REGION 9 ECONOMIC DEVELOPMENT SOUTHWEST COLORADO COUNCIL OF GOVERNMENTS BROADBAND ROADMAP

May 2023

Abstract

In 2017, the Southwest Colorado Council of Governments hired NEO Connect to create a Broadband Plan for their five-county region. The purpose of this report is to provide an update for Broadband Plan, given the everchanging broadband landscape and needs of our communities. Region 9 Economic Development District of Southwest Colorado and the Southwest Colorado Council of Governments requested that NEO support their efforts in applying for a middle mile fiber grant through NTIA. This report provides the information submitted to the NTIA for enhancing middle mile infrastructure throughout southwest Colorado. Additionally, this report addresses the last-mile connectivity strategies that can be implemented for the region. .

Prepared by Diane Kruse, NEO Connect

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BROADBAND ROADMAP REGION 9

Introduction

In 2017, the Southwest Colorado Council of Government (SWCCOG) engaged NEO Fiber, Inc., doing business as NEO Connect (NEO) to prepare a strategic broadband plan for Southwest Colorado Regional Broadband Plan for an area encompassing thirteen local government jurisdictions, consisting of Archuleta, Dolores, La Plata, and San Juan Counties as well as the municipalities of Bayfield, Cortez, Dolores, Durango, Ignacio, Mancos, Pagosa Springs, Rico, and Silverton. A companion report was also created for the Ute Mountain Ute Tribe in 2017.

In August of 2022 the SWCCOG and the Region 9 Economic Development District of Southwest Colorado joined to further address broadband issues in the region, collaborating together to leverage the previous work of the SCAN network, and to update the initial plan created by NEO. The pandemic of 2020 highlighted the disparities of communities that have robust, affordable and abundant broadband and those that do not. In response to these disparities, there are numerous federal and state programs available to invest in broadband infrastructure. Local governments are taking a more active role in ensuring their communities have reliable, abundant and affordable broadband services for their citizens. This report provides an updated Broadband Roadmap for Region 9 to improve broadband services by leveraging various grant funding programs that have become available after the pandemic. In fact, Region 9 and NEO created a grant application for NTIA's middle mile program to use one of the federally-funded programs to improve middle mile fiber infrastructure in the region. This report provides information that was created for the NTIA application to address the lack of middle mile fiber infrastructure in the region. This report also provides strategies for implementing and addressing last-mile infrastructure.

As having access to very high-speed broadband and data communication services is becoming a critical component for education, government services, economic development, healthcare, utility operations, first responders and business operations, local governments are considering various approaches and strategies that can be taken to facilitate more investment in fiber optic infrastructure. This facilitation can take the form of implementing broadband friendly policies and ordinances to reduce the cost of implementation by the private sector, to investing and implementing fiber on major roads within the region, to entering into public-private partnerships to promote further broadband investment.

Considerations that impact a local government's broadband strategy and involvement include the level or amount of local government investment, examination of models and approaches implemented by other local governments or communities, exploration of how networks are typically implemented, constructed and operated, as well as exploration of public-private partnership models that are emerging in the industry and possible financing strategies for implementation. This report will provide detail on all of the various strategies to improve broadband infrastructure.

Background of the SCAN project

In 2010, the SWCCOG was awarded a $3 million Department of Local Affairs grant to implement a high-capacity network for the regional governments. This network, known as the Southwest Colorado Access Network (SCAN), was the SWCCOG's first large-scale endeavor. The total project, including local matching funds, was over $4 million.

The primary driver for this initiative was the lack of affordable broadband options and in some cases, complete absence of broadband capabilities in the region. The SCAN project built fiber between some of the key anchor institutions within each of the communities. This fiber is now being used by many service providers to provide more abundant broadband services to these anchor institutions, in some communities. Further, some of the communities built out additional fiber and conduit throughout their respective cities and towns to connect more government, schools, healthcare and libraries. The SCAN project did not address building fiber between communities and to major internet hubs, which would substantially benefit key stakeholders in the region as well as internet service providers. The middle mile expansion seeks to overcome some of the limitations of the SCAN project.

About Region 9 and Background on the NTIA Grant Submission

Region 9 Economic Development District of Southwest Colorado Inc. (Region 9) was formed in 1989 and is a nonprofit, 501(c)6 public, private partnership that was founded to promote and coordinate economic development activities in the five counties of Archuleta, Dolores, La Plata, Montezuma, and San Juan, the ten cities and towns, as well as the Southern Ute and Ute Mountain Indian Tribes, the only two tribes in Colorado. Region 9's partner organization, the Southwest Colorado Council of Governments, owns and manages the SCAN network, a fiber optic network that connects many of our anchor institutions and government offices throughout our region. The current SCAN network does not provide middle-mile connectivity between our communities.

Region 9 applied for the NTIA middle mile grant which was due in September 2022. In addition to the five counties, ten municipalities, and two Tribes described in the paragraph above, Region 9 also worked with La Plata Electric, Empire Electric, and the Colorado Department of Transportation, as all three entities have provided additional in-kind match contributions for the grant application.

About NEO Connect

NEO Fiber, Inc., doing business as NEO Connect, is a Colorado-based firm that was formed in 2010, and has offices in Denver and Glenwood Springs. NEO is a privately-held, woman-owned business. Our experience spans more than 200 broadband-planning and implementation projects across the United States, Canada and the U.S. Virgin Islands. NEO is one of a handful of companies in the industry that has first-hand experience in planning, community engagement, design/engineering, business modeling, financing, owning, and operating fiber optic, wireless and FTTH networks. NEO provides community broadband planning services for local governments that want to improve the lives and economic opportunities of their constituents. NEO's core competences include strategic and financial planning, design and engineering services, Gigabit planning services, project management and construction oversight.

NEO has become a leader in municipal broadband planning in the State of Colorado. NEO has provided planning, evaluation, management, and/or implementation services for 45 of the state's 64 counties, and for

49 cities and towns statewide. The vast majority of these projects have been rural, grant-funded efforts aimed at enabling economic development, educational opportunities, public safety, government accessibility, and lowering costs and improving services for all. In addition to work in Colorado, NEO continues to work nationally to improve broadband services for local governments. NEO completed the State of Tennessee's strategic broadband plan, assisting the State in developing policies, strategies and funding mechanisms to improve services throughout many of its economically distressed counties. In Mississippi, NEO developed, built and operated one of the first FTTP projects in the state. That project expanded from a single master planned community to working with nine large municipalities to bring Gigabit services to all of their constituents. In recent years, NEO has worked on broadband projects in California, Florida, Utah, the Virgin Islands, Michigan, Minnesota, Kansas, Mississippi, Illinois, and Arizona.

NEO's founder and CEO, Diane Kruse has served as Chairman of the Fiber Broadband Association, a national industry organization that provides advocacy, education and resources to companies, organizations and communities who want to deploy the best networks through Fiber to the Premise networks. Kruse also served as Masters of Ceremonies and Chairman of the Broadband Communities' Summit, another broadband advocacy organization helping to shape the national conversation regarding improving broadband services. Kruse has developed and implemented broadband plans for over 200 municipalities and counties throughout the U.S. and her previous company, Zoomy Communications designed, built, owned and operated FTTP networks for numerous master planned communities across the U.S. Kruse will provide consulting, advisory, project management and oversight of this program, assisting Region 9 team in all areas of implementation.

For more than 25 years, eX² Technology management team members have worked together designing, building, commercializing and maintaining healthcare, energy and intelligent transportation, broadband networks throughout the US. Through their combined efforts, eX² team members have designed and built more than 2M+ fiber miles and accumulated $340M+ in duct and dark fiber sales. NEO and eX²'s engineering team have worked together for more than 18 years. EX²'s Chad Renfro will lead the design efforts for the project. Renfro has over 15 years of experience in the telecommunications and fiber optic industry with a proven track record for strategic and successful project implementations. NEO's and eX²'s staff will support Kruse's and Renfro's efforts.

Methodologies and Activities Conducted During the Planning Process

There are a number of activities that were undertaken to put together Region 9 Broadband Roadmap for improving broadband services in the region. These activities included:

1. Broadband Availability Research. Independent research was conducted in regard to broadband availability reported though Broadband Now, the State of Colorado and the Federal Communications Commission. NEO's team mapped the broadband availability using several of these sources, along with overlay of address data provided by the County's GIS departments.

2. Existing Assets and Planned Fiber Builds. Much work was completed to assemble maps of existing assets and planned fiber builds. Key contributors for this effort include Eric Hittle, Jim McClain, Rick Smith and Beth Kremer. NEO compiled and produced maps in preparation for this Roadmap and the NTIA grant application and worked with key stakeholders to determine priorities for planned fiber builds within the region.

3. Preliminary Design and Engineering. Preliminary design and engineering services were conducted to connect to the "outside world" or to "internet supply" with fiber for a middle mile strategy.

4. Standardizing Policies for Broadband Implementation. There are a number of policies and ordinances that can be standardized across the entire study area to further promote broadband investment and reduce the cost of fiber optic implementation. NEO's team assembled the existing policy information and has made recommendations on standard policy language for improving existing dig once, shadow conduit and land use policies. Many of the local governments seem to have a dig once policy in place. These could be further improved by implementing a shadow conduit policy, that requires installation of additional conduit whenever work is being done within the right of way that the Counties retain for broadband development. A carefully-worded dig once or shadow conduit policy should not require entities who have opened a trench to be required to allow their competitors to place fiber or conduit within the trench. The dig once or shadow conduit policy should not provide a disincentive for private providers to dig trenches to homes and neighborhoods, as their take-rate models are usually based on some level of assumed exclusivity for the conduit they pay to put in.

5. Strategies and Plans. And finally, this report was assembled to provide a path forward towards implementation of several strategies and plans to improve broadband and data connectivity for the region. Primarily Region 9 and its participating governments should leverage grant funding that has become available in response to the pandemic.

The Broadband Roadmap will focus on accelerating infrastructure by providing standardized policies that are broadband friendly, and establishing cost estimates for further expansion of middle mile fiber infrastructure and Fiber to the Premise builds. The intention of the Broadband Roadmap is to create shovel-ready projects to align with federal and state funding programs.

Understanding Broadband Thresholds

The FCC and the State of Colorado require existing service providers to report their advertised service offerings on a quarterly basis. This information is compiled and mapped through a number of databases and mapping tools. The mapping information is a notoriously incorrect representation of the actual speeds and service levels available for two primary reasons. First, the service levels and speeds are based upon advertised speeds, rather than actual speeds available. Second, if one household within a census block has access to a certain speed, the service providers are able to report that this service level is available to the entire census block. There has been a national conversation within the past several years to work on ways to improve the mapping data to better reflect actual speeds.

The FCC maps now have companion maps, produced by the National Telecommunications and Information Administration (NTIA), that provide information on actual speed test data and other data that establishes indication of broadband need. NTIA is the Executive Branch agency that is principally responsible for advising the President on telecommunications and information policy issues. NTIA's programs and policymaking focus is largely on expanding broadband Internet access and adoption in America, expanding the use of spectrum by all users, and ensuring that the Internet remains an engine for continued innovation and economic growth.

It is important to view the FCC and State of Colorado mapping data with caution and to gather speed test and other available data to determine actual speeds available. Speed test data provides actual speeds available at a household level and is a better indication of existing broadband service available. Another data point is to enter address data into the service provider's websites to determine what level of service can be ordered.

In Colorado, the State uses the definition and threshold of 25 megabits per second (Mbps) in download speeds and 3 Mbps in upload speeds to determine whether an area is served.

There are a number of funding programs that use another threshold – that being **underserved.**
An **underserved** area is an area in which households or businesses do receive service at or above the FCC threshold but lack access to broadband service at speeds 100 Mbps in download and 20 Mbps in upload speeds. These thresholds are important because they determine whether an area is unserved or underserved, or in other words, whether or not these areas are eligible for various funding programs.

This report will provide strategies to address areas that are severely lacking broadband service and are considered priority areas for most of the State of Colorado and federal government funding programs. This benchmark is 10/1 Mbps. Many of the broadband programs within the American Rescue Plan Act, and the Infrastructure Investment and Jobs Act allow investment in broadband for areas that do not have 100/20 Mbps in service. Therefore, this report will provide information to address the priority areas with an eye for maximizing the funding programs that allow for funding locations that are underserved, lacking 100/20 Mbps.

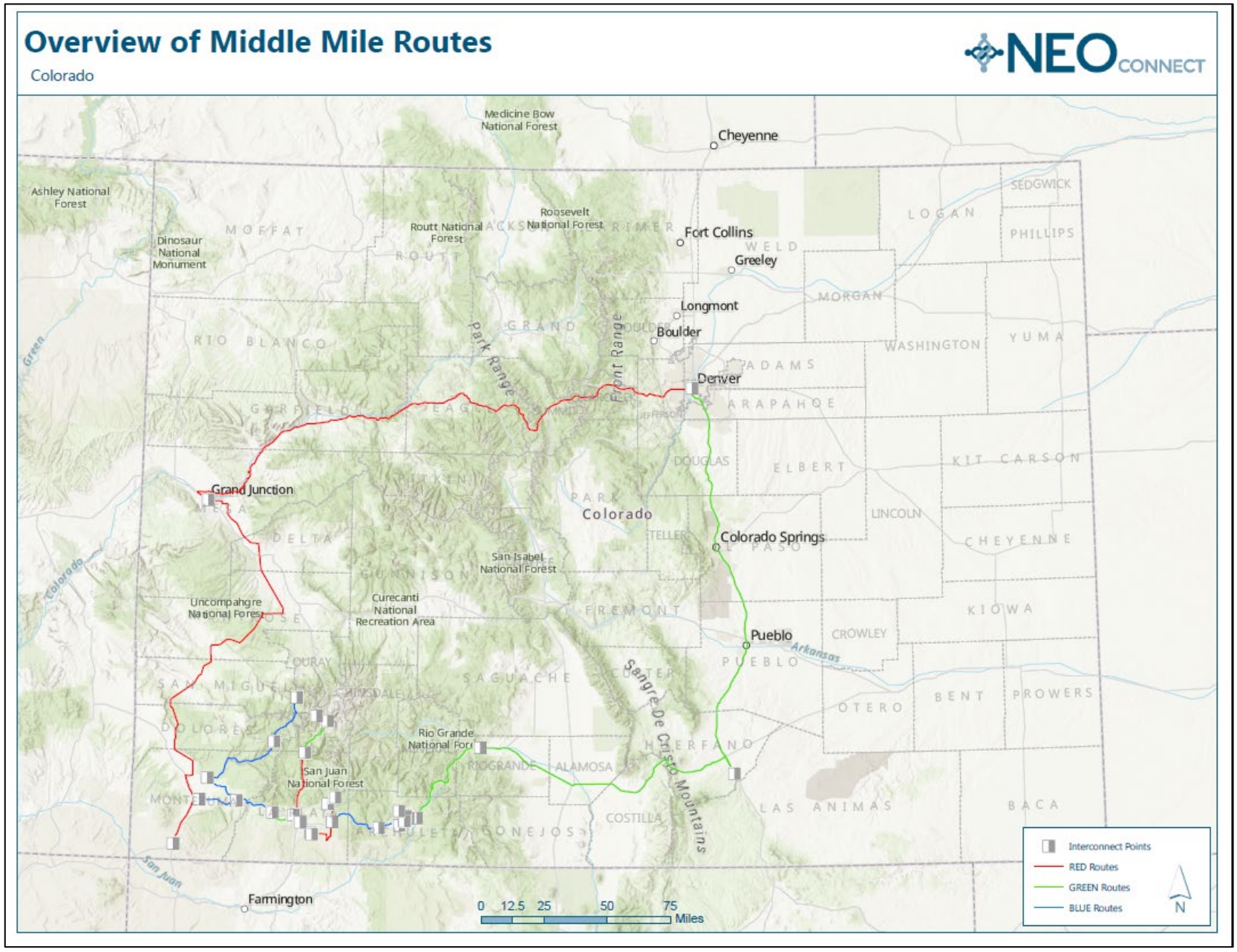
Another distinction is how service is being provided. Wireline service refers to service that is being provided over copper wire such as DSL, over coax such as most cable systems or over fiber optic facilities. Wireless broadband connects a home or business to the Internet using a radio link between the customer's location and the service provider's facility.

The gold standard for bandwidth capability is quickly becoming offering Gigabit services or speeds that support 1,000 Mbps. This requires building fiber to every home and business and is referred as "Fiber-to-the-Premise," or "Fiber-to-the-Home," or "Fiber-to-the-Business." With the tremendous growth in broadband demand, plans for long-term implementation of infrastructure must take into consideration the need for more fiber networks to be deployed and expanded.

Section 1, the NTIA Grant Application, Addressing Middle Mile Connectivity in the Region

The southwest corner of Colorado is a broadband desert, an area that lacks sufficient broadband resiliency and critical infrastructure. The multiple collaborators are working together to solve this issue and to ensure that needed infrastructure will be made available on an open access basis to all providers indiscriminately. The proposed network will promote broadband connection resiliency by creating alternative network paths to eliminate potential single points of failure.

An overview map of the proposed network is shown on the following page. Red lines are existing fiber or planned fiber that has already been funded through other grant programs. The blue lines depict new routes that will be built with grant dollars if funded and the green lines are routes that will be acquired through an Indefeasible Right of Use (IRU). NEO has provided .kml and .kmz GIS files of the fiber routes to Region 9 as a deliverable of the project.


Overview of Middle Mile Routes
Colorado
NEO CONNECT
Medicine Bow National Forest
Cheyenne
Ashley National Forest
Dinosaur National Monument
Routt National Forest
Roosevelt National Forest
Fort Collins
Greeley
Longmont
Boulder
Denver
Park Range
Front Range
Grand Junction
Colorado
Colorado Springs
San Isabel National Forest
Uncompahgre National Forest
Curecanti National Recreation Area
Pueblo
Arkansas
Sangre De Cristo Mountains
Rio Grande National Forest
San Juan National Forest
Farmington
San Juan
Green
Colorado
MOFFAT
ROUTT
JACKSON
GRAND
RIO BLANCO
GARFIELD
PITKIN
LEAD
PARK
TELLER
EL PASO
DOUGLAS
ELBERT
ARAPAHOE
ADAMS
WELD
LOGAN
SEDGWICK
PHILLIPS
MORGAN
WASHINGTON
YUMA
KIT CARSON
LINCOLN
CHEYENNE
KIOWA
CROWLEY
PUEBLO
OTERO
BENT
PROWERS
MESA
DELTA
GUNNISON
FREMONT
CUSTER
SAGUACHE
OURAY
SAN MIGUEL
DOLORES
MONTEZUMA
LA PLATA
ARCHULETA
CONEJOS
RIO GRANDE
ALAMOSA
COSTILLA
HUERFANO
LAS ANIMAS
BACA
0 12.5 25 50 75
Miles
Interconnect Points
RED Routes
GREEN Routes
BLUE Routes
N

The needed network will connect several fiber routes that have been built by La Plata Electric Association (LPEA), the SCAN network, and the networks in process and planned to be built by the Southern Ute Indian Tribe (SUIT) and the Ute Mountain Ute Tribe (UMUT) through the tribes' successful applications of other grant programs. The following existing routes are provided as in-kind match and connection of the region in an NTIA application. If not received, this project and planned routes will continue to be pursued.

- Arch-2, SCAN fiber along County 600 from the Intersection of Hwy 160/Piedra Road to the Intersection of Cloman Road/Piedra Road.
- Arch-6, SCAN fiber along Hwy 160 from the Intersection of Hwy 160/Hwy 84 (CDOT Vault) near Pagosa Springs to the CNL located at Pagosa Springs Medical Center
- LaPlata-1 LPEA fiber along Hwy 501 from Bayfield to Pine Valley
- LaPlata-2 LPEA fiber along Hwy 501 from Pine Valley to Vallecito
- LaPlata-3 SUIT fiber from Bayfield to Durango
- LaPlata-4 SCAN fiber from the Durango CNL to a vault located at 545 Wilson Gulch Dr, Durango, CO 81301, at the Police Station
- LaPlata-5 SUIT fiber from the vaults near Mercy Hospital to Intersection Hwy 172/Hwy 309
- LaPlata-7 LPEA fiber along Hwy 550 from Durango to Cascade Village
- Reg10-1 Region 10 fiber from the vault at Hwy 184 & Hwy 145 Intersection to Region 10's CNL in Grand Junction
- Reg10-2 Region 10 fiber planned from Grand Junction to Denver along the I-70 corridor
- UMUT-1 fiber along Hwy 491 from Cortez to Towaoc to the UMUT Visitor's Center

These routes are depicted in red on the maps provided. Ideally, NTIA will fund the build of the following new fiber routes, shown on the maps in blue:

- Arch-1, along Hwy 160 from Pagosa Springs - Vault, Intersection of Hwy 160/Hwy 84 to Vault, Intersection of Hwy 160/Parelli Institute Drive
- Arch-3, along County Rd 600 from the Intersection of Cloman Road/Piedra Road to Hatcher Water Tower
- Arch-4, along Hwy 160 from the Intersection of Parelli Institute Drive to Intersection of Hwy 160/Hwy 151
- Arch-5, along Hwy 160 from the Intersection of Hwy 151 to Bayfield - Intersection of Hwy 160/151
- LaPlata-6, along Hwy 309 from the Intersection of Hwy 172/Hwy 309 to the Durango International Airport
- LaPlata-9, along Hwy 160 from Hesperus to Mancos
- LaPlata-10, from the Durango Lumen (formerly CenturyLink) Central office to the Durango Carrier Neutral Location
- LaPlata-11, from the vault at 65 Mercado St #250 in Durango, near Mercy Hospital to the vault near the police station at 545 Wilson Gulch Dr in Durango
- LaPlata-12, from the drop pole located at 1328 Co Rd 501 in Bayfield near the Foursquare Church to the Bayfield CNL located at 215 E Lakeside Dr, in Bayfield
- SUIT-1, from the TriState substation vault in Hesperus to Red Mesa
- Mont-1, along Hwy 160 from Mancos to Cortez Intersection Hwy 160/Hwy 145
- Mont-2, along Hwy 184 from Mancos to Dolores Intersection Hwy 184/Hwy 145

- Mont-3, along Hwy 145 from Dolores Intersection Hwy 184/Hwy 145 to Rico
- Dol-1, along Hwy 145 from Rico to Telluride
- SanJ-2, from the Zayo vault in Silverton, Tristate/LPEA Substation to the San Miguel Power Association Substation on Ophir Pass - Intersection Hwy 550/Forrest Road 679

Additionally, the plans to acquire IRUs on existing fiber from Zayo, Colorado Department of Transportation (CDOT), and TriState Generation, shown on the map in green:

- LaPlat-8 from the manhole at the Intersection of 2nd Ave/11th Street in Durango, to TriState's Substation (Drop Pole) in Hesperus
- St-1, along I-25 from Denver to Walsenberg from Zayo
- St-3, along Hwy 160 from Walsenberg to South Fork from Zayo
- St-3, along Hwy 160 from South Fork to Pagosa Springs from CDOT
- SanJ-1, along Hwy 550 from Cascade Village to Silverton from Zayo

This network, when built, will connect to Region 10 League for Economic Assistance and Planning's (Region 10) existing network starting in Cortez, which connects six counties to Grand Junction, Colorado, and then connects communities along the I-70 corridor to Glenwood Springs, Colorado. In Glenwood Springs, Region 10's network connects with Project THOR, which then connects to Denver. Project THOR is a middle mile network establishing carrier-class connectivity between 14 communities across Northwest Colorado and the Northwest Colorado Council of Governments Point of Presence in Denver.

