

# Fiber Readiness Study



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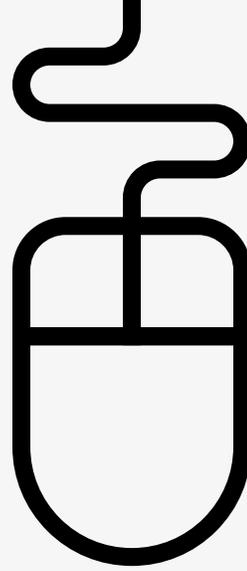
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### Menu Bar

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# 1 Executive Summary

The San Joaquin Council of Governments (SJCOG) conducted this Fiber Readiness Study to inventory existing fiber networks and identify opportunities to expand the fiber optic network throughout San Joaquin County. This final report summarizes the project vision, best practices in fiber optic network expansion, the role of municipalities, high-impact fiber gap assessment, and potential funding opportunities or strategies.

This study focuses on expanding the **middle-mile fiber optic network** in San Joaquin County. The middle mile refers to the fiber connection between a regional or national network and the local last-mile providers who connect fiber to end-users. In rural areas, the middle mile may refer to the town's connection to a larger metropolitan areas where it interconnects with major carriers.

## San Joaquin Fiber Goals

SJCOG created a Working Group for the Fiber Readiness Study. The Working Group identified three goals for the expansion of the fiber optic network in San Joaquin County:

- Implement existing traffic management plans to facilitate the advancement of intelligent transportation systems to improve safety and mobility for all modes.
- Plan for and future-proof the fiber optic and transportation networks for upcoming emerging technologies and intelligent transportation systems.
- Lay the foundation for fiber expansion into local communities to enhance access and connectivity and improve digital literacy.

## Role of Public Agencies in Expanding Fiber Optic Networks

Fiber networks can be private, public, local agencies, or government. Private networks are built, maintained, and operated by private **Internet Service Providers (ISPs)**. Municipal fiber networks can support advanced transportation systems management, government services like school networks, emergency services, and public utility monitoring and management.

Connecting **community anchor institutions (CAIs)** to fiber assets owned by the public entity and building out the middle mile and last mile provides technology and cost saving opportunities for municipalities. Expanding municipal fiber networks can also enable private ISPs to provide faster or cheaper internet service to residents and businesses.

When designed and implemented properly, municipal networks generally provide an acceptable payback period that morphs into future cost savings. Municipal fiber networks can be viewed as an investment but not one easily assigned a return on investment (ROI) percentage. For more information on municipal fiber network investments, see **Appendix H**.

# Best Practices

## Step 1: Assemble Stakeholders, Define Goals, Identify Champions

The most important tool for building a regional fiber network is to **identify a Fiber Champion(s)**— an individual (or group of individuals) well-networked throughout the local jurisdictions, passionate about implementing fiber expansion, and motivated to push for the success of the project. Each local municipality and county needs to identify at least one champion to represent their efforts.

Fiber expansion is a long-term commitment and requires that all champions can initiate change and motivation on the long-term scale, while being up to date on all fiber technology innovations.



## Step 2: Assess Existing Inventory

Municipalities need up-to-date network maps to maintain their network and to be a resource to locate their utility prior to others' construction in proximity to the municipality's fiber optic cable (like mapping gas, water, or electric utilities).

This project mapped pathways and ownership of existing municipal fiber. It is important to keep this map updated as new fiber or conduit pathways are added.

To build the single-view map, we coordinated with Caltrans, the county, municipalities, AT&T, and Comcast.

Accessing the existing fiber inventory is not easy. Not all private ISPs are willing to share their data. Those that do may not provide complete information or may not update the public data frequently. Municipalities may consider their fiber data confidential due to security concerns. Data sharing agreements or non-disclosure agreements can help municipalities confidentially share their data with agencies such as SJCOG to keep the inventory updated.



## Step 3: Develop a Business Model

Municipalities must select a business model approach (or a blend of several approaches) that fits the local context of their unique needs, community goals, existing infrastructure, and level of public capacity and investment. Common business models for building a fiber network include:

- **Do Nothing:** A municipality continues to rely on private internet service providers (ISPs), may be bound to costly technology updates of private ISPs, and likely has limited control over network costs and any future expansion or upgrades.
- **City Leases Infrastructure:** A municipality lays empty conduit or dark fiber (fiber cables within conduit that are not yet connected or “lit”), then leases the excess infrastructure to private ISPs to connect and provide service to customers. Municipalities may need to update local permitting processes to streamline the lease of public infrastructure such as poles and conduit to ISPs.
- **City Partners with Internet Service Provider:** The municipality may establish a public-private partnership (PPP) to work with a private ISP. Entity roles can be negotiated in the PPP agreement, such as the municipality provides the physical infrastructure, while the private ISP is responsible for activating the network and serving customers.
- **City Provides Services:** The municipality is the primary ISP. The local government is fully responsible for providing service to residents including all operations, maintenance, and customer service requests. Most cities that have followed this approach had a previously established, publicly owned electric distribution utility.
- **Combined Business Models:** Municipalities might select a combination of these business models.

## Step 4: Review and Enact Fiber Practices

Policies and practices to enable fiber expansion include:

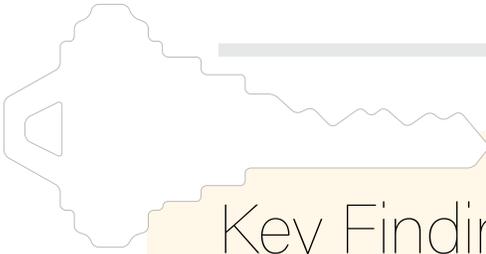
- **Dig Once/Dig Smart** policies require conduit installation during local construction projects, such as repairing pipes or building roads and enable the municipality or future providers to install fiber more easily and cheaply by threading it through existing conduits.
- **Collaborate, Coordinate, and Partner.** These policies promote regional municipal cooperation and coordination and facilitate regional partnerships.
- **Integrate into Existing Plans and Planning Processes** by declaring broadband as essential infrastructure or as a utility to promote the importance of accessible connectivity for all. Fiber should be considered in any roadway design, cost estimate, or construction project.

Regardless of the business model, cities can expand the municipal fiber network by **re-investing revenue** to maintain and expand the infrastructure and **maximizing conduit installation** for more opportunity to lease or trade for revenue (ex: lay two 2” conduits on local roads; multiple 4” conduits on major roads).



# Fiber Network Gap Assessment

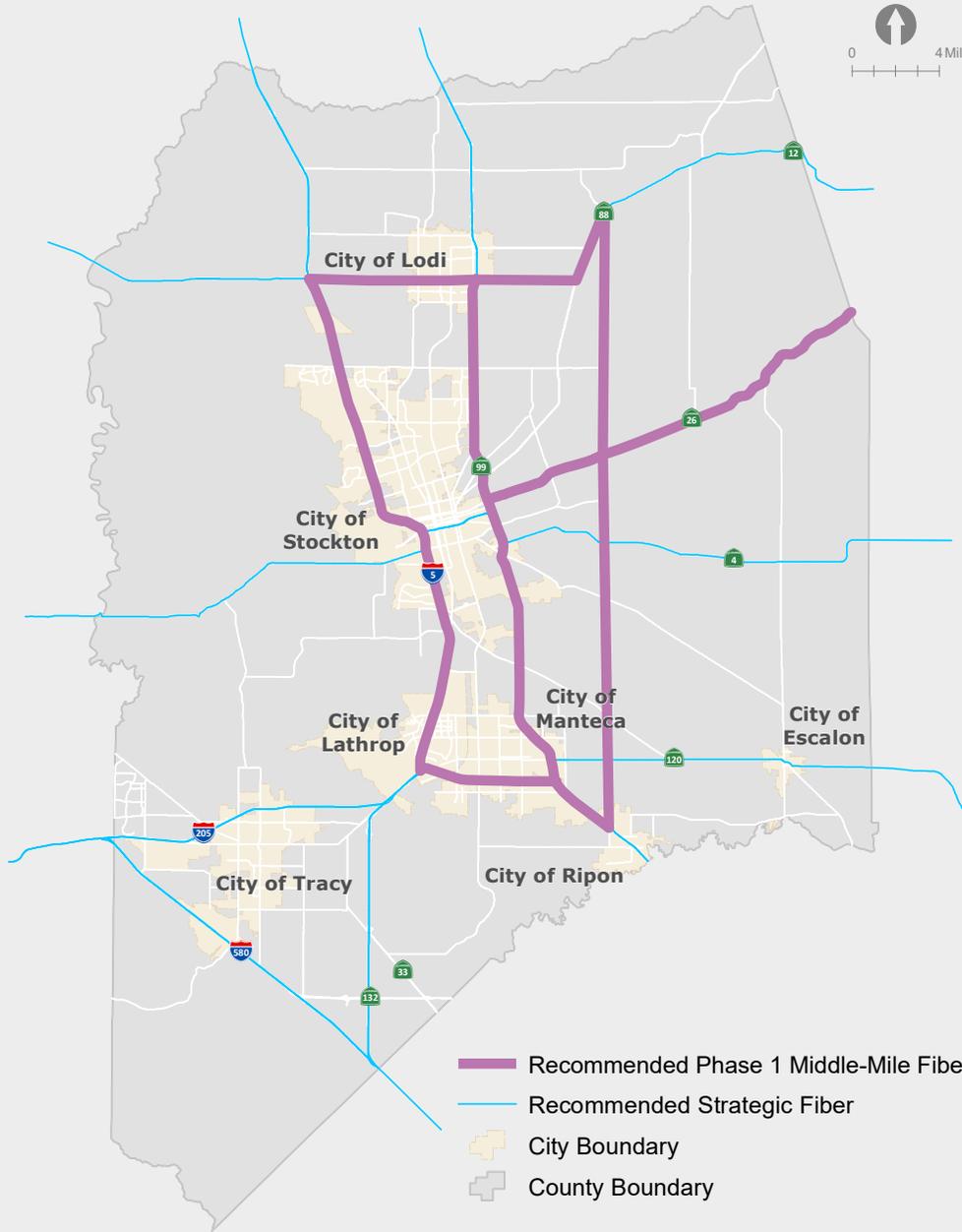
The study ranked gaps in the existing municipal fiber network based on transportation needs and opportunities to connect government institutions. We outline a process for municipalities to add their own local priorities, including communities of concern, planned developments, and economic development plans.



## Key Findings

- The existing municipal fiber network in San Joaquin County is limited, but those municipalities are working to update or expand their networks.
- Several municipalities are in the process of conducting fiber master plans and selecting a business model.
- The Strategic Broadband Corridors identified in the [2019 Strategic Broadband Corridors Report](#) are a strong start to build out a county-wide fiber network, but they don't meet all of the county's needs.
  - The state's Strategic Broadband Corridors don't reach all of the county's congested corridors, fiber-connected intelligent transportation systems, or traffic signals.
  - The state's Strategic Broadband Corridors won't connect all government institutions in San Joaquin County to municipally owned middle-mile fiber.
- Jack Tone Road and SR 26 are strategic middle-mile pathways to bring fiber closer to underserved communities on the eastern side of San Joaquin County.
- Building a county-wide fiber network could start with two central fiber rings using the state's Strategic Broadband Corridors and key county corridors:
  - Central Fiber Ring: Hwy 12 (north), Hwy 99 (east), Hwy 120 (south), I-5 (west)
  - Eastern Fiber Ring: Hwy 12 (north), Jack Tone Road (east), Hwy 99 (south), Hwy 99 (west)
- Expanding middle-mile fiber throughout San Joaquin County is the priority and can begin in two phases:
  - Phase 1: Strategic Broadband Corridors and initial Fiber Rings
  - Phase 2: Staged expansion of municipal fiber networks

**Figure 1.** Phase 1 High-Impact Fiber Middle-Mile Fiber Network for San Joaquin County



## Recommendations

SJCOG can support county-wide and local fiber expansion by facilitating a Fiber Task Force and by keeping the single-view fiber inventory up to date. The Task Force of local “fiber champions” should discuss new development plans, opportunities for coordinated Dig Once policies or construction efforts, and funding opportunities. The Task Force can lead the fiber inventory map updates. SJCOG could simply maintain and update the existing GIS inventory map. However, procuring a fiber asset management software platform likely better meets the needs and will be more cost-effective in the long run to maintain accurate information.

After a municipality selects a business model approach, SJCOG can help to coordinate between agencies and private industry and to prioritize high-impact gaps for fiber expansion.

# Report Organization

This report is organized as follows:

## Section 2

An **introduction** to fiber optic network applications.

## Section 3

A summary of **best practices** local agencies can take to expand municipal middle-mile fiber and to support private ISP fiber expansion, and a **review of utility policies and permitting processes** of member agencies in the San Joaquin region.

## Section 4

An **existing inventory assessment** mapping the municipal fiber pathways.

## Section 5

An initial **gaps assessment** in existing fiber.

## Section 6

A **high-impact location assessment** where fiber optic may be most impactful.

## Section 7

A summary of **funding opportunities** for fiber network expansion.

## Section 8

**Guidance on mid- and long-term phasing** of fiber optics throughout the region.

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# 2 Introduction

Fiber optic networks are the critical information-sharing backbone of the increasingly digital world. The current fiber network across San Joaquin County is limited. Expanding the fiber optic network throughout San Joaquin County can help:

- **Reduce congestion** through improved signal timing and regional transportation management,
- **Improve safety** through better traffic monitoring and traveler information systems, and
- **Create opportunities** for expanded internet access for business, residences, and public sector use.

The San Joaquin Council of Governments (SJCOG) conducted this Fiber Readiness Study to expand high-speed communications to support advanced transportation system management and transportation innovation.

This final report summarizes the project vision, best practices in fiber optic network expansion, the role of municipalities, high-impact fiber gap assessment, and potential funding opportunities or strategies. The draft report was shared with the Working Group for review and comment.

## Project Need

Coordination and partnerships are critical to expanding a fiber optic network. SJCOG created a Working Group for the Fiber Readiness Study, which includes planning and public works representatives from the local municipalities and county, SJCOG staff, San Joaquin County Office of Education, the San Joaquin Partnership/San Joaquin Business Council, Caltrans District 10, the California Public Utilities Commission, and private partners such as Comcast. **Appendix J** lists Working Group members.

The Working Group identified three **goals** for the expansion of the fiber optic network in San Joaquin County:

- **Implement existing traffic management plans to facilitate the advancement of intelligent transportation systems to improve safety and mobility for all modes (including freight and goods movement),** such as traffic monitoring, signal coordination, incident management, congestion management identified in the Caltrans District 10 Integrated Corridor Management Plan and the new Stockton ITS Master Plan.
- **Plan for and future-proof the fiber optic and transportation networks for upcoming emerging technologies and intelligent transportation systems,** (which might include system monitoring, data collection, communication, vehicle automation, or surveillance) to support future Integrated Corridor Management Plans.
- **Lay the foundation for fiber expansion into local communities to enhance access and connectivity and improve digital literacy** to connect homes, businesses, community anchor institutions, etc.

Expanding the region's fiber optic network supports broader regional strategies from the [2018 Regional Transportation Plan/Sustainable Communities Strategies \(RTP/SCS\)](#), including:

- Strategy No. 12—Optimize existing transportation system capacity through available and/or innovative strategies.
- Strategy No. 15—Improve transportation options linking residents to employment centers within and out of the county.

# What Is Fiber and How Can Municipalities Use It?

Fiber networks are the most critical infrastructure in the digital world. Fiber optic cables can transmit large amounts of data over long distances faster than other communication mediums.

**Internet service delivery options have evolved from legacy copper dial-up to high-speed fiber connectivity.**

**Dial-up:** By far the slowest and oldest option, dial-up, connects to the internet via a copper telephone line. Dial-up users cannot be on the phone or the internet at the same time and a new connection must be made each time – creating that familiar screeching connection sound.

**Digital Subscriber Line (DSL):** Provides faster service than dial-up, with the ability to use both phone and internet at the same time and basic web browsing.

**Cable:** Provides service via separate copper or coaxial cable wires for high-speed internet service and streaming capabilities for multiple devices. Companies like Comcast/Xfinity or Spectrum offer these cable services.

**Fiber:** The fastest option, internet services are delivered via fiber optic cables and provides much faster upload and download internet speeds and streaming capabilities on multiple devices and can support a variety of emerging technologies.

**Wireless:** Services such as 5G that use radio waves (instead of wires) to provide service from small cell base stations less than 1,000 feet away. Wireless service can be for mobile internet (smartphones) or fixed at home with a receiver that picks up signals from base stations nearby. Currently, 5G usually provides slower speeds than fiber due to, distance to the end-user, network congestion and subscriber density but companies are working to install more antennas and radios to improve speeds. Wireless technologies rely on a robust fiber infrastructure in order to deliver data services across cellular networks.

A fiber optic network can enable rural and urban areas alike to benefit from emerging technologies, including:



**Smart City applications**, such as automated utility meter reading, improved traffic management, and automated vehicle support.



**Remote working/learning**, such as telecommuting, telemedicine, and distance learning.



**Government applications**, such as efficient and effective access to essential services, public safety, coordinated security across sites, and civic engagement.



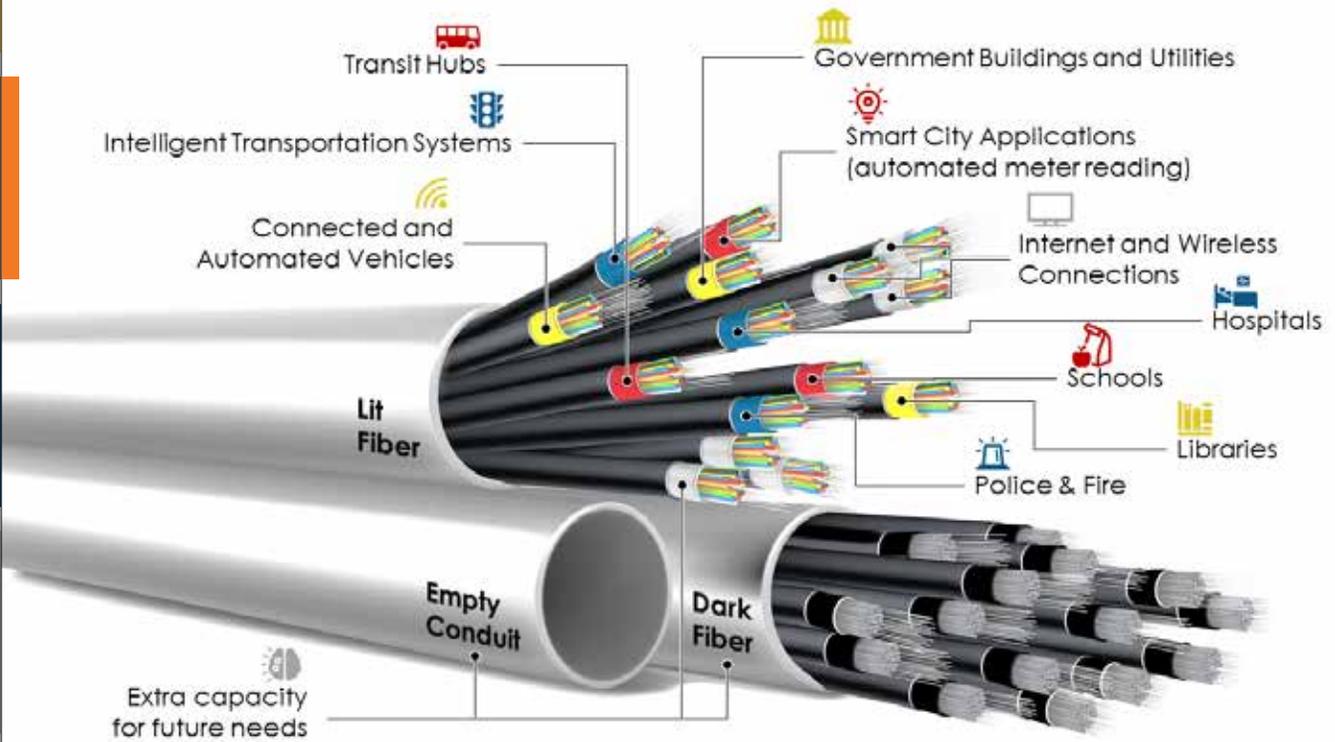
**Economic development** to attract new businesses and residents through expanded internet access, and to encourage private ISPs to provide faster service than they currently provide.

**Figure 2** shows some examples of municipal fiber optic network connections.

**Appendix A** provides key terms and definitions, such as:

- **Lit Fiber:** fiber optic cables that are currently in use.
- **Dark Fiber:** fiber optic cables that are installed but not currently in use.
- **Empty conduit:** tubing (such as PVC piping) that is installed and ready to have fiber optic cables pulled through as needed.

**Figure 2.** Possible uses of municipal fiber optic networks



<p><b>Transportation</b></p> <p>Advanced ITS with Performance Monitoring</p> <p>Automated Vehicles</p> <p>Smart City applications</p> <p>Regional traffic management with remote monitoring</p>	<p><b>Government Institutions</b></p> <p>Coordinated security across locations</p> <p>Reduced cost of service over individual ISP plans for internet + phone</p>	<p><b>Residents and Businesses</b></p> <p>Power for cities to encourage ISPs to provide faster service than they are currently providing</p>

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# What is Broadband?

The FCC defines entry-level broadband internet as a minimum download speed of 25 megabits per second (Mbps) and upload speed of 3 Mbps (or 25/3 Mbps). Cable speeds range from 10/5 to 500/50 Mbps. Fiber provides much higher speeds from 250/250 to over 1,000/1,000 Mbps. Fiber optic networks offer what is known as a “symmetric” connection, which means that the download/upload rates are comparable in speed. Current industry recommendations are for at least 10 Mbps speeds per person to support teleworking or remote learning. In response to connection challenges during the pandemic, legislators and industry are asking the FCC to increase its broadband definition to a minimum of 100/100 Mbps speeds.

## How much internet speed do you need?

Typical Activity	Recommended Speeds
 Video Conferencing	1.8-8 Mbps
 Email or Chat*	1 Mbps
 Web Browsing	5 Mbps
 Stream Media	5-25 Mbps

*\*More bandwidth may be needed to share photos or videos in conversations, and when downloading larger assets (like images and attachments) from emails.*

To find out what internet speeds you need, check out online calculators like the BroadbandNow Bandwidth Calculator: <https://broadbandnow.com/bandwidth-calculator>



# How is Fiber used in Transportation?

Connectivity is the backbone of Transportation Agencies critical facility connectivity, Intelligent Transportation Systems (ITS) and the Internet of Things (IoT).

## Intelligent Transportation Systems (ITS)

A range of technologies to improve safety and mobility by enhancing communications and integration between travelers, vehicles, infrastructure, and transportation service providers.

## Internet of Things (IoT)

All of the physical devices that are connected to internet and sharing and collecting data, from vehicles to smart watches and fitness trackers and home appliances.

## Critical Facility Connectivity

The connectivity between the agencies' physical sites such as, motor vehicles, operations centers, highway buildings, and district locations.

Fast and reliable communications networks are necessary to support many of the desired transportation improvements and ITS applications identified in the Caltrans District 10 Integrated Corridor Management Plan (2019) and in the *SJCOG Congested Corridors Plan (2020)*.

Many ITS and advanced travel demand management applications target reducing traffic congestion, improving safety, and monitoring system performance, including:

- Variable speed limits
- Adaptive signal system
- Real-time traveler information systems
- Advanced incident management
- Integrated Corridor Management (ICM)
- Live Traffic Camera Streaming
- Emerging mobility options
- Transit signal priority
- Bus rapid transit.

Creating a robust fiber-optic network backbone with the transportation system will set the stage for additional high-speed communications and connections to homes, businesses, and community anchor institutions.

# Do Wireless Communications Need Fiber?

Fiber is the backbone of the next generation of wireless communications, including 5G. 5G networks provide greater speed and capacity than current 4G networks, but will rely on a dense network of new wireless transmitters called small cells, connected to each other and the internet via fiber-optic cables.

In the near term, many areas will not have access to 5G because 5G relies on fiber optic wired communications backbones that are not available in many areas. Other new wireless technologies such as low Earth orbit satellites at much lower altitudes than traditional satellites, including SpaceX's Starlink satellite network, could provide high speed connections to these harder to reach areas.

## What is the Role of Public Agencies in Expanding Fiber Optic Networks?

Fiber networks can be private, public, local agencies, or government. Private networks are built, maintained, and operated by private Internet Service Providers (ISPs).

Municipal fiber networks can support advanced transportation systems management, government services like school networks, emergency services, and public utility monitoring and management.

When designed and implemented properly, municipal networks generally provide an acceptable payback period that morphs into future cost savings. Municipal fiber networks can be viewed as an investment but not one easily assigned a return on investment (ROI) percentage. For more information on municipal fiber network investments, see **Appendix H**.

Expanding municipal fiber networks can also enable private ISPs to provide faster or cheaper internet service to residents and businesses.

SJCOG, local municipalities, or other regional players like the Business Council could establish a permanent fiber or broadband working group with local stakeholders and fiber champions. Each stakeholder group—municipalities, school districts, hospitals, higher education, public libraries, public safety, and others—should identify a fiber champion to participate in the working group and work within their organizations to build momentum for fiber expansion. Champions understand the benefits of fiber, have a clear understanding of the goals and vision, and make the long-term commitment to building out a fiber network.

The working group, supported by a set of diverse champions, increases stakeholder buy-in, aligns goals and objectives, and reduces the dependence on individual champions.

# 3 Best Practices & Policy Review

This section outlines the best practices for fiber optic network readiness and expansion. SJCOG and its member agencies can follow these best practices to expand the fiber optic network in San Joaquin County.



## Step 1: Assemble Stakeholders, Define Goals, Identify Champions

Expanding a regional fiber network starts with **bringing the right stakeholders to the table**. At the local municipality level, the primary individuals, groups, and organizations that should be considered for stakeholder involvement include:

- Community staples (schools, libraries, community center, public safety, etc.)
- Utility services (public works and electric utilities) and private Internet Service Providers (ISPs)
- Local government representatives (specifically members of developmental services and economic development)
- Any others expressing interest, passion, and support of fiber expansion (such as Technology Councils or members of the Business Council or Chamber of Commerce).

SJCOG could establish a permanent Working Group and continue to facilitate coordination and information sharing among local Fiber Champions and stakeholders after this Fiber Readiness Study project ends.

A critical element of the fiber expansion process is involving local governments, elected officials, and business leaders due to their decision-making influence.

## What is the Role of Local Agencies?

The best practices that local agencies can adopt to expand the fiber optic network are:



### Step 1: Assemble Stakeholders, Define Goals, Identify Champions



### Step 2: Assess Existing Inventory



### Step 3: Develop a Business Model



### Step 4: Review and Enact Fiber Practices

The stakeholder working group should **develop a clear and compelling message** to summarize the goals and objectives of fiber expansion to educate and inform decision makers about the benefits of system expansion.

The message will be carried into discussions with local governments, politicians, as well as the public to inspire support from local communities. Elected officials and decision makers should be informed of planned efforts to gain their support for the projects.

The most important tool for building a regional fiber network is to **identify a Fiber Champion(s)**. A fiber expansion champion is an individual (or group of individuals) who is well-networked throughout the local jurisdictions, passionate about implementing fiber expansion, and is motivated to push for the success of the project. For fiber expansion efforts across a larger area, **it is important for each local municipality and county to identify at least one champion to represent their efforts**. Fiber expansion is a long-term commitment and requires that all champions can initiate change and motivation on the long-term scale, while being up to date on all fiber technology innovations.

Potential working group members include a "Fiber Champion" for each city, the county, school districts, libraries, police, fire, hospitals, as well as Caltrans, private ISPs, and the San Joaquin Business Council. A fiber champion could be a role for SJCOG or other regional players like the Business Council.

We coordinated with AT&T and Comcast staff during the development of this Fiber Readiness Study.

Without dedicated funding at SJCOG to maintain a working group, SJCOG could consider this activity for new state and federal funding opportunities in the near term.



## Step 2: Assess Existing Inventory

Expanding the fiber networks depends on an internet service provider or a community's ability to install fiber-optic cables. This installation process typically takes place in one of two ways:

- Cables are hung from existing utility poles (above ground), or
- Cables are buried in conduit underground.

Both installation options require that the fiber-optic cables are installed in public right-of-way, regardless of who owns or operates them. **To install, expand, and maintain fiber networks, municipalities need to know where existing infrastructure is located.**

An existing inventory assessment accumulates data identifying existing fiber optic lines, utility poles, manholes, handholes, splice locations, underground utilities, and any infrastructure that could provide additional installation and connection opportunities (such as poles, conduit, and splice enclosures). The data should specify ownership of any existing infrastructure.

By collecting this data, municipalities can identify:

- Where existing fiber optic lines are located to avoid unnecessary duplication.
- Where fiber optic lines are needed to connect community anchor institutions.
- How fiber optic lines should be efficiently installed in specific locations (e.g., above ground on existing utility poles or underground in existing conduit).
- Where fiber optic lines can be accessed as tie-in locations for future expansion.

By comparing the locations of existing fiber and locations of community anchor institutions, municipalities can identify gaps between existing fiber lines along key corridors and to key municipal buildings to prioritize their expansion plans.

Once assembled, the existing inventory assessment is a valuable resource to fiber expansion by informing future planning along primary corridors.

Municipalities need up-to-date network maps to maintain their network and to be a resource to locate their utility prior to others' construction in proximity to the municipalities fiber optic cable (like mapping gas, water, or electric utilities).

This project mapped existing municipal fiber pathways into one complete view (see **Section 4: Existing Fiber Networks**). It is important to keep this single-view map updated real-time and maintained with accurate information as the municipalities or county expands these fiber and conduit networks. **SJCOG (or any city committed to building a municipal fiber network) could consider procuring a fiber asset management software platform.** Alternatively, SJCOG could simply maintain and update existing GIS maps, but a software platform better serves the overall network management need.

**SJCOG** could use this tool to maintain a single view of where public agencies own their own fiber or conduit throughout San Joaquin County.

When expansion is needed, SJCOG will know who to contact to learn if fiber or conduit is available to be shared amongst its public partners. The fiber asset software platform could also be used for the operations and maintenance of the fiber system. This will help with fiber locates during construction projects.

**Lathrop** is considering a fiber asset management platform for their municipal fiber network. There may be opportunities to coordinate efforts among jurisdiction to jointly fund the effort through SJCOG or through Lathrop with a memorandum of agreement. SJCOG could also consider this asset management activity for new state and federal funding opportunities in the near term.

Initially, the fiber networks will connect key infrastructure (such as traffic signals or cell towers) and key institutions (like traffic management centers, schools, or government buildings). As the region develops a strategy to build out fiber networks, the agencies should consider implementing fiber ring designs, a fiber network best practice. **Fiber rings** create redundancy and diversity in a larger fiber network by creating a continuous path that provides two paths from each location and diverse ISP connections providing additional security for municipal operations. A network of fiber rings, rather than a hub-and-spoke network layout, provides a more resilient system in the event of a damaged or broken line or Internet outage. To maximize fiber network efficiency, it is recommended that once fiber segments are installed along priority roadways, they are connected to each other to create rings.



## Step 3: Develop a Business Model

There are significant costs when deploying a fiber network, so local governments should understand what investments are needed and what deployment models are possible to achieve the benefits of a successful fiber network expansion.

There are several business-model approaches to building a fiber network.

Depending on a municipality's unique needs, community goals, existing infrastructure, and level of public capacity and investment, municipalities should select a business model approach (or a blend of several approaches) that fit the local context.

Following are some common approaches and examples to expanding a municipal fiber network. More information is available in the Community Network's *Muni Models Factsheet* and the City of Lodi's *Broadband Feasibility Study*.

