactive advanced services including VoIP, telemedicine, and online education applications using high-quality voice, data, graphics, and video telecommunications. A reliable service is resilient to regular outages and enable a reliable provision of broadband.
- **Packet Loss:** The Measuring Broadband America program denotes a packet as lost if the latency exceeds 3 seconds or if the packet is never received. Packet losses might affect the perceived quality of phone calls or video conferencing.

2.4 Current and New Broadband Technologies for Residential and Business Sectors

This subsection describes different broadband technologies used to deliver broadband service. The technologies are grouped based on current CPUC categories including wireline, fixed wireless and mobile.

2.4.1 Wireline Broadband

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[22] Federal Communications Commission (FCC). *2016 Broadband Progress Report.* https://apps.fcc.gov/edocs_public/attachmatch/FCC-16-6A1.pdf

Wireline broadband technologies include: digital subscriber line (DSL), cable modem and fiber-to-the-home (FTTx). Cable modem and FTTx technologies are primarily deployed in dense urban and suburban areas. Legacy DSL technologies reach these areas in addition to some rural areas near to concentration points. Deployment and coverage limitations of these technologies include access to rights-of-way and potential high costs of underground deployments. In some cases, aerial deployments can be an optimal and cost-effective solution to carry out these deployments. For more details on broadband technologies including advantages and limitations see **Appendix 8.1 Broadband Technologies**.

Table 1. Wired Broadband Technologies.

Technology	Physical Layer	Downstream/Upstream Speeds
Digital Subscriber Line (xDSL)	Copper Telephone Lines	6/1 Mbps (ADSL2/ADSL2+ @ 12,000 feet loop) 35/6 Mbps (VDSL2 @ 3,000 feet loop) 20/4 Mbps (VDSL2 @ 5,000 feet)
Cable Modem	Coaxial Cable	40/30 Mbps (DOCSIS 2.0) 1000/200 Mbps (DOCSIS 3.0) 20/1-2 Gbps (DOCSIS 3.1) 10/6 Gbps (DOCSIS 4.0)
Fiber-to-the-Home (FTTH)	Fiber Optics	2.5/2.5 Gbps(GPON) 1.25/1.25 Gbps (EPON) 10/10 Gbps (NG-PON2, XG-PON)

2.4.2   Fixed Wireless Broadband

Fixed wireless broadband includes IEEE 802.11 standard, LTE (4G), millimeter-wave, high-speed satellite, Television White Spaces, among others. These technologies are primarily deployed in areas where wireline technologies do not have complete coverage, such as rural areas. Deployment and coverage limitations of these technologies include obstructions (i.e. terrain and/or vegetation) between the antenna at the customer premises and the access point or base station located on a pole or tower. These obstructions can prevent or disrupt communications in fixed wireless radio links by causing attenuation, scattering, diffraction and absorption of electromagnetic waves. Theoretical speeds might significantly reduce (by 5x or more) depending on line-of-sight (LOS), obstructions, spectrum interference, number of simultaneous end users, multiple access protocols, and in some cases atmospheric precipitations. For more details on broadband technologies including advantages and limitations see **Appendix 8.1 Broadband Technologies**.

Table 2. Fixed Wireless Broadband Technologies.

Technology	Physical Layer	Downstream/Upstream Speeds
IEEE 802.11 Standard	Unlicensed Spectrum	300 Mbps (2.4 GHz 802.11n) 900 Mbps (5 GHz 802.11ac)
LTE	Licensed & Unlicensed Spectrum	40/30 Mbps (DOCSIS 2.0) 1000/200 Mbps (DOCSIS 3.0) 20/1-2 Gbps (DOCSIS 3.1) 10/6 Gbps (DOCSIS 4.0)
Millimeter-wave	Licensed & Unlicensed Spectrum	2.5/2.5 Gbps
TV White Spaces	Unlicensed Spectrum	27 Mbps (6MHz Channel IEEE 802.11af) 427 Mbps (6MHzx4 Channel MIMO IEEE 802.11af) 24 Mbps (6MHz Channel IEEE 802.22)
High-Speed Satellite	Licensed Spectrum	800 Mbps x 2 (Medium Earth Orbit Satellites) 50 to 150 Mbps (Low Earth Orbit Satellites)

2.4.3 Mobile Broadband

Mobile broadband includes packet-based data technologies such as 2G (GPRS, EDGE and CDMA2000), 3G (WCDMA, HSDPA, HSPA and CDMA2000 EV-DO), and 4G (LTE and WiMAX). Although evolution of these technologies has made mobile broadband services much more versatile and useful to consumers by providing mobility and portability, there are important differences between mobile and fixed broadband. Mobile transmissions, due to using wireless spectrum, operate under environmental factors that can impact consistent coverage and speeds. These technologies are primarily deployed in densely populated urban areas and, in a smaller scale, in rural areas. Coverage limitations of mobile broadband come from obstructions (i.e. terrain and/or vegetation) between base stations located on towers and mobile devices, and availability and access to the licensed spectrum. For more details on broadband technologies including advantages and limitations see **Appendix 8.1 Broadband Technologies**.

Table 3. Mobile Broadband Technologies.

Technology	Physical Layer	Downstream/Upstream Speeds
4G (LTE)	Licensed Spectrum	300 Mbps (aggregated download speeds) 900 Mbps (5 GHz 802.11ac)
5G	Licensed Spectrum	Gigabit capacity

2.5 Broadband Demand Drivers

The demand for broadband has grown in the last decade and it is estimated to continue growing. The Cisco Annual Internet Report[23], which includes projections for Internet users, devices, connections, and network performance, estimated the following internet usage for the North America Region:

- By 2023, North America will have **345 million Internet users** (**92 percent of regional population**), up from 328 million (90 percent of regional population) in 2018.
- By 2023, North America will have **329 million mobile users** (**88 percent of regional population**), up from 313 million (86 percent of regional population) in 2018.
- By 2023, North America will have **5.0 billion networked devices/connections**, up from 3.0 billion in 2018.
- By 2023, North America will have **25 percent of all networked devices mobile-connected** and **75 percent will be wired or connected over Wi-Fi**.
- By 2023, North America's **average fixed broadband speed will reach 141.8 Mbps**, which represents 2.5-fold growth from 2018 (56.6 Mbps).
- By 2023, North America's **average mobile connection speed will reach 58.4 Mbps**, which represents 2.7-fold growth from 2018 (21.6 Mbps).
- By 2023, North America's **average Wi-Fi speeds from mobile devices will reach 110 Mbps**, which represents 2.3-fold growth from 2018 (46.9 Mbps).

Furthermore, the COVID-19 pandemic has accelerated this growth in the last year. Following the shelter-at-home order, most areas of Californian's lives had to be conducted from home, including working, attending classes, healthcare appointments, carrying out purchases, and accessing other online services.

To set-up a video conference — with a teacher, professor, primary care physician, co-worker, client, supplier, or a family or friend — requires high-speed internet service for consistent and reliable high-definition video and sound. Internet service at slow speeds causes blurry and frozen images and choppy sound. The same service degradation occurs with other interactive online applications. Furthermore, the internet service has to be able to handle multiple simultaneous internet users, as it has been the case in most households during the shelter-at-home order. Table 4, from the FCC's Household Broadband Guide[24], shows that a household with at least three users/devices conducting telecommuting or distance education functions needs advanced service (more than 25Mbps).

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[23] Cisco Annual Internet Report (2018-2023). https://www.cisco.com/c/en/us/solutions/collateral/executive-perspectives/annual-internet-report/white-paper-c11-741490.pdf
[24] https://www.fcc.gov/consumers/guides/household-broadband-guide

Table 4. FCC's Household Broadband Guide

	Light Use (Basic functions: email, browsing, basic video, VoIP, Internet radio)	Moderate Use (Basic functions plus *one* high-demand application: streaming HD video, multiparty video conf., telecommuting, online	High Use (Basic functions plus *more than one* high-demand application running at
1 user on 1 device	Basic	Basic	Medium
2 devices at a time	Basic	Medium	Medium/Advanced
3 devices at a time	Medium	Medium	**Advanced**
4 devices at a time	Medium	**Advanced**	**Advanced**

Basic Service = 3 to 8 Mbps
Medium Service = 12 to 25 Mbps
Advanced Service = More than 25 Mbps

For households with multiple internet users, it is highly recommended to purchase speeds higher than 25 Mbps, as in many internet service plans, the contracted speed is referred as "up to" or "a maximum of". Therefore, households should subscribe to higher speeds, in case the internet service does not reach the maximum advertised or contracted speed.

Other residential broadband drivers[25] include the following:

- **Video services:** Video services provide a wide range of options including video streaming, video on demand (VoD), IP TV, video games and video conferencing. Real-time entertainment such as video streaming is responsible for most downstream bytes during peak periods[26].
- **Data services:** Web-browsing is responsible for approximately 10 percent of downstream data traffic during peak period Internet use. Data transfer is another application that is growing in demand and is commonly used in telecommuting. Downstream speeds impact the time websites take to fully load, and the time files take to transfer from servers to user's devices.
- **Voice services:** Voice services have been replacing traditional telephone service by allowing users to make phone calls using broadband connections; also called VoIP technology. Residential VoIP subscribers has been steadily increasing since 2008.
- **Social networking and cloud applications:** Social networking applications have increased in demand and cloud computing has also risen in demand due to its capability to allow users to store and access data and information (photos, music, emails, documents, etc.) over the Internet.

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[25] Federal Communications Commission (FCC). (2015, February 4). *2015 Broadband Progress Report and Notice of Inquiry on Immediate Action to Accelerate Deployment*. Federal Communications Commission Hearing, Washington, D.C., *FCC 15-10,* 21-25.

[26] Sandvine Intelligent Broadband Networks, Global Internet Phenomena Report, 2H 2014 at 5 (2014), https://www.sandvine.com/downloads/general/global-internet-phenomena/2014/2h-2014-global-internetphenomena-report.pdf.

For community anchor institutions (in different fields), and businesses, broadband drivers include the following:

- **Education:** Access to online educational material such as educational videos, interactive learning tools, and video conferencing tools for teachers.
- **Health Care:** Improved imaging techniques produce large data files and moving these files between providers requires substantial capacity. Video conference and online platforms provide more effective and efficient health care delivery by connecting physicians with physicians and patients with physicians.
- **Agriculture:** The rise of "precision agriculture" combined with increasing interest in the use of "telematics" and "big data" for agriculture. Precision agriculture offers opportunities for improved farming efficiency, food safety and enhanced environmental sustainability.
- **Manufacturing**: Manufacturers leverage the Internet to compete in global markets, deploy new technologies, connect their workforce and customers, reduce costs, cut waste, enhance the environment and create safer, more reliable products. Manufacturing establishments in rural areas are involved in a variety of sectors: value-added food production, natural resource processing, and infrastructure management and clean-energy facilities.
- **Workforce:** Distance, online, and hybrid instruction provide access to learning for individuals who cannot always be physically present in a traditional classroom setting or who may not be available at the specific times classes are being offered. Employers also need broadband to access online training and classes to improve their employees' skills.
- **Emergency Services:** Cutting-edge technologies are critical for public safety communications allowing first responders to send and receive critical voice, video and data to save lives, reduce injuries, prevent crime and terror, and notify community members about emergencies and disasters. Rural geographies are in need of resilient, integrated, and interoperable systems to increase capacity, security and accessibility among emergency responders.
- **Machine-to-Machine Applications:** Machine-to-machine applications include smart meters, video surveillance, health care monitoring, transportation and package/asset tracking.

In summary, this section provided an overview of the role and importance of broadband internet for Yuba County, and also high-level technical information of current broadband standards and technologies. The main drivers for growing residential and business broadband demand were also described. The following section provides a detailed overview of the broadband service landscape in the County.

3 CURRENT BROADBAND LANDSCAPE IN YUBA COUNTY

This section of the plan provides a comprehensive assessment and analysis of the broadband landscape for residential, business and mobile subscribers in Yuba County. The analysis includes the footprint and services offered by last-mile[27] internet service providers (ISPs), mobile carriers, and middle-mile[28] providers. This analysis uses the latest 2020 broadband availability data[29] (as of December 2019) from the California Public Utilities Commission (CPUC), and 2019 Census data (projected population, households and housing units). For residential service, CPUC incorporates validation methods[30] which include both broadband service availability and subscribership at the census block level, and public feedback[31]. The assessment includes detailed analysis of 1) residential broadband service, 2) mobile broadband service, 3) business/commercial broadband service, and, 4) middle-mile broadband service.

3.1 Broadband Service Availability/Access for Residential Subscribers

3.1.1 Broadband Market and Internet Service Providers in Yuba County

The residential broadband market in Yuba County includes both wireline and fixed wireless broadband internet service providers. Table 5 shows the residential internet service providers, broadband technologies, and associated maximum advertised download and upload speeds. AT&T and Comcast offer wireline broadband service, provided by DSL and fiber optics, and cable modem, respectively. Fiber optics and cable modem provide 1 Gbps (1000 Mbps) or nearly this speed for download speeds. Lower wireline speeds are offered by DSL technologies from a few tens of Mbps up to 100 Mbps. Other ISPs offer terrestrial fixed broadband service, including also AT&T, which might use licensed, lightly licensed or unlicensed spectrum. Fixed wireless technologies offer download speeds from a few tens of Mbps up to 1 Gbps (1000 Mbps), in the case of GeoLinks.

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[27] The last-mile network is defined as the last segment of the connection between a communication provider (e.g., telephone company central office, internet service provider) and the customer (residential, commercial, or mobile).

[28] The middle-mile network is defined as the network infrastructure that connects last-mile networks to other network service providers, major telecommunications carriers, and the greater internet.

[29] CPUC broadband availability data released in November 2020 of broadband deployment as of December 2019. https://www.cpuc.ca.gov/industries-and-topics/internet-and-phone/broadband-mapping-program/california-broadband-availability-maps-and-gis-data

[30] California Public Utilities Commission (CPUC). *Guidelines for Broadband Data Submission.* https://www.cpuc.ca.gov/industries-and-topics/internet-and-phone/broadband-mapping-program/guidelines-for-broadband-data-submission

[31] California Public Utilities Commission (CPUC). *Broadband Availability Public Feedback.* https://www.cpuc.ca.gov/industries-and-topics/internet-and-phone/broadband-mapping-program/broadband-availability-public-feedback

Table 5. Residential internet service providers, broadband technologies, and associated maximum advertised download and upload speeds.

ISP	Technology	Maximum Download/Upload Advertised Speed (Mbps)
AT&T Service	ADSL2, ADSL2+ VDSL Optical Carrier / FTTx Fixed Wireless	25/2 Mbps 25/5, 50/10, 75/20, 100/20 Mbps 1000/1000 Mbps 10/1 Mbps
Cal.net	Fixed Wireless	25/4 Mbps
Comcast	Cable Modem DOCSIS 3.1	986.5/35 Mbps
DigitalPath	Fixed Wireless	10/2, 25/5, 50/10, 75/10 Mbps
GeoLinks	Fixed Wireless	1000/1000 Mbps
Shastabeam	Fixed Wireless	20/3 Mbps
SkyHi Broadband	Fixed Wireless	30/30 Mbps
Smarter Broadband	Fixed Wireless	25/4 Mbps
Succeed.Net	Fixed Wireless	50/10 Mbps

The following table (Table 6) presents the percentage of the market (population, household and housing units) served by each ISP. Comcast serves the largest segment of residential subscribers offering service to nearly 80% of the population in Yuba County, which accounts for around 76% of households. Next is AT&T which offers service to nearly 67% of the population and 65% of households. The third and fourth largest service providers in the County are Digital Path and Succeed.Net serving nearly 14% and 10% of the population, and 16% and 11% of households, respectively. The other providers serve less than 1% of the population and households. Wireline providers (Comcast and AT&T) serve the largest percentages of population and households, followed by fixed wireless providers at a lower scale. The coverage by each technology is presented later in this section.

Table 6. Percentage of the residential market served by each ISP.

ISP	Population	Pop %	Households	HH %	Housing Units	HU %
Comcast	61,104	79.6%	19,514	75.9%	21,462	75.0%
AT&T Service	51,208	66.7%	16,591	64.5%	17,951	62.8%
DigitalPath	10,457	13.6%	4,046	15.7%	4,603	16.1%
Succeed.Net	7,522	9.8%	2,856	11.1%	3,162	11.1%
Cal.net	686	0.9%	225	0.9%	239	0.8%
SmarterBroadband	587	0.8%	228	0.9%	247	0.9%
SkyHi Broadband	356	0.5%	114	0.4%	119	0.4%
GeoLinks	282	0.4%	113	0.4%	115	0.4%
Shastabeam	105	0.1%	37	0.1%	41	0.1%
Yuba County	**76,773**		**25,723**		**28,605**	

Another important metric to assess the broadband market and competition in the County is the number (concentration) of internet service providers, or choices that consumers have for residential broadband service. Table 7 below presents the number of ISPs serving different percentages of population, households, and housing units. Based on households, 5.3% of households are not served by ISPs, and 23.7% (nearly a quarter) has only one provider (choice) offering internet service. Around 67% have access to two ISPs, 3.2% to three ISPs and 0.5% to four ISPs. **From the number of ISPs and percentages of households served, around 96.3% of households have access to only two or less ISPs. This indicates the broadband market is not very competitive and does not offer multiple choices to most residential consumers.**

Table 7 Number of ISPs serving different percentages of population, households, and housing units.

ISPs Serving Minimum of 6/1 Mbps	Population	Pop %	Households	HH %	Housing Units	HU %
0 ISPs	3,505	4.6%	1,357	5.3%	1,664	5.8%
1 ISPs	17,673	23.0%	6,099	23.7%	7,121	24.9%
2 ISPs	53,074	69.1%	17,309	67.3%	18,787	65.7%
3 ISPs	2,193	2.9%	824	3.2%	889	3.1%
4 ISPs	328	0.4%	134	0.5%	143	0.5%
Yuba County	**76,773**		**25,723**		**28,605**	

Figure 2 shows a map of the market concentration in the County. Areas with three or four ISPs offering service are scattered in the County, including a few census blocks within and surrounding Linda, Loma Rica, Smartsville and Dobbins, to the South of the Beale Air Force, and a few census blocks along Highway 70 (North of Marysville). The rest of populated areas in the valley and foothills have access to two or less ISPs. By the size of the geographical area, the Northeast part of the County exhibits the most unserved (no ISPs) and less competitive market.
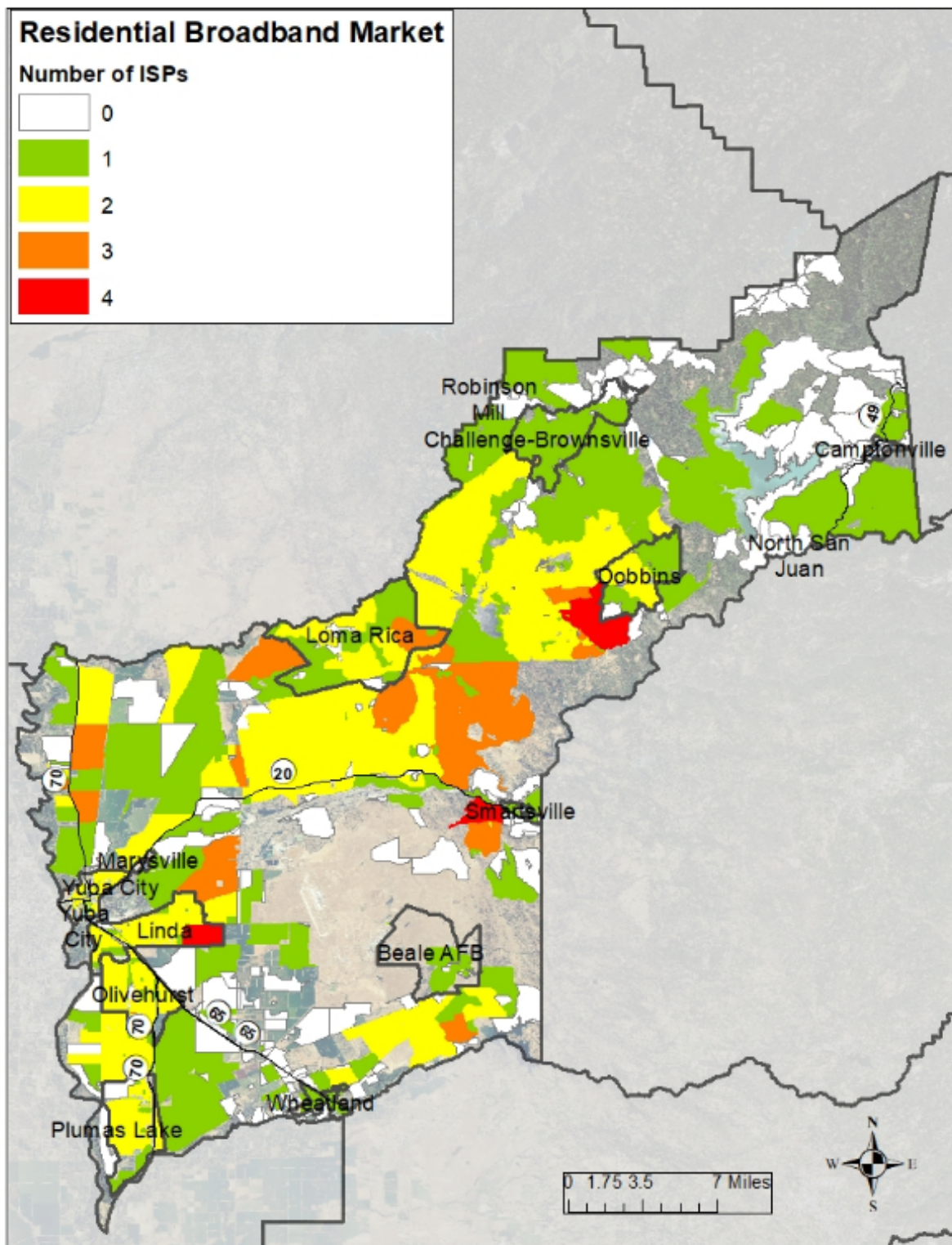
Figure 2. Residential market concentration map in Yuba County.

3.1.2 Broadband Service Coverage by Speed

Table 8 shows the broadband service availability at different broadband speed standards including: 1) 6/1 Mbps (CA standard), 2) 25/3 Mbps (FCC standard), 3) 100/20[32] Mbps (Governor's Executive Order and the California Broadband for All Action Plan), and 4) 1000/500 Mbps (FCC definition of gigabit service). The service availability is estimated using census block-level broadband availability data from the CPUC. These data are collected on an annual basis from a majority of last-mile broadband service providers in the state, and it can be used to estimate the number of served and unserved households. These data include fixed broadband service provided by either wireline (i.e., xDSL, cable modem, and fiber optics) or fixed wireless service (i.e., licensed, lightly and unlicensed spectrum), or both.

At the California standard (6/1 Mbps), 94.7% of households are reported as served, and at the FCC standard (25/3 Mbps), 94.1% are served. They account for 1,357 and 1,519 unserved households, respectively. It is important to note that the current California standard of 6/1 Mbps is inadequate for households to carry out today's internet service usage, including teleworking, distance education and telehealth. Current efforts in California legislature (2021) aim to increase the state standard from 6/1 Mbps to at least 25/3 Mbps, matching the federal standard. The federal standard of 25/3 Mbps is the minimum recommended for household internet usage. Nevertheless, higher speeds are highly recommended for to ensure advanced connectivity for multiple simultaneous internet users at home.

At the new California Action Plan goal of 100Mbps downstream, 76.6% of households are served, leaving 6,021 unserved households. In the case of the FCC's gigabit definition, only 3.2% of households are served, and nearly 25,000 unserved households.

It is important to note, first, the CPUC broadband availability data is self-reported from ISPs and telecom companies, and second, many stakeholders (local governments, communities, residents, and other ISPs) have expressed concerns that some of the data does not reflect what is actually available. Therefore, the total number of unserved households might exceed estimations from CPUC data. To improve data accuracy, the CPUC has implemented several broadband coverage validation methods, such as taking subscribership data into account before registering a census block as "served." Public feedback[33] and ground truth testing at the address level using speed testing apps (e.g., CalSPEED[34]) is also an important validation method.

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[32] The California Action Plan defines the broadband speed goal of 100 Mbps downstream. It does not define an upstream speed. For purposes of this analysis, a 20Mbps upstream speed is used.
[33] California Public Utilities Commission (CPUC). *Broadband Availability Public Feedback.*
 https://www.cpuc.ca.gov/Broadband_Availability_and_Public_Feedback/
[34] CalSPEED. http://calspeed.org/

Table 8 Broadband service availability at different broadband speed standards including: 1) 6/1 Mbps, 2) 25/3 Mbps, 3) 100/20 Mbps, and 4) 1000/500 Mbps.

Yuba County	Households	Served Households		Unserved Households	
		Number	Percent	Number	Percent
6Mbps/1Mbps	25,723	24,366	94.7%	1,357	5.3%
25Mbps/3Mbps	25,723	24,204	94.1%	1,519	5.9%
100Mbps/20Mbps	25,723	19,702	76.6%	6,021	23.4%
1000Mbps/500Mbps	25,723	836	3.2%	24,887	96.8%

Figure 3 shows the layered broadband coverage at the different broadband speed standards presented above. The higher speed, gigabit service (in gray), is available in a few census blocks in Marysville, Linda, Olivehurst, and Plumas Lake. These areas are located mostly along or nearby Highway 70, which indicates a potential high-speed high-capacity backbone along this route. There is also gigabit service available in an area North of Smartsville, provided by a fixed wireless provider. The next speed tier, 100/20 Mbps, is available also in urban areas along Highway 70 (Marysville, Linda, Olivehurst, and Plumas Lake), and in Wheatland, Beale Air Force Base, and North of Smartsville. There is also coverage in a few areas North of Marysville along Highway 70, and along County Road 20. ISPs offering gigabit and/or 100/20 Mbps are AT&T, Comcast and GeoLinks. It is important to note that both speed services are not available in most towns and census designated places (CDPs) in the Central and Northeastern parts of the county. The next speed standards, FCC 25/3 Mbps and CA 6/1 Mbps, are offered in most cities, towns and CDPs, by the ISPs listed in Table 5 –The CA 6/1 Mbps footprint is just slightly larger than the FCC 25/3 Mbps by a few census blocks. **This coverage theoretically reaches the Northeastern part of the county, however, local broadband stakeholders (i.e., ISPs, local government officials and staff, and residents) reported a perception of much less coverage in those areas.**

Residential Broadband Coverage

- Served 1000Mbps/500Mbps
- Served 100Mbps/20Mbps
- Served 25Mbps/3Mbps
- Served 6Mbps/1Mbps
- Unserved Slow Service 6Mbps/1Mbps
- Unserved No Service 6Mbps/1Mbps
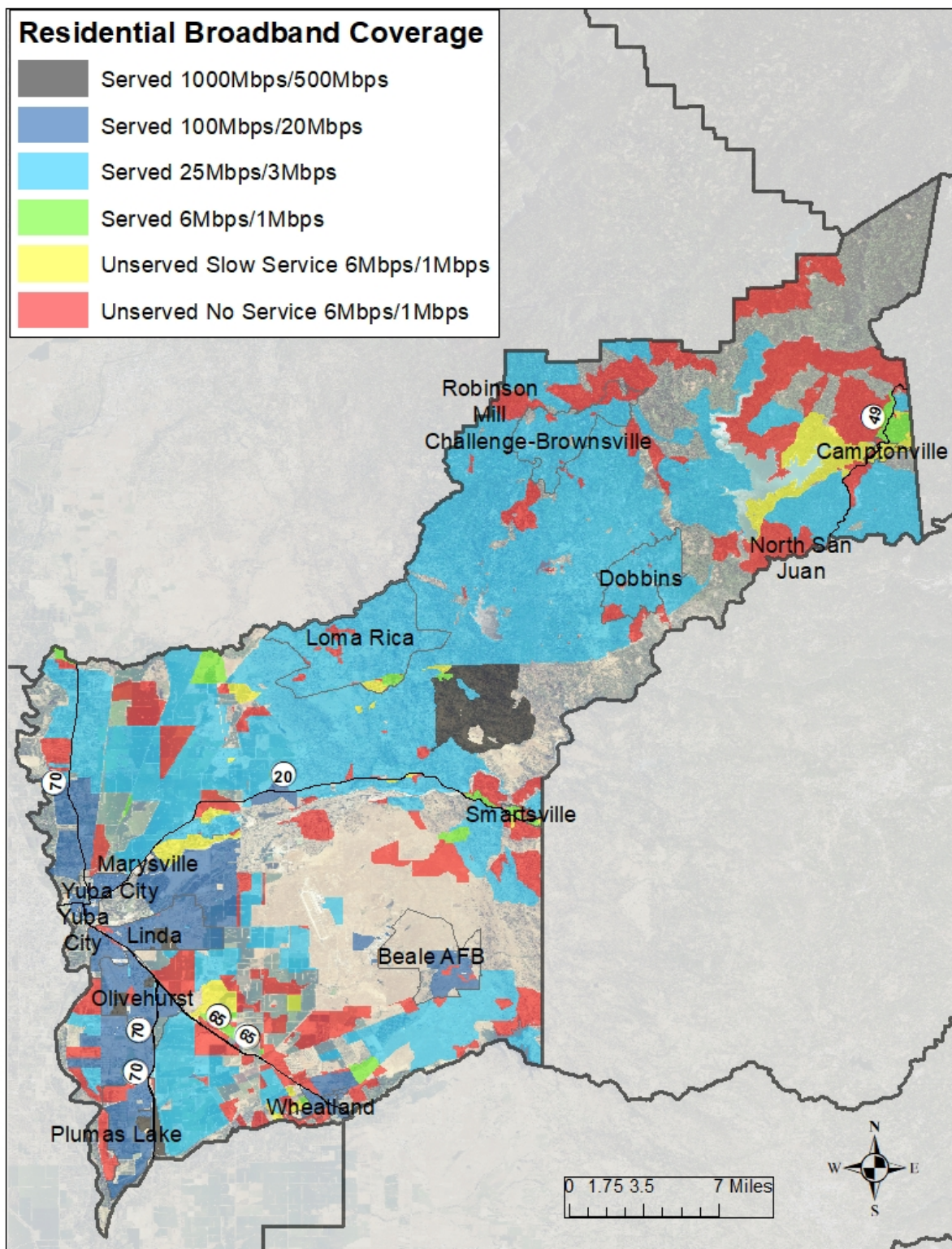
Figure 3. Coverage map at the different broadband speed standards including: 1) CA (6.1 Mbps), 2) FCC 25/3 Mbps, 3) CA Action Plan (100/20 Mbps), and 4) FCC Gigabit definition (1000/500 Mbps).

3.1.3 Broadband Service Coverage by Technology

This subsection presents the broadband coverage by technology which helps to identify the existing footprint of telecommunications infrastructure and services (i.e., copper telephone lines, cable television, communications towers or repeaters) that enable providing broadband service, and their potential for expansion or upgrades. The copper infrastructure, also called public service telephone network (PSTN), enables the xDSL, ADSL2, ADSL2+, and VDSL broadband technologies and services. Depending on the PSTN infrastructure condition (i.e., equipment, copper lines, poles, and distance to concentration points and backbones), upgrades may lead (in the best-case scenario) to only a couple of tens of Mbps. Therefore, this technology (DSL standard family) are not suitable and recommended for future proof broadband service (gigabits or hundreds of Mbps). The cable modem technology, provided through the coaxial cable television and hybrid fiber-coaxial networks currently offers among the highest broadband speeds (up to gigabits or hundreds of Mbps). Fiber optics (F.O) networks, used to provide residential fiber-to-the-home (FTTH) service, offer the highest speeds of up to several gigabits (Gbps). F.O. can be deployed in brownfield (co-exist and co-locate with legacy systems) or greenfield (brand new deployments) scenarios. Expanding the footprint of cable modem and fiber optics networks (both wireline technologies) will make these future-proof high speeds available to more customers. In recent years, fixed wireless technologies have also been able to provide broadband service up to a few hundred Mbps, and in some conditions, reaching up to gigabit service. Fixed wireless technologies are primarily deployed in areas where wireline technologies have incomplete coverage, such as some suburban and most rural areas. Deployment and coverage limitations of fixed wireless come from obstructions (terrain/vegetation) between the antenna at the customer premises and transceivers located at a pole or tower.

Table 9 presents the household coverage for the main broadband technologies offered in Yuba County for residential service. DSL technologies offer service to nearly 77% of households, closely followed by cable modem with around 76%. Next is fixed wireless with 20% and lastly FTTx with nearly 3%. The highest two coverages are provided by a legacy and a future-proof technology. FTTx and fixed wireless exhibit low percentages of coverage.

Table 9 Household coverage for the main broadband technologies for residential service: xDSL, Cable Modem, FTTH, and fixed wireless.

Yuba County	Households	Served Households		Unserved Households	
		Number	Percent	Number	Percent
ADSL2, ADSL2+, VDSL	25,723	19,768	76.8%	5,955	23.2%
Cable Modem	25,723	19,514	75.9%	6,209	24.1%
Fixed Wireless	25,723	5,194	20.2%	20,529	79.8%
FTTx	25,723	723	2.8%	25,001	97.2%

DSL technologies (ADSL2, ADSL2+, and VDSL), shown in Figure 4, are offered in urban areas along Highways 70 and 65 (Marysville, Linda, Olivehurst, Plumas Lake and Wheatland). It also provides service to areas along County Road 20 and in Smartsville. Other areas include Beale Air Force Base, and Camptonville in the Northeastern part of the county.
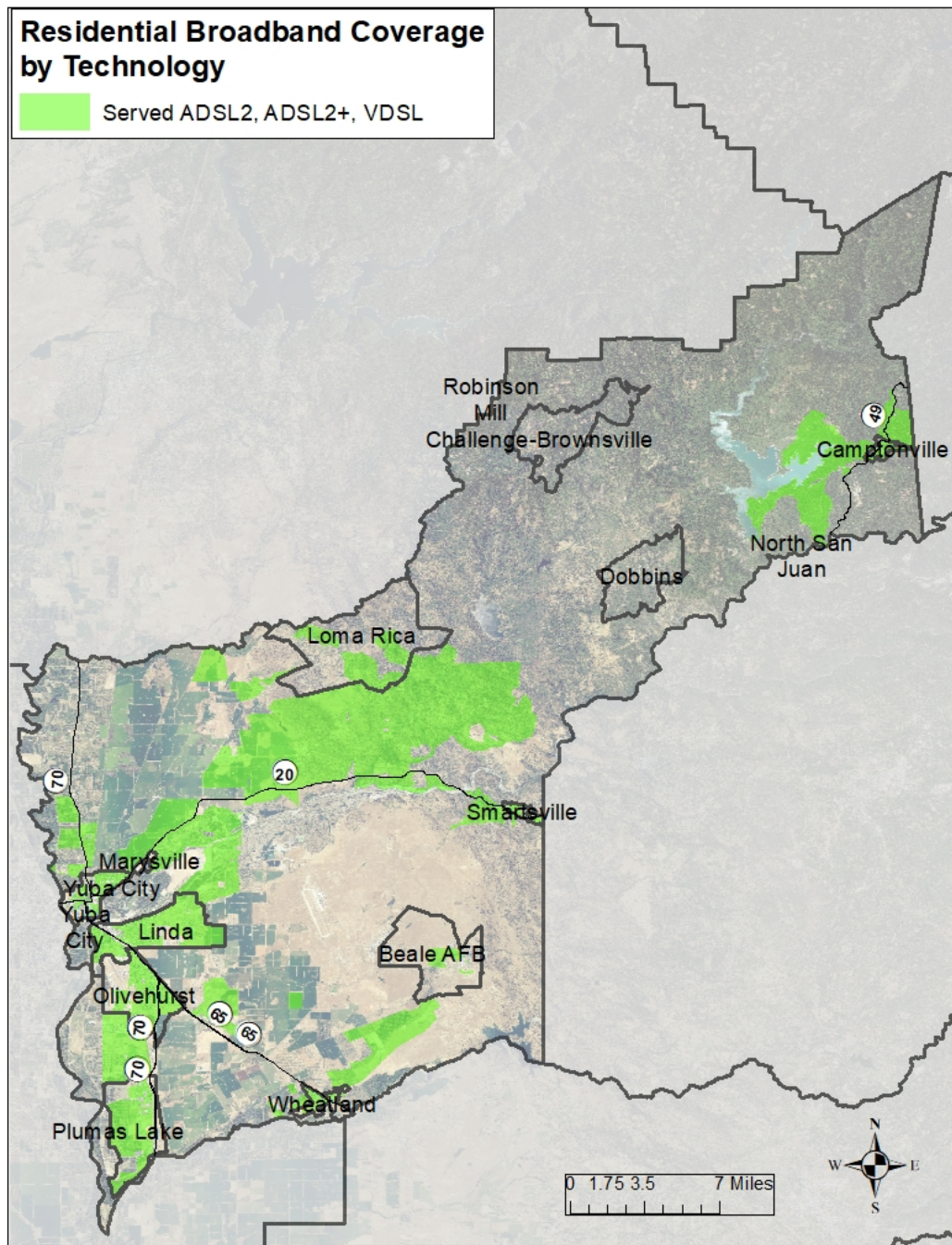
Figure 4. Coverage of the xDSL (ADSL2, ADSL2+, VDSL) technology in Yuba County.

The cable modem coverage, shown in Figure 5, is more concentrated in the West part of the county in urban areas (Marysville, Linda, Olivehurst, Plumas Lake, and Wheatland) along Highways 70 and 65, and in the Beale Air Force Base area. It is important to note, as shown in Table 9, that both DSL and cable modem serve around 76% of households in the county, which indicates that three quarters of the households are located in the Western side of the county.
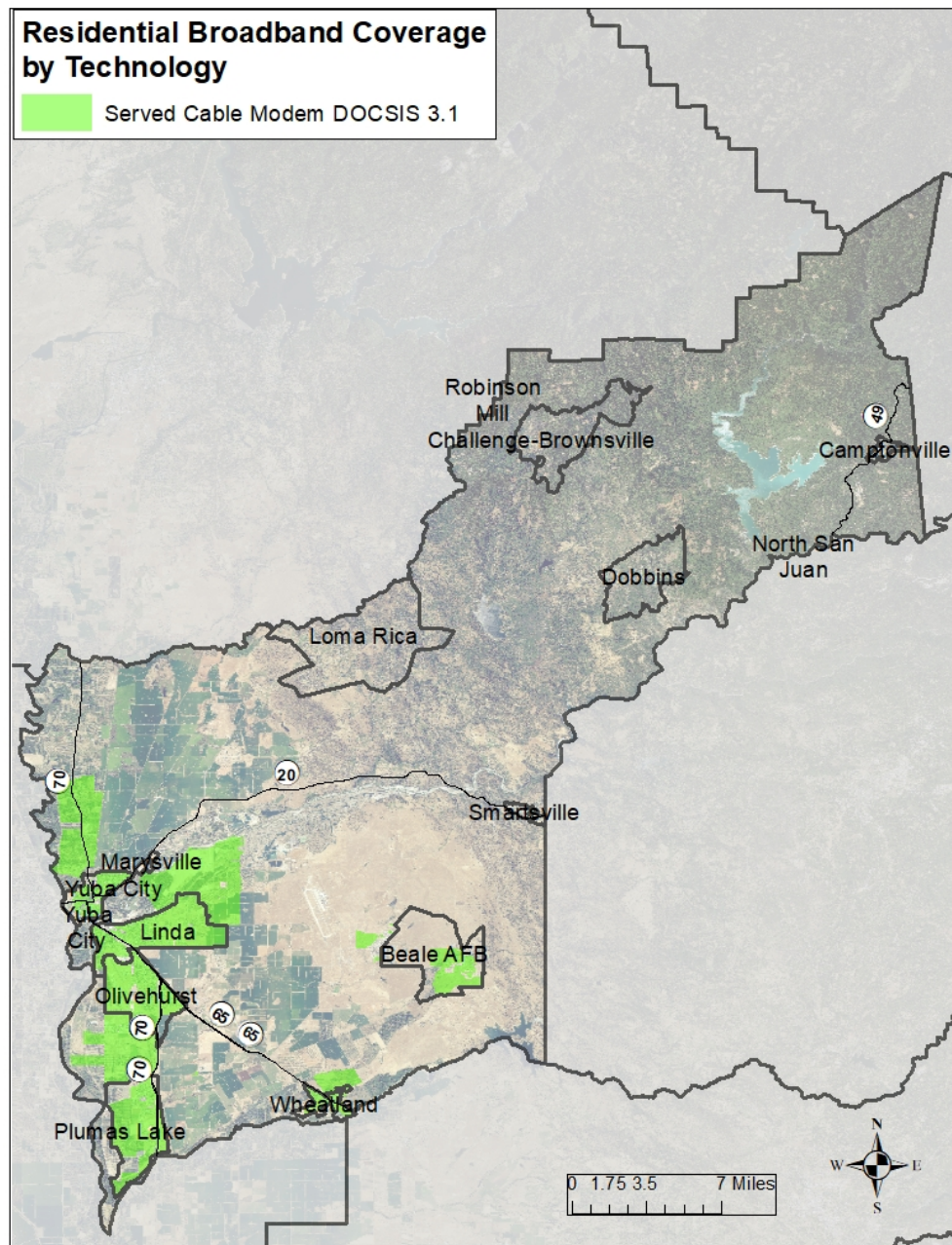
Figure 5. Coverage of the Cable Modem technology in Yuba County.

Figure 6 presents the coverage of the fixed wireless technology, which has a larger presence than the xDSL and cable modem technologies in rural areas in the Central and Eastern parts of the county. It serves the rural communities of Loma Rica, Challenge-Brownsville, Dobbins, Camptonville, and surrounding areas. In the Eastern part of the county, it serves some areas in Linda and Olivehurst, and scattered rural areas along Highways 70 and 65, and County Road 20. There is also coverage to the South of the Beale Base.
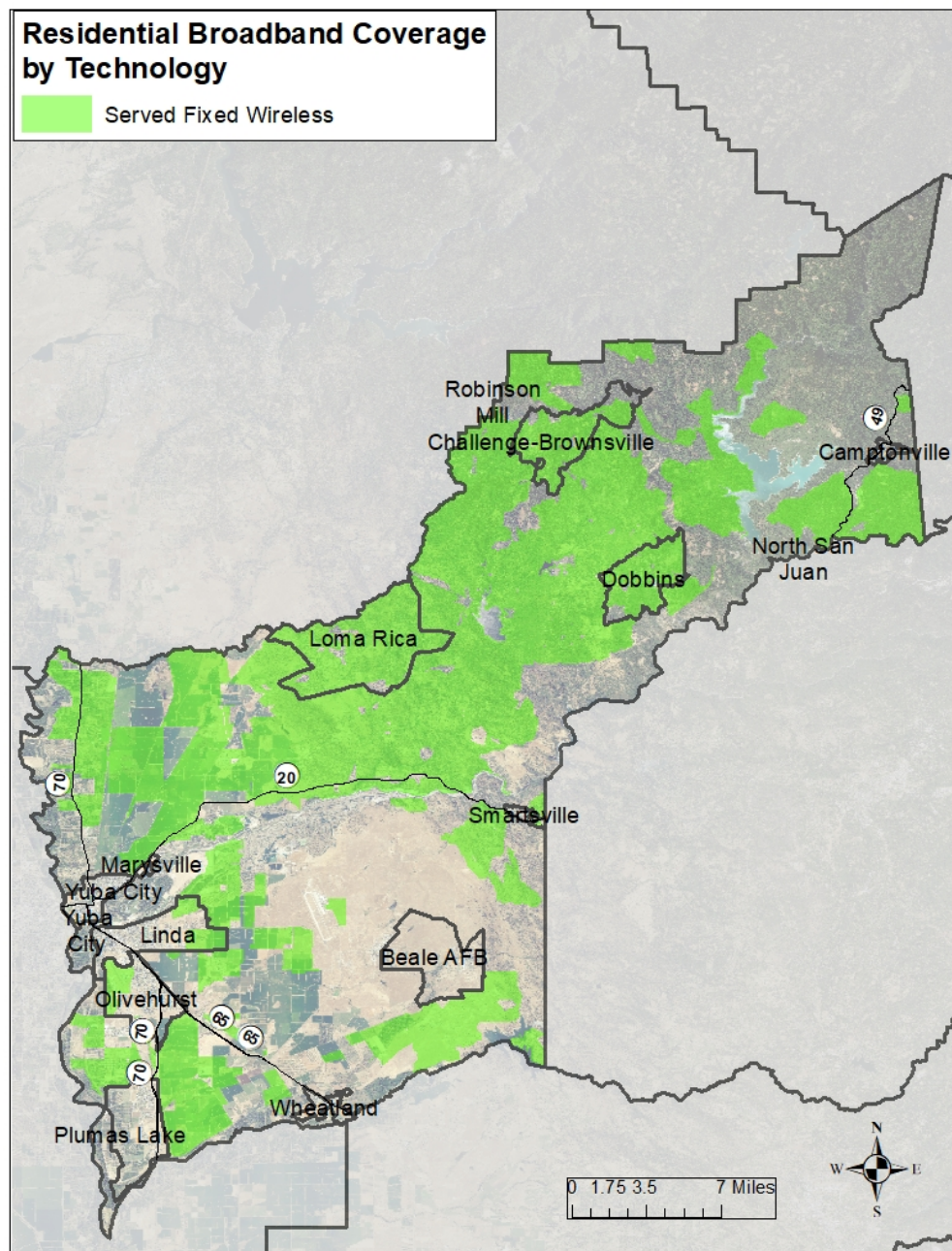
Figure 6. Coverage of the fixed wireless technology in Yuba County.

The fiber-to-the-home (FTTH) service, shown in Figure 7, is only offered in a few census blocks and areas in Marysville, Linda, Olivehurst, and Plumas Lake, mostly along or nearby Highway 70. It is important to highlight that this is the technology with the highest speed capability and currently exhibit the lowest level of deployment in the county.
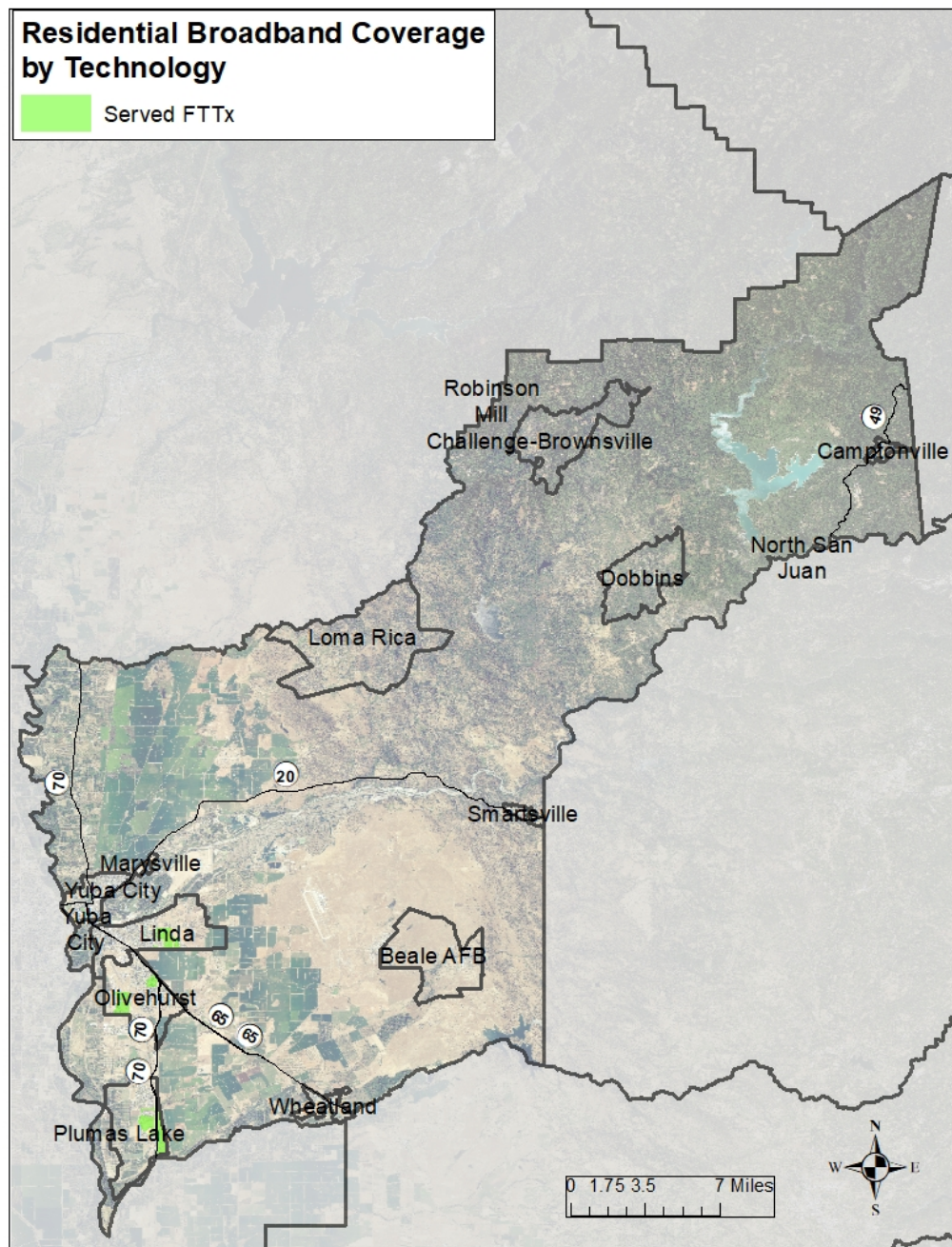
Figure 7. Coverage of the fiber-to-the-home (FTTH) technology in Yuba County.

3.2 Broadband Service Availability/Access for Mobile Subscribers

The mobile broadband market in Yuba County includes mobile carriers offering service using legacy 3G (Third Generation) (i.e., CDMA and GSM) and 4G (Fourth Generation) (i.e., LTE). Mobile service availability is depicted using broadband availability data from the CPUC, collected from mobile carriers in the state. For assessing mobile broadband coverage in Yuba County, this analysis includes only 4G LTE coverage (not legacy 3G), and the footprint of carriers offering such mobile service. Table 10 lists the mobile carriers in the county and the minimum advertised speeds offered. This speed description is different than CPUC's residential fixed broadband data, as those data presents maximum advertised speeds.

Figure 8 below presents the aggregated LTE coverage of the four carriers in the county, which depicts almost ubiquitous LTE service in urban, suburban and rural areas. There are coverage gaps in the central and Northeastern parts of the county. **It is important to note, that based on input provided by multiple broadband stakeholders during meetings and interviews for the preparation of this plan, the perceived mobile broadband coverage is less than the reported one by mobile carriers.**

Table 10.Mobile carriers in Yuba County and the minimum advertised speeds offered.

Mobile Carrier	Technology	Minimum Download Advertised Speed (Mbps)	Minimum Upload Advertised Speed (Mbps)
AT&T Mobility	LTE	9.7 Mbps	2.8 Mbps
Sprint Communications	LTE	4 Mbps	1 Mbps
T-Mobile	LTE	9 Mbps	4 Mbps
Verizon Wireless	LTE	5 Mbps	2 Mbps
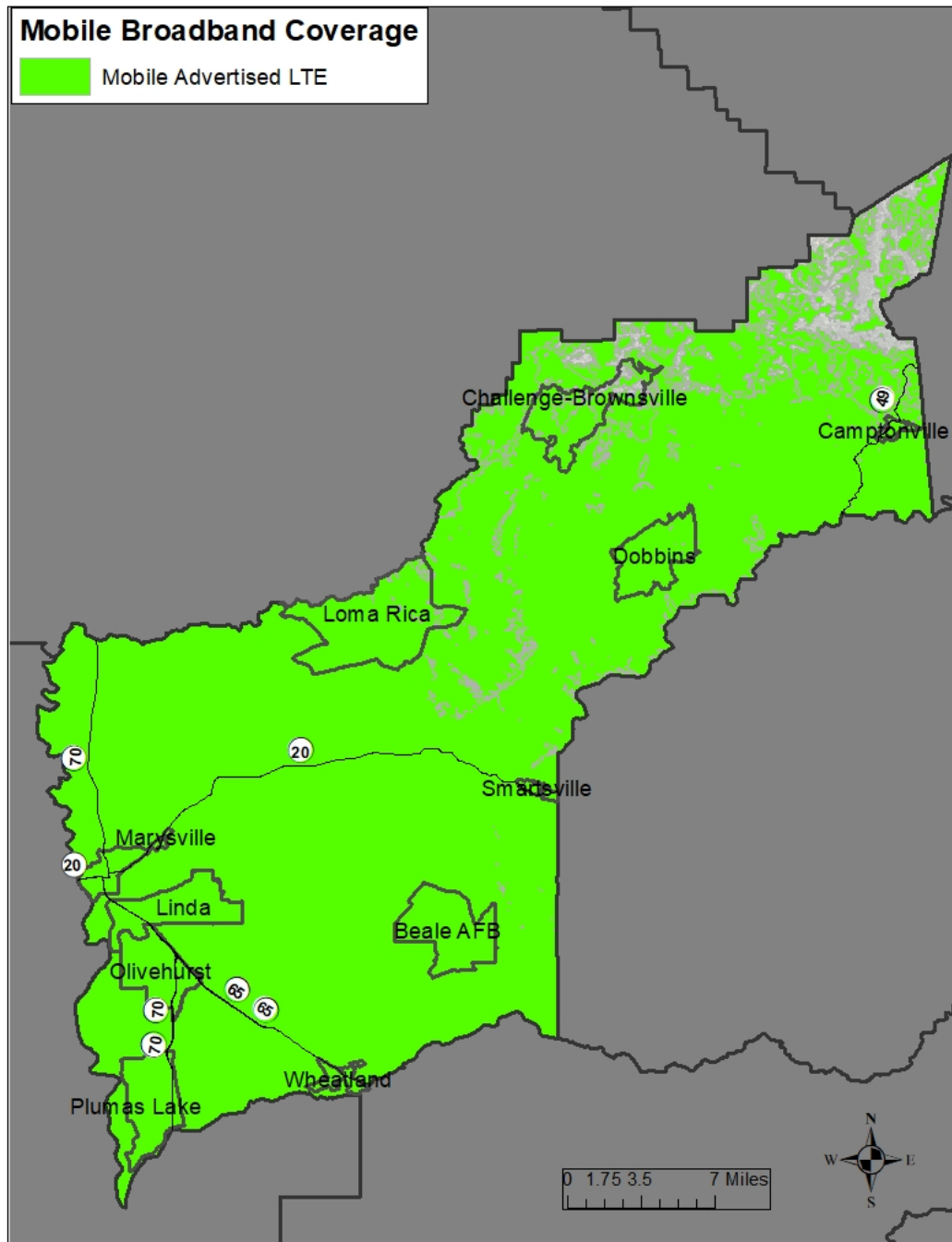
Figure 8. Aggregated LTE coverage map of the four carriers in the county.

Figure 9 presents the mobile broadband coverage for AT&T Mobility. This coverage provides service in urban (Marysville, Linda, Olivehurst, Plumas Lake, Wheatland) and rural areas in the Western part of the county along Highways 70, 65 and County Road 20, including the Beale Air Force Base area. In the

Northeast, there is partial coverage in Loma Rica, Dobbins, Challenge- Brownsville, and Camptonville. There are large mobile broadband gaps in rural and open areas in this part of the county.
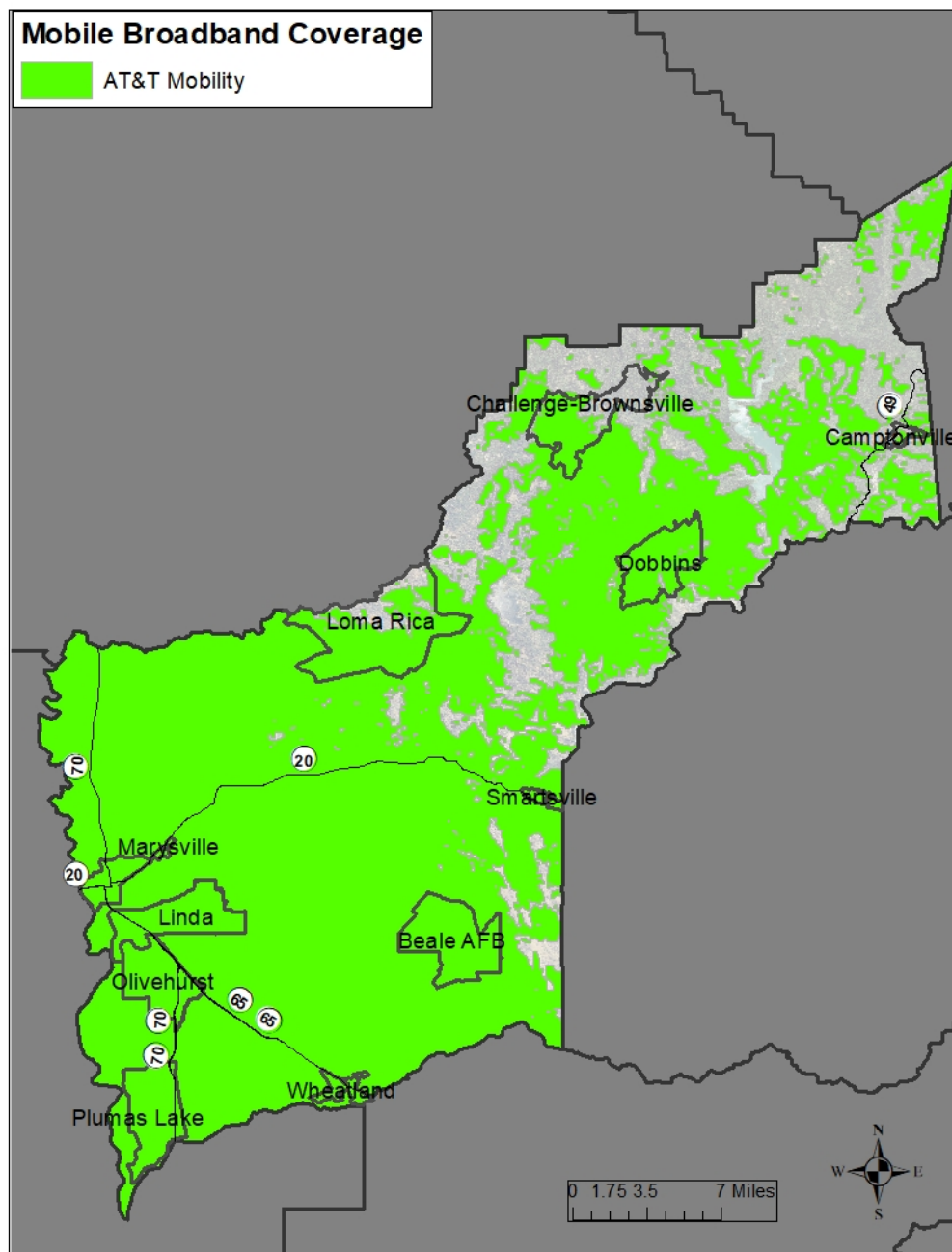
Figure 9. LTE coverage map offered by AT&T Mobility.

Figure 10 presents the coverage for Sprint Communications. It provides service in urban (Marysville, Linda, Olivehurst, Plumas Lake, Wheatland, and Smartsville) and rural areas in the Western part of the

county along Highways 70, 65 and County Road 20. In the Central and Northeast regions of the county, there is minimal and partial coverage in the Beale Air Force Base, Loma Rica, Dobbins, Challenge-Brownsville, and Camptonville.
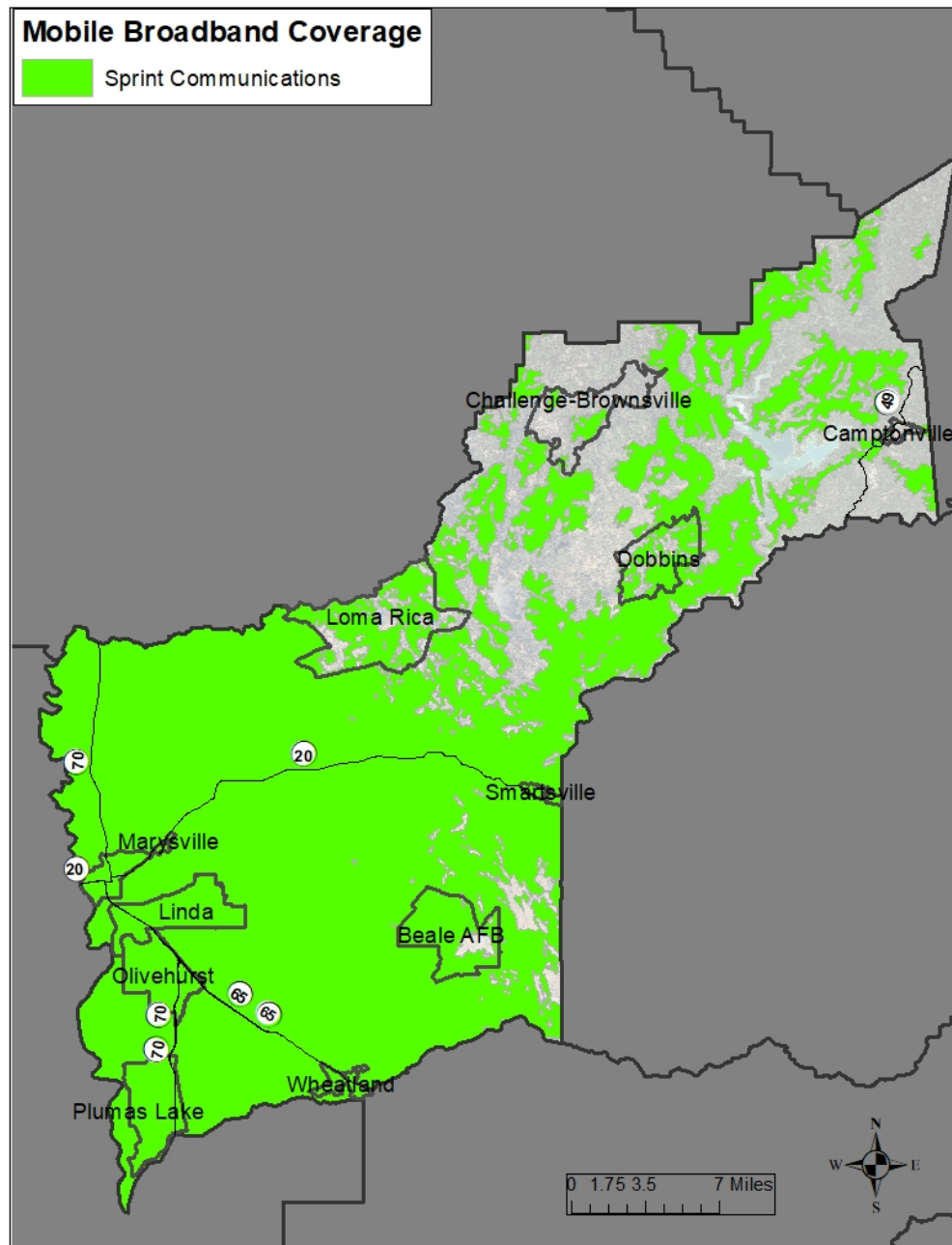
Figure 10. LTE coverage map offered by Sprint Communications.

Figure 11 presents the mobile broadband coverage for T-Mobile. The reported coverage includes the Western, Central and Easter parts of the county, except for the most Northeastern area (North and East of Challenge-Brownsville).
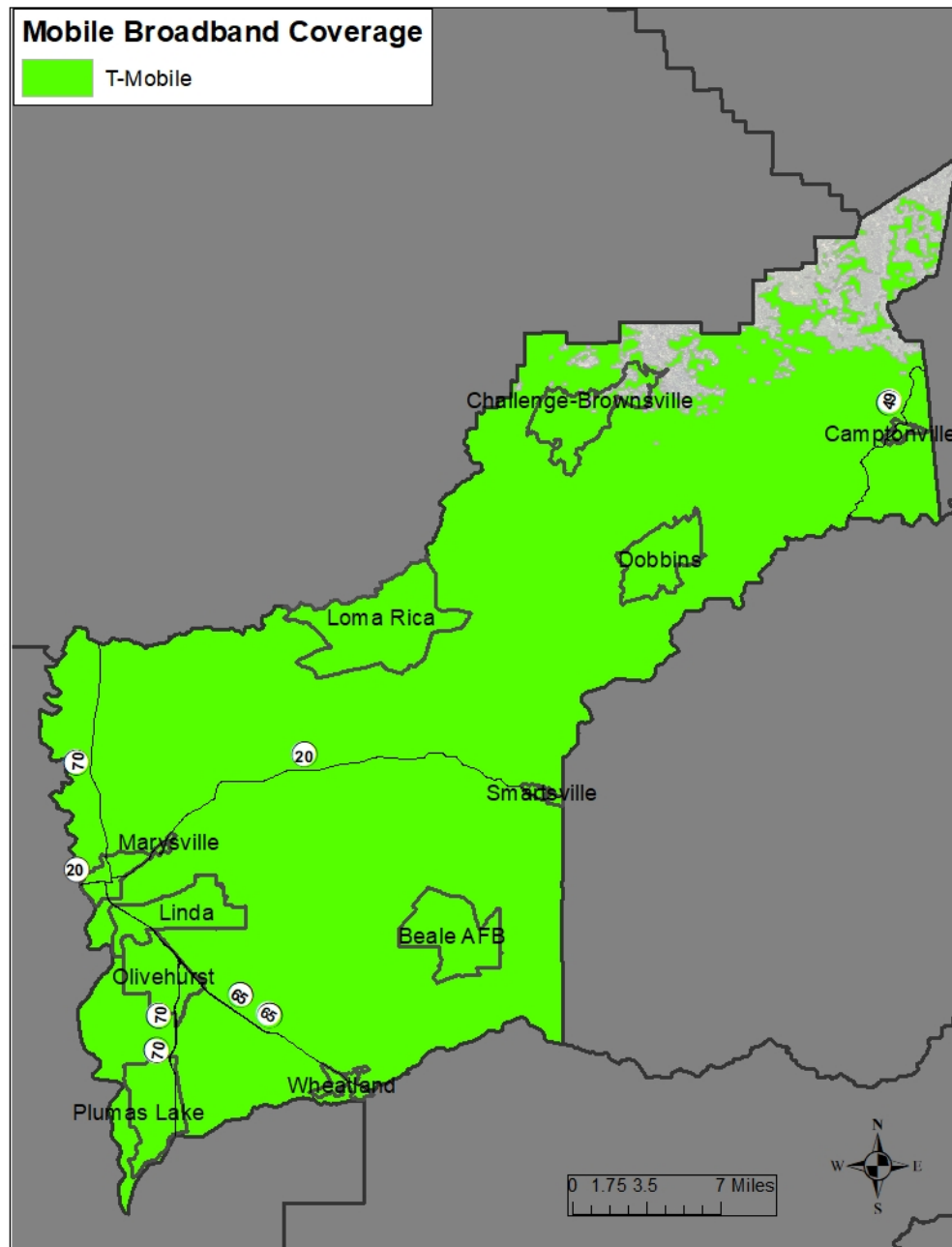
Figure 11. LTE coverage map offered by T-Mobile.