Level of Broadband Need

All of the communities within the region are considered rural. Most of our communities, except for Durango and Cortez, are defined as unserved and underserved, lacking access to advanced broadband capacity. These include the communities of Mancos, Dove Creek, Dolores, Rico, Silverton, Bayfield, Ignacio, and Pagosa Springs. The housing and commercial developments located in unincorporated areas outside these communities are severely unserved. Below are the statistics according to BroadbandNow.

- La Plata County: 37% lack access to 100 Mbps, and 16% lack access to 25 Mbps
- Montezuma County: 42% lack access to 100 Mbps, and 11% lack access to 25 Mbps
- Dolores County: 76% lack access to 100 Mbps, and 15% lack access to 25 Mbps
- Archuleta County: 57% lack access to 100 Mbps, and 13% lack access to 25 Mbps
- San Juan County: 81% lack access to 100 Mbps, and 6% lack access to 25 Mbps

In addition to low speeds, customers pay high costs for poor connectivity. The lack of affordable and abundant connectivity curtails economic development, educational attainment, investment in businesses, entrepreneurship, and public safety responses. Compounding the situation is the lack of middle mile infrastructure within the region. Lumen is the only telecommunications backhaul provider in the region. Access to only one provider impacts pricing, further investment in broadband, and the ability to maintain connectivity during an outage. The lack of middle mile infrastructure has cut off our region, leaving our communities vulnerable to manmade and natural disasters and susceptible to outages. Investing in middle mile infrastructure in the southwest region of Colorado will not only impact our communities but will positively impact the entire 4-corners region and the entire State of Colorado.

In addition to lacking access to advanced broadband and middle mile infrastructure, our region has census tracts demonstrating persistent poverty or historically disadvantaged. This project will impact those regional census tracts (Montezuma County 9693, 9694) and historically disadvantaged (La Plata County 9403). Both counties support the needs of the two tribal partners by further expanding their successful grants awarded to-date.

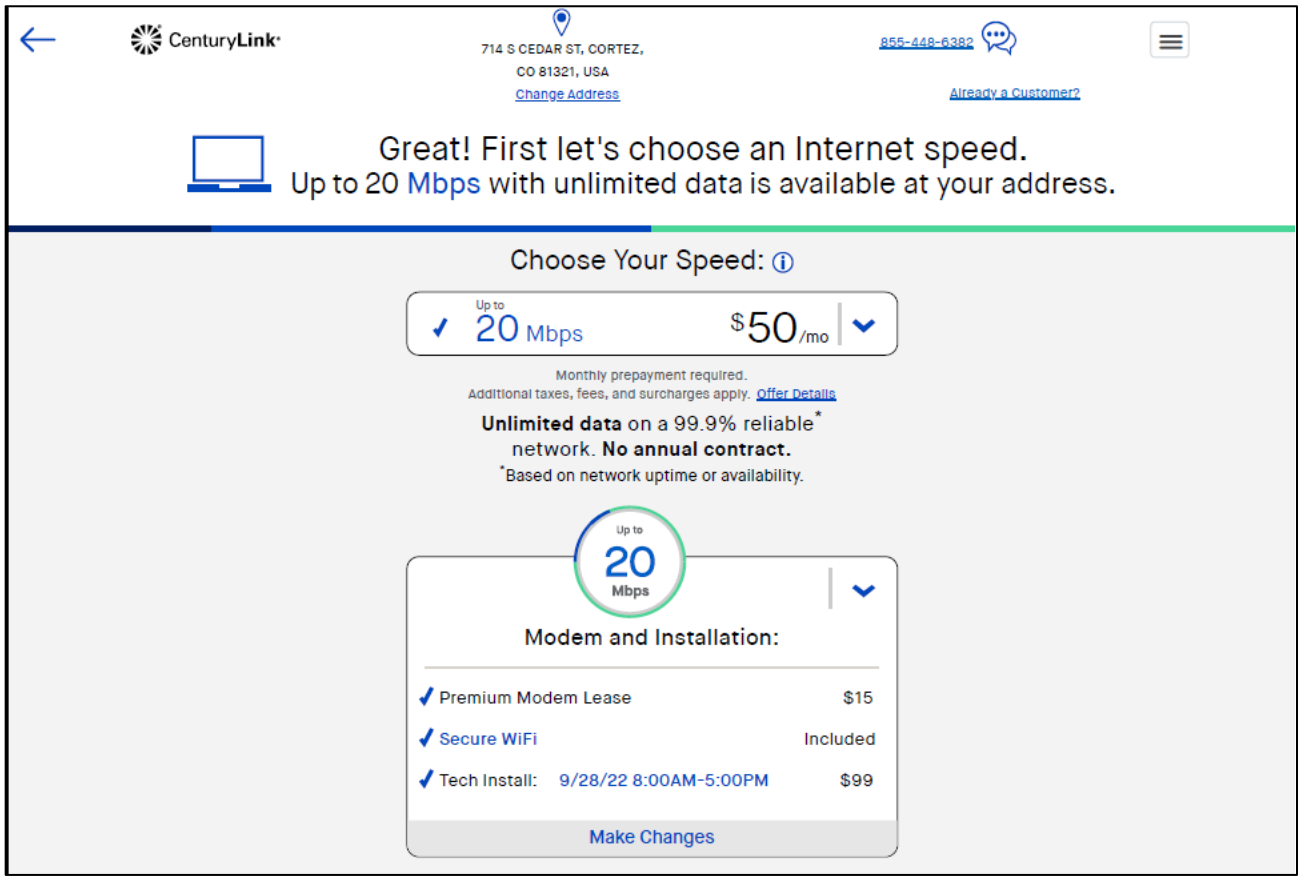
Southwest Colorado's total population is 129,054, with a median household income of $59,709. The top industry sectors are retail trade, accommodation and food services, and health care and social assistance, a reflection of our tourism and outdoor recreation jobs that tend to be lower wages. Retail trade is the largest employment sector in Region 9 area, with 8,364 jobs. In San Juan County, retail trade is not only the largest employment sector, it is 56% greater than the next employment sector, accommodations, and food services. This County has experienced frequent internet interruptions due to a lack of redundancy and, like most of the region, depends upon the ability to process credit and debit card payments. "The lack of needed middle mile infrastructure has crippled our business's ability to transact business on numerous occasions," said Beth Kremer, Economic Development Coordinator of San Juan County. "When outages have occurred, this has impacted access to cellular, 911, public safety, banking, credit card, and internet services."

The COVID-19 crisis exasperated the lack of broadband infrastructure even further. During the pandemic, the lack of broadband services made it even more difficult for students to attend classes, workers to telecommute and access workforce development training, and healthcare providers to serve the needs of the communities through online medical appointments. Investment in broadband will help strengthen our existing businesses, diversify our economies, improve economic development opportunities and incentivize additional business and entrepreneur investment in our communities. Additionally, investment in broadband infrastructure will improve the region's cellular, public safety, and emergency 911 services. Our ISPs will benefit from the project as it will reduce backhaul and transport services, dramatically improving their ability to reach end users and financially sustain their services. Several ISPs have expressed their intended investment in last mile services with the implementation of the project. These providers have demonstrated sustainable business plans to support such interconnection. Ting has committed to invest significantly in the region if this middle mile project is funded. Partnerships also extend to our electric coops, whose involvement will facilitate better power and utility management, supporting Automated Metering Infrastructure (AMI) and Supervisory Control and Data Acquisition (SCADA) operations. SCADA systems automate the monitoring, processing, distribution, recording, and display data gathered from remote field devices such as sensors, pumps, valves, and other end devices in power operations. CDOT's participation will allow for improved operations, vehicle location services, surveillance and provide emergency notifications, inclement weather, and road conditions notifications. And finally, filling gaps in our middle mile infrastructure will improve access to education, workforce development, and healthcare services.

Current Services

Southwest Colorado has significant middle mile fiber coverage gaps that we hope to fix through funding from the NTIA grant or other funding opportunities. A map of the middle mile project was provided with the grant application under Network Routes Maps and has been provided by NEO as a deliverable of the project. The green lines on the map indicate fiber that will be acquired through an Indefeasible Right of Use (IRU) from Zayo, TriState, and the Colorado Department of Transportation (CDOT). The red lines signify routes that are being provided as in-kind contributions. The blue lines are new priority fiber routes that will be constructed.

In Montezuma County, approximately 1,000 people do not have access to any wired internet service; 3,000 people do not have access to 25/3 Mbps. In the Town of Dolores (Montezuma County), Spectrum and Farmers claim to offer 1 Gbps; however, the average download speed is 11.62 Mbps. On the Ute Mountain Ute reservation in Towaoc, no broadband service is available in excess of 25/3 Mbps. However, the tribe has just received grant funding through the State of Colorado and is building out FTTP infrastructure. Lumen (formerly CenturyLink) claims to offer Gigabit service in the City of Cortez, Montezuma's largest city. However, when ground truthing this availability, only 20 Mbps is available to be ordered from Lumen (formerly CenturyLink). A screenshots of Lumen (formerly CenturyLink)'s advertised service, according to their website, is provided below.



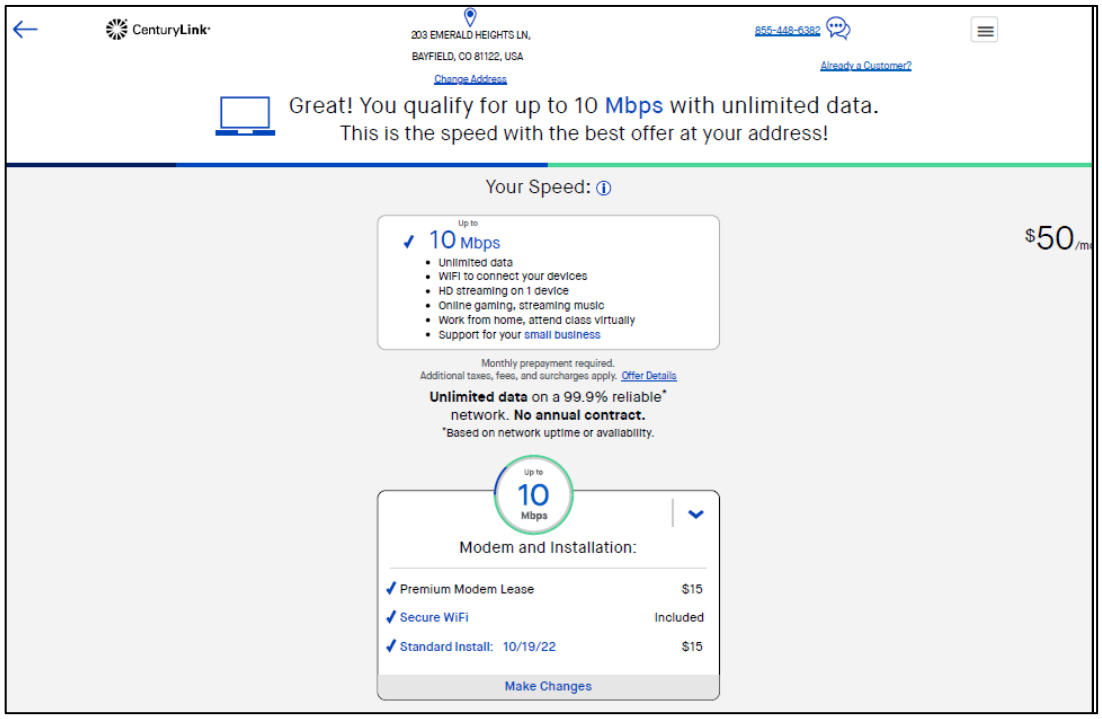
The City of Cortez has built an FTTP network throughout some of the community, and several companies are using this network to offer services to residents and businesses. In addition, the City has limited middle mile fiber serving the community.

Also, in Montezuma County, in Mancos, a town of 1,300, 64% of Mancos residents are still severely limited in wired broadband choices. Lumen (formerly CenturyLink), Farmers, Visionary, and Spectrum provide service. Spectrum claims to offer 1 Gbps of service, but upload speeds available from Spectrum are less than 20 Mbps.

In Dolores County, with a population of less than 2,000, approximately 100 people, or 5% of the county, do not have access to any wired internet service. Rico is served solely by Farmers Telephone. The average download speed in Rico is 13.31 Mbps, according to BroadbandNow. The Town of Dove Creek is not included in the middle mile network as Emery Telephone has secured funding to build out Fiber to the Premise within

Dove Creek. Emery has been at the regional table and looking at additional ways to connect our communities to Utah.

In La Plata County, approximately 3,000 people do not have access to any wired internet service. Approximately 9,000 people do not have access to 25/3 Mbps. Durango is the largest community in La Plata County, with almost 20,000 residents, and Ting, a local ISP, has recently announced building out FTTP. Durango supports a number of other providers, including Lumen (formerly CenturyLink), Spectrum, Visionary, AlignTec, Vero, and Brainstorm. Currently, 15% of people living in Durango have residential fiber service available to them. In neighboring Hesperus, 6.8% of the community is able to receive Ting Fiber. Lumen (formerly CenturyLink), Farmers, Brainstorm, Vero, and Visionary Broadband offer services in Hesperus, but none of the providers offer more than 100 Mbps. Bayfield, another community in La Plata County, has Lumen (formerly CenturyLink), which claims to offer 940 Mbps; however, when one enters address data into Lumen (formerly CenturyLink)'s website to check availability, for most households, only 3 Mbps is available to be ordered. In some cases, one could order 10 Mbps. Screenshots of Lumen (formerly CenturyLink)'s service are provided below. Plus, paying $50/month for this level of service is expensive.



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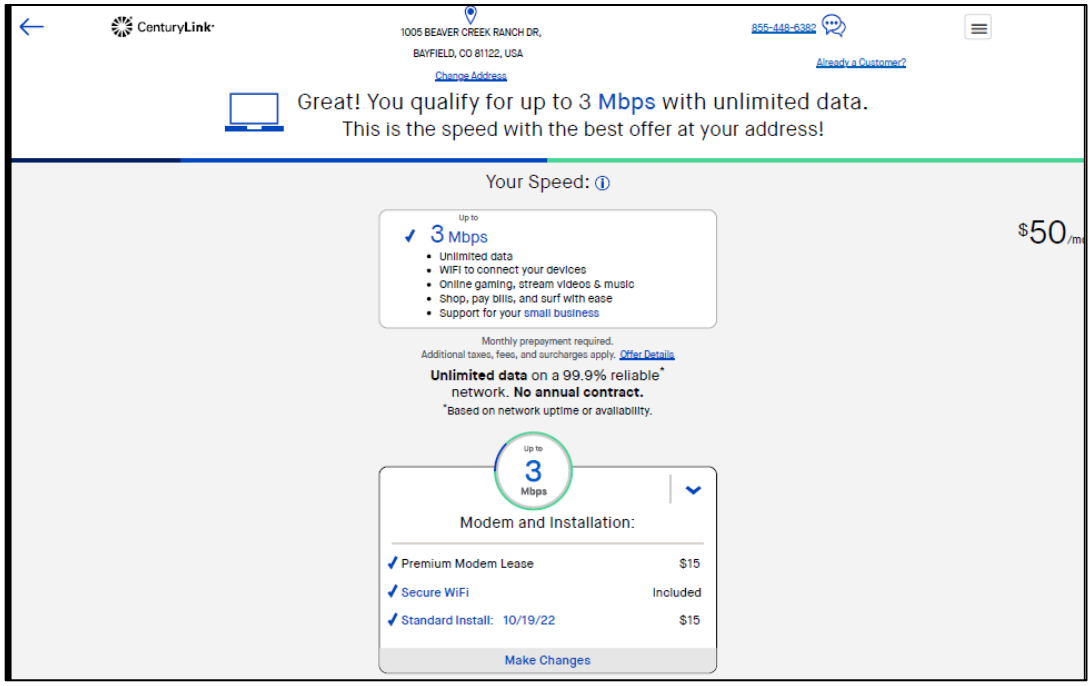


Ting has built fiber to 5.7% of the households in Bayfield. Other providers include those mentioned above for Durango, with the addition of Zito Media offering cable services to approximately 27.9% of the households. However, 69% of Bayfield residents are still severely limited in wired broadband choices.

The Southern Ute Tribe and the Town of Ignacio, located in La Plata County, have received grant funding to build out Fiber to the Premise (FTTP) services.

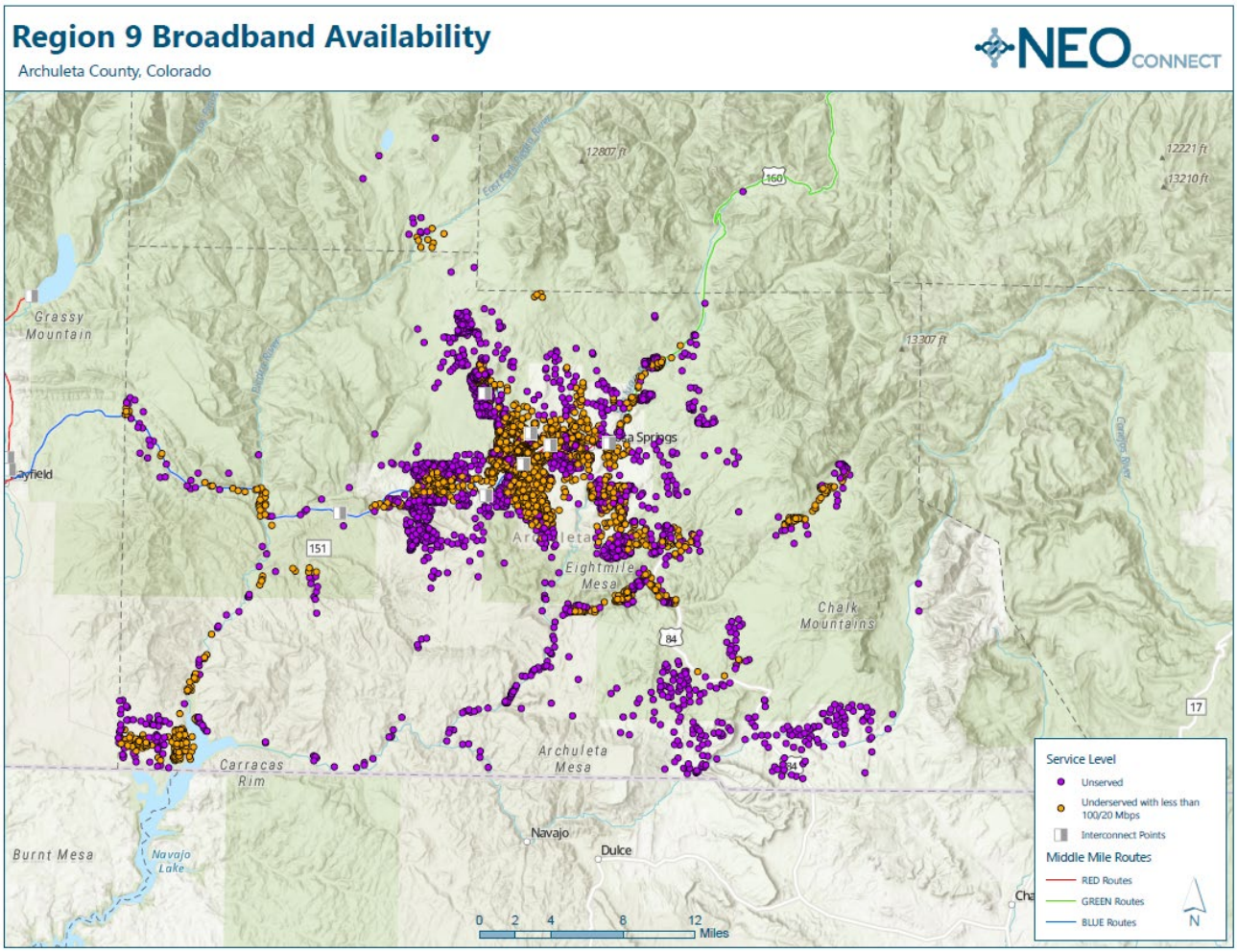
San Juan County's only town, Silverton, is cut off from most of the world with no resilient middle mile infrastructure available. Vero and Clearnetworx offer fiber service to a small portion of the community. Both companies expressed the need for better, more affordable backhaul and transport services.