## How can a Municipality Expand Middle-Mile Fiber?



### Do Nothing

City relies on leasing lines from private internet service providers (ISPs)

### Most common approaches in county



### City Leases Services to ISP

City leases public infrastructure such as poles, conduit, or dark fiber to ISPs



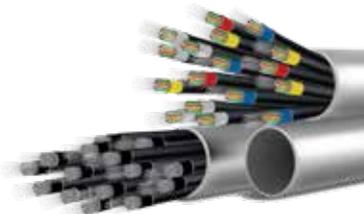
### City Partners with ISP

City establishes a public-private partnership with ISP to operate the network, while the city provides physical infrastructure



### City Provides Services

City owns, operates, and maintains the network, including providing direct service to customers



## Do Nothing

A city may choose not to pursue a municipal fiber network and continue to lease lines from private internet service providers (ISPs). In this model, cities continue to rely on ISPs and may be bound to costly technology updates of private providers. The city likely has limited control over city network costs and any future expansion or upgrades.

## City Leases Infrastructure

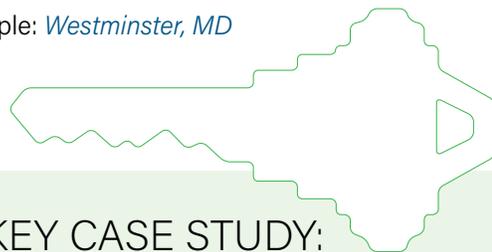
In this model, a city may lay empty conduit or dark fiber (fiber cables within conduit that are not yet connected or "lit"), then lease the excess infrastructure to private ISPs to connect and provide service to customers. Municipalities will likely need to change and update local permitting processes to streamline the lease of public infrastructure such as poles and conduit to internet service providers.

Example: [Winter Haven, FL](#)

## City Partners with Internet Service Provider

Partnership models balance risk and reward between the public and private partners. The city may establish a public-private partnership (PPP) to work with an internet service provider. The specific roles for each entity can be negotiated in the PPP agreement, such as the city provides the physical infrastructure, while the provide provider is responsible for activating the network and serving customers.

Example: [Westminster, MD](#)



## KEY CASE STUDY:

### WESTMINSTER/TING PUBLIC-PRIVATE PARTNERSHIP

The Westminster Fiber Network is the Mid-Atlantic's first community-wide gigabit fiber network, creating a competitive local marketplace for Internet services and providing community access to affordable gigabit Internet speeds. The City of Westminster constructs, owns, and maintains the dark fiber network. Under a lease agreement, a private partner (Ting Internet) installs equipment, lights the network, and provides service to customers.

Westminster's [Preliminary Feasibility Study and Request for Information \(RFI\) from 2013](#) enabled the City to identify one or more private partners who will provide network services to end-users within the City limits using City-built fiber infrastructure as part of the city's business plan.

Westminster's approach to public-private partnership is detailed in [Successful Strategies for Broadband Public-Private Partnerships](#) and example Request for Proposal (RFP) language for the PPP can be found on the [City of Government website](#).

Like some San Joaquin County municipalities, Carroll County, MD had initial discussions with private ISPs who wanted to charge the School System to build out their private fiber network. The public funding basically would have financed their build-out, which the private ISP could use for other things. The one-year lease cost to use the new private service would have been more than the cost to build the original Carroll County Public Network.

## City Provides Services

In this model, the city is the primary internet service provider. The local government is fully responsible for providing service to residents including all operations, maintenance, and customer service requests. Most cities that have followed this approach had a previously established, publicly owned electric distribution utility.

Examples: [Chattanooga, TN](#), [Wilson, NC](#), [Lafayette, LA](#)

## Combined Business Models

Municipalities might select a combination of these business models.

Example: The [Carroll County Public Network \(CCPN\)](#) in Maryland is an example of leasing, but the City of Westminster (which utilizes the CCPN) has a public-private partnership.

In many leasing or public-private partnership cases, the public entity provides its own connectivity to community anchor institutions (CAIs) while at the same time it can charge for the leasing of fiber and/or conduit. The financial savings of providing connectivity to CAIs (cost savings) as well as revenue generation creates a win-win scenario for municipalities. In many cases, the return on investment for construction can be achieved simply by the cost savings related to leased circuits for the CAIs. Using the return on investment for these functions makes any additional uses added benefits that are enabled by the initial investment for CAI connectivity.

**Appendix B** provides more details and lessons learned from Westminster, MD and Winter Haven, FL.



## Step 4: Review and Enact Fiber Practices

Local and regional government officials and policy leaders can develop policies that promote fiber optic network expansion and capital investments while aligning with local planning and development goals. Some municipalities have found success by changing their planning, development, and construction practices without having to change their municipal policies. Listed below are policies and practices to enable fiber expansion.

**Dig Once/ Dig Smart.** These policies require conduit installation during local construction projects, such as repairing pipes or building roads. Burying ready-made conduits enables the city or future providers to install fiber more easily and cheaply by threading it through existing conduits. The amount of conduit and fiber should be right sized to each individual community’s needs and expected growth. As defined by FHWA:

- “*Dig Once*” means requirements designed to reduce the number and scale of repeated excavations for the installation and maintenance of broadband utilities in highway ROW.
- “Joint Use” means mandating that public and private broadband infrastructure owners install at the same time, in the same trench, or in the same conduit(s). It may also mean the first utility in places extra conduits, and subsequent utilities must negotiate with that utility to occupy one or more of the empty conduits. Public-private partnerships also coordinate the joint use of conduit or trench access.

**Collaborate, Coordinate, and Partner.** These policies promote regional municipal cooperation and coordination and facilitate regional partnerships.

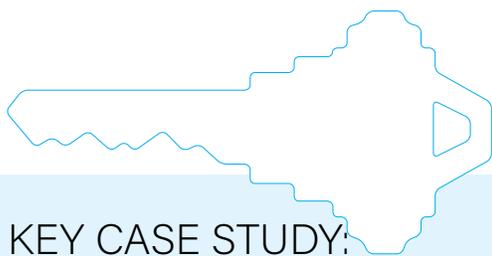
These practices may include:

- Establishing coordination processes within a city during the construction process to allow the city to take advantage of other projects for the installation of fiber. Coordination across city agencies or departments can maximize the amount of conduit installed as part of Dig Once/Dig Smart.
- Organizing, educating, and training staff on new fiber-enabling practices, such as tracking fiber assets, or construction and maintenance procedures.

**Integrate into Existing Plans and Planning Processes.** Policies that declare broadband as essential infrastructure or as a utility promote the importance of accessible connectivity for all. Any infrastructure or utility, including fiber, should be considered in any roadway design, cost estimate, or construction project. Integrating these practices into operating procedures, into transportation plans, and into the regional *Transportation Improvement Plan* (TIP) and *Statewide Transportation Improvement Projects* (STIP) can improve the effectiveness and coordination needed for fiber expansion.

Regardless of the business model, cities can expand the municipal fiber network by:

- **Re-investing revenue** to maintain and expand the infrastructure.
- **Maximizing conduit installation** for more opportunity to lease or trade for revenue (ex: lay two 2” conduits on local roads; multiple 4” conduits on major roads).



## KEY CASE STUDY: WINTER HAVEN, FL DIG ONCE POLICY

Winter Haven, Florida is home to a number of innovative software and information technology companies. At the heart of the City's technology infrastructure are the Inland Fiber and Data Park and the City of Winter Haven Broadband Initiative.

The Inland Fiber and Data Park consists of two downtown properties that are the hub for regional broadband connectivity. The data park hosts numerous broadband providers, a secure data center, and numerous technology and software-related companies.

Winter Haven implemented a *"dig once" broadband initiative* in 2004, where the City, in conjunction with other infrastructure projects, installs conduit and fiber whenever feasible. Now there is approximately 20 miles of City-owned fiber primarily in the city core that is available for lease to telecommunication service providers. Five percent of the lease revenue, along with a 5-percent-match from the provider, goes to a Science, Technology, Engineering, and Math (STEM) innovation fund, designed to encourage students to create business ideas.

Using City-owned fiber leased by a private provider, the City of Winter Haven Public Library was the *first gigabit library in the State of Florida*.

Winter Haven's *Local Funding Initiative Request* is available for reference.



## KEY CASE STUDY: SAN JOSE 5G & DIGITAL INCLUSION

The City of San Jose has successfully deployed 5G while also working to close the Digital Divide. Key aspects of San Jose's program include:

- Public-Private Partnership to deploy 5G small cells on city property
- *San Jose Digital Inclusion Partnership* (funded through an impact fee paid by private ISPs) provides broadband service, devices, and digital literacy to low-income youth and other vulnerable populations.
- Clear & Specific Guidelines to streamline the permitting review and approval process, along with design standards for implementation.
- Quick Notification Process requires a public notice period with on-site resources and additional notification to residents prior to construction.

# Local Plans and Policies

Permit process changes or collaboration are the authority and responsibility of the municipalities. The project team interviewed county and city staff to identify areas for improved efficiency, speed, or predictability in their permitting processes. This section summarizes policy, permitting, or process changes that could help local agencies expand the municipal fiber networks or collaborate with ISPs to accelerate the expansion of fiber across the county.

**Lathrop** includes fiber conduit funded by grants or Lathrop Transportation Development Act (TDA) funds in all road projects. The city targets installing four 2" conduits when they do roadway or utility construction. They typically use the same trench as their water lines. The city uses general funds to install conduit in places where someone else is doing work. For example, Lathrop requires developers to install fiber conduit whenever the need to build sewer to a new site. The city buys additional conduit to install during that construction. Lathrop has their own department to do their fiber locates. ISPs have not raised any specific process improvements or ordinance issues to Lathrop city staff.

**Lodi** has their own electric utility department (Lodi Electric Utility), which operates the city's existing 20 miles of fiber. They are currently focusing on upgrading their existing fiber network, and then focusing on opportunities like connecting their utility meters with fiber to enable automated meter reading and using fiber as an economic development tool. The city views fiber expansion as a key tool to future proof their system to provide government services, public safety, and business development. Lodi has a policy that imposes a fee to private ISPs or utility departments if they dig into a road that was resurfaced within 5 years. The funds from that fee go into a street fund, which might be able to fund additional fiber expansion.

**Manteca** is working to expand fiber through city ordinances. In 2019, the city passed an ordinance to establish an *Open Trench/Joint Trench Fiber Standard*. Now the city is working to pass an ordinance requiring new commercial or industrial construction to be fiber-to-the-node ready. Manteca also passed a resolution to use all telecommunication, conduit, and pole attachment lead fees for an Innovation Fund to maintain the city's growing conduit infrastructure.

**Stockton** has finalized the ITS Master Plan and is developing Citywide Fiber Optic Master Plan to guide its development of policies, planning, and outreach. The majority of Stockton's city-owned fiber is used for traffic signal interconnects. They lease the missing segments from AT&T. The city's fiber roadmap will focus on first connecting city buildings and traffic infrastructure, then connecting ancillary services like middle-mile ISP fiber to underserved communities and Smart City initiatives (like air quality sensors and parking monitoring). In 2021, Stockton issued a Dig Once ordinance and an updated Standard Specifications and Plans for road projects. These policies require public works to notify utilities of road projects planned by the city each year and to install larger or extra conduits to reduce future excavations. The city could establish a working group or formal communication process to make sure the Dig Once practice is working and to coordinate expansion based on the broadband master plan's vision.

**Tracy** has a Transportation Master Plan which identifies corridors to expand fiber to interconnect traffic signals with their traffic management center in the future. Tracy's city council approved a Dig Once concept in April 2017. The city staff meet regularly across departments, so they can share information about new projects or planned construction. Tracy identified the need to develop a process to review proposals and expedite approvals for private ISPs to lay conduit or attach to poles. Private ISPs identified a process improvement opportunity for Tracy: to create a straight-forward permitting process for fiber (like a building permit process) and to identify a point of contact at the city that ISPs should work with.

**Local agencies that do not yet have a Dig Once policy should consider developing one.** In December 2021, the Federal Highway Administration published a *new rule* requiring State departments of transportation to identify broadband utility coordinators and establish a process to coordinate telecommunications and broadband planning with transportation and land use planning to develop strategies that minimize repeated excavations and inefficiencies during roadway construction.

# 4 Existing Fiber Networks

Expanding and maintaining a municipal fiber network requires knowledge of where existing fiber assets are located, including conduit, fiber lines, and fiber optic splice enclosures. An updated map outlining these existing municipal fiber networks and network tie-in components facilitates coordination among Caltrans, SJCOG, San Joaquin County, the local municipalities, and neighboring jurisdictions. The single-view map serves as a central source of information.

Creating and maintaining a single-view map of municipal fiber networks throughout San Joaquin County supports partnerships and coordination between public agencies, government institutions, and private ISPs. These partnerships and coordination can include sharing resources or building off each other's networks through processes such as sharing conduit and terminals.

The map's detailed information would also assist in identifying and prioritizing gaps in the fiber network, allowing for detailed project plans to include installation of fiber assets, and the opportunity if desired to coordinate with public partners and private ISPs to expand the reach of fiber locally.

## Existing Municipal Fiber

Lathrop, Lodi, Manteca, Stockton, and Tracy provided maps of their existing municipal fiber pathways. For security purposes existing fiber data provided by the municipalities is not shown in the maps in this report. Caltrans-owned fiber pathways were determined from the 2019 Caltrans District 10 *Integrated Corridor Management Plan*.

All cities with existing municipal fiber reported having some gaps in their networks, so they rely on private ISP service or equipment to complete

their networks. Most cities have initially focused on using fiber to connect their traffic signals and traffic management centers, if applicable.

Lodi completed a Fiber Master Plan in 2020. Lodi has 20 miles of existing municipal fiber. However, this network is outdated, so the city's planned initial phase of work is to update the existing network before expanding. Manteca and Stockton are planning to complete fiber master plans.

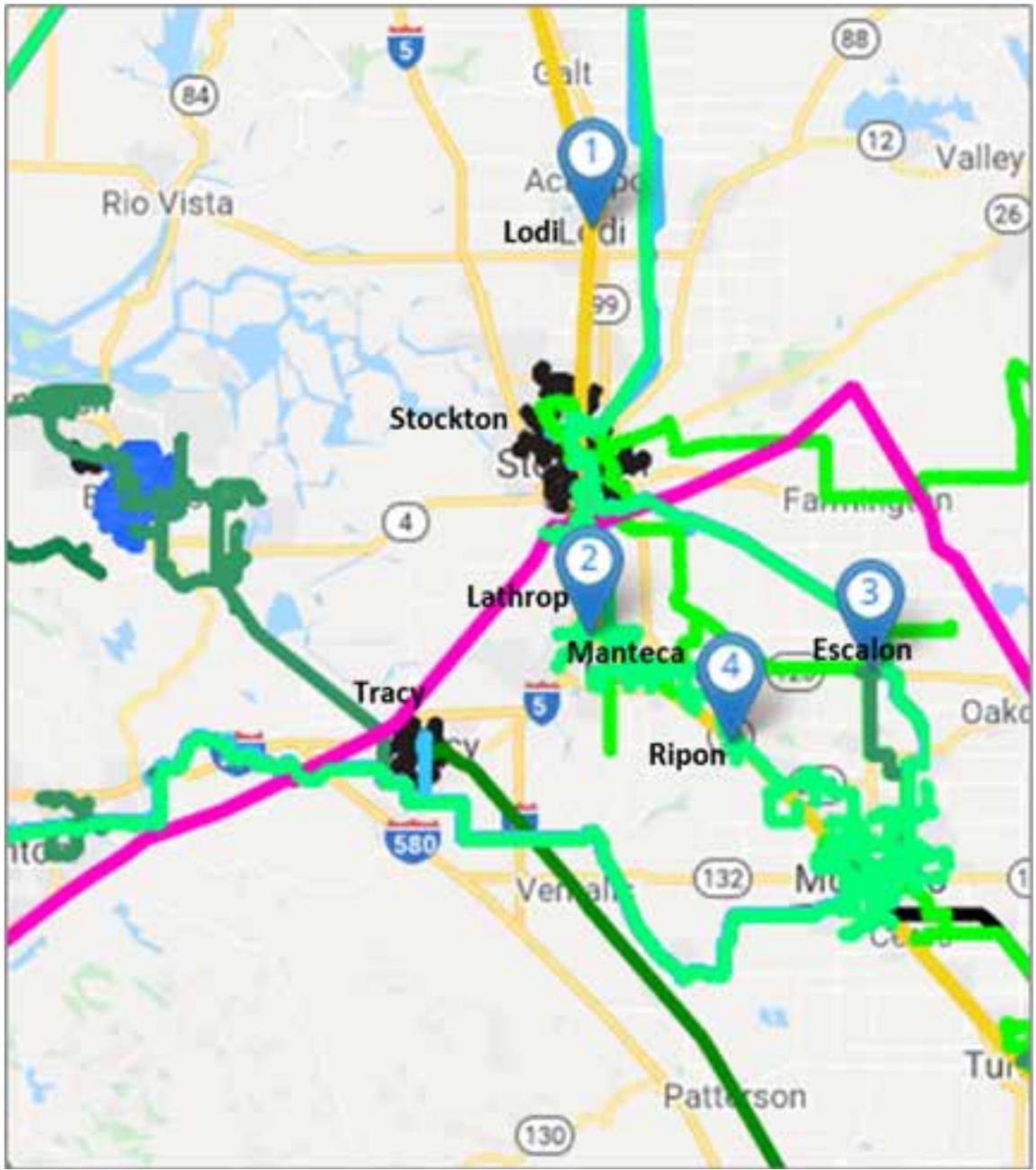
**Appendix C** provides the data request form shared with the agencies.

## Existing Private ISP Fiber

**Figure 3** shows existing private fiber pathways as voluntarily reported by private ISPs to the *FiberLocator* national database. **Appendix D** provides more detailed FiberLocator maps for each city.

The FiberLocator maps show ownership of fiber routes, not necessarily availability of service.

The maps are incomplete as none of the largest ISPs are reporting their information in the area, including AT&T, Comcast, Frontier, and Verizon. Additionally, the voluntarily self-reported data could be outdated. We coordinated with AT&T and Comcast for this study but could not obtain their proprietary fiber pathway data.



**FiberLocator**  
 San Joaquin County

- 1 Lodi, CA, USA
- 2 Lathrop, CA, USA
- 3 Escalon, CA 95320, USA
- 4 Ripon, CA 95366, USA

- Metro Networks**
- ✓ Crown Castle
  - ✓ Hibernia
  - ✓ Integra
  - ✓ Level 3 (TWT)

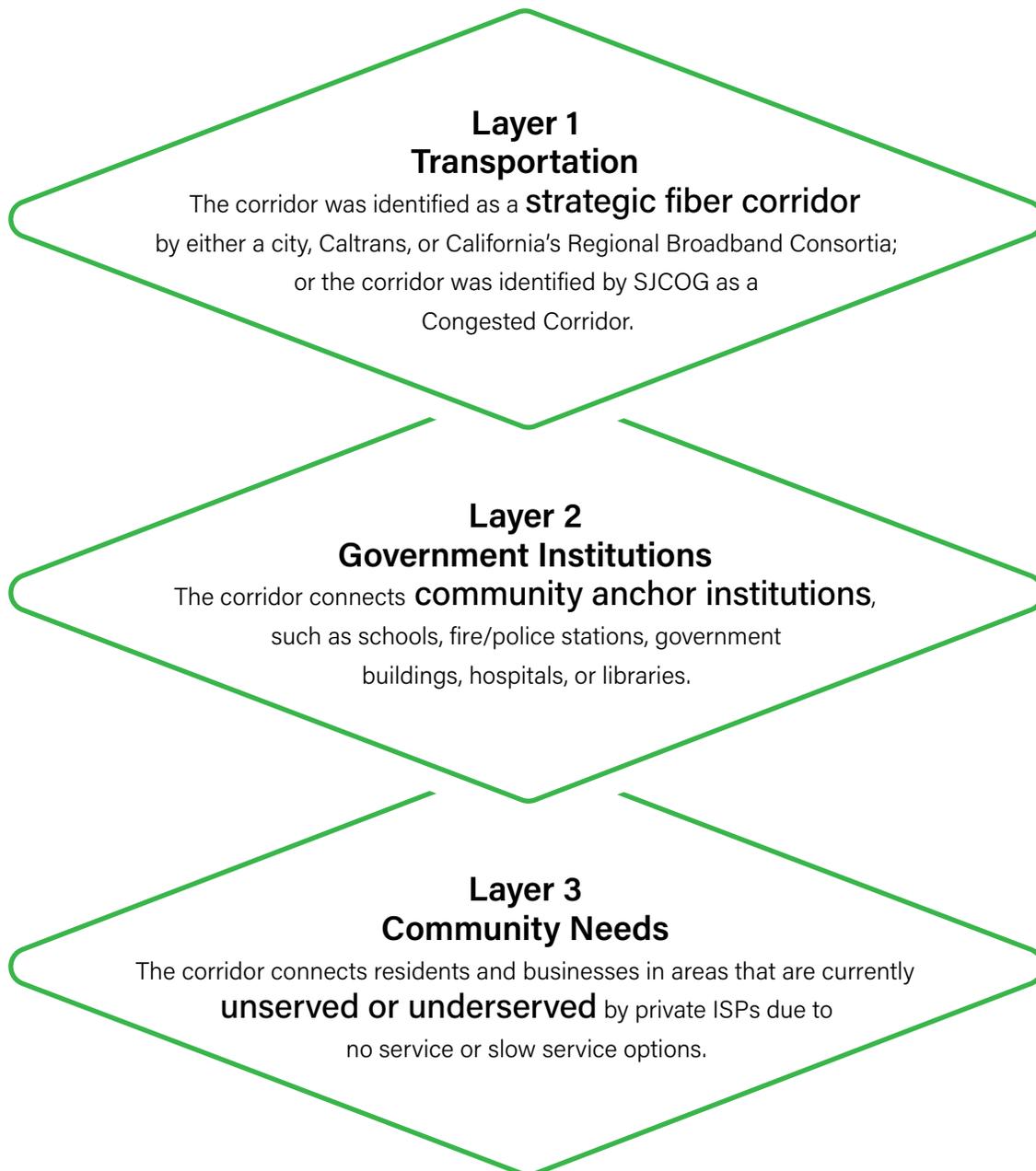
- ✓ Level3 Metro
- ✓ Rail America (ROW)
- ✓ TPx Communications
- ✓ Vast Networks
- ✓ Wave Business
- ✓ Windstream
- ✓ Zayo Metro

**Figure 3.** Private ISP Fiber Pathways in San Joaquin County from FiberLocator

# 5 Gaps Assessment

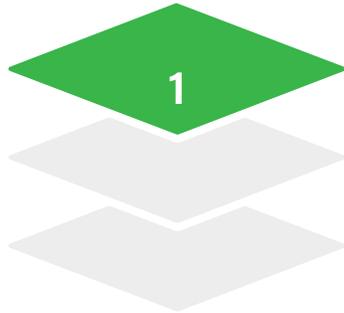
SJCOG can play an important role to expand fiber in the county by facilitating coordination between agencies and private industry, and by identifying high-impact gaps where fiber expansion could be prioritized.

The gap assessment was based on three layers.



# Gap Prioritization Methodology

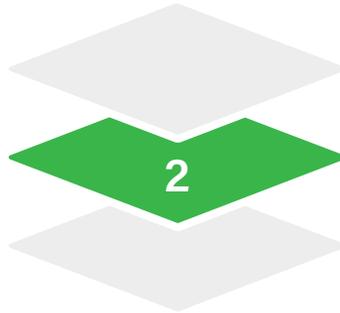
## Transportation



### Rank based on:

- SJCOG Congested Corridors
- State Strategic Broadband Corridors
- Planned Transportation Projects

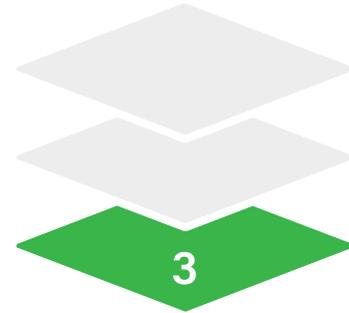
## Government Institutions



### Rank based on:

- Opportunities to connect Community Anchor Institutions (through supplemental last-mile connections)

## Community Needs



### Consider:

- Areas un-/under-served by current broadband service
- Areas of planned growth
- New tech-oriented business parks

# Layer 1: Transportation

Strategic locations for fiber optic or Broadband expansion within San Joaquin County were identified in the Caltrans District 10 *Integrated Corridor Management Plan* (2019) and California's Regional Broadband Consortia *Strategic Broadband Corridors Report* (2019).

Additionally, SJCOG identifies **Congested Corridors**, which might benefit from fiber-supported intelligent transportation systems for congestion management. The City of Tracy identified future fiber corridors to connect some of their traffic signals.

**Figure 4** shows the existing state fiber, as well as the proposed fiber or Broadband corridors.

In 2017, the California Internet for All Now Act (AB 1665) established the goal of achieving 98% broadband deployment in each region of California. California's Regional Broadband Consortia identified Strategic Broadband Corridors to deploy broadband with transportation projects throughout the state in the *2019 Strategic Broadband Corridors Report*. This report designated priority areas for the 'middle-mile' network that would allow for internet service providers to leverage and connect with community anchor institutions.

The proposed **Strategic Broadband Corridors** in San Joaquin County identified by the California Regional Broadband Consortia are:

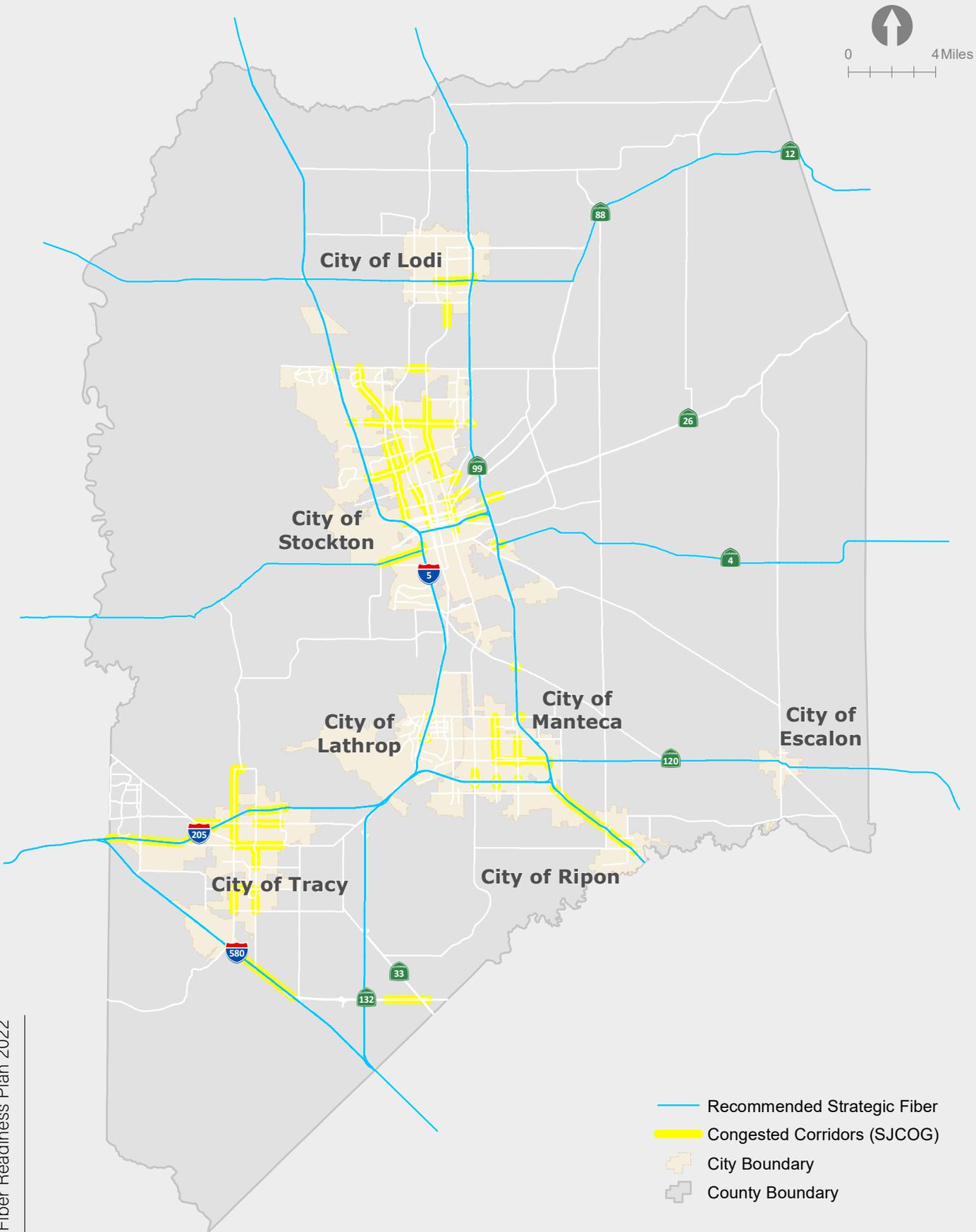
- CA-99 from the northern border of San Joaquin County to I-5 in Kern County (*San Joaquin Valley Regional Broadband Consortium (SJVRC) Priority #4*)
- I-5 from the northern border of San Joaquin County to the southern border in Kern County (*SJVRC Priority #5*)
- I-205 from I-580 to I-5 (*SJVRC Priority #6*)
- CA-120 from I-5 east through Manteca to Yosemite Village to CA-140 and CA-41 (*SJVRC Priority #7*)
- CA-12 from I-80 Fairfield to CA-49 Jackson (through Lodi) (*SJVRC Priority #8*)
- CA-12 entire Solano County from west border through Fairfield and Rio Vista to Lodi (*East Bay Broadband Consortium (EBBC) Priority #1*)
- CA-4 from Oakley to CA-49 Angels Camp (through Stockton) (*SJVRC Priority #9*)
- CA-4 entire Contra Costa County from I-80 through many under/unserved communities to Stockton (*EBBC Priority #2*)
- I-580 from Oakland to I-5 (*EBBC Priority #6*)

None of these state Recommended Strategic Broadband Corridors have existing municipal fiber in San Joaquin County.

## Layer 1 Key Findings

- The State's Recommended Strategic Broadband Corridors create opportunity to stage development of county-wide fiber networks.
- Congested corridors, fiber-connected intelligent transportation systems, and traffic signals would benefit from fiber expansion.

**Figure 4.** Existing, Proposed, and Recommended Strategic Fiber Corridors



- Recommended Strategic Fiber
- Congested Corridors (SJCOG)
- City Boundary
- County Boundary

## Layer 2: Government Institutions

**Community anchor institutions** are usually the priority connections for municipal networks. These community anchor institutions include schools, fire/police stations, government buildings, hospitals, and libraries across the county.

**Figure 5** provides the county-level view of the community anchor institutions in relation to the proposed or strategic fiber corridors from Gap 1.

These maps show some gaps where community anchor institutions are not being connected by the proposed strategic fiber corridors.

For this study, we considered traditional community anchor institutions--schools, colleges/universities, libraries, fire/police, hospitals, and government buildings (such as city halls, courthouses, and administrative offices).

