City of Morgan Hill 2035 General Plan

Telecommunications Infrastructure

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1. Executive Summary

1.1. Current infrastructure

Primary broadband infrastructure in Morgan Hill rates a "D" grade (1.0 out of 4.0 possible) using a "report card" scale initially developed in the East Bay Area and subsequently adopted by cities, regional organizations and other agencies throughout California.

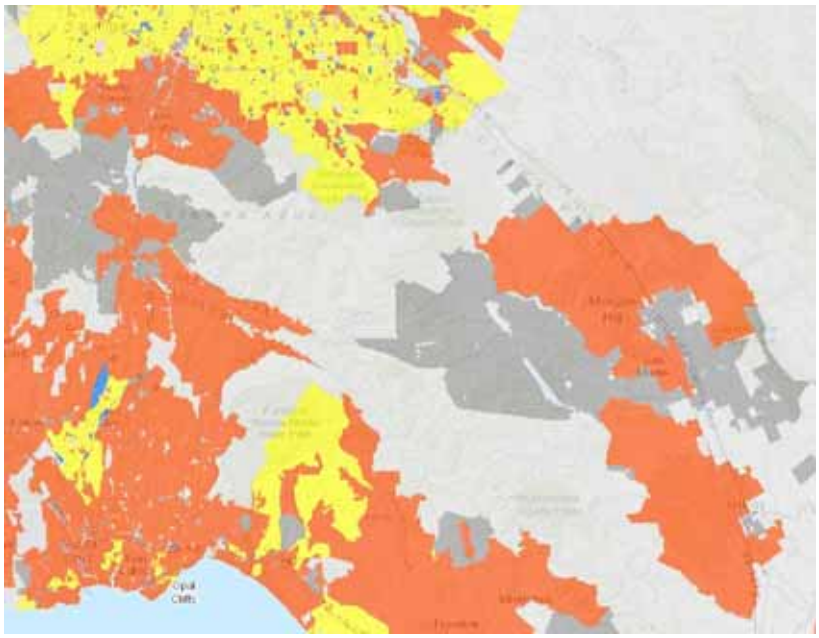

Figure 1.1 – Morgan Hill and regional broadband infrastructure grades, by census block. Red areas are "D" grades, grey are "F", yellow are "C". Larger maps are in Appendix A.

The relatively low grade in Morgan Hill is due to a lack of consistent upgrades by Verizon to the legacy telephone system it formerly operated (Frontier Communications took over ownership earlier this year) and the below industry average cable infrastructure maintained by Charter Communications.

By comparison, most cities to the north in Santa Clara and Alameda counties get at least a "C-" grade, with ratings between 1.7 and 2.0, on a 4-point scale. The two major cities to the south, Gilroy and Hollister, are more or less on a par with Morgan Hill. Both also receive "D" grades, at 1.0 and 1.1 out of 4.0 respectively.

The service available in Morgan Hill does not meet the expectations of the vast majority of residents. The minimum upload speed considered acceptable by 84% of residential customers who participated in an online survey is 6 Mbps or greater. The best commercially available service, from Charter, is advertized at a maximum speed of 5 Mbps. Only 30% of residents said that their current broadband service meets their needs.

There is also a disparity between the level of broadband service available to business and residential customers. On the whole, Frontier's system delivers faster speeds in residential areas than in commercial/industrial zones. Although Charter claims a consistent level of service throughout Morgan Hill, businesses report difficulty obtaining adequate service or, in some cases, any service at all.

When businesses were surveyed, 93% of respondents stated that the reliability is the most important aspect of their Internet service. Only 20% of those businesses are very satisfied with the current level of reliability, whereas 40% are not satisfied. Responses regarding broadband speeds were similar.

Table 1.1 - Primary broadband service providers - Morgan Hill

Telephone companies, DSL-based service by census block									
Download speed	**1 Mbps**	**1.5 Mbps**	**3 Mbps**	**5 Mbps**	**7 Mbps**	**6 Mbps**	**10 Mbps**	**12 Mbps**	**15 Mbps**
Frontier	10	36	43	25	94		40		120
AT&T			1		3				
Upload speed	**384 Kbps**	**512 Kbps**	**768 Kbps**	**1 Mbps**					
Frontier	46		162	160					
AT&T		1	3						
Charter - cable modem (DOCSIS 3.0) speeds claimed throughout service area									
Download	100 Mbps								
Upload	5 Mbps								

Secondary broadband service providers – Level 3 and TW Telecom – have moved in to fill some of the gaps left by the primary providers by offering more specialized services, including direct fiber optic connections to end users. Major fiber network operators also provide connectivity in Morgan Hill on a wholesale basis.

1.2. Broadband planning and policy

Local governments in California have virtually no direct authority over broadband providers, and few options for compelling them to upgrade infrastructure or improve service. On the other hand, advanced infrastructure must be developed if Morgan Hill is to keep pace with high tech development in Silicon Valley, attract and retain jobs and meet the expectations of residents.

Broadband development and planning options are available, however. Recommendations include:

1. Set higher standards for broadband infrastructure in new residential and commercial developments.
2. Work cooperatively with Frontier, Charter and mobile carriers to identify policy barriers that could be removed or incentives that might be offered to encourage greater investment in their systems in Morgan Hill.
3. Evaluate options for creating a third, citywide broadband system, either as a municipal enterprise or through cooperation or partnership with a private, competitive provider.
4. Pursue targeted broadband projects, with or without private sector partners, that address specific last mile infrastructure and/or service deficits in commercial and industrial zones, and that improve local availability of existing middle mile resources.
5. Establish programs to 1. identify, construct and document broadband assets for future use and 2. create an ongoing role for the City as a coordinating body that aggregates information and complaints and provides such to state and federal regulators.

Planning options range from setting out a long term road map for broadband development, to working cooperatively with incumbents providers, to establishing a detailed master plan that might include new service providers or even a direct role by the City itself.

Specific policies can be adopted that encourage greater investment in broadband infrastructure by service providers, create market opportunities for new entrants and establish baseline standards for new development and ongoing upgrades. These include "dig once" requirements that encourage, or even mandate, cooperation among utilities and the City when work is done in the public right of way. Other options include management and development of broadband-related City assets, changes in permit and leasing procedures, proactive measures regarding regulatory proceedings, and policies that stimulate demand for broadband services.

1.3. Conclusions and recommendations

This report recommends that the City articulate its role in broadband infrastructure planning and development, establish goals and adopt a phased approach to reaching those goals.

The first recommended step is to determine the level of the City's involvement and identify the roles and responsibilities that are appropriate to it, in order to set broadband infrastructure development goals and establish policies designed to reach those goals.

The City should first develop a roadmap based on the infrastructure "report card" grading criteria described more fully in Section 2.1 and Appendix B. Morgan Hill receives a "D" grade, in comparison to the "C" grades given to cities immediately to the north. Keeping in mind that those cities are also actively engaged in improving their broadband infrastructure, the City should lay out a road map that brings its broadband infrastructure up to the statewide average in the near term, and keeps pace with and/or exceeds it over the long term.

The initial phase should focus on creation of a roadmap for developing, organization and consolidation of the City's broadband-related assets and establishment of a proactive working relationship with primary broadband providers.

Once this initial work is done, the City can move to the second phase and implement ten recommended policies in the near term that set specific broadband development goals, ideally in cooperation with existing providers but independently when necessary. The primary market research conducted for this report indicates that residential and business broadband use and expectations differ in Morgan Hill, but in either case there is a significant amount of dissatisfaction with the choices available.

The City has the greatest amount of influence over greenfield and new or major remodelled infill development, and over work performed in the public right of way. By establishing clear broadband-related requirements for these kinds of projects, the City can encourage the construction of facilities that will support upgraded infrastructure. Municipal assets can be offered on open terms to any qualified broadband provider, and information about all broadband infrastructure can likewise be made

available, so as to reduce barriers to entry for new competitors and promote the more efficient use of existing resources by incumbents.

The third and subsequent phases represent a greater level of direct City involvement in broadband development. For example, prospective installation of city-owned conduit, either in conjunction with routine undergrounding programs or third party utility projects, puts the City in the position of being an active developer of broadband assets, rather than simply making use of resources obtained in the normal course of business. Putting teeth into “dig once” policies by imposing moratoria on street excavations following an open trench notification process puts similar pressure on utility companies to do the same.

Other measures include:

- Setting building standards that range from requirements for broadband infrastructure in new or redeveloped City right of way to specifications for wiring and access in new construction.
- Reviewing construction plans to maximize use of existing facilities.
- Mapping broadband assets and availability.
- Driving demand through open data, telecommuting and online services.
- Adapting the City’s wireless permitting practices to maintain control of the process in light of recent changes in state law and federal regulations.

These recommendations will allow the City to take both immediate and long term steps, to the degree desired, to encourage private sector investment, extend the benefits of modern telecommunications services to residents and businesses, attract new jobs and leverage existing City resources to promote the development of broadband infrastructure in ways that further the City’s goals.

2. Broadband Infrastructure and Service

2.1. Primary broadband infrastructure

The primary broadband infrastructure in Morgan Hill is owned and operated by Frontier Communications, which recently took over ownership and operation of Verizon's wireline telephone systems in California, and Charter Communications, which are the incumbent telephone and cable companies. When compared to the primary broadband infrastructure available to the average home or business in California, Morgan Hill is significantly below average, with a grade of "D" (1.0 on a 4 point scale), using criteria originally developed for the East Bay and Central Coast Broadband Consortia.

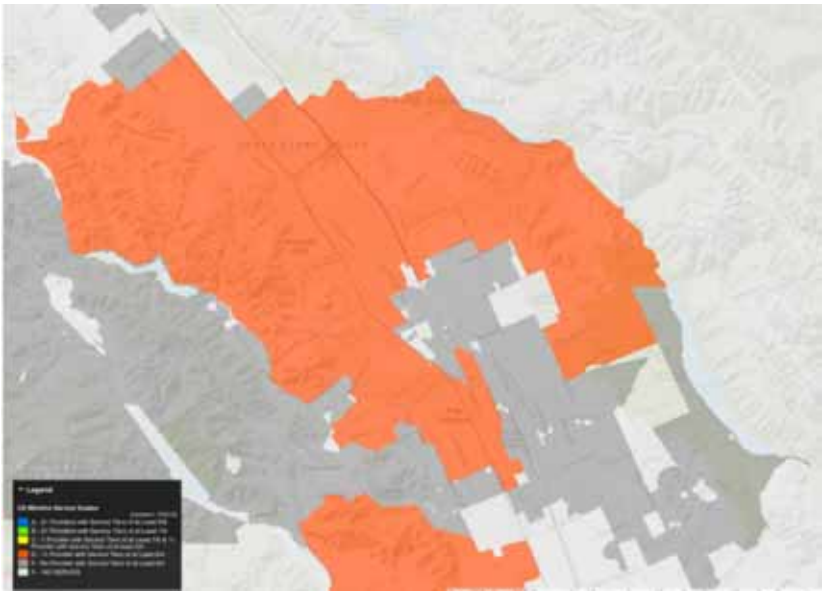

Figure 2.1 – Morgan Hill broadband infrastructure grades, by census block. Red areas are "D" grades, grey are "F". Larger maps are in Appendix A.

When compared to the primary broadband infrastructure elsewhere in the region, Morgan Hill's grade fits into a clear pattern: San Jose and communities to its north and east generally match the Californian average, with most grades falling within two-tenths of a point of "C" (2.0), while communities to the south are largely within one-tenth of a point of "D" (1.0). San Martin, which is largely unserved by Charter and has poor service from AT&T, is an outlier with an F+ (0.3).

Verizon, Charter and AT&T, along with two secondary service providers in Morgan Hill, filed availability, technology and service level reports with the Federal Communications Commission as of 31 December 2014. The data was then given to the California Public Utilities Commission, which further refined it. The analysis in this report is based on the data sets published by the CPUC and supplemented with standard census data, unless otherwise indicated. Another update to this data set, using information submitted as of the end of 2015 is expected later this year.

Frontier has not yet filed data regarding its new service territories, so the evaluation of its service and infrastructure in this study is based solely on the data provided by Verizon.

AT&T's service reports indicate that it provides service in four census blocks on the southern edge of Morgan Hill, south of Llagas Creek and between Santa Theresa Blvd. and Monterey Highway. A total

of 139 housing units are in these four census blocks, and it is not entirely clear that all are located within the city limits of Morgan Hill. This slight overlap is not significant in terms of evaluating city-wide infrastructure, although the data is included in the overall analysis below.

The sharp dividing line between Morgan Hill and San Jose is the result of having two different sets of primary infrastructure providers.

The original telephone company in Morgan Hill was the Western California Telephone Company, which also owned a system in Los Gatos and which was acquired by GTE in the 1970s. GTE merged with Bell Atlantic in 2000, and became Verizon. The company's capital investment strategy focused initially on converting copper-wire telephone systems to fully fiber optic systems[1] and on expanding its mobile telephone and broadband infrastructure. The return on the fiber conversion investments proved disappointing and Verizon discontinued the program and re-focused on its wireless business.

As a result, wireline service areas that weren't upgraded suffered from a lack of investment, initially because fiber conversion was the preferred upgrade path and later because consumer-focused wireline infrastructure of any kind – copper or fiber – became a much lower priority for the company. Last year, Verizon reached an agreement with Frontier Communications to sell its wireline systems in California, Texas and Florida. That transaction closed on 1 April 2016.

The incumbent telephone company in San Jose is AT&T. The systems there were developed and operated by Pacific Telephone and Telegraph Company within the old Bell System, and have retained a consistent Bell-centric line of ownership through Pacific Bell, SBC and, now, AT&T. These companies have had a track record of favoring copper-wire infrastructure over fiber, and have been more consistent in investing in ongoing upgrades and maintenance.

Table 2.1 - Broadband infrastructure grades

	Grade	GPA
Campbell	C	2.0
Milpitas	C-	1.9
Los Altos	C-	1.9
Cupertino	C-	1.9
San Jose	C-	1.8
Mountain View	C-	1.8
Saratoga	C-	1.8
Santa Clara	C-	1.7
Los Altos Hills	C-	1.7
Hollister	D	1.1
Los Gatos	D	1.0
San Juan Bautista	D	1.0
Gilroy	D	1.0
Morgan Hill	**D**	**1.0**
Monte Sereno	D-	0.8
Lexington Hills	D-	0.7
San Martin	F+	0.3

[1] Fiber optic systems use bundles of thin strands of glass or plastic – i.e., fibers – to carry information via light waves, as opposed to the electric signals carried by copper wires. Fiber optic technology allows for much greater data speeds and volumes than copper, usually by orders of magnitude.

As a result, the copper wireline systems acquired by Frontier from Verizon in California, including the one serving Morgan Hill, tend to be less capable than systems in comparable communities operated by AT&T.

When upload and download speeds reported by the two companies to the Federal Communications Commission are compared, the difference between the services offered by the two companies, and consequently the condition and capability of the supporting infrastructure, become evident. Taking Union City as a typical example – it received a "C-" (1.9) grade – the difference in supported speeds and underlying architecture becomes clear. Speeds in Union City skew higher on both the download and upload side than in Morgan Hill. The distribution of those speeds indicates that Frontier's service in Morgan Hill is based on Verizon's legacy DSL[2] and interim ADSL2 technology to a greater degree than in Union City, where AT&T has made substantial investments in more advanced VDSL technology (and upgrades to ADSL2 technology).

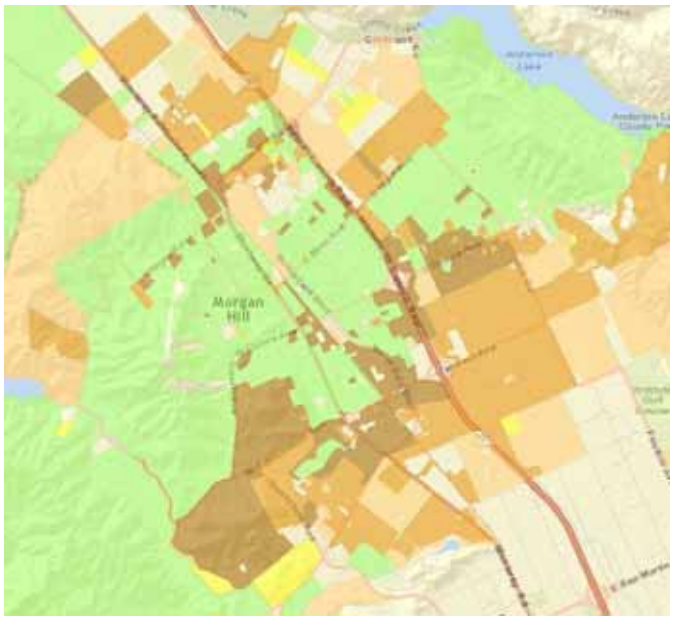

Figure 2.2 – Verizon DSL coverage in Morgan Hill. Note slower speeds further from the center. A larger version is in Appendix A.

From a consumer standpoint, the difference between the three technologies is readily apparent. If the service being received is branded as Uverse and television service is (or at least was, until recently) available, then it is VDSL-based. If it carries the Uverse brand and television service isn't available, it's ADSL2. If it doesn't carry the Uverse brand, it is legacy DSL service. AT&T has made a concerted effort over the past several years to transition customers from legacy service, which is subject to regulation by the California Public Utilities Commission, to unregulated Uverse branded service where it is available. Verizon's strategy, on the other hand, has been to sell off its regulated, wireline telephone systems, as it has just done in California.

The pattern of reported service levels in Morgan Hill also indicates a lack of infrastructure upgrades over the years. In communities where AT&T has invested in newer generations of DSL technology, it has also modified the architecture of the physical network that supports it. To a much greater degree than Verizon, AT&T has installed high capacity fiber optic cables deeper into neighborhoods, where it connects to shorter and more localized copper wires that, in turn, connect to customers. Since DSL

[2] "DSL" stands for digital subscriber line, and is a term that refers to technology developed by telephone companies to transmit data over the legacy copper telephone network. ADSL, ADSL-2 and VDSL are progressively more advanced versions of the technology. Older DSL technology is, for example, generally limited to 3 to 6 Mbps download speeds, ADSL-2 usually tops out in the 20 Mbps (or lower) download range and VDSL can support download speeds in excess of 40 Mbps.

service speeds are, to a great degree, a function of the distance traveled over copper wires, a typical pattern seen in AT&T markets is a checkerboard of fast speed reports around a number of neighborhood fiber "nodes[3]", surrounded by relatively small and compact areas of declining speeds.

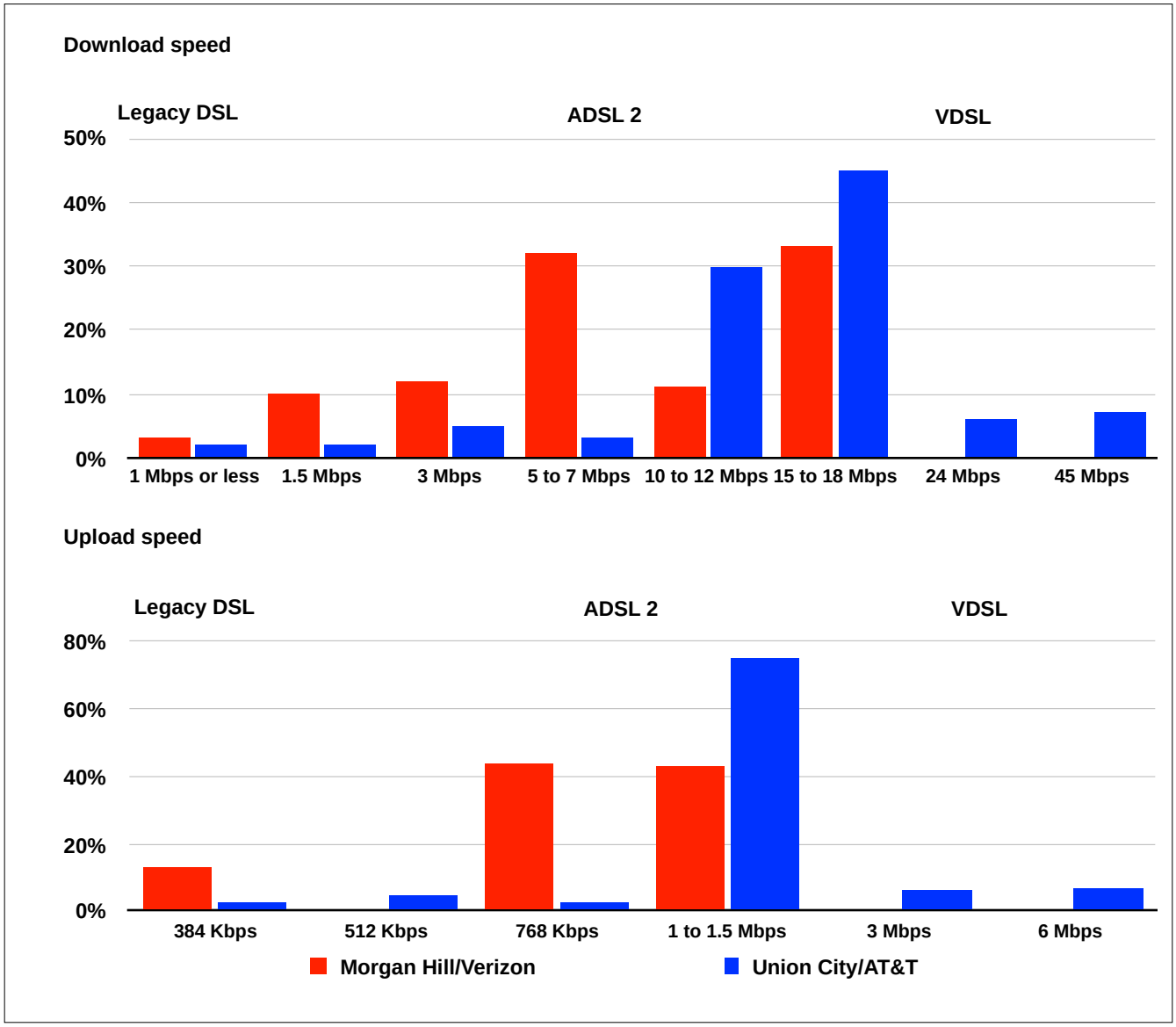

Figure 2.3 – Morgan Hill/Verizon versus Union City/AT&T broadband speeds, by census block.

By contrast, the overall pattern of service speeds reported on the system previously owned by Verizon in Morgan Hill indicates that this sort of fiber upgrade is not commonly present. DSL service is generally at its best in the center of the city, and drops off as the distance from the center increases. There are exceptions, particularly in the western and eastern areas of Morgan Hill, but the overall

[3] Although the term "node" can refer to many things, in this report it refers to a central box or vault in a neighborhood where high capacity fiber optic trunk lines connect to copper distribution lines that serve customers' homes or businesses.

pattern indicates that Verizon's former network relies on copper wired-based distribution and legacy architecture to a much higher extent than AT&T's networks to the north.

Charter Communications is the cable company serving Morgan Hill. Charter reports that it is using DOCSIS[4] 3.0 technology exclusively and, consistent with common practice in the cable industry, claims to deliver up to 100 Mbps download and 5 Mbps upload speeds everywhere in its broadband service area. The key phrase is "up to". It is a term of art in the broadband industry that means, in effect, that the technology that's been deployed in an area is theoretically capable of supporting the indicated service level, but consumers should not expect to experience that maximum service level consistently, if at all. Charter's ability to actually deliver promised speeds depends on the level of investment it has made in a particular neighborhood and the usage patterns of residents – the more people accessing the Internet in a given area, the lower the speeds each will receive. Charter also has a practice of not fully building out its cable systems to marginal residential areas, or to commercial and industrial zones.

Charter's reported service speeds are below average for the California cable industry overall. By contrast, Comcast, which serves San Jose and most of the remainder of the Bay Area, offers service at 150 Mbps download and 20 Mbps upload speeds, which is typical of cable companies in California.

Table 2.2 - Primary broadband availability in Morgan Hill

	Census blocks	Housing units	Population
AT&T	4	139	433
Charter	682	12,623	37,425
Frontier	368	11,201	33,377
Combined availability (all 3 carriers)	687	12,628	37,433
Union City total (including unserved)	729	12,857	37,882
AT&T	1%	1%	1%
Charter	94%	98%	99%
Frontier	50%	87%	88%
Combined availability (all 3 carriers)	94%	98%	99%

In other words, Morgan Hill is served by telephone and cable companies that offer significantly slower speeds than their peers elsewhere in California. Frontier's current service does not meet the California Public Utilities Commission's minimum standard of 6 Mbps download and 1.5 Mbps upload speeds anywhere in Morgan Hill – consistently on the upload side and frequently on the download side – and

[4] DOCSIS stands for "data over cable service interface specification", and is the set of standards used by cable companies in the U.S. to provide two-way Internet service over coaxial cable networks that were originally designed to deliver one-way television service.

Charter's speeds are lower than Comcast, Cox and Time Warner[5], its three peer companies in California.

Overall though, broadband availability at one level or another is nearly ubiquitous. Table 2.2 shows that 98% of homes in Morgan Hill – 12,628 out of 12,857 – have broadband service available at some speed from at least one company. The remaining unserved homes are scattered throughout Morgan Hill, but generally on the periphery (see Appendix D, sub-section 7).

"Broadband" refers generally to any telecommunications service capable of supporting digital data transmission at high speeds. These services can include and/or support Internet, television, telephone, private data networks and various specialized uses. Broadband service can be delivered in a variety of ways, including telephone lines (e.g., DSL), coaxial cable (e.g., cable modem), fiber optic cable, wireless cellular/ mobile service (e.g., cell phones, tablets, wireless modems), WiFi, point-to-point and point-to-multipoint fixed wireless service and hybrid networks. There are technical distinctions between the terms "broadband" and "Internet", but when discussing retail services offered to consumers and small businesses, the two can be used interchangeably.

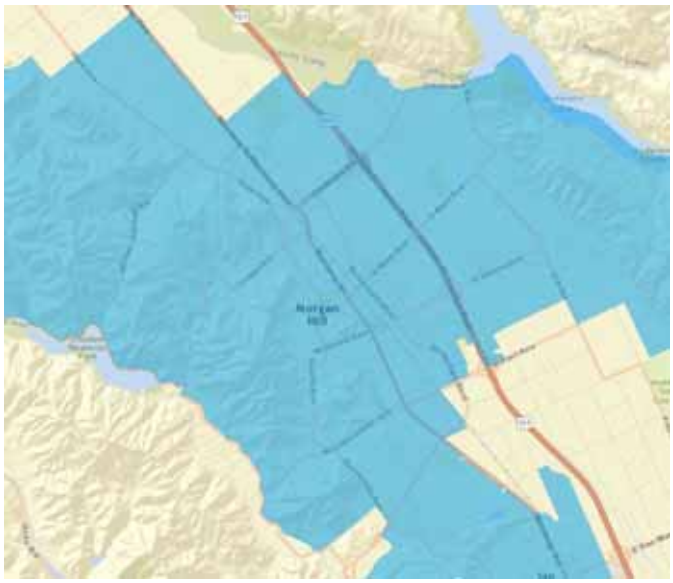

Figure 2.4 – Charter's claimed cable modem service availability. A larger version is in Appendix A.

The infrastructure grade of a census block is determined by the generally available level of service it supports. A "C" grade means a census block has the most common wireline service choices found in California, typical of the standard packages offered by, for example, AT&T and Comcast: a minimum of two providers, one just meeting the minimum standard of broadband service set by the CPUC (6 Mbps download and 1.5 Mbps upload) and the other exceeding it. A "D" grade – below the Californian average – is given when wireline service meets but does not exceed this standard or where consumers only have access to one qualifying service provider. If no qualifying service is available, a failing grade – "F" – is given. "A" and "B" grades are given where superior service is offered. Details regarding the grading method are in Appendix B.

Service levels reported by telephone and cable companies are listed separately because of the differences in the quality of the reports and the methods used to generate the data.

[5] On 18 May 2016, Charter Communications completed its purchase of Time Warner and Bright House cable systems in California. Since the transaction is so recent and no operational changes have been implemented, Charter and Time Warner systems are compared separately for the purposes of this report.

Primary broadband infrastructure is designed to provide retail level service, and often supports telephone and television service as well. It is the type of service that consumers buy for consumer-class home use, and small to medium-sized business use for routine, commercial-class Internet access. The two primary broadband companies in Morgan Hill, Frontier and Charter, have hybrid networks that use copper wires to connect directly to homes and businesses, and fiber optic lines that connect these local distribution networks to the Internet. In some cases, Frontier and Charter might use fiber optic lines to connect directly to a major customer, but neither report doing so in Morgan Hill.

Table 2.3 - Primary broadband service providers - Morgan Hill

Telephone companies, DSL-based service by census block									
Download speed	**1 Mbps**	**1.5 Mbps**	**3 Mbps**	**5 Mbps**	**7 Mbps**	**6 Mbps**	**10 Mbps**	**12 Mbps**	**15 Mbps**
Frontier	10	36	43	25	94		40		120
AT&T			1		3				
Upload speed	**384 Kbps**	**512 Kbps**	**768 Kbps**	**1 Mbps**					
Frontier	46		162	160					
AT&T		1	3						
Charter - cable modem (DOCSIS 3.0) speeds claimed throughout service area									
Download	100 Mbps								
Upload	5 Mbps								

Both Charter and Frontier offer significantly slower upload speeds than their peers, as well. As a general rule, disproportionately slow upload speeds are an additional indicator of poor infrastructure. The geographic gap between service speeds offered by the respective providers is the reason cities in AT&T's and Comcast's territories in the Bay Area receive broadband infrastructure grades in the "C" range and Morgan Hill receives a "D".

The primary broadband service providers in Morgan Hill report reaching most residential customers. Altogether, the primary providers (in this case, including AT&T) offer broadband service to 98% of housing units and 99% of the population in Morgan Hill, according to their own reports. These numbers are likely overstated, since the providers report partial coverage of a census block as full coverage. When looked at in detail, Frontier's coverage appears significantly poorer than Charter's, with gaps in the northern and southern edges of Morgan Hill, as well as some predominantly commercial/industrial areas.

2.2. Frontier and Charter transactions

On 1 April 2016, Frontier Communications assumed ownership of local wireline (copper and fiber) telephone systems owned by Verizon in California, including the one serving Morgan Hill. Frontier took operational control of its 2 million new customers in California by performing a "flash cutover",

which was an attempt to transfer all former Verizon customers into its systems at once. The flash cutover did not go as expected.

Three systematic problems caused service disruptions to what appears to be several thousand customers. Most of the customers affected were in southern California, but not all. Media reports indicated that some customers in Verizon's Bay Area systems also experienced service disruptions, primarily related to Internet access but also possibly to telephone service as well.

The three problems that affected the vast majority of customers reporting problems were:

- Corrupt data in the customer records imported from Verizon's system.
- Records that said some customers' equipment had one serial number when in fact it had another.
- The need to train ex-Verizon employees on Frontier's systems.

The first two problems – corrupt data and mismatched serial numbers – resulted in the transmission of incorrect authorization messages and other operational data to some customers. The number of customers affected is believed to be less than 1% of Frontier's new customer base, but even that relatively low percentage of errors resulted in probably 10,000 to 20,000 service disruptions. Many of service disruptions appear to be related to television service on fiber-to-the-home systems that Frontier acquired from Verizon in southern California, but telephone and Internet service was also affected statewide.

There were also service disruptions reported that were caused by incidental problems of the sort that's common for utility companies. These problems included, for example, a squirrel chewing through a cable and a vehicle hitting a utility pole. As a point of reference, Frontier expects to process an average of 50,000 trouble tickets a month in California in its normal course of business.

The third problem compounded the issues caused by the corrupt data, mismatched serial numbers and normal operational factors. Frontier's staffing plan for the cutover involved bringing in current Frontier employees from other regions to handle what they expected would be a higher than usual number of customer service calls, while using Verizon's existing call center in the Philippines as a back up resource. In the meantime, the former Verizon employees in California were to be trained on Frontier's systems in an orderly process that was intended to result in a 100% U.S.-based customer service staff following the transition period.

The flood of phone calls triggered by the faulty data Frontier received from Verizon overwhelmed the existing Frontier staff and more calls with more complex problems were transferred to the back-up call center than expected. Personnel at the back up call center were not equipped and/or trained to handle the level or volume of problems they faced, and the result was a high degree of customer anger and dissatisfaction.