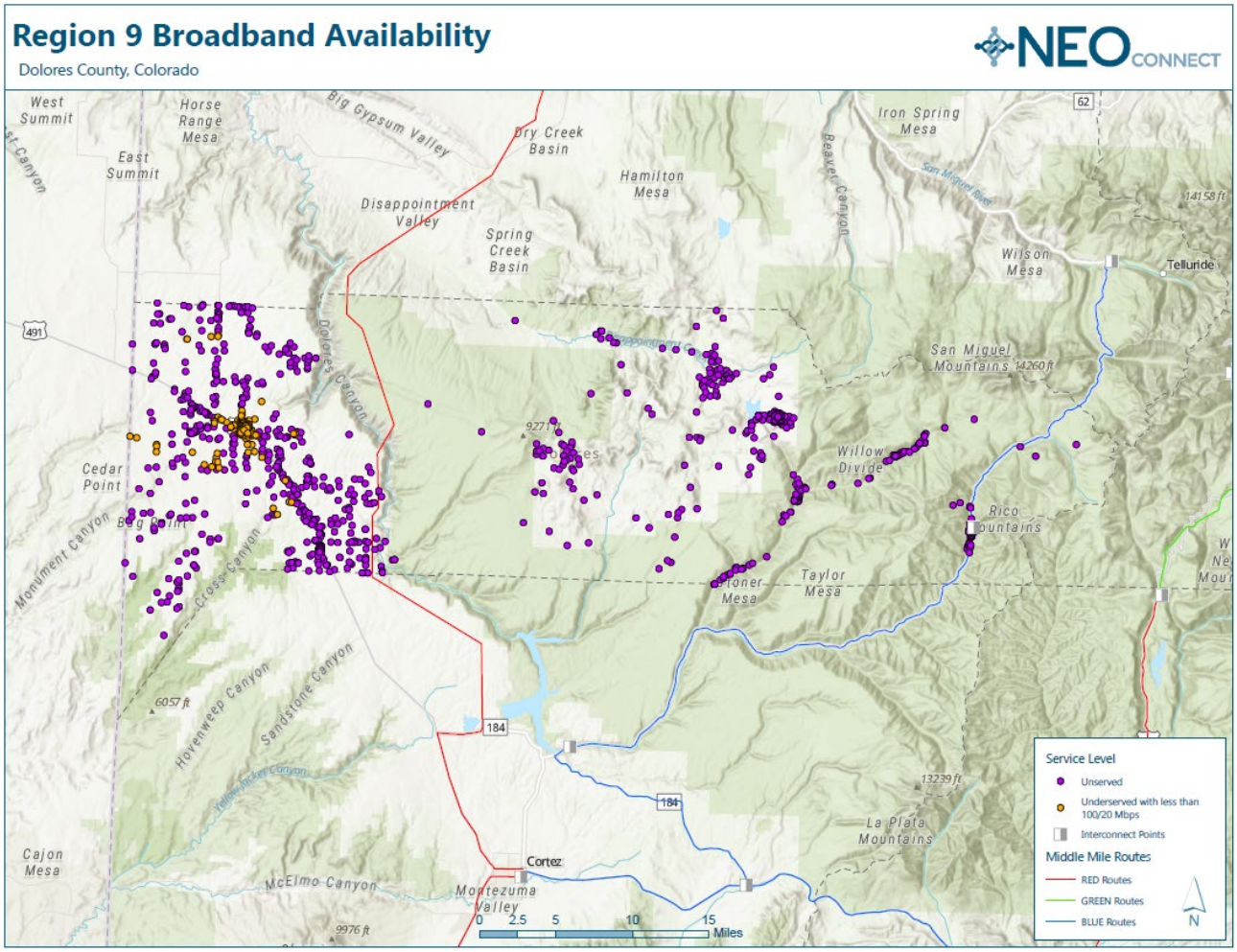
In Archuleta County, 54.3% or 6,000 people in Pagosa Springs have access to one or fewer wired internet providers. In addition, Zito offers cable service to 45% of the residents in Pagosa Springs. Other providers include Lumen (formerly CenturyLink) and Visionary, but neither company offers service greater than 100 Mbps. Visionary has started offering Gigabit services to a number of customers in the downtown area. Archuleta County, like Silverton, lacks resilient middle mile infrastructure, with all three incumbent providers relying primarily on the single Lumen fiber from Pagosa to Bayfield as their means of supplying bandwidth to the community.

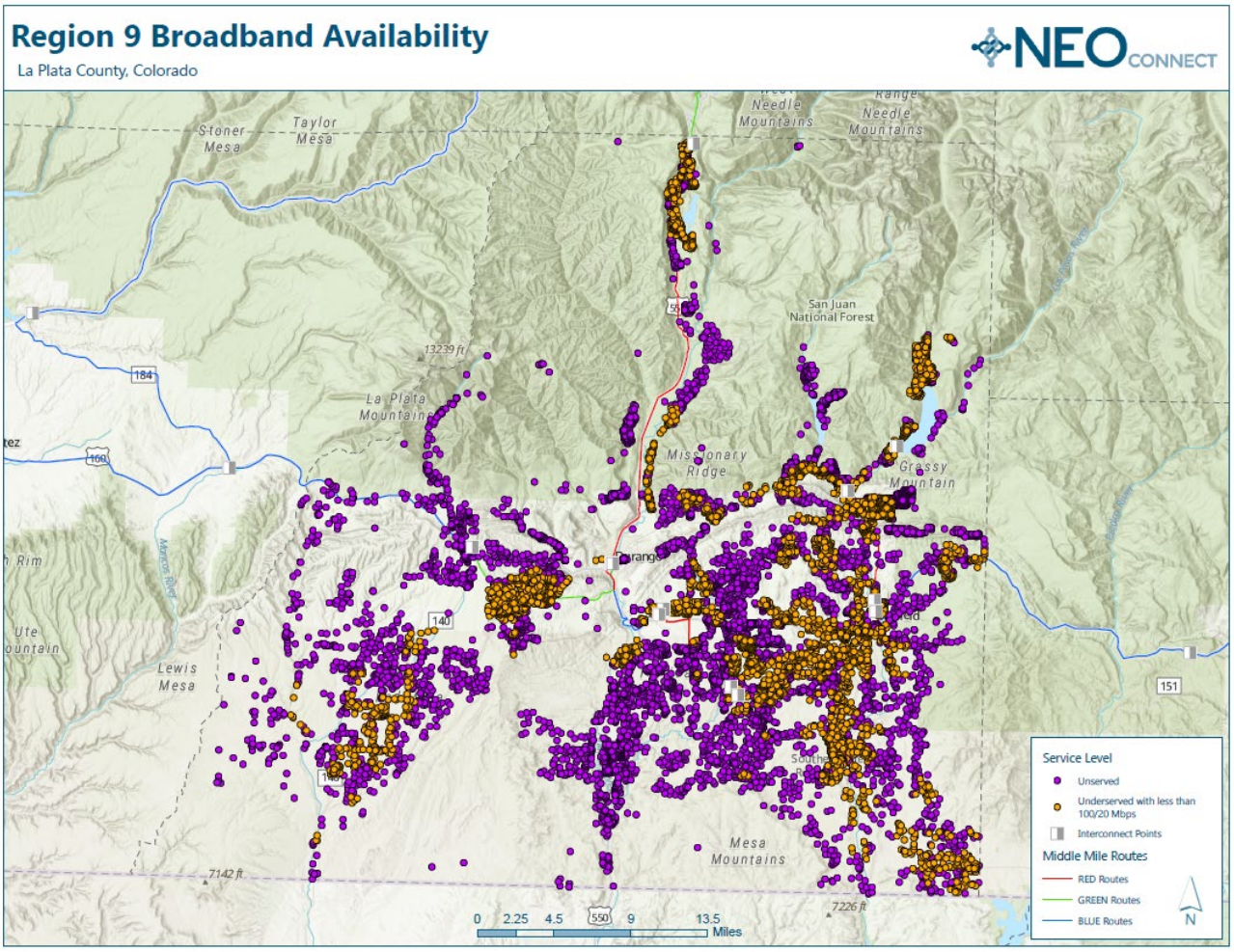
Although some investment has been made in last mile fiber in the region, the lack of existing middle mile infrastructure has been an impediment to further investment. Service providers have not been willing to invest in middle mile fiber simply because the return on investment is nonexistent with large expanses between communities and undulating mountainous terrain making building fiber difficult and expensive. With funding from the grant application, numerous ISPs will invest in last mile infrastructure as the business case dramatically improves for ISPs seeking a reasonable return on investment.

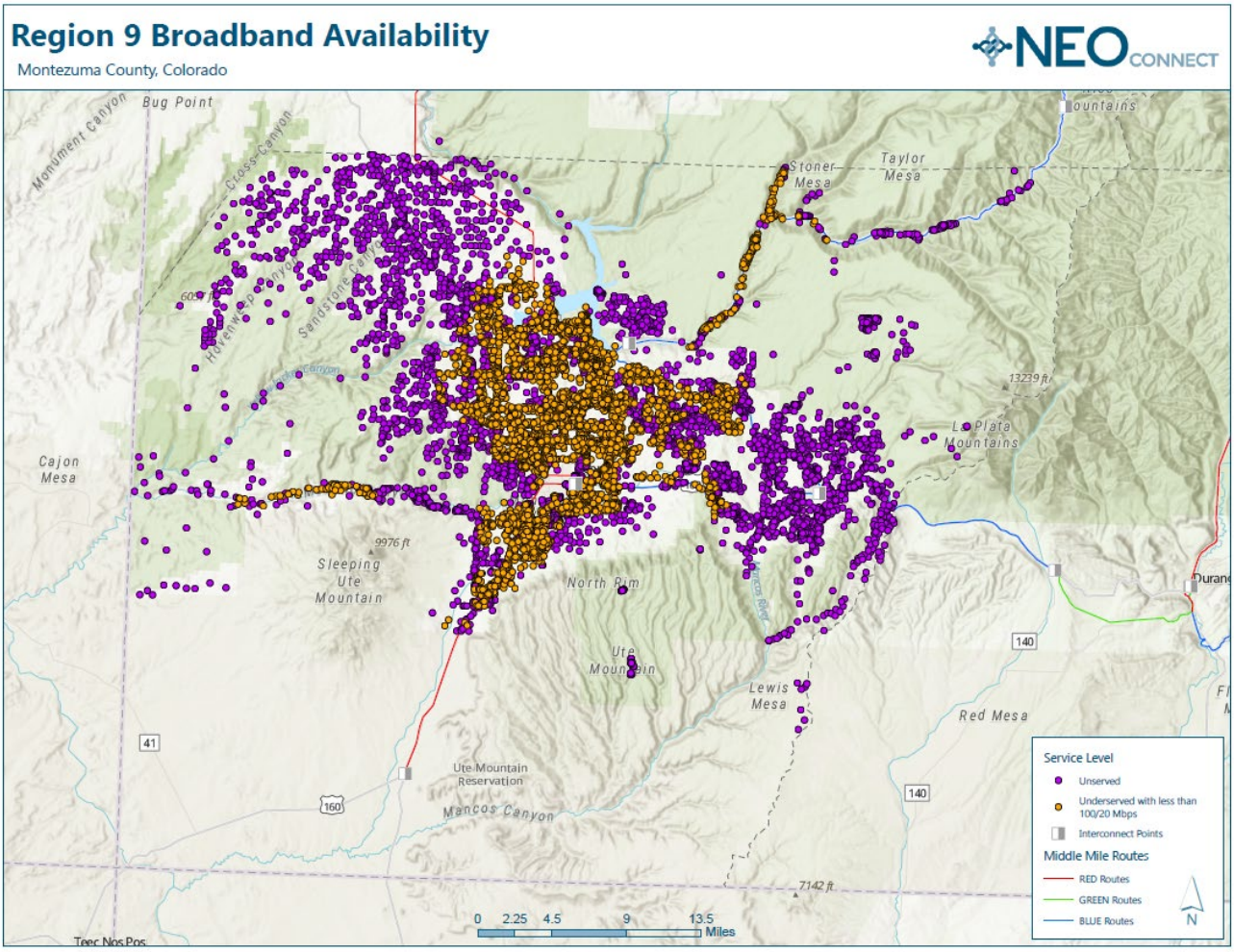
In all of the counties' unincorporated areas, services are severely lacking. Maps have been provided that show the unserved and underserved households throughout the region and are shown below. Further strategies are being developed with ISPs to invest and seek BEAD and other grant funding to build FTTP.

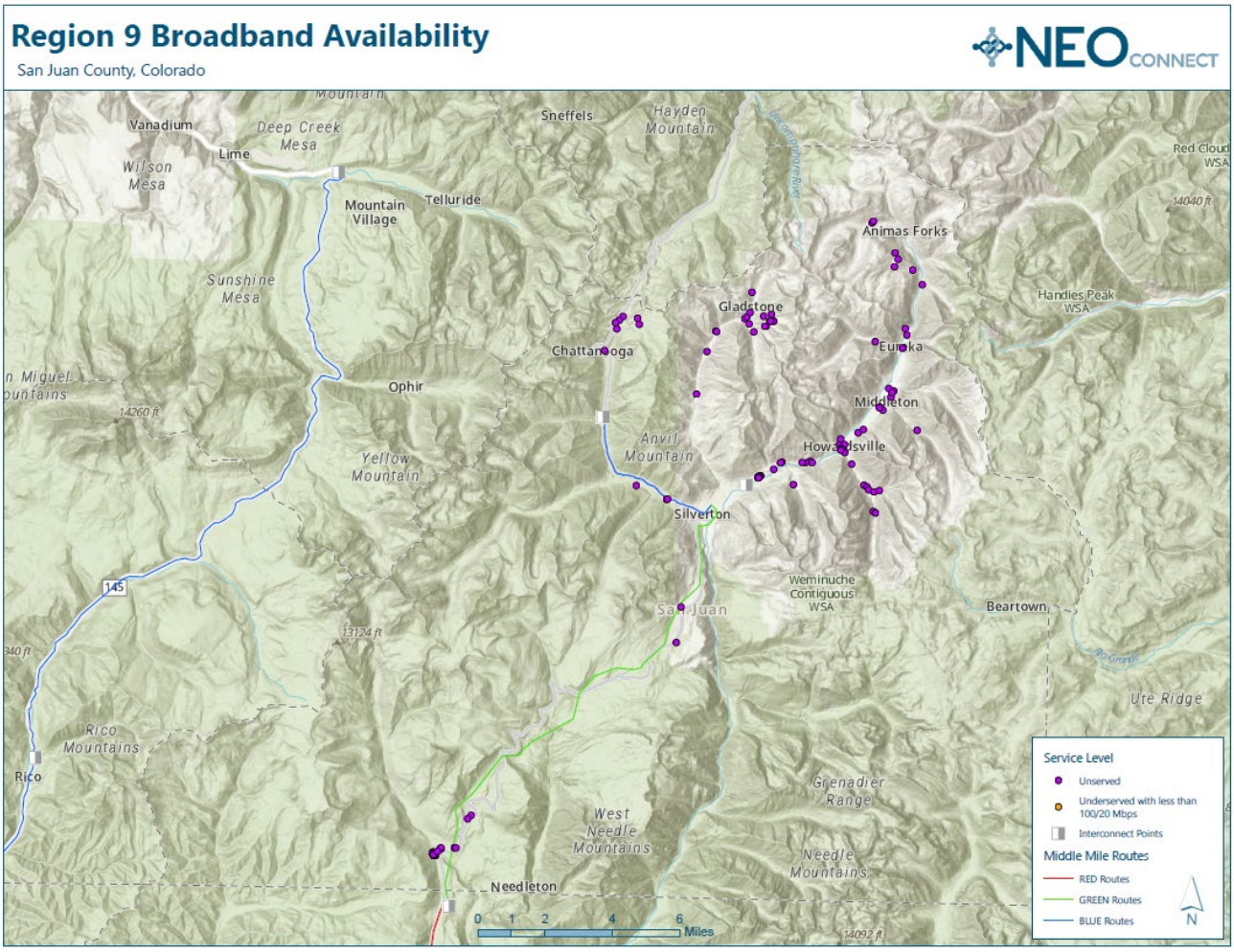
- La Plata: 8,482 unserved, 7,946 underserved households
- Montezuma: 5,186 unserved, 5,454 underserved households
- Dolores: 1,186 unserved, 457 underserved households
- Archuleta: 2,883 unserved, 4,324 underserved households
- San Juan: 130 unserved and 0 underserved households with a total population of 736.




Region 9 Broadband Availability
Dolores County, Colorado
NEO CONNECT
West Summit
Horse Range Mesa
East Summit
Big Gypsum Valley
Dry Creek Basin
Hamilton Mesa
Disappointment Valley
Spring Creek Basin
Iron Spring Mesa
Beaver Canyon
San Miguel River
14158 ft
Wilson Mesa
Telluride
62
491
Dolores Canyon
San Miguel Mountains 14260 ft
Willow Divide
Rico Mountains
Cedar Point
Beg Cliff
Monument Canyon
Cross Canyon
Ironer Mesa
Taylor Mesa
Hovenweep Canyon
Sandstone Canyon
6057 ft
184
13239 ft
La Plata Mountains
Cajon Mesa
McElmo Canyon
Cortez
Montezuma Valley
9976 ft
0 2.5 5 10 15 Miles
Service Level
Unserved
Underserved with less than 100/20 Mbps
Interconnect Points
Middle Mile Routes
RED Routes
GREEN Routes
BLUE Routes
N


Region 9 Broadband Availability
La Plata County, Colorado
NEO CONNECT
Stoner Mesa
Taylor Mesa
Needle Mountains
Needle Mountains
San Juan National Forest
13239 ft
La Plata Mountains
Missionary Ridge
Grassy Mountain
Lewis Mesa
Mesa Mountains
7142 ft
7226 ft
184
160
140
550
151
0 2.25 4.5 9 13.5 Miles
Service Level
Unserved
Underserved with less than 100/20 Mbps
Interconnect Points
Middle Mile Routes
RED Routes
GREEN Routes
BLUE Routes
N


Region 9 Broadband Availability
Montezuma County, Colorado
NEO CONNECT
Bug Point
Monument Canyon
Cross Canyon
Stoner Mesa
Taylor Mesa
13229 ft
La Plata Mountains
Cajon Mesa
9976 ft
Sleeping Ute Mountain
North Rim
Ute Mountain
Lewis Mesa
Red Mesa
Ute Mountain Reservation
Mancos Canyon
7142 ft
41
160
140
0 2.25 4.5 9 13.5 Miles
Service Level
Unserved
Underserved with less than 100/20 Mbps
Interconnect Points
Middle Mile Routes
RED Routes
GREEN Routes
BLUE Routes
N



Connecting Community Anchor Institutions

The NTIA grant required connecting any community anchor institutions that are located within 1000 feet of the proposed network. The SCAN network currently serves 129 community anchor institutions with fiber, of which 53 are located within 1000 feet of the proposed middle mile network. Though the project will not build new fiber to these existing locations, 123 other CAIs are located within 1000 feet of the proposed middle mile network and will be served with 1 - 10 Gbps service with the application. Please refer to the CAI maps provided by NEO as a deliverable of the project, as well as the list of anchor institutions that will be connected with the grant if funded.

Collaborative Efforts in Broadband Planning

This project is the result of a long-time collaboration of all the government jurisdictions that began in 2010 with the building of the SCAN open access network. Monthly coordination meetings are held for the Broadband Stakeholder Team, including area governments, county-level economic development organizations, La Plata Electric, TriState, Empire Electric, CDOT, Fort Lewis College, and the neighboring regions of Region 8 (San Luis Valley) and Region 10.

Internet Service Providers, including Clearnetworx, Ting, Farmers Telephone, Emery Telephone, Arcadian Networks, Visionary, Vero, Deeply Digital, FastTrack, AlignTec, and Zito Media, have met regularly during the planning process to facilitate a comprehensive broadband strategy for the region. All of these last-mile broadband providers have expressed interest in interconnecting with the middle mile infrastructure planned to be deployed. Additionally, our team has met regularly with Brandy Reitter, Executive Director at the Colorado Broadband Office, and her staff.

All of these regional stakeholders, including the State of Colorado, are well aware of and are incredibly supportive of our project and have been working closely to design the project. Reitter and her team members have attended Region 9's weekly broadband team leads meetings that began in the summer of 2022, as well as having a standing weekly meeting with Region 9 to provide technical assistance and guidance as needed.

Since January 2022, the Broadband Stakeholders Team has been meeting monthly to share information and collaborate around the needed service gaps, including joint grant applications and working in cohesion on a Regional Broadband Plan. The collaborative efforts have identified and mapped fiber optic assets throughout the region and supported our tribe's successful applications for several grant awards for building fiber within the two tribal territories of our region.

Furthermore, the team of partners has collaborated with our neighboring regions, Region 8 and Region 10, and the Colorado Department of Transportation to identify priority routes to provide continuous fiber throughout the region and the State of Colorado.

Implementation of Middle Mile Fiber, 5-year Timeline

Collaboration from stakeholders has facilitated the timely execution of the project on several fronts:

- Empire Electric will contribute pole attachments as an in-kind for 20 years
- CDOT will provide access to their right of ways along State highways as an in-kind contribution
- Archuleta County will provide access to their right of ways along County roads as an in-kind contribution
- La Plata Electric will provide existing fiber as an in-kind contribution
- The Southern Ute Indian Tribe will provide access to their fiber that is being built through several of their successful grant programs
- The Ute Mountain Ute Indian Tribe will provide access to their fiber that is being built through several recent successful grant programs
- IRUs will be acquired from TriState, CDOT, and from Zayo to timely connect some of the key routes in the region

Year One: Upon grant approval, service agreements will be signed with all partners as applicable, outlining their responsibilities and commitments to the project. After this, several RFPs will be written, and a competitive bid process will be held for the fiber construction labor, materials, and equipment. Region 9 staffing support for the grant implementation will also be confirmed. Key milestones for the first year will be completing the environmental review, the final design, awarding the RFPs, and obtaining permits.

In Year Two, the IRUs will be acquired, the equipment will be placed, and construction of the network will begin. Management of all project budgets and weekly meetings of broadband stakeholders will occur along with project teams.

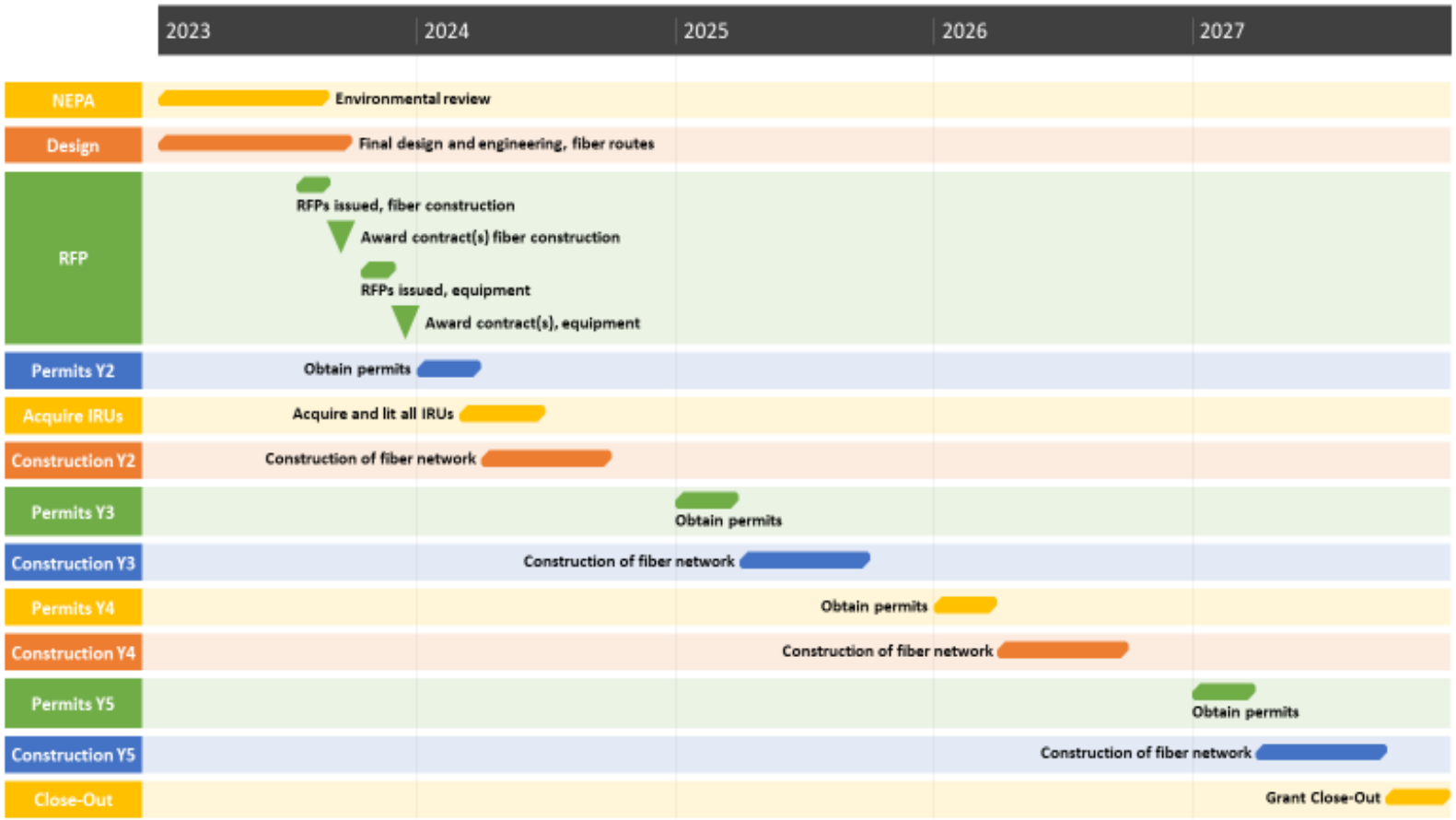
Years Three through Five: Continued permitting and construction of the fiber network. While each fiber network route is being constructed, construction of fiber to the community anchor institutions within 1000 feet of the network will also be completed, and the network will be tested and turned up.