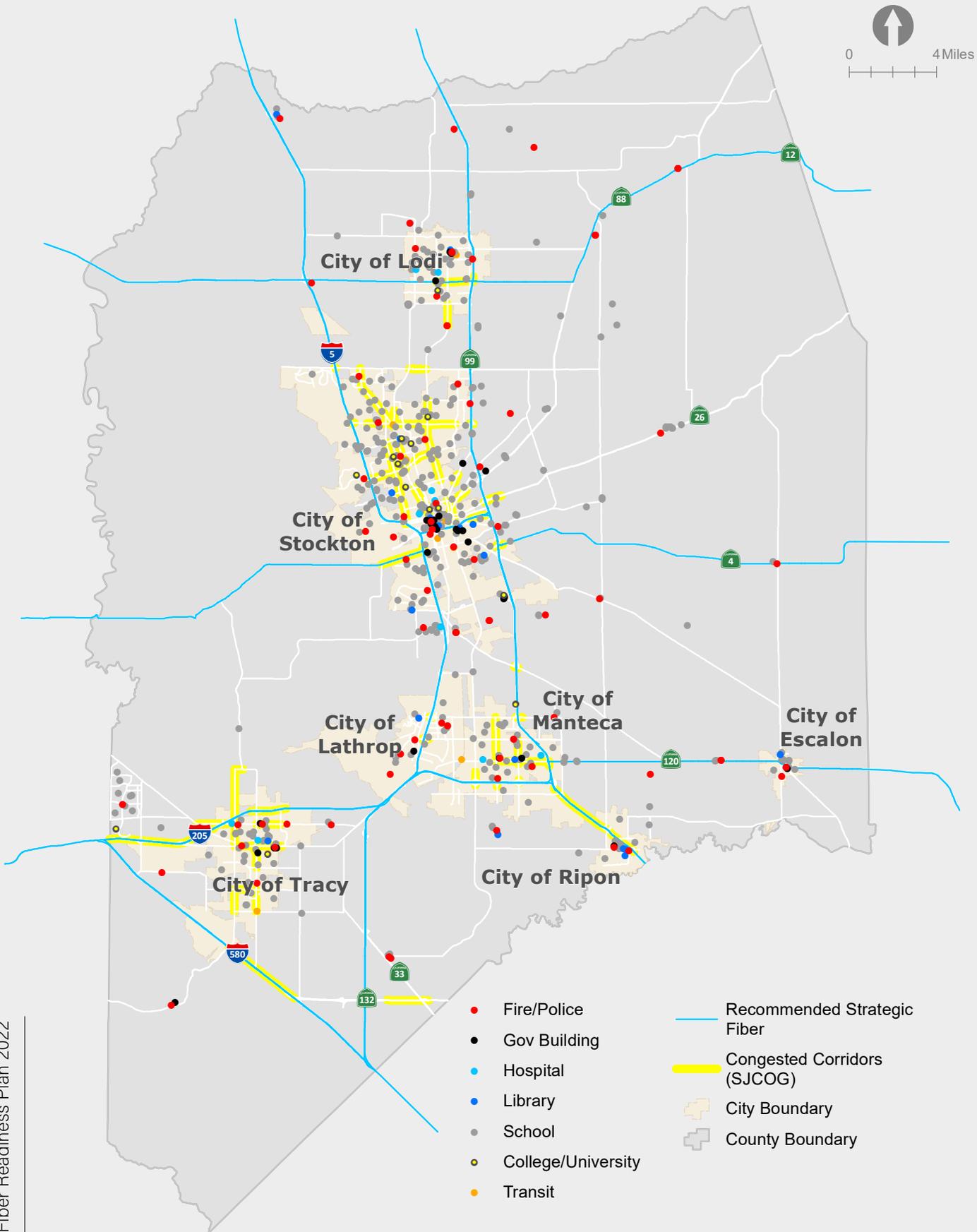
Additional types of government buildings that could be considered in local fiber feasibility studies as municipalities determine their business plan.

A role of the recommended Fiber Working Group will be to determine which community anchor institutions make sense to connect.

## Layer 2 Key Findings

- Connecting community anchor institutions (CAIs) to fiber assets owned by the public entity and building out the middle mile and last mile provides technology and cost saving opportunities for municipalities.
- The state's proposed strategic broadband corridors do not connect many CAIs in San Joaquin County to a municipally owned fiber network.
- The greatest opportunities for municipal network growth and cost savings comes when all CAI groups are actively involved in developing and using the network.

**Figure 5.** Existing and Planned Fiber Pathways with Community Anchor Institutions



- Executive Summary 1
- Introduction 2
- Best Practices & Policy Review 3
- Existing Fiber Networks 4
- Gaps Assessment 5
- High-Impact Gaps Assessment 6
- Funding Opportunities 7
- Recommendations & Next Steps 8
- Appendices 9

# Layer 3: Community Needs

The presence of private ISP fiber optics does not guarantee high-speed internet access is available for residents or businesses. Local stakeholders, including the project working group members and municipal staff, expressed a desire to eventually expand fiber connections to underserved residential and business communities.

By building out a municipal network, cities can lay a middle mile backbone to bring fiber closer to unserved and underserved communities. Similarly, laying empty conduit during any roadwork project reduces the cost of running fiber later. These efforts make it easier and cheaper for cities or private ISPs to complete last mile connections in the future.

**Figure 6** shows the existing Caltrans fiber, planned Caltrans fiber, CAIs, and the **maximum advertised internet speeds** in San Joaquin County. These maximum advertised internet speeds are provided by the California Public Utilities Commission's *Interactive Broadband Map*. While this map shows the highest advertised speed, not all residents or businesses can afford or choose to purchase internet at these top speeds. Additionally, providers may reduce speeds during periods of high use.

The FCC defines broadband as 25 megabits per second (Mbps) for download and 3 Mbps for upload. Current industry recommendations are for at least 10 Mbps speeds per person to support teleworking or remote learning. In response to connection challenges during the pandemic, legislatures and industry are asking the FCC to increase its broadband definition to a minimum of **100 Mbps speeds for download and upload** (a big difference from the current 25/3 speeds).

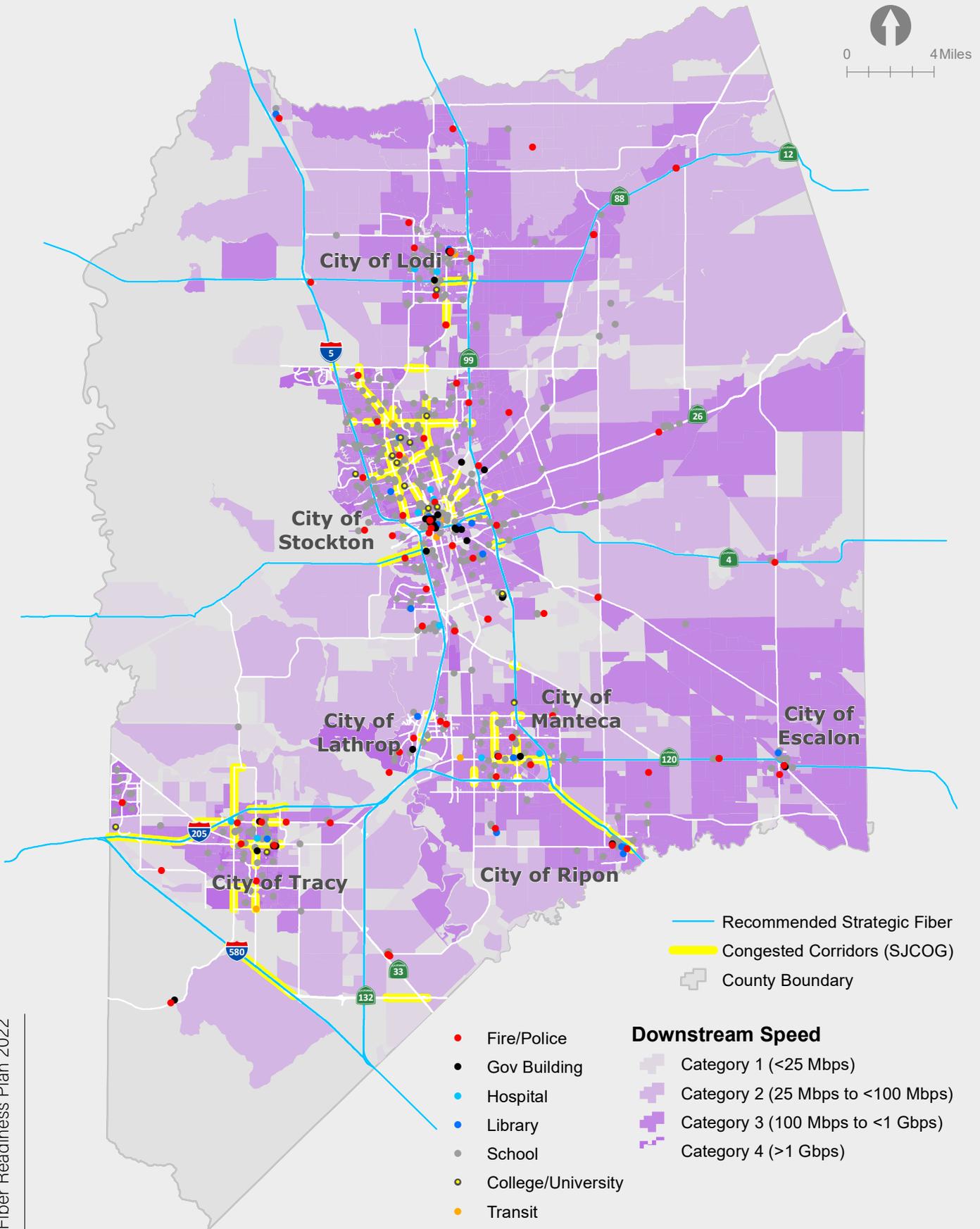
Lathrop and Manteca identified gaps in their fiber networks related to planned future developments or city annexations. Lathrop does not have any municipal fiber north of Lathrop Road. They see a need in expanding fiber along east-west crossroads and to their warehouse or industrial areas. Manteca identified gaps in the private ISP coverage in the city, where some ISPs offer business connections but do not offer residential services. Manteca also identified future fiber needs in areas where the city plans to expand, such as south of CA-120 or north of Lathrop Road and Roth Road to French Camp Road.

The County's public works department identified the opportunity for middle-mile fiber to connect disparate utility districts in remote locations where they are currently using lower bandwidth cellular connections that can be less reliable. Additional opportunities include traffic signal interconnect, connecting solid waste facilities, advanced meter reading infrastructure, flow control (by connecting rainfall and water level meters), and earthquake detection.

## Layer 3 Key Findings

- Building out a municipal network can lay a middle mile backbone to bring fiber closer to unserved and underserved communities that can begin to address service and affordability inequities.
- Connecting key transportation corridors and community anchor institutions can bring significant cost savings to municipalities, making future connections easier for homes and businesses and more cost effective for municipal governments.
- Some areas of the county are underserved by existing private ISP networks, because it is not cost-effective for ISPs to build to remote areas. Expanding the middle-mile fiber network will help reduce costs for ISPs to service these areas.

**Figure 6.** Existing, Planned, and Strategic Fiber Pathways with Maximum Advertised Internet Speeds



# 6

# High-Impact Gaps Assessment

The gap assessment methodology identified high-impact locations. These locations could be connected by middle-mile fiber networks to support key ITS advancements and make it easier to connect community anchor institutions and future underserved communities.

The gap assessment was based on two layers of criteria:

- **Layer 1:** The corridor was identified as a strategic fiber corridor by either a city, Caltrans, or California’s Regional Broadband Consortia; or the corridor was identified by SJCOG as a **congested corridor**.
- **Layer 2:** The corridor connects **community anchor institutions** (schools, fire/police stations, government buildings, hospitals, or libraries).

Municipalities have the flexibility to add additional layers of consideration and scoring to align with their respective local goals. These could include, but are not limited to, economic development, connections to underserved communities, high bandwidth user locations, connections to major employment or industrial and technology centers, higher population densities, specific Communities of Concern, or environmental concerns.

## Prioritizing Gaps

The prioritization methodology focused on bridging gaps in fiber infrastructure by identifying variables that the municipalities could concentrate on. These variables include:

- Roadway status as a congested corridor (as defined by SJCOG),
- Functional classification of the corridor (as defined by FHWA Road Function Classifications),
- Existence of planned or proposed roadway improvements, and
- Roadway proximity to community anchor institutions.

For consistency throughout the application of this methodology, the variables were organized into two layers.

- Layer 1 focused on transportation variables.
- Layer 2 focused on accommodating community anchor institutions.

These variables were confirmed with each city during their individual interviews.

Municipalities can use this methodology to score potential pathways based on their local prioritization goals. In addition to transportation (layer 1) and community anchor institution (layer 2) connection needs, municipalities could add a third layer to score community connections that align with their respective local goals. This can happen after the municipality determines their business model for municipal fiber networks.

# Layer 1: Transportation

Layer 1 focuses on identifying and prioritizing a roadway based on:

- Its status as a Congested Corridor,
- Functional classification,
- Ownership, and
- Whether it is currently a planned fiber pathway.

For the planned fiber pathways, the prioritization included proposed fiber corridors identified in the Caltrans District 10 *Integrated Corridor Management Plan* (2019) and recommended strategic fiber corridors identified in California’s Regional Broadband Consortia *Strategic Broadband Corridors Report* (2019).

**Table 1** outlines the prioritization methodology and scoring system for layer one: transportation.

**Table 1.** Layer 1 - Transportation Prioritization Methodology

Variable	Score
Is the corridor a congested corridor (as previously defined by SJCOG)?	<b>0 Points:</b> Not a congested segment <b>1 Point:</b> Connects two congested segments <b>2 Points:</b> Congested segment
What is the functional classification of the corridor?	<b>1 Point:</b> Collector <b>2 Points:</b> Arterial
Who owns and maintains the roadway?	<b>0 Points:</b> State <b>1 Point:</b> County <b>2 Points:</b> City
Is the corridor a planned fiber pathway?	<b>0 Points:</b> Unplanned <b>1 Point:</b> State Planned <b>2 Points:</b> City Planned

# Layer 2: Community Anchor Institutions

Layer 2 focuses on providing considerations for connecting traditional community anchor institutions (CAIs):

- schools (including colleges and universities),
- fire/police stations,
- government buildings,
- hospitals, or
- libraries.

awarded regardless of how many of that anchor type were within the 1,000-foot buffer. For example, a roadway segment near three schools and two fire stations would receive one point for connecting schools and one point for connecting fire stations.

Future utilizations of this methodology could choose to award multiple points for multiple connections, or to weight some connections more than others, given local community priorities. **Table 2** outlines the prioritization methodology and scoring system for Layer 2.

Community anchor institution connections were identified by assuming possible connectivity within a 1,000-foot buffer on either side of the roadway. For each community anchor institution type, only one point was

**Table 2.** Layer 2 - Community Anchor Institutions Prioritization Methodology

Variable	Score
Does a ROW fiber connection provide opportunity for school connection?	<b>0 Points:</b> No School(s) <b>1 Point:</b> One or more connections
Does a ROW fiber connection provide opportunity for fire/police connection?	<b>0 Points:</b> No Fire/Police Stations <b>1 Point:</b> One or more connections
Does a ROW fiber connection provide opportunity for hospital connection?	<b>0 Points:</b> No Hospitals <b>1 Point:</b> One or more connections
Does a ROW fiber connection provide opportunity for government building connection?	<b>0 Points:</b> No Government Buildings <b>1 Point:</b> One or more connections
Does a ROW fiber connection provide opportunity for library connection?	<b>0 Points:</b> No Libraries <b>1 Point:</b> One or more connections
Does a ROW fiber connection provide opportunity for transit hub connection?	<b>0 Points:</b> No Transit Hubs <b>1 Point:</b> One or more connections

## Layer 3: Population, Equity, Other Considerations

In addition to transportation (layer 1) and community anchor institution (layer 2) connection needs, the county and cities have the flexibility to add additional layers of consideration and scoring to align with their respective local goals. These could include, but are not limited to:

- high bandwidth sites,
- distance to existing fiber (shorter distances would received more points),
- economic development opportunities,
- connections to underserved communities,

- connections to major employment or industrial and technology centers,
- higher population densities,
- specific Communities of Concern, or
- environmental concerns.

**Appendix E** provides a map for the county and each city, which shows the maximum advertised internet speed by location. Internet speeds could potentially be referenced by future uses of the methodology.

## Summary of Prioritization

The methodology and prioritization process that were applied in this study focused on helping San Joaquin County achieve improvements to their transportation network through the implementation of fiber optic technologies. San Joaquin County and its municipalities have the option of adjusting the prioritization scoring process to weight layers and topics of consideration based on local goals, or to intentionally prioritize corridors that did not score high in our applied methodology.

This report presents the baseline scoring results of the applied methodology (Layers 1 and 2) to serve as a reference for each entity to adjust and customize to reflect their goals.

**Appendix F** includes the full prioritization methodology worksheets.

# High-Impact Municipal Fiber

This section presents the gap prioritization scoring results for the county and for each city.

**It is important to note that roadway corridors recommended in this study do not specify extents.** In most cases, the entire roadway extent should be considered a strategic fiber pathway (at least initially to the extents of developed areas along the roadway).

For each city, a table is presented and outlines the scoring results of the applied high-impact gaps assessment methodology (layers 1 and 2 only) and indicates specific factors within layers 1 and 2 that contribute to the score.

- **Combined Road Score.** The reported 'Combined Road Score' indicates the highest score for any given segment along that roadway. The higher the score, the more impactful fiber would be at that location.
- **State Strategic Broadband Corridor.** These are corridors that were identified as strategic for middle-mile fiber in the Caltrans District 10 Integrated Corridor Management Plan (2019) and California's Regional Broadband Consortia Strategic Broadband Corridors Report (2019).
- **Congested Corridor.** For congested corridors, fiber lines must be laid along the congested roadways to support traffic management strategies for those roads.
- **Community Anchor Institution.** For the connection of community anchor institutions, the laid fiber pathways do not need to align exactly with roadway scoring. In most cases fiber connections to community anchor institutions can be extended from other adjacent roadways. For example, a building does not need to be connected to fiber from the front door. "Last-mile" fiber connections can be made from alleys or from any side of the building.

- **Strategic Fiber Connections.** These connections do not influence a roadway's overall score. They indicate pathways for strategic fiber connections to planned developments. Typically, the strategic fiber connections to planned developments came directly from conversations with cities, in which they indicated specific locations and corridors.

In addition to the table shown for each city, a map is also presented. The maps depict the combined road score results, congested corridors, community anchor institutions, and the locations of recommended strategic fiber pathways.

Corridor scores focus on roadway segments that scored in the highest percentile. For clarity, this threshold varies by city. The focus of these segments is to outline roadways that create opportunities to address transportation issues and connect community anchor institutions at the county or municipal level.

The scoring prioritized local-owned roads over state roads, because the cities would have more control of the right of way for their local roads. State Strategic Broadband Corridors are indicated in the tables but do not necessarily have a Combined Road Score due to their status as state-maintained corridors. However, agencies can coordinate with Caltrans to leverage the corridors to develop municipal fiber networks.

In general, corridors within municipalities scored higher than corridors in the unincorporated county. This is because the congested corridors are primarily in the cities due to higher density, which leads to higher community connection scores. On maps of the unincorporated county areas, we show roadway scores of three (3) and higher. On city maps, we show roadway scores of four (4) and higher.

**Appendix G** includes all the high-impact location prioritization results shown below, sorted by roadway in alphabetical order.

# County-Wide High-Impact Municipal Fiber

The purpose of this Fiber Readiness Study was to inventory existing fiber networks and identify opportunities to expand the fiber optic network throughout San Joaquin County. Pages 38-40 present county-wide high-impact municipal fiber opportunities.

Based on the two-layer transportation and community anchor institution prioritization, the state’s **strategic broadband corridors** recommended by Caltrans and by the California Strategic Broadband Consortia create opportunities to stage development of municipal fiber networks throughout San Joaquin County.

At the county level, three additional corridors provide strategic connections to community anchor institutions: Kettleman Lane, Jack Tone Road, and Highway 26.

**Figure 7** shows the county-wide view of existing Caltrans fiber and planned fiber pathways in San Joaquin County, along with the locations of the community anchor institutions. Based on the methodology of this analysis, county roads scoring three or above are shown in **Figure 7**.

Although the route did not score high, one of the key north-south pathways, Jack Tone Road, may provide critical connections from the City of Ripon north to the City of Lodi and bring the middle-mile fiber close to underserved areas on the eastern side of the county. The fiber pathway could build on connections to the existing and planned fiber pathways on Highway 99 and Interstate 5 to begin to develop a fiber ring for the county. To further develop the fiber ring sharing Interstate 5 and Highway 99, **Kettleman Lane (Highway 12)** through the City of Lodi could provide a northern boundary to maintain fiber redundancy.

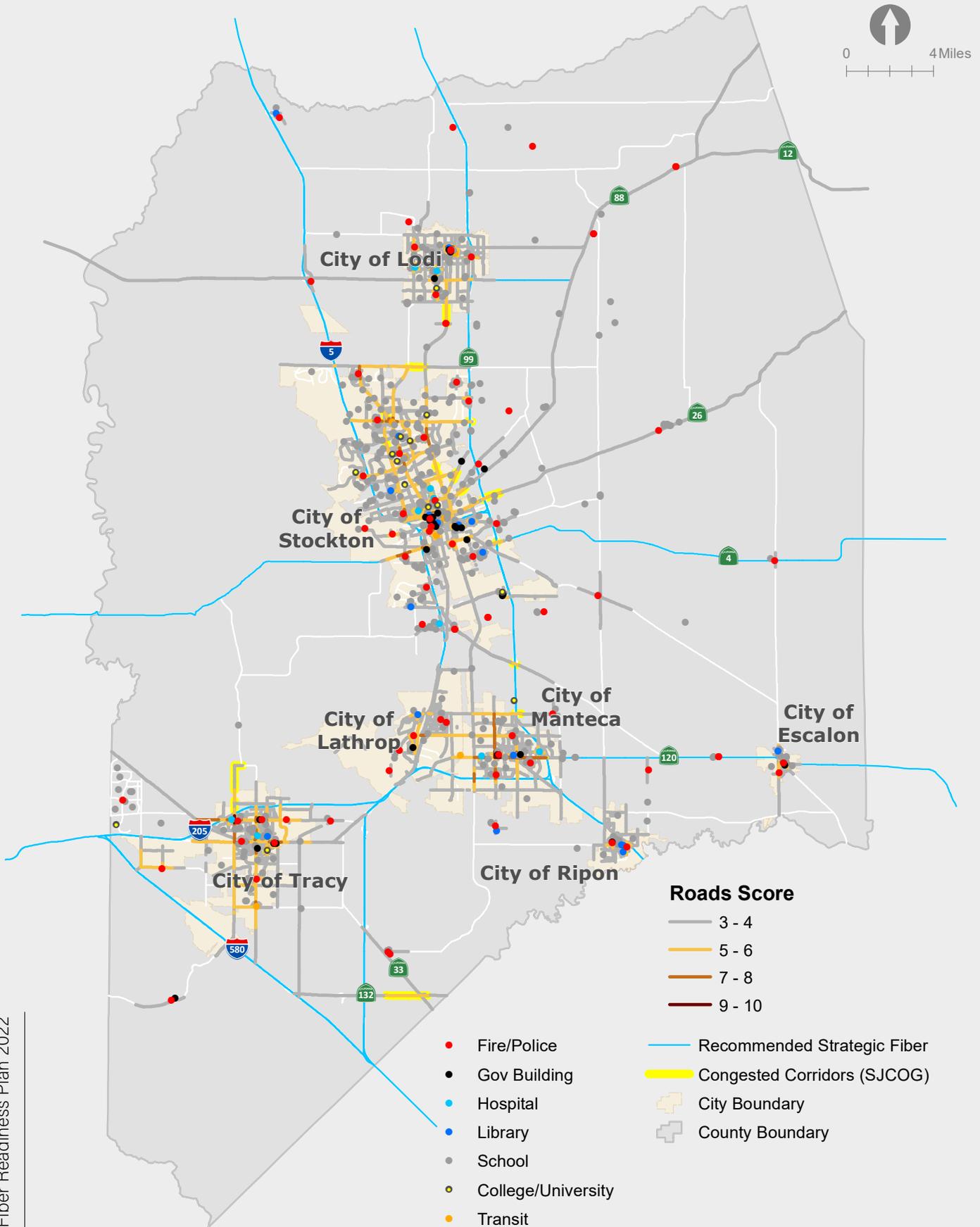
**Table 3.** Unincorporated San Joaquin County - Recommended Fiber Ring Pathways

High-Impact Corridor	Combined Road Score	Layer 1: Transportation		Layer 2: CAIs	Strategic Fiber Connections: Planned Development
		State Strategic Broadband Corridor	Congested Corridor	Community Anchor Institution	
Kettleman Lane	3			✓	
Jack Tone Road	3			✓	
Highway 4		✓		✓	
Highway 12		✓		✓	
Highway 26				✓	
Highway 99 and frontage roads		✓		✓	
Highway 120		✓		✓	
Interstate 5 and frontage roads		✓		✓	
Interstate 205		✓			
Interstate 580		✓			

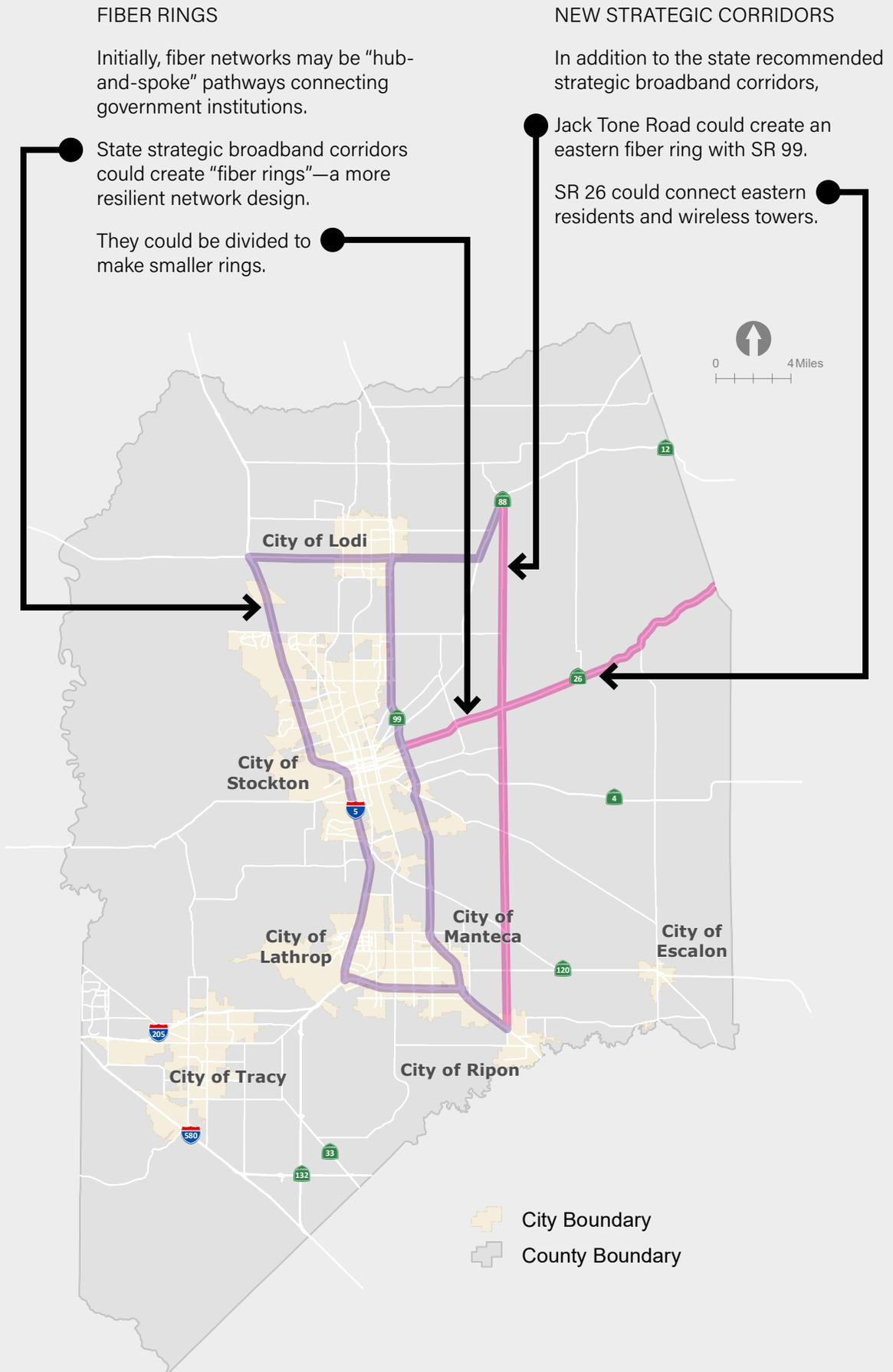
*State Strategic Broadband Corridors were identified as strategic middle-mile fiber corridors in the 2019 Strategic Broadband and Corridors Report. Consider coordinating with Caltrans to expand fiber network.*

*Note: Congested corridors need fiber along those specific corridors to connect to local transportation equipment. Government institutions / buildings can be connected by any nearby street, so downtown grids have more options for fiber pathways.*

**Figure 7.** High-Priority Road Scores for Unincorporated San Joaquin County



**Figure 8.** How to Build a Regional Fiber Network



# Municipality-Level High-Impact Fiber

As the county-wide middle-mile fiber backbones are developed, new opportunities are created to stage development of municipality-level middle-mile fiber and local municipal networks. Pages 41-55 discuss high-impact opportunities to expand fiber networks at the municipal level.

First, each municipality needs to determine which fiber optic business model they want to operate. With a business model in place, municipalities can consider these corridors as expansion opportunities.

Feasibility studies are needed to determine the specific locations and extents of fiber pathways at the municipal level. The high-impact corridors (or parallel corridors) identified in this study provided for guidance on strategic locations to help municipalities start to evaluate the feasibility of their fiber networks.

As discussed before, the road scores were determined based on Layer 1: Transportation and Layer 2: Community Anchor Institution connections.

Municipalities have the flexibility to add additional layers of consideration and scoring to align with their respective local goals, such as population density, equity, high bandwidth sites, economic development, etc.

The greatest opportunity for efficient and effective fiber network expansion happens when all community anchor institution groups participate in the planning process.

The following pages discuss potential fiber connections by municipality: Escalon, Lathrop, Lodi, Manteca, Ripon, Stockton, and Tracy.

# Escalon

These outlined pathways represent optimal starting points for beginning to build out a municipal fiber network because they would successfully connect the heart of Escalon and several community anchor institutions. To assist in connecting any municipal fiber, the city may leverage the installation of the state fiber through coordination with Caltrans to share terminals and ultimately install their own fiber lines. The expansion of fiber across actual pathways may vary depending on city goals, future developments, or other planned roadway construction where conduit could be installed.