According to information given to state regulators by Frontier, all of their California systems were back to "business as usual" status by June 2016.

On 18 May 2016, Charter Communications completed a purchase of cable systems belonging to Time Warner Cable and Bright House Networks, nationwide. Many of those systems are in southern California and the San Joaquin Valley. Charter has stated that there is no expectation of similar problems, because its plan is to transfer operational control and integrate system gradually over time, rather than do a flash cutover, as Frontier attempted.

However, this transaction will affect the existing Charter cable system that serves Morgan Hill. In addition to the financial considerations of the purchase itself and the cost of integrating millions of new customers over time, Charter will also have to bear the cost of fulfilling the conditions that were attached to the approval of the transaction by regulators, particularly the Federal Communications Commission (FCC) and the CPUC, but also by regulatory agencies in other states. These conditions include extending service and/or upgrading analog service to digital to up to 2 million new locations nationwide.

The Morgan Hill system is at the northernmost end of a chain of existing Charter systems that generally extends south into Santa Barbara County, and an estimated 20,000 to 30,000 of the digital conversions and line extensions required will be in this region. The combination of required upgrades, transaction financing considerations and system integration costs will very likely result in capital constraints that will limit investment in current Charter systems, such as the one in Morgan Hill, that are performing adequately from a management and regulatory point of view.

Both Frontier and Charter are required by the terms attached to regulatory approval of their respective purchases to provide other public benefits, including free WiFi service, free connections to a limited number of government agencies, discounted service packages for low income households and other programs intended to increase Internet adoption in disadvantaged communities. The companies were given a year or more to comply with these requirements and to date neither have provided any details regarding plans to do so.

2.3. Secondary service providers

In addition to the primary, retail level of service provided by Frontier and Charter, two other secondary companies provide commercial and industrial class service in Morgan Hill, via infrastructure or facilities they own themselves and/or leased facilities. Typically, these companies lease lines from the incumbent telephone company, but it is also possible that they are buying wholesale access from Charter.

The secondary broadband infrastructure in Morgan Hill is limited and generally falls into two categories: fiber optic networks and electronic enhancements to traditional copper wireline networks, likely leased from Frontier.

Two companies – Level 3 Communications and TW Telecom – report providing business-oriented services via leased lines (Level 3 acquired TW Telecom in 2014, but the companies still report service levels to the FCC separately). In accordance with state and federal rules, these companies are able to install equipment in Frontier’s central offices and use it to provide a higher level of service than would

ordinarily be available. Both focus primarily on industrial and commercial areas of Morgan Hill. Full coverage area maps are in Appendix A.

Figure 2.5 – Census blocks with fiber-to-the-premise service from Level 3. Larger map is in Appendix A.

TW Telecom claims to offer wireline service at 45 Mbps upload and download speeds in 11 census blocks and Level 3 reports the same in one census block. The type of technology reported – "other copper" – and the symmetrical speeds[6] are consistent with DS-3 service, which is an older type of high capacity data transport connection that typically uses copper wires leased from an incumbent telephone company, which in this case is Frontier.

Level 3 also reports providing 100 Gbps symmetrical service directly to end users via fiber optic lines in two census blocks.

Two long haul fiber corridors pass through Morgan Hill. The companies that have installed fiber optic cables along these corridors generally use it to connect large customers, Internet service providers and mobile telecommunications companies directly to major Internet exchanges and data centers in the Bay Area and Los Angeles, but some also use it for inter-city connections between customer sites and, in limited circumstances, intra-city connections.

Figure 2.6 – Fiber routes in Morgan Hill. A larger version is in Appendix A.

The larger corridor of the two runs along the Union Pacific right of way, going north and south through Morgan Hill. AT&T, Verizon, CenturyLink, Level 3 and Zayo are among the companies present. A supplemental corridor runs north and south along Monterey Rd. through Morgan Hill. Optic Access (now owned by Integra) and AT&T are present on this route.

At least four telecommunications companies are accessing fiber in Morgan Hill along this corridor: Frontier, Charter, Level 3 and Wave Broadband, which filed permit applications with the City of Morgan Hill requesting permission to build a fiber distribution network that is consistent with a

[6] Broadband service is considered symmetrical when upload and download speeds are the same.

network design intended to provide connections to cellular sites used by mobile telecommunications companies. It is likely that other companies are also accessing this trunk fiber, since it is standard practice in the mobile telecommunications business to provision cellular sites with direct fiber connections.

2.4. Commercial and industrial broadband infrastructure

It is much easier for primary broadband service providers to generate an acceptable return on investment in residential areas than in commercial or industrial ones, particularly densely populated urban and suburban neighborhoods. Standardized equipment can be used to provide a managed level of service, and each home can be offered a wide range of products including Internet access, television programming and telephone service. It is a predictable business, and capital investments can be made with a reasonable degree of certainty.

Industrial and commercial customers are more diverse and less predictable than residential subscribers. One business might need gigabit speeds at the highest quality-of-service levels, while the one next door is content with a standard, relatively slow DSL connection. As a result, incumbent carriers tend to approach commercial and industrial customers on a case by case basis. They do not prospectively build high speed infrastructure. Businesses seeking higher grade service are frequently presented with installation estimates in the thousands and tens of thousands of dollars range. Specialized, secondary companies offer a more diverse range of services to this market.

“Commercial class” service is defined as being similar to residential service in that the provider takes effectively all responsibility for installing, maintaining and supporting the service. Speeds are similar (6 to 150 Mbps), but service levels, reliability, consistency and pricing are higher.

“Industrial class” service refers to situations where the customer plays a much greater role in building and supporting the service, including buying different elements from different vendors and managing installation and support. Speeds would be higher – perhaps as high as 100 gigabits per second or more – and quality of service levels could be as high as found in top tier Internet exchanges. DS-3 circuits or dark fiber strands are examples of industrial class service. Large industrial customers frequently buy services directly from middle mile providers.

At this level of service, the distinction between “broadband” and “Internet” facilities becomes important. “Internet” service involves a connection, at whatever speed, to the vast, publicly accessible network of interconnected information technology (IT) resources that’s called the Internet. Internet service is usually obtained from a company that provides a connection between the end user and a major Internet exchange facility where data is handed back and forth between various networks: either a dedicated exchange facility or a data center where many companies install servers and other IT equipment. There are several such facilities in the Bay Area, including Fremont and San Jose, but none have been identified in Morgan Hill.

"Broadband" is a more generic term. It simply refers to a high speed data connection. That connection might be between an end user and an Internet exchange point, or it could be only for internal connections within a company.

The reports regarding Frontier's service in Morgan Hill (filed by Verizon) show a pattern of not prioritizing broadband service in commercial and industrial areas. This data is reported by census block, and not by street address or zone designation, so inferences must be made based on the number of housing units in a given census block, as reported by the U.S. Census Bureau (2010 census). Frontier provides no broadband service in 361 of 726 census blocks total in Morgan Hill, of which 275, or 76%, have zero housing units. Frontier offers broadband service in the remaining 368 census blocks, of which 97, or 26%, have zero housing units.

Figure 2.7 – Census blocks with enhanced copper service. Note correlation to commercial and industrial zones. A larger version is in Appendix A.

A census block with zero housing units is usually either vacant residential land or used for commercial, industrial or institutional purposes. However, comparison of the map of Frontier's reported service with a City of Morgan Hill zoning map indicates that these unserved census blocks are predominantly in areas zoned for commercial, industrial and institutional use.

In the census blocks with zero housing where Frontier does offer service, the reported download speeds are significantly slower than in census blocks containing residences. Since service would not be reported for vacant land, effectively all of these census blocks can be assumed to be commercial, industrial or institutional in nature.

In just over half (51%) of census blocks with residences, Frontier offers broadband at its two highest download speeds, 10 Mbps and 15 Mbps. In census blocks without residences, just under a quarter (24%) have that level of service. The lowest download speed service tiers – 3 Mbps and less – are offered in 35% of census blocks without residences, while only 20% of census blocks with residences have such service.

Census blocks with residences are inferred to be residential in character, while census blocks without residences are inferred to be commercial or industrial in nature.

Charter Communications reports serving a greater number of presumably commercial, industrial and/or institutional census blocks. Of the 352 census blocks in Morgan Hill with zero housing units, Charter

reports that it offers broadband to 340, or 97%. It also reports offering a uniform download speed of 100 Mbps in every census block it serves.

Table 2.4 - Frontier download speeds by land use

	3 Mbps or less	5 to 7 Mbps	10 to 15 Mbps
Commercial/industrial	35%	41%	24%
Residential	20%	29%	51%

Although there appears to be a significant disparity in commercial and industrial area service between Charter and Frontier, it should not be assumed that the difference is as great as it appears. It is common practice in the cable industry to advertize service to business customers without having the facilities in place to immediately provide that service, and with the intention of requiring those customers to pay for the cost of installing the necessary facilities.

The poor state of commercial-class Internet infrastructure in Morgan Hill was also brought out in the workshop and online surveys discussed below.

The two secondary providers – TW Telecom and Level 3 – specialize in providing service to business customers. The 14 census blocks served by the companies are all commercial, industrial or institutional in nature. Ten of these census blocks are in commercial planned unit developments or light industrial zoned areas on or near Cochrane Rd., Jarvis Dr., Tennant Ave. and Vineyard Blvd. Two are in or near the central business district on Monterey Rd., and one is south of there on Monterey Rd. The remaining census block appears to contain a Santa Clara County facility, north of Malaguerra Ave. on the north side of Morgan Hill. Frontier reports offering broadband service in 10 and Charter in 11 of these census blocks.

2.5. Wireless broadband service

Four mobile broadband companies – AT&T, Sprint, T-Mobile and Verizon – serve Morgan Hill. According to testing conducted by the California Public Utilities Commission, AT&T's expected mobile download speeds in Morgan Hill are in the 3 Mbps to 10 Mbps range, with speeds decreasing as users move from north to south in the city. Verizon has a similar pattern, but with lower expected download speeds, ranging from 768 Kbps to 6 Mbps.

Sprint is largely unable to provide reliable service in Morgan Hill. The CPUC's testing shows its effective coverage ending just north of the city limits. T-Mobile's download speeds are in the 1.5 Mbps to 3 Mbps range in the northern end of Morgan Hill, decreasing to the 768 Kbps to 1.5 Mbps range in the middle of the city, and effective coverage lacking in the southern end.

Fixed wireless Internet service is offered by at least two companies in Morgan Hill. Etheric reports offering spotty coverage in the city, in the 25 Mbps to 50 Mbps range. The data Etheric submitted to the

CPUC indicates that it can provide service in the eastern half of the city, but not on the western side. Examination of the mapping data provided by Etheric indicates that its coverage estimates are based on unsophisticated modeling of relatively few access points and cannot be taken at face value. Prospective customers are best advised to contact the companies to confirm availability and actual service levels.

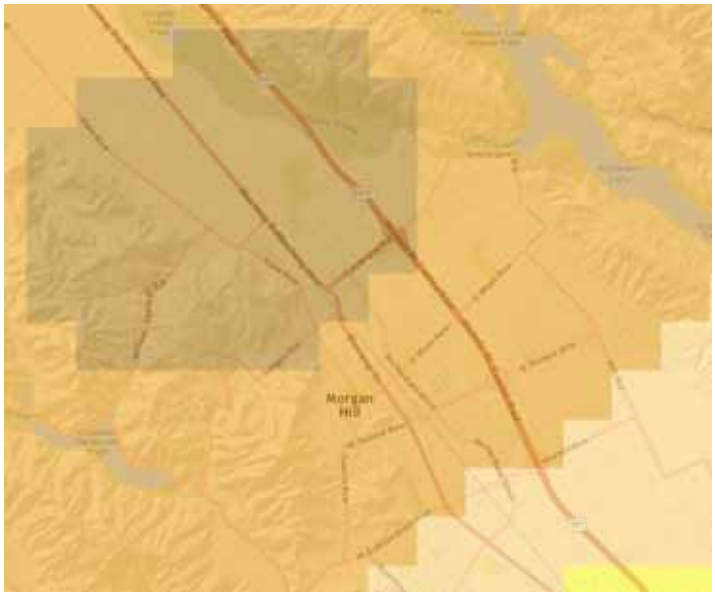

Figure 2.8 – AT&T's mobile broadband coverage in Morgan Hill, per CPUC testing. Dark brown indicates 6 Mbps to 10 Mbps download speeds, light brown and yellow are progressively slower. More and bigger maps are in Appendix A.

South Valley Internet does not report its coverage and service levels to the CPUC, and does not provide coverage data on its website. The company advises prospective customers to contact it to find out pricing, service level and availability details.

Both Etheric and SVI use unlicensed radio frequencies, which are subject to inference and may be preempted by other users. Any and all users have the same legal right to transmit on unlicensed frequencies, and must accept whatever interference or degradation results.

Other fixed wireless Internet service providers are active in the Bay Area and in northern San Benito County, and might offer service in the Morgan Hill area from time to time. The same caveats apply.

2.6. Broadband adoption rate

The most recent data collected and published by the California Public Utilities Commission (circa June 2012) indicates that broadband adoption and penetration in Morgan Hill is consistent with the statewide average in California.

The two metrics differ in that the adoption rate factors in broadband availability, while the penetration rate simply expresses broadband use as a percentage of overall population. Because broadband service of one kind or another is available to virtually every household in Morgan Hill, the two metrics are identical and this report will use the adoption figures for comparison.

Service providers consider this kind of customer data to be proprietary, and as a result the FCC and CPUC treat it confidentially. Exact figures for cities, or census tracks or blocks are not released. Other than state and county-level summaries, the only data published is an indication of which of six broad percentage ranges the adoption rate in any given census tract falls into. Even this scant information is suppressed when there are fewer than three service providers reporting customer data in a census tract, in order to preserve confidentiality.

The CPUC provided adoption data for eight census tracts that include a significant number of homes within the Morgan Hill city limits, and suppressed data for one. One census tract with an insignificant number of homes in Morgan Hill (4 homes) was disregarded, as were two census tracts with zero homes within Morgan Hill.

There are 11,360 homes within the Morgan Hill city limits and within the eight census tracts for which data was provided. Of those, 57% (6,470 homes) are reported to have household broadband adoption rates within a range of 60% to 74%, and 43% (4,890 homes) fall within a 75% to 89% range. None of the significant census tracts in Morgan Hill for which data was provided have adoption rates of 59% or less, or 90% or higher.

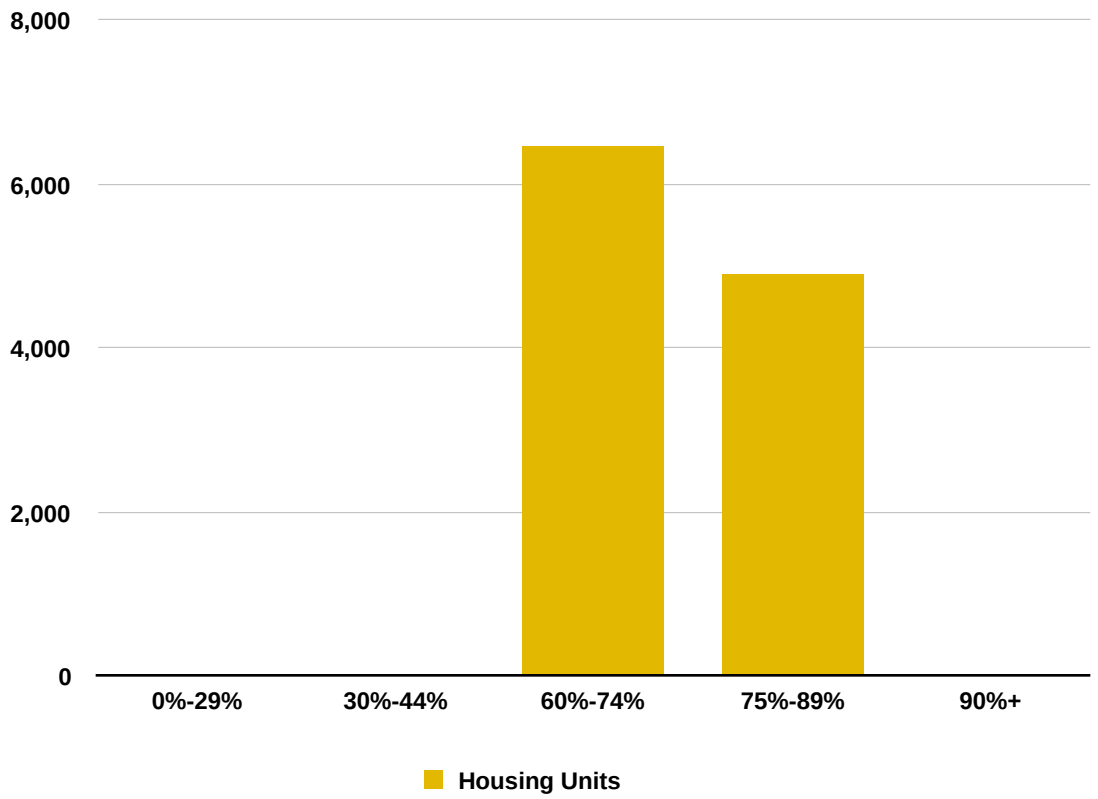

Figure 2.9 – Morgan Hill household broadband adoption rate by census tract.

By comparison, the California statewide adoption rate is 74%, Santa Clara County's is 81% and San Benito County's is 65%. In other words, the statewide rate is roughly at the center of the range and distribution of adoption rates within Morgan Hill, while approximately two-fifths of homes fall are in the same range as Santa Clara County overall and three-fifth of homes are in the same range as San Benito County overall.

2.7. Business and consumer perceptions

Tellus Venture Associates conducted primary market research to find out what residents and business people think about the broadband service and infrastructure that is available in Morgan Hill. A workshop was held for local businesses on 20 November 2015, and online surveys were conducted: one for local businesses in February 2016 and one for residents in March 2016.

Workshop

Ten people from Morgan Hill businesses and local government attended, representing:

- Anristu Americas
- Robinson Technologies
- Smith Commercial Management
- Leal Vineyards
- Morgan Hill City Government

Two representatives from Charter Communications were also present as observers, and did not participate in the discussion.

All companies represented have contracts with at least two broadband providers, including:

- Charter
- Exceed
- Verizon
- South Valley Internet
- AT&T Uverse
- Level 3
- BCN Networks
- NTT Etheric

Each company stated multiple times that they needed the redundancy because of a long history of re-occurring system reliability issues. They also expressed frustration regarding inadequate throughput and latency, and that none of the available broadband systems meet their current needs at an affordable price. Several participants detailed problems they had with their respective service providers regarding outages.

Each company has experienced significant growth over the past three years and they all expect this trend to continue in the foreseeable future. Each company stated that a major obstacle to realizing and sustaining that growth is the ability of the current broadband systems to meet data system needs at an affordable rate. Currently they are paying anywhere from $1,200 to $10,000 per month for services they do not find satisfactory, with the exception of one participant.

When asked to rate the level of satisfaction for their current broadband services in terms of: 1. overall reliability and 2. quality of service (i.e. throughput and latency) on a scale of 1 to 5 with 5 being excellent and 1 being very poor, each company gave a rating of 1 for each metric for their respective service provider, with the exception of one company which gave a 4 rating.

Major issues with current broadband service and providers include:

- System throughput and latency.
- System reliability.
- Extremely poor customer service, especially technical support.
- Length of time required to upgrade current service/system.
- Current pricing models, which are not a sustainable business model that facilitates growth and long term partnership.
- Limited system footprint, which does not support employees working remotely.

Business survey

There were 53 survey respondents, representing an 8.5% sample size, which is a statistically sound sample. Generally, any sample greater than 5% of total population is statistically relevant in analysis projections. However, because this survey was conducted online and the respondents were self-selected, the statistical validity of the results is open to question, and the data gathered should be considered qualitatively, rather than strictly quantitatively.

- 81% of respondents currently purchase Internet service for their business.
- 96% of the responding businesses have Internet access.
- 62% of the businesses responding allow telecommuting,
- Roughly one half purchase cellular (54%) and/or fixed line phone service (47%).

There does not appear to be a dominant trend among the respondents with regard to how these services are purchased, about one-third each purchase these services as a bundled package, separately or some combination:

- 27% - All my services are bundled
- 35% - All services are obtained through separate providers
- Some services are bundled, some are sold separately

Nearly one half of the respondents (47%) currently contract with Verizon for their broadband services, followed by Charter (40%). AT&T Uverse and South Valley Internet are currently used by 10% of the respondents as their primary broadband carrier.

- 31% of the respondents use DSL as their primary Internet connection.
- 18% use T-1 lines or similar (1960s vintage digital transmission technology using telephone lines).
- 13% use cable modem service.
- 13% use fixed wireless service.

When asked how important Internet access is:

- 88% of respondents said it is very or somewhat important in their ability to achieve strategic goals (68% very important).
- 80% said it was very or somewhat important in their ability to stay competitive (66% very important).
- 62% stated that it is very or somewhat important when deciding where to locate existing or future facilities (44% very important).

Nearly one-half (48%) do not have a backup or secondary connection, and of those who do have a secondary service, 14% use wireless and 7% rely on cable.

- 93% of respondents stated that the reliability of connection is the most important aspect of their businesses Internet service. Only 20% of those businesses are very satisfied with the current level of reliability, whereas 40% are somewhat/not at all satisfied with the current reliability of their Internet service.
- 80% responded that the speed of connection was very important while only 24% responded that they are very satisfied with current internet speed verses 42% stating that they are not at all or only somewhat satisfied with current internet speed.
- Technical support was identified as the 3rd most important service attribute (71%). Only 17% were very satisfied with their current level of tech support.

Each of these key metrics indicate a need for the current providers to substantially improve current systems and services.

In terms of value, 60% stated that the price of services was either very or somewhat important, only 11% are currently very satisfied with the price of services, 28% are neither satisfied or unsatisfied with current prices of services. This result is noteworthy. In our experience if only 10% to 15% of a customer base feels that they are getting good value for services it is a key indicator that most would likely switch providers if any were available.

Type of businesses responding:

- 15% of the respondents represented the Professional, Scientific & Technical Industries.
- 12% from the Finance, Insurance and Real Estate Community
- 11% from the Retail Sector
- 38% of the responding businesses have had a presents in Morgan Hill for more the 20 years.
- 31% between 1-5 years, and of that 31%, 17% have been in Morgan Hill less than 2 years.
- 51% have 5 or fewer employees
- 21% have between 6 and 20 employees

Consumer survey

There were 510 survey respondents, representing a 4.2% sample size. Because this survey was conducted online and the respondents were self-selected, the statistical validity of the results is open to question, and the data gathered should be considered qualitatively, rather than strictly quantitatively.

- 99% of respondents have internet access at their home.
- 98% of respondents currently purchase Internet for their home.
- 93% of respondents purchase cellular/mobile telephone service.
- 85% of the responding households purchase either cable or satellite television.

There does not appear to be a dominant trend among the respondents with regard to how these services are purchased:

- 5% - All my services are bundled
- 42% - All services are obtained through separate providers
- 48% - Some services are bundled, some are sold separately

More than half of the respondents (67%) currently use cable as their primary Internet connection, followed by DSL (14%) and Wireless (10%).

Only 30% of respondents reported that their current Internet speed was fast enough for their needs. Given that 65% of respondents say their employers allow telecommuting, it was surprising that only 24% considered the availability of Internet services prior to purchasing or renting a home.

Reliability of connection was very important to 93%, yet only15% reported being very satisfied with current reliability. It is alarming that 38% reported being either not at all satisfied or only somewhat satisfied.

86% said that speed of connection (including latency and throughput) was very important to 86% of respondents but, again, only 15% reported being very satisfied with the speed of their current Internet service, whereas 38% reported being either not at all satisfied or only somewhat satisfied. Similarly, 64% of the respondents said that the cost of services was very important and only 24% reported being very satisfied or somewhat satisfied with the price they were paying.

The minimum acceptable upload speed for Internet service was 6 Mbps or higher or higher for 84% of respondents:

- 6 Mbps – 25%
- 10 Mbps – 31%
- 25 Mbps – 28%

The minimum acceptable download speed for Internet was 10 Mbps or greater for 81% of respondents.

- 10 Mbps – 25%
- 25 Mbps or more – 56%

Our overall conclusion is that residential and business Internet customers in Morgan Hill are not satisfied with their current service and are not receiving a perceived good value.

2.8. Conclusions

The broadband availability data reported by Verizon (for the system now owned by Frontier Communications), Charter Communications, AT&T, Level 3 and TW Telecom and the results from primary market research conducted for this analysis paints a clear and consistent picture: broadband infrastructure and service in Morgan Hill is significantly poorer than the Californian and Bay Area average. The broadband adoption rate is generally lower than for Santa Clara County residents overall, however it is in line with the statewide average.

Frontier's system in Morgan Hill has not been maintained at the level and upgraded to the extent that AT&T's wireline systems have been in the Bay Area. It relies on older generations of technology and a legacy copper line network that has not been supplement with high capacity distribution fiber or reconfigured to provide even levels of availability throughout the city, to the same degree as networks in comparable cities to the north.

The predominance of commercial and industrial areas in the census blocks where Frontier offers no broadband service, and the generally lower level of service offered in the commercial and industrial areas it does serve indicates that the previous owner, Verizon, gave scant consideration to providing the commercial and industrial classes of broadband services that businesses rely on now, much less an ever increasing demand for bandwidth in the future.

Charter Communications does a better job of providing high speed broadband connectivity to residents and businesses, but it also falls short of meeting common industry standards. Although its advertized service levels in Morgan Hill are the same as it offers in most of the other California cities it serves, those service levels are significantly below that of its peers in the cable industry. Particularly, its advertized 5 Mbps upload speed is only a quarter of that offered by other major cable companies in California, which indicates that it is severely constrained by the condition of its network, the degree to which it has deployed upgraded technology and/or the resources – such as whole Internet bandwidth – it provides to its network. This upload speed also falls below a level considered to be adequate by 84% of Morgan Hill consumer respondents to the online survey described above.

Secondary companies – Level 3 and TW Telecom – have moved in to fill some of the gaps left by the primary providers with more specialized services, including via direct fiber optic network connections to end users. Major fiber network operators also provide connectivity in Morgan Hill on a wholesale basis.

Mobile broadband coverage is generally poorer in Morgan Hill than in areas to the north, but the level of service experienced by users will vary depending on the carrier, location and the number of users accessing service at the same time. Internet service is also offered in some locations from fixed wireless system operators, but little reliable information is available regarding actual coverage, availability and true service levels.

There is a sharp divide between the broadband service and infrastructure in residential areas, and that found in commercial and industrial areas. Although Frontier's service levels fail to meet the CPUC's minimum standard of 1.5 Mbps upload speeds anywhere in Morgan Hill, it meets or exceeds the minimum download standard of 6 Mbps in 72% of residential census blocks it serves. By comparison, it only meets the CPUC's download minimum in 61% of non-residential census blocks. Its highest tier of service – 15 Mbps download speeds – is available in 39% of residential census blocks, but only 13% of non-residential ones.

Charter's service reports indicate a more even distribution of broadband availability across residential and non-residential areas, meeting both the CPUC's 6 Mbps download/1.5 Mbps upload standard and the Federal Communication Commission's higher standard of 25 Mbps download and 3 Mbps upload speeds for "advanced services". However, that claim does not match the experience of Morgan Hill business people participating in the workshop and online survey described above. Participants reported unavailability of service from Charter, delays in installing service, and unreliable levels of service.

Although one company (Level 3, reporting as two separate service providers, Level 3 and TW Telecom) offers faster connections to a limited number of business customers, the responses from the survey and workshop indicates that this service is very expensive. The reported speed levels and technology employed for 12 of the 14 census blocks where Level 3 offers service indicates it is based on older and limited facilities.

The low level of residential broadband service in Morgan Hill, relative to other Bay Area and Silicon Valley communities, creates a competitive economic disadvantage for both the real estate market and for individuals who operate home-based businesses or have the option, but not the ability, to telecommute to jobs elsewhere. The inability of Morgan Hill residents to enjoy the same level of social, entertainment and recreational benefits as people living in the greater Bay Area results in a lower quality of life as well. The even lower level of commercial and industrial broadband service and infrastructure is a barrier to companies that might wish to locate or expand in Morgan Hill, and is a motivating factor for existing businesses that might consider moving elsewhere.

However, Morgan Hill is not isolated. The inter-city (middle mile) fiber routes that run along the railroad right of way and on city streets provide the essential connectivity that would make it possible for incumbent carriers to upgrade their networks or for new service providers to locate in Morgan Hill. This middle mile connectivity is a necessary resource. Many communities do not have access to it, but Morgan Hill does and should make the most of it.

Morgan Hill's future economic growth and living standards will be constrained or even degraded by its legacy broadband infrastructure and the substandard levels of broadband service it supports. The planning and policy analysis sections that follow offer both near term and long recommendations for addressing this problem. Solutions will necessarily involve the current incumbents, Frontier and Charter, but the capital and operational constraints both companies face as a result of recent transactions will require the involvement of other service providers as well.

3. Broadband infrastructure planning

Morgan Hill, like other California cities, has no direct role in regulating Internet service providers. However, the City can implement policies that help or hinder broadband infrastructure development and competition. Options include managing the use of city-owned facilities by Internet service providers, setting policy for shared use of public right of ways, becoming directly involved in developing broadband infrastructure and directly providing services, with or without private sector partners. Policy initiatives that encourage broadband infrastructure development can have a significant impact on the availability of service and facilities. Cities have attracted private, competitive broadband service providers by lowering barriers to entry and leveraging existing city infrastructure and budgets.

3.1. Types of infrastructure

Broadband infrastructure generally breaks down into two categories – middle and last mile – and supports four different types of service: consumer, commercial and industrial classes, and mobile.

Last mile infrastructure is used to deliver broadband service directly to customers from a central office or other distribution point operated by telephone, cable, mobile and other telecommunications companies. It is the type of infrastructure most commonly seen in Morgan Hill and, as described above, variations in its quality and capacity result in different service levels in different areas of the city. In Morgan Hill, these last mile facilities primarily consist of older generation telephone lines (Frontier), coaxial cables (Charter Communications) and cellular wireless sites, plus some very limited access via fiber optic cables.

Middle mile infrastructure connects the central offices and distribution points to major data centers and Internet exchanges, and provides the high capacity, wholesale bandwidth that is distributed on a retail basis via last mile infrastructure. As with other types of utilities, middle and last mile infrastructure is also sometimes referred to as transmission and distribution facilities, respectively. The terms can be used interchangeably.

In most of Morgan Hill, consumer, commercial and industrial class service is delivered via wireline networks, although service is also available via fixed wireless technology on a more limited basis.

As discussed above, consumer-class Internet access is typically a shared resource, with many subscribers contending for the same bandwidth, and is subject to speed and volume limits as determined by the provider. This type of service often meets the needs of small and medium businesses, but not always. And it is generally inadequate for larger companies, which need commercial and industrial class broadband facilities.

It is much easier for broadband service providers to generate an acceptable return on investment in residential areas than in commercial or industrial ones, particularly densely populated urban and suburban neighborhoods. Standardized equipment can be used to provide a managed level of residential-class service, and each home can be offered a wide range of products including Internet

access, television programming and telephone service. It is a predictable business, and capital investments can be made with a reasonable degree of certainty.

"Commercial class" service is defined as being similar to residential service in that the provider takes effectively all responsibility for installing, maintaining and supporting the service. Speeds are similar (6 to 150 Mbps), but service levels, reliability, consistency and pricing are higher.

"Industrial class" service refers to situations where the customer plays a much greater role in building and supporting the service, including buying different elements from different vendors and managing installation and support. Speeds would be higher – perhaps as high as a gigabit per second or more – and quality of service levels could be as high as found in top tier Internet exchanges. Large industrial customers frequently buy services directly from middle mile providers. DS-3[7] circuits or dark fiber strands are examples of industrial class services that are available in Morgan Hill, although it is the older, copper wire-based services, such as DS-3 circuits, which predominate.

Industrial and commercial customers are more diverse and less predictable than residential subscribers. One business might need gigabit speeds at the highest quality-of-service levels, while the one next door is content with a standard, relatively slow DSL connection. As a result, incumbent carriers tend to approach commercial and industrial customers on a case by case basis or be extremely selective in choosing which neighborhoods and business districts to upgrade. They do not prospectively build high speed infrastructure. Businesses seeking higher grade service are frequently presented with installation estimates in the thousands and tens of thousands of dollars range.