During the fifth year, all remaining work under the grant will be completed and closed out.

Implementation Team

The team that Region 9 has assembled has vast experience in monetizing, designing, building, overseeing construction and implementation of middle mile and last mile fiber networks as well as a wealth of best practices gained to ensure fiscally sustainable operation of these networks.

The timeline provided on the next page outlines key milestones, tasks, and respective timeframes. Key preparations include conducting the environmental review and final design of the fiber routes.


2023
2024
2025
2026
2027
NEPA
Environmental review
Design
Final design and engineering, fiber routes
RFP
RFPs issued, fiber construction
Award contract(s) fiber construction
RFPs issued, equipment
Award contract(s), equipment
Permits Y2
Obtain permits
Acquire IRUs
Acquire and lit all IRUs
Construction Y2
Construction of fiber network
Permits Y3
Obtain permits
Construction Y3
Construction of fiber network
Permits Y4
Obtain permits
Construction Y4
Construction of fiber network
Permits Y5
Obtain permits
Construction Y5
Construction of fiber network
Close-Out
Grant Close-Out

Workforce Priorities, Implementation Team

As the project lead, Region 9 is in a unique position to be already working on workforce priorities and educating our communities through data reports and presentations. For example, census data shows that Colorado workers will be more ethnically diverse in the future, and we must figure out how to make them both feel welcome in our communities and be job ready. In addition, we have a network of county-level economic development professionals in which we can conduct targeted outreach to a diverse pool of workers.

Region 9 will work closely with our team of management, financial staff, and contractors to ensure appropriate credentials and skills. Region 9 has a representative on the Southwest Workforce Board of Directors that oversees an 11-county rural area. Region 9 and partners will utilize this board and other resources for training opportunities and recruitment. We have two community colleges (Pueblo Community College Southwest and San Juan College 30 miles into New Mexico) and one four-year institution of higher learning, Fort Lewis College, in our region. Region 9 has experience in coordination to address workforce issues.

The environmental assessment's previously recorded archaeological and historic resources will be completed by a firm with an archaeologist. Biologists will conduct the biological field survey report. The remaining portions of the environmental assessment will be conducted by a firm with a minimum of eight years of conducting and providing compliance with NEPA, SHPO, and TERO requirements.

Design and engineering will be completed by a firm that has licensed professional engineers and a minimum of eight years of experience design and engineering middle mile and last mile fiber networks. In addition, project managers, construction firms, consultants, and construction managers will be provided by companies whose key people have experience in the fiber optic and construction management field.

Here are the job titles of the environmental assessment, design and engineering, construction and project management firm, consulting firms, and construction contractors that will be hired as contractors by Region 9:

Environmental Assessment Firm, Archeologist
Environmental Assessment Firm, Biologist
Environmental Assessment Firm, NEPA compliance consultant
Design and Engineering Firm, Professional Engineer
Design and Engineering Firm, Estimator
Design and Engineering Firm or Consulting Firm, Construction Manager
Design and Engineering Firm or Consulting Firm, Project Manager
Grant Compliance and Management, Consultant
Construction Firm, Construction Manager
Construction Firm, Fiber Construction Crew(s)
Construction Firm, Fiber Splicer(s)

A subcontracted workforce will perform this work. To ensure an appropriately skilled workforce, Region 9 will require firms to identify their key employees and provide their resumes, certifications, years working in the industry, and required professional licenses. Design, engineering, consulting and project management services

will be contracted using Region 9's procurement process and in compliance with federal and state requirements. Construction contractors will provide traffic management for all fiber routes, and to guarantee the safety of all, workers will be required to attend safety and traffic management training. In addition, construction contractors must provide proof of a robust in-house safety program for all workers.

Skilled Workforce

While the United States is undergoing a workforce shortage, Southwest Colorado, though aging like the rest of the nation, has a youthful workforce compared to the rest of the country. Colorado is also an in-migration state attracting workers from other states. The Colorado Demography Office has forecasted the working population growth by county between 2020 and 2030, and none of our five Southwest Colorado counties show a decline. https://demography.dola.colorado.gov/.

Our region is seeing a significant focus in our area high schools on Career & Technical Education (CTE) offerings to include more industries and trades in many of our area high schools. Some examples include the Innovation Center at Durango High School Campus, which has broken ground; a CTE facility on the Bayfield HS campus which includes work with Skills USA and HOSA – Future Health Professionals and Durango High Durango High School, which offers six career clusters with over 50 CTE courses and multiple career based clubs. The Montezuma-Cortez District and Durango District 9R are part of the Homegrown Talent Initiative that fostered industry leaders working with students, teachers, and school administrators to develop competency skills that will inform course development for post-secondary pathways. We have a Region 9 staff member participating in this initiative. The Southwest Colorado Education Collaborative was formed to integrate regional industries and high school interns into robust career pathway experiences like environmental science and building trades by partnering with local businesses to provide opportunities for students to job shadow; providing individually tailored internships; offering mobile learning labs that transcend traditional brick-and-mortar learning; and training students on the newest industry technologies. Business Education Connection (BEC) connects high school students with work-based learning and internship opportunities in professional environments. Animas High School in Durango is building its new facility on the campus of Fort Lewis College, our region's 4-year institution, which provides more cross-curriculum collaboration. Our awareness of these resources will result in utilizing them to help meet the needs of the project.

With improved internet connection and resilient broadband, people can stay in the rural communities they live in and, for many, where they grew up. Advanced broadband capacity helps to keep people in these communities by expanding job opportunities and ensuring people can work remotely if they choose and are able to. Broadband expansion, especially through fiber optics, also presents the opportunity to reskill workers from mining and oil and gas jobs – industries that have been declining rapidly in our area for years. An example of this can be found in Delta County, Colorado. They saw their coal mines shut down, and many people lost employment between 2014 and 2016. As a result, many people searched for jobs elsewhere, which meant relocating and leaving their homes. To keep people employed and in their communities, laid-off coal miners were trained to install fiber. SW Colorado looks to follow a similar model to train workers in the growing broadband and fiber optics field.

Technical Workforce and the Technical Team

For the new fiber routes that will be built, Region 9 will hire or contract with a project manager(s) experienced with managing aerial/buried fiber installation in the region to oversee the construction of the middle mile fiber network sections. These sections will be bid out to qualified fiber installation companies. There are a

number of CO and NM based companies that members of Region 9 have utilized to construct middle mile fiber networks in this area, and they will be notified when the bids are released. They will be considered as well as any other qualified contractors to build the network that respond to an RFP, and the construction contracts will be awarded by Region 9 on a best value basis. Once these sections are complete, and in operation, the maintenance and management of this fiber network will be managed by Region 9's staff and advice and oversight will be provided by a newly formed Broadband Technical Committee comprised of technical leads from within the region.

For the maintenance and management of CNL facilities that interconnect the Internet backhaul into and out of the region to the local backbone middle mile, these will be managed by each county they reside in, unless they don't have the technical capability and want Region 9 to have the Technical Committee to contract for management services. The aforementioned personnel that will form the initial committee have ample experience in managing data center type facilities.

Region 9 will purchase DWDM equipment to "light" the network. DWDM stands for Dense Wavelength Division Multiplexing, which is an optical multiplexing technology used to increase bandwidth over existing fiber optic backbones. The "dense" here refers to the fact that DWDM technology supports more than 80 separate wavelengths, each about 0.8 of a nanometer (nm) wide on a single optical fiber.

For the proposed DWDM ring that interconnects Region 9 to Denver, via two diverse paths, Region 9 expects to contract with Region 10 for a number of initial years, to configure and manage the DWDM and regeneration equipment needed to allow the ring to function, and to sell wavelengths and lit services to area ISPs.

Local ISP Support

Last mile objectives for the project include providing FTTP or Gigabit-enabled last mile services to the homes and businesses that are currently unserved or underserved. Region 9's goals are in alignment with the Executive Order signed by the State of Colorado's Governor Polis to develop plans to connect 99% of Colorado households to high-speed broadband capable of a minimum of 100/100 Mbps by 2027. Letters of intent have been received by Ting, Farmers Telephone, and Vero to provide services of a minimum of 100/100 Mbps for last mile services in the region. Region 9 will continue to work with service provider partners to facilitate private and grant program investment in last mile services. Region 9's network will be available on a non-discriminatory basis for interconnection to terrestrial and wireless last mile broadband providers and any other party making a bona fide request.

Region 9, through its affiliated and predecessor entity, the Southwest Colorado Council of Governments, conducted an RFI process in July of 2021 to engage private sector partners to work with Region 9 and its local government partners. Through this process, several ISPs, including Ting, Clearnetworx, Arcadian, Deeply Digital, Emery Telecom, Geoverse, Mammoth Networks, and Visionary, responded with commitments to build out last mile services, partner on grant opportunities, and work with the stakeholders in regional broadband planning activities.

Region 9 will provide dark fiber services to ISPs and other providers. Dark fiber services on the routes that will be provided as in-kind contributions and as IRUs can be provided immediately, and revenue from the network can be received as soon as the end of the first year or beginning of the second year. As various new fiber routes are constructed, additional dark fiber services on these segments can be provided and monetized.

Region 9 expects to partner with Region 10 to provide network monitoring and provisioning of lit services on the network such as Dedicated Internet Access and backhaul/transport services, along with collocation space at the Carrier Neutral Locations (CNLs) within the region.

Region 9 plans to coordinate participation in the State's BEAD program further to facilitate investment in Gigabit-enabled last mile broadband infrastructure. Region 9 will work with private sector partners to develop a plan to leverage this and any other funding mechanisms to meet Governor Polis's goals for the region.

Lack of Middle Mile Infrastructure in the Region, Why this is Important

Region 9 has been working closely with Region 10 to develop missing middle mile connections throughout the 5-county area. Currently, the region primarily supports one middle mile provider, Lumen (formerly CenturyLink). In addition, EagleNet, TriState, FastTrack, and CDOT have existing fiber located between communities. FastTrack and Lumen (formerly CenturyLink) offer lit services between Pagosa and Durango.

Broadband networks require access to an Internet "supply" – locations with an Internet hub, backhaul, or transport point, located in larger population centers. These Internet hubs can either be accessed by building fiber directly to the location, utilizing a point-to-point digital microwave link, or leasing existing infrastructure. The costs for leasing existing facilities or backhaul are often based upon mileage to the internet hubs. In either of these options, the costs to build directly from the Internet "supply" to rural areas are extremely capital intensive, and/or the monthly access charges for leasing infrastructure are too high. For example, in southwestern Colorado, the closest primary internet hub is located in Denver, over 385 miles away and seven hours by road. Albuquerque is 275 miles from Durango, a three-and-a-half-hour drive.

Lumen (formerly CenturyLink) offers lit services in this region and has fiber to the regional internet hubs in Albuquerque, Farmington, Salt Lake City, Denver, and Grand Junction. However, to date, Lumen (formerly CenturyLink) has not allowed other entities or local governments to "tap into their fiber" to extend a network, as is common for new homes to tap into a main waterline. Lumen (formerly CenturyLink) has recently allowed other ISPs to lease dark fiber for connectivity to the various communities, but their excess fiber is limited, and they, in most cases, are the only company that has fiber in the region and therefore, the lack of competition still does not drive down backhaul costs. Additionally, as discussed in the Level of Need section, Lumen (formerly CenturyLink) claims to offer Gigabit service in Cortez, however only 20 Mbps is available as shown on the screenshots from their website, attached to the upload portion of this section. The only option to access the existing fiber infrastructure is to lease fiber and pay for the backhaul and transport fees to the Internet hubs. Since these costs are based upon mileage back to the Internet hubs, the monthly access fees and dark fiber lease fees are high. The only realistic options are to subscribe to the high monthly service fees or build back the long distance to the internet supply.

These high monthly backhaul charges or capital costs to connect to Internet hubs are difficult to finance since most rural areas do not have the population to support an adequate return on investment for any providers to upgrade their networks.

In addition to needing alternative routes in and out of the region for redundancy, having access to faster, more affordable broadband services are also needed. Having more options to serve the market in terms of network facilities in and out of the region would not only impact the lack of redundancy options available, but also, having other alternatives to serve the region would greatly lower the costs for the current service providers providing services.

An example of these high backhaul costs is the Archuleta School District pays $2,000/month for a dedicated Gigabit service. Region 10 plans to offer dedicated Gigabit service for half of these costs.

This project will have a direct impact on expanding services to unserved and underserved homes, of which there are many throughout our region. As highlighted in the Level of Need section most of the communities in the application, except for Durango and Cortez, are considered unserved or underserved and lack access to advanced broadband capacity. Included in this upload section are county-level maps showing these unserved and underserved areas.

Stakeholders in the region have also been working to establish Carrier Neutral Locations in the region. New CNL facilities have recently been funded to be established in Cortez, Durango, Bayfield, Pagosa Springs, and plan to be funded in Alamosa.

Section 2, Capital Costs, Financial Impacts, Budget for Middle Mile Infrastructure

Fiscally Sustainable Middle Mile Strategies

Region 9 will adopt the following fiscally sustainable middle mile strategies:

1. Secure use of existing fiber through either acquisition of an IRU or through in-kind contributions. During the planning and collaboration process of this report, Region 9 worked with numerous stakeholders to identify existing fiber optic infrastructure and to negotiate use of existing fiber. Region 9 will acquire Indefeasible Rights of Use (IRUs) from the Colorado Department of Transportation (CDOT) and from Zayo for significant portions of the proposed middle mile network. The annual maintenance fees for these IRUs have been negotiated as an up-front payment included in the IRU capital costs for these routes. Therefore, Region 9 will not incur any annual maintenance fees as an operating expense. This is a fiscally sustainable approach minimizing Region 9's annual operating expenses.

Additionally, Region 9 has worked with La Plata Electric Association, TriState and with Region 10 who have built fiber infrastructure in the project area and will be providing fiber as an in-kind contribution. Region 9 has also collaborated with the Ute Mountain Ute Tribe and with the Southern Ute Tribe who will be building fiber optic middle mile infrastructure through their respective successful grant applications. Acquiring an IRU or obtaining access and use of existing fiber through an IRU significantly reduces the capital costs required to build these routes. Additionally, as these routes are existing, they can be immediately monetized through dark fiber leases or backhaul and transport services to the internet service providers, providing an immediate revenue stream to Region 9. And finally, the annual operating expenses to maintain the existing fiber will remain with the fiber infrastructure owners, eliminating a potential recurring annual expense for Region 9.

2. Secure in-kind pole attachment fees for 20 years. Most of the contemplated fiber routes will be constructed using underground construction methods. There are a few routes that will be built using existing utility poles through aerial construction. Empire Electric has agreed to provide its annual pole attachment fees, as an in-kind contribution to Region 9 for 20 years. Pole attachment fees are an annual operating expense for most infrastructure providers. Region 9 will not incur any annual pole attachment fee operating expenses for its middle mile network, through this agreement with Empire Electric. Additionally, during the final design and engineering stage of the grant implementation, if there are routes that can be built aerially, or through partnership with other electric cooperatives, Region 9 will continue to work with its stakeholders, TriState, Empire Electric and with La Plata Electric to minimize capital cost outlays as well as annual operating expenses through similar types of arrangements in regards to pole attachment fees and maintenance expenses.

3. Collaborate with Region 10 for the operations of the lit network. Region 10 has built an extensive network through six counties in western Colorado and has a stable track record of operating a middle mile network. Region 10 is currently expanding this network from Grand Junction to Denver, working with Mesa and Garfield Counties and with representatives from Project Thor, another existing middle mile network facilitated by local governments. Region 10 has a successful track record of operating their network and has established excellent working relationships with local internet service providers to lease collocation space, subscribe to lit backhaul and transport services and to lease dark fiber.

Region 10 will lease 2-4 strands of fiber from Region 9's middle mile fiber network and will manage the electronics on Region 9's network. Region 10 will assist in operating the CNLs for Region 9 stakeholders when asked. Region 10 and potentially Region 9 will monetize the proposed network through offering lit services to service providers. Region 9 will monetize the proposed network through offering dark fiber services to service providers. Outsourcing the lit services operations to Region 10 lowers Region 9's operating expenses and staffing requirements, lowering the operating and financial risk to Region 9.

4. Region 9 will offer wholesale broadband services to service providers. Region 9 will have a fiscally sustainable operating model by monetizing the network by offering wholesale broadband services to service providers. The model of offering dark fiber leases to service providers provides a healthy revenue stream to Region 9. During the planning and collaboration process of the grant effort, Region 9 has worked with several local service providers who have expressed interest in leasing dark fiber from Region 9 is the network is built. Although there are no contracts in place, as the network has not yet been built, numerous service providers have expressed their intention to work with Region 9 by leasing dark fiber after the network is built. Letters of interest have been provided in the grant application from Ting and from Frontier Communications.

These strategies provide a fiscally sustainable operating model for Region 9. Below is the projected Profit and Loss Statement for Region 9:

Income Statement

	Forecast Period							
	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7	Year 8
Revenues								
Network Services Revenues:								
Wholesale Lit Capacity	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wholesale Transit (Paid Peering)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Wholesale Data Services, CAIs (Other)	$ -	$ -	$ -	$ -	$ 370,800.00	$ 407,880.00	$ 448,668.00	$ 493,534.80
Retail Lit Capacity	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Retail Transit (Paid Peering)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Retail Data Services (Other)	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Dark Fiber	$ -	$ 327,801.60	$ 327,801.60	$ 327,801.60	$ 327,801.60	$ 1,062,643.76	$ 1,062,643.76	$ 1,062,643.76
Colocation	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Installation Revenues	$ -	$ 30,000.00	$ -	$ -	$ -	$ 61,236.85	$ -	$ -
Other Operating Revenues, IRUs	$ -	$ -	$ -	$ -	$ -	$ 101,080.80	$ 3,948.00	$ 115,527.78
Other Revenues, Grant Funding	$ 488,559.00	$ 287,309.00	$ 287,309.00	$ 287,309.00	$ 287,309.00	$ -	$ -	$ -
Uncollectible Revenues	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total Revenues	$ 488,559.00	$ 645,110.60	$ 615,110.60	$ 615,110.60	$ 985,910.60	$ 1,632,841.40	$ 1,515,259.76	$ 1,671,706.34
Expenses								
MMG Total Project Costs from SF-424	$ 488,559.00	$ 287,309.00	$ 287,309.00	$ 287,309.00	$ 287,309.00		$ -	$ -
Spares	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Backhaul	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Network Maintenance/Monitoring	$ -	$ -	$ -	$ -	$ -	$ 173,677.22	$ 173,677.22	$ 173,677.22
Utilities	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Leasing	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Salaries/Benefits	$ -	$ -	$ -	$ -	$ -	$ 520,000.00	$ 520,000.00	$ 520,000.00
Sales/Marketing	$ -	$ 35,000.00	$ -	$ -	$ -	$ 35,000.00	$ 35,000.00	$ 35,000.00
Customer Care	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Billing	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Corporate G&A	$ -	$ 35,780.16	$ 32,780.16	$ 32,780.16	$ 32,780.16	$ 112,388.06	$ 106,264.38	$ 106,264.38
Other Operating Expense	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Total	$ 488,559.00	$ 358,089.16	$ 320,089.16	$ 320,089.16	$ 320,089.16	$ 841,065.28	$ 834,941.59	$ 834,941.59
EBITDA	$ -	$ 287,021.44	$ 295,021.44	$ 295,021.44	$ 665,821.44	$ 791,776.12	$ 680,318.16	$ 836,764.74

There are several key assumptions for the above projected Profit and Loss:

1. Conservative Revenue Projections. Region 9 can start monetizing the existing fiber routes that will be acquired either through an IRU or through an in-kind contribution; however, in the projections shown above, Region 9 is projecting revenues from these routes will start during year 2. Additionally, Region 9 will be able to sell IRUs of fiber once the network is built. Region 9 conservatively did not include all potential revenues that could be realized with the sale of an IRU in its proforma. Region 9 conservatively assumed the sale of one IRU, in year 6, for two fibers on the Mont-2 route. There are other routes where Region 9 could receive additional revenues through the sale of an IRU.

Below are examples of IRU revenue that could potentially be offered through Region 9 and the respective revenue that could be generated. There are other routes included in the grant application that could be included; however, the following routes are those that may have the largest demand for an IRU.

Potential IRUs, not included in the Revenue Projections			Route	Mileage	# of Fibers	IRU Value, $3200/route mile	IRU Maintenance, $250/mile/year
Dol-1	Rico	Telluride	Hwy 145	24.22658333	6	$ 465,150.40	$ 6,057
LaPlat-9	Hesperus	Mancos	Hwy 160	17.31196023	6	$ 332,389.64	$ 4,328
Mont-1	Mancos	Cortez - Intersection Hwy 160/Hwy 145	Hwy 160	15.793875	6	$ 303,242.40	$ 3,948
Mont-2	Mancos	Dolores - Intersection Hwy 184/Hwy 145	Hwy 184	17.43434091	6	$ 334,739.35	$ 4,359
Mont-3	Dolores - Intersection Hwy 184/Hwy 145	Rico	Hwy 145	38.03789583	6	$ 730,327.60	$ 9,509

The payment for an IRU is typically paid upfront and is based upon the # of fibers, the route mileage and the cost per mile. The chart above provides the assumption of selling an IRU of 6 fibers, for the mileage of the respective routes at $3,200/route mile. This provides an upfront payment or IRU Value. As an example, the upfront payment for Dol-1 based upon these assumptions would be $465,150. The annual maintenance revenues for this route would be $6,057 per year. Again, these revenues are NOT included in the proforma projections shown above, but could be additional sources of revenue for Region 9.

Revenue assumptions included in the proforma projections provide for selling dark fiber leases at $70/mile/fiber. Here are the assumptions used to determine annual revenues for the dark fiber leases.