Figure 12 presents the mobile coverage for Verizon Wireless. It serves urban and rural areas in the Western part of the county along Highways 70 and 65 including (Marysville, Linda, Olivehurst, Plumas Lake, and Wheatland). It also covers rural areas along County Road 20 and Smartsville. In the Central and Northeast regions of the county, it provides partial coverage in Loma Rica, Dobbins, Challenge-Brownsville and Camptonville, and surrounding rural areas.
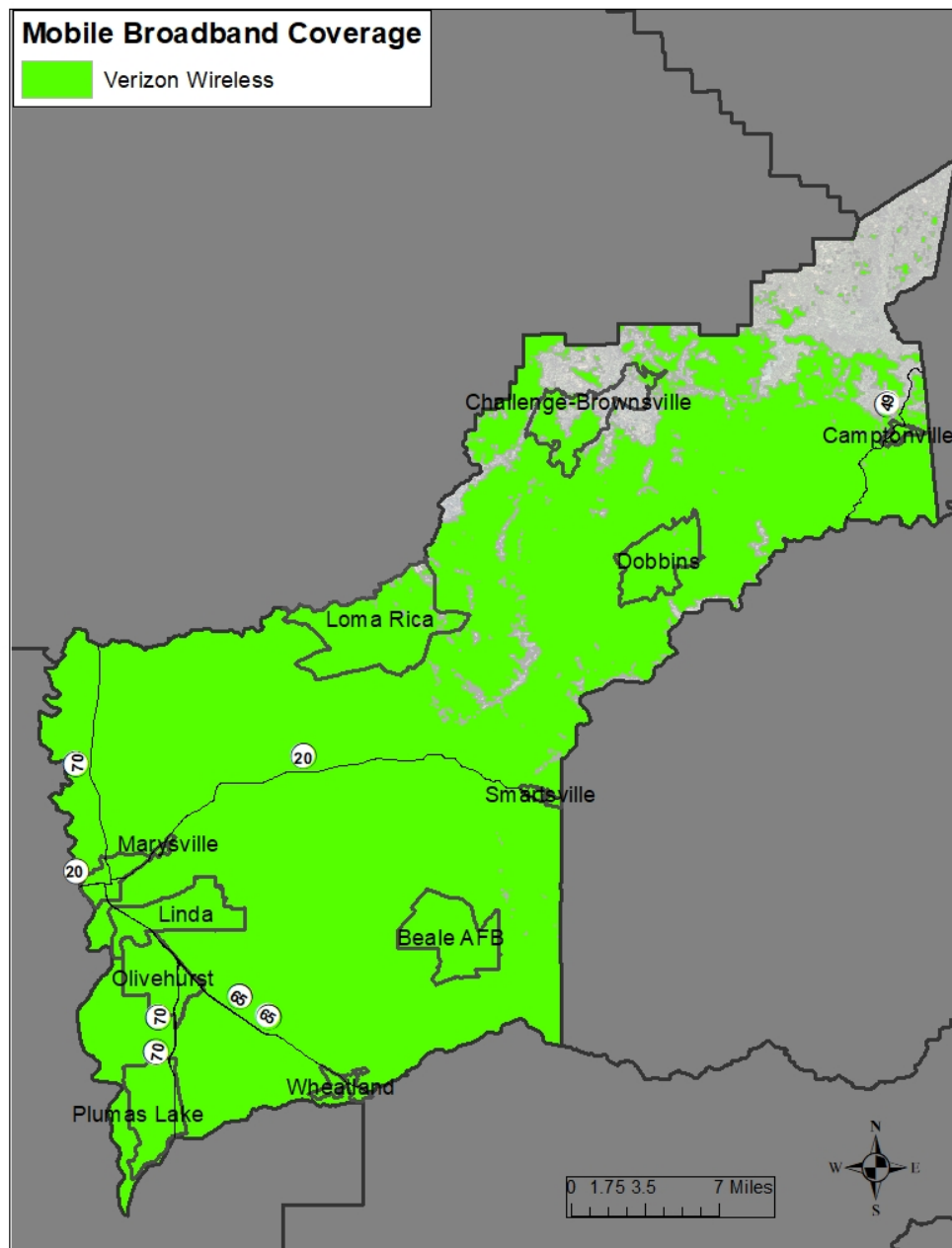
Figure 12. LTE coverage map offered by T-Mobile.

3.3   Broadband Service Availability/Access for Business Subscribers

The business broadband market in Yuba County also includes both wireline and fixed wireless broadband internet service providers. Based on CPUC broadband data, Table 11 shows the business tier internet service providers, service technologies, and committed speed rates. Comcast, Vast Networks, Level 3 and TPx Communications offer wireline broadband service, provided by cable modem or fiber-to-the-x (FTTx) technologies. Cable modem and fiber optics have the capability to provide hundreds of Mbps or Gigabit service. Cal.net, ColfaxNet, Digital Path, GeoLinks, Shastabeam, SmarterBroadband, and Succeed.Net offer business service using fixed wireless technologies, which have capabilities from tens of Mbps to few hundreds of Mbps. Other providers such as MCI, NetFortris, and XO Communications offer legacy technologies such as copper-wire based technologies other than xDSL (i.e., Ethernet over copper and T-1).

Table 11. Business tier internet service providers, service technologies, and committed speed rates.

ISP	Technology	Committed Interface Rate (CIR) (down/up)
Cal.net	Fixed Wireless	100/100 Mbps
ColfaxNet	Fixed Wireless	50/50 Mbps
Comcast	Cable Modem	No information
DigitalPath	Fixed Wireless	10/2, 25/5, 75/10 Mbps
GeoLinks	Fixed Wireless	250/250 Mbps
Level 3	Other Copper FTTx	45/45 Mbps 10/10, 100/100 Gbps
MCI	Other Copper	1.5/1.5, 3/3 Mbps
NETFORTRIS	Other Copper	1.5/1.5 Mbps
Shastabeam	Fixed Wireless	20/3 Mbps
Smarter Broadband	Fixed Wireless	No information
Succeed.Net	Fixed Wireless	50/10, 100/10 Mbps
TPx Communications	Other Copper FTTx Fixed Wireless	1.5/1.5, 4.5/4.5, 10/10, 100/100 Mbps 5/5, 20/20, 50/50, 500/500 Mbps 20/20, 25/5, 75/15, 100/100 Mbps
Vast Networks	FTTx	100 Gbps/100 Gbps
XO Communications	Other Copper	1.5/1.5 Mbps

3.3.1   Business Broadband Service Coverage by Speed

Figure 13 presents the business broadband coverage in Yuba County for two broadband speed tiers: 100/20 Mbps and 1000/500 Mbps (FCC's gigabit definition). The 100 Mbps speed tier is evaluated due to alignment with the California Broadband Action Plan, and also being recommended for businesses in a report (2018) by the Monterrey Economic Partnership and the Central Coast Broadband Consortium. The gigabit tier is evaluated due to it is future proof high-speed capability.

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The 100/20 Mbps service is available for businesses in areas of Marysville, Linda, Wheatland, Beale Air Force Base, Smartsville and Dobbins. Additionally, the service is offered in a few rural areas along Highway 70 and 65, including a corridor along the Hammonton Smartsville road (parallel to County Road 20), and North of Smartsville. The gigabit service is mostly available in the corridor along the Hammonton Smartsville road in the Western and Central parts of the county.
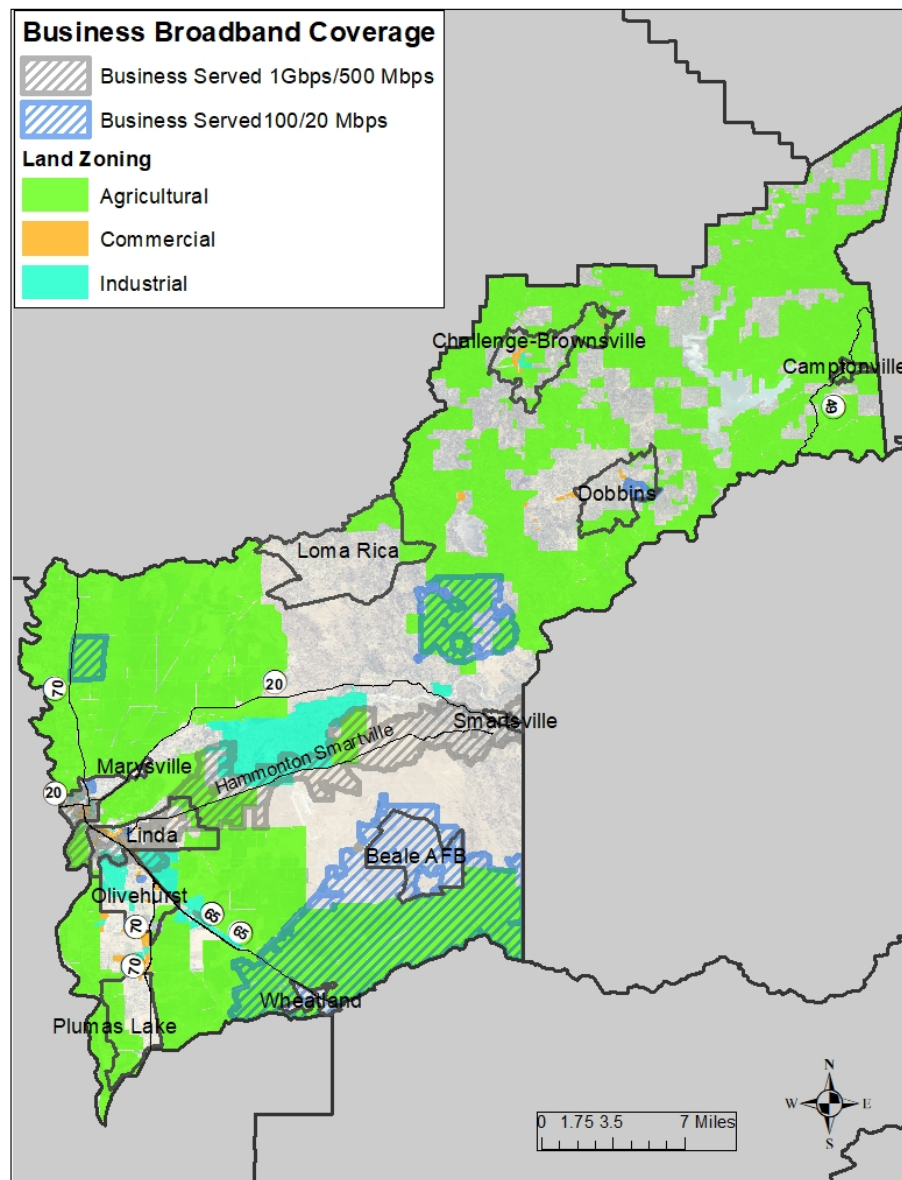
Figure 13. Business broadband coverage in Yuba County for two broadband speed tiers: 1) 100/20 Mbps, and 2) 1000/500 Mbps (FCC's gigabit definition).

3.3.2 Business Broadband Service Coverage by Technology

This subsection presents business broadband coverage by the main technologies offered by ISPs: cable modem, FTTx, and fixed wireless. Figure 14 shows the cable modem coverage for business customers. This service is offered in most urban areas along Highways 70 and 65, including Marysville, Linda, Olivehurst, Plumas Lake, Wheatland, and in some areas of the Beale Air Force Base. The service is mostly available in commercial and industrial areas, and a few agricultural areas surrounding urban areas.
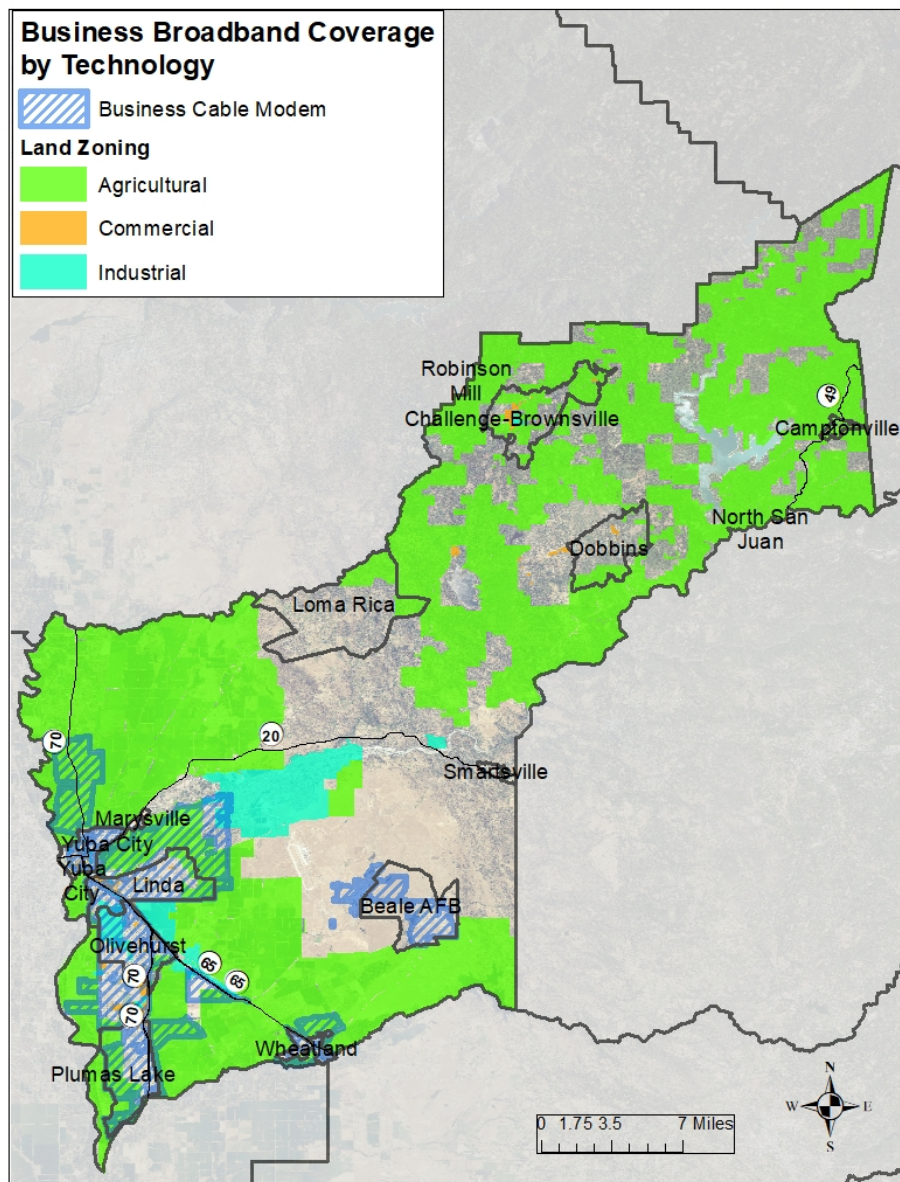
Figure 14. Cable modem coverage map for business customers.

Figure 15 presents the coverage of fiber-to-the-location (FTTx) service for business customers. The footprint of this service is available in a few urban areas in Marysville, Linda, and Olivehurst. This service is also available areas along the Hammonton Smartsville road, and in a couple of locations in Dobbins and the Beale Air Force Base. The service is mostly available in commercial and industrial areas, and very few agricultural areas.
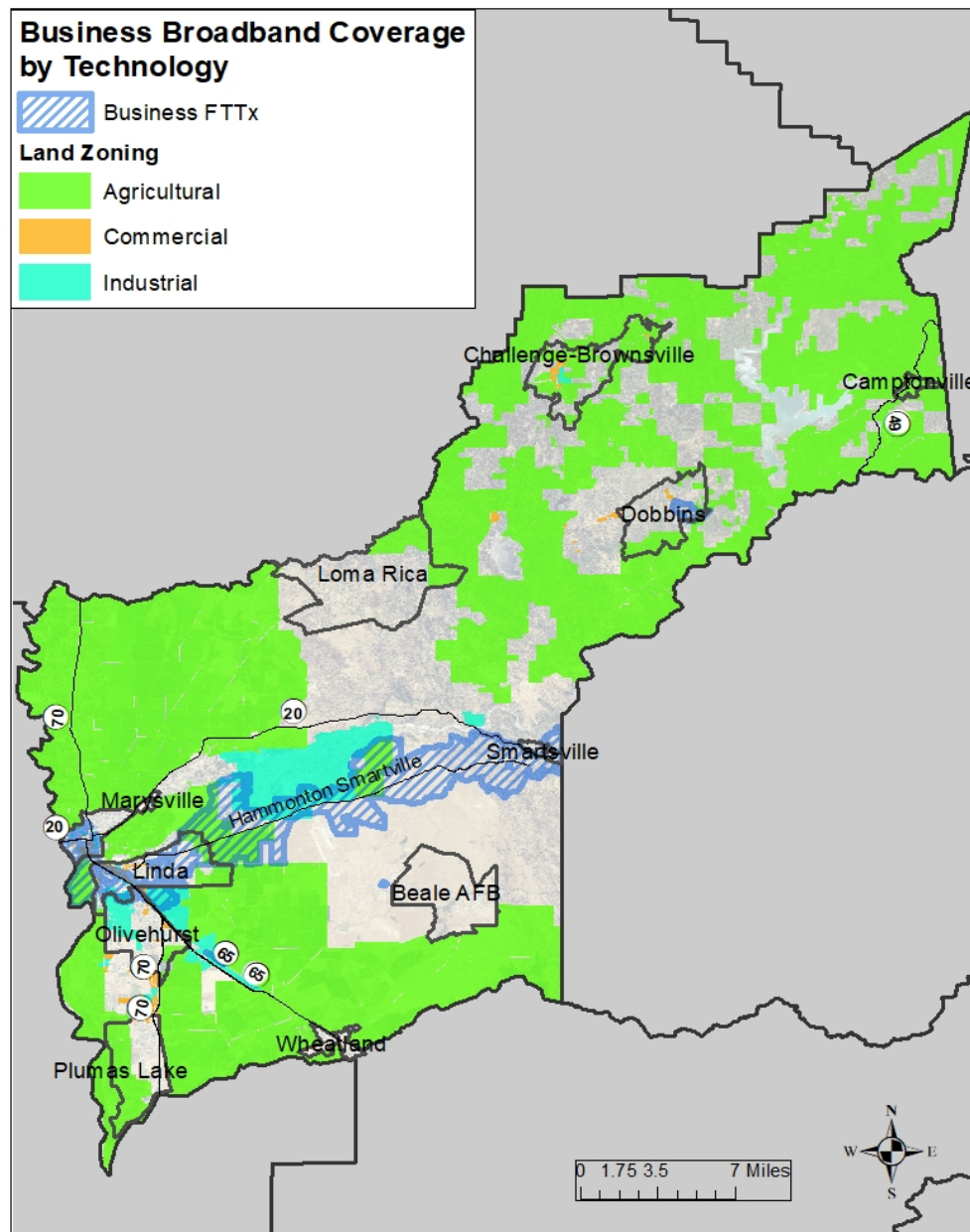
Figure 15. Coverage map of fiber-to-the-location (FTTx) service for business customers.

Figure 16 presents the fixed broadband coverage for business customers at minimum speeds of 100/20 Mbps. The footprint of this service is available in some areas in Marysville and Linda, and to the North of these towns along Highway 70. This service is also available in Wheatland and Beale Air Force Base, and surrounding areas. There is also coverage North of Smartsville. Within these areas, the fixed wireless service is available in commercial, industrial and agricultural areas.
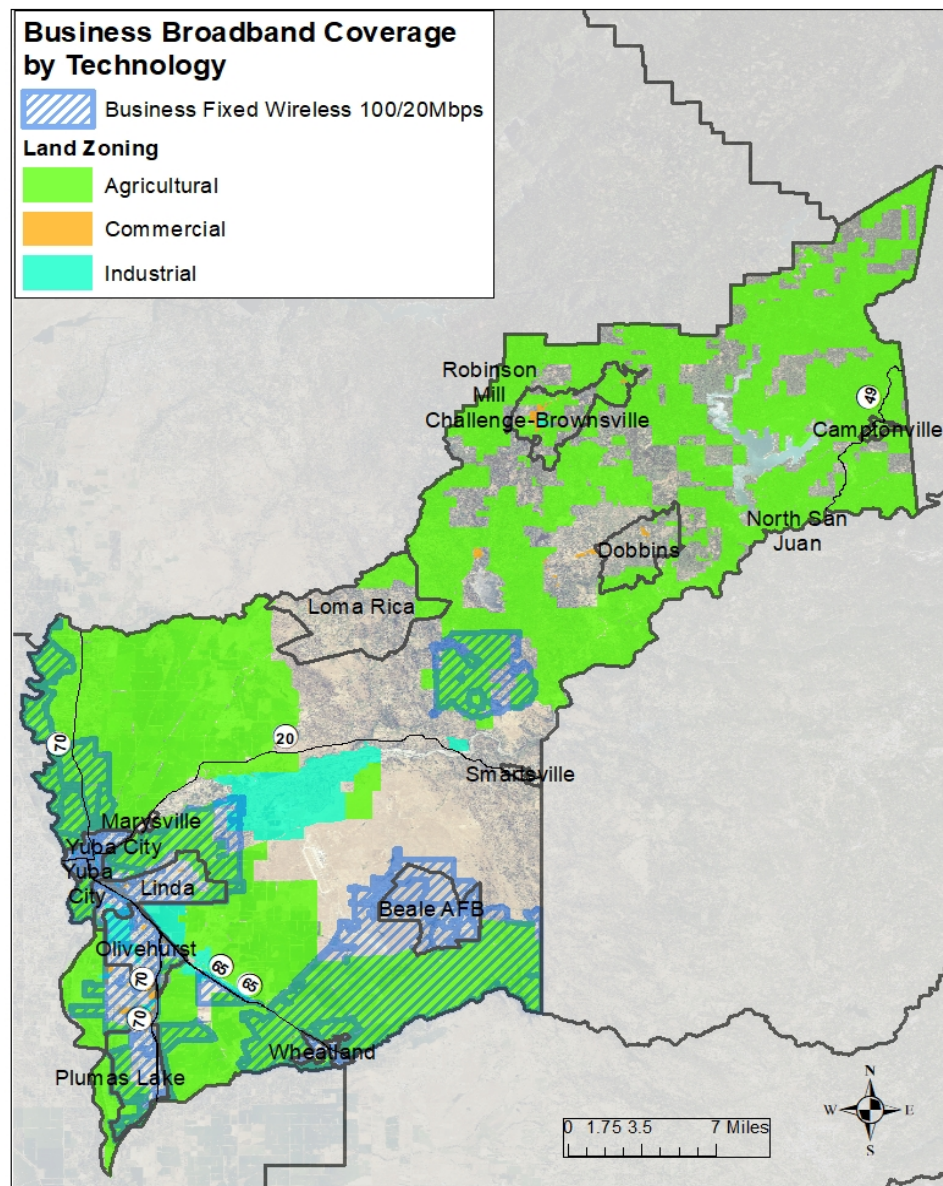
Figure 16. Fixed broadband coverage map for business customers at minimum speeds of 100/20 Mbps.

3.4 Middle-Mile Broadband Service Availability

Middle-mile fiber infrastructure provides high-capacity transport and transmission of data communications from an aggregation point (i.e., a central office, cable headend, or wireless switching station) to an Internet "POP" (point of presence). The availability, affordability, and access to middle-mile infrastructure are critical to planning last-mile broadband infrastructure projects and providing either wireline or fixed wireless services to residential and business customers.

Figure 17 shows the middle-mile infrastructure (i.e., fiber-optic backbones) in the county offered by Frontier, Integra, Level 3, and Vast networks. It is important to note that these fiber-optic carriers do not publish, report, or make available on their websites the fiber-optic routes. The routes presented in the figure were provided by other Regional Broadband Consortia — the Northeastern and Upstate California Connect Consortia, and the Central Cost Broadband Consortium — which have collected the data over the past few years from ISPs, local governments, or other broadband stakeholders with knowledge of fiber-optic deployments.

Based on these fiber optics routes, there are fiber carriers along Highway 70 in the Valley (Integra), and along the Hammonton Smartsville road to the foothills (Vast Networks). These middle-mile fiber deployments reach main urban centers and towns including Marysville, Linda, Olivehurst, Plumas Lake and Smartsville. Additionally, Frontier and Level 3 reach Marysville and Linda, respectively. Areas lacking fiber routes are the Northeast and Southeast parts of the county.

Middle-Mile Fiber Optics Routes
— Frontier (Buried)
— Integra
— Level3
— Vast_CVINNetwork
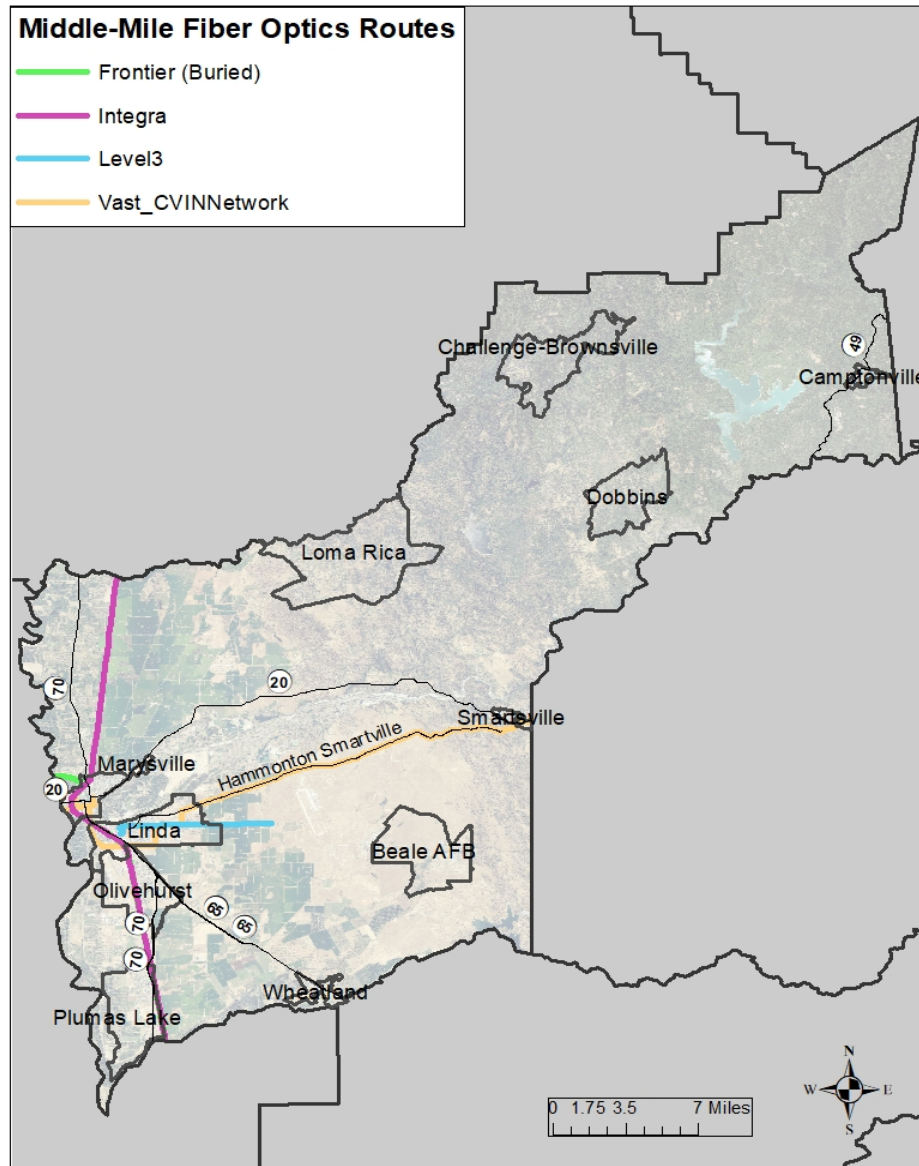
Figure 17. Middle-mile infrastructure (i.e., fiber-optic backbones) in the county offered by Frontier, Integra, Level 3, and Vast networks.

The **Broadband Landscape Analysis** presented in this section helps to identify broadband infrastructure and service gaps in Yuba County for residential, mobile and business broadband users. The analysis is based on the most recent and accurate broadband data available, which comes from the California Public Utilities Commission (CPUC), as these data validates ISPs' census block coverage only if there are actual residential customers in such census blocks. This is an additional validation feature that data from the Federal Communications Commission do not include yet.

Identifying the broadband infrastructure and services gaps assist with strategic planning for improving connectivity across multiple user sectors and in geographical areas within the County. The next section, **Broadband Needs and Demand Analysis**, complements the **Broadband Landscape Analysis** by providing additional input from different broadband stakeholders sectors, and results from speed testing and surveys. Based on findings and input from the **Broadband Landscape Analysis** and **Broadband Needs and Demand Analysis** sections, the **Broadband Plan** provides, in later sections, recommendations to 1) improve or expand broadband infrastructure and services, 2) develop and implement policies to accelerate broadband deployments, and 3) improve broadband adoption across multiple sectors. Furthermore, findings and results from this and the next section assist to estimate the cost for reducing the gaps, and also identifying potential local or regional partners to carry out cost-efficient broadband infrastructure deployments, along with public works or public utility projects in public right-of-ways.

4 BROADBAND NEEDS AND DEMAND ANALYSIS

This section presents the **Broadband Needs and Demand Analysis** conducted for the **Broadband Plan** in order to identify and quantify broadband access and adoption gaps in the County. It includes 1) conducting meetings and interviews with broadband stakeholders representing multiple sectors, 2) evaluating speed testing results, and 3) rolling out surveys focused on business sectors. The findings and results of this assessment are presented in this section.

Methodology

The outreach and engagement process in the County were central to developing this Strategic Master Broadband Plan. Valley Vision, working closely and in coordination with the Yuba County Broadband Task Force and the Yuba Water Agency, put together a comprehensive list of stakeholders from the various communities and sectors in the County. The list included local government elected officials and county and city planning staff; the education sector, including superintendents of the school districts and representatives from Yuba College; the business sector, including representatives from the Chamber of Commerce and Economic Development Corporation; the farming and agriculture sector; Beale Air Force Base; among others.

Virtual meetings were held with the representatives of these different sectors, to learn and gather input of broadband needs and gaps, identify priority areas for broadband improvement, discuss the specific ways their sector relies on and uses broadband, and their vision for a more connected community and county. Input and feedback obtained from these meetings informed the recommendations in the Broadband Plan, making sure that it is responsive to the unique needs of the community and provides actionable items.

In addition to these virtual meetings, Valley Vision also put together two online surveys addressed to 1) the business and commercial sector, and 2) farm and agricultural sector. The business/commercial sector survey was distributed to businesses in the County in collaboration with Yuba County, Yuba-Sutter Chamber of Commerce, and the Yuba-Sutter Economic Development Corporation. The farms and agricultural sector survey was distributed to local farmers and growers in collaboration with the University of California, Agricultural and Natural Resources (UCANR)-Cooperative Extension.

Additionally, it was also conducted a residential broadband service market analysis based on CPUC's CalSPEED test results from 2020 and 2021. These results assist to validate findings and trends presented in the Broadband Landscape Analysis, based on CPUC's ISP self-reported data.

4.1 Broadband Stakeholder Needs Assessment: Meetings/Interviews Findings

To identify and quantify broadband access and adoption needs, Valley Vision, in coordination with the Yuba County Broadband Task Force, conducted (from February to April 2021) a broadband needs assessment (virtual meetings), which included outreach and engagement to the following sectors:

- **Local Government Sector:** Yuba County and City of Wheatland.
- **Education:** School Districts of Camptonville, Marysville, Wheatland, and Plumas Lake, and Yuba College.
- **Business:** Yuba/Sutter Economic Development Corporation.
- **Farming and Agriculture:** UC Agriculture and Natural Resources (ANR) Cooperative Extension for Rice.
- **Local Broadband Stakeholders:** Beale Air Force Base.

The following are findings, results and highlights of the assessment that identified broadband-related needs, concerns, issues, challenges of the different sectors. Notes from these meetings, including meeting participants, are available in **Appendix 8.2 Notes from Broadband Needs Assessment**.

4.1.1   Future Jurisdiction Expansions in the County: New Wheatland City Limits

Wheatland, currently the smallest city in Yuba-Sutter with approximately 3,700-3,800 residents, is positioned to be one of the larger cities in the region because of a 2014-approved annexation of 4,500 acres to the East of the city. The Yuba Water Agency is working with the City of Wheatland on an Employment Zone Feasibility Study.

- **Broadband Related Highlight:** Future housing and commercial developments need to incorporate, from planning stage, broadband infrastructure and services along with other utility services.

4.1.2   Future Infrastructure Projects

Upcoming major infrastructure projects include the South Yuba Transportation Improvement Authority's planned infrastructure projects[35]: 1) the Wheatland Bypass, 2) a new freeway interchange at State Route 65 and South Beale Road, 3) a new freeway interchange North of Sheridan in Placer County at the Southern terminus of the bypass, and 4) a high capacity roadway between the new South Beale Road Interchange and the Plumas Lake Boulevard Interchange on State Route 70.

- **Broadband Related Highlight:** Local or regional infrastructure projects (digging/trenching/excavating) in public-right-of-way need to coordinate with local governments, internet service providers, and telecom companies to install broadband infrastructure in a cost-effective manner.

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[35] South Yuba Transportation Improvement Authority 8/4/2020 Agenda and Background. https://www.yuba.org/Yuba%20County/Community%20Development/SYTIA/08%2004%202020%20Agenda%20and%20Background.pdf

4.1.3 Education Sector Needs

The **Yuba College** campus has reliable and fast broadband — AT&T backbone of 10 Gbps, and Xfinity backup of 1 Gbps. However, many of the students and communities that the College serves do not have reliable broadband at home. The College successfully implemented several stop-gap measures to assist their students' transition to distance learning during the pandemic. These include extending the Wi-Fi signal from the school to the parking lot, so students can park and work from their cars, and providing students with wireless hotspots (Verizon and Sprint). However, these solutions are not sustainable, even with support from Coronavirus Aid, Relief, and Economic Security Act (CARES) funding due to the underlying broadband infrastructure gaps. As a result of the COVID-19 pandemic, the college experienced about a 20% decline in enrollment.

The areas served by the **Camptonville Elementary School District** includes canyons and rugged terrain, heavily forested, with no cellular service, which means that the hotspots from the major carriers do not work for many. The campus itself has reliable and fast broadband — a fiber optics connection that provides a gigabit line for up to 500 users. The issue for the District is connectivity for students when they are not on campus. There is an AT&T Center across the street from the school; those who live more or less a quarter mile from the Center can get DSL service. Otherwise, most residents still rely on their old dial-up service (copper phone lines). Some residents have tried HughesNet; however, the issues with that type of service (satellite) are the data caps and the expense. Some residents are signing up for the recently launched Starlink pilot service. Bringing new towers to this area is expensive due to the lack of power service, which needs to be factored in the total deployment cost. As a result of these barriers, the school saw about 10 out of their 50 students stop attending classes, and about 10 more who they do not see consistently.

In the **Marysville Joint Unified School District**, the schools themselves have reliable and fast broadband through the Corporation for Education Network Initiatives in California (CENIC)[36] network and using E-Rate funding (90% cost)[37]. The issue for the District is connectivity for students when they are not on campus. In the transition to distance learning brought about by the COVID-19 pandemic, the District partnered with three mobile carriers (T-Mobile, AT&T, and Verizon) to make available hotspots for students at home. These solutions are not sustainable in the long-term, even with support from CARES dollars due to the underlying broadband infrastructure gaps. There is concern that deploying towers (around $400,000) is also not sustainable due to the low-density and low-income families in the areas that the towers would serve, and as a result, a low return on investment which does not support the case for the investment. DigitalPath is available in some areas. Smartsville, the community served by the **Wheatland School District**, shares the same concerns as the Marysville Joint Unified School District.

The **Yuba County Office of Education** noted that, ultimately, the education sector's broadband needs are an equity issue that requires a strategic approach, in coordination with the County and communities, as well as state-level advocacy.

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[36] Corporation for Education Network Initiatives in California (CENIC). https://cenic.org/
[37] E-Rate/CTF Frequently Asked Questions. https://www.k12hsn.org/resources/erate/loa/faqs

As identified by representatives from the education sector, communities with connectivity issues include: Browns Valley, Challenge-Brownsville, Dobbins, Hallwood, Linda, Loma Rica, Marysville (North, West and heading up to the foothills), Olivehurst, Sierra Foothills, and Sutter borderline.

- **Broadband Related Highlight:** Education facilities have access to high-speed and reliable broadband service from connecting to the CENIC High-Speed Network (using E-Rate funding). This high-speed connectivity and infrastructure are not available for extending service for local residential use due to federal statutory restrictions. Major connectivity needs are from students at home in rural unserved areas. ISPs and mobile carriers do not expand service to these areas due to high-costs and low return-on-investment (ROI). Partners provided a list of communities that have none or poor internet connectivity for both mobile and residential service. Solutions need a strategic approach including long-term infrastructure solutions.

4.1.4   Beale Air Force Base

At Beale Air Force Base (Beale AFB), the government network rides its own backbone, and the major potential customers for commercial broadband service are residential subscribers — the approximately 500 families living on privatized base housing would be the primary beneficiaries. Currently, the residential broadband service is available through Comcast/Xfinity, Hughes Net, and AT&T (the latter includes Dish Network and Direct TV). There is broadband service available up to 10 Gbps or other lower speeds, depending on the provider. Most all of the current access to housing is through underground conduit. Mobile service is available in the residential area; however, off-base coverage depends on the provider. Mobile carriers include T-Mobile/Sprint, AT&T, Verizon, and Cricket. AT&T and Comcast have the current leases for cell towers and underground conduit in the housing area. There is also a new Verizon cell tower lease going into the hospital.

Other Beale AFB broadband needs that can be filled by commercial broadband include the installation of PurpleAir[38] sensors to measure particulates (these need to be connected to the internet) and other commercial off-the-shelf systems available to the private sector.

Another consideration is the future University Affiliated Research Center (UARC), a United States Department of Defense Program in partnership with the University of California system. The center will be located in the Wheatland area and off Spenceville Road. Developers are planning to build 5,000 new homes. A portion of the building may rely on the Beale AFB system, but there will still be a need for reliable broadband for the Center to conduct research and design work.

- **Broadband Related Highlight:** Current and future broadband service should meet needs of residential customers (500 families). There will be growing need for high-capacity backbone for the Base and residential area, in addition to the broadband capacity needs of the upcoming UARC. The new homes are likely to be part of the recently annexed area to Wheatland.

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[38] Purple Air https://www2.purpleair.com/

4.1.5 Business Broadband Needs

Representatives from the business sector, represented by the Yuba/Sutter Economic Development Corporation, noted the following areas where there are concerns regarding availability and reliability broadband internet service: The area around the Northern Yuba-Butte County line, the foothills in District 10 in Yuba County (North of Marysville), and the area around the Yuba County Airport. Most of the flatlands in the valley are well-served by commercial broadband. There are not many complaints regarding pricing in these areas. They also projected a new commercial area in the next few years: everything in the Olivehurst area, South of Wheatland, is prime for commercial development.

- **Broadband Related Highlight:** Identified areas of concern for commercial internet access are mostly in the foothills. Access and reliability are main issues. Additionally, new commercial developments should include availability of broadband infrastructure.

4.1.6 Farming and Agriculture Broadband Needs

In the farming and agriculture sector, there are two primary areas of connectivity need. First, in the fields, many of the devices (i.e., tractors, airplanes, drones, databases) require an internet connection, which is currently provided through satellite technology or mobile service. Second, many growers' offices based in rural areas do not have fast or reliable broadband internet (most areas outside Marysville).

In this sector, there is a movement towards more high-tech Ag (e.g., connected smart tractors), and there are databases that cannot be accessed without Internet (e.g., data for pest advisors). Some growers, or research and state organizations, use sensors in the farm fields. Most of these sensors are manual (i.e., require physically to plug and unplug portable USB devices to extract the collected data), but a few are cloud-based. These sensors are used for rainfall and humidity measurements, or soil or moisture probes, among other indicators.

The commercial internet pricing for connecting offices (i.e., Office in Yuba City for Sutter County) is expensive. The cost for a Comcast/Xfinity connection deployment from across the street was roughly $10,000.

Other potential users of broadband-reliant agriculture technology include rice mills, for their equipment, and food processors. Processors are increasingly using artificial intelligence (AI). In Wheatland, there are many agricultural areas.

- **Broadband Related Highlight:** There is a growing trend in Ag for connected devices, sensors and vehicles in farm fields. Connectivity for offices in urban areas is expensive, and minimally-available in rural areas. Additional potential demand for commercial broadband connectivity comes from industrial facilities (i.e., rice mills and food processors).

4.2 Residential Broadband Service Market Analysis

This residential broadband market analysis (from the supply side) uses speed tests results from the CPUC's CalSPEED[39] application, for both fixed and mobile service measurements, to assess (validate) actual levels of broadband coverage and speeds. The table below (Table 12) presents a summary of historical CalSPEED testing conducted in Yuba County for fixed and mobile measurements from 2013 to 2021. For this analysis and in order to assess a more recent snapshot of broadband service performance, only the results from 2020 and 2021 (as of June) are used.

Table 12 CalSPEED Fixed and Mobile Speed Measurements.

Year	CalSPEED Fixed Measurements	CalSPEED Mobile Measurements
2013	-	2
2014	-	65
2015	-	1
2016	-	-
2017	-	2
2018	-	15
2019	-	6
2020	6	9
2021 (As of June)	21	40

4.2.1 Fixed Residential Broadband Service

Figure 18 presents speed testing results (from 2020 to 2021) of fixed residential service (27 measurements). Some of the measurement points might overlap with each other in the map due to the scale of it, thus it is presented a description of the results.

- **Less than 6 Mbps (<6Mbps):** There are nine (9) tests results in this range located in Wheatland, Dobbins and West of Dobbins. The area within and around Dobbins is reported as served at 6 Mbps, then these results indicate that there are gaps or areas served below the CA standard of 6/1 Mbps. Eight out of nine results are from Digital Path (fixed wireless), and other one is from Consolidated Communications.
- **Greater than 6Mbps to less than 25Mbps (>6Mbps to < 25Mbps):** For this range, there are five (5) test results from Wheatland, Dobbins and West of Dobbins. Providers are Digital Path (fixed wireless) and AT&T (wireline). The area of Dobbins is also reported as served at 25 Mbps, then these results indicate that there are gaps at the FCC 25/3 Mbps standard.

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[39] The CalSPEED application (www.calspeed.org) is a professional-level broadband testing tool developed at California State University, Monterey Bay and is used by the CPUC for validating broadband coverage from any broadband subscriber location. CalSPEED allows conducting performance testing of both fixed and mobile broadband services, and testing results are displayed in the user device and then sent to a CPUC server for displaying on the California Broadband Availability Map (https://www.broadbandmap.ca.gov/).

- **Greater than 25 Mbps and less than 100 Mbps (>25Mbps to <100Mbps):** There eight (8) results located in Marysville and East of Marysville. Providers performing this speed range include AT&T, Comcast and Vast Networks (all wireline).
- **Greater than 100 Mbps (>100Mbps):** There are five (5) results located in Marysville and Linda. The providers are AT&T and Comcast (both wireline). These areas report coverage above 100 Mbps, so speed test confirm actual coverage in this range.

Overall, these speed test results indicate that the Central and Northeast parts of the county have speeds below 25Mbps and there is some discrepancy between the report coverage (based on self-reported ISP data to the CPUC) and actual measurements. In the West side of the county, in Marysville and Linda, there are higher speeds available (above 100Mbps). The highest speed results are provided by AT&T and Comcast's service.

It is important to note that the sample was only 27 speed tests, and only provides a small snapshot on broadband coverage and speed validation in the County. Further assessments and more speed tests are recommended in order to generate a more accurate depiction of both broadband coverage and speeds.
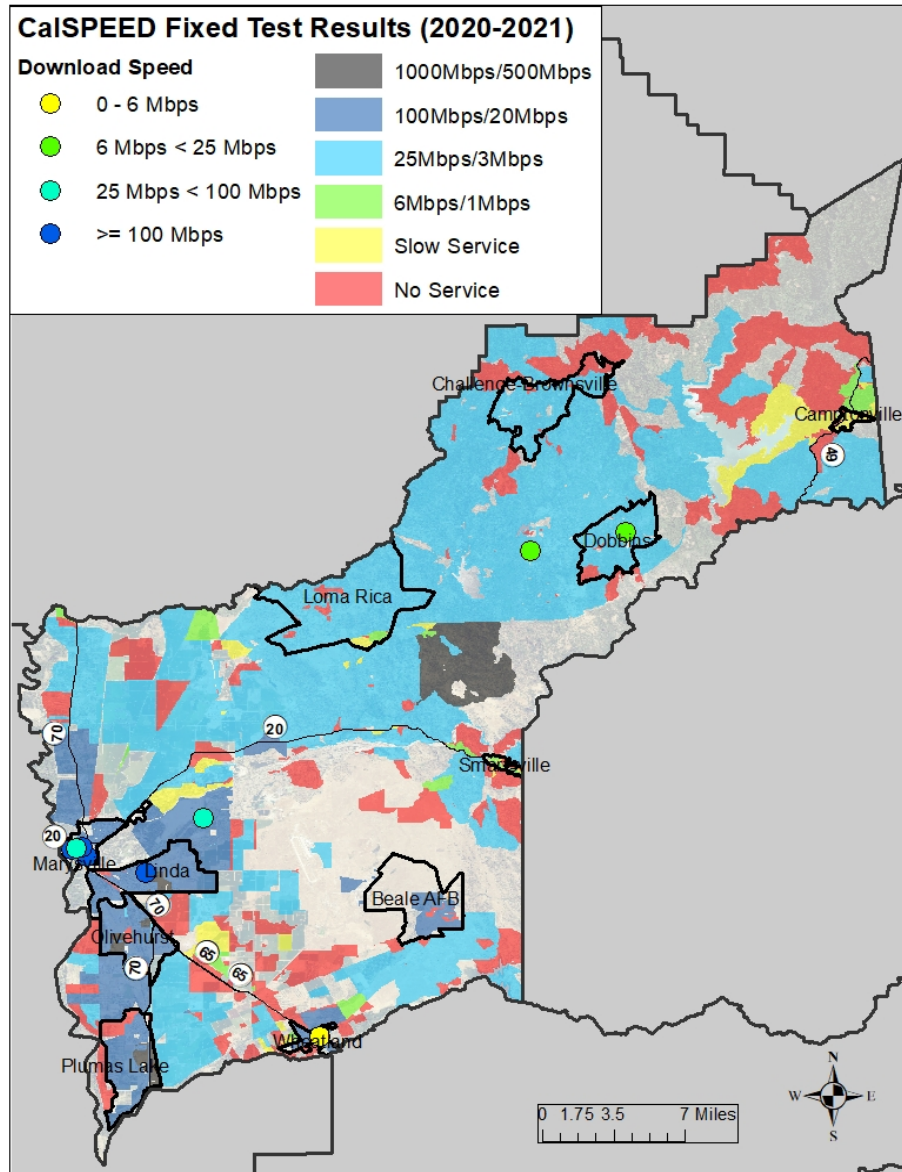
Figure 18. CalSPEED Fixed Test Results (2020-2021).

4.2.2 Mobile Broadband Service

Figure 19 presents speed testing results (from 2020 to 2021) of mobile broadband service (49 measurements). Some of the measurement points might overlap with each other in the map due to the scale of it, thus it is presented a description of the results:

- **Less than 6 Mbps (<6Mbps):** There are twenty-one (21) tests results in this range located in Loma Rica, Dobbins, Challenge-Brownsville and nearby areas. These results indicate that

there are gaps or areas served below the CA standard of 6 Mbps. Speed test results are from AT&T Mobility, Republic, T-Mobile and Verizon.

- **Greater than 6Mbps to less than 25Mbps (>6Mbps to < 25Mbps):** There are seventeen (17) measurements in this range located in Loma Rica, Dobbins, and Challenge-Brownsville. These mobile carriers include AT&T Mobility and Verizon.
- **Greater than 25 Mbps and less than 100 Mbps (>25Mbps to <100Mbps):** There are nine (9) measurements in this range from Marysville, Plumas Lake, and areas North of Dobbins. Mobile carriers achieving these higher speeds are AT&T Mobility and Verizon.
- **Greater than 100 Mbps (>100Mbps):** There are two (2) measurements in this speed range from Plumas Lake and by T-Mobile.

Overall, these mobile speed test results indicate that in the Northeast part of the county, in the edge of Loma Rica, Dobbins and Challenge-Brownsville, mobile broadband speeds are below the CA standard (6/1 Mbps). In the same area, but within town limits, there are higher speeds (6-25Mbps range) provided by AT&T Mobility and Verizon. Speeds in the next speed range (above 25Mbps) are available in the Western part of the county (Marysville), and few locations in the Northeast (North of Dobbins). The highest speed range is available in Plumas Lake by T-Mobile.

In the case of mobile broadband service, it is also important to note that the sample was only 49 speed tests, and only provide a small snapshot on mobile broadband coverage and speed validation in the county. Further assessments and more speed tests are recommended in order to generate a more accurate depiction of both mobile broadband coverage and speeds.
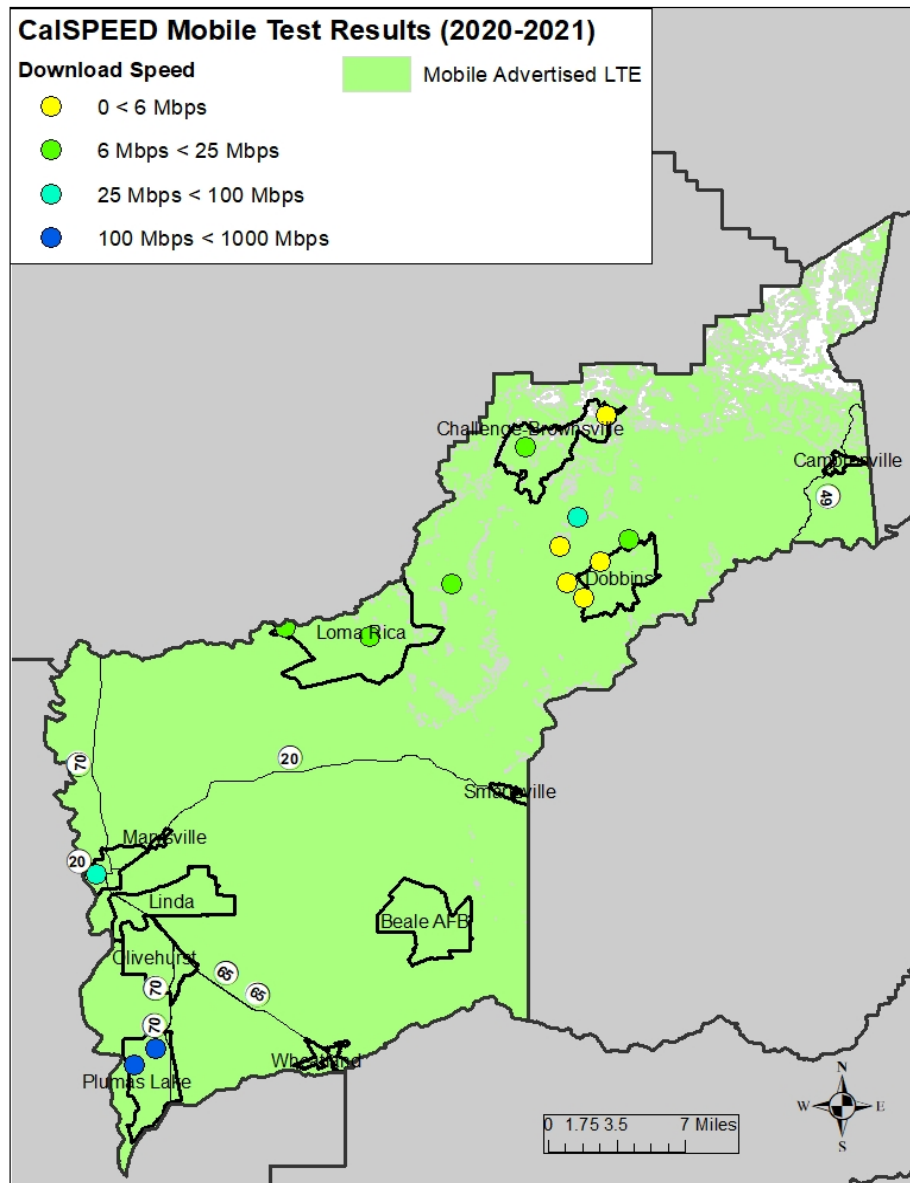
Figure 19. CalSPEED Mobile Test Results (2020-2021).

4.3   Business Broadband Service Market Research

This subsection presents results of two online surveys addressed to 1) the business and commercial sector, and 2) farm and agricultural sector. The business/commercial sector survey was distributed to businesses in the County in collaboration with Yuba County, Yuba-Sutter Chamber of Commerce, and the Yuba-Sutter Economic Development Corporation. The farms and agricultural sector survey was distributed to local farmers and growers in collaboration with the University of California, Agricultural and Natural Resources (UCANR)-Cooperative Extension.

4.3.1   Business Broadband Survey Results

The Business Broadband survey was answered by **35 businesses**. Figure 2 shows the geographical location of the respondents. There was a variety of industries that responded to this survey including: lodging and accommodations; agriculture and farming; retail trade; real estate, rental, and leasing; professional, scientific, and technical services; educational services; food and beverage services; and several other industries. The vast majority of respondents reported that their organization or business consists of 1 to 25 staff members (85.7% or 30), three (3) reported between 26 to 50 staff members (8.6%), and two (2) between 51 to 100 staff members (5.7%).
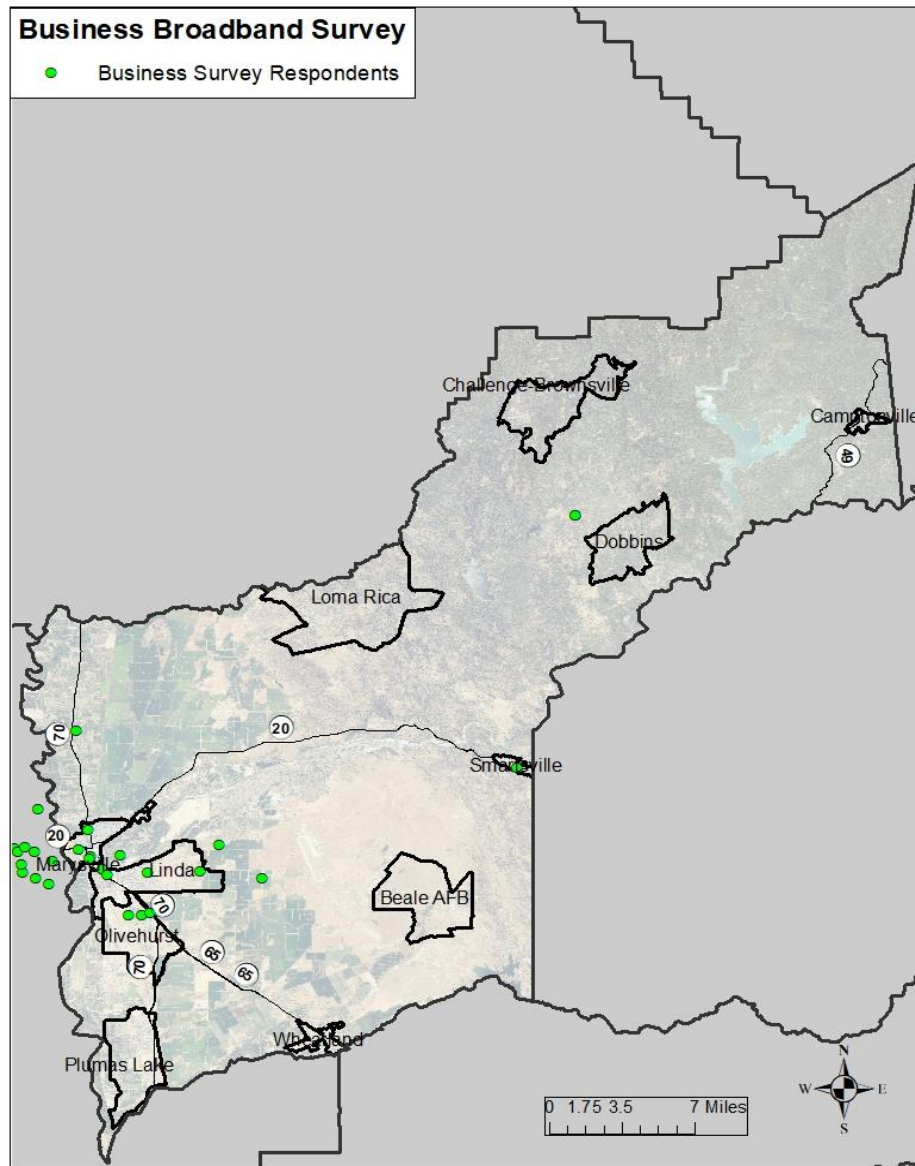
Figure 20. Business Broadband Survey Respondent Locations (n=35).

There were businesses located in several parts of the county that responded to this survey (Figure 20). Most are located near Marysville. Along with a few near Highway 70 in Olivehurst. There are a few located in the outskirts of Linda and one located near Dobbins in the North part of the county.

Internet Service Providers and Technology

Figure 21 shows that 34.3% (12) of respondents indicated that AT&T is their internet service provider, 34.3% (12) indicated Comcast-Xfinity, 17.1% (6) Succeed.Net, 5.7% (2) Verizon, 2.9% (1) indicated CalNet, 2.9% (1) reported Other, and 2.9% (1) did not have internet.
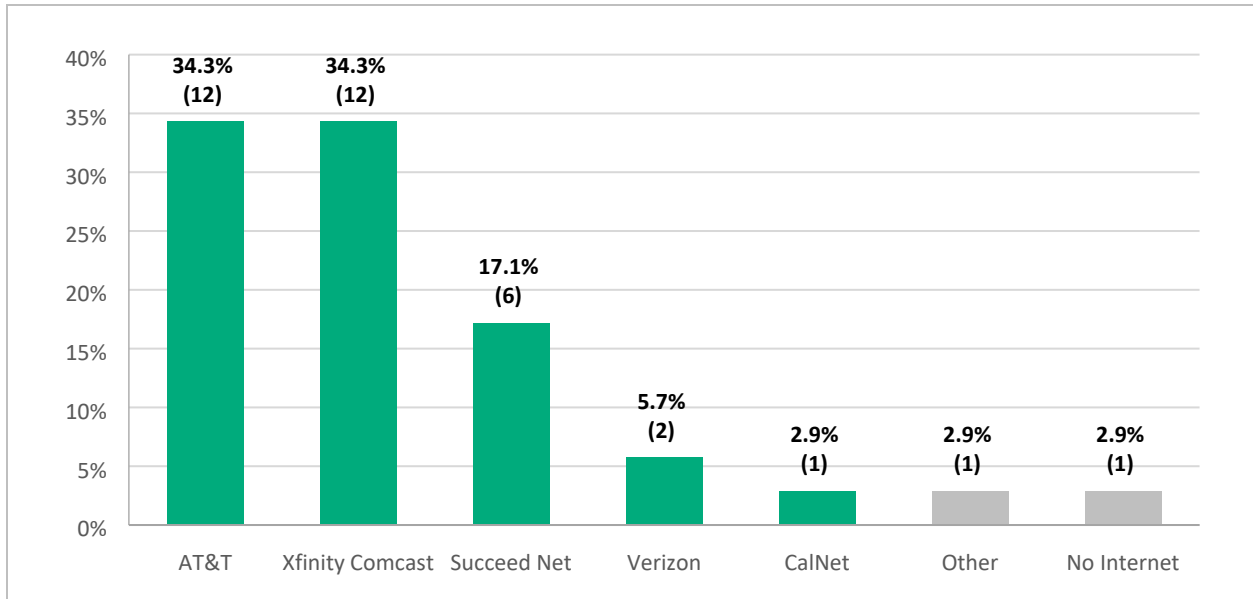
Figure 21. Internet Service Providers, Business Broadband Survey (n=35).

Nearly three in ten (28.6% or 10) of respondents indicated that Cable modem is the type of technology used for internet service, followed by 17.1% (6) using xDSL, 17.1% (6) using fixed wireless, 11.4% (4) using fiber optics, 5.7% (2) using satellite, 5.7% (2) using other technology, and 2.9% (1) using mobile LTE/mobile hotspot. There were 8.6% (3) of respondents that indicated they do not know the type of technology, while 2.9% (1) noted they do not have the internet service.
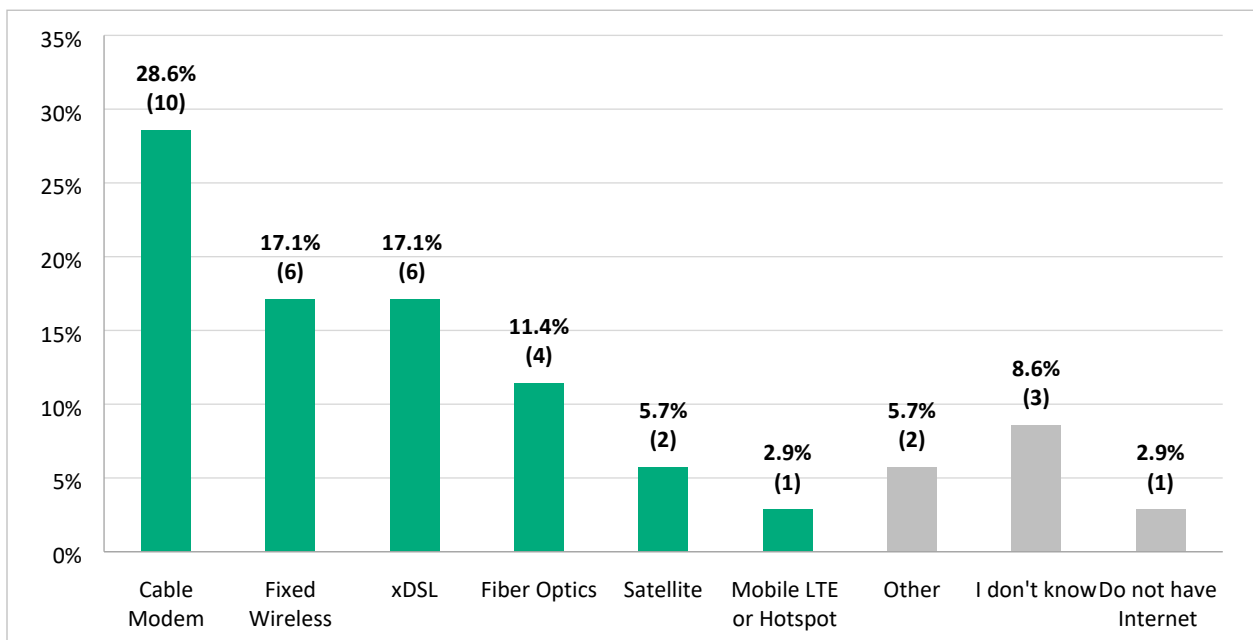
Figure 22. Internet Service Technology, Business Broadband Survey (n=35).

Actual Speeds (CalSPEED Test Results)

When asked to measure <u>download speeds</u> at their business or organization using the CalSPEED app, 20% (7) of respondents reported "less than 6Mbps," 25.7% (9) indicated "between 6 and 25 Mbps," 8.6% (3) reported "between 26 and 100 Mbps," while 20% (7) reported "between 101 and 500 Mbps," and only 2.9% (1) noted "over 500 Mbps." The respondent with over 500 Mbps uses Verizon as their service provider, and the next fastest speeds (between 101 and 500 Mbps) were served by Comcast Xfinity (5), AT&T (1), and Succeed.Net (1). There was one (1) respondent who indicated they do not have the internet, and seven (7) responded "I don't know" which was also the preferred option if respondents were unable to use the CalSPEED app.
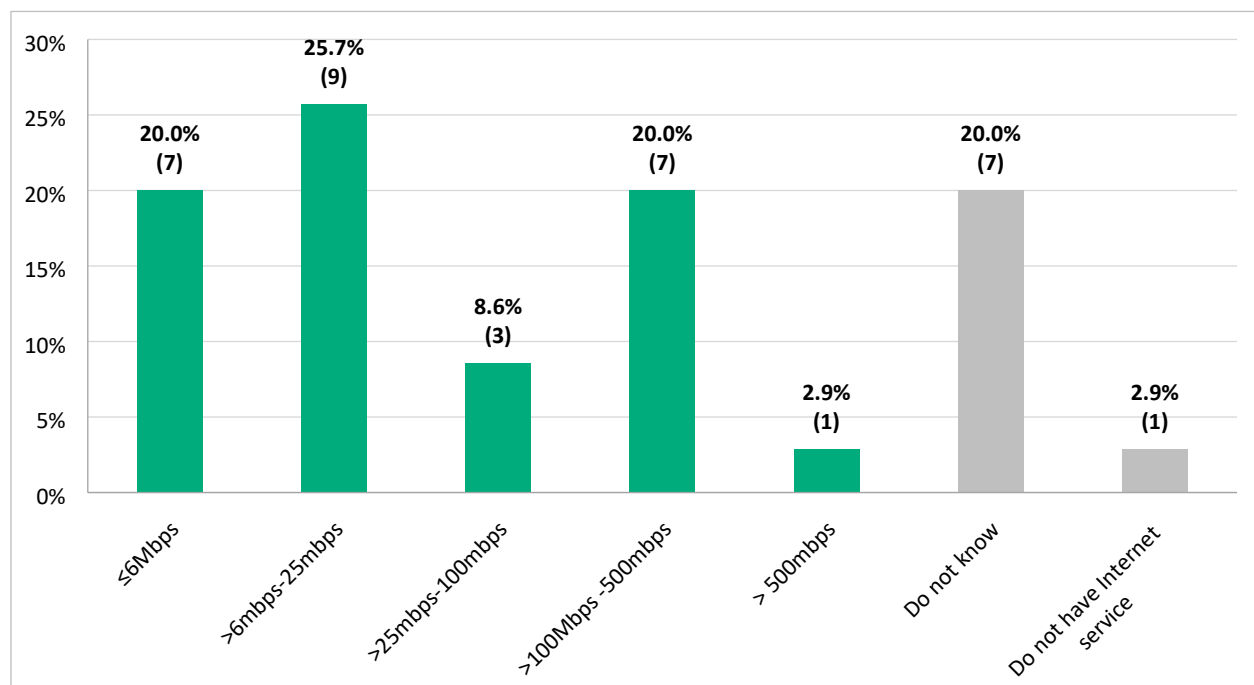
Figure 23. CalSPEED Actual Measured Download Speed, Business Broadband Survey (n=35).