The experience of other cities, particularly those in the Bay Area, shows that relatively small-scale efforts can result in significant improvements in commercial and industrial class broadband infrastructure by reducing the risk for private telecommunications companies. These steps have included streamlining permitting procedures, directing redevelopment funds towards broadband projects and other measures.

Mobile broadband infrastructure supports yet another type of service. It is differentiated from fixed services and infrastructure – consumer, commercial or industrial – in that it is accessible over a wide area, rather than in a specific place. Because it relies on limited radio frequency spectrum, mobile service has less overall capacity than service based on modern wireline technology and is more expensive to purchase, on a cost per megabyte basis. Although carriers will often make claims to the contrary, mobile service is not a generally acceptable substitute for wireline service, either in terms of service levels or cost. However, it is regarded as equally essential. The Federal Communications Commission's *2016 Broadband Progress Report*[8] defined this distinction:

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[7] "DS-3" is one of several standard types of data connections, originally developed for use by telephone companies. It refers to a copper wire-based circuit that can support speeds of approximately 45 Mbps.

[8] *Broadband Progress Report 2016*, Federal Communications Commission 28 January 2016, In the Matter of Inquiry Concerning the Deployment of Advanced Telecommunications Capability to All Americans in a Reasonable and Timely Fashion, and Possible Steps to Accelerate Such Deployment Pursuant to Section 706 of the Telecommunications Act of 1996, as Amended by the Broadband Data Improvement Act.

> Consumers have advanced telecommunications capability only to the extent that they have access to both fixed and mobile broadband service. As they currently exist, fixed and mobile broadband services are not functional substitutes for one another, as some commenters suggest. Rather, as many commenters recognize, in today's society, fixed and mobile broadband are both critically important services that provide different and complementary capabilities, and are tailored to serve different consumer needs…
>
> It is true that, at a high level of generality, both services provide consumers with broadband Internet access service. As we have explained, however, significant differences in service capability and pricing prevent fixed and mobile broadband from being adequate substitutes for one another. Although fixed and mobile broadband sometimes provide overlapping functionality, this does not compel the conclusion that the two services are interchangeable for purposes of our Inquiry. Indeed, Americans with access to only one type of service are often unable to take advantage of the full range of functionality offered by advanced telecommunications capability.

Cellular wireless sites are last mile facilities and rely on the same middle mile fiber optic networks as wireline systems.

3.2. Land use considerations

Implications for Future Development

The Morgan Hill land use alternatives evaluated in 2014 include four primary types of land use – single-family housing, multi-family housing, commercial and industrial – each of which have particular implications for broadband policy. All four, however, share the same need for core infrastructure.

Single-Family Housing

If a residential project is in the thousands of homes range, it might be practical for a developer or home owners' association to bring in a competitive telecommunications company as a primary Internet (or cable or telephone) service provider. In a gated community, the threshold might drop to hundreds, or even dozens, of homes because rules for providing television service are different when the public right of way is not involved. If residents agree to buy services in bulk – i.e., all residents subscribe to a base level of service, which might or might not include Internet service – then a broadband provider will be able to amortize construction costs over fewer homes.

Smaller last mile projects in residential developments will almost always rely on incumbents, which in Morgan Hill are Frontier and Charter. It is becoming common practice for new homes to include pre-wired data networks, but there is no single, industry standard for doing so, or for providing open access to existing or potential competitive networks. The City can play a role in setting these standards for new construction (and for major remodeling projects). The greater the degree of standardization and open access, the easier it is for prospective last mile competitors to enter the market and offer residents additional choices.

Multi-Family Housing

The same considerations apply as with single-family housing, with one major difference. Landlords and homeowner associations play a gatekeeper role and, up to a point, can control which broadband service providers can gain access to a property. In some cases, this control poses a barrier – e.g., landlords can prevent or refuse to pay for upgrades – but in other cases it can be an opportunity. Even a small multi-tenant property could be attractive to a competitive provider, due to the low cost per customer to build and maintain facilities, and the potential for bulk purchases of service, by landlords or homeowner/tenant groups. Google Fiber is following this model in San Francisco.

Commercial

Office and retail properties—particularly those with a large number of tenants—are attractive to incumbent and competitive service providers alike, particularly when some or all of the construction costs for broadband facilities are borne by property owners. However, without access to core infrastructure, competitive providers operate at a severe disadvantage. Municipal conduit and dark fiber facilities, along with policies that require lateral connections to new construction, can level the playing field.

Industrial

Companies and institutions will often prefer to work directly with the raw materials of broadband: dark fiber, electronic equipment, and direct connections to major Internet exchanges. Although organizations with large-scale bandwidth needs are often willing to invest in on-site upgrades, site selectors will bypass locations that lack access to this core infrastructure.

3.3. Municipal resources

City facilities that can support broadband development fall into two general categories: conduit and pole routes, and real estate.

Pole routes

Most California cities, including the City of Morgan Hill, do not own pole routes. The exceptions are cities that also operate municipal electric utilities, such as Alameda, Santa Clara and Palo Alto. Not coincidentally, these three cities were the first in the San Francisco Bay Area to embark on large scale, municipal broadband projects.

Conduit

According to the Public Works department, the City of Morgan Hill does not own a significant amount of broadband-capable conduit. Some conduit has been installed for traffic signal management purposes, but it is not designed to support interconnection of facilities over a significant footprint. The City also

apparently owns, by default, some abandoned conduit in various, scattered locations. This abandoned conduit has not been mapped or evaluated for re-use potential, and at this point appears to be irrelevant for broadband planning purposes.

Most cities in California similarly lack municipal conduit assets that are relevant to broadband planning. However, many do own significant conduit routes, particularly interconnect conduit used to manage traffic signal networks. Because traffic signals tend to be installed on busy streets in commercial areas, the conduit routes that serve them are usually well suited to support business-oriented broadband service and middle mile facilities. The City of San Leandro was the first in the Bay Area to make large scale use of traffic signal conduit for this purpose.

Other types of municipal conduit include empty conduit installed on a prospective basis – the Cities of Brentwood and Watsonville are examples – as well as conduit specifically designed to support internal city data networks and street light systems. Conduit installed for IT network purposes can be useful, but is usually more limited in scope than traffic signal systems. Electrical conduit installed for street light purposes is usually not well suited for broadband systems because of differences in the way electrical distribution networks are designed and maintained. The conduit used to deliver electricity to Morgan Hill's streetlights follow this pattern and appear to be designed to support relatively short connections to PG&E's distribution network. Using other city utility systems, such as sanitary and storm sewers, is likewise problematic.

Real estate

According to staff, the City of Morgan Hill is currently leasing space on city-owned water tanks to mobile broadband infrastructure companies, including Crown Castle, which owns and manages cellular wireless sites on behalf of mobile carriers. No other city-owned real estate assets were identified as being currently used by third-party broadband providers.

City-owned real estate – either vacant land or space inside buildings – can be used to house network electronics and data centers for fiber and other wireline projects. City buildings, street lights and other facilities can support public WiFi access points. Towers, tall structures and vacant land can be used for cellular sites and support facilities for wireline networks.

As discussed below, cities can use these resources to build municipally owned broadband infrastructure. Many different kinds of business arrangements can also be made with major incumbent providers and competitive independent companies, including swaps of service for access to facilities, partnerships and normal purchase agreements.

Agency IT budgets

Public agencies are usually among the biggest users of broadband service at the local level. Although there are restrictions on the use of services and facilities purchased with public funds, particularly those earmarked for educational purposes, public agencies can serve as anchor customers of new broadband

projects. Within limits, municipal information technology and telecommunications budgets can be directed in ways that support broadband development goals.

Although money allocated for educational networks cannot be used to subsidize municipal or public broadband service, it can be used to purchase service from competitive private or municipal service providers. For example, pre-purchase commitments made on behalf of U.C. Santa Cruz provided the critical initial revenue stream which made it possible for a private company, Sunesys LLC, to build a fiber line from Silicon Valley to Santa Cruz, and to successfully apply for state grant funds to build a second line from Santa Cruz to Soledad.

4. Broadband planning framework

4.1. Overview

The evaluation in Section 2 above reached several conclusions about the state of broadband infrastructure in Morgan Hill:

- Overall, primary last mile wireline infrastructure is generally below average in Morgan Hill, receiving a “D” grade, as opposed to the “C” and “C-” grades typically found to the north, in the greater Bay Area.
- The existing telephone network (now owned by Frontier Communications) was not upgraded to contemporary standards by Verizon.
- Charter Communications’ cable system supports higher broadband speeds but is less capable than systems operated by other major cable companies in California.
- Mobile broadband availability varies by carrier and location, and is often poorer than the service that is available in the greater Bay Area.
- There is a significant last mile infrastructure deficit in commercial and industrial areas, across all primary and secondary service providers.
- Competitive middle mile connectivity to major Internet exchanges is available and appears to be sufficient to support significant last mile upgrades.

There are a number of alternatives for addressing these deficiencies. As discussed in the policy section below, the City of Morgan Hill has no direct regulatory influence over telecommunications service and, where broadband service is concerned, few, if any, regulatory avenues to pursue at the state or federal level. Instead, the tools available are limited to persuasion, coordination, direct or indirect broadband initiatives, and policy that promotes or impedes broadband infrastructure development.

The City has several options for encouraging the development of core broadband infrastructure. It can do nothing and allow the incumbent service providers, working with property developers, to install telecommunications facilities that can only be accessed on their terms, as is generally the case in Morgan Hill today. The City might also establish requirements for installing fiber and conduit in new developments and, up to a point, mandate some level of access by competitive carriers. Or the City can take a more proactive role, ranging from installing its own conduit any time trenches are dug, to building out a dark fiber network, possibly extending to developed properties as well. This core infrastructure would also include connections to regional fiber networks, for greater utility and lower cost.

In general, the choices can be summed up as:

1. Set higher standards for broadband infrastructure in new residential and commercial developments.

2. Work cooperatively with Frontier, Charter and mobile carriers to identify policy barriers that could be removed or incentives that might be offered to encourage greater investment in their systems in Morgan Hill.
3. Evaluate options for creating a third, citywide broadband system, either as a municipal enterprise or through cooperation or partnership with a private, competitive provider.
4. Pursue targeted broadband projects, with or without private sector partners, that address specific last mile infrastructure and/or service deficits in commercial and industrial zones, and that improve local availability of existing middle mile resources.
5. Establish programs to 1. identify, construct and document broadband assets for future use and 2. create an ongoing role for the City as a coordinating body that aggregates information and complaints and provides such to state and federal regulators.

Broadband infrastructure initiatives (items 3 and 4 above) and related considerations follow; policy-based options (item 1, 2 and 5) are discussed in Section 5 below.

4.2. Initiative options

Similar to planning roads and water supplies, assessing alternatives for broadband infrastructure initiatives includes consideration of the immediate needs of existing companies as well as long term growth requirements for future commercial and industrial development, new businesses that might be relocated or started in Morgan Hill and new residential construction.

Even though existing broadband infrastructure is below average, the City of Morgan Hill is in a position to make targeted improvements and meet the increasing demand for low cost, high capacity, reliable broadband infrastructure and service from consumers as well as new and existing businesses. These options include:

Survey, map and systematically track broadband assets. As far as is known, the City of Morgan Hill does not own any conduit that might be capable of supporting broadband initiatives. However, the City does not systematically track conduit or other broadband assets and there is some degree of uncertainty. Conducting an engineering survey of known or suspected conduit locations and routinely entering information about conduit and other assets into a GIS database will give the City the ability to pursue opportunities or plan initiatives using accurate and immediately available data. The City can also evaluate city owned real estate and related facilities to determine if it might be available or appropriate to a broadband development project.

Build the City's inventory of municipal broadband assets. Over time, the City can improve its negotiating position with incumbent service providers and increase its independent options through coordinated planning of 1. internal information technology needs, 2. public works and transportation infrastructure construction and 3. conduit (and other broadband asset) development, via targeted projects or general policy implementation.

Develop a phased build out plan. Once the City has a systematic process for tracking current assets and coordinated plans for building its overall inventory, the next step would be to prioritize areas with the greatest need and/or the least attention from incumbents – older business parks, for example – and identify specific projects that those assets could support, or alternatively projects that fill gaps in those assets.

Seek private sector partners. Many cities have issued general requests for proposals, seeking private sector partners who are willing to finance and implement projects that achieve municipal objectives. Generally, the more assets – money or broadband infrastructure – that are put on the table, the more likely an RFP will produce a useful result. Alternatively, cities have used other procedures, such as exclusive negotiating rights agreements or non-exclusive leases of public assets, to recruit willing private companies.

Assess the potential for using existing City funds. This option is likely to be limited in scope, but, for example, the City could be an anchor tenant on new infrastructure built by a private carrier. Even a small amount of guaranteed revenue at the beginning of a capital-intensive project can make a big difference in the attractiveness of the business model to investors.

Investigate mutual use agreements with VTA, Caltrain and other agencies. Transit and regional and state transportation agencies often include conduit and fiber optic facilities in new construction or major upgrades. Often, these projects are coordinated with cities, at least at a public works/ transportation planning level. This coordination can and should include consideration of broadband development policies and priorities.

Establish a municipal dark fiber enterprise. See Appendix C for municipal broadband enterprise descriptions and examples. Table 4.1 summarizes significant examples.

Conduct a fiber-to-the-home feasibility study. The cost of building a full, fiber to the home system that serves every Morgan Hill home and business would be in the tens of millions of dollars range[9], perhaps approaching the $100 million point. A feasibility study can be used to assess such a project, from the point of view of operating it as a municipal enterprise as well as an opportunity to present to potential private sector partners (see Appendix C below). Table 4.1 summarizes significant examples.

4.3. Requests for proposals

California cities have used a number of different strategies to solicit interest in infrastructure partnerships, conduit leases and other broadband initiatives. Some examples are:

Benicia - The city targeted a specific industrial area, put $750,000 on the table and asked companies to bid to build a system that would provide service to the area. Several proposals were received and the city is in the final stages of negotiating a contract with one of the proposers. The advantage is that the

[9] *Financial analysis of user-financed residential broadband service in Palo Alto*, Tellus Venture Associates, June 2012.

city gets the economic development boost it wants at a defined cost and no additional risk or operational involvement.

Los Angeles - The city put some assets – mostly existing middle mile fiber – on the table, offered good will efforts to obtain other assets, such as pole routes that the city also owns, and asked for what amounts to a full fiber to the home system. Advantage is that it focuses attention on the city's goal of improving broadband access for all residents. Downside, so far, is that there's been no tangible result.

Salinas - The city put its conduit on the table (but no money) and asked companies for proposals to build out a broadband network in two targeted areas: downtown and a mostly greenfield area that's designated as an agricultural technology corridor. The RFP is still in process. The intended advantage is that the city will encourage economic development in two depressed areas and improve the city's overall infrastructure, and perhaps gain the benefit of better a better internal IT network, without incurring significant costs.

Watsonville - The city stitched 3 miles of existing conduit and fiber together with a mile of new conduit. It built, owns and operates the system. It was done as a standard public works build-to-spec bid (not a formal RFP), and the city went with the low bidder. The system was built with the intention of using it as a replacement for the INET formerly provided by Charter Communications. It serves that purpose now and the city is in the process of developing a standard rate card for leasing out surplus capacity to ISPs. Advantage is that the city has complete control over the network with guaranteed completion, and a much lower cost of operation for its IT infrastructure. Disadvantage is that the city pays the full construction cost (~$300,000) and ongoing operating expense (and responsibility).

Inyo County - The county asked for someone to both build a fiber to the home network and find the money to do it. Nothing substantial was on the table. Only two responses came back. One was from a construction company that basically said "if you give us enough money we'll build it for you". The other was from a reputable fiber company that offered to look for grant funding. Nothing has come of it yet, and it doesn't appear anything will. Advantage is zero risk. Disadvantage, to date, is zero gain.

Seattle - An RFP to lease out a short section (~200 feet) of city-owned conduit was issued. Advantage is the city gains revenue, and some economic development benefit. Disadvantage is that it's limited.

San Leandro - An exclusive negotiating rights agreement was entered into with a major local company, OSI Soft, to build a fiber enterprise called Lit San Leandro. No public RFP was published; the ENRA was in response to an offer made by a local company for use of city-owned conduit. A similar process was used in the City of Brentwood and the City of Santa Cruz. The advantage is that the city can quickly take advantage of a firm offer made by an interested party, and have greater control over the negotiating process. The disadvantage is that it requires an interested party at the beginning.

San Luis Obispo - An RFP to lease out two miles of city-owned conduit was issued. Similar to Seattle, but for a longer distance.

Table 4.1 Municipal broadband enterprises

		Markets Served					
City	**Business model**	**Business**	**Industrial**	**Public uses**	**Amenity WiFi**	**Homes**	**Financial notes**
Alameda	Formerly public, now private.	•		•		•	Funded by revenue bonds, bondholders lost when system was sold at 50% of value.
Austin, TX	Google Fiber, private.	•	?	•		•	No direct city investment, provided concessions regarding access to city assets, permits.
Benicia	Private with public funding.	•	•				Under development, funded by transportation grant
Brentwood	Conduit is developer funded; private operator.	•	?	•		•	Conduit deeded to city required in new construction. City leases conduit to 3rd party provider.
Kansas City	Google Fiber, private.	•	?	•		•	No direct city investment, provided concessions regarding access to city assets, permits.
Loma Linda	Conduit is developer-funded; city owns & operates system.	•	•	•		•	Conduit required in new & major remodel construction. Service is optional & fee-based.
Lompoc	City owned & operated, WiFi only.			•	•	•	WiFi-only system, funded by 10 year lease-back and subsidized by utility department.
Pacific Grove	Private, city funding undefined.	•		•		•	Either city or private provider will have to pay fee to company that funds/builds.
Palo Alto	City owned & operated, funded via electric utility. Dark fiber only.	•	•	•	•		$2+ million surplus/year, initially funded as electric infrastructure, now self supporting.
Provo, Utah	Built via city utility revenue bonds; sold to Google for $2.	•	?	•		•	Ratepayers still paying off electric revenue bond obligations incurred to build network.
San Francisco	CCSF owned; operated as an ad hoc service; built via IT budget		•	•			City conduit and fiber originally installed for public purposes; funded out of agency budgets.
San Leandro	City traffic signal conduit leased to local company.	•	•	•	•		Extension funded by EDA grant. City will receive revenue in future years.
Santa Clara	City owned & operated, funded via electric utility. Dark fiber only.	•	•	•	•		$500K surplus/year, initially funded as electric infrastructure, now self supporting.
Santa Cruz	City funded, leased by private operator	•	?	•		•	City responsible for any lease payment shortfall or default.
Santa Monica	City owned & operated "lit service": system built with IT budget funds.	•	•	•	•		Revenue appears to be at or above break even level.
Seattle	City conduit lease via RFP.		•				Limited conduit revenue only, no larger network built.
Watsonville	City owned fiber; run as ad hoc service; built via IT, public works budget.		•	•			Saved the City $150,000/year in telecoms costs, now generating revenue.

5. Policy options

Federal and State laws have largely preempted the ability of local government to regulate or manage telecommunications service providers. Cities may, however, adopt policies that encourage competition and put more choices in the hands of residents and businesses.

There are already many sections within the City's municipal code that have an impact on telecommunications facilities planning, policy and deployment. Provisions concerning encroachments, excavations, underground utility districts, towers, and zoning criteria are directly relevant to the construction and maintenance of new telecommunications facilities.

Appropriately, most of these provisions relate generally to utilities and are not specific to telecommunications planning. In some cases the language is restrictive (e.g., Chapter 15.08.070) and could exclude telecommunications facilities that are not built or owned by organizations that are regulated by the CPUC or FCC. In other cases (e.g., Chapter 12.12.010.E) definitions are broader, allowing for a greater variety of solutions. While useful, these provisions do not deal comprehensively with the issues, opportunities, and constraints involved in planning and deploying telecommunications facilities. Proactive measures, such as open trench notification requirements, are also generally lacking in Morgan Hill.

The code does contain language regarding municipal cable television franchises as well as provisions relating to newer statewide franchises. This language should be evaluated to ensure that, on the one hand, it does not inhibit the development of new infrastructure and, on the other, does not prevent the City from exercising appropriate oversight or proactively pursuing development of telecommunications projects.

As Morgan Hill 2035 General Plan moves forward, the City of Morgan Hill may choose to investigate the possibility of adopting a range of new policies that directly target broadband infrastructure development and broadband service availability.

5.1. Planning

5.1.1. **Develop a long term broadband infrastructure roadmap**. *Taking into account existing resources, City networking needs, economic and social development objectives and private sector investment plans, draft specific objectives for high speed network expansion into commercial and residential areas.*

5.1.2. **Solicit implementable ideas for upgrading Morgan Hill's broadband infrastructure**. *Hold informal staff discussions with local Internet service providers and provide notice to all interested parties of the City's goal of supporting equitable fiber optic network expansion.*

5.1.3. **Broadband Master Plan**. *Develop and maintain a Broadband Master Plan for prioritizing connectivity needs in future years, with an emphasis on delivering high bandwidth services to Morgan Hill's industrial and commercial land use districts and*

community anchor organizations (education, public services, public safety, and health care).

The benefits to a community of modern, high-speed broadband infrastructure generally break out into three categories: sustainable economic development, improved quality of life and greater social equity.

Technology forms the backbone of the local and regional economy, and will continue to do so in the future. As technology spreads through more aspects of everyday lives, tremendous opportunities arise to creatively and carefully use technology to shape the community. Technological innovation can help the City in many ways. It can facilitate citizen interaction with each other and government; company services to customers; and City services to visitors; and it can provide ways to showcase Morgan Hill's commitment to a sustainable environment.

Electronic services in particular (cable television, telephone, satellite, computer networking technologies, internet, radio, and other such services) create greater accessibility to and exchange of information, impact the ways people communicate, and create job opportunities. Enhancing and improving access to these resources will have a profound effect on the quality of daily life and work. Toward improving both, the City can examine and respond to the possibilities and challenges offered by—and the implications of—technological advances and opportunities.

5.2. Dig Once

Cities retain the ability to establish reasonable conditions and procedures for utility companies, including telecommunications carriers, to do construction work in the public right of way. There are many different approaches, but in general most street cut management – also known as "dig once" – policies intended to promote broadband fall into three categories: "open trench", "shadow conduit" and construction standards.

5.2.1. **Open Trench**. *Require and provide a process for notification and information about all major infrastructure and construction projects, including transportation projects and new residential subdivisions, to a shared data base so that broadband and other utility providers have the opportunity to coordinate infrastructure deployment with projects.*

Open trench policies require some degree of advance notice of any digging that's done in streets, sidewalks or other public places. This notice goes to other utilities that might be interested in installing facilities in that location or local agencies or both. If another utility wants to take advantage of the opportunity presented by the work, cost sharing arrangements can be negotiated or specified by policy. San Francisco, Santa Cruz and Berkeley have such policies.

Santa Cruz routinely sends out notifications of encroachment permit applications to utilities and other interested providers. Berkeley mandates participation in "city-sponsored utility coordination meetings" involving other utility companies, and requires companies to submit "general information regarding any Facilities that the Company plans to apply for permits to install within the [public right of way] in the next six (6) months, regardless of whether a permit is currently sought for those Facilities".

The City can also be a participant in the open trench process, either an installer of last resort (5.2.7 below) or as part of planned process for meeting internal networking needs (5.2.5 below).

5.2.2. **Conduit Specifications**. *Adopt standard specifications for placement and construction of conduit, applicable to both planned work in the public right of way and prospective installation of spare (or "shadow" conduit).*

Although the City generally does not have the authority to review proposed telecommunications projects on the basis of capacity or network design, it can create a preference for a minimum set of specifications. It can also establish standard specifications for conduit it installs, either for specific projects or on a prospective basis, and for conduit installed pursuant to building standards imposed on new development or major remodelling projects.

The City and County of San Francisco has developed standard conduit specifications for its own installations, and a similar effort is underway in San Benito, Santa Cruz and Monterey counties. Likewise, Caltrans is expected to adopt standard conduit specifications if a pending bill (AB 1549) receives final approval from the legislature and governor.

5.2.3. **Conduit Standards**. *Require spare, city-owned broadband conduit within joint utility trenches in new developments or major remodelling projects.*

5.2.4. **Lateral Connection Standards**. *Require spare, lateral broadband conduit to all structures within new developments or major remodelling projects.*

Requirements for installation of empty, fiber-ready conduit can be imposed on new construction and major remodelling projects. This conduit should, as a minimum, comply with the specifications developed in 5.2.2 above. Ownership of the conduit can be passed to the city, as in Brentwood, or remain with the property owner with the requirement it be connected to a municipal network, as in Loma Linda.

5.2.5. **Shadow Conduit - Public Works**. *Require installation of city-owned broadband conduit as a part of any suitable city public works project, including public buildings and all transportation projects.*

5.2.6. **Shadow Conduit - Undergrounding**. *Incorporate routine placement of spare, city-owned broadband conduit into utility undergrounding programs.*

5.2.7. **Shadow Conduit - Excavations**. *Include evaluation of need to install city-owned broadband conduit in review of any work or permit involving excavation in the public right of way and establishes process for requiring such installation.*

Shadow conduit policies build on the opportunity presented by open trench notifications. Cities can make it a routine practice to install empty conduit prospectively any time a suitable trench is available. Typical cost estimates are in the one dollar per foot range. Shadow conduit placement can be done according to a predetermined broadband infrastructure construction plan, or routinely in any suitable location. The risk is that the conduit would never be used; the benefit is that if even a small fraction of the installed conduit is eventually used, the cost savings and/or revenue it would generate would offset the additional installation cost.

Watsonville, Salinas and Santa Cruz have all adopted shadow conduit policies. Watsonville built a cross-city fiber network which included previously installed conduit and Salinas is currently pursuing a downtown fiber network using its shadow conduit.

5.2.8. **Excavation Moratorium**. *Establish a 5 year or more moratorium on excavations in the public right of way after completion of work conducted subsequent to an "open trench" notification process.*

Some jurisdictions require a moratorium – five years is common – on any other utility work being done in the public right of way following major street work after potentially interested parties have been given an opportunity to participate. This policy achieves two objectives. First, it minimizes wear and tear on streets – any time a cut is made in a street, its remaining useful life is reduced by 10% to 40%, depending on the circumstances. Second, it provides an incentive for telecommunications companies and other utilities to upgrade or infrastructure sooner rather than later by setting a deadline for doing so and by offering an opportunity to share costs.

San Francisco has such a policy, as does Berkeley, which states that “a Company may not excavate any Street that has been reconstructed or resurfaced by the [Public Works] Department or at its direction in the preceding five-year period and shall participate in City efforts to coordinate excavation activities”[10].

5.2.9. **Excess Capacity Utilization**. *Facilitate the use of existing conduit and other pathways by requiring encroachment permit applicants to demonstrate that alternatives do not exist, supported by City collection and coordination of information.*

To a certain extent, California law requires telecommunications carriers and other utilities to provide access to conduit and pole routes to other carriers. Cities can encourage and, to some degree, require this kind of cooperation.

[10] Berkeley Municipal Code 16.10.080 C 4

Berkeley requires anyone who applies for a permit to install new conduit in the ground to first show that there is no existing conduit (or pathway) that can be used instead, including conduit owned by other companies or the city, "whenever sufficient Excess Capacity is available on commercially reasonable terms and conditions". Berkeley's ordinance also gives the city broad scope to inspect work[11] and related documents[12], and to consider the availability of existing conduit capacity in approving or denying a permit application[13].

This requirement can also be used to encourage use of publicly-owned conduit and other resources. In order to be effective, however, sufficient information must be available to both the City and applicants. The asset management policies below are integral to this process.

5.2.10. **Establish a dedicated revenue account**. *This account would be funded through leases or rents of City property, including publicly owned conduit, for the purpose of communications infrastructure, and to be made available for construction and maintenance of public owned conduit.*

5.2.11. **Future Proofing**. *Encourage broadband providers to size underground and overhead facilities to accommodate future expansion, changes in technology, and where possible the facilities of other telecommunications and utility providers.*

Similar to shadow conduit policies, future proofing involves the installation of surplus conduits, ducts and pole space in anticipation of potential future need. Standard specifications can be included in building codes for new and major remodelled construction. For work done in the public of right of way, minimum sizes may be suggested, and encouraged by encroachment permit policies. For example, West Sacramento reduced encroachment permit fees for a conduit project in exchange for the inclusion of a spare, city-owned inner-duct within that conduit. The city subsequently leased out its inner-duct, recovered the initial cost and continued generating revenue.

Wireless facilities and supporting infrastructure, such as fiber optic networks, should also be planned with future needs in mind. The current trend is toward smaller cell areas and facility sizes, and this trend will accelerate as 5G standards are finalized and network upgrades begin.

[11] BMC 16.10.060 F

[12] BMC 16.10.080 G

[13] BMC 16.10.060 B 4

5.3. Asset management

5.3.1. **Asset Inventory**. *Identify city-owned assets, including fiber, conduit, rights of way and towers, that can support broadband infrastructure deployment.*

5.3.2. **Open Access**. *Make public assets available to all providers on an open and non-exclusive basis, commensurate with adopted policies regarding public benefits.*

5.3.3. **Master Leases**. *Establish standard terms and conditions for the lease of City assets such as buildings, towers and land by telecommunications companies.*

Performing an initial inventory and systematically following up – e.g., routinely logging newly constructed or identified assets – and then publishing the information or making it available to telecommunications companies upon request maximizes the opportunities to put broadband-related assets to work. Setting standard lease terms and access policies reduces the time and effort necessary for telecommunications companies to take advantage of those assets, which in turn makes the city a more attractive location for infrastructure upgrades or expansion and reduces barriers to competition.

5.3.4. **Telecom Operations and Maintenance Matrix**. *Establish detailed delineation of responsibilities for operating and maintaining city-owned conduit, fiber and other assets, and any attachments or equipment/facilities placement by third parties.*

When a mix of public and private assets are involved in a broadband project, responsibilities and roles for operation, maintenance and ongoing capital investment must be clearly stated. San Leandro uses an operations and maintenance matrix to assign roles and define demarcation points for responsibilities.

5.3.5. **GIS Logging**. *Require routine entry of conduit and other broadband asset data into geographic information systems.*

An important adjunct to both open trench and shadow conduit policies is a requirement that all conduit installed by public agencies and, ideally, private utilities, be logged into the city's GIS database. Watsonville was able to build its own city-wide data network because it had taken care over the years to keep its records up to date. On the other hand, cities that have failed to do so often lose track of where municipal conduit has been installed.

Collecting detailed information about telecommunications infrastructure, making it available in a convenient and useful way, and requiring, to the extent possible, that telecommunications companies cooperate with each other levels the playing field for smaller companies that might want to build new facilities or offer upgraded service. It also gives the City a means of participating in the telecommunications marketplace.

5.3.6. **Digital Plans**. *Establish a requirement that plans and other information be submitted by utilities, developers, contractors and others in an appropriate GIS format.*

Traditional, paper-based permit applications do not provide adequate access to information about telecommunications infrastructure installed in the public right of way or in conjunction other municipally regulated work. One solution, adopted by Santa Cruz County, the City of Santa Cruz and Berkeley, is to require permit applicants to submit maps in "electronic and/or other form required by the City, and include information describing the proposed facilities"[14]. This map data would also include "information regarding any Excess Capacity that will exist in such Facilities after the installation of the Company's Facilities" if requested by the City.

5.3.7. **Broadband infrastructure database**. *Build a database showing the types and location of broadband infrastructure in Morgan Hill.*

The City can improve the telecommunications market in Morgan Hill by compiling a geo-database of available infrastructure (and/or services). Information can be requested from service providers, collected from publicly available source and gathered from ground surveys. For example, the Central Coast Broadband Consortium has published a regional online, interactive map showing local and inter-city fiber routes and other infrastructure. Most of the data was the result of a professional survey, which was supplemented by information provided by local companies and other sources.