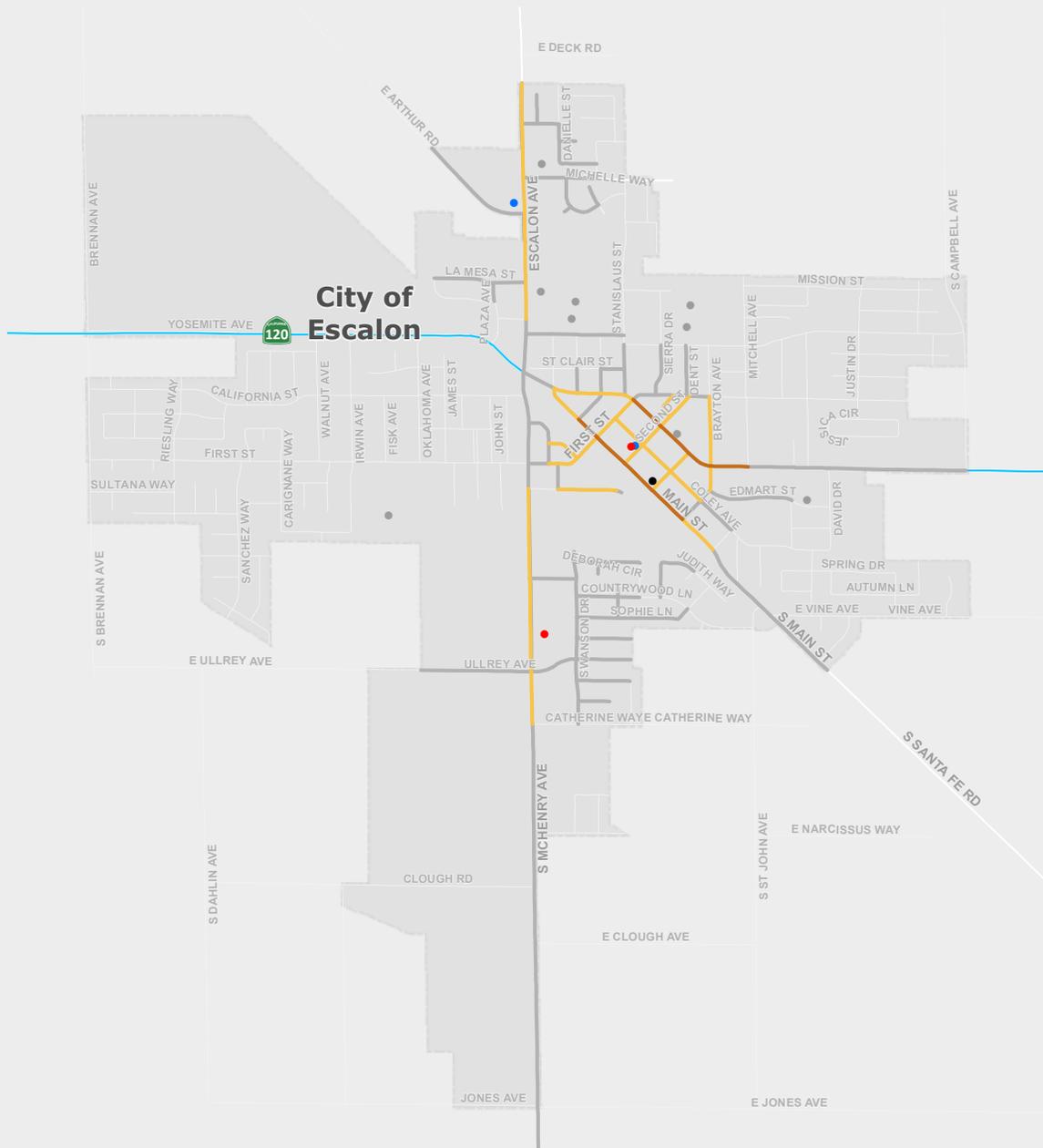
**Table 4.** City of Escalon - Recommended Fiber Expansion Pathways

High-Impact Corridor	Combined Road Score	Layer 1: Transportation		Layer 2: Community Anchor Institution	Strategic Fiber Connections: Planned Development
		State Strategic Broadband Corridor	Congested Corridor		
Jackson Avenue	7			✓	
Main Street	7			✓	
First Street	6			✓	
Brayton Avenue	5			✓	
Escalon Avenue / McHenry Road	5			✓	
Highway 120*		✓			

*\*Identified as strategic corridor in 2019 Strategic Broadband and Corridors Report. Consider coordinating with Caltrans to expand fiber network.*

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**Figure 9.** City of Escalon High-Priority Road Scores



<b>Roads Score</b>	● Fire/Police	— Recommended Strategic Fiber
— 3 - 4	● Gov Building	■ Congested Corridors (SJCOG)
— 4 - 5	● Library	■ City Boundary
— 5 - 6	● School	
— 6 - 7		
— 7 - 8		

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# Lathrop

Interstate 5 through the City of Lathrop has an existing Caltrans fiber pathway running along the route. The city may leverage the existing fiber pathway and coordinate with Caltrans to build off the existing fiber to accelerate expansion of a municipal fiber network within Lathrop. The expansion of fiber across actual pathways may vary depending on city goals, future developments, or other planned roadway construction where conduit could be installed. For example, development in the southwest region of Lathrop would provide a valuable opportunity for the city to implement and enforce a Dig Once policy. This policy would require the developers to install conduit and/or fiber lines within new roadway construction and development. Lathrop has already established a network of conduit throughout the city and has existing fiber connecting community anchor institutions that could be leveraged for future connections.

**Table 5.** City of Lathrop - Recommended Fiber Expansion Pathways

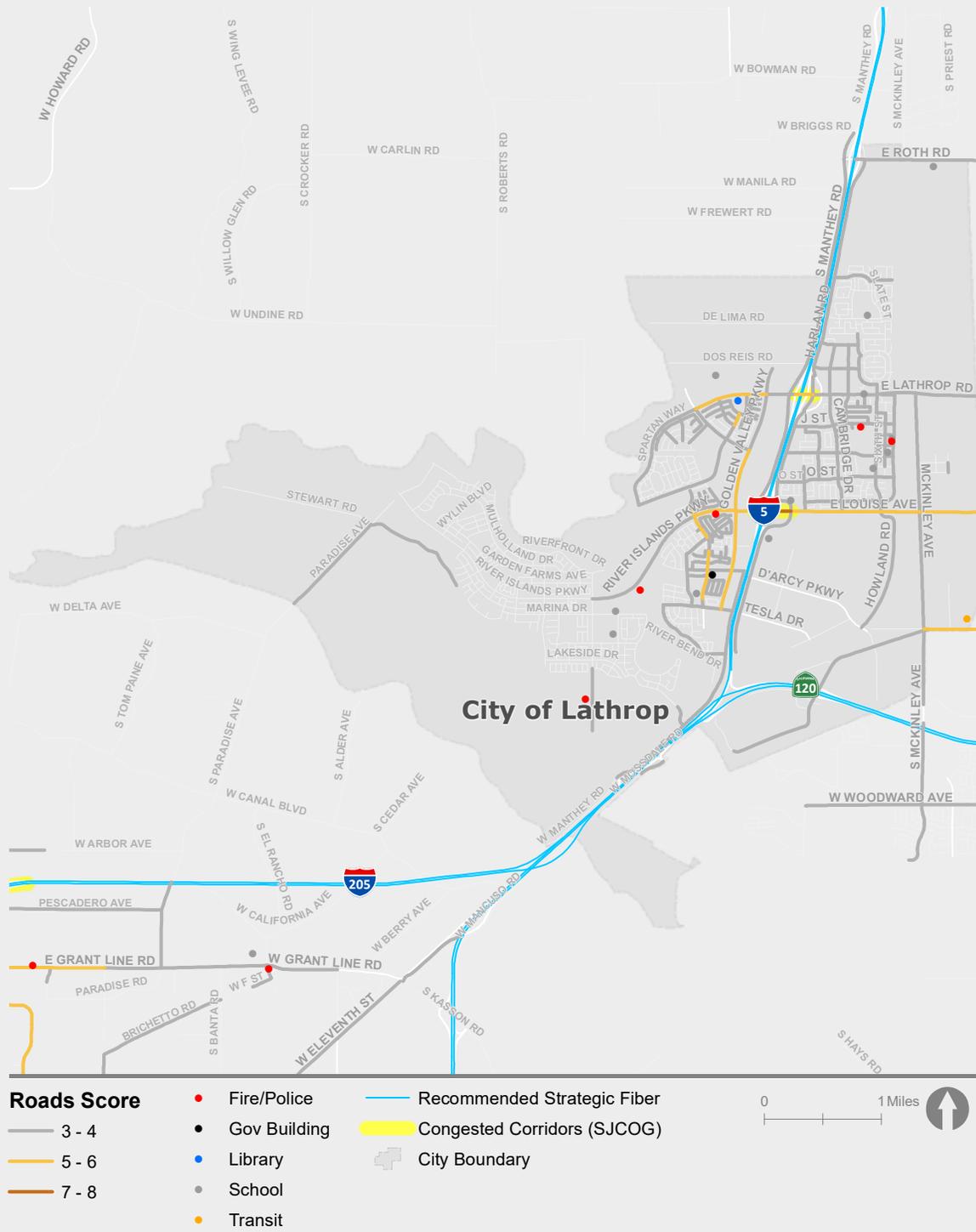
High-Impact Corridor	Combined Road Score	Layer 1: Transportation		Layer 2: Community Anchor Institution	Strategic Fiber Connections: Planned Development
		State Strategic Broadband Corridor	Congested Corridor		
Louise Avenue*	7		✓	✓	
Golden Valley Parkway*	6			✓	✓
Lathrop Avenue	6		✓	✓	
River Islands Parkway	6			✓	✓
McKinley Avenue	4			✓	
Interstate 5 and frontage roads*		✓		✓	✓
Highway 120**		✓			✓

\* Existing and Proposed Caltrans fiber identified in Caltrans District 10 Integrated Corridor Management Plan (2019). Consider coordinating with Caltrans to connect to existing fiber on I-5 and add connections as fiber is added to planned corridors on Louise Avenue and Golden Valley Parkway.

\*\* Identified as strategic corridor in 2019 Strategic Broadband and Corridors Report. Consider coordinating with Caltrans to expand fiber network.

Note: Congested corridors need fiber along those specific corridors to connect to local transportation equipment. Government institutions / buildings can be connected by any nearby street, so downtown grids have more options for fiber pathways.

**Figure 10.** City of Lathrop High-Priority Road Scores



# Lodi

The city may coordinate with Caltrans to build off the planned fiber to accelerate expansion of the fiber network within Lodi. The expansion of fiber across actual pathways may vary depending on city goals, future developments, or other planned roadway construction where conduit could be installed.

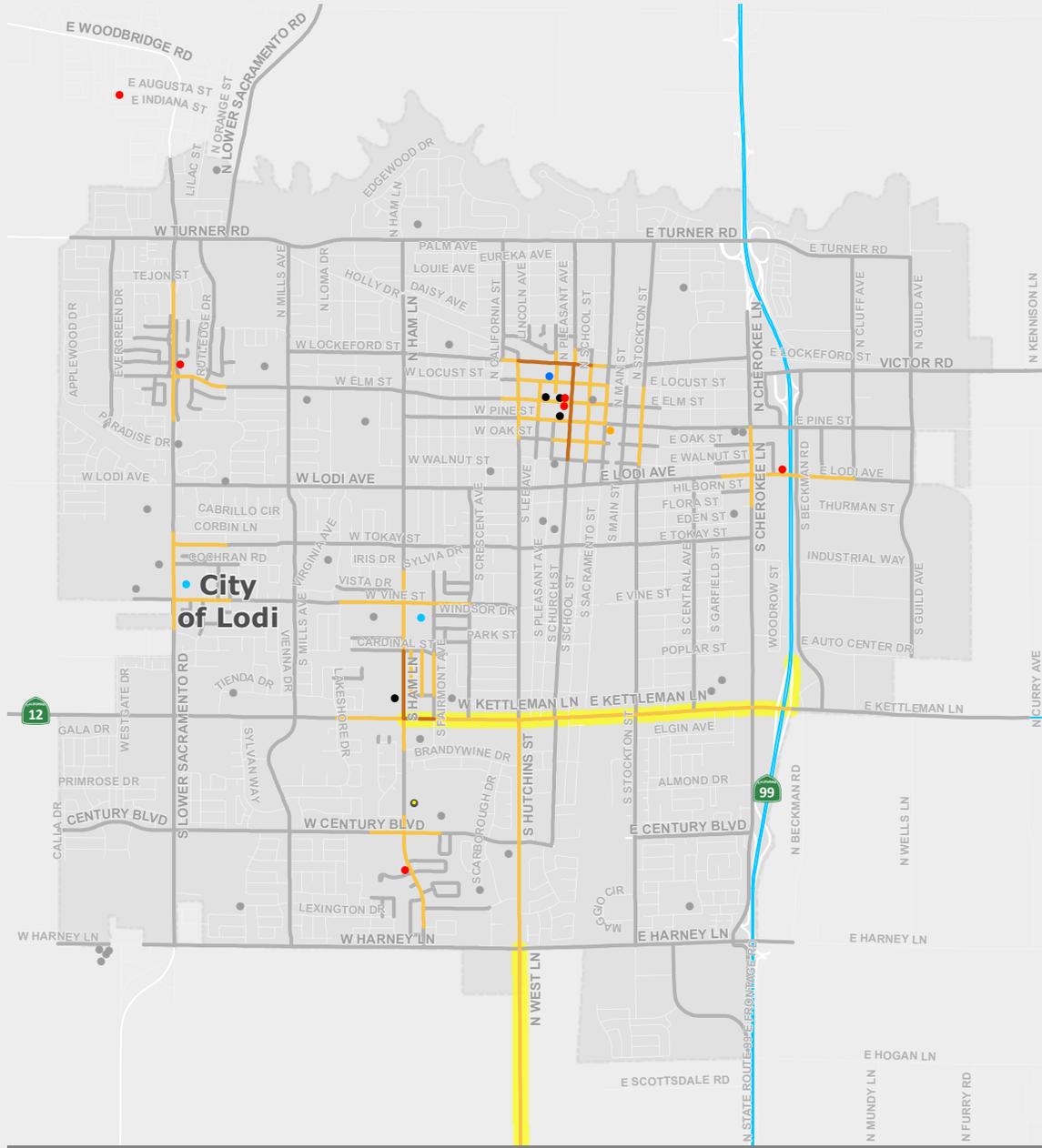
**Table 6.** City of Lodi - Recommended Fiber Expansion Pathways

High-Impact Corridor	Combined Road Score	Layer 1: Transportation		Layer 2: Community Anchor Institution	Strategic Fiber Connections: Planned Development
		State Strategic Broadband Corridor	Congested Corridor		
Ham Lane	7			✓	
Kettleman Lane (Highway 12)*	7	✓	✓	✓	
West Lane / Hutchins Street	6		✓	✓	
Lower Sacramento Road	6			✓	
Eight Mile	5		✓		
Lodi Avenue	5			✓	
Highway 99 and frontage roads*		✓			

\* Identified as strategic corridor in 2019 *Strategic Broadband and Corridors Report*. Consider coordinating with Caltrans to expand fiber network.

*Note: Congested corridors need fiber along those specific corridors to connect to local transportation equipment. Government institutions / buildings can be connected by any nearby street, so downtown grids have more options for fiber pathways.*

**Figure 11. City of Lodi High-Priority Road Scores**



<b>Roads Score</b>	● Fire/Police	— Recommended Strategic Fiber	0	0.5 Miles	↑
— 3 - 4	● Gov Building	— Congested Corridors (SJCOG)			
— 5 - 6	● Hospital	⊕ City Boundary			
— 7 - 8	● Library				
	● School				
	● College/University				
	● Transit				

# Manteca

These pathways represent optimal starting points for beginning to build out the municipal fiber network because they would successfully connect several congested corridors (i.e., Yosemite Avenue, Union Road) and community anchor institutions. To assist in connecting the eastern border of the city, the city may leverage off the existing fiber pathway along Highway 99 through coordination with Caltrans to share terminals to support additional connections for the city. The expansion of fiber across actual pathways may vary depending on city goals, future developments, or other planned roadway construction where conduit could be installed. For example, Manteca identified plans for future construction or annexation north of Lathrop Road and Roth Road and south of Highway 120.

**Table 7.** City of Manteca - Recommended Fiber Expansion Pathways

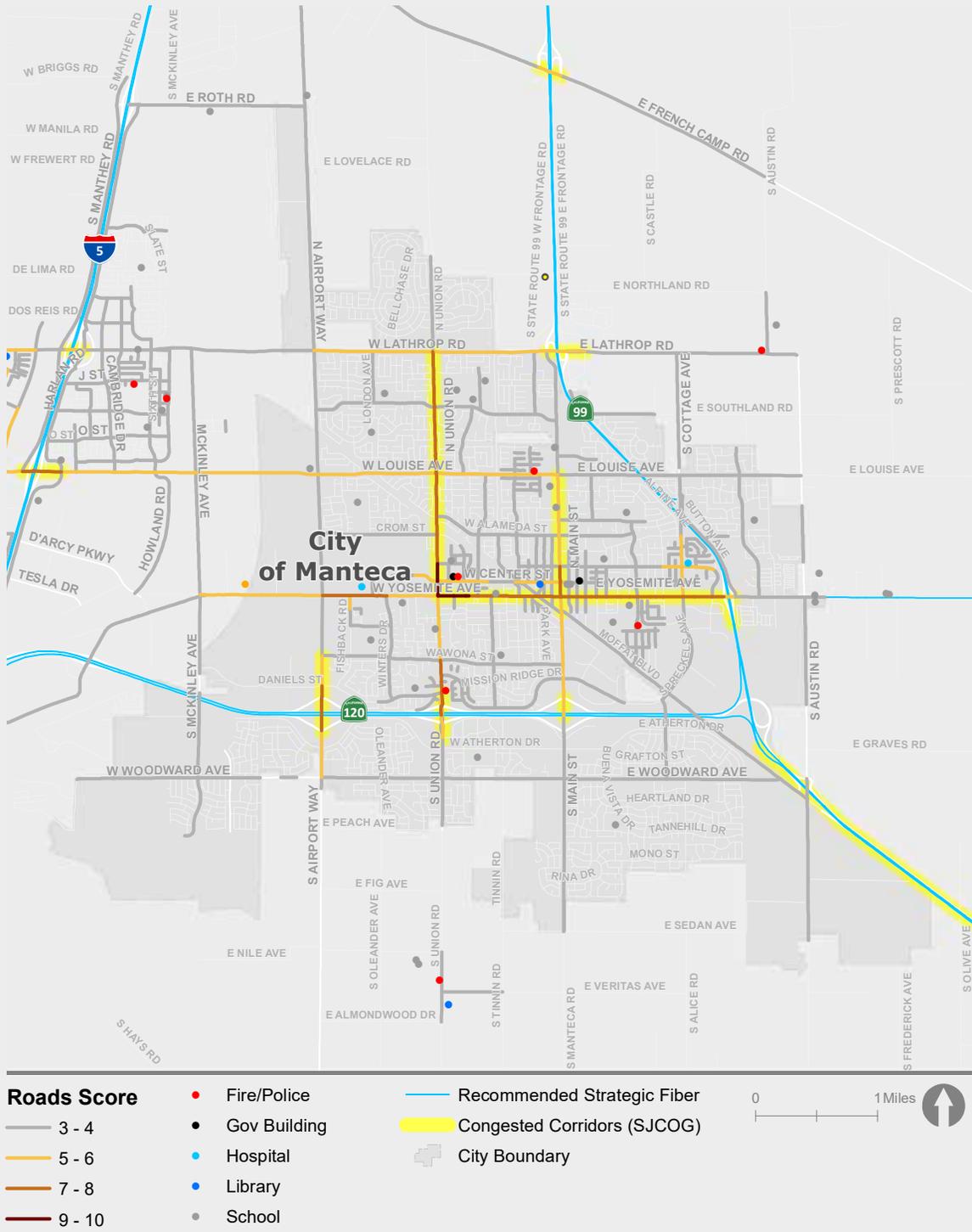
High-Impact Corridor	Combined Road Score	Layer 1: Transportation		Layer 2: Community Anchor Institution	Strategic Fiber Connections: Planned Development
		State Strategic Broadband Corridor	Congested Corridor		
Union Road*	9		✓	✓	✓
Yosemite Avenue*	9		✓	✓	
Main Street	8		✓	✓	✓
Airport Way*	7		✓	✓	✓
Lathrop Road*	6		✓	✓	✓
Louise Avenue*	6			✓	
Roth Road	4			✓	✓
Woodward Avenue	4			✓	
Highway 99**		✓	✓	✓	
Highway 120**		✓			

\* Caltrans plans to add fiber along segments of these roads in Manteca. Consider coordinating with Caltrans to expand fiber extensions.

\*\* Identified as strategic corridor in 2019 *Strategic Broadband and Corridors Report*. Caltrans has some existing state fiber along SR 99 in Manteca (identified in Caltrans District 10 Integrated Corridor Management Plan (2019)). Consider coordinating with Caltrans to expand fiber network.

Note: Congested corridors need fiber along those specific corridors to connect to local transportation equipment. Government institutions / buildings can be connected by any nearby street, so downtown grids have more options for fiber pathways.

Figure 12. City of Manteca High-Priority Road Scores



# Ripon

The city may leverage the existing fiber pathway along Highway 99 and coordinate with Caltrans to build off the existing fiber and share terminals to support additional connections in the city. Additionally, there might be opportunities to connect Ripon to municipal fiber through partnerships and coordination with Stanislaus County to the south. The expansion of fiber across actual pathways may vary depending on city goals, future developments, or other planned roadway construction where conduit could be installed.

From the county-wide perspective, Jack Tone Road was identified as a potential fiber pathway to meet the county's needs beyond the state's recommended strategic fiber corridors. This route would provide connection between Ripon and the northern part of the San Joaquin County, benefiting both parties and assisting in accelerating fiber expansion across the county. North Ripon Road may also provide future opportunities to expand the network to more northern areas of the city and county.

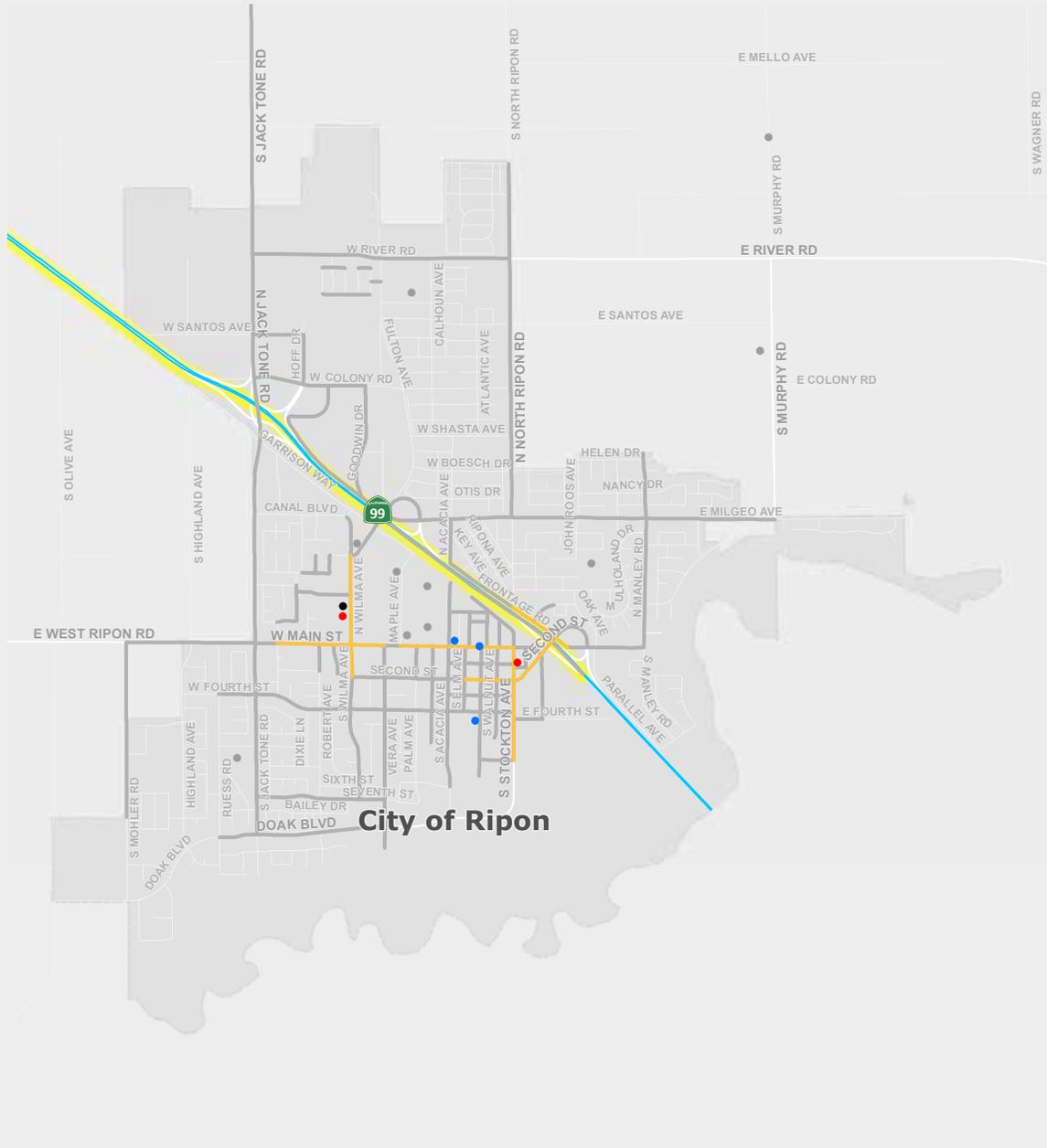
**Table 8.** City of Ripon - Recommended Fiber Expansion Pathways

High-Impact Corridor	Combined Road Score	Layer 1: Transportation		Layer 2: Community Anchor Institution	Strategic Fiber Connections: Planned Development
		State Strategic Broadband Corridor	Congested Corridor		
Main Street	6			✓	
Second Street	6			✓	
Stockton Avenue	6			✓	
Wilma Avenue	6			✓	
Jack Tone Road	4				
North Ripon Road	4				
Highway 99*		✓	✓		

*\* Identified as strategic corridor in 2019 Strategic Broadband and Corridors Report. Caltrans has some existing state fiber along SR 99 in Ripon (identified in Caltrans District 10 Integrated Corridor Management (2019)). Consider coordinating with Caltrans to expand fiber network.*

*Note: Congested corridors need fiber along those specific corridors to connect to local transportation equipment. Government institutions / buildings can be connected by any nearby street, so downtown grids have more options for fiber pathways.*

**Figure 13.** City of Ripon High-Priority Road Scores



<b>Roads Score</b>	● Fire/Police	— Recommended Strategic Fiber	0	0.5 Miles	↑
— 3 - 4	● Gov Building	— Congested Corridors (SJCOG)			
— 5 - 6	● Library	— City Boundary			
	● School				

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# Stockton

The City of Stockton recently completed an ITS Master Plan. In 2021, the city received \$3 million to develop a citywide Fiber Optic Master Plan and construct the first phase. The city's Fiber Optic Master Plan will focus on first connecting city buildings and traffic infrastructure, then connecting ancillary services like middle-mile ISP fiber to underserved communities and Smart City initiatives (like air quality sensors and parking monitoring). The City of Stockton should review their future Fiber Optic Master Plan with the recommended Fiber Working Group to discuss opportunities for implementation and partnerships.

Interstate 5 and Highways 4 and 99 have already been identified as recommended strategic fiber corridors at the state level. The expansion of fiber across actual pathways may vary depending on city goals, future developments, or other planned roadway construction where conduit could be installed. For example, MLK Boulevard, Airport Way, and Wilson Way are identified as key corridors in the city's new ITS Master Plan, so these corridors may be strategic pathways in the city's future Fiber Optic Master Plan.

It is important to note that the results shown here account for only transportation and community needs gaps, they do not account for population, equity, or other gap considerations. These additional considerations are likely to result in higher scoring roadways in areas such as south Stockton. To this extent, Stockton is recommended to strongly consider implementing additional layers of gap consideration to address social equity based on the city's community goals.

**Table 9.** City of Stockton - Recommended Fiber Expansion Pathways

High-Impact Corridor	Combined Road Score	Layer 1: Transportation		Layer 2: Community Anchor Institution	Strategic Fiber Connections: Planned Development
		State Strategic Broadband Corridor	Congested Corridor		
N Center Street	9		✓	✓	
Harding Way	8		✓	✓	
Main Street	8			✓	
Market Street	8			✓	
Oak Street	8			✓	
Pacific Avenue	8		✓	✓	
Weber Avenue	8			✓	
California Street	7			✓	
Charter Way / SR-4	7	✓	✓	✓	
Dr. Martin Luther King Jr. Boulevard	7		✓	✓	
El Dorado Street	7			✓	
Fremont Street	7		✓	✓	
Hammer Lane	7		✓	✓	
Lower Sacramento Road	7		✓	✓	
Miner Avenue	7			✓	
Park Street	7			✓	
Pershing Avenue	7		✓	✓	
San Joaquin Street	7			✓	
Thornton Road	7		✓	✓	
West Lane	7		✓	✓	
Wilson Way	7		✓	✓	

*Note: Congested corridors need fiber along those specific corridors to connect to local transportation equipment. Government institutions / buildings can be connected by any nearby street, so downtown grids have more options for fiber pathways.*

Figure 14. City of Stockton High-Priority Road Scores



<b>Roads Score</b>	● Fire/Police	— Recommended Strategic Fiber	0 1.5 Miles
— 3 - 4	● Gov Building	— Congested Corridors (SJCOG)	↑
— 5 - 6	● Hospital	■ City Boundary	
— 7 - 8	● Library		
— 9 - 10	● School		
	● College/University		
	● Transit		

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# Tracy

The recommended pathways in Tracy represent optimal starting points for beginning to build out the municipal fiber network because they would successfully connect several congested corridors (i.e., Grant Line Road) and community anchor institutions. Within the City of Tracy there are several roadways (i.e., Grant Line Road, Eleventh Street) with existing Caltrans-owned fiber pathways.

Interstate 205 and Interstate 580 have been identified as key congested corridors, and both are recommended fiber pathways by Caltrans.

To assist in connecting the northern and southern borders of the city, the city may leverage the installation of these fiber pathways through coordination with Caltrans to share terminals, supporting additional connections for the city. The expansion of fiber across actual pathways may vary depending on city goals, future developments, or other planned roadway construction where conduit could be installed.

**Table 10.** City of Tracy - Recommended Fiber Expansion Pathways

High-Impact Corridor	Combined Road Score	Layer 1: Transportation		Layer 2: Community Anchor Institution	Strategic Fiber Connections: Planned Development
		State Strategic Broadband Corridor	Congested Corridor		
Corral Hollow Road	10		✓	✓	
Eleventh Street	8		✓	✓	
Grant Line Road	8		✓	✓	
Tracy Boulevard	8		✓	✓	
MacArthur Drive	6			✓	
Valpico Road	6		✓	✓	
Fourth Street	5			✓	
Lammers Road	4				
Interstate 205*		✓	✓		
Interstate 580*		✓	✓		

\* Identified as strategic corridor in [2019 Strategic Broadband and Corridors Report](#). Consider coordinating with Caltrans to expand fiber network.

*Note: Congested corridors need fiber along those specific corridors to connect to local transportation equipment. Government institutions / buildings can be connected by any nearby street, so downtown grids have more options for fiber pathways.*

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Figure 15. City of Tracy High-Priority Road Scores



<b>Roads Score</b>	● Fire/Police	— Recommended Strategic Fiber	0 1 Miles
— 3 - 4	● Gov Building	— Congested Corridors (SJCOG)	↑
— 5 - 6	● Hospital	⊕ City Boundary	
— 7 - 8	● Library		
— 9 - 10	● School		
	● College/University		
	● Transit		

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# Conclusions

Expanding fiber optic networks throughout San Joaquin County is the priority. This sets opportunities to stage development and expansion of networks at the local level.

The result of the high-impact gaps assessment is a two-phase expansion plan.

- Phase 1: Build a county-wide fiber network backbone.
- Phase 2: Expand fiber networks at the municipal level.

## Phase 1 Priority Corridors for San Joaquin County

The greatest opportunity to expand fiber and the county level is to support the state's Strategic Broadband Corridors and to build two initial county-level fiber rings.

The **state strategic broadband corridors** create the middle-mile backbone needed for expansion and are part of the Phase 1 expansion:

- CA-99
- I-5
- CA-120
- CA-12
- CA-4

The state strategic broadband corridors form a **central fiber ring** in San Joaquin County connecting many cities and institutions in the central part of the county.