Dark Fiber Services Only								
Segment Label	From	To	Along	Miles	$70/mile * 2	# of providers	Monthly Revenue	Installation Revenues, $2,500 One time
LaPlat-1	Bayfield	Pine Valley	Hwy 501	8.76	$ 1,226.40	2	$ 2,453	$ 5,000
LaPlat-2	Pine Valley	Vallecito	Hwy 501	4.4	$ 616.00	2	$ 1,232	$ 5,000
St-3	South Fork	Pagosa Springs	Hwy 160	41	$ 5,740.00	1	$ 5,740	$ 2,500
LaPlat-7	Durango	Cascade Village	Hwy 550	28.4	$ 3,976.00	2	$ 7,952	$ 5,000
LaPlat-3	Bayfield	Durango CNL	Various Highways, See Map	24.7	$ 3,458.00	0	$ -	$ -
LaPlat-8	Durango, CenturyLink Central office,	Hesperus, term length is 6.83 years, TriState Regen	Transmission line	11.5	$ 1,610.00	2	$ 3,220	$ 5,000
St-1	Denver	Walsenberg	I-25	314	$ 43,960.00	0	$ -	$ -
St-2	Walsenberg	South Fork	Hwy 160	150	$ 21,000.00	0	$ -	$ -
SanJ-1	Cascade Village	Silverton	Hwy 550	16	$ 2,240.00	3	$ 6,720	$ 7,500
Arch-3	Intersection of Cloman Road/Piedra Road	Hatcher Water Tower	County 600	4.164964015	$ 583.09	1	$ 583	$ 2,500
SanJ-2	Silverton	Ophir Pass	Hwy 550	5.342818182	$ 747.99	0	$ -	$ -
Dol-1	Rico	Telluride	Hwy 145	24.22658333	$ 3,391.72	2	$ 6,783	$ 5,000
LaPlat-9	Hesperus	Mancos	Hwy 160	17.31196023	$ 2,423.67	2	$ 4,847	$ 5,000
Mont-1	Mancos	Cortez	Hwy 160	15.793875	$ 2,211.14	3	$ 6,633	$ 7,500
Mont-2	Mancos	Dolores	Hwy 184	17.43434091	$ 2,440.81	2	$ 4,882	$ 5,000
Mont-3	Dolores	Rico	Hwy 145	38.03789583	$ 5,325.31	3	$ 15,976	$ 7,500
LPE - 1	Durango	Cascade Village		28.4	$ 3,976.00	2	$ 7,952	$ 5,000
LPE - 2	Pagosa Medical Center	Arboles		29.8	$ 4,172.00	1	$ 4,172	$ 2,500
LPE - 3	Arboles	Ignacio		16.6	$ 2,324.00	2	$ 4,648	$ 5,000
LPE - 4	Bayfield	LaPlata County Line, Beaver Meadows		8	$ 1,120.00	2	$ 2,240	$ 5,000
LPE - 5	Bayfield	Forest Lakes		9	$ 1,260.00	2	$ 2,520	$ 5,000

Some of the routes, highlighted in blue are either too long to justify buying a dark fiber lease from the service providers. For example, the route from Denver to Walsenburg is 314 miles. The service providers would more likely purchase a lit service for this route through region 10, rather than a dark fiber lease through Region 9. The Bayfield to Durango route is owned by the Southern Ute Indian Tribe and therefore, the Tribe would receive revenues on this route rather than Region 9. For the other routes that are not highlighted, the number of providers for each route was projected based upon how many providers could realistically be supported in the respective markets or how many providers are currently providing services in those markets. For example, there are a few residential real estate developments near Pine Valley where 2 providers may lease dark fiber to serve that market (See Bayfield to Pine Valley route).

2. Administrative Costs will be paid through the grant in years 1-5. The first years of operation for any business are critical to its long-term viability. The administrative costs for Region 9 personnel required to manage the grant implementation and the wholesale broadband operations will be covered by the grant application dollars if awarded. This minimizes the financial operating risk to Region 9 during the first critical years of operations.

3. Solid Projections for Network Monitoring and Maintenance Expenses. Once the network is built, starting in year 6, Region 9 projected operating expenses for monitoring and maintenance of the network based upon independent research in the industry. Fiber maintenance of aerial networks average $1,069/mile and maintenance of underground fiber is $536/mile per year. It was assumed fiber locates would cost .10/foot for underground fiber. The formulas for these projections are:

    - Aerial Annual Maintenance = 52.9 miles aerial * 1,069/mile = $56,550
    - Underground Annual Maintenance = 110.07 miles underground * 536/mile = $58,999
    - Fiber locates = 110.07 miles underground * 5280 ft/mile * .10/ft = $58,119

4. Other Operating Expenses. As shown on the proforma, Region 9 is expecting ongoing staffing requirements shows as salaries and benefits, and ongoing marketing expenses and general administrative costs for operating the network.

The proforma shows a conservative and fiscally sustainable operating model for Region 9, with positive projected EBITDA for all years of operations.

Cost Details of the Project

The total costs for the project are $104,084,060.31. The project total includes the following project elements and expected costs.

COST CLASSIFICATION	a. Total Costs	b. Costs Not Allowable for Participation	c. Total Allowable Costs (Columns a-b)
1. Administrative and legal expenses	$ 1,637,794	$ -	$ 1,637,794
2. Land, structures, rights-of-way, appraisals, etc.	$ 368,000	$ -	$ 368,000
3. Relocation expenses and payments	$ -	$ -	$ -
4. Architectural and engineering fees	$ 719,496.09	$ -	$ 719,496
5. Other architectural and engineering fees	$ 500,000.00	$ -	$ 500,000
6. Project inspection fees, project and construction management	$ 4,317,650.00	$ -	$ 4,317,650
7. Site work	$ -	$ -	$ -
8. Demolition and removal	$ -	$ -	$ -
9. Construction, Labor and Materials of Fiber Network	$ 78,508,336.62	$ -	$ 78,508,337
10. Equipment	$ 8,656,949.94	$ -	$ 8,656,950
11. Miscellaneous	$ 1,525,000.00	$ -	$ 1,525,000
12. SUBTOTAL *(sum of lines 1-11)*	$ 96,233,226.65	$ -	$ 96,233,227
13. Contingencies, 10% of Construction, Labor and Materials	$ 7,850,833.66	$ -	$ 7,850,834
14. SUBTOTAL	$ 104,084,060.31	$ -	$ 104,084,060
15. Project (program) income	$ -	$ -	$ -
16. TOTAL PROJECT COSTS *(subtract #15 from #14)*	$ 104,084,060.31	$ -	$ 104,084,060
FEDERAL FUNDING			
17. Federal assistance requested, calculate as follows:			63.9758%
			$ 66,588,651.10
			$ 66,588,651.10

Figure 1: Overall Budget

There are several project components for the project. They are described in detail below.

1. Administrative Costs. Region 9 will be responsible for managing the implementation of the middle mile project. It is anticipated the broadband infrastructure deployment project will be completed within five years.

It is expected that a Project Manager will be required to manage the overall project implementation, working with various contractors and consultants to ensure the project is implemented smoothly, on time and under budget. The Project Manager will spend 75% of his time on managing the grant application and implementation. Project Manager costs are $42/hour * 40 hours/week * 75% of his time * 60 months.
A Technical Support person will manage the technical details of the project. It was assumed the Technical Support person would work 75% on the project with expected costs to be $40/hour * 40 hours/week * 4 weeks/month * 60 months * 75%. A full-time administrative person will assist in developing and tracking budgets, invoices, payment submissions and overall compliance of the grant. Costs were determined based upon $27/hour * 40 hours/week * 4 weeks/month * 60 months.

The total salary costs are estimated at $849,600 for the three staff people to support the project. Benefits are 14% of the total salary costs of $118,944.

The project will require legal review of RFPs, contractor agreements, intergovernmental agreements between Region 9 and its local government stakeholders, electric cooperatives and with Region 10. 575 hours of legal services at $350/hour were budgeted for the project, totaling $201,250 in legal services. Additionally, we anticipate the need to hire either technical or grant compliance consultants for the project with expected costs to be $195 per hour for 2400 hours or $468,000.

		Unit Type	Unit Cost	No. of Units	Total Cost
1. Administrative and Legal Expenses					
Staff, Salary, Project Manager	40 hours/week * 4 weeks * 75% * 60 months	Hour	$42.00	7200.00	$302,400
Staff, Salary, Technical Support	40 hours/week * 4 weeks * 75% * 60 months	Hour	$40.00	7200.00	$288,000
Staff, Salary, Admin and Compliance	40 hours/week * 4 weeks * 100% * 60 months	Hour	$27.00	9600.00	$259,200
Staff, benefits	14% of salary	Other	14%	$849,600	$118,944
Legal		Hour	$350	575.00	$201,250
Consultant	10 hours/week * 4 weeks * 60 months	Hour	$195.00	2400.0	$468,000
Total Administrative and Legal Expenses					$1,637,794

Figure 2: Administrative Expenses

2. **Land, structures, rights-of-way, appraisals, etc.** There is an existing Carrier Neutral Location (CNL) located at 2210 Main Street in Cortez that will need to upgrade the transmission equipment to a 3000 kVA transformer. Empire Electric will provide the new transformer with an expected budget cost of $150,000 plus a $50,000 installation fee for a total cost of $200,00.

Region 9 plans to secure collocation space at the CNL as an in- kind contribution valued at $700/month. This includes the 20-year agreement to lease the cabinet and includes 30 amps availability with a generator and UPS backup power. The in-kind contribution is valued at $168,000 which includes $700/month for the cabinet collocation fees * 12 months * 20 years. The planned in-kind contribution is shown below.

2. Land, Structures, Rights-of-Way, Appraisals, etc.			
Upgrade transmission at 2210		Other	$200,000.00
20-year cabinet collocation space	$700/month * 12 months * 20 years	Other	$168,000.00
Total Land, Structures, Rights-of Way, Appraisals, etc.			

Figure 3: Land, Structure, Rights-of Way, Appraisals

3. **Relocation expenses and payments.** There are no relocation expenses and/or payments anticipated for the project.

4. **Architectural and engineering fees.** The chart below provides a summary of the design and engineering fees for the fiber optic routes that will be built with the project.

		Unit Type	Unit Cost	No. of Units	Total Cost
4. Architectural and Engineering Fees					
Arch-1		Foot	$0.75	16644	$12,483
Arch-3		Foot	$0.75	22093	$16,570
Arch-4		Foot	$0.75	49261	$36,945
Arch-5		Foot	$0.75	129055	$96,791
Dol-1		Foot	$0.75	128238	$96,178
LaPlat-6		Foot	$0.75	7646	$5,734
LaPlat-9		Foot	$0.75	91856	$68,892
LaPlat-10		Foot	$0.75	419	$314
LaPlat-11		Foot	$0.75	2984	$2,238
LaPlat-12		Foot	$0.75	5927	$4,445
SUIT-1		Foot	$0.75	89232	$66,924
Mont-1		Foot	$0.75	85440	$64,080
Mont-2		Foot	$0.75	98555	$73,916
Mont-3		Foot	$0.75	195553	$146,665
SanJ-2		Foot	$0.75	36426	$27,319
Total Architechtural and Engineering Fees					$719,496

Figure 4: Architectural and engineering fees

Each route to be built is shown in blue on the maps provided with the application. Each route is labeled on the maps and the budget items. A detailed Bill of Materials is provided for each route on the Detailed Budget Justification spreadsheet as a new worksheet. The Bill of Materials has the estimated footages of each route, with the assumption of .75/foot for design and engineering services. The routes provided in Figure 4 and on the Detailed Budget Justification match the total footages on the respective Bill of Materials.

Design and engineering fees include a preliminary desktop design, a construction ride out, and final design with construction ready documents, construction typicals and an updated Bill of Materials. These deliverables can be used in the Request for Proposal (RFP) for construction of the network.

5. **Other architectural fees.** In order to comply with National Environmental Policy Act, the National Historic Preservation Act, and the Endangered Species Act, and other applicable environmental regulations, an environmental assessment will be conducted on all routes that will be constructed. An Environmental Assessment firm will be hired to complete this work with an anticipated budget of $200 per hour for 2500 hours with a total cost of $500,000.

		Unit Type	Unit Cost	No. of Units	Total Cost
5. Other Architectural and Engineering Fees					
Environmental Assessment		Hour	$200.00	2500.0	$500,000
Total Other Architectural and Engineering Fees					$500,000

Figure 5: Other Architectural and Engineering Fees

6. **Project inspection fees.** The fiber routes that will be constructed with the grant application will need to be inspected by a licensed design and engineering firm. Each route to be built is shown in blue

on the maps provided with the application. Each route is labeled on the maps and the budget items. A detailed Bill of Materials is provided for each route on the Detailed Budget spreadsheet as a new worksheet. The Bill of Materials has the estimated footages of each route, with the assumption of $3.50/foot for project inspection services. The routes provided in Figure 6 below and on the Detailed Budget match the total footages on the respective Bill of Materials.

		Unit Type	Unit Cost	No. of Units	Total Cost
6. Project Inspection Fees					
Arch-1		Foot	$3.50	16644	$58,255
Arch-3		Foot	$3.50	22093	$77,325
Arch-4		Foot	$3.50	49261	$172,412
Arch-5		Foot	$3.50	129055	$451,693
Dol-1		Foot	$3.50	128238	$448,832
LaPlat-6		Foot	$3.50	7646	$26,761
LaPlat-9		Foot	$3.50	91856	$321,496
LaPlat-10		Foot	$3.50	419	$1,466
LaPlat-11		Foot	$3.50	2984	$10,444
LaPlat-12		Foot	$3.50	5927	$20,745
SUIT-1		Foot	$3.50	89232	$312,312
Mont-1		Foot	$3.50	85440	$299,042
Mont-2		Foot	$3.50	98555	$344,941
Mont-3		Foot	$3.50	195553	$684,436
SanJ-2		Foot	$3.50	36426	$127,490
Project Management Fees	$200/hour * 20 hours/week * 4 week * 60 months	Hour	$200.00	4800.0	$960,000
Total Project Inspection Fees					$4,317,650

Figure 6: Project Inspection Fees

In addition to the project inspection fees, a project and construction management team will be on-site when needed to manage the construction contractors, provide grant compliance assistance, write RFPs, prepare and update budgets and assist with all reporting requirements and any other needed elements of the project implementation. Project Management fees of $200/hour for 20 hours/week times 4 weeks/months times 60 months is anticipated for a total of $960,000.

6. Site work. There are no site work fees anticipated for the project.

7. Demolition and removal. There are no demolition and removal fees anticipated for this project.

8. Construction, Labor and Materials of Fiber Network. Construction materials and labor for the network are 78,508,337.

Construction includes the materials and construction labor needed to build the Middle Mile fiber routes. Again, these routes are provided in the Detailed Budget spreadsheet and in Figure 7 below. Materials include, but are not limited to conduit, vaults, fiber optic cable, and tracer wire. Construction labor includes directional boring when building the network underground, aerial placement of fiber, installation of materials, and splicing and testing the fiber.

		Unit Type	Unit Cost	No. of Units	Total Cost
9. Construction					
Arch-1	See Bill of Materials	Other	$1,310,373.93	1	$1,310,374
Arch-3	See Bill of Materials	Other	$1,311,669.34	1	$1,311,669
Arch-4	See Bill of Materials	Other	$2,901,806.69	1	$2,901,807
Arch-5	See Bill of Materials	Other	$7,566,477.14	1	$7,566,477
Dol-1	See Bill of Materials	Other	$7,529,234.24	1	$7,529,234
LaPlat-6	See Bill of Materials	Other	$454,571.08	1	$454,571
LaPlat-9	See Bill of Materials	Other	$5,389,391.73	1	$5,389,392
LaPlat-10	See Bill of Materials	Other	$34,166.08	1	$34,166
LaPlat-11	See Bill of Materials	Other	$229,575.36	1	$229,575
LaPlat-12	See Bill of Materials	Other	$285,112.00	1	$285,112
SUIT-1	See Bill of Materials	Other	$5,226,930.68	1	$5,226,931
Mont-1	See Bill of Materials	Other	$5,075,487.34	1	$5,075,487
Mont-2	See Bill of Materials	Other	$1,026,161.03	1	$1,026,161
Mont-3	See Bill of Materials	Other	$2,142,169.51	1	$2,142,170
SanJ-2	See Bill of Materials	Other	$2,013,820.11	1	$2,013,820
IRU's					
LaPlat-8	IRU, TriState	Other	$134,733.00	1	$134,733
SanJ-1	IRU, Zayo	Other	$87,649.01	1	$87,649
St-1	IRU, Zayo	Other	$2,418,260.02	1	$2,418,260
St-2	IRU, Zayo	Other	$1,277,914.12	1	$1,277,914
St-3	IRU, CDOT	Other	$452,025.00	1	$452,025
CAI Construction, Materials		Other	$5,800.00	123	$713,400
Stakeholder Contribution	Cash	Other			
In-Kind Fiber Routes	Region 10, LPEA, Scan, See In-Kind Valuation Report	Other			$25,297,984
CDOT and County ROW	See In-Kind Valuation Report	Other			$4,802,706
Empire Electric Pole Attachment Fees	See In-Kind Valuation Report	Other			539,719
Bayfield CNL	See In-Kind Valuation Report	Other			$287,000
Total Construction					$78,508,337

Figure 7: Total Construction Labor and Materials, IRUs, CAIs, In-Kind Routes

Region 9's proposed network will connect to Region 10's existing network connecting east to Denver along the I-70 corridor, extending then east to southern Colorado and then connecting to Denver from both the south and the west to connect our region in the state fiber loop.

This will connect with existing Middle Mile networks implemented by Region 10 and Project THOR. Project THOR is a middle mile network establishing carrier-class connectivity between 14 communities across Northwest Colorado and the Northwest Colorado Council of Governments Point of Presence in Denver.

This network will impact the entire State of Colorado by providing much needed capacity, redundancy and resiliency. Below is a map of the grant project area, shown in Figure 8. The green lines on the map are IRUs that will be acquired with grant funds. Blue lines indicate the new fiber builds that will be constructed with the application and the red lines indicate where there is existing fiber that will be used as an in-kind contribution to the project.

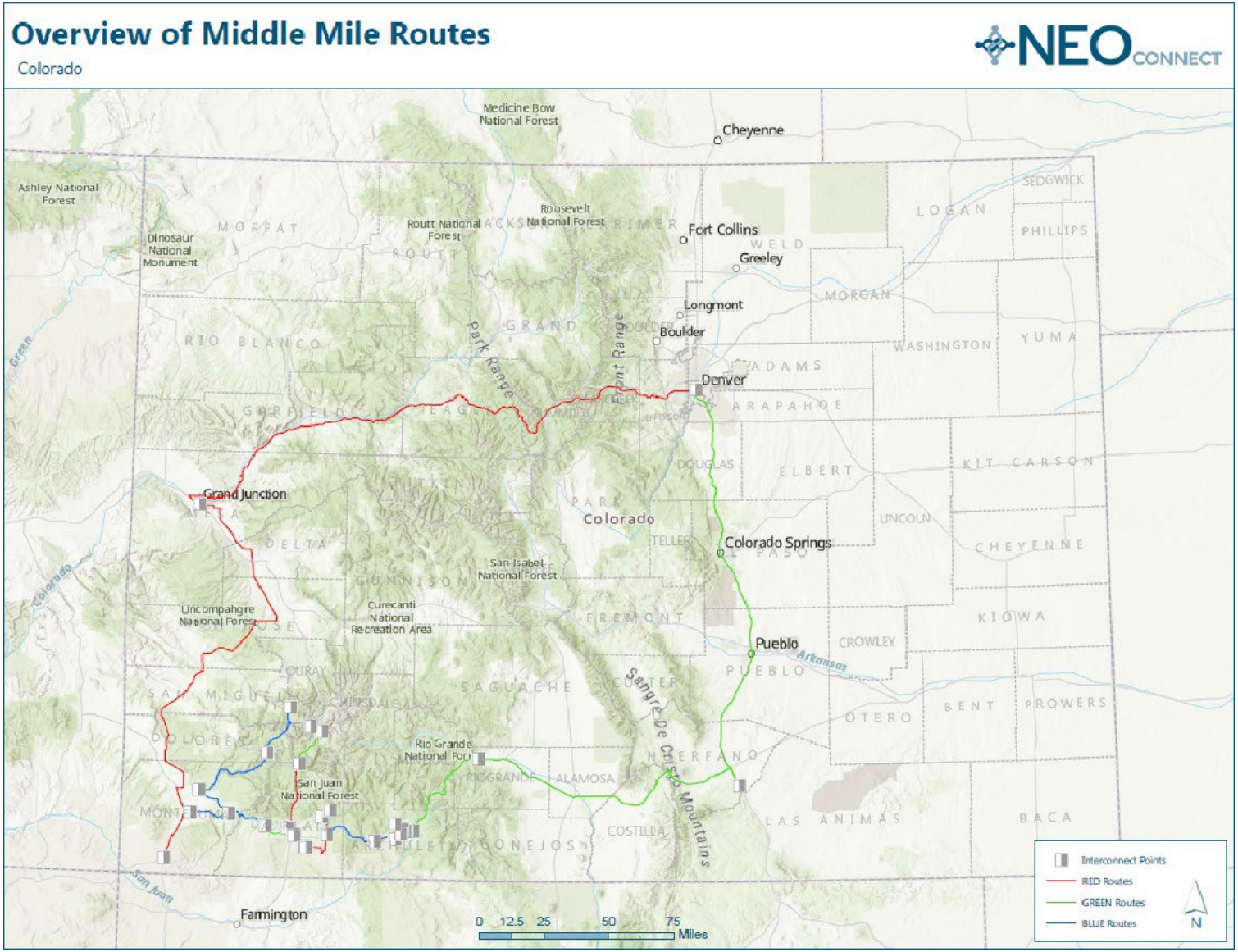


Figure 8: Overview Map of Region 9 Middle Mile Network

Blue Routes, New Routes, Detailed Bill of Materials

The grant application will fund the build of the following new fiber routes, shown on the maps in blue:

- Arch-1, along Hwy 160 from Pagosa Springs - Vault, Intersection of Hwy 160/Hwy 84 to Vault, Intersection of Hwy 160/Parelli Institute Drive
- Arch-3, along County Rd 600 from the Intersection of Cloman Road/Piedra Road to Hatcher Water Tower
- Arch-4, along Hwy 160 from the Intersection of Parelli Institute Drive to Intersection of Hwy 160/Hwy 151
- Arch-5, along Hwy 160 from the Intersection of Hwy 151 to Bayfield - Intersection of Hwy 160/151
- LaPlata-6, along Hwy 309 from the Intersection of Hwy 172/Hwy 309 to the Durango International Airport
- LaPlata-9, along Hwy 160 from Hesperus to Mancos
- LaPlata-10, from the Durango Lumen (formerly CenturyLink) Central office to the Durango Carrier Neutral Location
- LaPlata-11, from the vault at 65 Mercado St #250 in Durango, near Mercy Hospital to the vault near the police station at 545 Wilson Gulch Dr in Durango
- LaPlata-12, from the drop pole located at 1328 Co Rd 501 in Bayfield near the Foursquare Church to the Bayfield CNL located at 215 E Lakeside Dr, in Bayfield
- SUIT-1, from the TriState substation vault in Hesperus to Red Mesa
- Mont-1, along Hwy 160 from Mancos to Cortez Intersection Hwy 160/Hwy 145
- Mont-2, along Hwy 184 from Mancos to Dolores Intersection Hwy 184/Hwy 145
- Mont-3, along Hwy 145 from Dolores Intersection Hwy 184/Hwy 145 to Rico
- Dol-1, along Hwy 145 from Rico to Telluride
- SanJ-2, from the Zayo vault in Silverton, Tristate/LPEA Substation to the San Miguel Power Association Substation on Ophir Pass - Intersection Hwy 550/Forrest Road 679

For each of the new fiber routes, there is a detailed Bill of Materials provided in the Detailed Budget Justification. The Bill of Materials includes on the first two line items, the engineering fees described under category 4. Architectural and Engineering Fees and the project inspection fees shown under the category item 6. Project Inspection Fees. Under these two line items, the Bill of Materials includes the detailed list of Materials, unit costs and quantities, followed by the Construction Labor unit costs and quantities for the route. The first total includes the engineering, project inspection fees, the materials and the construction labor costs. The second total provides just the costs for materials and construction labor and these totals match the numbers provided in Figure 7.