5.4. Permitting

5.4.1. **Transparent Process**. *Delineate the process for ensuring fairness, including transparency, public notice and timetables and deadlines for timely review of any required local permits.*

5.4.2. **Permit Streamlining**. *Establish procedures to streamline the approval of broadband-related public right of way encroachment permits consistent with principles of fairness and competition for all providers.*

5.4.3. **Master Permits**. *Establish a process for issuing a master encroachment permit for large scale telecommunications projects, subject to standard conditions for specific circumstances.*

5.4.4. **Single Review**. *Limit permit requirements to encroachment permits for broadband infrastructure work in the public right of way.*

Complicated and/or opaque permitting processes can serve as barriers to entry for broadband companies that want to bring competitive service into a city. Permit processes for broadband projects that meet certain criteria – construction completely contained in the public right of way, for example – can be standardized through the use of checklists, reference designs and administrative reviews. As a first step, streamlining existing

[14] BMC 16.10.040

processes does not necessarily involve eliminating or consolidating review requirements. Rather, it recognizes that many broadband project reviews confront largely identical issues, which can be addressed in standard way.

Streamlining is important because it can reduce time and costs, and increase predictability for service providers, making Morgan Hill a more attractive target for capital investment. As described in Section 6 below, permit streamlining is now unavoidable for most permits involving wireless facilities, due to continuing changes in state and federal law.

Although care must be taken to protect the public's interests and ensure community values are maintained, some jurisdictions, such as the City of Santa Cruz, are moving permitting for broadband facility construction out of planning departments and completely into the hands of public works departments, which can use a relatively streamlined encroachment permit process to achieve the same ends in a single review. Costs to applicants are expected to drop from the tens of thousands of dollars to the hundreds of dollars.

One approach, advocated by Google Fiber, is to establish a master permit process for large scale projects. Standard conditions can be established for defined circumstances, with provisions for specific conditions when unique circumstances occur.

5.4.5. **Evergreen Permits**. *Authorize longer-term "evergreen" permits that provide a right to providers to enter specified easements to upgrade their infrastructure for an indefinite or significant period of time (such as 20 years) to upgrade the broadband service consistent with the adopted policies.*

An extension of the master permit concept, evergreen permits go one step further and allow upgrade and expansion work to take place within defined parameters over a longer period of time.

5.4.6. **Environmental and Aesthetic Mitigation**. *Set forth transparent and consistent procedures and process for preventing and/or mitigating environmental impacts and protecting and/or preserving visual integrity of jurisdiction.*

The California Environmental Quality Act allows for expedited review of many types of broadband projects, particularly when those projects occur within or on existing structures, including utility poles, or paved ground. Establishing clear guidelines for when the City will and won't allow broadband projects to proceed on the basis of a negative declaration will add predictability to the environmental review process and aid in defending any subsequent challenges.

As discussed in Section 6 below, state and federal law requires rapid CEQA review of permit applications for wireless projects, and only provides a limited window of time and discretion for addressing aesthetic issues. A simple and well defined process, with standard solutions where appropriate, will help avoid permit approval by default.

5.5. Smart Cities

5.5.1. **Broadband Building Standards.** *Require projects to provide broadband connectivity and include the infrastructure components necessary to support broadband, similar to requirements for other essential utilities.*

5.5.2. **Broadband Wiring Standards**. *Establish standards for broadband wiring in residential and commercial buildings, similar to standards for other utilities.*

5.5.3. **Smart Building Requirements**. *Specify "smart building" requirements for land use and construction permits for all projects (public, commercial, residential, industrial).*

Building standards can be used to increase broadband availability and access, and promote the use of broadband dependent applications that promote energy efficiency, safety and other public policy goals. The simplest approach is to require all new construction and major remodelling work to include broadband facilities and provisions for connecting those facilities to the necessary outside infrastructure. San Leandro has taken this approach.

The next level of involvement is to specify the types and extent of indoor wiring, connection panels and other "plumbing" required for new and remodelled construction, as Loma Linda has done, or establish specifications and requirements for broadband infrastructure in the public right of way and lateral connections from homes, as Brentwood has done.

The final stage is to include requirements for specific "smart building" features and applications, such as predictive climate control or health and security monitoring. These types of requirements bring intrinsic benefits, but also help drive demand for high quality broadband service.

5.5.4. **Public Facilities**. *Promote the provision of broadband facilities in all public buildings, major transportation and other infrastructure projects.*

It is commonplace to include basic information technology networking capabilities and Internet connectivity in plans for public buildings, transportation facilities and other public projects. These plans can be expanded to include provisions for supporting commercial broadband service on a partnership basis, for example by including spare conduit and inner-ducts or increasing the size of fiber optic cables. This spare capacity can be leased to private users or could form the basis of an economic development initiative, as AC Transit and Oakland are doing with a bus rapid transit project.

Public facilities can also serve as anchor tenants for new broadband infrastructure built by private companies, and provide a baseline of revenue that will justify the construction of facilities that can serve much larger areas of the city. The University of California, for example, offered sufficient revenue to Sunesys LLC to first build a fiber optic line from

Silicon Valley to Santa Cruz, and then extend it to the Salinas Valley. These lines are available to any user along the route, and have been credited with spurring economic development, particularly within the City of Santa Cruz.

5.5.5. **Telecommuting - City**. *Establish a telecommuting program for city employees.*

5.5.6. **Telecommuting - General**. *Encourage local businesses to develop telecommuting programs.*

Factoring telecommuting incentives and requirements into reviews of planned commercial developments, and establishing policies to encourage telecommuting by city employees when appropriate, can have the double benefit of reducing automobile traffic and increasing the demand for advanced broadband services. Mono County, for example, promotes telecommuting "as a viable method allowing visitors to stay in the region longer and work remotely, and attract new permanent residents".

5.6. Regulatory

5.6.1. **Regulatory Position**. *Articulate the interest of the jurisdiction in monitoring the reliability and quality of broadband connectivity in the local jurisdiction and ensuring appropriate speed availability.*

The California Public Utilities Commission (CPUC) regulates "telephone corporations" and, to a lesser extent, "cable television corporations" and "video service providers". These categories include Frontier Communications and, to a restricted extent, Charter Communications, which are the two primary retail broadband service providers in Morgan Hill. Intercity carriers are also regulated as telephone corporations.

Responsibility for regulating telephone corporations is shared between the CPUC and the Federal Communications Commission (FCC). Municipalities are allowed no authority in that regard.

Nevertheless, cities can be very effective advocates on behalf of residents and businesses. The City of Gonzales intervened in the CPUC's review of Charter's purchase of Time Warner and Bright House cable systems in California, and obtained an agreement to significantly upgrade the city's broadband service and infrastructure. Similar concessions were obtained by others during the review of Frontier's purchase of Verizon's telephone systems. Establishing a clear mission statement regarding the City's role as an advocate for better broadband infrastructure and service allows consistent routine communications with service providers regarding expectations and makes it possible to move quickly when windows of opportunity, such as regulatory proceedings at the CPUC or FCC, appear.

5.6.2. **Franchise Compliance**. *Monitor and audit compliance with state video franchising requirements*.

Originally, regulation of cable television corporations was the responsibility of local governments in California. Many were actively involved in regulating franchisees to the extent allowed by federal and state law until the Digital Infrastructure and Video Competition Act of 2006 (DIVCA) was approved by the California legislature.

DIVCA established statewide franchises for video service providers, which now includes telephone companies such as AT&T. DIVCA severely limits the role cities and other local government entities may play in regulating or otherwise influencing video service providers. Cities still receive a 5% franchise fee from video franchise holders, and have a limited opportunity to inspect their books to ensure compliance. Requirements for public access channels, consumer protection rules and obligations to build out infrastructure are also subject to municipal review, but enforcement authority is severely limited.

Nevertheless, some jurisdictions are taking an aggressive approach to franchise compliance monitoring. Palo Alto, on behalf of itself and neighboring cities, recently completed an audit of Comcast's compliance with franchise fee and public access channel requirements. Such an audit may form the basis for formal court proceedings, or informal negotiations with franchise holders.

5.6.3. **Specific Conditions Compliance**. *Monitor and audit Frontier and Charter compliance with CPUC and FCC mandates.*

Recently concluded proceedings at the CPUC and FCC resulted in approval of Frontier's purchase of Verizon's telephone system in Morgan Hill (along with others in California) and Charter's purchase of Time Warner and Bright House cable systems in the state. These approvals came with conditions regarding upgrades and line extensions, and other public benefits such as equipment for schools, digital literacy programs and connections for community anchor institutions.

The City can play a role in ensuring compliance with these conditions by identifying specific requirements that apply to Morgan Hill as well as general requirements that include it. The City can directly engage with the companies, and/or seek relief from the CPUC and FCC if compliance or cooperation is lacking.

5.6.4. **Enforcement Liaison**. *Establish a program for systematically collecting and aggregating public complaints and concerns regarding telecommunications services, and submitting information to appropriate state and federal regulatory agencies.*

The FCC's recent decision[15] to bring "broadband Internet access service" under common carrier regulation (often referred to as the "network neutrality" decision) tries to draw a

[15] *In The Matter of Protecting and Promoting the Open Internet;* Report and Order on Remand, Declaratory Ruling, and Order; Federal Communications Commission; adopted February 26, 2015 and released March 12, 2015.

clear line between the kind of regulation that does and does not apply to providers of those services. In particular, the FCC has ruled out regulation, by itself or states, of Internet service offerings, rates, or access to infrastructure by third parties, except to say that it will review complaints on an after-the-fact basis using a "just and reasonable" standard.

The decision specifically allows "any body politic, or municipal organization", as well as individuals and state utility commissions, to file complaints. It establishes formal and informal procedures for doing so, and creates an ombudsman's position to facilitate the process.

The CPUC's role is narrower and generally restricted to "telephone corporations", which can include traditional wireline carriers, such as Frontier, as well as broadband companies that use the public right of way. Its oversight responsibilities include enforcement of safety requirements, such as those related to utility poles, minimum telephone service standards, particularly relating to 911 access, and general compliance with applicable consumer laws and regulations. The commission has shown a willingness to couple this relatively narrow but well established jurisdiction with general but largely undefined responsibilities granted by federal law to extend its influence over broadband providers and other non-traditional telecommunications companies.

The FCC and CPUC have established procedures for the public to use in submitting and pursuing complaints against regulated companies. However, knowledge of these procedures is not widespread and making use of them involves a learning curve which can be an obstacle for many people. The City may reduce these barriers by acting as a middleman between residents and these two regulators.

The City can establish an enquiry and complaint process for businesses and/or residents that are seeking broadband services or are having problems with current providers. Although the City has limited authority in this regard, collecting this information and making it public is an effective first step toward providing incentives for telecommunications companies to voluntarily cooperate, expanding public knowledge of existing resources and constraints, and building a record for submission to the appropriate regulatory bodies.

5.6.5. **Performance Test Participation**. *Encourage public participation in CPUC and FCC broadband speed and performance test programs.*

The CPUC and FCC have separate but complementary programs that allow the public to conduct speed tests of wireless and wireline Internet service. This data is factored into assessments of needs and eligibility for various programs. The more data points that are submitted from a given area, the better the understanding of local conditions will be on the part of the public, local officials and state and federal regulators. The City can play a role in promoting participation in these testing programs.

5.7. Government operations

5.7.1. **Broadband Role**. *Establish an ongoing role for the City to play in identifying broadband needs and working proactively with businesses and service providers to meet those needs.*

5.7.2. **Evaluate long term City networking needs.** *Review existing City broadband facilities and budgets with due consideration to expected future traffic loads and expectations of available resources, and identify infrastructure development projects which are potentially of mutual interest to the City and private sector providers.*

5.7.3. **Anchor Tenant Positioning**. *Leverage City budget to stimulate demand for broadband facilities.*

5.7.4. **Interagency Coordination**. *Participate in regional and statewide planning and standards organizations.*

The City is a major purchaser of broadband services. By actively engaging with service providers as a customer, the City can influence the location and extent of infrastructure upgrades by incumbents, and provide opportunities for competitive carriers to enter the market. Coordinating these efforts, when possible, with large businesses and other agencies with similar needs, such as Santa Clara County or VTA, multiplies this influence.

The City can identify opportunities for investment by evaluating funding available for economic development initiatives, applying that funding to broadband construction plans – both public and private sector – and determine if those funds can be directed to support those projects, either through direct investment or indirectly through administrative means.

One alternative for the City to consider is transitioning from leased facilities to lines that it owns or controls on a long term basis, perhaps via a public/private partnership that allows the City to concentrate on its own operations while a private (usually for-profit) company focuses on the utility aspects of the business. Over time, money currently budgeted for leased lines could be increasingly invested in new facilities that would support economic development, or saved for other uses.

One example of this kind of public/private partnership is Lit San Leandro. The City of San Leandro has worked with a local company to build a 20-mile fiber optic ring through the industrial and commercial areas of the city, for use by local businesses. The City contributed the use of traffic signal conduit and in return received 30 fiber strands for its own use. The remaining capacity on the network is sold to local businesses by the private, for-profit partner, Lit San Leandro LLC.

Without new investment in local fiber optic infrastructure, the City – like other agencies, institutions and companies – will face increasing operating costs over time, for the use of ageing assets. Putting additional emphasis on long term infrastructure planning and investment, in cooperation with private sector carriers, is a potential solution to this problem.

5.7.5. **Validate broadband infrastructure mapping**. *Review information collected by state, federal and regional organizations, incorporate it into the City's GIS system and make it publicly available.*

Publishing reliable information regarding the availability of infrastructure and services is one of the most powerful policy tools available to the City to promote broadband development. The California Public Utilities Commission, the National Telecommunications and Information Administration and other agencies collect and publish a wide variety of information about broadband availability, access and adoption. Consolidating this information, as it relates to Morgan Hill, will lead to better planning and project development, by the City, telecommunications companies and others.

The City can develop a detailed geodatabase of existing fiber optic networks, including lateral connections, access points, splice points and information regarding ownership, and make it available for economic development purposes. Included in this database development can be an ongoing assessment of the condition of private utility poles and conduit. Over time, deficiencies can be documented and presented to either the owners or regulatory bodies to address.

5.7.6. **Upgrade broadband availability in publicly subsidized housing**. *Identify private and public sources of investment in broadband facilities and service in public housing and develop implementable initiatives.*

Publicly subsidized housing operators in Morgan Hill are eligible to apply for grants to upgrade broadband facilities in their properties and support programs designed to increase broadband adoption among public housing residents. The California Advanced Services Fund is one such source, and federal agencies, such as HUD, have similar programs.

5.7.7. **Online Access**. *Direct how government operations and services are to be provided online.*
5.7.8. **Online Permits**. *Streamline and provide online access to business and development permit processes.*
5.7.9. **Open Data**. *Establish an "open data" policy.*

The City also is, or can be, a major producer of online content and services. Maximizing the accessibility of information and public services via the Internet provides an incentive for people to adopt and increase their use of broadband services. Offering services, such as permits, to businesses via online platforms, such as the Open Counter system originally developed by the City of Santa Cruz, will also stimulate broadband demand, and attract new, high tech businesses by engaging with them on their own terms.

The City has a wealth of stored data – information collected from its programs on topics ranging from municipal finance to scientific and sociological data. Much of this data is already publicly available though not, in most cases, in machine readable formats that

programmers can easily use. The trend across local governments to make this kind of machine readable municipal data publicly accessible; this movement has been termed "Open Data".

6. Wireless

The Morgan Hill municipal code does not include a written policy regarding construction of wireless facilities. However, Planning Commission minutes and staff reports indicate that the City has procedures in place that appear to be generally consistent with the scope of its authority. However, recent changes in California law and federal decisions have shortened the timeframe available for exercising that authority in many, if not most, cases.

6.1. Constraints on local agency discretion

As of 1 January 2016, permit applications for wireless facilities within California have to be approved or denied by local governments within specific time frames, commonly referred to as "shot clocks". If the clock runs out, the application is "deemed approved". The new rules are the combined result of a new California state law – Assembly Bill 57 – which just took effect, two FCC decisions (and subsequent affirming decisions from federal appeals courts), existing California public utilities law and a California Public Utilities Commission rulemaking.

Depending on the type of facility and location involved, the applicable shot clock could be 60, 90 or 150 days. The clock begins running when the application is submitted. The City has 30 days to review the application and request additional information. In that case, the clock is tolled – stops – but starts again when the applicant responds. Additional requests for information are allowed under stricter limits and will toll the clock, but a response by the applicant starts it running again.

The only other ways to toll the clock is by mutual consent, or by approving or denying the application. It will not stop due to CEQA review, public hearing requirements, council meeting schedules or any other local agency process requirement. If the City has not approved or denied the application when the clock runs out, it is "deemed approved". The applicant must notify the City that it is proceeding with construction on that basis and the City has 30 days to file a lawsuit seeking to block it.

There are three primary methods the City can use to maintain control of the process:

- Front load the application process by requiring a comprehensive submission (backed up by a standard checklist), covering all contingencies from the very beginning.
- Structure the review process so that a legitimate administrative denial can be quickly issued if appropriate.
- Adopt a short form application and review process for pre-approved, standard solutions for wireless facilities, to encourage applicants to voluntarily choose appropriate designs and locations.

6.2. Determining which shot clock applies

The wireless permit "shot clock" rules that went into effect on New Year's Day result in three different shot clock limits (60, 90 and 150 days), and California law (including a California Public Utilities Commission rulemaking, 14-05-001) creates two different classes of wireless facilities: construction by a mobile carrier in the public right of way and everything else.

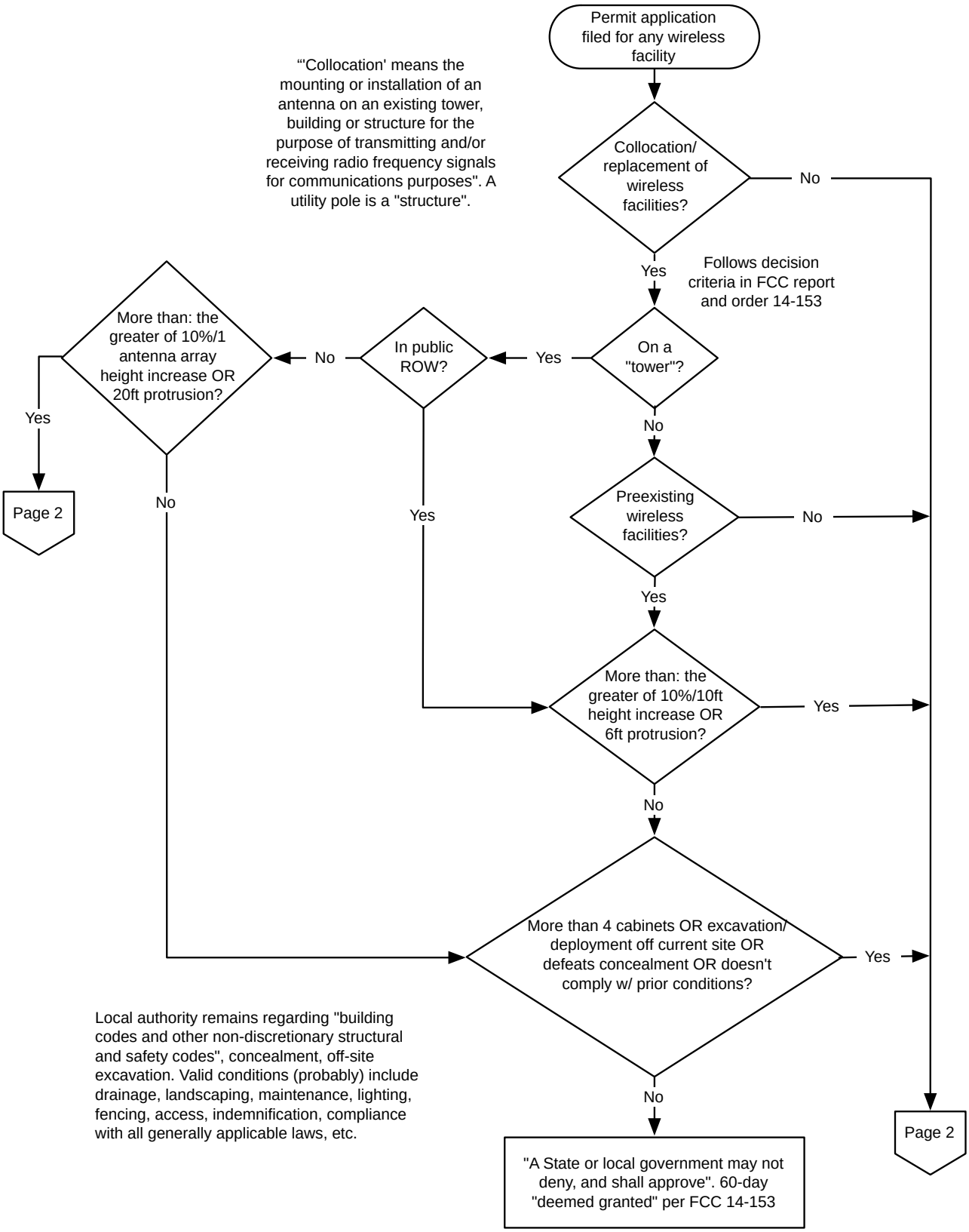


Figure 6.1 – Wireless permit "shot clock" flowchart, page 1.

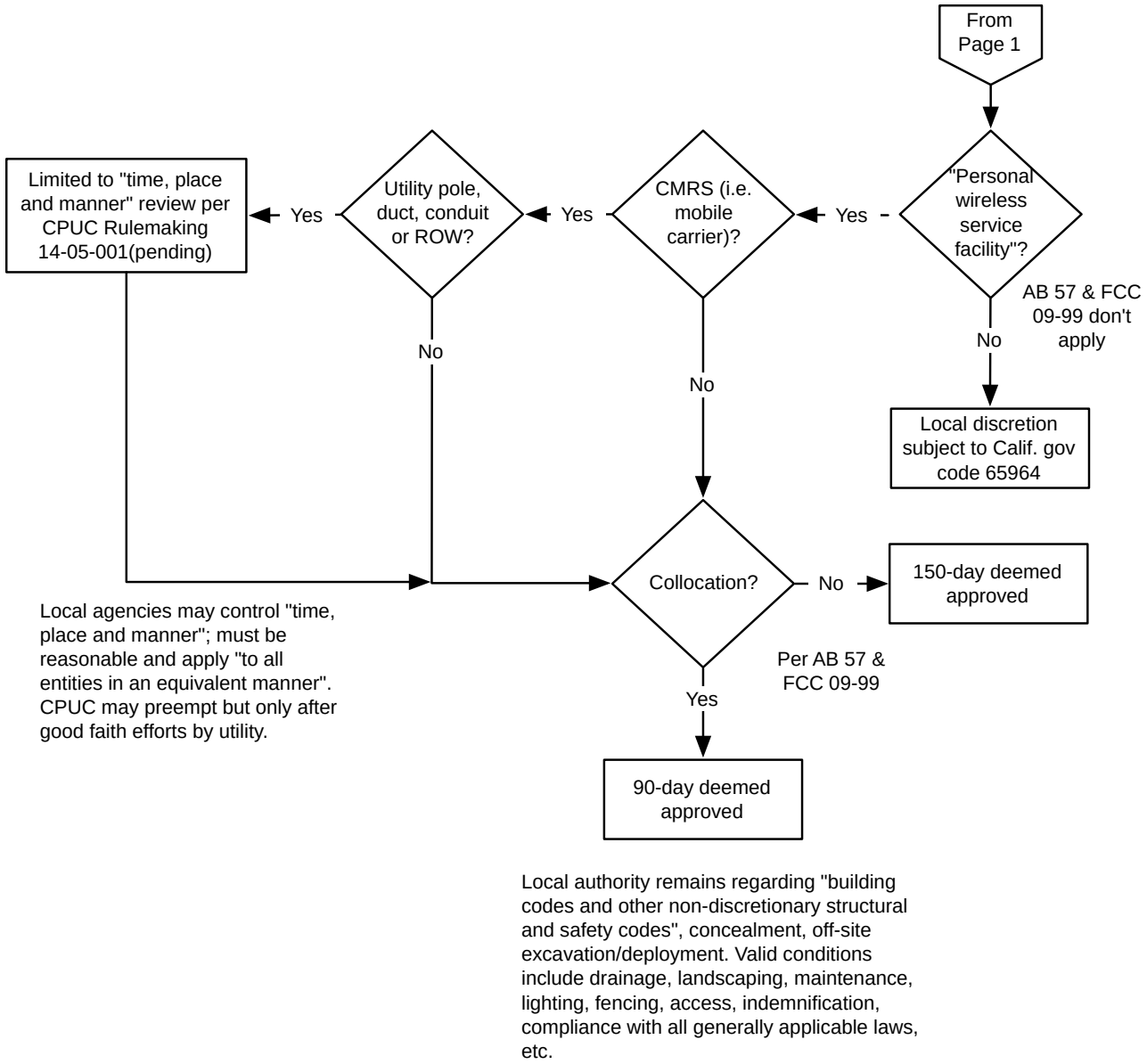


Figure 6.2 – Wireless permit "shot clock" flowchart, page 2.

Figures 6.1 and 6.2 contain a flowchart that gives an overview of how the different rules relate to each other. The result is three basic scenarios:

- Minor collocation of transmission equipment on an existing structure (or replacement of existing transmission equipment): 60 days with significant limits on criteria the City may consider when reviewing the application. This shot clock results from a 2014 FCC order (14-153), which was recently upheld by the federal fourth circuit court of appeals.

- Major collocation: 90 days. This shot clock is the result of the combination of Assembly Bill 57 and a 2009 FCC ruling (09-99), which AB 57 references (for the sake of brevity, I'll just refer to this as the AB 57 rule).
- New facilities (i.e., anything else): 150 days, per AB 57.

The 60-day shot clock applies to wireless facilities built for nearly any purpose; the 90 and 150-day clocks only apply to "personal wireless service", which are defined as "commercial mobile services, unlicensed wireless services, and common carrier wireless exchange access services". In other words, wireless telephone or broadband facilities. It wouldn't include, for example, satellite services or public safety facilities.

Another potential difference could be in the definition of "collocation". The FCC 60-day order is based on Section 6409(a) of the Middle Class Tax Relief and Job Creation Act of 2012, and is often referred to as the "6409 rules". The order makes it clear that in order to be eligible, a collocation has to be on an existing wireless facility, while the 2009 shot clock ruling could be interpreted as applying to any preexisting structure. That's one of many details that are likely to be worked out in court or by the FCC.

Section 6409 says in part that "a State or local government may not deny, and shall approve, any eligible facilities request for a modification of an existing wireless tower or base station that does not substantially change the physical dimensions of such tower or base station". The order says...

> A modification “substantially changes” the physical dimensions of a tower or base station, as measured from the dimensions of the tower or base station inclusive of any modifications approved prior to the passage of the Spectrum Act, if it meets any of the following criteria:
>
> - For towers outside of public rights-of-way, it increases the height by more than 20 feet or 10%, whichever is greater; for those towers in the rights-of-way and for all base stations, it increases the height of the tower or base station by more than 10% or 10 feet, whichever is greater;
> - For towers outside of public rights-of-way, it protrudes from the edge of the tower more than twenty feet, or more than the width of the tower structure at the level of the appurtenance, whichever is greater; for those towers in the rights-of-way and for all base stations, it protrudes from the edge of the structure more than six feet;
> - It involves installation of more than the standard number of new equipment cabinets for the technology involved, but not to exceed four cabinets;
> - It entails any excavation or deployment outside the current site of the tower or base station;
> - It would defeat the existing concealment elements of the tower or base station; or
> - It does not comply with conditions associated with the prior approval of the tower or base station unless the non-compliance is due to an increase in height, increase in width, addition of cabinets, or new excavation that does not exceed the corresponding “substantial change” thresholds.

The order also allows local governments to "continue to enforce and condition approval on compliance with generally applicable building, structural, electrical, and safety codes and with other laws codifying

objective standards reasonably related to health and safety". However, local governments "may only require applicants to provide documentation that is reasonably related to determining whether the eligible facilities request meets the requirements of Section 6409(a)".

Similarly, existing CPUC policy limits the scope of local authority over utility pole use in the public right of way by licensed mobile carriers to the same kind of "time, place and manner" restrictions that might apply to other telephone companies (and, as a practical matter, to cable and electric companies).

Under the AB 57 criteria, the definition of a major collocation is fairly narrow. Generally, it's any attachment of new equipment to an existing structure that falls within the same dimension limits as the 6409 rules (except the tighter restrictions on facilities in the public right of way don't apply) but entails more construction work, or modifications to existing conditions. There is room to debate whether an apparent collocation actually falls under the 150-day instead of the 90-day clock, but the clock will run while the debate continues.

Although AB 57 doesn't directly apply to the 60-day shot clock – it specifically excludes facilities that are eligible under the 6409 rules – the procedural requirements are, for the most part, identical. As a practical matter, the only question is whether the applicable shot clock is 60, 90 or 150 days. Expect wireless carriers to be more aggressive about claiming "deemed granted" status now that any application for wireless facilities falls under one shot clock or another.

Once a shot clock expires, or an applicant believes it has, then the applicant has to notify the City that it is proceeding on that basis and the City then has 30 days to challenge the "deemed approved" assumption in court. There's no guidance in AB 57 as to what happens if the City doesn't go to court – alternatives range from an applicant being able to simply start work on the basis of the notice, to the City being required to automatically issue the permits, to an applicant being required to obtain a court order confirming the deemed approved status. The City should consider the position it will initially take in those circumstances, but be prepared to adjust as practice and the courts clarify the procedure.

However it happens, though, carriers are likely to prevail eventually in at least some cases, and the City needs to consider what it will do in that event. One option is to create conditions of approval that would automatically apply if a deemed granted action occurs. Rather than trying to craft a default policy from scratch, however, the City might instead rely on existing design requirements or precedent. The carrier could be served notice that even though the applicable permits have been automatically granted, it is still responsible for adhering to the standards, conditions and precedent that apply to such permits and the City will enforce those terms as it would with any other permit. In other words, there's nothing special or exempt about a permit that's been deemed granted. The same rules apply, the only difference is in the method of approval.

6.3. Preserving City control of wireless permitting

The City of Morgan Hill has only a couple of sticks and one carrot left when it comes to administering permits for wireless facilities.

The biggest stick is the application requirements. An incomplete application is the only specific grounds for "tolling" (i.e., stopping) the clock, other than mutual agreement. The City has 30 days to ask for additional information, and 10 days for subsequent (albeit limited) requests if it falls under 6409 rules. The time it takes to review the application and request additional information counts against the shot clock, but the clock will be tolled (stopped) while the applicant is responding. Once an application is complete, either by default or formal acceptance by the City, the clock will run while any discussions or questions or negotiations continue.

The only way to maintain control of the clock is to explicitly require all potentially relevant information be included in the initial application. Specific, predetermined information should be routinely required in an initial application and itemized in a detailed checklist provided to the applicant.

A checklist allows the City to quickly review an application and, where necessary, write a comprehensive request for additional information. The less time required to determine that an application is incomplete, the more quickly the clock is stopped. But more importantly, it helps ensure that all deficiencies will be caught in the first review. Under 6409 rules, the City can make subsequent requests for additional information within 10 days but only in regard to items identified in the initial request. The primary FCC ruling referenced in AB 57 is less specific about limitations on additional requests for information, but until the question has been fully litigated the safest course is to assume that the same limits apply.

A further step is requiring wireless carriers to hold their own community meeting, prior to either considering an application complete or allowing a carrier to submit a new facility or colocation permit application. Such a meeting would make any subsequent public hearing less contentious by reducing the sense of surprise for community members and allow more potentially unforeseen land use challenges (e.g., noise concerns from specific equipment cabinet or generator placement) to be resolved earlier on during the review process. Furthermore the community meetings may allow for more substantive engagement by wireless carriers with neighborhood groups, so that less-intrusive sites are initially proposed. Any challenges that do occur will happen while the clock is running and could, perversely, result in an application being deemed granted because the process required for denial was not completed.

The City should take what steps it can to guard against “Trojan Horse” applications, where a seemingly innocuous facility is approved and built under the more rigorous review allowed by AB 57, but then significantly modified later under the more lax standards of the 6409 rules.

The City should also require the inclusion evidence of approval by all other necessary public agencies, such as Caltrans, as a mandatory item on the application checklist.

A community meeting requirement or Caltrans approval are examples of requirements that might apply to a new facility but not a minor collocation, for example. It's an important consideration because 6409 limits application requirements to items necessary for determining whether a proposed collocation qualifies for the expedited 60-day review. The application should establish that all applications are considered to be subject to the 150-day shot clock rule unless the applicant submits specific

information that demonstrates otherwise. If the information is omitted or insufficient, the application could be tolled or denied on that basis.