- CA-12 (north)
- CA-99 (east)
- CA-120 (south)
- I-5 (west)

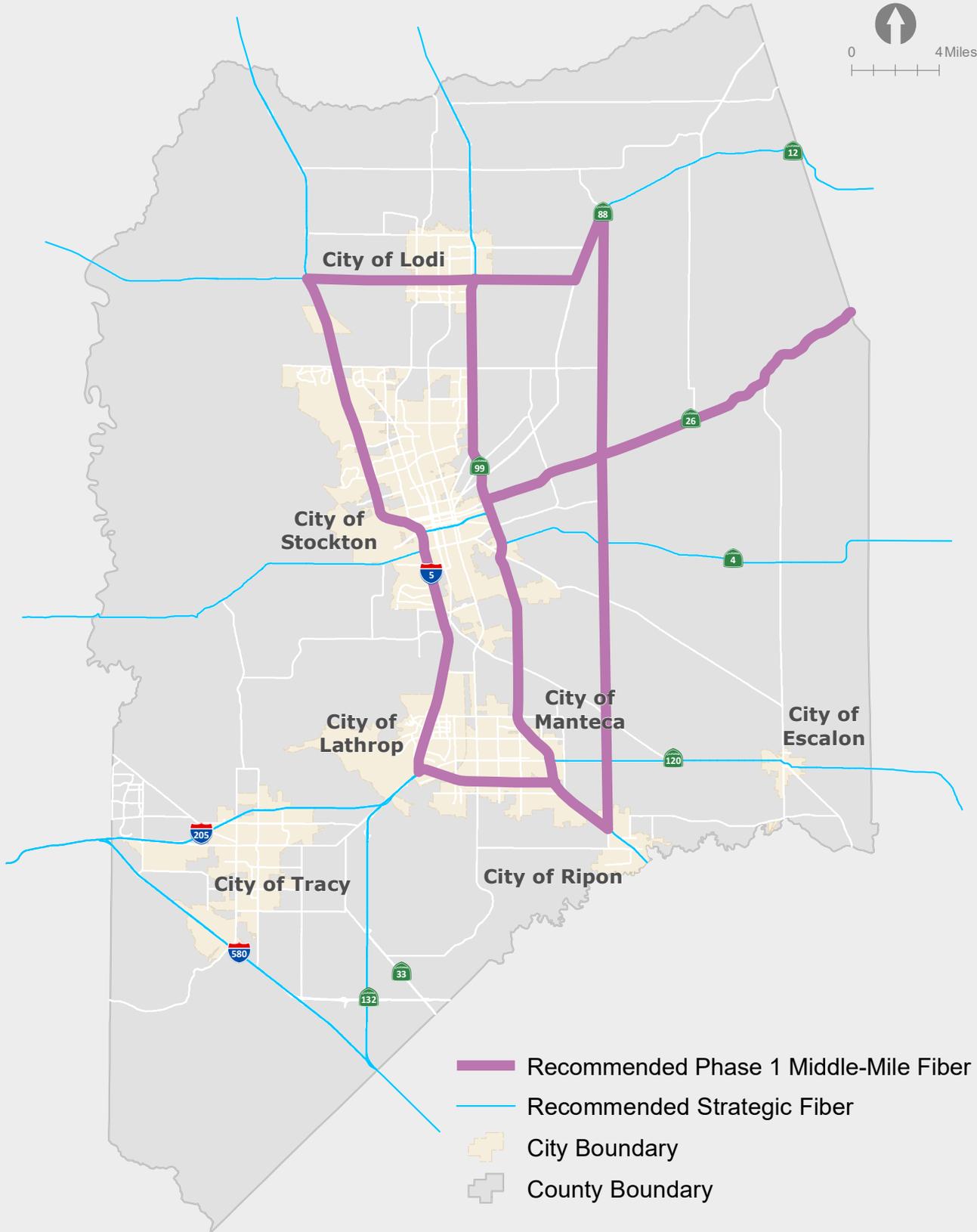
An **eastern fiber ring** is made by:

- CA-12 (north)
- Jack Tone Road (east)
- CA-99 (south)
- CA-99 (west)
- CA-26 (connector)

**Highway 26 (CA-26)** and **Jack Tone Road** are not congested corridors or a state identified strategic broadband corridors, but they provide key connections to community anchor institutions in the eastern portion of the county and are part of the Phase 1 expansion.

Future feasibility studies are needed to determine specific pathway locations and connections. For example, Jack Tone Road does not connect directly to SR-12/SR-88 in Lockeford, and there are multiple potential pathways that could be used to make the connection.

**Figure 16.** Phase 1 High-Impact Fiber Middle-Mile Fiber Network for San Joaquin County



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# Phase 2 Local Fiber Expansion Opportunities

At the municipality level, the high-impact locations should be considered as planned construction and development are discussed. These corridors, or parallel corridors, can be strategic locations for initial municipal fiber network development. **Table 11** lists the highest scoring roads based on the Level 1 (transportation) and Level 2 (community anchor institution) rating for San Joaquin County. It is important to note that none of these roads are among the State’s Strategic Broadband Corridors, which means San Joaquin County municipalities and SJCOG will need to lead the prioritization and coordination to add fiber on these roads.

San Joaquin County and its municipalities have the option of adjusting the prioritization scoring process to weight layers and topics of consideration based on local goals, or to intentionally prioritize corridors that did not score high in our applied methodology.

**Each municipality needs to determine which fiber optic network business model they want. Based on that decision, the agencies can decide if they want to install fiber or conduit only along these roads. The commitment of local agencies to build municipal fiber networks will also help SJCOG prioritize corridors that scored the same rating.**

**Table 11.** Highest-Scoring Roads Based on Level 1 and Level 2 Rating for San Joaquin County

High-Impact Corridor/ Jurisdiction	Combined Road Score	Layer 1: Transportation		Layer 2: Community Anchor Institution	Strategic Fiber Connections: Planned Development
		State Strategic Broadband Corridor	Congested Corridor		
Corral Hollow Road/ Tracy	10		✓	✓	
Center Street/ Stockton	9		✓	✓	
Union Road/ Manteca	9		✓	✓	✓
Yosemite Avenue/ Manteca	9		✓	✓	
Church Street/ Lodi	8			✓	
Eleventh Street/ Tracy	8		✓	✓	
Grant Line Road/ Tracy	8		✓	✓	
Harding Way/ Stockton	8		✓	✓	
Main Street/ Manteca	8		✓	✓	✓
Main Street/ Stockton	8			✓	
Market Street/ Stockton	8			✓	
Oak Street/ Stockton	8			✓	
Pacific Avenue Stockton	8		✓	✓	
Tracy Boulevard/ Tracy	8		✓	✓	
Weber Avenue/ Stockton	8			✓	

# 7 Funding Opportunities

Expanding the fiber network is not cheap. According to the 2019 Caltrans District 10 Integrated Corridor Management Plan (ICMP), fiber communication trunk lines for transportation projects cost about \$500,000 per mile and a recent *Broadband Feasibility Study* by the City of Lodi estimated up to \$900 per premise for fiber to the premise last-mile connection. (This cost is generally an average of \$2,000 per home passed.) Once a city selects a business model approach, there are various ways to fund a fiber network expansion.

## Best practices for funding a municipal fiber network include:

-  Use long-term, low-rate municipal bonds to fund the middle-mile network expansion
-  Lease conduit or fiber to ISPs
-  Use grant funding for middle mile expansion and last-mile connections
-  Swap conduit with an ISP in exchange for connecting your government site
-  Incentivize broadband infrastructure investment, especially in rural areas and new developments (such as tax credits, development impact fee credits)

### California SB-156

- \$3.25 BILLION for middle mile
- \$1 BILLION for urban last mile
- \$1 BILLION for rural last mile
- \$750 MILLION for loan loss reserve fund

### IIJA Act: SMART Grant (Section 25005)

- \$500 MILLION to support planning and construction of smart technology projects
- Awards for large, mid-sized, and rural communities

### Infrastructure Investment and Jobs Act (IIJA): Broadband (Sec. 60102)

- \$42.45 BILLION for broadband deployment and adoption. \$100 MILLION reserved per state
- \$1 BILLION for middle-mile program to building high speed backbone for communities, businesses, and community anchor institutions
- \$2 BILLION ReConnect (RUS) program for eligible entities including local governments

Appendix I details additional federal, state, and local funding opportunities, strategies, and programs.

# 8 Recommendations & Next Steps

SJCOG can play a leading role in coordinating and communicating among various municipalities to continue to build momentum for fiber expansion. This Fiber Readiness Study sets the stage for SJCOG to compete for additional funding when it becomes available for activities described below.

## SJCOG'S Role

SJCOG can support county-wide and local fiber expansion by facilitating a Fiber Task Force and by keeping the single-view fiber inventory up to date with a fiber asset management platform.

## Lead a Fiber Task Force

**SJCOG should establish and facilitate a county-wide Fiber Working Group to communicate and coordinate across agencies and interest groups.** This working group should set goals and discuss new development plans, opportunities for coordinated Dig Once policies or construction efforts, and funding opportunities. By sharing information about planned developments and planned construction projects early, other stakeholders and private ISPs could piggyback on construction projects.

Potential working group members include a "Fiber Champion" for each city, the county, school districts, libraries, public safety, and hospitals, as well as Caltrans, private ISPs, and the San Joaquin Business Council. A fiber champion could be a role for SJCOG or other regional players like the Business Council.

If SJCOG cannot fund a permanent working group, SJCOG could consider this activity for new state and federal funding opportunities in the near term.

## Update the Fiber Inventory with an Asset Management Platform

This project compiled maps of existing municipal fiber pathways into one complete view. It is important to keep this single-view map updated as the cities or county expands these fiber and conduit networks. **SJCOG could consider procuring a fiber asset management software platform.** Alternatively, SJCOG could simply maintain and update the existing GIS maps. However, a software platform likely better meets these needs and will be more cost-effective in the long run to maintain accurate information.

Starting with the existing inventory maps from this study, SJCOG could use a fiber asset management tool to maintain a single view of where public agencies own their own fiber or conduit throughout San Joaquin County. When expansion is needed, SJCOG will know who to contact to learn if fiber or conduit is available to be shared amongst its public partners. This sharing could be in-kind, pooling funds, or doing joint builds to optimize the economies of scale of building once.

Once that single view is established, then the SJCOG can better understand the gaps and associated costs of connecting transportation infrastructure, community anchor institutions, residential, and commercial sites.

The fiber asset software platform could also be used for the operations and maintenance of the fiber system, as well documenting splice enclosures, pole numbers, handhole numbers, equipment, fiber strand allocation, splice details, etc. This will help with locates during construction project.

Examples of fiber asset management tools include:

- *OSPInsight* – Fiber Optic Network Management Software
- *Fiberone by NeXsysOne* – Telecom Project Management Tool & Tower Management Software
- *Patch Manager* – Comprehensive Cable & Asset Management Software Solution

Lathrop is considering a fiber asset management platform for their municipal fiber network. There may be opportunities to coordinate efforts among jurisdiction to jointly fund the effort through SJCOG or through Lathrop with a memorandum of agreement. SJCOG could also consider this asset management activity for new state and federal funding opportunities in the near term.

The current fiber network across San Joaquin County is limited. Expanding the fiber optic network throughout San Joaquin County can help to **reduce congestion** through improved signal timing and regional transportation management, **improve safety** through better traffic monitoring and traveler information systems, and **create opportunities** for expanded internet access.

SJCOG and local municipalities can be leaders to accelerate the fiber network expansion by following the four-step process outlined in this report:



**Step 1:** Assemble Stakeholders, Define Goals, Identify Champions



**Step 2:** Assess Existing Inventory



**Step 3:** Develop a Business Model



**Step 4:** Review and Enact Fiber Practices

Once a business model approach is selected, SJCOG can play an important role to expand fiber in the county by facilitating coordination between agencies and private industry, and by prioritizing high-impact gaps for fiber expansion. This Fiber Readiness Study identifies the high-impact locations that could be connected by middle-mile fiber networks to support key ITS advancements and to connect community anchor institutions.

# 9

## Appendices

### A. Terms & Definitions

**Aerial Fiber:** Fiber hung above ground, typically on utility poles.

**Broadband:** A generic term that refers to high-speed access to the Internet (as compared to 'dial-up' connections). Information transmission is digital, or transmitted as 'bits' of data, and the quality of broadband access is measured in terms of the rate of transmission, such as kbps, Mbps, Gbps, etc. Broadband connection types include cable modem, digital subscriber line (DSL), wireless/cellular, satellite, and fiber optic cable.

**Community Anchor Institutions (CAIs):** Schools, libraries, medical and health care providers, public safety entities, institutes of higher education, and other community support organizations. These institutions may provide outreach, access, equipment, and support services to facilitate greater use of broadband service. (Pew Center)

**Conduit:** A tube or trough made of metal, plastic, or fired clay, that acts as a protective casing for wiring.

**Dark Fiber:** Fiber optic cables that are installed but are currently unused, as opposed to "lit fiber".

**Digital Divide:** Refers to the gap between people who have access to modern information and communications technology and those who do not.

**Fiber Optic Cable:** Fiber-optic cable contains anywhere from a few to hundreds of optical fibers within a plastic casing. they transfer data signals in the form of light and travel hundreds of miles significantly faster than those used in traditional electrical cables.

**FTTX:** "Fiber to the Everything", also known as the Backbone of the Internet

**FTTP:** "Fiber to the Premise", a last mile fiber connection.

**FTTH:** "Fiber to the Home"

**FTTC:** “Fiber to the Cabinet/Curb”, a last mile fiber connection to transportation-related equipment.

**Gbps:** Gigabits per second, the unit of measurement typically employed for High-Speed Internet. Equivalent to a billion bits per second.

**Internet Service Provider (ISP):** A company that provides individuals, businesses, anchor institutions, etc., with a connection to the internet. ISPs include telephone and cable companies, wireless ISPs, electric cooperatives, municipal utilities, and mobile wireless providers. They use different technologies, including fiber, cable, DSL, and fixed wireless, to deliver internet service to their customers.

**Internet of Things:** Describes the network of physical objects that are embedded with sensors, software, and other technologies for the purpose of connecting and exchanging data with other devices and systems over the internet.

**Last-Mile Infrastructure:** Describes the last local fiber connection links between an internet service provider and end-users.

**Lit Fiber:** Fiber optic cables that are currently in use, as opposed to “dark fiber”.

**Mbps:** Megabits per second, the unit of measurement typically employed for broadband Internet. Equivalent to a million bits per second.

**Middle-Mile Infrastructure:** Describes the fiber connection segment from the regional or national network to local last mile providers. In rural areas, the middle mile may refer to the town’s connection to a larger metropolitan area where it interconnects with major carriers.

**Resource Sharing:** A type of agreement that DOTs (typically state-level) make with service providers for the exchange of the use of ROW or existing infrastructure, such as conduit, for the use of fiber optic services. These types of agreements particularly benefit the implantation of ITS infrastructures in rural areas.

## B. Peer City Interview Key Lessons

### Westminster, Maryland

The City of Westminster, Maryland started their fiber-optic network expansion in the early 2000s and has been working since then to connect as much of their community as possible. The key enabler was their ability to utilize a public sector, county-wide fiber-optic backbone (the Carroll County Public Network, or CCPN) to allow for community anchor institution connectivity, while providing fiber capacity and key fiber routes for interested private internet service providers (ISPs) to deliver residential service in a cost-effective model. The project would not have been possible without the preceding county-wide approach to fiber.

Working with their sole internet provider, Ting, Westminster has learned many key lessons along the way:

1. Own the passive components of the infrastructure: Part of Westminster's fiber expansion success has come from their own role in owning and maintaining the conduit, fiber and splice enclosures that are utilized and leased to their residential internet service provider Ting. By maintaining this influence over the infrastructure, Westminster can ensure that their community goals and values are met. They are also able to use their infrastructure to their advantage by collecting both base rent and a revenue share from its use.
2. Stay true to the community: As mentioned above, Westminster has gone out of their way to ensure that community goals and values are at the forefront of fiber use and expansion. They have always been open to working with others, but by maintaining this perspective, their efforts have strengthened their community with the implementation of fiber technologies.
3. Find a fiber champion: Westminster's primary fiber champion who has been an integral part of the fiber expansion in Westminster and Carroll County is Dr. Robert Wack. His passion and leading role in communicating among various politicians and across jurisdictions has created a strong foundation for the overall expansion of fiber technologies.
4. Build meaningful relationships: Expansion of fiber cannot be done with complete success by one person or organization, it is done most successfully and efficiently through teamwork and cooperation. Westminster has focused significant effort on building and maintaining relationships with surrounding local and county governments, as well as Westminster's own community.

# Winter Haven, Florida

The City of Winter Haven, Florida has been building and expanding its fiber optic network for the last 20 years. In 2004 the city implemented a Dig-Once broadband initiative. Through their experience expanding their fiber-optic network, the City of Winter Haven has learned several key lessons.

1. Dig Once Practice: Digging up roadways is significantly more expensive than buying and laying conduit during an existing construction project. To expand fiber reach more economically and efficiently, fiber and conduit are installed whenever feasible during roadway infrastructure projects. Through this practice, the City of Winter Haven lays as much conduit as they can with each project with the knowledge that eventually they will always be able to find a use for it.
2. Laying fiber and conduit can be strategic: After funding the installation process, following the Santa Monica, CA fiber practice, Winter Haven leases their facilities to various fiber providers to generate income, which they then use to pay off any debt and to reinvest into further expansion. The City of Winter Haven has also developed a process of using their fiber facilities as assets in a negotiating network expansion and connections of community anchor institutions.

3. Find a fiber champion: Making their fiber installation and expansion process possible is their fiber champion: Hiep Nguyen, Smart City Officer for Winter Haven. His support and commitment to the project since its beginning 20 years ago has been a key factor in Winter Haven's success.
4. Additional Resources regarding Winter Haven's fiber expansion efforts can be identified in the Polk Broadband Plan and the City of Winter Haven Broadband Study.

# C. Data Request Form

## SJCOG Fiber Readiness Plan Data Collection Request

Please upload available data to: <http://www.kittelson.com/fip>

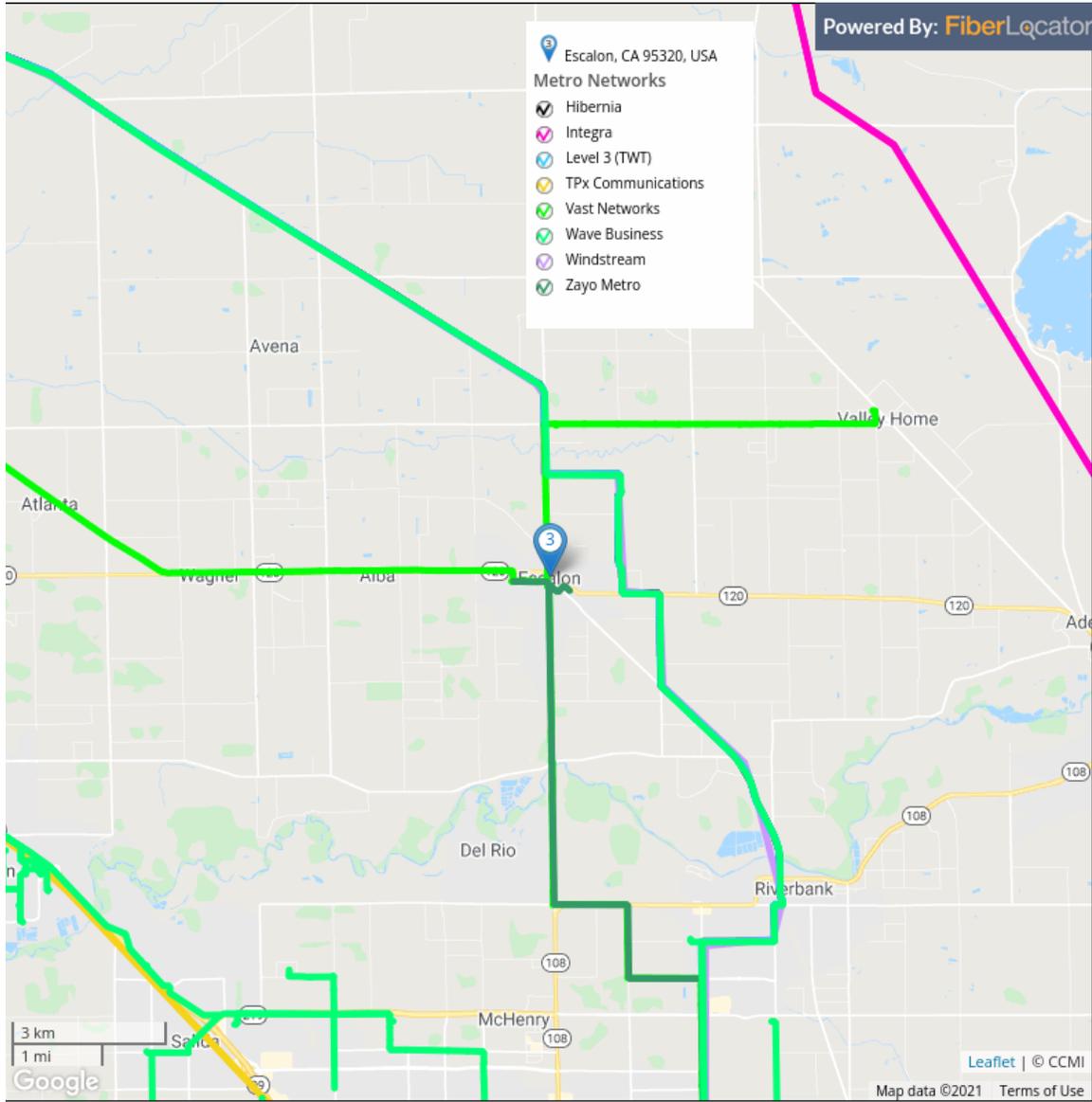
Jurisdiction Completing Form: Please Complete

Status	Data Need	Notes
<i>Choose an item.</i>	<b>Priority Needs (in shapefile or geodatabase format, unless noted otherwise)</b>	
<i>Choose an item.</i>	Fiber pathways (County-owned assets)	If available, please include if data is aerial or underground
<i>Choose an item.</i>	Fiber pathways (dark fiber leasing or leased circuit connectivity)	If available, please include if data is aerial or underground
<i>Choose an item.</i>	Locations of Towers	
<i>Choose an item.</i>	Fiber strand counts (288 ct, 96 ct, etc.)	
<i>Choose an item.</i>	Splice Locations	
<i>Choose an item.</i>	Poles* with fiber installed	* Pole ownership/operation rights are required
<i>Choose an item.</i>	Handholes/underground vaults with fiber	
<i>Choose an item.</i>	Names and Addresses of Community Anchor Institutions (CAIs) (e.g., govt buildings, libraries, schools, community colleges, higher education)	Can be provided in Excel or Word document if shapefile/geodatabase is unavailable
	<b>Other Priority Needs (basic information)</b>	
<i>Choose an item.</i>	Number of CAIs connected to County-owned fiber assets	
<i>Choose an item.</i>	Number of CAIs connected to Service Provider fiber assets	
<i>Choose an item.</i>	Miles of Aerial plant	
<i>Choose an item.</i>	Miles of Underground plant	
<i>Choose an item.</i>	Pole counts (how many poles is your fiber installed on)	Counts if shapefile/geodatabase is unavailable
<i>Choose an item.</i>	Handhole/underground vaults counts (how many underground vaults does your fiber run through)	Counts if shapefile/geodatabase is unavailable
	<b>Other data needs (in shapefile or geodatabase format)</b>	
<i>Choose an item.</i>	Transportation or public entity device locations (e.g., cameras, speed sensors)	
<i>Choose an item.</i>	Fiber route gaps	
<i>Choose an item.</i>	Parcels/Lots with Address information	
<i>Choose an item.</i>	Right of Way/Easements	
<i>Choose an item.</i>	Streetlights	
<i>Choose an item.</i>	Overhead Strand (Guys & Anchors)*	* Ownership/operation rights are required
<i>Choose an item.</i>	Underground Utilities	
<i>Choose an item.</i>	Manholes	
<i>Choose an item.</i>	Pavement Condition Index	
<i>Choose an item.</i>	Zoning	
<i>Choose an item.</i>	Building Footprints	
<i>Choose an item.</i>	Planned Capital Improvements	

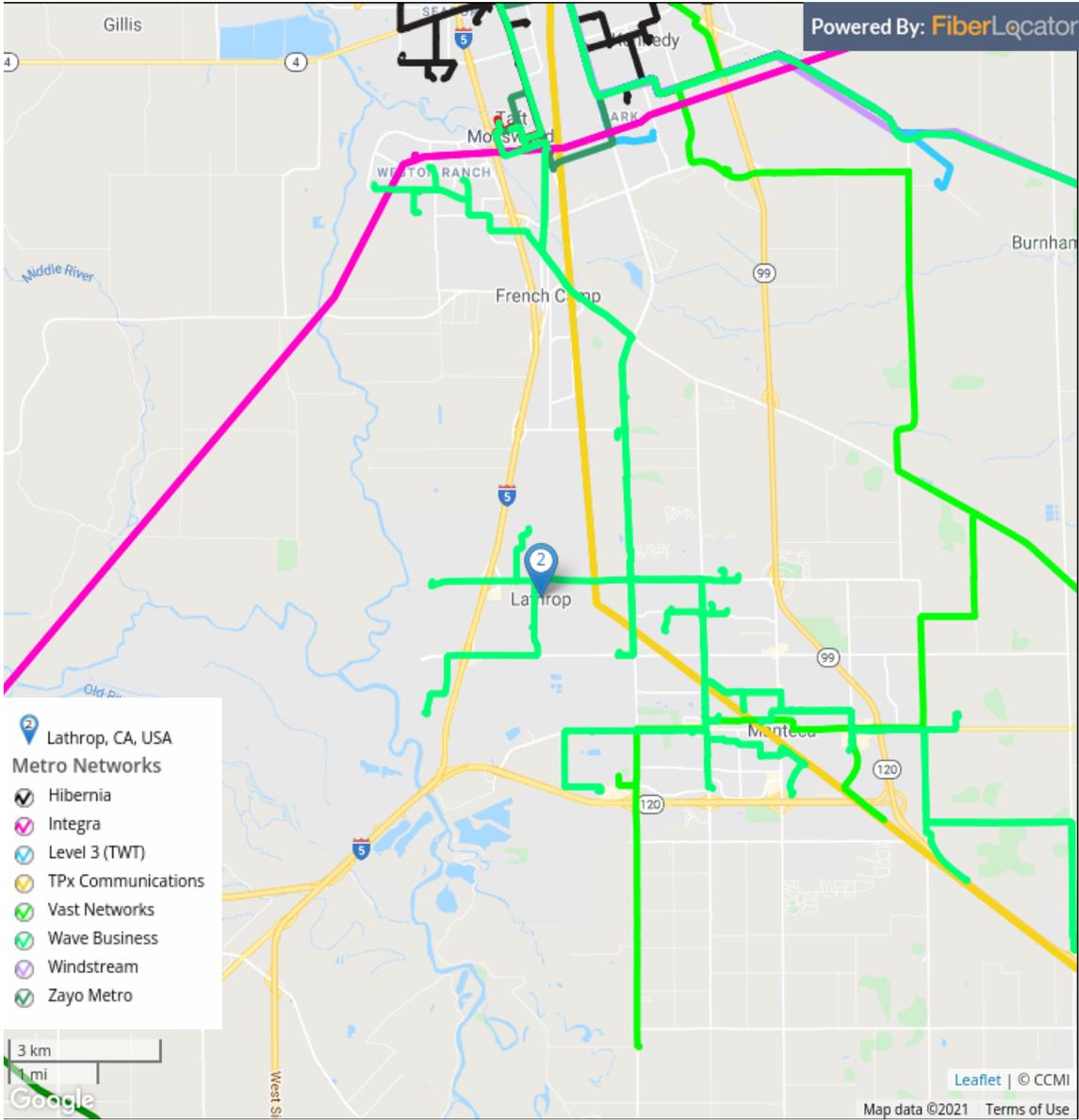
CAI = Community Anchor Institution (e.g., govt buildings, libraries, schools, community colleges, higher education)

# D. Detailed FiberLocator Maps

## Escalon



# Lathrop and Manteca

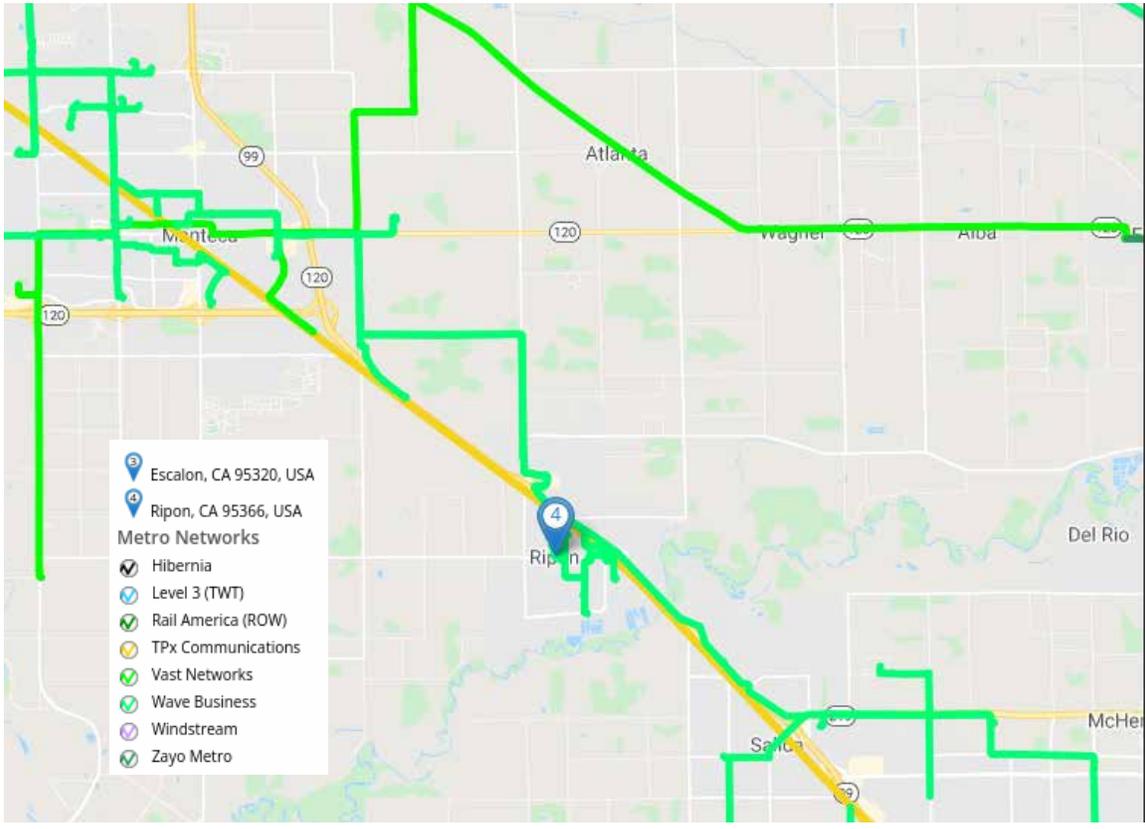


- 1 Executive Summary
- 2 Introduction
- 3 Best Practices & Policy Review
- 4 Existing Fiber Networks
- 5 Gaps Assessment
- 6 High-Impact Gaps Assessment
- 7 Funding Opportunities
- 8 Recommendations & Next Steps
- 9 Appendices