Below are the detailed Bill of Materials for each route.

Arch-1

Description	Quantitiy		Unit Rate	Total
Engineering - Route	16,644	Feet	$ 0.75	$ **12,483.16**
Construction Inspection	16,644	Feet	$ 3.50	$ **58,254.76**
.				
Materials				
Conduit, HDPE, 1.25" SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	24,000	Ft	$ 1.16	$ **27,840.00**
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	50	Ea	$ 7.94	$ **397.00**
1.25" Simplex Duct Plugs	19	Ea	$ 11.35	$ **215.65**
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	40	Ea	$ 1.86	$ **74.40**
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	7	Ea	$ 2,422.81	$ **16,959.67**
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	1	Ea	$ 53.40	$ **53.40**
SM Fiber Optic CABLE - 144 Count	18,000	Ft	$ 2.17	$ **39,060.00**
Dome Splice Closure, 11.5" x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), three ground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	1	Ea	$ 519.14	$ **519.14**
Splice Tray, 36ct	7	Ea	$ 37.09	$ **259.63**
	-			
Construction				
Prepare Splice Case	1	Ea	$ 407.14	$ **407.14**
Fiber Optic Cable Splice & Test	206	Ea	$ 61.07	$ **12,580.50**
Set 36" x 60" x 36" Handhole	7	Ea	$ 2,849.95	$ **19,949.65**
Set Locate Marker Post	1	Ea	$ 244.28	$ **244.28**
Bore and Place 1.25" HDPE Duct	16,644	Ft	$ 37.50	$ **624,158.18**
Rock Adder	6,472	Ft	$ 81.43	$ **526,996.55**
Place Fiber Optic Cable in 1.25" Duct	16,644	Ft	$ 2.44	$ **40,658.74**
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ea	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	$ **1,381,111.85**
			Total Constuction Labor and Materials	$ **1,310,373.93**

Arch-3				
Description	**Quantitiy**		**Unit Rate**	**Total**
Engineering - Route	22,093	Feet	$ 0.75	**$ 16,569.61**
Construction Inspection	22,093	Feet	$ 3.50	**$ 77,324.86**
.				
Materials				
Conduit, HDPE, 1.25" SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	32,000	Ft	$ 1.17	**$ 37,440.00**
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	50	Ea	$ 8.00	**$ 400.00**
1.25" Simplex Duct Plugs	25	Ea	$ 11.44	**$ 286.00**
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	40	Ea	$ 1.87	**$ 74.80**
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	9	Ea	$ 2,422.81	**$ 21,805.29**
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	2	Ea	$ 53.81	**$ 107.62**
SM Fiber Optic CABLE - 144 Count	24,000	Ft	$ 2.19	**$ 52,560.00**
Dome Splice Closure, 11.5" x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), three ground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	2	Ea	$ 523.12	**$ 1,046.24**
Splice Tray, 36ct	9	Ea	$ 37.37	**$ 336.33**
	-			
Construction				
Prepare Splice Case	2	Ea	$ 407.14	**$ 814.27**
Fiber Optic Cable Splice & Test	274	Ea	$ 61.07	**$ 16,733.28**
Set 36" x 60" x 36" Handhole	10	Ea	$ 2,849.95	**$ 28,499.50**
Set Locate Marker Post	2	Ea	$ 244.28	**$ 488.56**
Bore and Place 1.25" HDPE Duct	22,093	Ft	$ 37.50	**$ 828,480.60**
Rock Adder	3,299	Ft	$ 81.43	**$ 268,628.19**
Place Fiber Optic Cable in 1.25" Duct	22,093	Ft	$ 2.44	**$ 53,968.65**
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ea	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	**$ 1,405,563.81**
			Total Constuction Labor and Materials	**$ 1,311,669.34**

Arch-4

Description	Quantitiy		Unit Rate	Total
Engineering - Route	49,261	Feet	$ 0.75	$ **36,945.38**
Construction Inspection	49,261	Feet	$ 3.50	$ **172,411.78**
.				
Materials				
Conduit, HDPE, 1.25 " SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	56,000	Ft	$ 1.16	$ **64,960.00**
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	100	Ea	$ 7.93	$ **793.00**
1.25" Simplex Duct Plugs	56	Ea	$ 11.34	$ **635.04**
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	80	Ea	$ 1.86	$ **148.80**
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	21	Ea	$ 2,422.81	$ **50,879.01**
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	3	Ea	$ 53.33	$ **159.99**
SM Fiber Optic CABLE - 144 Count	52,000	Ft	$ 2.17	$ **112,840.00**
Dome Splice Closure, 11.5 " x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), threeground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	3	Ea	$ 518.47	$ **1,555.41**
Splice Tray, 36ct	21	Ea	$ 37.04	$ **777.84**
	-			
Construction				
Prepare Splice Case	4	Ea	$ 407.14	$ **1,628.54**
Fiber Optic Cable Splice & Test	610	Ea	$ 61.07	$ **37,252.92**
Set 36" x 60" x 36" Handhole	21	Ea	$ 2,849.95	$ **59,848.96**
Set Locate Marker Post	4	Ea	$ 244.28	$ **977.13**
Bore and Place 1.25" HDPE Duct	49,261	Ft	$ 37.50	$ **1,847,269.08**
Rock Adder	7,390	Ft	$ 81.43	$ **601,746.68**
Place Fiber Optic Cable in 1.25" Duct	49,261	Ft	$ 2.44	$ **120,334.29**
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ft	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	$ **3,111,163.85**
			Total Constuction Labor and Materials	$ **2,901,806.69**

Arch-5

Description	Quantitiy		Unit Rate	Total
Engineering - Route	129,055	Feet	$ 0.75	$ 96,791.46
Construction Inspection	129,055	Feet	$ 3.50	$ 451,693.49
.				
Materials				
Conduit, HDPE, 1.25" SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	136,000	Ft	$ 1.15	$ 156,400.00
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	250	Ea	$ 7.89	$ 1,972.50
1.25" Simplex Duct Plugs	146	Ea	$ 11.28	$ 1,646.88
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	200	Ea	$ 1.85	$ 370.00
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	55	Ea	$ 2,422.81	$ 133,254.55
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	9	Ea	$ 53.05	$ 477.45
SM Fiber Optic CABLE - 144 Count	131,000	Ft	$ 2.16	$ 282,960.00
Dome Splice Closure, 11.5" x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), three ground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	9	Ea	$ 515.69	$ 4,641.21
Splice Tray, 36ct	55	Ea	$ 36.84	$ 2,026.20
	-			
Construction				
Prepare Splice Case	11	Ea	$ 407.14	$ 4,478.49
Fiber Optic Cable Splice & Test	1,599	Ea	$ 61.07	$ 97,651.52
Set 36" x 60" x 36" Handhole	56	Ea	$ 2,849.95	$ 159,597.22
Set Locate Marker Post	11	Ea	$ 244.28	$ 2,687.10
Bore and Place 1.25" HDPE Duct	129,055	Ft	$ 37.50	$ 4,839,573.08
Rock Adder	19,201	Ft	$ 81.43	$ 1,563,482.81
Place Fiber Optic Cable in 1.25" Duct	129,055	Ft	$ 2.44	$ 315,258.14
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ea	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	$ 8,114,962.09
			Total Constuction Labor and Materials	$ 7,566,477.14

Dol-1

Description	Quantitiy		Unit Rate	Total
Engineering - Route	128,238	Feet	$ 0.75	$ 96,178.37
Construction Inspection	128,238	Feet	$ 3.50	$ 448,832.40
.				
Materials				
Conduit, HDPE, 1.25" SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	136,000	Ft	$ 1.15	$ 156,400.00
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	250	Ea	$ 7.89	$ 1,972.50
1.25" Simplex Duct Plugs	145	Ea	$ 11.28	$ 1,635.60
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	200	Ea	$ 1.85	$ 370.00
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	55	Ea	$ 2,422.81	$ 133,254.55
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	9	Ea	$ 53.05	$ 477.45
SM Fiber Optic CABLE - 144 Count	131,000	Ft	$ 2.16	$ 282,960.00
Dome Splice Closure, 11.5" x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), threeground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	9	Ea	$ 515.70	$ 4,641.30
Splice Tray, 36ct	55	Ea	$ 36.84	$ 2,026.20
	-			
Construction				
Prepare Splice Case	11	Ea	$ 407.14	$ 4,478.49
Fiber Optic Cable Splice & Test	1,588	Ea	$ 61.07	$ 96,979.74
Set 36" x 60" x 36" Handhole	55	Ea	$ 2,849.95	$ 156,747.27
Set Locate Marker Post	11	Ea	$ 244.28	$ 2,687.10
Bore and Place 1.25" HDPE Duct	128,238	Ft	$ 37.50	$ 4,808,918.54
Rock Adder	19,188	Ft	$ 81.43	$ 1,562,424.26
Place Fiber Optic Cable in 1.25" Duct	128,238	Ft	$ 2.44	$ 313,261.25
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ft	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	$ 8,074,245.01
		Total Constuction Labor and Materials		$ 7,529,234.24

LaPlat-6				
Description	Quantitiy		Unit Rate	Total
Engineering - Route	7,646	Feet	$ 0.75	$ 5,734.50
Construction Inspection	7,646	Feet	$ 3.50	$ 26,761.00
.				
Materials				
Conduit, HDPE, 1.25" SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	8,000	Ft	$ 1.20	$ 9,600.00
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	15	Ea	$ 8.19	$ 122.85
1.25" Simplex Duct Plugs	9	Ea	$ 11.70	$ 105.30
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	20	Ea	$ 1.92	$ 38.40
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	3	Ea	$ 2,422.81	$ 7,268.43
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	1	Ea	$ 55.05	$ 55.05
SM Fiber Optic CABLE - 144 Count	9,000	Ft	$ 2.24	$ 20,160.00
Dome Splice Closure, 11.5" x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), three ground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	1	Ea	$ 535.18	$ 535.18
Splice Tray, 36ct	3	Ea	$ 38.23	$ 114.69
	-			
Construction				
Prepare Splice Case	1	Ea	$ 407.14	$ 407.14
Fiber Optic Cable Splice & Test	95	Ea	$ 61.07	$ 5,801.68
Set 36" x 60" x 36" Handhole	3	Ea	$ 2,849.95	$ 8,549.85
Set Locate Marker Post	1	Ea	$ 244.28	$ 244.28
Bore and Place 1.25" HDPE Duct	7,646	Ft	$ 37.50	$ 286,725.00
Rock Adder	1,181	Ft	$ 81.43	$ 96,165.47
Place Fiber Optic Cable in 1.25" Duct	7,646	Ft	$ 2.44	$ 18,677.76
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ea	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	$ 487,066.58
Total Construction Labor and Materials				$ 454,571.08

LaPlat-9

Description	Quantitiy		Unit Rate	Total
Engineering - Route	91,856	Feet	$ 0.75	$ 68,892.00
Construction Inspection	91,856	Feet	$ 3.50	$ 321,496.00
.				
Materials				
Conduit, HDPE, 1.25 " SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	96,000	Ft	$ 1.16	$ 111,360.00
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	200	Ea	$ 7.90	$ 1,580.00
1.25" Simplex Duct Plugs	104	Ea	$ 11.29	$ 1,174.16
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	140	Ea	$ 1.85	$ 259.00
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	39	Ea	$ 2,422.81	$ 94,489.59
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	7	Ea	$ 53.12	$ 371.84
SM Fiber Optic CABLE - 144 Count	93,000	Ft	$ 2.16	$ 200,880.00
Dome Splice Closure, 11.5 " x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), threeground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	7	Ea	$ 516.38	$ 3,614.66
Splice Tray, 36ct	39	Ea	$ 36.89	$ 1,438.71
	-			
Construction				
Prepare Splice Case	8	Ea	$ 407.14	$ 3,257.09
Fiber Optic Cable Splice & Test	1,138	Ea	$ 61.07	$ 69,498.08
Set 36" x 60" x 36" Handhole	40	Ea	$ 2,849.95	$ 113,998.02
Set Locate Marker Post	8	Ea	$ 244.28	$ 1,954.25
Bore and Place 1.25" HDPE Duct	91,856	Ft	$ 37.50	$ 3,444,600.00
Rock Adder	13,712	Ft	$ 81.43	$ 1,116,529.15
Place Fiber Optic Cable in 1.25" Duct	91,856	Ft	$ 2.44	$ 224,387.18
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ea	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	$ 5,779,779.73
Total Construction Labor and Materials				$ 5,389,391.73

LaPlat-10				
Description	Quantity		Unit Rate	Total
Engineering - Route	419	Feet	$ 0.75	$ 314.20
Construction Inspection	419	Feet	$ 3.50	$ 1,466.24
.				
Materials				
Conduit, HDPE, 1.25" SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	8,000	Ft	$ 1.16	$ 9,280.00
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	1	Ea	$ 7.90	$ 7.90
1.25" Simplex Duct Plugs	1	Ea	$ 11.29	$ 11.29
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	1	Ea	$ 1.85	$ 1.85
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	1	Ea	$ 2,422.81	$ 2,422.81
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	1	Ea	$ 53.12	$ 53.12
SM Fiber Optic CABLE - 144 Count	600	Ft	$ 2.16	$ 1,296.00
Dome Splice Closure, 11.5" x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), three ground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	1	Ea	$ 516.38	$ 516.38
Splice Tray, 36ct	1	Ea	$ 36.89	$ 36.89
	-			
Construction				
Prepare Splice Case	1	Ea	$ 407.14	$ 407.14
Fiber Optic Cable Splice & Test	5	Ea	$ 61.07	$ 305.35
Set 36" x 60" x 36" Handhole	1	Ea	$ 2,849.95	$ 2,849.95
Set Locate Marker Post	1	Ea	$ 244.28	$ 244.28
Bore and Place 1.25" HDPE Duct	419	Ft	$ 37.50	$ 15,709.76
Rock Adder	-	Ft	$ 81.43	$ -
Place Fiber Optic Cable in 1.25" Duct	419	Ft	$ 2.44	$ 1,023.36
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ea	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	$ 35,946.52
Total Construction Labor and Materials				$ 34,166.08

LaPlat-11

Description	Quantitiy		Unit Rate	Total
Engineering - Route	2,984	Feet	$ 0.75	$ 2,238.00
Construction Inspection	2,984	Feet	$ 3.50	$ 10,444.00
.				
Materials				
Conduit, HDPE, 1.25" SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	8,000	Ft	$ 1.16	$ 9,280.00
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	6	Ea	$ 7.90	$ 47.40
1.25" Simplex Duct Plugs	3	Ea	$ 11.29	$ 33.87
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	4	Ea	$ 1.85	$ 7.40
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	1	Ea	$ 2,422.81	$ 2,422.81
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	1	Ea	$ 53.12	$ 53.12
SM Fiber Optic CABLE - 144 Count	5,000	Ft	$ 2.16	$ 10,800.00
Dome Splice Closure, 11.5" x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), three ground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	1	Ea	$ 516.38	$ 516.38
Splice Tray, 36ct	1	Ea	$ 36.89	$ 36.89
	-			
Construction				
Prepare Splice Case	1	Ea	$ 407.14	$ 407.14
Fiber Optic Cable Splice & Test	37	Ea	$ 61.07	$ 2,259.60
Set 36" x 60" x 36" Handhole	1	Ea	$ 2,849.95	$ 2,849.95
Set Locate Marker Post	1	Ea	$ 244.28	$ 244.28
Bore and Place 1.25" HDPE Duct	2,984	Ft	$ 37.50	$ 111,900.00
Rock Adder	1,000	Ft	$ 81.43	$ 81,427.16
Place Fiber Optic Cable in 1.25" Duct	2,984	Ft	$ 2.44	$ 7,289.36
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ea	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	$ 242,257.36
Total Construction Labor and Materials				$ 229,575.36

LaPlat-12

Description	Quantitiy		Unit Rate	Total
Engineering - Route	5,927	Feet	$ 0.75	$ 4,445.25
Construction Inspection	5,927	Feet	$ 3.50	$ 20,744.50
.				
Materials				
Conduit, HDPE, 1.25" SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	8,000	Ft	$ 1.16	$ 9,280.00
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	11	Ea	$ 7.90	$ 86.90
1.25" Simplex Duct Plugs	7	Ea	$ 11.29	$ 79.03
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	20	Ea	$ 1.85	$ 37.00
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	3	Ea	$ 2,422.81	$ 7,268.43
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	1	Ea	$ 53.12	$ 53.12
SM Fiber Optic CABLE - 144 Count	8,000	Ft	$ 2.16	$ 17,280.00
Dome Splice Closure, 11.5" x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), three ground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	1	Ea	$ 516.38	$ 516.38
Splice Tray, 36ct	3	Ea	$ 36.89	$ 110.67
	-			
Construction				
Prepare Splice Case	1	Ea	$ 407.14	$ 407.14
Fiber Optic Cable Splice & Test	73	Ea	$ 61.07	$ 4,458.14
Set 36" x 60" x 36" Handhole	3	Ea	$ 2,849.95	$ 8,549.85
Set Locate Marker Post	1	Ea	$ 244.28	$ 244.28
Bore and Place 1.25" HDPE Duct	5,927	Ft	$ 37.50	$ 222,262.50
Rock Adder	-	Ft	$ 81.43	$ -
Place Fiber Optic Cable in 1.25" Duct	5,927	Ft	$ 2.44	$ 14,478.56
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ea	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	$ 310,301.75
Total Construction Labor and Materials				$ 285,112.00

SUIT-1

Description	Quantity		Unit Rate	Total
Engineering - Route	89,232	Feet	$ 0.75	$ 66,924.00
Construction Inspection	89,232	Feet	$ 3.50	$ 312,312.00
.				
Materials				
Conduit, HDPE, 1.25“ SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000‘ reel	88,000	Ft	$ 1.16	$ 102,080.00
1.25“ Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	160	Ea	$ 7.90	$ 1,264.00
1.25" Simplex Duct Plugs	179	Ea	$ 11.30	$ 2,022.70
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	160	Ea	$ 1.85	$ 296.00
Hand Hole Assembly, HDPE Polymer Cover, 36“ x 60" x 36”, w/Shield Split Lid, Telecom Logo, Hex Bolts	68	Ea	$ 2,422.81	$ 164,751.08
Marker Post, Dome, 72“, White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: ”Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511“	6	Ea	$ 53.14	$ 318.84
SM Fiber Optic CABLE - 144 Count	90,000	Ft	$ 2.16	$ 194,400.00
Dome Splice Closure, 11.5“ x 29.5”, 6 round cable entry ports, 6 cable attachments, basket(D6), three ground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	6	Ea	$ 516.60	$ 3,099.60
Splice Tray, 36ct	36	Ea	$ 36.90	$ 1,328.40
	-			
Construction				
Prepare Splice Case	7	Ea	$ 407.14	$ 2,849.95
Fiber Optic Cable Splice & Test	1,058	Ea	$ 61.07	$ 64,612.45
Set 36" x 60" x 36" Handhole	37	Ea	$ 2,849.95	$ 105,448.17
Set Locate Marker Post	7	Ea	$ 244.28	$ 1,709.97
Bore and Place 1.25" HDPE Duct	89,232	Ft	$ 37.50	$ 3,346,200.00
Rock Adder	12,509	Ft	$ 81.43	$ 1,018,572.29
Place Fiber Optic Cable in 1.25" Duct	89,232	Ft	$ 2.44	$ 217,977.24
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ea	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	$ 5,606,166.68
			Total Constuction Labor and Materials	$ 5,226,930.68

Mont-1				
Description	Quantitiy		Unit Rate	Total
Engineering - Route	85,440	Feet	$ 0.75	$ 64,080.37
Construction Inspection	85,440	Feet	$ 3.50	$ 299,041.74
.				
Materials				
Conduit, HDPE, 1.25" SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	88,000	Ft	$ 1.16	$ 102,080.00
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	160	Ea	$ 7.90	$ 1,264.00
1.25" Simplex Duct Plugs	179	Ea	$ 11.30	$ 2,022.70
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	160	Ea	$ 1.85	$ 296.00
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	68	Ea	$ 2,422.81	$ 164,751.08
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	6	Ea	$ 53.14	$ 318.84
SM Fiber Optic CABLE - 144 Count	90,000	Ft	$ 2.16	$ 194,400.00
Dome Splice Closure, 11.5" x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), three ground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	6	Ea	$ 516.60	$ 3,099.60
Splice Tray, 36ct	36	Ea	$ 36.90	$ 1,328.40
	-			
Construction				
Prepare Splice Case	7	Ea	$ 407.14	$ 2,849.95
Fiber Optic Cable Splice & Test	1,058	Ea	$ 61.07	$ 64,612.45
Set 36" x 60" x 36" Handhole	37	Ea	$ 2,849.95	$ 105,448.17
Set Locate Marker Post	7	Ea	$ 244.28	$ 1,709.97
Bore and Place 1.25" HDPE Duct	85,440	Ft	$ 37.50	$ 3,204,018.60
Rock Adder	12,509	Ft	$ 81.43	$ 1,018,572.29
Place Fiber Optic Cable in 1.25" Duct	85,440	Ft	$ 2.44	$ 208,715.30
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ea	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	$ 5,438,609.45
			Total Constuction Labor and Materials	$ 5,075,487.34

