



Broadband Technical Report

For

**Arizona Strategic Enterprise
Technology Office (ASET)**

and

**Arizona Telecommunications &
Information Institute (ATII)**

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WACOG Broadband Technical Report

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WACOG Broadband Technical Report

Preface:

High speed Internet is the new essential infrastructure for this century's job creation, educational and healthcare transformation, and economic development; just as highways, railroads, canals, electricity, and telephone were for previous generations. It is the 21st century's infrastructure challenge and it is becoming ever more critical that **Western Arizona Council of Governments (WACOG - <http://www.wacog.com/>)** communities have adequate bandwidth to grow our local economies, create jobs, and improve education, healthcare, public safety, and quality of life.

Earlier this year saw the formation of a **WACOG Broadband Steering Committee (<http://www.wacog.com/broadband.html>)** with broad participation among regional economic development, educational technology, transportation, government IT, healthcare, and public safety stakeholders. The Committee and its activities are being funded, in part, by a federal broadband grant administered through the **State of Arizona's Digital Arizona Program (DAP - <http://azbroadband.gov/>)**.

WACOG has been selected to receive these funds to help advance broadband assessment, gap analysis, strategy, tactics, and application adoption in our region, Yuma, La Paz, and Mohave counties. **International Research Center (<http://www.researchedge.com/>)** has been hired under the grant and their consultants are facilitating the WACOG Broadband Steering Committee, collecting and analyzing regional broadband and economic data, producing a series of reports, and otherwise assisting with this project.

There are several **Digital Arizona Program (DAP)** initiatives at the state level. The **Digital Arizona Council (DAC - http://www.digitalarizona.gov/Digital_Arizona_Council/About_DAC.html)** meets quarterly and is working on an Arizona Broadband Strategic Plan draft. The **Arizona Broadband Map portal (http://www.digitalarizona.gov/Maps/Arizona_Broadband_Maps.html)** offer interactive insight to broadband coverage across the state and the community planning version integrates substantial demographic and economic data to aid policy analysis and planning.

DAP has recently launched an **Arizona Broadband Speed Test (<http://www.digitalarizona.gov/Survey/AffiliationQuestion.html>)** for gathering information about broadband coverage and performance across the State. They are strongly encouraging WACOG broadband stakeholders to take the speed test periodically and to also distribute the information and request to utilize among their respective stakeholder community.

The **Arizona Strategic Enterprise Technology Office (ASET)** coordinates these initiatives. Their office address is 100 N. 15th Ave. Suite 400, Phoenix, AZ 85007, and their main phone number is: (602) 542-2250. Additional information and resources may be found online at the ASET website: <http://aset.azdoa.gov/> and the Digital Arizona Program's (DAP) website at <http://DigitalArizona.gov/>. The DAP primary email address is question@DigitalArizona.gov.

Disclaimer: This report is written by International Research Center, a research and consulting firm. None of the information in this report should be construed as official public policy of WACOG or the Arizona State government. However, funding to assist in producing this report came from a federal NTIA grant managed by an Arizona State agency.

WACOG Broadband Technical Report

Executive Summary:

The **Western Arizona Council of Governments** (WACOG - <http://www.wacog.com/>) is a non-profit membership corporation representing local governments and providing a wide variety of services within the three rural Arizona counties of Yuma, La Paz, and Mohave. The **WACOG Broadband Steering Committee** (<http://www.wacog.com/wacog-broadband-steering.html>) was formed with broad participation among regional economic development, educational technology, transportation, government IT, healthcare, and public safety stakeholders to help ensure that the WACOG region has adequate bandwidth to grow our local economies, create jobs, and improve education, healthcare, public safety, and quality of life.

Recognizing that there are areas of rural America whose broadband needs are unserved or underserved, Congress through the American Recovery and Reinvestment Act of 2009 (the "Recovery Act"), appropriated \$7.2 Billion for broadband grants, loans, and loan guarantees to be administered by the United States Department of Agriculture's Rural Utilities Service (the "RUS") and the Department of Commerce's NTIA. These funds are targeted to help with the investments needed to bring broadband to poorly served rural areas of the country and have been allocated with the hope that our rural broadband infrastructure deployment and service availability will improve.

Connecting rural America with adequate broadband is being compared to the Rural Electrification Act of 1935 and the Federal-Aid Highway Act of 1956, which respectively first helped to bring electric and telephone service to all rural areas of the country and later connected rural areas to urban areas through interstate highways, both of which transformed rural economic and social life. A number of Arizona broadband infrastructure projects, public computer centers, and sustainable broadband adoption projects were funded and the status of these projects relevant to WACOG are discussed below.

Arizona's rural communities are now receiving Community Broadband Planning and Technical Assistance help. ASET and its non-profit partner, the Arizona Telecommunications & Information Institute (ATI Institute - <http://aztii.org/>), have qualified and approved a cadre of consultants who have been selected by regional government coalitions to provide strategic planning, technical assistance, and grant writing, e-commerce training and assistance across Arizona's rural areas. WACOG has engaged **International Research Center** (<http://www.researchedge.com/>) under the grant and their consultants are facilitating the **WACOG Broadband Steering Committee**, collecting and analyzing regional broadband and economic data, producing a series of reports, and otherwise assisting with this project to achieve the following goals:

- Evaluate, Plan and Build Local Broadband Capacity
- Identify and Engage Community Stakeholders
- Conduct Regional Broadband Events and Training Exercises
- Create Strategic Plans for Digital Inclusion and Broadband Projects
- Provide Technical Assistance to Assess Community Assets and Broadband Capabilities
- Develop Business Cases and Plan for Demand Aggregation
- Determine Broadband Applicability to Regional Rural Job Opportunities
- Identify and Investigate Grant Opportunities
- Promote Community Engagement

This **WACOG Broadband Technical Report** focuses on extensive gap analysis including broadband services and infrastructure availability for the WACOG region and selected communities. It also provides background on relevant broadband technologies and recommends community broadband strategies, policies, and initiatives. This **Broadband Technical Report** is complemented by a companion **WACOG Broadband Business Case Analysis (BCA) Report** and the development of both are funded by a federal National Telecommunications and Information Administration (NTIA) grant awarded to the State of Arizona. ASET, along with legislature and our Governor, have taken steps to improve our regulatory environment including passage of the Digital Arizona Highways Bill (aka SB1402) that allows and encourages providers to use ADOT rights-of-way to place fiber optic infrastructure along roadways. We hope to see the deployment of middle mile fiber infrastructure occurring along a number of State highways with associated local access and last mile connectivity going forward.

The results of WACOG regional broadband analyses from a rich variety of data sources confirm that rural Arizona requires better high-speed broadband capacity to keep pace with the modern world. Given the expansive, often difficult rural terrain across the state of Arizona, community-serving organizations like libraries, public schools, and healthcare facilities as well as enterprises and residents at home often have difficulty accessing high-speed broadband services essential for education, commerce, and economic development. The data gathered indicate that broadband offerings in the WACOG Region are diverse in capacity and cost, and very spotty in coverage, leaving many residents and businesses without a better Internet experience option.

Maps developed during this process show significant “dead zones” or underserved areas as can be seen in the appendices of this WACOG Broadband Technical Report. In addition to these areas that lack coverage it is important to understand that a number of homes and businesses within the shown wireless coverage areas cannot obtain wireless service at broadband speeds or at all because they are blocked by trees or located in a low-lying area that wireless signals cannot reach. There is anecdotal evidence to suggest that as many as 25% of the homes within the indicated coverage areas cannot receive an adequate wireless connection. Further, in some areas where DSL is generally available, the quality of the copper cabling to some homes is too poor for DSL to work at advertised speeds. However, current wireless Internet service providers have been and seem to be continuing on a path of expanding coverage areas and increasing bandwidth (speed), but understandably aren’t willing to make guarantees regarding future services.

While there does not seem to be an overwhelming groundswell of demand in the WACOG area for better Internet, there are instances in which the lack of broadband capacity leaves rural small businesses and residents at a distinct disadvantage when compared to their counterparts in more densely populated areas like Phoenix and Tucson. For instance, the FCC has found that access to fixed and mobile broadband services has the potential of benefiting the agriculture business, enhancing educational opportunities, improving health care, enhancing the County’s public safety and homeland security needs, assisting individuals with disabilities and offering potentially enormous environmental benefits. Many of the larger businesses located in and around WACOG may be generally satisfied with available services as a result of customization and a much higher monthly rate. However, smaller businesses and home-based businesses in more rural areas often have either just one or no broadband Internet service options except for satellite, which retains the issues of latency, data caps, and significantly higher cost. We continue with this **Broadband Technical Report’s** gap analysis, including broadband services and infrastructure availability for the WACOG region and selected communities, complemented by the **WACOG Broadband Business Case Analysis (BCA) Report**.

WACOG Broadband Gap Analysis:

The Arizona State Land Department (ASLD) is maintaining the related Arizona Broadband Map at <http://broadbandmap.az.gov/map/> loaded with the last broadband data set. Additionally, there is a special Community Planning version of the broadband map available at <http://broadbandmap.az.gov/CommunityPlanningMap/> and loaded with demographic data and special analysis tools that will aid community broadband analysis and planning. These tools are designed to mutually serve both Arizona's broadband consumer and provider communities, as well as contribute to State policy and strategic planning. It should help lead consumers to provider web sites and information about their broadband offerings, hopefully becoming an important tool in the Broadband Provider's (BP's) marketing efforts.

The purpose of the Arizona Broadband Assessment Project (AZ BAP) is to identify both the availability and speed of broadband services, and the location of broadband infrastructure throughout Arizona, including middle mile infrastructure and Community Anchor Institutions (CAIs). This project is provided through the American Recovery and Reinvestment Act of 2009 (ARRA) and the Broadband Data Improvement Act (BDIA), and in conjunction with the National Telecommunications and Information Administration (NTIA) and the Federal Communications Commission (FCC). AZ BAP is managed by the Arizona Strategic Enterprise Technology Office (ASET) under the Arizona Department of Administration (ADOA) in partnership with the Arizona State Land Department (ASLD), contractor Data Site Consortium, Inc. and their GIS subcontractor, TerraSystems Southwest (TSSW).

Fresh broadband data was submitted to the NTIA on April 1, 2013 for the Spring 2013 cycle which attempts to capture and reflect broadband availability and conditions in the field as of December 31, 2012. See Appendices A-D for regional broadband statistics and detailed county and selected population area maps which can be summarized as follows:

Yuma County Broadband Overview:

- There is limited DSL coverage in Yuma County centering on the Greater Yuma area including Somerton with just a little coverage in the Welton area. Just 63.3% of the population can get DSL at ≥ 768 Kbps downstream and a slim 40.6% can get ≥ 6 Mbps. The Arizona broadband mapping team has discovered an issue in processing Frontier's DSL coverage and will make corrections in the pending Fall 2013 submittal, likely resulting in reporting of slightly less coverage.
- Cable modem based broadband covers 82.2% of the Yuma County population, again centering on the Greater Yuma area including some of Somerton and San Luis, with speeds ≥ 10 Mbps.
- Fixed wireless (licensed and unlicensed) has a more extensive footprint estimated to reach 95.0% of the Yuma County population in the Greater Yuma area and along the I8 corridor at speeds up to 6 Mbps, but is barely available (1.6%) at higher speeds.
- Mobile wireless has by far the broadest footprint, estimated to reach 100.0% of the Yuma County population at speeds ≥ 768 Kbps and virtually the same footprint at 98.9% for speeds up to 6 Mbps, but nothing higher.
- A limited number of Middle Mile points, almost always fiber fed, are available primarily from Airband Communications, Level3 Communications, CenturyLink, and Zayo.

La Paz County Broadband Overview:

- There is limited DSL coverage in La Paz County centering on the Parker, Quartzsite, and Salome areas. Just 67.1% of the population can get DSL at ≥ 768 Kbps downstream and a very slim 26.1% can get ≥ 6 Mbps. The Arizona broadband mapping team has discovered an issue in processing Frontier's DSL coverage and will make corrections in the pending Fall 2013 submittal, likely resulting in reporting of slightly less coverage.
- Cable modem based broadband covers a meager 28.7% of the La Paz County population, with spotty coverage in the Parker area and virtually no coverage elsewhere.
- Fixed wireless (licensed and unlicensed) has no footprint in La Paz County with 0.1% of the population covered at the lowest broadband speed of ≥ 768 Kbps.
- Mobile wireless has by far the broadest footprint, estimated to reach 99.9% of the La Paz County population at speeds ≥ 768 Kbps and but dropping precipitously to 24.4% for speeds ≥ 3 Mbps. Quartzsite is largely covered by a 4G network delivering ≥ 6 Mbps, but the rest of the county is confined to lower speeds for now. Aggressive mobile provider 4G upgrades should shift the situation over time.
- A limited number of Middle Mile points, almost always fiber fed, are available primarily from Wecom, Airband Communications, Level3 Communications, CenturyLink, and Zayo.

Mohave County Broadband Overview:

- There is significant DSL coverage in Mohave County especially in the Bullhead City, Kingman, and Lake Havasu City areas with just a little coverage in the Colorado City and Mesquite areas. Some 89.2% of the population can get DSL at ≥ 768 Kbps downstream and 73.1% can get ≥ 6 Mbps. The Arizona broadband mapping team has discovered an issue in processing Frontier's DSL coverage and will make corrections in the pending Fall 2013 submittal, likely resulting in reporting of slightly less coverage.
- Cable modem based broadband covers 77.7% of the Mohave County population, again centering on the Bullhead City, Kingman, and Lake Havasu City areas with speeds ≥ 3 Mbps and 75.8% with speeds ≥ 10 Mbps. There is no apparent cable coverage in the Colorado City and Mesquite areas.
- Fixed wireless (licensed and unlicensed) has an extensive footprint estimated to reach 91.6% of the Mohave County population primarily in the Bullhead City, Kingman, and Lake Havasu City areas with just a little coverage in the Mesquite area and none in Colorado City. Fixed wireless coverage at ≥ 3 Mbps is available to only 64.1% of the population and at ≥ 6 Mbps is available to only 31.6% of the population.
- Mobile wireless has by far the broadest footprint, estimated to reach 96.2% of the Mohave County population at speeds ≥ 768 Kbps but only 48.4% for speeds ≥ 3 Mbps and 0% with speeds ≥ 6 Mbps.
- A limited number of Middle Mile points, almost always fiber fed, are available primarily from Wecom, Airband Communications, Level3 Communications, and CenturyLink.

Recommendations for Action:

Within each of the three WACOG counties and their respective communities, WACOG should now put in place strategies and action plans, as described here and in more detail in the **Community Planning Guidelines and Recommendations** of the **WACOG Broadband Business Case Analysis (BCA) Report** to meet the emerging broadband capacity requirements so as to support the four key Internet application areas.

The central theme for these action plans is communication among all stakeholders. The importance of maintaining a dialogue between community stakeholder groups, including elected officials, and broadband providers to learn issues and strategize paths forward cannot be over emphasized. We suggest WACOG undertake a series of short-term (tactical) options followed by a longer-term plan to pursue other, more strategic options. See list below:

Short Term Activities

- Educate citizens about options that already exist.
- Define and aggregate the demands among public institutions, commercial enterprises, non-profits, and residential users, getting pledges of support to purchase services.
- Support the expansion of wireless coverage in each County by facilitating use of existing towers by wireless providers and advocating that wireless providers expand coverage in known problem areas.
- Work with ASET, ATIC/ATI Institute, and others to apply for grants and loans to improve middle mile bandwidth.
- Consider subsidizing infrastructure enhancements through grant funding.

Strategic Plan

In order to use the Internet to its greatest potential (such as operating online businesses, telecommuting, and participating in video-based education) WACOG should plan for a long-term future that provides reliable Internet speeds in excess of 10Mbps, perhaps 50-100 Mbps to all homes and businesses. In some cases the schools and businesses will require up to 1,000 Mbps (1 Gbps) to support advanced applications and purposes. Because current offerings don't reach everyone and most are quite limited in bandwidth, WACOG could undertake the following longer-term activities to improve the situation.

- Encourage wireline telephone providers to apply for grants and loans that would allow them to expand coverage.
- Continue demand aggregation and engage potential providers in reaching practical ROIs by reducing their costs to deploy and operate and/or build a customer base.
- Seek out partnerships to build out a fiber backbone within the cities that would allow either fiber to the home (FTTH) or fiber as a middle mile technology which could potentially be shared between multiple providers and technologies.
- Consider supporting efforts toward a community area network and/or public Wi-Fi.
- Research and consider pilot studies of other wired and wireless technologies.

Priorities

Recognizing an array of diverse needs with many potential solutions, strategic priorities are:

- Options that support improved connectivity to local units of government.
- Options that support economic development and job creation.
- Options that support educational, telehealth, and public safety activities.
- Options that support service to residential users of better Internet as a service.

Viable County and Regional Options:

While WACOG communities provide many services that support economic development, it is clear that broadband service to residents and businesses should generally be available from commercial providers in a free market environment, rather than offered by government, though some public wireless projects are the exception. The following strategies and activities are suggested and should be considered and pursued where appropriate.

Provide Information to the Public about Existing Options

During public meetings and by targeted outreach, WACOG can coach the counties to help its businesses and residences and stakeholders to help their constituencies by:

- Publishing selected portions of this and the rest of the WACOG Broadband Steering Committee reports and working documents, including maps and tables on your website.
- Developing a concise “brochure” for residents about broadband and distributing it within mailings required for other purposes and with e-mail blasts.

Consider Partnering with Incumbent and Competitive Phone Companies

As part of our research in the availability of better Internet service in WACOG, it became apparent that in addition to the major players like Frontier and CenturyLink, the residents and businesses are served by a variety of smaller carriers, such as Integra Telecom, Level 3, and TDS Telecom. These companies, while smaller in Arizona, have advertised availability of better Internet services in portions of their territories. While it appears that many of these telcos have reasonably good coverage of better Internet, they are likely constrained by the availability of capital to expand and/or upgrade their systems especially in this tight capital market.

There may be several unique opportunities for WACOG to engage and partner with these smaller providers and even larger ones with regard to grant opportunities. We recommend that WACOG explore these potential opportunities with the smaller providers as part of Round 2 activities. If opportunities do exist to partner with these companies, WACOG has the potential to contribute to the significant upgrade of selective providers’ service offerings by enabling Government or shared assets to be used in these rural areas.

Make Use of Existing County/Municipal Towers

WACOG counties and communities own or have access to a number of towers and water towers for public safety purposes as well as buildings whose structures could support wireless transmissions. Not all of the towers and buildings are open for use by commercial entities, but many may be, depending on the wind load capacity and location as well as various policy, security or other constraints. As an example, GovNet has contracted with schools and Counties to make use of a good number of these structures. WACOG should expand that process to include other providers and opportunities.

Recognizing that wireless providers already cover much of the municipalities, it may be in WACOG’s best interest to maximize those providers’ coverage and bandwidth within the population centers as well as en route to rural areas by offering space on available towers to wireless providers at affordable prices to encourage expansion of their coverage areas. This may require changing some policies. Like other tower owners, authorities in rural Arizona could choose to allow commercial wireless providers to attach equipment to towers and

distribute services from those sites. Typically, separate agreements are negotiated for each type of facility at each tower location.

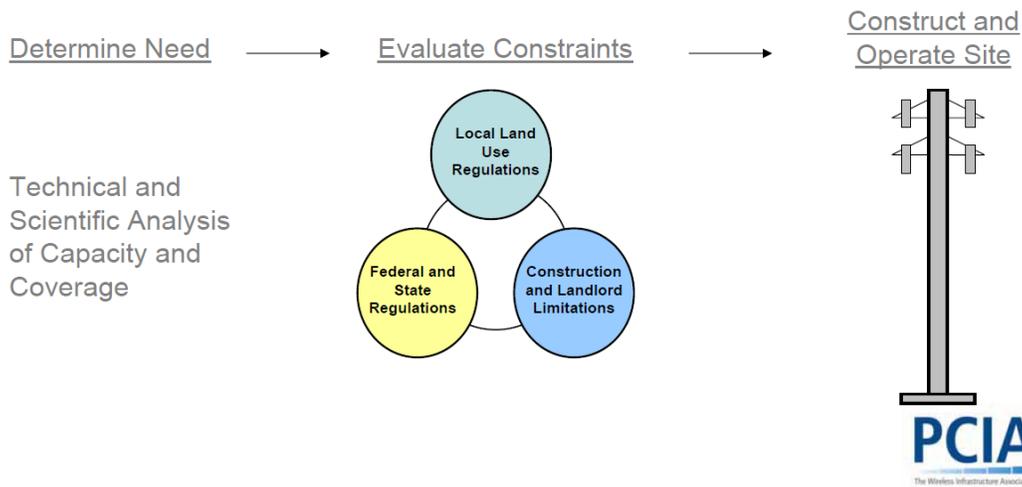
Physically, there are many possibilities for how and where equipment might be located on a tower. Due to cabling limitations for Power over Ethernet, most wireless providers must locate their antennas at less than 300 feet above the ground. Depending on the areas to be covered with new services, providers may want only one or multiple 60-degree coverage angles and therefore may wish to lease only a portion of any particular vertical space on a tower. Space is usually allocated at 10-foot intervals, but due to wind load parts of towers may not be usable for antenna placement. Thus each installation is unique. For any negotiated lease, those wishing to lease tower space would be responsible to conduct wind-load studies and to obtain and develop space on which to locate ground-based equipment and systems.

Recommended activities include:

- Identify Government towers in poorly served areas of WACOG.
- Invite Cities, Villages and Towns located in the Region to partner in this effort.
- Conduct an engineering review of each tower to determine whether each tower has capacity to allow additional providers.
- Identify and meet with potential providers.
- Conduct a financial and legal review.
- Identify legal process and terms to partner with competitive carriers.
- Distribute information about known towers to local providers who might otherwise not know this option exists (only towers taller than 200 feet must be registered with the FCC so the availability of towers less than that height would not be generally known). This will help ensure fair access for commercial entities.
- Encourage municipalities that own water towers to offer similar terms to providers.

Siting Process Considerations

The process of siting wireless communications facilities implicates a variety of inputs and limitations.



See the PCIA's Model Wireless Telecommunications Facility Siting Ordinance at http://www.pcia.com/images/Advocacy_Docs/PCIA_Model_Zoning_Ordinance_June_2012.pdf for a good starting point in the development of your own community's wireless siting ordinance.

Expansion of Broadband Wireless Coverage by Commercial Providers

Service to end-users

Meet with current and prospective wireless providers to review the coverage map showing known poor or non-existent coverage areas (Appendices B-D) and encourage those providers to specifically target those areas for expanded coverage.

Middle mile infrastructure

Consider working with providers to apply for grants and loans to improve middle mile bandwidth and to make any government owned or controlled conduit or dark fiber part of the dialogue and equation.

Apply for grant funds to subsidize tower and pole installations

Although current wireless providers cover a large portion of WACOG, many homes are located in heavily wooded areas or at low elevations and thus cannot receive wireless signals. In many cases, the addition of a pole of 60-90 feet would elevate an antenna above the treetops and low hills. Each pole would cost approximately \$3,500 - \$5,000 to install, though tower assets run in the tens or hundreds of thousand dollars. This is cost prohibitive for most residents or communities. An option to resolve this would be to submit a broadband grant request in which citizens paid a portion of the costs and WACOG applied for and received grant funding for the remainder. WACOG could work with the public to learn what level of subsidization would make this affordable for citizens. However, WACOG should fully understand potential liability issues and cost/benefit analysis before proceeding.

Manage a Broadband Request for Information (RFI) Process

Many government entities and private enterprises use a Request for Information (RFI) process to engage the telecom providers, assist in the information gathering process, and guide the development of a possible Request for Proposals (RFP) to follow. At the time of this document's development the State of Arizona Department of Administration (ADOA) and Governor's Office of Education Innovation have developed an information gathering RFI for the purpose of gathering broadband providers' input and improving broadband in schools. That RFI is included as Appendix G of this document as an example and possible template for the creation of a community or regional RFI.

Although there are many steps to ensure success, the basic steps to get started and proceed through the process are listed in the checklist that follows:

- Define broadband gaps, existing services, as well as current and future needs working with regional stakeholders
- Explain the particulars of an RFI process to stakeholders who may participate in purchasing and posit the role and value to the community
- Prepare the RFI including defining expectations and rules
- Identify broadband provider including those currently active in the area, as well as others thought interested and/or willing to enter the regional market area
- Advertise and distribute the RFI with timelines to reply
- Plan for submitted questions and potentially an open Q&A forum
- Issue any needed addendums based on provider feedback and questions
- Review and evaluate responses grading against specific criteria if appropriate
- Review internally what has been learned from the RFI and decide on next steps
- Engage specific providers in further discussions and development of opportunities

- Issue a follow on Request for Proposals (RFP) if deemed appropriate and necessary
- Formalize relationships and contracts with selected telecom providers

Enhance Public Access

Work with GovNet and other large pipe providers to secure services to anchor institutions and then provide high-speed Internet connectivity to other municipal government entities and institutions to facilitate public services. One possibility is to use Government towers for point-to-point wireless links. The advantages to doing so are that the backbone may already exist and if so, is highly reliable. Another option would be to construct fiber connections between the municipalities' peripheral areas and downtown area for the larger cities. This would be a more expensive option, but could provide more bandwidth.

Actively support non-profit, schools, libraries, and municipal entities that plan to enhance access to broadband and/or provide computers for disadvantaged residents. Examples of supportive actions WACOG or its stakeholders could undertake might include:

- Provide meeting rooms for training classes and Business Assistance Centers in all areas,
- Establish a volunteer service program in which participants assist with training classes and/or in setting up computers,
- Support a community-led initiative to train and educate members of the community how to use broadband and better Internet,
- Encourage local businesses to donate computers and volunteer their services to support sustainable broadband adoption.

Identify Potential Collaborative Grant Projects

Consider collaborating with ASET and other public-service entities, including neighboring counties, community and technical colleges, healthcare organizations, and K-12 school districts. Each of these entities has valid reasons to promote more available and affordable broadband services in the region, and each has resources or assets to bring to the table, as well as access to a differentiated portfolio of grant resources based on their profile, status, resources, and experience.

For example, healthcare organizations have qualified staff that could conduct remote "house calls" for homebound patients; but this requires reliable, high capacity broadband connectivity to the home. K-12 districts want to ensure students have quality Internet access at home as more and more course material is now available only online. Those districts have land and buildings that could be used to host network equipment sites. There are many possibly avenues and opportunities to explore and consider across the various broadband stakeholder types.

Future Planning:

The logical progression of this study began with researching the current broadband offerings followed by analyzing the gaps between those and community needs. Using that information, this study and the complementary WACOG Broadband Business Case Analysis (BCA) Report posited detailed community planning guidelines and recommendations for action. WACOG needs to begin to address the gaps outlined here and start the remediation of limited access to better Internet. The Steering Committee and broadband consultant efforts need to move into outlining feasible ways to fill the broadband chasm and estimating costs and conditions to implement. Some of the potential next steps are detailed above and in the BCA Report, as well as outlined below.

Phase 1 – Inventory, Needs Identification and Gap Analysis

This phase requires a significant effort to continue to gather data about the current status of broadband services, gaps, and needs, including initiatives such as these:

- Open forum style meetings for businesses to provide information about their uses of and needs for broadband.
- Meetings for municipal officials throughout the Region.
- Public meetings with a target audience of citizens from the poorly served areas.
- An invitation to hundreds of area businesses to participate in an online survey regarding needs.
- Brief interviews with businesses located in business parks and a physical review of observable facilities in business parks.
- Additional phone call interviews with WACOG's largest businesses and institutions.
- A survey mailed to residents regarding service quality.
- A poll of the Internet Service Providers to request and obtain information about offerings, prices and coverage areas.

Phase 2 - Cost Estimating

Any particular augmentation or addition of broadband service coverage and capabilities will have a tangible cost to be considered and weighed in the evaluation process. Current and potential broadband providers will have their own internal ROI models, go to market strategy, capital resources and constraints, as well as owner or shareholder issues. Community demand aggregation and offering of fiber and/or vertical assets at low or no cost can definitely shift the equation, as can grant contributions from a variety of sources. See the section **Understanding and Changing the Broadband Investor Equation** in the **WACOG Broadband Business Case Analysis (BCA) Report** for an actual equation to consider and examples of how community efforts can change the math.

Phase 3 - Ownership/Operations Models and Potential Partnerships

If during or after the first two phases there is a good case to take action, WACOG and its stakeholder alliance may choose to give the go-ahead for a study team to evaluate various models to enhance broadband infrastructure to meet current and future needs. Or depending on the circumstances and opportunities choose to pursue specific projects with specific public and private partners. Deliverables for Round 2 will include information regarding potential take rate, ownership/operations options, and potential partnerships as well as action plans for moving forward if desired focused on the four selected WACOG regions.

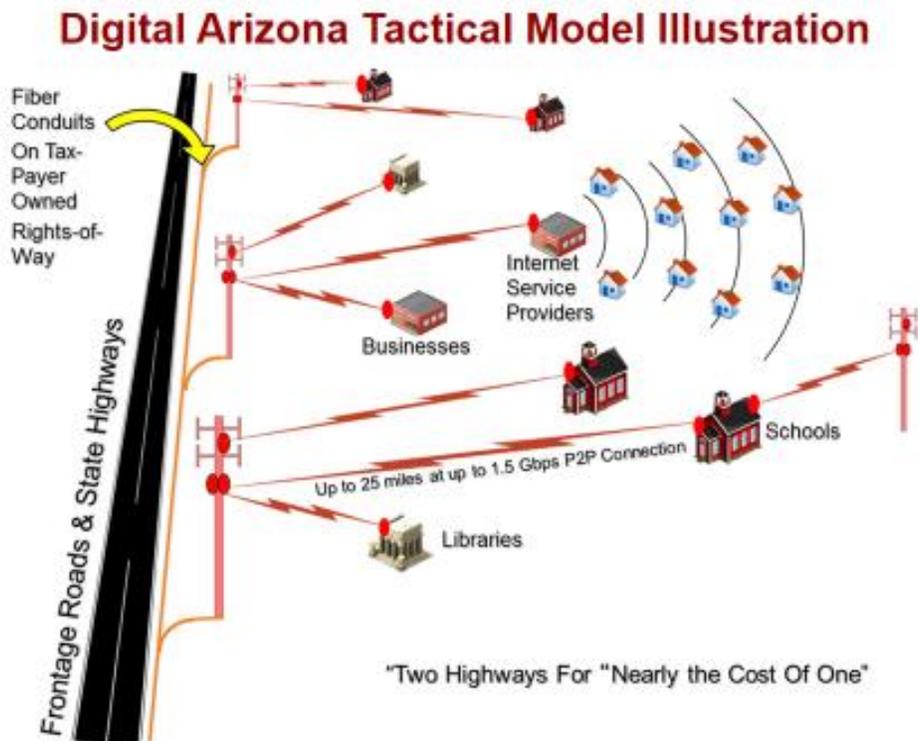
Potential Broadband Technologies:

In keeping with the State's desire to consider longer-term economic development and the need to be aware of specific broadband technology and market developments, we also examined some broadband technologies that may not currently be available throughout the WACOG region, but might be in the future. Specifically this section discusses Middle Mile Fiber and Point-to-Point/Multipoint Wireless, 4G (WiMAX and LTE) Wireless, 5G Wireless, Wireless Broadband from Aerial Platforms, Satellite Broadband, Fiber to the Home and Premises, and Broadband over Power Line (BPL).

Middle Mile Fiber and Point-to-Point/Multipoint Wireless

ASET, along with legislature and our Governor, have taken steps to improve our regulatory environment including passage of SB1402 (the Digital Arizona Highways Bill) that allows and encourages providers to use ADOT rights-of-way to place fiber optic infrastructure along roadways. Because of the passing of SB 1402, ASET's Digital Arizona Program (DAP) is working closely with ADOA's Public Safety Interoperable Communications (PISC) Office, which has responsibility for FirstNet planning and outreach. The objective of this effort is to explore synergistic ways of using SB 1402 to potentially lower the costs of expanding rural backhaul infrastructure for use by FirstNet while sharing those expanded resources to benefit educational, healthcare, and economic development uses in rural communities.

An example of a tactical model being considered in Arizona is to deploy middle mile fiber in highway Rights-of-Way that feeds towers from which mobile and fixed wireless broadband can be distributed to nearby communities and populations. Mobile broadband can be delivered over large swaths of territory for building-based and mobile users at 3G and 4G performance levels, while fixed wireless broadband from the fiber-fed towers can be scaled up to a gigabit per second and higher depending on the equipment selected. Fixed wireless receiving sites in the community may themselves become retransmitters of broadband by various means including via Wi-Fi networks. This is illustrated in the drawing below.



Source: Arizona Strategic Enterprise Technology Office (ASET)

4G (WiMAX and LTE)

Most mobile providers have begun the process of upgrading their cellular systems to a newer version of mobile wireless technology known as 4G (4th generation). Their initial focus has been on major metropolitan areas, but they are increasingly deploying 4G in the rural areas they have traditionally covered, albeit with some significant lag from the urban area. As the carriers install these network upgrades users see significant improvements in performance that vary according to the capabilities of their phones or other connected devices.

The competition between next generation cellular technologies LTE (Long Term Evolution) and WiMAX (Worldwide Interoperability for Microwave Access) is well underway. WiMAX has been quicker to market and already has operational networks in some areas, but more providers worldwide have announced they will use LTE and have ramped up related investments and deployments leveraging existing cellular network infrastructure.

Since cellular upgrade efforts tend to start in larger metro areas and “trickle down” to less densely populated areas later, customers in rural Arizona may have to wait some time to reap any benefits since the previous generation (3G) of services only quite recently came online in most of this area. However, even after these technologies are implemented, the “footprints” won’t necessarily cover more territory than is now the case. Community-based demand aggregation, measurable economic development and population/traffic growth can help motivate mobile wireless providers to target new geographic areas and increase the size of the covered territory.

Once rolled out, both LTE and WiMAX will provide significantly greater bandwidth than is now available. The claims for 4G range are for 7 Mbps to more than 20 Mbps downstream while WiMAX can perform in the 100 Mbps+ range. However, such claims should be taken with a grain of salt until there are enough users on the systems to indicate the true capacity when heavily used. Interestingly, WiMAX is often implemented by smaller, regional and local wireless providers using different licensed frequencies than the larger companies.

5G Wireless

Just when you thought we could take a breath on 4G in our marketplace 5G (5th generation) is fast approaching. 4G standards have stabilized and networks are beginning to be deployed and leveraged in advanced mobile applications. With the historical 10-year cycle new generations of cellular advancement, the mobile research community is looking to the next set of innovations in wireless communications networks likely to be deployed around 2020.

No definition for 5G wireless is yet available, but it may well seek to exceed the 4G peak service rates of 100 Mbps for high mobility users and 1 Gbps for low mobility users or at least deliver those rates more consistently and with greater spectral and/or energy efficiency, as well as improved service quality and user experience. As we seek to remain connected all the time to the Internet, the cloud, and to the various technological things (Internet of things) in our lives, wireless networks will continue to be challenged to provide the speed, capacity, and end user service experience desired.

New services and devices will continue to emerge that deliver real-time information and media streaming, as well as leverage location and context based information, providing new capabilities and experiences well beyond those of today. However, in the absence of 5G standards, we will see many wireless technology and services vendors begin to tout their latest ultrafast wireless advances as 5G.

Wireless Broadband from Aerial Platforms

There are quite a few methods of providing high-capacity wireless broadband from aerial platforms placed at stratospheric heights including unmanned aerial systems (UAS) that include a wide variety of drones with powered flight and lighter than air platforms that may be tethered or left to drift with the prevailing winds. These generally haven't been deployed in the U.S. to any significant degree for wide broadband delivery, but they are likely to be at some point.

Some interesting examples include Chandler's Space Data Corporation (<http://www.spacedata.net/>), which offers a balloon-based SkySite Platform as a low-cost solution for data communications in remote areas with a coverage circle of over 400 miles. They are often used for remote telemetry and military field support, but may find use in cross-continental clusters for filling in the mobile wireless industry's dead zones so often found in rural areas. Google Project Loon (<http://www.google.com/loon/>) is a similar, though more recent balloon-based wireless platform initiative currently focused on third world environments with little mobile service today.

Satellite Broadband

Satellite-delivered broadband and Internet relies on one or more satellites in geostationary earth orbit (GEO) above the equator, a number of ground stations known as gateways that relay bulk data to and from the satellite via earth to sky radio transmission, and a small satellite dish antenna with a transceiver and modem located at the subscriber's premises.

Smaller businesses and home-based businesses or simply residences in more rural areas often have either just one or no broadband Internet service options except for satellite, which retains the issues of latency, data caps, and significantly higher cost. However, satellite services have been becoming more competitive with higher speeds in the 3-15 Mbps download and more generous data caps, though cost for some remains an issue.

Fiber to the Home and Premises

This method of providing service involves installing fiber optic cabling directly into each building (business or house). This technology is often referred to as Fiber to the Home (FTTH) or Fiber to the Premises (FTTP) across an entire area in comparison to direct Optical Carrier (OC) high capacity fiber circuits generally provided only to specific medium and large enterprise customers.

In some parts of the eastern United States, Verizon Communications has installed this type of service to residential and business customers. Verizon has dubbed its service FiOS. AT&T has also installed some FTTH in portions of Texas. In almost all cases, the providers installed these systems in densely populated, high-income areas. In less populated areas it can be difficult for for-profit companies to justify the cost to install new FTTH systems. There are an estimated 135 FTTH/FTTP projects around the country and such systems are growing significantly, but they still represent a very small portion of the broadband market.

A variation on this theme is to install fiber most of the way and then use copper cabling to reach the last few hundred feet to individual buildings. This type of installation is often referred to as Fiber to the Neighborhood/Fiber to the Node (FTTN). In the cable TV industry, the technology used for the last few hundred feet is usually coaxial cabling while in the telephone industry, it would be the existing phone wire. FTTN can be a phased step toward

fiber to the home/fiber to the premise. A fiber to the home network is a major investment with an eye toward major long-term benefits. Those benefits include the following:

- Using fiber rather than copper cabling vastly increases the amount of data that can be transmitted. Fiber to the premise systems typically offer speeds from 10 Mbps to 100 Mbps per subscriber, and bandwidth amounts can be guaranteed, unlike wireless.
- Fiber has virtually unlimited bandwidth potential. 100 Gigabits capacity over 25 miles has been demonstrated, and even greater speeds are expected through ongoing research and development. Installed fiber capacity can often be expanded by changing out termination equipment.
- Fiber is immune to interference and much more secure from eavesdropping.
- Fiber has a long useful lifetime (30+ years) and, unlike wireless technologies, can be considered a long-term asset, rather than something that depreciates in value.

Many communications experts believe fiber is the only truly viable option for the long run and that it is simply a matter of time until everyone requires the service capacity only fiber can deliver. However, practically speaking, fiber broadband connectivity will remain very spotty for some time to come and relatively ubiquitous deployment would require the commitment of substantial investment by the private and/or public sectors that do not seem imminent.

Broadband over Power Line (BPL)

Broadband over Power Line (BPL) can deliver broadband Internet access over electrical power lines. To date, BPL has faced significant technical and market challenges in getting traction with utility companies. There are difficulties with interference as high and medium voltage electrical systems generate unintentional signals in some of the transmission ranges used by wireless networks. There is also the need to install special equipment to bridge signals around the frequent line transformers. The excitement around BPL is that it uses existing electrical power lines to distribute broadband to connected premises. This can mean a much smaller initial investment than bringing in new cabling for other technologies, but trials to date have been modest and the future of this technology in the marketplace remains uncertain.

A related item to keep in mind for BPL and electric utilities is that utilities generally install fiber bundles alongside power transmission lines. Each electric utility company could become suppliers for middle mile better Internet connections by leasing dark fiber and lit capacity. Electric utility companies also own power poles and sometimes street lights that can be leased for attachment of Wi-Fi access points or other wireless infrastructure.

Appendix A: Arizona Broadband Statistics (for Spring 2013)

	Statewide		Rural		Sparsely Pop. Rural	
All Broadband Tech (Except Satellite) 1 or More Providers	Population	Household	Population	Household	Population	Household
≥ 768 Kbps Down	99.5%	99.5%	97.5%	97.6%	95.2%	95.7%
≥ 3 Mbps Down	97.8%	97.5%	88.8%	88.3%	81.6%	81.0%
≥ 6 Mbps Down	95.6%	95.2%	78.3%	77.8%	67.3%	65.9%
≥ 10 Mbps Down	95.1%	94.6%	75.8%	75.0%	63.3%	61.6%
All Broadband Tech (Except Satellite) 2 or More Providers	Population	Household	Population	Household	Population	Household
≥ 768 Kbps Down	98.5%	98.6%	92.7%	93.2%	87.8%	88.7%
≥ 3 Mbps Down	95.6%	95.2%	78.0%	77.3%	67.7%	65.8%
≥ 6 Mbps Down	91.1%	90.1%	60.7%	59.5%	49.8%	47.1%
≥ 10 Mbps Down	89.0%	87.8%	51.8%	50.5%	43.1%	41.1%
All Broadband Tech (Except Satellite) 3 or More Providers	Population	Household	Population	Household	Population	Household
≥ 768 Kbps Down	97.6%	97.3%	87.7%	87.4%	79.9%	79.2%
≥ 3 Mbps Down	92.3%	91.1%	65.4%	63.7%	55.2%	52.3%
≥ 6 Mbps Down	85.4%	83.6%	44.1%	41.6%	35.4%	32.5%
≥ 10 Mbps Down	81.5%	79.5%	31.2%	29.6%	23.0%	22.3%
DSL, xDSL & Other Copper Tech	Population	Household	Population	Household	Population	Household
≥ 768 Kbps Down	93.1%	92.8%	73.4%	73.9%	62.5%	64.1%
≥ 3 Mbps Down	87.2%	86.4%	54.9%	55.2%	41.9%	43.0%
≥ 6 Mbps Down	79.9%	78.4%	41.3%	41.0%	30.2%	30.8%
≥ 10 Mbps Down	70.1%	68.4%	31.1%	31.0%	23.8%	24.1%
Cable Modem Technologies	Population	Household	Population	Household	Population	Household
≥ 768 Kbps Down	89.3%	88.7%	55.5%	55.9%	31.9%	34.3%
≥ 3 Mbps Down	89.3%	88.7%	55.5%	55.9%	31.9%	34.3%
≥ 6 Mbps Down	89.2%	88.6%	55.1%	55.5%	31.5%	33.8%
≥ 10 Mbps Down	89.2%	88.6%	55.1%	55.5%	31.5%	33.8%
Fixed Wireless Technologies	Population	Household	Population	Household	Population	Household
≥ 768 Kbps Down	94.7%	94.5%	76.1%	76.1%	68.3%	68.6%
≥ 3 Mbps Down	62.0%	62.9%	63.1%	62.1%	53.2%	51.5%
≥ 6 Mbps Down	34.8%	34.9%	24.8%	22.8%	20.1%	17.7%
≥ 10 Mbps Down	5.4%	5.4%	10.4%	8.4%	8.1%	6.6%
Mobile Wireless Technologies	Population	Household	Population	Household	Population	Household
≥ 768 Kbps Down	98.7%	98.9%	93.7%	94.6%	90.2%	91.5%
≥ 3 Mbps Down	92.8%	91.5%	68.0%	65.4%	61.0%	57.2%
≥ 6 Mbps Down	87.0%	85.3%	49.5%	47.0%	47.6%	54.3%
≥ 10 Mbps Down	86.9%	85.2%	49.2%	46.8%	47.1%	43.1%
	Population Count	Household Count	Population Count	Household Count	Population Count	Household Count
Arizona Totals (2010 Census)	6,392,017	2,844,526	1,274,234	601,889	651,358	329,022

Arizona Broadband Coverage Table Notes

See a textual description and analysis of this data in the section below, **Arizona Statewide Digital Landscape and Situational Analysis**.

Data presented in the table above is as collected by the State of Arizona for the NTIA and FCC broadband maps and submitted in Spring 2013 for Broadband Provider (BP) coverage declared as of 12/31/12. Population across Census Blocks and in proximity to Road Segments are based on calculations utilizing U.S. Census 2010 data.

The Census Bureau identifies two types of urban areas: **Urbanized Areas (UAs)** of 50,000 or more people and **Urban Clusters (UCs)** of at least 2,500 and less than 50,000 people. Per the Census Bureau, **“Rural”** encompasses all population, housing, and territory not included within Urbanized Areas (UAs). For Arizona analysis purposes, **“Sparsely Populated Rural”** encompasses all population, housing, and territory not included within either Urbanized Areas (UA) or Urban Clusters (UC). Using an Urban Area/Cluster GIS Layer, Arizona is calculated to have a total of 241,666 Census Blocks per the 2010 Census of which:

- 86,648 Census Blocks are in Urban Areas (UAs)
- 19,479 Census Blocks are in Urban Clusters (UCs)
- 106,127 Census Blocks total are in Urban Areas (UAs) or Urban Clusters (UCs)
- 155,018 Census Blocks are in Rural areas (Outside UAs only) with a population count of 1,274,234 and household count of 601,889
- 135,539 Census Blocks are in Sparsely Populated Rural areas (Outside both UAs and UCs) with a population count of 651,358 and household count of 329,022

For wireline providers, census blocks greater than 2 square miles intersected by covered road segments were added to their reported list of census blocks less than or equal to 2 sq. mi. For fixed and mobile wireless providers, census block counts were based on census blocks that intersected (were touched by) an overlaying wireless provider's service area. Satellite providers which tend to offer lower downstream and upstream data rates are not included in the Broadband Providers (BPs) for purposes of this analysis. All census blocks, regardless of area or water characteristic were included in this analysis.

Arizona Statewide Digital Landscape and Situational Analysis

From the Arizona Broadband Assessment Project (AZ BAP) data for Spring 2013, we know that a healthy 99.5% of Arizona households can get broadband of at least 768 Kbps download from at least one provider, not including available satellite service. As we move to rural areas that decreases to 97.6% of households. And for sparsely populated rural areas, the percentage decreases further to 95.7% of households, leaving more than 4% of sparsely populated rural households without any broadband coverage at all except satellite.

When we consider the more reasonable modern connection speed of at least 3 Mbps download, the availability percentages start to visibly decline to 97.5% of households statewide, 88.3% for rural areas, and 81.0% for sparsely populated rural areas leaving some 19% of households in sparsely populated rural areas without what we would consider adequate bandwidth. At a somewhat higher connection speed of 6 Mbps download, the availability percentages more precipitously decline to 95.2% of households statewide, 77.8% for rural areas, and only 65.9% for sparsely populated rural areas leaving some 34% of households in sparsely populated rural areas without such higher performance services.

For the availability of 3 Mbps download from more than a single Broadband Provider, analysis shows that for All Technologies, 97.8% of the statewide population has access to at least one provider, 95.6% access to at least two providers, and 92.3% access to at least three providers. For Arizona's rural areas, 88.8% of the population has access to at least one provider, 78.0% access to at least two providers, and 65.4% access to at least three providers. And for Arizona's sparsely populated rural areas, 81.6% of the population has access to at least one provider, 67.7% access to at least two providers, and 55.2% access to at least three providers.

Looking at specific technologies, DSL, xDSL & other copper delivered services at connection speeds of at least 3 Mbps download are available to 86.4% of households statewide, 55.2% for rural areas, and 43.0% for sparsely populated rural areas. At a somewhat higher connection speed of 6 Mbps download, the availability percentages more precipitously decline to 78.4% of households statewide, 41.0% for rural areas, and only 30.8% for sparsely populated rural areas. The Arizona broadband mapping team has discovered an issue in processing Frontier's DSL coverage and will make corrections in the pending Fall 2013 submittal, likely resulting in reporting of slightly less coverage.

Cable modem services at connection speeds of at least 3 Mbps download are available to 88.7% of households statewide, 55.9% for rural areas, and 34.3% for sparsely populated rural areas. The cable industry has invested heavily in a new generation of DOCSIS 3.0 services to be able to deliver connection speeds of 10 Mbps download or greater to 88.6% of households statewide, but that percentage declines to 55.5% of rural households and only 33.8% of sparsely populated rural households.

Fixed wireless services at connection speeds of at least 768 Kbps download, including Wi-Fi networks and other fixed wireless technologies, are available to 94.7% of individuals statewide, 76.1% for rural areas, and 68.3% for sparsely populated rural areas. At connection speeds of at least 3.0 Mbps, fixed wireless services are available to only 62.0% of individuals statewide, 63.1% of those living in rural areas and 53.2% of those in sparsely populated rural areas.

Mobile wireless services at connection speeds of at least 768 Kbps download, generally 3G services edging into 4G, are available to 98.7% of individuals statewide, 93.7% for rural areas, and 90.2% for sparsely populated rural areas. At connection speeds of at least 3.0 Mbps, well into 4G service range, mobile wireless services have rapidly expanded and are now available to 92.8% of individuals statewide, but only to 68.0% of those living in rural areas and 61.0% of those in sparsely populated rural areas.

Satellite broadband services at connection speeds of at least 1.5 Mbps download are available to all individuals statewide with a view of the southern sky and ability to mount a small satellite dish. Connection speeds of up to 10 Mbps and beyond are available selectively within defined geographic footprints.

Appendix B: Yuma County Analysis & Views

	<u>Population</u>
Yuma County	205,174
Yuma (County Seat)	94,824
San Luis	31,080
Somerton	14,796
Welton	2,974
Unincorporated	61,500
Cocopah Indian Reservation	

Note: Estimates drawn from the July 1, 2012 Population Estimates of the Office of Employment & Population Statistics, Arizona Department of Administration <http://www.workforce.az.gov/pubs/demography/July1-2012PopulationEstimates.pdf>

Yuma County Broadband Overview:

There is limited DSL coverage in Yuma County centering on the Greater Yuma area including Somerton with just a little coverage in the Welton area. Just 63.3% of the population can get DSL at ≥ 768 Kbps downstream and a slim 40.6% can get ≥ 6 Mbps. The Arizona broadband mapping team has discovered an issue in processing Frontier's DSL coverage and will make corrections in the pending Fall 2013 submittal, likely resulting in reporting of slightly less coverage.

Cable modem based broadband covers 82.2% of the Yuma County population, again centering on the Greater Yuma area including some of Somerton and San Luis, with speeds ≥ 10 Mbps.

Fixed wireless (licensed and unlicensed) has a more extensive footprint estimated to reach 95.0% of the Yuma County population in the Greater Yuma area and along the I8 corridor at speeds up to 6 Mbps, but is barely available (1.6%) at higher speeds.

Mobile wireless has by far the broadest footprint, estimated to reach 100.0% of the Yuma County population at speeds ≥ 768 Kbps and virtually the same footprint at 98.9% for speeds up to 6 Mbps, but nothing higher.

A limited number of Middle Mile points, almost always fiber fed, are available primarily from Airband Communications, Level3 Communications, CenturyLink, and Zayo.

More detailed views of the Greater Yuma area including Somerton and San Luis follow the county level views to allow for more granular inspection of coverage by technology type across the major population centers.

Yuma County Broadband Coverage for Spring 2013

All Broadband Tech (Except Satellite)	Yuma County		State of Arizona	
	Population	Household	Population	Household
≥ 768 Kbps Down	100%	100%	99.5%	99.5%
≥ 3 Mbps Down	99.1%	98.75%	97.8%	97.5%
≥ 6 Mbps Down	84.2%	86.1%	95.6%	95.2%
≥ 10 Mbps Down	82.4%	83.3%	95.1%	94.6%
DSL, xDSL & Other Copper Tech	Population %	Household %	Population	Household
≥ 768 Kbps Down	63.3%	62.4%	93.1%	92.8%
≥ 3 Mbps Down	50.0%	47.8%	87.2%	86.4%
≥ 6 Mbps Down	40.6%	39.1%	79.9%	78.4%
≥ 10 Mbps Down	27.9%	26.8%	70.1%	68.4%
Cable Modem Technologies	Population	Household	Population	Household
≥ 768 Kbps Down	82.2%	83.2%	89.3%	88.7%
≥ 3 Mbps Down	82.2%	83.2%	89.3%	88.7%
≥ 6 Mbps Down	82.2%	83.2%	89.2%	88.6%
≥ 10 Mbps Down	82.2%	83.2%	89.2%	88.6%
Fixed Wireless Technologies	Population	Household	Population	Household
≥ 768 Kbps Down	95.0%	95.8%	94.7%	94.5%
≥ 3 Mbps Down	95.0%	95.8%	62.0%	62.9%
≥ 6 Mbps Down	1.6%	2.6%	34.8%	34.9%
≥ 10 Mbps Down	0%	0%	5.4%	5.4%
Mobile Wireless Technologies	Population	Household	Population	Household
≥ 768 Kbps Down	100%	100%	98.7%	98.9%
≥ 3 Mbps Down	98.9%	98.5%	92.8%	91.5%
≥ 6 Mbps Down	0%	0%	87.0%	85.3%
≥ 10 Mbps Down	0%	0%	86.9%	85.2%
	Population Count	Household Count	Population Count	Household Count
County Totals (2010 Census)	195,751	87,850	6,392,017	2,844,526

Notes: Data presented in table above is as collected by the State of Arizona for the NTIA and FCC broadband maps and submitted in Spring 2013 for Broadband Provider (BP) coverage declared as of 12/31/12. Population across Census Blocks and in proximity to Road Segments are based on calculations utilizing U.S. Census 2010 data.

See also the complementary **WACOG Arizona Broadband Technical Report** in Appendix B for additional Yuma County broadband maps by each technology type, detailed views of the Yuma/San Luis/Somerton areas, and a table of the 14 broadband providers known to be active in the county including their technology type(s) and speed range(s).