The only other stick is the threat of denial. The value of that threat is greatest when the information included in the application creates a sufficient record to support denial because subsequent inquiries could end up providing the applicant an opportunity to run out the clock. If possible, denials should be done on an administrative basis. Noticing and other requirements for City Council and Planning Commission agenda items could likewise result in a deemed granted outcome.

It can be argued that the shot clock requirements make it less likely that a denial will be appealed. Refiling the application would reset the clock and could provide the applicant with greater predictability and a faster outcome than a court challenge would offer. At that point, however, an even better alternative for the applicant might be to agree to toll the clock. The credible threat of denial creates an incentive for mutual cooperation, and does it in a way that gives the applicant a clearer idea of how to balance the costs.

The one carrot to offer is the establishment of standard, pre-approved plans and thereby create the opportunity for the applicant to avoid lengthy and detailed application requirements up front and the possibility of denial down the road. The 6409 rules allow cities to give preferential treatment to proposals for facilities that would be located on municipal property, and presumably the same would apply under the AB 57 rules.

6.4. Considerations for applications involving the public right of way

Other than the more restrictive qualification criteria for the 60-day shot clock and a categorical exclusion for NEPA (but not section 106 NHPA) review in the 6409 rules, the FCC's rules do not differentiate between applications for facilities in the public right of way and on private property. The 6409 order does, however, "conclude that Section 6409(a) applies only to State and local governments acting in their role as land use regulators and does not apply to such entities acting in their proprietary capacities", and it specifically refuses to draw a clear line between those two roles except to say "like private property owners, local governments enter into lease and license agreements to allow parties to place antennas and other wireless service facilities on local-government property, and we find no basis for applying Section 6409(a) in those circumstances".

The arguments laid out in the order and in subsequent court cases indicate that at least some cities consider ROWs to be municipal property, so that question is likely to be litigated at some point. California law, though, effectively makes ROWs state property and limits municipal authority over telephone company work (wired or wireless) in the public right of way to "reasonable control as to the time, place, and manner in which roads, highways, and waterways are accessed". However, local ordinances that regulate the location and appearance of wireless facilities in the ROW are allowed so long as a local government 1. "does not abuse its discretion or arbitrarily or unfairly deny requests for access", 2. establishes reasonable rules, 3. applies the rules "to all entities in an equivalent manner" and 4. the rules do not effectively prohibit wireless facilities.

Consequently, the City can enforce aesthetic and other standards for installation of wireless facilities, particularly small/micro cell sites often referred to as distributed antenna systems (DAS), on existing utility poles and on new poles placed in the ROW. The process is subject to federal shot clock limits and it may be reviewed by the California Public Utilities Commission. Location may also regulated, but not in a way that particularly singles out wireless carriers.

6.5. Pre-approval of standard solutions

As noted above, the City can offer the carrot of a short form application and/or expedited processing for projects that involve standard, pre-approved cell site installations. Over time, detailed specifications for what is and isn't acceptable could be developed either by the City or others, but in the short term the City could establish a process for approving reference designs submitted by either carriers or equipment manufacturers. It's possible that an interagency group, for example under the auspices of the California League of Cities or a professional organization, could assume that responsibility, but for now it's up to the City.

As a general and quickly implementable policy, the City can encourage the organization of applications such that generic, non-proprietary information – manufacturer's specs or a particular landscaping scheme, for example – is presented separately in a standardized format. Once the application has been approved, the generic elements can be published on the City's website as an example of an acceptable solution. Those elements could either be downloaded and included "as is" in subsequent applications by anyone – allowing virtually instant review by the City – or modified to the minimum extent necessary for faster review. This process could speed up review of multiple applications by a single carrier, and in the long run it could simplify the process for everyone. But any acceleration of the City's overall processing ability would happen gradually over time.

Other fast track considerations could include locating facilities in the ROW on busier or wider streets in commercial and industrial areas, rather than in residential neighborhoods, or when set back a certain distance from residential properties.

Rather than try to establish a comprehensive reference design review process, the City could consider immediately pursuing some degree of standarization for two specific cases: replacement/upgrade of streetlights and installation of new or upgraded utility poles.

There are a couple of different ways to approach light standards. From an administrative perspective, the simplest solution is to establish specifications for new light standards intended to support wireless facilities (existing City light standard specifications might suffice) and design parameters for the attachments. Initially those parameters can be stated generally, in terms of high and width/ circumference and placement on the pole (e.g., on the pole top), but as experience is accumulated, the general requirements could be replaced by specific reference designs. The carrier would either rent space on an existing City light standards, or replace a deficient City-owned light standard with a conforming one, with the City maintaining ownership of the new pole. Rent can be deferred for a period of time sufficient for the carrier to recoup the construction cost. Since it's a city-owned asset, an

encroachment permit and, possibly, a use permit wouldn't be necessary. A design permit could be issued, if necessary, on the basis of the standardized, pre-approved specifications.

Maintaining ownership of the supporting pole also gives the City more flexibility under FCC rules, since it will be acting in its capacity as a landlord, rather than a regulator. For example, it could limit or prohibit attachment of additional equipment, as would otherwise be allowed under the 6409 rules.

Another alternative is for the carrier to own the light standard and operate it under terms that are similar to those that apply to electric utilities. The carrier might be persuaded to absorb some or all of the operating cost of the light, but the City's negotiating power in that regard is limited: past a certain point, it would make more sense economically for the carrier to apply for permits under standard procedures. There's also the question of how much of the standard permitting procedure may be waived, although presumably any precedents set by the City in regard to other public utilities would apply.

It would be more difficult for the City to create significantly different standards for installation of new utility poles by wireless carriers in the ROW – in general, rules that apply to one utility must apply to all – but creating a fast track process based on the City's future needs could be defendable. It would also be reasonable to create a fast track permit process for a metal pole – either completely new or as a replacement for an overloaded wooden one – that would be available to any utility. As with light standards, the City could also establish specifications and/or reference designs for the wireless equipment that would be attached. Although opponents could still invoke the appeals process, the worst case is that the shot clock would simply expire (and the City might, in that case, be able to agree that a 90-day shot clock applies). The City could choose not to challenge the "deemed approved" status, but still be confident that the resulting installation would comply with all applicable regulations.

6.6. Summary

AB 57 has created a situation where rigorous review of applications for wireless facilities, including opportunities for public comment and decisions by elected officials, works against the original purpose of safeguarding the public interest. In order to work within the limits set by State and federal rules, the City of Morgan Hill should adapt its current wireless facilities review process to allow for rapid decisions via comprehensive application information, rapid administrative decisions and incentives for applicants to propose conforming designs from the very beginning. Existing city code should be reviewed and modifications considered to ensure its provisions do not work against the original intent, now that the game has changed. Recommendations for doing so can be found in Section 7.6 below.

7. Recommendations

The overall recommendation of this report is for the City to articulate its role in broadband infrastructure planning and development, establish goals and adopt a phased approach to reaching those goals.

The trend at the state and federal level is toward less regulation of telecommunications companies. Local governments in California no longer manage franchises for video service and state regulation is minimal. Pending legislation in Sacramento would transition landline telephone service away from its current regulatory regime, which is based on assumptions regarding legacy analog technology, and toward a less restrictive environment that might or might not be in keeping with current digital technology trends. Broadband and Internet service is not directly regulated at the state level at all, and federal agencies have adopted a “light touch” approach, where they have considered intervention at all.

Morgan Hill, like other California communities, should consider its policy and program choices not just in terms of municipal authority, which is limited, but also in terms of opportunities to become a partner and an active participant in broadband infrastructure development initiatives. The specific recommendations below identify a path that begins with a strategic vision and moves through several steps, each representing greater involvement by the City in broadband development and an increasingly engaged role.

Recommendations for wireless facilities planning and management are treated separately. Development of wireless facilities, particularly those designed to support mobile broadband services, is necessary to meet increasing consumer demand and because construction of mobile infrastructure also requires additional investment in the fiber optic networks that support it. On the other hand, the City has a stewardship responsibility regarding environmental regulations, other community standards, and the use of the public right of way. Recent changes in state law and federal regulations has made exercising this responsibility problematic, and require adjustments to City policy and procedures in the near term.

In order to develop a sustainable economy by fostering new technology-based enterprises and expanding the City’s technology infrastructure, as called for by the Morgan Hill 2035 General Plan, the following steps are recommended:

7.1. Strategic vision

5.1.1. **Long term broadband infrastructure roadmap**
5.6.1. **Regulatory position**
5.7.1. **Broadband role**

The first step in setting broadband infrastructure development goals and establishing policies designed to reach those goals is to determine the level of the City’s involvement and identify the roles and responsibilities that are appropriate to it.

It is recommended that the City first develop a roadmap based on the infrastructure "report card" grading criteria in Section 2. Morgan Hill receives a "D"/1.0 grade on that four point scale, in comparison to the "C"/2.0 or thereabouts grades currently given to cities immediately to the north. Keeping in mind that those cities are also actively engaged in improving their broadband infrastructure, the City should lay out a road map that brings its primary broadband infrastructure up to the statewide average in the near term, and keeps pace with and/or exceeds it over the long term. Similar goals should be set for commercial and industrial class infrastructure.

The City should also determine the extent of its involvement in the telecommunications regulatory process – nearly all of which is outside its direct control – and whether it will be an active participant and advocate in the broadband development process, a passive observer, or something in between. These recommendations assume that the City wishes to actively work to develop and improve local broadband infrastructure.

7.2. Core broadband planning and management

5.1.2. **Solicit ideas for infrastructure upgrades**
5.3.1. **Asset inventory**
5.3.5. **GIS logging**
5.3.6. **Digital plans**
5.4.1. **Transparent process**
5.5.4. **Public facilities**
5.6.3. **Specific conditions compliance**
5.7.2. **Long term City networking needs**

Before setting specific policy or launching broadband development initiatives, the City should establish ongoing working relationships with telecommunications providers and organize its internal resources and standard processes to support the achievement of the goals in its long term road map.

Incumbent providers, particularly Charter Communications and Frontier Communications, are in the best position to embark on infrastructure upgrade projects. They are also in a position to inhibit or even block competing initiatives by smaller companies or new market entrants. Engaging in an ongoing conversation that focuses on the City's road map will allow the City to ascertain the degree to which incumbents' goals coincide with its own and identify the gaps that need to be addressed.

The City can work with Frontier and Charter to develop and implement plans to address those problems, and provide ongoing information regarding service conditions to existing and prospective businesses. If Frontier and/or Charter are not willing to meaningfully engage, then the City will have to find remedies on its own, including pursuing regulatory options and creating opportunities for competitors to enter the market.

As a result of regulatory approval conditions placed on their recently approved transactions, Charter and Frontier have specific obligations they must fulfil in their California service areas. The City should immediately establish clear expectations as to what that fulfilment entails in Morgan Hill, and monitor

progress on a quarterly basis.These regulatory conditions represent a unique and immediate opportunity for the City, one which is unlikely to reoccur in the foreseeable future.

The City is also a participant in the development process. It owns and controls assets that are essential to broadband infrastructure development. Identifying and routinely tracking those assets, along with improvements made by third parties pursuant to encroachment or other permits, will allow the City to manage and employ its resources to the greatest effect. Creating a transparent process for managing and developing those resources, and making them available to interested parties will maximize their value, both as capital assets and as day to day tools.

The City can also design and build future public works projects and other facilities with broadband development goals in mind, and plan its internal IT network development along those same lines.

7.3. Baseline broadband development policy

5.1.3. **Broadband master plan**
5.2.1. **Open trench**
5.2.2 **Conduit specifications**
5.2.3. **Conduit standards**
5.2.4. **Lateral connection standards**
5.2.5. **Shadow conduit - public works**
5.3.2. **Open access**
5.3.7 **Infrastructure database**
5.4.2. **Permit streamlining**
5.7.3. **Anchor tenant positioning**

Ten policies are recommended for near term adoption and implementation. The first step is to develop the City's long term roadmap into a specific master plan that sets goals for the type and extent of broadband infrastructure in residential, commercial, industrial and other land use categories. The primary market research conducted for this report indicates that residential and business broadband use and expectations differ in Morgan Hill, but in either case there is a significant amount of dissatisfaction with the choices available.

The City has the greatest amount of influence over greenfield and new or major remodelled infill development, and over work performed in the public right of way. By establishing clear broadband-related requirements for these kinds of projects, the City can encourage the construction of facilities that will support upgraded infrastructure. Establishing an "open trench" notification process any time excavation work is done in the public right of way offers all interested parties, including the City, potential cost savings or unique opportunities to pursue upgrade or new utility construction projects. Setting minimal technical specifications for broadband conduit, where appropriate, and requirements for main conduit and lateral connections in new or major remodelled construction, or in public works projects ensures, over time, the development of a consistent and adequate level of basic infrastructure.

The City's own assets can be offered on open terms to any qualified broadband provider, and information about all broadband infrastructure can likewise be made available, so as to reduce barriers to entry for new competitors and promote the more efficient use of existing resources by incumbents. The City can further reduce barriers by streamlining permit processes and create incentives for infrastructure development that meets City goals by using its information technology budget to position itself as the anchor tenant for particularly critical projects.

These baseline policies primarily serve to standardize and focus existing policy and practices on well articulated broadband development goals, without requiring major new initiatives or changes.

7.4. Second phase broadband development policy

5.2.6. **Shadow conduit - undergrounding**
5.2.7. **Shadow conduit - excavations**
5.2.8. **Excavation moratorium**
5.3.3. **Master leases**
5.4.3. **Master permits**
5.4.4. **Single review**
5.4.6. **Environmental and aesthetic mitigation**
5.5.1. **Broadband building standards**
5.5.2. **Broadband wiring standards**
5.6.2. **Franchise compliance**

A baseline broadband development program can be supplemented with more proactive measures that position the City as an active participant in broadband development initiatives. These steps can be taken either at the same time as adoption of baseline policies or later, after the effectiveness of the baseline program is assessed.

Each of the above policies represent a greater level of direct City involvement in broadband development. Prospective installation of city-owned conduit, either in conjunction with routine undergrounding programs or third party utility projects, puts the City in the position of being an active developer of broadband assets as such, rather than simply making use of resources obtained in the normal course of business. Putting teeth into "dig once" policies by imposing moratoria on street excavations following an open trench notification process puts similar pressure on utility companies to do the same.

Adopting a master lease template for third party use of City assets allows for more aggressive marketing, with either the goal of increasing revenue or incentivizing development, or both. A master permit process for large scale projects can be likewise used to attract the attention of companies, including incumbents, that might be interested in pursuing major upgrades, and position Morgan Hill as a better destination for investment. The same is true of a single review process for smaller projects and standard, predictable environmental and aesthetic mitigation requirements.

Adding broadband requirements to construction standards will build the City's inventory of high-tech enabled real estate over the long term and provide a competitive incentive for owners of older property to retrofit. The more properties that are "gigabit ready", the more cost effective it is to upgrade and add infrastructure and facilities upstream, and the more demand there will be for that level of service.

A consistent, proactive approach to enforcement of video franchise requirements, even to the limited extent allowed under California law, also puts the City in the role of an active participant in the broadband industry, albeit as a regulator who sits on the other of the table from the companies involved. Doing so can improve the City's negotiating position with some broadband providers and build, and possibly fund, in-house expertise that can be used to pursue further measures.

All of these policies are recommended for the City's adoption over the long term, and the City should consider including some in its initial baseline program if more rapid progress is desired in specific policy areas.

7.5. Broadband development options

5.2.9. **Excess capacity utilization**
5.2.10. **Dedicated revenue account**
5.2.11. **Future proofing**
5.3.4. **Telecom O&M matrix**
5.4.5. **Evergreen permits**
5.5.3. **Smart building requirements**
5.5.5. **Telecommuting - City**
5.5.6. **Telecommuting - general**
5.6.4. **Enforcement liaison**
5.6.5. **Performance test participation**
5.7.4. **Interagency coordination**
5.7.5. **Validate infrastructure mapping**
5.7.6. **Broadband in public housing**
5.7.7. **Online access**
5.7.8. **Online permits**
5.7.9. **Open data**

The broadband development options listed above can be divided into two groups: incremental enhancements to proactive second phase policies – for example, combining City-owned asset development initiatives into an ongoing enterprise fund – and policies that serve to increase demand for high speed broadband service and promote its adoption by residents. The recommended approach to these options is to defer action on them until a baseline program is established and the extent of City involvement and the degree to which it will be an active in developing broadband infrastructure has been determined.

7.6. Wireless facilities management

The changes in California and federal law regarding municipal authority over wireless facilities, as described in Section 6 above, make it advisable to quickly respond by changing City procedures, specific policies and, where necessary, the Municipal Code to ensure continued control of the process and avoid permit issuance by default. A dozen specific steps are recommended:

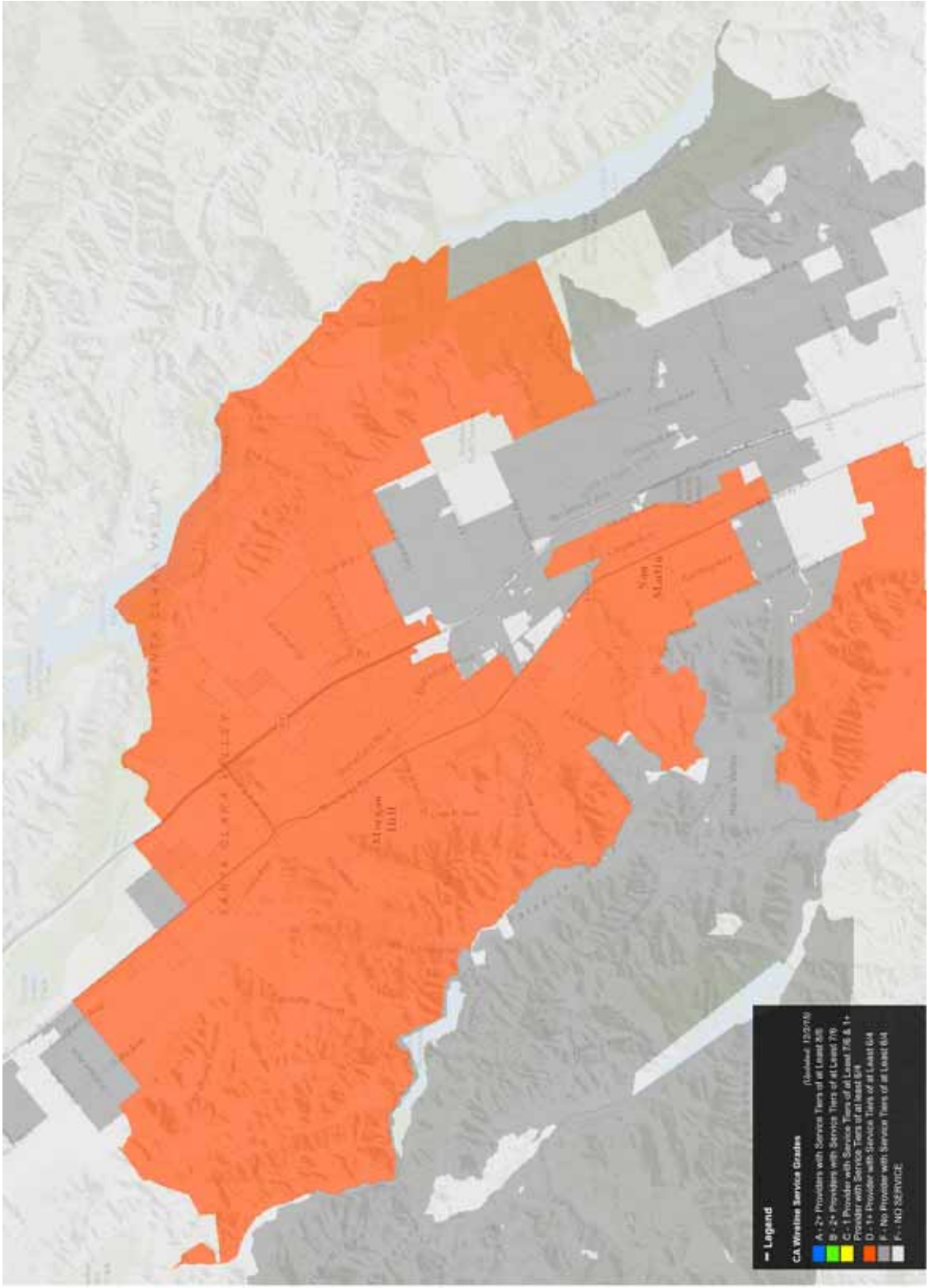
1. Create a comprehensive checklist of items that must be included in a wireless facilities application.
2. In the application, establish the presumption that the 150-day clock applies unless the applicant 1. states otherwise and 2. provides specific information that demonstrates eligibility for the 60 or 90 day clocks. Any application for a location that doesn't already support wireless facilities would automatically be subject to the 150-day clock. Failure to provide the necessary information would be grounds for either denial or immediate tolling.
3. Include all possible questions, documentation, other city departments/outside agency approvals , etc., as a standard requirement of an initial design permit application. In particular, the application should include all information required for use and encroachment permits or other approvals by other City departments to demonstrate that it complies "with generally applicable building, structural, electrical, and safety codes and with other laws codifying objective standards reasonably related to health and safety".
4. Descriptions of the facilities, including photo simulations, should include 1. the facilities as currently designed. 2. as potentially modified according to the federal rules described in Section 6.2 above (e.g. 20 feet higher and 20 feet wider in all directions).
5. Require evidence, including blueprints and photo simulations, that shows that proposed modifications to existing facilities will not "defeat concealment" and that new facilities will be able to support concealment even if later modified under federal rules.
6. Require full documentation regarding all previous permits for existing facilities, in order to determine that a collocation/modification complies "with conditions associated with the prior approval".
7. Require all CEQA-related studies, including seasonal-dependent biological assessments, to be completed and included in the application.
8. Structure the application and the process so that denials can be issued administratively during the design permit review, even for reasons pertinent to use and encroachment permit reviews.
9. Decide what position the City will take if and when presented with the initial "deemed approved" notices from carriers. Will the City routinely challenge the presumption in court? Will it demand that the applicant obtain a court order confirming the presumption (and use its enforcement powers if the applicant refuses)? Will it concede the point but still require the applicant to follow City policies and conditions? If so, what are those policies and conditions?

10. Establish preferred specifications for streetlight mounted wireless facilities, including the light standard itself, and for equipment mounted on utility poles.
11. Create a short form application/checklist for proposed wireless facilities that are mounted on light standards or utility poles and conform to the preferred specifications.
12. Review the Municipal Code to determine if procedural changes can be made to safeguard the City's ability to reach decisions within the allowable time frames.