Mont-2

Description	Quantitiy		Unit Rate	Total
Engineering - Route	98,555	Feet	$ 0.75	$ 73,915.88
Construction Inspection	98,555	Feet	$ 3.50	$ 344,940.78
.				
Materials				
Conduit, HDPE, 1.25" SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	-	Ft	$ -	$ -
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	-	Ea	$ -	$ -
1.25" Simplex Duct Plugs	-	Ea	$ -	$ -
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	140	Ea	$ 1.85	$ 259.00
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	-	Ea	$ -	$ -
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	-	Ea	$ -	$ -
SM Fiber Optic CABLE - 144 Count	100,000	Ft	$ 2.16	$ 216,000.00
Dome Splice Closure, 11.5" x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), three ground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	7	Ea	$ 517.62	$ 3,623.34
Splice Tray, 36ct	42	Ea	$ 36.98	$ 1,553.16
	-			
Construction				
Prepare Splice Case	8	Ea	$ 407.14	$ 3,257.09
Fiber Optic Cable Splice & Test	1,221	Ea	$ 61.07	$ 74,566.92
Set 36" x 60" x 36" Handhole	-	Ea	$ -	$ -
Set Locate Marker Post	-	Ea	$ -	$ -
Bore and Place 1.25" HDPE Duct	-	Ft	$ -	$ -
Congested Area Duct Placement	-	Ft	$ -	$ -
Rock Adder	-	Ft	$ -	$ -
Place Fiber Optic Cable in 1.25" Duct	-	Ft	$ -	$ -
Aerial Placement of Strand	92,053	Ft	$ 5.29	$ 487,216.60
Aerial Placement of Lashed Fiber	92,053	Ft	$ 1.63	$ 149,912.80
Install Down Guys	109	Ea	$ 57.00	$ 6,212.89
Install Screw Anchors	93	Ea	$ 122.14	$ 11,359.09
Install Rock Anchors	17	Ea	$ 211.71	$ 3,599.08
Bond Strand to Neutral/Pole Ground	359	Ea	$ 24.43	$ 8,769.70
Install Riser Guard	36	Ea	$ 162.85	$ 5,862.76
Light Tree Trimming	9,205	LS	$ 1.79	$ 16,490.41
Heavy Tree Trimming	9,205	Ls	$ 4.07	$ 37,478.20
			Total	$ 1,445,017.69
			Total Constuction Labor and Materials	$ 1,026,161.03

Mont-3

Description	Quantitiy		Unit Rate	Total
Engineering - Route	195,553	Feet	$ 0.75	$ 146,664.95
Construction Inspection	195,553	Feet	$ 3.50	$ 684,436.41
.				
Materials				
Conduit, HDPE, 1.25" SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	-	Ft	$ -	$ -
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	-	Ea	$ -	$ -
1.25" Simplex Duct Plugs	-	Ea	$ -	$ -
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	-	Ea	$ -	$ -
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	-	Ea	$ -	$ -
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	14	Ea	$ 53.04	$ 742.56
SM Fiber Optic CABLE - 144 Count	198,000	Ft	$ 2.16	$ 427,680.00
Dome Splice Closure, 11.5" x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), three ground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	14	Ea	$ 515.63	$ 7,218.82
Splice Tray, 36ct	83	Ea	$ 36.84	$ 3,057.72
	-			
Construction				
Prepare Splice Case	17	Ea	$ 407.14	$ 6,921.31
Fiber Optic Cable Splice & Test	2,422	Ea	$ 61.07	$ 147,912.43
Set 36" x 60" x 36" Handhole	-	Ea	$ -	$ -
Set Locate Marker Post	-	Ea	$ -	$ -
Bore and Place 1.25" HDPE Duct	-	Ft	$ -	$ -
Congested Area Duct Placement	-	Ft	$ -	$ -
Rock Adder	-	Ft	$ -	$ -
Place Fiber Optic Cable in 1.25" Duct	-	Ft	$ -	$ -
Aerial Placement of Strand	195,553	Ft	$ 5.29	$ 1,035,017.47
Aerial Placement of Lashed Fiber	195,553	Ft	$ 1.63	$ 318,466.91
Install Down Guys	236	Ea	$ 57.00	$ 13,451.77
Install Screw Anchors	201	Ea	$ 122.14	$ 24,550.29
Install Rock Anchors	36	Ea	$ 211.71	$ 7,621.58
Bond Strand to Neutral/Pole Ground	781	Ea	$ 24.43	$ 19,078.38
Install Riser Guard	78	Ea	$ 162.85	$ 12,702.64
Light Tree Trimming	20,084	LS	$ 1.79	$ 35,978.44
Heavy Tree Trimming	20,084	Ls	$ 4.07	$ 81,769.19
			Total	$ 2,973,270.86
			Total Constuction Labor and Materials	$ 2,142,169.51

Sanj-2				
Description	Quantitiy		Unit Rate	Total
Engineering - Route	36,426	Feet	$ 0.75	$ 27,319.31
Construction Inspection	36,426	Feet	$ 3.50	$ 127,490.12
.				
Materials				
Conduit, HDPE, 1.25" SDR 11, Smooth Wall, Orange, No Tape, No Wire, Price per ft, 8000' reel	40,000	Ft	$ 1.17	$ 46,800.00
1.25" Push Lock Coupler, SDR, 50 per Carton, SAP# 116341	54	Ea	$ 7.98	$ 430.92
1.25" Simplex Duct Plugs	32	Ea	$ 11.41	$ 365.12
Fiber Warning Tags 20 per pack Caution Fiber Optic Cable Orange Tag with Black Lettering Not Custom	40	Ea	$ 1.87	$ 74.80
Hand Hole Assembly, HDPE Polymer Cover, 36" x 60" x 36", w/Shield Split Lid, Telecom Logo, Hex Bolts	12	Ea	$ 2,422.81	$ 29,073.72
Marker Post, Dome, 72", White w/Orange Polydome, 5 Position Test Station, Includes Custom Route Marker: "Warning Buried Fiber Optic Cable - Before Digging Call Diggers Hotline 1-800-242-8511"	2	Ea	$ 53.68	$ 107.36
SM Fiber Optic CABLE - 144 Count	38,000	Ft	$ 2.18	$ 82,840.00
Dome Splice Closure, 11.5" x 29.5", 6 round cable entry ports, 6 cable attachments, basket(D6), three ground lugs and flash valve. No trays. Tyco FOSC450-D6-6-NT-0-D3V Single: 768f Max / Mass: 1152f Max	2	Ea	$ 521.85	$ 1,043.70
Splice Tray, 36ct	12	Ea	$ 37.28	$ 447.36
	-			
Construction				
Prepare Splice Case	2	Ea	$ 407.14	$ 814.27
Fiber Optic Cable Splice & Test	288	Ea	$ 61.07	$ 17,588.27
Set 36" x 60" x 36" Handhole	12	Ea	$ 2,849.95	$ 34,199.41
Set Locate Marker Post	2	Ea	$ 244.28	$ 488.56
Bore and Place 1.25" HDPE Duct	36,426	Ft	$ 37.50	$ 1,365,965.55
Rock Adder	4,232	Ft	$ 81.43	$ 344,599.72
Place Fiber Optic Cable in 1.25" Duct	36,426	Ft	$ 2.44	$ 88,981.35
Aerial Placement of Strand	-	Ft	$ -	$ -
Aerial Placement of Lashed Fiber	-	Ft	$ -	$ -
Install Down Guys	-	Ft	$ -	$ -
Install Screw Anchors	-	Ft	$ -	$ -
Install Rock Anchors	-	Ft	$ -	$ -
Bond Strand to Neutral/Pole Ground	-	Ft	$ -	$ -
Install Riser Guard	-	Ea	$ -	$ -
Light Tree Trimming	-	LS	$ -	$ -
Heavy Tree Trimming	-	Ls	$ -	$ -
			Total	$ 2,168,629.54
			Total Constuction Labor and Materials	$ 2,013,820.11

144-counts of fiber are planned for all of the routes to allow Region 9 to monetize the fiber, by providing dark fiber leases to ISPs and other providers. These middle mile routes will provide route diversity for all of the counties, municipalities and tribes, reducing the backhaul and transport operating costs associated with connecting to internet hubs. The middle mile network will provide increased network capacity for last-mile circuits, increased network performance, and lower costs for backhaul and transport; all of which will provide affordable and reliable broadband to a woefully underserved region.

The budget includes actual footage for the conduit based upon the routes' actual distance. Conduit can be purchased in reels of 8,000 feet. Unit prices reflect the current pricing for construction labor and materials, and reflect the rise in labor and materials pricing spurred on by supply chain issues and inflation seen in the fiber industry since the pandemic.

Fiber will be pulled in a 1.25" HDPE duct or conduit. The number and placement of handholes or vaults will be determined during the final design and engineering of the network based upon the number of cameras, kiosks, access ramps, etc. potentially needed by the Colorado Department of Transportation (CDOT) and to allow access to serve potential last mile applications. CDOT will allow access to their rightof way at no cost

with the exchange of 24 fibers on State Highway routes. Detailed depictions of drop points, handholes and fiber counts by route are not showing on the maps as these networks have not yet been designed.

Green Lines, Acquired IRUs

Additionally, the grant will acquire IRUs on existing fiber from Zayo, Colorado Department of Transportation (CDOT), and TriState Generation, shown on the map in green:

- LaPlat-8 from the manhole at the Intersection of 2nd Ave/11th Street in Durango, to TriState's Substation (Drop Pole) in Hesperus
- St-1, along I-25 from Denver to Walsenburg from Zayo
- St-3, along Hwy 160 from Walsenburg to South Fork from Zayo
- St-3, along Hwy 160 from South Fork to Pagosa Springs from CDOT
- SanJ-1, along Hwy 550 from Cascade Village to Silverton from Zayo

Price quotes were obtained for each of these IRUs from the various network owners and prices for these routes are provided below. The pricing includes the acquisition costs of the IRU and maintenance on the route for the term.

IRU's					
LaPlat-8	IRU, TriState	Other	$134,733.00	1	$134,733
SanJ-1	IRU, Zayo	Other	$87,649.01	1	$87,649
St-1	IRU, Zayo	Other	$2,418,260.02	1	$2,418,260
St-2	IRU, Zayo	Other	$1,277,914.12	1	$1,277,914
St-3	IRU, CDOT	Other	$452,025.00	1	$452,025

Including and capitalizing the maintenance costs for the acquired IRU routes will reduce operating expenses for the project going forward. This best practice uses a fiscally sustainable strategy to ensure short-term and long-term success of the project. Acquiring IRUs will allow the routes to be monetized immediately, generating revenues through dark fiber leases within the first eighteen months of the project, rather than waiting until the fiber routes are built.

CAI Construction Labor and Materials

Community anchor institutions will also significantly benefit if the application is funded. The SCAN network currently serves 129 community anchor institutions with fiber, of which 53 are located within 1000 feet of the proposed middle mile network. Though the project will not build new fiber to these locations, 123 other CAIs are located within 1000 feet of the proposed middle mile network and will be served with 1 - 10 Gbps service with the application. Please refer to the CAI maps provided.

Region 9 assumed an average cost of $5,800 to pay for the drop fiber, construction, materials and equipment for the 123 community anchor institutions that are located within 1000 feet of the proposed middle mile network. Projected costs to connect these CAIs are $713,400.

Red Routes, In-Kind Contributions

The proposed network will connect several fiber routes that have been built by La Plata Electric Association (LPEA), the SCAN network, and the networks in process and planned to be built by the Southern Ute Indian Tribe (SUIT) and the Ute Mountain Ute Tribe (UMUT) through the tribes' successful applications of other grant programs. The following existing routes are provided as in-kind match and connection of the region.

- Arch-2, SCAN fiber along County 600 from the Intersection of Hwy 160/Piedra Road to the Intersection of Cloman Road/Piedra Road.
- Arch-6, SCAN fiber along Hwy 160 from the Intersection of Hwy 160/Hwy 84 (CDOT Vault) near Pagosa Springs to the CNL located at Pagosa Springs Medical Center
- LaPlata-1 LPEA fiber along Hwy 501 from Bayfield to Pine Valley
- LaPlata-2 LPEA fiber along Hwy 501 from Pine Valley to Vallecito
- LaPlata-3 SUIT fiber from Bayfield to Durango
- LaPlata-4 SCAN fiber from the Durango CNL to a vault located at 545 Wilson Gulch Dr, Durango, CO 81301, at the Police Station
- LaPlata-5 SUIT fiber from the vaults near Mercy Hospital to Intersection Hwy 172/Hwy 309
- LaPlata-7 LPEA fiber along Hwy 550 from Durango to Cascade Village
- Reg10-1 Region 10 fiber from the vault at Hwy 184 & Hwy 145 Intersection to Region 10's CNL in Grand Junction
- Reg10-2 Region 10 fiber planned from Grand Junction to Denver along the I-70 corridor
- UMUT-1 fiber along Hwy 491 from Cortez to Towaoc to the UMUT Visitor's Center

These routes are depicted in red on the maps provided in the application's Network Route Maps section and on the map shown in Figure 8. The in-kind IRUs can be monetized immediately by Region 9 by offering dark fiber leases to ISPs. This strategy ensures both a short-term and long-term viable approach to financial sustainability. Access to fiber for the routes owned by the Tribes will be done through a trade of like services rather than as an in-kind contribution. The remaining routes are provided as an in- kind contribution to the project with an in-kind valuation of $25,297,984. A detailed evaluation of this in-kind contribution has been conducted. A number of valuation methodologies were used to determine the value of the in-kind fiber routes. Below is a summary of the results of these valuation methodologies. The average value is $25,297,984.

Valuation Methodologies, In-Kind Fiber Routes	**Value**
IRU Value Low	$ 21,706,870
IRU Value Medium	$ 24,981,745
IRU Value High	$ 34,833,174
Total Replacement Value	$ 42,631,334
Revenue Multiples, Projections, 6 * Revenue	$ 14,115,863
Revenue Multiples, Projections, 7 * Revenue	$ 16,468,506
EBITDA Multiples, Projections, 17 * EBITDA	$ 20,768,937
EBITDA Multiples, Projections, 22 * EBITDA	$ 26,877,448
Average	**$ 25,297,984**

Additionally, as mentioned above, CDOT will provide access to their right of way as an in-kind contribution to the project. In the past, CDOT has assessed a value of $7 per foot for the value of this contribution. The County is also providing access to their right of way. Below is a chart describing how the in-kind calculation for the right of way was calculated. The number of miles and feet per route are shown below, with the value of $7 per foot, resulting in an in-kind contribution for CDOT and the County of $4,802,706.07. The Archuleta County's contribution is $157,582 and CDOT's contribution is valued at $4,645,124.

Route	Highway	Type	Footages	Value per Foot	In-Kind Value
Arch-1	Hwy 160	New Build	16644	$7	$ 116,510
Arch-3	County 600	New Build	22093	$7	$ 154,650
Arch-4	Hwy 160	New Build	49261	$7	$ 344,824
Arch-5	Hwy 160	New Build	129055	$7	$ 903,387
Dol-1	Hwy 145	New Build	128238	$7	$ 897,665
LaPlat-6	Hwy 309	New Build	7646	$7	$ 53,522
LaPlat-9	Hwy 160	New Build	91856	$7	$ 642,992
LaPlat-10	2nd Ave	New Build	419	$7	$ 2,932
LaPlat-11	Hwy 160	New Build	2984	$7	$ 20,885
LaPlat-12	Hwy 160	New Build	5927	$7	$ 41,487
Mont-3	Hwy 145	New Build	195553	$7	$ 1,368,873
SanJ-2	Hwy 550	New Build	36426	$7	$ 254,980
	Total	**Total for CDOT and County Road Right of Way**			**$ 4,802,706.07**

Additionally, Empire Electric is providing pole attachment fees at no cost to the project for 20 years. Below is the calculation for this in-kind contribution. The number of poles for the routes are shown below. The annual cost per pole for the pole attachment fee is $22, resulting in an in-kind contribution of $539,718.68.

Montezuma County, Empire Electric In-kind Contribution, Waive Pole Attachment fees for 20 years							
County	**Segment ID**	**Highway**	**# of miles**	**# of Feet**	**# of poles**	**Annual Cost per Pole**	**In-Kind Value**
Montezuma Cnty	Mont-1	Hwy 160	16.18191213	85440	570	$22	$250,625.46
Montezuma Cnty	Mont-2	Hwy 184	18.66562648	98555	657	$22	$289,093.22
						Total	**$539,718.68**

The Town of Bayfield secured grant funding through the State of Colorado's Department of Local Affairs to establish a Carrier Neutral Location (CNL). The total project costs are $574,000, of which DOLA will pay for 50% or $287,000. The grant is provided as another in-kind contribution for the project.

Cash Match

La Plata County is contributing cash in the amount of $1,000,000 and Archuleta County is contributing $400,000 in cash. The State of Colorado is expected to contribute, and application has been made to the State's match fund for infrastructure projects.

10. Equipment. Below is a summary of the equipment costs for the grant.

		Unit Type	Unit Cost	No. of Units	Total Cost
10. Equipment					
Cienna	See Bill of Materials, Cienna Equipment	Other	$2,412,251.73	1	$2,412,252
Juniper	See Bill of Materials, Juniper Equipment	Other	$4,782,701.81	1	$4,782,702
Juniper Edge Equipment	See Bill of Materials, Juniper Edge Equipment	Other	$1,461,996.40	1	$1,461,996
Total Equipment					$8,656,950

Figure 9: Equipment Summary

Detailed Bill of Materials were received from Cienna and Juniper for the equipment for the project. Region 9 will purchase DWDM equipment to "light" the network. DWDM stands for Dense Wavelength Division Multiplexing, which is an optical multiplexing technology used to increase bandwidth over existing fiber optic backbones. The "dense" here refers to the fact that DWDM technology supports more than 80 separate wavelengths, each about 0.8 of a nanometer (nm) wide on a single optical fiber.

Product Family Description	Item Code	List Price	Discount %	Customer Unit Price	Qty	Total Customer Ext Price
5132						
Core						
5132,(2)100G QSFP28,(2)100G QSFP-DD,SYNC,EXT. TEMP,DUAL AC POWER,REC	170-5132-901	5,453.70	56.35	2,380.54	14	33,327.56
Cables (Core)						
AC POWER CORD, IEC C13, AUTO LOCK, NORTH AMERICA,TYPE B	170-0114-900	26.50	56.34	11.57	28	323.96
Software Licenses						
SAOS BASE OS, ETHERNET & OAM SOFTWARE LICENSE FOR 5132, PERPETUAL	S75-LIC-5132EO-P	3,492.70	56.35	1,524.57	14	21,343.98
SAOS SECURITY SOFTWARE LICENSE FOR 5132, PERPETUAL	S75-LIC-5132SEC-P	265.00	56.35	115.67	14	1,619.38
QSFP-DD						
WL5N 100G-200G TYPE 2.0 QSFP-DD	180-3520-900	19,080.00	38.89	11,659.79	14	163,237.06
QSFP28						
100G, MULTIMODE QSFP28 SR4, 70M, 850 NM	XCVR-Q00Z85	3,392.00	69.93	1,019.97	14	14,279.58
Subtotal NET Price - 5132						**234,131.52**
6500						
CUSTOMER NETWORK INTEGRATION CODES						
6500 7-SLOT TYPE 2 PACKS-IN-PLACE KIT	NTYY99EF	185.50	0.00	185.50	5	927.50
6500 7-SLOT TYPE 2 PACKS-IN-PLACE KIT	NTYY99EF	185.50	0.00	185.50	5	927.50
6500 SHELF CONFIGURATIONS						
6500 7-SLOT OPTICAL TYPE 2 SHELF ASSEMBLY	NTK503KA	3,816.00	46.65	2,035.84	5	10,179.20
42 CHANNEL MUX/DEMUX (CMD42) 112.5 GHZ C-BAND MODULE	NTT862NA	5,109.20	46.65	2,725.76	6	16,354.56