Actual Speed vs Contracted (Advertised Speeds)

Participants were asked how their measured speeds from the CalSPEED app compared to the contracted speeds. The contracted speeds are the speeds promised by your internet provider when you sign up for the plan. Nine (9) reported download and upload speeds lower than contracted (27.3%), 11 indicated that the speeds were more or less the same as contracted (33.3%), and no one indicated that the speeds were higher than contracted. Two (2) reported they do not have the internet, and 11 respondents indicated they did not know. Two respondents did not answer this question.
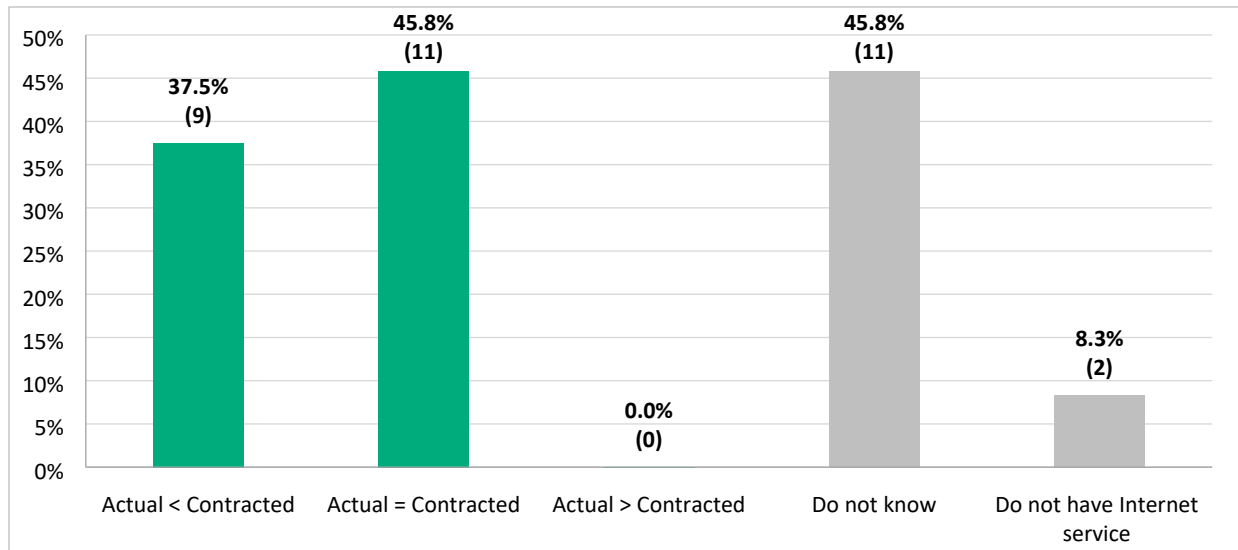
Figure 24. Comparison Actual Speed vs Contracted Speed, Business Broadband Survey (n=33).

Service Satisfaction

Just over half (51.4% or 18) of the respondents reported that the business/organization's current internet service is good enough for its needs, the majority were Comcast Xfinity (8) customers, AT&T (4), Succeed.Net (4), along with Verizon (1) and CalNet (1). Another 42.9% (15) indicated it is not good enough for their needs, and two (2 or 5.7%) indicated "unsure."
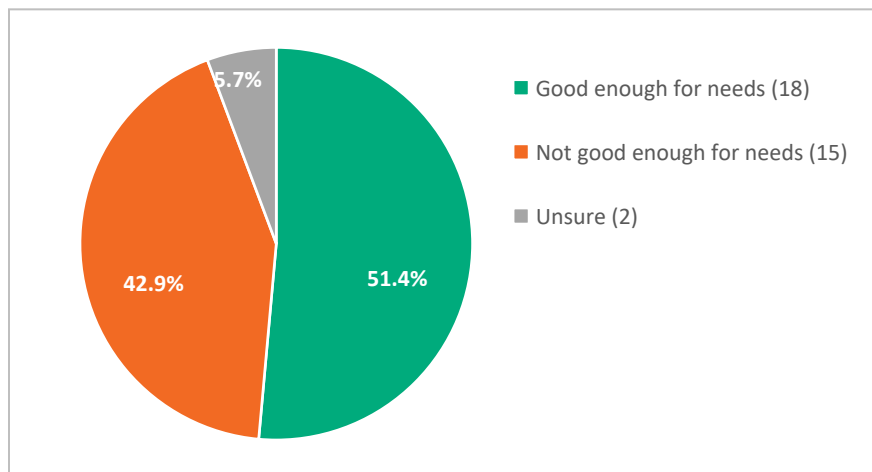
Figure 25. Internet Service Satisfaction, Business Broadband Survey (n=35).

Of the 18 respondents who provided multiple reasons why their internet service is not good enough, the most common response was that it is not fast enough (12 or 66.7%). Breaking down by provider, respondents were customers of AT&T (5), Comcast (3), Succeed.Net (2), Verizon (1), Other (1). Just over half (10 or 55.6%) said it is unreliable with regular service interruptions; five customers of AT&T (5),

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Comcast (2), and one customer of Succeed.Net (1), Other (1), and Verizon (1). Seven (7 or 38.9%) noted it is too expensive; three are AT&T customers (3), two use Succeed.Net (2), and one uses Comcast (1). Five (5 or 27.8%) reported the customer service is insufficient; four are AT&T customers (4), and one uses Comcast (1). One (1 or 8.3%) respondent reported they do not have internet due to the cost of service.
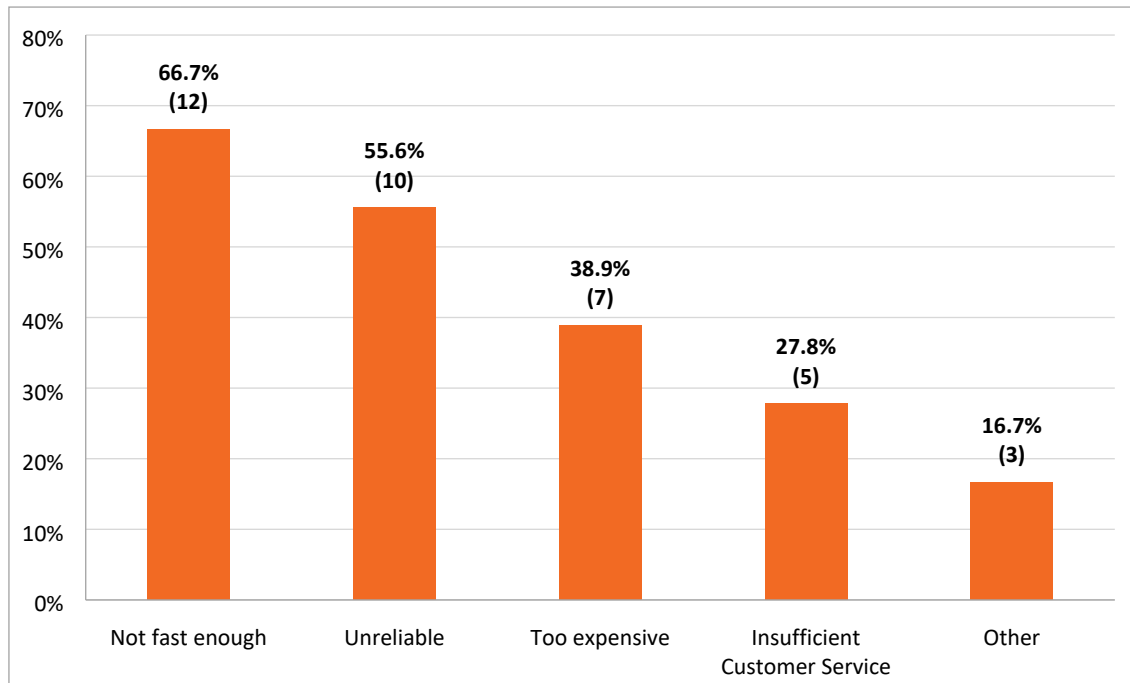
Figure 26. Internet Service Perception, Business Broadband Survey (n=18).

Internet Usage

Of the respondents that have internet service (n=34), the majority use the internet in a general capacity (85.3%), 73.5% use it for online payment processing whether through credit cards or other means, 70.6% use online business applications (for accounting, payroll, etc.), another 67.7% gather online research and information, 64.7% also access social media for the business/organization, 64.7% use the internet for teleconferencing or video conferencing (through Zoom or other platforms), and 61.8% use the internet for online banking. Just over half of the 34 respondents use the internet for online data backup services (55.9%), 50% for online file sharing and collaboration, 47.1% for security monitoring, 29.4% indicated web hosting, and four (4 or 11.8%) for agriculture and farming technologies, while four (4) participant added utilities control, another for "convenience for guests."
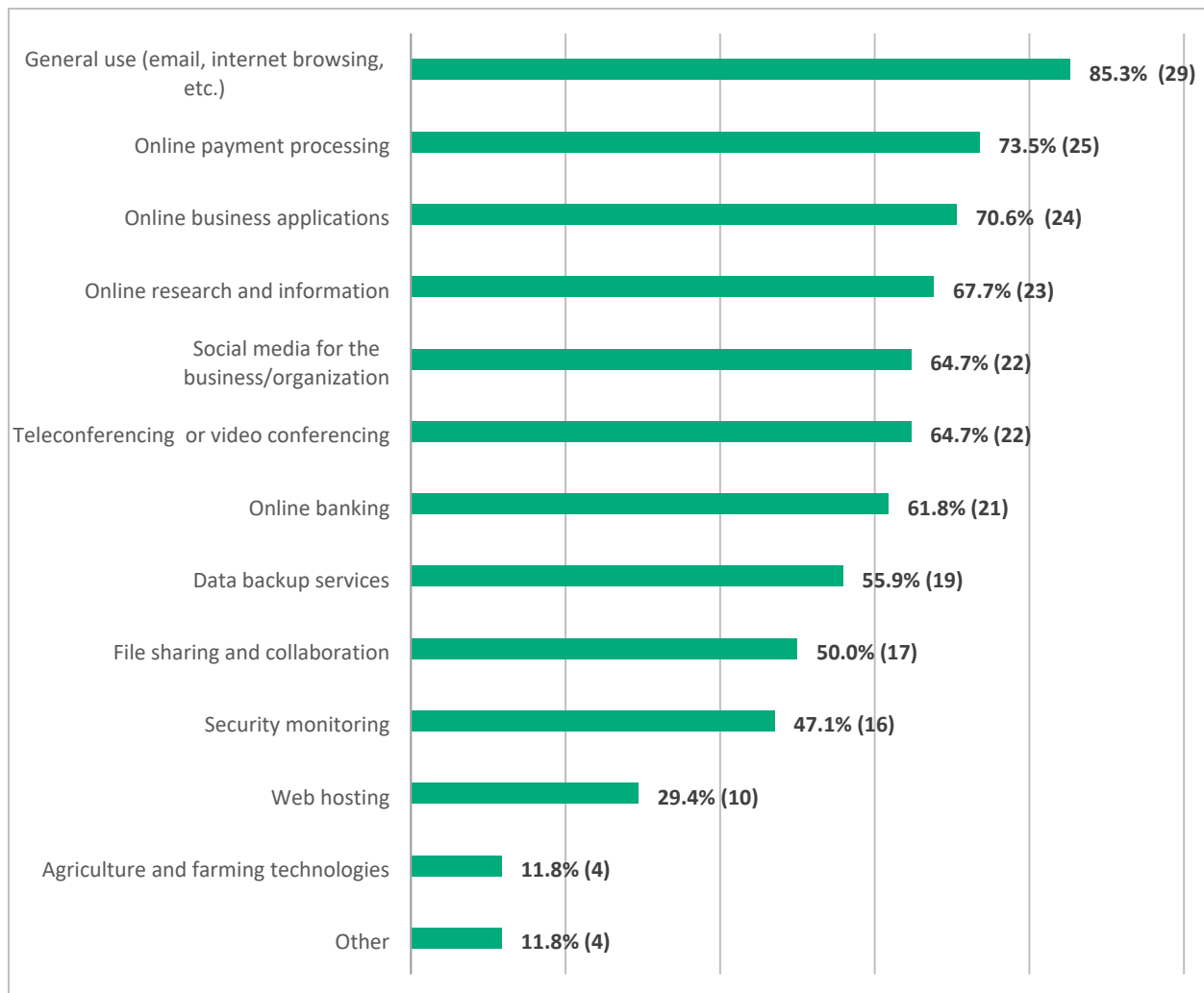
Figure 27. Internet Service Usage, Business Broadband Survey (n=34).

General use (email, internet browsing, etc.) 85.3% (29)
Online payment processing 73.5% (25)
Online business applications 70.6% (24)
Online research and information 67.7% (23)
Social media for the business/organization 64.7% (22)
Teleconferencing or video conferencing 64.7% (22)
Online banking 61.8% (21)
Data backup services 55.9% (19)
File sharing and collaboration 50.0% (17)
Security monitoring 47.1% (16)
Web hosting 29.4% (10)
Agriculture and farming technologies 11.8% (4)
Other 11.8% (4)

4.3.2 Farm and Agriculture Broadband Business Survey

The Farm and Agriculture Broadband Survey was distributed through partners at the Yuba-Sutter Farm Bureau, Agricultural Commissioner for Yuba County, and the growers list through the University of California Cooperative Extension (UCCE) Sutter-Yuba Counties. There were **18 respondents** that took part in this survey between May and June 2021. Several participants indicated the farm they are answering for has a variety of products. Ten (55.6%) reported fruit trees (peaches, cherries, olives, etc.), eight (8 or 44.4%) reported nut trees, six (6 or 33.3%) have livestock, four (4 or 22.2%) are commodity crop farms (rice, wheat, soy, etc.), and three (4 or 22.2%) reported field and row crops, along with two (2 or 11.1%) others reported grazing lands and horses.

4.3.2.1 Internet Service in Farms and Fields (Outside Office Area)

Internet Service Providers and Technology

When asked what internet service the farms use 50% (9) reported AT&T, 22.2% (4) use Succeed.Net, 11.1% (2) use Verizon, 5.6% (1) use T-Mobile, and 5.6% (1) using Hughes. It is important to note one (1) respondent noted they have two Internet Service Providers on site, they reported Succeed.Net and Verizon, they did not indicate which was for the office or the field. There were 11.1% (2) respondents that noted they do not have internet service in the field.
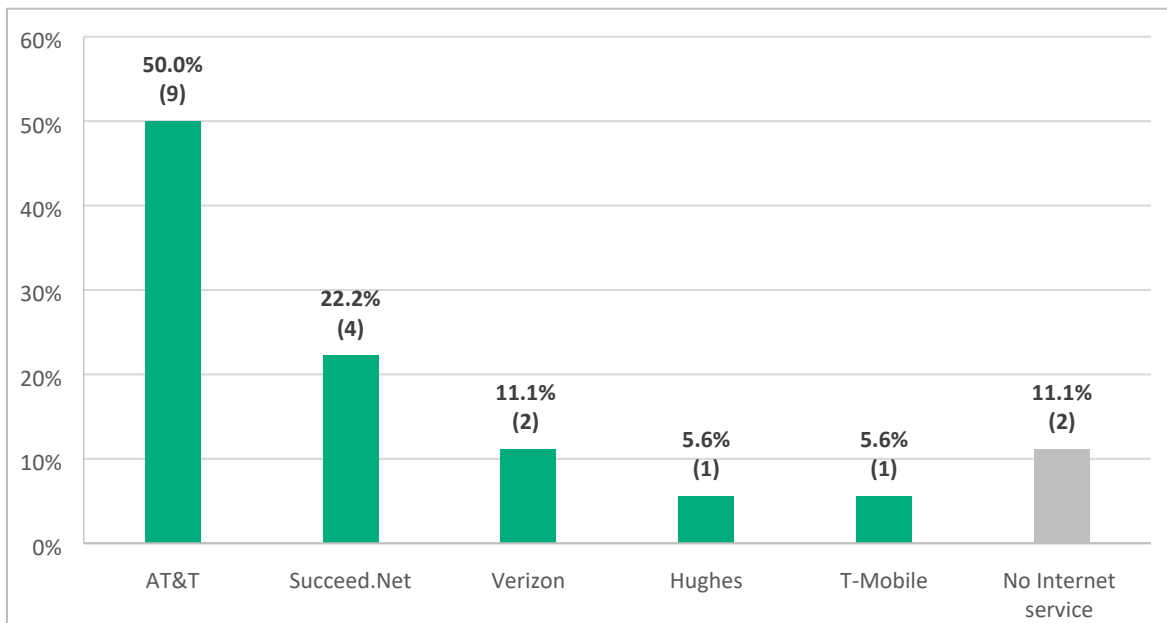
Figure 28. Internet Service Providers, Farm and Agriculture Broadband Survey (n=18).

Regarding the technology used for field connectivity, 35.3% (6) use mobile LTE or mobile hotspot, fixed wireless is used by 23.5% (4), 5.9 % (1) use satellite as well as 5.9% (1) using xDSL, and 5.9% (1) use fiber optics. Nearly a quarter (23.5% or 4) do not have internet service in the field. It is noted that in the previous question, two (2) respondents reported not having internet service in the field, and in this question, four (4) respondents reported the same. It is assumed that the increase in the responses mean not to have actual usable internet in the field, in comparison to some level of mild internet coverage.
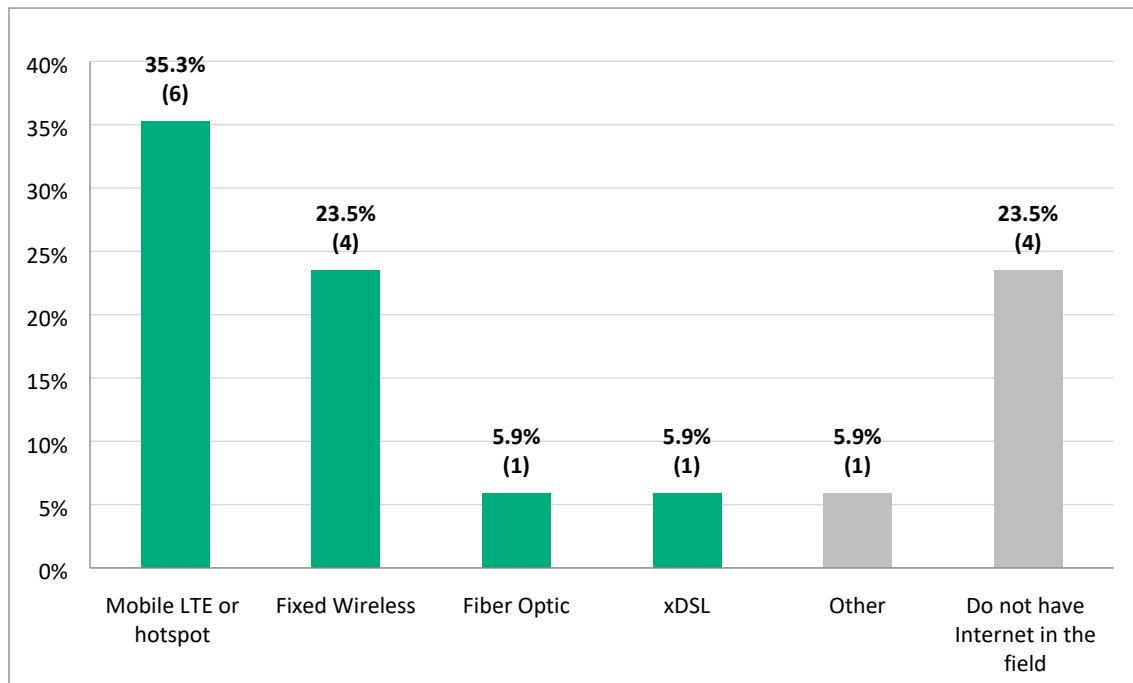
Figure 29. Internet Service Technology, Farm and Agriculture Broadband Survey (n=17).

Service Satisfaction

Only three (3) respondents reported that their internet service is good enough (16.7%). Of the 18 respondents, 15 (83.3%) that indicated their service is not good enough.
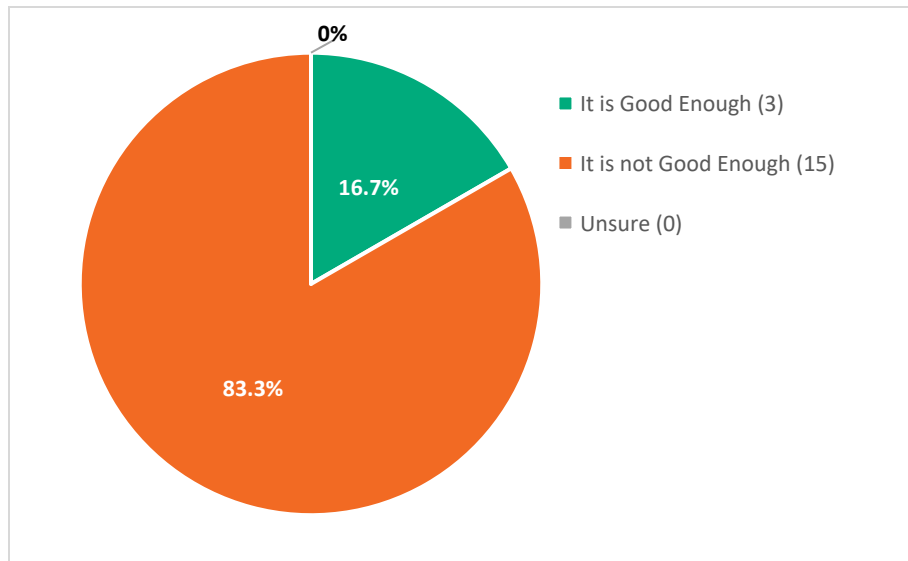
Figure 30. Internet Service Satisfaction, Farm and Agriculture Broadband Survey (n=18).

Of the 15 respondents that noted that their internet service is not good enough, the majority noted their internet is not fast enough at their farm (12 or 80%) – some are AT&T customers (4), DSL (2), Succeed.Net (2), along with Verizon (2), and T-Mobile/Sprint. Almost three of four (73.3%) indicated that their internet service is unreliable, five are AT&T customers (5), Succeed.Net (2), Verizon (2), along with DSL (1), and T-Mobile/Sprint (1). Less than half said it was too expensive (46.7%), three are AT&T customers (3), one uses DSL (1), Succeed.Net (1), and T-Mobile/Sprint (1). Only AT&T customers said the customer service was insufficient (2 or 13.3%).
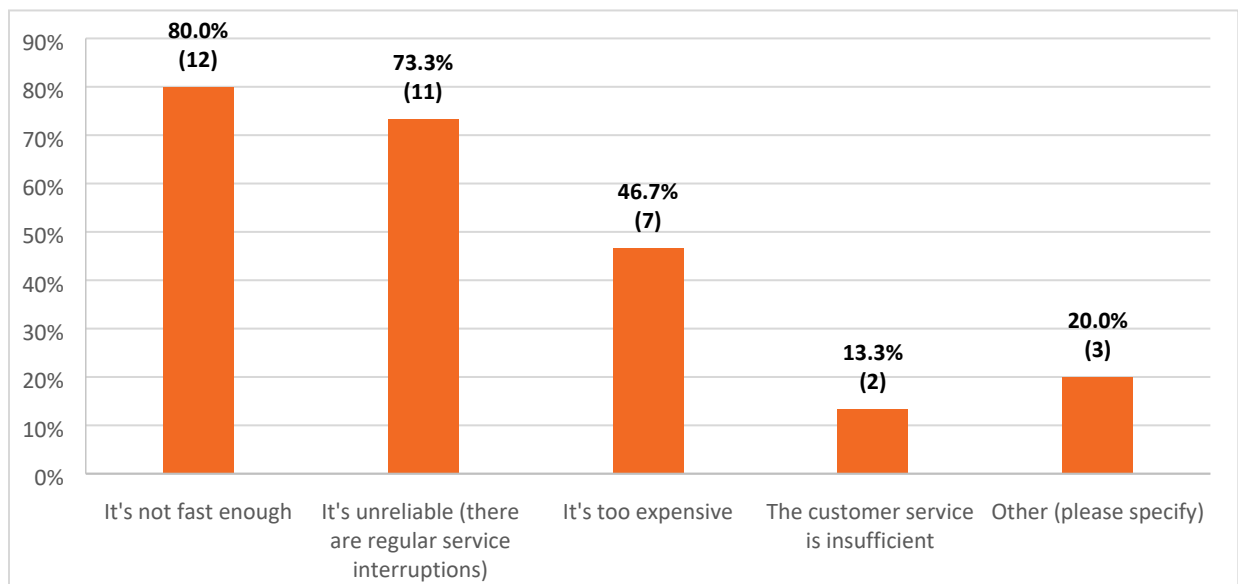
Figure 31. Reasons for internet service not being good enough (n=15).

Only 5.6% (1) of respondents noted that internet problems have no effect on the operation of their farm, 38.9% (7) find it mildly inconvenient, 27.8% (5) find it moderately disruptive, and 27.8% (5) find it severely disruptive.
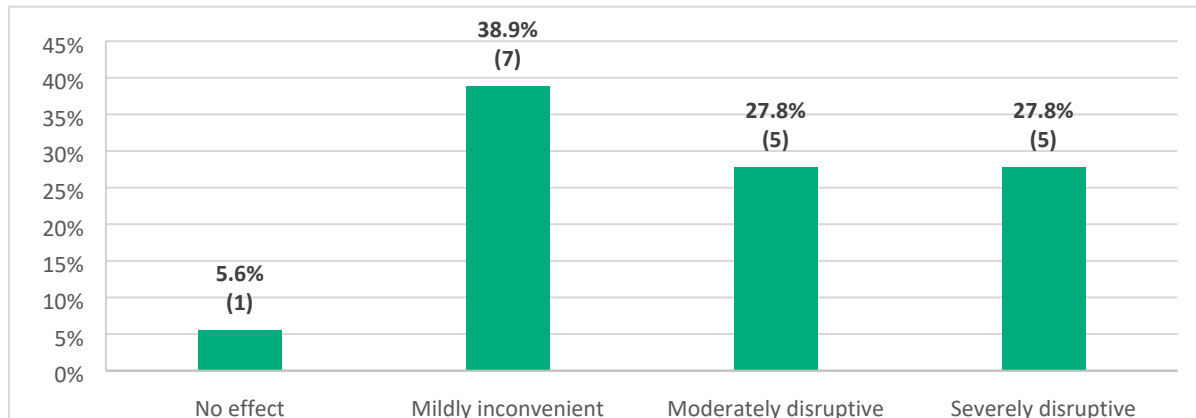
Figure 32. What effect do internet problems have on the operation of the farm? (n=18).

Potential Farming Improvements by Improved Internet Service

When asked "what tasks would be enabled or improved by better internet service on the farm?" the majority of respondents selected 'remote control and monitoring of farm systems (e.g., irrigation)' (14 or 82.4%), followed by 10 (58.8%) selected 'usage of soil and crop sensors,' and nine (9 or 52.9%) selected 'storage and analysis of soil, crop, animal, or other data (e.g., productivity data).' Four (4 or 23.5%) respondents said they would have better service for 'aerial monitoring and farming activities via drones,' four (4 or 23.5%) could improve 'usage of autonomous or remote farming equipment (e.g., driverless tractors),' and one (1 or 5.9%) would improve 'usage of autonomous or remote farming equipment (e.g., driverless tractors).' Six (6) respondents added other ideas such as marketing (buying and selling) produce and livestock (2), monitoring and emergency alarms (2), security (1), information on their industry (1), along with tasks as simple as email access (1).
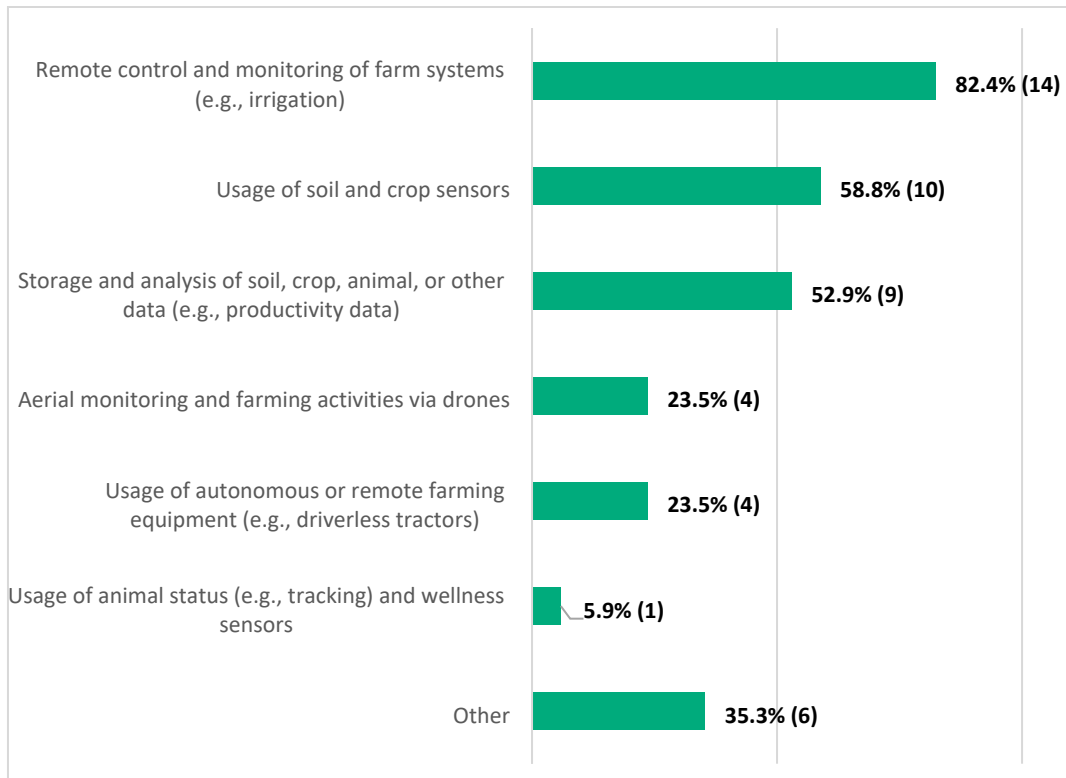
Figure 33. Internet Usage, Farm and Agriculture Broadband Survey (n=17).

Internet Service Importance

Over half (55.6%) of the respondents indicated that high-speed internet service is 'extremely important' to operations in the field (e.g., on the farm itself), five (5 or 27.8%) said 'very important,' and three (3 16.7%) said somewhat important, while none of the respondents noted it was 'not important.'
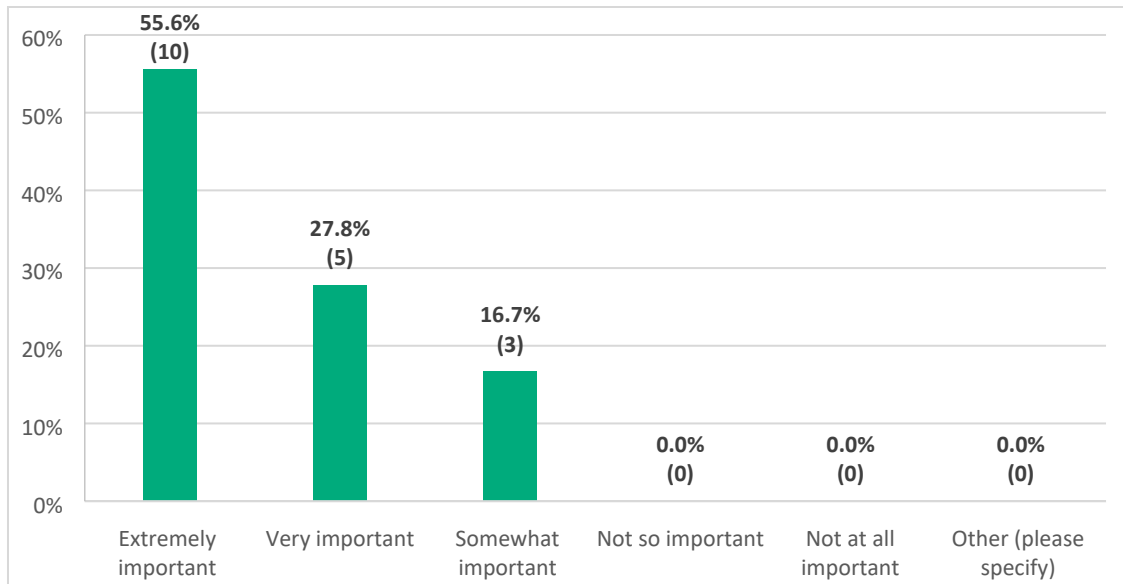
Figure 34. How important is high-speed internet service to operations in the field (e.g., on the farm itself)? (n=18)

4.3.2.2 INTERNET SERVICE IN THE FARM OFFICE

Internet Service Providers and Technology

Fourteen (14) respondents noted their internet for their farm office, 35.7% (5) of respondents use AT&T for their farm office internet, 28.6% (4) use Succeed.Net, along with 21.4% (3) using Verizon, and 7.1% uses Digital Path (1), T-Mobile/Sprint (1), Viasat (1) and Other (1). Two (2) respondents noted that there are two different ISP's on site at the office.
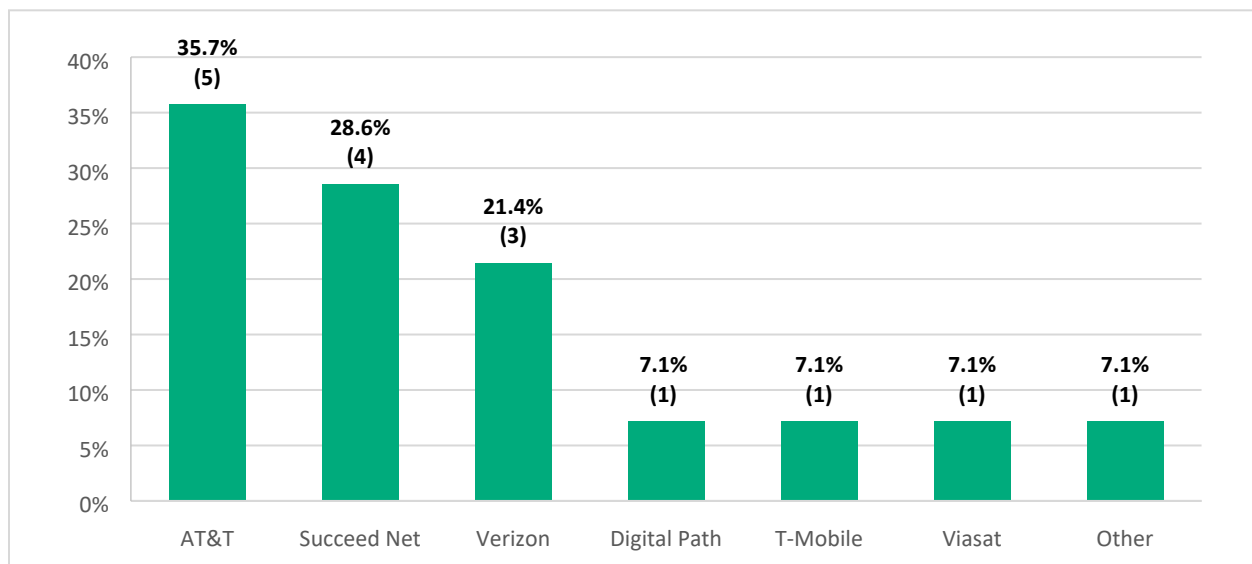
Figure 35. Internet Service Providers for Farm Offices, Farm and Agriculture Business Survey (n=14).

Over one-third (35.3% or 6) use fixed wireless for office connectivity, 23.5% (4) use mobile LTE or mobile hotspot, 11.8% (2) use satellite service, 11.8% (2) use xDSL, 5.9% (1) use fiber optics, and 5.9% (1) use Other. 5.9% (1) reported they don't have internet service in the farm office.
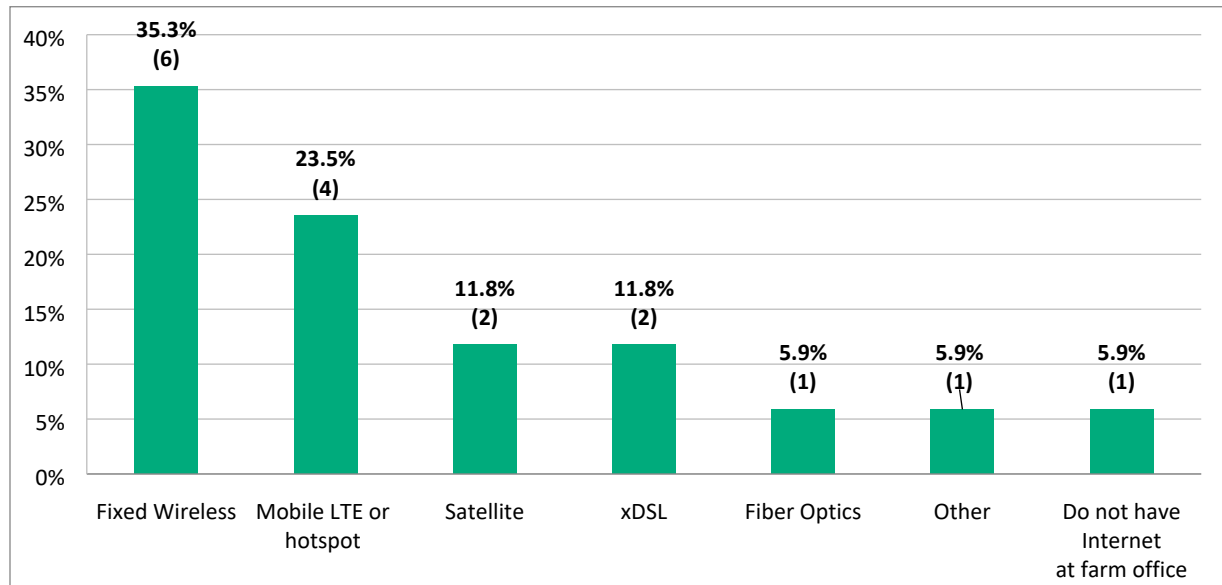
Figure 36. Internet Service Technology for Farm Offices, Farm and Agriculture Business Survey (n=17).

CalSPEED Assessments

Respondents were asked to check their download and upload speeds using the CalSPEED application. Although 5.6% (1) reported they don't have internet and 27.8% (5) selected 'I don't know,' 38.9% (7) reported download speeds of '6 Mbps or below,' and 27.8% (5) reported 'between 7 Mbps and 25 Mbps.' AT&T (2), Succeed.Net (2), and Viasat (1) are the fastest providers for these respondents.
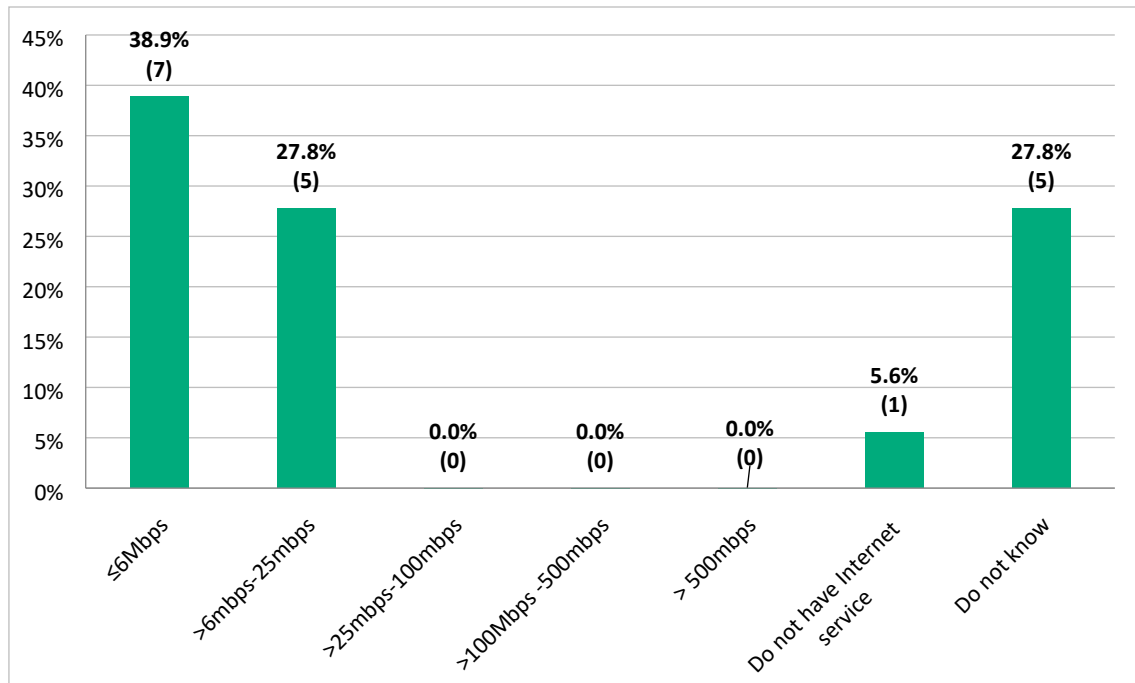
Figure 37. Actual Measured Download Speed at Farm Office, Farm and Agriculture Business Survey (n=18).

Of those that know their current internet speeds and their contracted speeds, six (6) noted the speeds are lower than contracted, three (3) noted they are about the same, and no one selected that their speeds are higher than contracted.

Service Satisfaction

Only three (3) respondents reported that their internet service is good enough (17.7%). The other 14 (82.4%) respondents are not satisfied with their internet services; from these respondents, in a follow up question (allowed to selected multiple answers), 86.7% (13) noted that there are no other options in their area, 6 (40%) noted that all other options are too expensive, one (1) respondent added that they receive poor customers service when they attempt to change internet service providers.
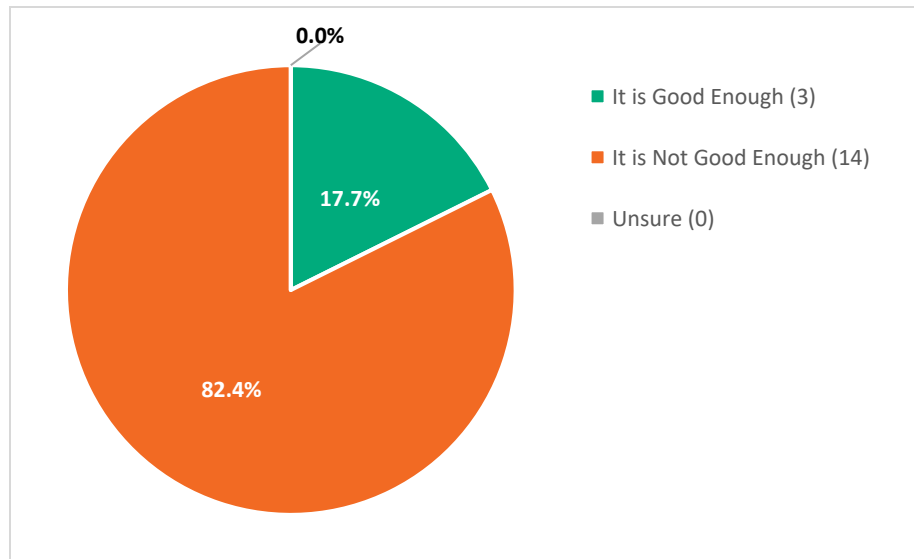
Figure 38. Service Satisfaction, Farm and Agriculture Business Survey (n=17).

Of the respondents (14) that noted their service is not good enough, over three of four (76.9% or 10) respondents noted that their internet is not fast enough, 69.2% (9) indicated the internet is unreliable, 46.2% (6) noted that their internet is too expensive, 7.7% (1) noted that they receive insufficient customer service. One respondent did not answer this question.
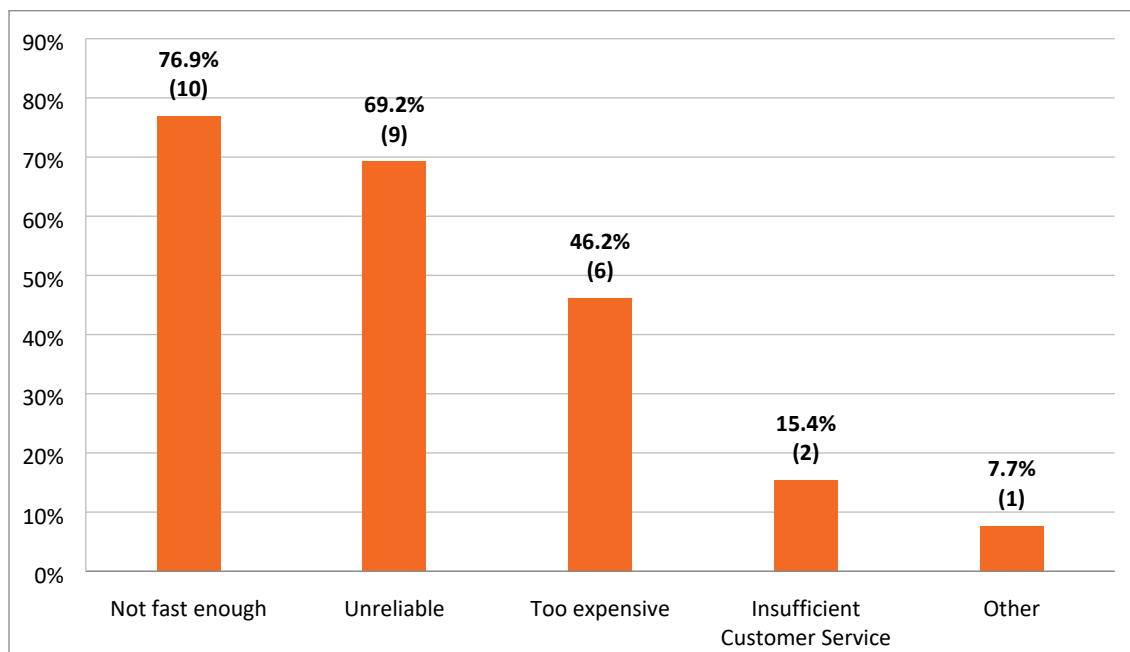
Figure 39. Service Satisfaction Issues, Farm and Agriculture Business Survey (n=13).

Internet Usage

When asked "what business activities are performed at your farm office?" respondents selected multiple answers. The majority indicated general use (emails, internet browsing, etc.) (15 or 93.8%), gathering online information (15 or 93.8%), online banking (13 or 81.3%), along with 11 (68.8%) reporting online business applications (for accounting payroll, etc.), as well as 11 (68.8%) indicated teleconferencing. Nine (9 or 56.3%) reported they use agriculture and farming technologies. The following four categories all had seven (7 or 43.8%) respondents select them: online payment processing, social media for the business/organization, security monitoring, and online file sharing and collaboration. Then six (6 or 37.5%) selected online data backup services, and two (2 or 12.5%) added sales and marketing tasks (Other).
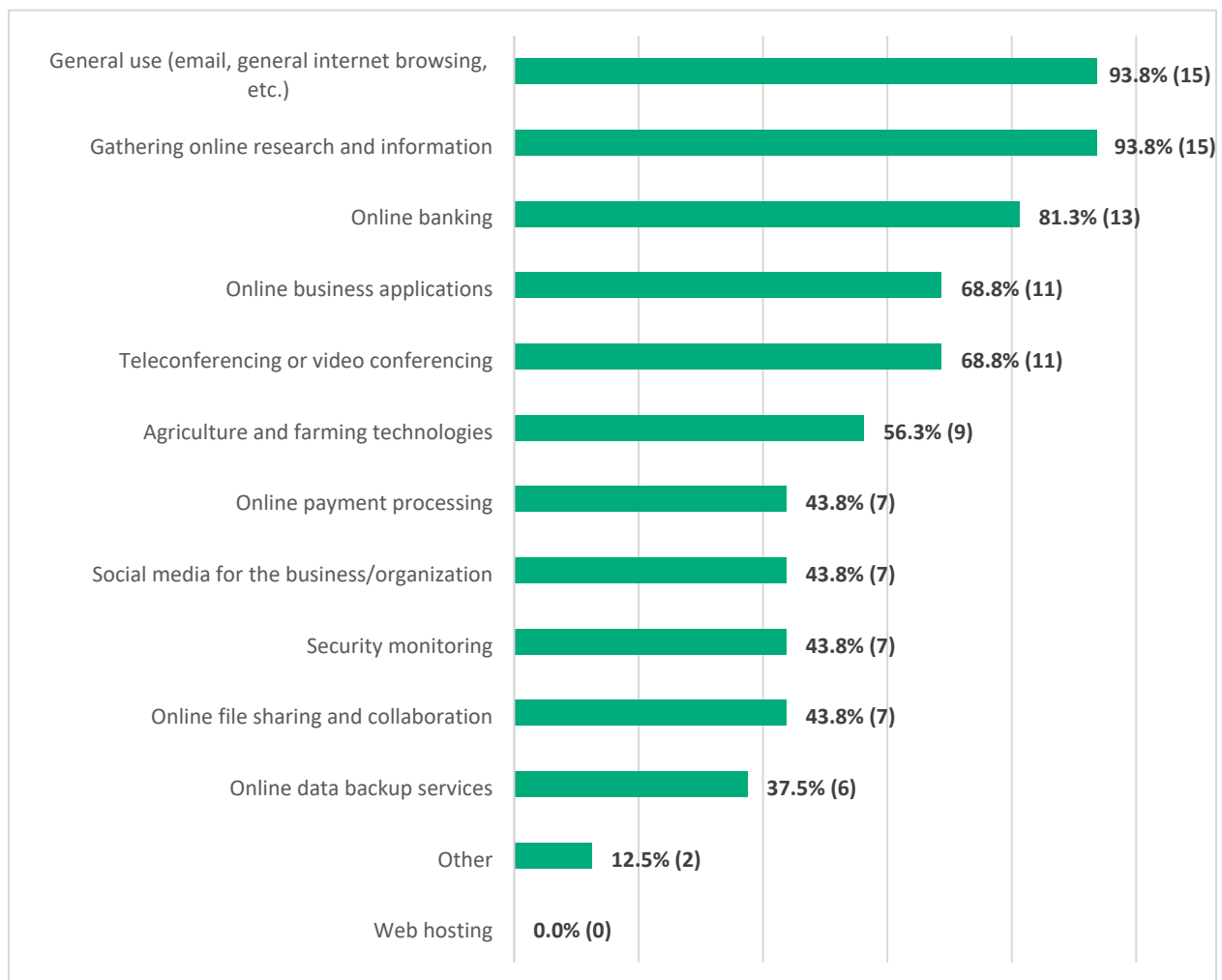
Figure 40. Internet Service Usage, Farm and Agriculture Business Survey (n=16).

Internet Service Importance

Over half (10 or 55.6%) indicated that high speed internet is 'extremely important' to operations in the farm office, five (5 or 27.8%) reported it is 'very important,' two (2 or 11.1%) reported 'somewhat important,' and one (1 or 5.6%) noted 'not so important.'
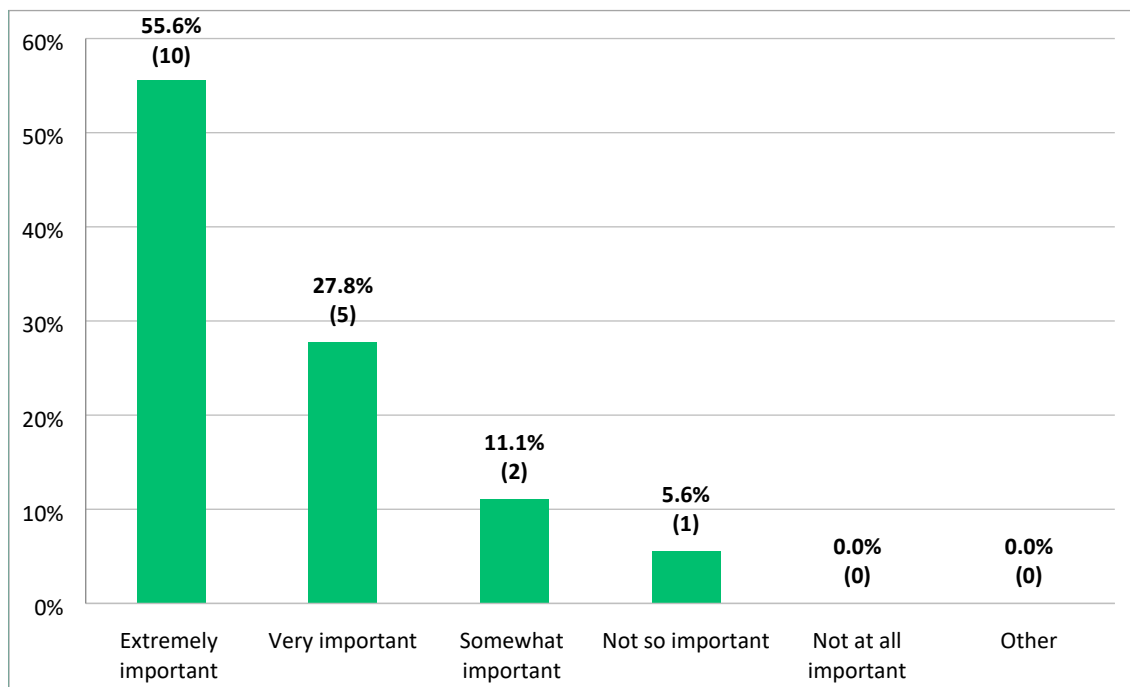
Figure 41. Internet Service Importance, Farm and Agriculture Business Survey (n=18).

When ranking the most important aspects of service, over half of the respondents noted reliability to be most important (56.3%), followed by speed, price, and then customer service.

This **Broadband Needs and Demand Analysis** helped to identify the broadband service needs and gaps across multiple user sectors in the County. The analysis, based on input from broadband stakeholders and survey results, complements the data-based **Broadband Landscape Analysis**. The findings and results from both analyses guided the development of the recommendations presented in the following sections. These recommendations are focused on three main areas: 1) improving or expanding broadband infrastructure and services, 2) developing and implementing policies to accelerate broadband deployments, and 3) improving broadband adoption across multiple sectors.

5 RECOMMENDATIONS TO EXPAND/UPGRADE BROADBAND INFRASTRUCTURE AND SERVICES

This section presents recommendations, strategies, and approaches to proactively accelerate expansion and upgrade of broadband infrastructure and services in Yuba County. The recommendations address the **needs, findings, results and gaps identified** in **Section 3 Current Broadband Landscape in Yuba**, and **Section 4 Broadband Needs and Demand Analysis**. The recommendations include the following:

- Setting future-proof broadband performance standards for the County
- Selecting priority areas for broadband expansion and upgrades
- Validating broadband coverage and speeds
- Expanding broadband infrastructure and services to priority areas
- Developing strategic partnerships for cost-effective broadband deployments
- Applying to Federal and State broadband infrastructure and services programs/grants

The **Yuba County Broadband Task Force** should lead the countywide broadband efforts in partnership with broadband stakeholders including State and local agencies, community anchor institutions (i.e., education, healthcare, public safety, etc.), community-based organizations, business organizations, internet service providers and telecommunications companies (incumbent, competitive or new entrants), among others.

5.1 Setting Future-Proof Broadband Performance Standards for the County

A critical step for planning immediate and long-term goals for expanding, upgrading or launching broadband infrastructure and services in the County is to determine broadband performance standards. **Section 2.3 Broadband Definitions and Speed Standards** describes current Federal and State broadband standards. Most of these broadband standards are defined in terms of downstream and upstream speeds. **Section 3 Current Broadband Landscape in Yuba** presents existing residential broadband coverage at the following speed standards:

- **6/1 Mbps:** Previous California standard. It has been updated (2021) to match the FCC standard.
- **25/3 Mbps:** Federal Communications Commission (FCC) and New CA standards.
- **100/x Mbps:** The California Broadband for All Action Plan speed goal (December 2020).
- **1Gbps/500Mbps:** FCC Gigabit service definition.

The COVID-19 pandemic highlighted the importance of broadband internet for most areas of residents' lives including teleworking, attending classes, healthcare appointments, carrying out purchases, entertainment, and accessing myriad of online services. **"High-speed internet service"** can allow consistent and reliable videoconferencing (high-definition video and sound) and data file exchange.

From the standards listed above, the minimum broadband speed recommended[40], based on FCC guidelines, to handle multiple simultaneous internet users at home is the 25/3 Mbps FCC standard.

Figure 42 shows unserved areas (at census block level) at this standard and the range of number of households at each census block. Based on 2020 CPUC broadband data (as of December 2019), there are 1,519 unserved households (5.9% of households) scattered across the county. There is a higher concentration of unserved households in the Northeast part of the county nearby and around Camptonville, Challenge-Brownsville, and Dobbins.
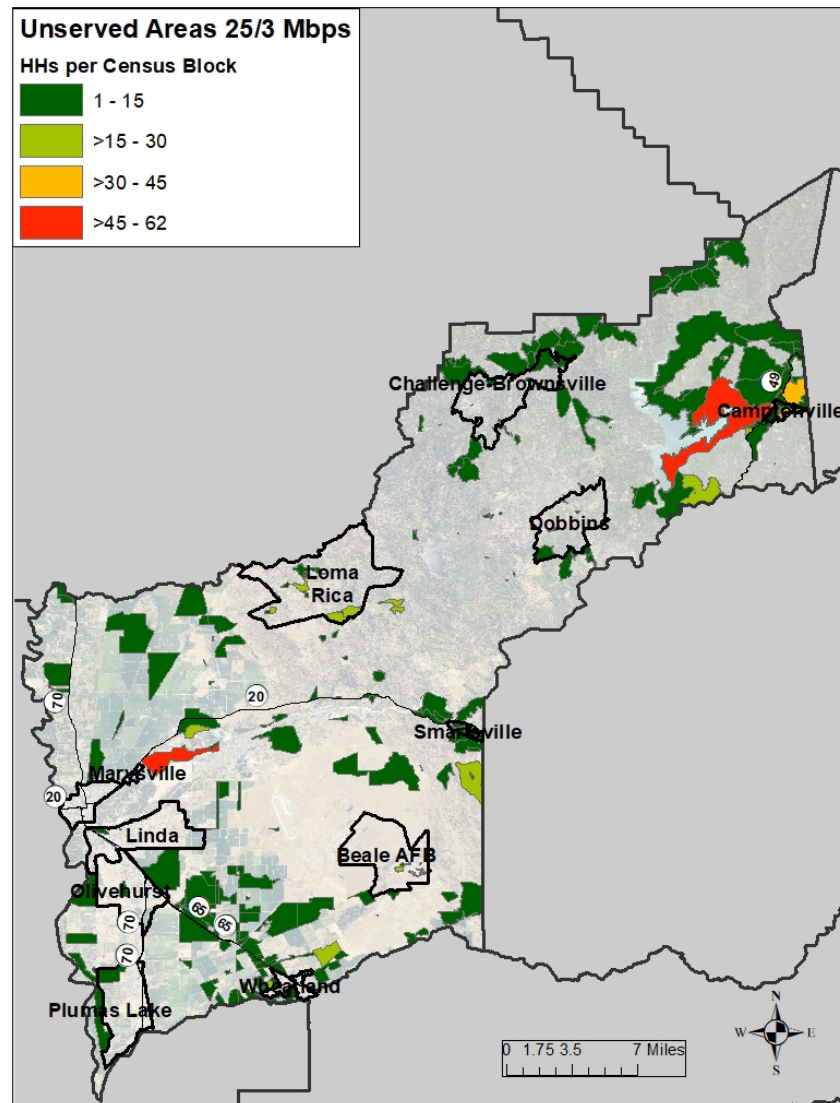
Figure 42. Unserved Areas at 25/3 Mbps per Census Block.

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[40] Policy Brief: How Much Speed Do You Need? https://www.valleyvision.org/wp-content/uploads/Policy-Brief_BB-Speed-Cost_11.3.20.pdf

In the case of signing up for a 25/3 Mbps internet service (or speeds in that range), based on most advertised monthly internet plans, it will provide **"up to"** or **"a maximum of"** that speed. Additionally, depending on network congestion and internet usage peak hours, among other factors, residential users will end up having speeds slower than 25/3 or, in some cases, just a fraction of it. Then, it is recommended to set a **near-term goal (1-5 years)** for a higher speed. In that regard, aligning to the recent 100 Mbps downstream standard of the California Broadband Action Plan will ensure appropriate and future-proof residential service.

Figure 43 shows unserved areas at 100/20 Mbps at the census block level and range of households at each census block. There are 6,021 unserved households (23.4%) at this standard. Unserved areas are mostly located outside urban areas in the West part of the county. In the Central and Northeastern parts of the county, unserved areas are the communities and surrounding areas.
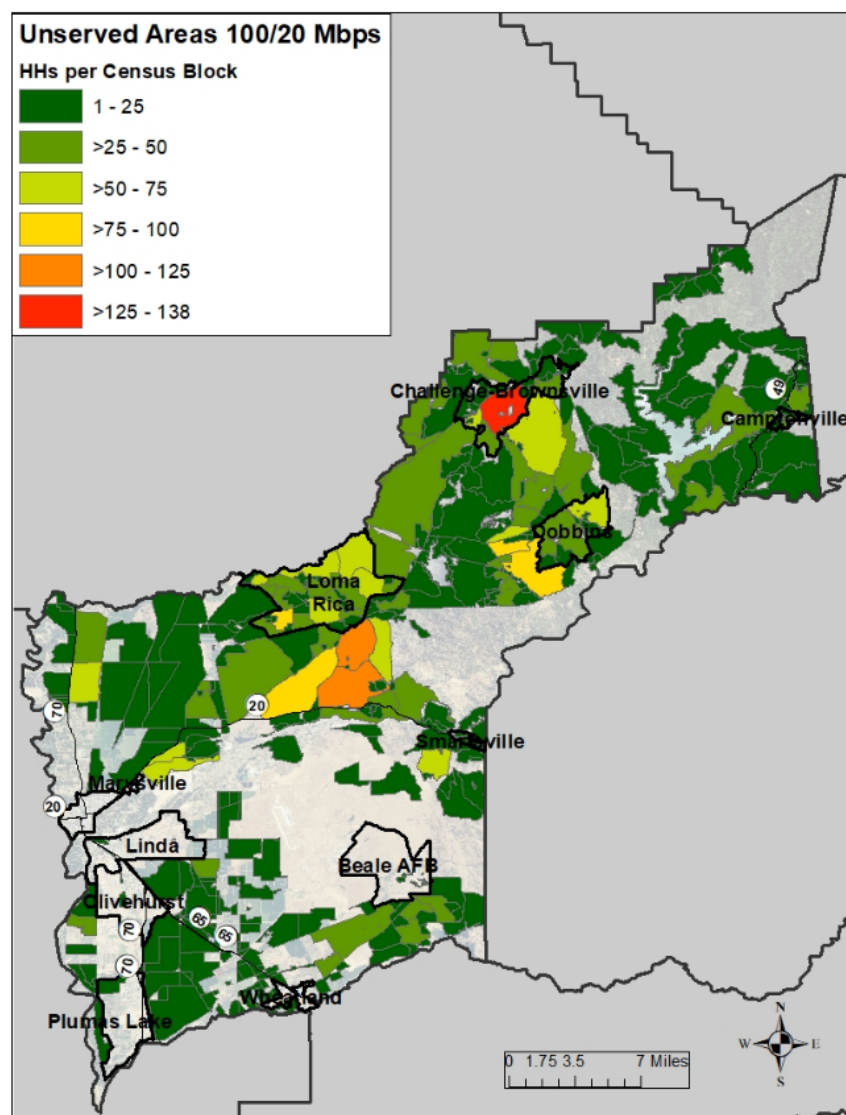
Figure 43. Unserved Areas at 100/20 Mbps per Census Blocks.

For the long-term (5-10 years), planning to become a gigabit county will ensure deploying future-proof infrastructure to handle the growing internet usage for all residents and businesses. Figure 44 below shows unserved areas at the FCC gigabit definition. Nearly all households in Yuba County, 24,887 (96.8%) are unserved at this speed.
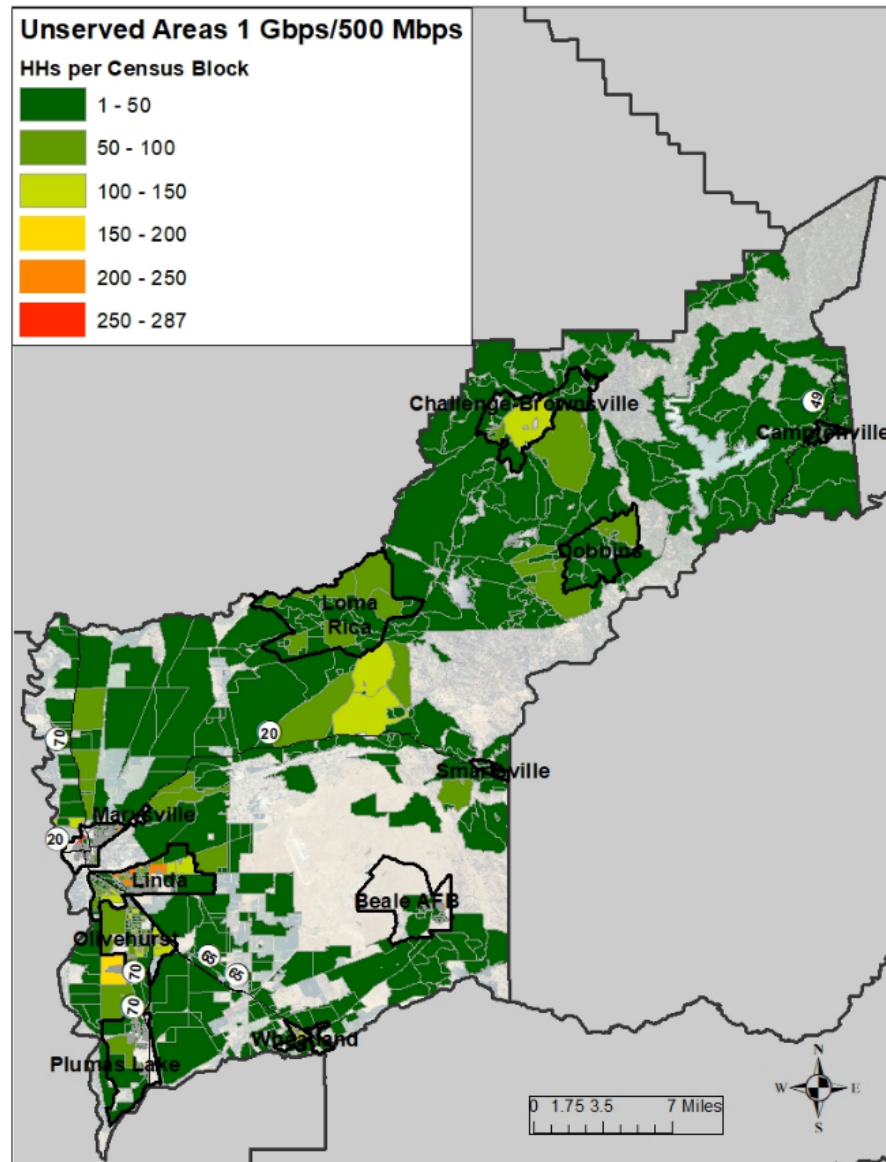
Figure 44. Unserved Areas at 1 Gbps/500 Mbps per Census Block.