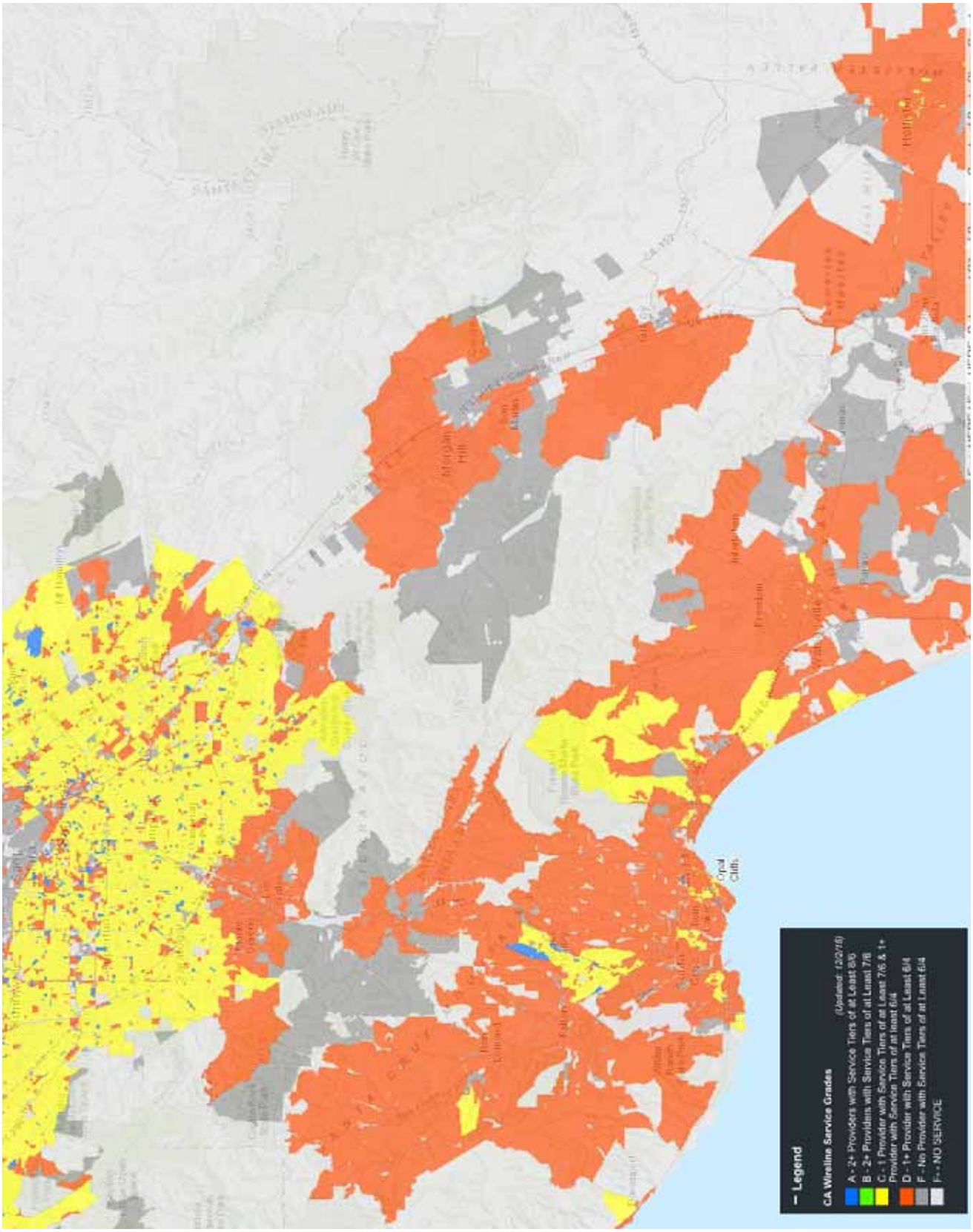
Appendix A - Maps

1. Infrastructure grading maps

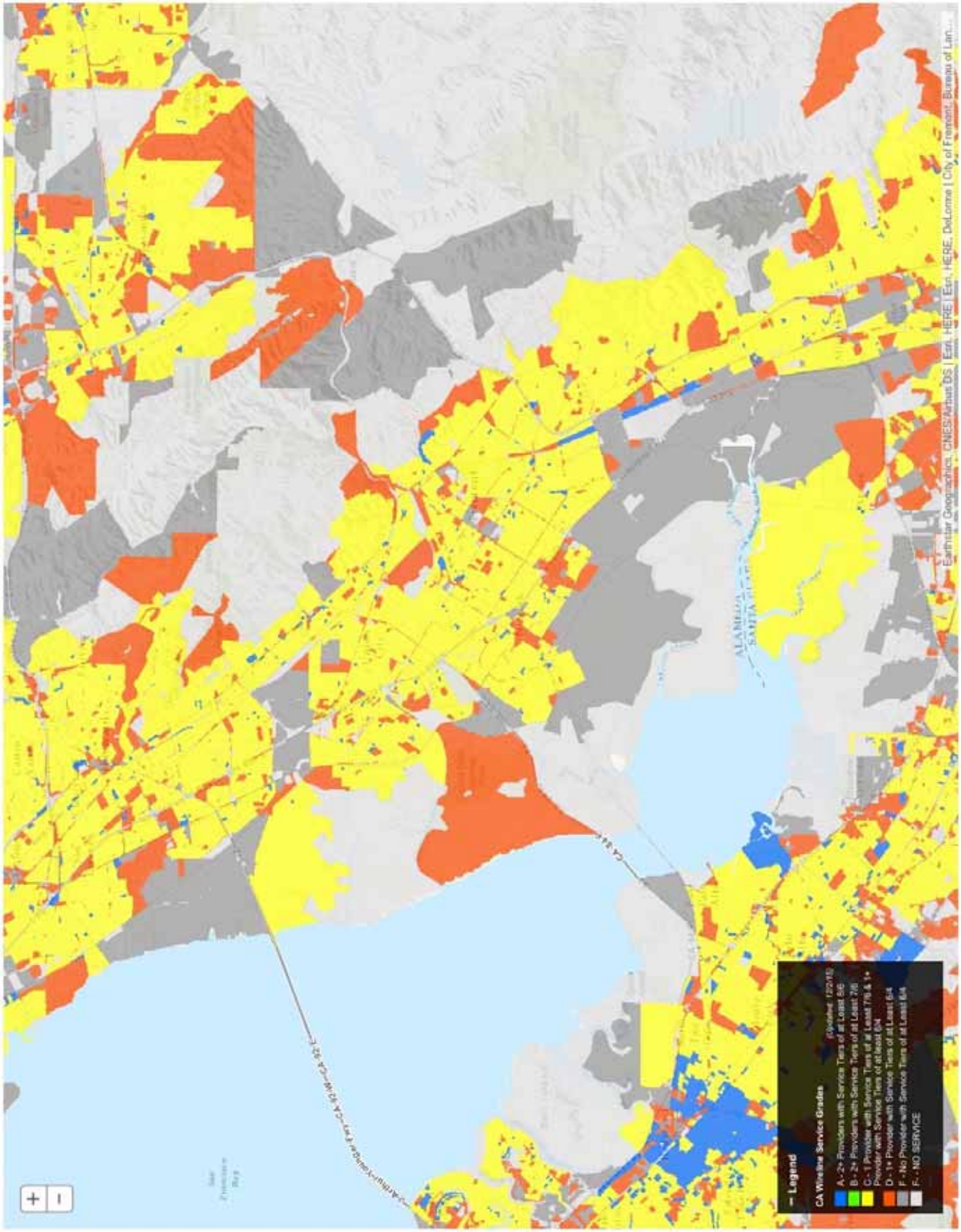
Morgan Hill



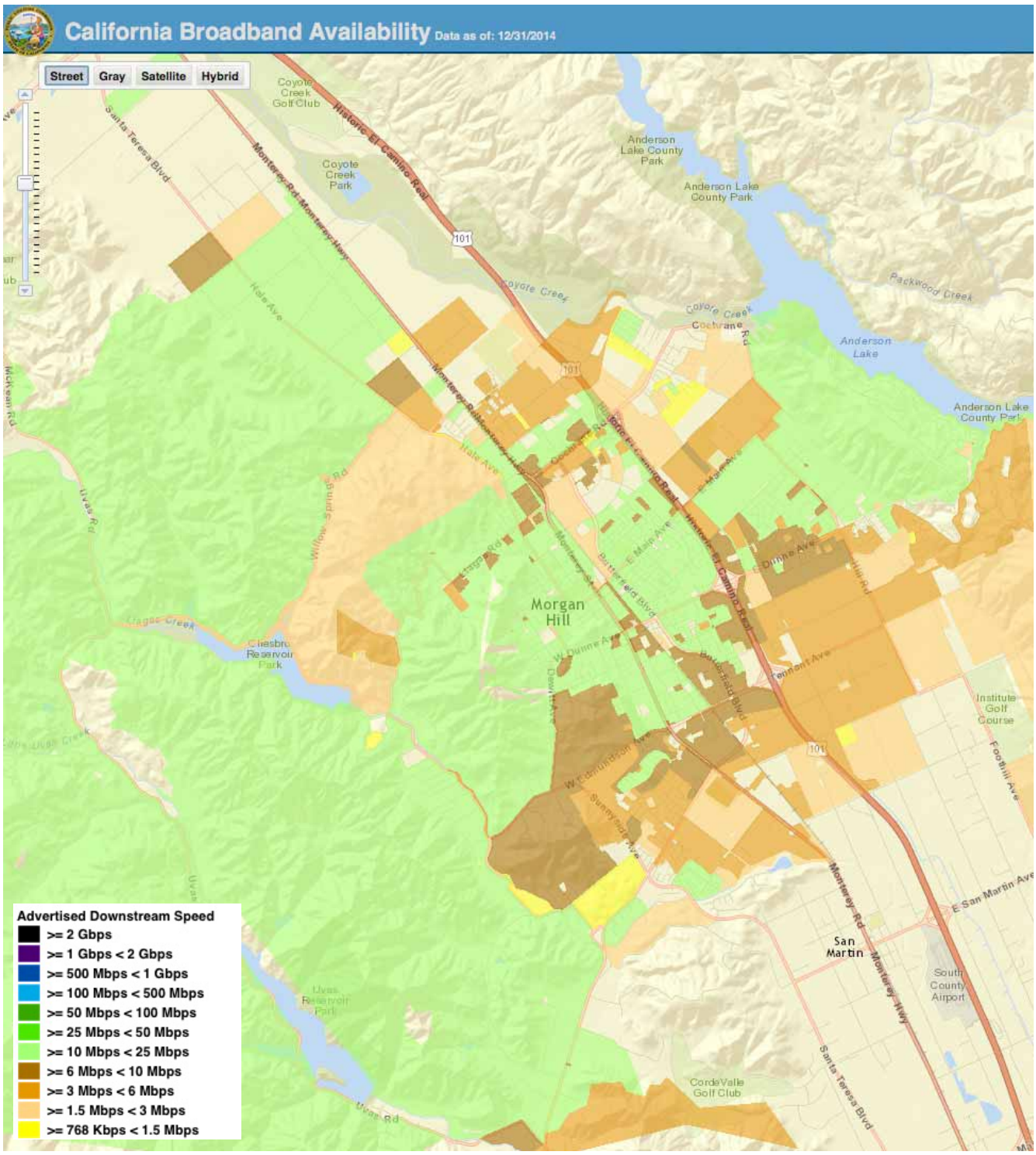
South Bay Area



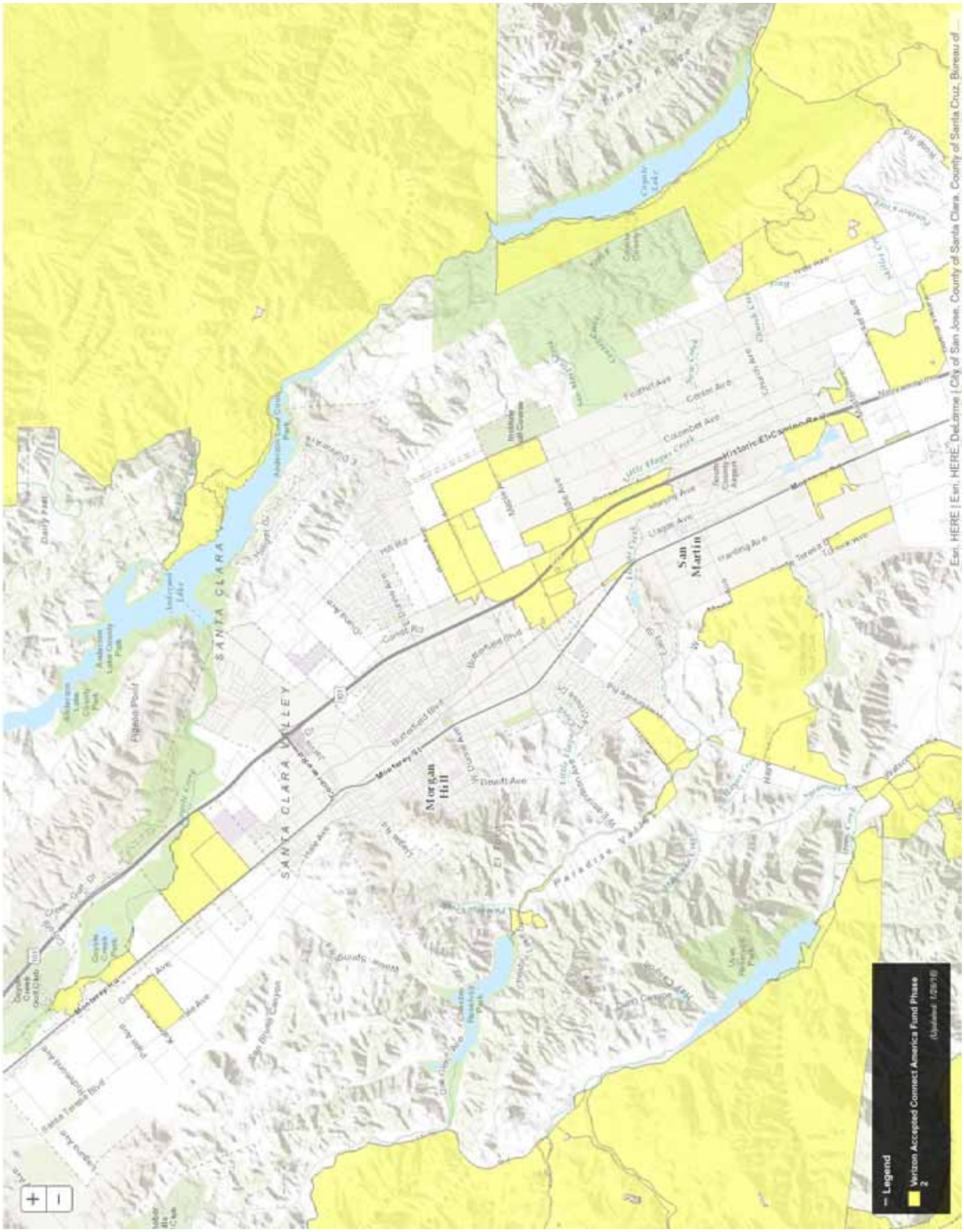
East Bay Area



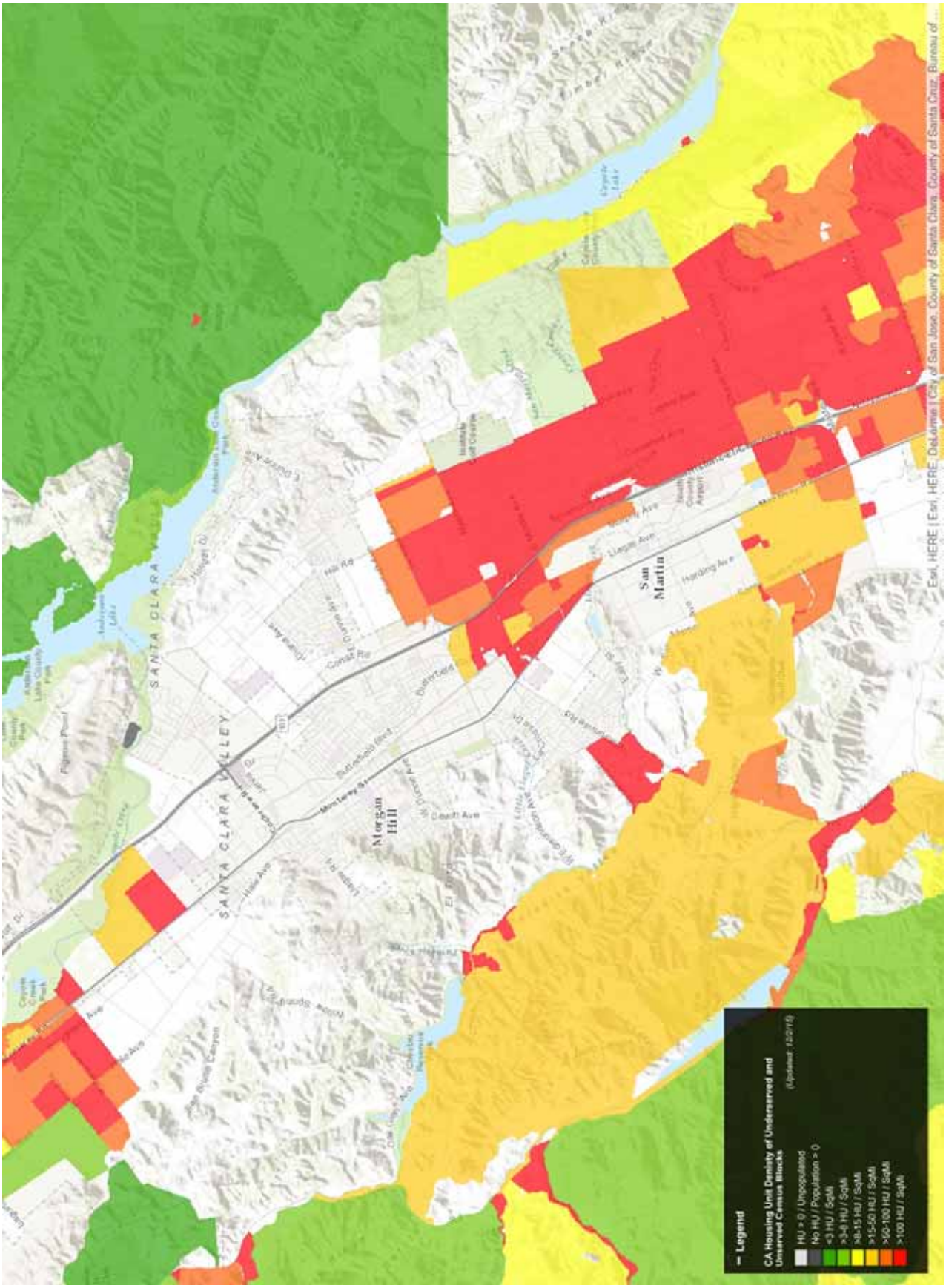
2. Frontier (formerly Verizon) DSL service



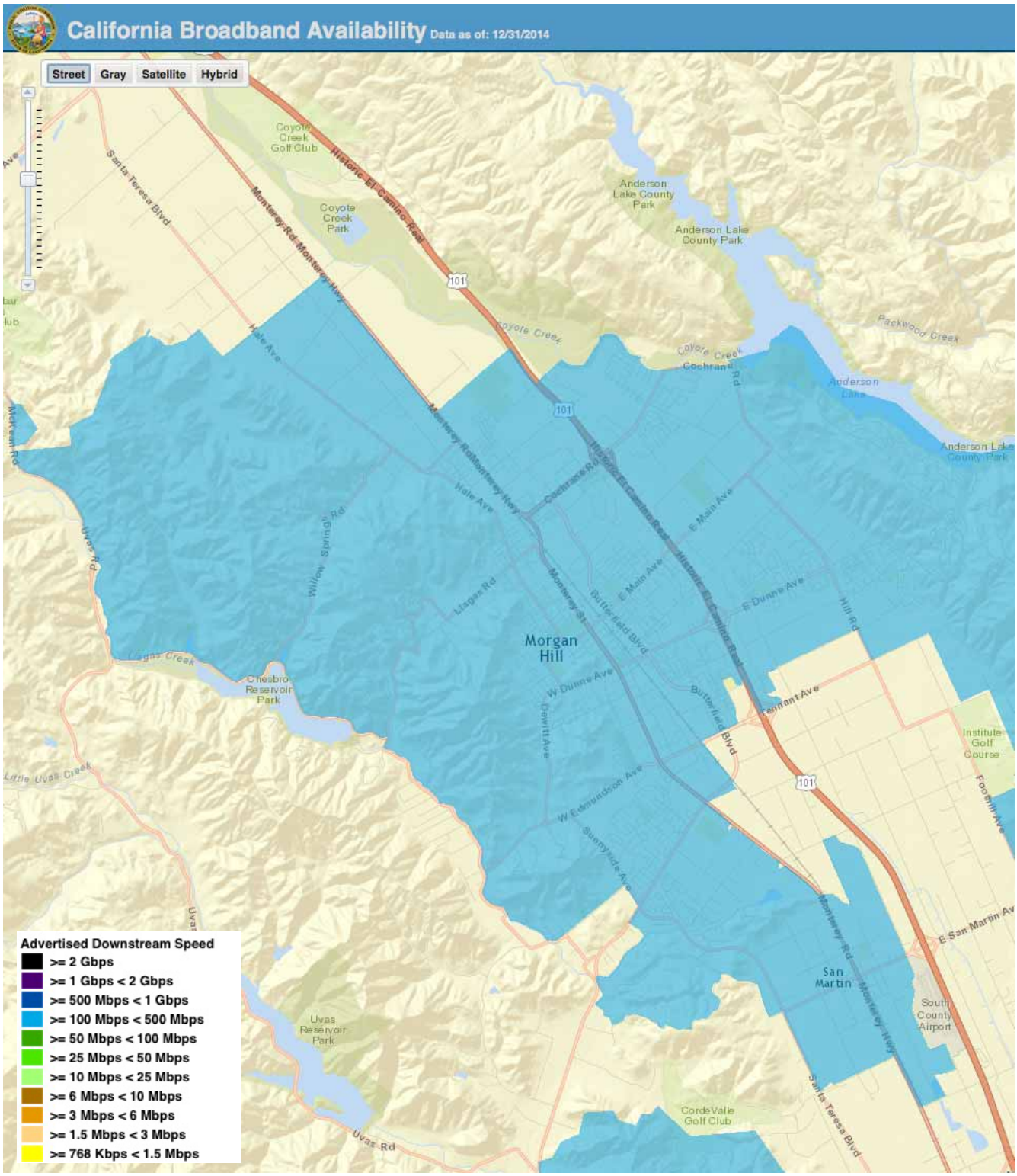
Frontier – census blocks qualified for federal upgrade subsidies (CAF-2 program)



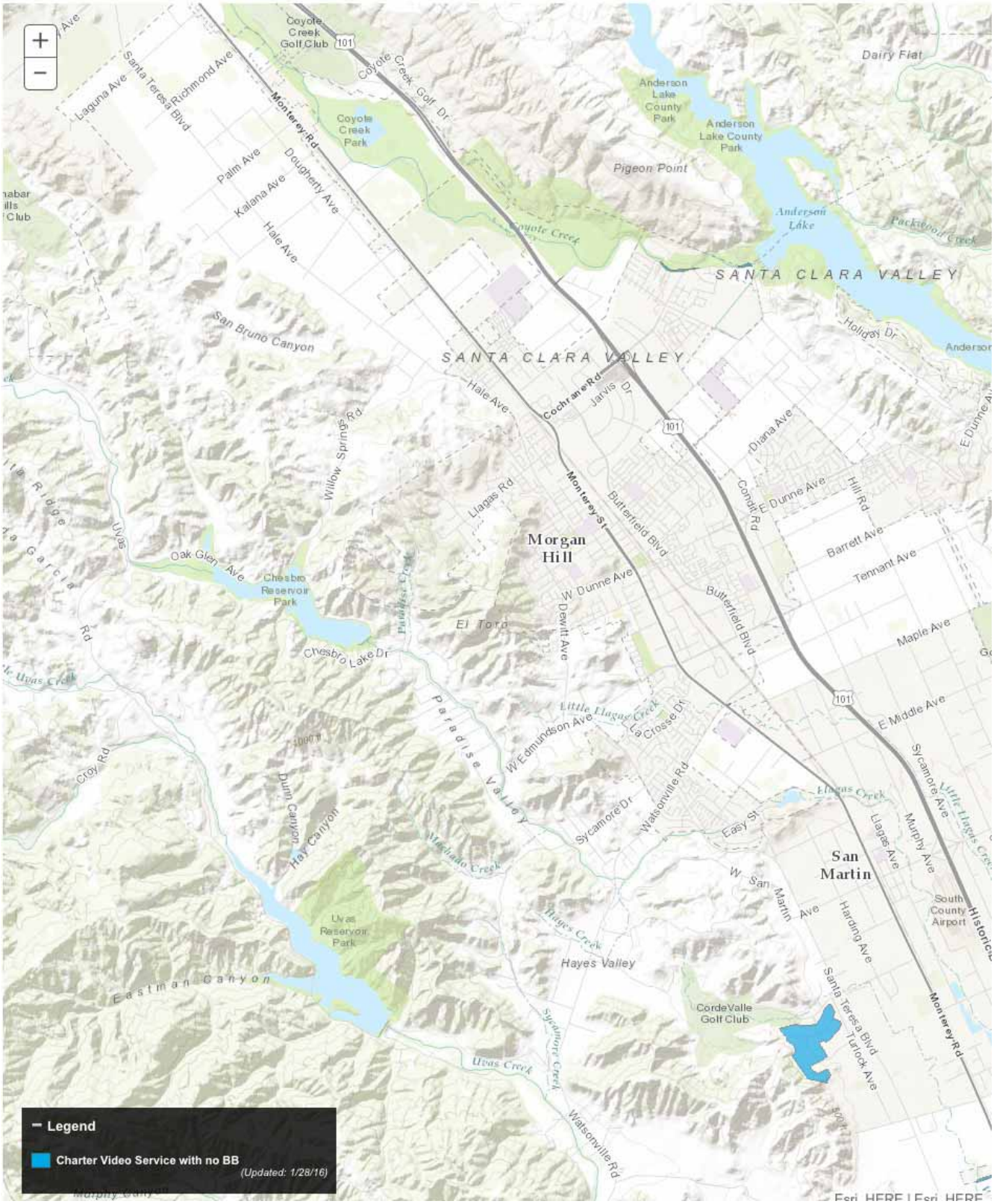
Census blocks provisionally eligible for California Advanced Service Fund subsidies



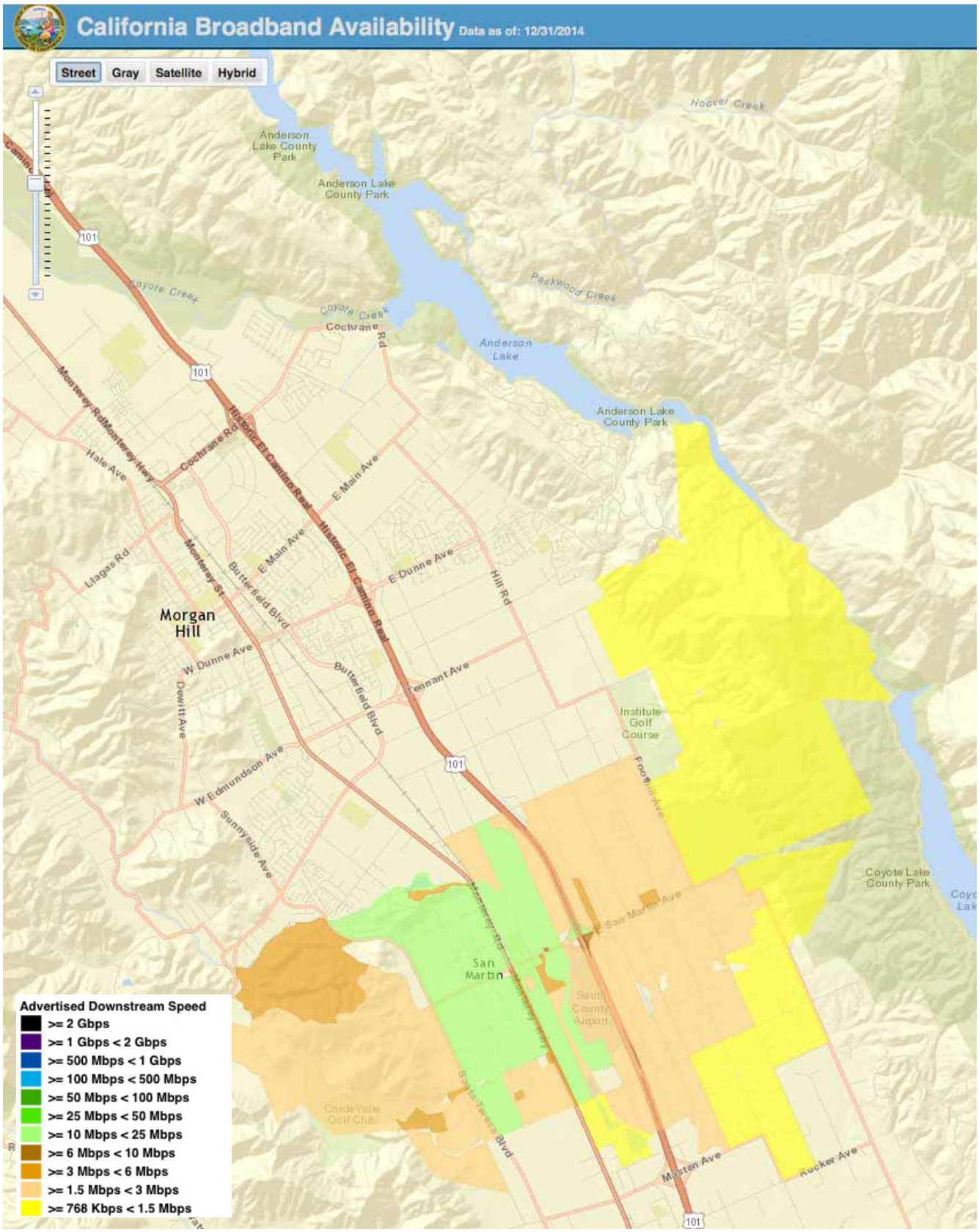
3. Charter cable modem service



Charter coverage gaps (versus assigned franchise area)