Yuma County Broadband Providers (14)

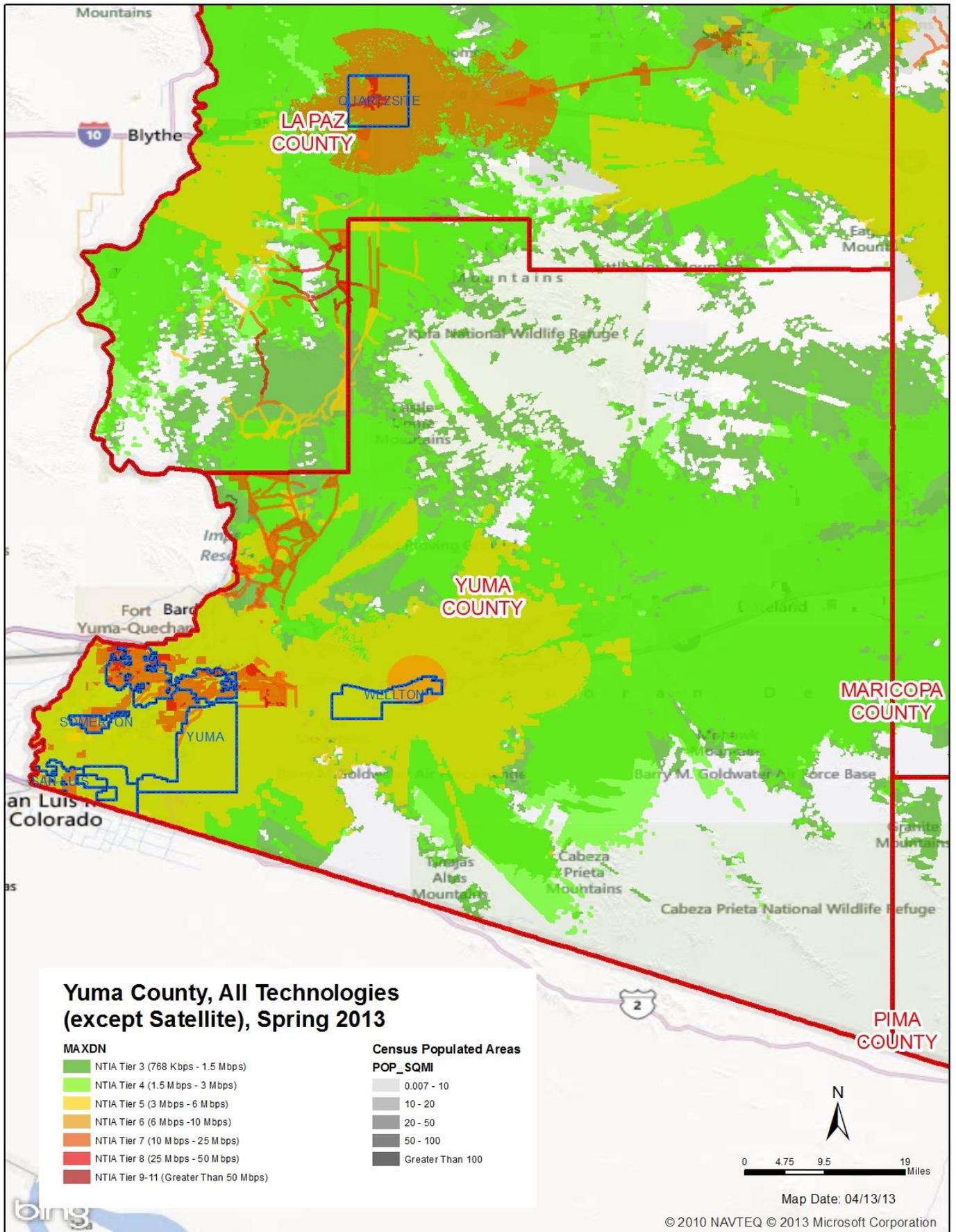
Broadband Provider	Service Type	Advertised Download Speed	Advertised Upload Speed	Download Speed Tier	Upload Speed Tier
Airband	Fixed Wireless	6 - 10 Mbps	1.5 - 3 Mbps	6	4
AT&T Mobility	Mobile Wireless	1.5 - 3 Mbps	768 Kbps - 1.5 Mbps	4	3
		3 - 6 Mbps	3 - 6 Mbps	5	5
Beamspeed	Fixed Wireless	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
CenturyLink	DSL (Asymmetric)	1.5 - 3 Mbps	768 Kbps - 1.5 Mbps	4	3
		3 - 6 Mbps	200 - 768 Kbps	5	2
		3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
		6 - 10 Mbps	768 Kbps - 1.5 Mbps	6	3
		10 - 25 Mbps	768 Kbps - 1.5 Mbps	7	3
		25 - 50 Mbps	3 - 6 Mbps	8	5
		25 - 50 Mbps	10 - 25 Mbps	8	7
Frontier Southwest	DSL (Asymmetric)	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
		10 - 25 Mbps	1.5 - 3 Mbps	7	4
		25 - 50 Mbps	3 - 6 Mbps	8	5
HNS (Hughes, Echostar)	Satellite	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
		10 - 25 Mbps	1.5 - 3 Mbps	7	4
Level 3 Communications	Fiber	> 1 Gbps	> 1 Gbps	11	11
Skycasters (VSAT Systems)	Satellite	6 - 10 Mbps	1.5 - 3 Mbps	6	4
Sprint Communications	Mobile Wireless	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
StarBand Communications	Satellite	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
TDS Telecom	DSL (Asymmetric)	10 - 25 Mbps	768 Kbps - 1.5 Mbps	7	3
Time Warner Cable	Cable	10 - 25 Mbps	1.5 - 3 Mbps	7	4
Verizon Communications	Mobile Wireless	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
ViaSat	Satellite	1.5 - 3 Mbps	200 - 768 Kbps	4	2
		3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3

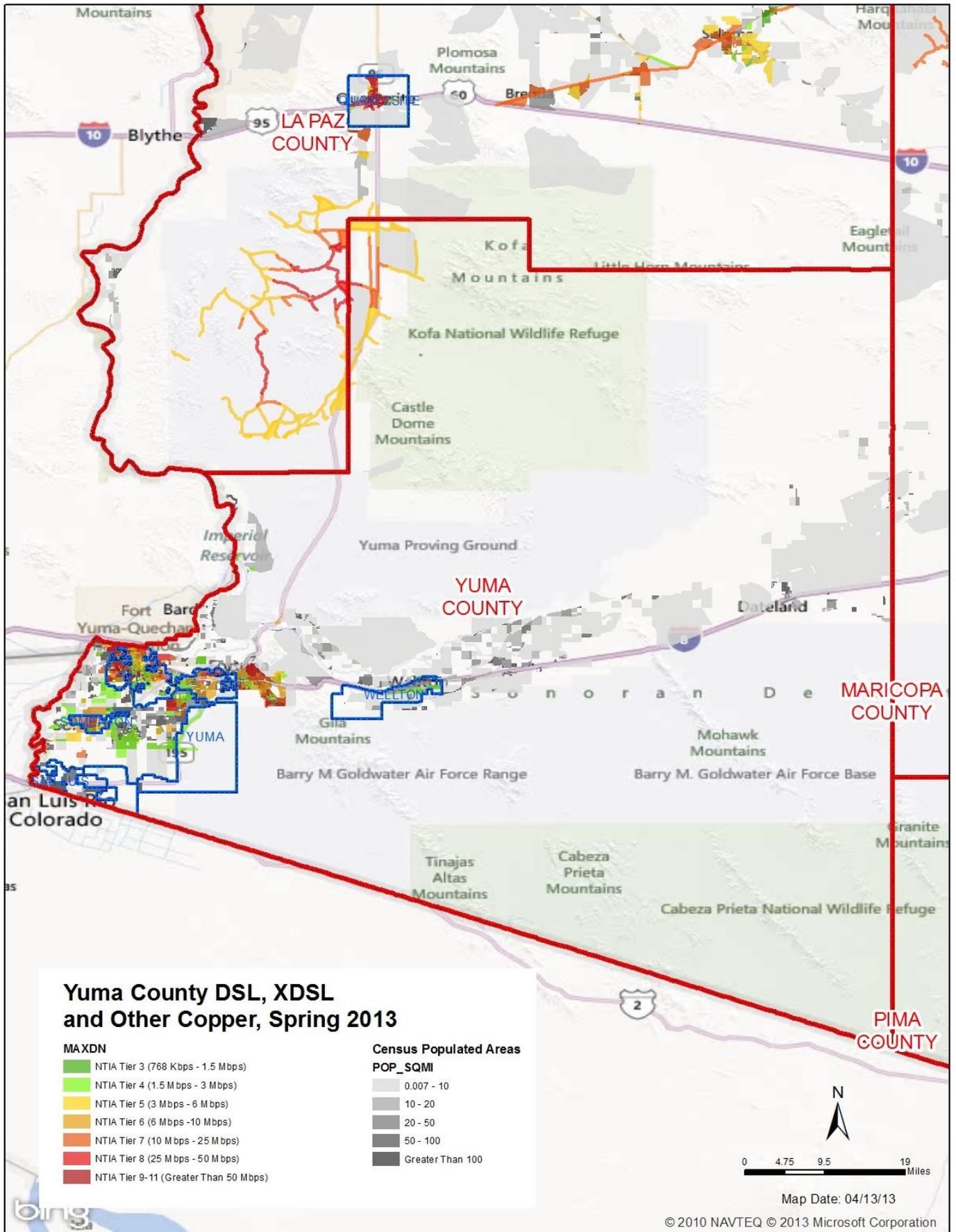
Yuma County Selected Demographics

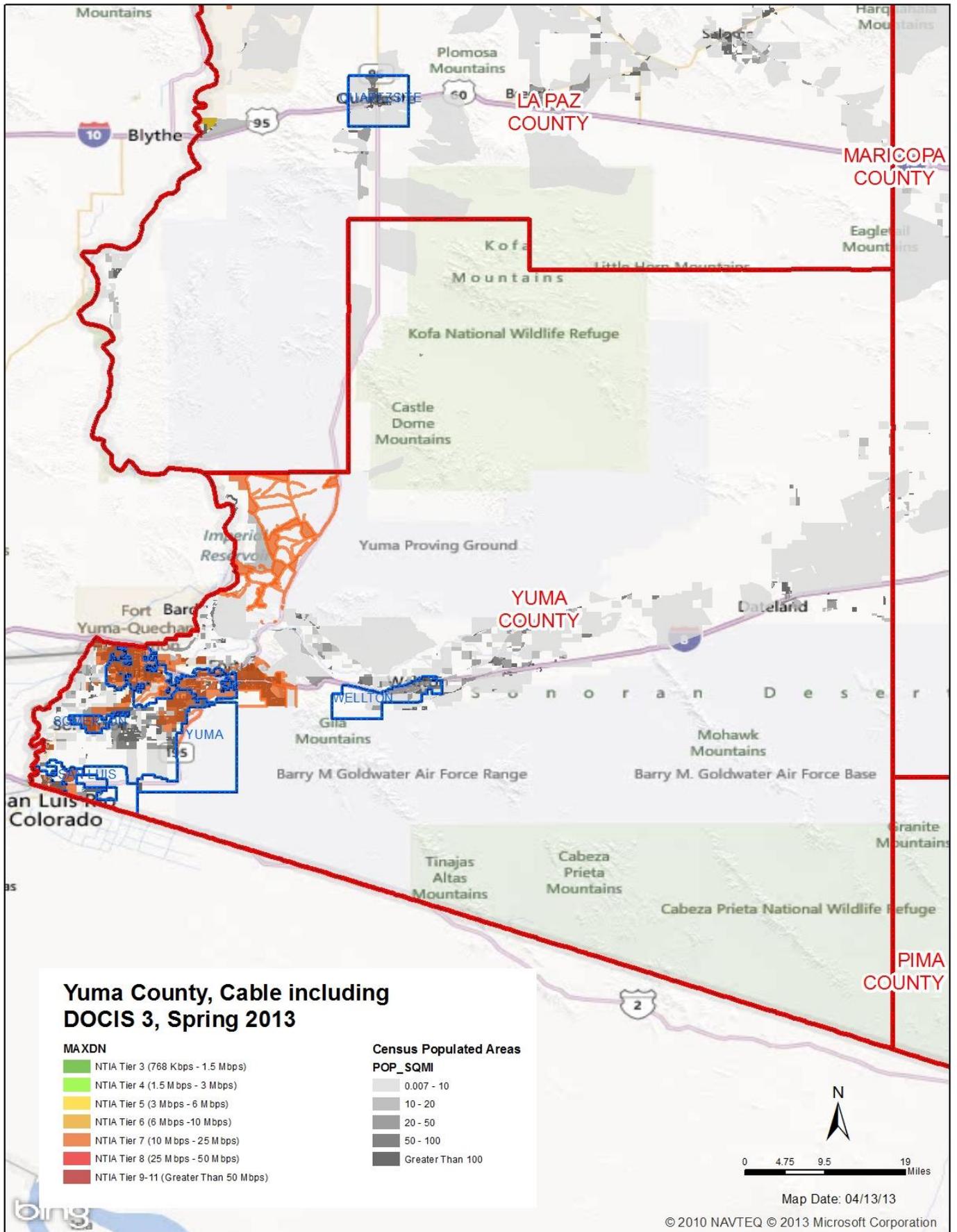
Baseline Demographics	Yuma County	State of Arizona
County seat/State capitol	Yuma	Phoenix
Land area in square miles	5,513.99	113,594.08
Population, 2012 estimate	200,022	6,553,255
Population, percent change, 4/1/10-7/1/12	2.2%	2.5%
Persons under 18 years, percent, 2012	27.2%	24.7%
Persons 65 years and over, percent, 2012	16.4%	14.8%
Persons per household, 2007-2011	2.67	2.64
Persons per square mile, 2010	35.5	56.3
High school graduate or higher, percent of persons age 25+, 2007-2011	71.9%	85.2%
Bachelor's degree or higher, percent of persons age 25+, 2007-2011	13.9%	26.4%
Per capita income in the past 12 months (2011 dollars), 2007-2011	\$18,778	\$25,784
Median household income, 2007-2011	\$41,441	\$50,752
Persons below poverty level, percent, 2007-2011	20.8%	16.2%
Homeownership rate, 2007-2011	70.4%	66.6%
Total civilian labor force, 7/13	96,485	3,017,815
Total employment, 7/13	63,226	2,766,640
Total unemployment, 7/13	33,259	251,175
Unemployment rate, 7/13	34.5%	8.3%

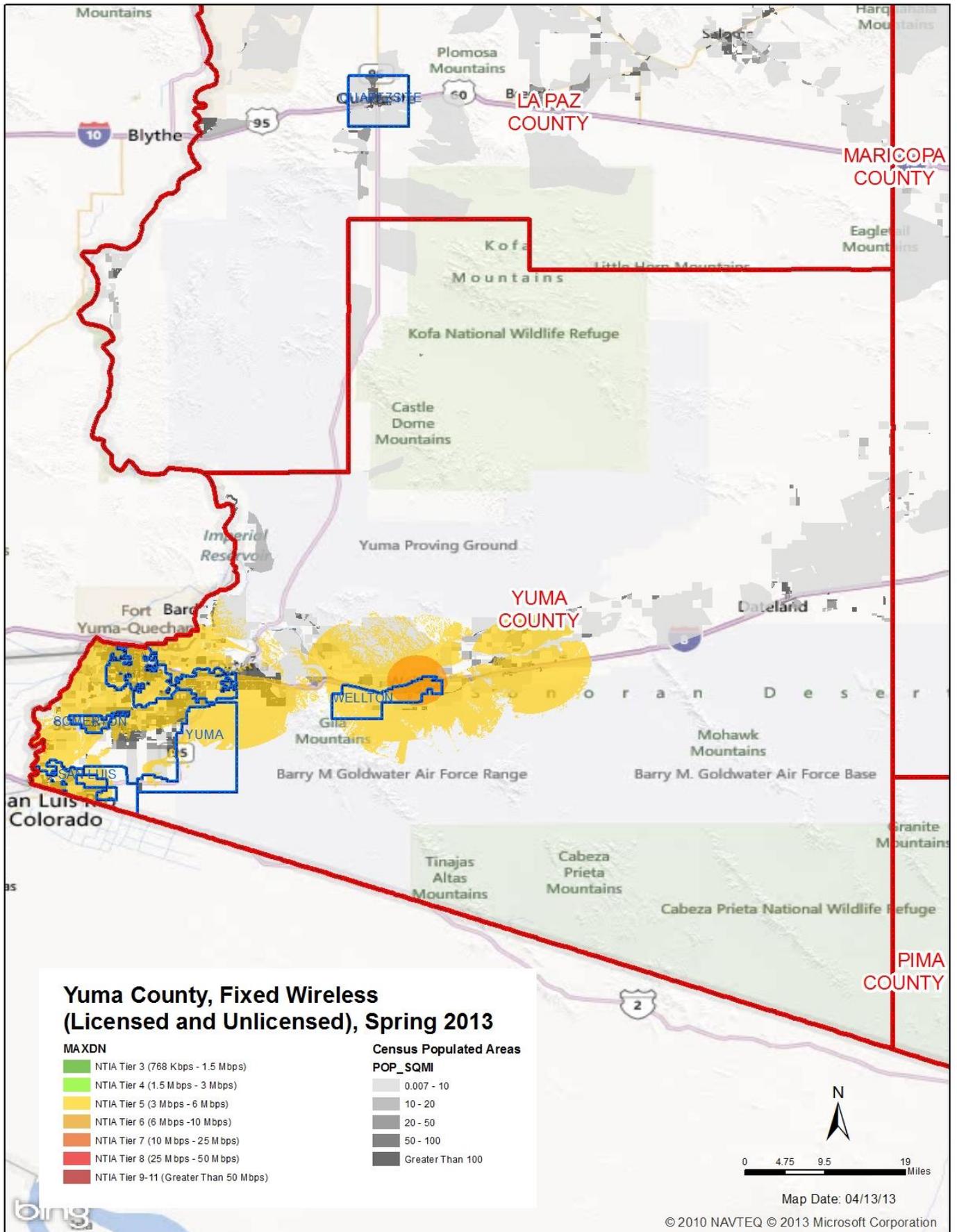
Employment by Category (July 2013 Estimates)	Yuma County by Population	Statewide by Population	Yuma County %	Statewide %
Total Nonfarm	47,600	2,453,900	100.0%	100.0%
Total Private Employment	33,700	2,088,300	70.8%	85.1%
Goods Producing	4,000	296,200	8.4%	12.1%
Mining and Construction	2,200	139,400	4.6%	5.7%
Manufacturing	1,800	156,800	3.8%	6.4%
Service-Providing	43,600	2,157,700	91.6%	87.9%
Private Service-Providing	29,700	1,792,100	62.4%	73.0%
Trade, Transportation & Utilities	8,600	482,600	18.1%	19.7%
Information	600	39,600	1.3%	1.6%
Financial Activities	1,300	183,200	2.7%	7.5%
Professional & Business Services	6,300	360,500	13.2%	14.7%
Educational & Health Services	6,900	369,700	14.5%	15.1%
Leisure and Hospitality	4,600	272,100	9.7%	11.1%
Other Private Services	1,400	84,400	2.9%	3.4%
Government	13,900	365,600	29.2%	14.9%
Federal Government	3,600	55,700	7.6%	2.3%
State & Local Government	10,300	309,900	21.6%	12.6%

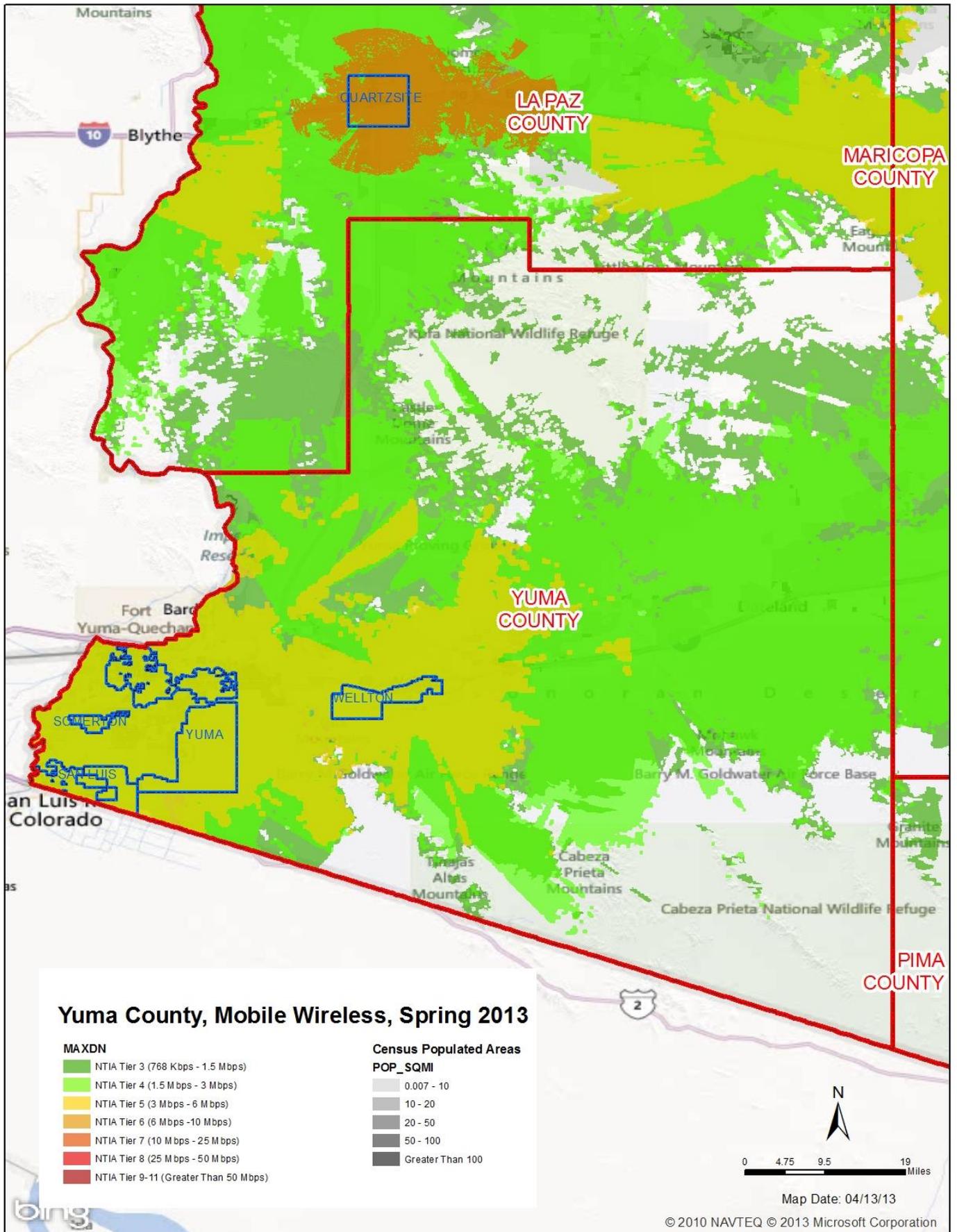
Sources: U.S. Census Bureau State & County QuickFacts (<http://quickfacts.census.gov/>) and ADOA Office of Employment & Population Statistics (<http://www.workforce.az.gov/>). For employment by category estimates, farm employment, private household employment, and self-employment are excluded and all employment statistics are non-seasonally adjusted.

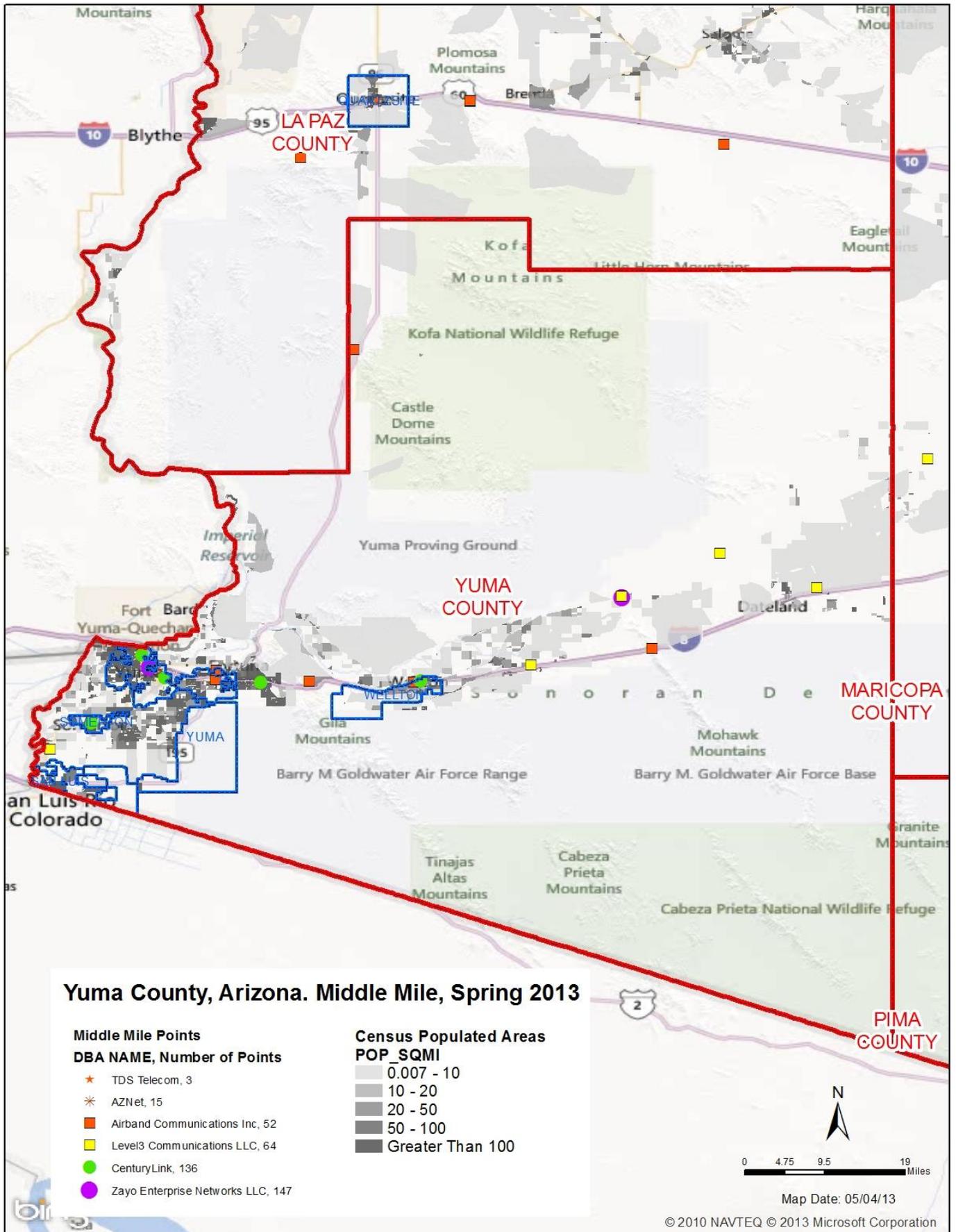


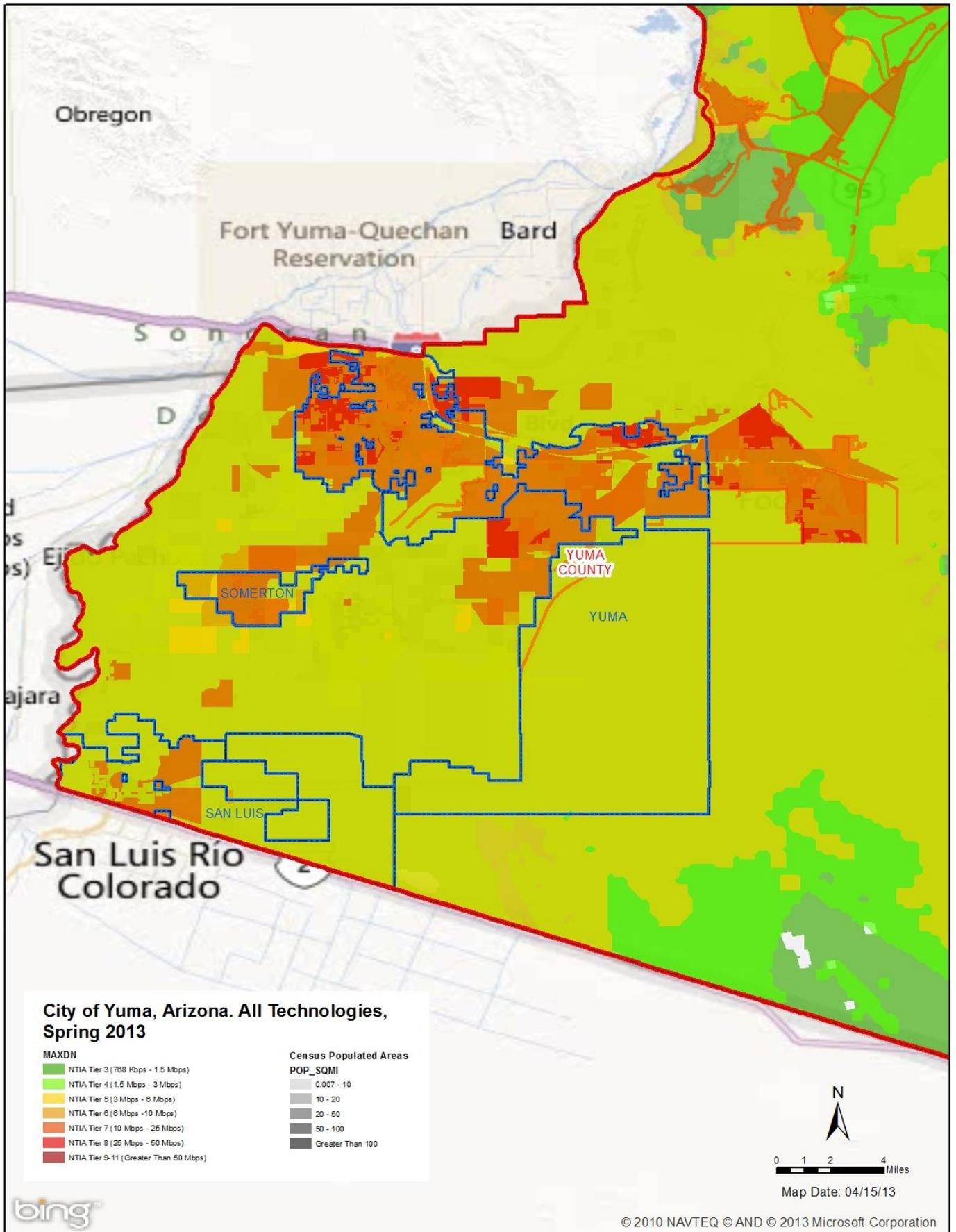


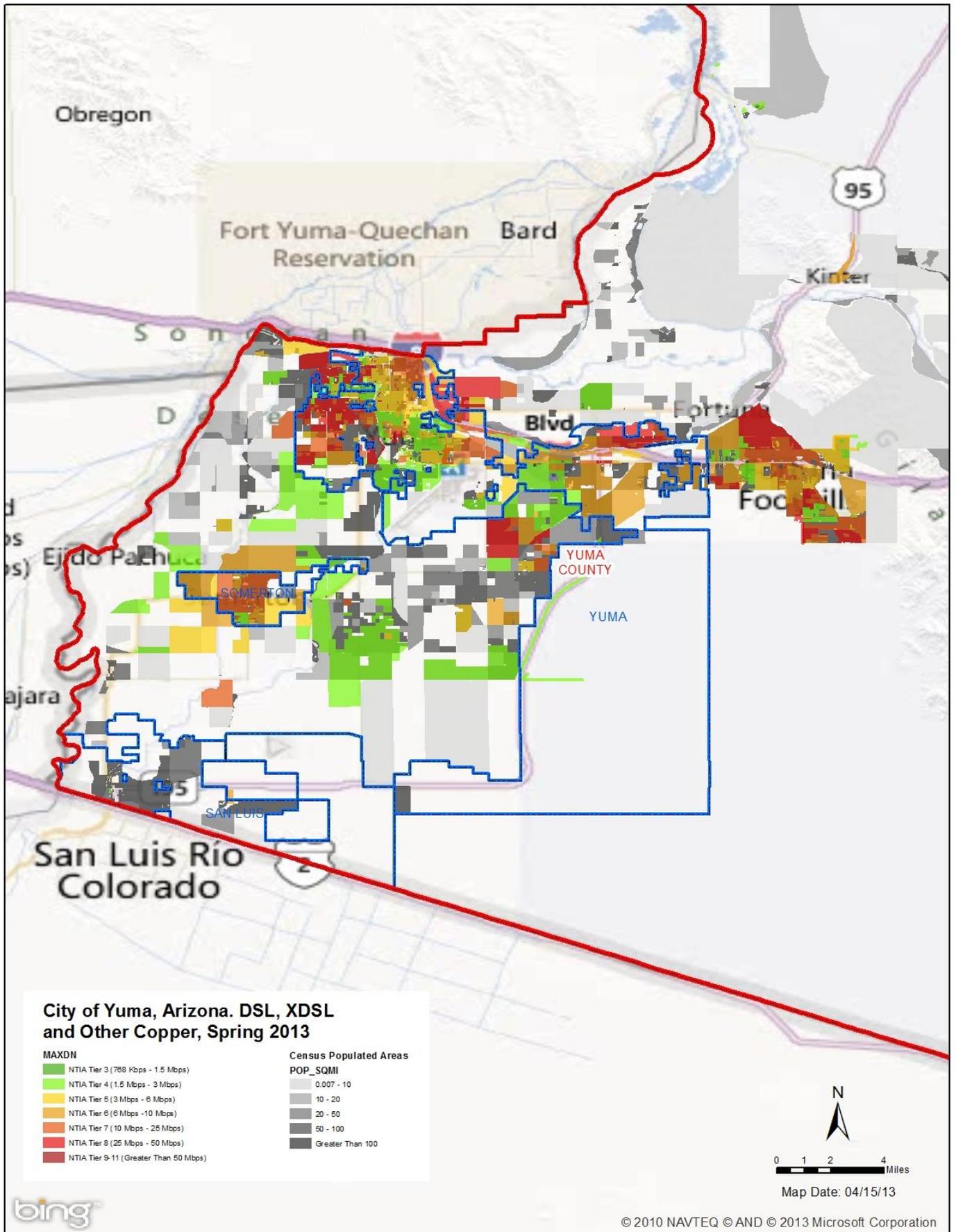


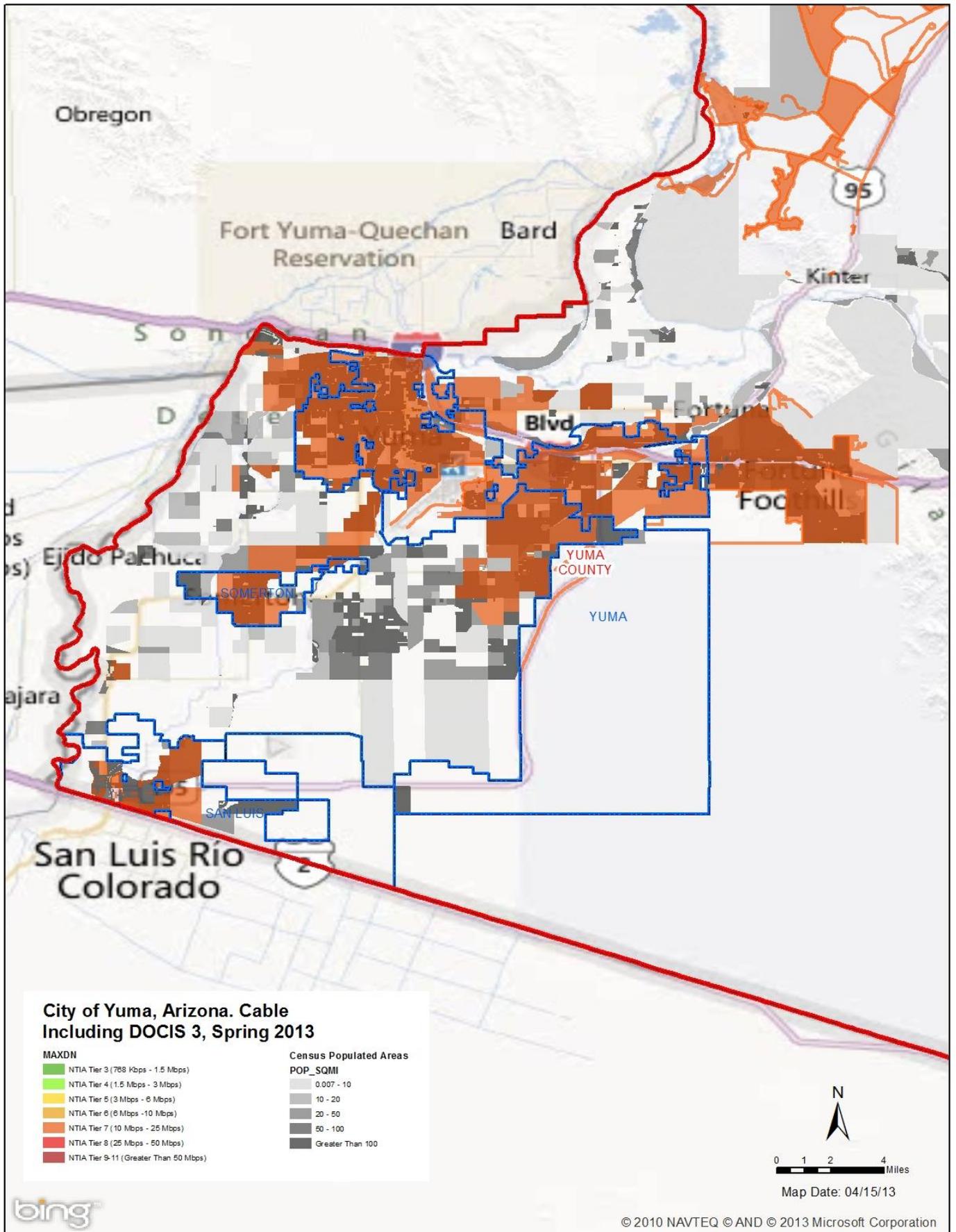


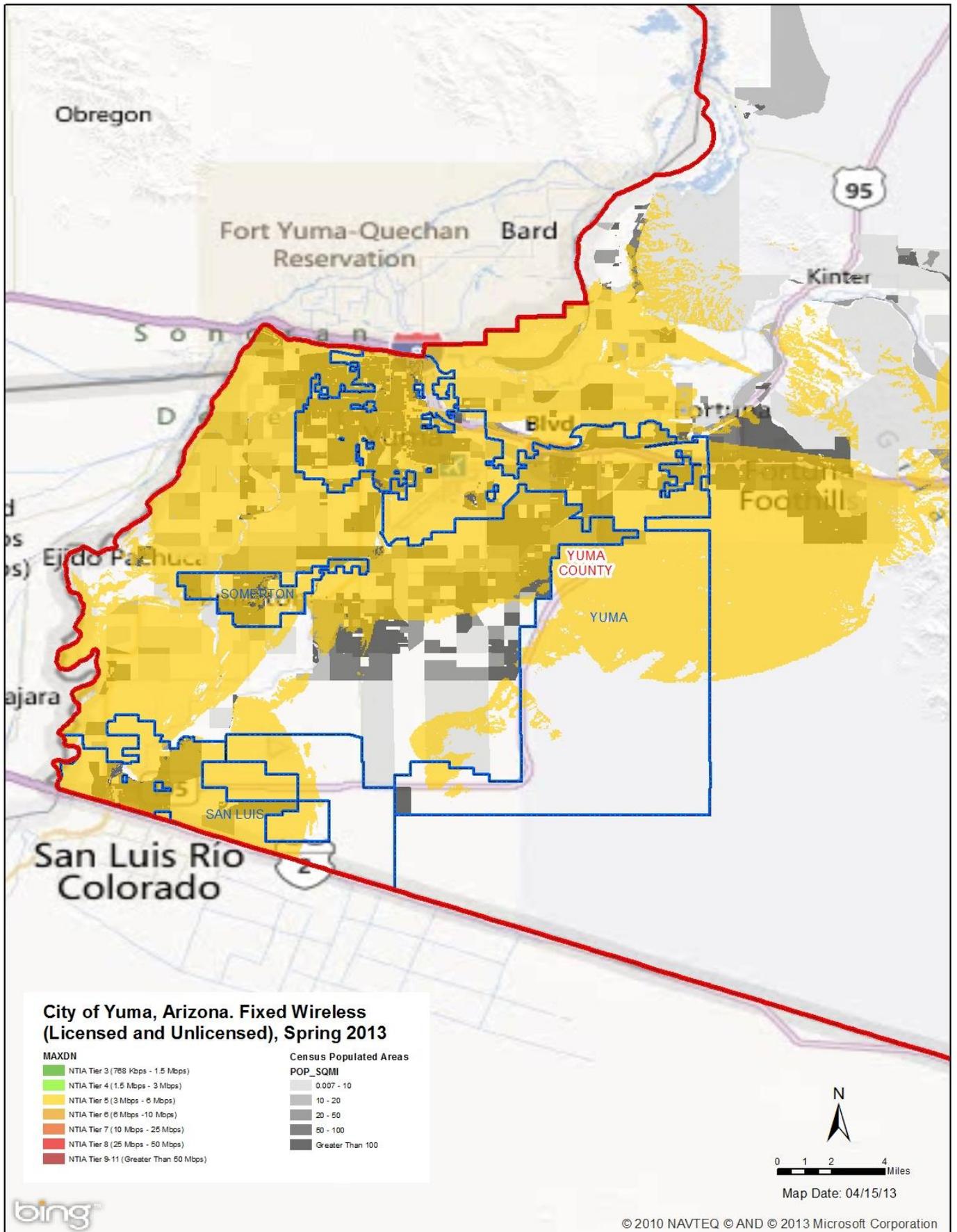


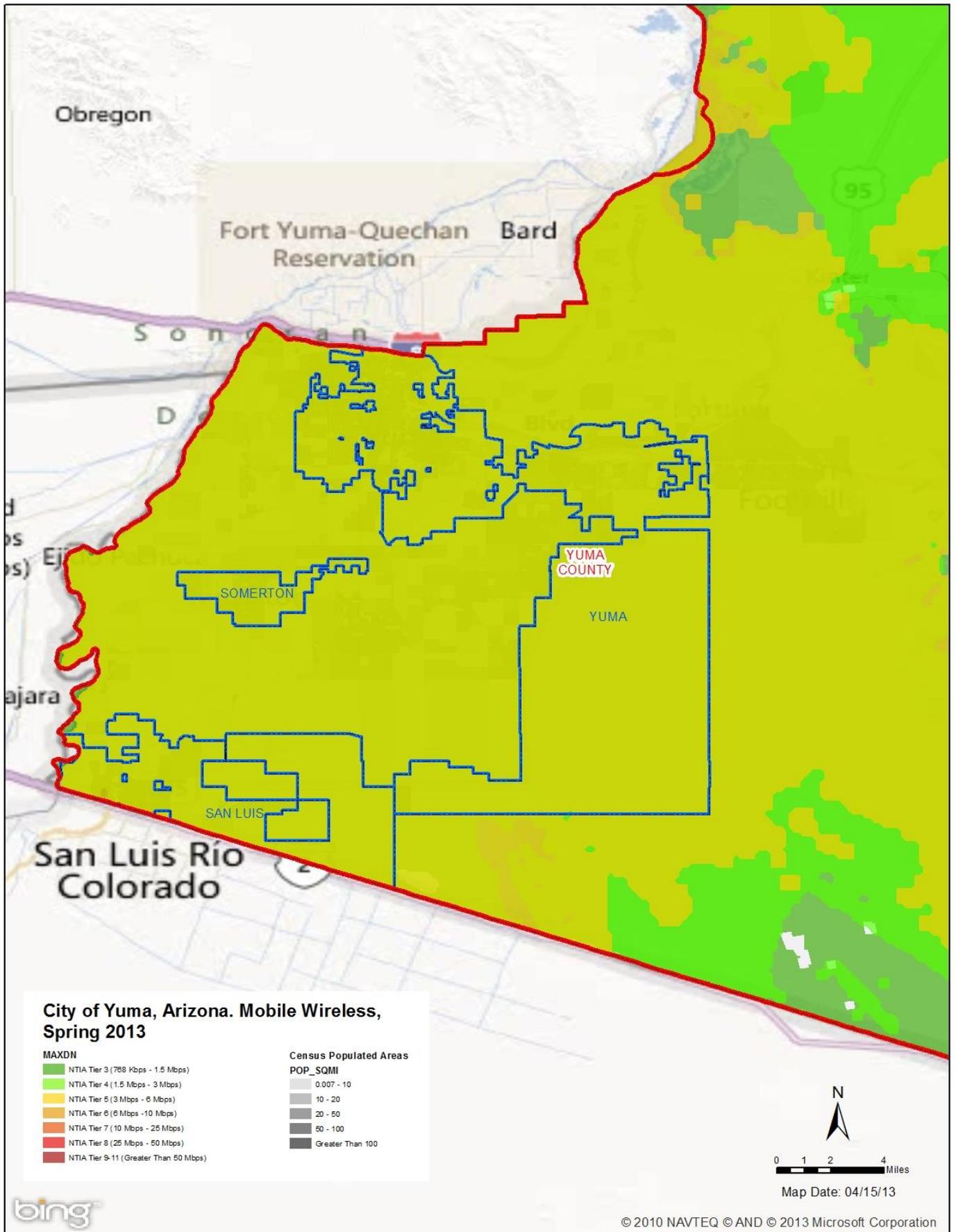












Appendix C: La Paz County Analysis & Views

	<u>Population</u>
La Paz County	20,902
Parker (County Seat)	3,082
Quartzsite	3,773
Unincorporated	14,047
Bouse	
Ehrenberg	
Salome/Wenden	
Colorado Indian Reservation	

Note: Estimates drawn from the July 1, 2012 Population Estimates of the Office of Employment & Population Statistics, Arizona Department of Administration <http://www.workforce.az.gov/pubs/demography/July1-2012PopulationEstimates.pdf>

La Paz County Broadband Overview:

There is limited DSL coverage in La Paz County centering on the Parker, Quartzsite, and Salome areas. Just 67.1% of the population can get DSL at ≥ 768 Kbps downstream and a very slim 26.1% can get ≥ 6 Mbps. The Arizona broadband mapping team has discovered an issue in processing Frontier's DSL coverage and will make corrections in the pending Fall 2013 submittal, likely resulting in reporting of slightly less coverage.

Cable modem based broadband covers a meager 28.7% of the La Paz County population, with spotty coverage in the Parker area and virtually no coverage elsewhere.

Fixed wireless (licensed and unlicensed) has no footprint in La Paz County with 0.1% of the population covered at the lowest broadband speed of ≥ 768 Kbps.

Mobile wireless has by far the broadest footprint, estimated to reach 99.9% of the La Paz County population at speeds ≥ 768 Kbps and but dropping precipitously to 24.4% for speeds ≥ 3 Mbps. Quartzsite is largely covered by a 4G network delivering ≥ 6 Mbps, but the rest of the county is confined to lower speeds for now. Aggressive mobile provider 4G upgrades should shift the situation over time.

A limited number of Middle Mile points, almost always fiber fed, are available primarily from Wecom, Airband Communications, Level3 Communications, CenturyLink, and Zayo.

More detailed views of the Parker and Quartzsite areas follow the county level views to allow for more granular inspection of coverage by technology type across the major population centers.

La Paz County Broadband Coverage for Spring 2013

All Broadband Tech (Except Satellite)	La Paz County		State of Arizona	
	Population	Household	Population	Household
≥ 768 Kbps Down	99.9%	99.9%	99.5%	99.5%
≥ 3 Mbps Down	73.9%	76.8%	97.8%	97.5%
≥ 6 Mbps Down	59.1%	67.8%	95.6%	95.2%
≥ 10 Mbps Down	59.0%	67.6%	95.1%	94.6%
DSL, xDSL & Other Copper Tech	Population %	Household %	Population	Household
≥ 768 Kbps Down	67.1%	67.0%	93.1%	92.8%
≥ 3 Mbps Down	63.8%	64.5%	87.2%	86.4%
≥ 6 Mbps Down	26.1%	37.3%	79.9%	78.4%
≥ 10 Mbps Down	26.0%	37.1%	70.1%	68.4%
Cable Modem Technologies	Population	Household	Population	Household
≥ 768 Kbps Down	28.7%	28.1%	89.3%	88.7%
≥ 3 Mbps Down	28.7%	28.1%	89.3%	88.7%
≥ 6 Mbps Down	27.2%	27.2%	89.2%	88.6%
≥ 10 Mbps Down	27.2%	27.2%	89.2%	88.6%
Fixed Wireless Technologies	Population	Household	Population	Household
≥ 768 Kbps Down	0.1%	0.1%	94.7%	94.5%
≥ 3 Mbps Down	0%	0%	62.0%	62.9%
≥ 6 Mbps Down	0%	0%	34.8%	34.9%
≥ 10 Mbps Down	0%	0%	5.4%	5.4%
Mobile Wireless Technologies	Population	Household	Population	Household
≥ 768 Kbps Down	99.9%	99.9%	98.7%	98.9%
≥ 3 Mbps Down	24.4%	29.5%	92.8%	91.5%
≥ 6 Mbps Down	24.1%	29.1%	87.0%	85.3%
≥ 10 Mbps Down	24.1%	29.1%	86.9%	85.2%
	Population Count	Household Count	Population Count	Household Count
County Totals (2010 Census)	20,489	16,049	6,392,017	2,844,526

Notes: Data presented in table above is as collected by the State of Arizona for the NTIA and FCC broadband maps and submitted in Spring 2013 for Broadband Provider (BP) coverage declared as of 12/31/12. Population across Census Blocks and in proximity to Road Segments are based on calculations utilizing U.S. Census 2010 data.

See also the complementary **WACOG Arizona Broadband Technical Report** in Appendix C for additional La Paz County broadband maps by each technology type, detailed views of the Parker and Quartzsite areas, and a table of the 13 broadband providers known to be active in the county including their technology type(s) and speed range(s).

La Paz County Broadband Providers (13)

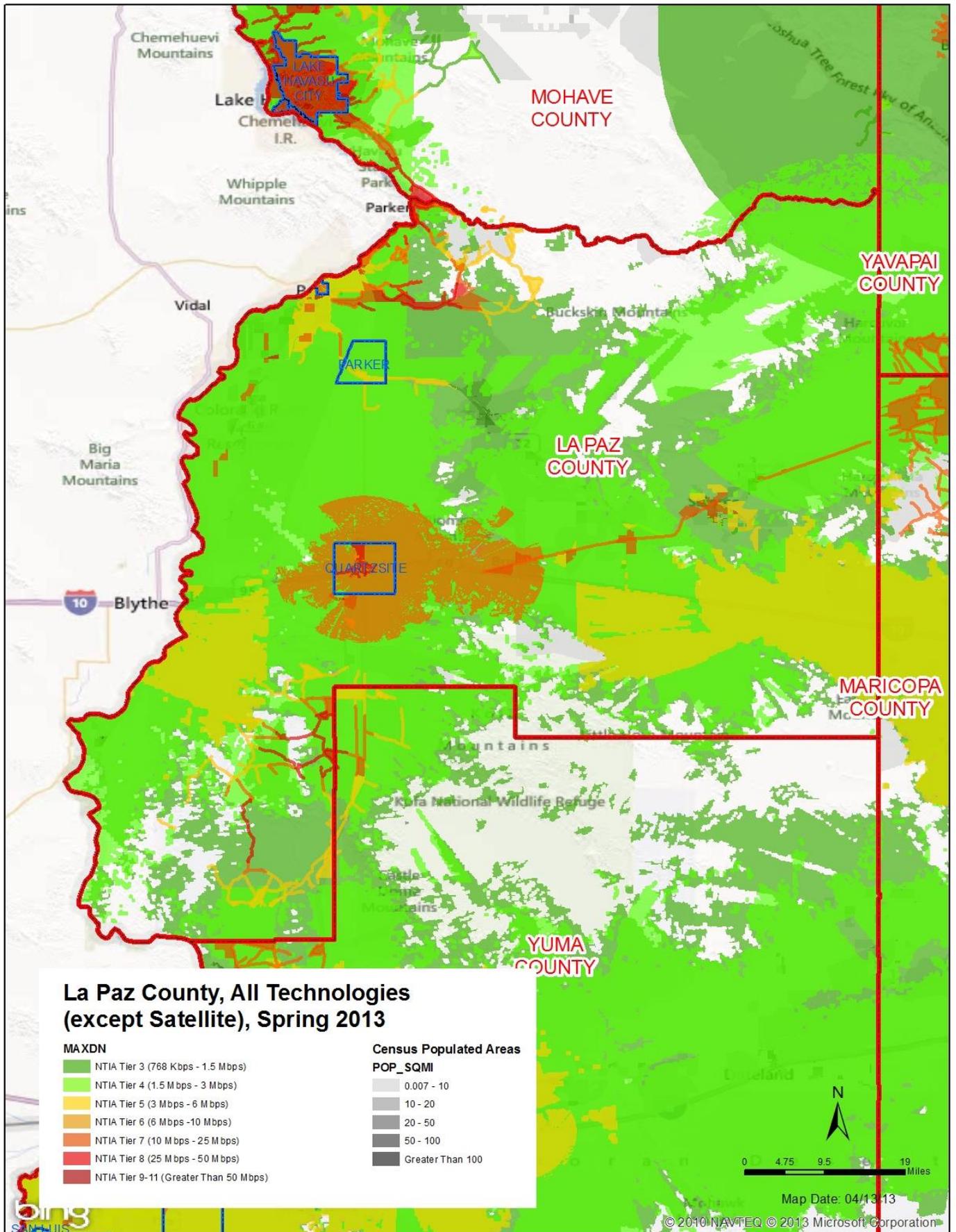
Broadband Provider	Service Type	Advertised Download Speed	Advertised Upload Speed	Download Speed Tier	Upload Speed Tier
AT&T Mobility	Mobile Wireless	1.5 - 3 Mbps	768 Kbps - 1.5 Mbps	4	3
		3 - 6 Mbps	3 - 6 Mbps	5	5
CommSpeed	Fixed Wireless	768 Kbps - 1.5 Mbps	768 Kbps - 1.5 Mbps	3	3
Frontier Citizens Utilities Rural	DSL (Asymmetric)	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
		10 - 25 Mbps	1.5 - 3 Mbps	7	4
		25 - 50 Mbps	3 - 6 Mbps	8	5
Frontier Southwest	DSL (Asymmetric)	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
		10 - 25 Mbps	1.5 - 3 Mbps	7	4
		25 - 50 Mbps	3 - 6 Mbps	8	5
HNS (Hughes, Echostar)	Satellite	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
NPG Cable (Suddenlink)	Cable	3 - 6 Mbps	200 - 768 Kbps	5	2
		10 - 25 Mbps	1.5 - 3 Mbps	7	4
		25 - 50 Mbps	1.5 - 3 Mbps	8	4
		50 - 100 Mbps	3 - 6 Mbps	9	5
Skycasters (VSAT Systems)	Satellite	6 - 10 Mbps	1.5 - 3 Mbps	6	4
Sprint Communications	Mobile Wireless	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
StarBand Communications	Satellite	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
T-Mobile	Mobile Wireless	1.5 - 3 Mbps	200 - 768 Kbps	4	2
Table Top Telephone	DSL (Asymmetric)	10 - 25 Mbps	768 Kbps - 1.5 Mbps	7	3
TDS Telecom	DSL (Asymmetric)	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
		1.5 - 3 Mbps	200 - 768 Kbps	4	2
		3 - 6 Mbps	200 - 768 Kbps	5	2
		6 - 10 Mbps	200 - 768 Kbps	6	2
		10 - 25 Mbps	768 Kbps - 1.5 Mbps	7	3
		25 - 50 Mbps	1.5 - 3 Mbps	8	4
Time Warner Cable	Cable	10 - 25 Mbps	1.5 - 3 Mbps	7	4
Verizon Communications	Mobile Wireless	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
		10 - 25 Mbps	3 - 6 Mbps	7	5
ViaSat	Satellite	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3

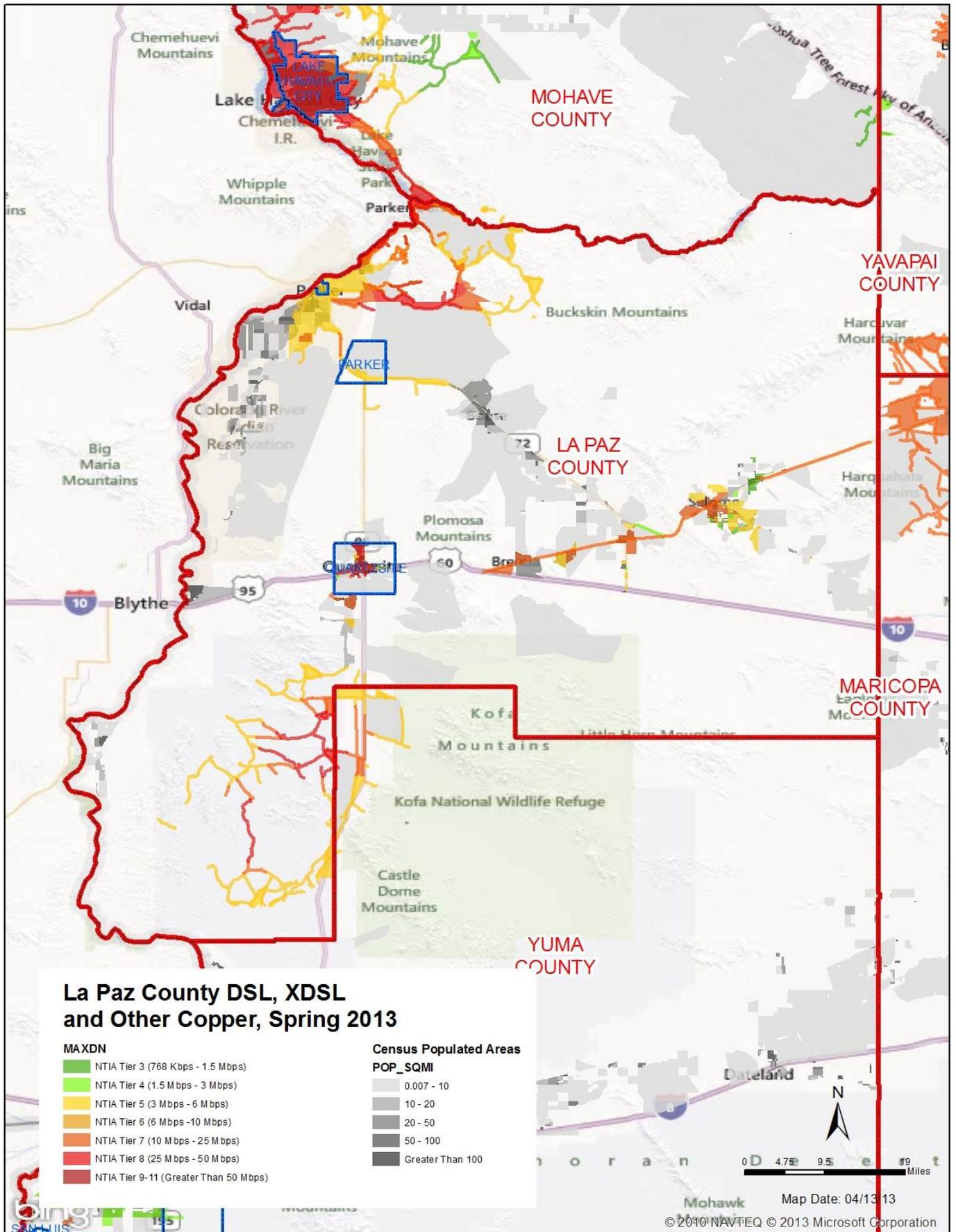
La Paz County Selected Demographics

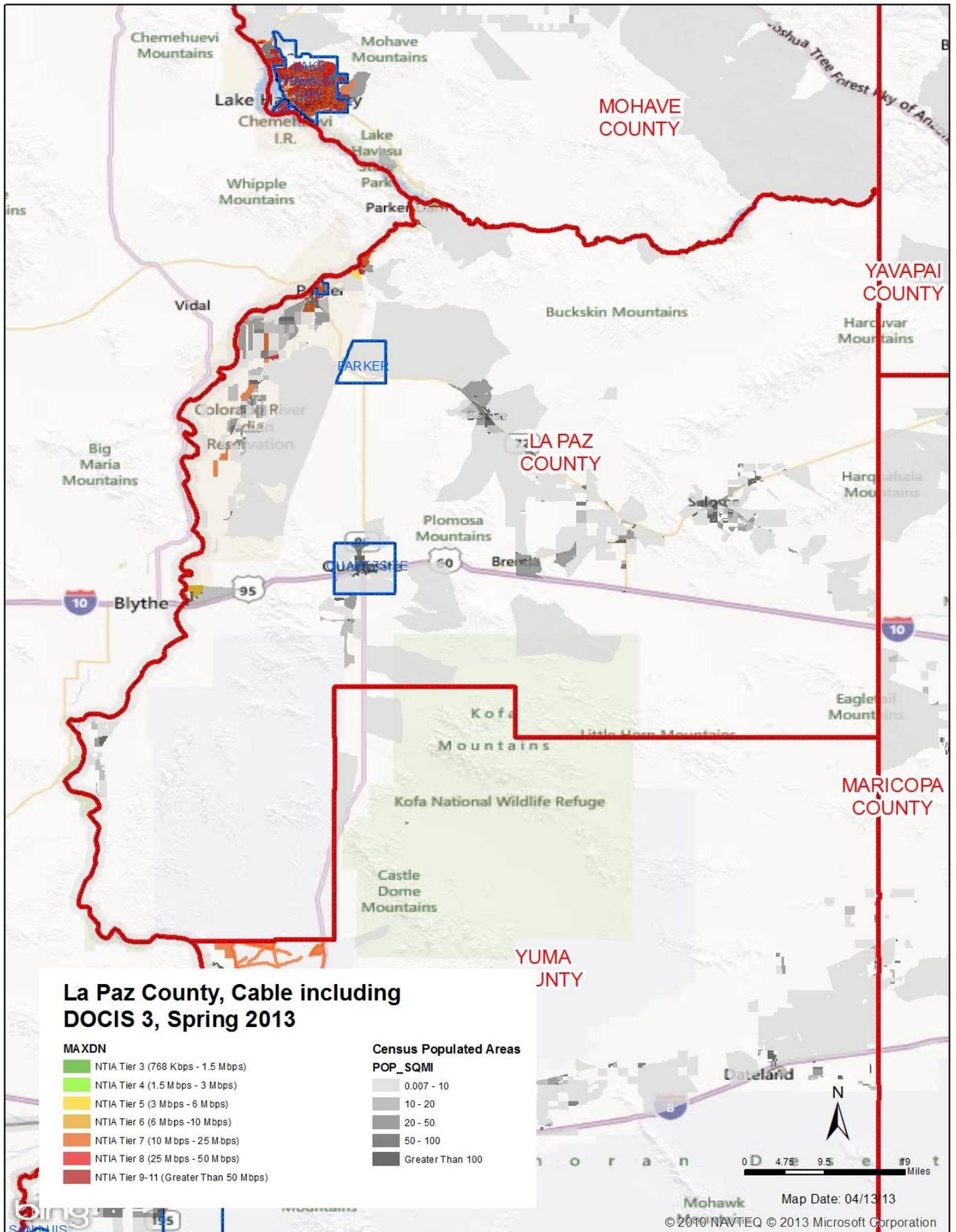
Baseline Demographics	La Paz County	State of Arizona
County seat/State capitol	Parker	Phoenix
Land area in square miles	4,499.63	113,594.08
Population, 2012 estimate	20,281	6,553,255
Population, percent change, 4/1/10-7/1/12	-1.0%	2.5%
Persons under 18 years, percent, 2012	17.7%	24.7%
Persons 65 years and over, percent, 2012	34.9%	14.8%
Persons per household, 2007-2011	1.96	2.64
Persons per square mile, 2010	4.6	56.3
High school graduate or higher, percent of persons age 25+, 2007-2011	75.4%	85.2%
Bachelor's degree or higher, percent of persons age 25+, 2007-2011	9.3%	26.4%
Per capita income in the past 12 months (2011 dollars), 2007-2011	\$21,358	\$25,784
Median household income, 2007-2011	\$32,220	\$50,752
Persons below poverty level, percent, 2007-2011	19.4%	16.2%
Homeownership rate, 2007-2011	74.6%	66.6%
Total civilian labor force, 7/13	7,761	3,017,815
Total employment, 7/13	7,060	2,766,640
Total unemployment, 7/13	701	251,175
Unemployment rate, 7/13	9.0%	8.3%