In summary, it is critical to set a broadband speed standard for the county. **Setting these standards will guide planning and expectations for new broadband deployments when supporting, promoting, facilitating or partnering with internet service providers, broadband infrastructure providers, telecommunication companies, or potential municipal internet utilities**. The county's broadband speed

standards are not to be mistaken with Federal or State broadband standards which determine eligibility for subsidies or grants programs. State and Federal broadband infrastructure programs have minimum speed thresholds for households and census blocks eligibility. For example, the California Advanced Services Fund (CASF)/Broadband Infrastructure Grant Program provides subsidies to carry out deployments in census blocks unserved at 6/1 Mbps (Current CA standard)[41]. Federal programs from the FCC or USDA provide subsidies for census blocks, areas or locations unserved at 10/1 Mbps and/or 25/3 Mbps. Nevertheless, these programs also define the minimum speeds for the new deployments or upgrades. It is in this regard that **the county must communicate or require through incentives that applicants should propose deployments at the set county standards (i.e., 100 Mbps or gigabit standards)**. Most broadband technologies (i.e., FTTx, cable modem, or high-speed fixed wireless) are able to satisfy these speed standards to deploy future-proof service for residents, businesses and community anchor institutions.

It is important to highlight that setting broadband standards speeds for the county might include residential and business services, as well as community anchor institutions. **Businesses and community anchor institutions require higher speeds than residential service users, including higher reliability and consistency. It is recommended to set standards in the range of hundreds of Mbps and up, including symmetrical downstream and upstream speeds.**

In addition to setting broadband standards based on speeds. It is also highly recommended to incorporate quality-of-service (QoS) metrics, such as the one shown in Table 13. Input from broadband stakeholders and business/farms survey results (in **Section 4 Broadband Needs and Demand Analysis**) pointed out that broadband internet service (both residential and business) was perceived as **unreliable**. Achieving high levels of quality-of-service will impact on middle-mile and last network design and routes, and as a result, in overall deployment costs. For example, for ensuring high reliability and low latency of broadband internet service, networks need to include diverse (redundant, additional, or backup) middle-mile backbones in case of high internet data traffic, system failures, or natural disaster (i.e., wildfires) might affect overall last-mile service in the County.

Table 13. Broadband Service QoS Metrics.

Quality-of-Service Metric	Metric Target
Reliability (uptime)	99.9%
Latency	<50 ms primary <120 ms back-up
Jitter	<20 ms
Packet Loss	<1%

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[41] The California Legislature is currently reviewing and discussing bills which will increase the current CA broadband standard from 6/1 Mbps to 25/3 Mbps or higher speeds. This new legislation will have an impact on eligibility for the CASF Broadband Infrastructure Grant Program.

5.2 Priority Areas Selection and Local Partner Input for Broadband Projects

Another important step towards planning of broadband expansion, upgrades or launching new infrastructure and services is to identify priority areas (residential and business). Based on broadband coverage data and analysis from **Section 3 Current Broadband Landscape in Yuba County,** and findings and input from **Section 4 Broadband Needs and Demand Analysis**, this subsection presents identified unserved areas.

The input from local partners is critical to identify and quantify unserved priority areas. Local partners work closely with the community and have firsthand knowledge of broadband related needs, or can support efforts to gather information of such needs. For this report, input (through interview, video conferences, and surveys) on broadband needs was gather from the following sectors:

- **Local Government Sector:** Yuba County and Cities of Wheatland.
- **Education:** School Districts of Camptonville, Marysville, Wheatland, and Plumas Lake, and Yuba College, and County Superintendent.
- **Business:** Yuba/Sutter Economic Development Corporation, Yuba-Sutter Chamber of Commerce, and E-Center. Additionally, online business survey on broadband needs disseminated to businesses across the County.
- **Farming and Agriculture:** UC Agriculture and Natural Resources (ANR) Cooperative Extension for Rice, and Yuba Water Agency. Additionally, online farm and agriculture business survey on broadband needs disseminated to farms and growers across the county.
- **Local Broadband Stakeholders:** Beale Air Force Base.

The input from these groups was quantified and aggregated in order to identify broadband needs and priority geographic areas for broadband deployments. These areas included:

- Unserved residential areas
- Unserved or underserved industrial, commercial, business and agricultural areas
- Unserved or underserved community anchor institutions

After identifying priority geographic areas for broadband deployments, these areas were plotted in digital maps, along with CPUC broadband availability data, and are presented in the following subsections.

5.2.1 Residential Unserved Priority Areas

The needs and demand analysis, including outreach to broadband stakeholders in Yuba County from different sectors, provided the following list of areas and communities in the need of improved broadband service:

- Browns Valley
- Challenge-Brownsville
- Dobbins

- Hallwood
- Linda
- Loma Rica
- Marysville (North, West and heading up to the foothills)
- Olivehurst
- Sierra Foothills
- Sutter borderline
- Wheatland (new city limits)

Figure 45 shows these areas and broadband **unserved areas** at **25/3 Mbps** (FCC Standard), **100/20 Mbps** (CA Action Plan), and **1000/500 Mbps** (FCC Gigabit Definition). Clusters of unserved priority areas at 25/3 Mbps are located in 1) the Northeast part, 2) Central part (Browns Valley), and 3) rural unincorporated areas in the valley. Unserved areas at 100/20 Mbps are located, in addition to the unserved 25/3 Mbps areas, extensively in the Northeast and Central parts of the County. Unserved areas at 1000/500 Mbps (gigabit service) are located, in addition to the previous areas, in the Western part of the county, including Wheatland and Beale Air Force Base. Table 14 presents the number of unserved households at the different standards.

Table 14. Number of unserved households at the different speed standards.

Yuba County	Households	Served Households		Unserved Households	
		Number	Percent	Number	Percent
25Mbps/3Mbps	25,723	24,204	94.1%	1,519	5.9%
100Mbps/20Mbps	25,723	19,702	76.6%	6,021	23.4%
1000Mbps/500Mbps	25,723	836	3.2%	24,887	96.8%

It is important to highlight that many stakeholders (local governments, communities, residents, and other ISPs) have expressed concerns that some of the data does not reflect what is actually available. Therefore, the total number of unserved households might exceed estimations from CPUC data. To improve assessment of broadband coverage, it is critical to conduct ground truth testing at the address level using speed testing apps (e.g., CalSPEED[39]) or surveys. An initial broadband coverage and speed assessment, based on 2020 and 2021 CalSPEED data, is presented in **Section 4.2.1 Broadband Needs and Demand Analysis**. These measurements confirm that there are likely more unserved areas at 25/3 in the Central and Northeast parts of the county. They also point out that higher speeds (25/3 and 100/20 Mbps) are available in urban and suburban areas in the West part of the county along Highways 70 and 65.

Residential Unserved Priority Areas

- Unserved 25/3 Mbps
- Unserved 100/20 Mbps
- Unserved 1000/500 Mbps
- Priority Communities
- Wheatland (New City Limits)
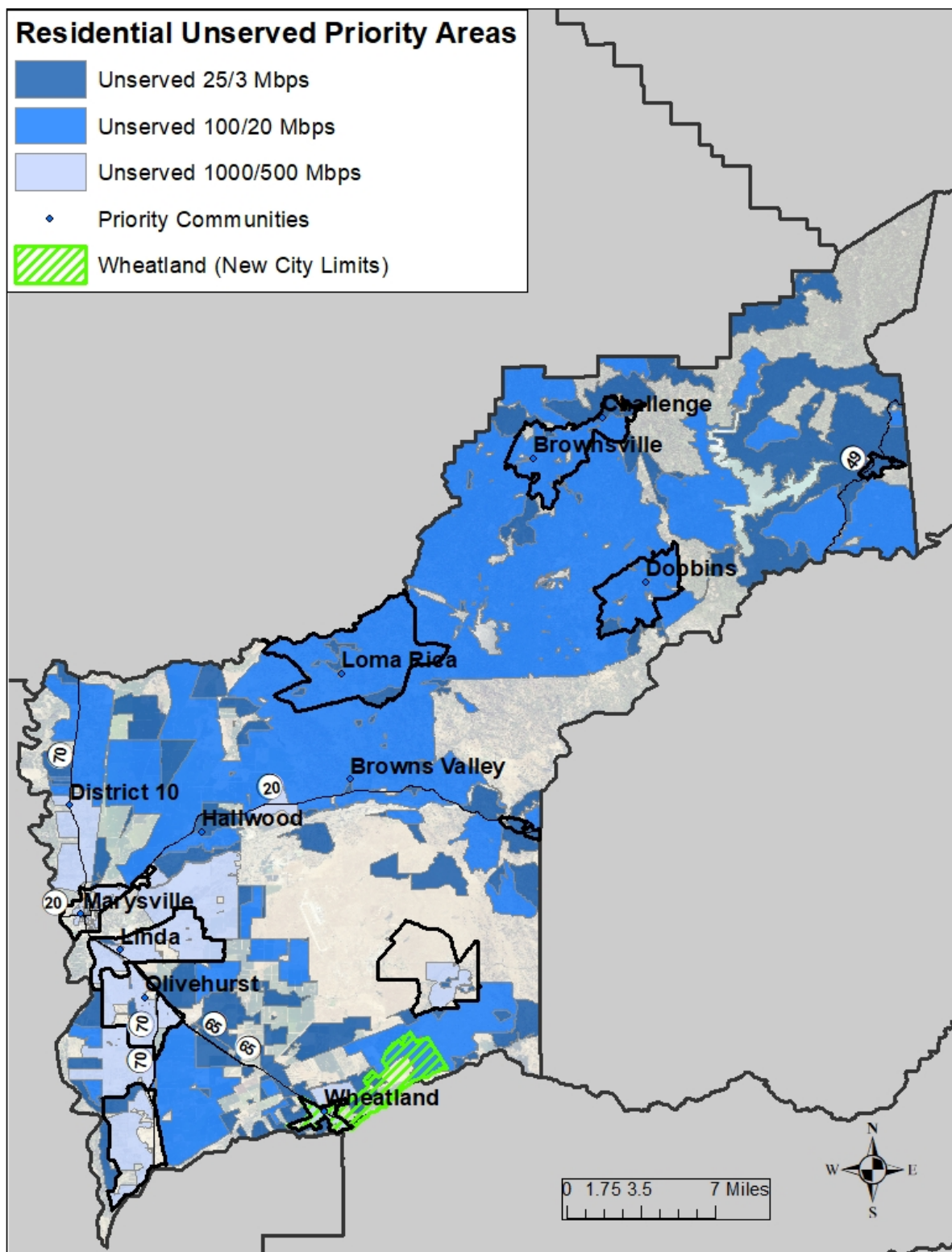
Figure 45. Residential Unserved Priority Areas in Yuba County

Additionally, it is important to factor the future expansions in the county including: 1) the 2014-approved annexation in Wheatland, 2) the South Yuba Transportation Improvement Authority planned infrastructure projects, and 3) the Olivehurst area and around Wheatland (prime for commercial development). These areas need to be included when selecting priority areas and ensuring that broadband infrastructure is already in place ahead of these new developments, or deployed in tandem. Furthermore, this also includes leveraging potential opportunities for smart city and county deployments. Broadband should be factored into the Yuba Water Agency Employment Zone Feasibility Study that is being conducted for the annexation in Wheatland.

5.2.2   Mobile Broadband Unserved Priority Areas

Mobile broadband coverage is important and highly impact altogether residents, businesses and operations of community anchor institutions in different sections. As stated in a 2016 CPUC Decision[42], mobile broadband is not a substitute for fixed broadband service but a complement for conducting voice and data communications, and accessing the internet and online resources. **Findings from Section 4.1 Broadband Stakeholder Needs** Assessment**, especially from the education, and farming and agriculture sectors, point out that mobile broadband coverage is poor and spotty outside the main urban and suburban areas in the county.** During the pandemic (shelter-at-home order), most school districts worked with the California Department of Education and Department of Technology, along with mobile carriers to provide hotspots to students and student families to conduct distance education at home and access school online resources. The education sector (K-12 and college levels) in Yuba County reported that in many cases, there was not mobile broadband coverage so students were not able to conduct distance learning or access online educational resources.

Figure 46 presents the mobile broadband coverage, identified priority communities, and mobile CalSPEED testing. Priority areas in the Central and Northeast parts of the county exhibit mobile test results of speeds mostly below 25 Mbps. Locations at the end or outside the communities have download speeds below 6 Mbps. Similar to the case of fixed residential service, highest mobile broadband speed test results are in locations in the West of the county, in communities along Highway 70 (Marysville and Plumas Lake).

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[42] CPUC's Decision Analyzing the California Telecommunications Market and Directing Staff to Continue Data Gathering, Monitoring and Reporting on the Market.
https://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M171/K031/171031953.pdf
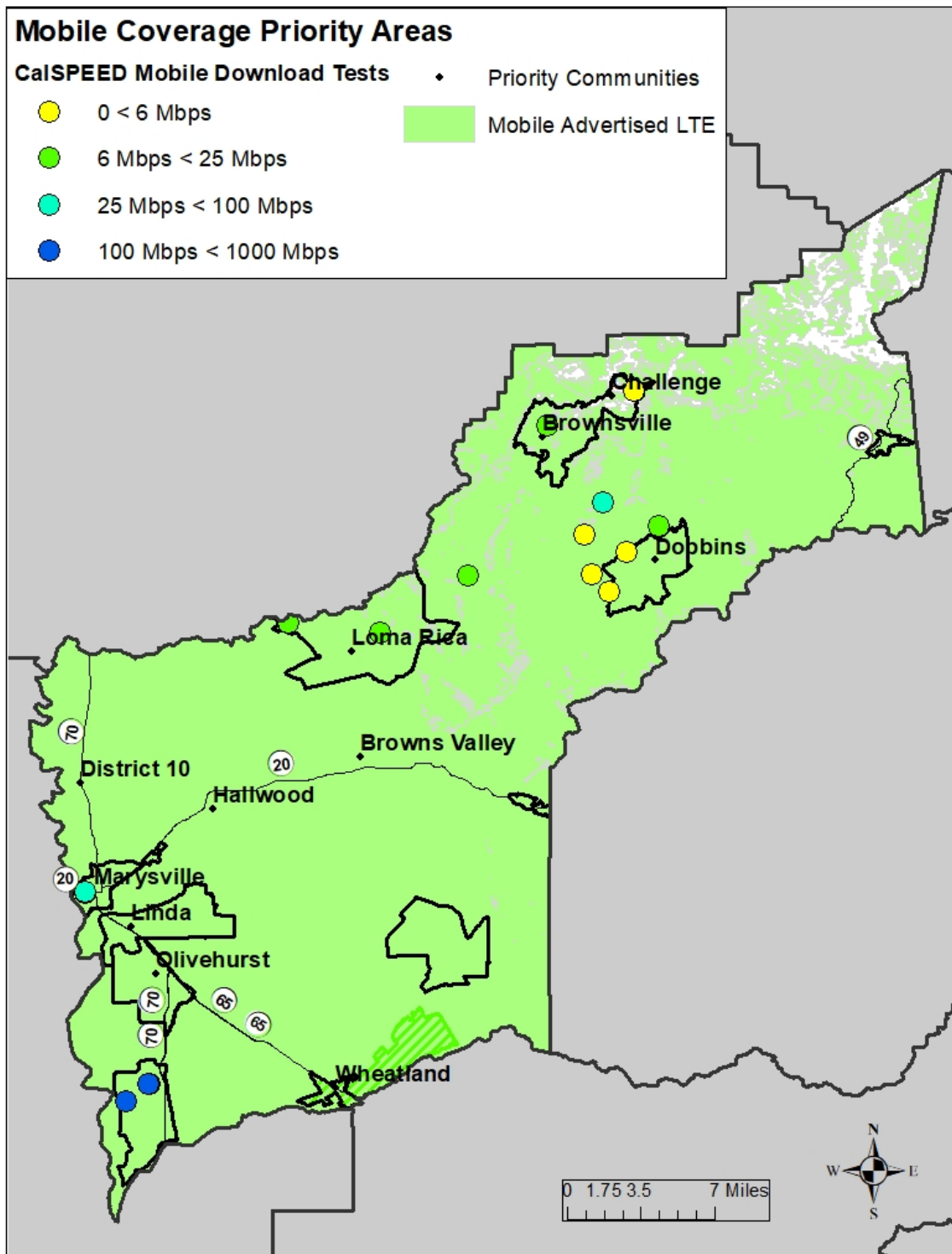
Figure 46. CalSPEED Mobile Coverage Priority Areas.

5.2.3 Business Unserved Priority Areas

In addition to identifying residential unserved priority areas, it is equally important to identify potential broadband demand coming from business customers. In many cases the low number of unserved households, and their scattered location across rural areas and rough terrain, will not be sufficient to make a compelling business case for ISPs to deploy broadband infrastructure to these areas; not even with grants or subsidies. **In this scenario, demand aggregation[43] of additional potential customers for broadband services comes as a solution to address financial barriers of serving high-cost areas.**

Figure 47 shows buildings and facilities located in unserved (at 100/20 Mbps) business agricultural, commercial, and industrial areas in Yuba County (aggregated from several sub-categories). Results from both the business broadband service survey and farm/agricultural business broadband survey indicated the perception, by majority of respondents, that business broadband service was too slow or unreliable. Most common technologies for businesses were cable mode, xDSL, and fixed wireless. Few respondents used fiber optics or satellite. In farm fields, most respondents used mobile LTE or hotspot and fixed wireless.

Quantifying the number of buildings in agricultural, commercial and industrial areas helps to identify potential demand from business customers operating in these zones. Table 15 presents the estimated number of unserved buildings in agricultural, commercial or industrial areas in the county.

Given the trends toward high-tech agriculture, ensuring broadband coverage in agricultural areas will enable farmers to leverage opportunities for precision agriculture. With respect to Beale AFB and the University Affiliated Research Center, there is a need to expand and enable commercial high-speed backbone capacity service for these areas.

Table 15. Number of Buildings by Usage, Yuba County.

Zoning/Use	Unserved (100/20 Mbps) Buildings
Agricultural	2,514
Commercial	916
Industrial	427
Total:	3,857

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[43] Preferred Scenarios for Unserved Households in the Connected Capital Area Broadband Consortium (2021). p 34. Demand Aggregation: Community Anchor Institutions and Businesses. https://www.valleyvision.org/wp-content/uploads/CCABC_Preferred_Scenario_Report_2021-Final-1.pdf
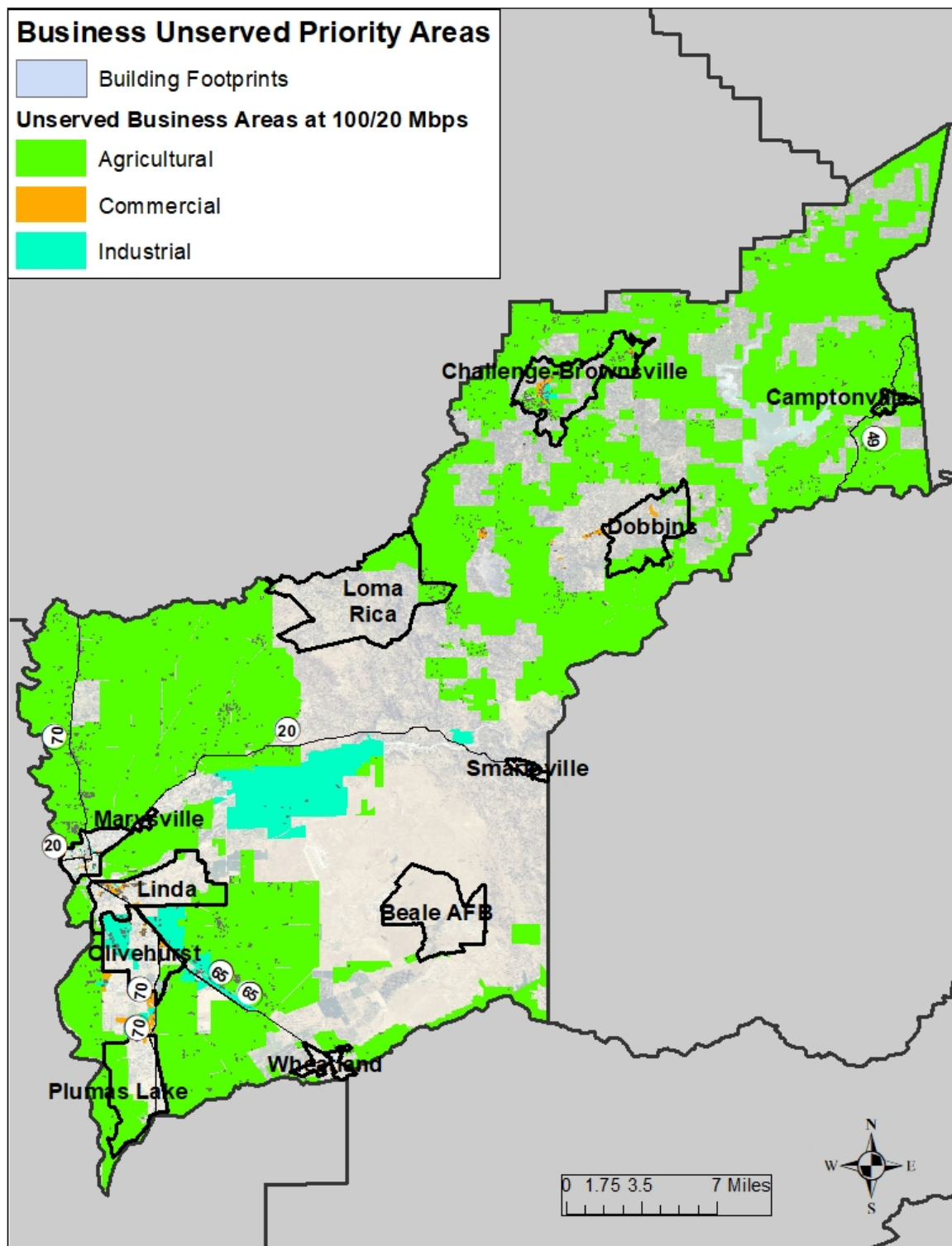
Figure 47. Business Unserved Priority Areas

In summary, identifying and selecting priority areas (for residential, mobile and business broadband service), based on broadband stakeholders' input, CPUC data, and other analysis will help for strategic planning for expanding, upgrading or launching broadband infrastructure and services. Other criteria than can be included for further prioritization include the following:

- Economically distressed areas (i.e., median household income), and demographic (i.e., population and household density);
- Eligible areas for State or Federal broadband infrastructure grants at highest possible funding level;
- Existing infrastructure and potential partnerships with public utilities, local governments, community anchor institutions, among others;
- Economic development and number of unserved businesses, anchor institutions (i.e., local government buildings, health care centers, education facilities, etc.), and public safety locations

It is recommended to make publicly available the final result of the priority areas selection in the county online portal. In this manner, ISPs, broadband infrastructure providers, telecom companies, municipal internet utilities, special districts and others, can assess potential opportunities in the Yuba County, including investing private funding, federal or state subsidies, or through public-private partnerships.

5.3   Validating Broadband Coverage and Speeds

Another important step in order to identify priority areas, it is to validate actual broadband coverage and speeds available in the County. **Section 4 Broadband Landscape in Yuba County** presents broadband coverage and speeds available based on CPUC broadband availability data. As it is also pointed out in that section, the total number of unserved households might exceed estimations from CPUC data: 1) CPUC data is self-reported from ISPs and telecom companies, and 2) many stakeholders (local governments, communities, residents, and other ISPs) have expressed concerns that some of the data does not reflect what is actually available.

To improve data accuracy, the CPUC has implemented several broadband coverage validation methods[44] including: 1) CalSPEED mobile app[39], 2) CalSPEED for Desktop, 3) Online Survey, and 4) hard copy survey. **Section 4.2 Residential Broadband Service Market** presents CalSPEED measurements of both fixed residential and mobile broadband service. These results confirm that certain measurement points exhibit slower speeds than reported to CPUC. However, this initial sampling is not enough to estimate the actual number of additional unserved census blocks and households.

It is recommended to conduct validation and ground truth of actual broadband coverage and speeds; especially in priority areas or areas that residents and/or broadband stakeholders widely report issues

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[44] CPUC Broadband Availability Public Feedback:
https://www.cpuc.ca.gov/Broadband_Availability_and_Public_Feedback/

regarding lack of internet access, and poor and unreliable connectivity. As the CPUC gathers data from providers (supply side of the internet service market) on an annual basis (scaling back from twice a year), the County, in partnership with a coalition of broadband stakeholders, should carry out annual or bi-annual broadband service (coverage and speed) validation campaigns with internet users (demand side of the internet service market). These validation campaigns can be based on promoting downloading and running the CPUC's CalSPEED[45] app. Benefits from conducting these validation campaigns include:

1. Identifying additional broadband coverage gaps across the county;
2. Identifying additional eligible areas (below certain speed thresholds) for Federal or State broadband infrastructure programs;
3. Learning actual performance of services provided by ISPs and telecom companies;
4. Identifying gaps or deficient service areas for local broadband stakeholders to do collaborative work on finding solutions;
5. Generating a service or providers ranking based on validation results that can help consumers to make informed choices when contracting for internet services.

On this last point, as the internet service market is unregulated, providing information on service and providers performance will help consumers to choose best choices for them. Providers will have an additional incentive to improve offers and plans best on quality and affordable pricing.

5.4   Expanding Broadband Infrastructure and Services to Priority Areas

This subsection presents recommendations and strategies for expanding, upgrading or launching infrastructure and services to the identified priority areas. Bringing reliable high-speed broadband service to residential, mobile, and business priority areas, will require deploying both middle-mile and last-mile infrastructure.

5.4.1   Expanding Middle-Mile Broadband Infrastructure

Based on existing middle-mile fiber optics routes (i.e., Highways 65 and 70, and Hammonton Smartsville road), Figure 48 and Figure 49 below show there are non-major middle-mile infrastructure along Browns Valley or reaching the Northeast part of the county. However, based on information from the CENIC's K12 High-Speed Network (HSN) (see **Section 5.5 Strategic Partnerships to Expand Broadband Infrastructure and Services**), there are high-speed fiber optic connections to elementary schools in those parts of the county. AT&T currently provides this connectivity and most likely through an AT&T's

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[45] The CalSPEED application (www.calspeed.org) is a professional-level broadband testing tool developed at California State University, Monterey Bay and is used by the CPUC for validating broadband coverage from any broadband subscriber location. CalSPEED allows conducting performance testing of both fixed and mobile broadband services, and testing results are displayed in the user device and then sent to a CPUC server for displaying on the California Broadband Availability Map (https://www.broadbandmap.ca.gov/).

middle-mile fiber optics backbone. Nevertheless, middle-mile routes from only one carrier is not sufficient to ensure diversity of services and competition.
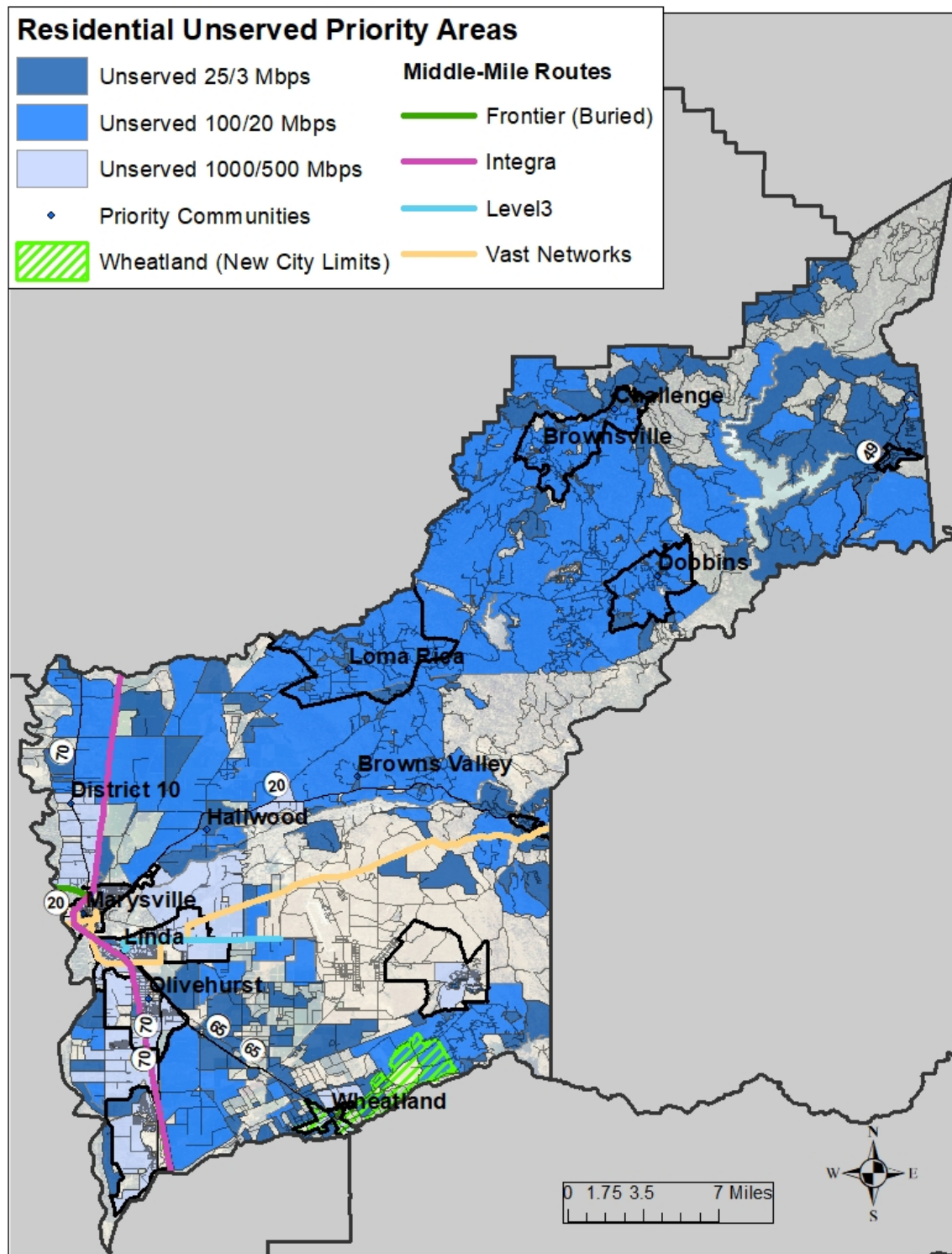
Figure 48. Residential Unserved Priority Areas and Middle-Mile Routes.
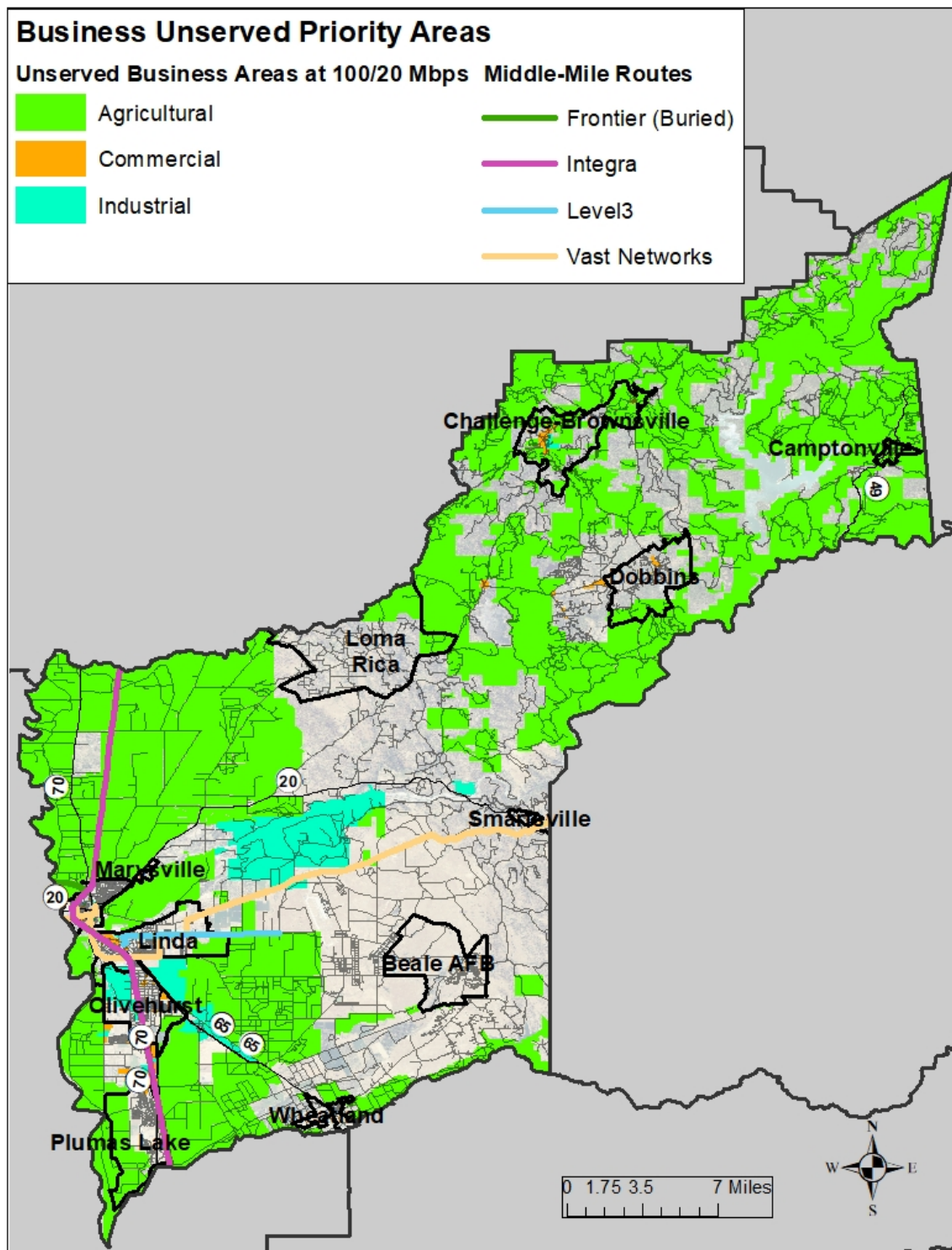
Figure 49. Business Unserved Priority Areas (100/20 Mbps) and Middle-Mile Routes.

As shown in the competition market analysis, most areas in the Central and Northeast parts of the county have two or less ISP choices. In many cases, ISPs which operate both middle-mile and last-mile networks, might not be willing to sell backbone connectivity to other last-mile providers (potential competitors), or they set interconnection pricing that is too expensive[46]. In other cases, ISPs are willing to negotiate and come to agreements (i.e., leasing access or swapping) to access high-speed fiber optics backbones. To reach unserved priority areas, it is recommended to support and promote deployment of additional middle-mile infrastructure and ensure that middle-mile is not only available, but also accessible and affordable. This will enable more last-mile providers (i.e., fiber optics, cable modem, or fixed wireless) to expand networks to those areas or upgrade existing last-mile service.

Another middle-mile provider reaching unserved areas in the Central part of the county is Vast Networks. Vast Networks offers high speed connectivity to the business, education and healthcare sectors, including dark fiber and cellular backhaul. An option for expanding middle-mile backbone to the Northeast is expanding from the Vast Networks route coming from Nevada County and building a backbone to the North.

The County and local jurisdictions, in partnership with internet service or infrastructure providers and public utilities, should assess optimal routes (i.e., highways, county roads, streets) and estimated cost for carrying out these middle-mile deployments. Table 16 below presents high-level estimated cost ranges to deploy aerial and underground fiber optic deployments. To determine estimated costs for a specific route and deployment type, it is necessary to conduct a more detailed feasibility study. It is also important to identify existing assets from different broadband stakeholders, including public-rights-of-way (PROW), underground conduit, poles, among others. Furthermore, partnerships with public utilities, transportation and public works projects will help to identify synergies for deploying broadband infrastructure and reduce deployment costs. The following subsections will provide further details on developing an asset inventory, establishing partnerships and funding sources for broadband infrastructure.

Table 16. Estimated Middle-Mile Fiber Deployment Costs.

Middle-Mile Fiber Deployment	Estimated Minimum Cost per Mile ($)	Estimated Maximum Cost per Mile ($)	Estimated Mean Cost per Mile ($)
Aerial Fiber Deployment	21,614	$66,460	$44,037
Underground Fiber Optics Deployment	98,760	$392,000	$245,380

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[46] This topic was widely discussed and reported during the 2018 rulemaking proceeding for the CASF Broadband Infrastructure Grant Program. Multiple broadband stakeholders reported this issue and submitted comments on this topic. As a result, CPUC ruled that CASF projects that only deploy middle-mile infrastructure are not eligible for grant funding. For a project that includes funding for middle-mile infrastructure, the Commission is required to verify that the proposed middle-mile infrastructure is indispensable for accessing the last-mile infrastructure. Comments on this proceeding reported cases where lacking access (even to existing) to middle-mile is a bottleneck to expand services to unserved areas.

5.4.2 Last-Mile Broadband Infrastructure

To expand reliable high-speed broadband service to both unserved residential and business priority areas, support for expansion of last-mile broadband infrastructure is needed. This subsection presents a high-level cost analysis for connecting unserved households at different broadband standards in Yuba County.

For the potential project areas, options for expanding, upgrading or launching broadband service might include using wired or fixed wireless technologies. Future-proof wireline broadband technologies include cable modem and fiber-to-the-home. These technologies are primarily deployed in urban and suburban areas. Deployment and coverage limitations of these technologies include access to right-of-way or poles, and high costs associated with rolling underground lines or aerial deployments. Future-proof fixed wireless broadband technologies include 802.11 standard (unlicensed spectrum), LTE (unlicensed, lightly licensed, and licensed spectrum), millimeter-wave (unlicensed, lightly licensed, and licensed spectrum), among other technology options (proprietary FDD or TDD OFDM-based solutions). These technologies are primarily deployed in areas where wireline technologies have incomplete coverage, such as some suburban and most rural areas. Deployment and coverage limitations of these technologies come from obstructions (terrain/vegetation) between the antenna at the customer premises and the access point or base station located at a pole or tower.

For this analysis, the total cost of required deployments is calculated by first estimating the cost per household. Data on cost per household for broadband deployments can be found based on analysis of CPUC funding of past approved CASF broadband infrastructure projects from 2013 to 2019. These aggregated data are used to calculate the average and ranges of the cost per household, factoring in both technology (e.g., fiber-to-the-home and fixed wireless) and geographic area (shown in Table 17). Geographic area is taken into account because, for example, it would be more expensive to deploy in the foothill and mountains, versus the flatter terrain in the Valley.

The average cost per household to provide fiber-to-the-home (FTTH), with capability to provide broadband service from hundreds of Mbps to Gigabits, in flat terrain with moderate vegetation is $11,550; in mountainous terrain with forests, it is $23,967. To provide fixed wireless, with capability to provide broadband service from tens to few hundreds of Mbps, the average cost per household is $1,303.

Table 17. Estimated Last-Mile Deployment Cost per Household.

Technology	Minimum Cost per HH	Maximum Cost per HH	Average Cost per HH
FTTH: Flat Terrain-Moderate Vegetation	$8,040	$16,813	$11,550
FTTH: Mountain Terrain-Forest	$11,505	$43,591	$23,967
Fixed Wireless: Mountain Terrain-Forest	$960	$1,645	$1,303

Using the average cost per household data, and the number of unserved households at different speed standards, Table 18 shows the total cost for three different deployment scenarios:

1. Deploying only FTTH (100%);
2. Deploying FTTH (75%), complemented with fixed wireless (25%); and
3. Deploying half FTTH (50%) and half fixed wireless (50%).

In some rural areas with low household density and/or harsh geography, FTTH might be cost prohibitive, or it could take several years before ISPs expand to those areas, even with the help of public infrastructure grants. In those cases, fixed wireless comes as a potential solution. There is a tradeoff between deployment cost (FTTH is more expensive than wireless) and broadband capacity (FTTH up to gigabits and wireless up to a few hundreds of Mbps). It is recommended to expand FTTH (the most future-proof technology) to where it is feasible (technical aspects) and viable (cost-effective), and complement with fixed wireless deployments. Carrying out only fixed wireless deployments is not recommended, as the performance of wireless technologies is highly dependent on the terrain, vegetation and weather. Furthermore, theoretical speeds of fixed wireless might be significantly reduced (by 5x or more) depending on line-of-sight (LOS), obstructions, spectrum interference, number of simultaneous end users, multiple access protocols, and in some cases atmospheric precipitation.

For the FTTH cost estimation, this analysis uses Geographic Information Systems (GIS) tools to identify and quantify the number of unserved households located in flat terrain with moderate vegetation, and the number of unserved households in mountainous terrain with dense vegetation. Using this GIS analysis, the proper FTTH cost per household is assigned. In sum, Table 18 presents the total cost for connecting unserved (not available minimum speeds of 25/3, 100/20, and 1000/500 Mbps) households to achieve 100% broadband availability:

Table 18. Estimated Costs to Connect All Unserved Households.

Broadband Standard	Unserved HHs to 100%	FTTH 100%	FTTH 75% & Wireless 25%	FTTH 50% & Wireless 50%
25/3 Mbps	1,519	$28,235,671	$21,671,567	$15,107,464
100/20 Mbps	6,021	$101,963,990	$78,434,333	$54,904,677
1000/500 Mbps	24,887	$319,867,576	$248,007,622	$176,147,668

Table 19 below presents the estimated number of unserved buildings and facilities in agricultural, commercial and industrial zones, along with the estimated cost to deploy business broadband service using fiber optics (gigabits capacity) and combination of fiber optics and fixed wireless technologies (hundreds of Mbps capacity). The methodology incorporates geography, zoning, and deployment specific normalizations for broadband deployments and costs, and common industry infrastructure deployment criteria when serving business customers in open rural areas (mostly aerial fiber) or commercial areas (mostly underground), and distance to an existing business broadband footprint or

middle-mile backbone. The cost to serve nearly 3,857 unserved business locations in Yuba County ranges from $63.9 Million to $102.4 Million.

Table 19. Estimated Cost to Connect All Unserved (100/20Mbps) Business Locations.

Business Broadband Standard	All Unserved Locations (Agricultural, Commercial and Industrial)	FTTx 100%	FTTx 75% & Wireless 25%	FTTx 50% & Wireless 50%
100/20	3,857	$102,497,609	$83,217,972	$63,938,335

Based on data from **Section 3 Current** Broadband Landscape in Yuba and **Section 4 Broadband Needs and Demand Analysis** (including CalSPEED testing results), these are last-mile providers that could deploy future-proof high-speed broadband to unserved priority residential and business areas:

- **AT&T:** It provides the highest speeds available (1000/1000 Mbps or Gigabit) using FTTH service. However, the AT&T's FTTH footprint is minimal (2.8% of households) in the County, available only in a few census blocks in urban areas along Highway 70. The County should work with this ISP and support expansion of the FTTH footprint to the Central and Northeast parts of the county. In the last few years, AT&T has applied to recent Federal Broadband Programs such as the Connected America Fund (CASF), and FirstNet. However, AT&T has not applied to recent annual cycles (2019, 2020, and 2021) of the California Advanced Services Fund Program-Broadband Infrastructure Grants.
- **Comcast:** It provides among the highest download speeds using Cable Modem service, and has a large footprint in the county (75.9% of households). The County should support expansion of this footprint to the Central and Northeast parts of the county. In recent years, Comcast has not applied to Federal or State Broadband Infrastructure Programs or Grants.
- **Fixed Wireless Providers:** Fixed wireless providers offer (aggregated) service to 20.2% of households mostly located in some urban and many rural areas in the West part of the county, and also in parts of the Central and Northeast parts of the county. A few speed testing results from Digital Path indicate lower speeds than reported by WISPs. Further testing is recommended to validate actual broadband coverage and speeds. The County should support improving and expanding the coverage of the fixed wireless footprint, currently offering speeds only a fraction of the capacity offered by FTTH or Cable Modem. The exception is the gigabit service offered by GeoLinks. However, GeoLinks currently has only a very small footprint in the county. Providing fixed wireless service is highly dependent on the available high-capacity middle-mile backbone to connect to the internet. If there is no middle-mile fiber optics available, the other option is a microwave (or other wireless technology) backhaul until it reaches a middle-mile fiber interconnection point. It is important to note that a wireless backhaul provides much less capacity than fiber optics, and just adds to the total infrastructure cost in comparison to directly connecting to middle-mile fiber optics. The County should work

with WISPs to support potential solutions to the lack of middle-mile fiber optics in the Central and Northeast parts of the county, and additionally, supporting WISPs accessing public assets for deployment of broadband equipment.

- **New Entrants:** Based on the competition analysis, in Section 3.1.1 Broadband Market and Internet Service Providers in Yuba County, 96.3% of households have access to only two or less ISPs. There is not much diversity of choices in terms of ISPs. It is recommended to support new entrants, especially to serve areas where existing ISPs might not be interested in providing service. Large incumbents and local WISPs have specific target markets and business models. A potential disruptive and innovative new entrant might be able to identify unserved areas and markets, and find niches. Reviewing past CASF Broadband Infrastructure Grant projects will help to identify new regional and local ISPs that are rapidly growing with innovative business models and services.

Another important aspect to support expansion of last-mile broadband deployment is assisting grantees or awardees of federal and state broadband infrastructure grants and programs including:

- **California Advanced Services Fund (CASF)[47]:** In 2020, Digital Path applied for a project in the Butte and Yuba Counties to deploy high-speed fixed wireless to 582 eligible unserved households for a total of $ 872,761. This project, along with most project applications submitted in the 2020 cycle, is still under review by the CPUC. The estimated review process is due February 2022. This process was extended from the statutory 6-month review timeline due to updates on the CASF Program, including extensions due to the pandemic, and updating the guidelines to incorporating support to RDOF projects (providing complementary CPUC funding). After approval of the project, and conducting environmental review, the project grantee has two years to complete the deployments.
- **Rural Digital Opportunity Fund:** In December 2020, the Federal Communications Commission (FCC) announced the results of the Rural Digital Opportunity Fund Phase I auction[48.] A winner in the region and in Yuba County is LTD Broadband (9 census block groups). After finalizing the auction process, the project deployment timeline is as follows: 40% year 3, +20% year 4, + 20% year 5, and +20% years 6 to 8.

The diversity of ISPs (i.e., incumbent, regional and local competitive, new entrants) and broadband technologies (i.e., FTTH, cable modem, and fixed wireless) will help to reach ubiquitous access to reliable, affordable and high-speed broadband internet service in the county, as there is no one-size-fits-all-solution.

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[47] CASF Application Project Summaries: https://www.cpuc.ca.gov/industries-and-topics/internet-and-phone/california-advanced-services-fund/casf-infrastructure-project-summaries.
[48] The map can be viewed at https://www.fcc.gov/reports-research/maps/rdof-phase-i-dec-2020/.

5.5 Strategic Partnerships to Expand Broadband Infrastructure and Services

5.5.1 Local Governments (Asset Inventory)

Local governments (County and local jurisdictions) can support expansion of broadband infrastructure through development of a comprehensive data set of available broadband-related assets (asset inventory), and making this information publicly available through an online map viewer. As a result, and based on providing access to these assets, local governments can evaluate options for establishing partnerships with ISPs to support the deployment of infrastructure to the identified priority areas. These partnerships can range from directly leasing the assets to establishing public-private-partnerships (PPPs). PPPs can greatly help ISPs reduce upfront capital expenditures, especially to reach unserved and high-cost rural areas, when government entities own infrastructure constructed with grant funds. Cost-efficient broadband deployment can be achieved by allowing access to publicly owned assets for installing broadband infrastructure and equipment. For this purpose, local governments need to develop an asset inventory and an associated master lease agreement.

The asset inventory might include the following categories:

- **Mounting infrastructure**, including poles, antennas, towers, buildings and substations to install wireless radios and antennas, aerial fiber optic and coaxial cable, and other broadband or energy equipment.
- **Broadband-related assets**, including underground conduit, fiber optics, and spectrum to pass fiber optics cable or to provide the physical layer for broadband communications.
- **Land and space**, including public-rights-of-way, land, and substations to co-locate or install broadband underground conduit, communications huts, network nodes, equipment, cabinets, racks and servers.

After generating the asset inventory, it is equally important to generate a master lease agreement. The purpose of this agreement is to reduce processing time and the complexity of leasing a local government's broadband-related assets. This lease agreement allows for the installation, operation and maintenance of ISPs, broadband infrastructure providers and mobile carriers' equipment and infrastructure on County-owned assets. The agreement should include fee structures, agreement duration, renewal terms, access and responsibilities of the parties, and co-location rights, among other legal requirements.

Figure 50 shows land ownership as well as registered towers and electric transmission lines. These are useful when planning deployment in unserved areas. Existing towers can allow for the co-location of fixed and mobile broadband equipment and, as a result, reduce upfront costs, compared to installing a brand-new tower. **Broadband infrastructure providers** (i.e., Crown Castle and American Tower) lease space and backhaul capacity. Some tower owners are also **safety and emergency response agencies** (i.e., police and fire departments, sheriff). Proper equipment co-location standards allow for multiple providers to install and operate multiple services without causing any harmful interference.
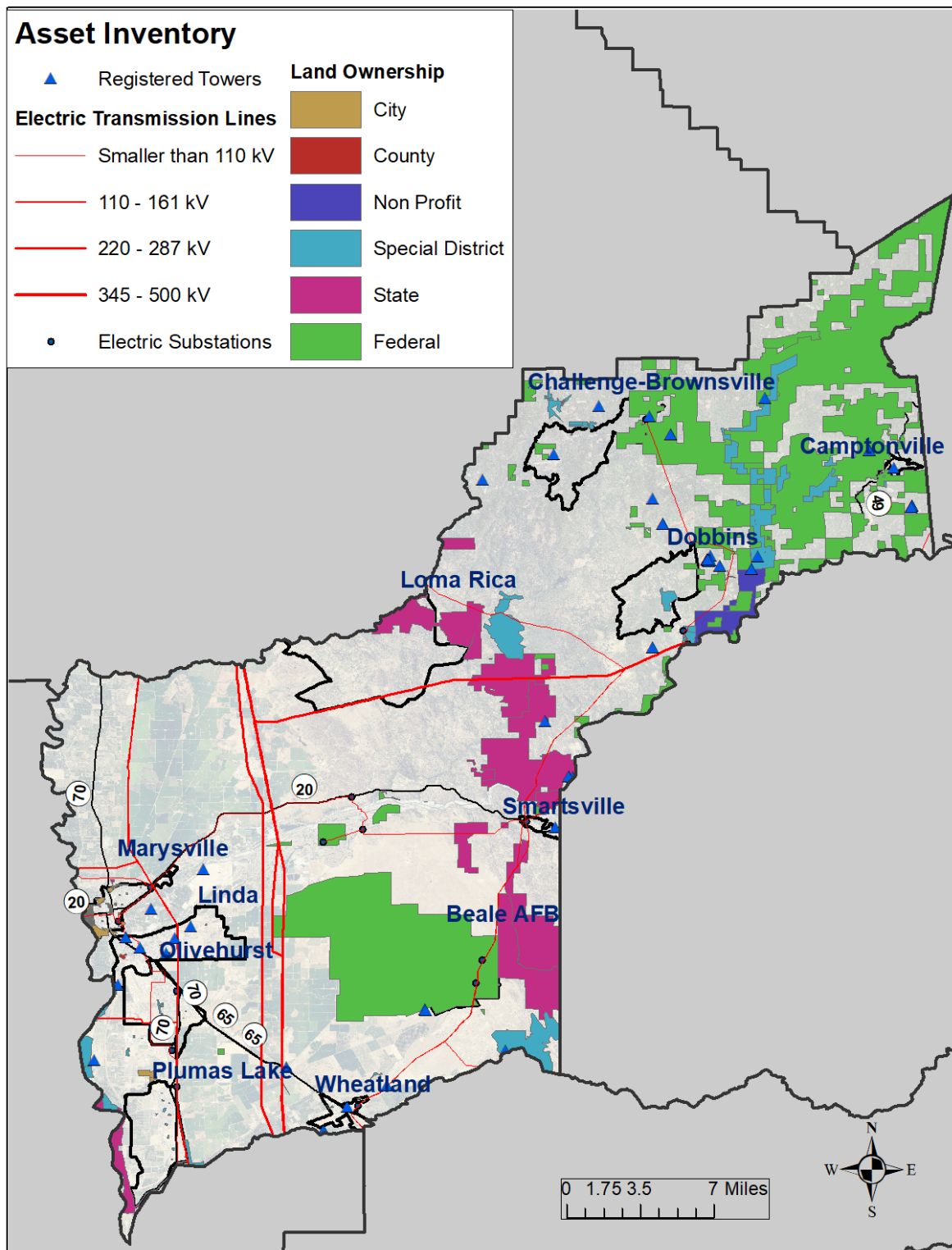
Figure 50. Asset Inventory to Support Broadband Expansion.

In the case of an unserved area without any nearby towers, a new tower can be built in city or county-owned land, ideally within the footprint of an energy utility. The location of transmission lines, substations, or footprints of energy companies is useful to assess whether sites are ready for building and powering broadband huts or nodes. It is important to note that the design of brand-new broadband infrastructure should be future-proof, should accommodate for aggregated growing demand in the targeted areas, and should explore shared infrastructure with multiple providers.

The **Sacramento Area Council of Governments (SACOG)** is a recommended partner to support the development of a comprehensive asset inventory in the County, including local jurisdictions.

5.5.2 California Department of Transportation (Caltrans)

Expanding and upgrading broadband infrastructure is more cost-efficient if it is done in coordination with the infrastructure deployment of federal or state agencies, public utilities, and local public works departments. In California, broadband stakeholders have partnered with the California Department of Transportation (Caltrans) to coordinate installation of broadband infrastructure along projects in state highways, to reach high-cost rural unserved or underserved areas.

This coordination goes beyond traditional requests to access Caltrans rights-of-way to install telecom or broadband infrastructure along highways. California Assembly Bill 1549[49], passed in 2016, requires that Caltrans notify broadband deployment companies and organizations on its website of transportation projects that involve construction methods suitable for the installation of broadband. This notification is carried out during the planning phase of specified Caltrans-led highway construction projects. After receiving notification from Caltrans, companies or organizations working on broadband deployment can then collaborate with Caltrans to install a conduit suitable for broadband infrastructure as part of a project.

AB 1549 also required Caltrans to develop guidelines to facilitate the installation of broadband conduit on state highway rights-of-way. Based on these guidelines, there are two methods by which broadband stakeholders may work with Caltrans, known as "dig once/dig smart" projects:

1. **A stand-alone encroachment permit project**, for broadband deployment companies who prefer to complete the planning, design, and installation of their conduit alone, using contractors of their choice; or
2. **A planned transportation partnering project**, for broadband deployment companies who prefer to work more closely with Caltrans during stages of planning, design, and installation of the conduit, apply for a planned transportation partnering project.

Both cases require broadband stakeholders to complete encroachment permits before proceeding with the broadband conduit installation.

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[49] Assembly Bill No. 1549. https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB1549.

Figure 51 below shows the Caltrans Broadband Partnership Opportunity Map featuring projects in the Consortium region. These Caltrans projects include, as of September 2020, the following:

- **Project Initiation Documents (PID):** A segment of Highway 65 between Olivehurst and Wheatland
- **State Highway Operations and Protection Program (SHOPP):** A segment of Highway 70, North of Marysville.
- **Non SHOPP Projects:** A segment of Highway 70 between Marysville and Plumas Lake.
- **Strategic Broadband Corridors:** Highway 20 from Marysville to Smartsville.

Caltrans has points of contact in each district. These point of contact can provide detailed information on the status of projects suitable for broadband infrastructure deployments and can assist with the coordination for joint deployments.

The Strategic Broadband Corridors, listed above, were submitted by the Regional Broadband Consortia to the California Transportation Commission (CTC) for consideration to become part of the Comprehensive Multimodal Corridor Planning Guidelines. The corridors were selected by each regional broadband consortium for its region based on the route being needed as a middle-mile infrastructure to provide the following:

1. Backhaul connectivity from unserved areas making it possible for ISPs to more effectively serve last-mile customers.
2. Diverse connectivity routes to ensure better redundancy and resiliency.
3. Backhaul for anchor institutions, county fairgrounds, and/or tribal lands.

These strategic corridors are very important throughout California to facilitate the deployment of broadband infrastructure and affordable services to 98% of the households in each of the consortium regions.

The corridors for the Connected Capital Area Broadband Consortium (CCABC) Region (counties of Sacramento, Sutter, Yolo and Yuba) were developed in partnership between the Consortium and the Sacramento Area Council of Governments (SACOG). Partnership with SACOG is important in order to identify upcoming transportation and capital improvement projects in the region and in the county.
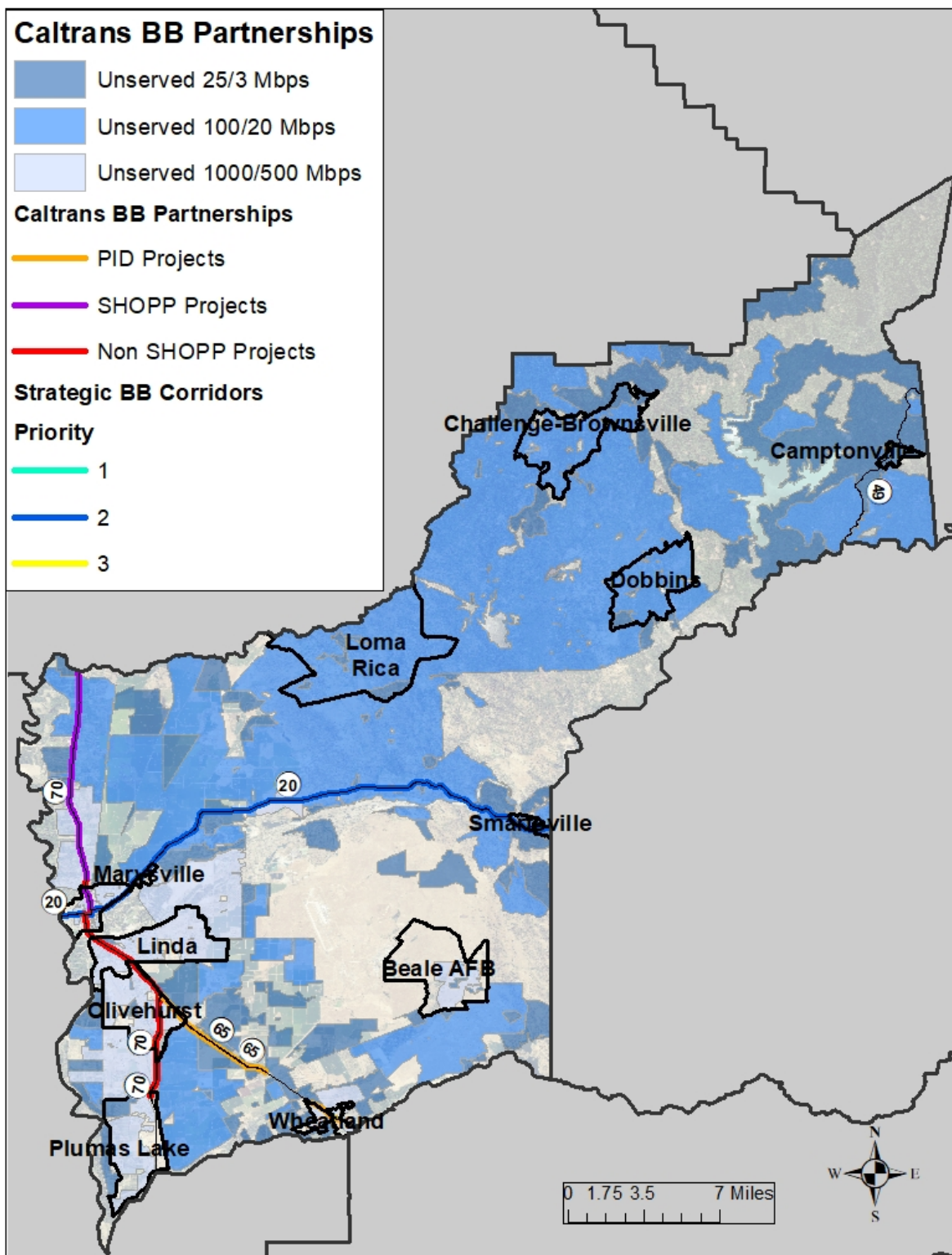
Figure 51. Upcoming Caltrans's infrastructure projects in Yuba County.

5.5.3 Corporation for Education Network Initiatives in California (CENIC)

The Corporation for Education Network Initiatives in California (CENIC)[50] operates "CalREN" (California Research and Education Network), a high capacity computer network with more than 8,000 miles of optical fiber, serving K-12 schools, public libraries, California State University, the University of California, and private universities. CENIC's network and resources provide cost-effective, high-bandwidth networking to support needs of community members (i.e., faculties, staff, students, associated research groups) and innovation.

Partnerships with CENIC provide opportunities to connect community anchor institutions to the CENIC network at Gigabit speeds, such as the K12 High Speed Network (HSN) which connects schools in California to CENIC.

It is important to note that most schools purchase high-speed connectivity using Federal E-rate and California Teleconnect Fund subsidies. Based on current federal legislation, connections provided through E-rate cannot extend connectivity beyond school property boundaries. However, opportunities to leverage CENIC network infrastructure and resources might result from expanding and connecting to core network elements (i.e., nodes and links) and identifying synergies with new network deployments, especially in the planning and implementation stages.

Figure 52 shows connectivity in Yuba County based on CENIC data and K12 HSN Data. Most K12 schools have fiber optics connections of 1 Gbps across the county. There are also a few schools in Wheatland and Camptonville which have 100 Mbps connections. This high-speed connectivity in schools in Browns Valley and the Northeast part of the county indicates that there is middle-mile infrastructure along that area. Most of these connections are provided by AT&T which might be the most likely owner and operator of such middle-mile backbone.

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[50] Corporation for Education Network Initiatives in California (CENIC) connects California to the world — advancing education and research statewide by providing a world-class network essential for innovation, collaboration, and economic growth https://cenic.org/
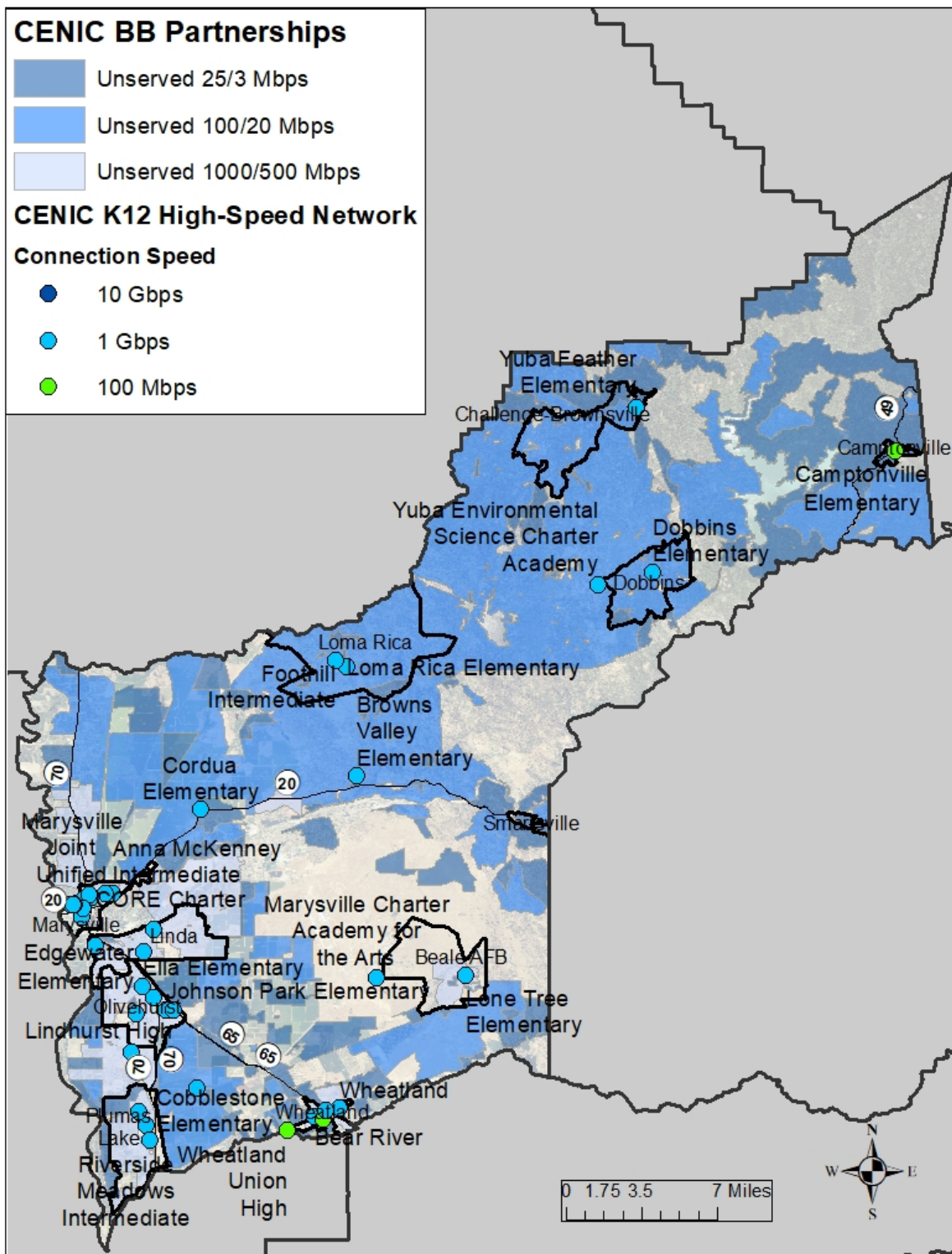
Figure 52. CENIC Broadband Partnerships and K12 High Speed Network Speeds.