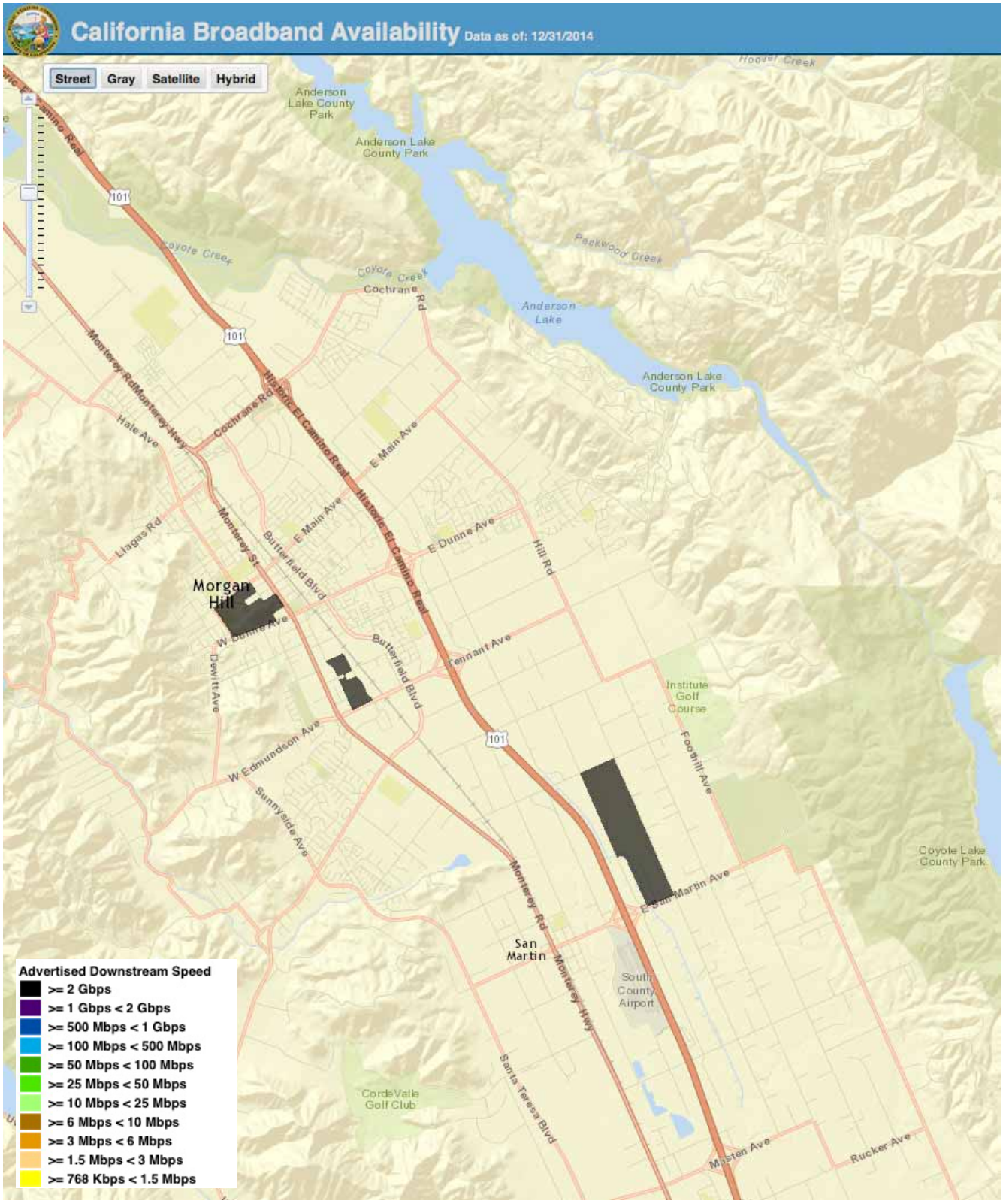


4. AT&T DSL service



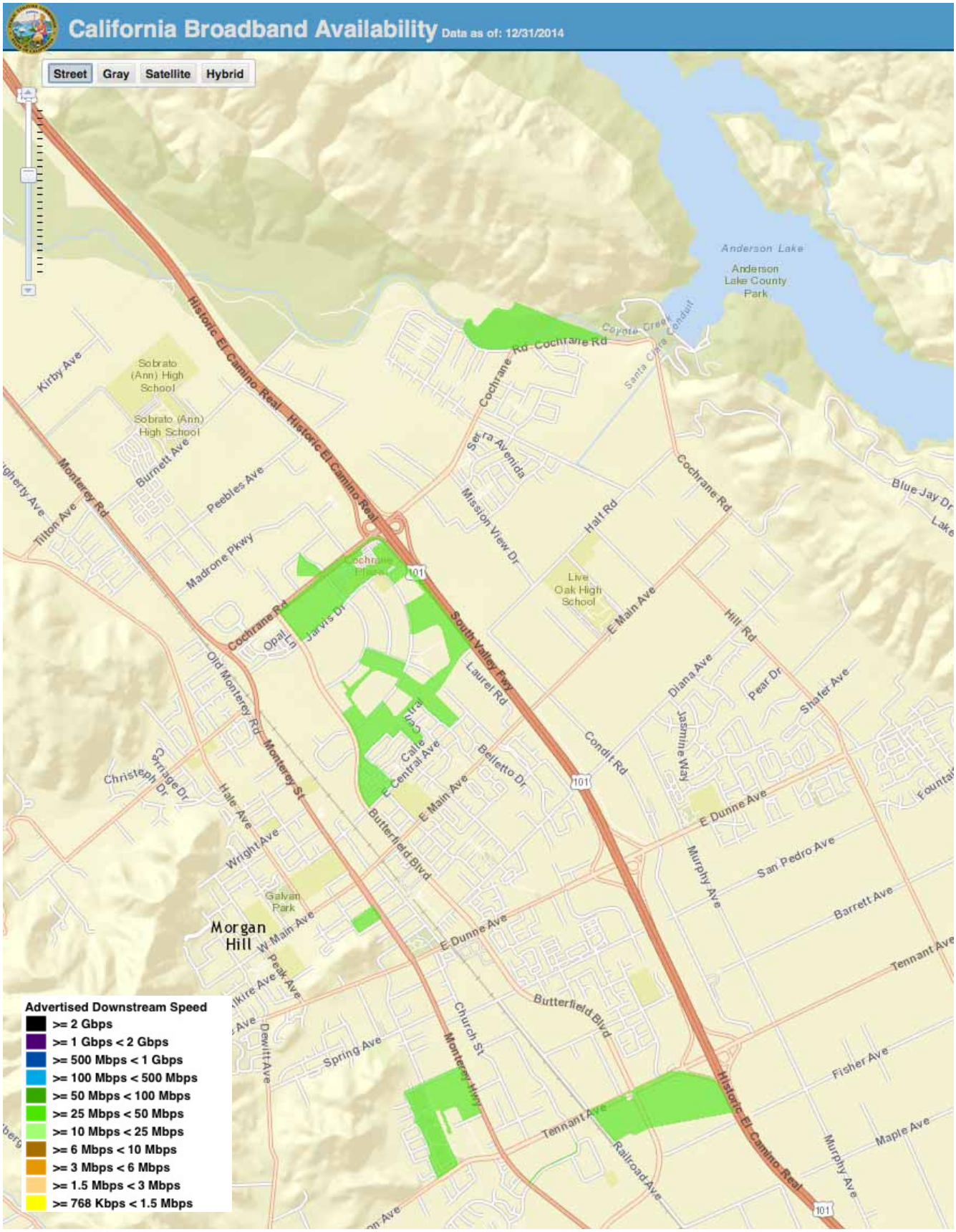
5. Secondary providers

Level 3 fiber locations

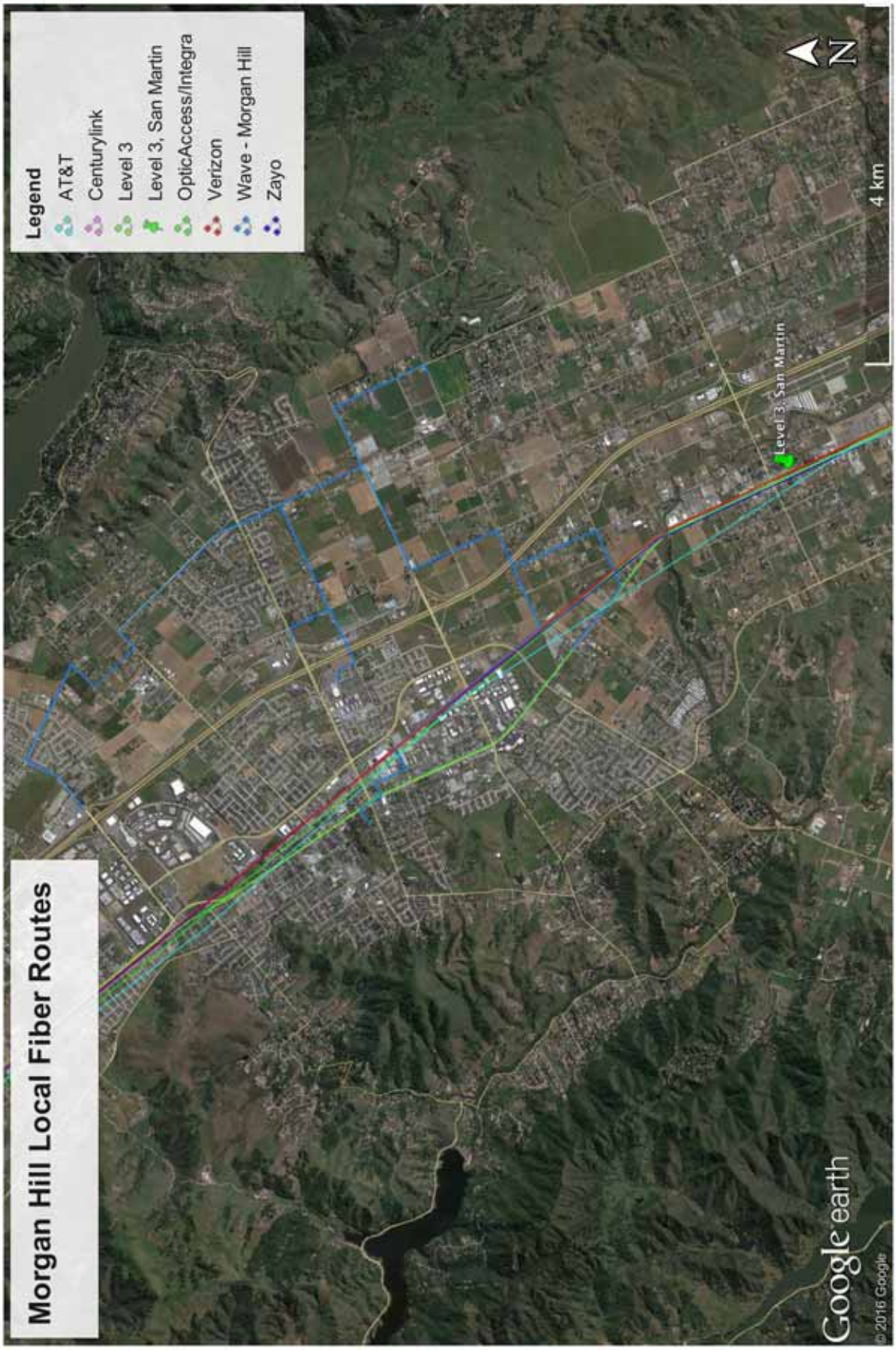


Level 3 enhanced copper locations

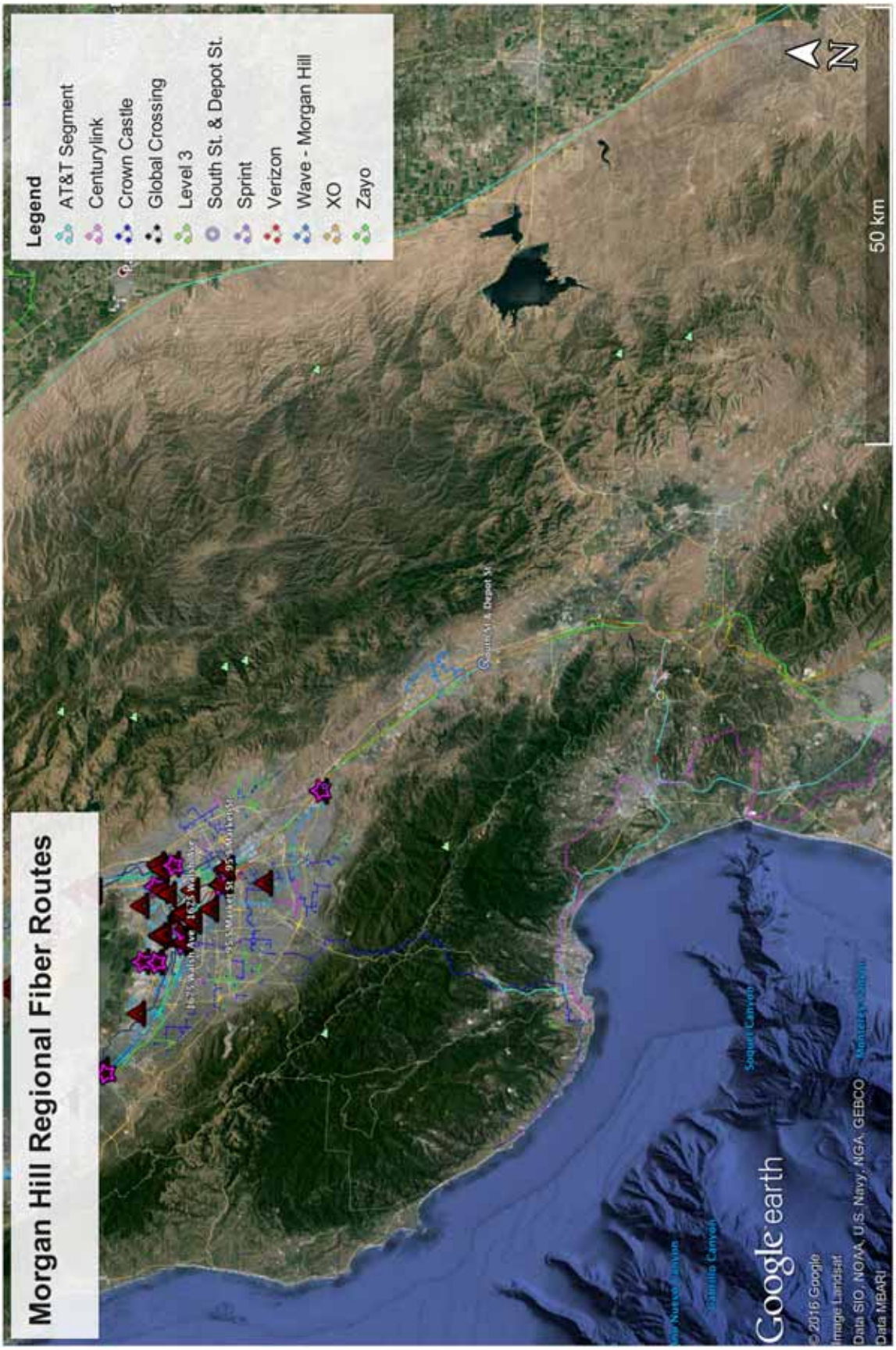
TW Telecom enhanced copper locations



Local fiber optic network routes

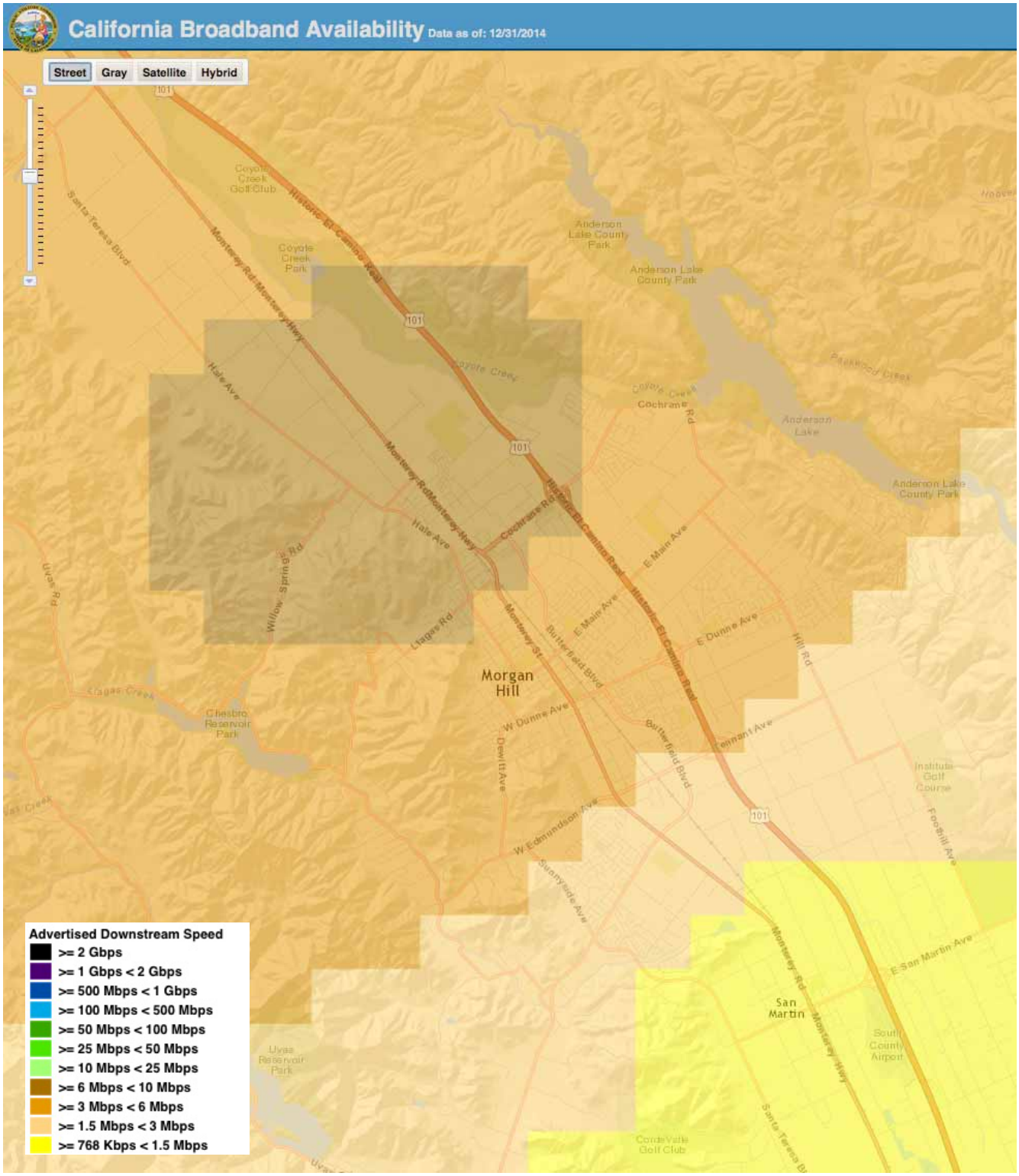


Regional fiber optic network routes

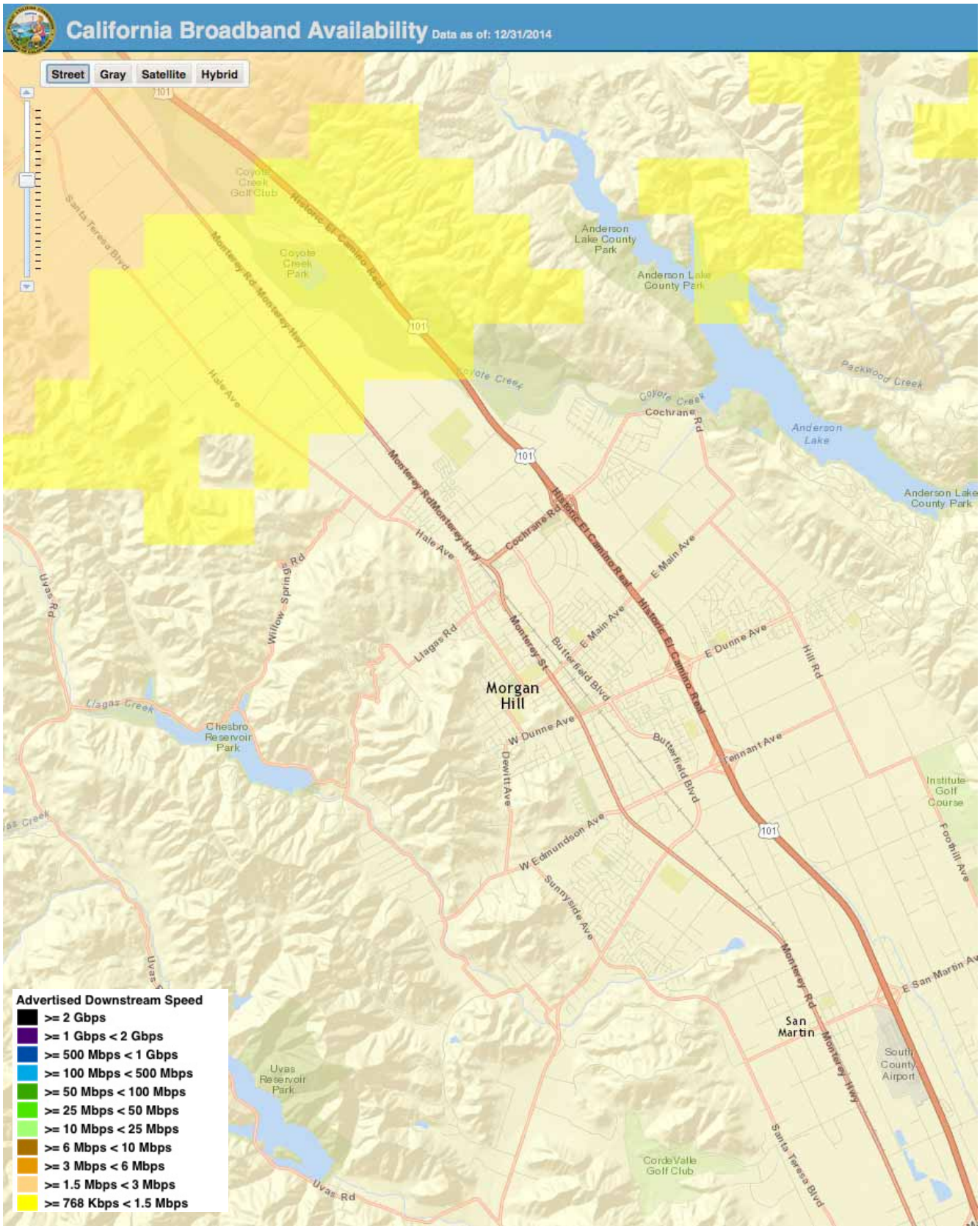


6. Wireless broadband availability

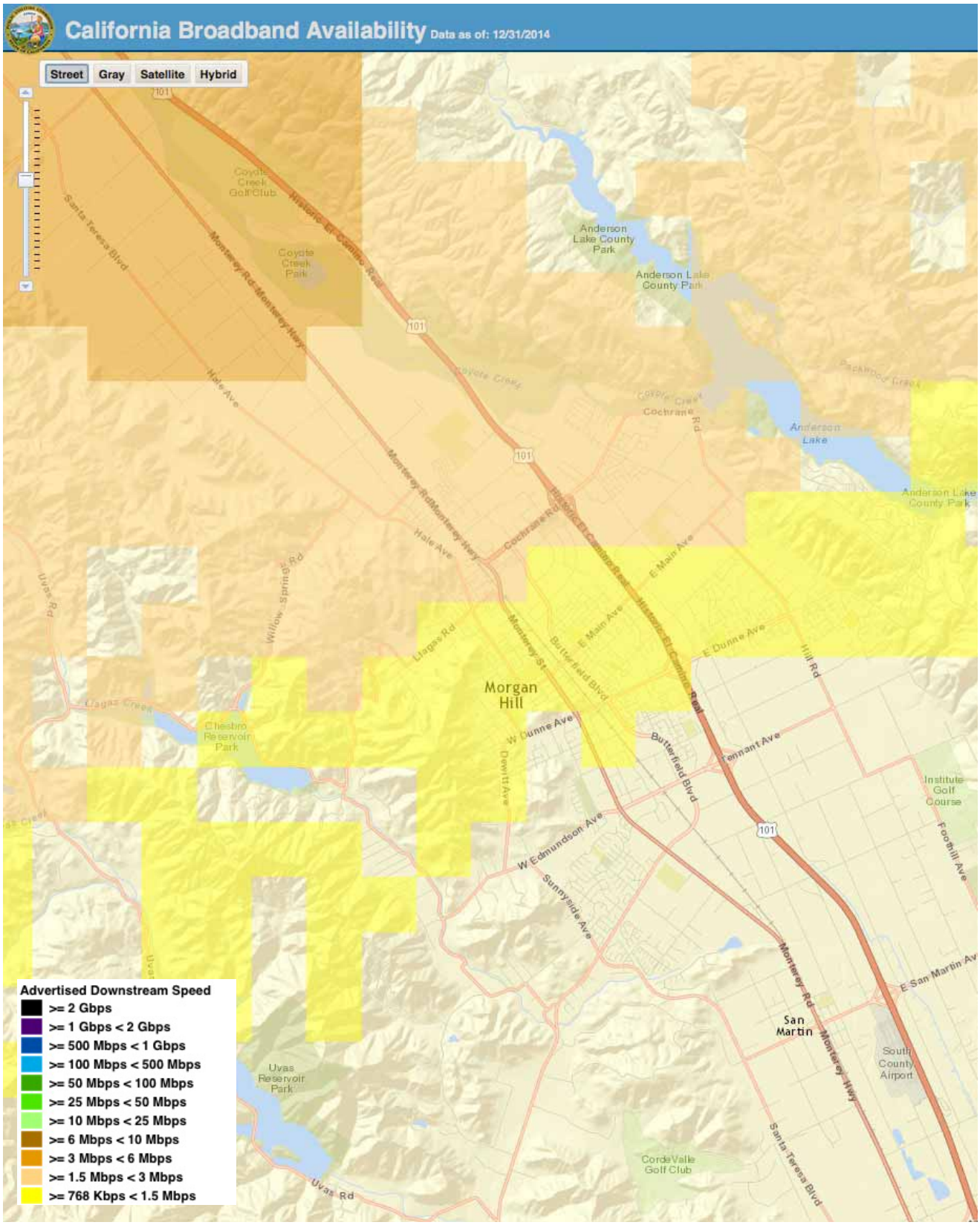
AT&T mobile broadband service



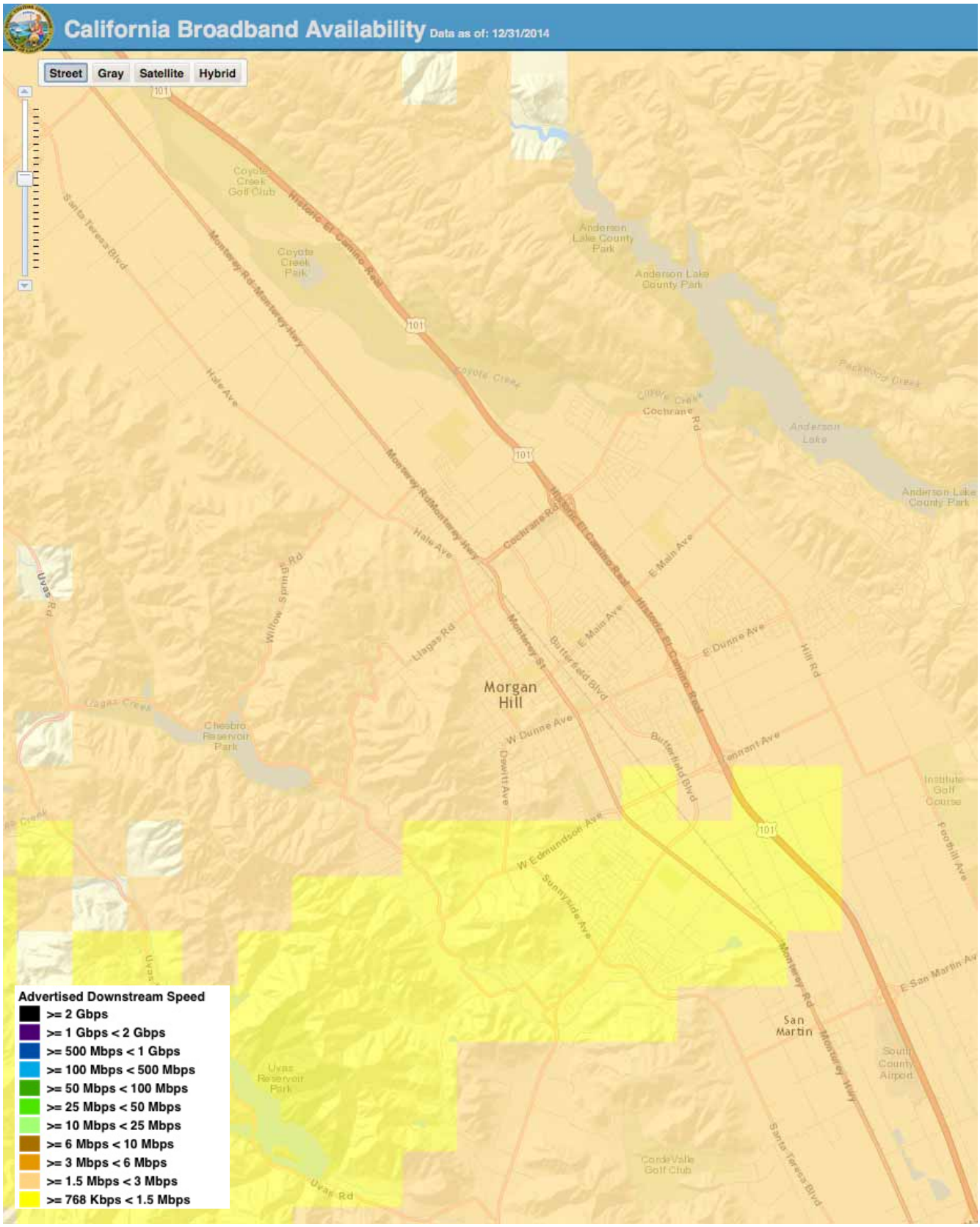
Sprint mobile broadband service



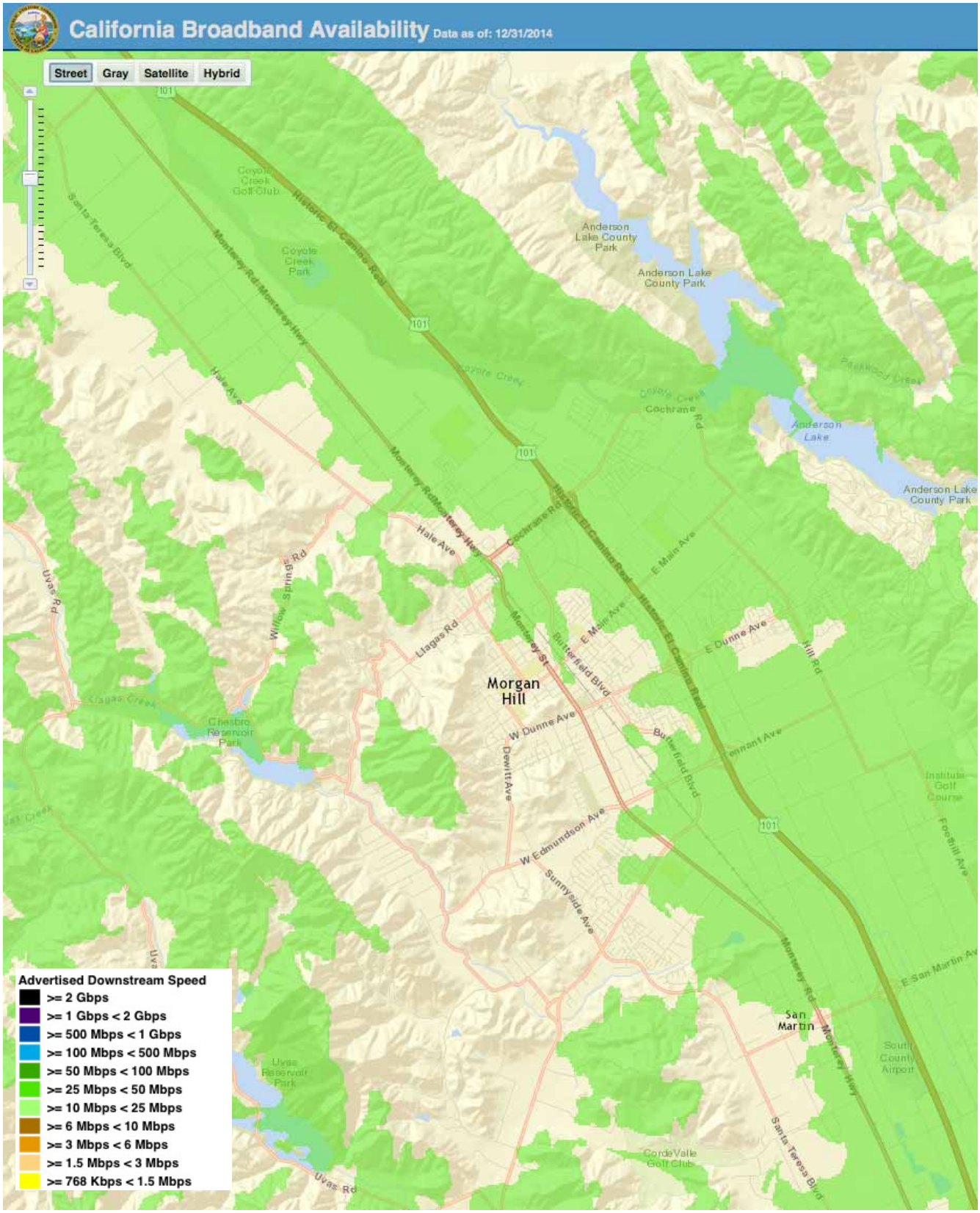
T-Mobile mobile broadband service



Verizon mobile broadband service



Etheric fixed wireless service area (unlicensed)



Appendix B - Infrastructure grades

Methodology

In a study conducted for the East Bay Broadband Consortium (EBBC) in 2013[16], in cooperation with the Central Coast Broadband Consortium, core broadband infrastructure was evaluated in Alameda, Contra Costa and Solano Counties using data submitted to the California Public Utilities Commission by Internet service providers. A comparative report card was developed, with the average grade – "C" – set at the most prevalent infrastructure, and corresponding service levels, in the state: a combination of relatively high speed cable modem and mid-range telephone company DSL facilities.

This methodology was subsequently used by the Central Coast Broadband Consortium to evaluate California broadband infrastructure and service on a statewide basis, on behalf of the California Emerging Technology Fund. It was later adopted by the Tahoe Broadband Consortium, the Broadband Consortium of the Pacific Coast and the California Center for Rural Policy.

The primary data for assessing the quantity and quality of broadband infrastructure comes from the California Public Utilities Commission, which collects service level reports from providers throughout the state. This data can be broken down to the census block level, and shows what level of service Internet companies claim to provide, but not necessarily what they deliver. The accuracy of this data and the definition of service levels varies from company to company, although it is generally consistent within any given company. In other words, if Company Z exaggerates the speeds and availability of home Internet service, it tends to do so to more or less the same extent everywhere. By using a comparative system for ranking, rather than using the absolute values provided, the variation in the accuracy of the data can be smoothed out and an apples-to-apples comparison can be achieved.

The data collected by CPUC was divided into three categories: core wireline service, commercial broadband service providers and mobile carriers.

Consumer-class service throughout California was assessed, and used as one of the two primary grading benchmarks, the other being the CPUC's standard for minimum acceptable service of 6 Mbps download/1.5 Mbps upload speed. Upload speed was given equal weight to download speed, even though it's generally less critical for consumers, because upload speed gives a good indication of the capacity of the underlying infrastructure. When a service provider skimps on upload speeds, as frequently happens, it is usually because its cables and other core equipment have a limited capacity.

Grades were then assigned as follows:

A - Two competing providers, both advertizing maximum download speeds of at least 25 Mbps and maximum uploads speeds of 6 Mbps, or 3 or more competing providers offering that standard of service in combination.

[16] *East Bay Broadband Report Card*, Tellus Venture Associates, 28 January 2014.

B - Competing providers, both advertizing maximum download speeds of at least 10 Mbps and maximum uploads speeds of 6 Mbps.

C - Competing providers, one advertizing max down/up speeds of at least 10/6 Mbps and the remainder meeting CPUC's minimum 6 down/1.5 up standard.

D - At least one provider advertizing speeds that meet the CPUC's minimum standards of 6 Mbps down and 1.5 Mbps up.

F - At least one provider offers service, but no service is available that meets the CPUC's minimum standard of 6 Mbps down and 1.5 Mbps up (meets CPUC's definition of underserved).

F- - No broadband service available (meets CPUC's definition of unserved).

A "C" grade indicates that the consumer class broadband services, and consequently the underlying core infrastructure, in a given area meets the statewide average. A "D" grade means it meets the minimum passing service standard set by the CPUC. "F" grades indicate full or partial failure, which also means the area is eligible for infrastructure construction subsidies from the Commission. "A" and "B" grades show that service in an area is superior to the California average.

The first step in grading was to give a letter grade to each census block in the three counties. Then, the grade points were tallied, weighted by population and averaged for the census blocks within cities, counties and unincorporated areas, to produce a numerical grade on a four point scale, which was rounded to the nearest tenth.

The numerical grade point average for an area was then converted to a letter grade on the following scale:

A	4.0
A-	3.7-3.9
B+	3.3-3.6
B	3.0-3.2
B-	2.7-2.9
C+	2.3-2.6
C	2.0-2.2
C-	1.7-1.9
D+	1.3-1.6
D	1.0-1.2
D-	0.7-0.9
F+	0.3-0.6
F	0.0-0.2
F-	No service available

Appendix C – Municipal enterprises

Several cities, including San Leandro, Benicia, Palo Alto and Santa Clara in the Bay Area, either own and operate commercial and industrial class fiber optic networks, or partner with private companies to make sure those resources are available to the community.

1. Dark fiber

Palo Alto and Santa Clara operate dark fiber networks which have proved very profitable. Once installed these systems require little upkeep other than fixing accidental breaks, and customer service is mostly limited to making the initial connections – for a fee – and sending periodic bills.

San Leandro has given a local company non-exclusive access to its traffic signal network (a near-loop of approximately 11.5 miles in length) and to 7.5 miles of new conduit it built using a federal grant. In return, the city received ownership of approximately 10% of the fiber installed by the company and eventually will receive cash payments, as the business becomes profitable. Similarly, the City and County of San Francisco is leasing surplus capacity in its own fiber optic network to Google Fiber, as part of a targeted effort to improve broadband service to multiple dwelling units.

2. Fiber to the home

Direct municipal involvement in providing consumer-class service via fiber-to-the-home (FTTH) systems has a less successful track record, particularly in communities such as Morgan Hill which are served by two large, consumer-oriented broadband providers. Frontier and Charter, between them, offer a range of residential Internet service in Morgan Hill and most residents subscribe to it, with Charter appearing to have about two-thirds of broadband customers. Both companies offer telephone service, and Charter has an extensive television line-up. Although both companies are the target of complaints about service and prices, it is evident from the research conducted for this study that their service offerings fall within the range desired by most residents. Both companies have a national presence and millions of customers. They enjoy substantial operating economies of scale, including the ability to negotiate favorable terms with television programming providers, and can pick and choose which neighborhoods to upgrade on the basis of expected return on investment.

City-run systems do not have those economies of scale and cannot discriminate amongst residents on the basis of their economic potential. Consequently, it is usually impossible to compete with entrenched incumbents on the basis of lower prices offered, due to national-scale purchasing power and operating efficiencies, or lower costs incurred as a result of limiting the provision of advanced services to high potential customers.

Although a municipal FTTH system could theoretically offer more television programming options and greater broadband speeds at the same price as copper-based incumbent service providers, this competitive strategy usually results in lower net revenue and ongoing operating losses, particularly when employed against major incumbents such as Charter or Frontier.

The only successful example of a municipally operated FTTH system in California is Loma Linda, which only provides Internet service – and not television service – to newly constructed or remodeled homes where the developer or property owner has installed empty conduit for the city's use. The City of Loma Linda – which is 4 square miles in size and suburban in character – has invested in a fiber backbone network to support this service, but much of the cost of building and operating it is borne by the several colleges and hospitals in town which act as anchor customers.

It is possible for cities in competitive urban markets to build and operate FTTH systems, but it is not reasonable to expect that operating costs and capital pay-back requirements – bond payments, for example – will be met by customer revenue in the near to mid term. Instead, a municipal FTTH operator must expect to subsidize operations for the foreseeable future, via the general fund, grant money, tax increment financing or assessments on property owners or utility ratepayers.

3. Business Models

California cities have a wide range of choices when considering how to pursue broadband projects. They can work with, or even own, for profit corporations, participate in cooperatives and non profit corporations or they can own and operate a broadband network, either fully or in partnership with a private sector company.

Generally, California cities (and some special districts) can provide telecommunications services within their boundaries with few restrictions. Even if a city provides a service that falls under the CPUC's jurisdiction, it is exempt from CPUC oversight. On the other hand, it is subject to all the controls, restrictions and obligations that pertain to any other municipal function, such as public oversight, open access and Brown Act requirements.

Full City Ownership

A common way of organizing a municipal telecommunications utility is to run it via a separate enterprise fund. Examples include the cities of Palo Alto, Santa Clara, Lompoc, Alameda and Chattanooga, which all have municipal electric utilities, and Santa Monica, which operates a business-oriented lit fiber service via its information technology department.

Advantages: City controls operating policy and benefits from any profits generated, most regulatory requirements do not apply.

Disadvantages: City would have to support any financial deficits, could require additional costs such as staff time.

Partial City Ownership

When a city contributes resources to a broadband network project, it can take ownership of specific parts of that network, rather than owning and operating the entire system.

Examples include the cities of San Leandro and Brentwood, which are leasing conduit to a competitive service provider. Another example is the City of Monterey. When Comcast installed an institutional network as part of its former franchise agreement, the city paid for extra fiber strands to be installed. Those strands are the property of the city, and are now being used to provide effectively free connectivity between city locations even though local franchise agreements have been preempted at the state level.

Advantages: City gains access to telecommunications resources for its own use and can exercise a degree of control over the operation of a system that it helped to fund.

Disadvantages: Control is only partial. Continued access to the resource may depend on the viability or cooperation of a private sector partner. Care must be taken to avoid exposure to liability or unreasonable ongoing costs.

Corporation/LLC

Limited liability companies and for-profit corporations of various types can do business with few restrictions. Telecommunications companies are potentially an exception. For example, if it is deemed to be a telephone company (CLEC/competitive local exchange carrier) a private company would fall under the California Public Utilities Commission's jurisdiction.

Corporations are owned by shareholders, and different classes of stock can have different voting rights. The assets of a corporation can be sold or assigned to shareholders or others with few restrictions. To a great degree, ongoing governance and control of a corporation can be predetermined by the founders, who can also put requirements and restrictions on how it can do business and structure it to achieve goals they set (and benefit from), within limits.

For-profit organizations make money, pay taxes and distribute dividends to shareholders. Individual shareholders can usually sell their stock, although there are ways to limit the ability of new stock owners to control the company. The City can be a shareholder of such a corporation, even the sole shareholder.

Examples run from national organizations (AT&T and Comcast) to intrastate networks (Sunesys, now a subsidiary of Crown Castle) to local companies (Cruzio Internet). Several public-private partnerships were formed to apply for ARRA grants in 2009 and 2010. Examples include the City of Oakland and the City of Watsonville, which did not receive funds.

Advantages: freedom of action, ability to maintain control, able to operate company for the direct benefit of shareholders, able to borrow money and take private investment.