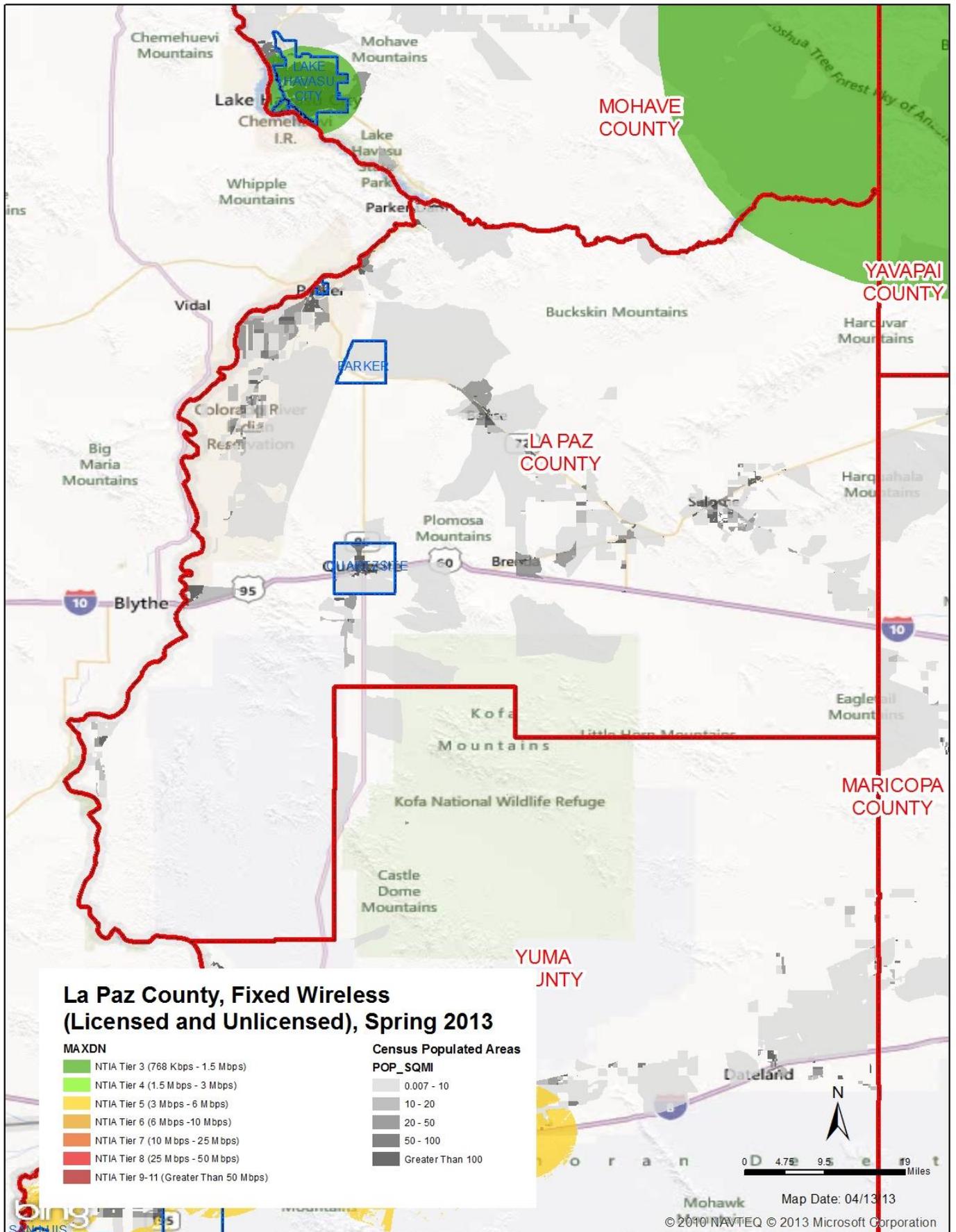
Employment by Category (July 2013 Estimates)	La Paz County by Population	Statewide by Population	La Paz County %	Statewide %
Total Nonfarm	5,125	2,453,900	100.0%	100.0%
Total Private Employment	2,800	2,088,300	54.6%	85.1%
Goods Producing	425	296,200	8.3%	12.1%
Mining and Construction	-	139,400	-	5.7%
Manufacturing	-	156,800	-	6.4%
Service-Providing	4,700	2,157,700	91.7%	87.9%
Private Service-Providing	2,375	1,792,100	46.3%	73.0%
Trade, Transportation & Utilities	1,150	482,600	22.4%	19.7%
Information	-	39,600	-	1.6%
Financial Activities	-	183,200	-	7.5%
Professional & Business Services	-	360,500	-	14.7%
Educational & Health Services	-	369,700	-	15.1%
Leisure and Hospitality	-	272,100	-	11.1%
Other Private Services	1,225	84,400	23.9%	3.4%
Government	2,325	365,600	45.4%	14.9%
Federal Government	300	55,700	5.9%	2.3%
State & Local Government	2,025	309,900	39.5%	12.6%

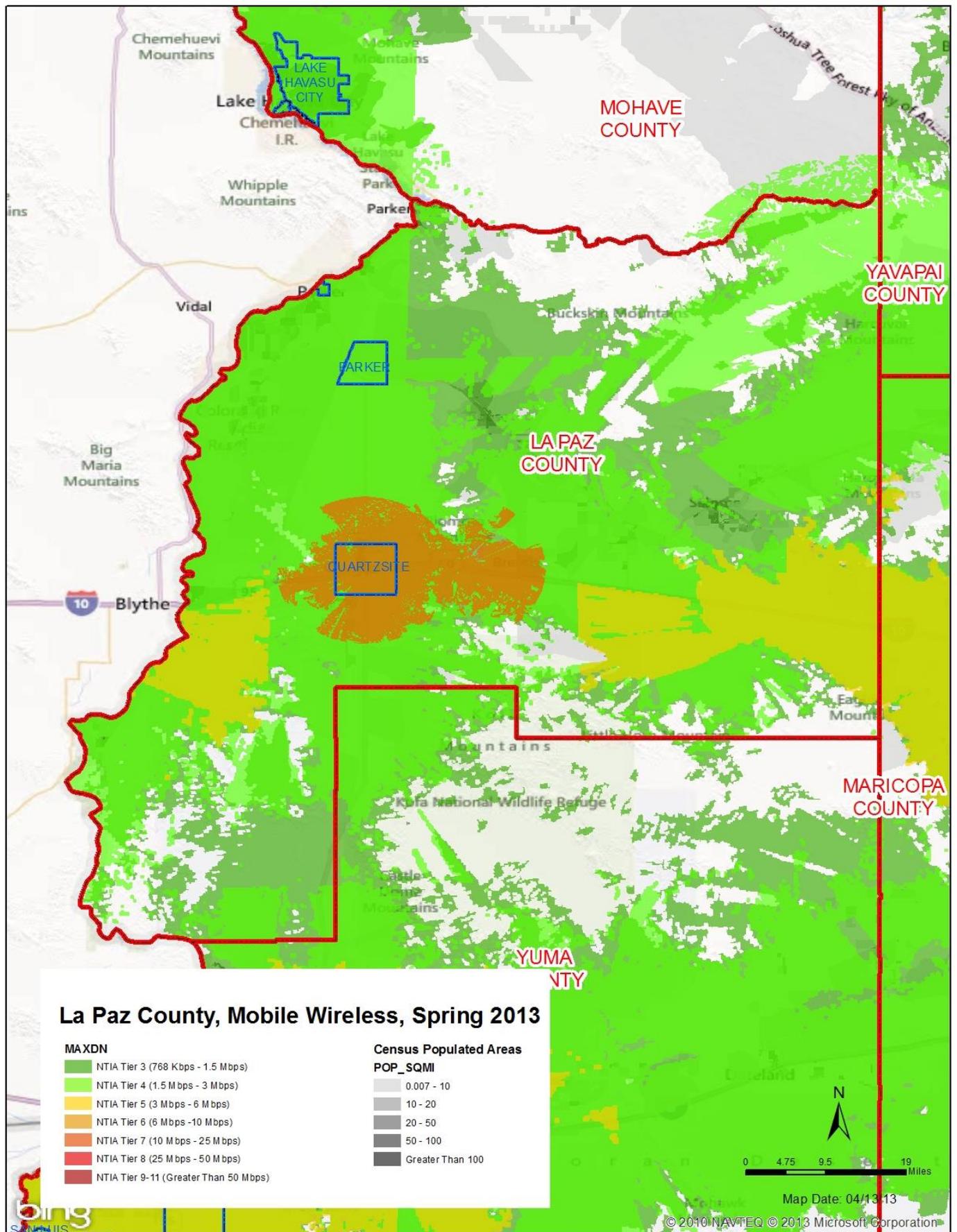
Sources: U.S. Census Bureau State & County QuickFacts (<http://quickfacts.census.gov/>) and ADOA Office of Employment & Population Statistics (<http://www.workforce.az.gov/>). For employment by category estimates, farm employment, private household employment, and self-employment are excluded and all employment statistics are non-seasonally adjusted.

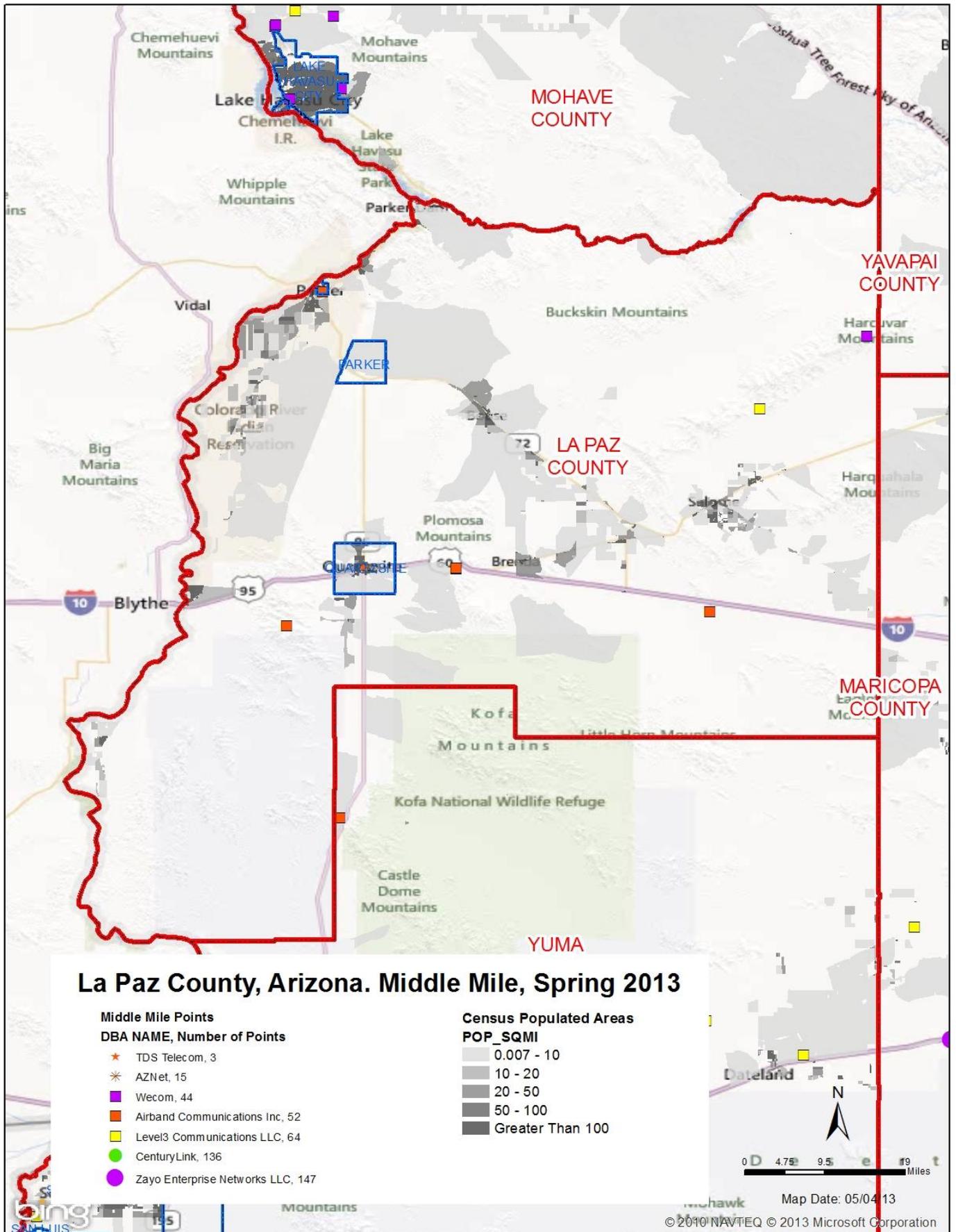








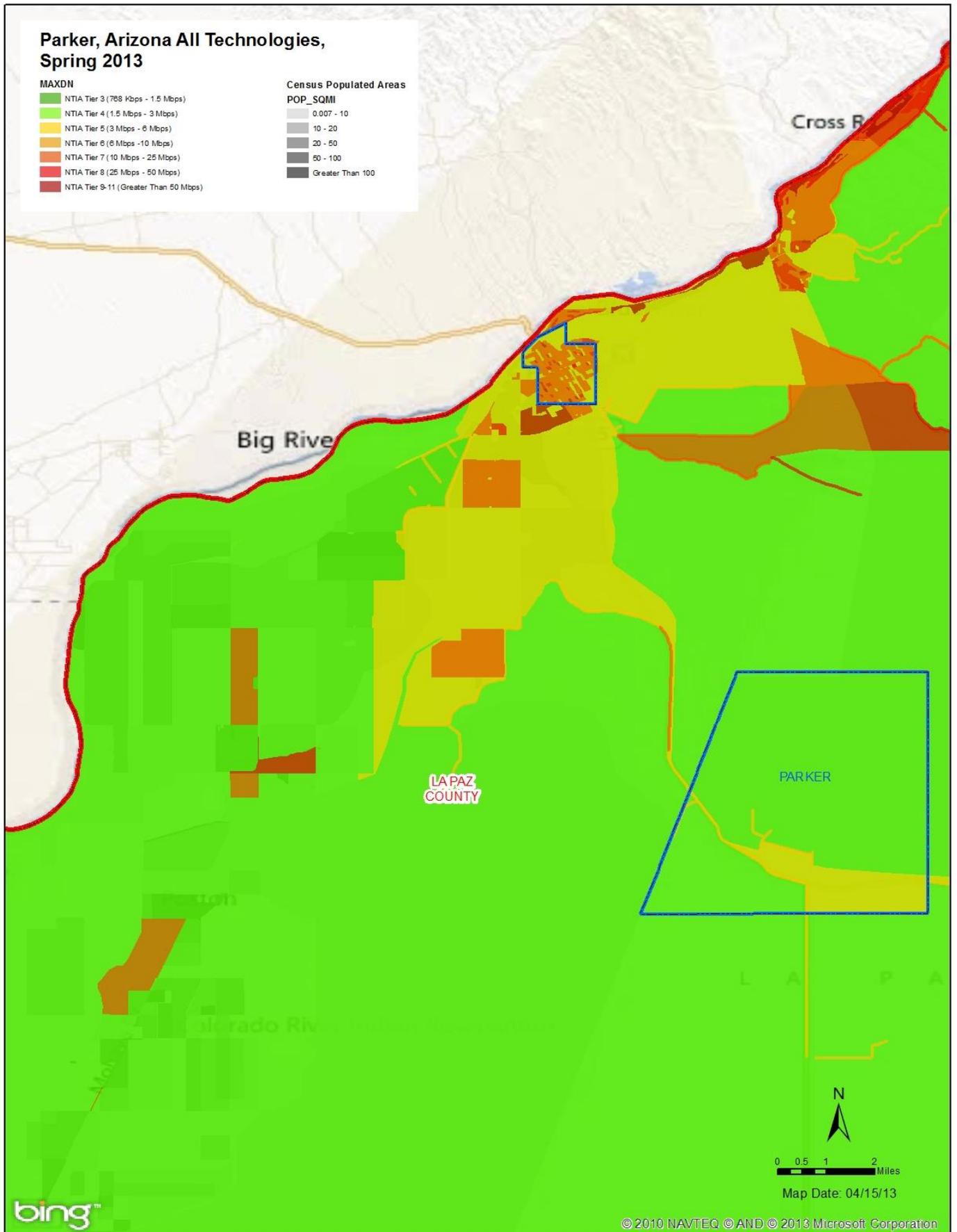




Parker, Arizona All Technologies, Spring 2013

- MAXDN**
- NTIA Tier 3 (768 Kbps - 1.5 Mbps)
 - NTIA Tier 4 (1.5 Mbps - 3 Mbps)
 - NTIA Tier 5 (3 Mbps - 6 Mbps)
 - NTIA Tier 6 (6 Mbps - 10 Mbps)
 - NTIA Tier 7 (10 Mbps - 25 Mbps)
 - NTIA Tier 8 (25 Mbps - 50 Mbps)
 - NTIA Tier 9-11 (Greater Than 50 Mbps)

- Census Populated Areas
POP_SQMI**
- 0.007 - 10
 - 10 - 20
 - 20 - 50
 - 50 - 100
 - Greater Than 100



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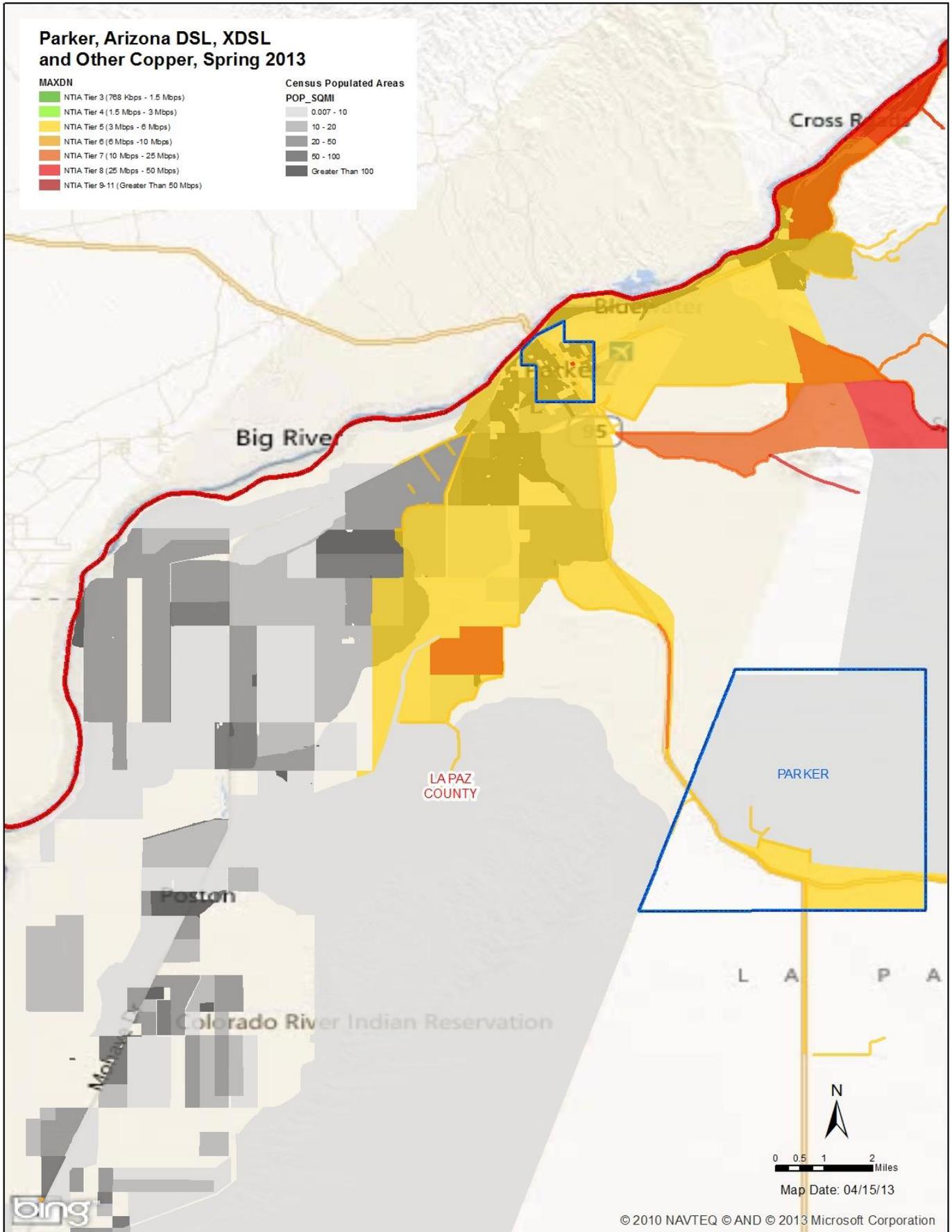
Parker, Arizona DSL, XDSL and Other Copper, Spring 2013

MAXDN

- NTIA Tier 3 (768 Kbps - 1.5 Mbps)
- NTIA Tier 4 (1.5 Mbps - 3 Mbps)
- NTIA Tier 5 (3 Mbps - 6 Mbps)
- NTIA Tier 6 (6 Mbps - 10 Mbps)
- NTIA Tier 7 (10 Mbps - 25 Mbps)
- NTIA Tier 8 (25 Mbps - 50 Mbps)
- NTIA Tier 9-11 (Greater Than 50 Mbps)

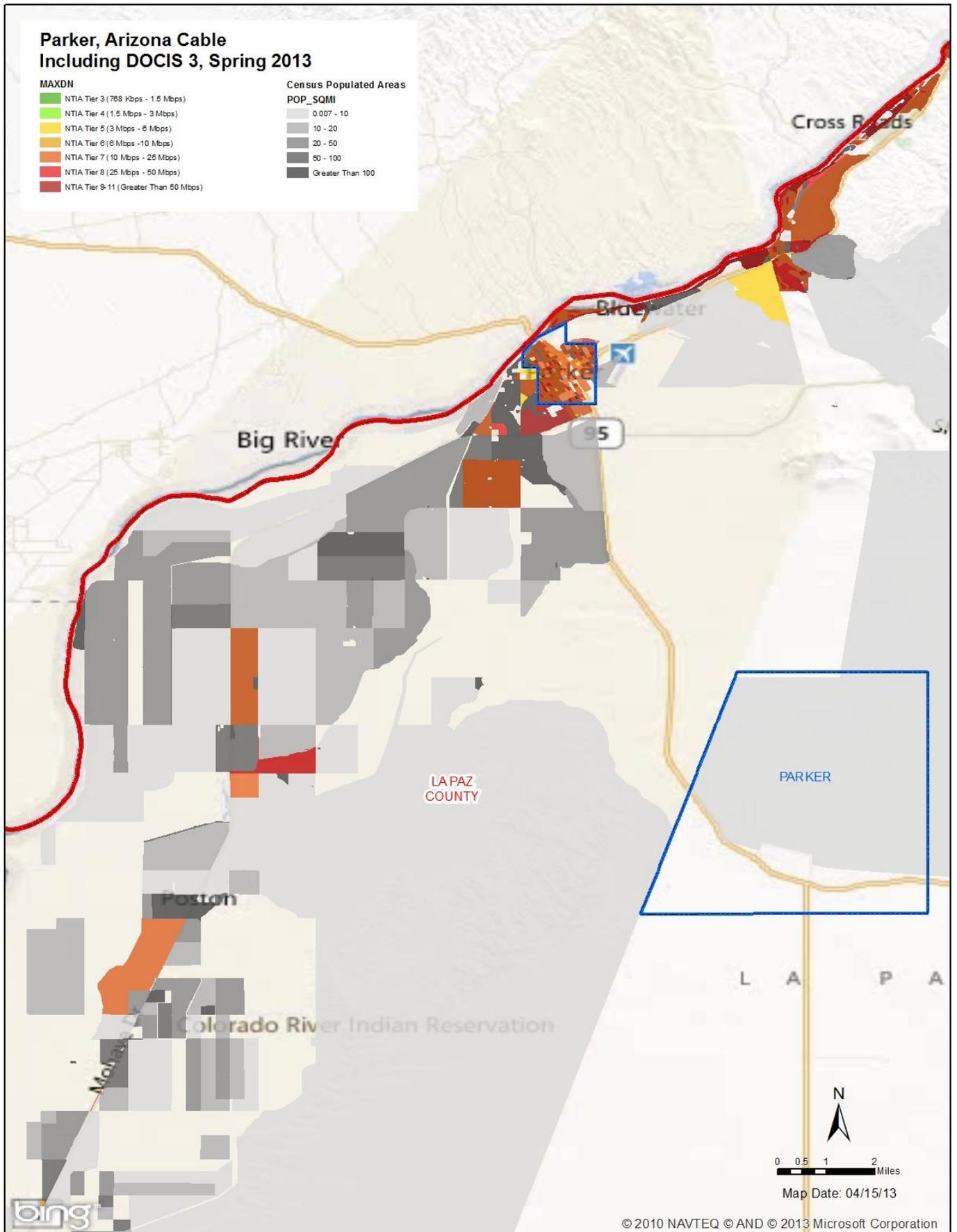
Census Populated Areas

- POP_SQMI
- 0.007 - 10
 - 10 - 20
 - 20 - 50
 - 50 - 100
 - Greater Than 100



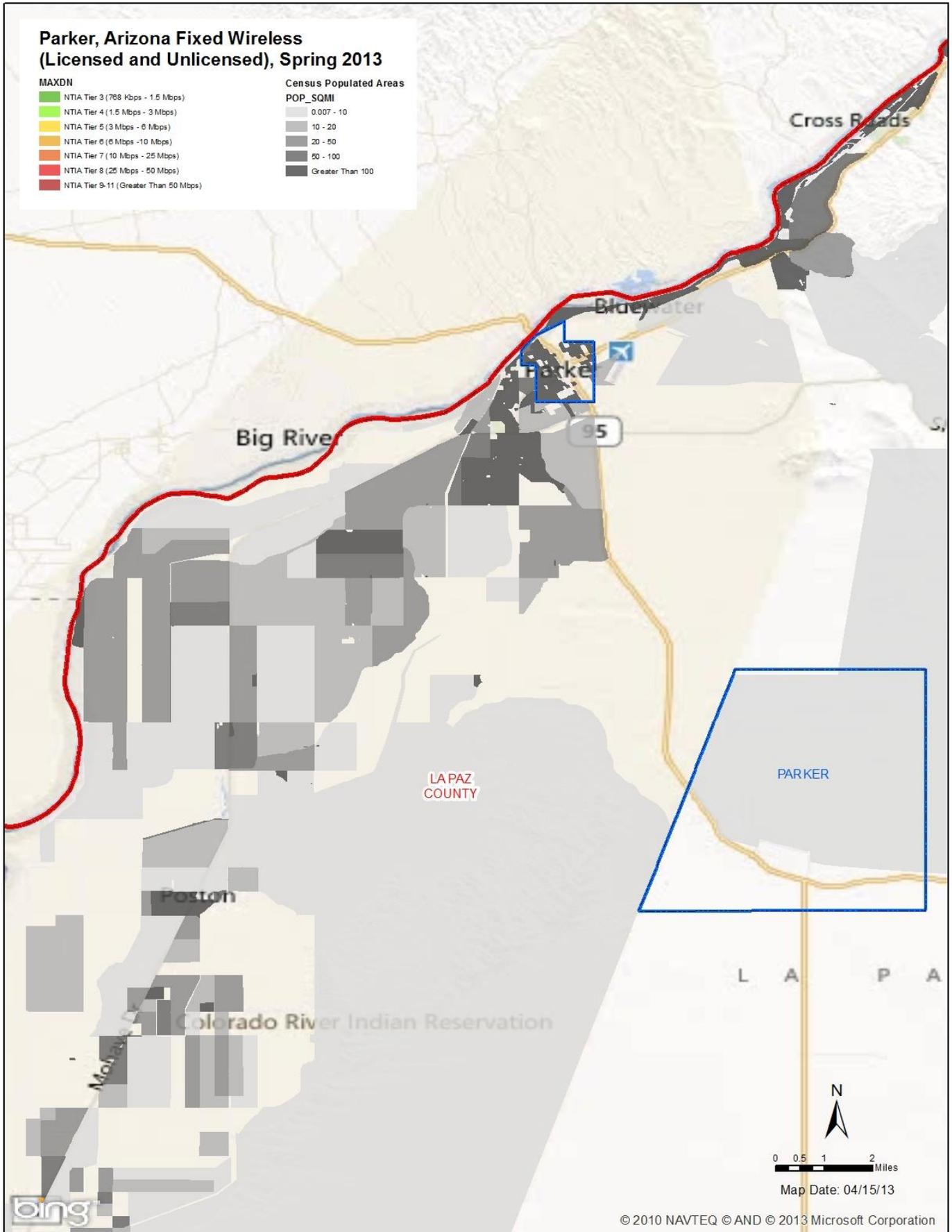
Parker, Arizona Cable Including DOCIS 3, Spring 2013

MAXDN	Census Populated Areas POP_SQMI
NTIA Tier 3 (768 Kbps - 1.5 Mbps)	0.007 - 10
NTIA Tier 4 (1.5 Mbps - 3 Mbps)	10 - 20
NTIA Tier 5 (3 Mbps - 6 Mbps)	20 - 50
NTIA Tier 6 (6 Mbps - 10 Mbps)	50 - 100
NTIA Tier 7 (10 Mbps - 25 Mbps)	Greater Than 100
NTIA Tier 8 (25 Mbps - 50 Mbps)	
NTIA Tier 9-11 (Greater Than 50 Mbps)	



Parker, Arizona Fixed Wireless (Licensed and Unlicensed), Spring 2013

MAXDN	Census Populated Areas POP_SQMI
NTIA Tier 3 (768 Kbps - 1.5 Mbps)	0.007 - 10
NTIA Tier 4 (1.5 Mbps - 3 Mbps)	10 - 20
NTIA Tier 5 (3 Mbps - 6 Mbps)	20 - 50
NTIA Tier 6 (6 Mbps - 10 Mbps)	50 - 100
NTIA Tier 7 (10 Mbps - 25 Mbps)	Greater Than 100
NTIA Tier 8 (25 Mbps - 50 Mbps)	
NTIA Tier 9-11 (Greater Than 50 Mbps)	



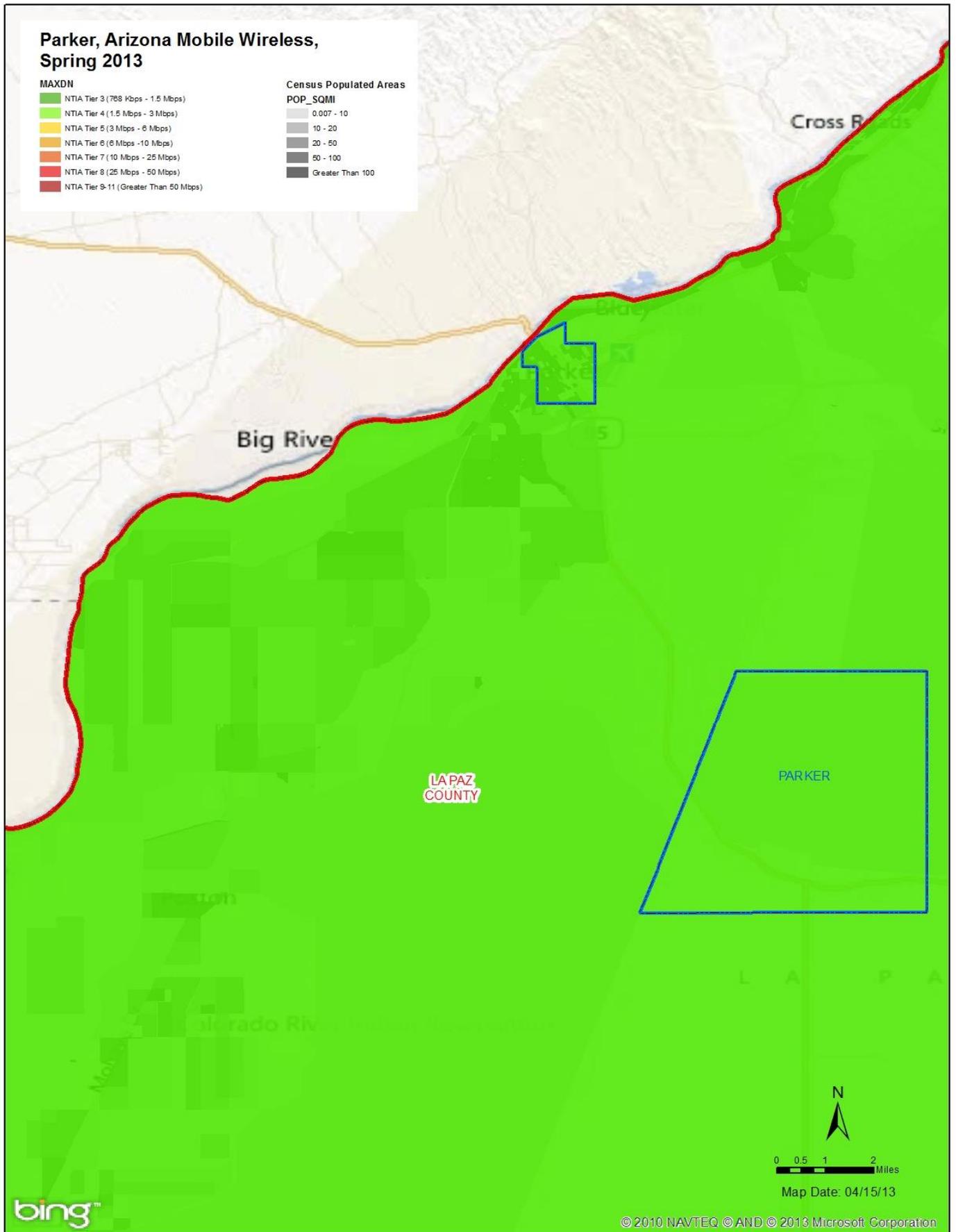
Parker, Arizona Mobile Wireless, Spring 2013

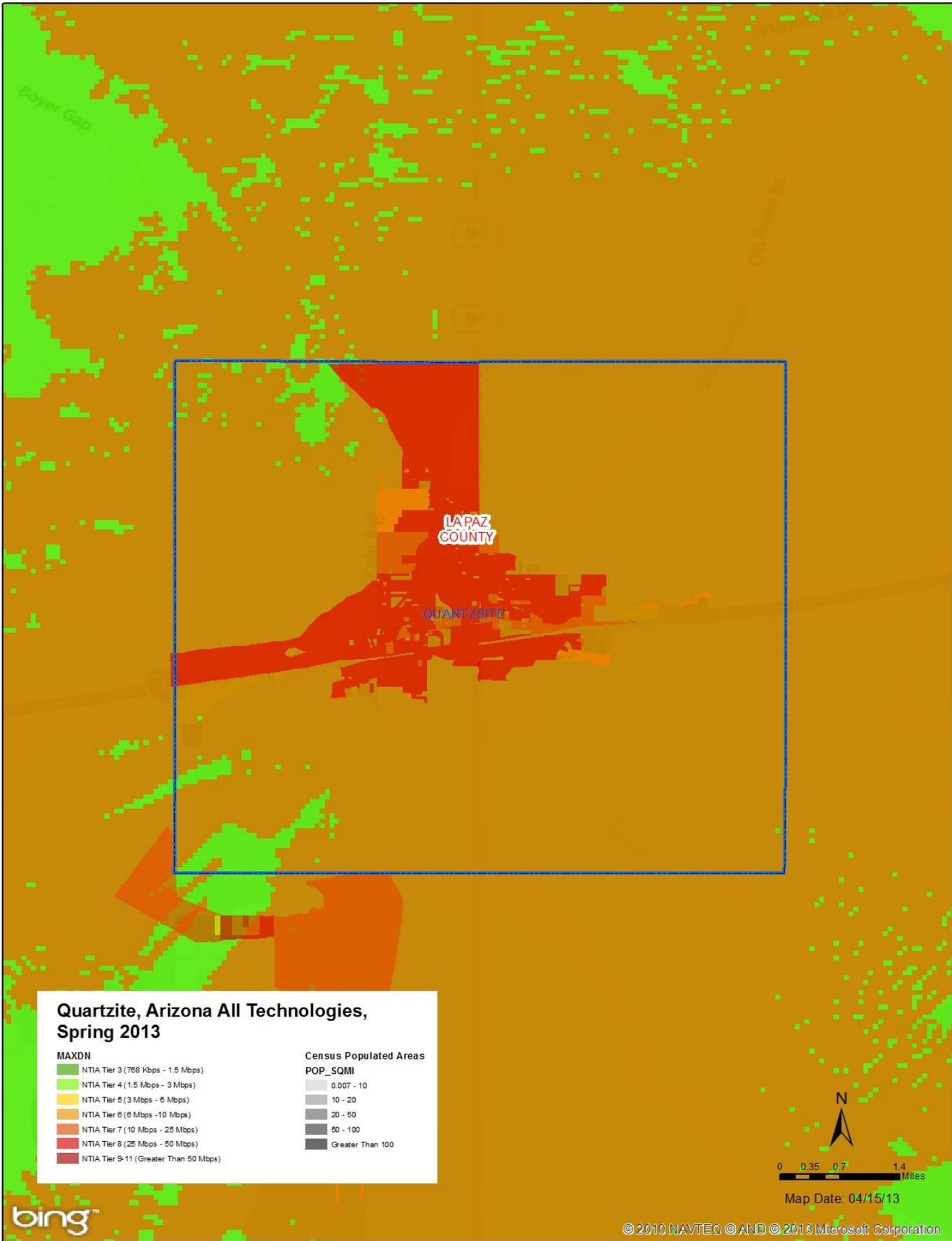
MAXDN

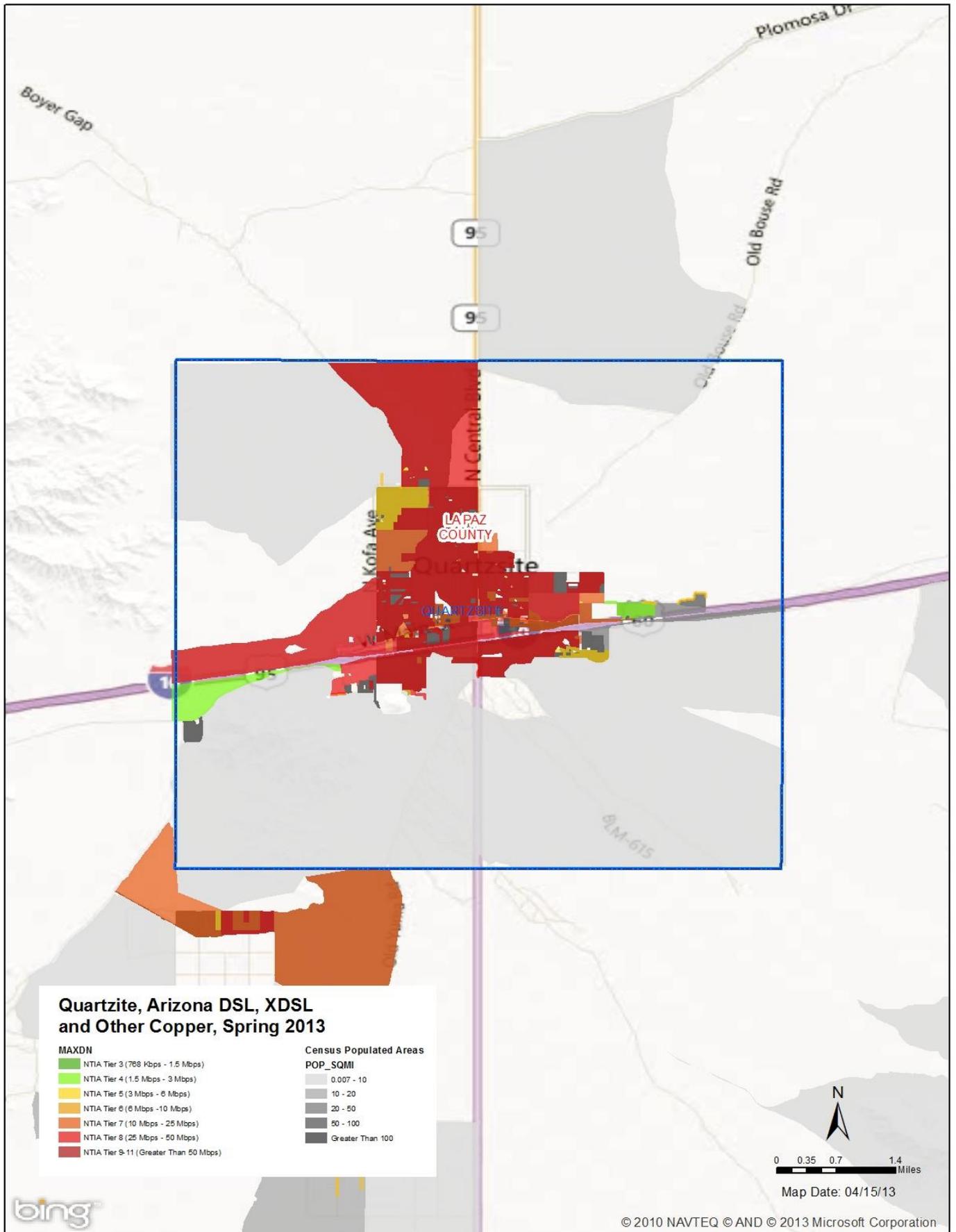
- NTIA Tier 3 (768 Kbps - 1.5 Mbps)
- NTIA Tier 4 (1.5 Mbps - 3 Mbps)
- NTIA Tier 5 (3 Mbps - 6 Mbps)
- NTIA Tier 6 (6 Mbps - 10 Mbps)
- NTIA Tier 7 (10 Mbps - 25 Mbps)
- NTIA Tier 8 (25 Mbps - 50 Mbps)
- NTIA Tier 9-11 (Greater Than 50 Mbps)

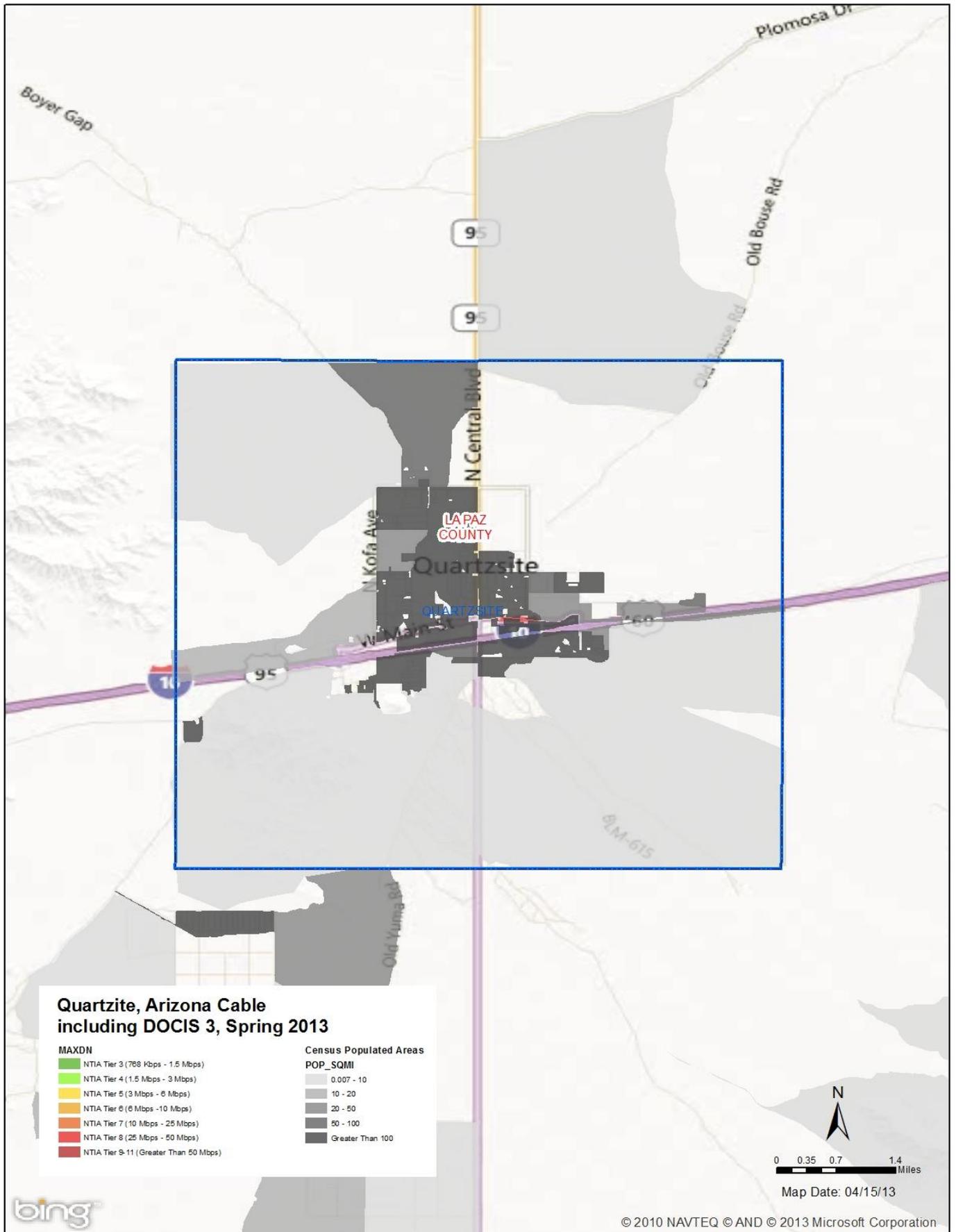
**Census Populated Areas
POP_SQMI**

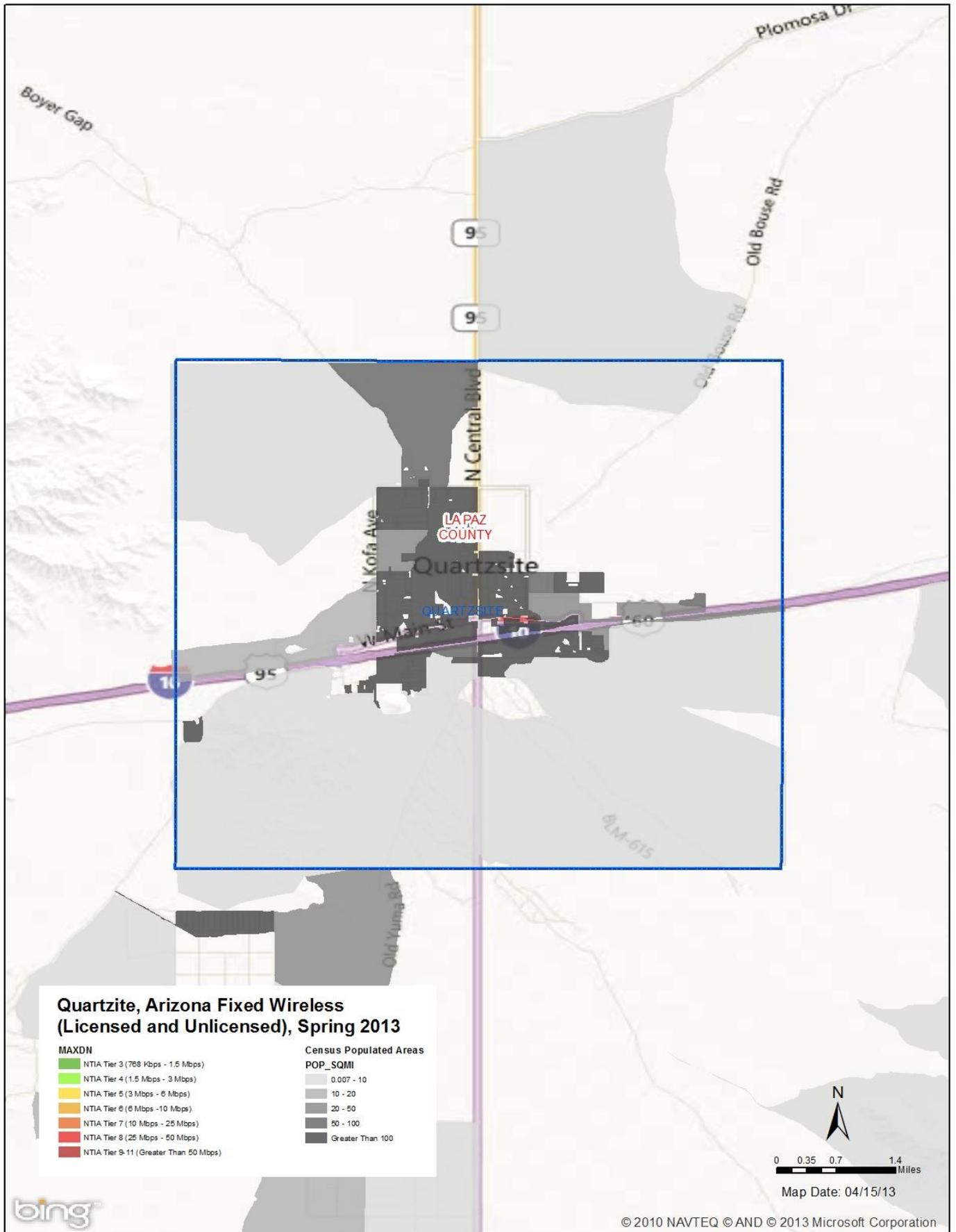
- 0.007 - 10
- 10 - 20
- 20 - 50
- 50 - 100
- Greater Than 100

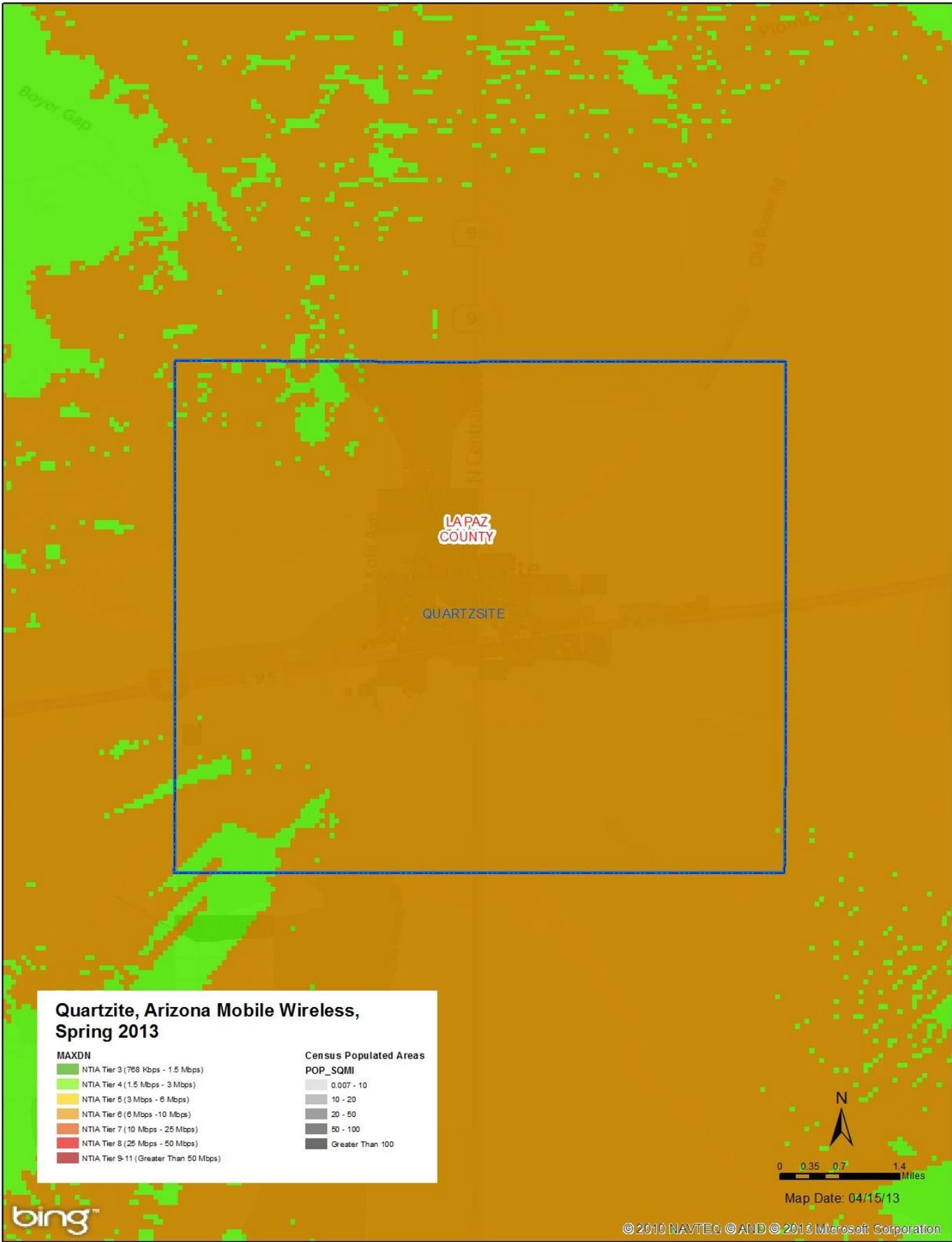












Appendix D: Mohave County Analysis & Views

	<u>Population</u>
Mohave County	203,072
Kingman (County Seat)	28,335
Lake Havasu City	52,720
Bullhead City	39,516
Colorado City	4,818
Unincorporated	77,683
New Kingman/Butler	

Note: Estimates drawn from the July 1, 2012 Population Estimates of the Office of Employment & Population Statistics, Arizona Department of Administration <http://www.workforce.az.gov/pubs/demography/July1-2012PopulationEstimates.pdf>

Mohave County Broadband Overview:

There is significant DSL coverage in Mohave County especially in the Bullhead City, Kingman, and Lake Havasu City areas with just a little coverage in the Colorado City and Mesquite areas. Some 89.2% of the population can get DSL at ≥ 768 Kbps downstream and 73.1% can get ≥ 6 Mbps. The Arizona broadband mapping team has discovered an issue in processing Frontier's DSL coverage and will make corrections in the pending Fall 2013 submittal, likely resulting in reporting of slightly less coverage.

Cable modem based broadband covers 77.7% of the Mohave County population, again centering on the Bullhead City, Kingman, and Lake Havasu City areas with speeds ≥ 3 Mbps and 75.8% with speeds ≥ 10 Mbps. There is no apparent cable coverage in the Colorado City and Mesquite areas.

Fixed wireless (licensed and unlicensed) has an extensive footprint estimated to reach 91.6% of the Mohave County population primarily in the Bullhead City, Kingman, and Lake Havasu City areas with just a little coverage in the Mesquite area and none in Colorado City. Fixed wireless coverage at ≥ 3 Mbps is available to only 64.1% of the population and at ≥ 6 Mbps is available to only 31.6% of the population.

Mobile wireless has by far the broadest footprint, estimated to reach 96.2% of the Mohave County population at speeds ≥ 768 Kbps but only 48.4% for speeds ≥ 3 Mbps and 0% with speeds ≥ 6 Mbps.

A limited number of Middle Mile points, almost always fiber fed, are available primarily from Wecom, Airband Communications, Level3 Communications, and CenturyLink.

More detailed views of the Bullhead City, Kingman, and Lake Havasu City areas follow the county level views to allow for more granular inspection of coverage by technology type across the major population centers.

Mohave County Broadband Coverage for Spring 2013

All Broadband Tech (Except Satellite)	Mohave County		State of Arizona	
	Population	Household	Population	Household
≥ 768 Kbps Down	99.4%	99.0%	99.5%	99.5%
≥ 3 Mbps Down	97.3%	96.1%	97.8%	97.5%
≥ 6 Mbps Down	92.3%	89.5%	95.6%	95.2%
≥ 10 Mbps Down	86.8%	84.3%	95.1%	94.6%
DSL, xDSL & Other Copper Tech	Population %	Household %	Population	Household
≥ 768 Kbps Down	89.2%	87.8%	93.1%	92.8%
≥ 3 Mbps Down	83.3%	80.6%	87.2%	86.4%
≥ 6 Mbps Down	73.1%	70.1%	79.9%	78.4%
≥ 10 Mbps Down	54.5%	52.0%	70.1%	68.4%
Cable Modem Technologies	Population	Household	Population	Household
≥ 768 Kbps Down	77.7%	77.4%	89.3%	88.7%
≥ 3 Mbps Down	77.7%	77.4%	89.3%	88.7%
≥ 6 Mbps Down	75.8%	75.8%	89.2%	88.6%
≥ 10 Mbps Down	75.8%	75.8%	89.2%	88.6%
Fixed Wireless Technologies	Population	Household	Population	Household
≥ 768 Kbps Down	91.6%	92.4%	94.7%	94.5%
≥ 3 Mbps Down	64.1%	61.5%	62.0%	62.9%
≥ 6 Mbps Down	31.6%	26.8%	34.8%	34.9%
≥ 10 Mbps Down	0.6%	0.5%	5.4%	5.4%
Mobile Wireless Technologies	Population	Household	Population	Household
≥ 768 Kbps Down	96.2%	96.2%	98.7%	98.9%
≥ 3 Mbps Down	48.4%	45.8%	92.8%	91.5%
≥ 6 Mbps Down	0%	0%	87.0%	85.3%
≥ 10 Mbps Down	0%	0%	86.9%	85.2%
	Population Count	Household Count	Population Count	Household Count
County Totals (2010 Census)	200,186	110,911	6,392,017	2,844,526

Notes: Data presented in table above is as collected by the State of Arizona for the NTIA and FCC broadband maps and submitted in Spring 2013 for Broadband Provider (BP) coverage declared as of 12/31/12. Population across Census Blocks and in proximity to Road Segments are based on calculations utilizing U.S. Census 2010 data.

See also the complementary **WACOG Arizona Broadband Technical Report** in Appendix B for additional Mohave County broadband maps by each technology type, detailed views of the Bullhead City, Kingman, and Lake Havasu areas, and a table of the 24 broadband providers known to be active in the county including their technology type(s) and speed range(s).