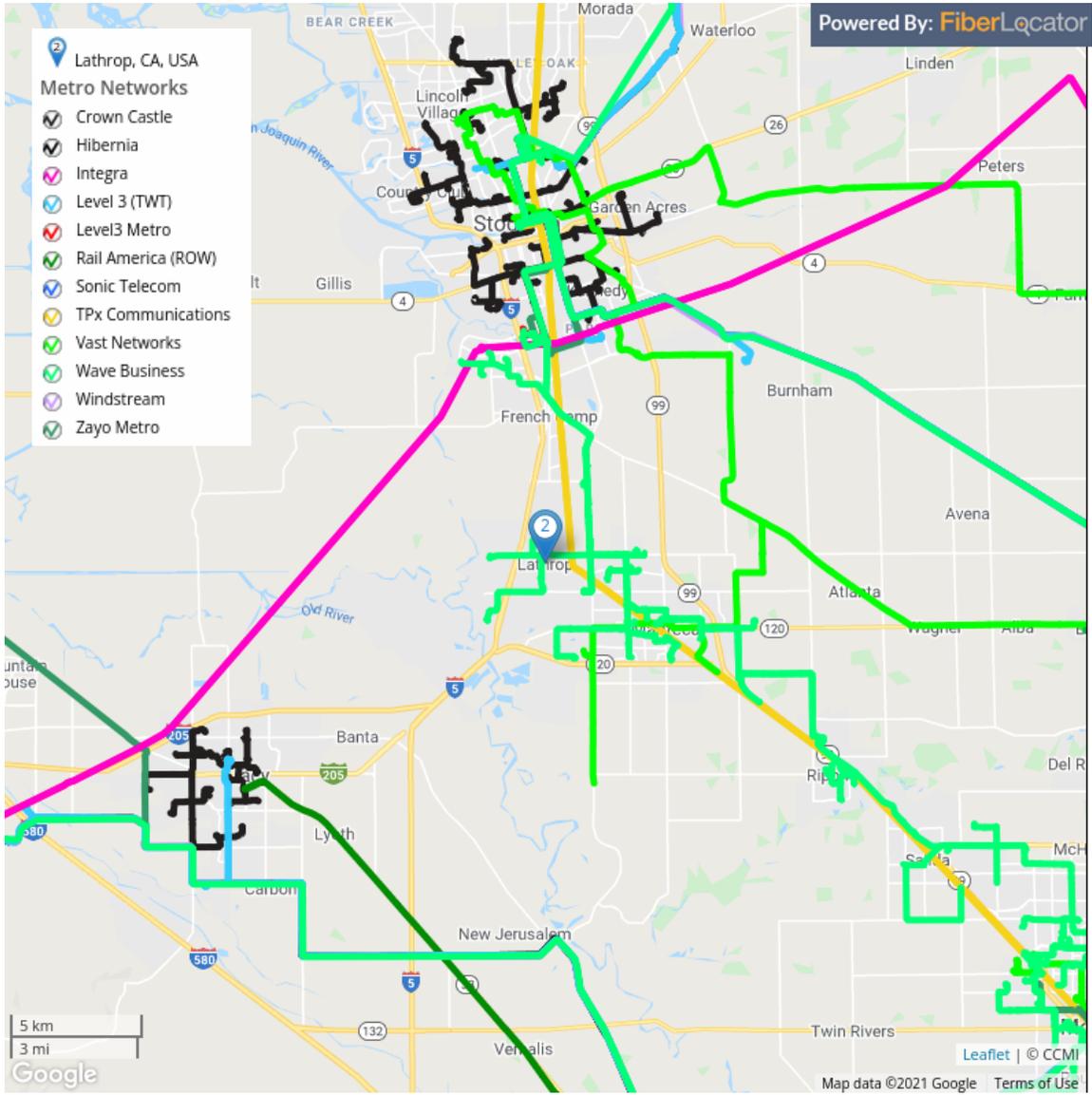


1	Executive Summary
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9	Appendices

# Ripon



# Stockton, Lathrop, Manteca, and Tracy



Executive Summary

Introduction

Best Practices & Policy Review

Existing Fiber Networks

Gaps Assessment

High-Impact Gaps Assessment

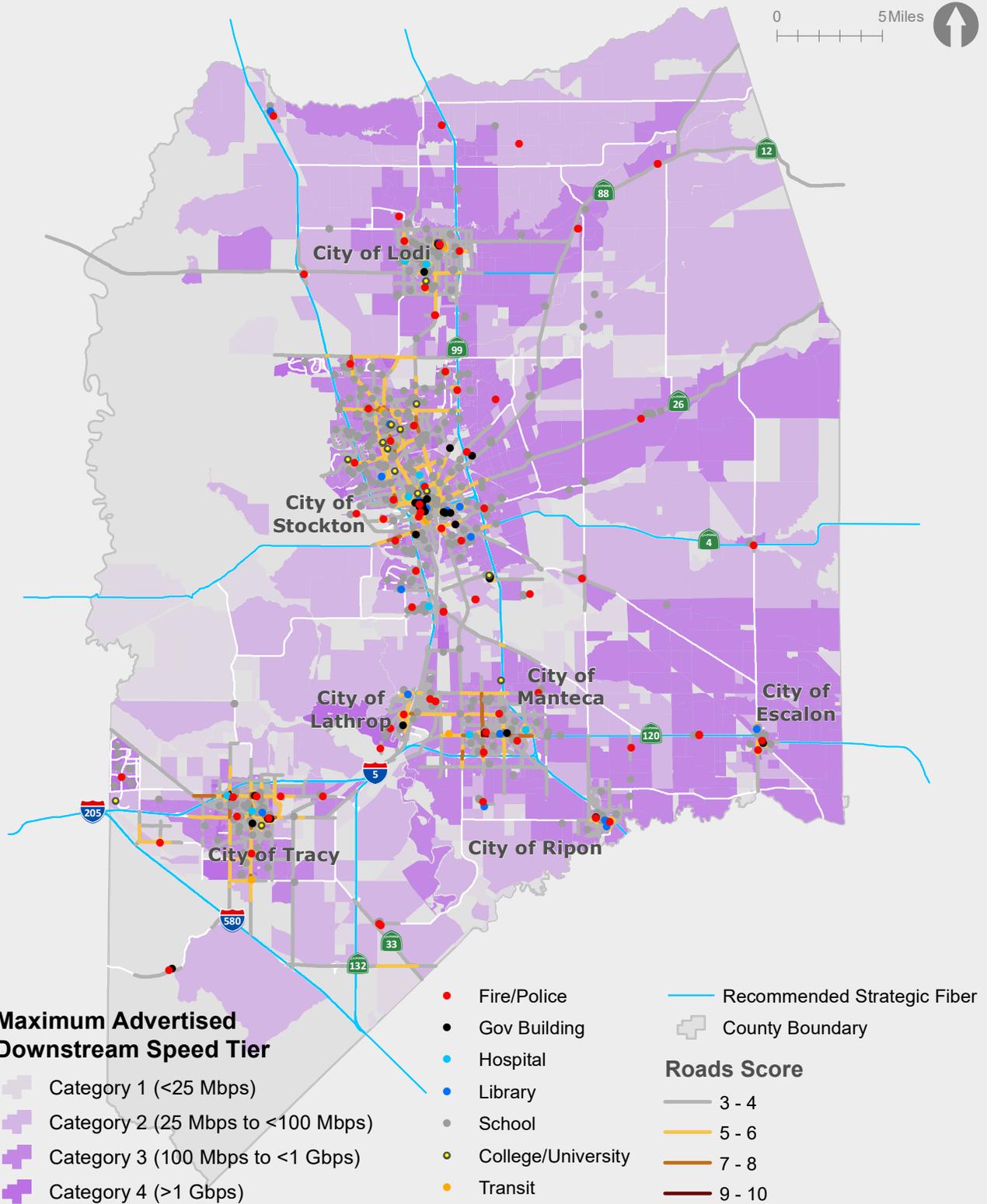
Funding Opportunities

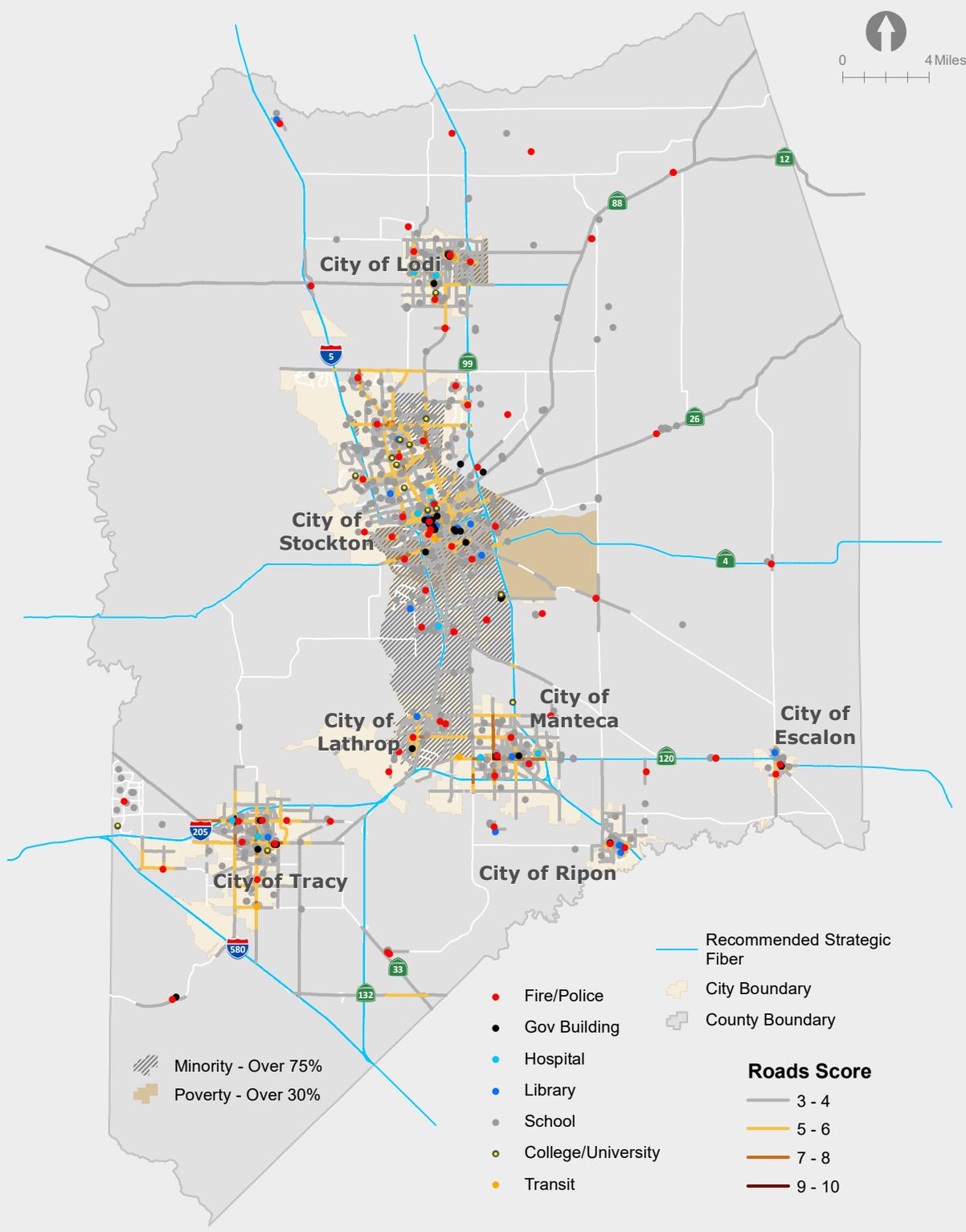
Recommendations & Next Steps

Appendices

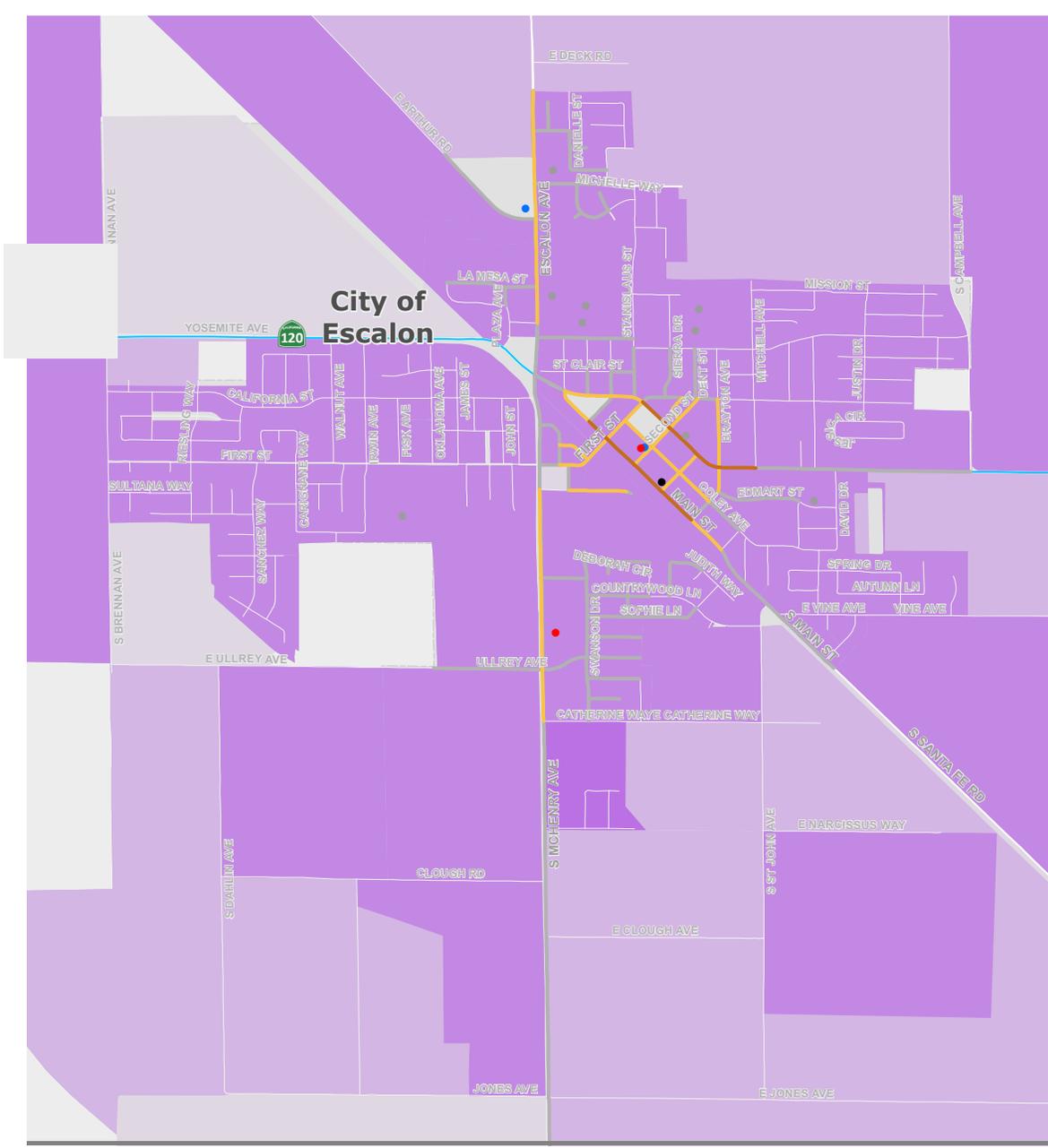
# E. Example Level 3 Community Considerations

- 1 Executive Summary
- 2 Introduction
- 3 Best Practices & Policy Review
- 4 Existing Fiber Networks
- 5 Gaps Assessment
- 6 High-Impact Gaps Assessment
- 7 Funding Opportunities
- 8 Recommendations & Next Steps
- 9 Appendices





Note: Fiber pathways are graphical displays, not specific locations. Does not reflect quality or quantity of existing networks.



- Roads Score**
- 3 - 4
  - 5 - 6
  - 7 - 8
  - 9 - 10

- Fire/Police
- Gov Building
- Hospital
- Library
- School
- College/University
- Transit

- Recommended Strategic Fiber
- ⊕ City Boundary
- Downstream Speed**
- ⊕ Category 1 (<25 Mbps)
- ⊕ Category 2 (25 Mbps to <100 Mbps)
- ⊕ Category 3 (100 Mbps to <1 Gbps)
- ⊕ Category 4 (>1 Gbps)



1

2

3

4

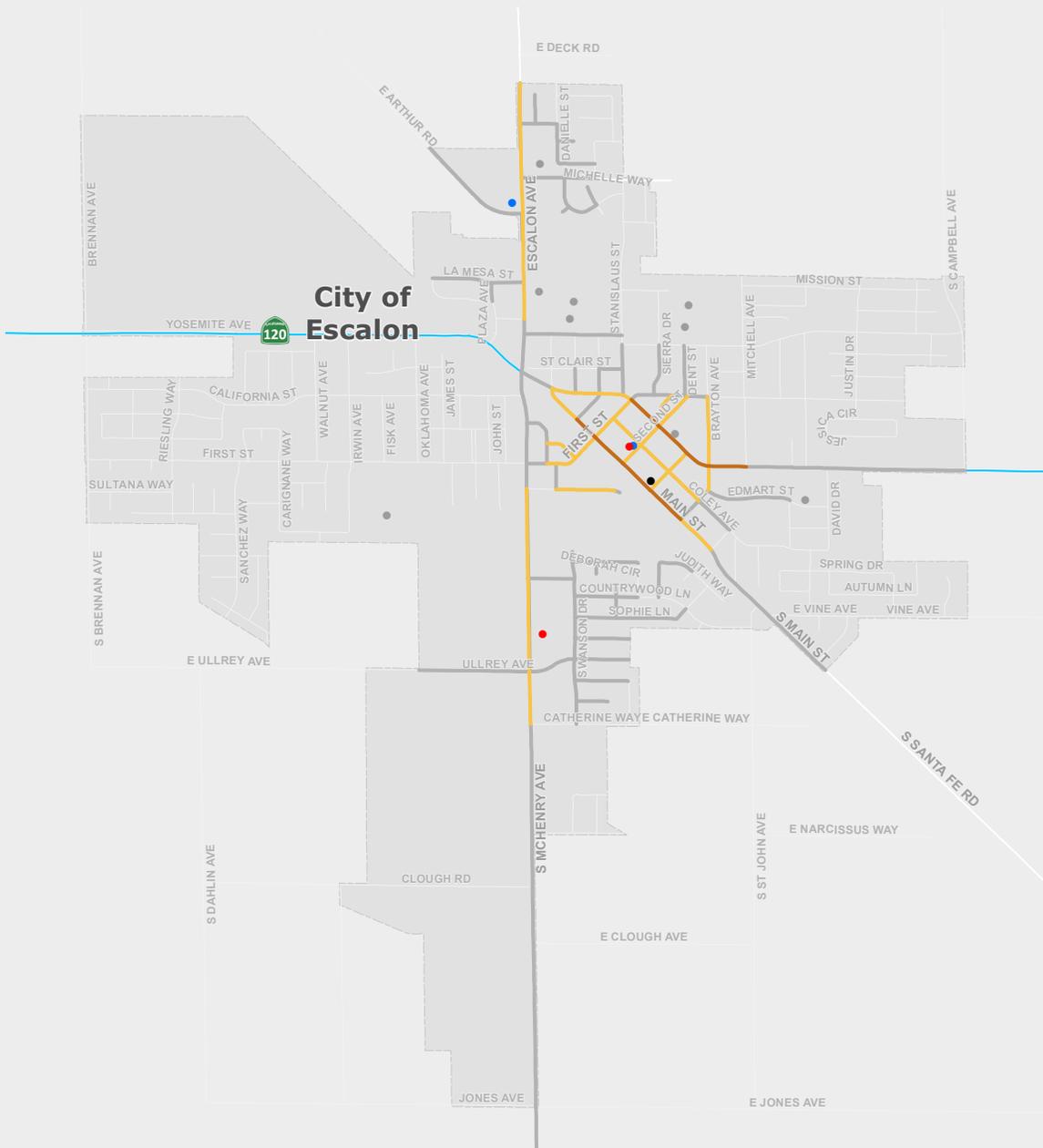
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6

7

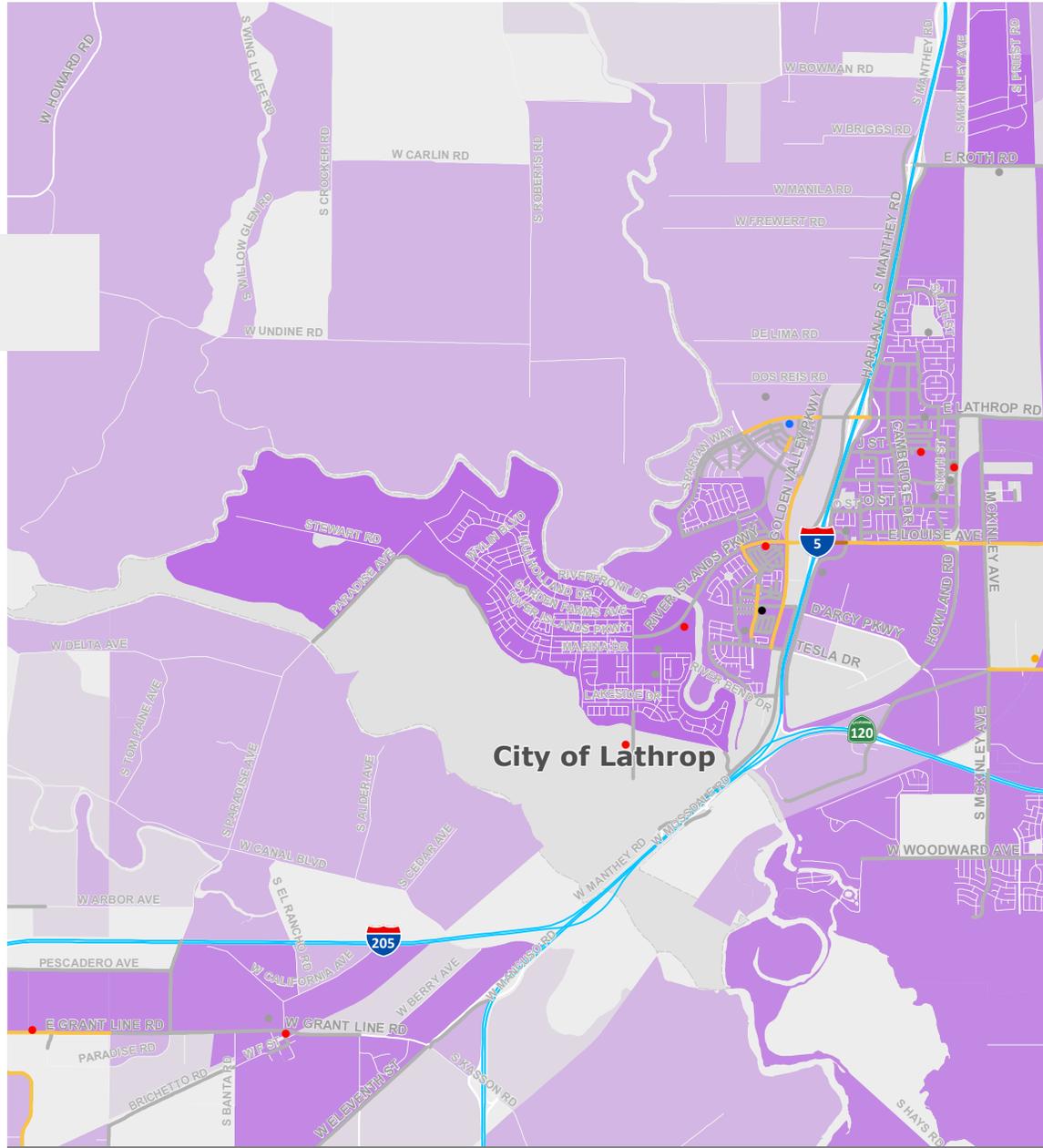
8

9

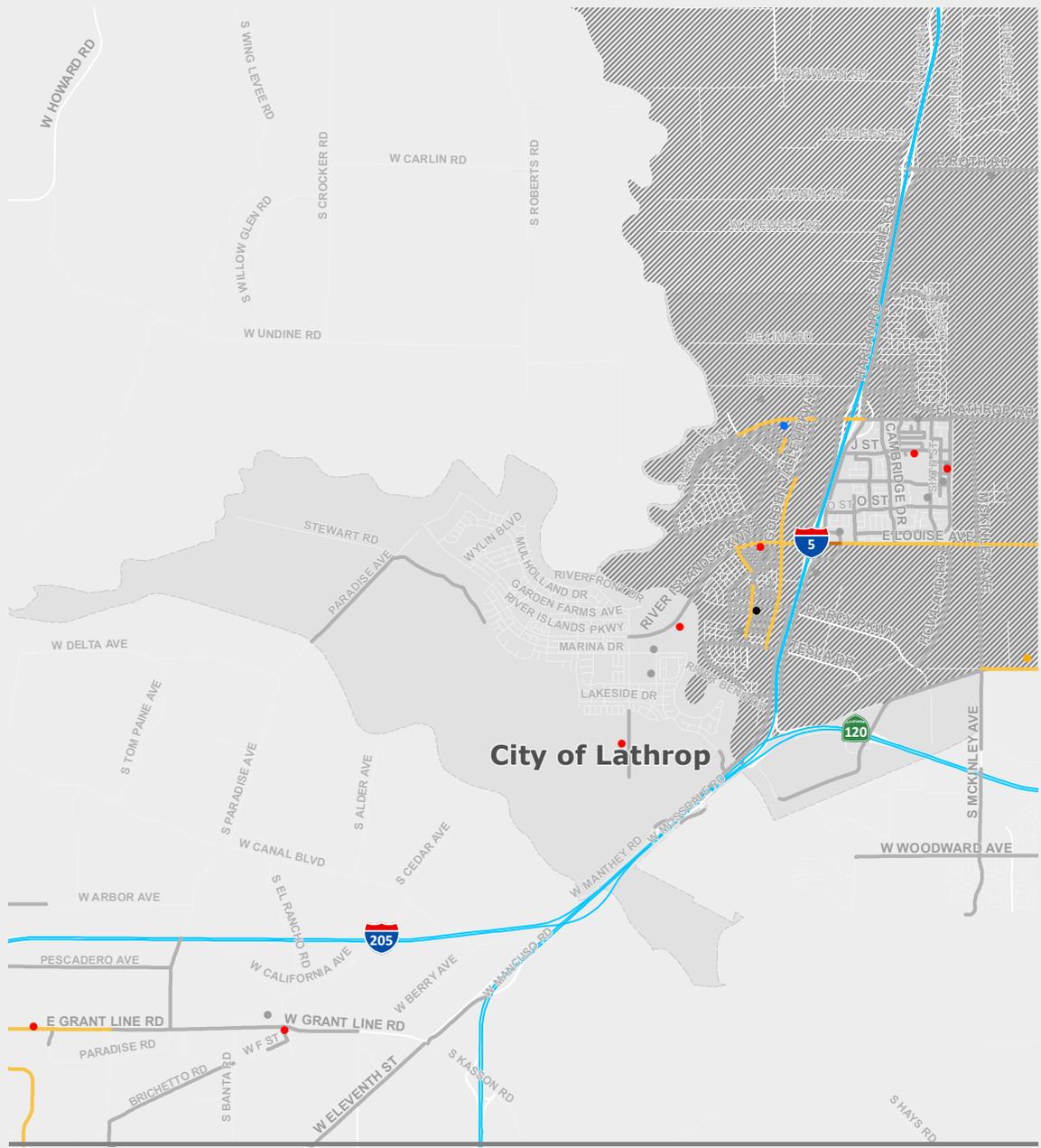


<b>Roads Score</b>	● Fire/Police	— Recommended Strategic Fiber
— 3 - 4	● Gov Building	▨ Minority - Over 75%
— 5 - 6	● Hospital	⊕ Poverty - Over 30%
— 7 - 8	● Library	⊞ City Boundary
— 9 - 10	● School	
	● College/University	
	● Transit	





<b>Roads Score</b>	● Fire/Police	— Recommended Strategic Fiber	0	1 Miles	↑
— 3 - 4	● Gov Building	▭ City Boundary			
— 5 - 6	● Hospital	<b>Downstream Speed</b>			
— 7 - 8	● Library	▭ Category 1 (<25 Mbps)			
— 9 - 10	● School	▭ Category 2 (25 Mbps to <100 Mbps)			
	● College/University	▭ Category 3 (100 Mbps to <1 Gbps)			
	● Transit	▭ Category 4 (>1 Gbps)			



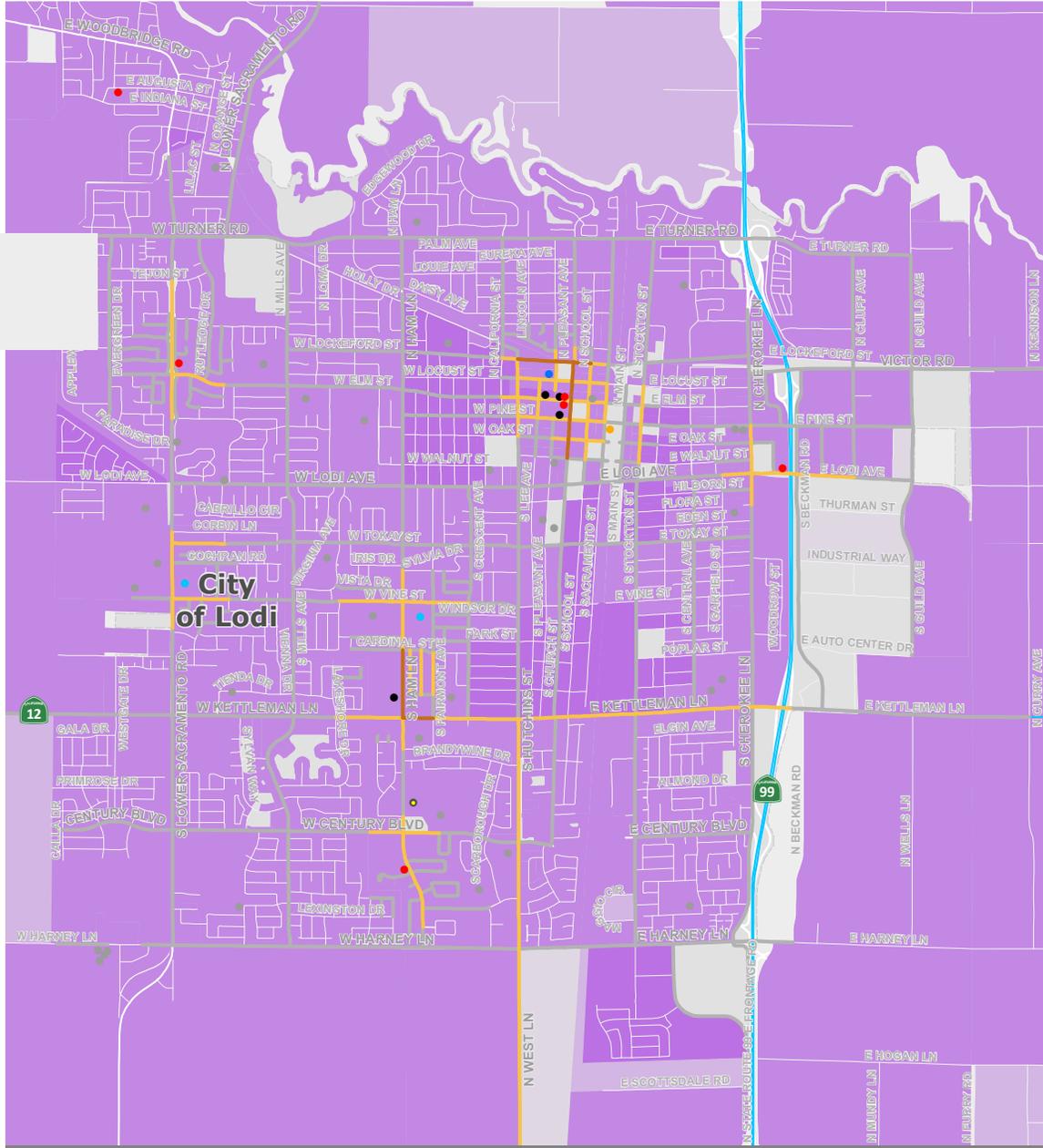
**Roads Score**

- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10

- Fire/Police
- Gov Building
- Hospital
- Library
- School
- College/University
- Transit

- Recommended Strategic Fiber
- ▨ Minority - Over 75%
- ⊕ Poverty - Over 30%
- City Boundary