5.5.4   Community Anchor Institutions

These local institutions and agencies (shown in Figure 53) include: airports, bus stations, colleges, emergency broadcast and disaster centers, fairgrounds, fire stations, healthcare facilities, libraries, local governments, community centers, power and energy facilities, police stations, public and private schools, among others. Figure 13 shows the business broadband footprint at gigabit and 100/20 Mbps speeds.
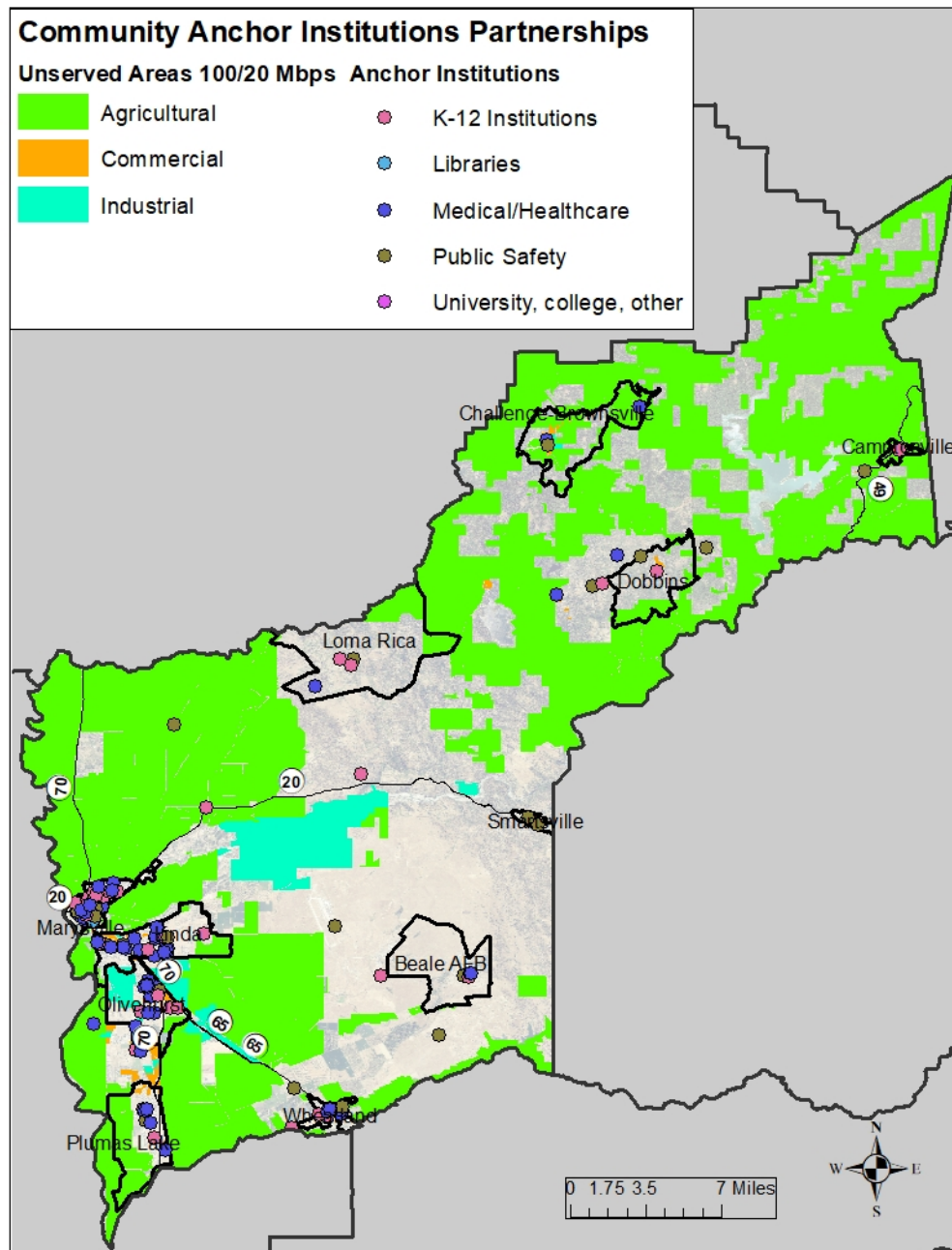
Figure 53. Community Anchor Institutions and Unserved Areas at 100/20 Mbps Anchor Institutions.

5.6 Applying to Funding Sources for Broadband Infrastructure Deployments

5.6.1 California Advanced Services Fund (CASF)

AB 1665[51], approved by the Governor on October 2017, extends the date of the California Advanced Services Fund (CASF)[52] goal (deploying broadband Internet service at speeds of 6/1Mbps to 98 percent of household in each consortium region) from 2015 to 2022 and authorizes the CPUC to collect an additional $300 million to the CASF Broadband Infrastructure Grant Account[53]. On December 2018, the CPUC approved the new rules for the Infrastructure Grant Account (Proceeding R1210012). **Recent California legislation (from July 2021) provided new funding for last-mile and middle-mile broadband infrastructure, among other provisions. It is important to keep track of the upcoming guidelines and requirements to apply to this new funding.**

As per the 2018 rules, the CPUC is allowed to fund all or a portion of a project, on a case-by-case basis. To determine the funding level (ranging from 60% to 100%) for a project, the Commission will consider the following factors:

- Baseline (60%): Areas served at speeds below 6 Mbps downstream and 1 Mbps upstream.
- Areas with only dial-up or no Internet connectivity (up to +40%)
- Low-income service (median household income no greater than $50,200) (up to +40%)
- Location and accessibility of the area meeting two of the following five characteristics (up to +10%):
    - Rugged or difficult terrain (e.g., mountains, desert, national or state forest);
    - Unincorporated community;
    - More than 10 miles from the nearest hospital;
    - More than 10 miles from the nearest state or federal highway; and/or
    - Rural census block, as defined by the U.S. Census Bureau.
- Existence of communication facilities that may be upgraded to deploy broadband (up to +10%)
- Project makes a significant contribution to achieving the program goal (up to +10%)

Eligible applicants for the CASF Infrastructure Account grant include the following:

- Entities with a Certificate of Public Convenience and Necessity (CPCN) that qualify as a "telephone corporation" as defined under Public Utilities (Pub. Util.) Code section 234;
- Wireless carriers who are registered with the Commission (i.e., hold a Wireless Identification Registration (WIR))—wireless carriers need not obtain a CPCN to qualify for CASF funding;

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[51] AB 1665 Internet for All Now Act https://www.internetforallnow.org/internet_for_all_now_act_of_2016
[52] California Advanced Service Fund (CASF) https://www.cpuc.ca.gov/industries-and-topics/internet-and-phone/california-advanced-services-fund
[53] CPUC Decision 18-12-018 Appendix 1 – Broadband Infrastructure Account Requirements Guidelines and Application Materials. http://docs.cpuc.ca.gov/PublishedDocs/Published/G000/M250/K330/250330089.PDF

- Non-telephone corporations that are facilities-based broadband service providers—the Commission uses the NTIA definition of a facilities-based broadband service provider, which is generally defined as any entity providing Internet access service or middle mile transport, over its own fixed or wireless facilities to residence, businesses, or other institution;
- A local governmental agency if no other eligible entity applied.

The current CASF infrastructure grant program is oversubscribed and pending state legislation will extend the surcharge to continue funding and open eligibility for more eligible applicants.

5.6.2   Federal USDA Reconnect Program

The USDA ReConnect Program[54] is a pilot program that offers federal financing and funding options in the form of loans, grants, and loan/grant combinations to facilitate broadband deployment in areas that don't currently have sufficient access to broadband (10 Mbps/1 Mbps). This pilot program allows applicants to deploy broadband infrastructure to provide high-speed Internet e-Connectivity to as many rural premises as possible, including homes, community facilities for health care and public safety, schools, libraries, farms, ranches, factories, and other production sites.

For a geographic area to be eligible to receive funds from this pilot program, it must meet two criteria[55]:

1. **It must be rural:** Service areas are not located in a city, town, or incorporate area that has a population greater than 20,000 or an urbanized area adjacent to a city or town with a population greater than 50,000 people. Eligible areas must be completely contained within a rural area or composed of multiple rural areas.
2. **Most households must currently have insufficient Internet service:** At least 90 percent of households in the proposed area must not have sufficient access to broadband service (fixed terrestrial broadband service at 10 Mbps downstream and 1 Mbps upstream).

Eligible applicants for the USDA Reconnect Program must be able to supply retail broadband to customers. Applicant include:

- Cooperatives, non-profits, or mutual associations
- For-profit corporations or limited liability companies
- States, local governments, or any agency, subdivision, instrumentality, or political subdivision thereof
- A territory or possession of the U.S.
- An Indian tribe

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[54] U.S. Department of Agriculture – ReConnect Loan and Grant Program. https://www.usda.gov/reconnect
[55] Additionally, no part of the proposed area may overlap with the service area of a company that has received a broadband loan from the Rural Utilities Service (RUS) as defined in this Funding Opportunity Announcement (FOA).

5.6.3 Other Funding Sources for Broadband Infrastructure

Table 20. Department of Agriculture – Broadband Infrastructure Funding

Department of Agriculture: Programs and Overview	Type of Funding			
	Discretionary	Subsidy	Formula	Loan or loan guarantee
Rural Business-Cooperative Service **Business and Industry (B&I) Guaranteed Loan Program** https://www.rd.usda.gov/programs-services/business-industry-loan-guarantees The Business and Industry program bolsters the availability of private credit by guaranteeing loans made by lenders to rural businesses. This program improves the economic health of rural communities by increasing access to business capital through loan guarantees that enable commercial lenders to provide affordable financing for businesses in eligible rural areas.				X
Rural Utilities Service **Community Connect Grant Program** https://www.rd.usda.gov/community-connect The Community Connect program helps fund broadband deployment in rural communities where it is not yet economically viable for private-sector providers to deliver service. The grants offer financial assistance to eligible service providers that will construct, improve, or expand broadband networks in rural areas.	X			
Rural Utilities Service **Distance Learning and Telemedicine (DLT) Grant Program** https://www.rd.usda.gov/programs-services/distance-learning-telemedicine-grants The Distance Learning and Telemedicine program helps rural communities use the unique capabilities of telecommunications to connect to each other and to the world, overcoming the effects of remoteness and low population density.	X			

| Rural Utilities Service
Rural Broadband Loan and Loan Guarantee Program (Broadband Program)
https://www.rd.usda.gov/programs-services/rural-broadband-access-loan-and-loan-guarantee
The 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 lending speed in eligible rural areas. | | | | X |
| **Rural Utilities Service**
Telecommunications Infrastructure Program
https://www.rd.usda.gov/programs-services/telecommunications-programs/telecommunications-infrastructure-loans-loan
The Infrastructure program provides financing for the construction, maintenance, improvement and expansion of telephone service and broadband in rural areas. | | | | X |

Table 21. Department of Commerce – Broadband Infrastructure Funding.

Department of Commerce: **Programs and Overview**	**Type of Funding**			
	Discretionary	Subsidy	Formula	Loan or loan guarantee
National Telecommunications and Information Administration Broadband Infrastructure Program https://broadbandusa.ntia.doc.gov/resources/grant-programs The Broadband Infrastructure Program makes grants on a competitive basis to covered partnerships for covered broadband projects. The term "covered partnership" means a partnership between: (A) a State, or one or more political subdivisions of a State; and (B) a provider of fixed broadband service. NTIA encourages municipalities, nonprofits, or cooperatives that own and/or operate broadband networks to participate in this program as part of a covered partnership.	X			

Economic Development Administration **FY 2020 EDA Public Works and Economic Adjustment** **Assistance Programs** https://eda.gov/funding-opportunities/ The Economic Development Administration (EDA) has published the FY 2020 Public Works and Economic Adjustment Assistance Programs Notice of Funding Opportunity (PWEAA NOFO). Projects funded by these programs will support work in Opportunity Zones and will support the mission of the Department by leading to the creation and retention of jobs and increased private investment, advancing innovation, enhancing the manufacturing capacities of regions, providing workforce development opportunities, and growing ecosystems that attract foreign direct investment. Grants and cooperative agreements made under these programs are designed to leverage existing regional assets and support the implementation of economic development strategies that advance new ideas and creative approaches to advance economic prosperity in distressed communities. This funding also includes responses to COVID.	X			

6 POLICY RECOMMENDATIONS TO SUPPORT BROADBAND INFRASTRUCTURE DEPLOYMENT AND TO REDUCE ENTRY BARRIERS

This section of the **Broadband Plan** presents recommendations for developing, adopting and implementing best policy and ordinance practices for supporting, promoting and accelerating expansion and upgrades of broadband infrastructure and services in Yuba County. These policies can help to create additional incentives (on top of federal or state grants) for internet service providers (ISPs) or broadband infrastructure providers to carry out last-mile and middle-mile broadband deployments, and as a result, achieving the County's broadband coverage and service goals. As broadband providers (incumbent, competitive or new entrants) assess and evaluate potential areas and projects for new deployments, **critical decision making factors are existing barriers** for new infrastructure build ups or upgrades. Barriers might include cost, time, permit process clarity and consistency, feasibility, viability, among others, not only in the Yuba County Code of Ordinances but in comparison to other jurisdiction prospects. The proposed local policies in this section focus on reducing these barriers to help the County become more competitive and innovative, and as a result, attracting more private and public broadband infrastructure investment.

6.1 Current Broadband Policies/Ordinances in the Municipal Code

In developing policy recommendations for the Yuba County Strategic Master Broadband Plan, Valley Vision began with an analysis of the current policy landscape in the County, including the policies, regulations, and ordinances that the County already has in place with respect to broadband.

The Yuba County Code of Ordinances includes several provisions on standards for wireless communications facilities (i.e., development, siting, installation, and operation) and the design review process. These provisions apply broadly to telecommunications infrastructure. There are no provisions in the Code that deal specifically with broadband infrastructure, although there are numerous provisions that deal with the conduit required for operating a cable tv franchise. Broadband-specific infrastructure regulations serve to streamline infrastructure deployment processes, including lowering costs and maximizing efficiency and wait times — all critical to making the County investment-ready.

Table 22. Current Broadband-Related Ordinances in Yuba County's Municipal Code.

Ordinance	Title, Section, Chapter	Overview and Remarks
Wireless communications facilities standards[56]	11.32.290	Provides standards and procedures to regulate wireless communications antennas and related facilities (development, siting, installation, and operation); Applies to "all wireless communication facilities," including cellular and internet, but is not specific to infrastructure for broadband deployment
Design review applicability[57]	11.56.020	Provides the applicability of the Chapter on design review procedure; Applies to "telecommunications facilities"
Drainage easements[58]	11.45.090	Provides the parameters for the drainage easements for closed conduits
Uses permitted for cable tv franchise [59]	6.15.100	Permits the Grantee to install conduit as may be necessary and appurtenant to operating and providing a CATV system
Location of property of grantee[60]	6.15.160	The costs of easements, trenching, and construction of the conduits required to bring cable service to the new construction or development will be borne by the Grantee [of the cable tv franchise], the developer, or the property owner, as may be agreed upon between them.

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[56] Wireless communications facilities standards
https://library.municode.com/ca/yuba_county/codes/code_of_ordinances?nodeId=TITXIDECO_DIVIIZOOVDI_CH11.32STSPUS_11.32.290WICOFA
[57] Design review applicability
https://library.municode.com/ca/yuba_county/codes/code_of_ordinances?nodeId=TITXIDECO_DIVVAD_CH11.56DERE_11.56.020AP
[58] Drainage easements
https://library.municode.com/ca/yuba_county/codes/code_of_ordinances?nodeId=TITXIDECO_DIVIVLADI_CH11.45DERE_11.45.090DREA
[59] Uses permitted for cable tv franchise
https://library.municode.com/ca/yuba_county/codes/code_of_ordinances?nodeId=TITVIBULIRE_CH6.15CATESY_6.15.100FRUSPE
[60] Location of property of grantee
https://library.municode.com/ca/yuba_county/codes/code_of_ordinances?nodeId=TITVIBULIRE_CH6.15CATESY_6.15.160LOPRGR

6.2 Policies for Promoting and Improving Telecommunications Infrastructure

Based on the assessment of existing telecommunications and broadband-related policies, the following are recommended policy approaches that would encourage and facilitate investment in broadband infrastructure deployment. These main categories of policies and activities to promote and accelerate broadband deployment are based on best practices across the state that have helped to improve the broadband access and adoption levels of different jurisdictions. They cover the following areas:

- Future-Ready Broadband Planning
- Permitting, Licensing and Other Regulations
- Dig Once/"Dig Smart" Policy
- Master License Agreements
- Programmatic County EIR
- Coordination with Stakeholders
- Broadband Coverage and Speed Data Gathering

Valley Vision prepared the **Getting Connected: A Broadband Deployment and Resource Guide for Local and Regional Government Leaders**[61] for the California Emerging Technology Fund that is a resource compendium of best practices and case studies covering the above topics and more. The Guide includes links to examples of specific policies, ordinances, plans regulations that could serve as models or templates for the County. Examples from the Resource Guide are referenced in the below subsections.

6.2.1 Future-Ready Broadband

The County should support deployment of broadband infrastructure and services by promoting the inclusion of broadband facilities in planning for all public buildings, major transportation and all public works projects. Broadband infrastructure should also be planned for and included ahead of new housing and commercial developments. It includes developing standards for future construction and developments (for new public, commercial, residential and industrial projects), including broadband building and wiring standards to support broadband in new construction and buildings.

An example of an opportunity for the approach of proactively developing standards for future-ready broadband is in the City of Wheatland, specifically for developments and projects in the new 4,500 acres added to the city limits. This approach has been successful in other communities across the state.

6.2.2 Adopt Permitting, Licensing, and Other Regulations

The County should create regulations (e.g., through amendments to the Code of Ordinances) that are specific to broadband infrastructure, including:

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[61] https://www.valleyvision.org/resources/getting-connected-a-broadband-resource-guide/

- **Streamlining the processes around deployment, particularly permitting**: Overly burdensome permitting is both a time to build and cost issue; for providers, one of their biggest challenge is in the project management and timeline aspects of the process. Delays also drive up project costs. An area where permit streamlining can be adopted is with colocation: when it comes to upgrades, if the expansion is not substantial, then the review process should not have to be as exhaustive. Instead, securing a permit should be administrative or over the counter. In addition, requirements should be scaled to the size and complexity of the project rather than a one size fits all approach. If providers know they can secure a permit in 90 days, they are more likely to do business in that jurisdiction.
- **Updating ordinances**. For example, the definitions for fixed wireless technology and small cell tower technology are not the same, and if ordinances do not reflect these differences, they need to be updated. Fixed wireless deployment requires its own language in municipal codes and ordinances.
- **Creating clear permit application processes and efficient online tools**. The permitting process varies from jurisdiction to jurisdiction. A lack of clear processes forces providers to rely on in-house knowledge, which can lead to delays and additional costs. Glitches in the application or intake process can significantly increase the time it takes to secure the necessary permits. Some jurisdictions have a designated liaison to help applicants move efficiently through the permitting process.
- **Developing an asset inventory**. Developing and maintaining an up-to-date and publicly-accessible asset inventory. A complete and up-to-date asset inventory ensures that internet service providers do not run into issues stemming from the segregation of assets, and that the parties involved are seeing all the opportunities for partnerships. An asset inventory can include poles, antennas, towers, buildings, aerial fiber optic and coaxial cable, underground conduit, electromagnetic spectrum, public-rights-of-way, land, among others. The County can generate revenues from leasing assets and expediting projects.
- **Adopting a standard Master License Agreement for broadband infrastructure deployment**. A Master License Agreement is made between the Licensor (i.e., the jurisdiction, such as a county or city) and Licensee (i.e., the internet service or infrastructure provider). It allows the Licensee to use and make attachments to certain structures, according to the terms set forth in the Agreement. The Licensor commits to accommodating the Licensee's use and attachment to the structures.

6.2.3   Adopt a "Dig Once, Dig Smart" Policy

This policy promotes the placement of fiber or conduit in the ground any time there are digging, trenching or excavation projects in the public-right-of-way, especially transportation projects. Since construction costs represent the most expensive item in a broadband deployment budget, as opposed to the fiber and conduit itself, a Dig Once policy is a cost-effective approach for reducing the cost of broadband infrastructure deployment. By reducing these deployment costs, Dig Once reduces barriers for expanding infrastructure, especially to reach unserved high-cost rural areas. It also reduces barriers for new market entrants, creating a competitive marketplace that ultimately can result in more options, lower prices, and higher quality of service for consumers. Dig Once can help to reduce traffic, noise, and safety concerns caused by constant construction work. Many communities have adopted this policy, often as part of a broadband strategic plan.

In the adoption and implementation of Dig Once policies, there are two common approaches that the County can take. The first would be to serve as the coordinator or facilitator of Dig Once projects; the second is to serve as the owner of the infrastructure.

- In serving as the coordinator or facilitator, the County would require the main excavator — usually either a public or private utility company or a transportation agency— to inform other interested parties about the opening of the public-right-of-way. The County would help to coordinate with these other parties, to enable them to join in the project (i.e., through organizing coordination meetings, overseeing the entire process, and expediting the permitting process). Once the main excavator has deployed the fiber or conduit, it will either lease it to other parties (including counties or cities) or request that they pay the incremental cost of this additional deployment.
- In serving as the owner, the County can either join the excavator's project and pay for the conduit or fiber installation, or opt out of the project if a cost-benefit analysis reveals that it is not worth the investment. To fund participation in the project, the County can either make use of the public works budget or county capital program funds. The conduit and fiber can be leased to providers and other users, generating revenues that cover the cost of construction.

In addition to adopting a Dig Use/Dig Smart policy, the County should work with SACOG, special districts and public utilities, providers and anchor institutions to identify potential joint use infrastructure projects. The Caltrans District Office has a broadband coordinator who can assist with joint use projects, including on permit streamlining and rights of way. https://dot.ca.gov/programs/design/wired-broadband/poc.

6.2.4 Adopt Innovative Policies and Technology

There are many new types of techniques and policies that jurisdictions are adopting that the County should explore. A few are summarized below.

- **Microtrenching[62]**: This is an alternative to the costly traditional method of digging down deep to lay cable/conduit. With micro-trenching, only a very shallow tunnel is dug to lay the cable, and then the tunnel is sealed shortly after. One issue with microtrenching, which has prevented it from becoming widely adopted, is an absence of a recognized set of standards or best practices. However, the City of Loma Linda[63] has had much success in implementing this technology, and may serve as a model. The Southern California Association of Governments (SCAG) is working with Crown Castle to explore this possible approach.
- **Policies that support high-capacity fiber backbone**: There are many benefits to fiber build outs, including bringing in new jobs. A lack of this backbone can hinder wireless internet service providers and 5G carriers from deploying in unserved areas, as well as in urban underserved areas with aging infrastructure. The County should leverage new State broadband investment

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[62] https://www.connectcalifornia.com/internet-service/microtrenching-state-municipal-policy-california
[63] https://www.ppc-online.com/loma-linda-case-study

resources that will be dedicated to building out an open access middle-mile network and last mile networks, and other federal resources, to ensure fiber builds.

- **Adopt the Digital Equity Bill of Rights**[64]**:** Digital Equity is defined by the National Digital Inclusion Alliance as a condition in which all individuals and communities have the information technology capacity needed for full participation in our society, democracy and economy. Digital Equity is necessary for civic and cultural participation, employment, lifelong learning, and access to essential services. Digital Equity requires deployment and adoption of information technologies enabled by access to broadband, including wireline and wireless technologies. The California Emerging Technology Fund is leading partnership efforts to advance Digital Equity policies across the state. Both SCAG and the San Diego Association of Governments (SANDAG) have adopted digital equity resolutions across their member jurisdictions.

- **Adopt a Broadband Access Policy or a Policy to Bring Broadband in Unserved Communities:** This is especially critical given the degree to which COVID-19 has widened the Digital Divide. The specific provisions and recommendations in these policies are listed in the example below.

- **5G Deployment**: Deployment of 5th generation mobile networks or "5G," as it is commonly called, has gained momentum in recent years. 5G enhances citywide voice and data capacity and improves emergency communication capabilities. It is projected to be an asset for prosperity. A "5G ready" jurisdiction can stay ahead of the curve, leveraging the technology to accelerate many aspects of economic development. However, 5G has to be part of a broader ubiquitous broadband strategy. It also must be understood in terms of how it needs to be deployed, i.e., needing a fiber backbone and traveling relatively short distances, thus requiring many nodes. If not adequately understood and planned for, it will only deepen the Digital Divide in a community. One useful case study here is the City of San Jose[65.]

6.2.5   Coordinate with Stakeholders

The County should ensure clear and consistent lines of communication with Internet Service Providers, telecommunication companies, infrastructure providers, and critical broadband stakeholders including state agencies (i.e., Caltrans, the CPUC, and the Department of Technology) and public utilities (i.e., PG&E, the Yuba Water Agency, and special services districts). It should also include safety and emergency response agencies including police and fire departments, and the Sheriff's office, and other community anchor institutions (i.e. education, health care, economic development, among others). Additionally, monthly or bi-monthly workgroup meetings with County and local city planning offices and regional broadband leaders — led by the Yuba County Broadband Task Force — can ensure that broadband remains a consistent priority, and that there is coordination among the different levels of government, especially given the major new state and federal funding resources for broadband infrastructure deployment that will be coming into the county.

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[64] https://www.cetfund.org/action-and-results/public-awareness-and-education-get-connected/digital-equity-bill-of-rights/
[65] https://www.sanjoseca.gov/your-government/department-directory/office-of-the-city-manager/civic-innovation/broadband-strategy-and-small-cell-deployment-5147

6.2.6 Allocate Staff Resources

Increasing staff capacity at the County level will help ensure a coordinated, focused approach to advance broadband priorities. Roles can include coordinating with Internet Service Providers, assisting with facilitating broadband-related permit applications, and tracking legislative, policy and funding initiatives. These roles are especially important given the needs to accelerate broadband deployment, access and adoption, foster investment, and catalyze and support projects. Having a designated staff lead will enable the County to participate in regional and statewide broadband efforts such as the Connected Capital Area Broadband Consortium, the Sacramento Coalition for Digital Inclusion, and the California Forward Broadband for All Work Group, with the goal to bring additional resources and best practices to implementation of the Broadband Strategic Plan.

6.2.7 Conduct Broadband Coverage and Speed Data Gathering

The County should continue conducting broadband coverage validation countywide and supporting State efforts, which includes widespread use of the CalSPEED (or other similar professional-level testing tools) app by residents and businesses. CalSPEED empowers end-users with a professional-level, industry-standard testing tool to measure the quality and speed of their residential fixed internet connection. This real-time ground truth testing data generated by the app is forwarded to the California Public Utilities Commission, which then uses it to generate more accurate broadband availability maps and information for funding eligibility. It also provides a more accurate overall view of actual speeds and areas for investment.

6.3 Best Policy Practices in California to Expand Broadband

The following are a few specific examples of best practices that the County could consider. Many more examples are including in the Getting Connected Resource Guide referenced above.

6.3.1 Dig Once, Dig Smart Policies

Calaveras and Tuolumne Counties' General Permit Conditions and Specifications for Trench Cuts and Street Resurfacing[66]: The Calaveras and Tuolumne Counties Trench Restoration Policy are directed at all contractors and utility companies who perform excavation work within the public Right-of-Way. The Policy focuses on trench restoration, resurfacing, and maintenance, including detailed road resurfacing requirements in an attempt to protect county roads and road infrastructure from the effects of trench installation. The Policy recognizes that a "one size fits all" approach may not be appropriate, and includes the following scenarios: roads repaved or resurfaced within the last 3 years; roads with a Pavement Condition Index (PCI) above 80; and roads in good or fair condition (PCI between 45 and 80), etc. It includes exceptions to trenching prohibitions (e.g., service for buildings where no other

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[66] https://publicworks.calaverasgov.us/Portals/PublicWorks/Documents/Forms/Trench%20Restoration%20Policy.pdf

reasonable means of providing service exists) and opportunities for alternative solutions that may benefit the county, contractors, and utility companies.

San Benito's Multi-Use Streets Policy, adopted in October 2015[67]: The San Benito County Policy provides for a full range of infrastructure main line and distribution, above and below ground, in initial roadway design and construction and in reconstruction projects involving more than surface pavement treatment: "San Benito County shall implement a complete streets policy through the planning, design, construction, maintenance and operation of new and retrofit regional and local transportation facilities, enabling safe access and mobility of pedestrians, bicyclists, transit users, and vehicle operators and passengers of all ages and abilities. San Benito County shall implement a 'dig once' policy by including provision for a full range of infrastructure main line and distribution, above and below ground, as appropriate, in initial roadway design and construction and in reconstruction projects involving more than surface pavement treatment."

6.3.2   Master License Agreements

City of Salinas' License Agreement for Wireless Installations on Public Structures[68]: Under this Agreement, the City of Salinas grants ExteNet Systems California the non-exclusive revocable right to use certain sites throughout the city to replace or upgrade structures and infrastructure, including making wireless installations (i.e., small wireless facilities).

City of Santa Cruz' License Agreement for the Use of City Poles and Rights-of-Way for Small Cell Facilities Pole Installation[69]: Under this Agreement, the City of Santa Cruz grants Crown Castle the non-exclusive revocable right to use designated city poles and rights-of-way for installing small cell facilities.

6.3.3   Others

County-wide Environmental Impact Report (EIR). As of early 2021, the County of Nevada is conducting a study on developing a programmatic county-wide Environmental Impact Report (EIR). The study is being directed by a workgroup that includes County staff, the Sierra Business Council which manages the Gold Country Broadband Consortium, the California Emerging Technology Fund, and an environmental law firm. The goals of the study are as follows:

- Remove or reduce California Environmental Quality Act (CEQA) barriers and streamline the project permitting process, to reduce costs for local broadband providers and expedite implementation of innovative last mile broadband projects.
- Create a toolkit to help internet service providers navigate permitting and CEQA compliance.

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[67] https://www.tellusventure.com/downloads/bank/san_benito_streets_policy_3nov2015.pdf
[68] https://tellusventure.com/downloads/bank/mla/salinas_extenet_master_license_agreement_wireless_signed_31mar2020.pdf
[69] Master License Agreement between the City of Santa Cruz and Crown Castle NG West LLC. https://tellusventure.com/downloads/bank/mla/santa_cruz_crown_castle_mla_12sep2017.pdf

The programmatic county-wide EIR would help further the advancement of affordable broadband to all Nevada County residents and businesses, while protecting public health, the environment, historical landmarks, and the indigenous heritage of the area.

7 RECOMMENDATIONS TO IMPROVE BROADBAND SERVICE ADOPTION

This section presents, first, broadband adoption definitions, and residential broadband adoption rates at different speed standards (consumer connections) in Yuba County. Second, available broadband adoption resources for residential service and other important uses are listed in this section, including affordable internet service plans, digital literacy/skills programs, access to affordable hardware devices, and distance education and telehealth/telemedicine resources. Third, this section presents recommendations to improve residential broadband adoption and other uses of internet connectivity. Finally, this section presents a comprehensive list of Federal funding opportunities for broadband adoption programs.

7.1 Broadband Adoption Definitions

The broadband adoption rate is defined by the CPUC as the number of consumer fixed broadband access subscriptions (connections) over the total households (or housing units) within a defined geographic area that are offered broadband Internet access service[70]. Traditionally, broadband adoption/subscribership has been defined as residential subscribership to high speed internet access. For the purposes of the digital capacity of communities, broadband adoption is defined in a more comprehensive manner as daily access to the internet[71]:

- At speeds, quality and capacity necessary to accomplish common tasks
- With the digital skills necessary to fully participate online (digital literacy), and
- On a personal device and secure convenient network

Hardware devices[72] refer to the physical components and devices that allow people to access technology and broadband internet. This includes consumer devices such as computers/laptops/tablets, monitors, keyboards, mice, printers, and scanners. Hardware that might be provided by internet service providers (ISP) include modems and routers, hotspot devices, and cable connections (at a cost to the consumer, or through a public or private subsidy).

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[70] 2020 Annual Report – California Advanced Services Fund. Program Year January 2020-December 2020. Published April 2021. https://www.cpuc.ca.gov/industries-and-topics/internet-and-phone/california-advanced-services-fund/casf-performance-and-financial-audit-reports

[71] Practical Definition of Broadband Adoption - National Digital Inclusion Alliance https://www.digitalinclusion.org/blog/2015/11/09/practical-definition-of-broadband-adoption/#:~:text=For%20those%20working%20to%20increase,to%20fully%20participate%20online%2C%20and

[72] Tech Terms - Hardware Definition, updated December 5, 2006 https://techterms.com/definition/hardware

Digital literacy[73] means having the skills you need to live, learn, and work in a society where communication and access to information is increasing through digital technologies like internet platforms, social media, and mobile devices. These skills can empower people to leverage technology safely and effectively. The American Library Association's digital-literacy task force offers this definition: "Digital literacy is the ability to use information and communication technologies to find, evaluate, create, and communicate information, requiring both cognitive and technical skills."

Digital literacy also encompasses a broader range of skills—everything from using e-mail and social media and reading on a Kindle, to gauging the validity of a website or creating and sharing YouTube videos[74]. Building digital literacy/skills improve the lives of students, job seekers, and community members to meaningfully engage in civic life. There are different aspects to digital literacy:

- Finding and consuming digital content
- Creating digital content
- Communicating or sharing it

These digital skills translate into the ability to navigate distance learning as it became required during the start of the pandemic, and still continues in some places. "Distance learning" means instruction in which the student and instructor are in different locations. This may include interacting through the use of a computer and communications technology, as well as delivering instruction and check-in time with the teacher. Distance learning may include video or audio instruction in which the primary mode of communication between the student and instructor is online interaction, instructional television, video, telecourses, or other instruction that relies on computer or communications technology. It may also include the use of print materials incorporating assignments that are the subject of written or oral feedback[75].

Another important on-line use, as shown in the pandemic, is for telemedicine/telehealth. According to the California Telehealth Resource Center, "Telehealth is a collection of means or methods for enhancing health care, public health, and health education delivery and support using telecommunications technologies."[76] Telehealth is a collection of means and methods to enhance care delivery via telehealth and a service delivered to a person, not a specific clinical service. Ideally, in person and telehealth should be held to the same quality and practice standards. Telehealth was more

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[73] What is digital literacy? - Western Sydney University, 2016. https://www.westernsydney.edu.au/studysmart/home/study_skills_guides/digital_literacy/what_is_digital_literacy

[74] Education Week. https://www.edweek.org/teaching-learning/what-is-digital-literacy/2016/11

[75] California Department of Education https://www.cde.ca.gov/ci/cr/dl/

[76] California Telehealth Resource Center. https://www.caltrc.org/get-started/what-is-telehealth/#:~:text=Telehealth%20is%20a%20collection%20of,and%20support%20using%20telecommunications%20technologies.&text=Its%20use%20crosses%20most%20health,health%2C%20and%20many%20other%20domains)

commonly known as telemedicine, but telehealth is more inclusive of how it crosses most health service disciplines, including dentistry, counseling, physical therapy, and home health to name a few.

Telehealth encompasses four distinct domains of applications:

- Live Videoconferencing (Synchronous): Live, two-way interaction between a person and a provider using audiovisual telecommunications technology.
- Store-and-Forward (Asynchronous): Transmission of recorded health history through an electronic communications system to a practitioner, usually a specialist, who uses the information to evaluate the case or render a service outside of a real-time or live interaction.
- Remote Patient Monitoring (RPM): Personal health and medical data collection from an individual in one location via electronic communication technologies, which is transmitted to a provider in a different location for use in care and related support.
- Mobile Health (mHealth): Health care and public health practice and education supported by mobile communication devices such as cell phones, tablet computers, and PDAs. Applications can range from targeted text messages that promote healthy behavior to wide-scale alerts about disease outbreaks, to name a few examples.

Access to high-speed internet has been a critical imperative during the pandemic, given the need for remote work and the continuation of hybrid work situations. It has also been a lifeline for businesses who need the internet in order to conduct e-commerce and reach customers and suppliers. Overall, the internet provides a crucial link to information and ability to connect to vital services. One recent example of needing the internet is for scheduling vaccinations.

Among those who are online, many are only connected via their place of work, school, or in public access spaces such as libraries and cafes[77]. Although internet infrastructure is installed where most people live, affordability and other barriers reduce the number of people accessing the internet from home even in major cities. There are also rural areas lacking access to useful internet speeds due to distance from urban infrastructure, including fiber networks, and other factors.

7.2 Residential Broadband Adoption Rates

There are still 27.1% of housing units in Yuba County that do not have or purchase any internet service, according to the CPUC Broadband Adoption Data[78] (housing unit metric). Data regarding broadband subscriptions are confidential (ISP's proprietary information) but the CPUC does publish a limited set of broadband adoption statistics by census tract[79]. To protect confidentiality of the individual ISPs, in accordance with guidelines developed by the United States Department of Commerce, the CPUC withholds data from some areas due to 1) one service provider having over 80 percent of the area's

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[77] Alliance for Affordable Internet. https://a4ai.org/covid-19-shows-why-internet-access-is-a-basic-right-we-must-get-everyone-connected/
[78] CPUC data provided by the Communications Division – Video Franchising & Broadband Analysis Group.
[79] California Interactive Broadband Map. https://www.broadbandmap.ca.gov/

subscriptions, or 2) an area having fewer than three service providers. Table 23 shows adoption rates in Yuba County. Nearly half (47.9%) of housing units do not have internet connections of at least 25/3 Mbps (25 Mbps downstream and 3 Mbps upstream), and only one-third (34%) have connections at a minimum of 100Mbps downstream.

Table 23. Yuba County Residential Housing Speeds (CPUC).

Yuba County	Housing Units (HUs)	HUs Connections	HUs Connections (Percent)	HUs Without Connections (Percent)
Any Speeds	28,650	20,886	72.9%	27.1%
6Mbps/1Mbps	28,650	19,453	67.9%	32.1%
10Mbps/1Mbps	28,650	18,766	65.5%	34.5%
25Mbps/3Mbps	28,650	14,927	52.1%	47.9%
100Mbps DL	28,650	9,942	34.7%	65.3%

Figure 54 to Figure 57 show (based on CPUC broadband adoption data as of December 2019) adoption rates (percentage of housing units) and the broadband internet speeds that they have access to at Census tract level in Yuba County. The adoption rates are presented for the following broadband speed standards: 1) Any speed, 2) 6/1 Mbps (previous CA standard updated in mid-2021), 3) 25/3 Mbps (FCC and New CA standard updated in mid-2021), 4) 100 Mbps downstream (Governor's Executive Order and the California Broadband for All Action Plan). At the different speed standards, the census tracts near Beale Air Force Base, Linda, and Plumas Lake have the most broadband adoption across all speeds, often over 80%.

Figure 54 shows the adoption rates (based on housing units) for any internet speeds (all aggregated speeds) in Yuba County. The highest rates (>80%) of any speeds are around Beale Air Force Base, a central area of Linda, and Plumas Lake (including neighboring areas). Marysville, Olivehurst, some areas in Linda, Wheatland, and surrounding areas have rates between 60-80% adoption rates. The central part of the county has adoption rates of 40-60%, and the Northeast part exhibits the lowest rates, 20-40%.
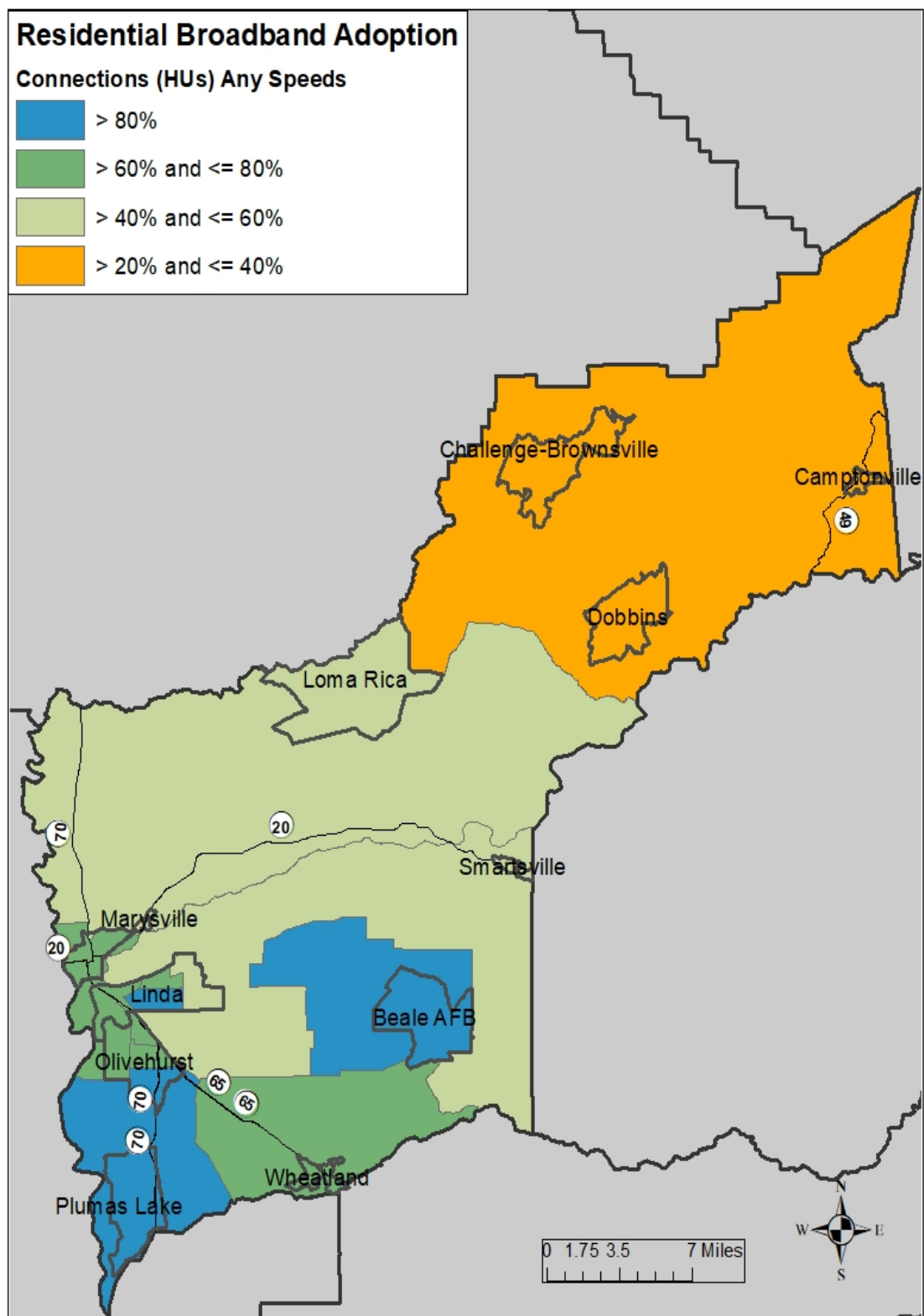
Figure 54. Residential Broadband Adoption, Any speeds (All Aggregated Speeds).

The map in Figure 55 shows the previous broadband standard (updated in mid-2021) for speeds in California at 6Mbps download and 1Mbps upload (6/1 Mbps). Beale Air Force Base, central areas in Linda, and Plumas Lake continue to have high rates of adoption, greater than 80%. Marysville, Olivehurst, and Wheatland follow with between 60 to 80% adoption rates at 6/1 Mbps. The remaining south county areas are between 40 to 60%. Areas North of Marysville and Smartsville have the lowest adoption rates between 20 to 40%.
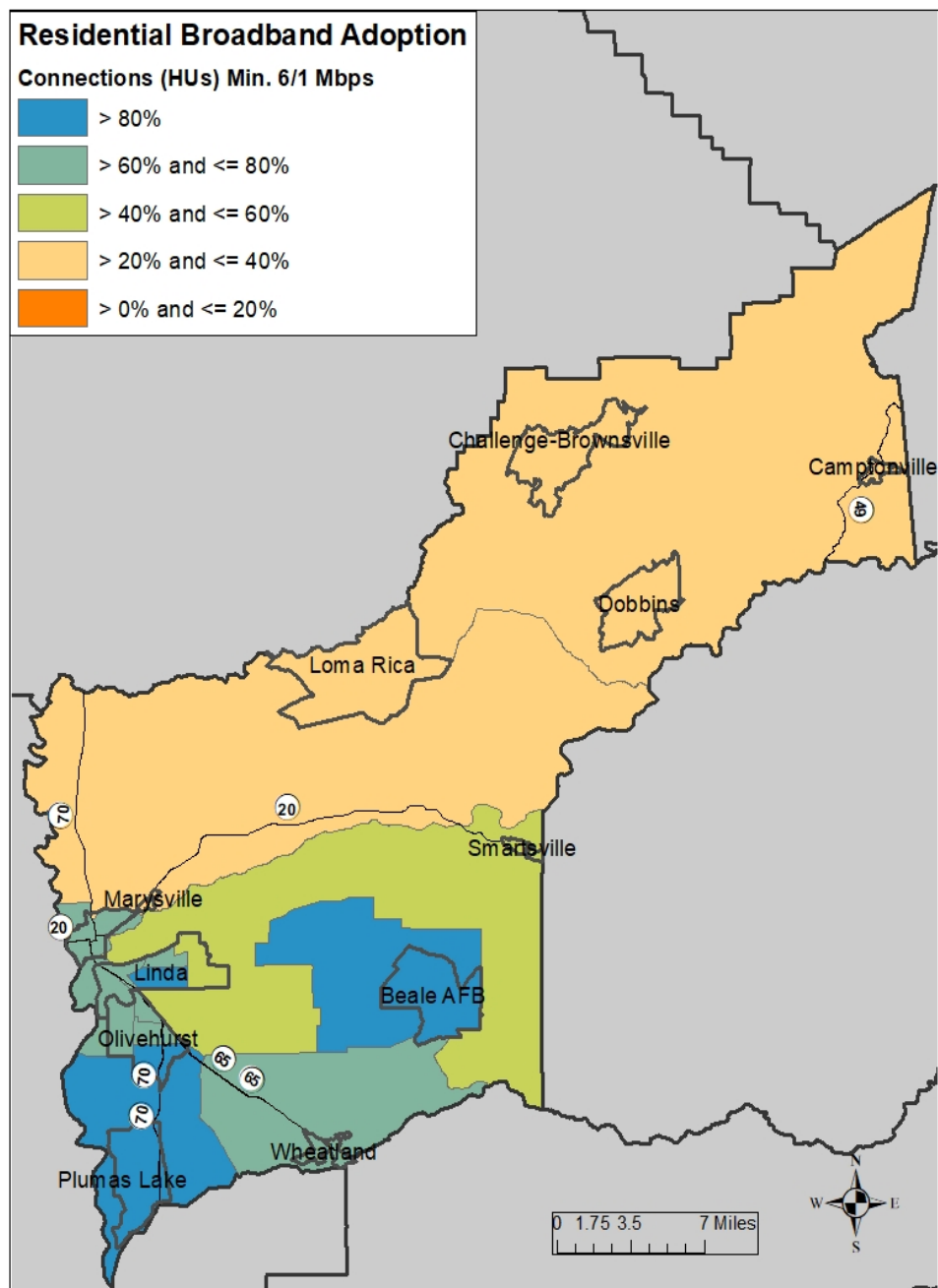

Figure 55. Residential Broadband Adoption, 6/1 Mbps (California Standard).

At the 25/3 Mbps speed standard (FCC and New CA standard), about half of the geographic region (Central and Northeast parts) in Yuba County has less than 20% connections, as shown in Figure 56. Beale Air Force Base, areas in Linda, and Plumas Lake still hold the highest rates of broadband adoption in the county, over 80%. A small area in Marysville has between 60 to 80% adoption rate for the 25/3 Mbps speeds. Then 40 to 60% adoption rates are from Marysville to Olivehurst and also around Wheatland. Much of the rural area surrounding Beale Air Force Base has a 20 to 40% adoption rate at this speed.
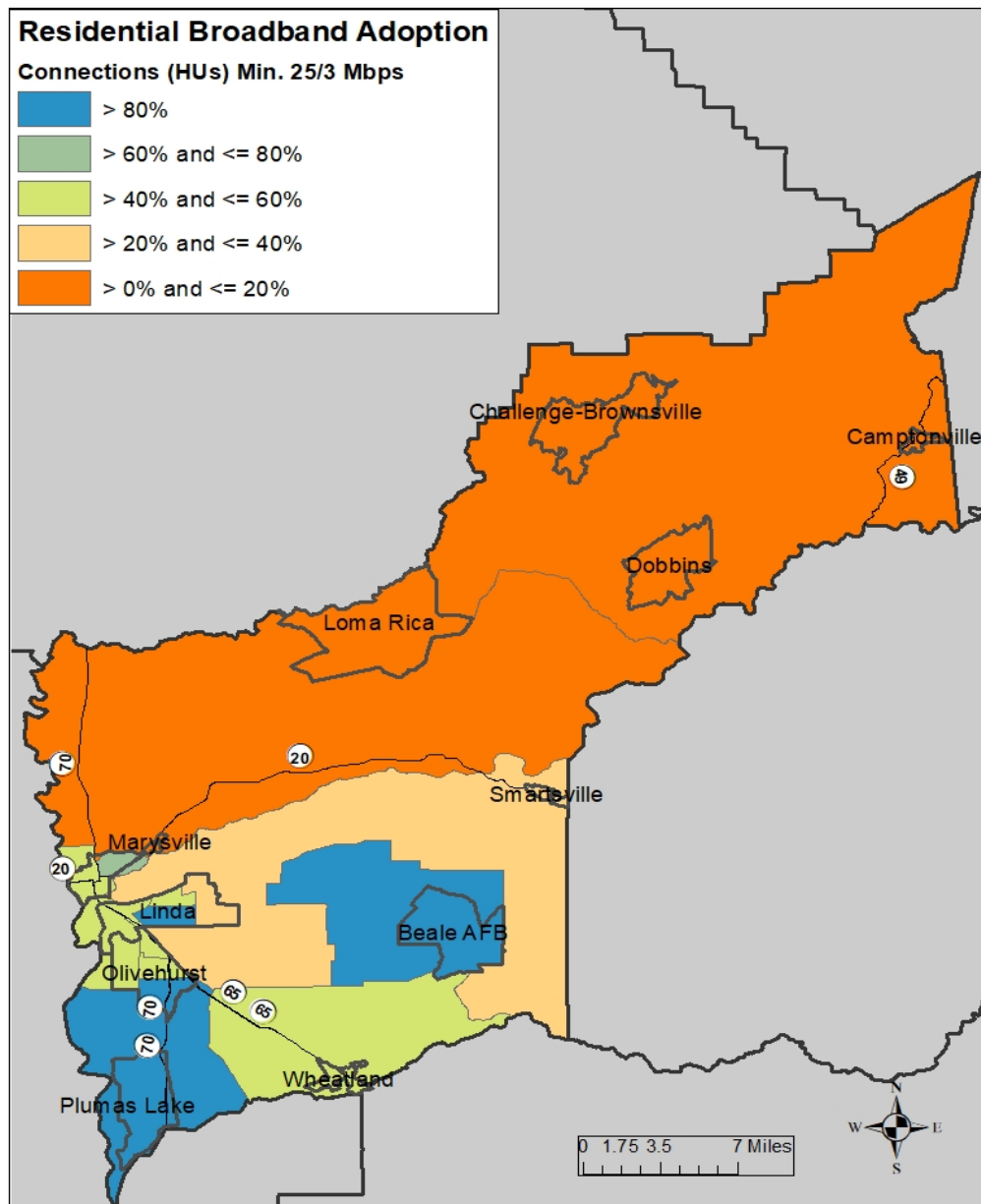

Figure 56. CPUC Broadband Adoption, 25/3 Mbps (United States standard speed).

Figure 57 shows the adoption rate for 100 Mbps. None of the census tracts have over 80% adoption rate for 100 Mbps internet speed, which is the goal for broadband speeds in California based on the Governor's Executive Order (EO-N-73-20) and the new California Broadband Action Plan. Over a third of the area in Yuba County, in the Northeast, has no housing units with 100 Mbps. While another third, in the Central and Western parts, has below 20% adoption at this speed. Marysville and South to Olivehurst has between 20 to 40% broadband adoption. Wheatland has slightly higher rates of adoption between 40 to 60%. Beale Air Force Base, areas in Linda and Plumas Lake have the highest broadband adoption rates, between 60 to 80%.
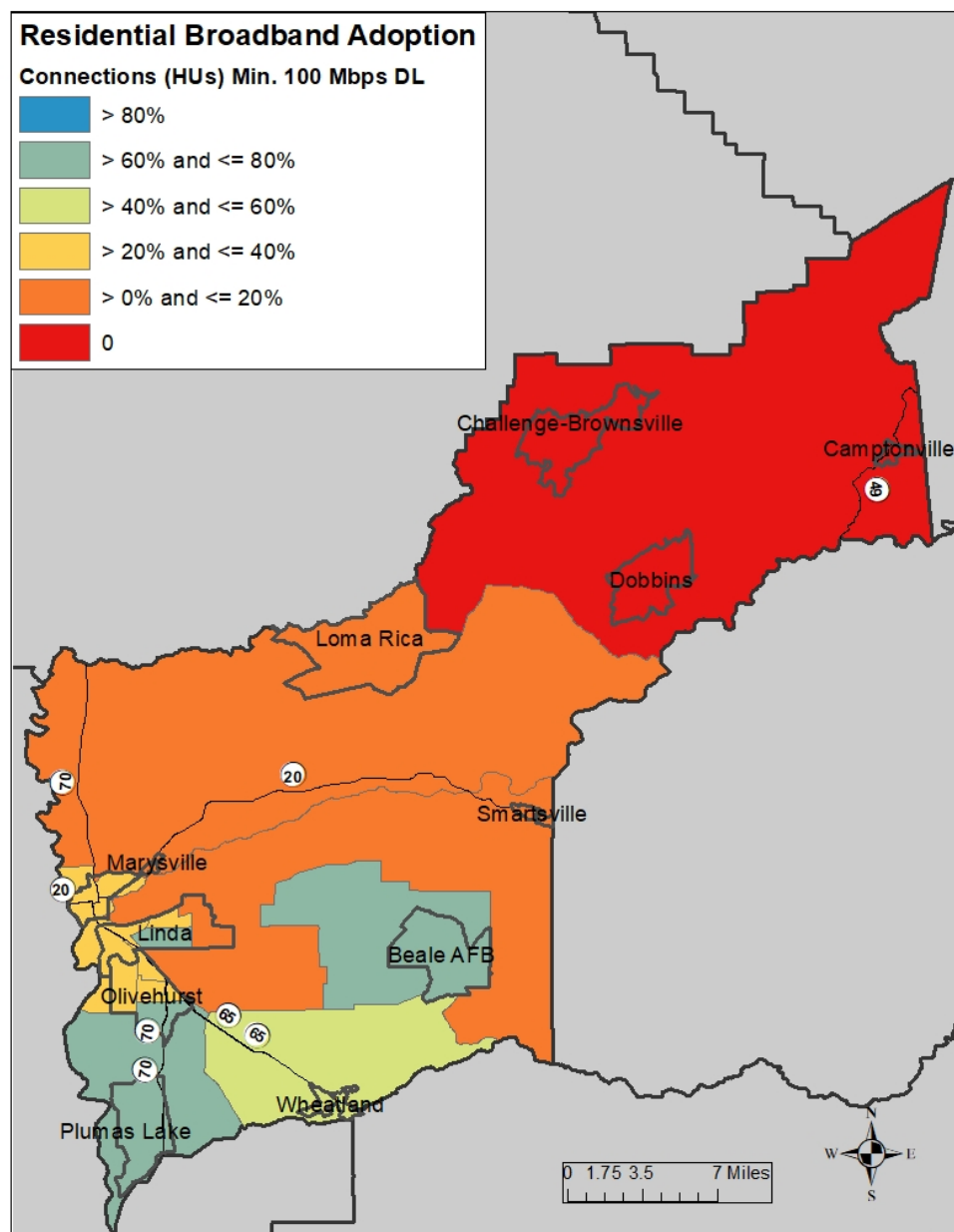

Figure 57. CPUC Broadband Adoption, 100 Mbps (New California Action Plan speed).

7.3 Existing Broadband Adoption Resources

This report identifies broadband adoption resources available in Yuba County. Analysis based on outreach with key organizations and anchor institutions, as well as research and documentation of various sources indicates that current adoption resources in the County are limited. Even so, there are useful resources that can help residents to utilize the internet more efficiently and benefit from online services, applications, and information. As a result, broadband adoption and usage will increase. Furthermore, increasing broadband adoption and the internet subscriber's base will ensure business sustainability for future broadband infrastructure investments in the County. In this subsection, affordable internet services are listed, along with digital literacy and skills resources available through several online organizations. Telehealth or telemedicine, access to hardware devices, and distance education resources are also listed. These resources, while limited, do help serve Yuba County residents and businesses with their broadband needs.

7.3.1 Affordable Internet Service Programs

Internet service providers offer several speed options for the Yuba County area. There are nine (9) service providers in the county; the largest providers are Comcast/Xfinity, AT&T and Digital Path, providing broadband access (offering service which is not the same as actual subscriptions) to around 76%, 65% and 16% of households, respectively (see Broadband Landscape Section). **Residents do not have many provider choices, as 96.3% of households have access to two or less providers**. Even when service is provided, the speed can be at the lower end of the threshold. In the case of broadband service for businesses, based on our survey, several respondents noted that they do not have choices in ISPs or even speeds because of their locations. Table 24 shows residential monthly internet service plans of different ISPs. The lowest prices for internet service are provided through AT&T (Fiber at 300 Mbps for $35 a month), and Xfinity (fiber at 25 Mbps for $30 a month)[80]. However, these services are available only in the Western part of the County, mostly along Highways 70 and 65. Wireless internet service providers (WISPs) offer service in suburban and rural areas in the county. Broadband service also is available through satellite options, which can be useful in more rural areas.

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[80] AT&T and Comcast have also affordable plans for qualifying low-income households. AT&T offers 25Mbps for $10, and Comcast offers (Internet Essentials) 50Mbps for $10. However, information of these affordable plans is not featured in the provider's website when starting an initial internet service inquiry/search. In the case of Comcast, the Internet Essentials program has a different website.

Table 24. Internet speeds and Pricing per Month within Yuba County.

Type of service provided	Download Speed	Pricing/month	Price Per Mbps
AT&T			
Fiber	300	$35	$0.12
IPBB	100	$55	$0.55
Fiber	75	$45	$0.60
DigitalPath-Metro			
WISP	75	$81	$1.08
WISP	50	$71	$1.42
WISP	25	$152	$6.08
WISP	10	$83	$8.30
WISP	6	$68	$11.33
WISP	3	$58	$19.32
DigitalPath-Rural			
WISP	75	$131	$1.75
WISP	50	$96	$1.92
WISP	25	$153	$6.12
WISP	10	$93	$9.30
WISP	6	$78	$12.99
WISP	3	$68	$22.65
HughesNet[81]			
Satellite	25	$60	$2.40
Satellite	25	$70	$2.80
Satellite	25	$100	$4.00
Satellite	25	$150	$6.00
Suceed.Net			
Fixed wireless	40	$110	$2.75
Fixed wireless	50	$150	$3.00
Verizon			
5G Home internet	940	$70	$0.07
LTE ("4G LTE")	25	$40	$1.60
Viasat			
Satellite	50	$100	$2.00
Satellite	25	$70	$2.80

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[81] HughesNet offers the same download speed for their plans, with ranges of data saving features which increase the overall cost for each plan.

Satellite	12	$50	$4.17
Xfinity Comcast			
Fiber	1000	$95	$0.09
Fiber	25	$30	$1.20

Figure 58 presents the download speeds and pricing per Mbps (as a standardized pricing unit) from Table 24. Most residential plans in the County offer downstream speeds at or below 50 Mbps. Around half of the internet plan speeds meet the current FCC and New CA standard (25/3 Mbps), but most of the speeds are below the CA Broadband Action Plan speed (100 Mbps download). It is important to note that the price per Mbps decreases as download speed offers increase, which indicates that broadband technologies providing higher speeds have an overall better and more cost-efficient service pricing.
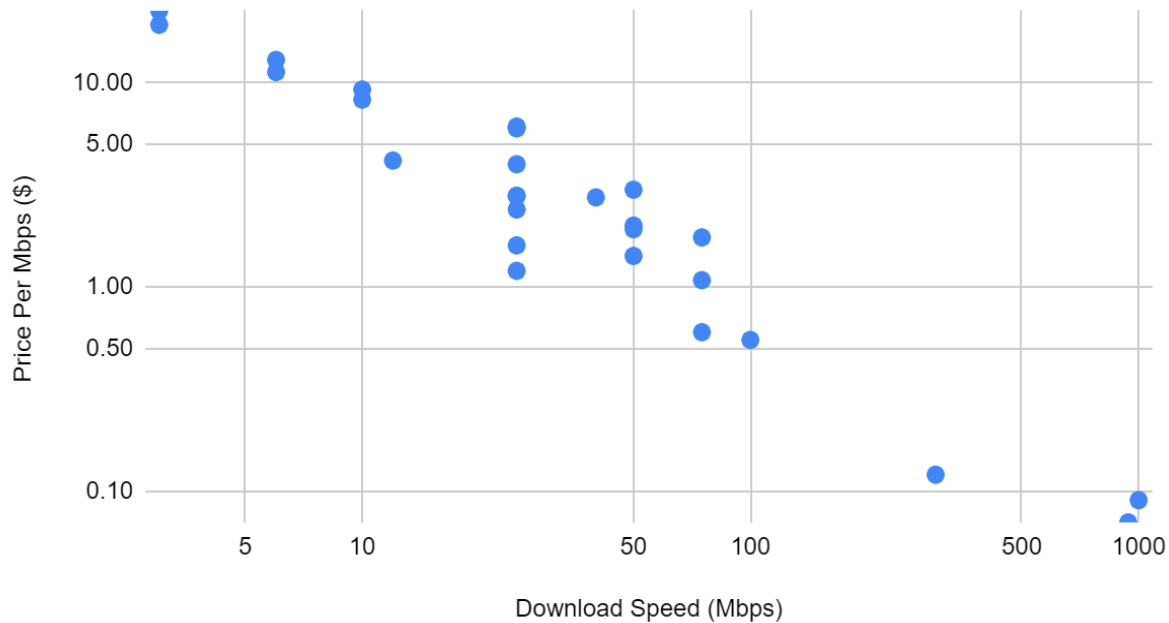

Figure 58. Logarithmic Price per Mbps and Download Speeds.

Nearly all internet service providers in Yuba County offer discounted start up rates. Comcast and AT&T offer 2-months of free internet service for low-income households that are new subscribers, although this offer does not extend to existing customers. Several companies, including AT&T, Comcast, and other ISPs have different policies on service termination, late fees, and data cap waivers. New customers who sign up for Internet Essentials with Comcast receive 60 days of free internet service, increased speeds from 15/2 Mbps to 25/3 Mbps, 40 hours of Xfinity Wi-Fi hotspots per month, and open on an unlimited basis. The following presents summaries on AT&T, Comcast and Digital Path (three largest providers by number of households in the County) affordable offers:

- **AT&T** offers 100Mbps with no data caps. For customers who qualify as low-income, there is no termination regardless of ability to pay; AT&T waives late payment fees due to inability to pay, and keeps public Wi-Fi hotspots open for those who need them. This provider also participates in the FCC's Emergency Broadband Benefit (EBB) program[82] and makes internet service more affordable for qualified customers through Access from AT&T, a low-cost broadband offering.
- **Comcast** efforts include offers of free Internet Essentials (IE) service for new customers, free public Wi-Fi hotspots, and flexible payment plans. New Comcast customers who sign up for Internet Essentials will receive 60 days of free internet service, increase speeds from 15/2 to 25/3, 40 hours of Xfinity Wi-Fi hotspots per month and open on an unlimited basis. Comcast also has an Internet Essentials Partnership with the Yuba County Office of Education, which is comprised of five K-12 school districts and one K-8 rural Charter school; the Office sponsors and pays for monthly IE service, then distributes the codes to families who sign up through the Office. The Office usually pays for this service for 6 to 9 months. Comcast also participates in the federal government's Emergency Broadband Benefit (EBB) program, and offers up to $50 per month off the cost of internet service, and $75 per month in Tribal areas.
- **DigitalPath[83]** offerings are available in urban and rural areas. There are standard monthly plan offers but not reduced or affordable plans. The rural broadband plans cost $10 or more for similar speeds in urban locations.

7.3.2 Digital Skills & Digital Literacy Programs

Digital literacy and skills are investments to improve the lives of students, job seekers, and community members so they can meaningfully engage in civic and work life. As part of this assessment, Valley Vision identified and contacted several organizations and reviewed online sites to document several of the resources in the County, with their services described below.

Yuba County Library[84]: The Library closed during the pandemic in March 2020, and it is open in most capacities as of May, 2021. Patrons asked for ways they could still utilize library resources while staying home. The Library extended its Wi-Fi access from the original operating hours of 8 am to 8pm to availability 24/7, out to their parking lot. This has since been adjusted to the current library operating hours of 9 am to 6 pm as restrictions slowly lift. The Library's website also offers digital resources for adults and children, in the list below. The federal Emergency Broadband Connectivity program has enabled libraries and schools to extend their Wi-Fi connections beyond the boundary of the properties, which previously was not permitted under federal regulations for the E-rate program which subsidizes internet service for these institutions. It is hoped that this will become a permanent change. There is

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[82] A temporary Federal program rolling out nationwide to assist consumers who have experienced financial hardship as a result of COVID-19, using the qualifications set by Congress and the FCC. This program will likely be extended through additional pandemic recovery funding.

[83] DigitalPath Internet Plans https://www.digitalpath.net/residential/plans

[84] Yuba County Public Library https://www.yuba.org/departments/library/index.php

also funding available through the Emergency Broadband Connectivity program as well as other federal recovery funding sources for libraries.

Table 25. Yuba County Library Online Resources, Adults and Children (K-College).

Yuba County Library Adult Resources	
Resource	**Description**
JobNow & VetNow	Free live online assistance for job seekers, veterans, and their families
Learning Express	Offers interactive tutorials, practice tests, e-books, flashcards for academic skill-building, standardized test preparation, career development and more
Library To-Go - OverDrive	Digital collection allows patrons to access eBooks, audiobooks and videos anytime and anywhere.
RBdigital Magazines	The world's largest newsstand, offers full-color digital magazines for anytime, anywhere reading on desktops, mobile devices, and apps
Driving Tests	Practice for your California DMV driving test with online practice tests
Library services for people with print disabilities	Assistive Technology, National Federation for the Blind NEWSLINE, Telephonic Reader Programs, and NLS Talking (Audio) and Braille Books
Yuba County Library Youth Resources	
Resource	**Description**
TumbleBooks	An online library of picture books. TumbleBooks are created by taking existing picture books and adding animation, sound, music, and narration to produce an electronic picture book which you can read, or have read to you anytime and anywhere
CultureGrams	Learn about countries from all over the world and the U.S. states. For students grades 2-12.
eLibrary Research eBooks and Magazines	A multidisciplinary database, designed for students and educators at high schools, community colleges, and four-year universities. Editorially created pages provide valuable context for both common and obscure research topics. The full text content includes books, magazines, journals, newspapers, photographs, transcripts, and videos. (Grades 6+)
ProQuest Research Companion	Information literacy tools and tutorials to help develop critical thinking. (Grades 8+)
SIRS Discoverer	Research content for novice researchers, especially elementary and middle school students and educators. (Grades 3-9)
SIRS Issue Researcher	A curriculum-aligned database of content organized by complex issues, ideally for middle and high school students and educators. (Grades 6+)

Before the risk of COVID-19, the Library was and will return as a place to use public computers and access Wi-Fi on personal devices, as well as access printers. In the future the Library hopes to make hardware devices available, such as hotspots and Chromebooks to check out for those who can't afford them. These items would be loaned out with agreements and a process that the Library would create for patrons. The Chromebooks would also be utilized for in-house workshops and senior technology navigation assistance.

Yuba County One Stop Center[85]: Northern Central Counties Consortium (NCCC) is a Joint Powers Agency of four counties including Yuba County that administers the region's federal workforce development program resources and provides additional resources to support residents and businesses, both job seekers and employers. Internet access through computers is offered for online job searching. Staff assistance is available to help those interested in job search activities such as developing resumes, completing applications, accessing labor market information, performing skills test, obtaining certificates of referrals to other agencies and services as needed. NCCC also supports job training and support services at Yuba College. There is an office for students that offers a computer lab, internet access, a study area, and a small lending library for textbooks.

E Center[86]: The E-Center is a private non-profit agency based out of Yuba City that builds healthy communities through education, employment and environmental awareness. Currently E Center administers federally funded programs to include Women's Infant and Children (WIC), Head Start, Early Head Start, Migrant and Seasonal Head Start, Migrant Early Head Start Programs and other programs in eight Northern California counties that support healthy children and families. E Center offers Zoom sessions for training staff, parent conferences, as well as home visits; they also created rooms specifically for Zoom so that the children have a more interactive experience. Zoom also has a translation feature that has been helpful for parent conferences with migrant agricultural workers.