Mohave County Broadband Providers (24)

Broadband Provider	Service Type	Advertised Download Speed	Advertised Upload Speed	Download Speed Tier	Upload Speed Tier
AT&T Mobility	Mobile Wireless	1.5 - 3 Mbps	768 Kbps - 1.5 Mbps	4	3
		3 - 6 Mbps	3 - 6 Mbps	5	5
		10 - 25 Mbps	3 - 6 Mbps	7	5
Baja Broadband	Cable	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
CommSpeed	Fixed Wireless	768 Kbps - 1.5 Mbps	768 Kbps - 1.5 Mbps	3	3
DataMax Wireless	Fixed Wireless	6 - 10 Mbps	1.5 - 3 Mbps	6	4
Fort Mojave Telecom	DSL (Asymmetric)	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
Frontier Citizens Utilities Rural	DSL (Asymmetric)	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
		768 Kbps - 1.5 Mbps	768 Kbps - 1.5 Mbps	3	3
		1.5 - 3 Mbps	200 - 768 Kbps	4	2
		1.5 - 3 Mbps	768 Kbps - 1.5 Mbps	4	3
		3 - 6 Mbps	200 - 768 Kbps	5	2
		3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
		6 - 10 Mbps	200 - 768 Kbps	6	2
		6 - 10 Mbps	768 Kbps - 1.5 Mbps	6	3
		10 - 25 Mbps	1.5 - 3 Mbps	7	4
		25 - 50 Mbps	3 - 6 Mbps	8	5
Frontier Southwest	DSL (Asymmetric)	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
Golden Valley	Cable	3 - 6 Mbps	200 - 768 Kbps	5	2
Greenfield Communications	Fiber	6 - 10 Mbps	1.5 - 3 Mbps	6	4
HNS (Hughes, Echostar)	Satellite	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
Infowest	Fixed Wireless	10 - 25 Mbps	3 - 6 Mbps	7	5
Leap Wireless (Cricket)	Mobile Wireless	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
NPG Cable (Suddenlink)	Cable	3 - 6 Mbps	200 - 768 Kbps	5	2
		10 - 25 Mbps	1.5 - 3 Mbps	7	4
		25 - 50 Mbps	1.5 - 3 Mbps	8	4
		50 - 100 Mbps	3 - 6 Mbps	9	5

Mohave County Broadband Providers (Continued)

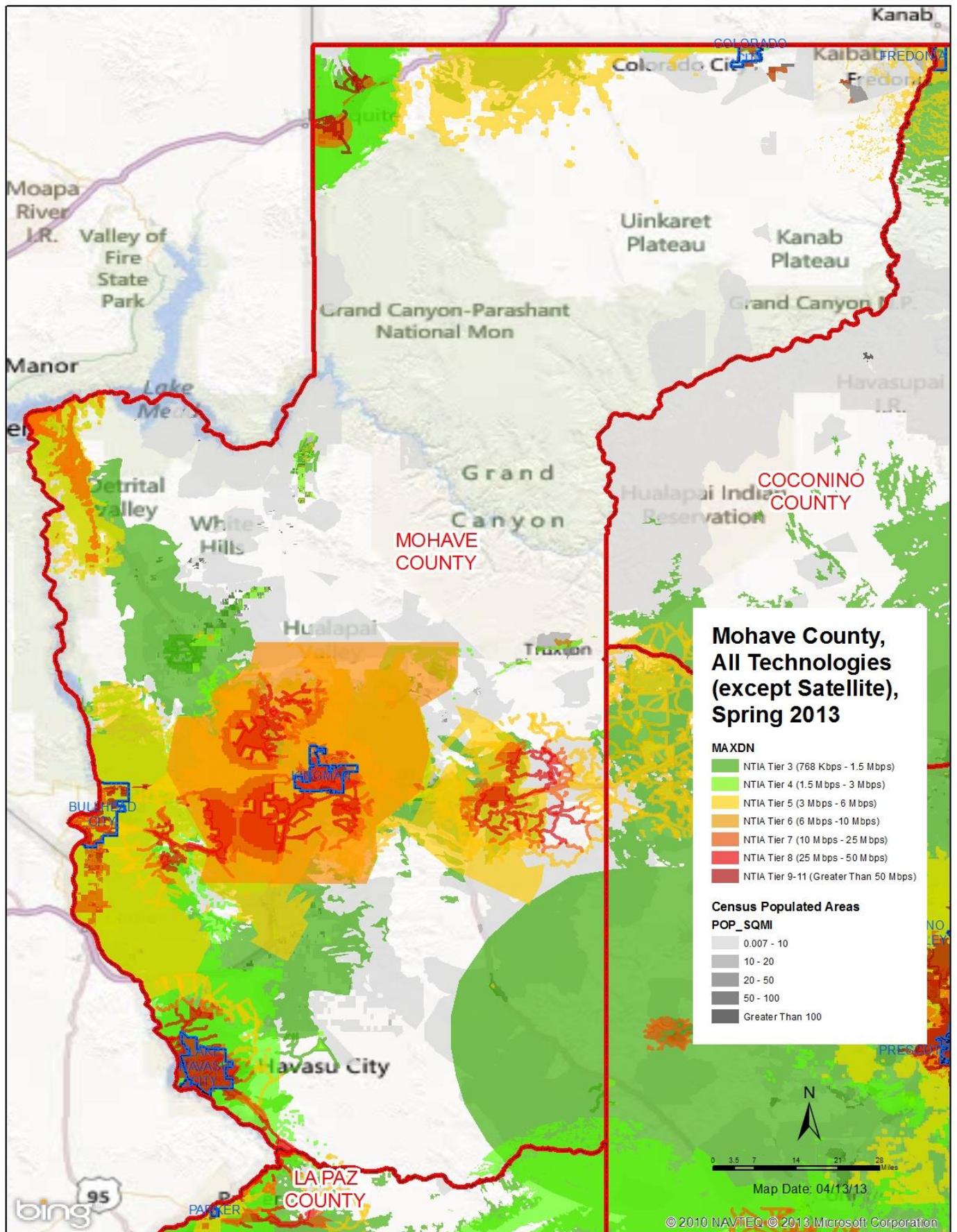
Broadband Provider	Service Type	Advertised Download Speed	Advertised Upload Speed	Download Speed Tier	Upload Speed Tier
Rio Virgin Telephone (Reliance Connects)	DSL (Asymmetric)	10 - 25 Mbps	768 Kbps - 1.5 Mbps	7	3
	Fiber	50 - 100 Mbps	50 - 100 Mbps	9	9
Skycasters (VSAT Systems)	Satellite	6 - 10 Mbps	1.5 - 3 Mbps	6	4
South Central Utah Telephone Association	DSL (Asymmetric)	10 - 25 Mbps	1.5 - 3 Mbps	7	4
Sprint Communications	Mobile Wireless	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
StarBand Communications	Satellite	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
Table Top Telephone	DSL (Asymmetric)	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
T-Mobile	Mobile Wireless	1.5 - 3 Mbps	200 - 768 Kbps	4	2
		6 - 10 Mbps	1.5 - 3 Mbps	6	4
Transworld Network	Fixed Wireless	3 - 6 Mbps	1.5 - 3 Mbps	5	4
Verizon Communications	Mobile Wireless	768 Kbps - 1.5 Mbps	200 - 768 Kbps	3	2
ViaSat	Satellite	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3
Xpressweb Internet	Fixed Wireless	3 - 6 Mbps	768 Kbps - 1.5 Mbps	5	3

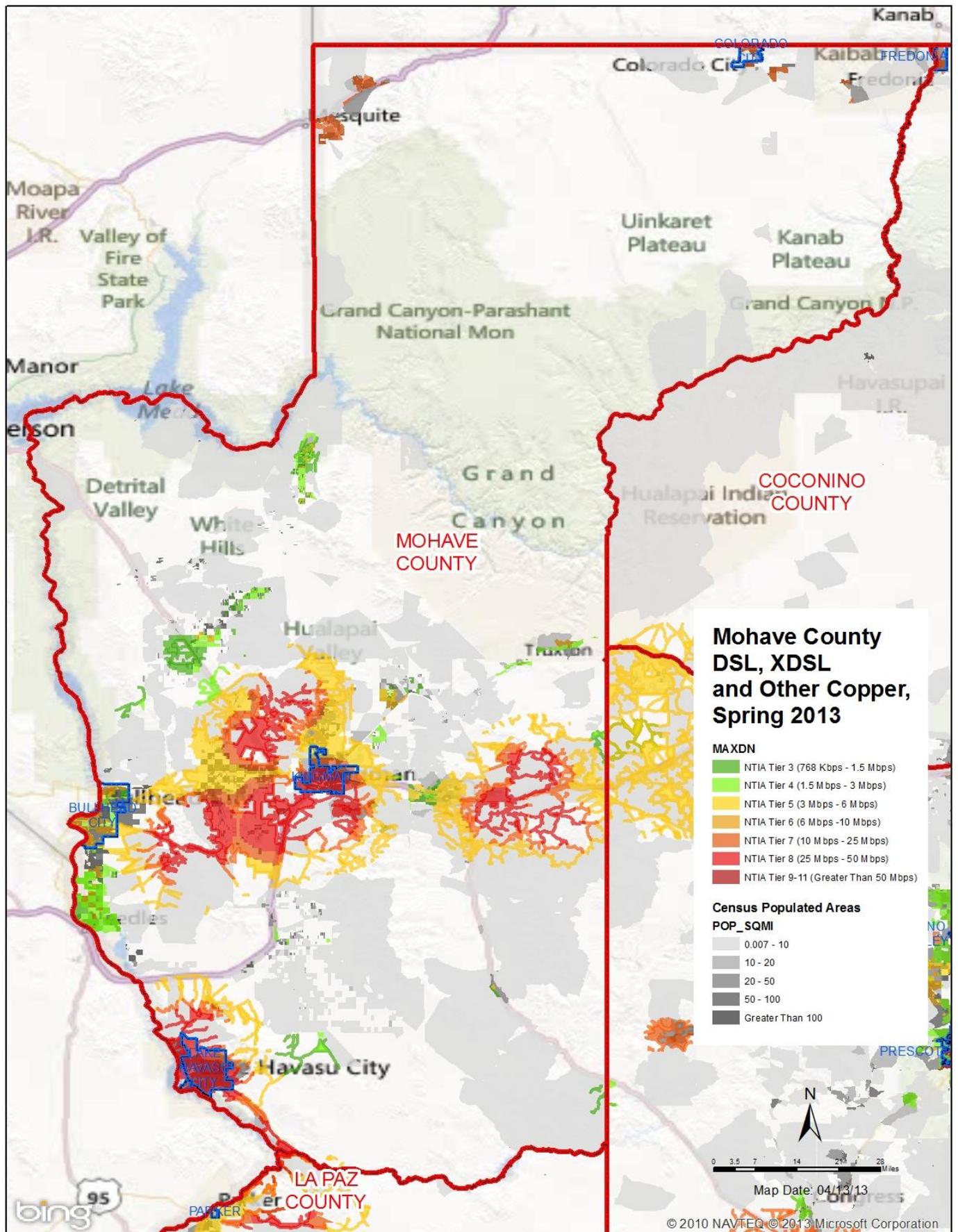
Mohave County Selected Demographics

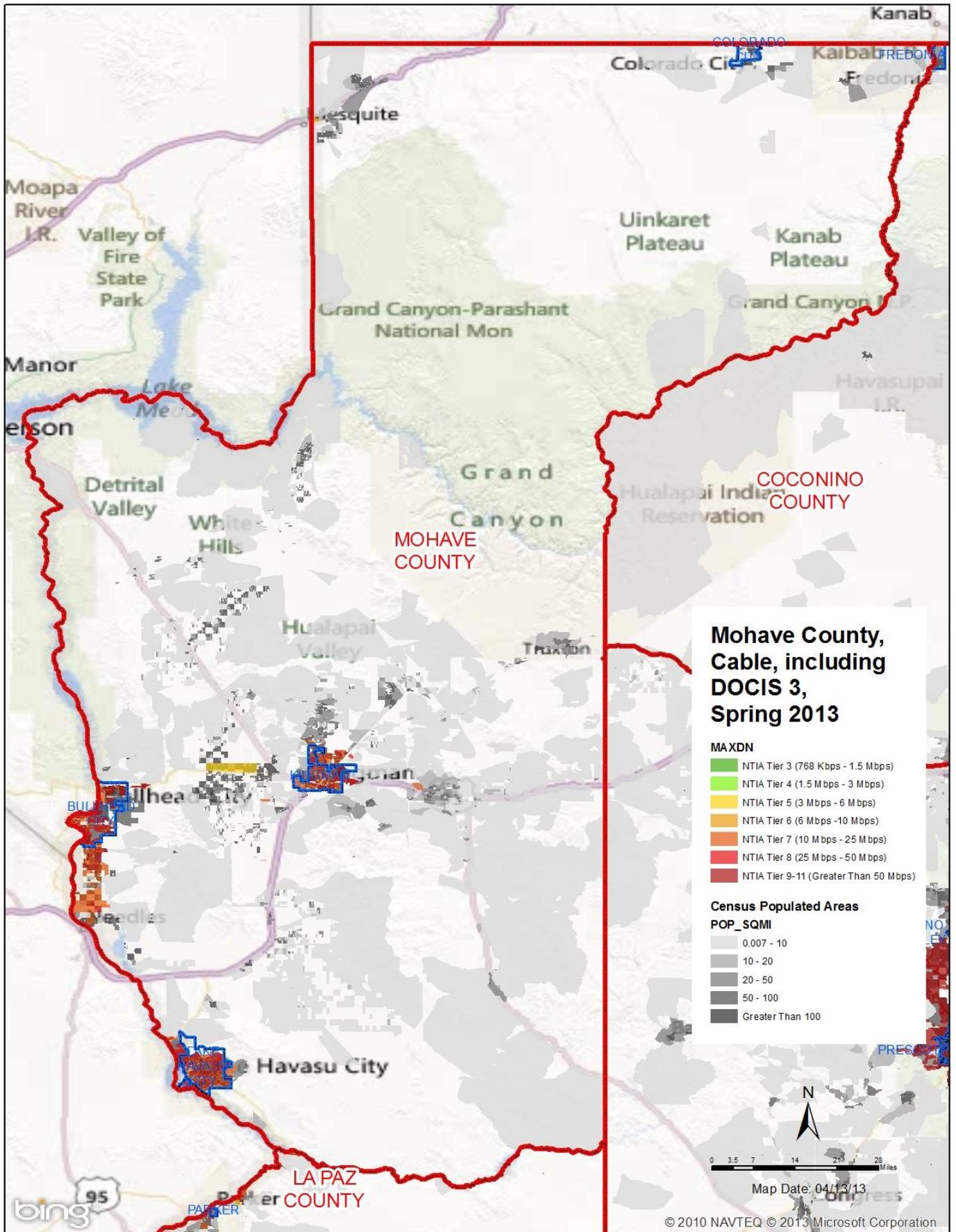
Baseline Demographics	Mohave County	State of Arizona
County seat/State capitol	Kingman	Phoenix
Land area in square miles	13,311.08	113,594.08
Population, 2012 estimate	203,334	6,553,255
Population, percent change, 4/1/10-7/1/12	1.6%	2.5%
Persons under 18 years, percent, 2012	19.8%	24.7%
Persons 65 years and over, percent, 2012	24.9%	14.8%
Persons per household, 2007-2011	2.45	2.64
Persons per square mile, 2010	15.0	56.3
High school graduate or higher, percent of persons age 25+, 2007-2011	83.9%	85.2%
Bachelor's degree or higher, percent of persons age 25+, 2007-2011	12.2%	26.4%
Per capita income in the past 12 months (2011 dollars), 2007-2011	\$21,457	\$25,784
Median household income, 2007-2011	\$40,573	\$50,752
Persons below poverty level, percent, 2007-2011	16.8%	16.2%
Homeownership rate, 2007-2011	71.2%	66.6%
Total civilian labor force, 7/13	83,641	3,017,815
Total employment, 7/13	75,565	2,766,640
Total unemployment, 7/13	8,076	251,175
Unemployment rate, 7/13	9.7%	8.3%

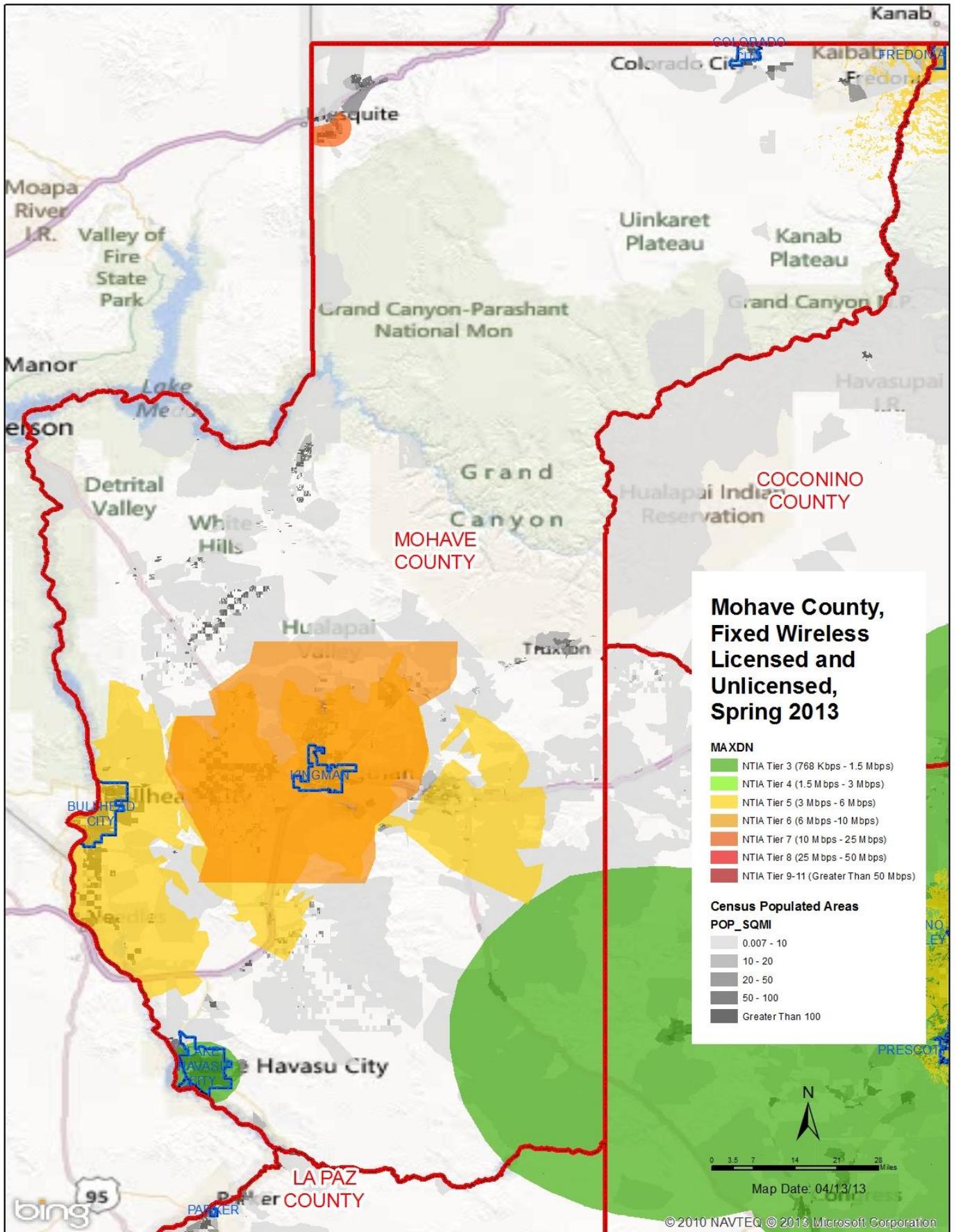
Employment by Category (July 2013 Estimates)	Mohave County by Population	Statewide by Population	Mohave County %	Statewide %
Total Nonfarm	44,000	2,453,900	100.0%	100.0%
Total Private Employment	36,700	2,088,300	83.4%	85.1%
Goods Producing	4,800	296,200	10.9%	12.1%
Mining and Construction	2,000	139,400	4.5%	5.7%
Manufacturing	2,800	156,800	6.4%	6.4%
Service-Providing	39,200	2,157,700	89.1%	87.9%
Private Service-Providing	31,900	1,792,100	72.5%	73.0%
Trade, Transportation & Utilities	10,400	482,600	23.6%	19.7%
Information	600	39,600	1.4%	1.6%
Financial Activities	1,800	183,200	4.1%	7.5%
Professional & Business Services	3,600	360,500	8.2%	14.7%
Educational & Health Services	8,300	369,700	18.9%	15.1%
Leisure and Hospitality	5,500	272,100	12.5%	11.1%
Other Private Services	1,700	84,400	3.9%	3.4%
Government	7,300	365,600	16.6%	14.9%
Federal Government	500	55,700	1.1%	2.3%
State & Local Government	6,800	309,900	15.5%	12.6%

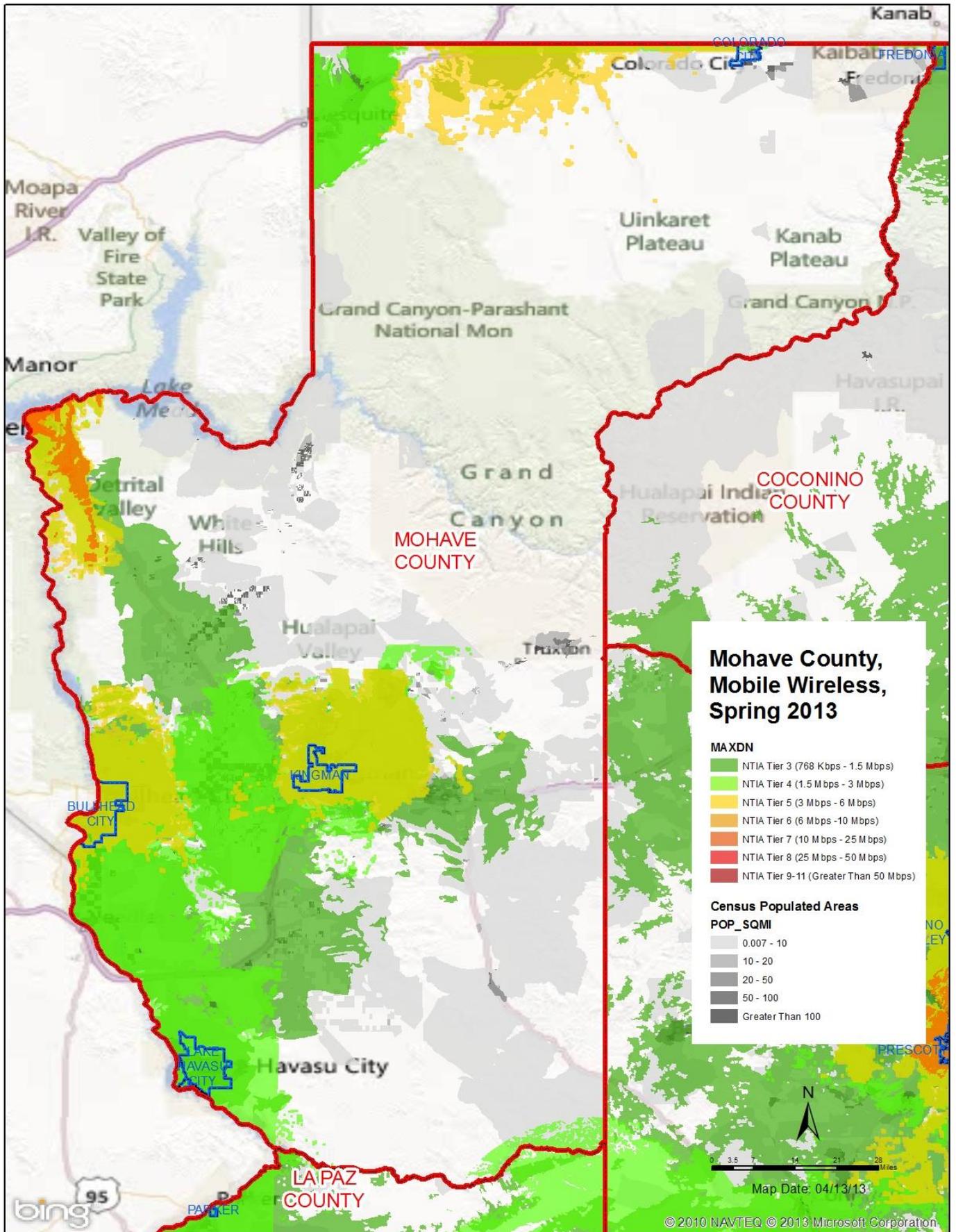
Sources: U.S. Census Bureau State & County QuickFacts (<http://quickfacts.census.gov/>) and ADOA Office of Employment & Population Statistics (<http://www.workforce.az.gov/>). For employment by category estimates, farm employment, private household employment, and self-employment are excluded and all employment statistics are non-seasonally adjusted.

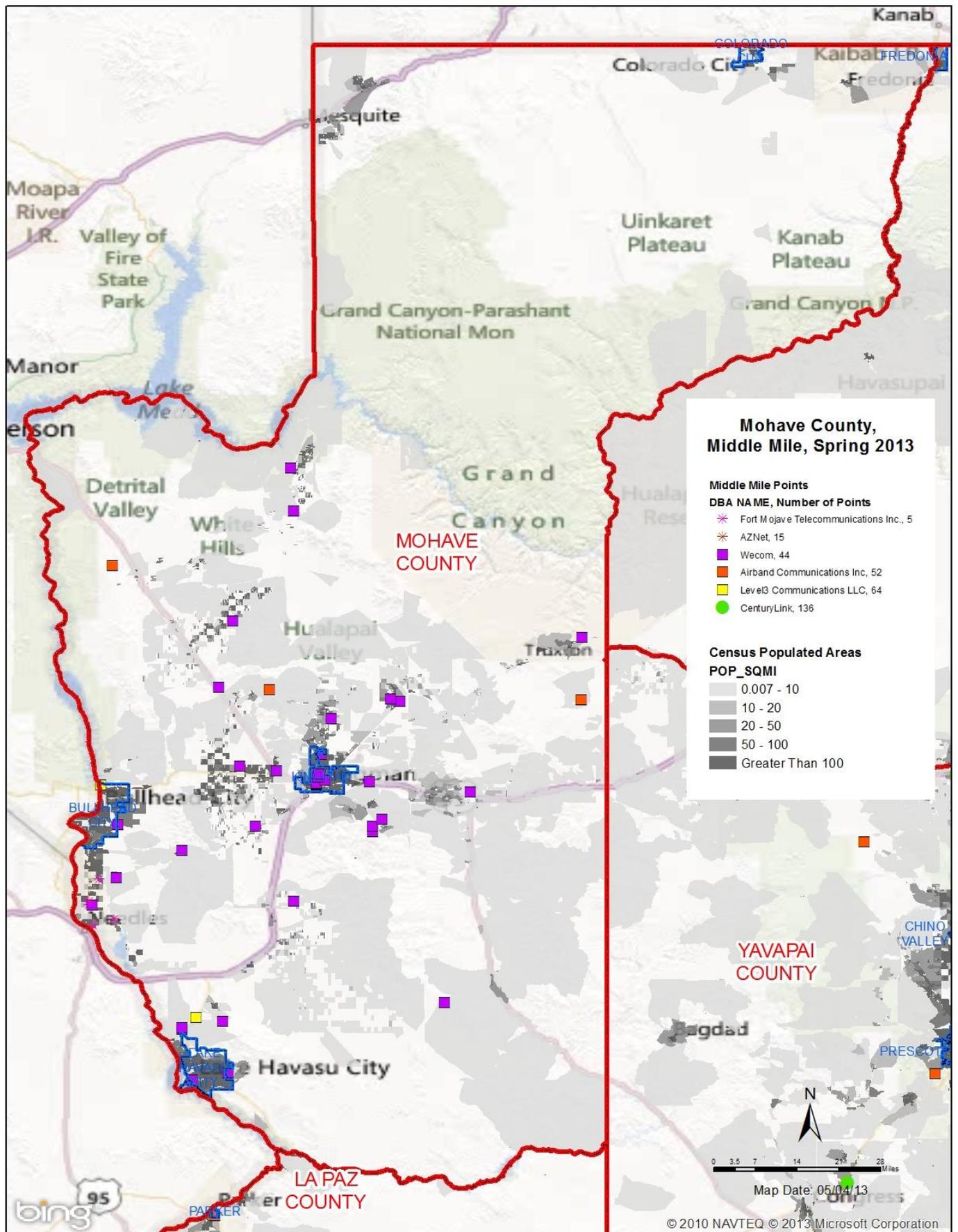








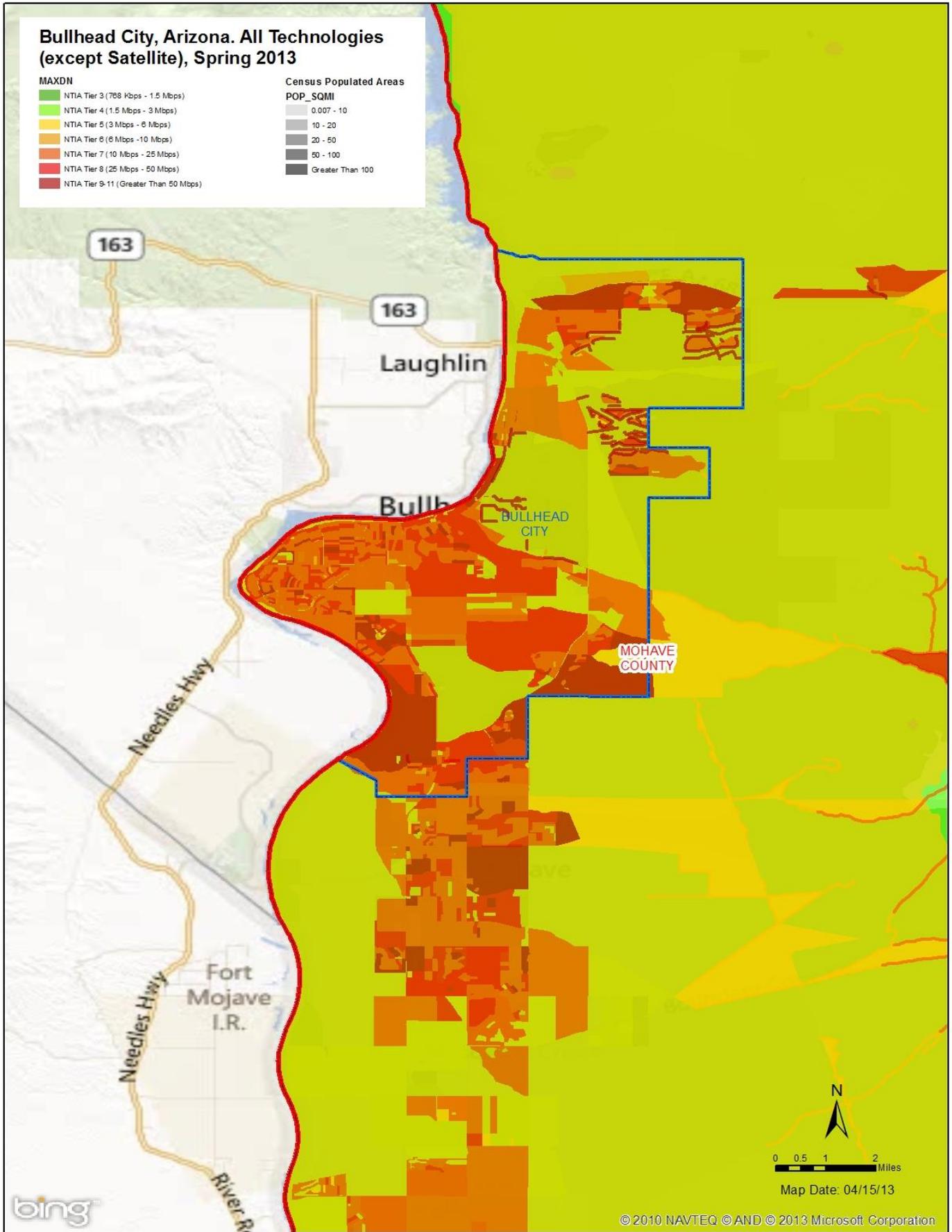




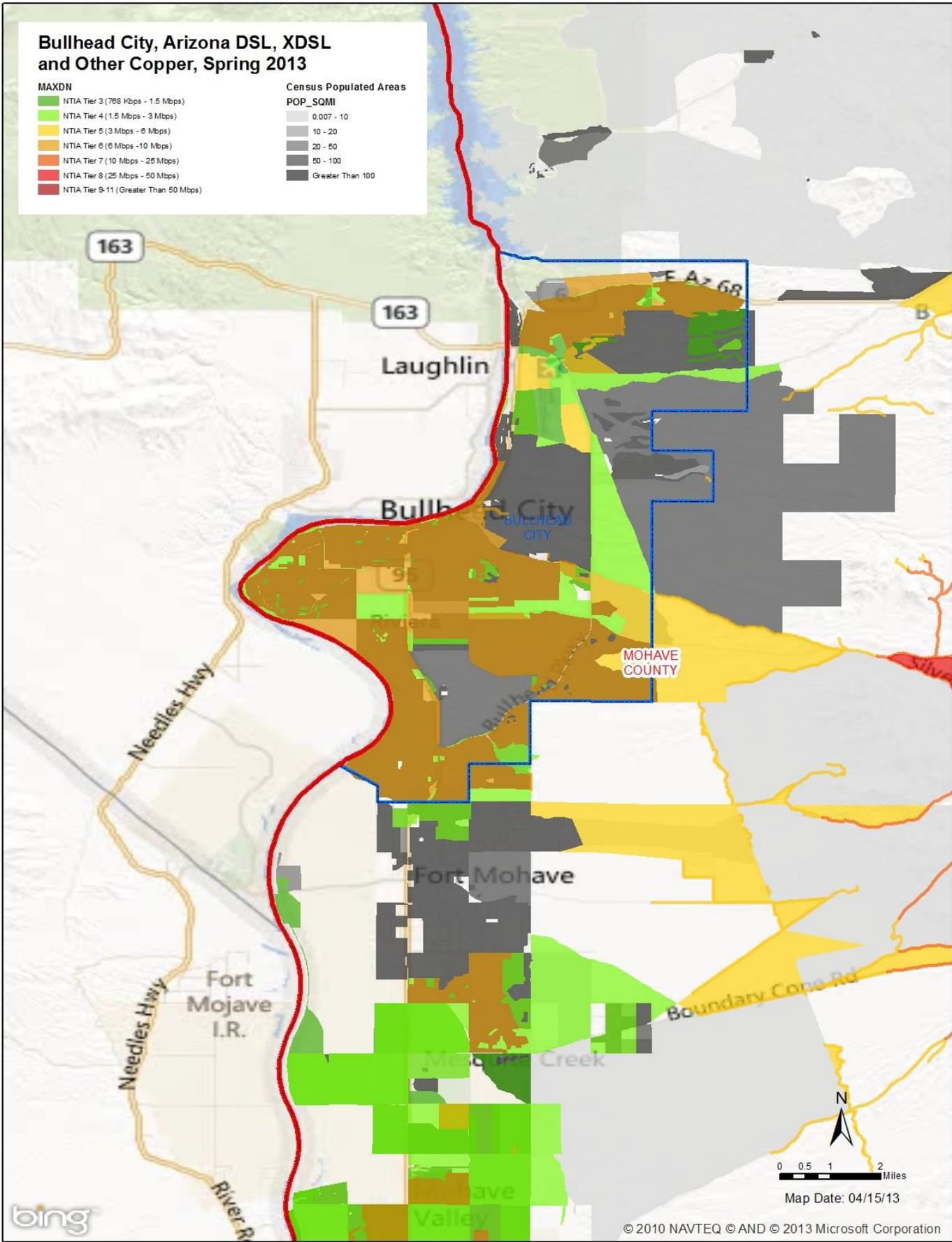
Bullhead City, Arizona. All Technologies (except Satellite), Spring 2013

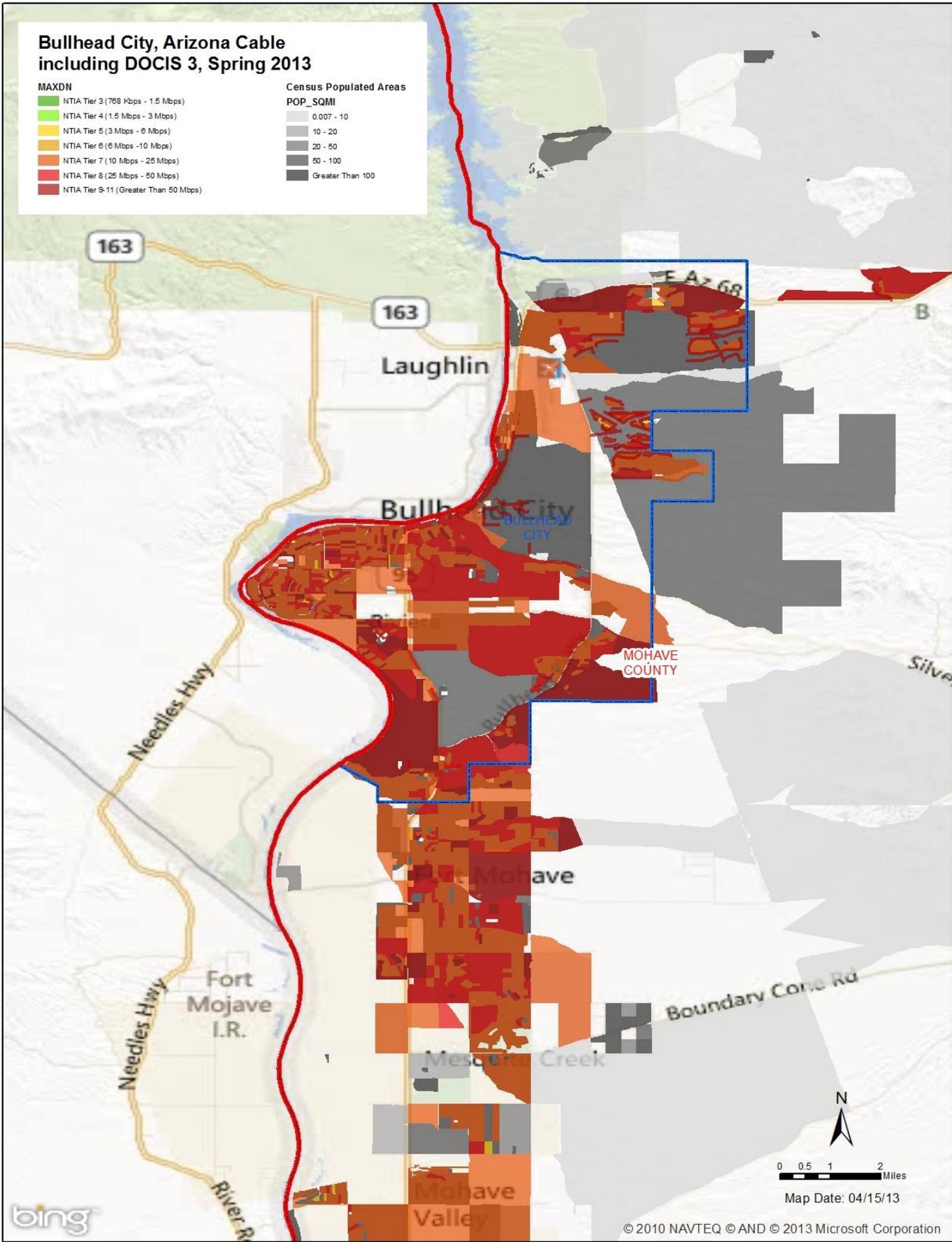
- MAXDN**
- NTIA Tier 3 (768 Kbps - 1.5 Mbps)
 - NTIA Tier 4 (1.5 Mbps - 3 Mbps)
 - NTIA Tier 5 (3 Mbps - 6 Mbps)
 - NTIA Tier 6 (6 Mbps - 10 Mbps)
 - NTIA Tier 7 (10 Mbps - 25 Mbps)
 - NTIA Tier 8 (25 Mbps - 50 Mbps)
 - NTIA Tier 9-11 (Greater Than 50 Mbps)

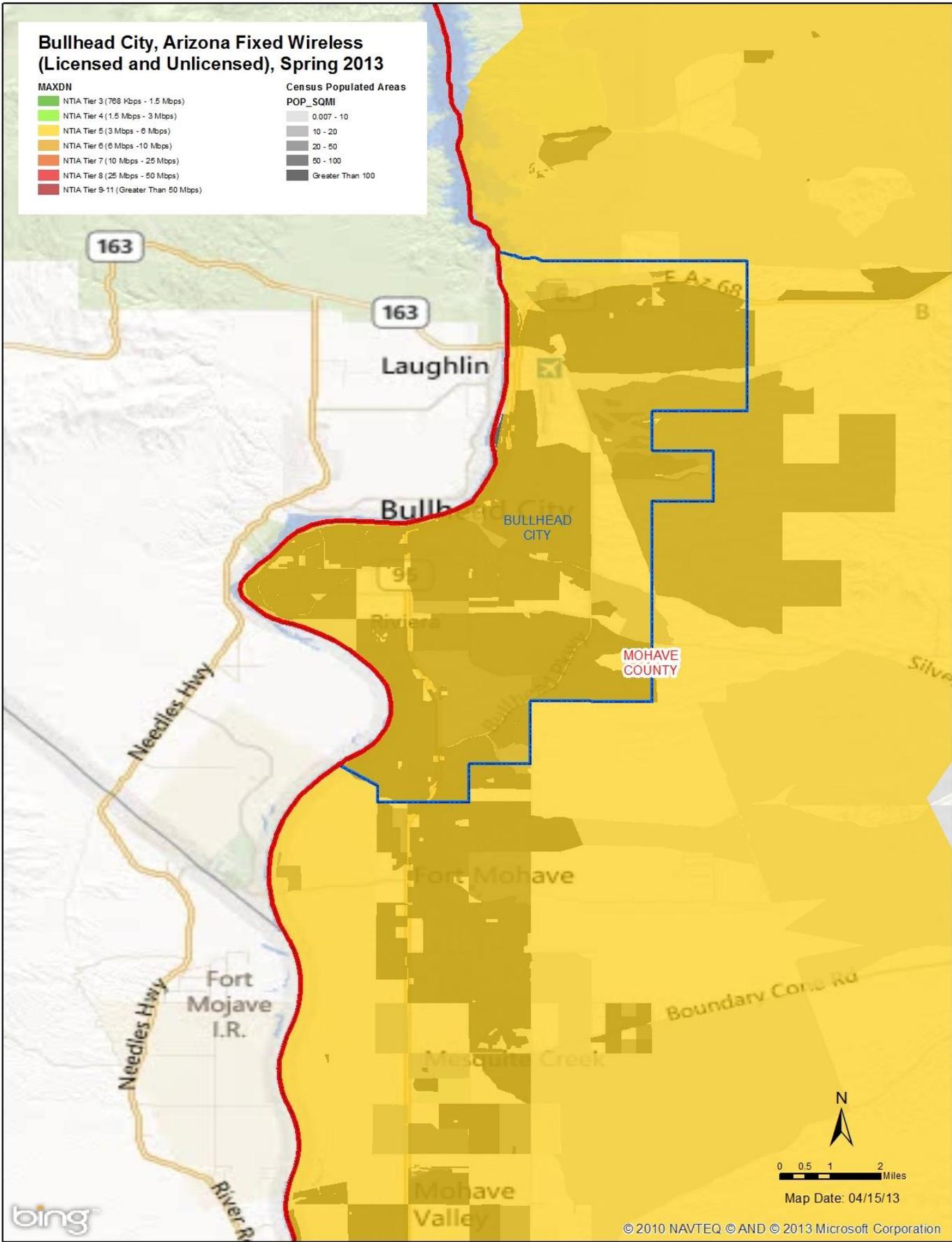
- Census Populated Areas
POP_SQMI**
- 0.007 - 10
 - 10 - 20
 - 20 - 50
 - 50 - 100
 - Greater Than 100

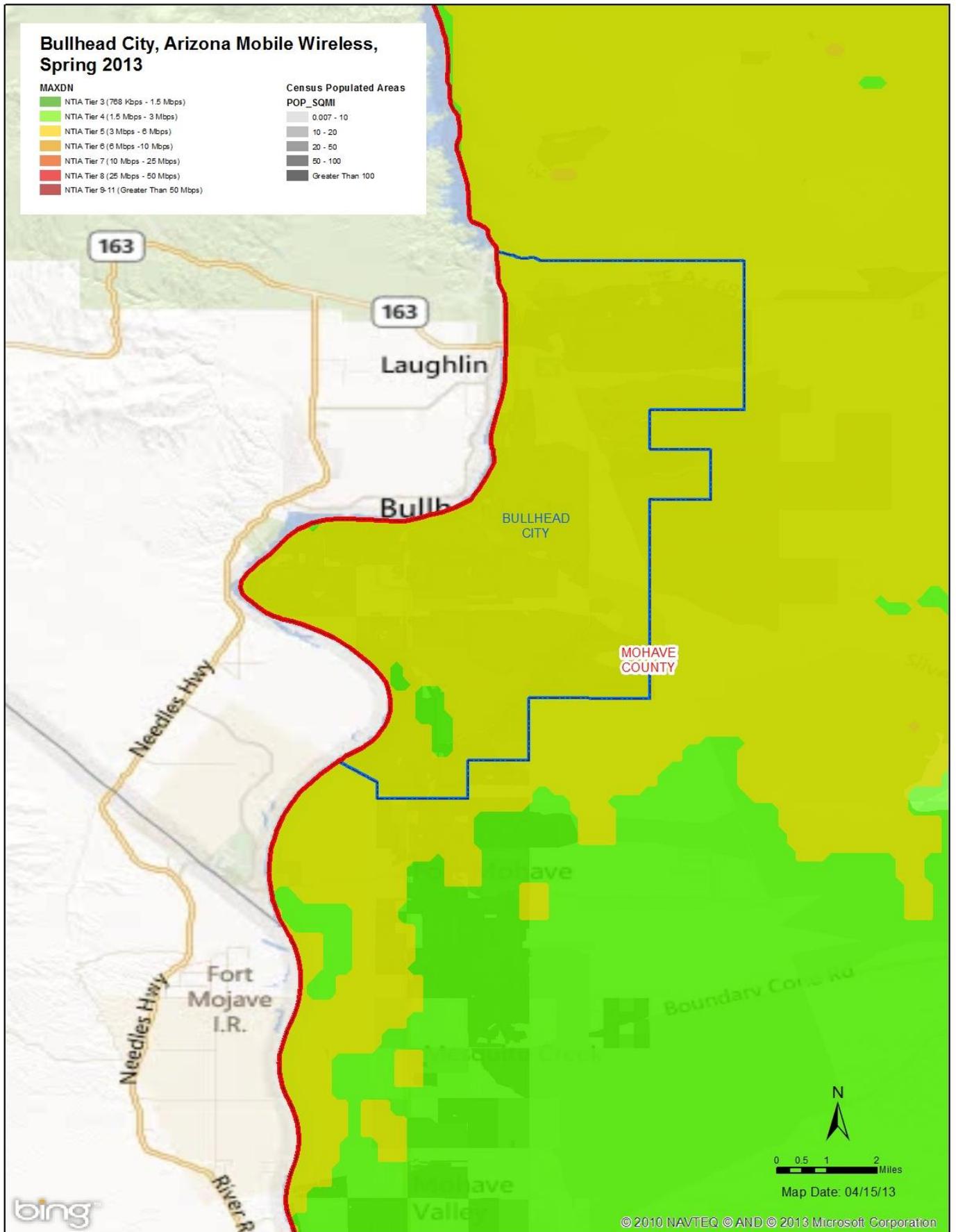


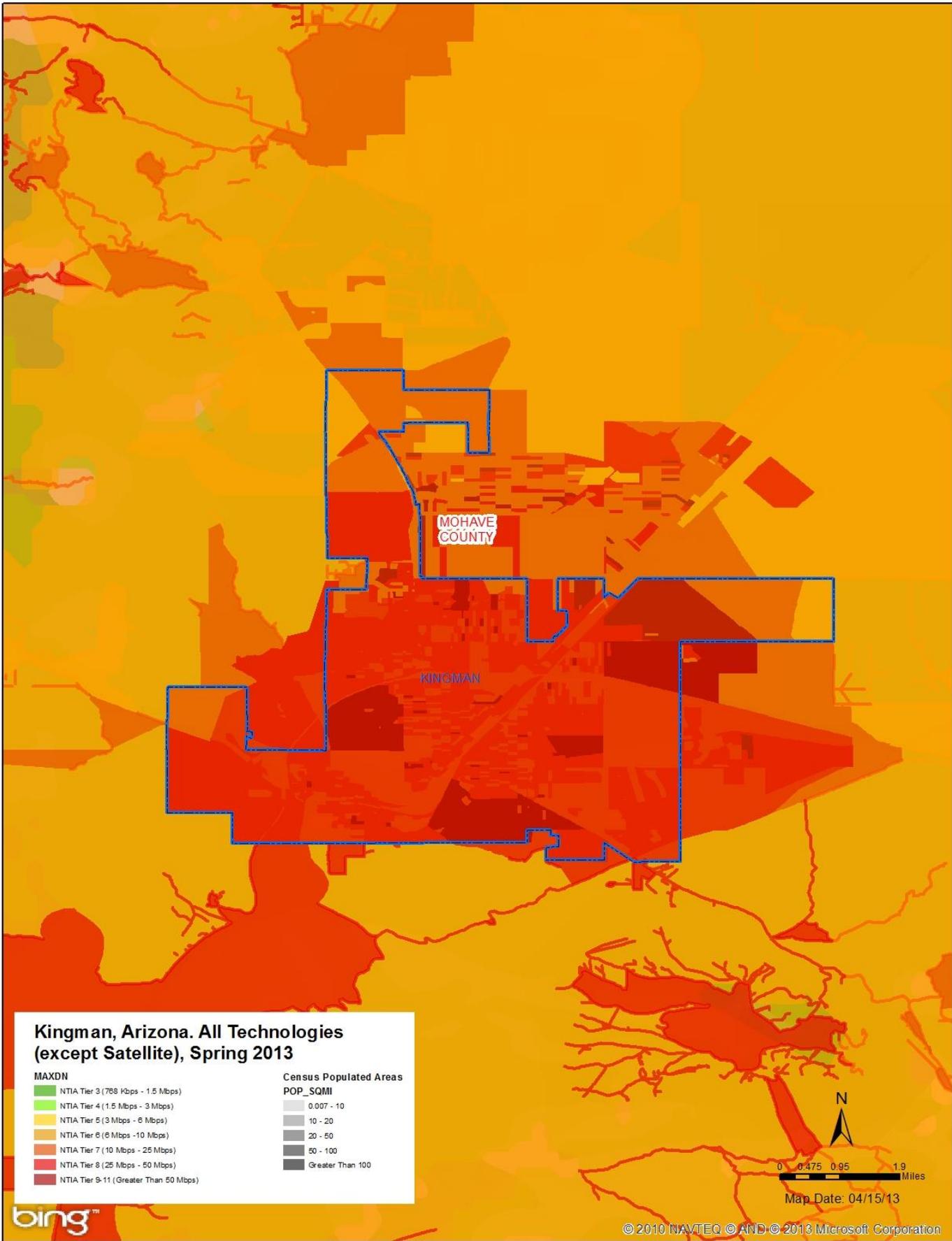
© 2010 NAVTEQ © AND © 2013 Microsoft Corporation