0 1 Miles



**Roads Score**

- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10

**Recommended Strategic Fiber**

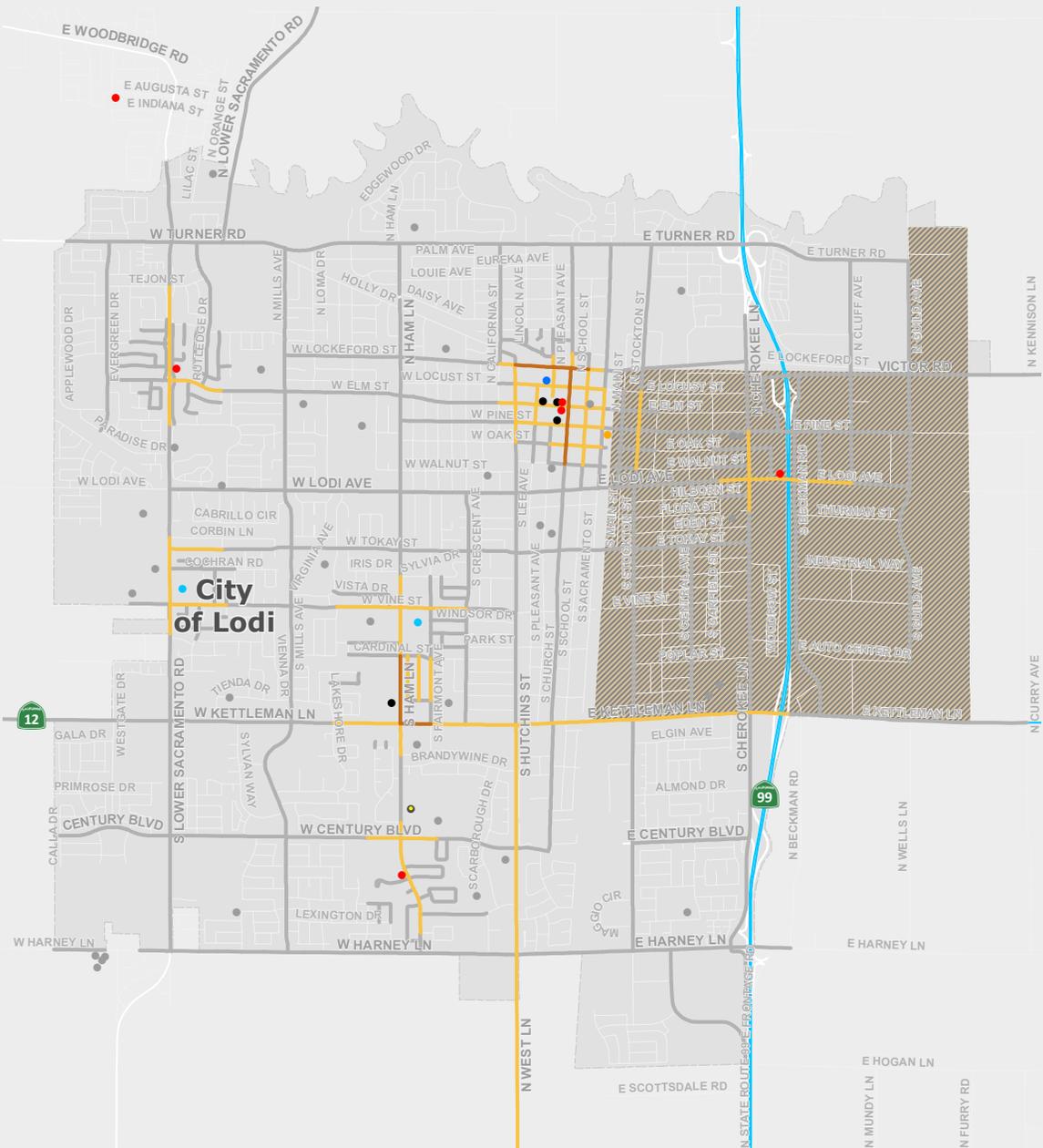
**City Boundary**

**Downstream Speed**

- Category 1 (<25 Mbps)
- Category 2 (25 Mbps to <100 Mbps)
- Category 3 (100 Mbps to <1 Gbps)
- Category 4 (>1 Gbps)

0 0.5 Miles

- Fire/Police
- Gov Building
- Hospital
- Library
- School
- College/University
- Transit



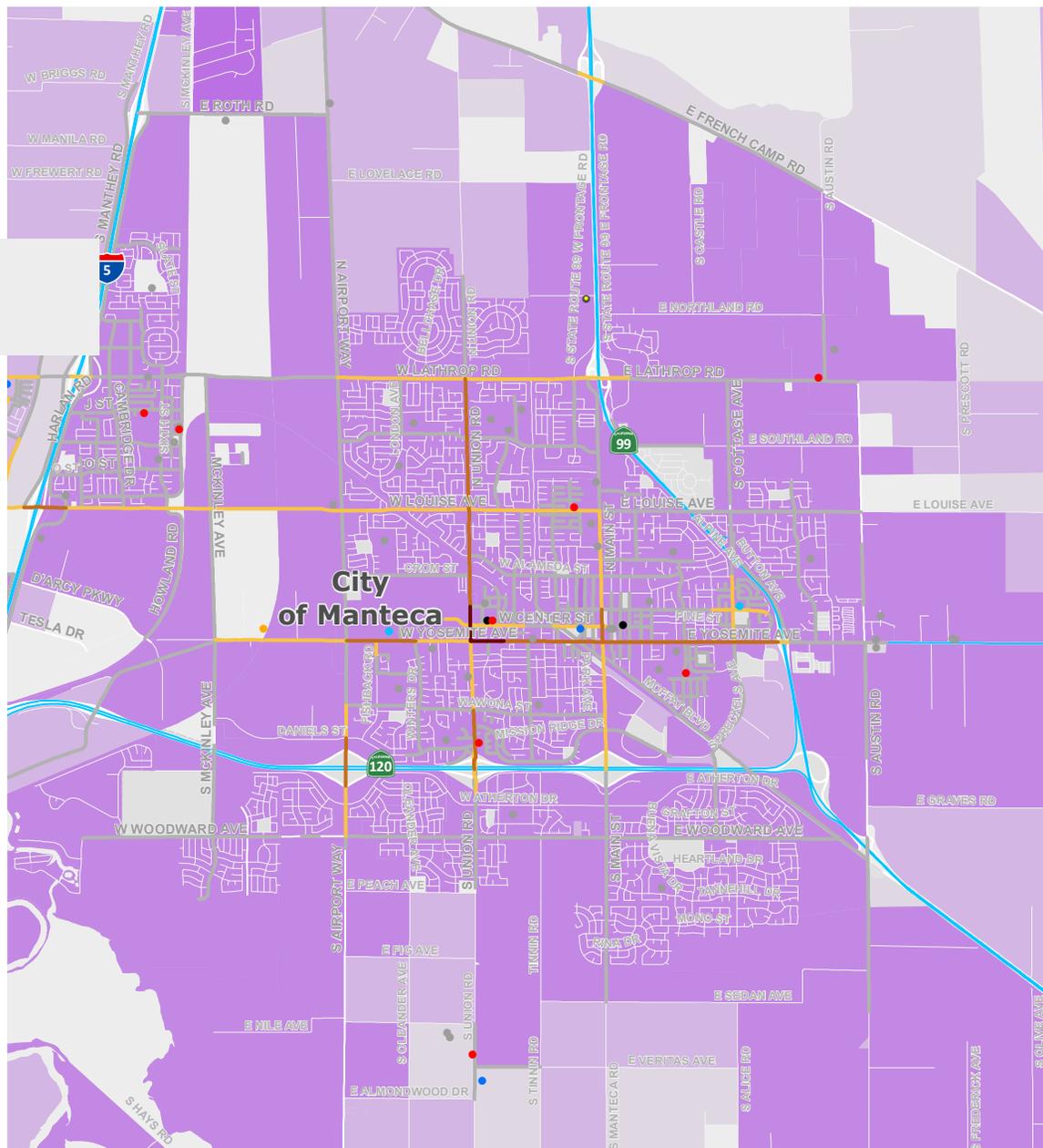
**Roads Score**

- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10

- Fire/Police
- Gov Building
- Hospital
- Library
- School
- College/University
- Transit

- Recommended Strategic Fiber
- ▨ Minority - Over 75%
- Poverty - Over 30%
- City Boundary

0 0.5 Miles



**Roads Score**

- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10

**Downstream Speed**

- Category 1 (<25 Mbps)
- Category 2 (25 Mbps to <100 Mbps)
- Category 3 (100 Mbps to <1 Gbps)
- Category 4 (>1 Gbps)

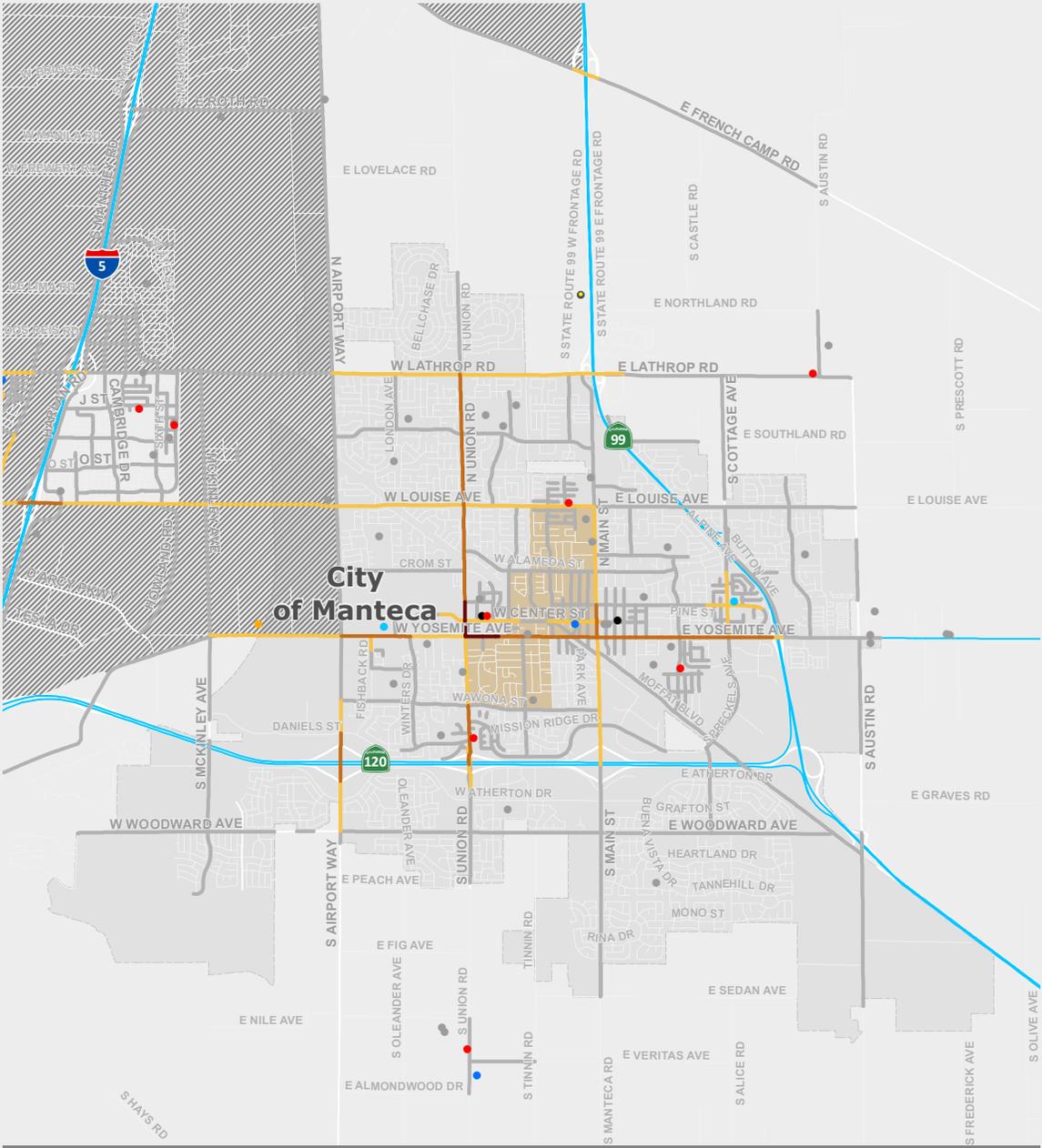
**Public Facilities**

- Fire/Police
- Gov Building
- Hospital
- Library
- School
- College/University
- Transit

**Other Symbols**

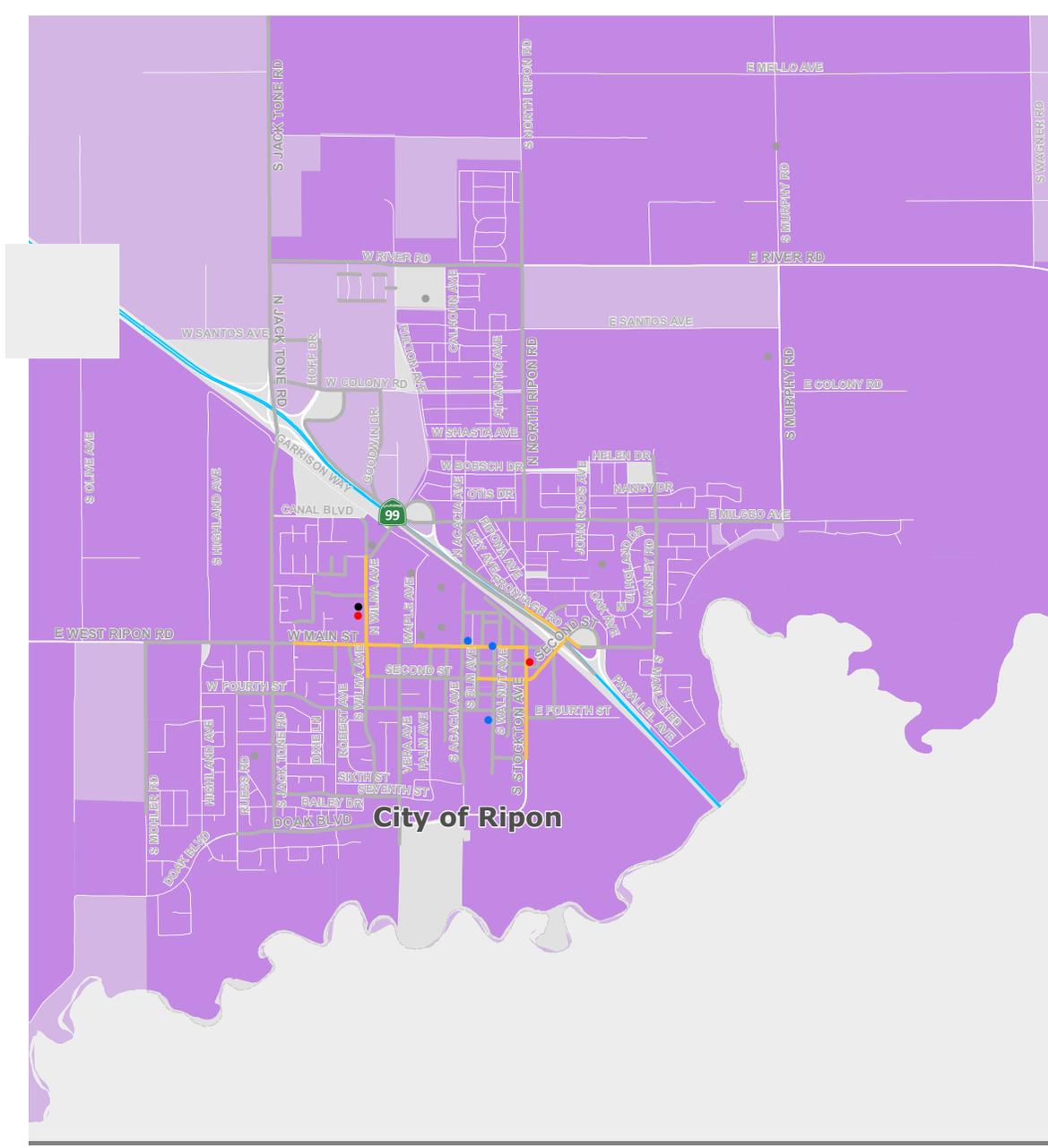
- Recommended Strategic Fiber
- City Boundary

0 1 Miles



<b>Roads Score</b>	● Fire/Police	— Recommended Strategic Fiber	0	1 Miles	↑
— 3 - 4	● Gov Building	▨ Minority - Over 75%			
— 5 - 6	● Hospital	▨ Poverty - Over 30%			
— 7 - 8	● Library	▨ City Boundary			
— 9 - 10	● School				
	● College/University				
	● Transit				

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**Roads Score**

- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10

**Landmarks**

- Fire/Police
- Gov Building
- Hospital
- Library
- School
- College/University
- Transit

**Downstream Speed**

- Category 1 (<25 Mbps)
- Category 2 (25 Mbps to <100 Mbps)
- Category 3 (100 Mbps to <1 Gbps)
- Category 4 (>1 Gbps)

**Other Symbols**

- Recommended Strategic Fiber
- City Boundary

0 0.5 Miles

1

2

3

4

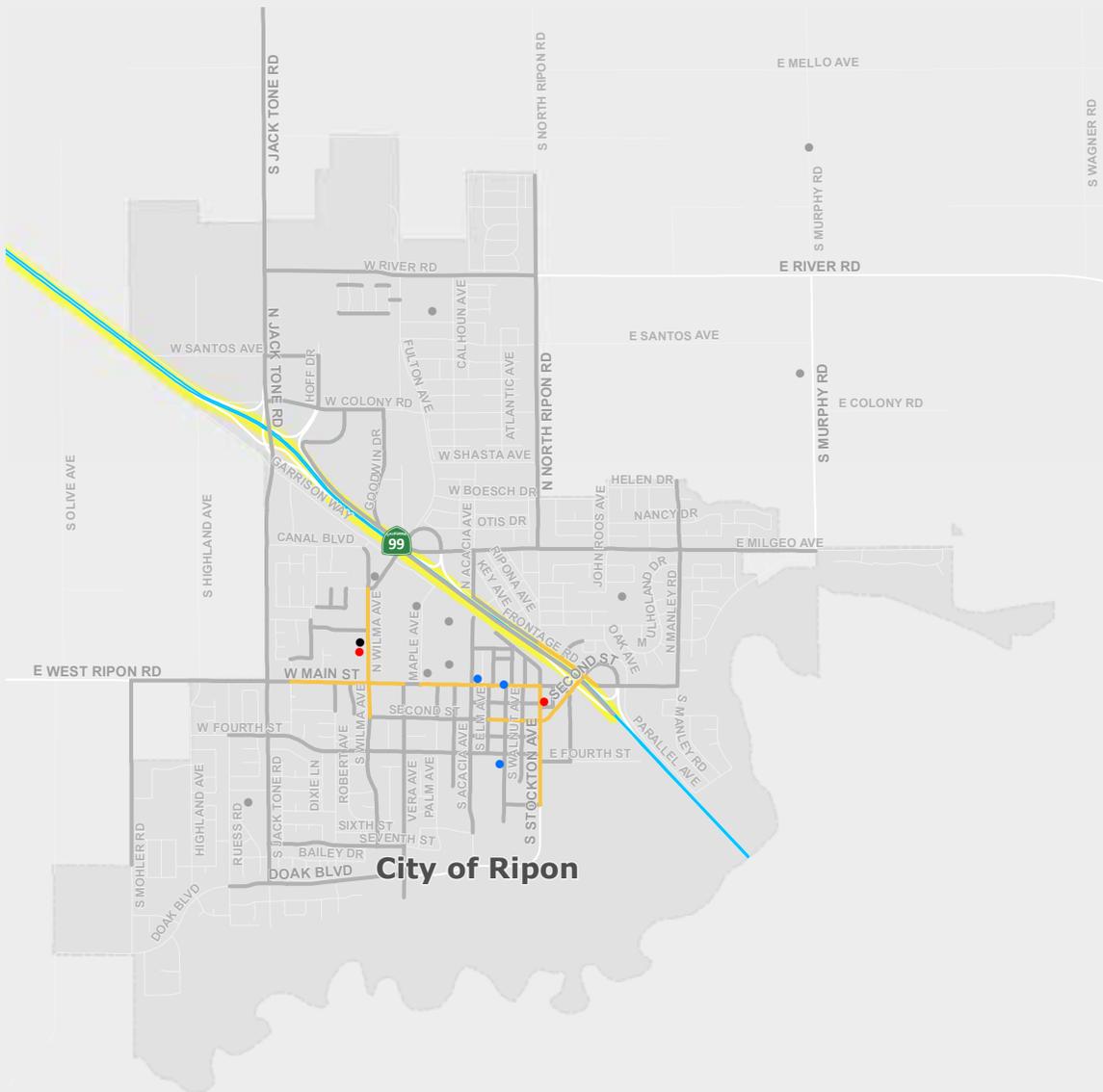
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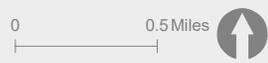


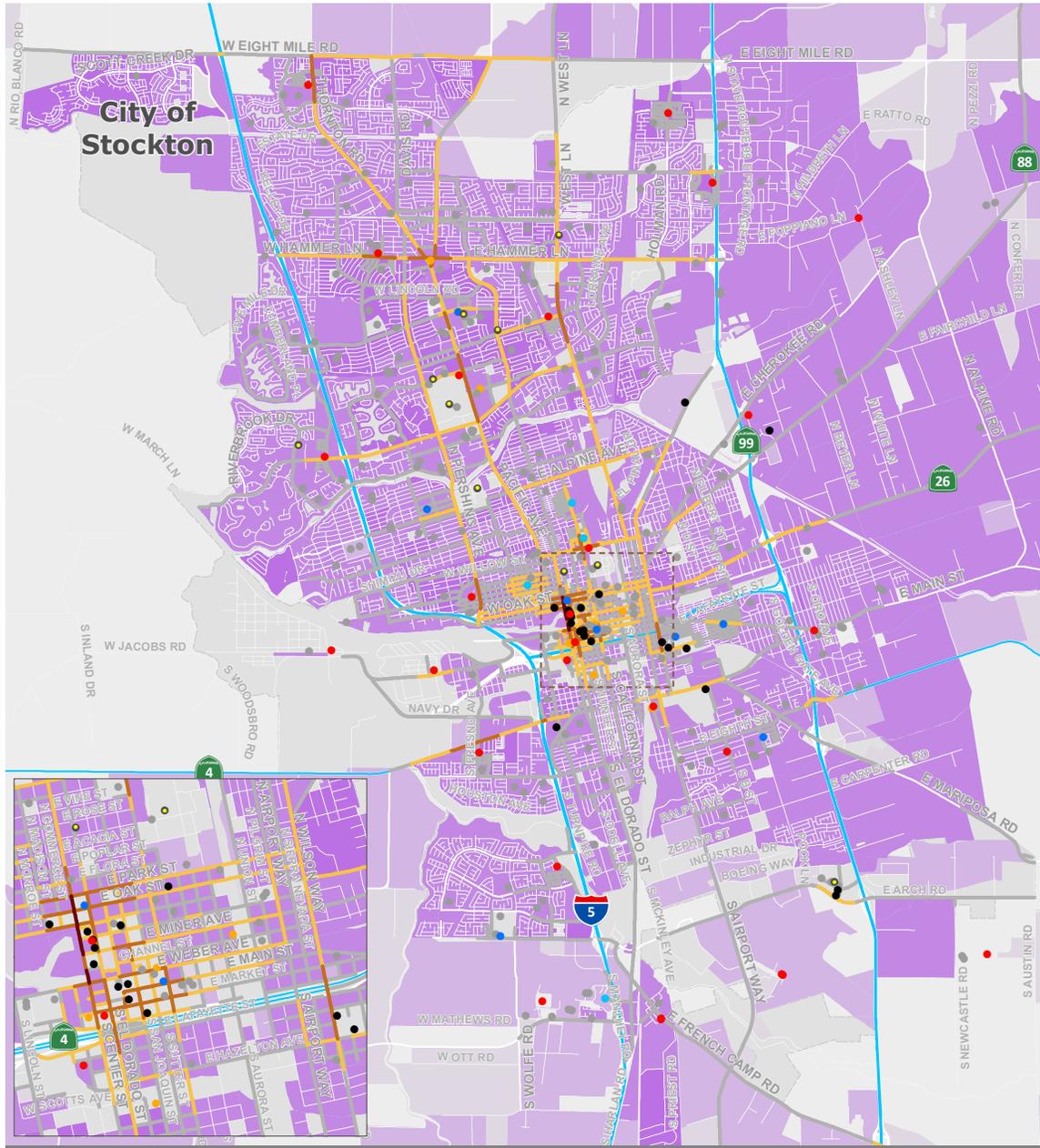
**Roads Score**

- 3 - 4
- 5 - 6

- Fire/Police
- Gov Building
- Library
- School

- Recommended Strategic Fiber
- Congested Corridors (SJCOG)
- City Boundary





**Roads Score**

- 3 - 4
- 5 - 6
- 7 - 8
- 9 - 10

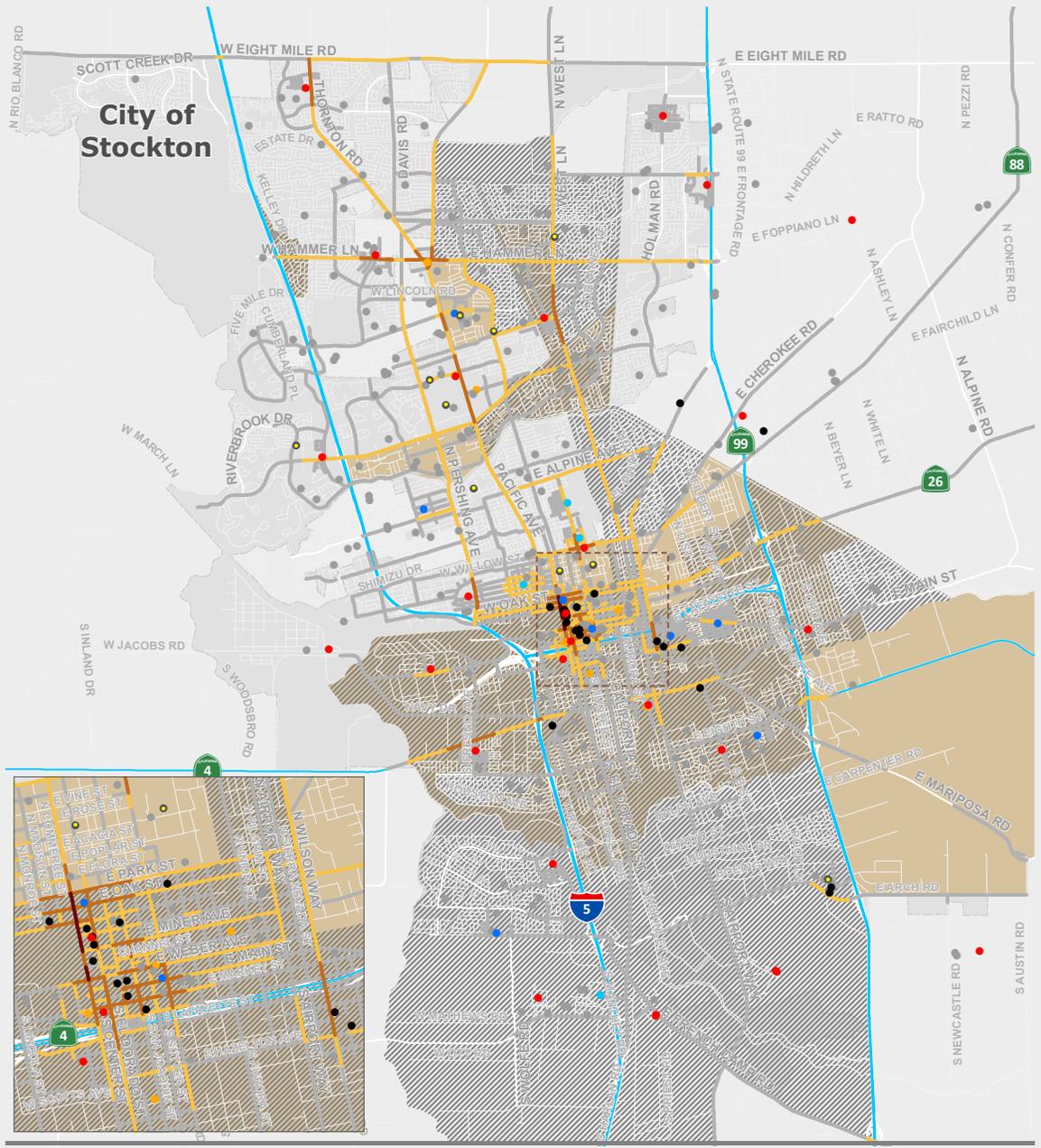
**Downstream Speed**

- Category 1 (<25 Mbps)
- Category 2 (25 Mbps to <100 Mbps)
- Category 3 (100 Mbps to <1 Gbps)
- Category 4 (>1 Gbps)

**Other Symbols:**

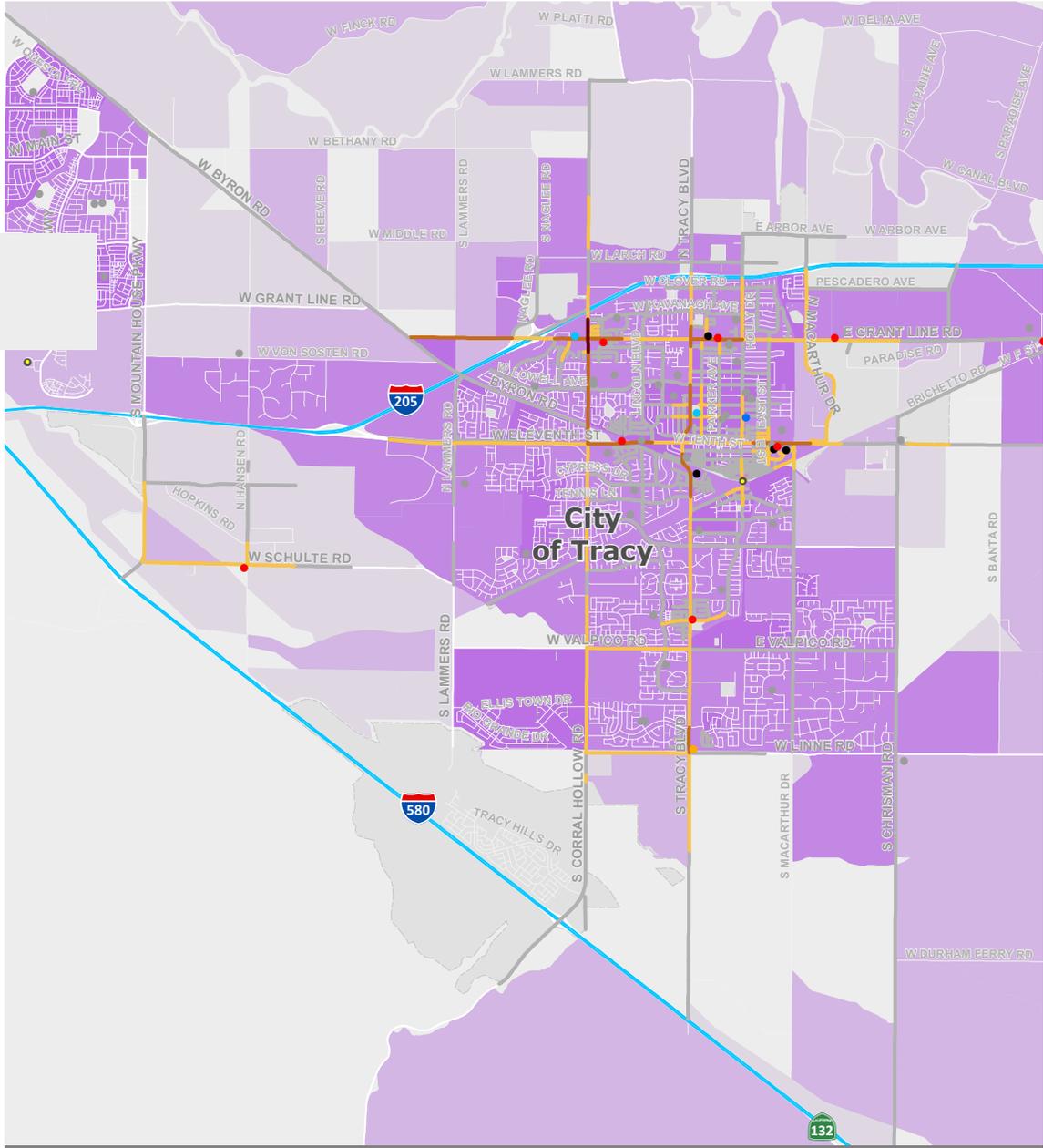
- Fire/Police
- Gov Building
- Hospital
- Library
- School
- College/University
- Transit
- Recommended Strategic Fiber
- ⊕ City Boundary