Area on Aging 4[87]**:** Provides support for adults over age 55 to access resources, report their aging needs, training access, as well as schedule services. Its website is a resource for mature adults to connect with services in their area. The resources available in Yuba County cover a variety of needs including caregiver respite, health insurance counseling, employment services, food delivery, as well as residential repairs, long term care services, and transportation services.

Comcast RISE[88]: This program offers a range of services such as digital skills, hardware, as well as broadband access to business owned by people of color. The application was open until May 7th, 2021 for the latest round but is accepting applications which will be approved on a quarterly basis through December 2022. If approved, businesses receive one or more of the following:

- Consulting for advertising and marketing research how to grow your business;

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[85] Yuba County One Stop Center https://www.yubacoe.org/onestop
[86] E-Center http://www.ecenter.org/
[87] Area on Aging, Area 4 https://agencyonaging4.org/yuba-sutter-counties/
[88] Comcast RISE https://www.comcastrise.com/

- Media, a linear TV media schedule;
- Creative Production, Turnkey production of a 30-second commercial, plus media strategy consultation and 90-day media placement schedule;
- Technology makeover, computer equipment, and internet, voice, and cybersecurity for 12 months;

7.3.3   Access to Affordable Hardware Devices

Hardware devices are defined as technology equipment, such as computers, tablets, Wi-Fi hotspots, etc. The availability of free and low-cost computing devices is necessary to access resources and information. Some resource websites are not adapted for cell phone viewing, which in many households can be the only hardware device. Therefore, providing the community with computers, tablets, printers, as well as hotspots to increase internet speeds can help improve access for the community. There are several organizations and institutions that provide these resources.

Regarding hardware devices, **E Center** purchased several hotspots at $50 each with monthly payments for the internet service from AT&T. E Center will continue to offer these as long as there is funding available, to use for hybrid learning accommodations. E Center also noted that Comcast is offered through schools as a monthly subscription bundle so households don't have to apply themselves.

Throughout the pandemic in 2020 **Yuba College** offered hardware devices such as Wi-Fi hotspots as well as laptops for check out. The College extended its Wi-Fi signal into their parking lot for students and staff to connect with their own devices.

Based on data from the latest 2019 American Community Survey (ACS), in the figures that follow, maps show that 80% or more households in Yuba County have 1 or more computing devices (Figure 59). Less than 20% have only a desktop or laptop at home (Figure 60), which indicates that at least 60% of households have additional computing devices at home including wireless mobile devices. This indicates there is a need to have websites and resources available in formats compatible with cellphones and tablets. Many government websites have not adapted to this format. Until the 2020 pandemic most public health websites were difficult to view on mobile devices, and many entities have started to address this topic as customers revealed difficulties through feedback.
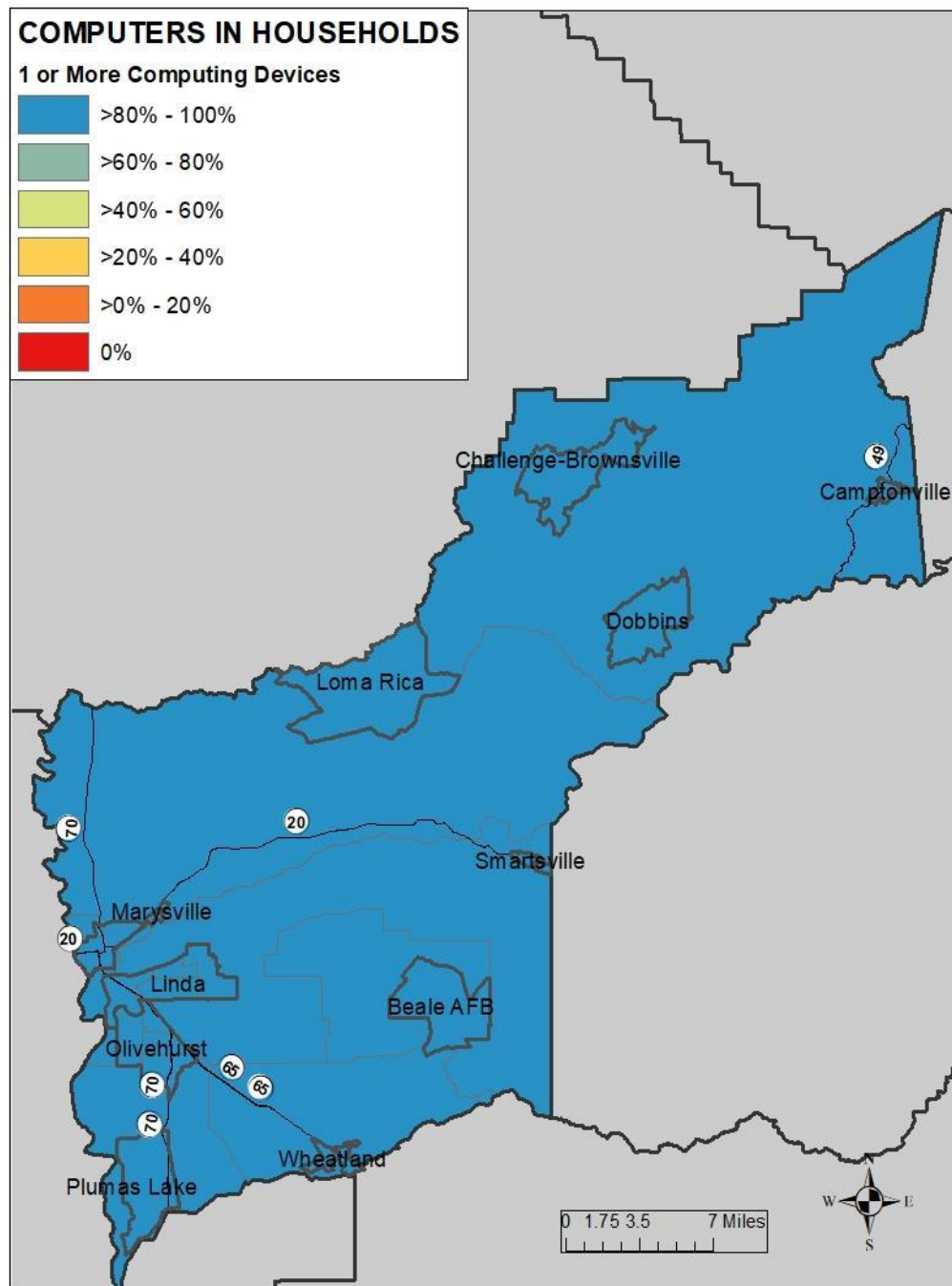
Figure 59. Computing Devices in Households, 1 or more computing devices (ACS 2019).
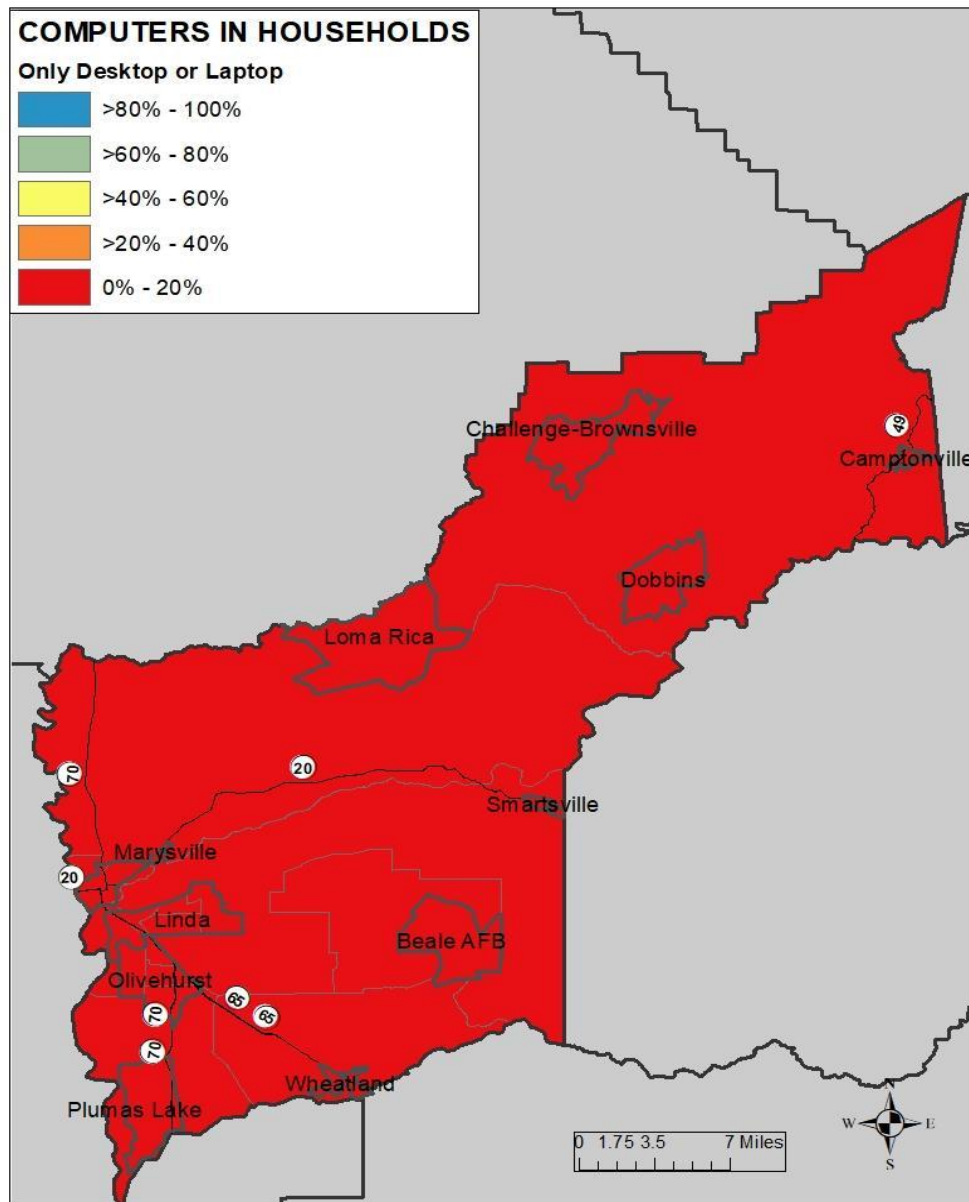
Figure 60. Computing Devices in Households, Only Desktop or Laptop (ACS 2019).

Figure 61 shows that 20 to 40% of households around Olivehurst and Yuba City have only wireless portable devices as their internet connection, while less than 20% of the remaining county households only have a portable device. These results indicate the need to support and expand programs that provide laptops or PCs to residents, as portable devices are not sufficient to conduct fully functional distance education or telework activities.
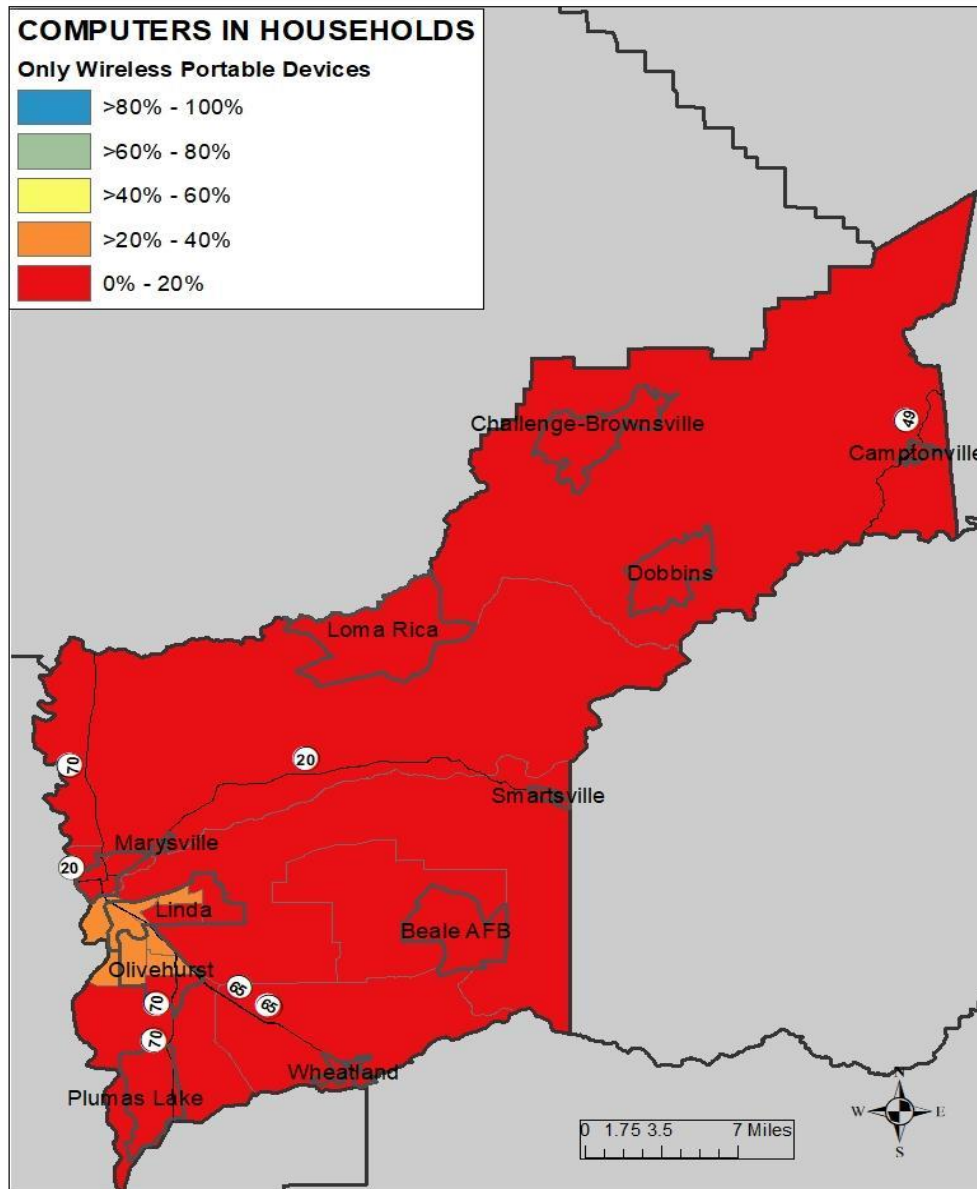
Figure 61. Computing Devices in Households, only Wireless Portable Devices (ACS 2019).

7.3.4 Distance Education

Throughout the pandemic, schools had to adapt to distance learning. Some schools took longer than others to implement changes. Initially, school districts experience difficulties to find online systems that worked for their students and staff. Adequate internet connections at home were an issue for many families and students, especially with multiple devices connecting online stretching the bandwidth for parents working from home as well as youth distance learning. The California Department of Education

has provided guidelines on how to facilitate distance learning.[89] As noted, the County has five school districts. The following summarizes some of the key resources for the four K-12 Districts used to assist students during the pandemic.

The Camptonville Elementary School District helps students' households to connect (providing devices and hotspots) with the Internet in order to enable online classes and resources. Providing students with devices was not a long term effective option because the region it serves is primarily rural with canyons and rugged terrain and is heavily forested, without many cell towers and currently poor connectivity. In At the school location, there is a fiber optics connection (through E-rate and CENIC's High Speed Network) - Gigabit line for 500 users.

The Maryville Joint Unified School District has a Distance Learning website portal that provides resources and information to parents and students during school closures. They include low-cost internet options, Wi-Fi campus hours, social-emotional tools to support children through the pandemic, Google tools and resources, and learning resources such as virtual school trips and other enrichment resources for learning at home.

The Plumas Lake Elementary School District does not have any resources listed on its website; however, each school has online resources for students.

- **Cobblestone Elementary** has student resources in the library for subjects such as Language Arts, Math, Science, Social Science, and Physical Education[90].
- **Rio Del Oro Elementary** has a distance learning webpage[91]. This page has several "how to" videos to support families during distance learning in Google Classroom, Wonder Assignments, as well as Clever.
- **Riverside Meadows Intermediate School's** webpage[92] leads families to each departments' own useful links, such as online flashcards, reading lists, facts of the day, digital history, and much more.

The Wheatland School District has a web portal for families to access Home to School Learning[93]. This webpage has "free enrichment resources for students and families - ideas that can be shared, printed, downloaded, and accessed on a variety of personal devices." Resources include:

- General Resources
    - Xfinity Wi-Fi Free for Everyone
    - Khan Academy

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[89] Distance Learning Instruction Planning Guidance. California Department of Education https://www.cde.ca.gov/ls/he/hn/guidanceplanning.asp
[90] For the Students of Cobblestone Elementary http://cse.plusd.org/About-Us/Library/For-The-Students/index.html
[91] Distance Learning at Rio Del Oro Elementary http://rdo.plusd.org/Distance-Learning/index.html
[92] Departments at Riverside Meadows Intermediate School http://rsm.plusd.org/Departments/index.html
[93] Home to School Learning Resources https://www.wheatlandsd.com/ParentsCommunity/Home-to-School-Learning/index.html

- o   Education Companies offering free subscriptions due to school closings
- o   Free Printable Activity Packets for Parents
- o   Studies Weekly
- Read-Aloud and Listening
- ELA/ELD/Writing
- Math, History/Social Science, Science, World Language
- Virtual Field Trips
- VAPA
- Physical Fitness
- Social-emotional Support Ideas
- Additional resources that include national park exploration, outer space, world history, and many more activities.

During the pandemic and in recent months, Xfinity Wi-Fi hotspots were available to anyone who needs them for free – including non-Xfinity Internet subscribers. A map of Xfinity Wi-Fi hotspots is available at www.xfinity.com/wifi. Once at a hotspot, consumers should select the "xfinitywifi" network name in the list of available hotspots and then launch a browser.

Wheatland School District and schools within the district have high speed connectivity through E-rate and CENIC's High Speed Network (HSN).

Wheatland School District also has an Educational Technology Program Information portal[94]. This webpage is a place to help guide families during distance learning. It has videos, web-based applications used during distance learning, and helpful tips and tricks. Other resources include Chromebook login information, K-8 HP Stream Laptop info, Clever, Google Classroom, Linewize and Zoom.

7.3.5   Telehealth and Telemedicine

Valley Vision recognized the challenges rural residents and healthcare providers face with broadband connectivity. Health care systems in rural areas have been disproportionally impacted by a lack of or minimal options of medical care. Rural areas experience long-standings barriers in providing adequate health care. Finding the necessary professional expertise in a rural area is a fundamental problem.

As technology has progressed, hospitals and clinics adopted telehealth to increase access to and quality of health care. Although first created to serve the needs of geographically remote areas with limited health care access, telehealth has progressed to address various aspects of health care. Telehealth also aids in reducing the cost of health care, balancing the quality of care among segments of the population, and increasing access to specialists.

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[94] Wheatland School District Educational Technology Program Information
https://www.wheatlandsd.com/ParentsCommunity/Educational-Technology-Portal/index.html

Telehealth Landscape

Table 26 presents the ratio of health care providers (i.e., primary care physicians, mental health providers, and dentists) to population. According to the 2021 County Health Rankings and Roadmaps[95], the ratios in Yuba County are higher than in California. These ratios mean there are thousands of residents to every one provider, specifically 4,340 residents to every primary care physician, which is more than 3 times the ratio for California overall. This disparity is similar to other rural counties in the region.

Table 26. Yuba County and California's Ratio of Health Care Providers to Population (Source: 2021 County Health Rankings and Roadmaps).

Location	Yuba County	Overall California
# Primary Care Physicians	18	*31,557*
Ratio	4,340:1	*1,250:1*
# Mental Health Providers	177	*147,492*
Ratio	440:1	*270:1*
# Dentists	27	*34,385*
Ratio	2,910:1	*1,150:1*

Table 27 below provides mean and median wages for several health care occupations in the North Valley-Northern Mountains Region of California nonmetropolitan area, based on data from the US Bureau of Labor Statistics[96]. Although this data covers a wide area of the state, it shows there are very few specialists working in the region.

Table 27. Occupational Employment and Wage Statistics, US Bureau of Labor Statistics (2020).

Employment and Wage Variables	Occupation (SOC code)						
	Dietitians and Nutritionists	Physical Therapists	Registered Nurses	Nurse Practitioners	Radiologic Technologists and Technicians	Surgical Technologists	Opticians, Dispensing
Employment	30	70	1290	80	120	30	-
Employment per 1,000 jobs	0.345	0.698	13.287	0.796	1.227	0.356	-
Hourly Wages							
Mean	$ 36.28	$ 47.41	$ 49.95	$ 58.66	$ 46.56	$ 36.15	$ 15.90
Median	$ 39.10	$ 47.45	$ 50.62	$ 58.27	$ 47.21	$ 36.56	$ 15.13
Annual Wages							
Mean	$ 75,450	$ 98,610	$ 103,890	$ 122,010	$ 96,840	$ 75,190	$ 33,070
Median	$ 81,320	$ 98,690	$ 105,290	$ 121,210	$ 98,200	$ 76,040	$ 31,460

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[95] County Health Rankings and Roadmaps https://www.countyhealthrankings.org/app/california/2021/overview
[96] Occupations Data from US Bureau of Labor Statistics https://data.bls.gov/oes/#/home

Most clinics are located near Marysville, in the South west region of the County. Traveling from Strawberry Fields, in the Northern most part of the county, can take at least 2 hours of travel time total.

Primary Care and Clinics

Ampla Health offers home phone/video appointments via Zoom that are covered by medical insurances.

Vituity[97], through **Adventist Health** and **Rideout**, has an experienced panel of telehealth physicians with long-standing relationships serving insurers, ACOs, employers, and national telehealth vendors. Their suite of solutions and custom-designed platforms provides a seamless experience to patients and onsite clinicians.

There are several other clinics in Yuba County, mainly located near Marysville, however they do not note that they offer telehealth options on their websites that the public can view.

Mental and Behavioral Health

Yuba College offers student telehealth resources for both physical and mental health services. The mental health resources are a one-year agreement using TimelyCare for students to navigate the COVID-19 pandemic[98]. These resources are only available to enrolled students and staff.

Table 28 presents mental health resources (phone numbers and websites) available in Yuba-Sutter. There are available phone lines for suicide and mental health crisis, intervention skills, and aging friendships. Tips about knowing the warning signs of people with suicidal thoughts, how to find the words to discuss suicide, and Local, State, and National resources can be found at **Suicide is Preventable**[99] links that are placed throughout County mental health and telehealth websites.

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[97] Vituity https://www.vituity.com/services/telehealth/teleurgent-care/
[98] Yuba College telehealth services https://yc.yccd.edu/free-telehealth-program-for-yuba-college-students/
[99] Suicide is Preventable https://www.suicideispreventable.org/

Table 28. Yuba- Sutter Mental Health Telehealth Resources.

Yuba-Sutter County Crisis Lines	Overview	Phone	Website
County Suicide and Mental Health Crisis Line	County Psychiatric Emergency Services (available 24/7)	530.673.8255 or 1-800-SUICIDE	https://www.suicideispreventable.org/
Institute on Aging Friendship Line	Provides 24/7 crisis intervention and emotional support to older adults who are depressed, bereaved, or lonely.	1-800-971-0016 1-415-752-3778	https://www.ioaging.org/services/all-inclusive-health-care/psychological-services/center-for-elderly-suicide-prevention
Suicide Prevention and Crisis Services (WellSpace Health)	Nationally Accredited Suicide Prevention Crisis Center (AAS) available 24/7/365. Crisis Chat via TEXTING- Text the word HOPE to 916.668.iCan (4226)	1-800-273-8255 or (916)368-3111 or 1-800-SUICIDE	http://suicideprevention.wellspacehealth.org
Yuba-Sutter County Mental Health Programs			
Sutter Yuba Network of Care	This Web site is a resource for individuals, families and agencies concerned with behavioral health. It provides information about behavioral health services, laws, and related news, as well as communication tools and other features.	530-674-1885 ext. 114	http://sutter.networkofcare.org/mh/index.aspx

Another comprehensive county resource is the **Sutter-Yuba Behavioral Health**[100] website, this also includes resources for suicide along with other categories, such as medications, disability assistance, financial assistance, homeless services, legal services, support and advocacy, veteran services, and much more.

Despite a small population within Yuba County, substance abuse does impact many residents. The Sutter-Yuba Behavioral Health Services (SYBH) provides help to individuals and families in Yuba and Sutter Counties. Both Sutter and Yuba counties organize community health needs, and problems such as opioid abuse have impacted both. **Bi-County Substance Abuse Services**[101] offers resources for drug abuse prevention and early intervention, treatment, and support group services.

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[100] Sutter-Yuba Behavioral Health https://sutter.networkofcare.org/mh/index.aspx
[101] Bi-County Substance Abuse Services https://www.suttercounty.org/government/county-departments/health-and-human-services/substance-abuse

7.4 Recommendations

This section of the Plan provides recommendations to improve broadband adoption in Yuba County. These recommendations are based on the gaps and findings identified earlier in this section (using CPUC and ACS data), and also based on research findings and documentation of existing broadband adoption resources, and best practices from other organizations. Many resources are listed for the Greater Sacramento Region on the Sacramento Coalition for Digital Inclusion (SCDI) website[102]. This initiative is funded in part by the support of the region's four Workforce Development Boards, including North Central Counties Consortium (NCCC). Valley Vision manages the Coalition and has been conducting research and outreach to identify digital inclusion resources throughout the Greater Sacramento Region. As noted, the resources identified for Yuba County are rather limited and were often difficult to identify.

An overall recommendation for the County, and existing digital inclusion organizations and institutions is to increase capacity for digital resources, potentially hiring more staff, and conduct more proactive outreach and advertising of resources to the community through all forms of online and broadcast media. The limited availability of on-site locations for digital resources underscores the need for more online resources in a rural county such as Yuba County. Providing a technology navigation center in each town could provide more resources for accessing affordable internet plans, digital skills and literacy programs, hardware devices, distance education supports, as well as telemedicine assistance for residents near services they already access.

7.4.1 Affordable Internet Services

Yuba County could develop a portal that links to websites or internet services provider websites listing affordable plans. This portal would need to be updated on a quarterly basis as a minimum requirement. Several potential links to feature in the portal would be the following:

- National Telecommunications and Information Administration (NTIA) - Broadband USA[103], including a link to the Federal Funding Guide[104] (for eligible applicants).
- The Federal Communications Commission (FCC) - Telecommunications Access Policy Division supports the Emergency Broadband Benefit (EBB) Program[105]. EBB provides support for broadband services and certain devices to help low-income households stay connected during the COVID-19 pandemic.
- FCC offers updates on broadband funding resources frequently through their Lifeline Program for Low-Income Consumers portal.[106]

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[102] Sacramento Coalition for Digital Inclusion. https://digitalinclusionsac.org/
[103] National Telecommunication and Information Administration. https://www.ntia.doc.gov/category/broadband
[104] National Telecommunication and Information Administration Federal Funding Guide. https://broadbandusa.ntia.doc.gov/resources/federal/federal-funding
[105] FCC Emergency Broadband Benefits (EBB) Program. https://www.fcc.gov/emergency-broadband-benefit-program
[106] FCC Lifeline Program for Low-Income Consumers. https://www.fcc.gov/general/lifeline-program-low-income-consumers

Low-income population might find the privacy provided through the internet to be more comfortable, as entering a store to ask about affordable and low-income rates could be uncomfortable. By providing a safe space for people to ask about such services, like a technology navigation center, people might seek out offers they wouldn't have been willing to explore on their own. A digital navigator is also very helpful for assisting customers through a sometimes complicated application process.

These affordable plans are not freely offered even online without providing personal information first, which could be daunting or worry potential customers that they might be placed on spam lists or hacked. These concerns can be minimized with proper information and support.

7.4.2 Digital Skills and Literacy

Local digital skills programs have traditionally been under-resourced in the Northern California Region. The County, local organizations (especially educational institutions), the Library and nonprofits can uplift residents to be more technologically educated by providing digital skill building activities. Valley Vision worked with technology and education experts to identify digital skills assessments and resources, and they recommended the following two resources:

- **Northstar Digital Literacy**[107] is a respected digital literacy assessment that tests computer skills. When test takers are logged in to Northstar Online Learning, the Northstar assessment result page links to self-directed online learning practice for skills not yet mastered. Guests can build skills in key areas, and demonstrate your knowledge by earning certificates and badges. Northstar Digital Literacy was initially used in Minnesota but has been rapidly expanding and is endorsed by K-12 Adult Education in the region.
- **International Society for Technology in Education (ISTE)**[108] has a wide variety of resources related to digital skills and literacy, along with an initiative of Skillrise[109] which is a website that helps organizations leverage educational technology to upskill workers for the careers of today and tomorrow.

The County and local organizations could also provide links to additional resources, such as Microsoft, Mozilla, Google, and IBM Skills.

- **Microsoft**[110] has some free resources for youth and adult learners on how to use their own products, since Microsoft Office is an important tool in digital skills that could be linked from nearly any agency.

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[107] Northstar Digital Literacy www.digitalliteracyassessment.org
[108] International Society for Technology in Education (ISTE) https://www.iste.org/
[109] Skillrise - An ISTE Initiative https://skillrise.org/
[110] Microsoft Virtual Workshops and Trainings https://www.microsoft.com/en-us/store/workshops-training-and-events?icid=vl_uf_932020

- **Mozilla**[111] believes that the internet has the ability to transform communities and help the company achieve their goals if people have the skills to wield its power. They have curated a core curriculum to teach these skills, and hope that people will use this curriculum, build on it, improve it, and share it with others as a way to make more people Web Literate and keep the internet healthy and open for all.
- **IBM Skills**[112] helps students, professionals, job seekers, and small businesses build critical skills through free online courses, programs, and badge credentials created in partnership with governments, NGOs and schools from all over the world.
- **Grow with Google**[113] has free digital skills training for small businesses, individuals, job seekers and students, educators, and professionals.

The County Broadband Task Force could provide updated resource lists along as part of its ongoing activities, and could explore a framework for developing a digital equity skills curriculum, an example of which is the Digital Skills for Diverse Users of Seattle, Washington[114]. The Sacramento Coalition for Digital Inclusion can also assist with identifying resources but it would be useful for the Task Force to work with local partners to develop more programs and services.

7.4.3 Access to Affordable Hardware Devices

In nearby counties, Computers 4 Kids (C4K)[115] in partnership with United Way refurbishes computers by hiring students to work on them through a work study program. C4K then educates families on the devices that are donated. C4K's goal is to provide students with the valuable tools, resources, and supplies they need in order to continue to be productive and successful in school.

Due to the rural nature of the County, hardware devices should be high quality and provide sufficient connectivity range. Having devices that can receive the high speed internet access will ensure that residents receive the full potential of their service providers.

Having a technology navigation center that would provide a space for free Wi-Fi and access to computing devices in each town would also reach the rural areas of the County. As an example, Sacramento County Public Library used COVID recovery funds to equip a mobile van that is basically a portable library and roving hotspot; the community is aware of the schedule for its route to access the services in their neighborhood.

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[111] Mozilla: Web Literacy https://foundation.mozilla.org/en/initiatives/web-literacy/
[112] IBM Skills for All https://www.ibm.com/skills/
[113] Grow with Google https://grow.google/
[114] Digital skill sets for diverse users: A comparison framework for curriculum and competencies. Seattle Digital Equity Initiative. March 2019.
http://www.seattle.gov/documents/Departments/Tech/DigitalEquity/digital%20skills%20for%20diverse%20users.pdf
[115] Computers 4 Kids http://www.c4kca.org/

7.4.4 Distance Education

Hybrid models at Yuba College could benefit students and teachers. These models include enabling more students to participate in education while living remotely, along with encouraging those with disabilities or limited transportation available, or who have work and child/elder care responsibilities. A survey distributed through the California State University system reported that "many found valuable upsides to virtual learning: greater flexibility in their college-work-life balance, fewer expenses, and the power to keep students in college."[116] This allowed many students and staff to effectively manage a number of different aspects of their lives, from parenting to living and working in rural areas. By providing the virtual option for students, the CSU administrator noted that they could achieve higher graduation rates while eliminating equity gaps through the flexibility that virtual learning affords to anyone from any background.

Distance education should also be supported by hardware devices and digital skills/literacy training. These could be supported through schools along with internet services providers that provide low-income and affordable devices including hotspots.

7.4.5 Telehealth and Telemedicine

Maintaining the increased access to telehealth services after the COVID-19 pandemic will be important to provide access for those living in rural parts of Yuba County, as well as those who are unable to leave their home for health or scheduling conflicts. For many people, up to two hours of travel time plus the appointment can take up much of a person's day when they have work, family, and other priorities. This inconvenience of driving across the county could discourage people from seeking preventative services and increase health concerns in the future. Health professionals should refresh on telehealth safety guidelines and trainings to stay up to date and provide the best care for patients.

It is important to note that telehealth is only as good as the broadband internet, phone access and reliability of the patient's location. The County could establish access points and staff to assist patients who might need hands on help accessing portals and hardware devices. Collecting survey data on patient needs and preferences regarding their telehealth access would also be beneficial to hear the voice of patients or residents. Health professionals should have a pre- and post-survey to save time and increase the effectiveness and productivity of telehealth appointments.

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[116] Many CSU students see big upsides to online learning. Now, there is a push to expand it. Los Angeles Times, June 4, 2021. https://www.latimes.com/california/story/2021-06-04/covid-changes-csu-future-students-want-more-online-learning

7.5 Other Broadband Adoption Funding Sources

The following tables list current Federal funding opportunities and programs for improving broadband adoption. Each program has a different criterion for usages and applicants, these are often for libraries, local governments, health care facilities, educational institutions, and others that were presented in the Adoption Section of this Plan.

There are major new state and federal funding resources coming through with new legislation and recovery funding, including a new federal digital equity legislation. As of July 2021, the United States announced nearly $1 trillion dedicated to infrastructure, which includes broadband. It is recommended that County staff should track and monitor these opportunities as they become available. Information can also be found through the Connected Capital Area Broadband Consortium (CCABC)[117].

Table 29. Federal Funding Opportunities: Department of Education.

Department of Education: Programs and Overview	Type of Funding			
	Discretionary	Subsidy	Formula	Loan or loan guarantee
Full-Service Community Schools https://oese.ed.gov/offices/office-of-discretionary-grants-support-services/school-choice-improvement-programs/full-service-community-schools-program-fscs/ The Full-Service Community Schools (FSCS) program provides support for the planning, implementation, and operation of full-service community schools that improve the coordination, integration, accessibility, and effectiveness of services for children and families, particularly for children attending high-poverty schools, including high-poverty rural schools.	X			
GEAR UP (Gaining early awareness and readiness for undergraduate programs) https://www2.ed.gov/programs/gearup/index.html This discretionary grant program is designed to increase the number of low-income students who are prepared to enter and succeed in postsecondary education. GEAR UP provides six-year or seven years grants to states and partnerships to provide services at high-poverty middle and high schools. GEAR UP grantees serve an entire cohort of students beginning no later than the seventh grade and follow the cohort through high school.	X			

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[117] Connected Capital Area Broadband Consortium (CCABC). https://www.valleyvision.org/projects/connected-community-initiative/

Department of Education: Programs and Overview (Continued)	Type of Funding			
	Discretionary	Subsidy	Formula	Loan or loan guarantee
Impact Aid Programs https://oese.ed.gov/offices/office-of-formula-grants/impact-aid-program/ The mission of this program is to disburse Impact Aid payments to local educational agencies that are financially burdened by federal activities. Funds are provided under Section 7002 and 7003(b) of the ESEA to local public school districts that serve significant numbers of federally connected children and that have lost a substantial portion of local property tax base due to the acquisition of federal property.			X	
Rural and Low-Income School Program https://oese.ed.gov/offices/office-of-formula-grants/rural-insular-native-achievement-programs/rural-education-achievement-program/rural-and-low-income-school-program/ The purpose of the Rural and Low-Income School (RLIS) grant program is to provide poor, rural districts with financial assistance to address the unique needs of rural school districts that frequently lack the personnel and resources needed to compete effectively for federal competitive grants and receive formula grant allocations in amounts too small to be effective in meeting their intended purposes.			X	

Department of Education: Programs and Overview (Continued)	Type of Funding			
	Discretionary	Subsidy	Formula	Loan or loan guarantee
Small, Rural School Achievement Program https://oese.ed.gov/offices/office-of-formula-grants/rural-insular-native-achievement-programs/rural-education-achievement-program/small-rural-school-achievement-program/ The purpose of the Small, Rural School Achievement (SRSA) program is to provide small, rural local educational agencies (LEAs) with financial assistance to address the unique needs of rural school districts that frequently lack the personnel and resources needed to compete effectively for Federal competitive grants and receive formula grant allocations in amounts too small to be effective in meeting their intended purposes.			X	
Title III, Part B: Strengthening Historically Black Colleges and Universities Program https://www2.ed.gov/programs/iduestitle3b/index.html This program provides financial assistance to Historically Black Colleges and Universities (HBCUs) to establish or strengthen their physical plants, financial management, academic resources, and endowment-building capacity.	X			
Student Support and Academic Enrichment Program, Title IV, Part A https://oese.ed.gov/offices/office-of-formula-grants/safe-supportive-schools/student-support-and-academic-enrichment-program/ To improve student's academic achievement by increasing the capacity of states, local educational agencies, schools and local communities to: (1) provide all students with access to a well-rounded education; (2) improve school conditions for student learning; and (3) improve the use of technology in order to improve the academic achievement and digital literacy for all students.			X	

Table 30. Federal Funding Opportunities: Department of Agriculture.

Department of Agriculture: Programs and Overview	Type of Funding			
	Discretionary	Subsidy	Formula	Loan or loan guarantee
Community Facilities (CF) Direct Loan and Grant Program https://www.rd.usda.gov/programs-services/community-facilities-direct-loan-grant-program This program provides affordable funding to develop essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings.		X		
Community Facilities (CF) Guaranteed Loan Proram https://www.rd.usda.gov/programs-services/community-facilities-guaranteed-loan-program This program provides loan guarantees to eligible private lenders to help build essential community facilities in rural areas. An essential community facility is defined as a facility that provides an essential service to the local community for the orderly development of the community in a primarily rural area, and does not include private, commercial or business undertakings.		X		X

Table 31. Federal Funding Opportunities: Department of Commerce.

Department of Commerce: Programs and Overview	Type of Funding			
	Discretionary	Subsidy	Formula	Loan or loan guarantee
COVID-19 Telehealth Round 2 https://www.fcc.gov/covid19telehealth Round 2 of the COVID-19 Telehealth Program will administer $249.95 million in additional funding appropriated in the CARES Act for the COVID-19 Telehealth Program to support "efforts of health care providers to address coronavirus by providing telecommunications services, information services, and devices necessary to enable the provision of telehealth services" during the COVID-19 pandemic.	X			
Rural Health Care Program https://www.usac.org/rural-health-care/ The Rural Health Care (RHC) Program provides funding to eligible public or non-profit health care providers for broadband and telecommunications services necessary for the provision of health care.	X			Discount on eligible telecommunications services.

Table 32. Federal Funding Opportunities: Institute of Museum and Library Services (IMLS).

Institute of Museum and Library Services (IMLS): Programs and Overview	Type of Funding			
	Discretionary	Subsidy	Formula	Loan or loan guarantee
Grants to States Program https://www.imls.gov/grants/grants-states Using a population based formula, more than $160 million is distributed among the State Library Administrative Agencies (SLAAs) every year. SLAAs are official agencies charged by law with the extension and development of library services, and they are located in: (1) Each of the 50 states and the District of Columbia. (2) The Territories (Guam, American Samoa, the Commonwealth of Puerto Rico, the Commonwealth of the Northern Mariana Islands, and the U.S. Virgin Islands). (3) The Freely Associated States (Federated States of Micronesia, Republic of Palau, and the Republic of the Marshall Islands).			X	
National Leadership Grants for Libraries https://www.imls.gov/grants/available/national-leadership-grants-libraries National Leadership Grants for Libraries Program (NLG-L) support projects that enhance the quality of library and archive services nationwide by advancing theory and practice. Successful proposals will generate results such as new tools, research findings, models, services, practices, or collaborative approaches that will be widely used, adapted, scaled, or replicated to extend the benefits of federal investment.	X			

8 APPENDICES

8.1 Broadband Technologies

8.1.1 Wireline Broadband

Wireline broadband technologies include: digital subscriber line (DSL), cable modem and fiber-to-the-home (FTTx). Cable modem and FTTx technologies are primarily deployed in dense urban and suburban areas. Legacy DSL technologies reach these areas in addition to some rural areas near concentration points. Deployment and coverage limitations of these technologies include access to rights-of-way and potential high costs of underground deployments. In some cases, aerial deployments can be an optimal and cost-effective solution to carry out these deployments.

8.1.1.1 Digital Subscriber Line (DSL)

Legacy DSL technology (including standard evolution) is defined as broadband service provided over traditional copper telephone lines (without disrupting regular telephone calls) already installed in homes and businesses. DSL offers the following speeds:

- DSL with loops of over 12,000 feet: Uses ADSL2/ADSL2+ to provide rates of 6 Mbps downstream and 1 Mbps upstream. To provide faster speeds, DSL operators can bond loops (over 30 Mbps if sufficient number of copper loops are available) and continue to shorten loop lengths.
- DSL with loops of over 5,000 or 3,000 feet: Typically uses VDSL2 to provide 35 Mbps downstream and 6 Mbps upstream over loops of 3,000 feet, and 20 Mbps downstream and 4 Mbps upstream over loops of 5,000 feet.

Limitations of this technology include speed sensitivity related to distance from central offices, lack of expansion of traditional telephone lines resulting in a lacking DSL footprint growth, and not providing future-proof data rates of hundreds of Mbps or gigabit service.

8.1.1.2 Cable Modem

Uses coaxial cables already installed by cable television operators to deliver video and sound. Cable modem uses the Data Over Cable Service Interface Specification (DOCSIS) standard and can provide from 40 Mbps downstream and 10 Mbps upstream (DOCSIS 1.1) and up to 10 Gbps downstream and 6 Gbps upstream (DOCSIS 4.0). Benefits of this technology include large coverage areas for consistently fast speeds with low packet loss and latency. Limitations include low numbers of or single cable broadband providers in most areas.

8.1.1.3 Fiber Optics

Fiber-optic technology converts electrical signals carrying data to light and sends the light through transparent glass fibers of a few microns in size. There are three basic types of FTTP deployments: point-to-point (P2P) networks, active Ethernet networks and passive optical networks (PON). PON is the most widely deployed residential FTTP (fiber-to-the-premises) technology in the United States. Fiber-based service can provide speeds from 2.5 Gbps downstream and upstream (Gigabit PON or GPON), and 1.25 Gbps downstream and upstream (Ethernet PON or EPON), to 10 Gbps downstream and upstream (Next Generation PON or NG-PON2, and 10 Gigabit PON or XG-PON). These PON capacities can be split up to 256 residential users providing from tens of Mbps to gigabits broadband service. Benefits of fiber include consistently high speeds and transmitting across large distances without signal degradation. Limitations include the requirement of new infrastructure, in contrast to DSL and cable modems using already deployed telephone and cable television infrastructure, but fiber is preferred for providing the highest broadband capacity.

8.1.2   Fixed Wireless Broadband

Fixed wireless broadband includes IEEE 802.11 standard, LTE (4G), millimeter-wave, high-speed satellite, Television White Spaces, among others. These technologies are primarily deployed in areas where wireline technologies do not have complete coverage, such as rural areas. Deployment and coverage limitations of these technologies include obstructions (i.e. terrain and/or vegetation) between the antenna at the customer premises and the access point or base station located on a pole or tower. These obstructions can prevent or disrupt communications in fixed wireless radio links by causing attenuation, scattering, diffraction and absorption of electromagnetic waves. Theoretical speeds might significantly reduce (by 5x or more) depending on line-of-sight (LOS), obstructions, spectrum interference, number of simultaneous end users, multiple access protocols, and in some cases atmospheric precipitation.

8.1.2.1   IEEE 802.11 Standard

The IEEE 802.11 Standard operates in unlicensed bands (2.4 GHz and 5 GHz) and was originally designed for wireless local area networks (WLANs) to enable communication among devices in a range from up to few hundred feet; however, equipment manufacturers developed 802.11 based long-range solutions able to span several miles of coverage. IEEE 802.11 can provide aggregated downstream speeds for up to a few hundred of Mbps. i.e., 300 Mbps using 2.4 GHz (IEEE 802.11n), and 900 Mbps using 5 GHz (IEEE 802.11ac). Benefits of 802.11 include the low cost of access points (APs) and customer premise equipment (CPEs) due to large economies of scale achieved by this technology. Limitations include potential interference leading to signal degradation due to operating in a widely used, unlicensed spectrum.

8.1.2.2   Fixed LTE

Long-Term Evolution (LTE) was designed by the 3rd Generation Partnership Project (3GPP) for mobile communications in densely populated areas (see mobile broadband). LTE has also been used to provide

fixed broadband services in rural areas. LTE can provide speeds for end users up to tens of Mbps downstream to customers. For benefits and limitations see LTE in the Mobile subsection.

8.1.2.3 Millimeter-wave

Technology operating in millimeter waves is currently used for high-speed backhauling (point to point) to connect cell sites or access points in order to provide high-speed internet. There is assigned licensed and unlicensed spectrum for millimeter-wave technology. The unlicensed millimeter-wave spectrum operates in the 60 GHz band (57–66 GHz), offering 7 GHz of bandwidth, and the licensed millimeter-wave operates in the 71 to 76 GHz and 81 to 86 GHz, offering bandwidth from 10 to 80 MHz, although for shorter distances. Equipment working on these bands is affected by heavy atmospheric absorption, which limits range of operations, but also unwanted interference. Millimeter-wave can achieve up to 2.5 Gbps for a mile-long point-to-point radio link.

8.1.2.4 High-Speed Satellite

This type of broadband technology is currently offered by companies such as O3b (stands for "Other 3 Billion") and Starlink (from Space X). O3b provides satellite communication backhaul service offering low latencies and data rates comparable to fiber-optic technology. O3B has a constellation of 12 satellites with a ground period of 360 minutes using the Ka-band, providing a coverage of 45 degrees North/South latitudes. The satellites provide 10 beams per region (7 regions), totaling 70 remote beams for the entire constellation. The latency is less than 150 milliseconds due to the use of Medium Earth Orbit (MEO) satellites. The maximum available aggregated throughput per beam (over a single transponder) is 1.6 Gbps (800 Mbps x 2) and each beam provides coverage of 400 miles. Starlink uses Low Earth orbit (LEO) satellites and the Ku-band and Ka-band. Starlink is now delivering initial beta service and test users can expect to see data speeds vary from 50Mbps to 150Mbps and latency from 20ms to 40ms in most locations. Starlink also has brief periods of no connectivity at all. As this company launches more satellites, install more ground stations and improve our networking software, data speed, latency and uptime have the capability to improve.

8.1.2.5 Television White Spaces (TV White Spaces)

White Spaces can be defined as part of the spectrum available for a radio communication application at a given time, in a given geographical area, on a non-interfering/non-protected basis with regard to primary and other services. The TV White Spaces technology (IEEE 802.11af and IEEE 802.22 Standards) operates in white spaces of the broadcast television spectrum (from 54 MHz to 862 MHz). It was designed for wireless local area networks (WLANs) with a range up to a few miles and wireless regional area networks (WRANs) with a range up to several tens of miles. TVWS can achieve aggregated data rates of a few tens of Mbps (27 Mbps IEEE 802.11af, 24 Mbps IEEE 802.22) to hundreds of Mbps (427 Mbps 6 MHz x 4 channels IEEE802.11af) allowing it to provide downstream speeds of a few to tens of Mbps per user. The TVWS technology has the advantage of enhanced propagation features due to the use of frequencies bellow 1 GHz, allowing for the penetration of walls, vegetation, moderate hills and other obstacles.

8.1.3   Mobile Broadband

Mobile broadband includes packet-based data technologies such as 2G (GPRS, EDGE and CDMA2000), 3G (WCDMA, HSDPA, HSPA and CDMA2000 EV-DO), 4G (LTE and WiMAX), and 5G. Although evolution of these technologies has made mobile broadband services much more versatile and useful to consumers by providing mobility and portability, there are important differences between mobile and fixed broadband. Mobile transmissions, due to using wireless spectrum, operate under environmental factors that can impact consistent coverage and speeds. These technologies are primarily deployed in densely populated urban areas and, in a smaller scale, in rural areas. Coverage limitations of mobile broadband come from obstructions (i.e. terrain and/or vegetation) between base stations located on towers and mobile devices, and availability and access to the licensed spectrum.

8.1.3.1   Legacy Technologies (2G and 3G)

These mobile technologies include packet-based data services that evolved from the GSM and CDMA mobile technologies. For GSM, these technologies include: GPRS and EDGE (100–130 kbps data rates), UMTS or WDCMA (220–320 kbps), HSPA (several Mbps). For CDMA these technologies include: CDMA2000 (307 kbps), CDMA2000 EV-DO (3.1 Mbps). Limitations of these legacy technologies include low speeds in comparison to new-generation mobile broadband and wireline and fixed wireless broadband.

8.1.3.2   4G Long-Term Evolution (LTE)

Long-Term Evolution (LTE) was designed by the 3rd Generation Partnership Project (3GPP) for mobile communications in densely populated areas and can achieve aggregated data rates up to 300 Mbps allowing to provide speeds for end users up to tens of Mbps downstream and a few Mbps upstream to customers. The most common LTE bands range from 700 MHz to 3.8 GHz. Benefits of this technology include data rates in some cases comparable to wireline and fixed wireless broadband services and flexible network design allowing combination of macro- and microcell sites to cover demand needs of specific geographical areas. Limitations include purchasing new devices that support LTE service and plans that might include data caps.

8.1.3.3   5G

5G is the 5th generation mobile network technology designed to connect mobile users, machines, objects, and devices. The 5G technology is capable to deliver higher multi-Gbps peak data speeds, ultra-low latency, more reliability, massive network capacity, increased availability, and a more uniform user experience to more users. The 3rd Generation Partnership Project (3GPP) defined the global specifications for 3G UMTS (including HSPA), 4G LTE, and 5G technologies. 5G is based on OFDM (Orthogonal frequency-division multiplexing), a method of modulating a digital signal across several different channels to reduce interference. 5G also uses wider bandwidth technologies such as sub-6 GHz and mmWave.

8.2 Notes from Broadband Needs Assessment

Local Governments Sector (2/24/2021) Jim Goodwin, Wheatland City Manager	
Input/Perspective from Sector/Jurisdiction	*Needs/Potential Demand*
Currently the smallest city in Yuba-Sutter (3,700-3,800 residents), but positioned to be one of the larger cities in the region because of a 2014-approved annexation of 4500 acres to the East of the city. The 4500 acres, right now, are primarily pasture, and there's a subdivision on the Western end of the property. It was given Tier 1 Zoning in 2014. Lon and the Yuba Water Agency are under contract with the City of Wheatland to do an Employment Zone Feasibility Study, and there is a lot of alignment with Beale AFB. In terms of timing: Property owners are likely to seek some entitlement over the next two years; three to five years to secure those. There will be limited construction or development in that area in the next 3-5 years, and significant investment in the next 5 years and beyond. Small business community; no healthcare facilities; no large retailers; handful of restaurants; a couple of different professional offices; Sierra Central Credit Union branch office. There is a retiree population associated with Beale AFB.	• 2014-approved annexation of 4,500 acres to the East of the city (Hope Farm and Johnson Rancho annexation areas). The 4500 acres, right now, are primarily pasture, and there's a subdivision on the Western end of the property. It was given Tier 1 Zoning in 2014. • Lon and the Yuba Water Agency are under contract with the City of Wheatland to do an Employment Zone Feasibility Study, and there is a lot of alignment with Beale AFB. • Coming major infrastructure projects: 1) South Yuba Transportation Improvement Authority (joint exercised of power agreement-Yuba County and Wheatland), 2) East of Wheatland highway (full bypass), and 3) sewer project to connect to water plant (check on water agency projects). • There are a lot of agricultural areas; e.g. Bishop pumpkin farms. • There is a subdivision (edge of the city with Jasper Lane), nearby to an existing Wheatland neighborhood, in the annexation zone. • There is a retiree population associated with Beale AFB.
Education Sector (03/03/2021) Patrick Brose, Camptonville Elementary School District Superintendent Tawny Dotson, Yuba College President	
Input/Perspective from Sector/Jurisdiction	*Needs/Potential Demand*
Yuba College: • The IT team has been trying to extend the WiFi signal from the school within school property, but weather (summer) is a consideration for student parking. • Wireless hotspots have been checked out. Other students drive down to campus.	Camptonville Elementary School District and the community it serves • Lots of canyons and rugged terrain, no cell phone service. Heavy forested. • There is communication in town in Grass Valley. • Coming from Grass Valley, no cell service outside of Nevada County.

• There is an AT&T backbone of 10Gbps - Campus to Woodland. Xfinity 1 Gbps backup backbone. • Camptonville Elementary School District. • There is capacity for 500 users and there are only 50. • Uses E-rate. • Current issue is connectivity for user devices when they are not in campus. • There is a fiber optics connection - Gigabit line for 500 users.	• Hotspots from major carriers don't work. • Most people still rely on old copper phone lines. • There is an AT&T Center in the town, across the street from the school. It has beam dishes with a direct signal from the valley. Fiber line to the Center, and if you live a quarter mile you can get DSL service. • Some have tried HughesNet, but the barrier is the data cap, plus it's very expensive. • One of the teachers is part of the beta test for Starlink (Elon Musk). • Community is open to different things, including Starlink. • Issue of bringing power to towers? (check power grid footprint). • Dream scenario: 100 Mbps stable connection with no data caps. • Student drop-off: Out of 50, there about 10 they don't see ever, and 30 they see consistently. Yuba College: • (CARES) Subsidies for the internet are not helpful, because there is no internet available to pay for. • Due to the pandemic, saw about a 20% decline in enrollment. • 20% or less online classes prior to pandemic. 95% of them online during the pandemic; will continue to primarily be in distance education for at least another year. • There is Verizon and Sprint. • Some students could not get internet from hotspots-CARES hotspots are not sustainable. Communities with connectivity issues: • Sutter (borderline) • Browns Valley • Loma Rica • Up in the hills • Sierra Foothills • Linda • North of Yuba County and Marysville

Local Broadband Stakeholders - Beale Air Force Base (3.4.2021)
Robert Lala, DAFC, 9 RW A7I
Michael Ladarola, Lt Col USAF ACC 9 RW/A6

Includes additional follow-up information provided by Housing Manager and Community Planner

Input/Perspective from Sector/Jurisdiction

- Major potential customer for broadband at Beale AFB is residential; government network rides a different backbone (its own backbone), although there is potential in the future that we will rely more on commercial → more and more demand on the base to link to commercial broadband ("dirty internet"), to supplement government backbone - DoD conducts infrastructure inspections. There is a need to increase capacity.
- 500 families on base, 15,000 people in privatized base housing would be primary beneficiaries; current service is Verizon. Commercial internet service is for residential subscribers. AT&T service is not operational. Verizon put up the tower, and they are leasing the land from the base.
- UARC - University Affiliated Research Center that will partner with the University of California system → need for broadband here, although a portion of the building may rely on the Air Force system. UARC will conduct research and design. Moving to the planning stage.
    - In the Wheatland area, off Spenceville Road.
- Developers planning to build 5,000 new houses (potentially around the Wheatland annexation area).
- Other broadband gap that can be filled by commercial broadband:
    - Installing purple air sensors to measure particulates → these need to be connected to open-source internet.
    - Other commercial off the shelf systems available to the private sector → a lot of this could feed back to the base.
- Residential Internet service is currently provided through Comcast/Xfinity, Hughes Net and AT&T. For families that choose not to use Comcast/Xfinity, they can go through Dish Network or Direct TV which utilizes AT&T for internet service. Current service is cable modem.
- All residents have access up to 10GB or depending on provider.
- More choices are always great; however, I believe current service with Comcast has been satisfactory. Other companies are not able to provide the level of service due to their delivery i.e. satellite internet such as Viasat.
- Mobile service is available in the residential area. However, just as it would be off-base it depends on your provider. Providers include T-Mobile/Sprint, AT&T, Xfinity, Verizon, & Cricket. There may be a few more or less popular options. The installation of Beale AFB Home's T-Mobile's (merged with Sprint) tower once complete should deliver a much better service. The completion for AT&T to run their fibers should be done any day now.
- There are empty utility poles along Camp Beale Road and in the areas where they destroyed the housing units to the South of Gavin Mandary Road. Most all of the current access to housing is through underground conduits. I don't know their capacities, but would think there is room for more. Any use of them, or water towers, etc. would require a lease.
- Comcast and AT&T have the current leases for cell towers and underground conduits in the housing area. There is also the new Verizon cell tower lease going into the hospital. They do not go into the housing area at this time.

Business Sector (03/26/2021)
Business Sector (03/26/2021) **Marni Sanders, Yuba/Sutter Economic Development Corporation** **Jackie/Brynda Stranix, Yuba/Sutter Economic Development Corporation**
Input/Perspective from Sector/Jurisdiction

- At the Chamber, they don't get feedback from businesses regarding internet activity; not an area they've had a lot of focus on.
- Most of the flatlands of the county are pretty well-served, but the foothills are struggling; no access to email and other regular functions.
- Other areas of concern:
    - Northern Yuba-Butte County line; foothills in District 10 in Yuba County (North of Marysville), area around airport.
- No complaints about price; speed and reliability is the issue.
- Projected new commercial areas in the next few years:
    - Everything in the Olivehurst area, South of Wheatland, is prime for commercial development.

Farming and Agriculture Sector (04/01/2021)
Farming and Agriculture Sector (04/01/2021) **Whitney Brim-De Forest, UCANR County Director, Sutter-Yuba Counties, UCCE Rice Advisor (Sutter, Yuba, Placer and Sacramento Counties)**
Input/Perspective from Sector/Jurisdiction

- Two areas of need:
    - In the fields, reliance of devices connected through satellites or cell phones.
    - Offices based in rural areas that don't have broadband.
- A lot of people don't have access to internet where they are (really, anywhere outside Marysville).
- In the industry, there is a movement towards more high-tech Ag.
    - There are databases that cannot be accessed without internet. E.g. Data for pest advisors.
    - GPS-connected smart trackers (tractors, airplanes, drones).
    - Nowadays, machinery is all connected.
- The Rice Lab facility experienced internet blackouts.
- There is a Rice Experimentation (multi-million) facility South of Chico.
    - It has broadband connectivity - Perhaps cable.
    - Providers in the area: Succeed.Net and AT&T.
    - 30-40 staff.
- Office in Yuba City (Sutter County) required connection across the street. Original broadband service was AT&T but switched to Comcast-Xfinity (across the street deployment cost $ 10k).
- Some growers, and also research and state organizations, use sensors in the farm fields.
    - A lot of these are manual, some are cloud based.
    - Sensors are used for rainfall and humidity data (mostly research-related, or state regulatory agencies).

- Soil or moisture probes (although it may be pest controllers and not growers who are using this).
- Other potential tech users include rice mills and food processors-Equipment in the mill process.
- Ag flying and flying company - Pilots.

<div style="background-color:green">

Education Sector (04/15/2021)
Amy Nore, Communications Coordinator at Yuba County Office of Education
Bryan Williams, Director of Technology at the Marysville Joint Unified School District
Craig Guensler, Superintendent at Wheatland Elementary School District
Francisco Reveles, Superintendent of Schools at Yuba County Office of Education
Gary Cena, Superintendent at Director of Technology at the Marysville Joint Unified School District
Jeff Roberts, Superintendent at Plumas Lake Elementary School District

Needs/Potential Demand

</div>

- Major issue with home connectivity, especially low-income households.
- Deployed CARES 1,000 hotspots. They worked well in the valley.
- Hotspots provide service through 3 providers: T-Mobile, AT&T and Verizon.
- Textbooks are now digital in computers.
- Distance learning is now a fundamental part of education.
- Teachers need connectivity for the future.
- Another connectivity issue is related to the power safety shutdown.
- Towers are expensive solutions ($400k) but maybe the solution is expensive.
- Areas with broadband gaps:
    - Marysville, heading up the foothills
    - Challenge-Brownsville
    - Loma Rica
    - Brows Valley
    - Dobbins
    - Hallwood
    - West Marysville
    - Olivehurst

- MJUSD:
    - E-Rate pays for 90% of the CENIC fiber lines; the schools themselves have great connection. There is 1Gbps connectivity to all schools.
    - Connectivity at school sites was good, the problem is at home.
    - Hard copies and material packages are not a feasible option for education.
    - Education needs to support distance learning and independent study.
    - During the pandemic, it partnered with three providers: T-Mobile, AT&T and Verizon.
    - Putting towers up is not feasible, because families in the area who cannot recoup those costs.
    - Satellite service is not great, and it's expensive.
    - Digital Path is available in some areas.
    - There is a lack of infrastructure; no amount of CARES dollars will fix this.

- Wheatland
  - In Smartsville, same issues as in MJUSD.
  - An issue is the high cost of a tower $400k.
  - School sent a driver with the equipment in the bus.
  - From packets to Google docs.

- Yuba County Office of Education
  - Ultimately, an equity issue; not a school issue, but a community and county issue.
  - What is needed is not tactical solutions, but a more strategic approach to the problem; the need to approach this demographically.
  - The need for state-level advocacy.