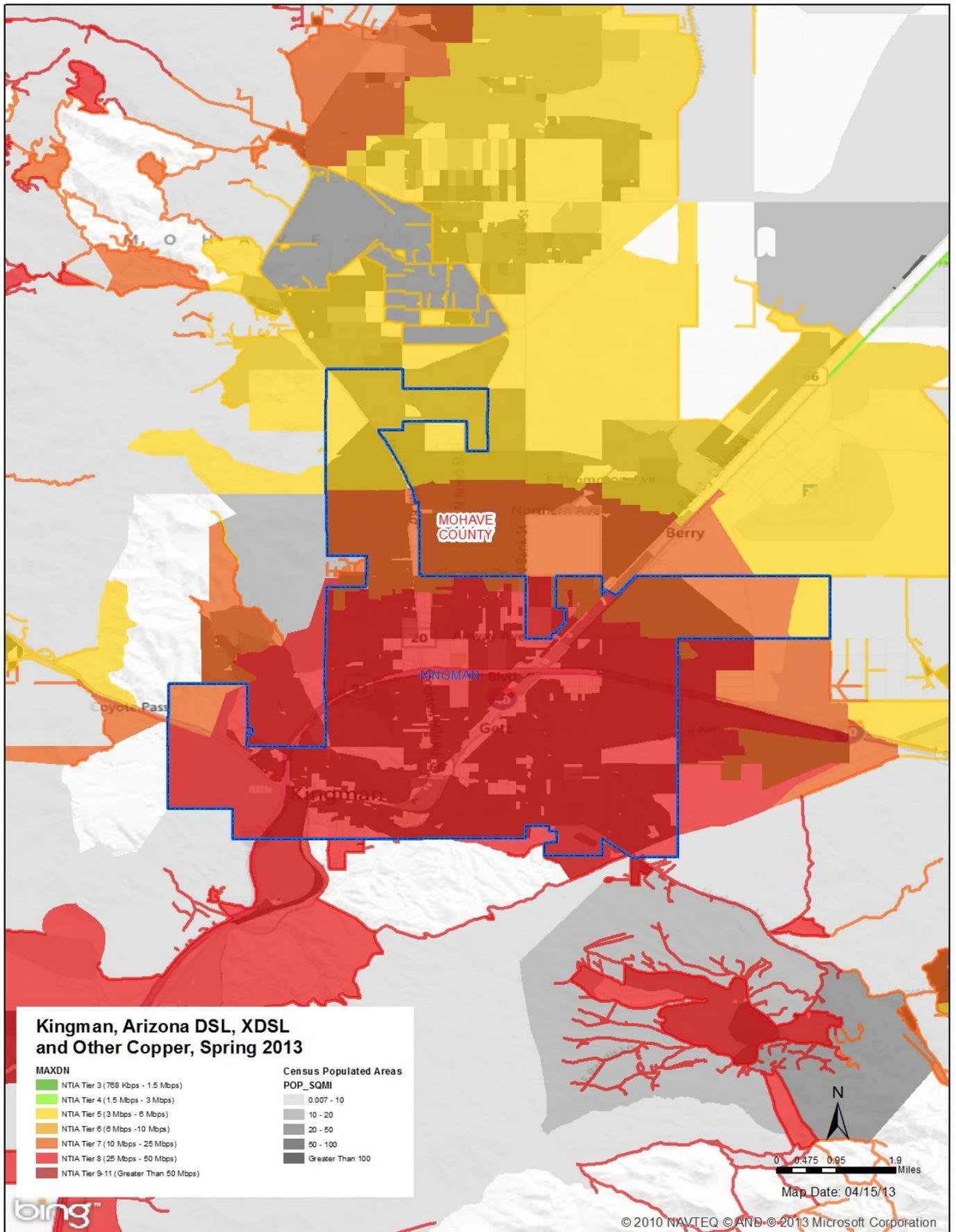


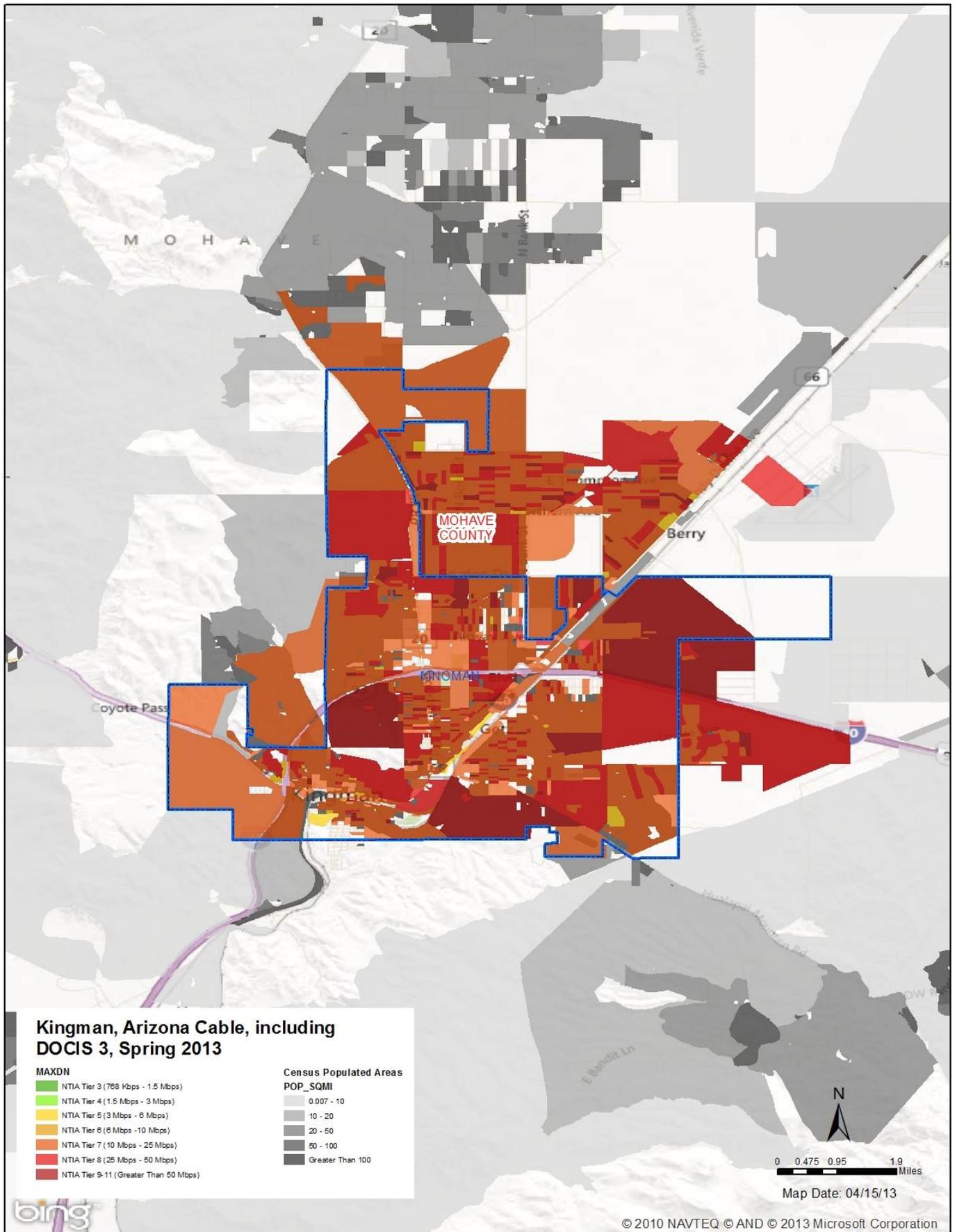


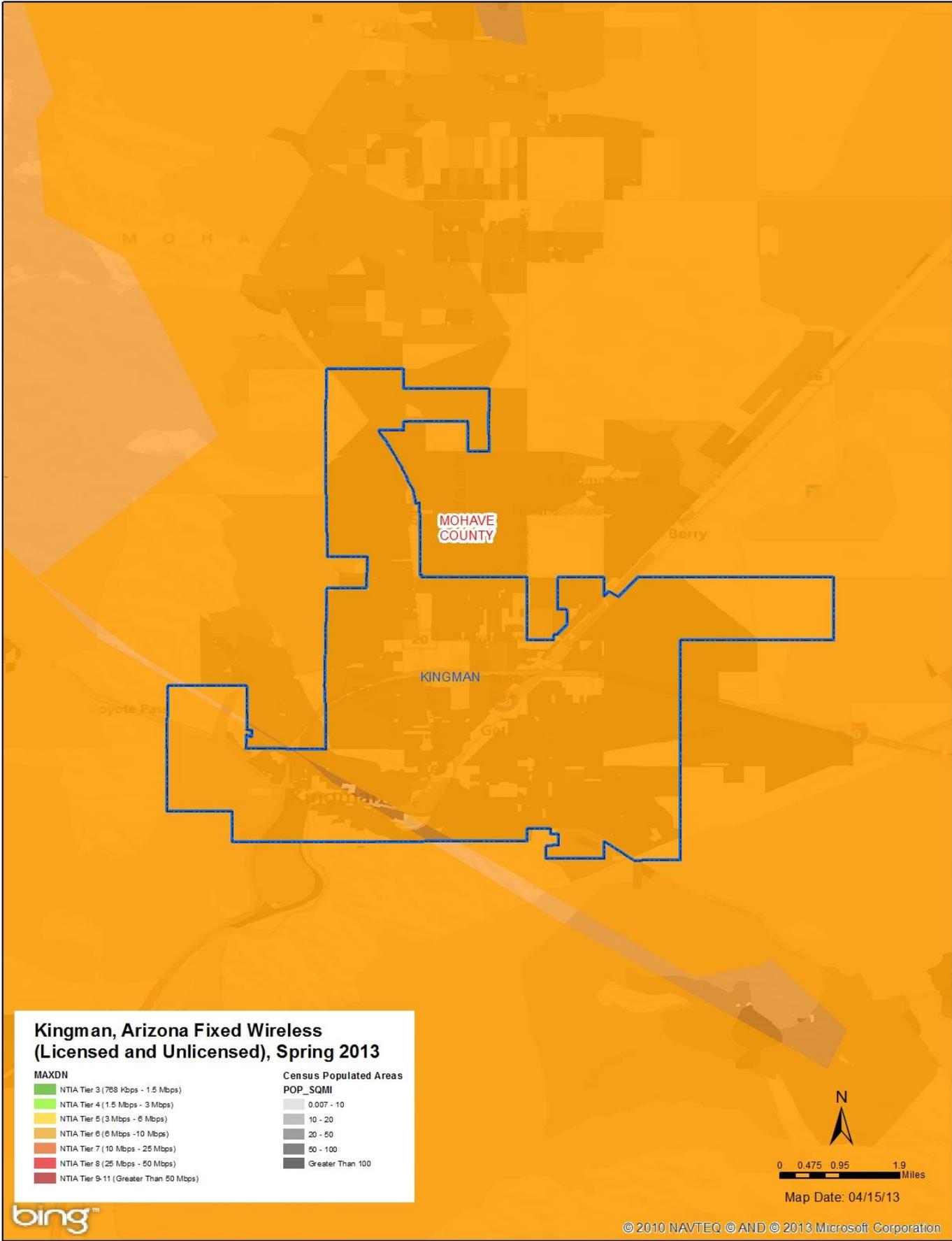


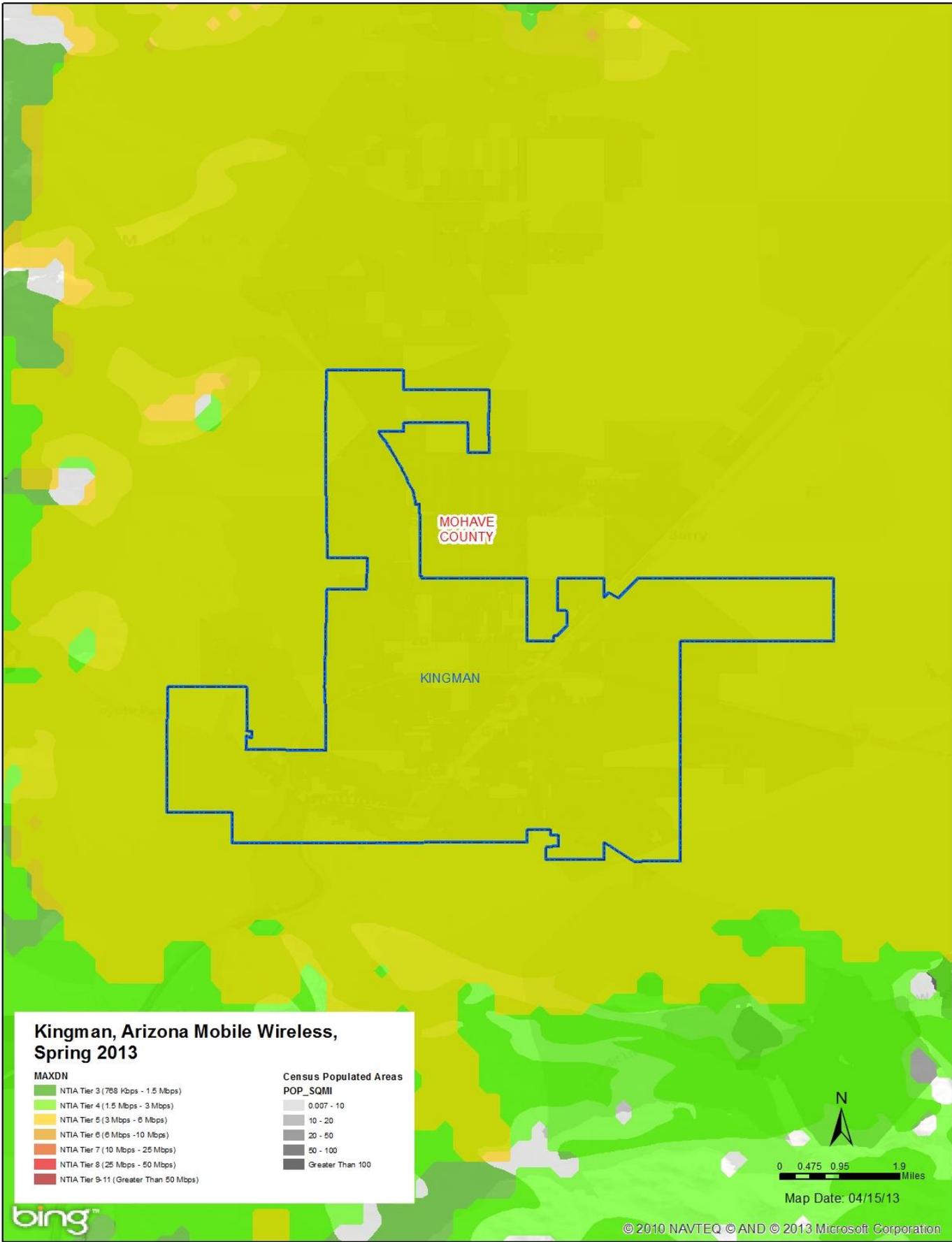


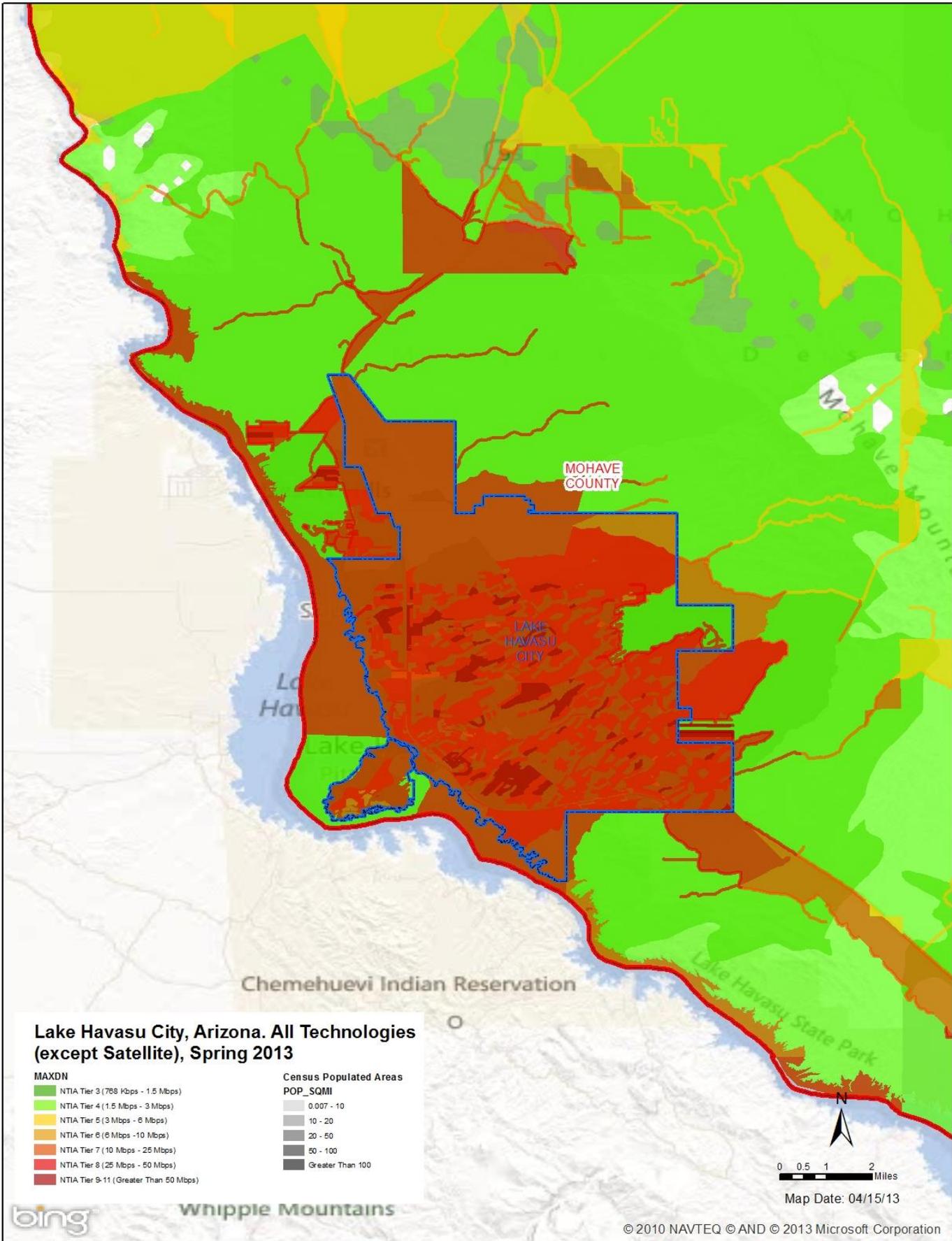


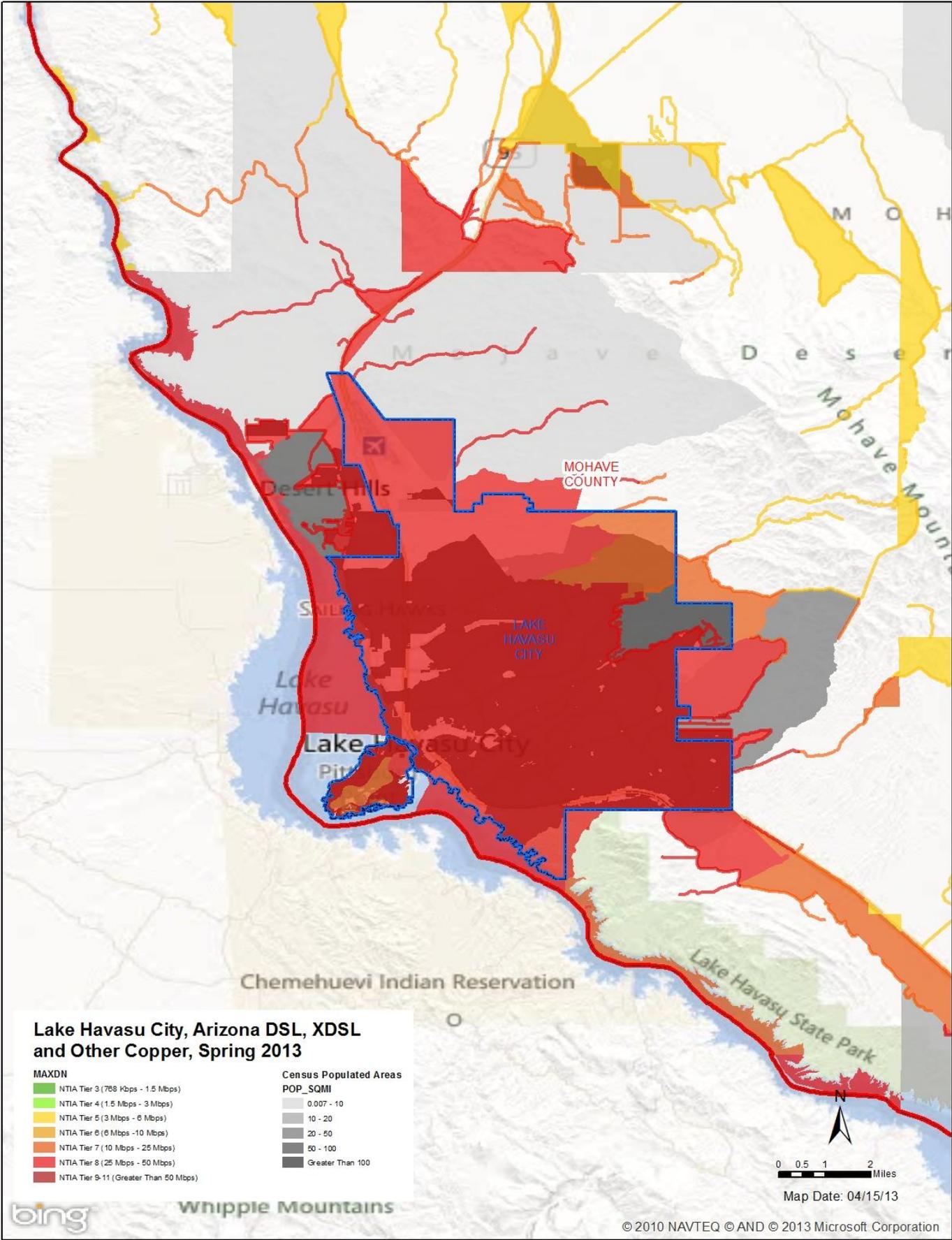


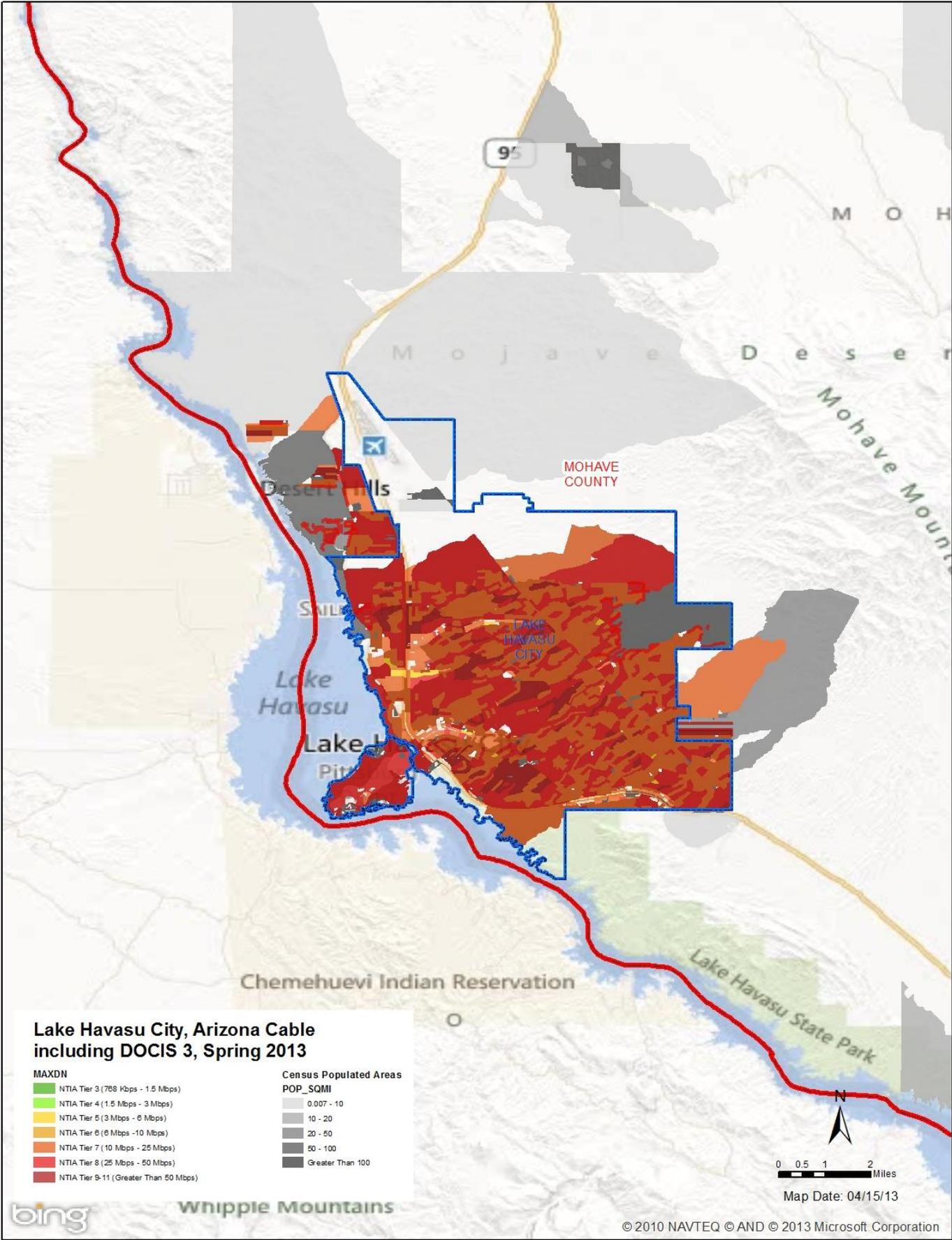


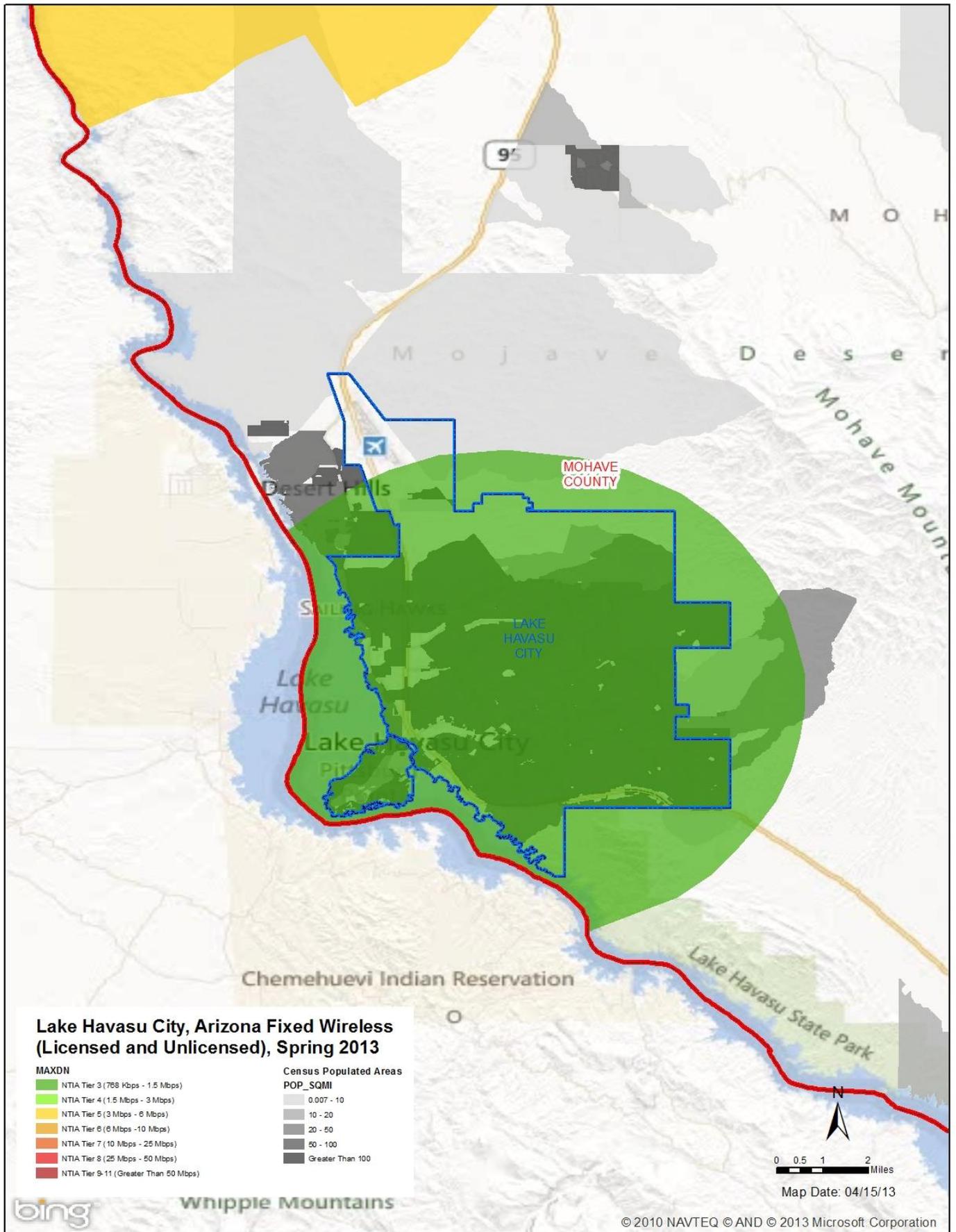


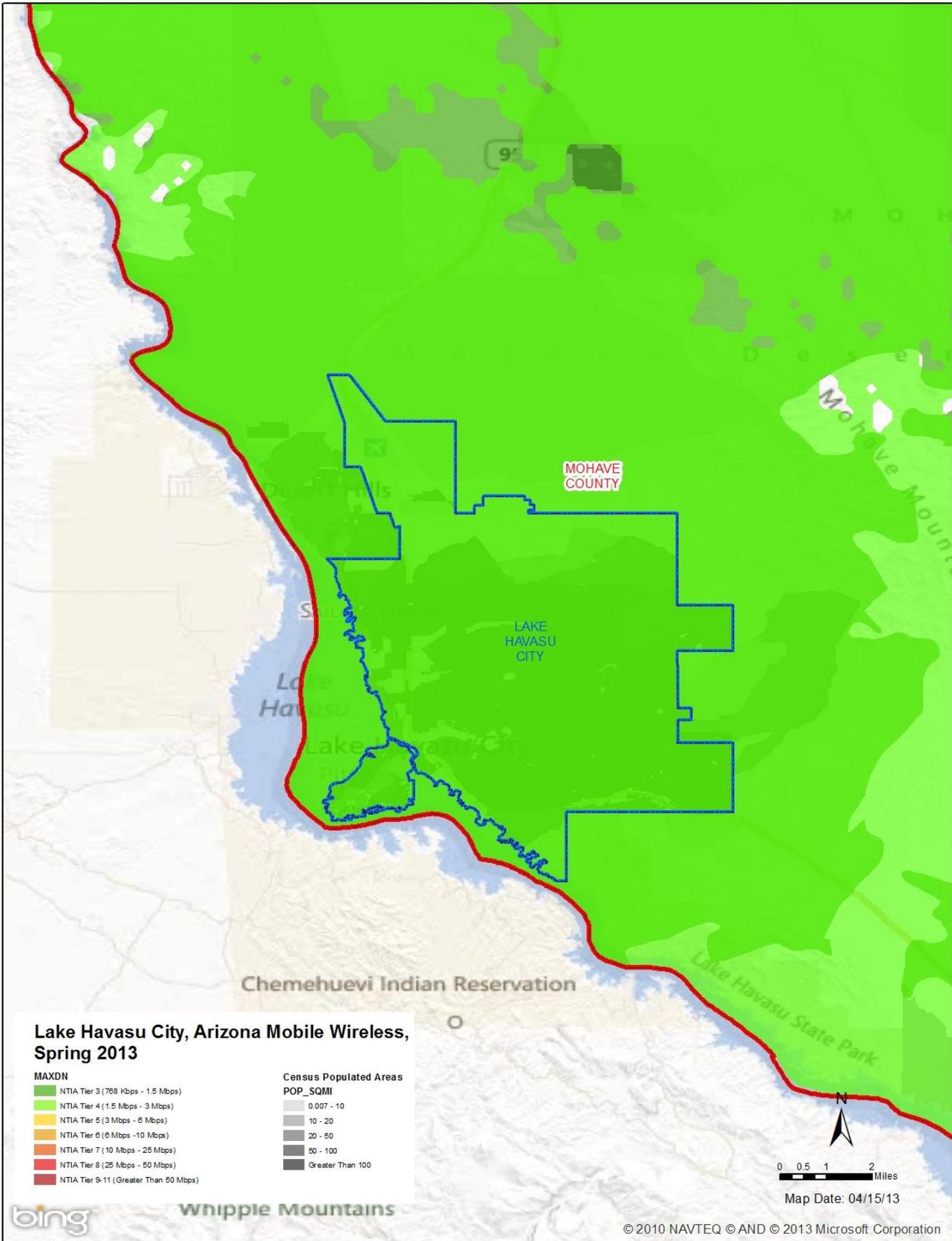




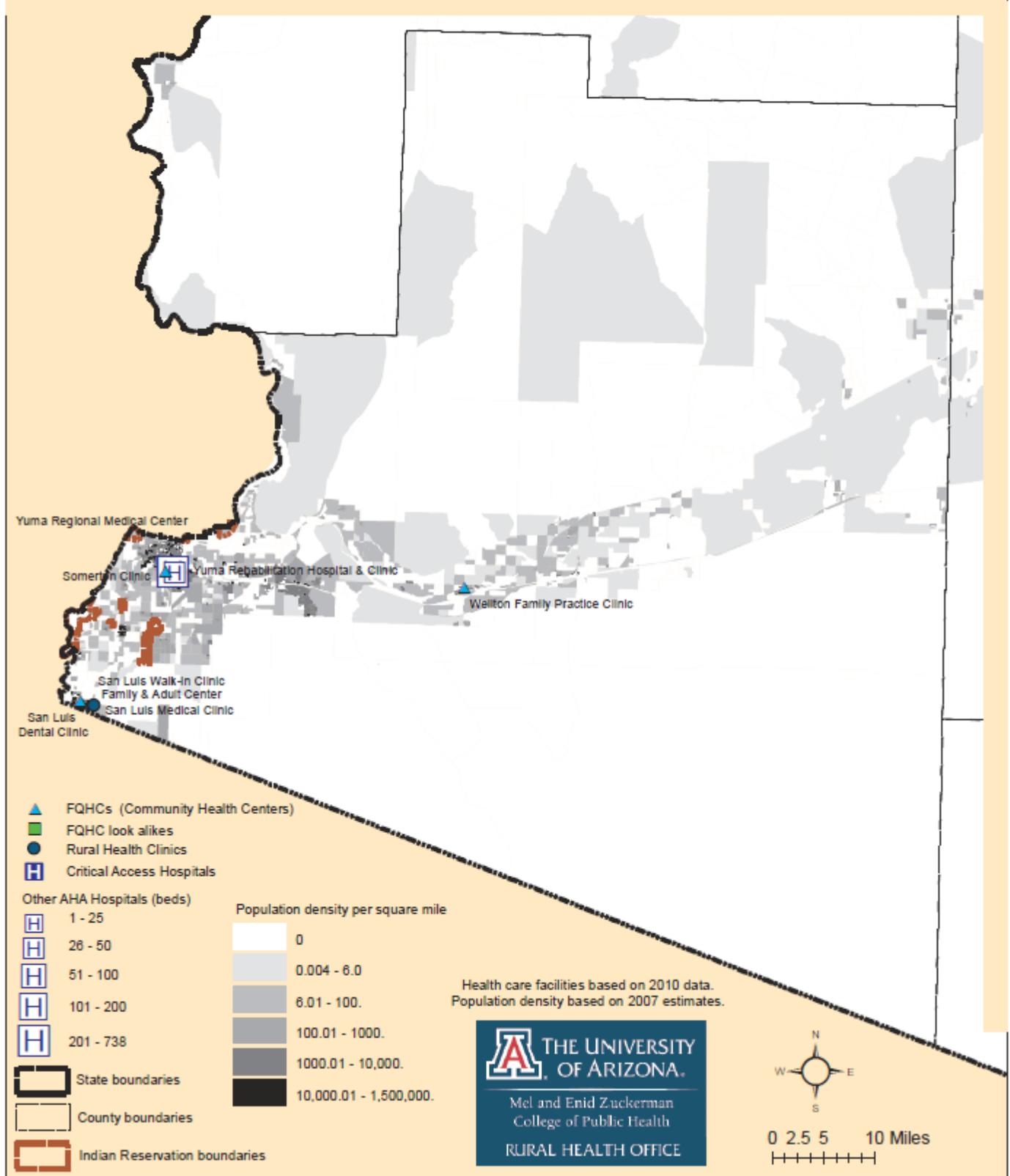








Hospitals, Clinics, and Population Density of Yuma County, Arizona

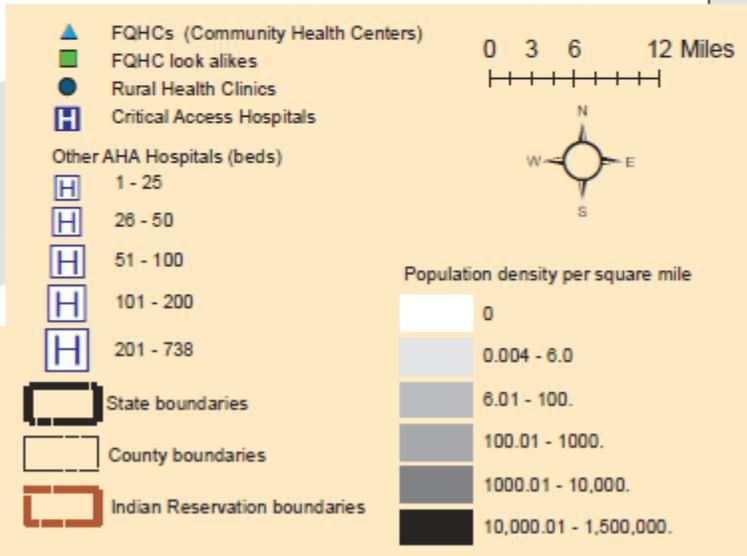
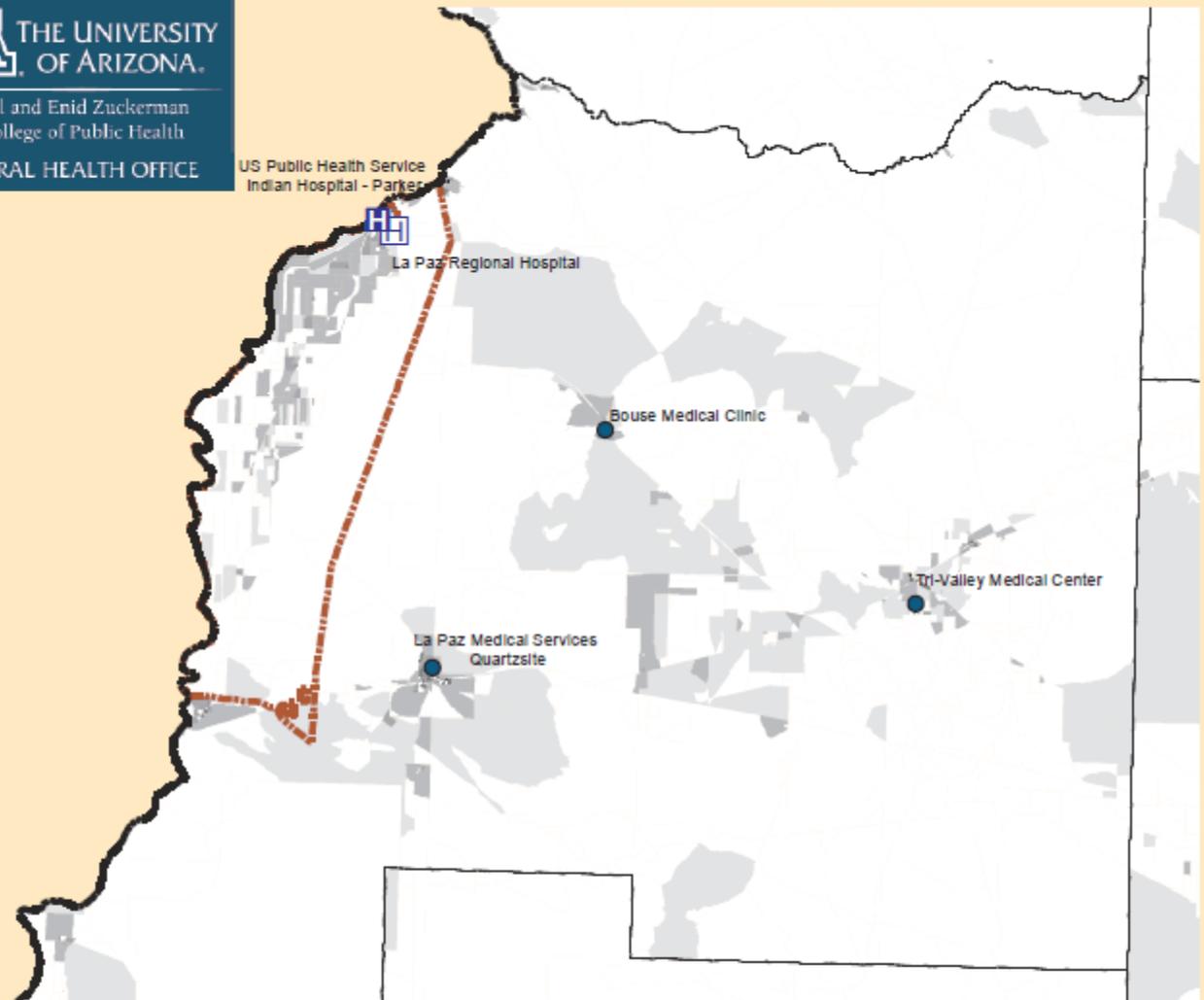


Hospitals, Clinics, and Population Density of Cochise County, Arizona



Mel and Enid Zuckerman
College of Public Health

RURAL HEALTH OFFICE



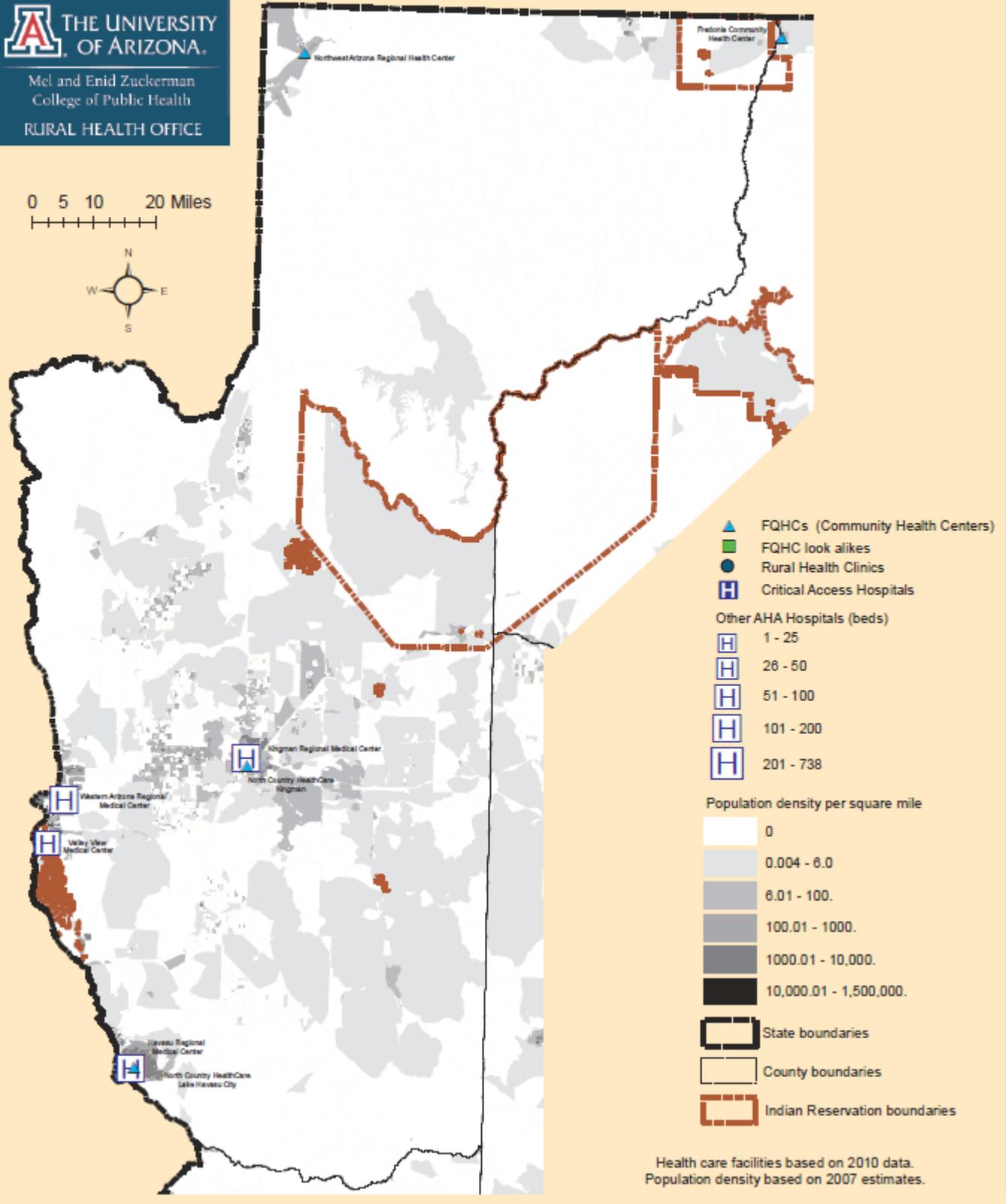
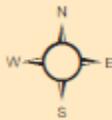
Health care facilities based on 2010 data.
Population density based on 2007 estimates.

Note: Title is in error. Should be labelled La Paz County rather than Cochise County.

Hospitals, Clinics, and Population Density of Mohave County, Arizona


THE UNIVERSITY OF ARIZONA.
 Mel and Enid Zuckerman
 College of Public Health
 RURAL HEALTH OFFICE

0 5 10 20 Miles

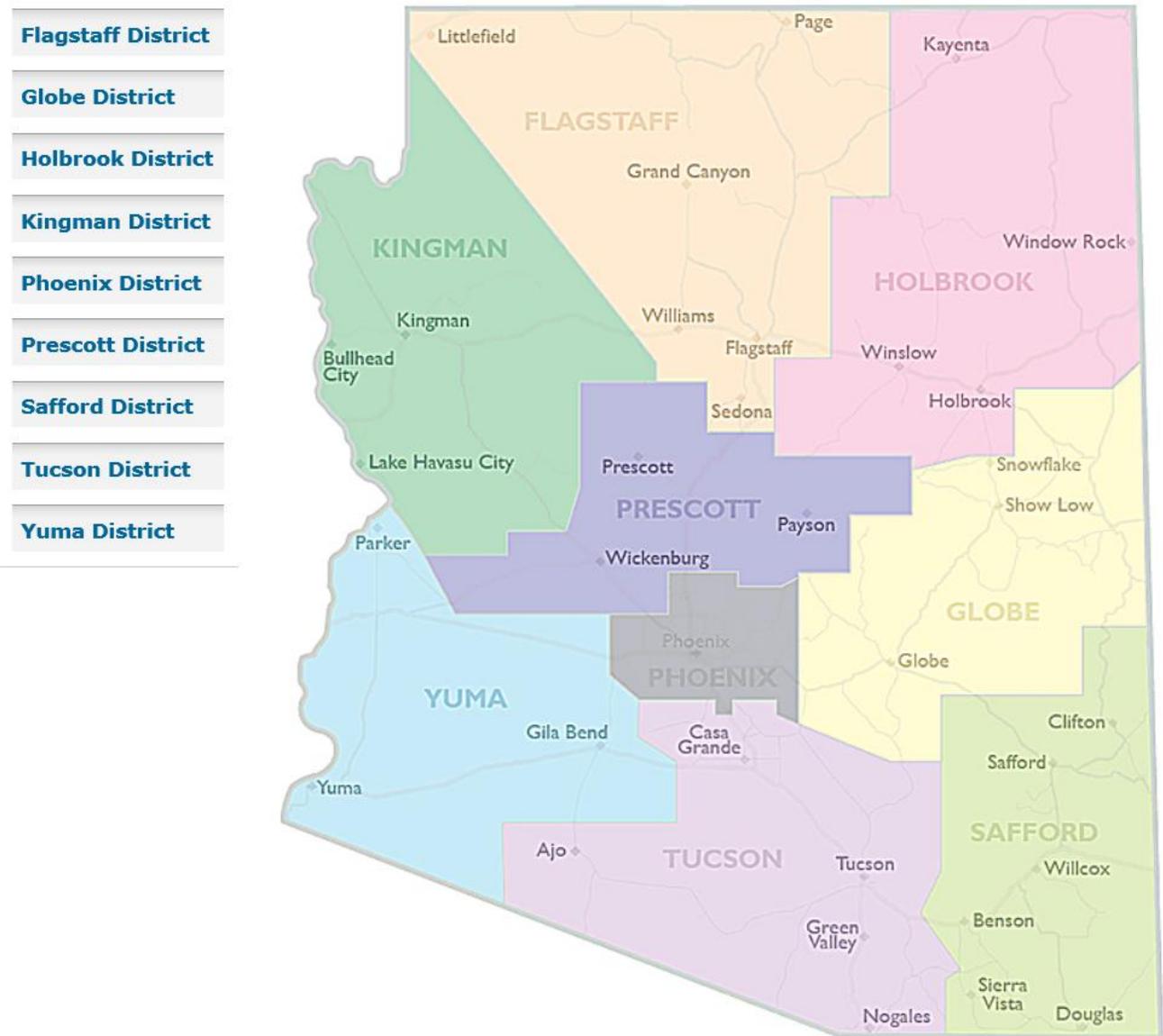


Appendix F: Arizona Transportation and Other Public Infrastructure

Arizona Department of Transportation (ADOT):

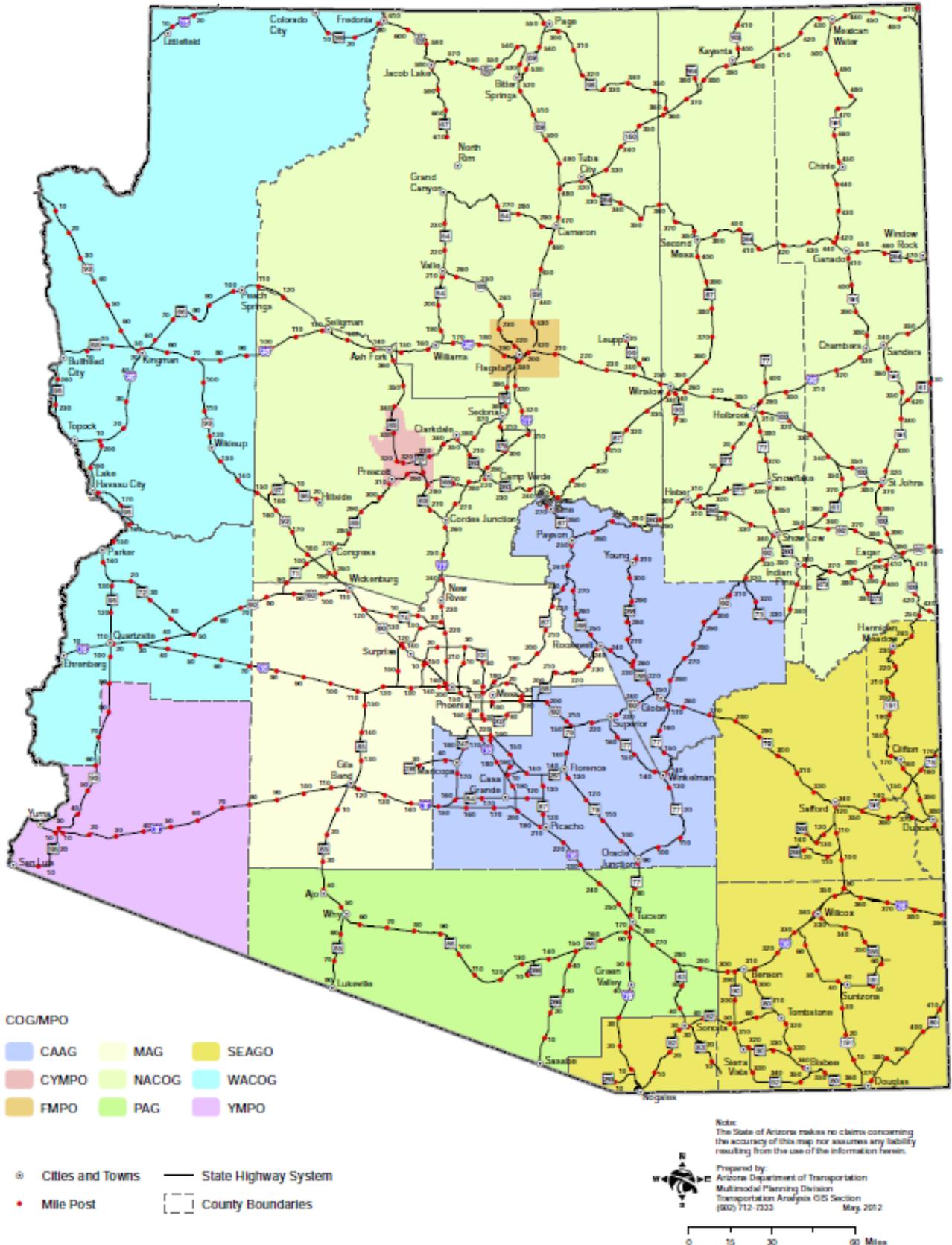
The Arizona Department of Transportation (ADOT) is a multi-modal transportation agency serving one of the fastest growing areas of the country. ADOT is responsible for planning, building and operating a complex highway system in addition to building and maintaining bridges and the Grand Canyon Airport. ADOT is funded by individuals and businesses through fuel taxes, motor carrier fees, vehicle title, registration, and license fees to build and operate the State's transportation systems. Statewide projects are managed by their district offices. The map below shows how ADOT Engineering and Maintenance Districts are defined.

ADOT Engineering and Maintenance Districts



For a list of ADOT Projects by District see the district-by-district listings at http://www.azdot.gov/highways/projects/projects_by_district.asp for details.

Arizona COGs and MPOs



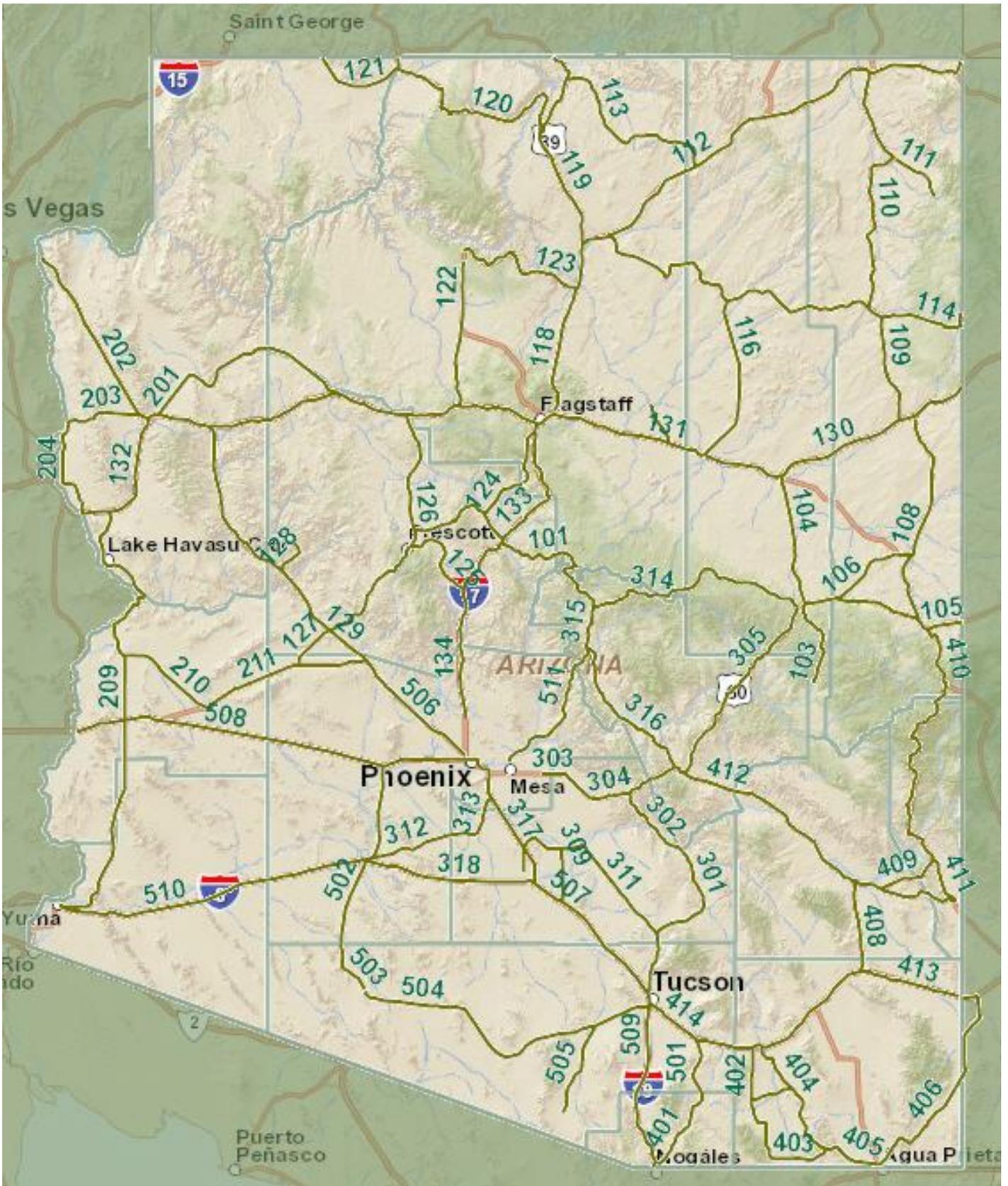
Source: <http://www.azdot.gov/mpd/gis/maps/index.asp>

State Highway Junction System



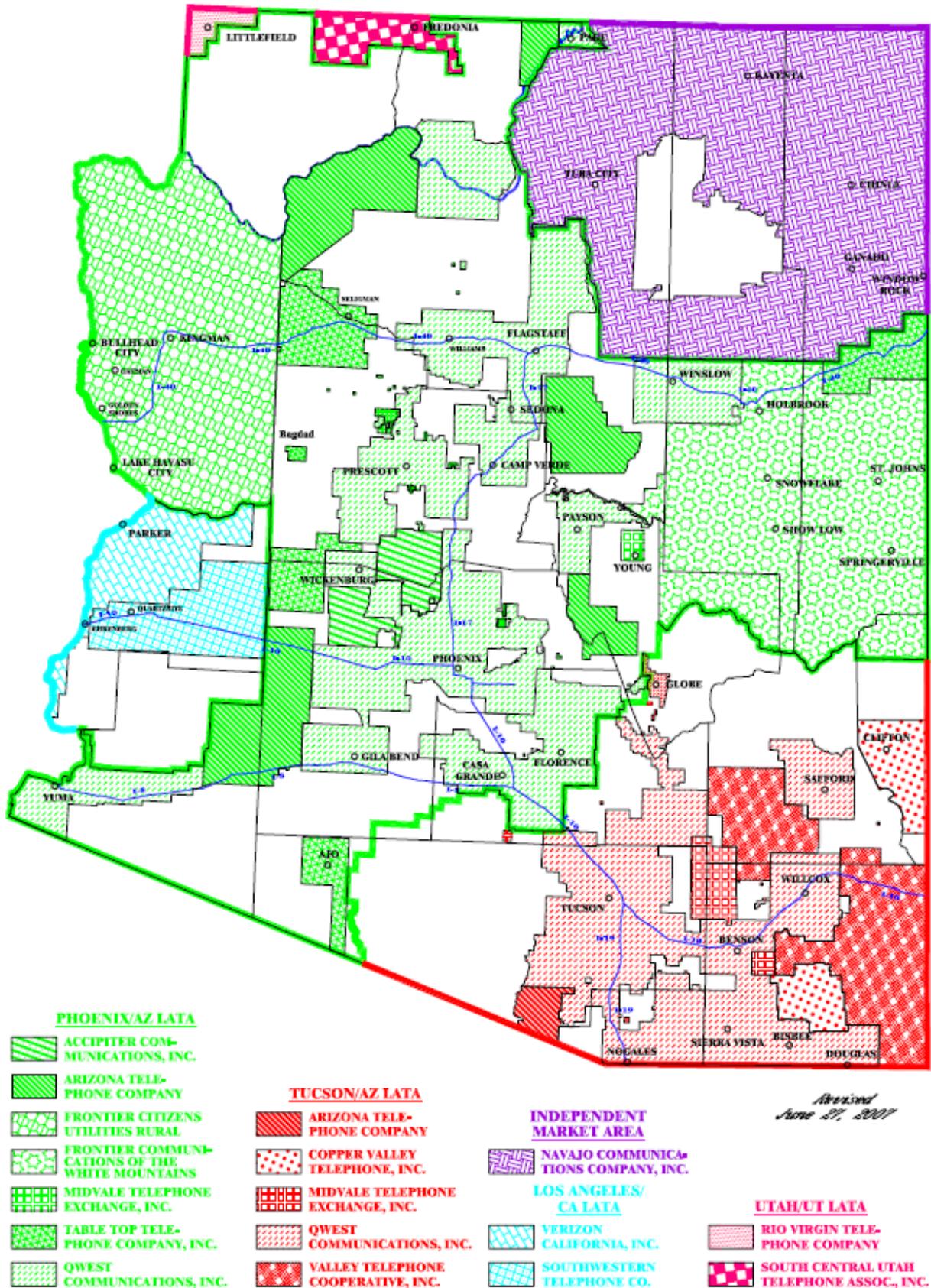
Source: ADOT (<http://www.azdot.gov/mpd/gis/maps/index.asp>)

Arizona Highways as Defined Road Segments



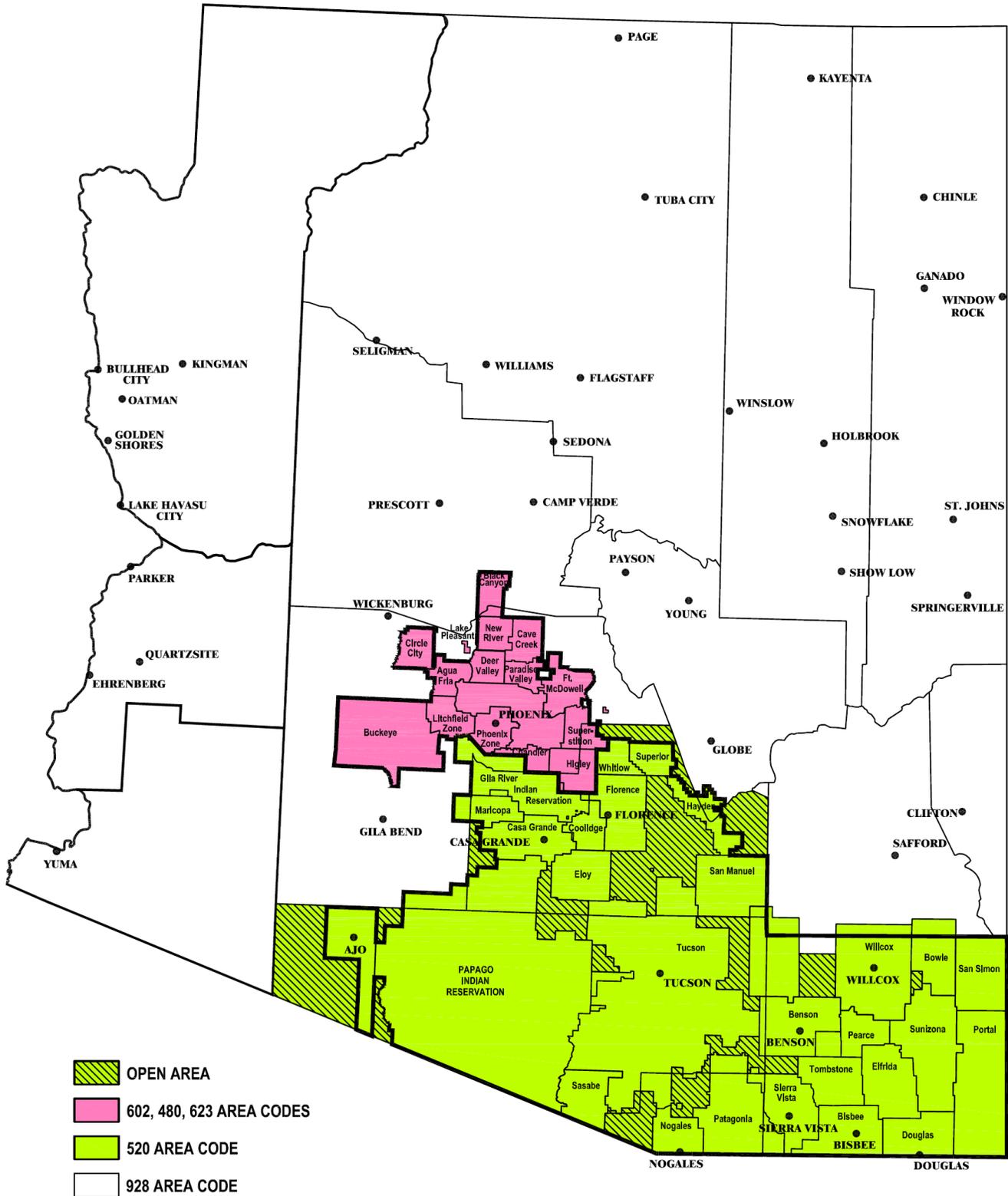
Source: State of Arizona Community Planning Map
(<http://broadbandmap.az.gov/CommunityPlanningMap/>)