Disadvantages: could bear a regulatory burden, would likely require arms-length dealings with the City, no guarantee that it will always put the public interest foremost.

Non-Profit

A non-profit corporation can do nearly everything a for-profit corporation can do. The major differences are that a non-profit must offer some kind of public benefit, has limits on the amount of cash surplus it can generate from its operations and its governance structure is less controllable by the founders.

Non-profits aren't owned by anyone. The corporation is governed by a board that can be chosen by voting members, named by organizations designated in the bylaws or picked by the board itself. There are restrictions on the degree to which board members can act on items in which they have a financial interest.

With self-perpetuating boards or boards chosen by voting members, there is a chance that the organization will take a direction that was not intended by the founders. A board with directors appointed by other people or organizations, for example the founders, is less likely to take an unintended direction but there are limits on the extent to which appointed directors can act in the interest of their parent organization.

A mutual benefit corporation is another type of non-profit, and is similar in concept to a cooperative.

In California, CENIC (Corporation for Education Network Initiatives in California) is a non-profit that runs a statewide broadband network supporting K-12 and higher education institutions. It is a membership based non-profit, controlled primarily by major public and private universities, which in turn are its major customers. Because it is a non-profit serving primarily government entities (as well as a few private non-profit schools) it can more directly serve the needs of its members than it could if its members were for-profit companies.

The Nevada Hospital Association (technically a not-for-profit professional association) received a $20 million ARRA grant to build a public access fiber network throughout Nevada. OneCommunity received a similar grant to build a fiber network in Ohio, as did the University Corporation for Advanced Internet Development, which is working on a national network primarily for higher education use.

Advantage: some freedom of action, less potential for conflict of interest with the City.

Disadvantage: can be difficult to maintain control over the long term, financial and managerial options are restricted.

Cooperative

Cooperatives are not-for-profit corporations that are usually set up to provide some kind of benefit to members. Commonly, cooperatives are set up to pool buying power. Although there can be different classes of membership with different rights, generally governance is on the basis of one vote per

member, regardless of the amount of business a member does with the cooperative. Operating surpluses, on the other hand, are usually distributed to members according to how much business they do with the co-op.

The board of directors is chosen by a vote of eligible members. Although there are ways that founders can maintain a large degree of influence, it is possible that other members, representing a majority of votes, can gain control.

Examples:

California Broadband Cooperative. This ARRA grant recipient built and is now operating a 500 mile fiber optic network from Reno, down the eastern side of the Sierra generally along U.S. 395 in California to Barstow.

Plumas-Sierra Rural Electrical Co-op. A rare California example of a traditional rural utilities cooperative. These sorts of organization are common in the midwest and south, and provide telecommunications services as well as electricity.

Mid-Atlantic Broadband Cooperative. Located in rural Virginia, operates a fiber optic network of several hundred miles. Built with tobacco settlement money and ARRA funds.

Advantages: can be run strictly for the benefit of members, has freedom of action and can do business as a private company would.

Disadvantage: can be run strictly for the benefit of members (rather than focusing on public policy objectives), difficult for the founders to maintain control.

4. Municipal broadband case studies

Some cities, such as Palo Alto, San Leandro, Benicia and Santa Monica, are involved to one degree or another in developing broadband facilities and services for commercial and industrial areas. Other cities, for example Alameda, Loma Linda, Lompoc and Provo, Utah, have pursued broadband projects that are focused on providing consumer-class Internet service to homes. Still others, such as Santa Cruz, Brentwood, Kansas City and Austin, Texas, have used policy initiatives to attract private fiber-to-the-home projects.

Each city has its own particular set of circumstances, constraints and needs, but all have determined that broadband is an essential twenty-first century utility – as necessary for economic development and social equity as water or electricity – and that there is a public interest in encouraging its development.

Municipal broadband business models include city or county owned and operated networks, partnerships with private companies, and facilitation of the development of completely private systems.

Examples (in California unless otherwise indicated) include:

City of Palo Alto – the municipal electric utility has installed more than 40 miles of fiber optic cables, which it makes available to business and industrial customers, and is supplementing this coverage with publicly available, amenity grade WiFi access (i.e., intended to meet occasional, on-the-spot needs of tourists and shoppers, for example, rather than daily household, business or educational needs). No residential service is offered. The system generates more than $2 million in surplus revenue a year.

City of Santa Clara - similar to Palo Alto, the city's electric utility provides access to fiber optic lines to businesses, and also uses the smart meter infrastructure it has installed to support amenity grade WiFi service. This system also generates an annual surplus.

City of San Leandro - as noted above, the city entered into an agreement with a local company, Lit San Leandro, to provide access to city-owned conduit. This private company installed fiber optic lines in the city's conduit, to support commercial and industrial customers as well as public uses. In the second phase of this project, the city applied for and received a grant from the federal Economic Development Administration to install additional conduit in order to extend the fiber network. In exchange, the city receives access to the network for its own use and, eventually, will receive conduit lease revenue. The city incurs costs to support the project and currently generates no direct revenue, but has had significant success in attracting new, high technology businesses.

City of Lompoc - the city's electric utility department built and continues to operate a municipal WiFi utility which was originally intended to provide ubiquitous Internet access to homes and businesses. Although using WiFi to provide primary Internet access to homes proved problematic, the system provides a valuable, albeit low speed, lifeline option for residents and access for visitors. The revenue generated by this service is not sufficient to meet costs, and it is currently subsidized by other city funds.

City and County of San Francisco - over the years, San Francisco has developed an extensive, municipally owned fiber system to meet internal networking needs. Surplus capacity in the system is leased to private companies, most notably Google Fiber, which is using it to connect to multiple dwelling units. Going forward, this municipal network will be expanded as opportunities are presented. A policy is in place that requires inclusion of broadband conduit in public projects and to provide an option for placement of publicly-owned conduit in private projects which involve cutting into streets and other right of ways.

City of Watsonville - since the end of local cable television franchising in California, cable companies have begun charging cities for the use of institutional networks – INETs – originally provided at little or no cost. Charter Communications initially wanted to charge the City of Watsonville $150,000 a year for the use of its INET, which connected critical city facilities. Because the city had a policy of routinely keeping an inventory of conduit and other network assets that had been installed on a prospective basis as well as for specific projects over the year, it was able to use conduit routes it already owned to duplicate all but a few segments, totalling a mile, of the INET system. The remaining

gaps were connected via conduit installed by the city for about the cost of two years of service from Charter.

City of Brentwood - for the past 17 years, the city has required new home construction to include empty conduits which are deeded over to the city. An agreement has been reached with an independent Internet service provider, Sonic.net, to use the city-owned conduit to install fiber lines and provide fiber-to-the-home service to homes already served by conduit, and extend the system over time throughout the city.

City of Pacific Grove - a contract was approved with SiFi Networks, a U.K.-based company, which provides the company with access to city streets, right of ways and sewers in order to build a fiber-to-the-home network. Originally, the project would have been funded by SiFi Networks, using capital raised overseas and repaid with guaranteed leases from incumbent operators. This financing mechanism is commonly used in Europe and elsewhere in the world, however incumbent business models in the U.S. do not support it. Consequently, SiFi Networks proposed that the City take over responsibility for lease payment at an annual cost of approximately $1 million per year, which might or might not be offset by operating surplus. So far, this plan has met with skepticism.

Kansas City, Kansas and Missouri and Austin, Texas – local governments have worked with Google Fiber to facilitate construction of privately-owned, competitive fiber-to-the-home systems. This facilitation includes access to government owned facilities, such as right of ways and pole access for fiber installation and real estate leases for equipment huts, as well as a high degree of cooperation in granting permits and carrying out inspections.

Appendix D – Funding options

Some California cities are in a position to use economic development resources, including federal and state grants and other financing vehicles to expand existing broadband facilities, either on behalf of private companies or as part of a municipal enterprise. Examples of potential funding sources include the Economic Development Administration, U.S. Department of Agriculture and the Federal Communications Commission's Connect America Fund phase 2 (CAF-2) on the federal level, and the California Teleconnect Fund, the California Advanced Services Fund (CASF) and the California Infrastructure and Economic Development Bank at the state level.

All these programs have different eligibility and matching fund requirements, service levels, application processes, design and due diligence standards and schedules. To a degree, these programs are complementary, but in many respects there are conflicting requirements or standards. Another, larger problem is that each program – including local telecommunications budgets that receive state and federal subsidies – is independently administered and, with the occasional exception of CASF, is managed without regard for the others.

To an extent, this variety is useful. For example, homes that are not eligible for CAF subsidies might be eligible for funding from CASF. The challenge is to comprehensively analyse eligibility on a census block by census block and project by project basis, and coordinate grant and loan applications and service contracts accordingly.

The challenge in Morgan Hill is to identify which funding sources are realistically available, given the City's economic and demographic characteristics and existing service levels.

1. Bond funding

The City of Santa Cruz is in the process of negotiating an agreement with a local Internet service provider – Cruzio – to operate a fiber-to-the-premise system that would be built with money raised via revenue lease bonds. Cruzio would be responsible for making bond payments, although the City remains the ultimate guarantor.

Other municipal broadband projects have been built via other types of bonds or lease-back financing.

The City of Alameda funded construction of a cable television and Internet system by its municipal electric utility with revenue bonds secured only by revenue from the project. It could not generate sufficient revenue to meet its bond obligations and the system was sold at a loss to the local private cable operator, Comcast. Because the bonds were only backed by revenue from the cable system, and not the electric utility or the city's general fund, bondholders lost approximately 50% of their investment. The city was able to successfully defend the subsequent lawsuits. Since then, no California city has funded a broadband project using pure revenue bonds.

The City of Provo, Utah began building a fiber to the home system with bond repayment guaranteed by revenue, first from the project and then from its municipal electric utility. However, the revenue was insufficient to meet bond obligations and a mandatory $5.25 monthly fee was added to residential and commercial electric bills. The system was subsequently sold to Google for a nominal amount, although the bond obligations remain with the city and local electric ratepayers.

2. Infrastructure financing districts

Although it can be difficult to gain approval for traditional bond measures, new legislation enacted in 2014 (Senate Bill 628) gave local agencies the ability to form enhanced infrastructure financing districts and issue tax increment financed bonds with 55% voter approval. These districts can also use incremental property tax gains to pay back other kinds of financing, including private loans. Additionally, Assembly Bill 2292, passed the same year, added broadband infrastructure to list of allowable projects that may be pursued by traditional infrastructure financing districts.

To date, no California jurisdiction has formed such a district for broadband project purposes.

3. Economic Development Administration

Jurisdictions that are eligible for grants from the federal Economic Development Administration (EDA) may apply for grants to build certain types of broadband infrastructure and perform various broadband related planning tasks, including feasibility studies and engineering work. Broadband infrastructure projects can be eligible for grants under the EDA's public works program, which typically funds 50% of project costs up to $3 million. Planning grants also typically require a 50% match, and will provide up to $1,250,000 in funding.

The first such grant in California was received by the City of San Leandro to build underground telecommunications conduit, which it then made available to a private telecommunications company. The EDA has recently put a higher priority on broadband infrastructure, and is accepting proposals for such grants within its regular application cycle.

4. Transportation funding

Broadband projects as such are not eligible for funding under the various state and federal transportation infrastructure programs, but broadband facilities installed as elements of transportation projects are usually eligible for funding. Typically, broadband facilities must either enhance the operations of the transportation project or improve public safety. Examples include spare capacity included in traffic signal interconnect conduit and conduit installed in bike paths to support public safety agencies.

A proposed bill (AB 1549) is pending in the California legislature and, if approved, would require Caltrans to include broadband facilities, such as conduit, in its future construction projects.

5. Educational broadband programs

The federal E-rate program provides subsidies to schools and libraries, including funds to upgrade supporting infrastructure under certain circumstances. The Corporation for Education Network Initiatives in California (CENIC) funds, builds and manages educational broadband networks in California, including high capacity networks for higher education. Generally, the specific resources funded through these sorts of programs are restricted to use only by qualified schools, libraries and research institutions, but in many cases those specific resources can be purchased from or be made part of a larger project. If, for example, municipal conduit projects were to be planned in Morgan Hill, consideration should be given to opportunities to link to eligible schools and libraries that might be able to contribute such funds.

It is also advisable to maintain an ongoing conversation with school districts that serve Morgan Hill. Educational organizations are not required to consult with other local agencies when using federal and state funds to build broadband infrastructure.

6. Telemedicine programs

As with educational broadband programs, federal and state agencies provide funding for broadband resources that support telemedicine programs. For example, the California Telehealth Network, based at U.C. Davis, receives federal funding to provide network services to, primarily, rural health care facilities. Typically, telemedicine programs buy services from existing providers rather than constructing facilities, and can potentially be anchor tenants of new broadband projects.

7. California Advanced Services Fund

The State of California has established the California Advanced Services Fund (CASF) to pay for broadband infrastructure in areas where service that meets the CPUC's minimum standard of 6 Mbps download and 1.5 Mbps upload speeds is not available. Typically, CASF will subsidize 60% of construction costs in areas where substandard service is available and 70% in areas where broadband service is not available at all. An additional 20% of constructions costs, up to a total of $500,000, can be covered via loans from CASF.

An analysis of census data and broadband availability reports submitted by service providers to the CPUC indicates that only a negligible number of homes in Morgan Hill are in census blocks that are arguably eligible for CASF funding, based on an analysis of wireline service availability. However, when deciding whether or not to approve CASF grants, the CPUC also takes mobile and fixed wireless service availability into account. As mentioned above, most of the mobile broadband service that is available in Morgan Hill does not meet the CPUC's minimum standard, and is not likely to be an obstacle. Fixed wireless Internet service is spotty, but there are locations – particularly in areas not well served by wireline providers – where challenges from fixed wireless operators might also be problematic.

Out of a total of 12,857 housing units in Morgan Hill (2010 census), all but 235 are automatically excluded from CASF eligibility on the basis of wireline service. Most, if not all, of the 235 would probably be considered ineligible on the basis of fixed or mobile wireless service, although more testing would be required.

Adding to the problem is the fact that these arguably eligible homes are in scattered locations around the edge of the city (see map in Appendix A). There is an insufficient concentration of eligible homes to support independent service providers' business models, given the fixed costs involved, including the cost of developing and defending a CASF infrastructure grant or loan application. Given those costs and the probability that few or none of the homes would ultimately be verified as eligible, even Frontier Communications, which routinely applies for CASF grants in more rural areas, would not likely be interested in pursuing such funding in Morgan Hill.

Separate CASF accounts provide funding to public housing entities for broadband facilities in eligible properties and for programs that promote broadband adoption by residents of public housing. First Community Housing received a $34,838 grant for broadband facilities in 100 living units at its Murphy Ranch property on East Dunne Avenue in Morgan Hill. Eden Housing received two grants, $28,029 and $19,028, for, respectively, its Jasmine Square and Royal Court properties on Monterey Rd. A grant application for $34,020 was for the Butterfield Retirement property on Butterfield Blvd. Two grants are pending for EAH Housing, $40,620 and 40,085 for Cochrane Village on Butterfield Blvd. and Village Avante on Del Monte Ave., respectively. No CASF public housing broadband adoption grants have been awarded in Morgan Hill.

8. Connect America Fund

The Federal Communications Commission gives operating subsidies to telephone companies that provide broadband service in rural and/or remote areas, as a part of its universal service mandate. In the current round – Phase 2 – of the Connect America Fund (CAF-2) program, the FCC offered large telephone companies a right of first refusal to accept these funds or not, on a state by state basis. Frontier accepted CAF-2 subsidies in California for its existing systems as well as those acquired from Verizon, including approximately $3 million for locations in Santa Clara County. AT&T accepted CAF-2 subsidies as well, including approximately $260,000 for Santa Clara County locations.

As the map in Appendix A shows, there are census blocks in the area surrounding Morgan Hill that are eligible for CAF-2 funding, in service territories that belong to both Frontier and AT&T. However, only three such census blocks served by Frontier and one served by AT&T are within the city limits of Morgan Hill. Of those four census blocks, three are unpopulated and one contains only a single housing unit. As a practical matter, Morgan Hill is not currently eligible for CAF-2 funding.

The FCC will be releasing a supplementary list of eligible census blocks later this summer, however it is unlikely to include a significant number of census blocks within Morgan Hill or, indeed, any at all.

The FCC closed the application window in 2014 for its rural broadband experiments program, also funded through CAF. Initially, three projects in California – two in Monterey County and one in the

San Joaquin Valley – were provisionally funded, but all three failed to meet program requirements and were dropped from consideration. In at least two cases, the applicants were unable to obtain the particular kind of technical and financial expertise required by the FCC and other federal agencies. In all three cases, the areas involved had much smaller populations and were either more remote and/or had economies that were more dependent on agriculture than Morgan Hill's.

9. Rural Utilities Service

The U.S. Department of Agriculture runs several broadband-related grant and loan programs via the Rural Utilities Service (RUS). These programs include Community Connect Grants, loans and loan guarantees and a series of gigabit community pilot projects. The loan programs are available on a year-round basis, while application windows are periodically announced for the grant programs.

In the past, service providers in California have had difficulty qualifying for and/or winning RUS funding. The programs have been designed with midwestern and southern business models and demographics in mind, which are markedly different from conditions in California. These programs typically define eligibility in terms of population, to distinguish between rural areas, which are fundable, and urban areas, which are not. Under any of the USDA definitions used, Morgan Hill's population is well in excess of the established limits and would be considered an ineligible urban area.

10. ARRA programs

American Recovery and Reinvestment Act of 2009 (ARRA) included the Broadband Technology Opportunities Program (BTOP) run by the National Telecommunications and Information Administration and the Broadband Initiatives Program (BIP) run by the Rural Utilities Service. Several billion dollars in grants and loans were awarded, and the programs are no longer funded or active, except to the extent that the responsible agencies are managing implementation and compliance. In the past, though, some cities received stimulus grants for the purpose of building publicly available telecommunications networks. Chattanooga, Tennessee is the best known example. It received approximately $100 million in grants through ARRA and, via its municipal electric utility, used it to build a fiber-to-the-home system.

11. Other funding sources

Both the State of California and the federal government operate programs that provide funding to various types of agencies – for example police and fire departments, sheriffs' offices and other first responders – for the purpose of purchasing broadband and other telecommunications services and facilities. Typically, this money is not directly available for construction of commercially available broadband infrastructure but can used to support business plans on an ongoing basis.

Appendix E - Glossary

ADSL	Asymmetric Digital Subscriber Line: DSL service with a larger portion of the capacity devoted to downstream communications, less to upstream. Typically thought of as a residential service. ADSL2 is the second generation of ADSL technology and provides higher service levels.
ATM	Asynchronous Transfer Mode: A data service offering by ASI, that can be used for interconnection of customer's LAN. ATM provides service from 1 Mbps to 145 Mbps utilizing Cell Relay Packets.
Backhaul	Connecting Internet access to a location over long or short distances. Traditionally, wired networks have been necessary for backhaul, but with 802.16, also known as WiMAX, backhaul via wireless will become even more common than it is with WiFi.
Bandwidth	The amount of data transmitted in a given amount of time; usually measured in bits per second, kilobits per second, and megabits per second.
Bit	A single unit of data, either a one or a zero. In the world of broadband, bits are used to refer to the amount of transmitted data. A kilobit (Kb) is approximately 1,000 bits. A megabit (Mb) is approximately 1,000,000 bits.
Broadband	"Broadband" refers generally to any telecommunications service capable of supporting digital data transmission at high speeds. These services can include and/or support Internet, television, telephone, private data networks and various specialized uses. Broadband service can be delivered in a variety of ways, including telephone lines (e.g. DSL), coaxial cable (e.g. cable modem), fiber optic cable (e.g. Lit San Leandro), wireless cellular/mobile service (e.g. cell phones, tablets, wireless modems), WiFi, point-to-point and point-to-multipoint wireless service (e.g. TelePacific, Etheric) and hybrid networks (XO Communications). Although different organizations use different criteria, the California Public Utilities Commission considers 6 Mbps download and 1.5 Mbps upload speed to be a standard for adequate broadband service availability. Unless otherwise stated, this report uses the CPUC definition.
Byte	The amount of memory space needed to store one character, which is normally 8 bits.
Cable modem	A device that hooks to your cable TV line to allow your computer to receive data at about 1.5 Mbps. The theoretical maximum for downstream transactions is 27 Mbps and 2.5 Mbps upstream, but the connection is usually much slower because the provider may be hooked to the Internet via a T-1 line.
CDMA	The type of digital cellular phone network used throughout most of the United States, but rare elsewhere in the world. CDMA stands for Code Division Multiple Access, and CDMA2000 1x is the third-generation, or 3G, extension to which CDMA cellular operators are upgrading their networks. It is a digital

	cellular technology that uses spread-spectrum techniques. Unlike competing systems, such as GSM, that use TDMA, CDMA does not assign a specific frequency to each user. Instead, every channel uses the full available spectrum. Individual conversations are encoded with a pseudo-random digital sequence. CDMA consistently provides better capacity for voice and data communications than other commercial mobile technologies, allowing more subscribers to connect at any given time, and it is the common platform on which 3G technologies are built.
Cell	The geographic area covered by a cellular telephone transmitter. A connected group of cells form a cell system, which is what you gain access to when you sign up for cellular telephone service.
Cellular	A mobile communications system that uses a combination of radio transmission and conventional telephone switching to permit telephone communications to and from mobile users within a specified area.
CLEC	Competitive Local Exchange Carrier: Wireline service provider that is authorized under state and Federal rules to compete with ILECs to provide local telephone service. CLECs provide telephone services in one of three ways or a combination thereof: a) by building or rebuilding telecommunications facilities of their own, b) by leasing capacity from another local telephone company (typically an ILEC) and reselling it, and c) by leasing discreet parts of the ILEC network referred to as UNEs.
Coaxial cable	A type of cable that can carry large amounts of bandwidth over long distances. Cable TV and cable modem service both utilize this technology.
Commercial class	Broadband service similar to residential service in that the provider takes effectively all responsibility for installing, maintaining and supporting the service. Speeds are similar (6 to 100 Mbps), but service levels, reliability, consistency and pricing are higher.
Copper	Most telephone and cable lines are built using copper wires, which is a telecommunications technology that has been in use since the 19th century. The term is to distinguish lower capacity copper wires (and cables) from higher capacity fiber optic strands (and cables) that are made from glass or plastic.
CPCN	Certificate of Public Convenience and Necessity: Authorization given by the CPUC to telecommunications carriers in order to provide service in the state of California.
Dark fiber	Fiber optic cables are composed of many, very thin fiber optic strands made of glass. A laser is used to send a beam of light through a fiber optic strand, and this beam carries data from one end to the other. If no electronic equipment (i.e., the laser) is connected to a strand, it is literally dark, and cannot carry data. Dark fiber is sought after and used by telecommunications carriers and large companies that prefer to install and operate their own electronic equipment at either end.

Dial-Up	A technology that provides customers with access to the Internet over an existing telephone line.
DS3	A dedicated phone connection supporting data rates of about 43Mbps (megabits per second). Also called a T-3, the line actually consists of 672 individual channels, each of which supports 64Kbps. DS3 lines are used mainly by Internet Service Providers (ISPs) connecting to the Internet backbone. Large businesses also use DS3 lines when they have large sites to interconnect.
DSL	A common form of broadband Internet connection. DSL stands for Digital Subscriber Line.
E-Rate	A Federal program that provides subsidy for voice and data lines to qualified schools, hospitals, CBOs, and other qualified institutions. The subsidy is based on a percentage designated by the FCC. CTF benefits are calculated net of the E-rate subsidy.
E911	Enhanced 911, an emergency service that automatically sends phone number and location information to the operator. E911 comes in handy, say, when you need to get emergency help and are unable to speak or don't know your location.
Ethernet	The most common networking standard in the world, formally known as IEEE 802.3.
Fixed wireless	Broadband systems based on fixed wireless technology provide Internet service using outdoor antennas installed on homes and businesses. It is most commonly found in rural areas, but it is also sometimes used by businesses to compensate for poor wireline service in urban areas. Fixed wireless systems can provide services between two specific locations – i.e., point to point – or from a central access point to many locations in the surrounding areas – i.e., point to multipoint.
FTTN	Fiber To The Neighborhood: A hybrid network architecture involving optical fiber from the carrier network, terminating in a neighborhood cabinet with converts the signal from optical to electrical.
FTTP	Fiber To The Premise.
Gigahertz	A measure of electromagnetic wave frequency equal to one thousand million (1,000,000,000) hertz, often abbreviated as GHz and used to specify the radio frequency used by wireless devices. 802.11a networks operate at 5 GHz. 802.11b and g networks use 2.4 GHz, which is susceptible to interference from nearby cordless phones and microwave ovens that use the same frequency.
GPON	Gigabyte-Capable Passive Optical Network: GPON uses a different, faster approach (up to 2.5 Gbit/s in current products) than BPON.

GSM	Global System for Mobile Communications: This is the current radio/telephone standard in Europe and many other countries except Japan and the United States.
Hub	A common connection point for devices, such as computers and printers, in a network.
ILEC	Incumbent Local Exchange Carrier. An ILEC is a telephone company that was providing local service when the Telecommunications Act of 1996 was enacted. Compare with CLEC, a company that competes with the already established local telephone business.
Industrial class	Broadband service where the customer plays a much greater role in provisioning and supporting the service, including buying different elements from different vendors and managing installation and support. Speeds would be higher – perhaps as high as a Gigabit per second or more – and quality of service levels could be as high as Tier 1. Comcast's Business Class service or AT&T's business DSL service are examples of commercial class service. A DS-3 or dark fiber strands are examples of industrial class service.
I-Net	Institutional Network. Provides a high-speed connection between government, educational and community entities. It is often negotiated with a cable franchise, in exchange for using right-of-way in a jurisdiction.
ISP	Internet Service Provider: A company providing Internet access to consumers and businesses, acting as a bridge between customer (end-user) and infrastructure owners for dial-up, cable modem and DSL services.
LAN	Local Area Network: A geographically localized network consisting of both hardware and software. The network can link workstations within a building or multiple computers with a single wireless Internet connection.
Last mile	Infrastructure (e.g., fiber optic lines, distribution boxes, equipment vaults, poles, conduit) that provides broadband service to end users or end-user devices (including households, and businesses).
Lit fiber	Fiber optic cables are composed of many, very thin fiber optic strands made of glass. A laser is used to send a beam of light through a fiber optic strand, and this beam carries data from one end to the other. When this kind of electronic equipment (i.e., the laser) is installed and operating, then the fiber strand is literally "lit" and ready to transmit data, either for the company that operates it or for third-party customers.
Local Loop	A generic term for the connection between the customer's premises (home, office, etc.) and the provider's serving central office. Historically, this has been a wire connection; however, wireless options are increasingly available for local loop capacity.

MAN	Metropolitan Area Network: A high-speed date intra-city network that links multiple locations with a campus, city or LATA. A MAN typically extends as far as 50 kilometers.
Managed services	The type of service provided by dominant incumbent providers, such as AT&T and Comcast. Rather than providing a simple connection between points – via lit or dark fiber – these companies provide full Internet bandwidth services, at a speed and quality of service level they specify, and sometimes with quantity limits, i.e., data caps. It is analogous to water service: these companies sell "water" and don't rent out access to their "pipes".
Mbps	Megabits per second: 1,000,000 bits per second. A measure of how fast data can be transmitted.
Middle mile	Broadband infrastructure that does not predominantly provide broadband service to end users or to end-user devices, and may include interoffice transport, backhaul, Internet connectivity, or special access. Middle mile facilities are the link between last mile facilities and major interconnection points, such as those that form the core of the Internet.
Modem	Short for modulator/demodulator. A modem modulates outgoing digital data into analog signals so they can be sent over copper phone lines, and demodulates incoming analog signals into digital.
Overbuilders	Building excess capacity. In this context, it involves investment in additional infrastructure project to provide competition.
PON	Passive Optical Network: A Passive Optical Network consists of an optical line terminator located at the Central Office and a set of associated optical network terminals located at the customer's premise. Between them lies the optical distribution network composed of fibers and passive splitters or couplers. In a PON network, a single piece of fiber can be run from the serving exchange out to a subdivision or office park, and then individual fiber strands to each building or serving equipment can be split from the main fiber using passive splitters / couplers. This allows for an expensive piece of fiber cable from the exchange to the customer to be shared amongst many customers thereby dramatically lowering the overall costs of deployment for fiber to the business (FTTB) or fiber to the home (FTTH) applications.
Rights-of-Way	Legal rights of passage over land owned by another. Carriers and service providers must obtain rights-of-way to dig trenches or plant poles for cable systems, and to place wireless antennae.
Router	An intelligent network device that goes one step beyond bridging by converting address-based protocols that describe how packets move from one place to another. In practice, this generally comes down to translating between IP addresses and MAC addresses for data flowing between your local network and the Internet. Many people use the term interchangeably with "gateway." You

	must enter the IP address of your router when configuring network settings manually.
Subscribership	Subscribership is how many customers have subscribed for a particular telecommunications service.
Switched Network	A domestic telecommunications network usually accessed by telephones, key telephone systems, private branch exchange trunks, and data arrangements.
T-1	The T-1 standard was introduced in 1961 in order to support a bi-directional speed of 1.5 Mbps at a high quality-of-service level, using the copper wires of the time. Because it is a dedicated and managed circuit, its performance is usually substantially better than shared services such as DSL or cable modem, even in cases where the claimed top speed of those shared services is many times higher. A T-1 circuit is generally considered to be the lowest level of service that can be described as industrial or carrier class.
Telco	An abbreviation for Telephone Company.
Telecommunications	Refers to all types of data transmission, from voice to video.
Throughput	The amount of data that can be transmitted in a given amount of time. Throughput is commonly measured in bits per second. (Although throughput is not really a measurement of speed, most people, including us, use the word "speed" when talking about a high-throughput network.)
Universal Service	The idea of providing every home in the United States with basic telephone service.
VDSL	Very-high-bit-rate digital subscriber line (VDSL or VHDSL)[1] is a digital subscriber line (DSL) technology providing data transmission faster than asymmetric digital subscriber line (ADSL) over a single flat untwisted or twisted pair of copper wires (up to 52 Mbit/s downstream and 16 Mbit/s upstream),[2] and on coaxial cable (up to 85 Mbit/s down- and upstream)[3] using the frequency band from 25 kHz to 12 MHz.[4] These rates mean that VDSL is capable of supporting applications such as high-definition television, as well as telephone services (voice over IP) and general Internet access, over a single connection. VDSL is deployed over existing wiring used for analog telephone service and lower-speed DSL connections. This standard was approved by ITU in November 2001.
Videoconferencing	Conducting a conference between two or more participants at different sites by using computer networks to transmit audio and video data.
VLAN	Virtual Local Area Network. A network of computers that behave as if they are connected to the same wire even though they may actually be physically located on different segments of a LAN.
VoIP	Voice Over Internet Protocol: A new technology that employs a data network (such as a broadband connection) to transmit voice conversations.

VPN	A method of creating an encrypted tunnel through which all traffic passes, preventing anyone from snooping through transmitted and received data. VPN stands for virtual private network.
WAN	Wide Area Network, A collection of local area networks connected by a variety of physical means. The Internet is the largest and most well-known wide area network. Wide area network is generally abbreviated to WAN.
WiFi	Short for wireless fidelity and is meant to be used generically when referring of any type of 802.11 network, whether 802.11b, 802.11a, dual-band, etc. The term is promulgated by the WiFi Alliance. Any products tested and approved as "WiFi Certified" (a registered trademark) by the WiFi Alliance are certified as interoperable with each other, even if they are from different manufacturers. A user with a "WiFi Certified" product can use any brand of access point with any other brand of client hardware that also is certified. Typically, however, any WiFi product using the same radio frequency (for example, 2.4 GHz for 802.11b or 11g, 5 GHz for 802.11a) will work with any other, even if not "WiFi Certified." Formerly, the term "WiFi" was used only in place of the 2.4 GHz 802.11b standard, in the same way that "Ethernet" is used in place of IEEE 802.3. The Alliance expanded the generic use of the term in an attempt to stop confusion about wireless LAN interoperability.
WiMAX	Another name for the 802.16 wireless networking specification used for long-haul and backhaul connections.
Wireless ISP	A company that provides wireless Internet access. The term is often abbreviated to WISP.
WLAN	Wireless Local Access Network, a LAN that can be connected to via a wireless connection.

Sources: Tellus Venture Associates, California Public Utilities Commission, Neratech, Wikipedia.