8.3 Full-Page Maps

Figure 62. Residential market concentration map in Yuba County.
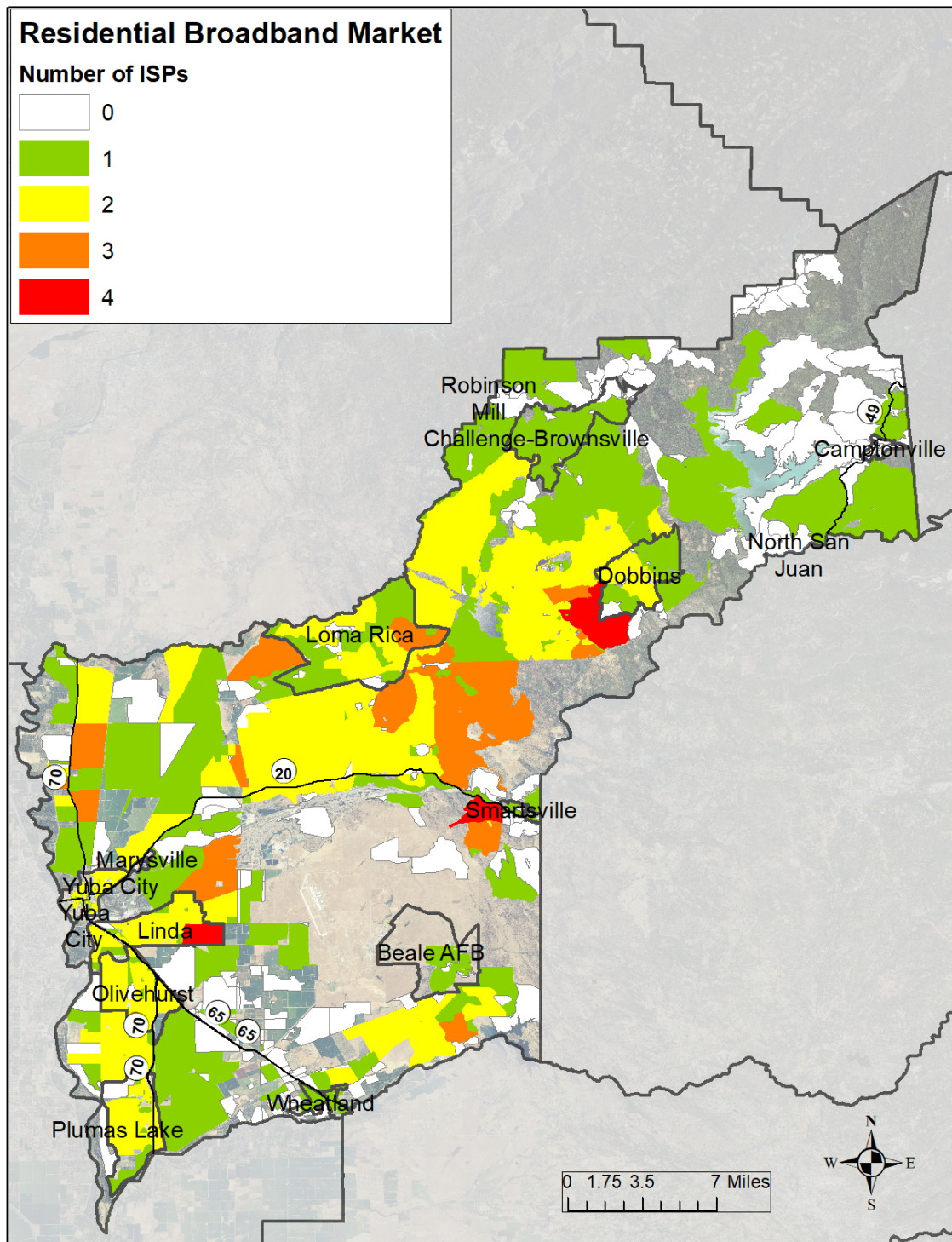
Figure 63. Coverage map at the different broadband speed standards including: 1) CA (6.1 Mbps), 2) FCC 25/3 Mbps, 3) CA Action Plan (100/20 Mbps), and 4) FCC Gigabit definition (1000/500 Mbps).
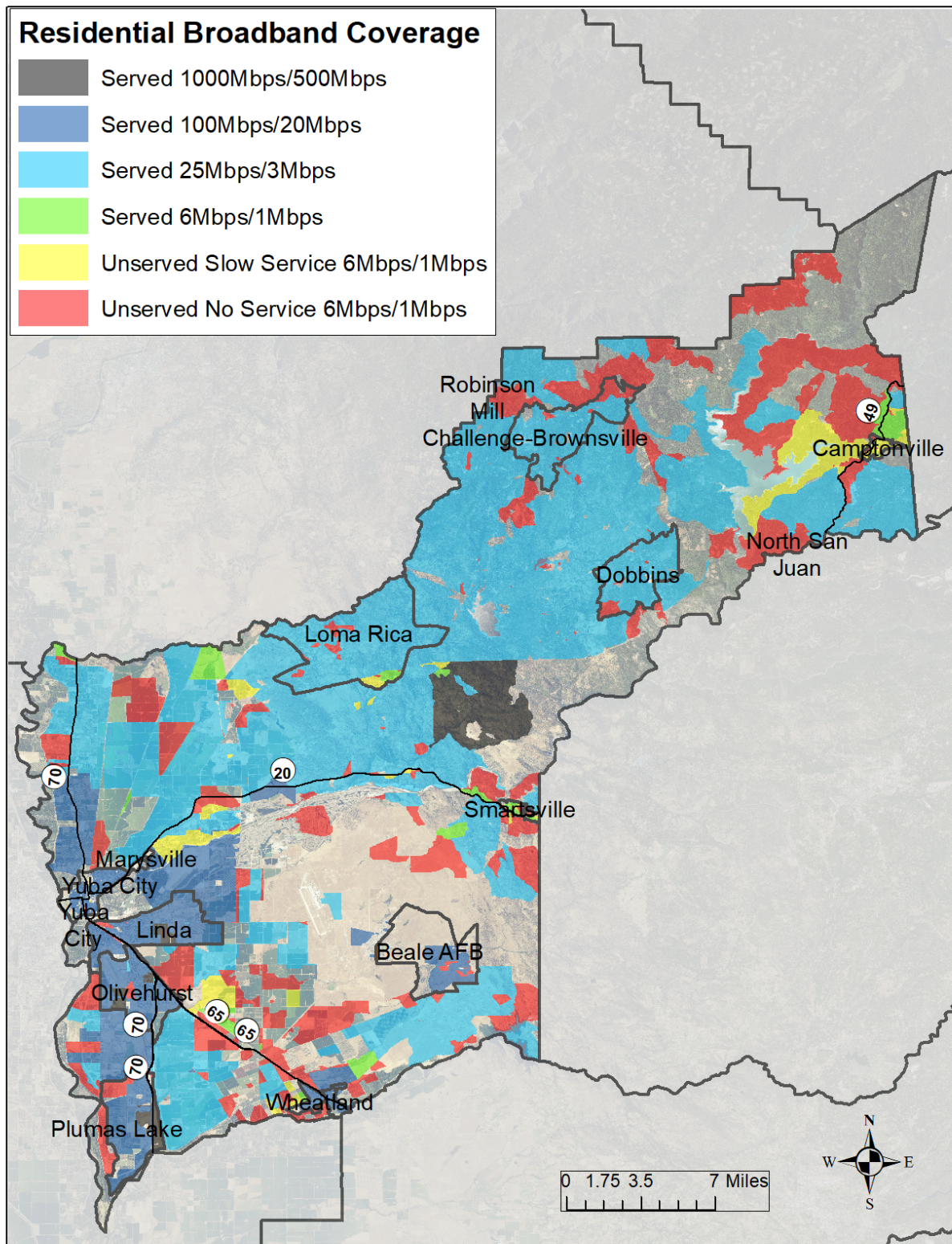
Figure 64. Coverage of the xDSL (ADSL2, ADSL2+, VDSL) technology in Yuba County.
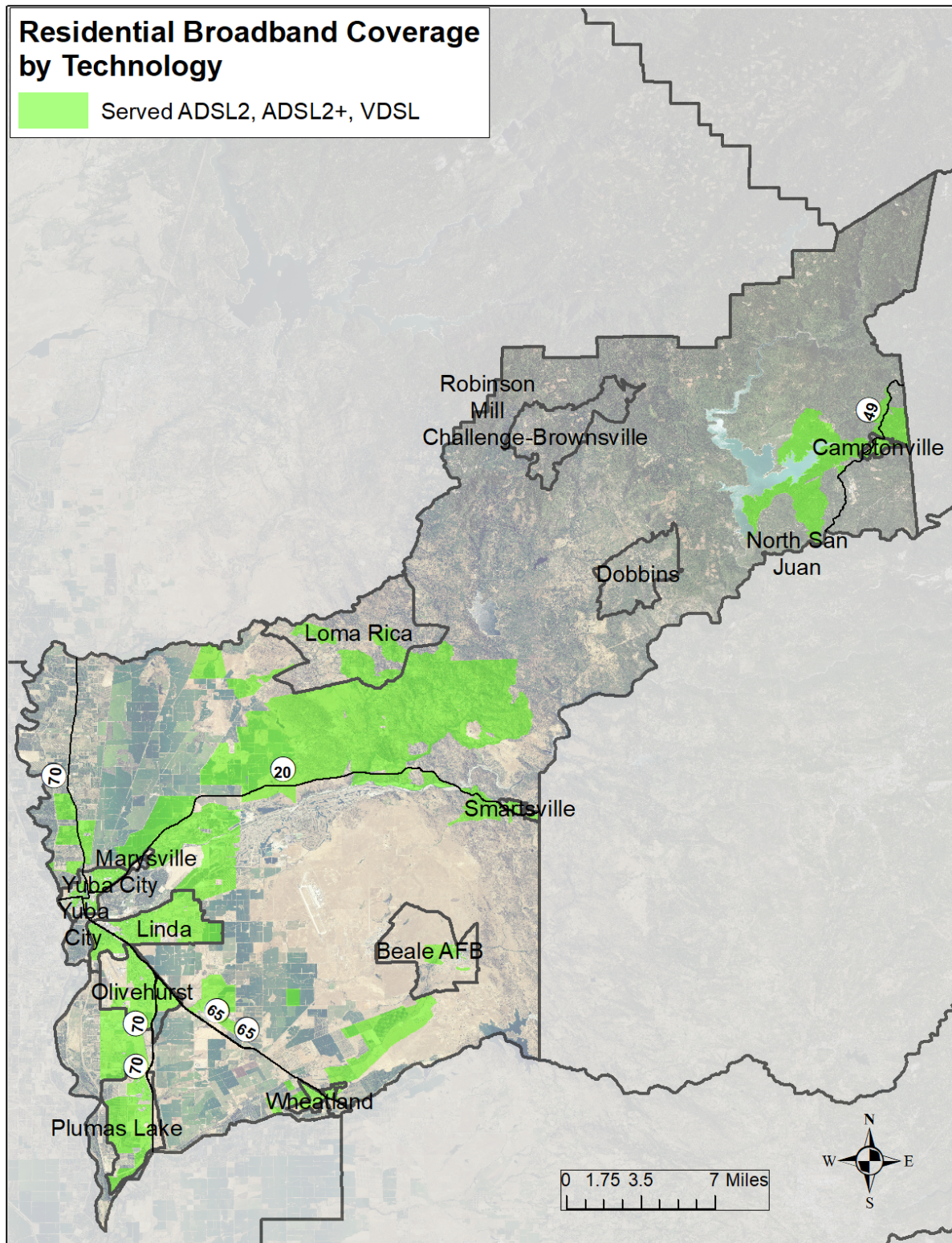
Figure 65. Coverage of the Cable Modem technology in Yuba County.
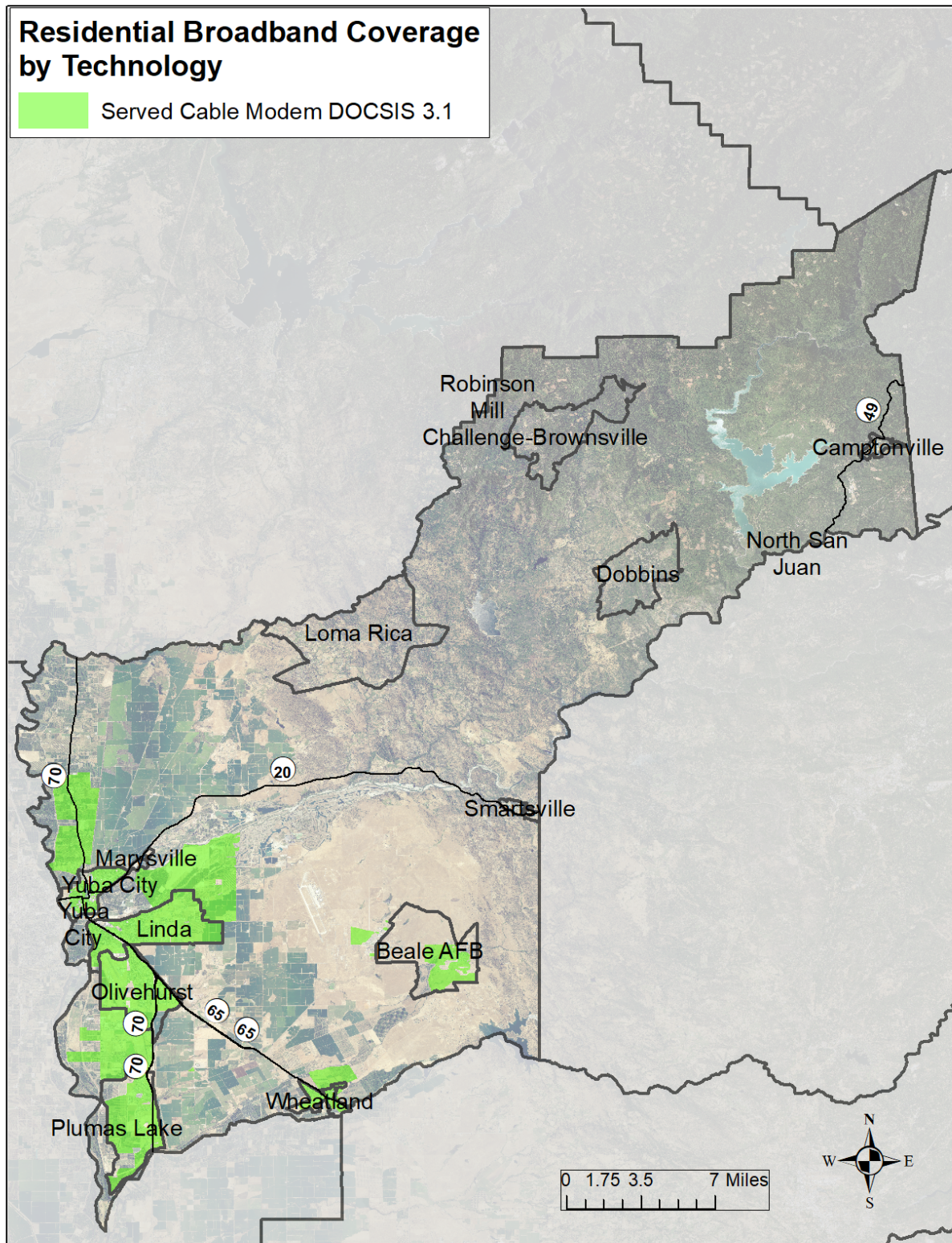
Figure 66. Coverage of the fixed wireless technology in Yuba County.
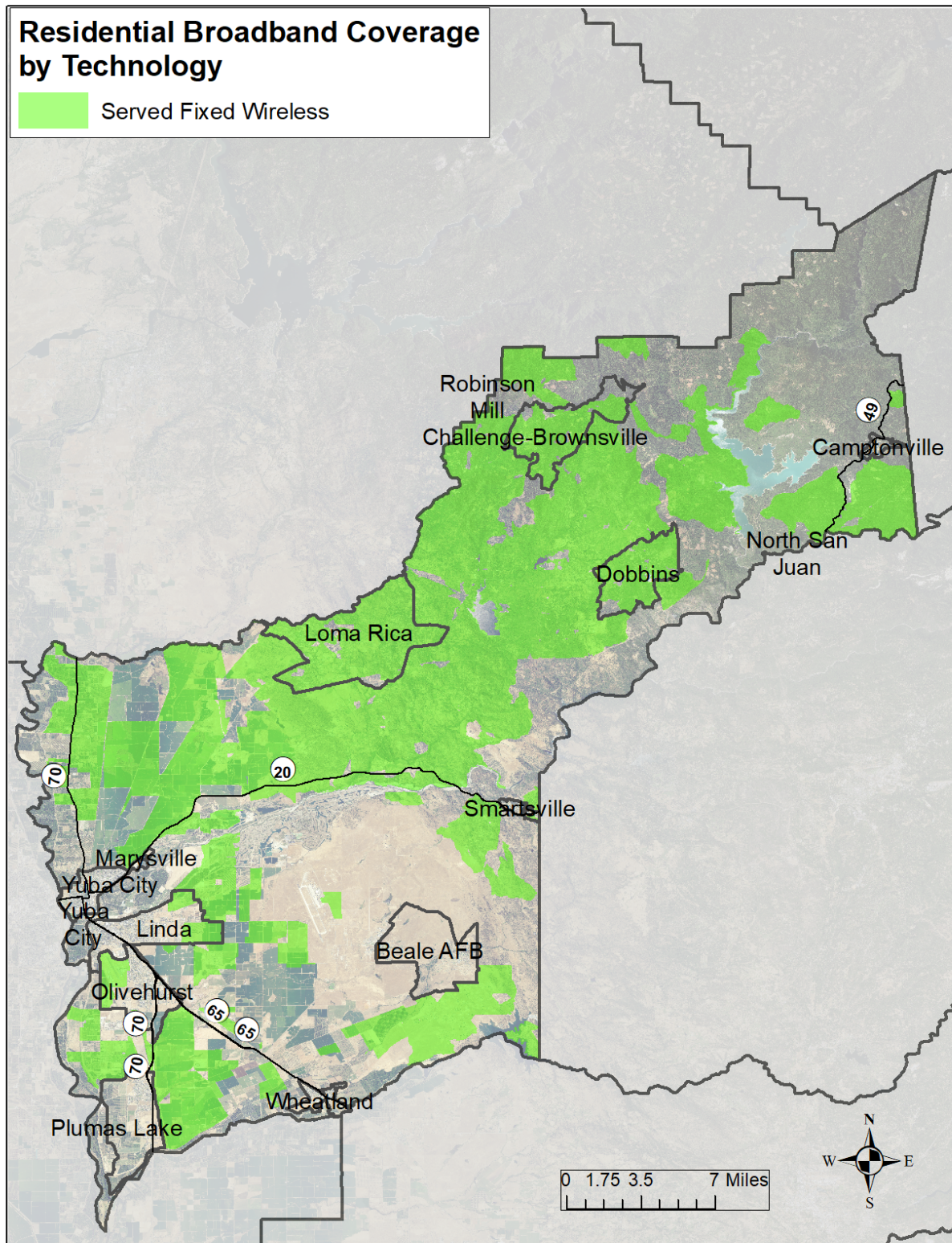
Figure 67. Coverage of the fiber-to-the-home (FTTH) technology in Yuba County.
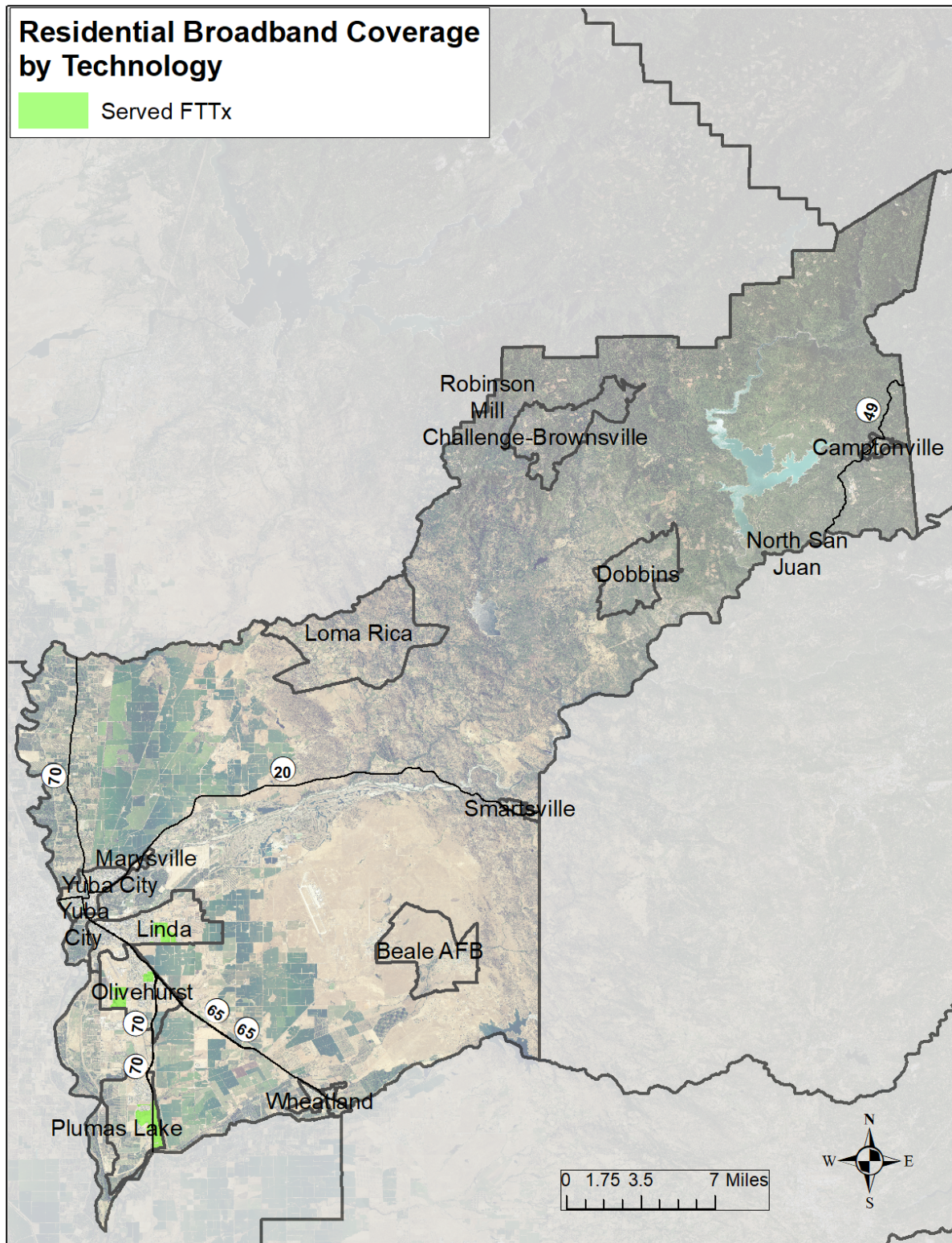
Figure 68. Aggregated LTE coverage map of the four carriers in the county.
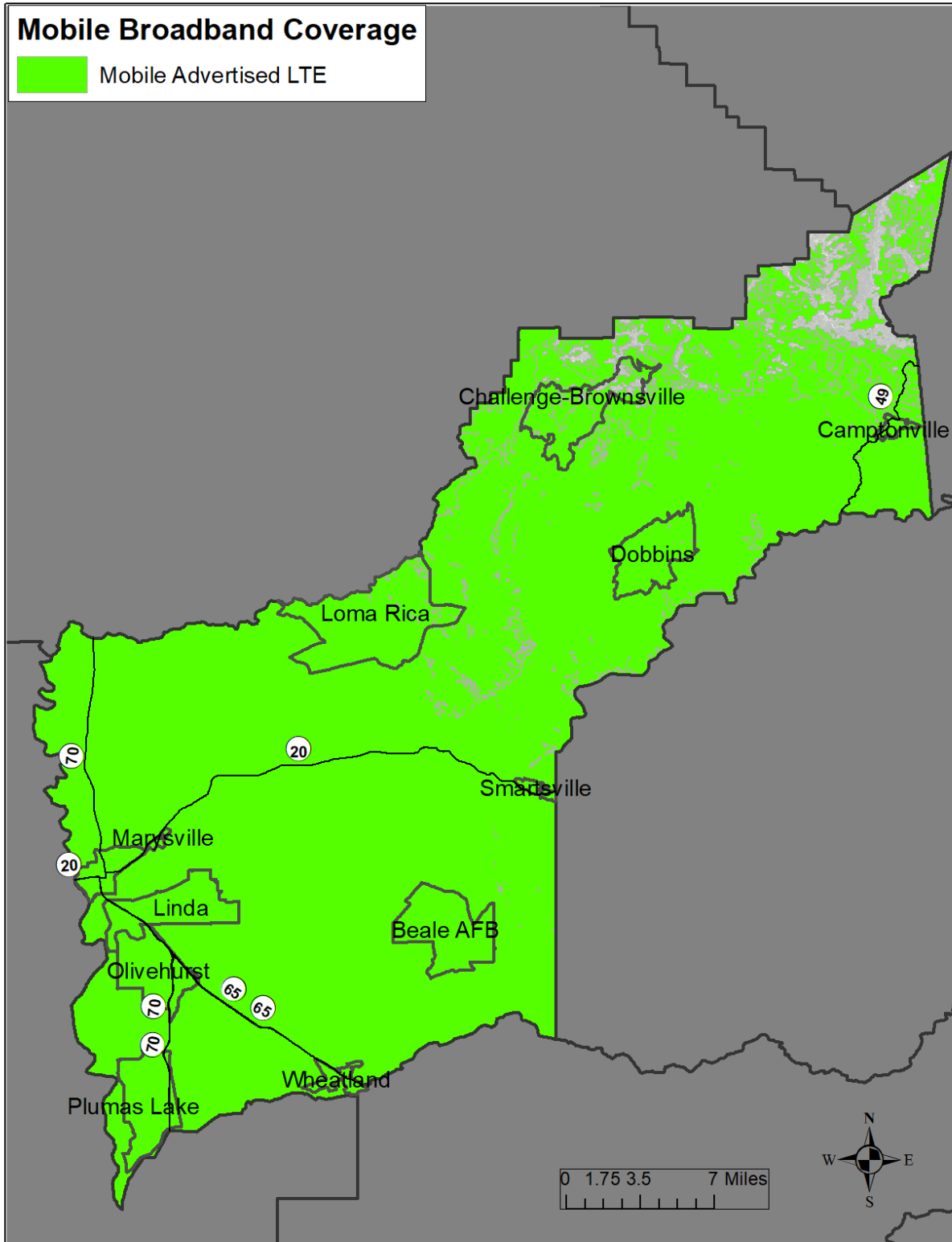
Figure 69. LTE coverage map offered by AT&T Mobility.
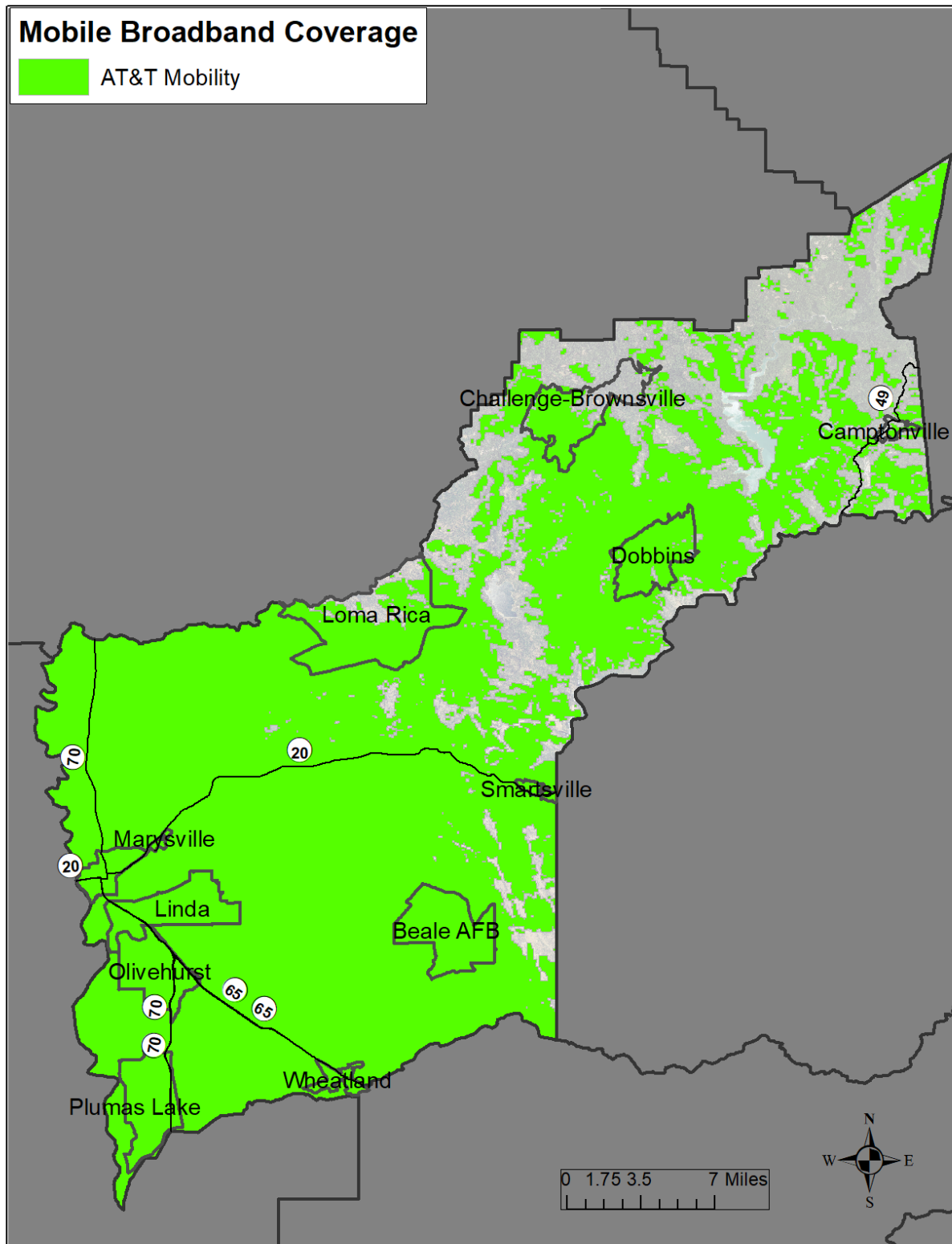
Figure 70. LTE coverage map offered by Sprint Communications.
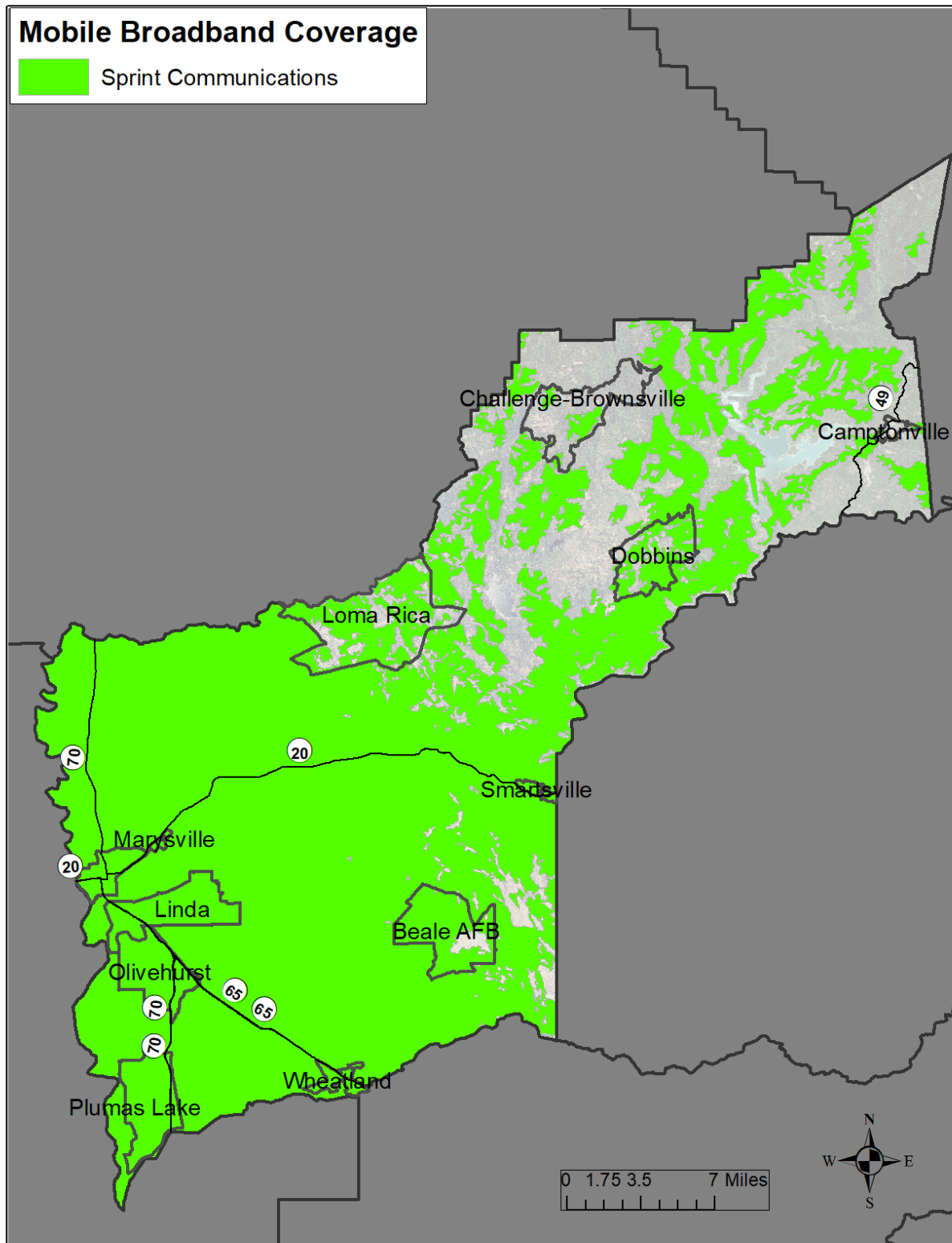
Figure 71. LTE coverage map offered by T-Mobile.
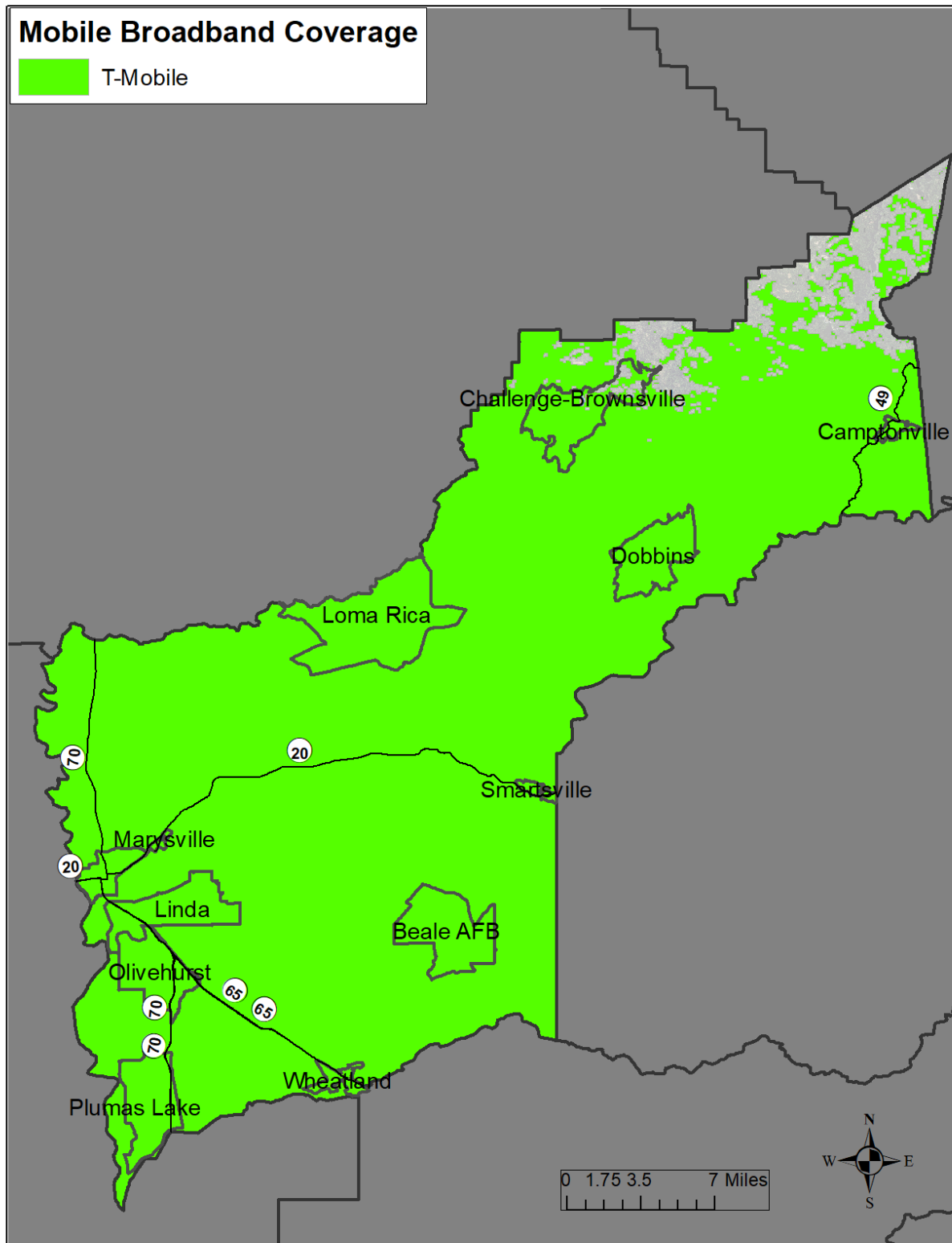
Figure 72. LTE coverage map offered by Verizon.
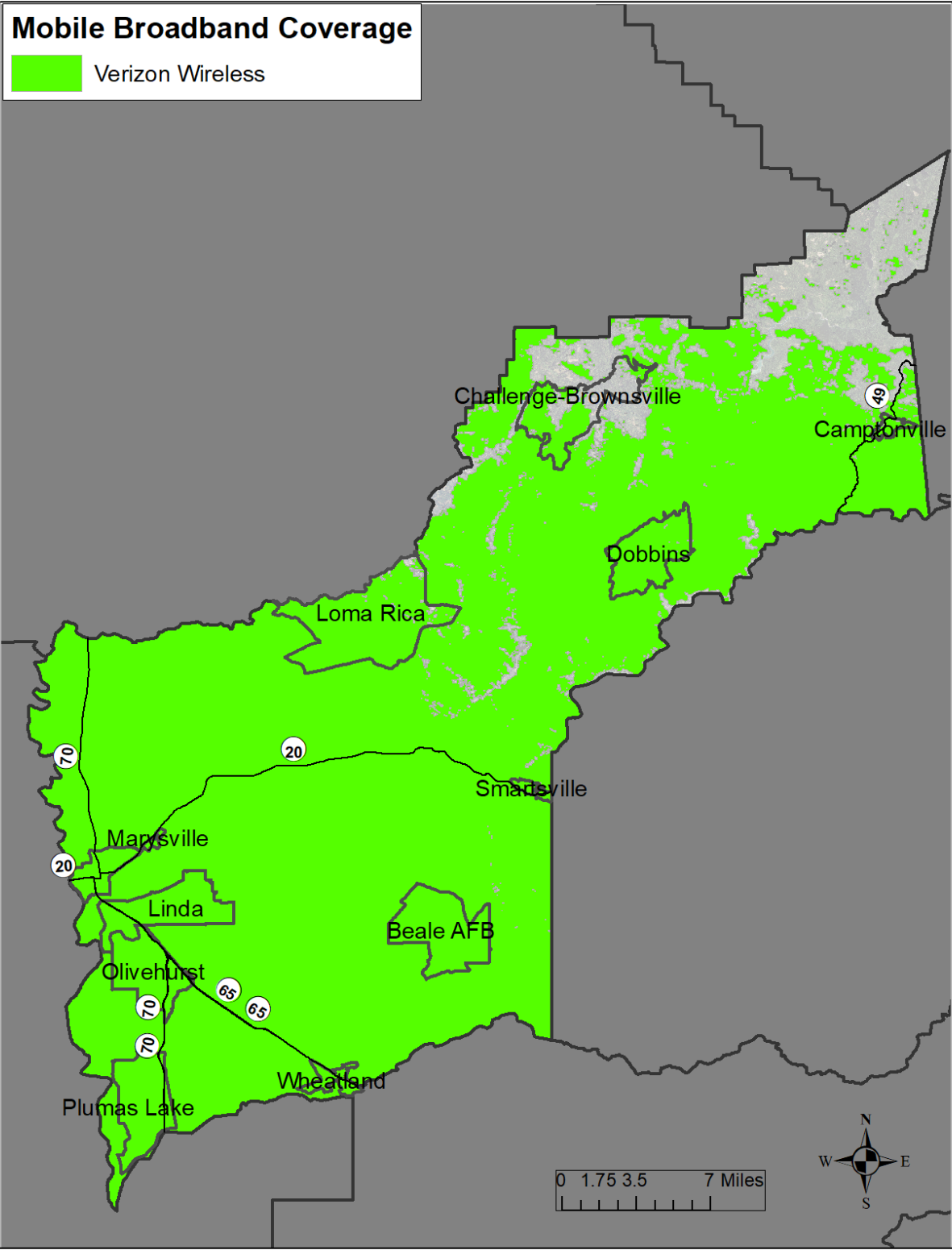
Figure 73. Business broadband coverage in Yuba County for two broadband speed tiers: 1) 100/20 Mbps, and 2) 1000/500 Mbps (FCC's gigabit definition).
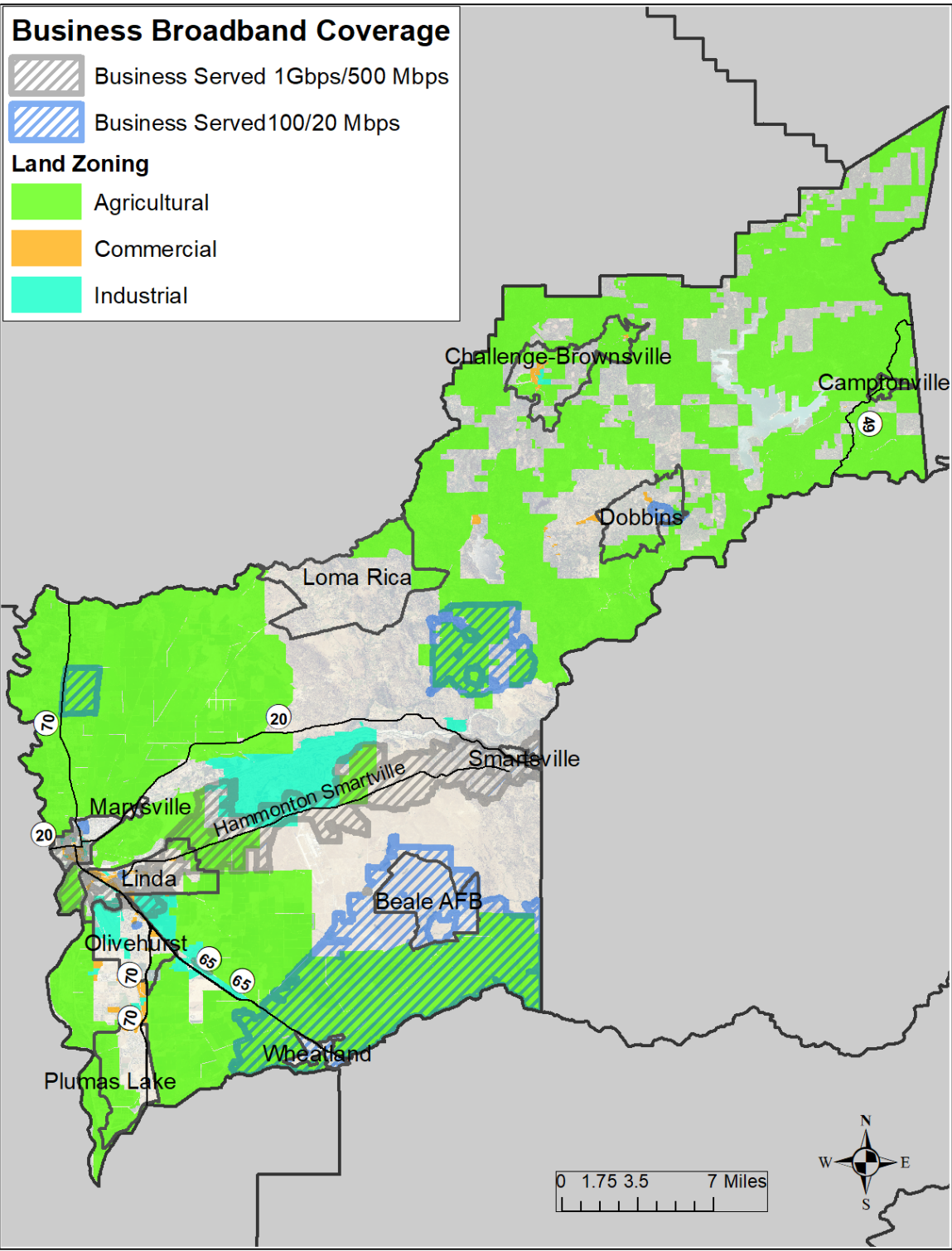
Figure 74. Cable modem coverage map for business customers.
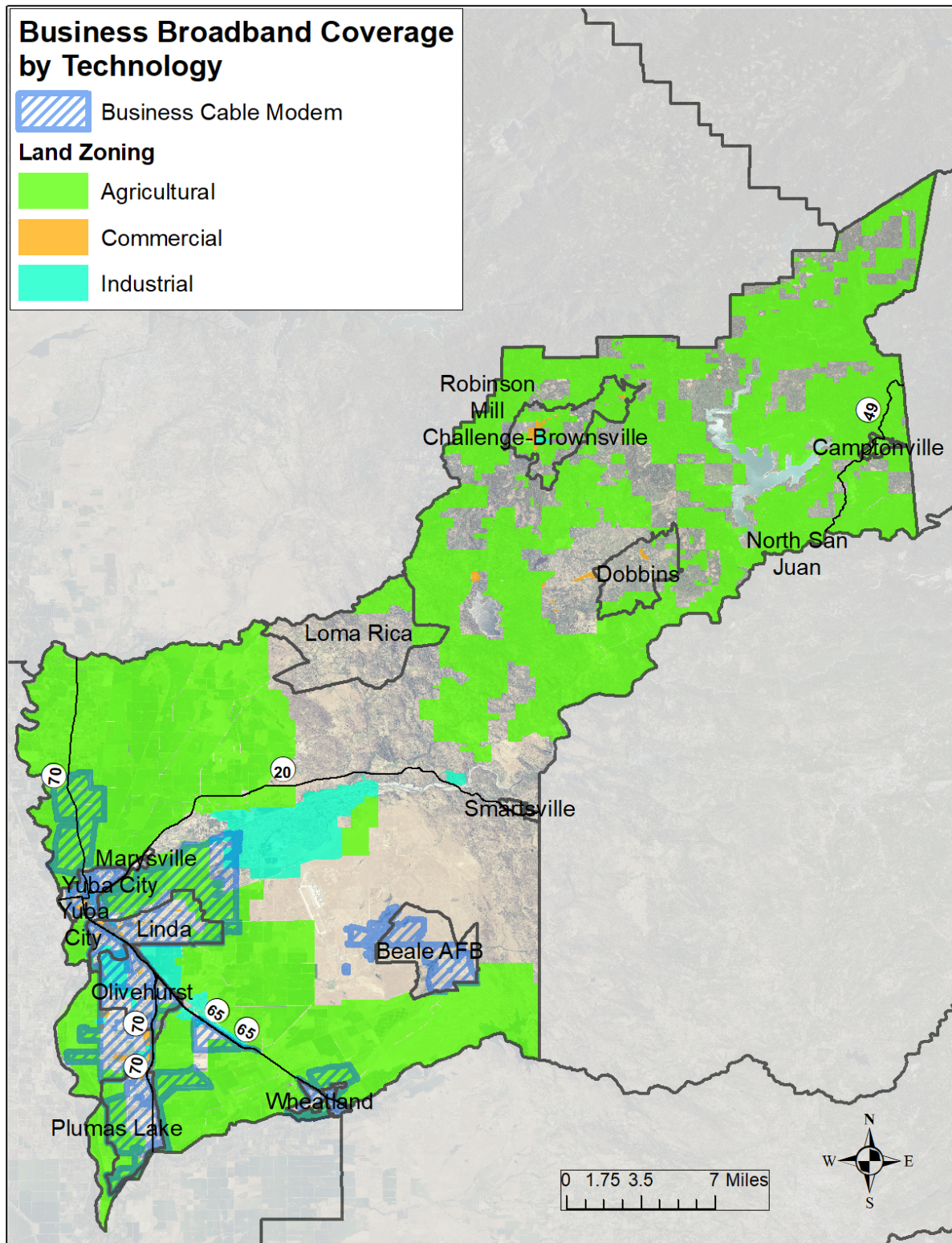
Figure 75. Coverage map of fiber-to-the-location (FTTx) service for business customers.
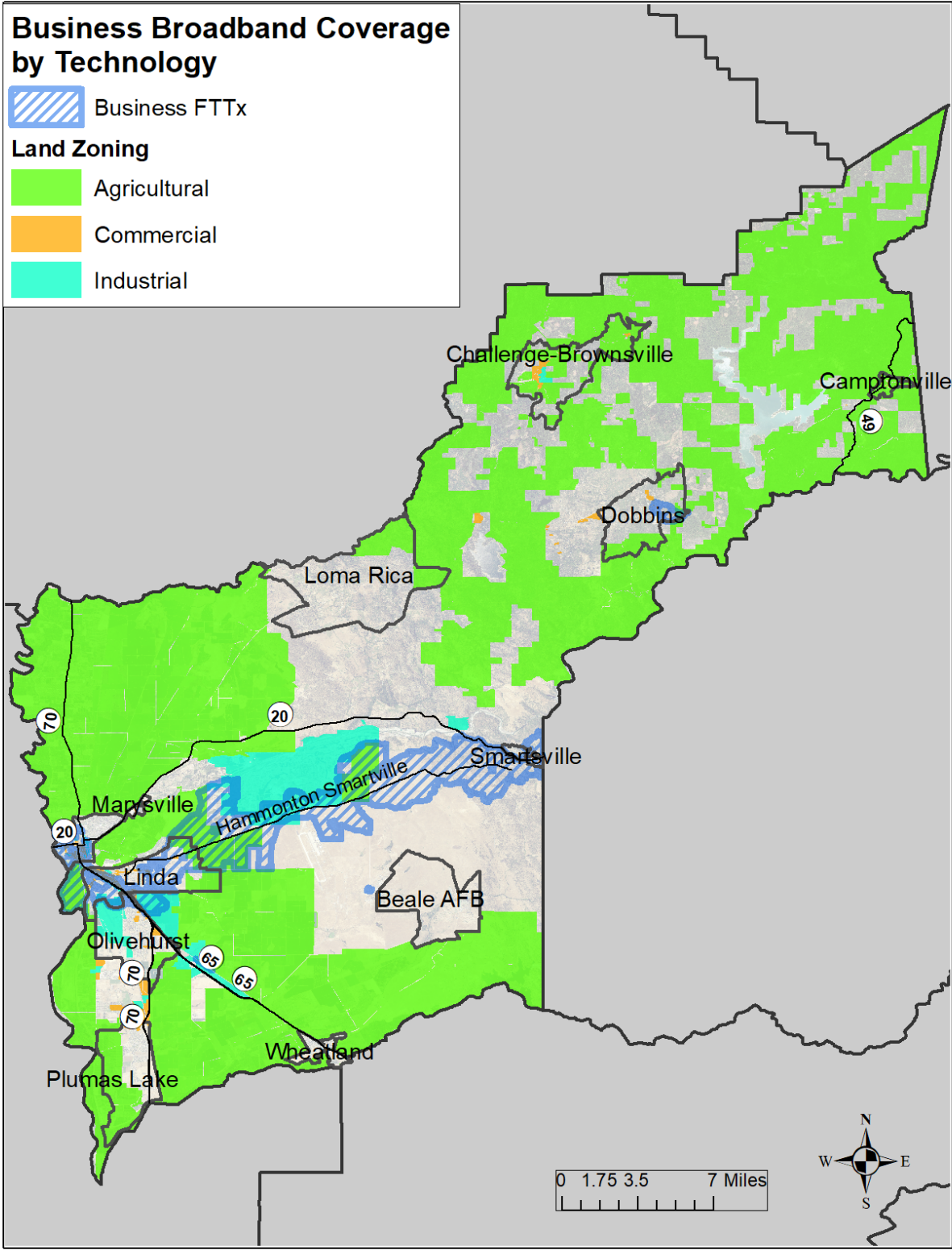
Figure 76. Fixed broadband coverage map for business customers at minimum speeds of 100/20 Mbps.
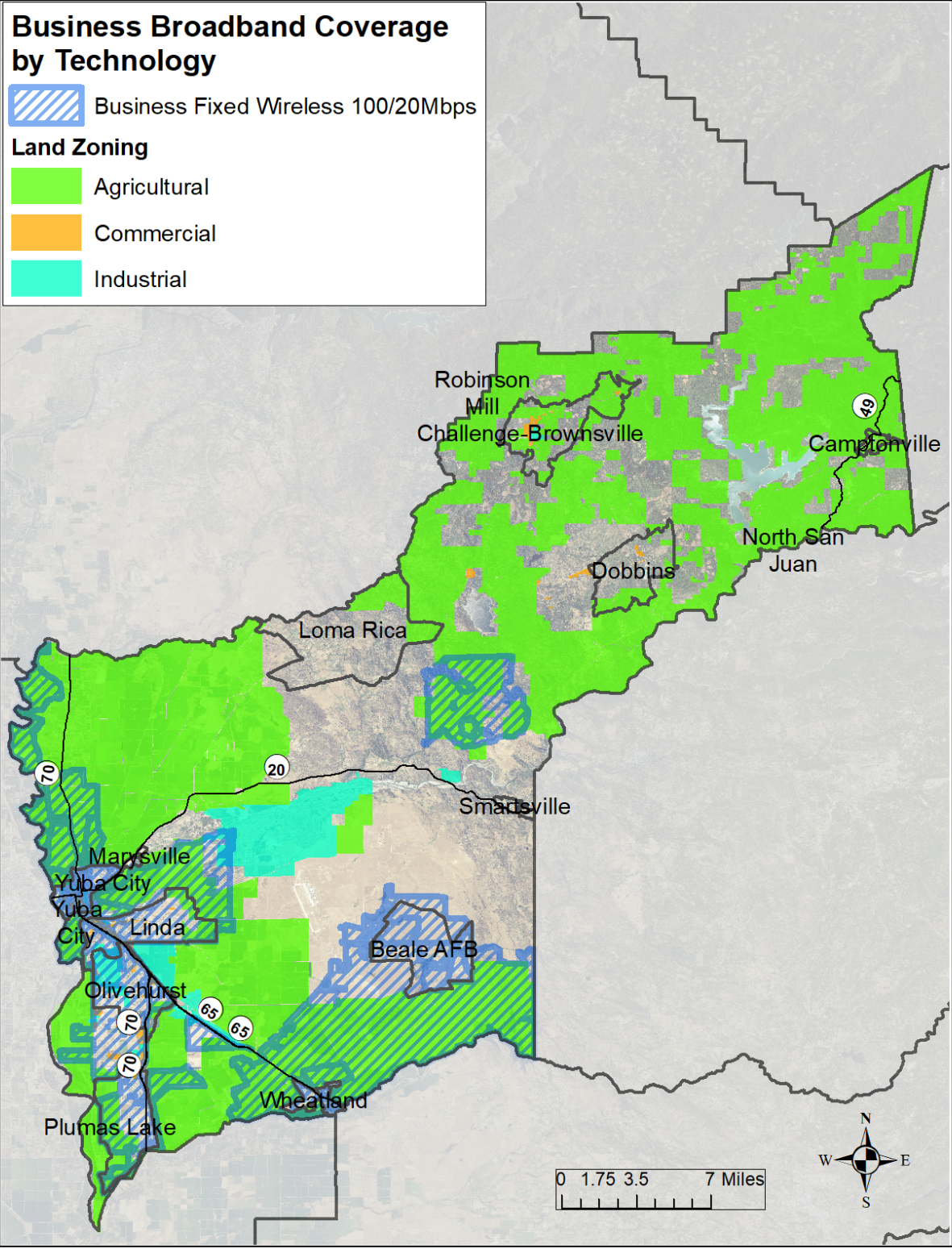
Figure 77. Middle-mile infrastructure (i.e., fiber-optic backbones) in the county offered by Frontier, Integra, Level 3, and Vast networks.
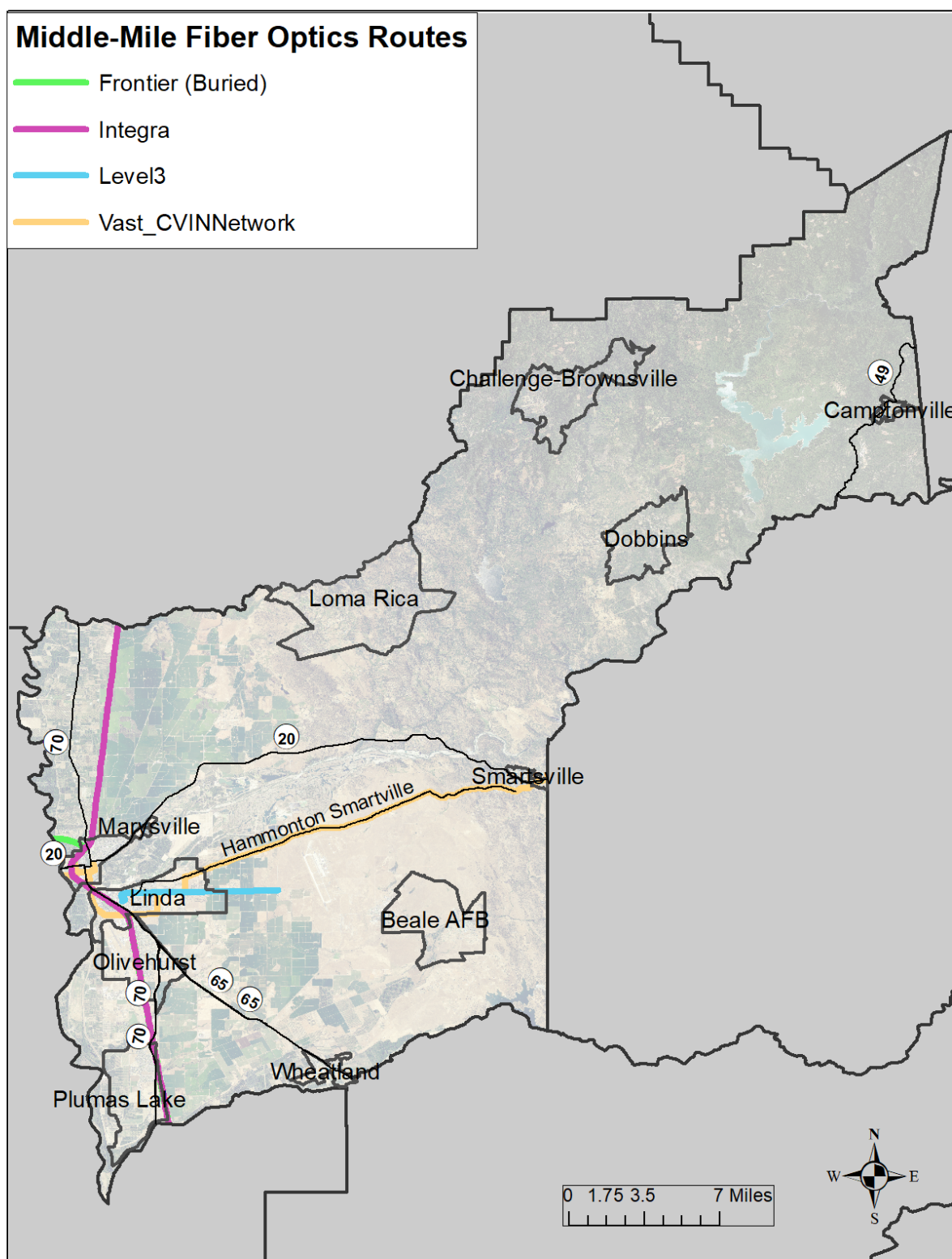
Figure 78. CalSPEED Fixed Test Results (2020-2021).
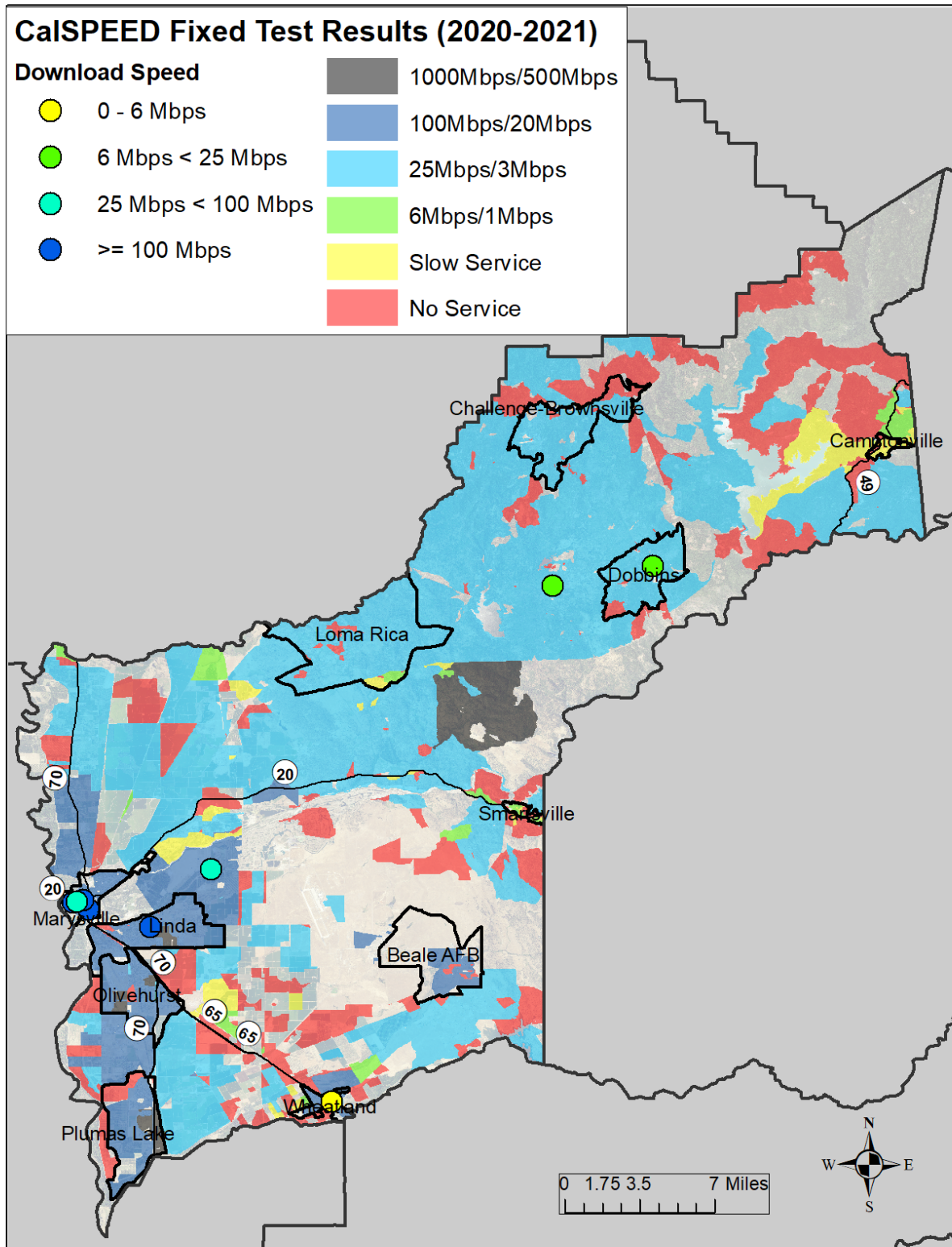
Figure 79. CalSPEED Mobile Test Results (2020-2021).
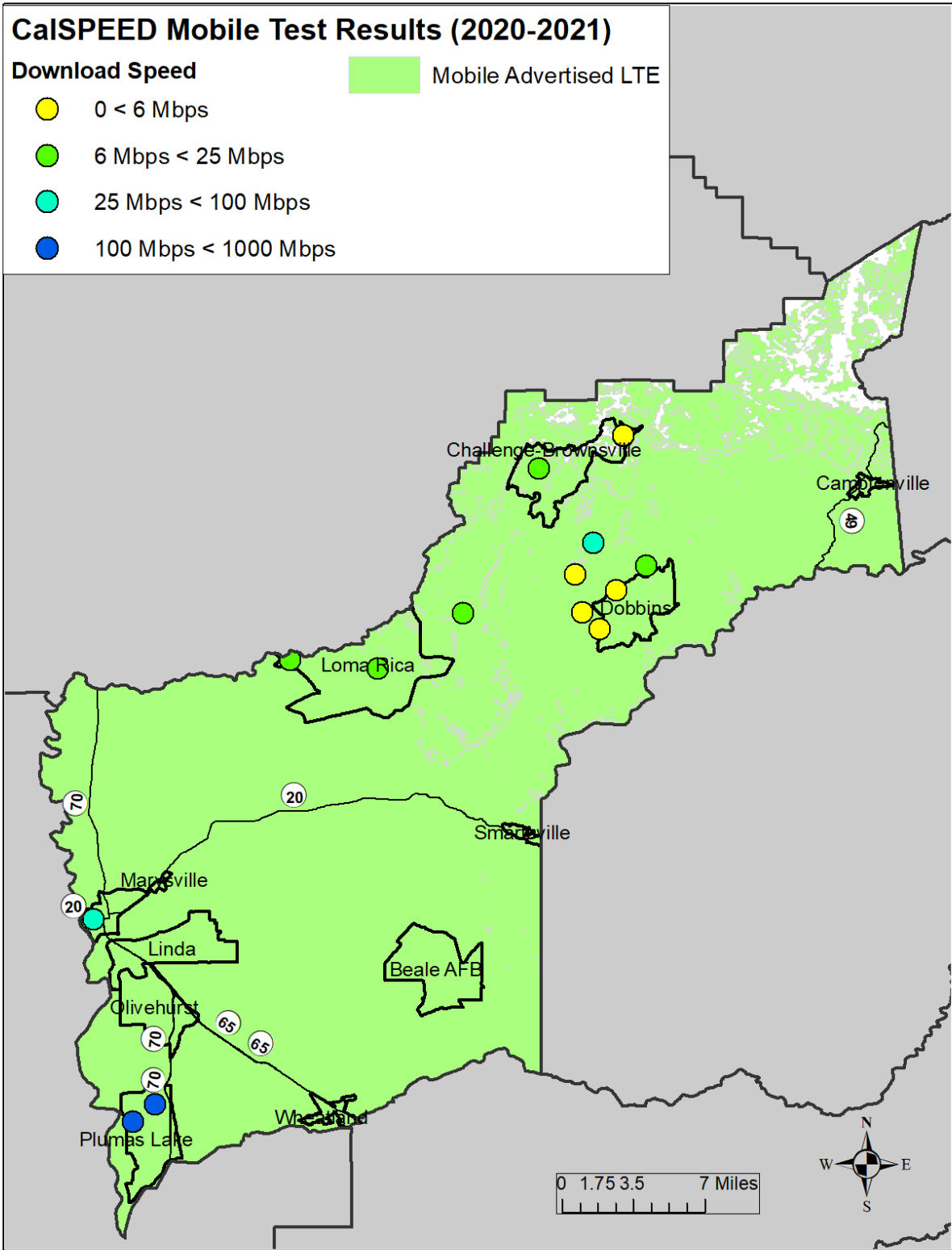
Figure 80. Business Broadband Survey Respondent Locations.
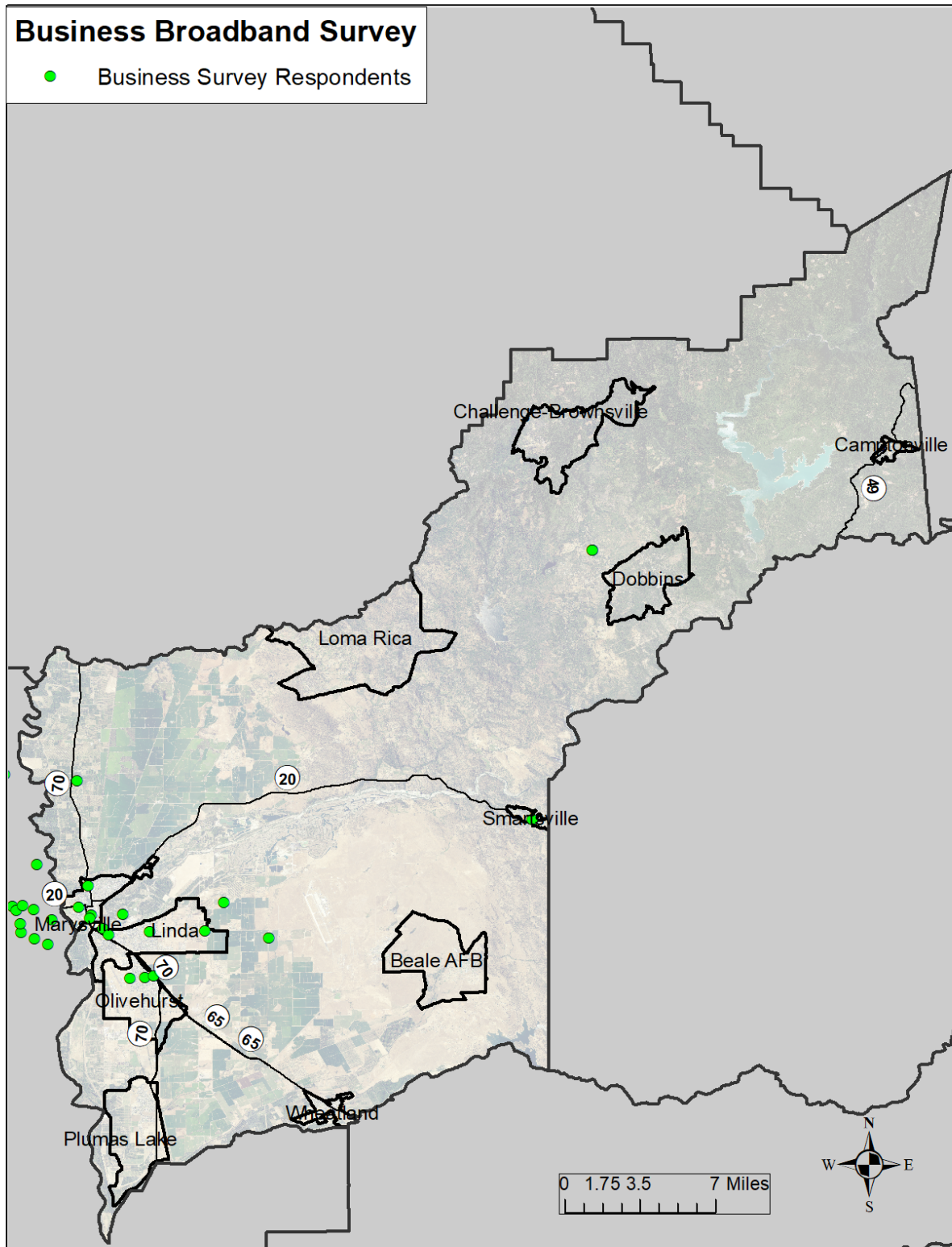
Figure 81. Unserved Areas at 25/3 Mbps per Census Block.
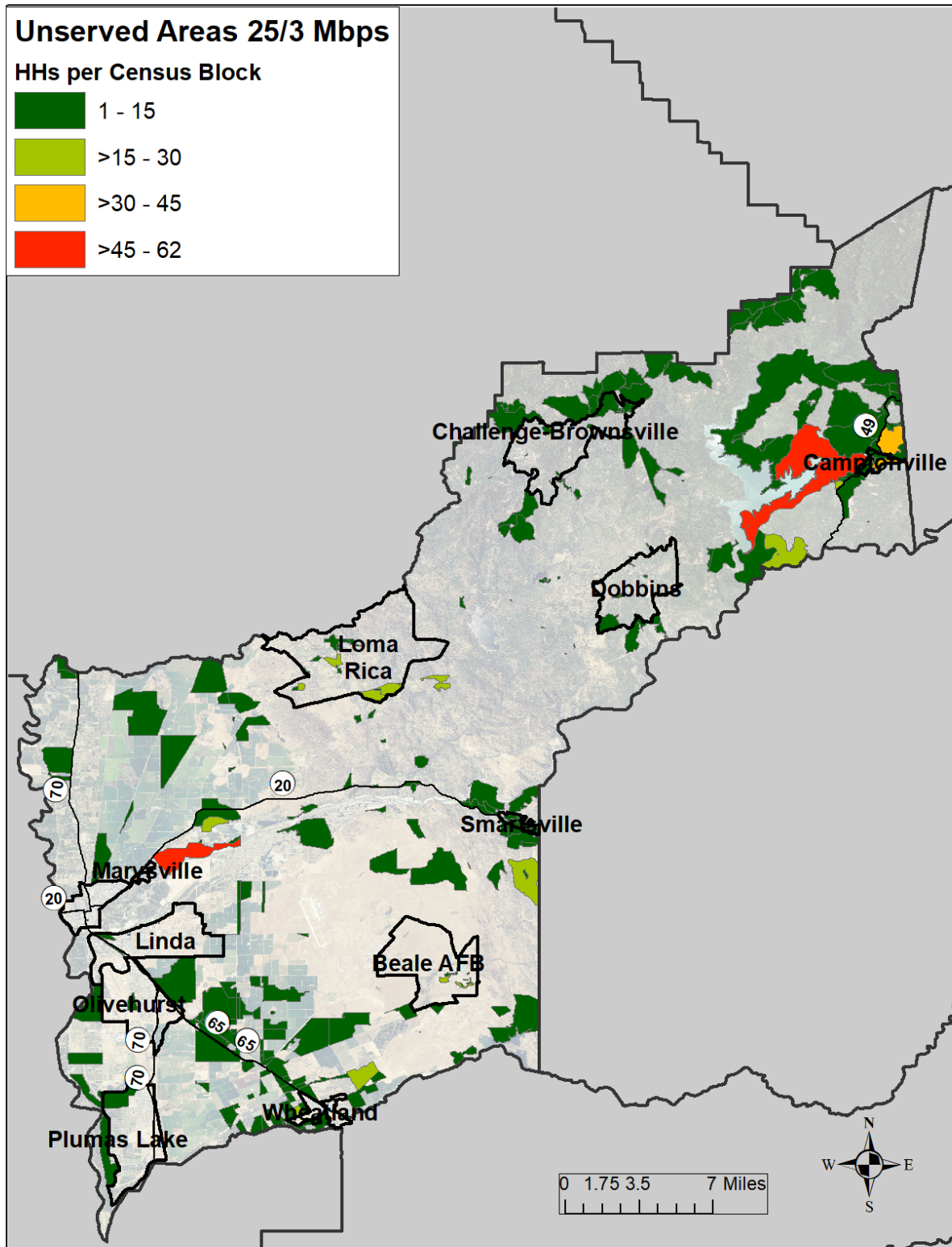
Figure 82. Unserved Areas at 100/20 Mbps per Census Blocks.
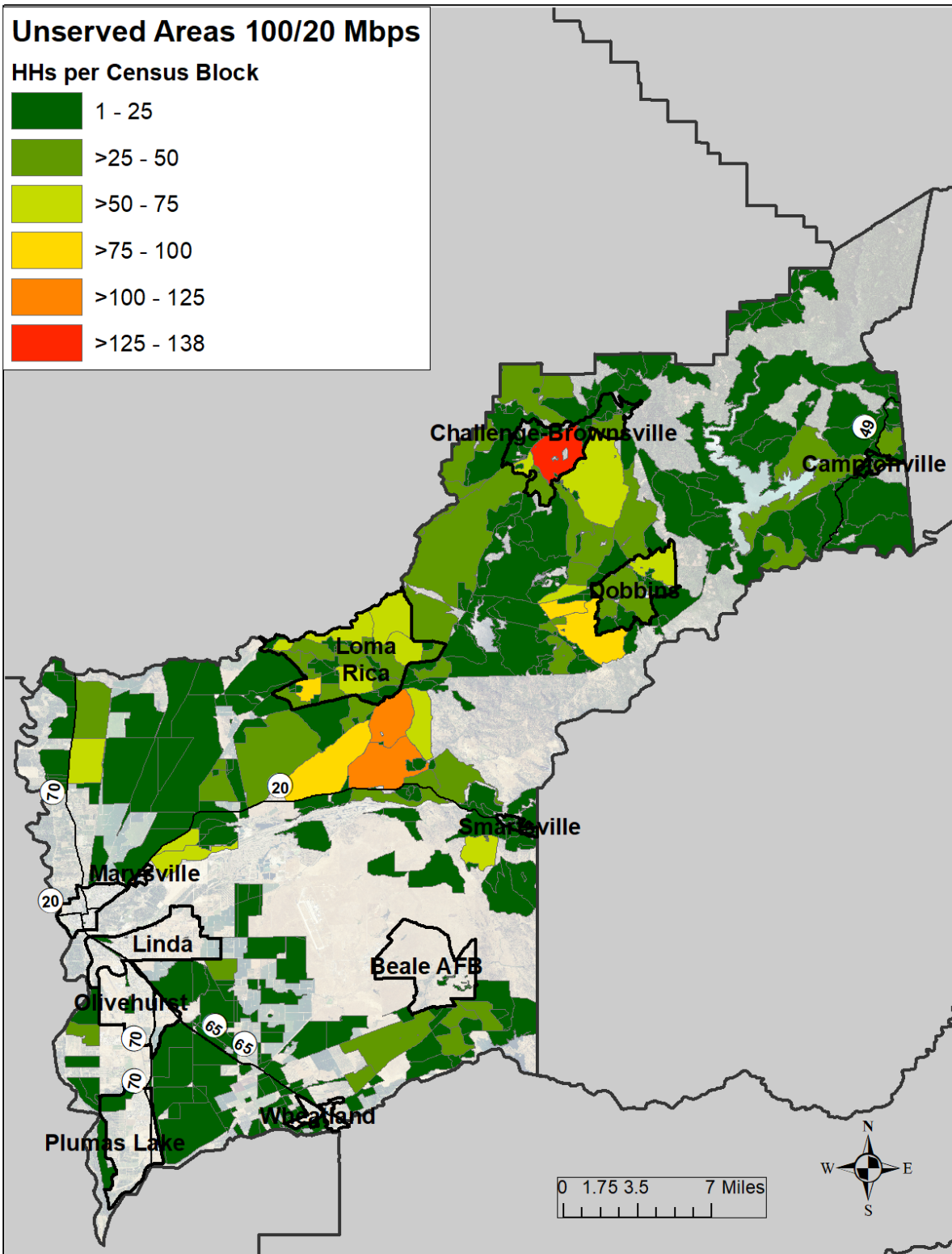
Figure 83. Unserved Areas at 1 Gbps/500 Mbps per Census Block.