Arizona ILEC Service Areas & LATA Boundaries Map



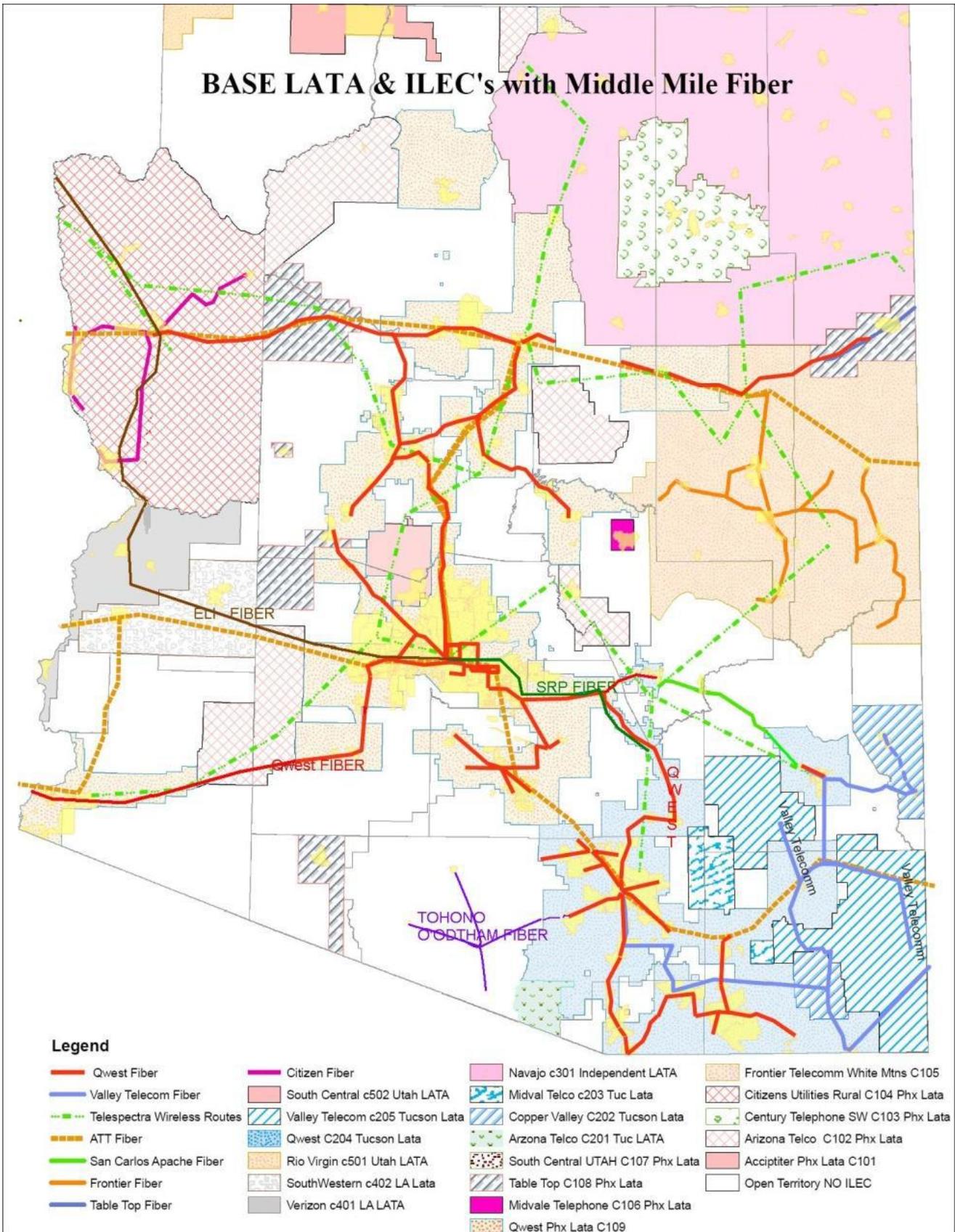
Source: Arizona Corporation Commission (ACC - <http://www.azcc.gov/divisions/utilities/telecom.asp>)

Arizona Area Code Boundaries Map



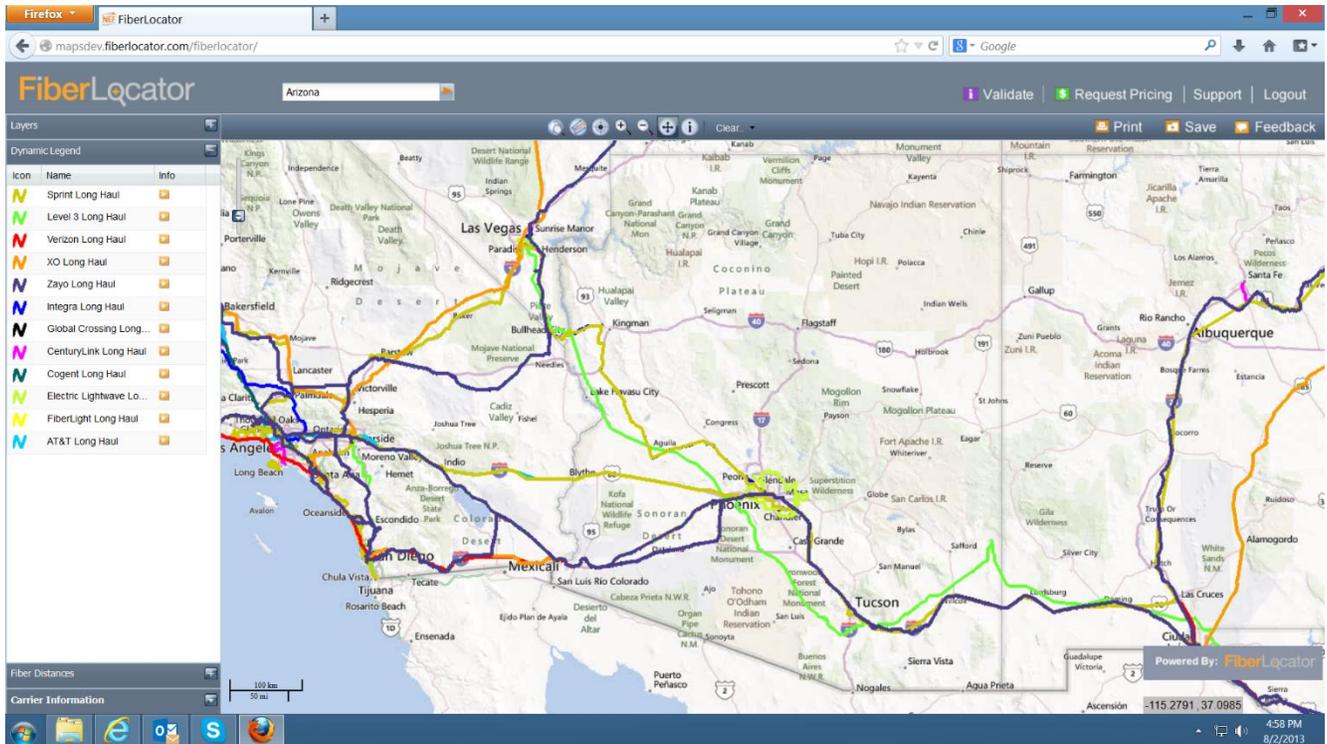
Source: Arizona Corporation Commission (ACC - <http://www.azcc.gov/divisions/utilities/telecom.asp>)

Arizona Selective Middle Mile Fiber Map

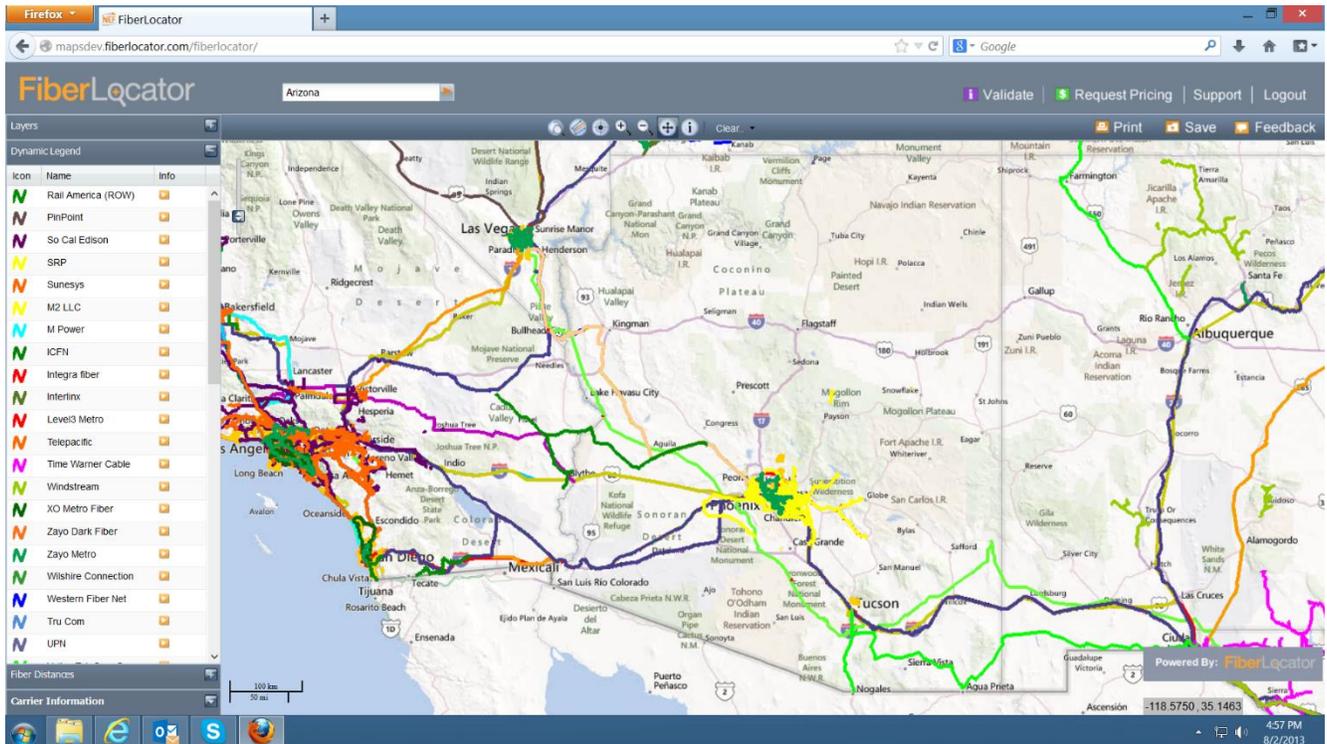


Source: Arizona Strategic Enterprise Technology Office (ASET - <http://aset.azdoa.gov/>)

Arizona Selective Long-Haul Fiber Map

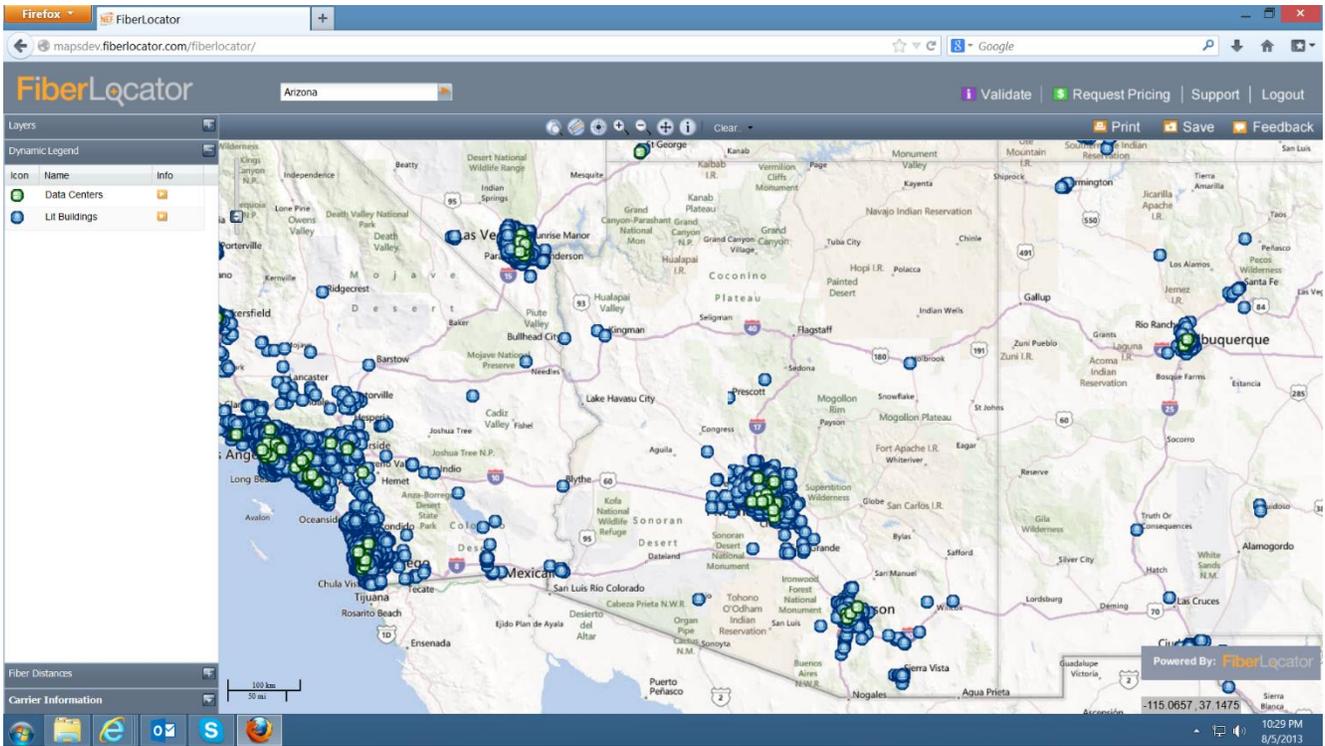


Arizona Selective Long-Haul and Metro Fiber Map



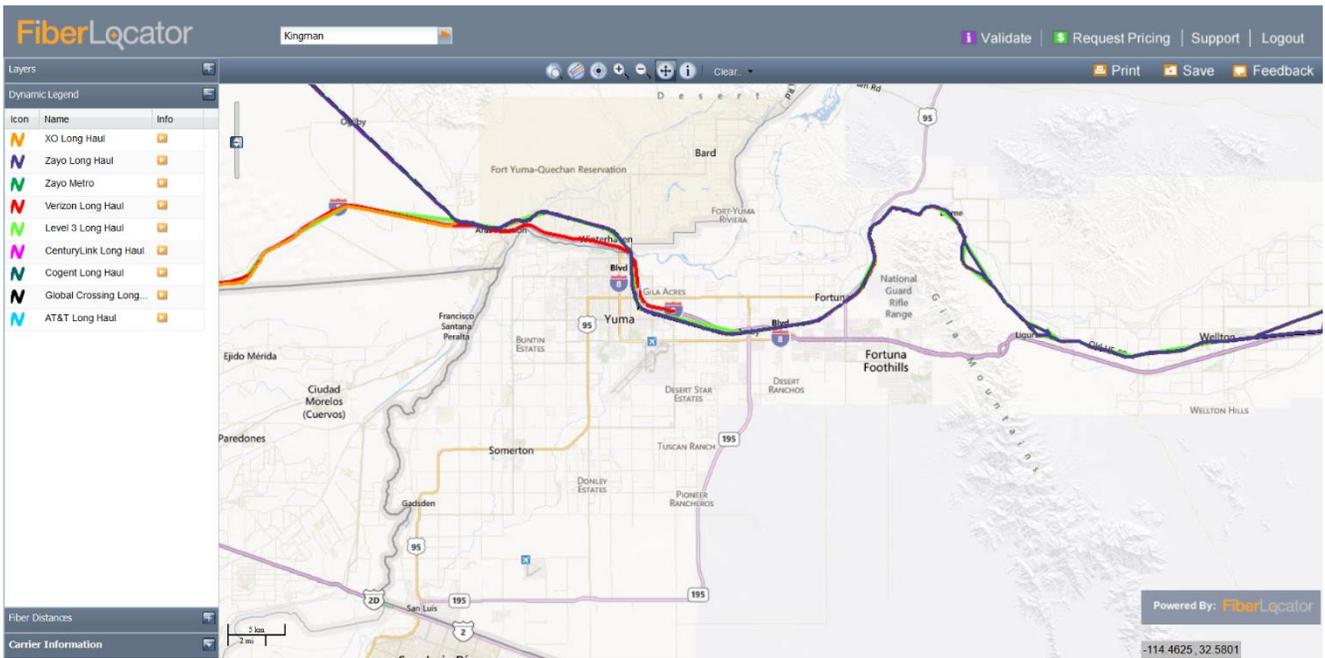
Source: NEF FiberLocator (<http://www.fiberlocator.com/>)

Arizona Data Centers and Lit Buildings Map

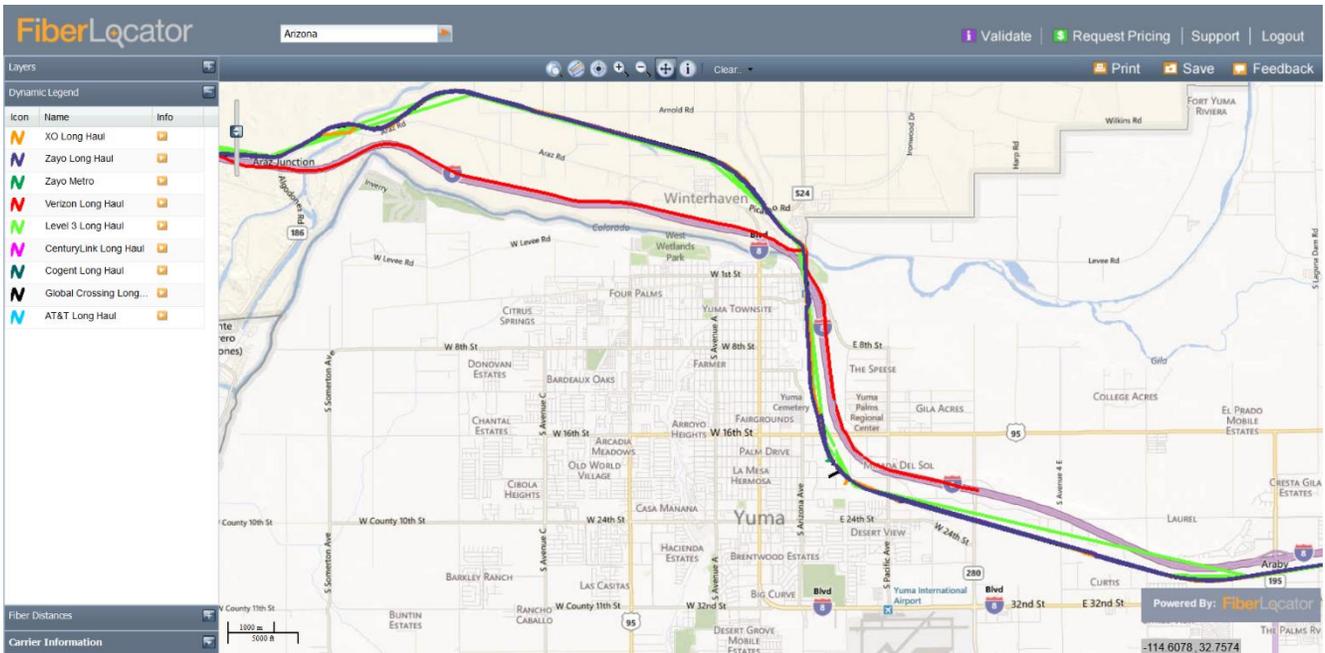


Source: NEF FiberLocator (<http://www.fiberlocator.com/>)

City of Yuma Area Selective Fiber Maps

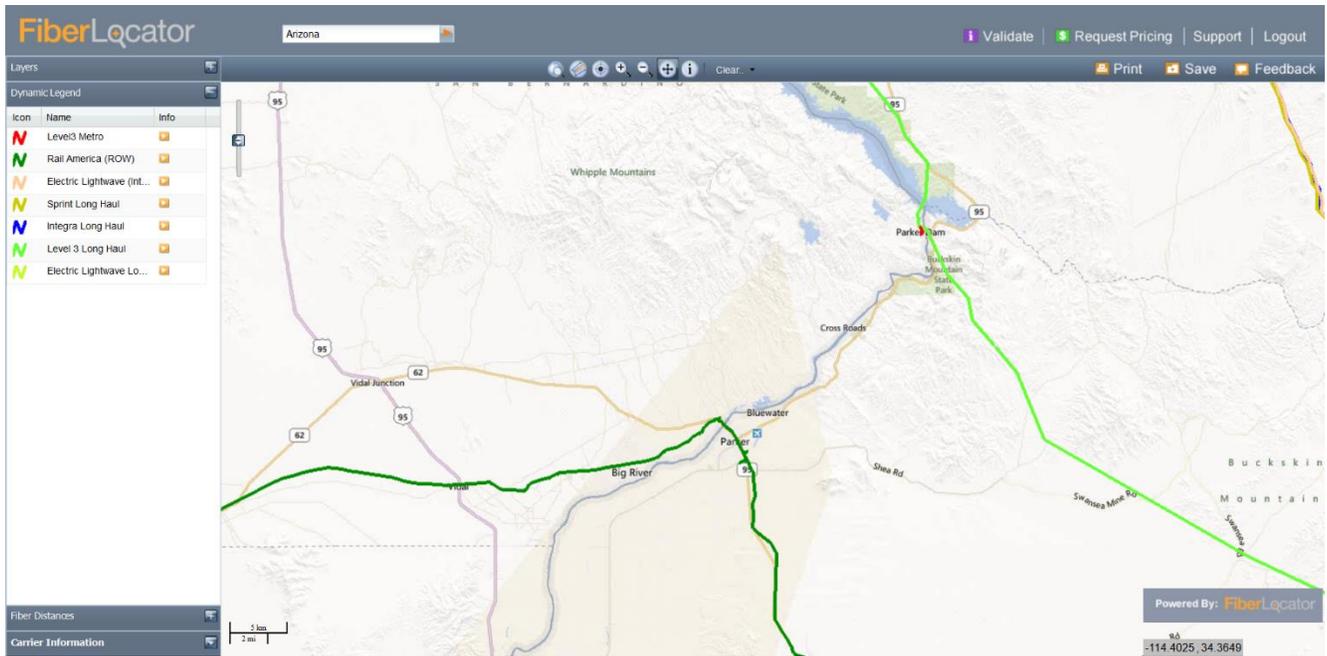


City of Yuma Detail Selective Fiber Maps

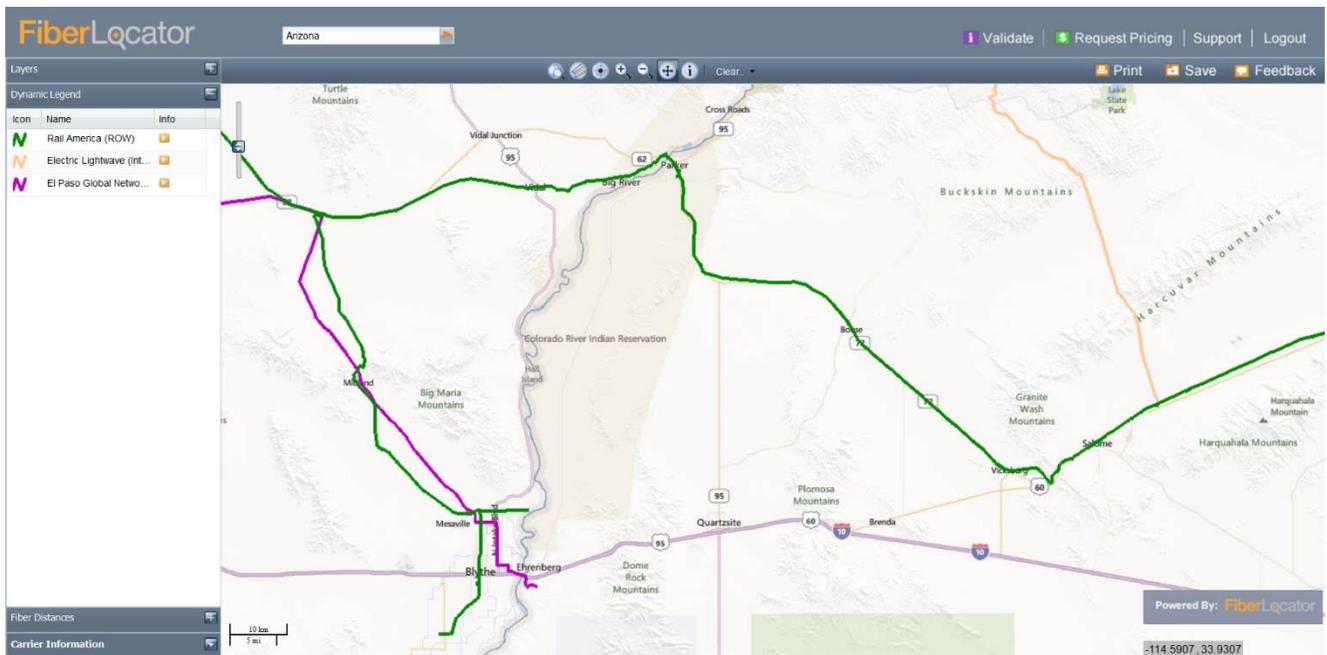


Source: NEF FiberLocator (<http://www.fiberlocator.com/>)

Parker-Quartzsite Area Selective Fiber Maps

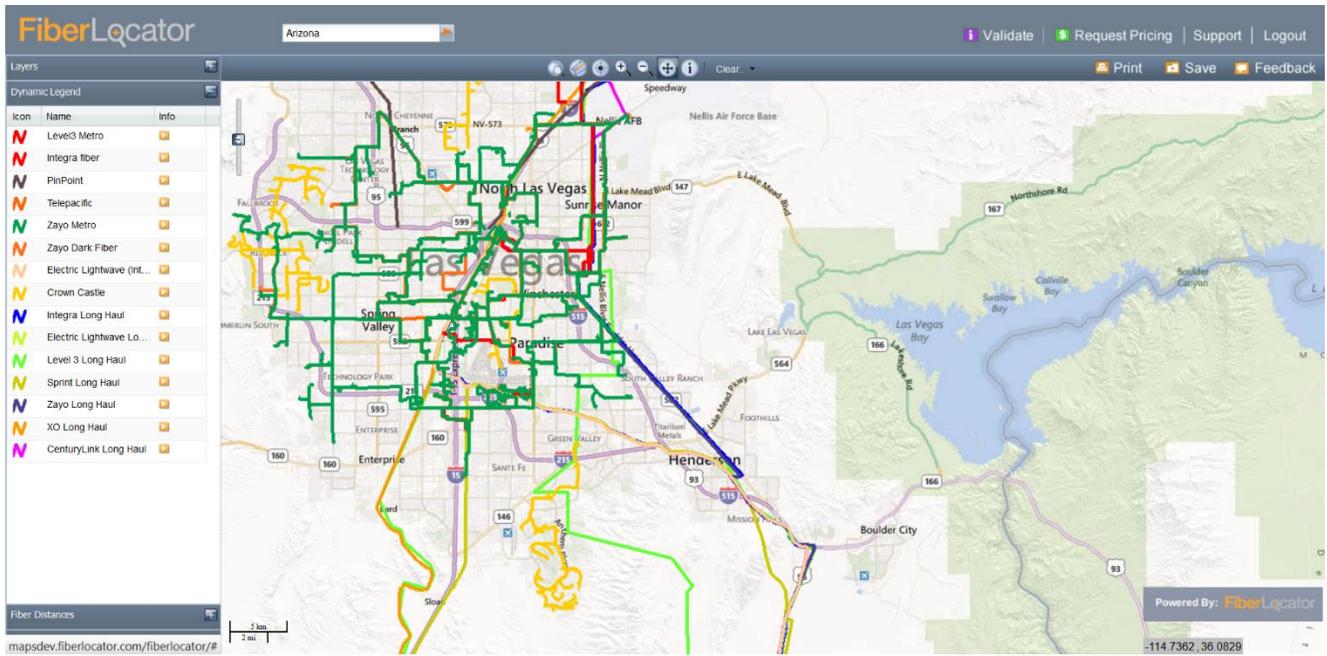


Parker Detail Selective Fiber Maps

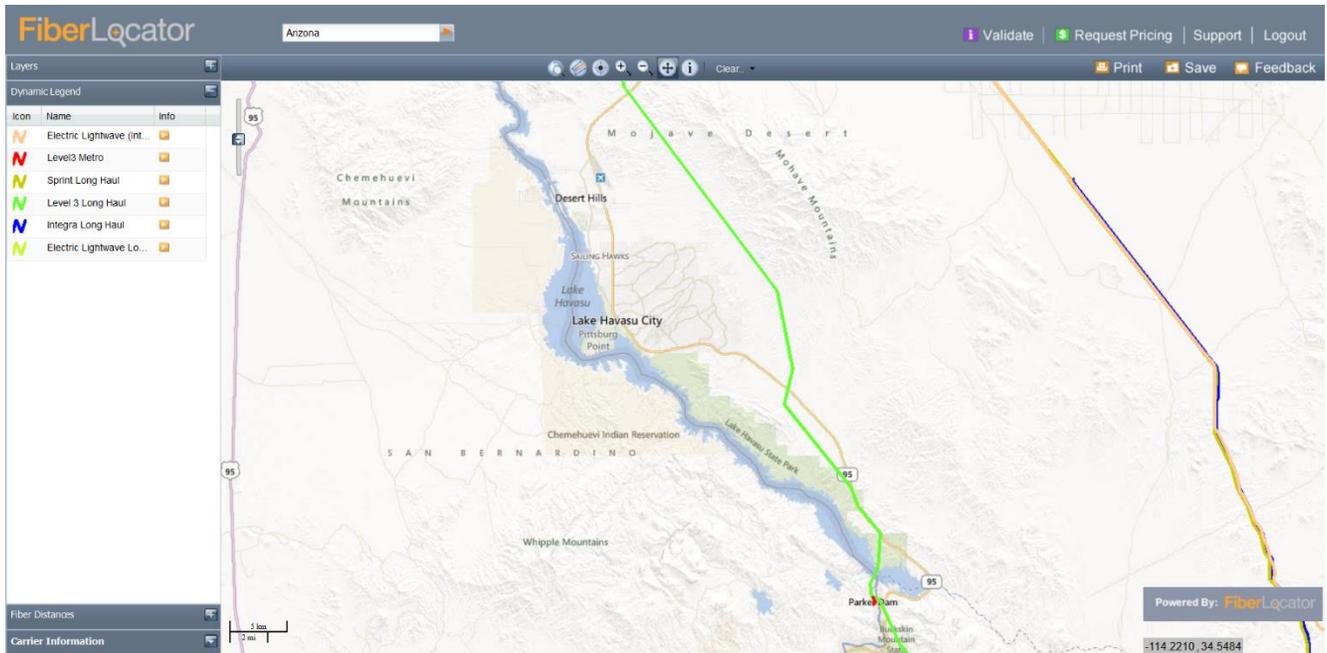


Source: NEF FiberLocator (<http://www.fiberlocator.com/>)

Boulder City Area Selective Fiber Maps

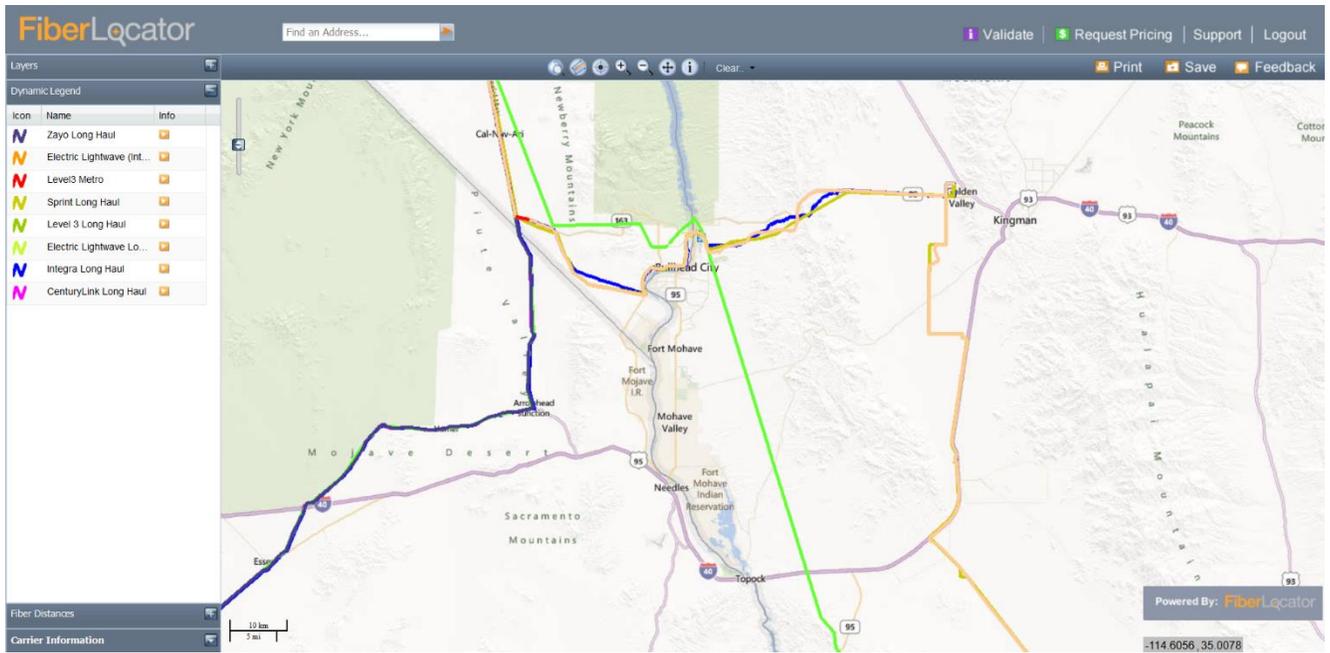


Lake Havasu City Area Selective Fiber Maps



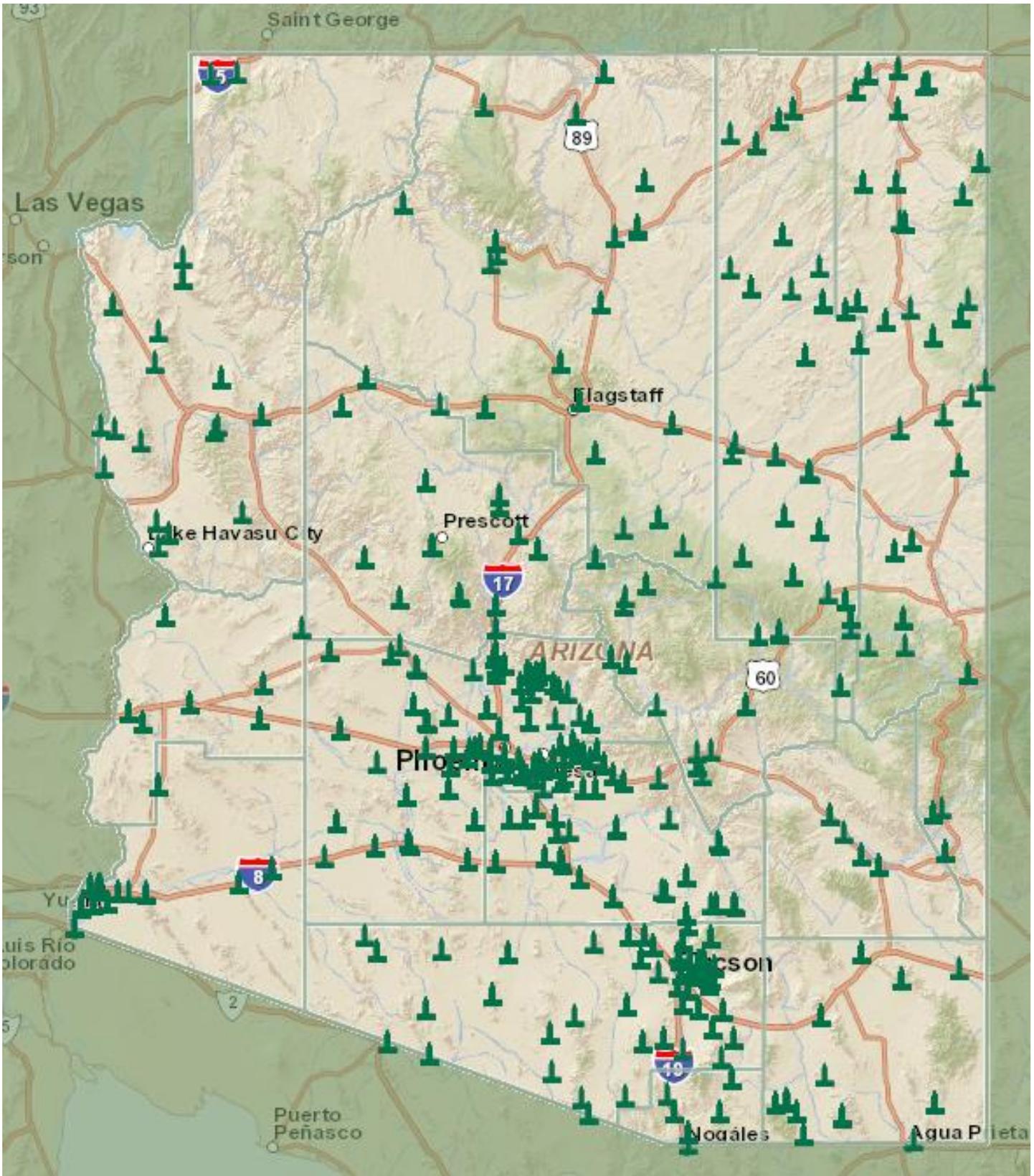
Source: NEF FiberLocator (<http://www.fiberlocator.com/>)

Bullhead City-Kingman Area Selective Fiber Maps



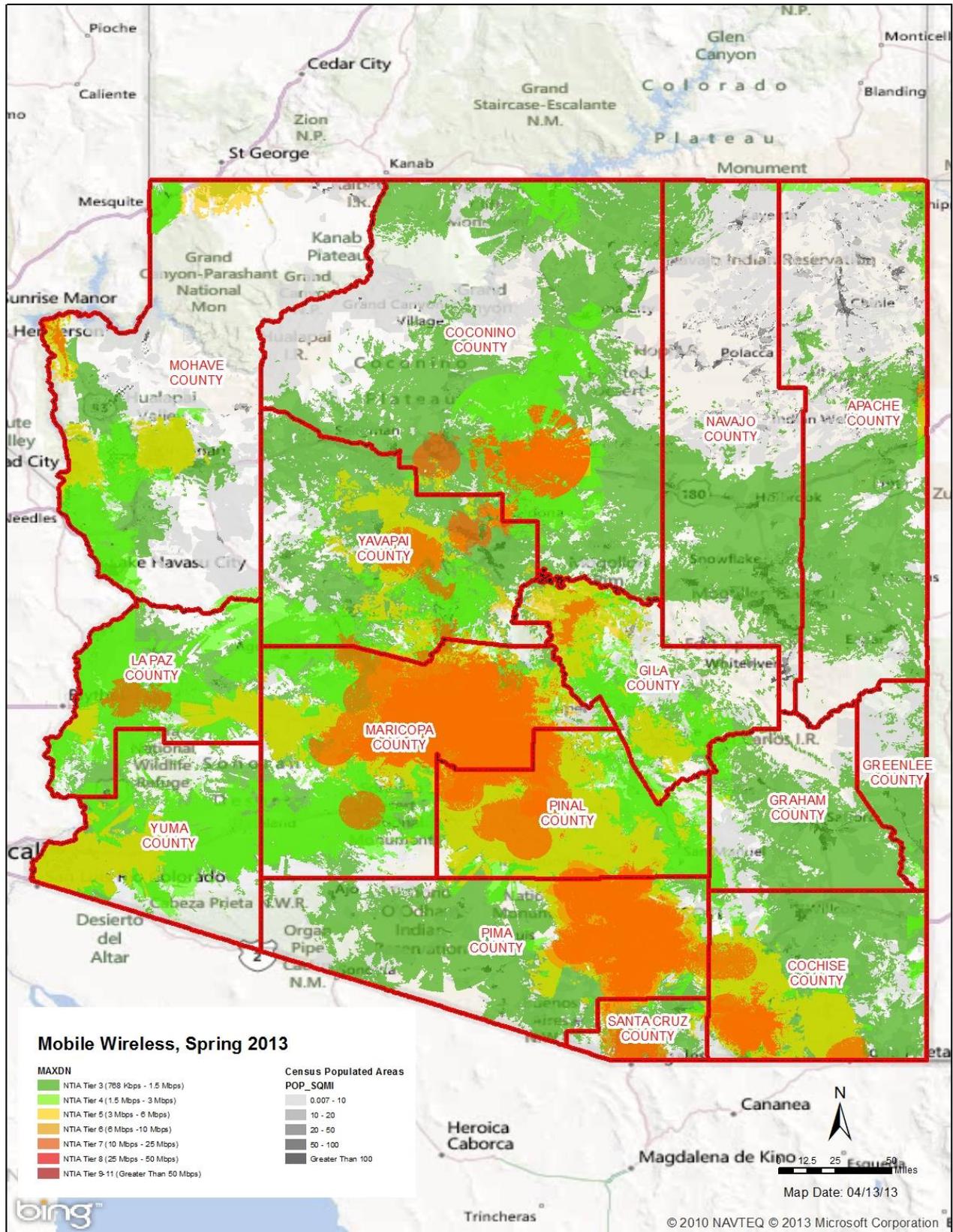
Source: NEF FiberLocator (<http://www.fiberlocator.com/>)

Arizona Communication Towers Map



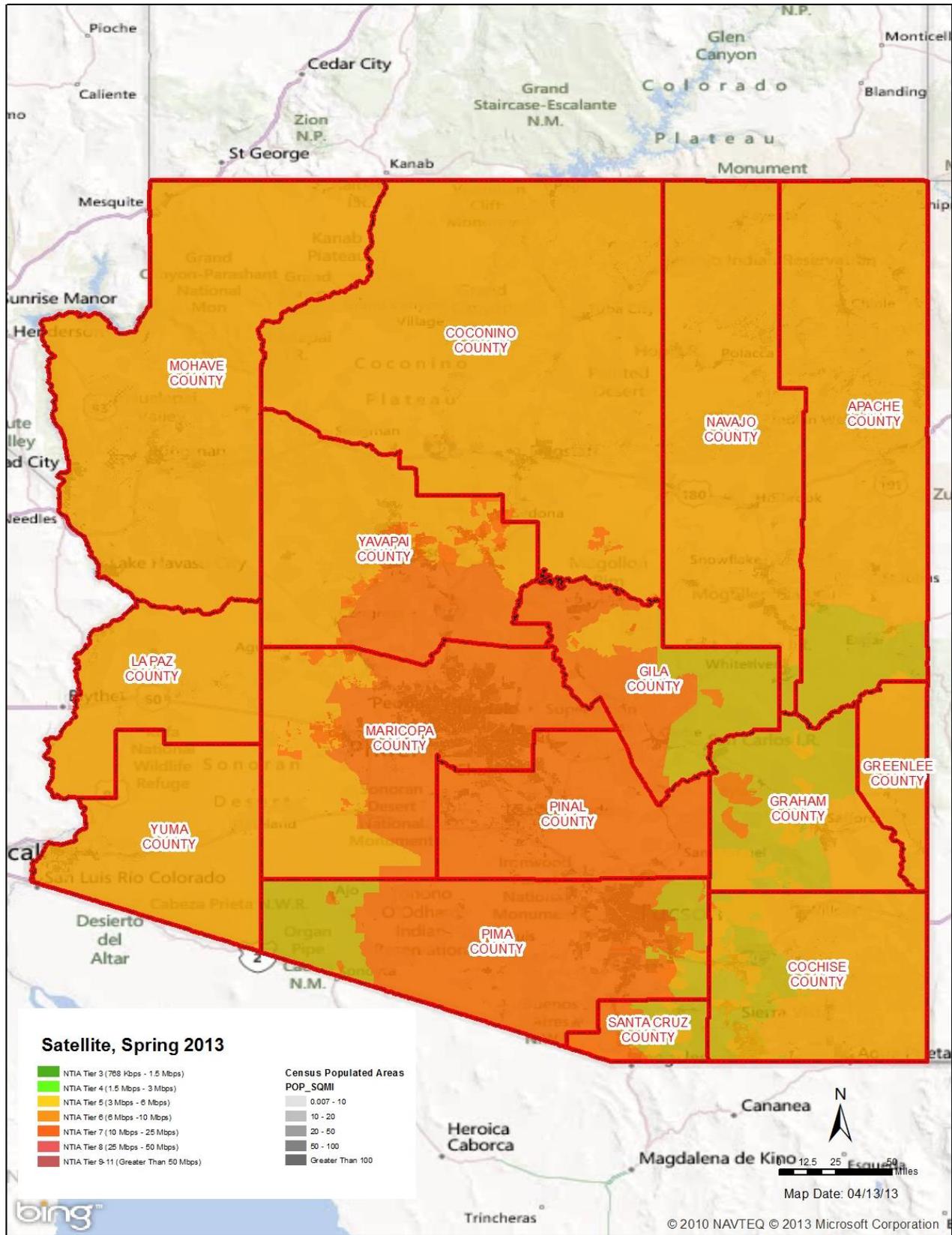
Source: FCC Antenna Structure Registration (ASR) Database (<http://wireless.fcc.gov/antenna/>) & State of Arizona Community Planning Map (<http://broadbandmap.az.gov/CommunityPlanningMap/>)

Arizona Mobile Broadband Coverage as of Spring 2013



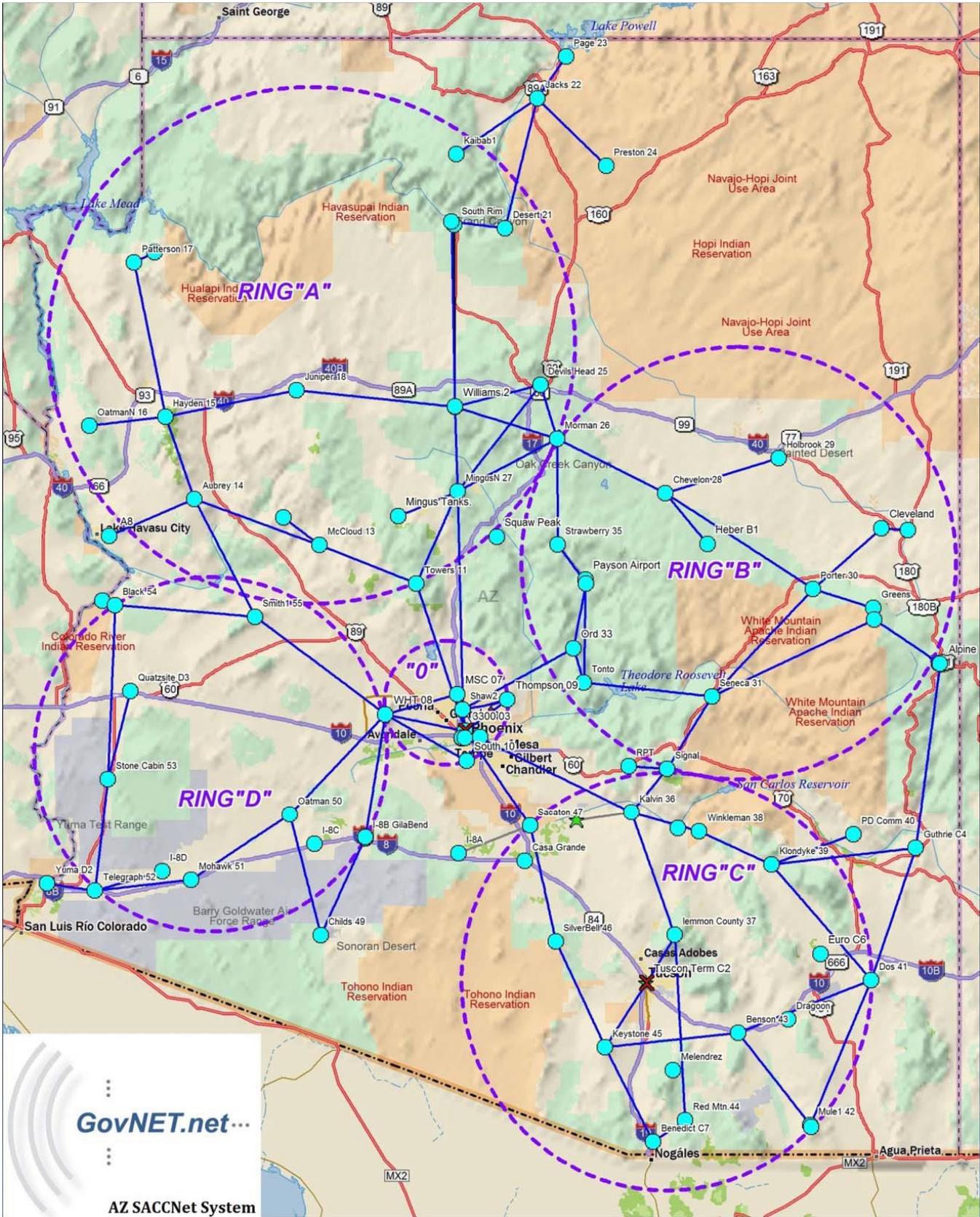
Source: State of Arizona Community Planning Map
<http://broadbandmap.az.gov/CommunityPlanningMap/>

Arizona Satellite Broadband Coverage as of Spring 2013



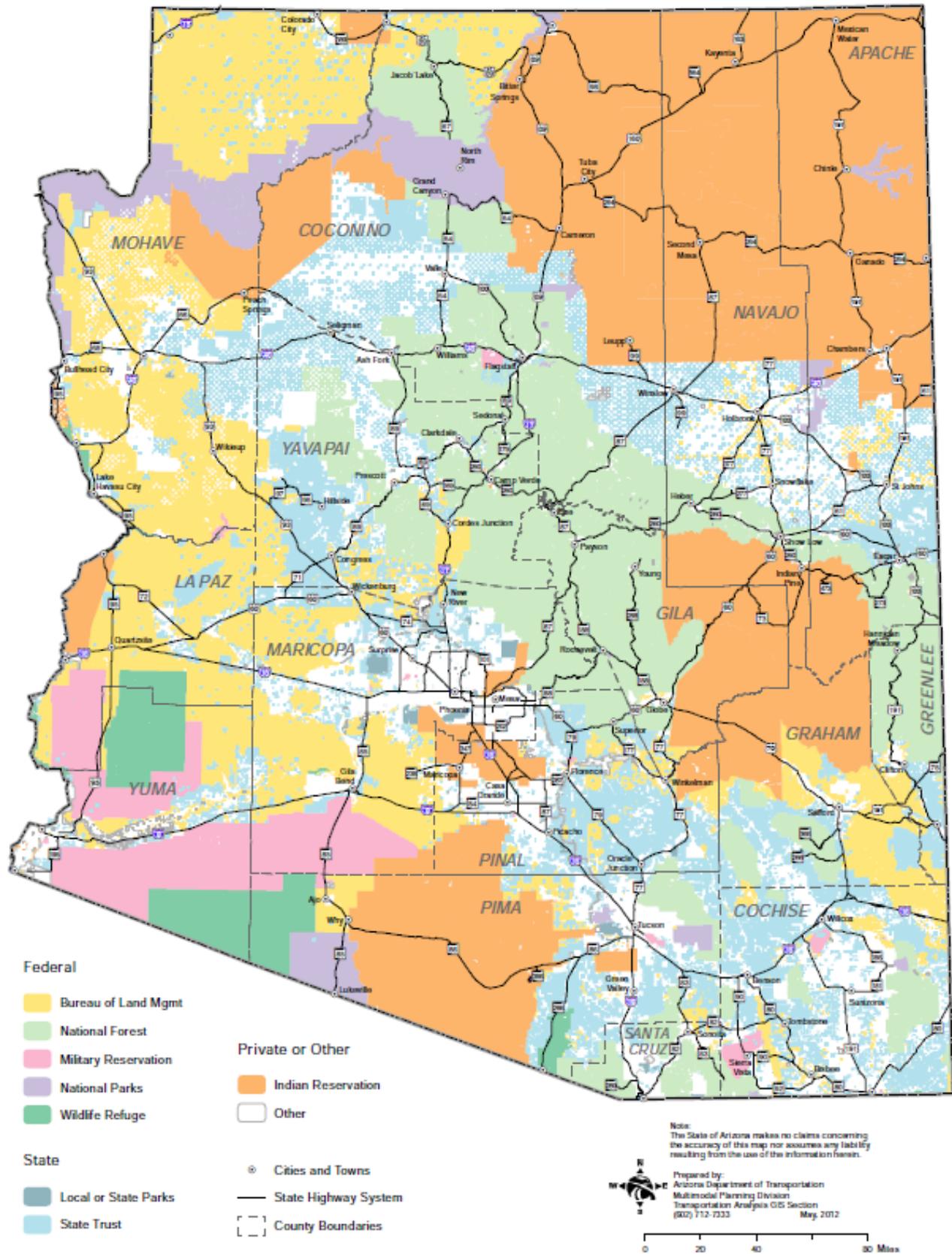
Source: State of Arizona Community Planning Map
<http://broadbandmap.az.gov/CommunityPlanningMap/>

GovNET Inc./SACCNET Planned Ring Network Map



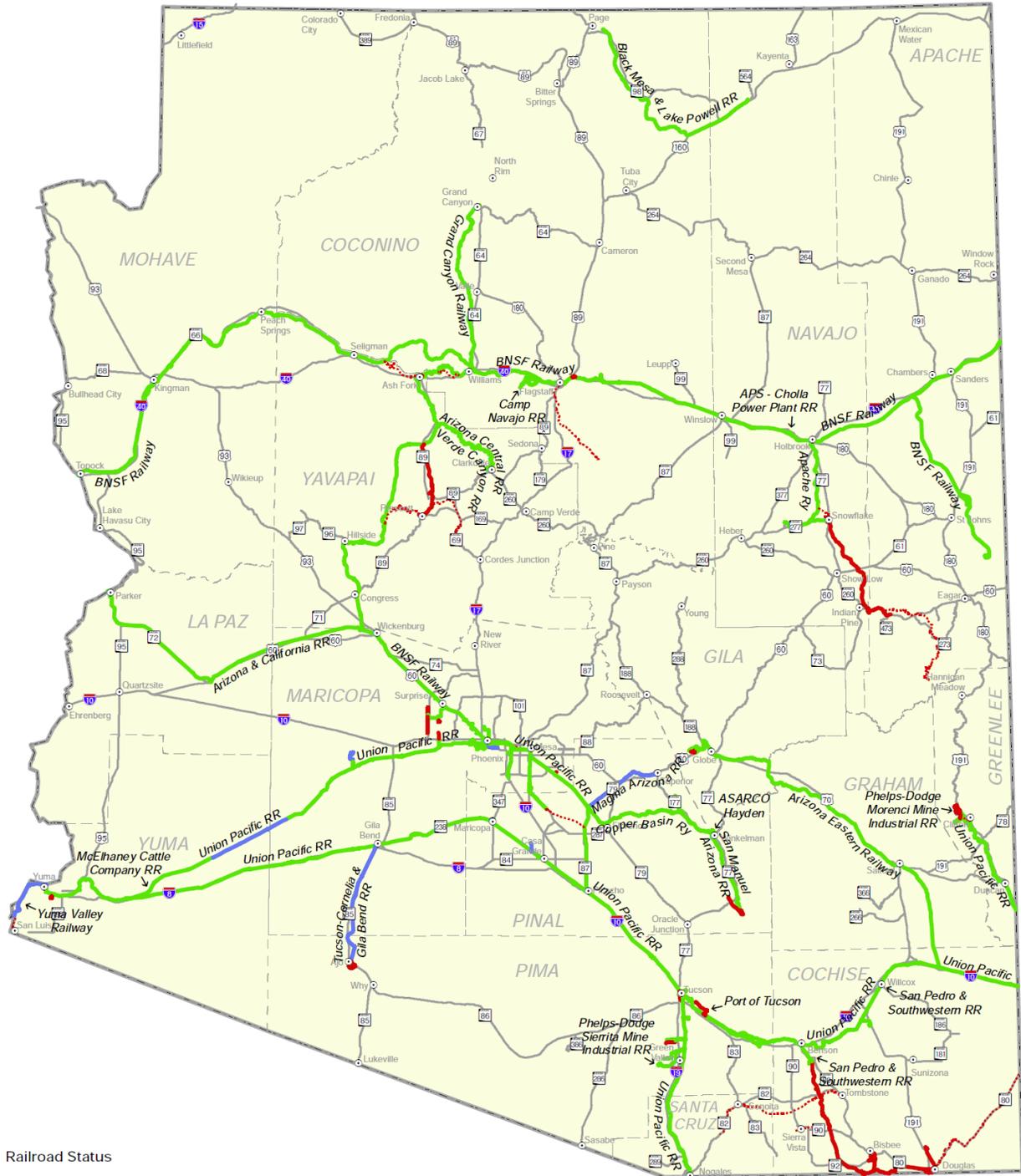
Source: GovNET Inc./SACCNET (<http://www.govnet.net/>)

Land Ownership



Source: ADOT (<http://www.azdot.gov/mpd/gis/maps/index.asp>)

Arizona Railroads (Service Status and Ownership)



- Railroad Status**
- In Service
 - Out of Service
 - Abandoned (1980 - 2007)
 - - - - Abandoned (1950 - 1979)
- Cities and Towns
 - State Highway System
 - - - - County Boundaries

Note:
The State of Arizona makes no claims concerning the accuracy of this map nor assumes any liability resulting from the use of the information herein.