0 1.5 Miles

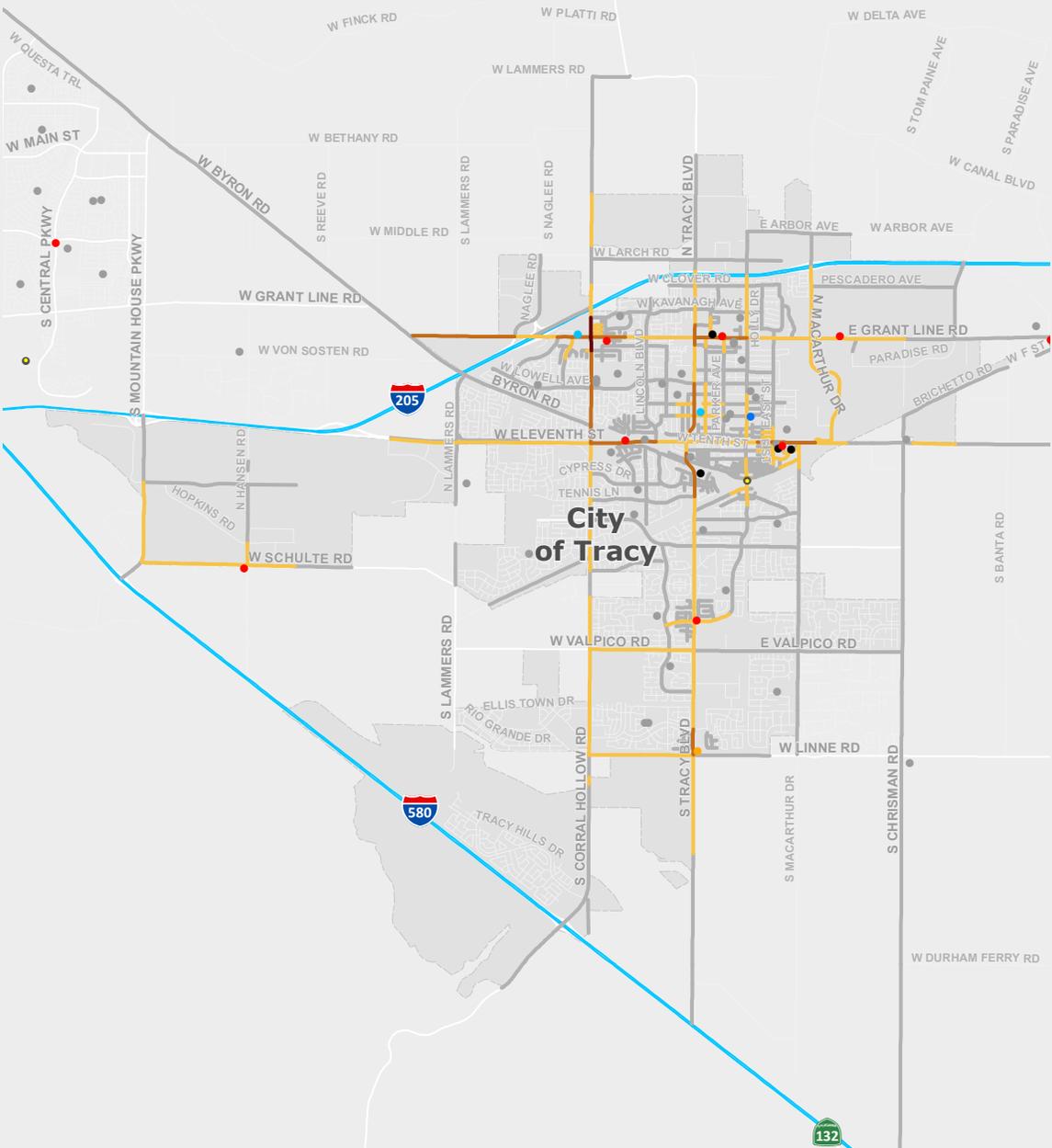


<b>Roads Score</b>	● Fire/Police	— Recommended Strategic Fiber	0 1.5 Miles
— 3 - 4	● Gov Building	▨ Minority - Over 75%	↑
— 5 - 6	● Hospital	▨ Poverty - Over 30%	
— 7 - 8	● Library	▨ City Boundary	
— 9 - 10	● School		
	● College/University		
	● Transit		

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<b>Roads Score</b>	● Fire/Police	— Recommended Strategic Fiber	0 1 Miles
— 3 - 4	● Gov Building	⊕ City Boundary	
— 5 - 6	● Hospital	<b>Downstream Speed</b>	
— 7 - 8	● Library	⊕ Category 1 (<25 Mbps)	
— 9 - 10	● School	⊕ Category 2 (25 Mbps to <100 Mbps)	
	● College/University	⊕ Category 3 (100 Mbps to <1 Gbps)	
	● Transit	⊕ Category 4 (>1 Gbps)	



<b>Roads Score</b>	● Fire/Police	— Recommended Strategic Fiber	0 1 Miles
— 3 - 4	● Gov Building	▨ Minority - Over 75%	↑
— 5 - 6	● Hospital	⊕ Poverty - Over 30%	
— 7 - 8	● Library	⊞ City Boundary	
— 9 - 10	● School		
	● College/University		
	● Transit		

# F. Full Prioritization Methodology Worksheet

## Layer 1: Transportation

Variable	Score
Is the corridor a congested corridor (as previously defined by SJCOG)?	<b>0 Points:</b> Not a congested segment <b>1 Point:</b> Connects two congested segments <b>2 Points:</b> Congested segment
What is the functional classification of the corridor?	<b>1 Point:</b> Collector <b>2 Points:</b> Arterial
Who owns and maintains the roadway?	<b>0 Points:</b> State <b>1 Point:</b> County <b>2 Points:</b> City
Is the corridor a planned fiber pathway?	<b>0 Points:</b> Unplanned <b>1 Point:</b> State Planned <b>2 Points:</b> City Planned

## Layer 2: Community Anchor Institutions

Variable	Score
Does a ROW fiber connection provide opportunity for school connection?	<b>0 Points:</b> No School(s) <b>1 Point:</b> One or more connections
Does a ROW fiber connection provide opportunity for fire/police connection?	<b>0 Points:</b> No Fire/Police Stations <b>1 Point:</b> One or more connections
Does a ROW fiber connection provide opportunity for hospital connection?	<b>0 Points:</b> No Hospitals <b>1 Point:</b> One or more connections
Does a ROW fiber connection provide opportunity for government building connection?	<b>0 Points:</b> No Government Buildings <b>1 Point:</b> One or more connections
Does a ROW fiber connection provide opportunity for library connection?	<b>0 Points:</b> No Libraries <b>1 Point:</b> One or more connections
Does a ROW fiber connection provide opportunity for transit hub connection?	<b>0 Points:</b> No Transit Hubs <b>1 Point:</b> One or more connections

# Layer 3: Population, Equity, and Other Considerations

The table below provides an example of how a city may apply this methodology to population, equity, and other considerations. Although not included in the methodology for this memo, the county and cities have the flexibility to add additional layers of consideration and scoring to align with their respective local goals, including but not limited to economic development, connections to underserved communities, connections to major employment or industrial/technology centers, higher population densities, specific Communities of Concern, or environmental concerns.

Variable	Score
Does a ROW fiber connection provide opportunity for major employment or industrial/tech center connections?	<b>0 Points:</b> No connections <b>1 Point:</b> Existing center(s) <b>2 Points:</b> Existing center(s) Local High Priority
What is the population density served by the connection?	Scoring Range determined per city by density range from city census data
Is the corridor within a defined community of concern?	<b>0 Points:</b> Not a community of concern <b>1 Point:</b> Partly within CoC <b>2 Points:</b> Totally encompassed within CoC

# G. Alphabetical High-Impact Prioritization Results

HighImpact Corridor	Combined Road Score	Layer 1: Transportation			Strategic Fiber Connections: Planned Development	Jurisdiction
		State Strategic Broadband Corridor	Congested Corridor	Layer 2: Community Anchor Institution		
Airport Way	7		✓	✓	✓	Manteca
Benjamin Holt Drive	5			✓		San Joaquin County
Brayton Avenue	5			✓		Escalon
California Street	7			✓		Stockton
Corral Hallow Road	10		✓	✓		Tracy
Dr. Martin Luther King Jr. Boulevard	7		✓	✓		Stockton
Eight Mile Road	5		✓			Lodi
Eight Mile Road	5		✓			San Joaquin County
El Dorado Street	7			✓		Stockton
Eleventh Street	8		✓	✓		Tracy
Escalon Avenue/McHenry Road	5			✓		Escalon
Farmington Road	5		✓			San Joaquin County
First Street	6			✓		Escalon
Fourth Street	5			✓		Tracy
Fremont Street	7		✓	✓		Stockton
Fremont Street	5		✓			San Joaquin County
French Camp Road	5		✓			San Joaquin County
Golden Valley Parkway	6			✓	✓	Lathrop
Grant Line Road	8		✓	✓		Tracy
Ham Lane	7			✓		Lodi

High Impact Corridor	Combined Road Score	Layer 1: Transportation			Strategic Fiber Connections: Planned Development	Jurisdiction
		State Strategic Broadband Corridor	Congested Corridor	Layer 2: Community Anchor Institution		
Hammer Lane	7		✓	✓		Stockton
Hammer Lane	5		✓	✓		San Joaquin County
Harding Way	8		✓	✓		Stockton
Highway 4/ Charter Way	7	✓				Stockton
Highway 12		✓		✓		San Joaquin County
Highway 99		✓		✓		San Joaquin County
Highway 99		✓				Lodi
Highway 99			✓	✓		Manteca
Highway 99			✓			Ripon
Highway 99		✓				Stockton
Highway 120		✓		✓		San Joaquin County
Highway 120		✓				Escalon
Highway 120		✓			✓	Lathrop
Highway 120		✓				Manteca
Interstate 5		✓		✓		San Joaquin County
Interstate 5		✓		✓	✓	Lathrop
Interstate 5		✓				Stockton
Interstate 205		✓	✓			Tracy
Interstate 580		✓	✓			Tracy
Jack Tone Road	3			✓		San Joaquin County
Jack Tone Road	4					Ripon
Jackson Avenue	7			✓		Escalon
Kettleman Lane	3			✓		San Joaquin County

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High Impact Corridor	Combined Road Score	Layer 1: Transportation			Strategic Fiber Connections: Planned Development	Jurisdiction
		State Strategic Broadband Corridor	Congested Corridor	Layer 2: Community Anchor Institution		
Kettleman Lane (Highway 12)	7	✓	✓	✓		Lodi
Lammers Road	4					Tracy
Lathrop Avenue	6		✓	✓		Lathrop
Lathrop Road	6		✓	✓	✓	Manteca
Lathrop Road	6		✓		✓	San Joaquin County
Lodi Avenue	5			✓		Lodi
Louise Avenue	7		✓	✓		Lathrop
Louise Avenue	6			✓		Manteca
Lower Sacramento Road	6			✓		Lodi
Lower Sacramento Road	7		✓	✓		Stockton
MacArthur Drive	6			✓		Tracy
Main Street	7			✓		Escalon
Main Street	8		✓	✓	✓	Manteca
Main Street	6			✓		Ripon
Main Street	8			✓		Stockton
March Lane	6		✓	✓		Stockton
Market Street	8			✓		Stockton
McKinley Avenue	4			✓		Lathrop
Miner Avenue	7			✓		Stockton
North Ripon Road	4					Ripon
Oak Street	8			✓		Stockton
Park Street	7			✓		Stockton
Pacific Avenue	8		✓	✓		Stockton

High Impact Corridor	Combined Road Score	Layer 1: Transportation			Strategic Fiber Connections: Planned Development	Jurisdiction
		State Strategic Broadband Corridor	Congested Corridor	Layer 2: Community Anchor Institution		
Pershing Avenue	7		✓	✓		Stockton
Pershing Avenue	5		✓			San Joaquin County
River Islands Parkway	6	✓		✓	✓	Lathrop
Roth Road	4			✓	✓	Manteca
San Joaquin Street	7			✓		Stockton
Second Street	6			✓		Ripon
Stockton Avenue	6			✓		Ripon
Thornton Road	7		✓	✓		Stockton
Thornton Road	5		✓			San Joaquin County
Tracy Boulevard	8		✓	✓		Tracy
Union Road	9		✓	✓	✓	Manteca
Valpico Road	6		✓	✓		Tracy
Waterloo Road	5		✓			San Joaquin County
Weber Avenue	9			✓		Stockton
West Lane	7		✓	✓		Stockton
West Lane/ Hutchins Street	6		✓	✓		Lodi
West Lane	6		✓	✓		San Joaquin County
Wilma Avenue	6			✓		Ripon
Wilson Way	7		✓	✓		Stockton
Wilson Way	5		✓			San Joaquin County
Woodward Avenue	4			✓		Manteca
Yosemite Avenue	9		✓	✓		Manteca
Yosemite Avenue/ Highway 132	5		✓			San Joaquin County

# H. The Municipal Fiber Network Investment

A standard “rule-of-thumb” Return-On-Investment (ROI) percentage of a publicly funded Municipal Broadband Network can be extremely challenging to compute for many reasons including:

- Variability of technology it is replacing
- How the network will be utilized? (public only, commercial, hybrid, etc.)
- Density of connections of the network location
- The need to compare current technologies to future “unknown” technologies
- Unknown opportunity costs
- Unknown potential cost-avoidance

Since most investments in municipal/county fiber are not viewed in terms of profitability, it is often more generally accepted to compute a payback period. While many of the same variables and challenges apply and the number of years is stated in a range, this measure provides a more concrete indicator for decision-makers. The good news is that it is generally accepted that municipal networks, when designed and implemented properly, do provide an acceptable payback period that morphs into future cost savings. It truly can be viewed as an investment but not one easily assigned an ROI percentage.

Traditionally, from an investor’s viewpoint, fiber networks built by internet server providers typically had a payback period of 15-20 years. However, over time, the demand for higher bandwidth for business and households has increased. With the higher demand to enable IoT devices, as well as the deployment of 5G wireless networks, global IP traffic was growing at 25% per year even before the impact of the COVID-19 pandemic. The take rate for fiber-to-the-home networks has grown from 35% to nearly 50% in recent years according to The Fiber to the Home Council Americas. This increase in demand in conjunction with government investment and higher efficiencies in lower costs related to deployment have many providers now reporting a payback period of 5-7 years and some as low as 3-5 years.

While improvements in the commercial market bode well for overall fiber broadband investment, it does not necessarily translate to municipal fiber networks that also offer full ISP service. A report by Christopher S. Yoo and Timothy Pfenninger from the University of Pennsylvania entitled *Municipal Fiber in the United States: An Empirical Assessment of Financial Performance* demonstrates a very mixed result. Of the 20 projects reviewed, only 9 reported positive cash flows and only two had reasonable payback periods. In fact, many of these projects have exited the market and sold out to private companies. Admittedly, this report focused on a purely Net Present Value financial analysis and did not consider many other positive side effects and benefits of the broadband network, cost-avoidance, or opportunity costs. However, it is a good overview of the challenges of the fully converged broadband stack model where the municipal or county government acts as the ISP.

The more pertinent analysis is of the connected or integrated broadband stack model that is the recommended approach. In this model, the fiber infrastructure is created for three distinct purposes. The first is to create a county or municipal wide network for all community anchor institutions and government facilities. The individual networks are operated by the various stakeholder groups and the backbone infrastructure is financed and maintained by the municipal or county government. In most cases, it is recommended that these services be outsourced as most government entities do not have the capacity nor is it the core competency of their IT organization.

The second primary use is to create business and economic development opportunities by using the excess capacity of the infrastructure as a middle-mile dark fiber network that can be used by other ISPs to provide last-mile service to businesses and residents. In many cases, this allows small local providers the ability to compete with the larger companies as the cost of leasing fiber from the government organization is far more cost-effective than building out infrastructure. The government entity realizes revenue from leasing of the infrastructure. In other cases, businesses may lease fiber to create point-to-point connections to multiple locations within (or even outside) of the municipality or county. This second use also creates the opportunities for resource-sharing and cooperative efforts with outside government entities including the state.

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The third opportunity is to allow for the creation of public-private partnerships where an outside provider utilizes the backbone network to provide fiber-to-the-home service. This can be accomplished through a straight leasing agreement between the government entity and the private provider, a revenue-sharing model, a resource-sharing agreement, or some combination of the three. This is the fastest growing model and is highlighted in Public Infrastructure/Private Service: A Shared-Risk Partnership Model for 21st Century Broadband Infrastructure published in October 2020 by the Benton Institute for Broadband & Society. There are numerous examples cited including Westminster, Maryland; West Des Moines, Iowa; Springfield, Missouri; and Urbana/Champaign, Illinois. These are very specific models of public-private partnerships with detailed financial analyses. These analyses are designed to find an acceptable ROI.

For the purposes of simplicity, the best explanation of payback periods can best be demonstrated in an analysis of the first primary use noted above, connection of community anchor institutions and government locations. This analysis also can vary based on the same factors outlined above at the beginning of this discussion. Each municipal/county fiber infrastructure is unique and requires a feasibility study that analyzes fiber broadband project costs against ongoing connectivity functionality and leased circuit costs. However, a survey of feasibility studies done for these types of institutional networks shows payback periods generally in the 7-12-year range.

For example, the feasibility study prepared for Carroll County, MD by Columbia Telecommunications Corporation on August 10, 2005, analyzed just the current leased-line costs for Carroll County Public Schools, Carroll County Public Library, Carroll Community College, and Carroll County Government and projected a 12-year payback. However, it is noted that "these figures are conservative because they only include the current costs, and do not account for increased costs due to present and future needs. Any increase in the costs of leased services will significantly lower the payback period." This reality came to pass, and Carroll County realized a payback period within eight years for those two reasons and by further expanding the network and including the eight municipalities and public safety. Further, the county began leasing fiber for purposes two and three above and is realizing revenue that helps offset the cost of the outsourced service provider maintaining and

managing the infrastructure. Another important aspect to consider is that the costs used for the feasibility study was based on 2005 technology. Over the years, as demands on bandwidth increased, the costs of comparable leased line circuits would have been much higher and a significant amount of the functionality that this fiber network provides would not have even been possible. The opportunity cost would have been enormous. Further, it is hard to calculate the economic development benefit of the county providing broadband service capabilities to both business and residents. It was this initial investment that enabled the public-private partnership between the City of Westminster and Ting highlighted in this report.

Other feasibility studies for locations including the Town of Holly Spring, North Carolina; City of Batavia, Illinois; and City of Culver City, California present similar payback period estimates.

# I. Funding Opportunities

These funding opportunities focus on transportation-related infrastructure programs to begin to build a fiber-optic network backbone through San Joaquin County.

One important role that SJCOG can play in advancing the fiber optic network within the region will be leading grant applications to fund local projects that further the region’s goals for transformational technology readiness. SJCOG shares funding opportunities with its partner agencies through its Grants Database website. As new grant opportunities are identified, SJCOG could update its online Grant Database to share this information with the region.

## Federal Funding Opportunities

**Tables D-1 and D-2** delineate federal-aid programs and discretionary grants that could help SJCOG develop and expand its fiber optic network. In addition to the grants detailed below, the Infrastructure Investment and Jobs Act (IIJA) was recently signed into law (See **Section 6** for infrastructure bill funding opportunities). This made significant investments in fiber expansion and transformative transportation projects.

**Table D-1:** Active Federal-Aid Funding Opportunities

Program	Description	Example Eligible Projects
<i>Congestion Mitigation and Air Quality Improvement Program (CMAQ)</i>	Provides a flexible funding source for transportation projects and programs to help meet the requirements of the Clean Air Act. Funding is available to reduce congestion and improve air quality for areas to comply with national air quality standards.	<ul style="list-style-type: none"> <li>• Transit and shared mobility</li> <li>• ITS projects</li> <li>• Multimodal traveler information</li> <li>• Real time traffic control systems</li> <li>• HOV lanes</li> <li>• Transportation system management and operations</li> </ul>
<i>Surface Transportation Block Grant Program (STBG)</i>	Provides flexible funding that may be used by States and localities for projects to preserve and improve the conditions and performance on any Federal-aid highway, bridge and tunnel projects on any public road, pedestrian and bicycle infrastructure, and transit capital projects.	<ul style="list-style-type: none"> <li>• ITS and EV charging infrastructure</li> <li>• Operational improvements for highways</li> <li>• Transit capital projects</li> <li>• Ramp improvement projects</li> <li>• Bicycle and pedestrian improvements</li> <li>• Highway and transit safety improvements</li> </ul>

Program	Description	Example Eligible Projects
<i>Highway Safety Improvement Program (HSIP)</i>	Provides federal funding to achieve a significant reduction in traffic fatalities and serious injuries on all public roads. The HSIP requires a data-driven, strategic approach to improving highway safety on all public roads with a focus on performance.	<ul style="list-style-type: none"> <li>Safety improvements</li> <li>New or upgraded traffic signals</li> <li>Pedestrian warning flashing beacons</li> <li>Queue warning systems</li> <li>Collection, analysis, and improvement of safety data</li> </ul>
<i>National Highway Performance Program (NHPP)</i>	Provides support for the condition and performance of the National Highway System (NHS), for the construction of new facilities on the NHS, and to ensure that investments of Federal-aid funds in highway construction are directed to support progress toward the achievement of performance targets established in a State's asset management plan for the NHS.	<ul style="list-style-type: none"> <li>Operational improvements, including transportation system management and operations</li> <li>Infrastructure-based ITS</li> <li>Undergrounding public utility infrastructure carried out in conjunction with an otherwise eligible project</li> </ul>

**Table D-2: Active Federal Discretionary Grant Programs**

Program	Description	Example Eligible Projects
Advanced Transportation Technologies and Innovative Mobility Deployment Program (ATTIMD)(formerly ATCMTD Program)	Competitive grants for the development of model deployment sites for large scale installation and operation of advanced transportation technologies to improve safety, efficiency, system performance, and infrastructure return on investment.	<ul style="list-style-type: none"> <li>Advanced traveler information systems</li> <li>Advanced transportation management systems</li> <li>Asset management and maintenance assessment</li> <li>Public transportation systems</li> <li>Advanced safety systems</li> <li>Autonomous and connected vehicle projects</li> <li>Integration of ITS</li> </ul>
<i>Rebuilding American Infrastructure with Sustainability and Equity (RAISE) Grant (Formerly BUILD and TIGER Grants)</i>	Competitive grants investing in road, rail, transit, and port projects that promise to achieve national objectives and have a significant local or regional impact.	<ul style="list-style-type: none"> <li>Capital infrastructure repair</li> <li>Safety improvements</li> <li>Connect communities to jobs</li> <li>State of good repair for ITS and other infrastructure</li> </ul>

Program	Description	Example Eligible Projects
<i>Infrastructure for Rebuilding America (INFRA) Grants</i>	Competitive grants to nationally and regionally significant freight and highway projects.	<ul style="list-style-type: none"> <li>Roadway improvements to Improve the safety, efficiency, and reliability of the movement of freight and people.</li> <li>Reduce highway congestion and bottlenecks.</li> </ul>
<i>Smart and Connected Communities (S&amp;CC)</i>	Competitive grants from National Science Foundation (NSF) to promote the growth of Smart and Connected Communities (S&CC). Encourages research that will address the fundamental technological and social science dimensions of these communities.	<ul style="list-style-type: none"> <li>Transportation and personal mobility technologies</li> <li>Automated Vehicles</li> <li>AI and Machine Learning</li> <li>ITS</li> <li>Smart City applications</li> </ul>
<i>Congestion Relief Program</i>	Competitive grants to advance innovative, integrated, and multimodal solutions to reduce congestion and the related economic and environmental costs	<ul style="list-style-type: none"> <li>Deployment and operation of integrated congestion management systems, systems that implement or enforce HOV toll lanes or pricing strategies, or mobility services</li> </ul>
<i>Rural Surface Transportation Grants</i>	Improve and expand the surface transportation infrastructure in rural areas to increase connectivity, improve the safety and reliability of the movement of people and freight, and generate regional economic growth and improve quality of life	<ul style="list-style-type: none"> <li>Integrated mobility management system, transportation demand management system, or on-demand mobility services</li> </ul>

# State Funding Opportunities

**Table D-3** briefly describes state and regional funding opportunities available for San Joaquin to expand its fiber network. For each project, there are examples of potential innovative transportation projects that meet the program’s eligibility criteria. Table D-4 summarizes state funding opportunities for broadband network specifically.

**Table D-3: Active State and Regional Funding Opportunities**

Program	Description	Example Eligible Projects
<i>Senate Bill 1 – Road Repair and Accountability Act of 2017</i>	Funds transportation improvements for state and local programs, including: <ul style="list-style-type: none"> <li>Solutions for Congested Corridors Program</li> <li>Transit Corridor Enhancement Program</li> <li>Local Partnership Program</li> <li>Active Transportation Program</li> <li>Trade Corridor Enhancement Program</li> </ul>	<ul style="list-style-type: none"> <li>Multimodal corridors</li> <li>HOV and managed lanes</li> <li>New or existing transit infrastructure improvements</li> <li>Transit hubs to increase linked trips or multimodal transportation modes</li> <li>Transit hubs or stations and nearby roadways providing accessibility for first mile and last mile connectivity to public transit systems</li> </ul>
<i>State Transportation Improvement Program (STIP)</i>	Funds new construction projects that add capacity to the transportation network. Transportation projects on and off the state highway system are typically funded from a variety of sources, including the Interregional Transportation Improvement Program (ITSP), the Regional Transportation Improvement Program (RTIP), and others.	<ul style="list-style-type: none"> <li>Operational improvements</li> <li>Safety improvements</li> <li>State highway improvements</li> <li>Intercity rail</li> <li>Regional highway and transit improvements</li> </ul>
<i>State Highway Operation and Protection Program (SHOPP)</i>	Funds repair and preservation, safety improvements, and some highway operational improvements on the State Highway System, including associated bicycle and pedestrian infrastructure as well as supporting infrastructure, such as culverts, ITS, rest areas, and maintenance stations. Funds are limited to capital improvements that do not add capacity.	<ul style="list-style-type: none"> <li>Safety improvements</li> <li>Operational improvements</li> <li>ITS and Transportation Management systems</li> </ul>

Program	Description	Example Eligible Projects
<i>Measure K Sales Tax Funding</i>	Sales tax measure for San Joaquin County to fund transportation improvements. The measure funds projects with an emphasis on a balanced transportation network and reducing VMT and improving air quality.	<ul style="list-style-type: none"> <li>Congestion relief projects</li> <li>Local roadway safety</li> <li>Transit and bicycle improvements</li> </ul>
<i>Regional Transportation Impact Fee (RTIF)</i>	County-wide fee funded by new development to mitigate the impacts of new development on the transportation network.	<ul style="list-style-type: none"> <li>The eligible projects are decided by SJCOG in association with the member agencies</li> </ul>
<i>Sustainable Transportation Equity Project (STEP)</i>	Transportation equity pilot program that aims to address community residents' transportation needs, increase access to key destinations, and reduce greenhouse gas emissions by funding planning, clean transportation, and supporting projects. (Note: The first solicitation was released and awarded in Summer 2020. Future solicitations, if any, are to be determined).	<ul style="list-style-type: none"> <li>Planning and capacity building to implement clean transportation projects</li> <li>Shared mobility deployments</li> <li>Parking management strategies</li> <li>Stakeholder engagement</li> </ul>

**Table D-4:** State Funding Opportunities for Broadband Networks

Program	Description	Example Eligible Projects
High-Speed Broadband Grant	California State Library has \$5 million in total estimated available funding and offers this grant to help existing California public libraries connect to the California Research and Education Network (CalREN). CalREN benefits K-20 students, educators, researchers, and others working in the libraries. The grant can be used for high-speed broadband construction or network equipment depending on the needs of the grantee. SJCOG might use this grant to purchase dark fiber network management software, wireless internet conduit, air conditioning (HVAC), uninterrupted power supply (UPS)/ battery backup and fund electrical system upgrades.	California State Library

Program	Description	Example Eligible Projects
<i>Broadband Infrastructure Grant</i>	The California Advanced Services Fund Commission is funding all or portions of a project on a case-by-case basis, considering the project area’s location and accessibility, existing communication facilities to be upgraded by fiber, and the contribution the project would make to the Commissions goal. This goal is to approve funding for broadband infrastructure projects that will provide broadband access to no less than 98% of California houses in each consortia region. The Commission had \$331m as of July 2018 to be spent on grants approved until 2022. The maximum funding level is 100%; the baseline for eligible projects is 60% of total construction costs.	California Advanced Services Fund
<i>Access Broadband Connect Grants</i>	<p>CETF, in partnership with Charter/ Spectrum and Frontier Communications, assists grantees with providing \$120 broadband subscriptions to low-income households in grantee areas.</p> <p>Priority consideration is given to community-based organizations focused in communities around School2Home schools with working relationships with the local school, city, and county governments and their human services agencies.</p> <p>Grantees will be responsible for: (a) outreach in-language and in-culture to priority low-income neighborhoods and populations; (b) basic digital literacy training and assistance in obtaining an affordable computing device; and (c) explanation of available affordable broadband offers and assistance in contacting the selected provider to sign up.</p> <p>The schedule for when CETF will be accepting Request For Letters of Interest (RLI’s) for the Charter Spectrum and Frontier Grant Deadlines will be posted soon.</p>	California Emerging Technology Fund

## Local Funding Strategies

Locally, SJCOG and its member agencies can pursue bold, innovative, and proven methods for financing fiber optic network expansion in the community. These options include:

- **General funds** from the main operating fund of cities, supported by a variety of local taxes such as property and sales taxes, can be used to supplement funding of fiber expansion projects. The City of Shafter, California successfully funded its Shafter Fiber Network in 2006 using city general funds and the South Bay Council of Governments used sales tax funds to develop a ring of dark fiber.<sup>1</sup> Westminster, Maryland increased their municipal property tax by 33% to fund their community fiber network.

1 *San Joaquin Valley Regional Broadband Consortium (SJVRBC). (August 2012). San Joaquin Valley Regional Broadband Consortium Primer. California Partnership for the San Joaquin Valley.*

- **Local option taxes** (such as a broadband expansion tax) could be considered for the local implementation of a fiber optic network.
- **Business improvement districts** (BIDs) are a specific geographical district formed by a group of property owners working together to share the cost of needed local capital improvements. The downtown Ventura, CA Property Based Business Improvement District includes a plan to expand the fiber optic network throughout downtown in the 2019 Management District Plan.<sup>2</sup>
- **Special districts** are limited-purpose local governments created by the people of a community to deliver specialized services essential to their health, safety, economy, and well-being.<sup>3</sup> The Midpeninsula Regional Open Space District in the San Francisco area is leading the development of a district-wide fiber optic network.<sup>4</sup>
- **Utility user taxes** may be levied for telephone and cable television services but must be approved by voters. If broadband were declared a utility by local policy, under the California Constitution a utility user tax could be levied on consumers' consumption of the utility service.<sup>5</sup>
- **Broadband impact fees** collect a fee from project developers to offset the corresponding increase in demand for municipal IT network support. These collected fees are then invested into capital improvements such as conduit and other facilities. The City of South San Francisco has adopted an ordinance that allows the city to collect broadband impact fees.<sup>6</sup>
- **Fiber Leasing Revenue.** Leasing city-owned conduit and fiber to businesses or internet service providers to connect their customers can yield significant revenues, depending on the city's fiber expansion business model.

## Additional Broadband Funding Opportunities

Additional grants and funding opportunities for expanding fiber and broadband networks include:

- High-Speed Broadband Grant (California State Library)
- Broadband Infrastructure Grant (California Advanced Services Fund)
- Access Broadband Connect Grants (California Emerging Technology Fund)

<sup>2</sup> City of Ventura. (July 2019). *City of Ventura Administrative Report*. <https://www.cityofventura.ca.gov/DocumentCenter/View/17477/11A>

<sup>3</sup> California Special Districts Association. (2021). *Special Districts: The Most Local of Local Governments*. <https://www.csda.net/special-districts/learn-about>

<sup>4</sup> Government Technology. (September 2018). *One Special District's Push for Broadband*. <https://www.govtech.com/network/one-special-districts-push-for-broadband.html>

<sup>5</sup> Bouras, C., Gkamas, A., & Tsiatsos, T. (2011). *Best practices and strategies for broadband deployment: Lessons learned from around the world*. In *Adoption, Usage, and Global Impact of Broadband Technologies: Diffusion, Practice and Policy* (pp. 128-142). IGI Global.

<sup>6</sup> Florida Department of Transportation, Office of Policy Planning. (October 2020). *Broad Uses, Broad Needs, Broadband: Planning for Florida's Transportation Infrastructure*. Transplex Web Series.

# J. SJCOG Fiber Readiness Study

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Organization	Contact Name	Contact Title
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Organization	Contact Name	Contact Title
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