Unserved Areas 1 Gbps/500 Mbps

HHs per Census Block

- 1 - 50
- 50 - 100
- 100 - 150
- 150 - 200
- 200 - 250
- 250 - 287
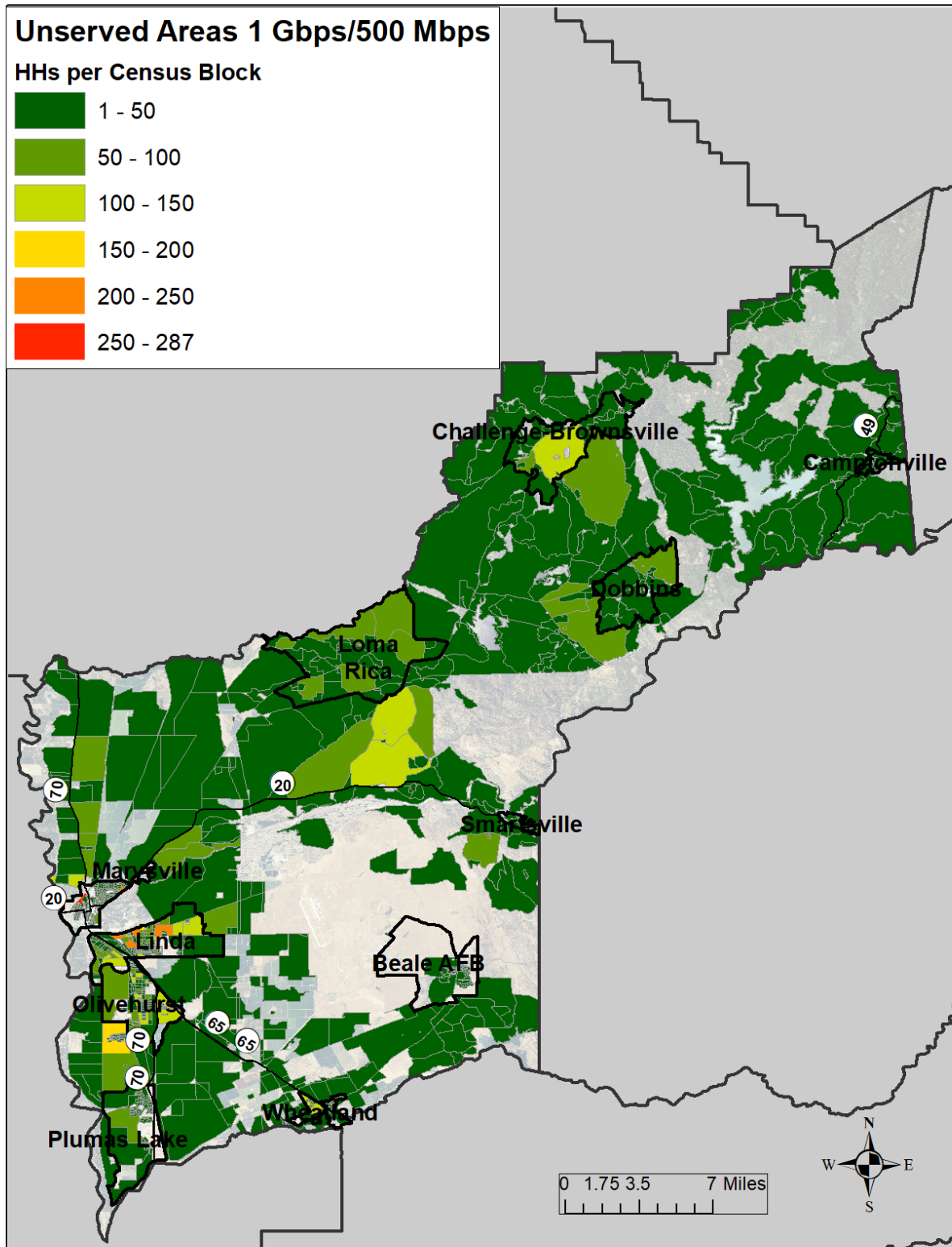
Figure 84. Residential Unserved Priority Areas in Yuba County.
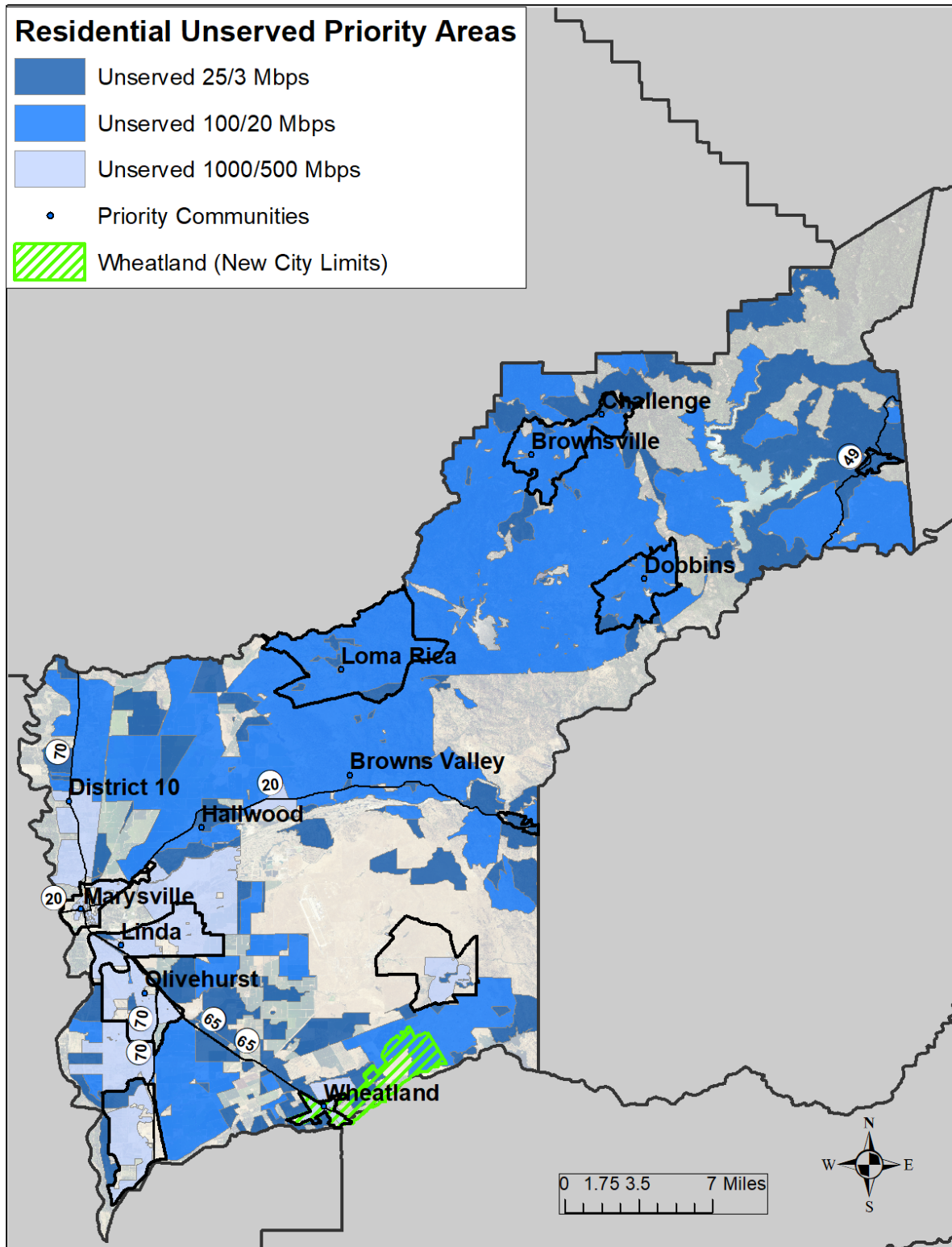
Figure 85. CalSPEED Mobile Coverage Priority Areas.
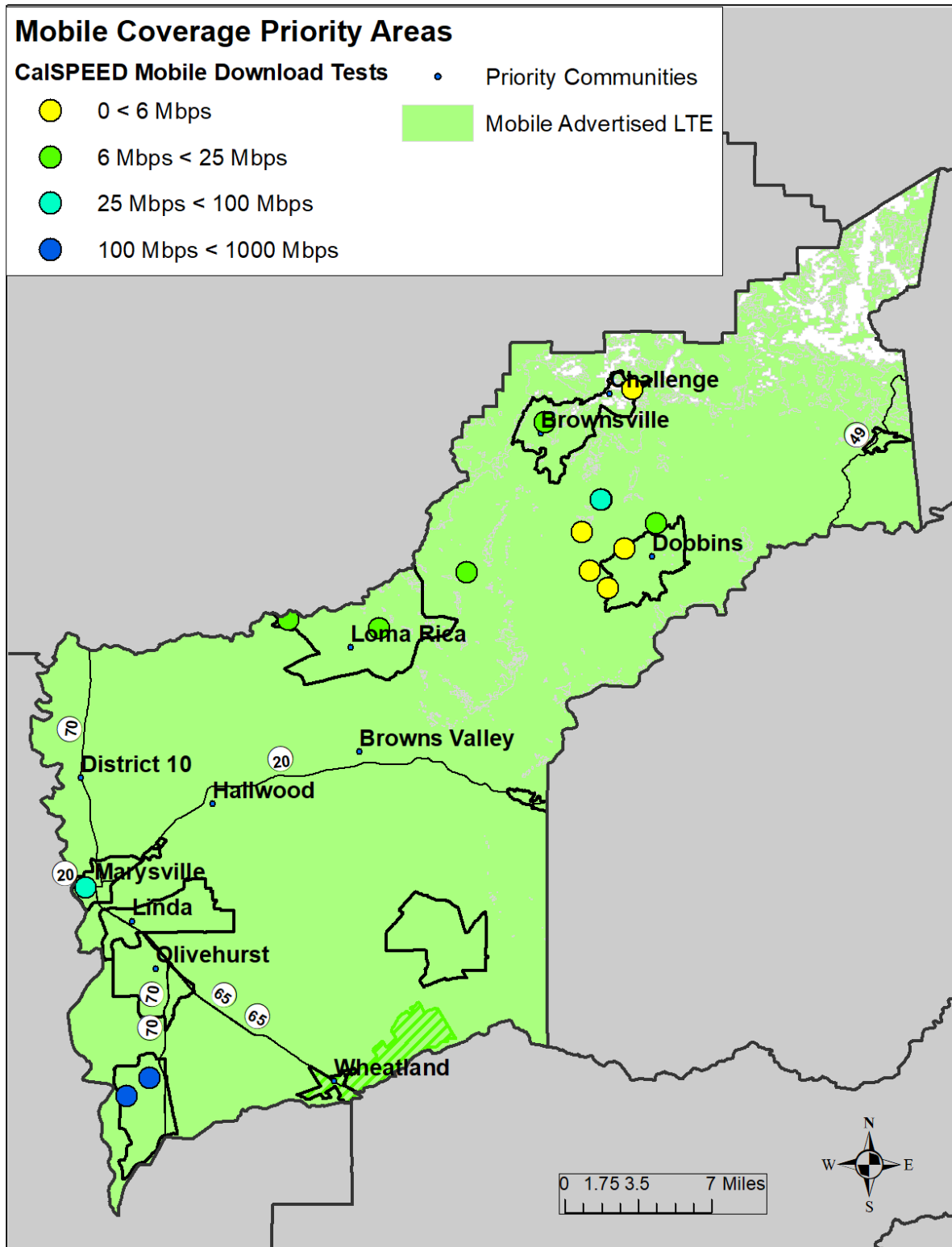
Figure 86. Business Unserved Priority Areas.
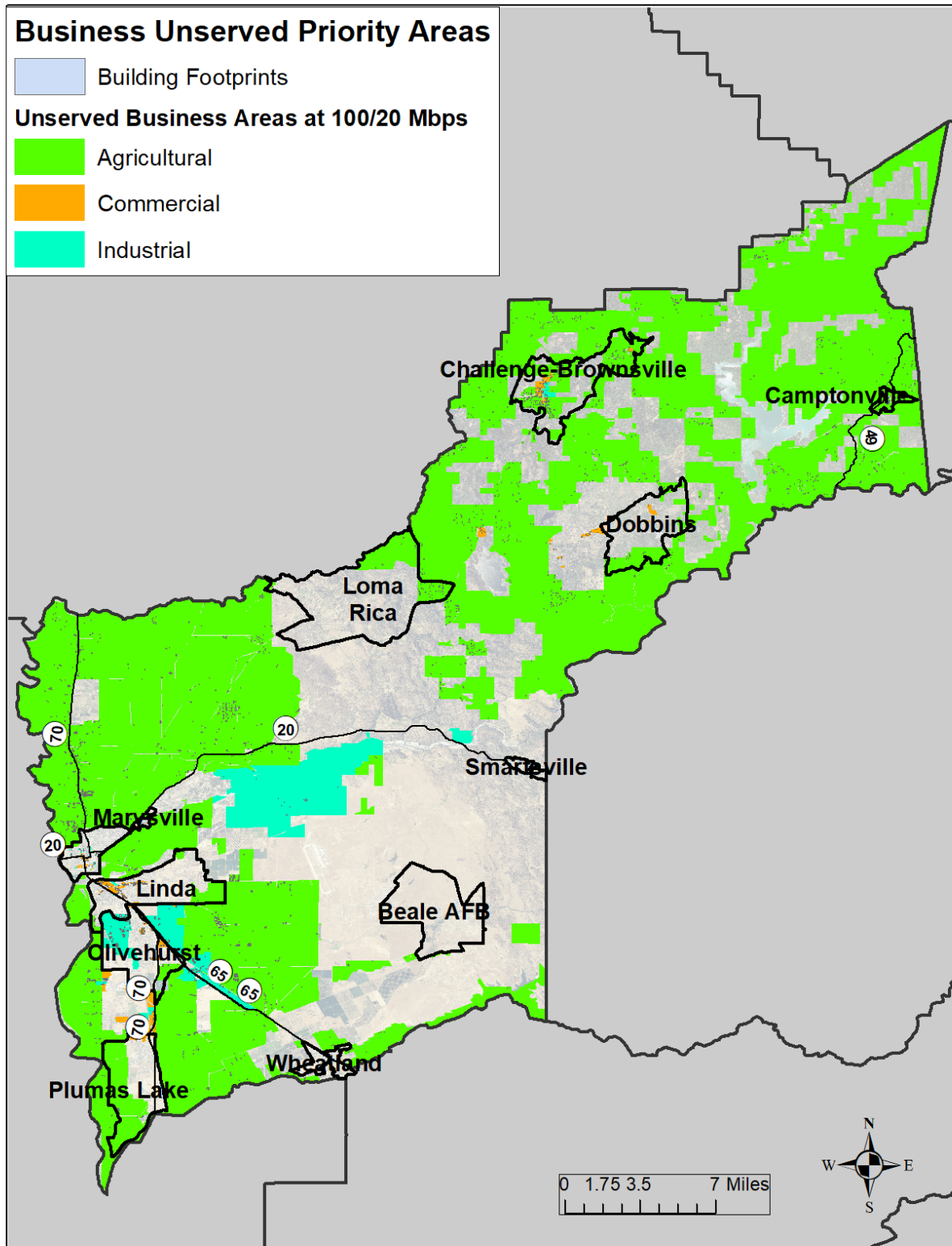
Figure 87. Residential Unserved Priority Areas with Middle-Mile Routes, Yuba County.
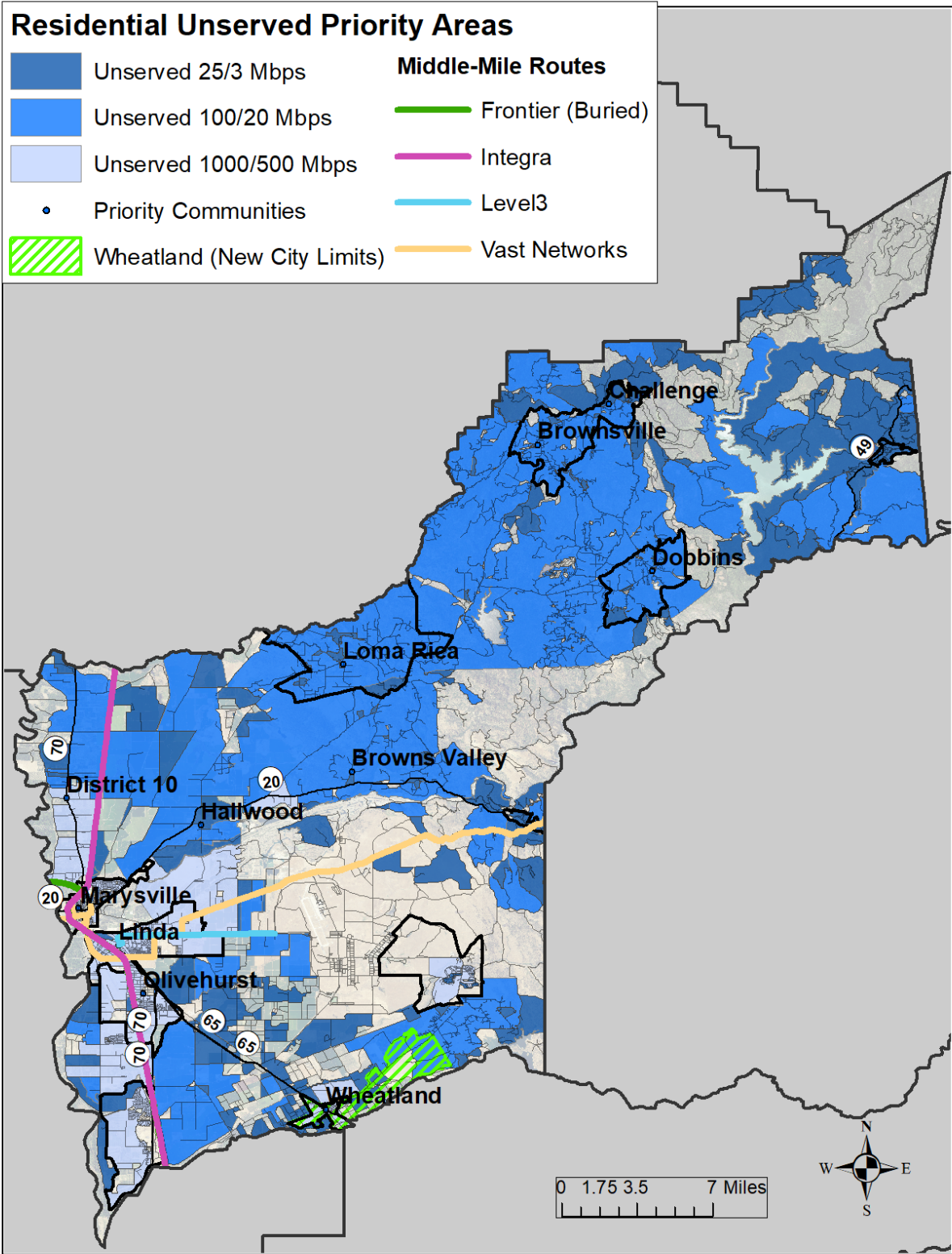
Figure 88. Business Unserved Priority Areas (100/20 Mbps) and Middle-Mile Routes.
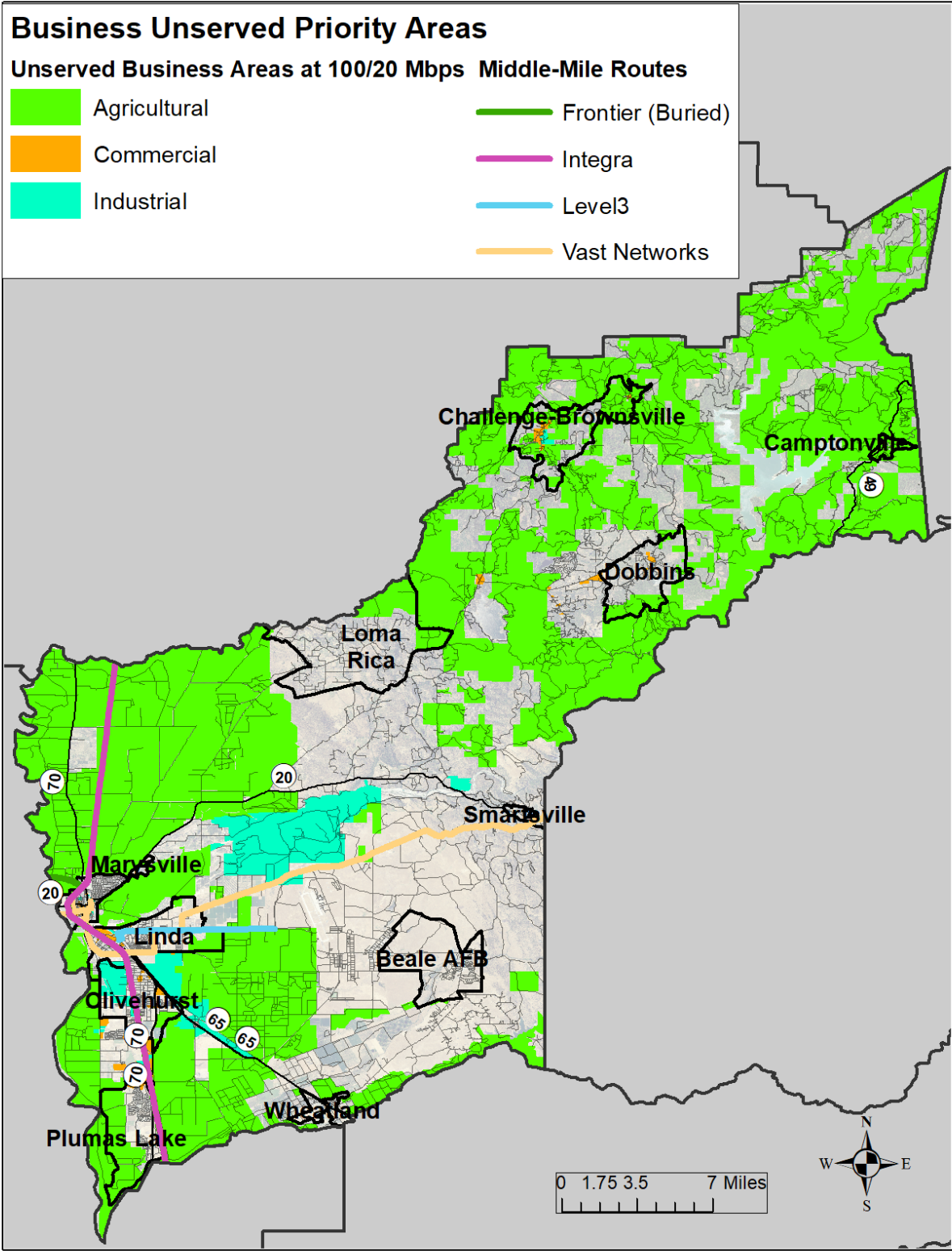
Figure 89. Asset Inventory Map.
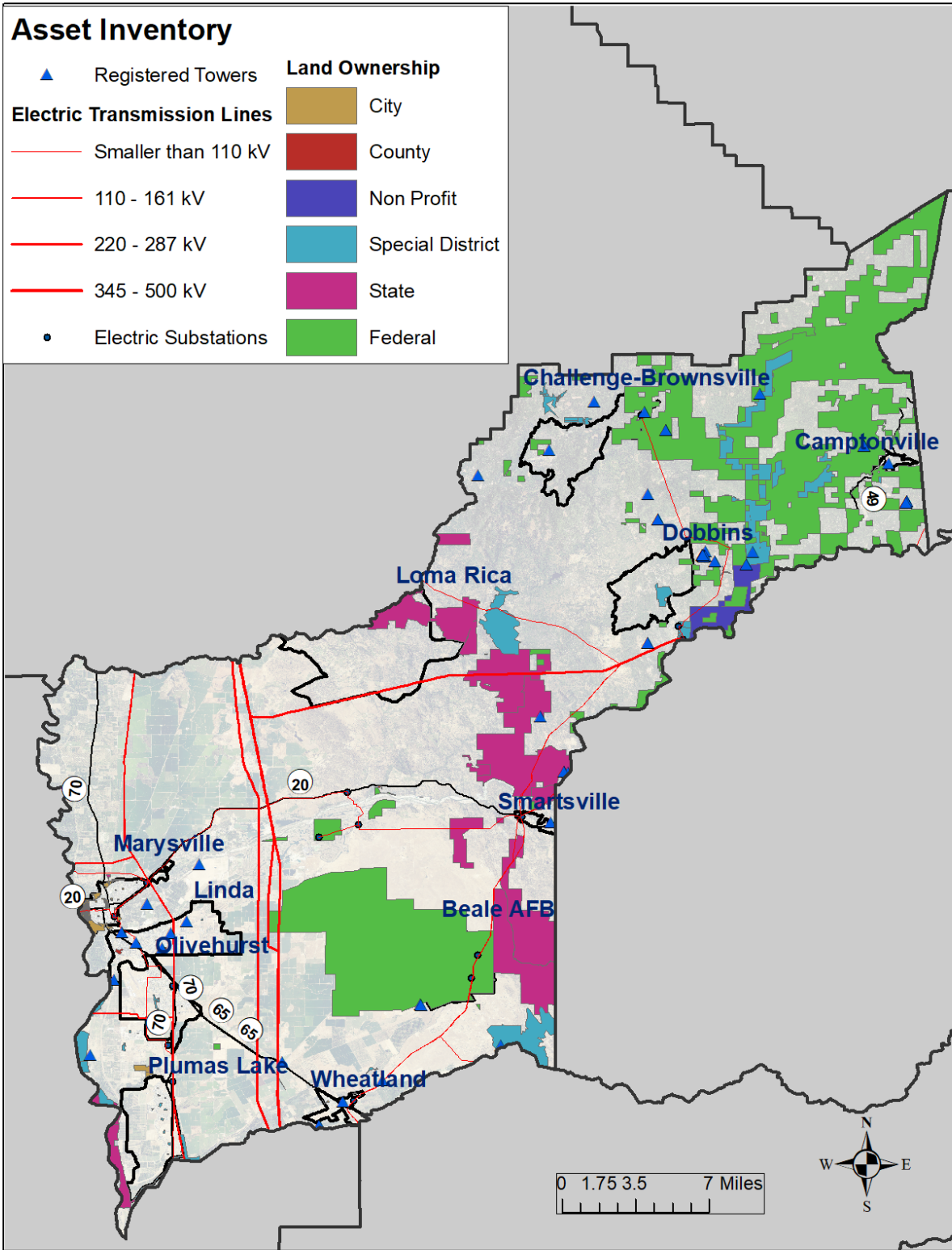
Figure 90. Upcoming Caltrans's infrastructure projects in Yuba County.
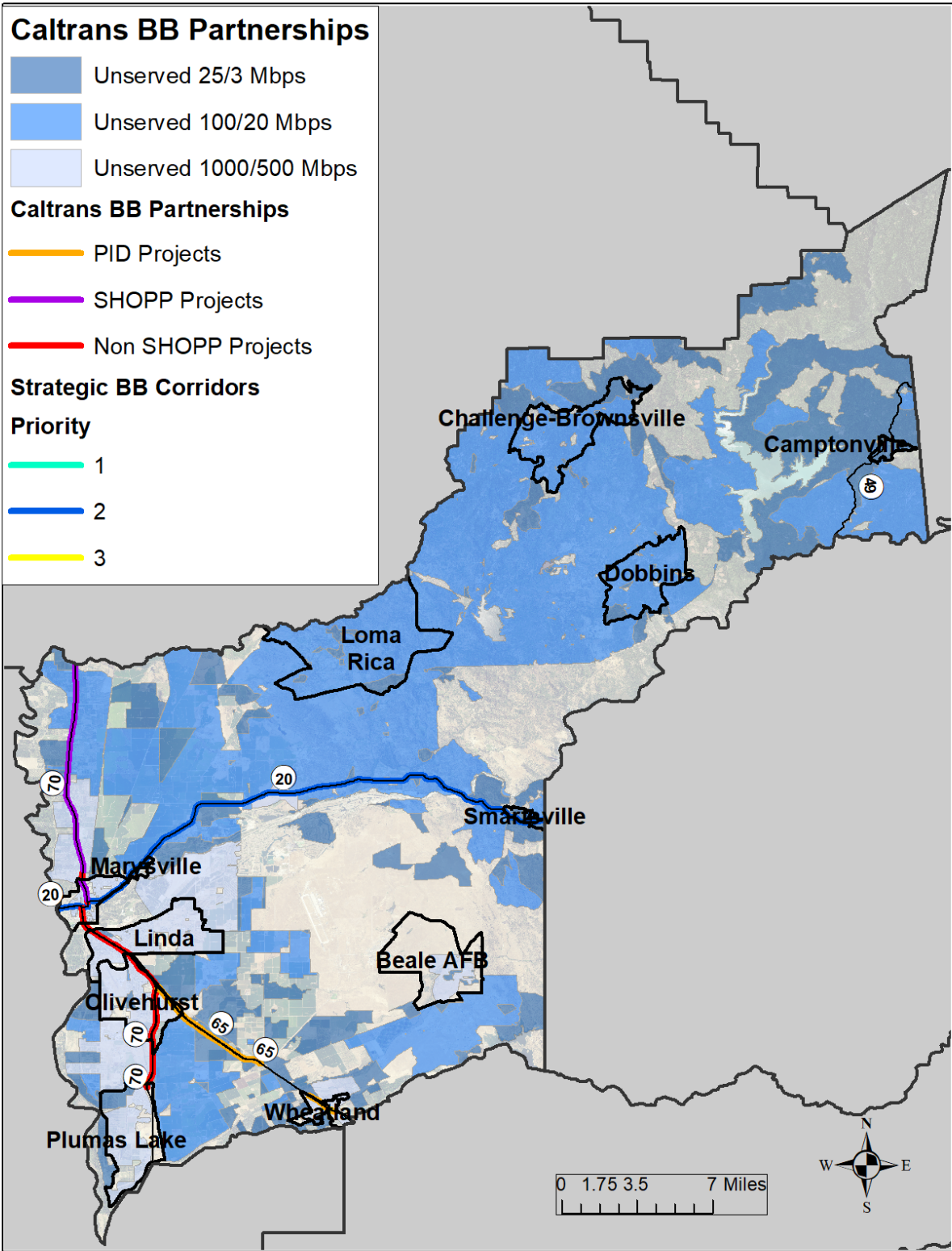
Figure 91. CENIC Broadband Partnerships and K12 High Speed Network Speeds.
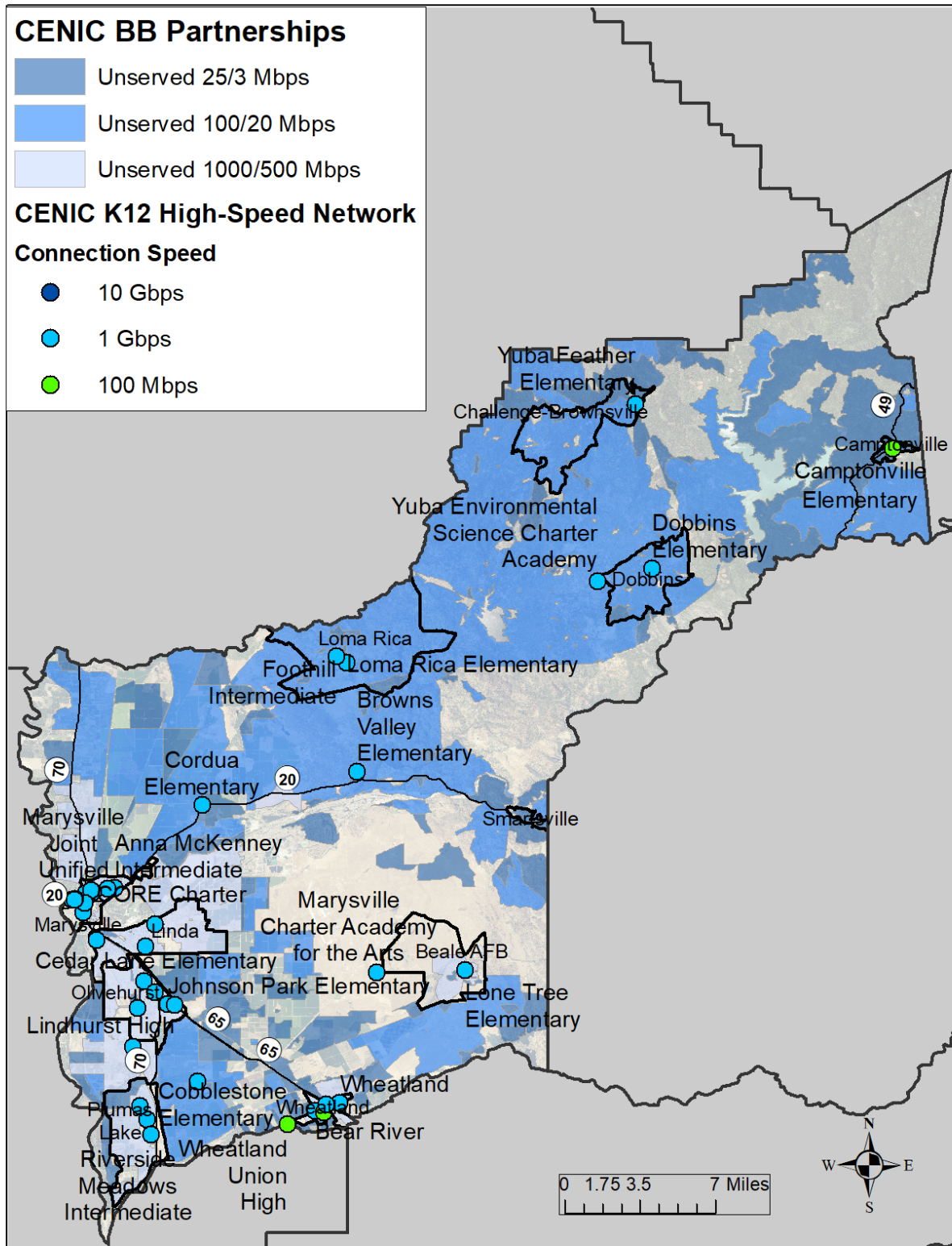
Figure 92. Community Anchor Institutions Partnerships, Unserved Areas 100/20 Mbps Anchor Institutions, Yuba County.
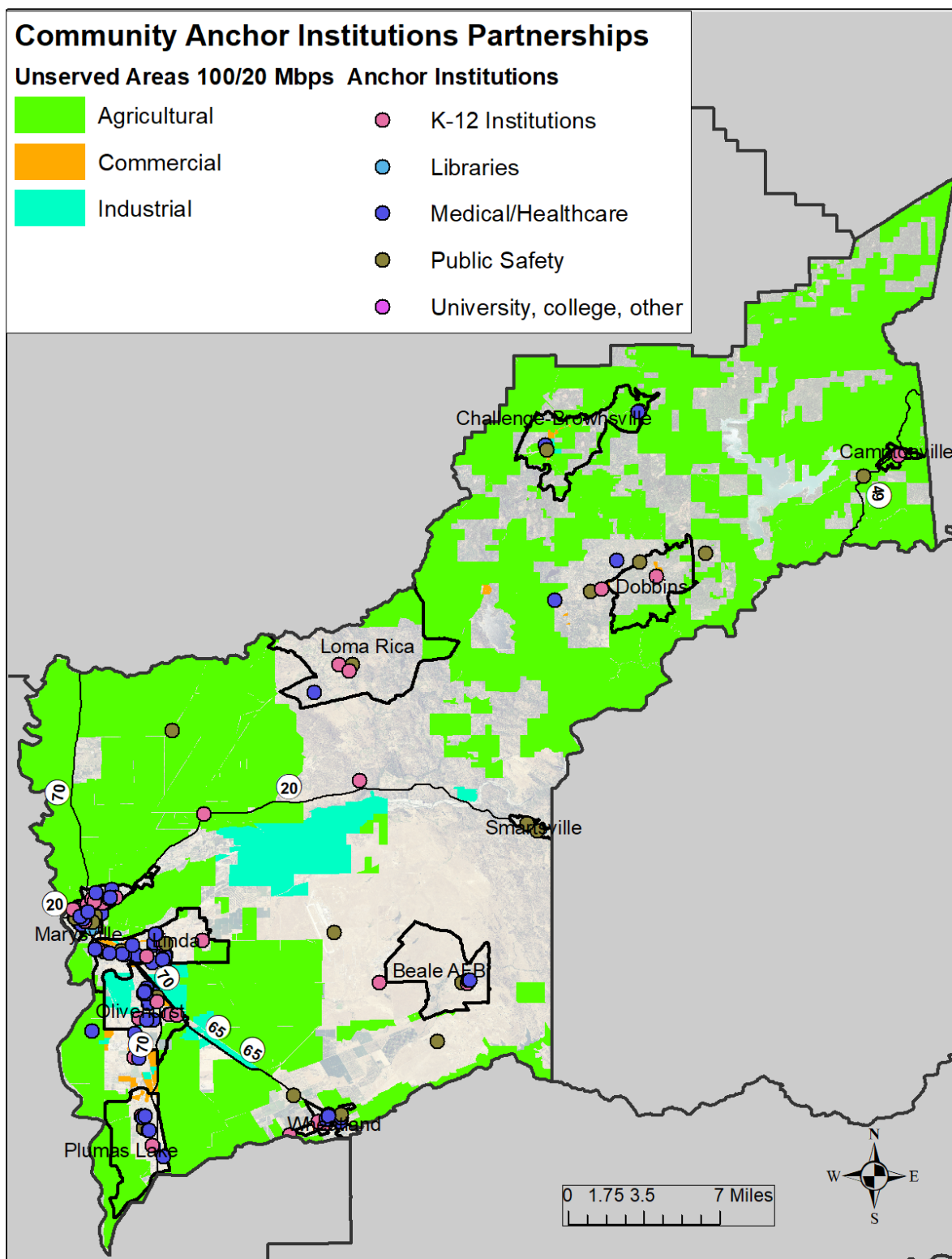
Figure 93. Residential Broadband Adoption, Any speeds (All Aggregated Speeds).
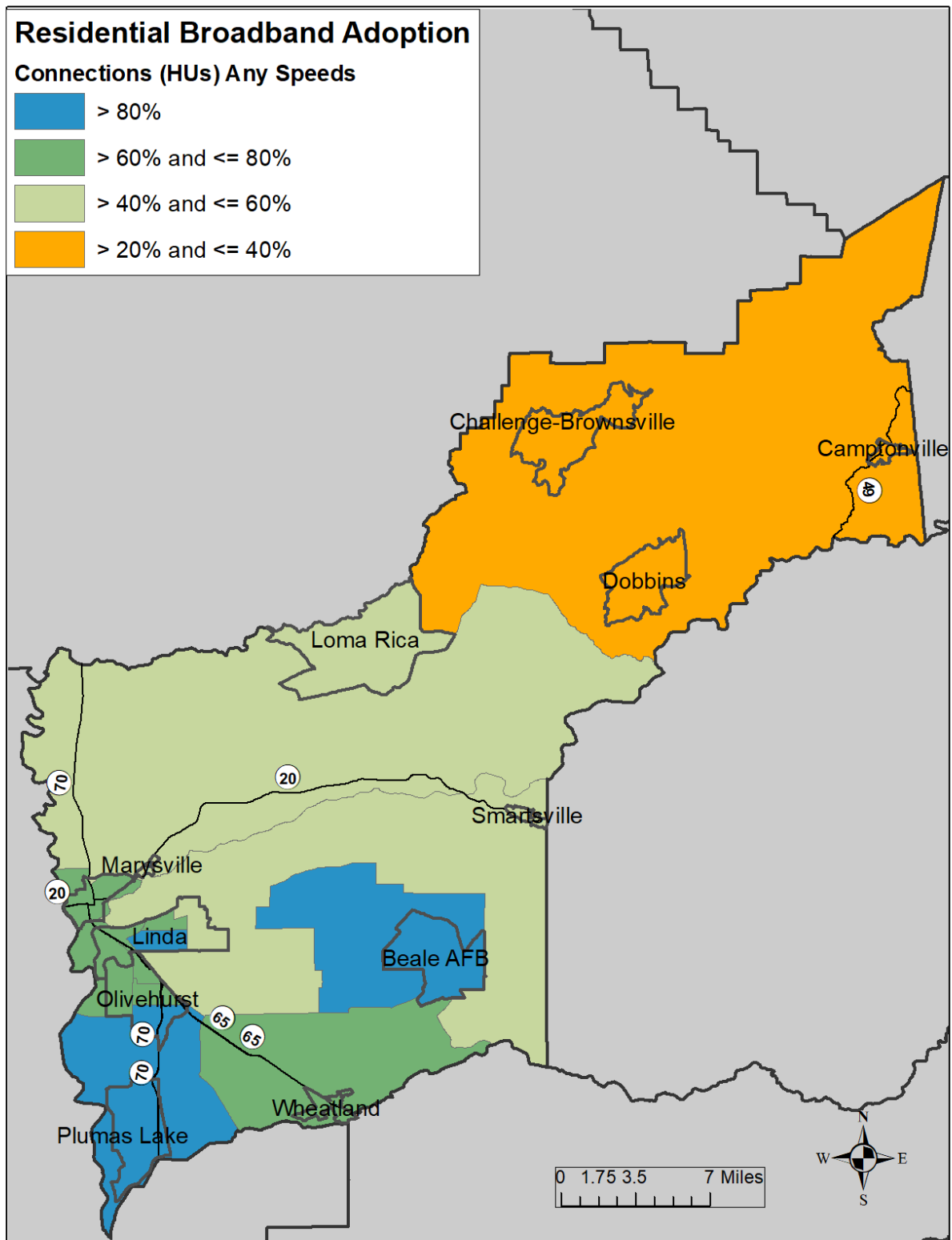
Figure 94. Residential Broadband Adoption, 6/1 Mbps (California Standard).
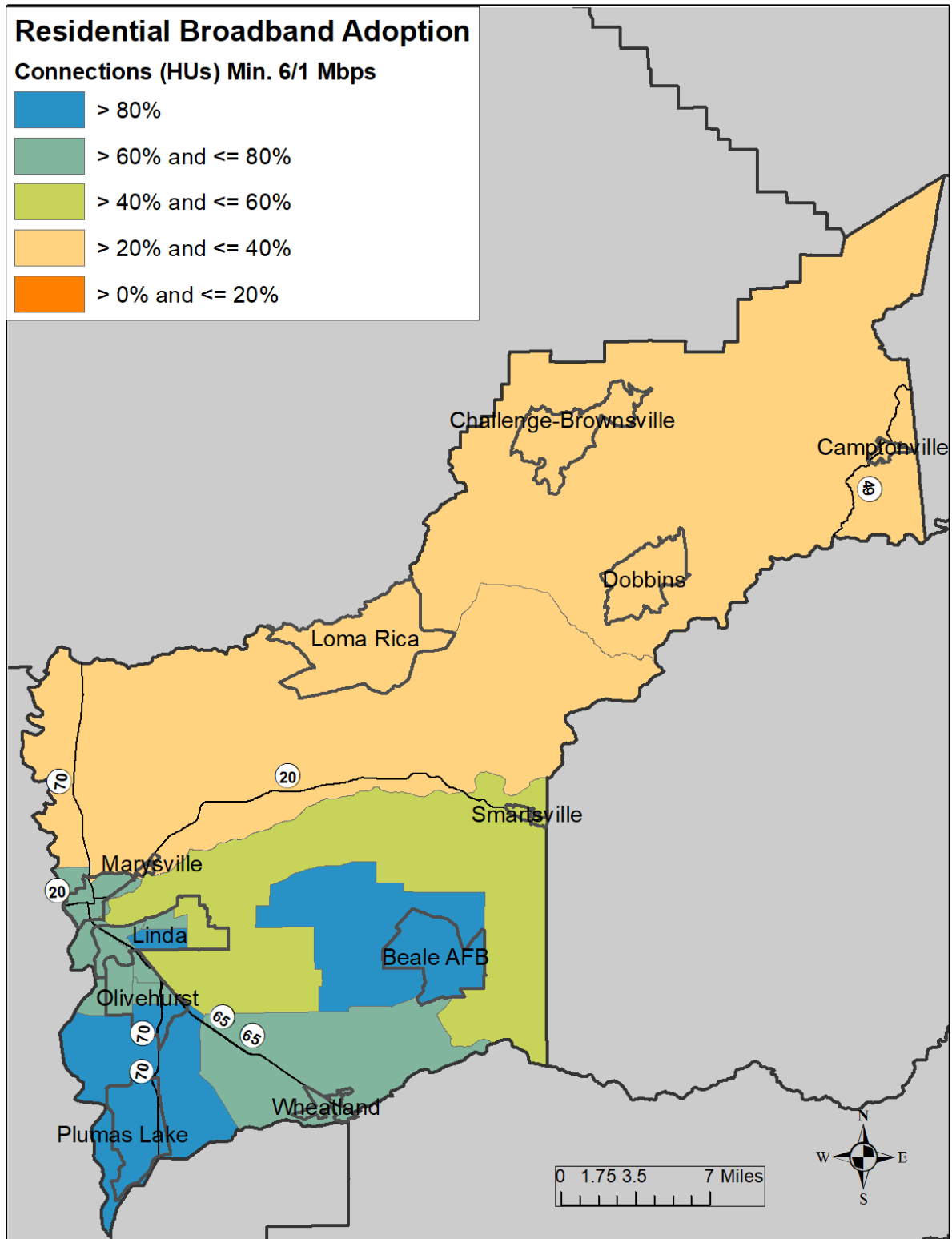
Figure 95. Residential Broadband Adoption, 25/3 Mbps (FCC standard).
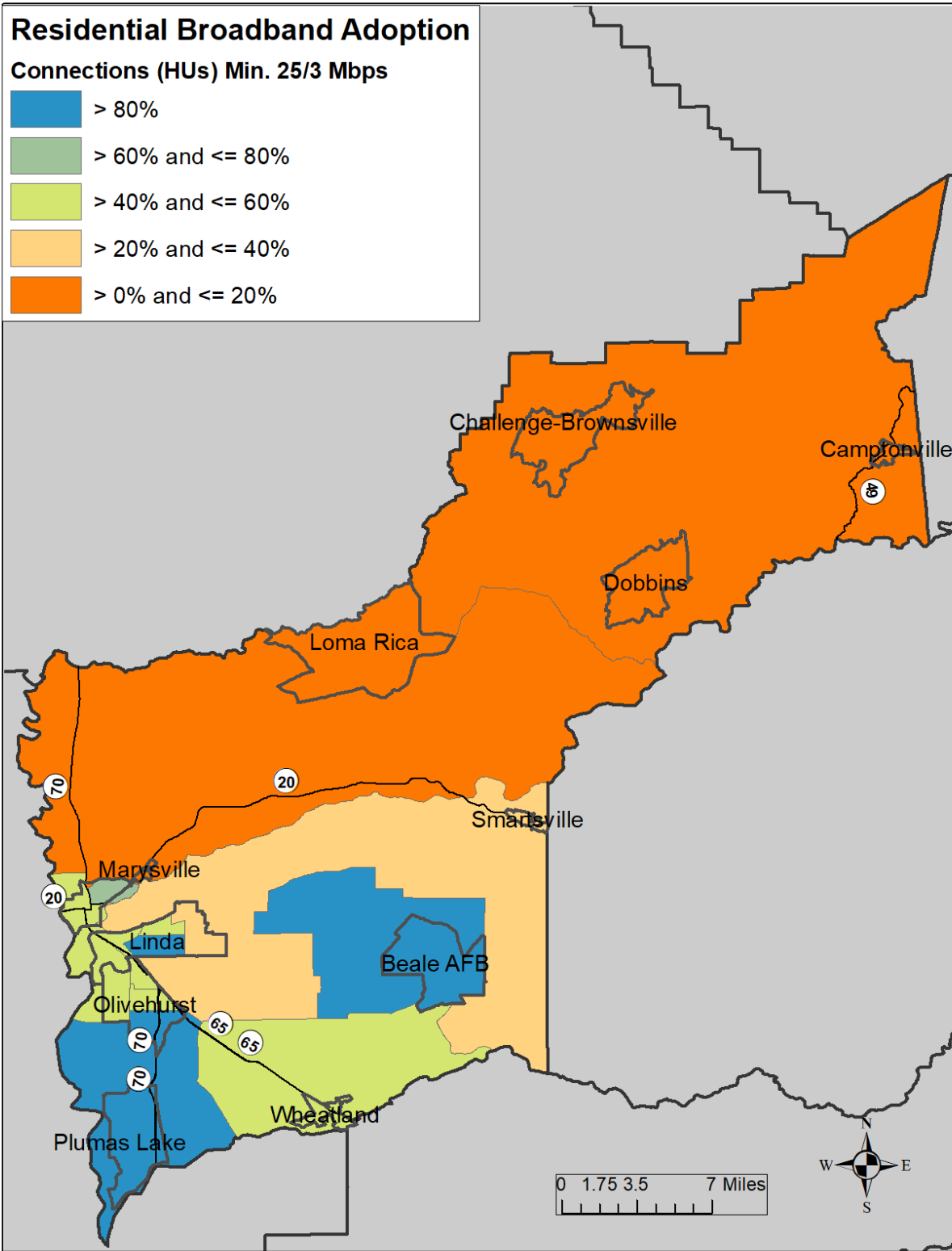
Figure 96. Residential Broadband Adoption, 100 Mbps (New California Action Plan speed).
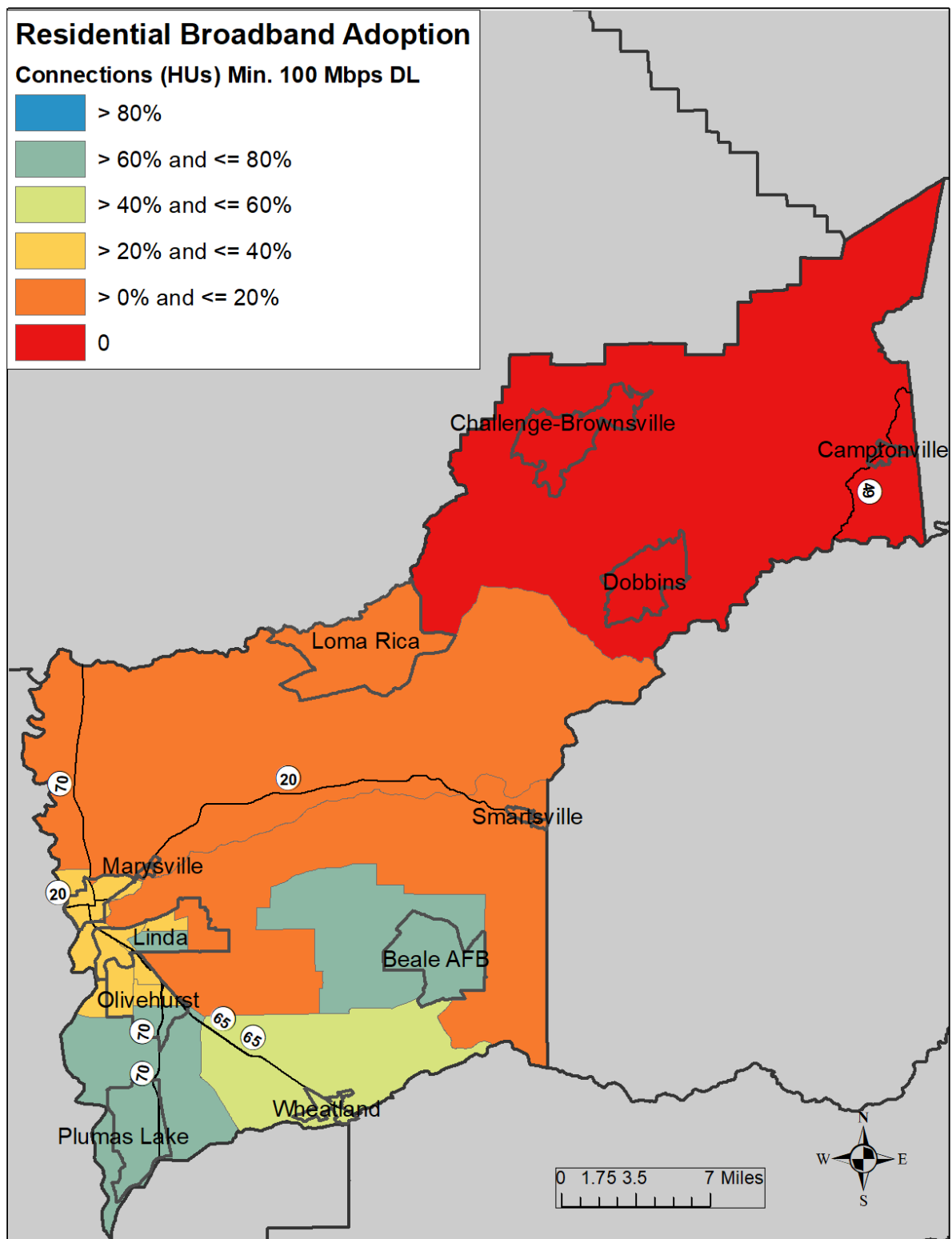
Figure 97. Computers in Households, 1 or more computing devices (American Community Survey 2019).
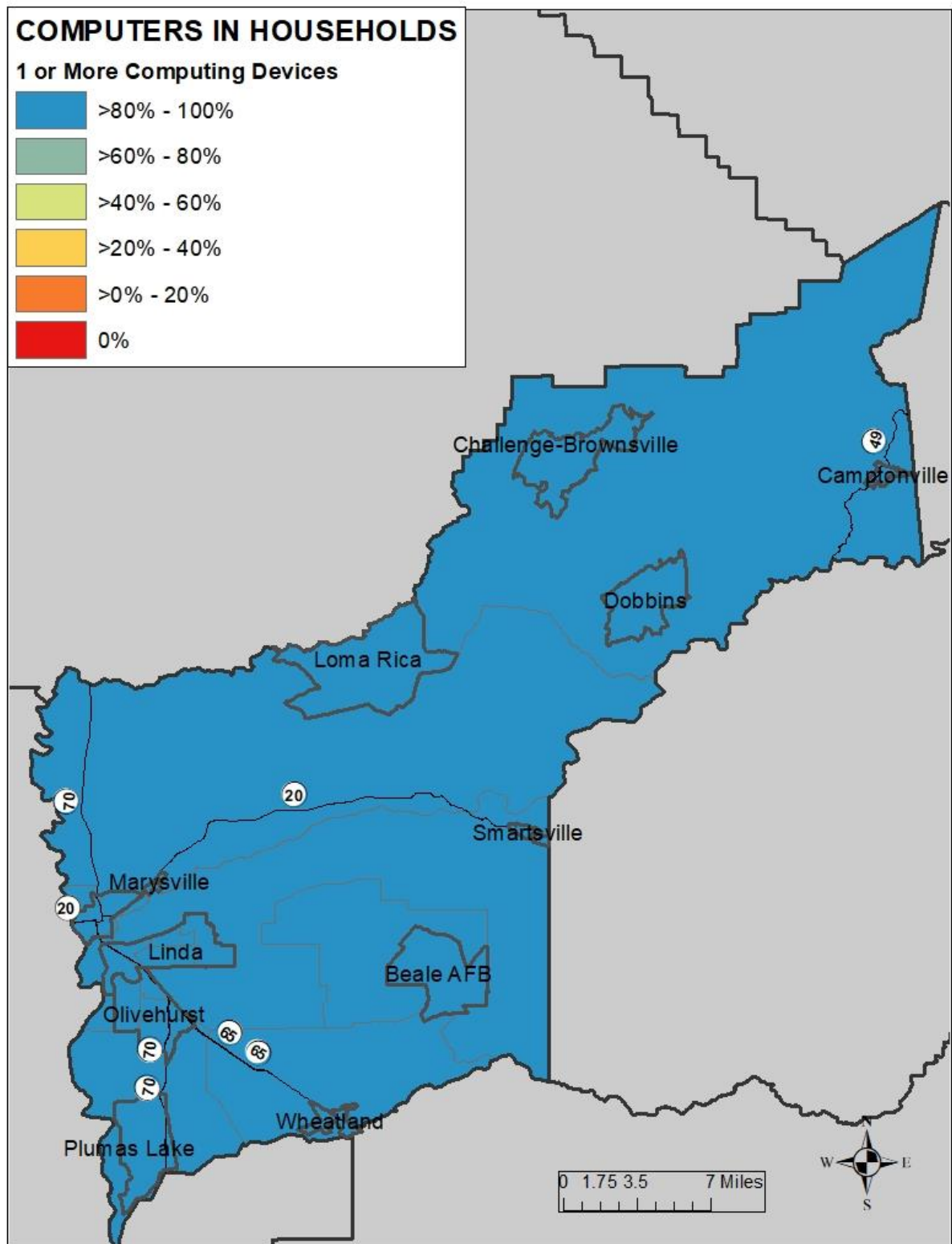
Figure 98. Computers in Households, only Wireless Portable Devices (American Community Survey 2019).
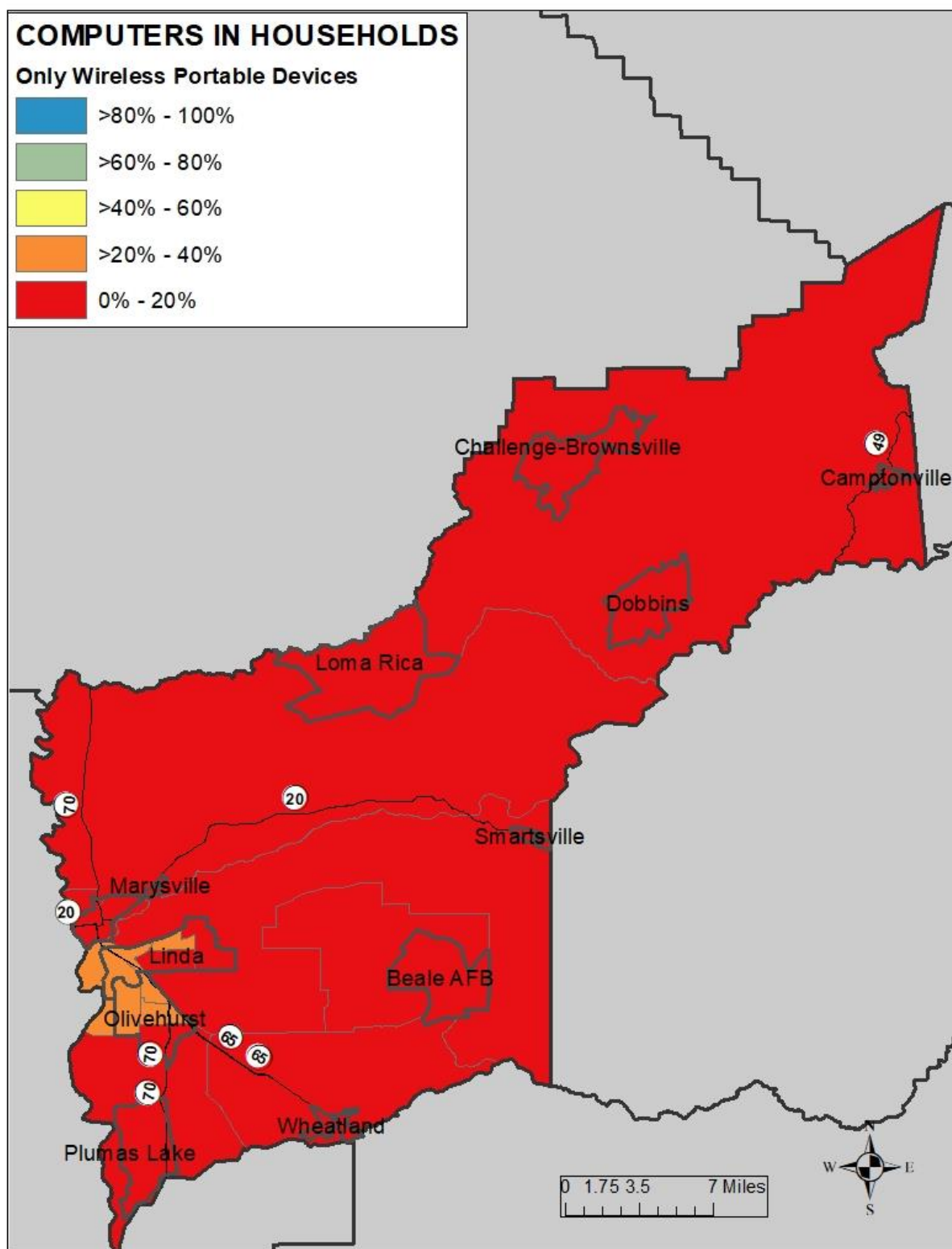
Figure 99. Computers in Households, Only Desktop or Laptop (American Community Survey 2019).