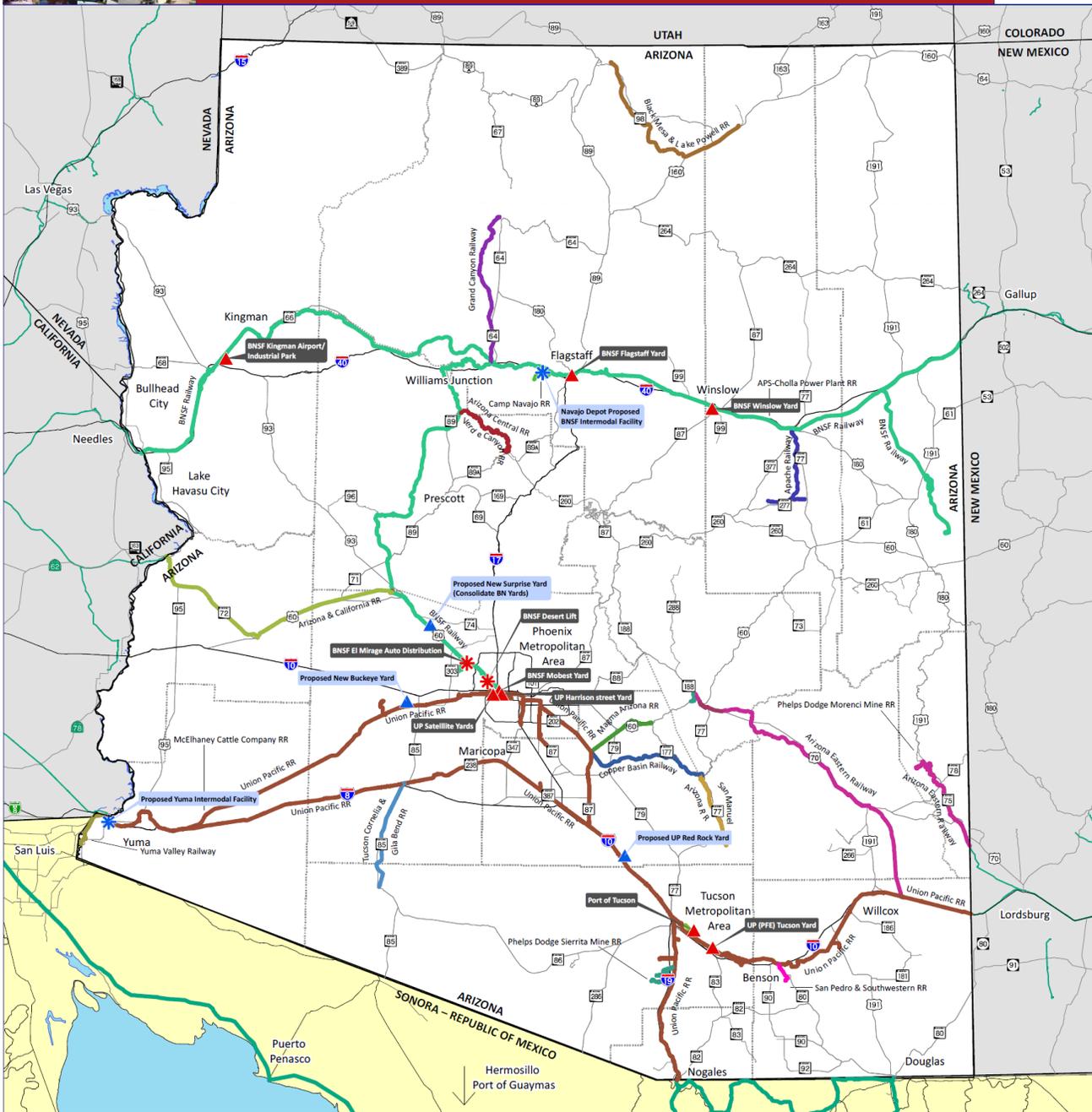


Prepared by:
Arizona Department of Transportation
Multimodal Planning Division
Transportation Analysis GIS Section
(602) 712-7333
May, 2012





Arizona State Rail Plan Existing Arizona Railroads



Legend

<p>U.S. Railroads</p> <ul style="list-style-type: none"> Apache Railway Arizona & California Railroad Arizona Central Railroad Arizona Eastern Railroad BNSF Railroad Black Mesa & Lake Powell Railroad Camp Navajo Railroad Copper Basin Railway Copper Spike Railroad 	<ul style="list-style-type: none"> Grand Canyon Railway Magma Arizona Railroad Phelps Dodge Railroad San Manuel Arizona Railroad San Pedro & Southwestern Railroad Tucson-Cornelia & Gila Bend Railroad UPRR Railroad Port of Tucson Yuma Valley Railroad 	<p>Mexican Railroad</p> <ul style="list-style-type: none"> Ferromex <p>Existing Railroad Facilities</p> <ul style="list-style-type: none"> ★ Intermodal Facility ▲ Classification Yard <p>Proposed Railroad Facilities</p> <ul style="list-style-type: none"> ★ Intermodal Facility ▲ Classification Yard 	<p>Major Roads</p> <ul style="list-style-type: none"> — Interstate/Freeway — State Highway --- County Boundary ☪ Water Body
---	--	---	--

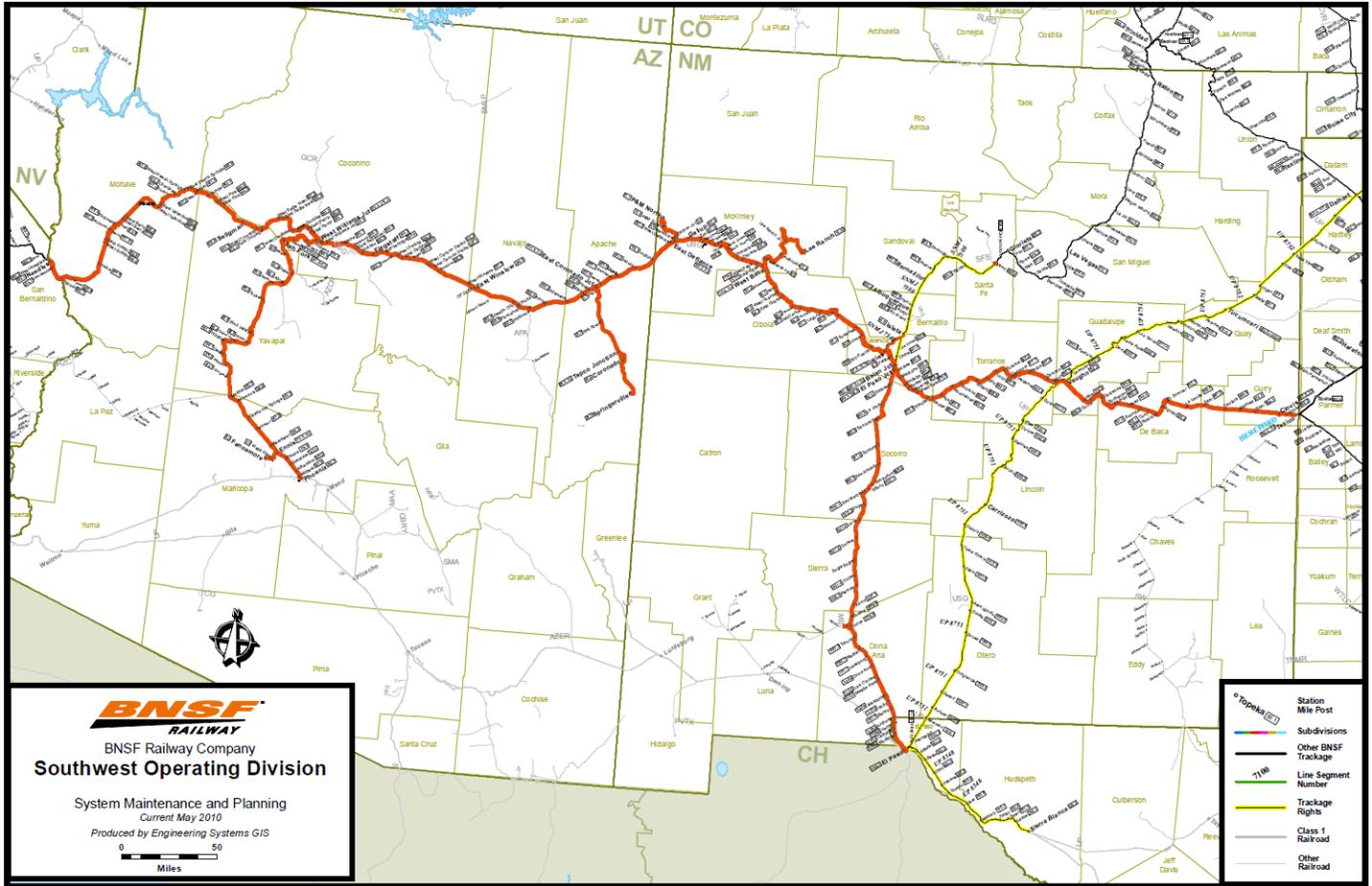
0 10 20 40 Miles

Sources: ASLD 2008, ADOT 2008, INEGI 2008

March 2010

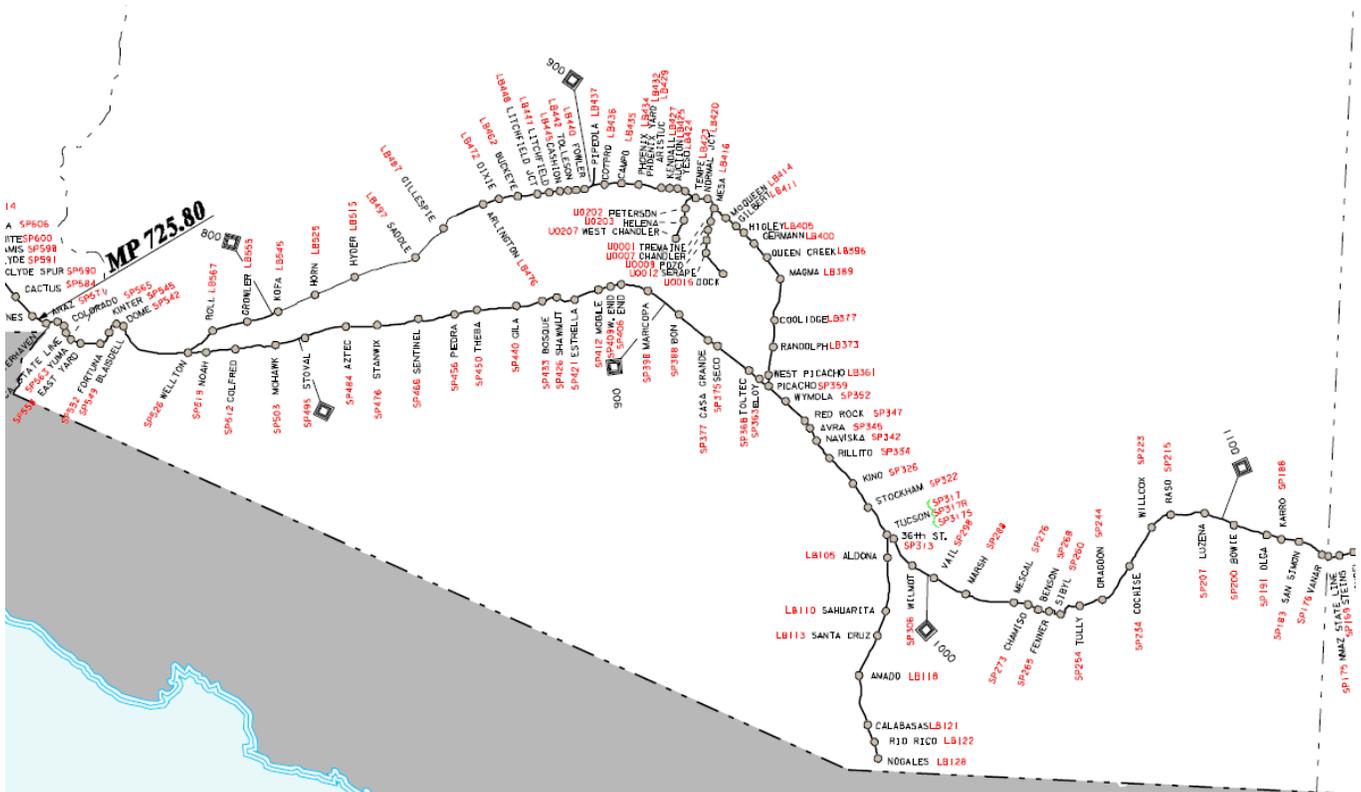
Source: ADOT (<http://www.azdot.gov/mpd/gis/maps/index.asp>)

BNSF Railway Vertical Assets in Arizona Map



Source: BNSF Railway (<http://www.bnsf.com/>)

Union Pacific Railroad Company Vertical Assets in Arizona Map

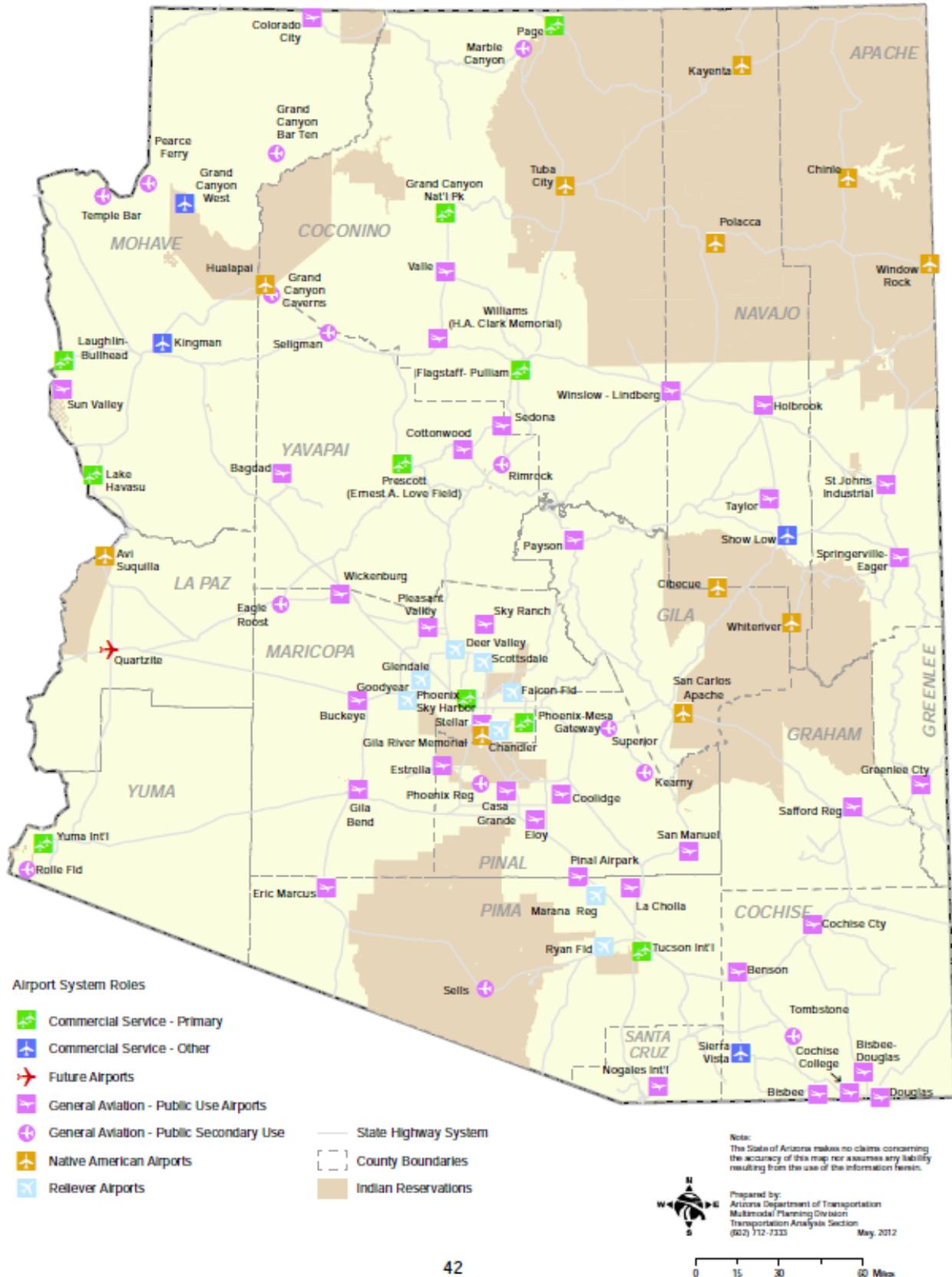


Union Pacific Railroad Company Vertical Assets in Arizona Table

City	State	Lat	Long	Structure Height	Ground AMSL	Total AMSL	Facility Type (SSS = Steel Self Support, SG = Steel Guyed, WP = Wood Pole, WS = Wood Structure)
Bowie (MIC)	AZ	321943	1092910	50	3760	3760	SSS
Casa Grande (MIC)	AZ	325233	1114519	80	1390	1465	SSS
Gila Bend (MIC)	AZ	325646	1124250	80	735	815	SSS
Heliograph Peak (MIC)	AZ	323857	1095055	150	10002	10152	SSS
Midway Wells (MIC)	AZ	324236	1140733	400	115	515	SG
Mount Lemmon (MIC)	AZ	322623	1104704	125	9050	9175	SSS
Oatman Mtn. (MIC)	AZ	330306	1130803	100	1690	1790	SG
Phoenix (MIC)	AZ	332640	1120404	100	1080	1180	SSS
Pinal Peak (MIC)	AZ	331649	1104910	100	7720	7820	SG
Telegraph Pass (MIC)	AZ	324013	1142005	80	1590	1670	SSS
Tucson (MIC)	AZ	321324	1105759	45	2384	2429	Bldg
Tucson Yard Office	AZ	325235	1104520	100	425	525	SSS
Welton (MIC)	AZ	324011	1140815	40	255	295	WP
White Tank Mtn. (MIC)	AZ	333431	1123441	80	4040	4120	SSS
Willcox (MIC)	AZ	321505	1094951	50	4167	4217	SSS
Yuma (MIC)	AZ	324322	1143654	60	130	190	SSS
Yuma East Yard (MIC)	AZ	324056	1143415	70	35	105	SSS

Source: Union Pacific Corporation (NYSE:UNP (<http://www.up.com/>))

Arizona Airports

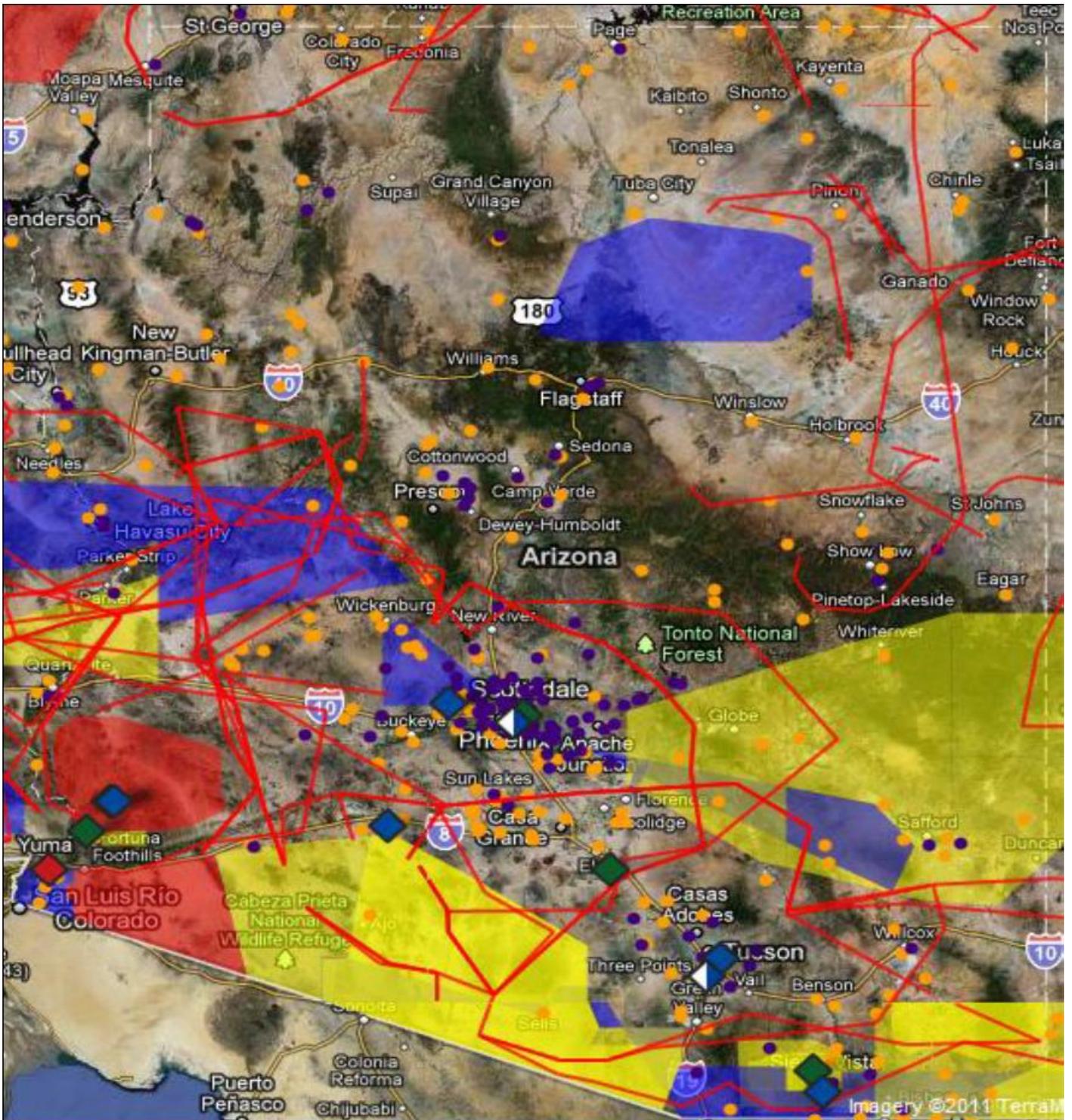


Arizona Test Range Complex (AzTRC)



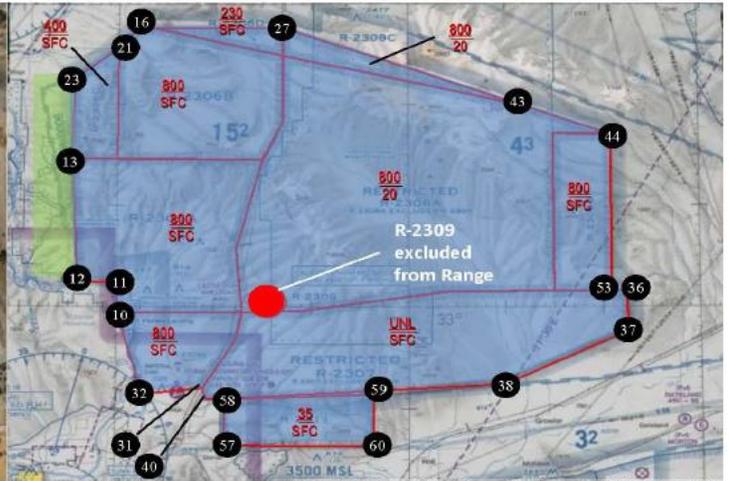
Source: Arizona Commerce Authority (ACA - <http://www.azcommerce.com/>)

Arizona Unmanned Aerial Systems (UAS) Special Use Airspace



Source: Aerospace & Defense Arizona (<http://www.azaerospace.com/>)

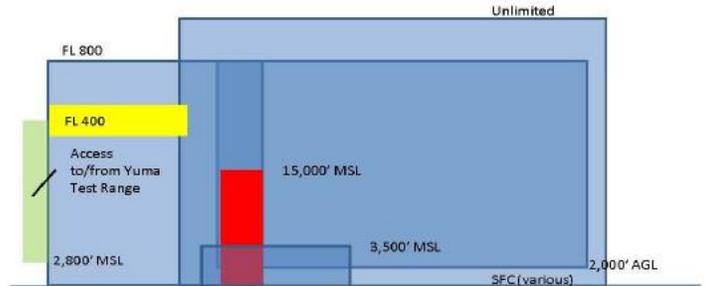
AzTRC Southwest Range - YPG Test Range



Phoenix Sectional 88th edition, effective Oct 2012 thru May 2013

Test Range Airspace			Test Range Airspace		
10	33.0000	-114.5008	37	32.9828	-113.6231
11	33.0339	-114.5008	38	32.8811	-113.8369
12	33.0339	-114.5675	40	32.8642	-114.3508
13	33.2542	-114.5778	43	33.3389	-113.7958
16	33.4744	-114.4411	44	33.2881	-113.6519
21	33.4406	-114.5008	53	33.0339	-113.6519
23	33.3897	-114.5778	57	32.7794	-114.3211
27	33.4744	-114.2175	58	32.8642	-114.318
31	32.8811	-114.3508	59	32.8642	-114.061
32	32.8642	-114.4647	60	32.7794	-114.064
36	33.0339	-113.6231			

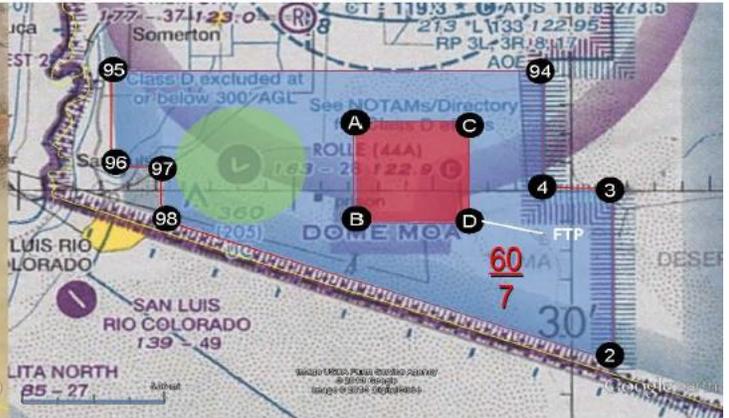
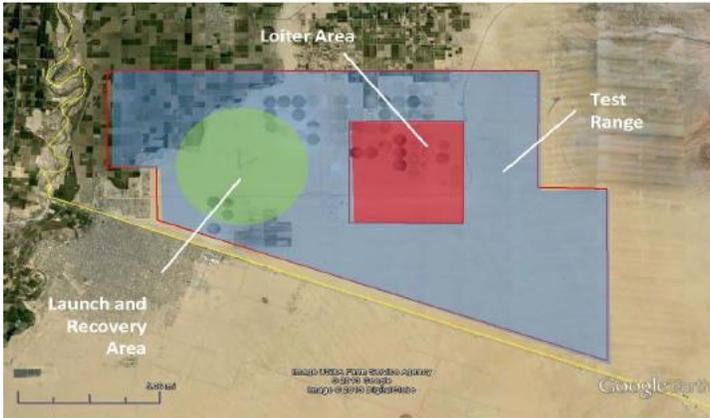
- Notes:
- 1) The YPG Test Range is accessed through the Yuma Test Range.
 - 2) The YPG UAS Test Range is overlaid on top of R-2306, 2307, 2308, and 2311 restricted airspace.
 - 3) All coordinates are approximate; please refer to official active sectional charts for exact internal and external boundaries.
 - 4) Lost link areas will be designated in coordination with YPG range authority prior to each operation.



Airspace projection seen from the south

Param.	Typical Range	Param.	Typical Range
Weight	0 – 20,000 lbs	Type	Fixed wing, rotorcraft
Speed	0 – 250 knots	Hours	24x7, SR/SS, 600/2200

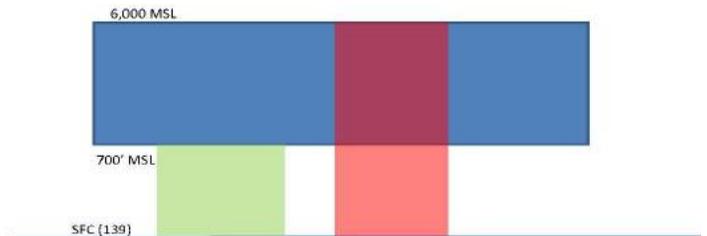
AzTRC Southwest Range - Rolle Test Range



Phoenix Sectional 88th edition, effective Oct 2012 thru May 2013

Test Range Airspace			Loiter Area 1		Launch & Recovery
2	32.3897	-114.4758	A	32.5382	-114.6311
3	32.4929	-114.4758	B	32.4802	-114.6311
4	32.4929	-114.5175	C	32.4802	-114.5625
94	32.5672	-114.5175	D	32.5382	-114.5625
95	32.5672	-114.7781			
96	32.5083	-114.7781			
97	32.5083	-114.7478			
98	32.4744	-114.7478			

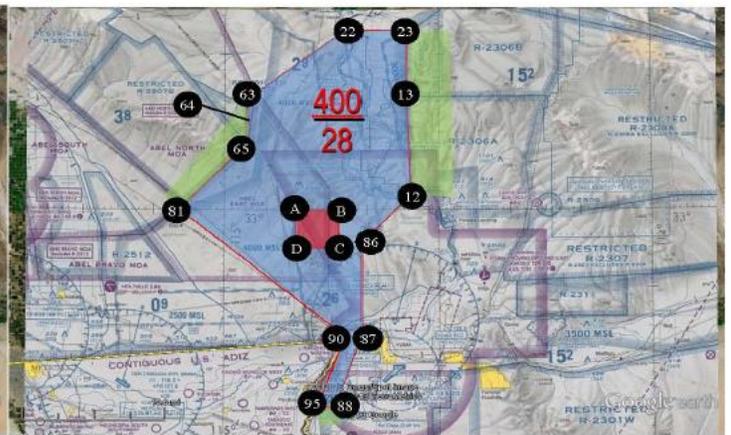
2 NM radius centered on Rolle Airfield (44A)



Airspace projection seen from the south

Param.	Typical Range	Param.	Typical Range
Weight	0 – 20,000 lbs	Type	Fixed wing, rotorcraft
Speed	0 – 250 knots	Hours	24x7

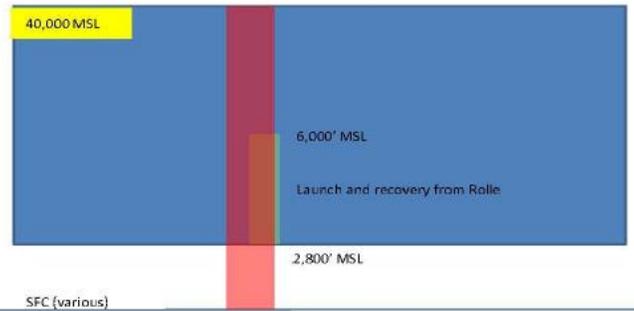
AzTRC Southwest Test Range – Yuma Test Range



Phoenix Sectional 88th edition, effective Oct 2012 thru May 2013

Test Range Airspace		Test Range Airspace	
23	33.3780 -114.5778	64	33.1742 -114.9399
13	33.2435 -114.5796	63	33.2384 -114.9479
12	33.0339 -114.5675	22	33.3780 -114.7102
86	32.9319 -114.6800	Lost Link Area	
87	32.7286 -114.6800	A	33.0000 -114.8333
88	32.5761 -114.7378	B	33.0000 -114.7333
95	32.5761 -114.7781	C	32.9167 -114.7333
90	32.7286 -114.7164	D	32.9167 -114.8333
81	33.0093 -115.1007		
65	33.1394 -114.9428		

The Yuma Test Range is accessed from the Rolle Test Range. It also connects to the Chocolate Mountains and YPG Ranges.



Airspace projection seen from the south

Param.	Typical Range	Param.	Typical Range
Weight	0 – 20,000 lbs	Type	Fixed wing, rotorcraft
Speed	0 – 250 knots	Hours	24x7

Source: Arizona Commerce Authority (ACA - <http://www.azcommerce.com/>)

Ports of Entry and Canamex Corridor



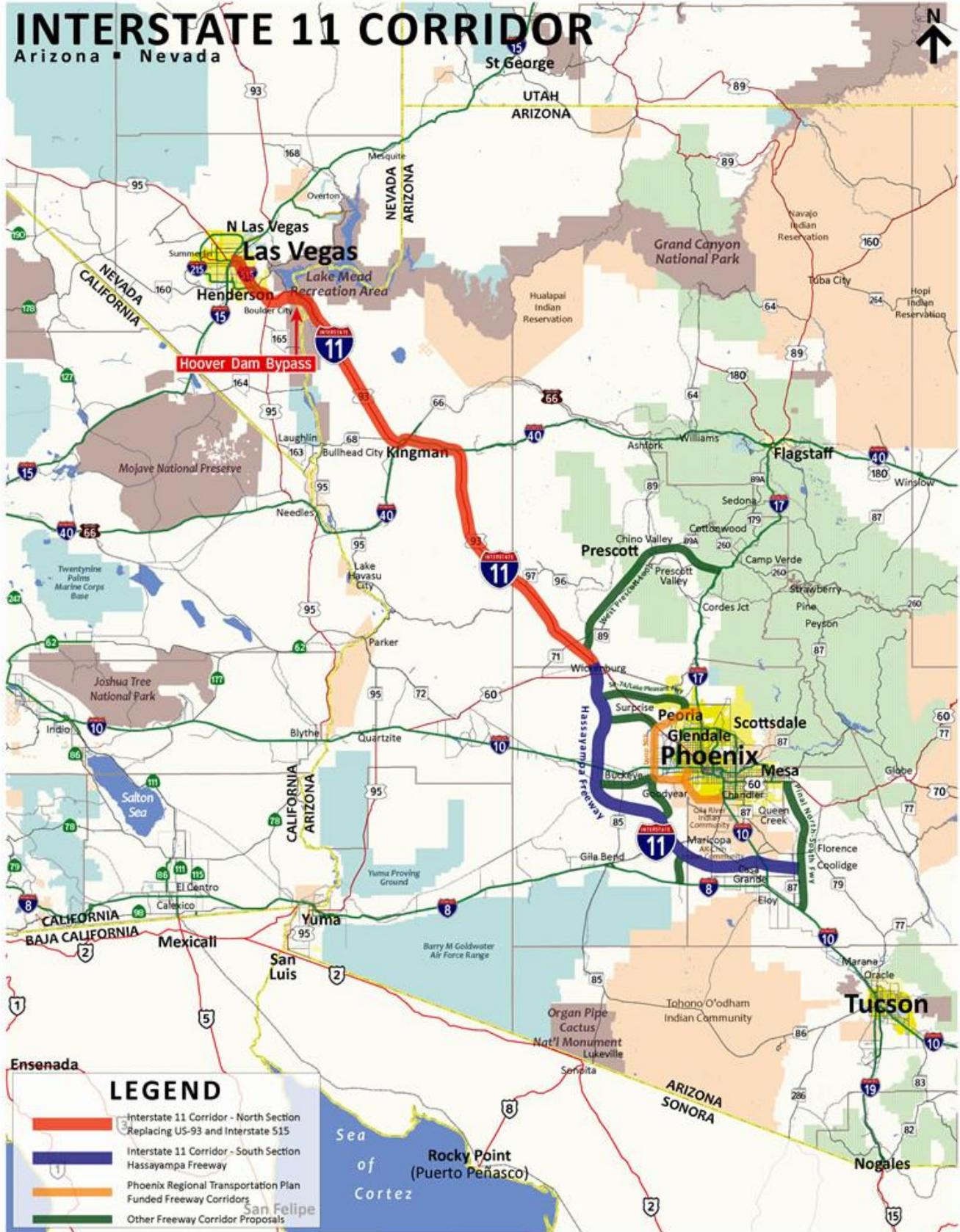
Source: ADOT (<http://www.azdot.gov/mpd/gis/maps/index.asp>)

I-11 & Intermountain West Corridor Possible Pathways From Mexico through Arizona Towards The Pacific Northwest and Canada



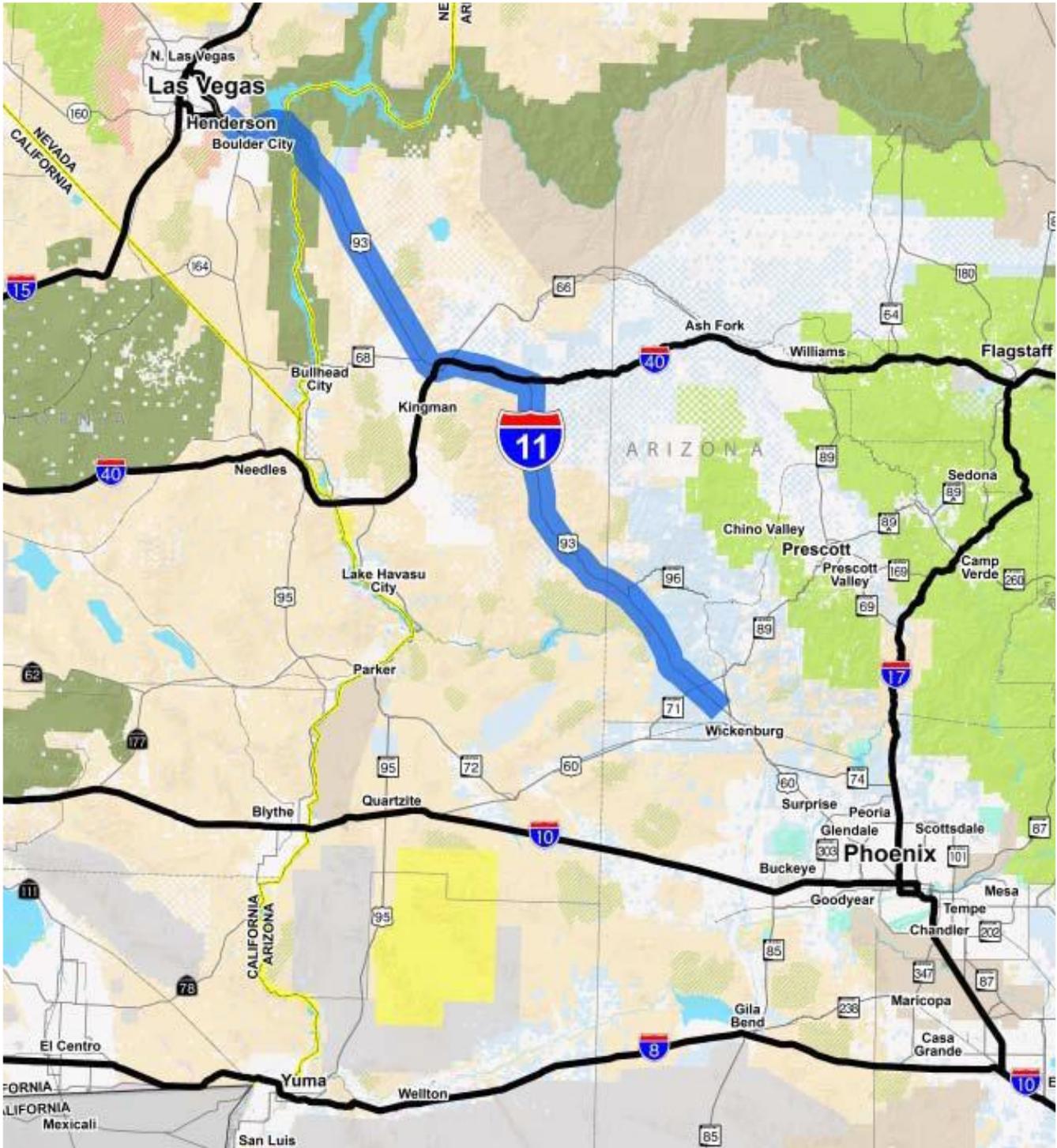
Source: I-11 & Intermountain West Corridor Study (<http://i11study.com/>)

Interstate 11 Corridor Possible Routes



Source: I-11 & Intermountain West Corridor Study (<http://i11study.com/>)

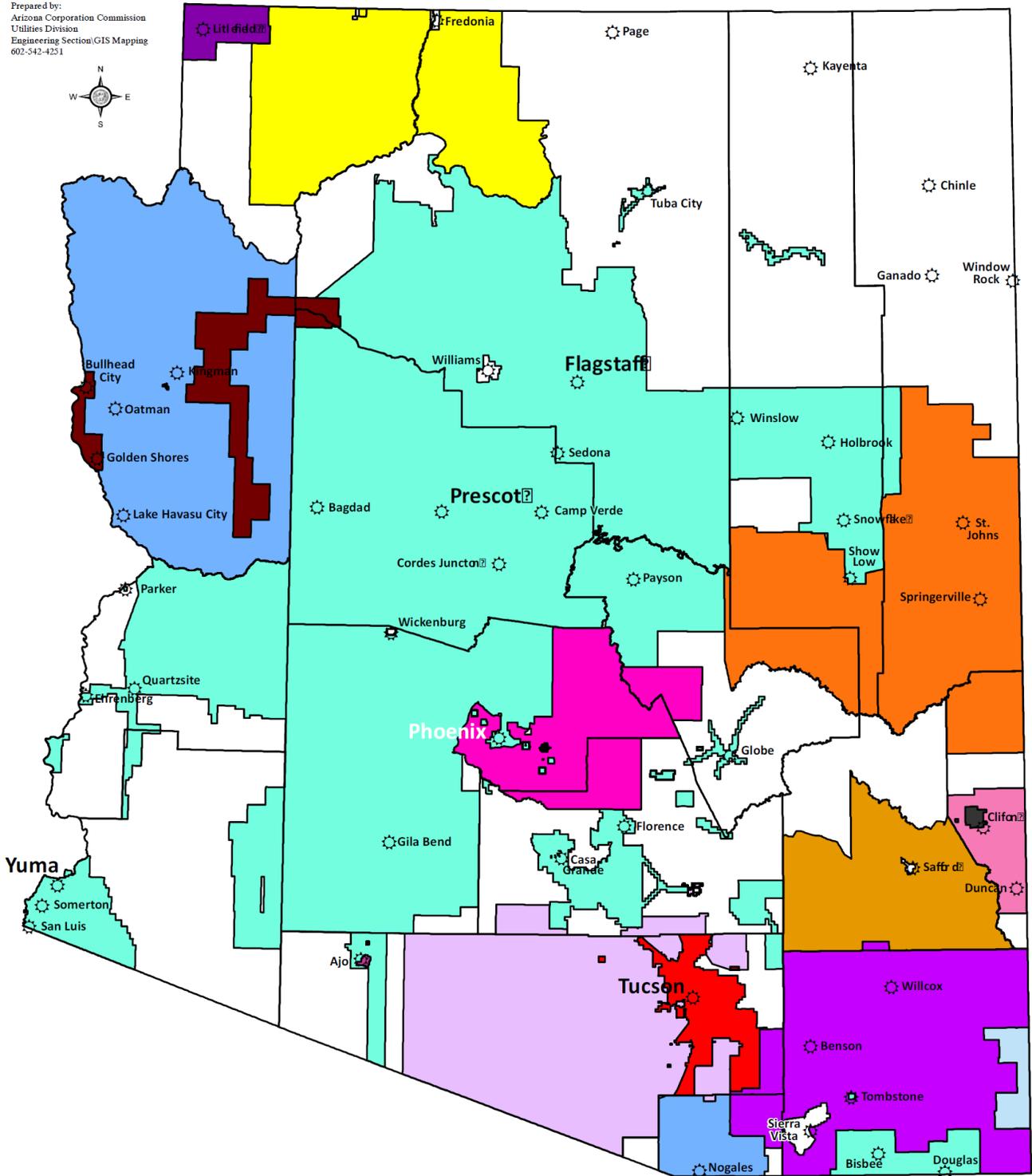
CANAMEX Corridor along US 93 between Phoenix and Las Vegas Designated as Future “I-11” in MAP-21 (2012)



Source: I-11 & Intermountain West Corridor Study (<http://i11study.com/>)

Arizona Electric Utilities Service Areas Map

Prepared by:
Arizona Corporation Commission
Utilities Division
Engineering Section/GIS Mapping
602-542-4251



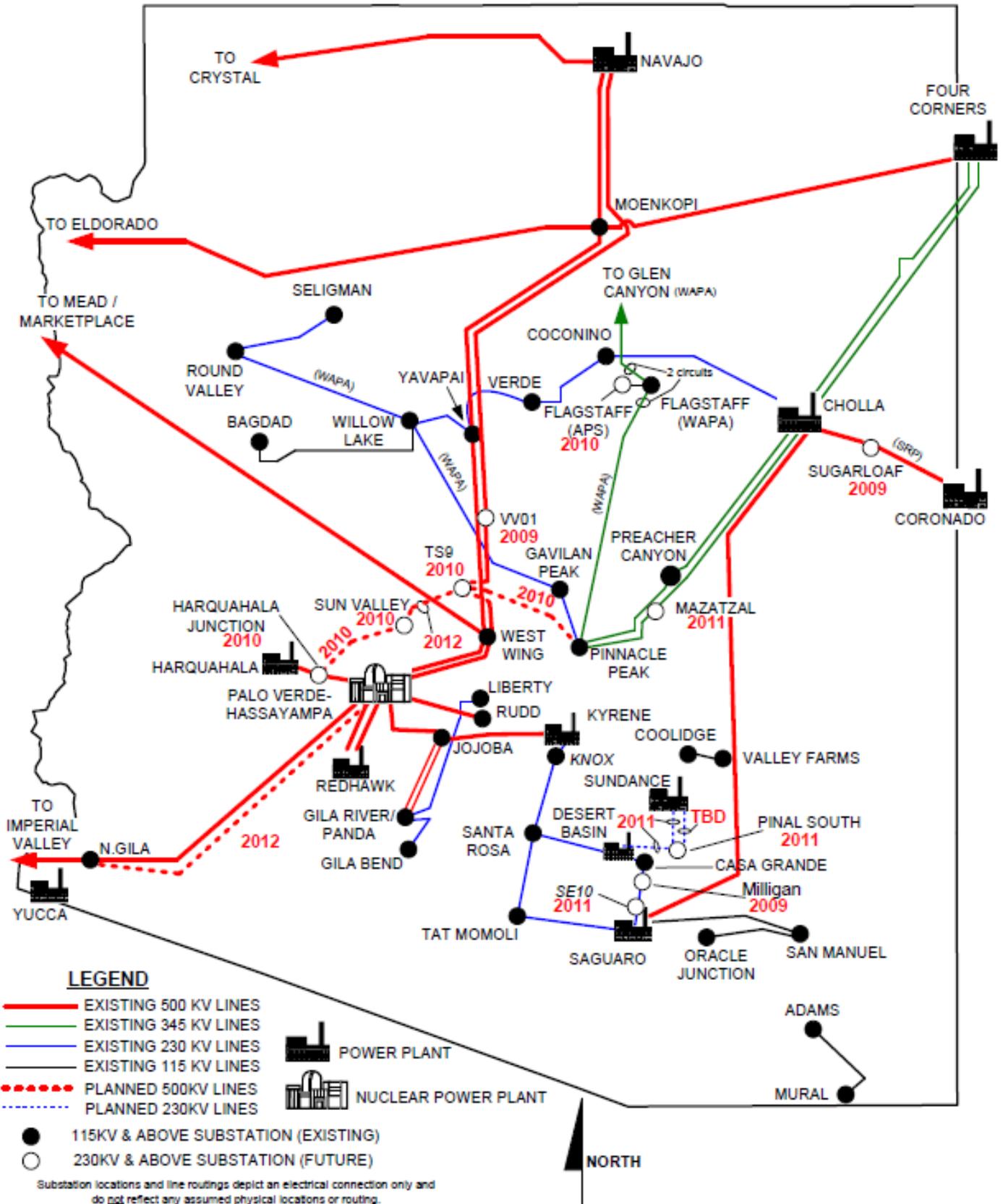
Revised January 1, 2013

STATE OF ARIZONA - ELECTRIC

- | | | |
|--|------------------------------------|---------------------------------------|
| Ajo Improvement Company | Garkane Power Association | Sulphur Springs Valley Electric Co-op |
| Arizona Public Service | Graham County Electric Cooperative | Trico Electric Cooperative |
| City of Mesa | Mohave Electric Cooperative | Tucson Electric Power |
| Columbus Electric Co-op | Morenci Water & Electric Company | UNS Electric, Inc. |
| Dixie Escalante Rural Electric Association | Navopache Electric Co-op | |
| Duncan Valley Electric Cooperative | Salt River Project | |

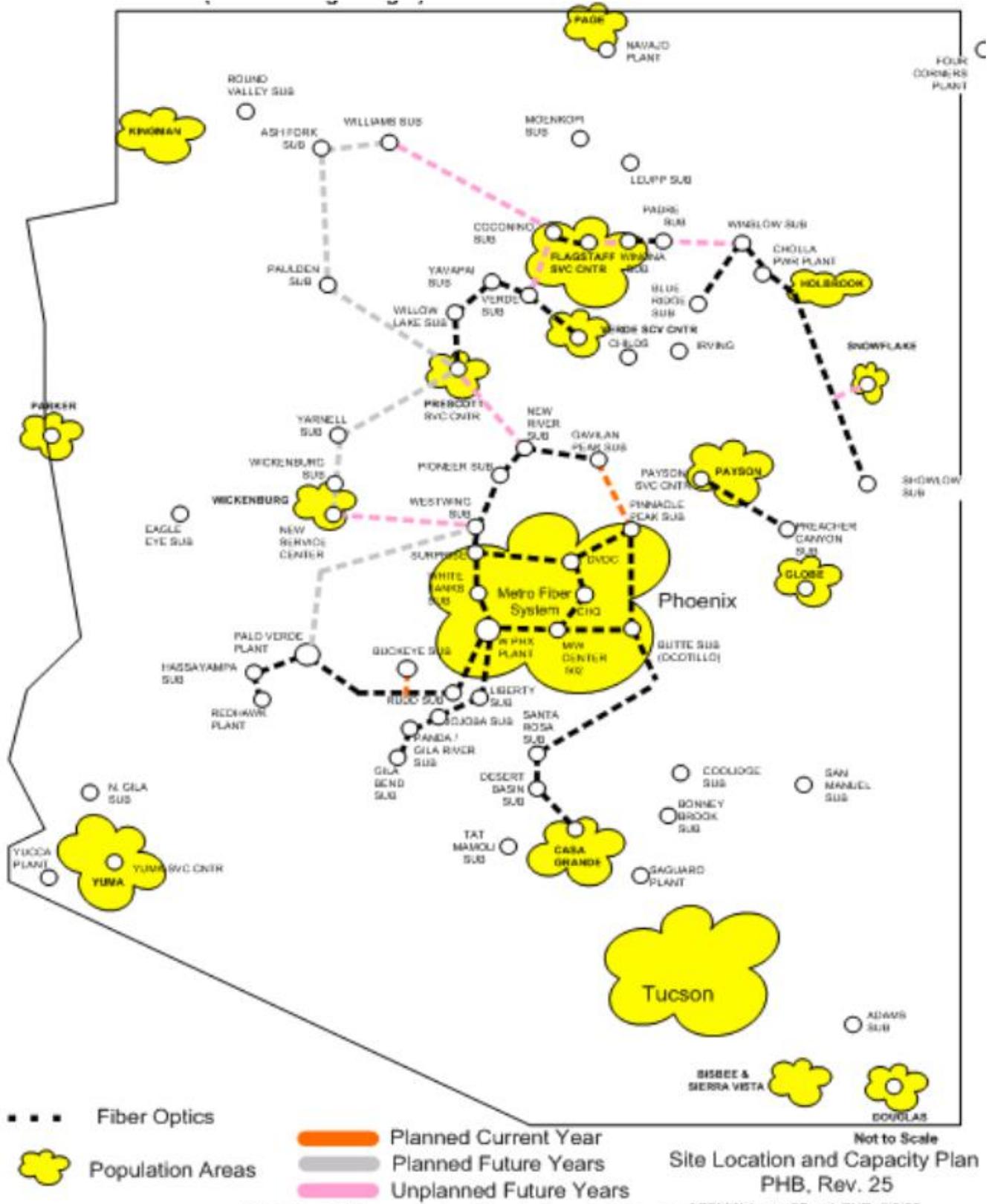
Source: Arizona Corporation Commission (<http://www.azcc.gov/divisions/utilities/electric.asp>)

Arizona Public Service (APS) Statewide Transmission Map 2008-17



Source: Arizona Corporation Commission (<http://www.azcc.gov/divisions/utilities/electric.asp>)

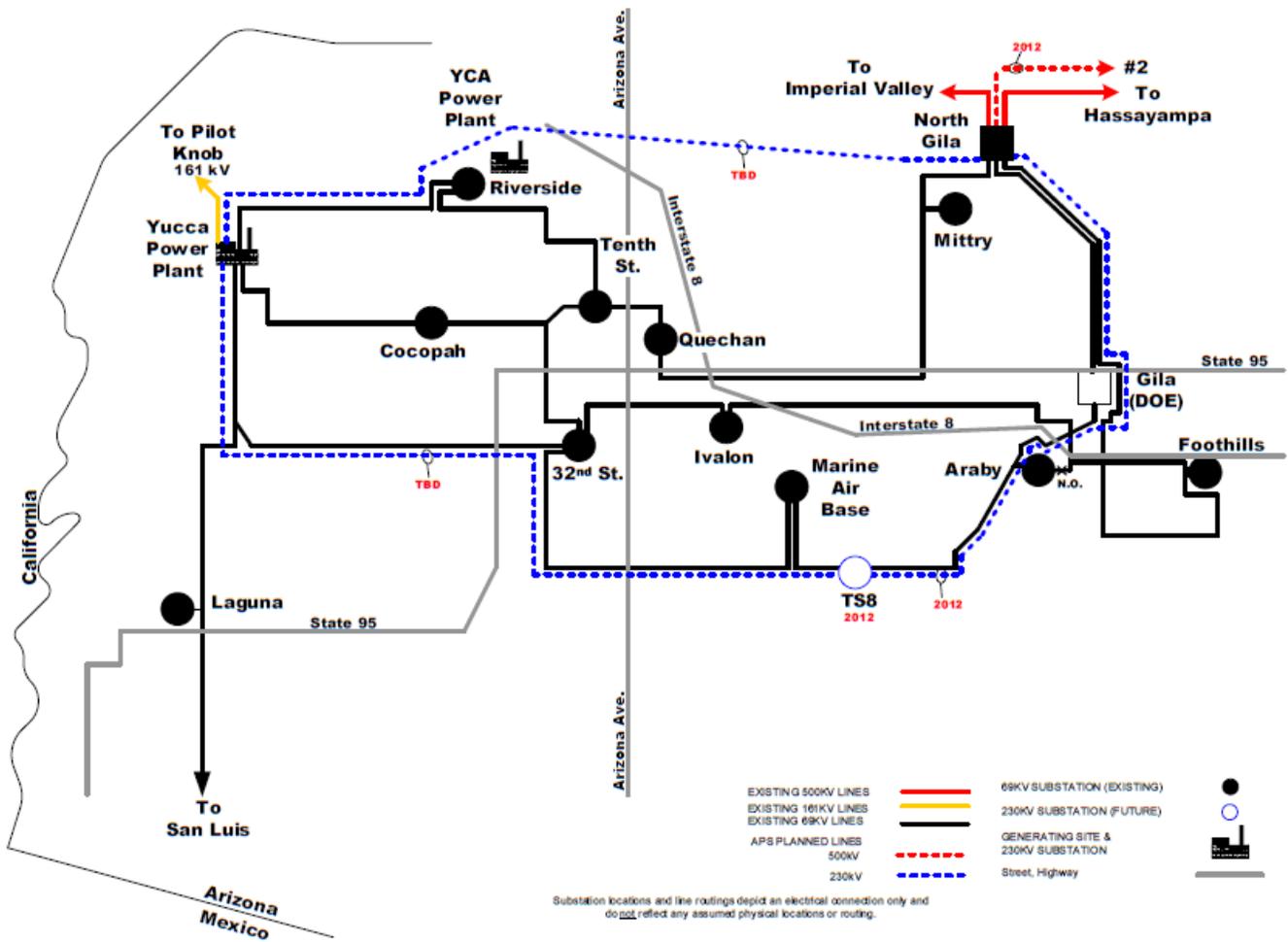
Arizona Public Service (APS) Digital Infrastructure Plan 2005 & On



APS Fiber Facts, Paul H. Bott

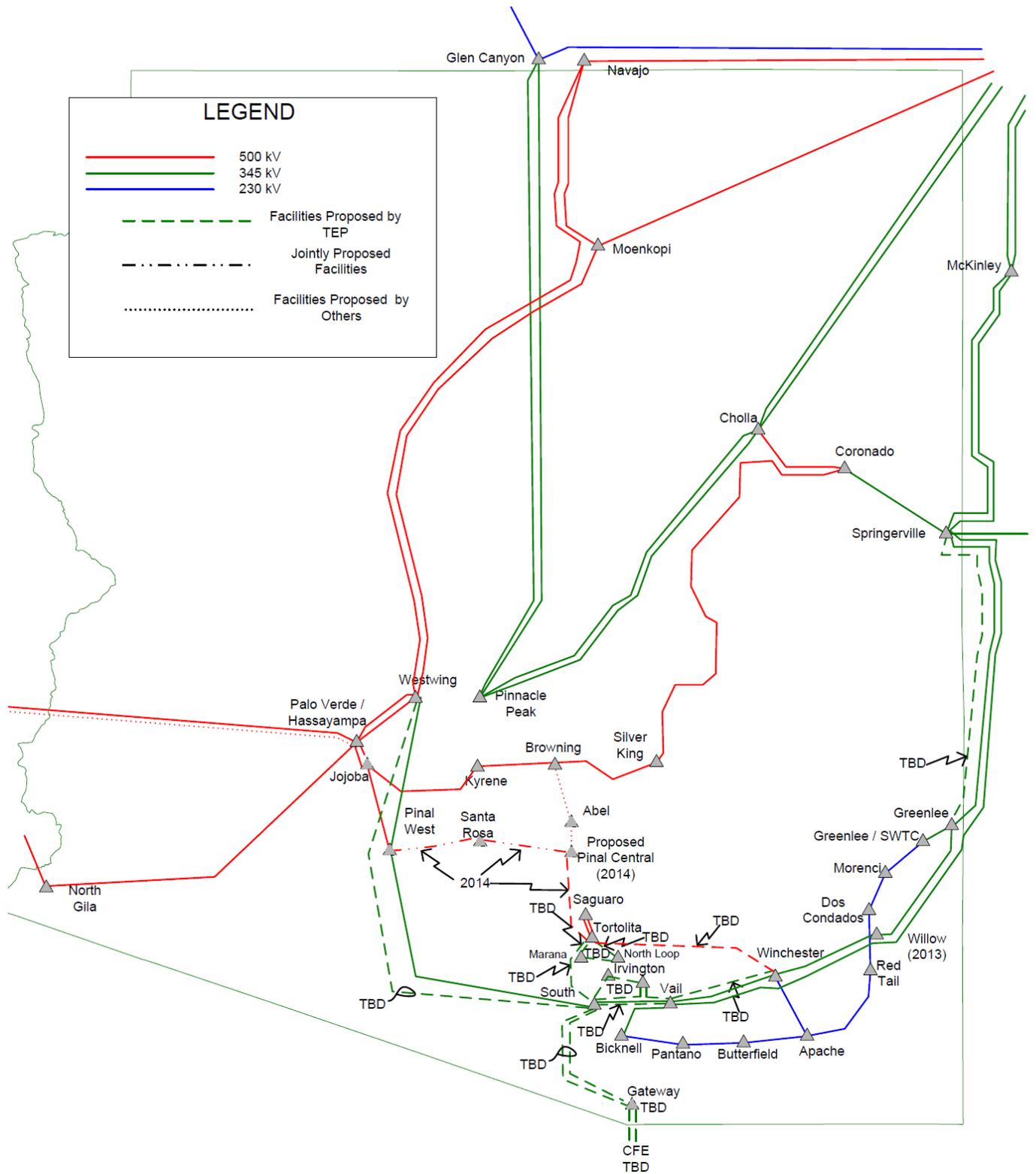
Source: Arizona Public Service (APS - <http://www.aps.com/>)

Arizona Public Service (APS) Yuma Area Transmission Map 2008-17



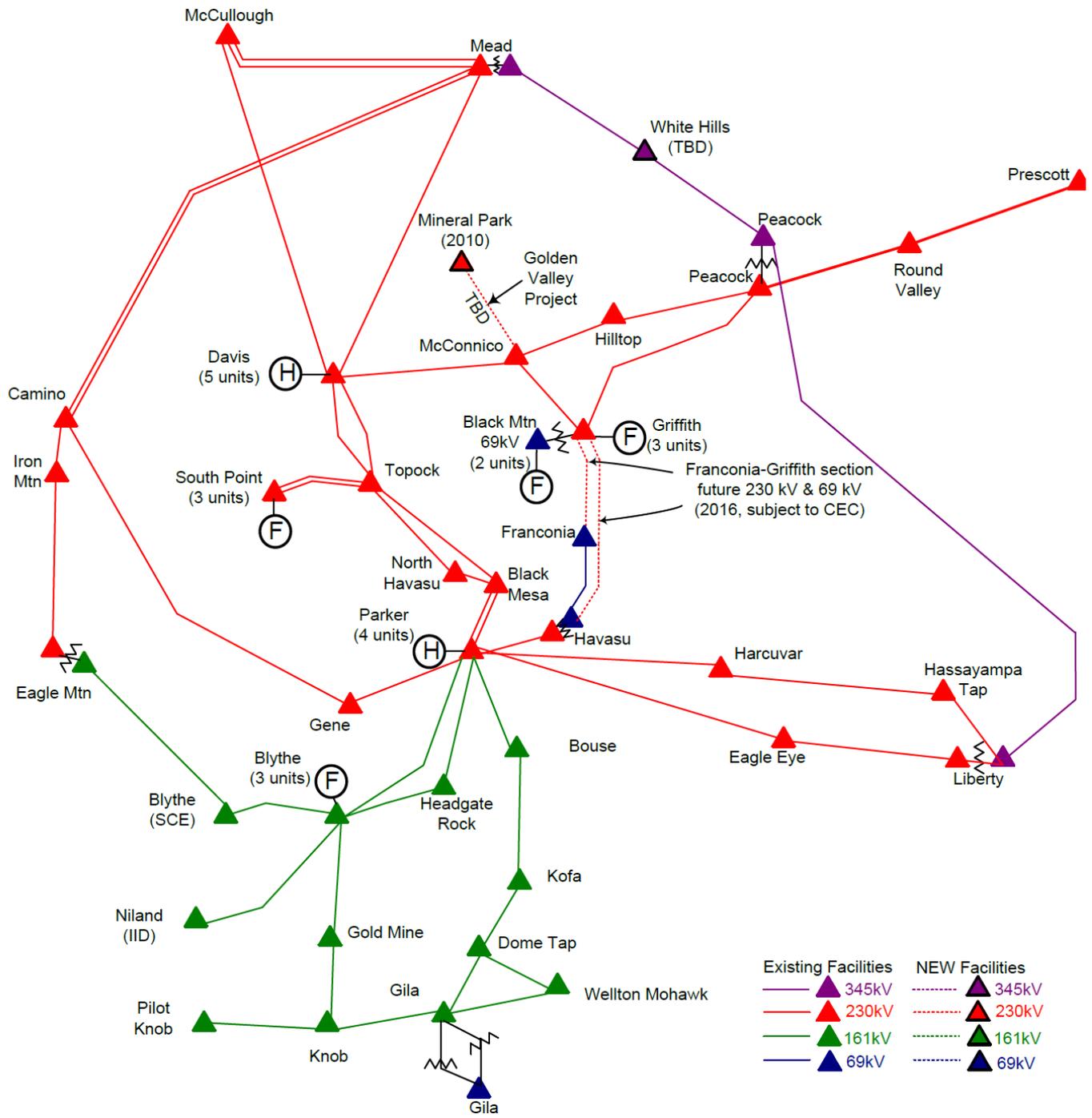
Source: Arizona Corporation Commission (<http://www.azcc.gov/divisions/utilities/electric.asp>)

Tucson Electric Power (TEP) Statewide Transmission Map 2010-19



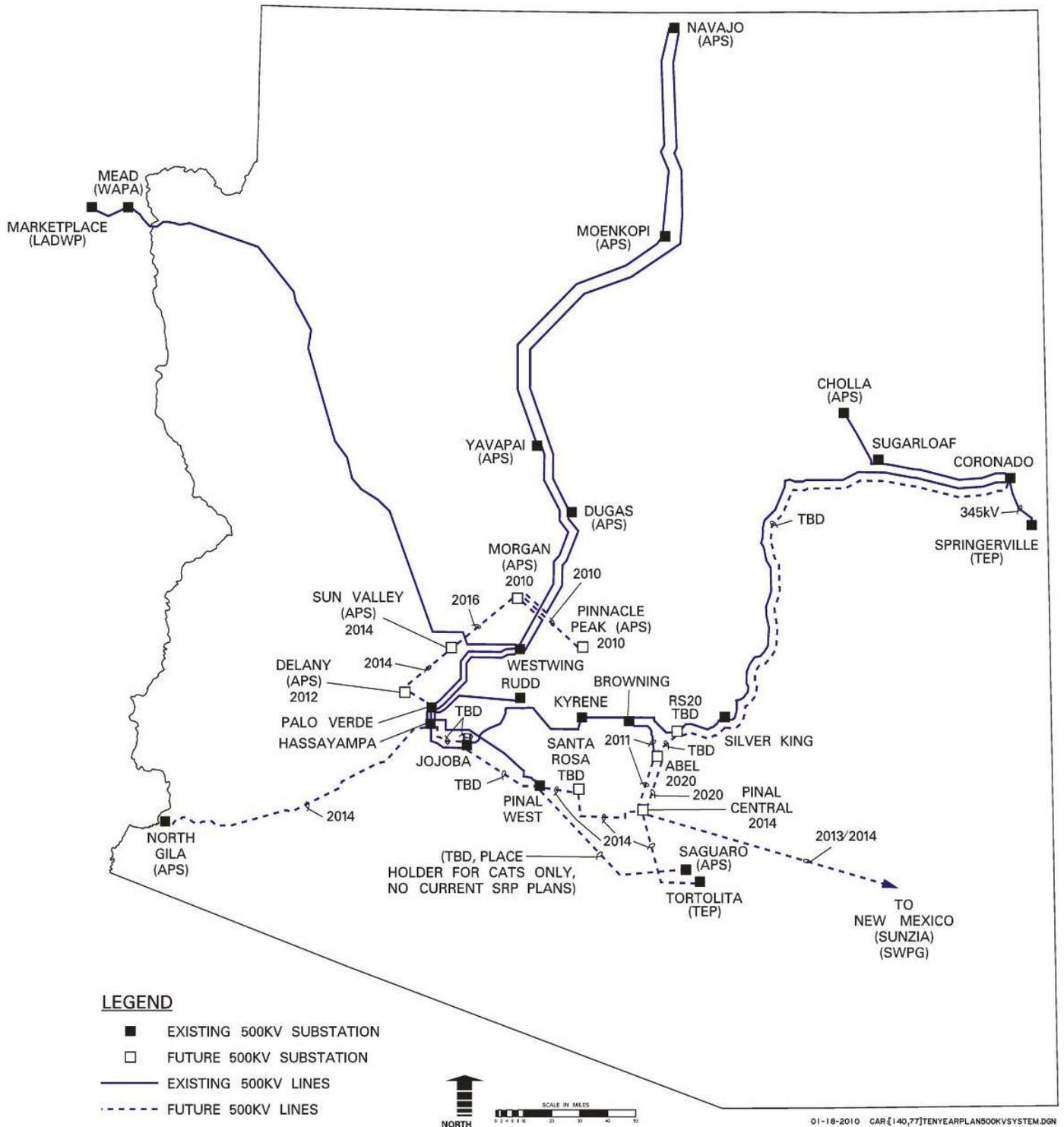
Source: Arizona Corporation Commission (<http://www.azcc.gov/divisions/utilities/electric.asp>)

UNS Electric Mohave County Transmission Map 2010-19



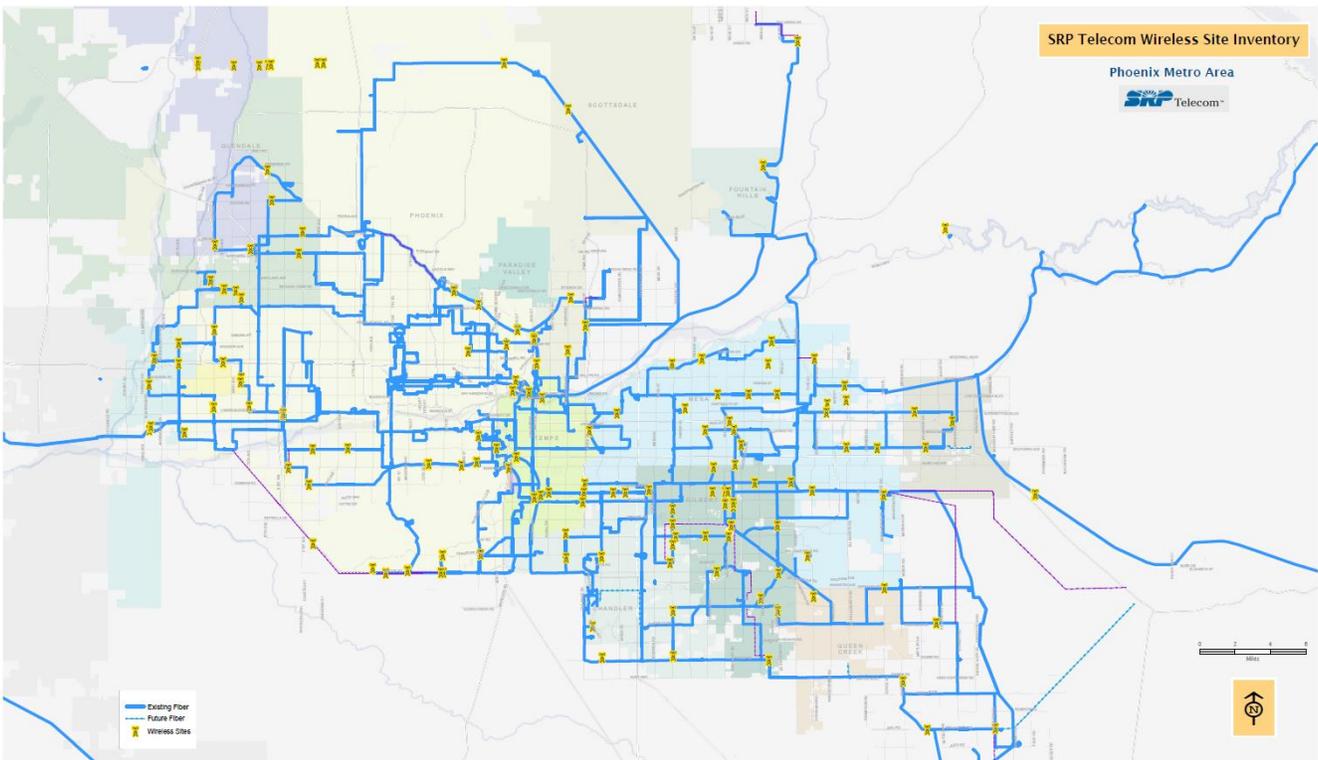
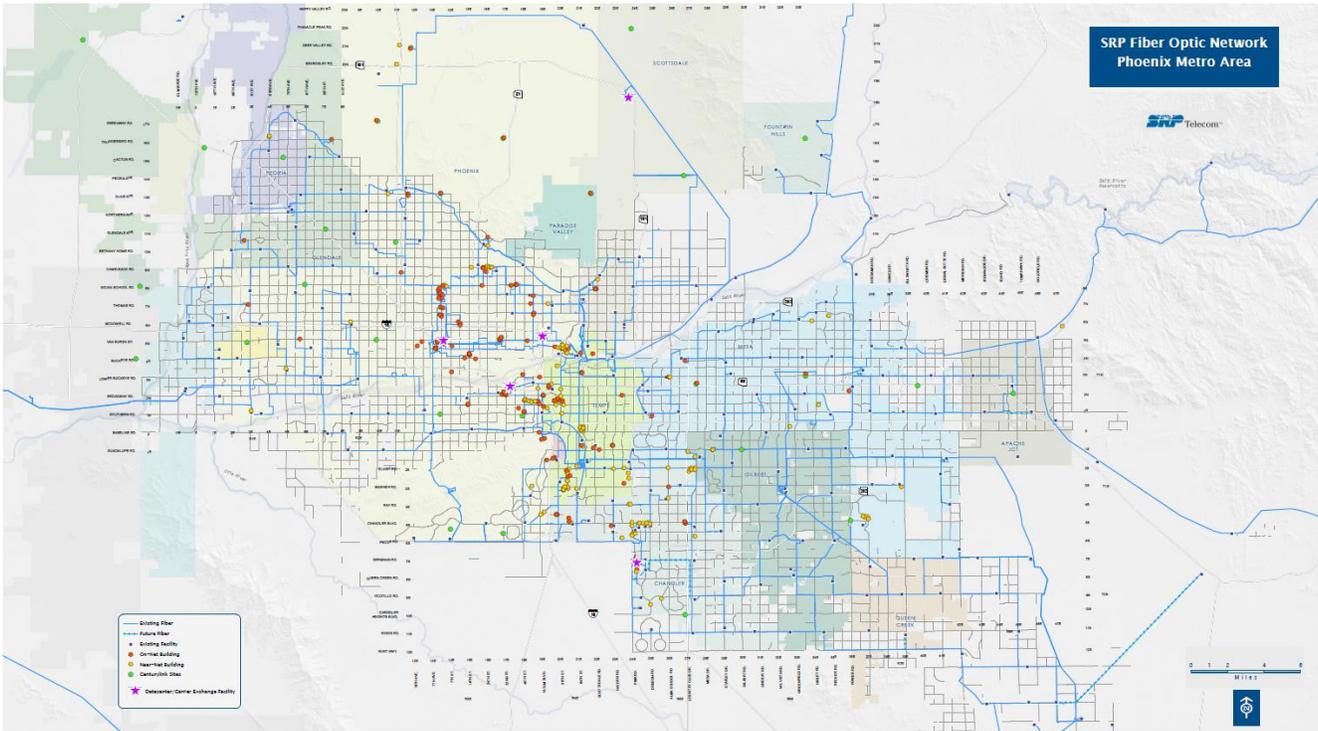
Source: Arizona Corporation Commission (<http://www.azcc.gov/divisions/utilities/electric.asp>)

Salt River Project (SRP) Statewide 500KV Transmission Map 2010-19



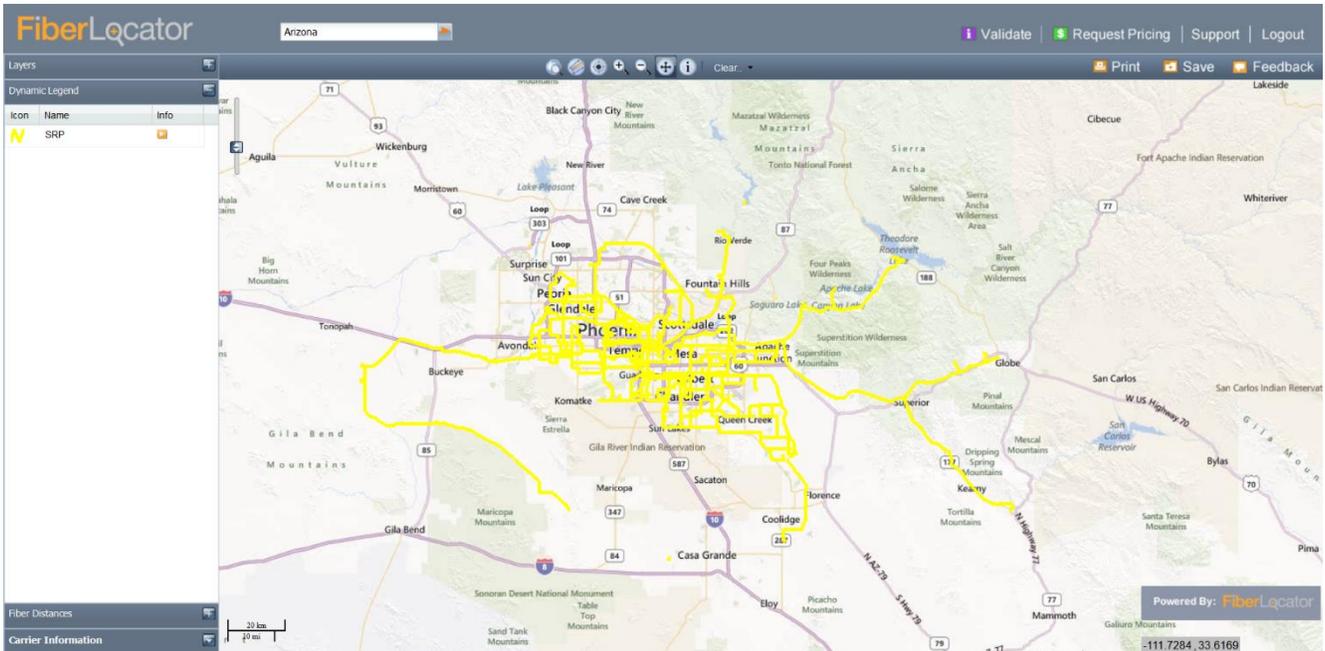
Source: Arizona Corporation Commission (<http://www.azcc.gov/divisions/utilities/electric.asp>)

Salt River Project (SRP) Phoenix Area Fiber Optic Network & Wireless Sites Maps



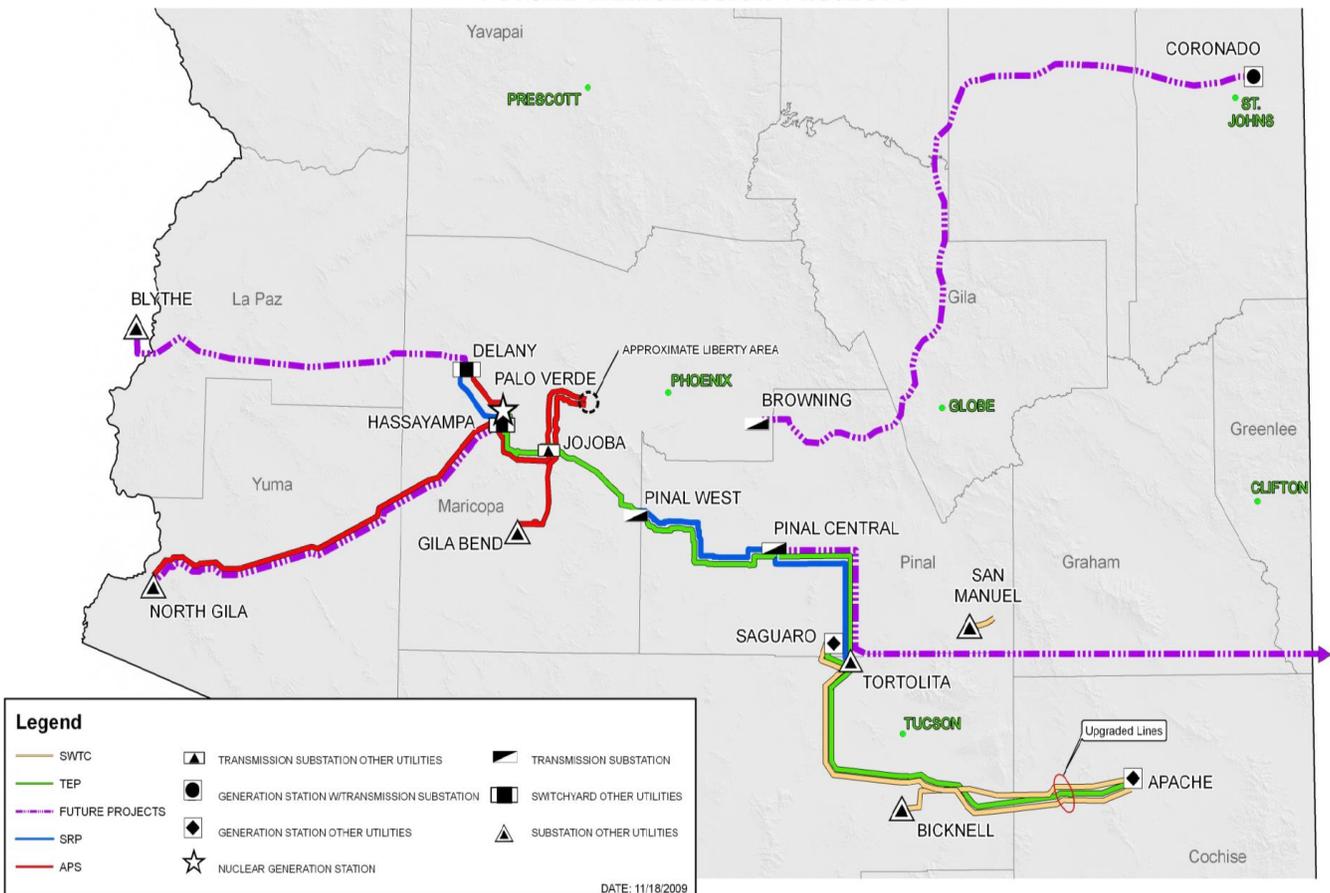
Source: Salt River Project (SRP) Telecom (<http://www.srptelecom.com/>)

Salt River Project (SRP) Phoenix Area & Eastern Mining District Fiber Optic Network Map



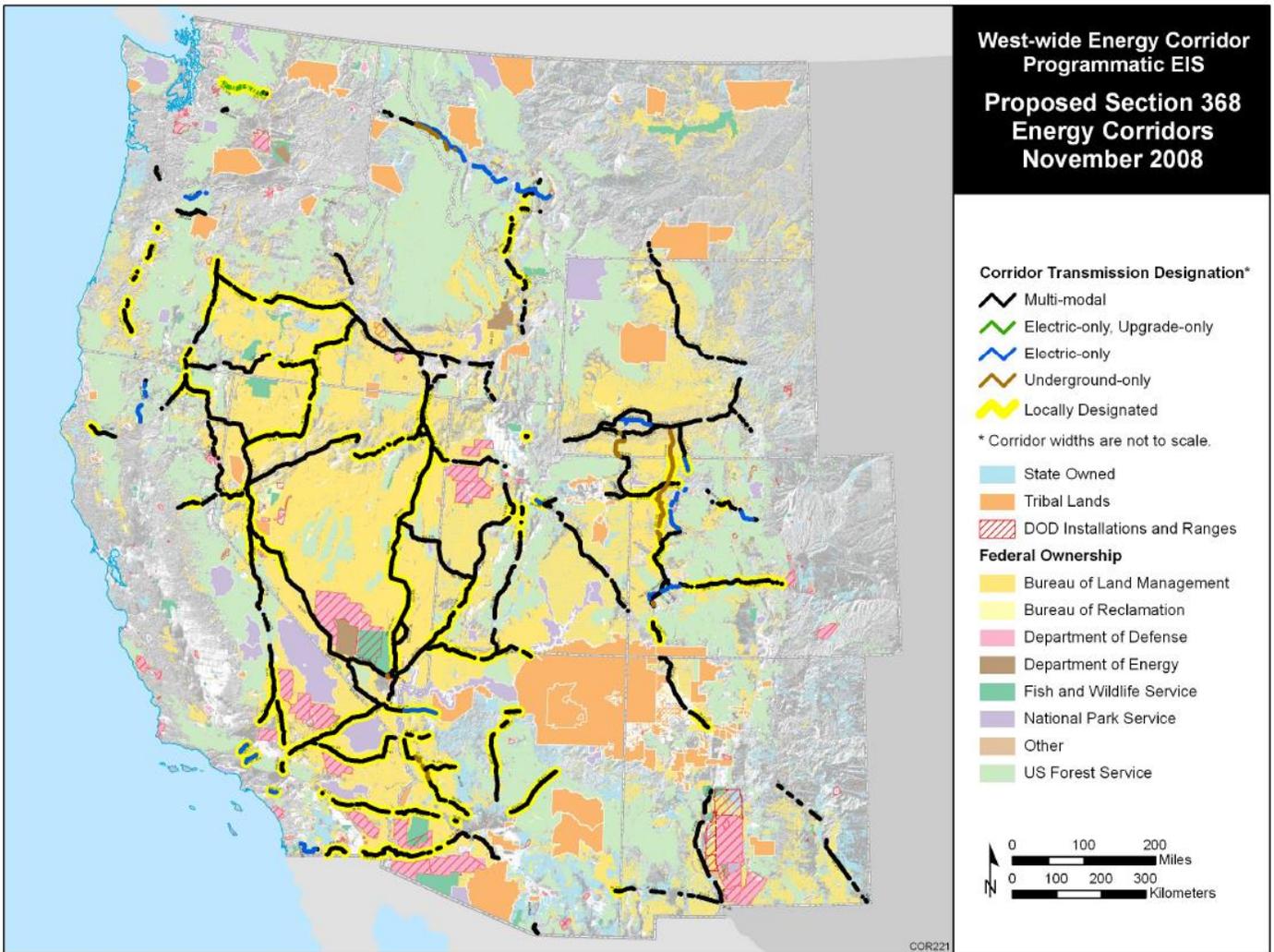
Source: NEF FiberLocator (<http://www.fiberlocator.com/>)

Arizona Utilities Top Renewable & Future Transmission Projects



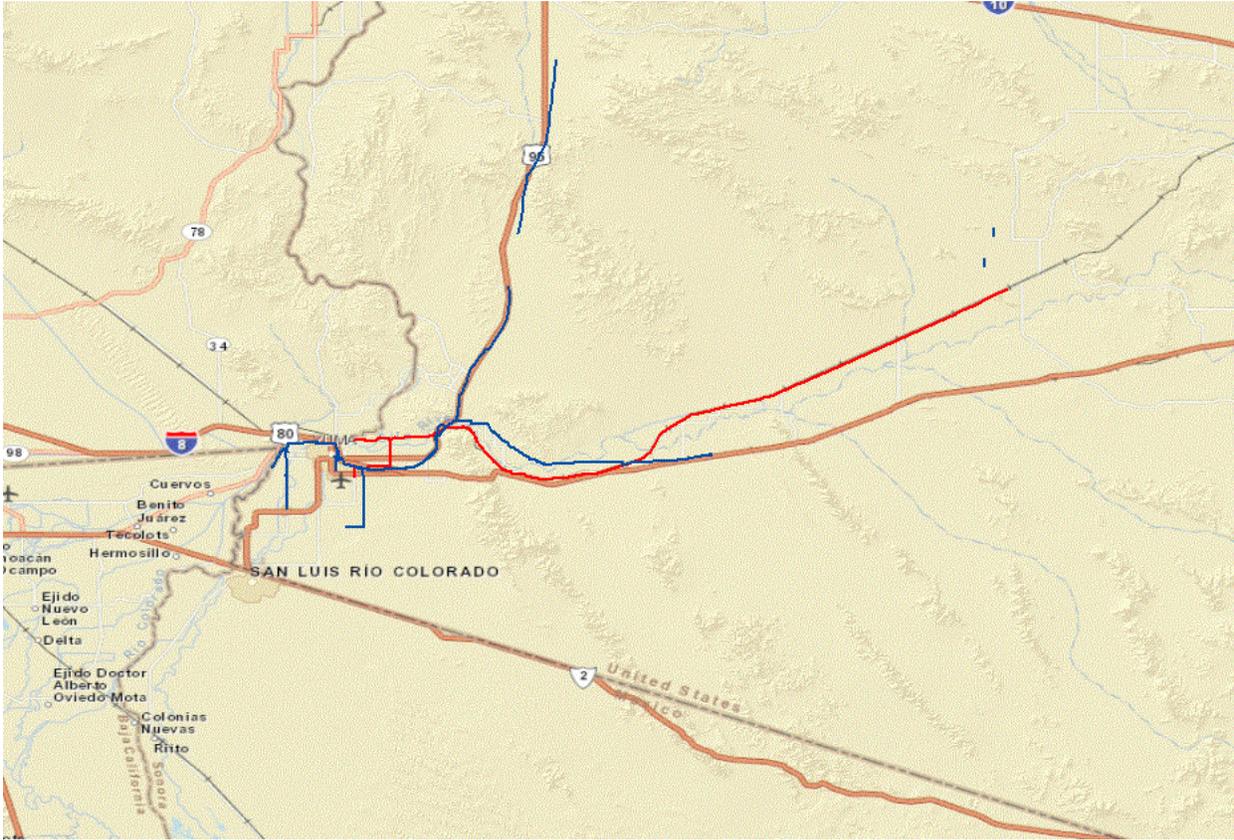
Source: Arizona Corporation Commission (<http://www.azcc.gov/divisions/utilities/electric.asp>)

West-wide Energy Corridor Programmatic EIS Proposed Section 368 Energy Corridors Map

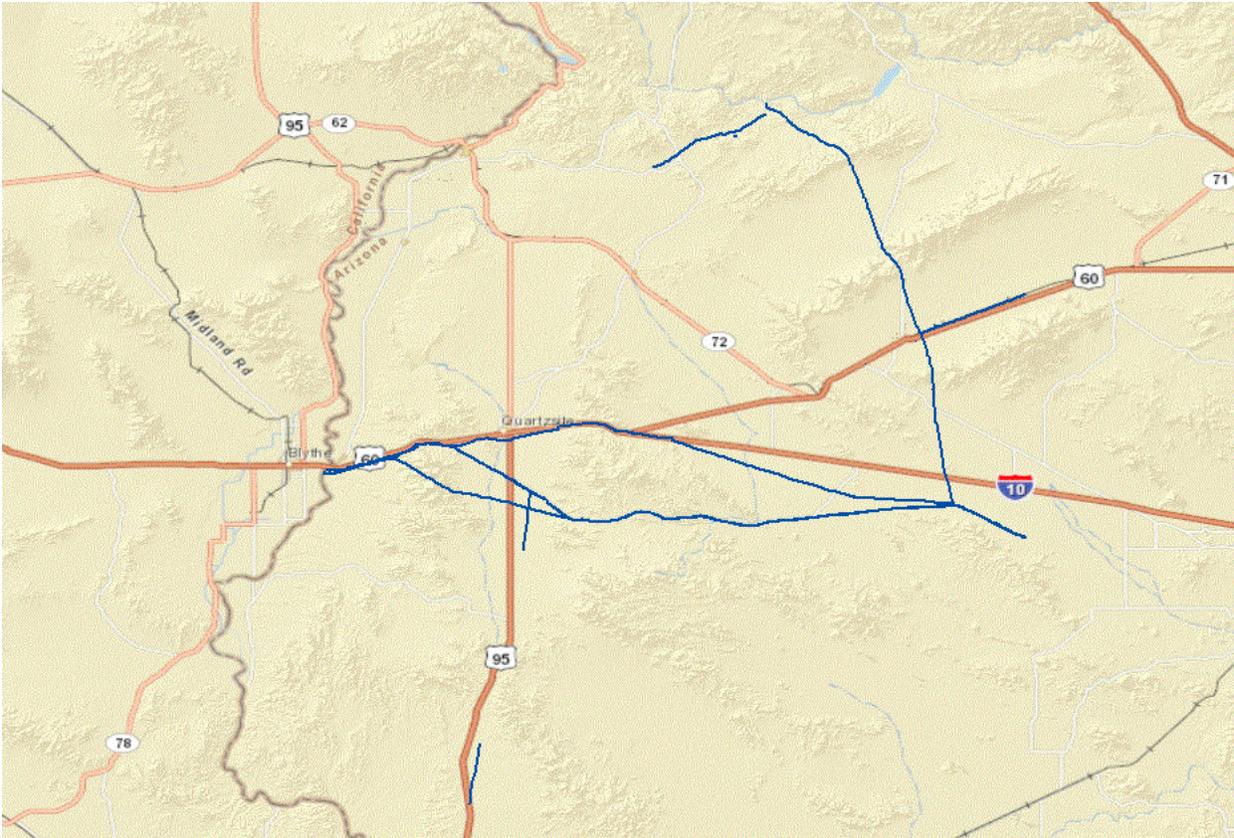


Source: West-wide Energy Corridor Programmatic Environmental Impact Statement (PEIS - <http://corridoreis.anl.gov/>)

Yuma County Natural Gas and Hazardous Material Pipeline Map

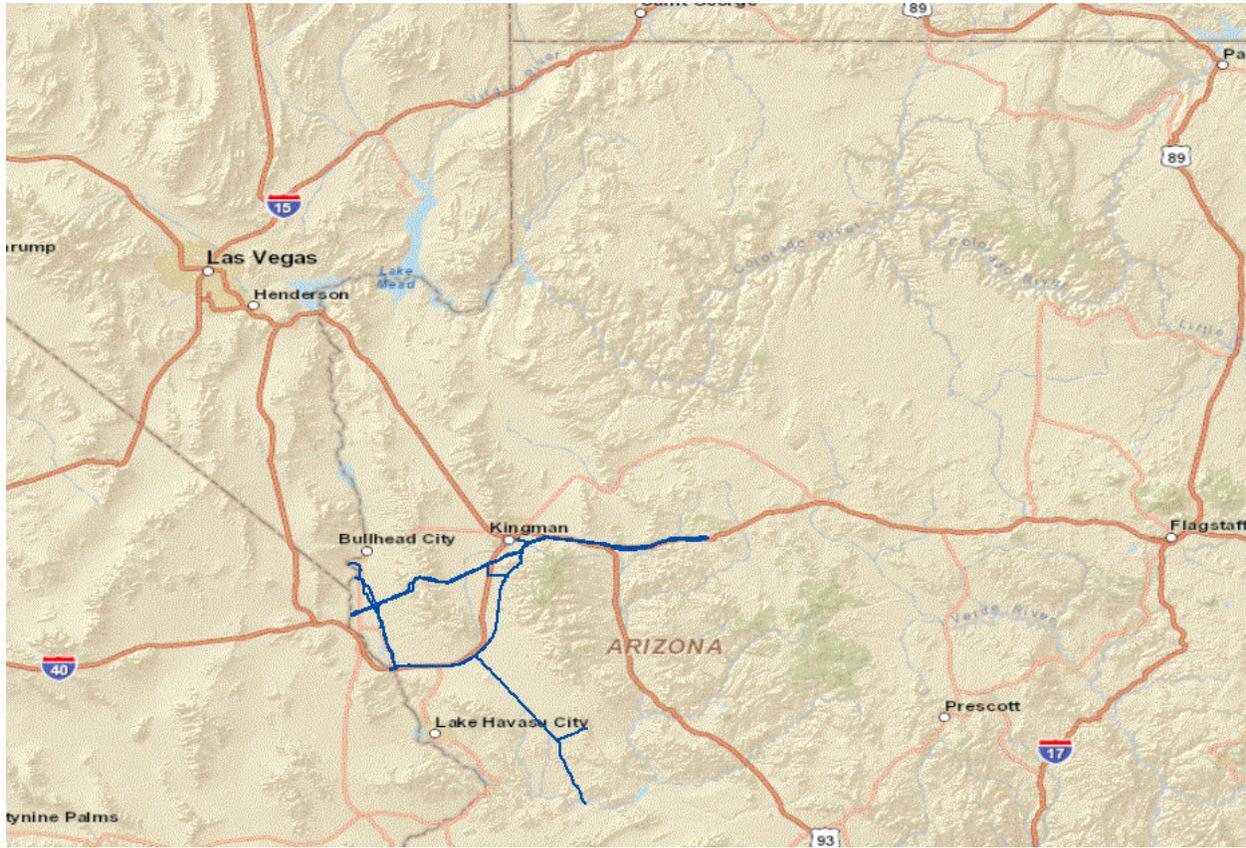


La Paz County Natural Gas and Hazardous Material Pipeline Map



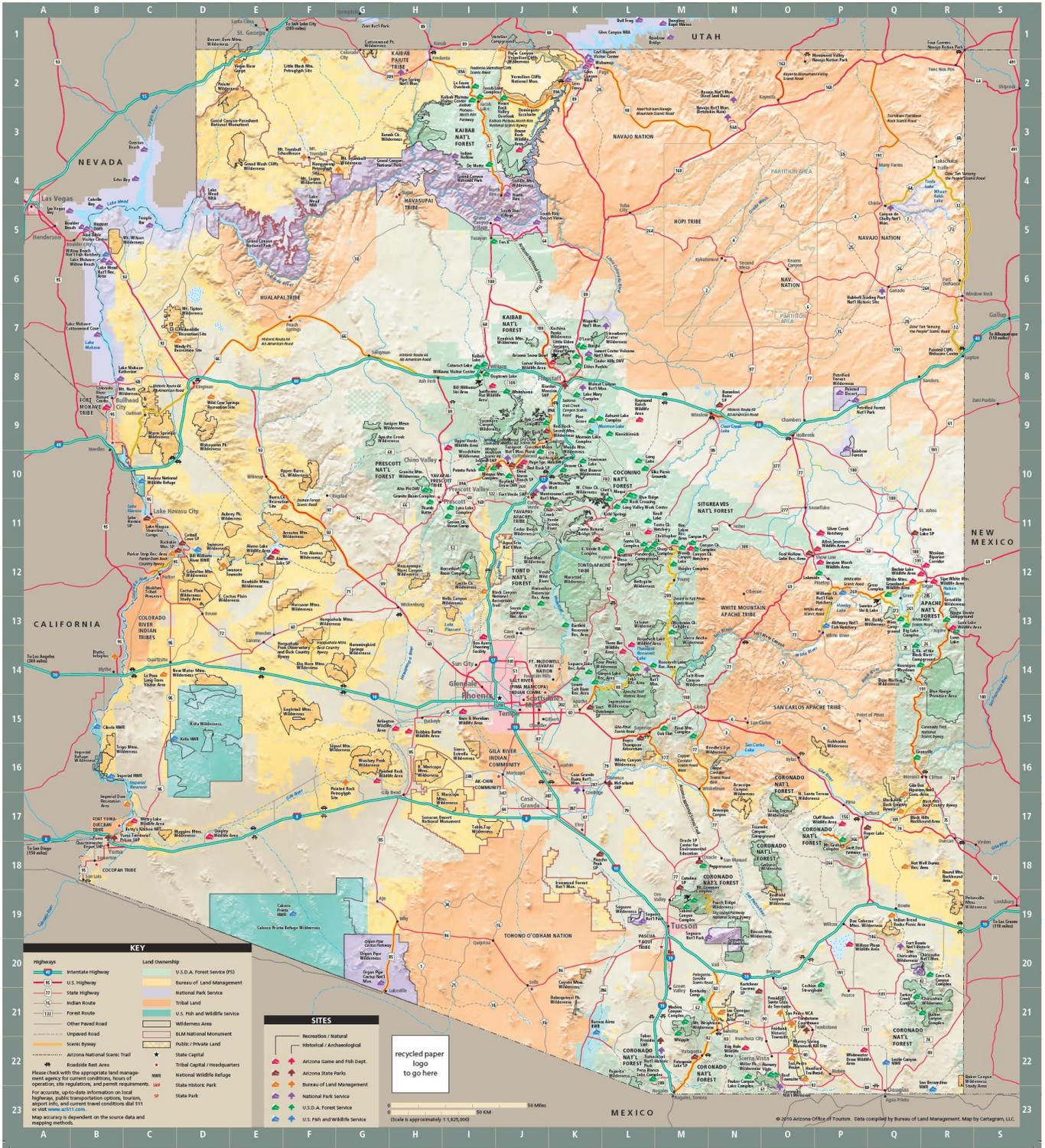
Source: U.S. DOT National Pipeline Mapping System (<https://www.npms.phmsa.dot.gov/>)

Mohave County Natural Gas and Hazardous Material Pipeline Map



Source: U.S. DOT National Pipeline Mapping System (<https://www.npms.phmsa.dot.gov/>)

Arizona Recreation and Historic Sites



Source: Arizona Department of Tourism
<http://www.arizonaguide.com/arizona-travel-info/arizona-maps>

Appendix G: Broadband Request for Information (RFI) Example

Introduction

The State of Arizona, Department of Administration and Governor's Office of Education Innovation, is seeking technical input and recommendations to expand Internet connectivity to Arizona schools that do not have enough Internet capacity to successfully conduct online assessments of their students in 2015. This is an essential priority to meet the increasing high speed and high capacity broadband demands of education throughout the state. This Request for Information is based on our expectation that Arizona telecommunications providers can think creatively and innovatively to simultaneously transform education and invest in our state's network infrastructure.

To fully maximize opportunities created by expanded network capacity, Arizona schools should work collaboratively with public libraries and higher education institutions. Improving Internet connectivity in public schools would provide significant advantages to community colleges, universities, and libraries.

The Internet connections that are proposed must be secure, affordable, redundant, resilient and scalable. The connections should leverage existing assets owned by private or public entities in Arizona that are eligible to participate in the federal E-Rate program. Vendors are encouraged to focus on leveraging recent advancements in network technologies and network components already in place throughout the state, in order to establish a robust broadband communication infrastructure sufficient to meet the increasing demands of public schools in the State.

The purpose of this RFI is to identify broadband scenarios along with innovative pricing models. This process will allow the Department of Administration and Governor's Office of Education Innovation to understand the vision of Arizona telecommunications providers for increasing Internet capacity at Arizona public schools to meet immediate and longer-term future Internet capacity needs. Vendors are encouraged to utilize current, emerging, and next-generation technology as well as alternative last-mile solutions to propose optimal network connections.

Submitting a Response

Interested vendors should submit answers to the questions in Section IV and any additional material necessary for reviewers to understand the response. The State is not interested in receiving elaborate promotional or advertising material; such materials will not be reviewed or considered. Respondents are solely responsible for all expenses associated with responding to this RFI.

Questions concerning this RFI may be submitted to: Carissa Cyr at ccyr@az.gov. Responses should be submitted electronically via email at the following: Carissa Cyr at ccyr@az.gov on or before **September 2, 2013 at 2:00pm, Mountain Standard Time.**

Background

Currently, Internet connections to Arizona public schools are provided through a bidding process managed by local school administrators. Consequently, there is great variability in the speed and capacity of Internet connections that are installed by independent telecomm providers. Some connections are high capacity, high speed fiber that is sufficient to support instructional, assessment, administrative, and training requirements for students, staff, and teachers. Other schools lack funding and IT staff support to contract and pay for adequate connectivity. These locally-managed projects can result in network and IT silos that are redundant and repetitive, and the cost of the connections may be higher than they would be if a state-wide purchasing process were used.

The Governor's Office of Education Innovation is overseeing a statewide data collection and interviewing project that includes all Arizona public schools. This activity will be completed in September. It will show what current network capabilities are at each school in all districts, how much more capacity is needed, and the portion of the cost that will be covered by E-Rate.

The current need to expand network capacity at many Arizona schools also creates an opportunity to consider state-wide approaches to design, install and manage this project in ways that may take advantage of existing backbone and middle mile network infrastructure. The AZNet system provides an excellent example of an effective and efficient state-managed network. It is managed by the Department of Administration to provide network connections to state agencies and employees throughout the state. A single contractor manages the entire network and only 8 state employees oversee the system. Another state-wide approach is an education partnership-managed network found in many states. In these networks, the central campuses of higher education institutions are typically the hubs of backbone network rings, and public education administrative facilities and schools link to the hubs with robust middle and last mile fiber connections.

This RFI is intended to accomplish the following goals and objectives:

- Communicate to vendors the need in many Arizona schools for higher speed, higher capacity Internet connections. Later this year, the statewide data collection project will provide interested telecomm vendors with the capacity, speed, and security capability of Internet connections at all schools.
- Provide opportunities for vendors to suggest statewide or regional approaches similar to the AzNet state network or an educational network partnership that could utilize and expand existing backbone and middle-mile infrastructure.
- Propose connectivity to the Sun Corridor Terapop and/or existing University networks in Tucson, Phoenix, or Flagstaff.
- Learn from vendors what technical and networking options are available, with an emphasis on creative approaches that will provide growing bandwidth capacity at public schools and improved security levels, at lower prices.
- Solicit informational pricing to assist the state in formulating future budget requests.
- Give vendors the opportunity to provide strategic planning recommendations which accommodate increasing bandwidth requirements.
- Give vendors the opportunity to address how to leverage existing assets owned by private or public telecomm providers that are eligible to participate in the federal E-Rate program.

Questions

For all questions, provide a clear and concise response. Include illustrative examples where appropriate.

Company Information

Company Information	Response
Company name Company address Parent company Describe ownership and/or strategic partnerships of your company	
Name and signature of the person responsible for the information contained in this RFI	

Phone number Fax number E-mail address Web site URL	
Company location (corporate office; other offices)	
Describe your network service(s) and strategy, including markets served. Include information regarding any strategic partnerships or alliances with other providers.	
Identify major customers that use your network/telecommunication/services and are willing to serve as references. Please provide the appropriate contact information including telephone numbers and email addresses. We are especially interested in any statewide or large regional networks you provide in Arizona, or other states that serve public sector institutions.	

High Level Technical Requirements

Vendors must provide network designs for the following options. For each network design option, include/describe:

High Level Technical Requirements	Response
A network configuration narrative, diagram(s) and supporting documentation as needed	
A flat rate and/or bandwidth and/or burstable based pricing model	
Strategic planning recommendations	
How does the solution leverage existing assets the vendor has in Arizona?	

Which Qualifications/Characteristics Can Be Satisfied?

Vendors must indicate whether or not the following qualifications or service characteristics are met in their response:

Which of the following Qualifications or Characteristics does the solution satisfy?	Response
Bandwidth on demand – ability to scale up and scale down as Internet needs dictate?	
Scalable, non-blocking architecture over isolated but shared (public & private) infrastructure?	
In which Arizona counties does the vendor currently deliver high speed network bandwidth?	
Is your company eligible to participate in the federal E-Rate program? Do you have a SPIN number? Describe your previous experience with the federal E-Rate program.	
Quality of Service – the ability to prioritize traffic through the network from source to destination	
How does the proposal leverage the vendor’s existing assets?	
Does the proposal allow logical/virtual isolation of data transport and services to separate and secure traffic, such as local school building to the school district office or school central IT location?	
Does the proposal allow multiple access circuit technologies to attach?	
Is the vendor willing to interconnect as needed to create a seamless regional or statewide network (from an end user’s perspective)? Does the proposal provide inter-connection to the Sun Corridor Terapop and/or existing university networks? Where would the inter-connection be located?	

Will connections transport voice, video, data, and Internet?	
How can your proposal provide centralized affordable security for all school districts?	
How will ISP Services be provided by the solution?	
Will the proposal support video service – including standards based HD video conferencing/telepresence, bridging, scheduling and help desk support?	
How does the solution provide for Ethernet handoff?	
Describe how your proposed technology could be used to benefit all school districts?	
Describe the type of security technology you propose to use?	

Which Network Designs or Connections are Proposed?

For the first 3 options, the network must be designed at the core and middle mile to be redundant, resilient, robust, scalable, secure and non-blocking. Clearly identify redundant paths and all single points of failure in all diagrams.

Network Designs or Connections	Response
1. Statewide or regional management contract in conjunction with a state or education partnership for all circuits and related network equipment in backbone, middle and last mile including the core nodes, aggregation nodes, secondary contracts, service and support.	
2. Individual management contracts for the network elements of core, middle-mile and last-mile service and support, or that interconnect the core, middle-mile and last-mile service and support.	

<p>3. Single management contract for all equipment in the middle mile including the core nodes, aggregation nodes, secondary contracts, service and support. Customer is responsible for the last mile from the site to an aggregation node.</p>	
<p>4. Contract does not include any equipment in middle mile including the core and aggregation nodes and no managed service level agreements. Customer is responsible for the last mile from the site to the Internet and managing Video services.</p>	

Vendors are encouraged to propose alternative network topologies and pricing models that may differ from the options that are described above.

Appendix H: Glossary of Telecom Terms

3G or Third Generation Wireless: This refers to the current state of cellular wireless data communications being actively deployed as a market overlay first in urban areas and along transportation corridors. The first generation was analog and the second was digital (CDMA, TDMA and GSM).

4G or Fourth Generation Wireless: This refers to the next step up for mobile wireless currently standardized and beginning to be deployed. Fourth generation systems provide higher-speed data connections of up to 100 Mbps for high mobility users and 1 Gbps for low mobility users, both fixed and mobile.

5G or Fifth Generation Wireless: This refers to the anticipated next step up for mobile wireless beyond 4G, but not yet standardized. Fifth generation systems will likely provide higher-speed data connections, both fixed and mobile with greater spectral and/or energy efficiency with improved service quality and user experience.

Antenna: Any structure or device used to transmit and/or receive electromagnetic waves for the provision of wireless services including, but not limited to, cellular, paging, personal communications services (PCS), and microwave communications.

Asymmetric: A connection with more capacity in one direction than the other. Most DSL and cable modem links are asymmetric, with higher capacity (speed) in the downstream path.

Attenuation: the deterioration of a signal over distance. Also may be referred to as “loss”

Backbone: This refers to the highest speed and widest bandwidth point of a communications circuit or path. In most cases data sources such as shared servers are connected to the backbone, with lower bandwidth circuits extending to user stations.

Backhaul: The intermediate links between the backbone of the network and the sub-networks or provider networks. See also “middle mile.”

Bandwidth: The amount of data (capacity) that can be carried by a circuit between two points of a network. Bandwidth is typically measured in Kilobits per second or Megabits per second (shortened to Kbps and Mbps). The top speed of modems is 56 Kbps. One strand of fiber optics can carry 20,000,000,000 bits per second (20 Gbps) or more.

Base Station: The central radio transmitter/receiver that maintains communications with end user sites within a given range. Although many base station site antennas are placed on specially constructed towers, where existing structures provide a site that is higher than its surroundings, antennas can be placed on those structures. For example, antennas have been placed on water towers, grain silos, and building rooftops.

BPL: Broadband over Power Line: A technology that allows broadband services to be delivered via electric lines. BPL is discussed in the **Potential Broadband Technologies** section of this report.

Broadband: A generic term for high-speed data transmissions. The current federal definition of broadband is a minimum of 768 Kbps downstream and 200 Kbps upstream.

Cable Modem: A device used to provide data services over a cable TV network. Users in a given locality (determined by the provider) share the available bandwidth, so when many local users are connected simultaneously they experience slower network performance.

Cell: The basic geographic unit of a wireless system, also the basis for the generic industry term ‘cellular.’ A geographic area is divided into ‘cells,’ each of which is equipped with a low-powered radio transmitter/receiver. The cells can vary in size depending upon terrain, capacity demands, etc. See also Base Station, Cell Site.

Cell Site: The place where communications equipment is located for each cell. A cell site includes antennas, a support structure for those antennas, and communications equipment to connect the site to the rest of the wireless or wired network. The equipment is normally housed in a small shelter or “hut” at the base of the site. See also Base Station, Cell.

Central Office: A term used by carriers when referring to switching points. May also be called a local exchange or telephone exchange.

CLEC: Competitive Local Exchange Carrier. A new entrant in a telecommunications market previously limited to one carrier. Contrast with ILEC.

Colocation: The siting of two or more separate companies' (or departments') equipment in or on the same structure/tower or building without the need to construct a new support structure or require a substantial increase in the size of an existing structure.

Contention: When multiple customers share a finite amount of broadband capacity and simultaneous use, they "contend" or compete with one another for that limited resource. Contention may be due to increased use or to inherent system design constraints. Synonymous with oversubscription.

CPE: Customer Premises Equipment. CPE is a term that refers to any equipment that is located at the customer's site.

Downstream/download: Data transfer from the web/Internet "down" to the customer. Typically measured in thousands of bits per second (Kbps) or millions of bits per second (Mbps). See also Upstream/upload.

DS-3 (Digital Signal, Level 3): A 44.736 Mbps carrier facility, (also referred to as a T3, and generally thought of as 45 Mbps), which is the equivalent of 28-T1 connections.

DAS: Distributed Antenna Systems. An alternative wireless network technology utilizing small antennas usually mounted on existing infrastructure in the public rights-of-way, such as utility poles, and are connected to a central hub by wireless or fiber backhaul. Due to their limited power and coverage area, DAS elements are typically deployed to supplement traditional macro sites.

DSL: Digital Subscriber Line. A service providing data connectivity (to the Internet or private networks) over ordinary copper telephone lines. DSL circuits are switched, not shared as cable modems, but bandwidth can vary greatly, based on both distance and the quality of the circuit. There is typically a distance limitation of approximately 12,000 to 18,000 feet from the nearest main facility (telephone company central office or equivalent).

DSLAM: DSL Access Multiplexer. Used to aggregate many DSL connections onto a single higher-bandwidth connection/link. DSLAM equipment is typically placed in above-ground equipment cabinets within or at the edge of neighborhoods.

Ethernet: Ethernet is a family of computer networking technologies for local area networks (LANs), standardized in 1985 as IEEE 802.3 and largely replacing competing wired LAN technologies. It is generally carried over twisted pair wiring and fiber optic links in conjunction with hubs or switches at data rates from 10 Mbps to 1 Gbps on LANs and up to 100 Gbps on MANs and WANs.

FCC: Federal Communications Commission. The government agency responsible for regulating telecommunications in the United States.

Fixed wireless: Refers to wireless systems that are permanently installed and designed to cover a specific area or site.

Gbps: Gigabits per second. A thousand Mbps or a million Kbps.

ILEC: Incumbent Local Exchange Carrier. The former monopoly local telephone carrier. Contrast with CLEC.

ISP: An Internet service provider is a business or organization that offers users access to the Internet and related services. Many but not all ISPs are telephone companies or other telecommunication providers and may be organized as commercial, community-owned, non-profit, or otherwise privately owned entities. They may provide a variety of services such as Internet access and transit, domain name registration, web site hosting, and colocation.

Kbps: Kilobits per second. Thousands of bits per second.

LAN: Local Area Network. A local area network is a computer network interconnecting computers, storage, and other peripherals in a limited area such as a home, school, computer laboratory, or office building over a small geographic area using Ethernet, Wi-Fi, and possibly other short range interconnection technologies. See also MAN and WAN.

"Last-mile" (sometimes referred to as "first mile"): This term is used to describe the final connection to a building as opposed to the high capacity circuits extending across a city or county. This connection is often the bottleneck that prevents high-speed network connectivity, due to lack of high capacity cabling options. Contrast with "middle mile."

Latency: The time it takes for a signal to travel between two points on a network. Also referred to as “delay”. When there is significant latency a normal voice conversation may be very difficult as the parties must wait for responses and may “talk over” each other.

Leased Line Services: These are typically communications circuits provided by a telephone company or cable company and leased for a monthly fee to a customer such as a city or school district. Typical leased lines include T-1 and T-3.

Line of Sight (LOS): Transmission limited to straight lines and in which the transmitting/receiving locations can be viewed/seen from one another. Most wireless wide area network transports require a line of sight from the sending location to the receiver.

MAN: Metropolitan Area Network. A metropolitan area network is a large computer network that spans a medium size geographic area such as a campus up to an entire metropolitan area, falling between a LAN and WAN. MANs provide Internet connectivity for LANs in a metropolitan region, and connect them to wider area networks like the Internet. See also LAN and WAN.

Mbps: Megabits Per Second - Million bits per second. Telephone modems operate at Kbps (thousands of bits per second) speeds, whereas local area networks operate at Mbps. See also Gbps.

Microwave: The portion of the electromagnetic spectrum, beginning with 1 GHz, which is used for many different wireless communications. Microwave links are often used in links where there is a line of site and a distance of less than 30 miles.

Middle mile: May also be referred to as backhaul. The links between ISPs and local or regional broadband service providers are considered “middle mile” connections. Contrast with “last mile”.

Monopole: A slender, self-supporting tower on which wireless antennas can be placed.

Oversubscription: See contention.

PROW: Public Right-of-Way or Public Rights-of-Way. The land/areas owned by a public entity such as a city or county that are used for installation of telecommunications and other services. For example, most counties own and control the PROW along county roads.

Right-of-Way (for outside plant cable): Refers to a designated space alongside a street or other access (such as a railroad line). An entity wishing to install cable among buildings must obtain the rights to a pathway for that cable. Right-of-way access must be granted by the owner of the path to be used, which may include public landowners (city, county, etc.), private landowners (railroad companies), or the owners of poles such as cable, telephone, or power companies. Cities typically require written permits for the use of their rights-of-way - usually for a fee. See also PROW.

Router: A device that “translates” among different types of network connections and speeds, and can also perform basic security functions. Routers are most frequently used at the point of incoming services such as ISP or carrier WAN connections.

Site Survey: Internet service provider personnel visit your home or business location to determine whether service is/can be made available there.

Symmetric: Used to describe communications technologies in which the upstream and downstream data rates are identical - e.g., High Bit-rate Digital Subscriber Line.

T-1 (DS1): In the United States the T-1 standard has a speed of 1.544 Mbps. T-1 circuits usually are provided by telephone companies using copper cabling, but fiber and wireless systems can be set up to provide T-1 connectivity as well.

Take Rate: The percentage of households or business that are offered service who choose to subscribe to that service. For example, if DSL service were available to 100 households and 33 elected to “take” that DSL service, the take rate would be 33%.

Underserved and Unserved: The FCC recently defined these terms that describe areas that lack broadband access. For complete definitions refer to the July 9, 2009 Federal Register Notice of Funds Availability (NOFA) at: http://www.ntia.doc.gov/files/ntia/publications/fr_bbnofa_090709.pdf.

Upstream/upload: Data transfer from the customer back to the web/Internet or provider. Typically measured in thousands of bits per second (Kbps) or millions of bits per second (Mbps). See also Downstream/download.

VoIP: Voice over Internet Protocol. A technology that puts voice (telephone) conversations over an IP “data” network. Can be used to aggregate (or “trunk”) multiple calls between buildings, or for individual calls from an IP-enabled telephone or from a computer equipped with a microphone and speaker. Skype is one example of VoIP.

VPN: Virtual Private Network. A network set up for specific sites and users and open only to authorized users. A VPN uses encryption to prevent communications from being deciphered by non-authorized personnel.

WAN: Wide Area Network. A wide area network is used to extend connectivity beyond a building or campus, usually through telephone carrier facilities, but may also be privately installed and owned. See also LAN and MAN.

Wi-Fi: Wi-Fi is a popular technology that allows an electronic device to connect to a LAN and through it to exchange data or connect to the Internet wirelessly over unlicensed spectrum with various levels of encryption and security. Devices connect to network resources via a wireless network access point (AP) or hotspot with a range of up to about 65 feet indoors and greater distances outdoors depending on configuration, antennas, and mesh connections with other Wi-Fi APs. Wi-Fi is defined by IEEE 802.11 wireless LAN standards

WiMAX: WiMAX (Worldwide Interoperability for Microwave Access) is a wireless communications standard designed to provide some 30 to 40 megabit-per-second data rates and up to 1 Gbps for fixed locations enabling the delivery of last mile wireless broadband access as an alternative to cable and DSL. It is similar to Wi-Fi, but it can enable usage at much greater distances and speeds. WiMAX is defined by IEEE 802.16 wireless LAN standards ratified by the WiMAX Forum. A variant, Mobile WiMAX is being selectively employed to complement or compete with 4G mobile wireless.

Wind load: The designed capacity of a tower to withstand wind forces. Each structure (mast, antenna, etc.) added to a tower adds to the overall wind load of that tower.

WISP: Wireless Internet Service Provider. A company that distributes Internet service via wireless networking. In order to provide service to a given location or territory. A WISP may develop its own tower sites and/or may lease space on towers or structures owned by others.