AUXILIARY SHELF EQUIPMENT						
COOLING FAN MODULE (7-SLOT SHELF)	NTK507PB	763.20	46.65	407.17	5	2,035.85
SHELF FRONT COVER (7-SLOT SHELF)	NTK509CPE6	439.90	46.65	234.69	5	1,173.45
SHELF BRKT KIT, 465 C-C, 100/127 S/B, EIA HP 7-SLOT SHELF	NTK509PE	84.80	46.65	45.24	5	226.20
CIENA N.A./C13 3.0 M. REV.H	NTK955CKE6	31.80	12.70	27.76	20	555.20
AC POWER CORD - NORTH AMERICA, STRAIGHT, IEC 60320 C15 (F) TO NEMA 5	NTK955EK	68.90	51.49	33.42	22	735.24
CBL PWR 8AWG 2.5M 2W2C LEFT ROUTED TO OPEN	NTTC01CFE6	132.50	12.70	115.67	1	115.67
CBL PWR 8AWG 2.5M 2W2C RIGHT ROUTED TO OPEN	NTTC01CHE6	132.50	12.70	115.67	1	115.67
COMMON EQUIPMENT						
POWER INPUT CARD (FUSED) 2-WIRE D-SUB, MAX 50A	NTK505QE	519.40	46.65	277.10	4	1,108.40
POWER CARD 100V-240VAC	NTK505RA	689.00	46.65	367.58	16	5,881.28
INTERFACE FILLER PACK	NTK505YAE5	79.50	46.64	42.42	8	339.36
6500 REL 12.8 NTK555NB SHELF PROCESSOR (SPAP-2 W/2XOSC FOR 6500-2/7 T	NTZF15MV	4,240.00	46.65	2,262.04	10	22,620.40
BROADBAND INTERFACES						
100GBASE-SR4, 4X25G, MMF, 850NM, 100M, MPO QSFP28	160-9400-900	3,392.00	69.93	1,019.97	30	30,599.10
100G OTR WL3N ENH C-BAND 1X QSFP28 CIRCUIT PACK	NTK538EK	51,600.80	38.89	31,533.25	22	693,731.50
TRANSCEIVER,10/100/1000BASE-T(SGMII) SFP, -40C TO 85C	NTTP61CA	245.15	38.89	149.81	22	3,295.82
SOFTWARE / SOFTWARE RTUs						
6500-D7/S8 BASE LICENSE	S74-LIC-NTK560JM	964.60	66.05	327.48	5	1,637.40
Licenses-FLEXERA-VIRTUAL						
6500 REL 12.8 SOFTWARE LICENSE	S74-LIC-NTK569MV	1.00		0.34	5	1.70
PTO KIT						
6500 WLAI MOTR TERRESTRIAL BASE KIT (NTK538DR W/LIC. FOR 4X100G CLIEN	NTZF53CM400G	108,946.80	38.89	66,577.39	2	133,154.78
Project Related Equipment						
1U BULK FIBER MANAGEMENT TRAY	174-0094-900	848.00	46.65	452.41	5	2,262.05
1U FIBER MANAGEMENT TRAY	NT0H57BBE6	763.20	46.65	407.17	12	4,886.04
SMALL OPTICAL INSTALLATION/IRM KIT	NTK509NZE6	233.20	46.65	124.41	12	1,492.92
SMALL OPTICAL INSTALLATION/IRM KIT	NTK509NZE6	233.20	46.65	124.41	5	622.05
OPTICAL INSTALLATION/IRM KIT	NTK609ZXE6	344.50	46.65	183.80	5	919.00
CONCRETE FLOOR ANCHOR KIT (ZONE4) - WAS NTRU0328	NTRU6328	212.00	12.70	185.08	10	1,850.80
PTE2000-EEA (EXT EQUIP APER - 600W X 300D X 2125H)- - WITH UNIVERSAL EN	NTRU6501	2,771.90	46.65	1,478.81	5	7,394.05
CABLE COVERS, 600 WIDE, OME-32 SHELF	NTRU6522	1,378.00	46.65	735.16	5	3,675.80
PTE2000-EEA TOP X-MBR PANEL W/ COVER - WAS NTRU0550	NTRU6550	344.50	46.65	183.80	5	919.00
Subtotal NET Price - 6500						**949,737.49**
ELS						
--						
FRONT COVER W/AIR FILTER KIT (1U ELS)	196-0610-900	445.20	46.65	237.51	6	1,425.06
FRONT COVER W/AIR FILTER KIT (2U ELS)	196-0620-900	530.00	46.65	282.76	2	565.52
ELS FLA2-48-M-AC 48 CH FILTERED LINE AMP2 CH 14-61 (100GHZ C-BAND)	196-1201-900	17,585.40	46.65	9,381.81	2	18,763.62
ELS FLA2-06-B4H-AC 6 CH FILTERED LINE AMP2 CH 47-50, 14, 61 (100GHZ C-BA	196-3221-900	14,893.00	46.65	7,945.42	2	15,890.84
ELS FLA2-06-B4L-AC 6 CH FILTERED LINE AMP2 CH 43-46, 14, 61 (100GHZ C-BAI	196-3231-900	14,893.00	46.65	7,945.42	2	15,890.84
ELS FLA2-06-C4L-AC 6 CH FILTERED LINE AMP2 CH 34-37, 14, 61 (100GHZ C-BAI	196-3251-900	14,893.00	46.65	7,945.42	2	15,890.84
ELS RELEASE 1.0.0 BASE SOFTWARE LICENSE	S96-LIC-ELS010000	869.20	10.00	782.28	8	6,258.24
ELS WAVELENGTH SPECTRUM LICENSE (PER CHANNEL)	S96-LIC-WAVESPEC	12,720.00	0.00	12,720.00	1	12,720.00
ELS CHANNEL EQUALIZATION VIRTUAL CERTIFICATE (PER CHASSIS)	S96-RTU-CHANNEL	620.10	10.00	558.09	8	4,464.72
ELS SPAN CONTROL VIRTUAL CERTIFICATE (PER CHASSIS)	S96-RTU-SPANCTLR	620.10	10.00	558.09	8	4,464.72
Subtotal NET Price - ELS						**96,334.40**
MCP						
Plus Licenses						
MCP PLUS SW WITH GEO-REDUNDANCY PERPETUAL LICENSE REL 6.X	S16-LIC-MCPPLG06	1.00		1.00	2	2.00
Plus RTUs						
MCP PLUS SW WITH GEO-REDUNDANCY PERPETUAL SCALE VIRTUAL RTU	S16-RTU-MCPPLG	1.00		124,788.49	1	124,788.49
Subtotal NET Price - MCP						**124,790.49**

Commons							
6500-R2 4-SLOT SHELF ASSEMBLY		NTK803DA	4,750.92	46.65	2,534.62	11	27,880.82
ACCESS PANEL (6500-R2)		NTK805NA	1,855.00	46.65	989.64	11	10,886.04
PIM 100V-240V AC (POWER INPUT MODULE)		NTK805SA	1,170.00	46.65	624.20	22	13,732.40
FRONT PANEL FOR 2X CTM (6500-R2)		NTK806DA	975.20	46.65	520.27	11	5,722.97
SHELF FAN MODULE		NTK807DA	1,431.00	46.65	763.44	22	16,795.68
SHELF FRONT COVER KIT (6500-R2)		NTK809DA	1,197.80	46.65	639.03	11	7,029.33
SHELF BRACKET KIT, 19IN RACK, 465MM C-C, EIA HP (6500-R2)		NTK809NT	222.60	46.65	118.76	11	1,306.36
I/F MODULE CARRIER (2X IM SLOTS)		NTK809SA	424.00	46.65	226.20	4	904.80
FILLER (FOR CTM SLOT)		NTK809VD	380.00	46.65	202.73	11	2,230.03
FILLER (FOR 2X IM SLOTS)		NTK809XA	583.00	46.65	311.03	7	2,177.21
FILLER (FOR IM SLOT IN CARRIER)		NTK809YA	466.40	46.65	248.82	4	995.28
CTM (CONTROL AND TIMING MODULE, RLS)		NTK810DA	5,724.00	46.65	3,053.75	22	67,182.50
Modules							
GE CWDM 1511NM SFP MODULE		NTK591VN	339.20	46.65	180.96	16	2,895.36
SRA C-BAND MODULE (SINGLE LINE RAMAN AMPLIFIER, RLS)		NTK830AA	16,557.20	46.65	8,833.27	4	35,333.08
DLA C-BAND 2X SFP MODULE (DUAL LINE AMPLIFIER, RLS)		NTK850BA	24,970.00	46.65	13,321.50	5	66,607.50
RLA 12X1 C-BAND 1X SFP MODULE (ROADM WITH LINE AMPLIFIER. RLS)		NTK852BA	50,450.00	46.65	26,915.08	6	161,490.48
Software, Licenses, Certificates, Customer Docs							
RLS OTDR LICENSE (PER SHELF)		S74-LIC-NTK800BA	159.00	0.00	159.00	11	1,749.00
RLS SPAN CALIBRATION LICENSE (PER SHELF)		S74-LIC-NTK800BC	159.00	0.00	159.00	11	1,749.00
RLS CONNECTION VALIDATION LICENSE (PER SHELF)		S74-LIC-NTK800BE	159.00	0.00	159.00	11	1,749.00
RLS PERFORMANCE MONITORING LICENSE (PER SHELF)		S74-LIC-NTK800BF	159.00	0.00	159.00	11	1,749.00
RLS NETWORK ALARM CORRELATION LICENSE (PER SHELF)		S74-LIC-NTK800BG	159.00	0.00	159.00	11	1,749.00
RLS NBI LICENSE (PER SHELF)		S74-LIC-NTK800BQ	3,180.00	0.00	3,180.00	11	34,980.00
Project Related Equipment							
PACKS-IN-PLACE KIT, 6500-R2		NTYY99EN	1,420.00	46.65	757.57	11	8,333.27
Subtotal NET Price - RLS							**475,228.11**
Total NET Price - Ciena Product							**1,880,222.01**
DEPLOYMENT SERVICES POC							
CIENA ADV USA FIRST 4/7 SLOT 6500 W/BUILD & 1 DGRS & UP TO 2 SERV CARD		8N0-ADBU-07F				5	29,521.00
CIENA ADV USA GRNFLD 6500 W/BUILD ADDL 1 DGRS OR UP TO 4 SERV CARDS		8N0-ADBU-ACG				13	11,644.10
CIENA ADV USA ADDL 2R2 4 SLOT W/BUILD & NO DGRS (SAME SITE)		8N0-ADBU-R02A				6	17,451.84
CIENA ADV USA FIRST 2R2 4 SLOT W/BUILD & NO DGRS		8N0-ADBU-R02F				5	21,465.00
UPLIFT FOR FRAME INSTALL (SAME SITE)		8N0-ULFT-FRM				5	8,633.00
Subtotal NET Price - DEPLOYMENT SERVICES POC							**88,714.94**
DESIGN AUDIT & OPER SVC POC							
MCP NMS INSTALL WITH REMOTE DELIVERY - 3 VM HA GR CLUSTER		80P-NMS0-MCP-VHR				1	16,780.22
MCP 1 DAY ONBOARDING WITH REMOTE DELIVERY		80P-NMS1-MCP				1	1,994.97
CIRCUIT PROVISIONING LAYER 1 (OTN, EXCLUDING PACKET) PER 10 CIRCUITS -		8NP-ULFT-CP02				1	217.28
UPLIFT FOR INTERNAL DCN DESIGN PER SHELF		8NP-ULFT-DCN1				5	1,547.15
SOLUTION PRINCIPLES - DCN < 50 NE		8NP-ULFT-SPD1				1	3,460.96
Subtotal NET Price - DESIGN AUDIT & OPER SVC POC							**24,000.58**
LOGISTICS							
FREIGHT/HANDLING CHARGES		495-0000-001				13	18.20
Subtotal NET Price - LOGISTICS							**18.20**
MAINTAIN SERVICES							
3 YEARS GLOBAL 5132 STANDARD HARDWARE REPAIR 10-DAY		80M-5132-HWM				1	7,376.00
3 YEARS GLOBAL 5132 NEXT BUSINESS DAY SHIP MANAGED SPARES		80M-5132-NBS				1	11,239.00
3 YEARS GLOBAL 5132 COMPREHENSIVE SUPPORT		80M-5132-SSP-COM				1	22,828.00
3 YEARS GLOBAL 6500 STANDARD HARDWARE REPAIR 30-DAY		80M-6500-HWM				1	29,102.00
3 YEARS GLOBAL 6500 NEXT BUSINESS DAY SHIP MANAGED SPARES		80M-6500-NBS				1	44,346.00
3 YEARS 6500 COMPREHENSIVE SUPPORT		80M-6500-SSP-COM				1	90,077.00
3 YEARS GLOBAL 6500 RLS STANDARD HARDWARE REPAIR 30-DAY		80M-6500R-HWM				1	14,708.00
3 YEARS GLOBAL 6500 RLS NEXT BUSINESS DAY SHIP MANAGED SPARES		80M-6500R-NBS				1	22,411.00
3 YEARS GLOBAL 6500 RLS COMPREHENSIVE SUPPORT		80M-6500R-SSP-COM				1	45,523.00
3 YEARS COHERENT ELS STANDARD HARDWARE REPAIR 10-DAY		80M-ELS-HWM				1	3,035.00
3 YEARS COHERENT ELS MANAGED SPARES NBD SHIP		80M-ELS-NBS				1	4,625.00
3 YEARS COHERENT ELS COMPREHENSIVE SUPPORT		80M-ELS-SSP-COM				1	9,393.00
3 YEARS MCP PLUS GEO-REDUNDANT SW, COMPREHENSIVE SUPPORT		80M-MCPPLG-COM				1	114,634.00
Subtotal NET Price - MAINTAIN SERVICES							**419,297.00**
Total NET Price - Ciena Services							**532,030.72**
Total Extended Price							**2,412,252.73**
Executive discount							**1.00**
Total Extended Price w/ Executive discount							**2,412,251.73**

Figure 10: Cienna Equipment Costs

Below is the Juniper Equipment Bill of Materials

CONVERGE TECHNOLOGY SOLUTIONS

5889 Greenwood Plaza Blvd
Suite 422
Greenwood Village CO 80111
Steve Riescher
steve.riescher@convergetp.com

To: REGION 10
Corey Bryndal
coreyb@region10.net

Quote Num: 1000660-001
Date: 7/15/2022
Expiration Date: 8/14/2022

Region10-Juniper MX10K4

Line	Qty	Product	Description	Sell	Ext Sell
100	1	**Juniper-MX10K4**		**$4,782,701.81**	**$4,782,701.81**
110	3	SVC-ND-LC9600-B	US - 3 YEAR - SVC-ND-LC9600-B	$74,409.55	$223,228.65
120	3	SVC-ND-LC9600-B	US - 3 YEAR - SVC-ND-LC9600-B	$74,409.55	$223,228.65
130	3	MX10K-LC9600-BASE	MX10K-LC9600 Integrated SKU with Base HW + Standard Junos SW, Perpetual	$334,125.00	$1,002,375.00
140	3	MX10K-LC9600-BASE	MX10K-LC9600 Integrated SKU with Base HW + Standard Junos SW, Perpetual	$334,125.00	$1,002,375.00
150	6	JNP10K-RE1-BB	JNP10K ROUTING ENGINE BASE SVCS	$0.00	$0.00
160	3	MX10004-4F-PREM	JNP10004/MX10004 Redundant 4-slot chassis - includes 2 Routing Engine, 3 Power Supplies, 2 Fan trays, 2 Fan tray Controllers and 4 Switch Fabric Cards (SF2 fabric or later)	$63,855.00	$191,565.00
170	36	JNP-QSFP-100G-SR4	QSFP28 100GBASE-SR4 OPTICS UP PERP 100M TRANSMISSION OVER PARALLEL MMF	$5,494.50	$197,802.00
180	36	JNP-QSFP-100G-SR4	QSFP28 100GBASE-SR4 OPTICS UP PERP 100M TRANSMISSION OVER PARALLEL MMF	$5,494.50	$197,802.00
190	9	JNP10K-PWR-AC2-BB	JNP10K 5000W AC Power Supply, Base Bundle	$0.00	$0.00
200	3	JUNOS-64-BB	JUNOS 64-BIT INTERNET SOFTWARE LICS US DOMESTIC VERSIONProduct stocked by manufacturer. Delivery times vary.	$0.00	$0.00
210	3	JNP10004-FRPNL-BB	JNP10004 Chassis Front Panel, Base Bundle	$0.00	$0.00
220	18	CBL-PWR2-330P6W	POWER CORD JNP10K AC2 CPNT IEC309-330P6W	$437.94	$7,882.92
230	1	JNP10004-CHAS-BB	JNP10004 Chassis Base Bundle	$0.00	$0.00
240	3	JNP10004-SF2-BB	JNP10004 Switch Fabric Card, Base	$5,940.00	$17,820.00
250	1	JNP10004-FRPNL-BB	JNP10004 Chassis Front Panel, Base Bundle	$0.00	$0.00
260	4	CBL-PWR2-330P6W	POWER CORD JNP10K AC2 CPNT IEC309-330P6W	$437.94	$1,751.76
270	2	JNP10004-FTC2-BB	JNP10004 Fan2 Controller, Base Bundle	$0.00	$0.00
280	2	JNP10004-FAN2-BB#	JNP10004 Fan-Tray dual-fans, Base Bundle	$0.00	$0.00
290	1	JNP10K-RE1-BB	JNP10K ROUTING ENGINE BASE SVCSProduct stocked by manufacturer. Delivery times vary.	$0.00	$0.00
300	1	MX10004-3F-BASE	JNP10004/MX10004 Base 4-slot chassis - includes 1 Routing Engine, 2 Power Supplies, 2 Fan trays, 2 Fan tray Controllers and 3 Switch Fabric Cards (SF2 fabric or later)	$43,807.50	$43,807.50
310	3	SVC-ND-MX10004	US - 3 YEAR - SVC-ND-MX10004	$15,212.61	$45,637.83
320	36	S-MX-4C-A1-D-3	SW, MX, 1x400GE ports, Advanced1, SoD (Scale on Demand, i.e. PAYG), Requires license compliance technology with SVC Customer Support, 3 Year	$31,143.75	$1,121,175.00
330	6	JNP10004-FTC2-BB	JNP10004 Fan2 Controller, Base Bundle	$0.00	$0.00
340	6	JNP10004-FAN2-BB	JNP10004 Fan-Tray dual-fans, Base Bundle	$0.00	$0.00
350	1	MX10K-LC9600-BASE#	MX10K-LC9600 Integrated SKU with Base HW + Standard Junos SW, Perpetual	$334,125.00	$334,125.00
360	1	SVC-COR-MX10004	Juniper Care Core Support for MX10004-PREMIUM, MX10004-4F-PREM, MX10004-BASE & MX10004-3F-BASE	$13,387.10	$13,387.10
370	2	JNP10K-PWR-AC2-BB	JNP10K 5000W AC Power Supply, Base Bundle	$0.00	$0.00
380	1	JUNOS-64-BB	JUNOS 64-BIT INTERNET SOFTWARE LICS US DOMESTIC VERSIONProduct stocked by manufacturer. Delivery times vary.	$0.00	$0.00
390	1	SVC-COR-LC9600-B	Juniper Care Core Support for MX10K-LC9600-BASE	$65,480.40	$65,480.40
400	4	JNP-QSFP-100G-SR4	QSFP28 100GBASE-SR4 OPTICS UP PERP 100M TRANSMISSION OVER PARALLEL MMF	$5,494.50	$21,978.00
410	3	JNP10004-CHAS-BB	JNP10004 Chassis Base Bundle	$0.00	$0.00
420	12	JNP10004-SF2-BB	JNP10004 Switch Fabric Card, Base	$5,940.00	$71,280.00

Grand Total	$4,782,701.81

Figure 11: Juniper Equipment Costs

The following Bill of Materials includes the edge equipment.

Products

SKU	Description	Service Duration	Disti Surcharge List Price	Discount	Quantity	Extended List Price	Extended Net Price
MX304-BASE					5	**$1,447,460.00**	**$1,447,460.00**
MX304-BASE	MX304 Base Chassis - price includes 1 Routing Engine, 2 power supplies & 3 fan trays		$97,200.00	0.00	5	$486,000.00	$486,000.00
JNP-PWR2200-AC-BB	Universal AC Power Supply, 2200W, Base		$0.00	0.00	10	$0.00	$0.00
JUNOS-64-BB	Junos 64-Bit Standard Base Bundle		$0.00	0.00	5	$0.00	$0.00
JNP304-RE-BB	JNP304 Routing Engine, BASE		$0.00	0.00	5	$0.00	$0.00
JNP304-CHAS-BB	JNP304 Chassis Base unit		$0.00	0.00	5	$0.00	$0.00
JNP-FAN-2RU-BB	Universal Fan, 2RU, Base		$0.00	0.00	15	$0.00	$0.00
MX304-LMIC16-BASE	MX304 1.6T Combo LMIC 16x100G / 4x400G-Integrated SKU with Base HW+Standard Junos SW, Perpetual		$104,800.00	0.00	5	$524,000.00	$524,000.00
JNP-QSFP-100G-SR4	QSFP28 100GBase-SR4 Optics for up to 100m transmission over parallel MMF		$8,392.00	0.00	10	$83,920.00	$83,920.00
QSFPP-4X10GE-SR	QSFP+, 4x10GBASE-SR, MMF OM3 300 meters and OM4 400 meters, Standard Temperature (0 through 70 DEGREE C), MPO-12 connector		$1,484.00	0.00	5	$7,420.00	$7,420.00
S-MX-1C-A1-C1-3	SW, MX, 1x100GE ports, Adv1, Class 1, with SW Support, 3 YEAR	36	$4,000.00	0.00	40	$160,000.00	$160,000.00
SVC-ND-MX304	Juniper Care Next Day Support for MX304-PREM	36	$20,304.00	0.00	5	$101,520.00	$101,520.00
SVC-ND-LMIC16-B	Juniper Care Next Day Support for MX304-LMIC16-BASE	36	$16,920.00	0.00	5	$84,600.00	$84,600.00
SRX300-SYS-JB					10	**$14,536.40**	**$14,536.40**
SRX300-SYS-JB	SRX300 Services Gateway includes hardware (8GE, 4G RAM, 8G Flash, power adapter and cable) and Junos Software Base (Firewall, NAT, IPSec, Routing, MPLS and Switching). RMK not included		$1,166.00	0.00	10	$11,660.00	$11,660.00
SVC-ND-SRX300JB	Juniper Care Next Day Support for SRX300-SYS-JB	36	$287.64	0.00	10	$2,876.40	$2,876.40
	Out of band management VPN/Firewall applicances		$1,500.00	0.00	5	$7,500.00	$7,500.00
	8-port serial console servers.		$650.00	0.00	5	$3,250.00	$3,250.00
	APC UPS's		$2,000.00	0.00	5	$10,000.00	$10,000.00
					Totals:	**$1,461,996.40**	**$1,461,996.40**

Figure 12: Juniper Edge Equipment Costs

10. **Miscellaneous.** For the miscellaneous charges, mapping software will be purchased and used for the construction phase of the network. Mapping software costs $80,000 per year and we assumed 5 years for a total of $400,000.

Other miscellaneous fees include the 1.5% service fees associated with obtaining the Letter of Credit. A Letter of Credit of approximately $15 Million will be secured, resulting in approximately $225,000 in service fees per year for five years. This resulted in a total cost of $1,125,000 for service fees on the Letter of Credit.

		Unit Type	Unit Cost	No. of Units	Total Cost
11. Miscellaneous					
Mapping Software	$80,000/year * 5 years	Other	$ 80,000.00	5	$400,000
1.5% Service Fees, Letter of Credit	$225,000/year * 5 years	Other	$225,000.00	5	$1,125,000
Total Miscellaneous					$1,525,000

Figure 13: Miscellaneous Costs

11. **Contingencies**. A contingency assumption of 10% of the materials and construction labor was assumed.

		Unit Type	Unit Cost	No. of Units	Total Cost
12. SUBTOTAL					
13. Contingencies					
Contingency	10% of Construction Labor and Materials	Other	10%	78,508,337	$7,850,834

Figure 14: Contingency Fees

Section 3: Why Build Middle Mile Fiber Routes? Invest in Middle-mile Infrastructure to Reduce Backhaul and Transport Costs

Bringing high-speed Internet and data communications capacity into and between communities and to an Internet hub is often referred to as "Middle-mile Infrastructure." Broadband networks require access to an Internet "supply" – locations where there is an Internet hub, backhaul or transport point, located in population centers. These Internet hubs can either be accessed by building fiber directly to the location, utilizing a point-to-point digital microwave link or leasing existing infrastructure. The costs for leasing existing facilities or backhaul are often based upon mileage. In either of these options, the costs to build directly from the Internet "supply" to rural areas are extremely capital intensive and/or the monthly access charges for leasing infrastructure are too high.

In rural areas, incumbent providers have infrastructure to link fiber back to these Internet hubs. Many of the incumbent providers, such as Lumen, Charter, AT&T, Frontier and Comcast may have their own fiber to these Internet hubs; however, most of the incumbent providers do not allow other entities or local governments to "tap into their fiber" to extend a network, as is common for new homes to tap into a main waterline. Some providers allow other ISPs to lease "dark fiber" which is fiber that doesn't have electronics or monthly services, (as opposed to "lit" services, which is a monthly fee-based service) for connectivity to the various communities or internet exchanges, but their excess fiber is limited. Most provide "lit services" for a monthly fee and these charges are typically priced based upon mileage to an internet exchange or hub. For rural areas such as those included in Region 9, the lit service fees for backhaul and transport are high.

High monthly backhaul-charges or up-front capital costs to connect to Internet exchanges or hubs are difficult to finance since most rural areas do not have the population to support an adequate return on investment for any providers to upgrade their networks. This issue was raised by other service providers serving the area. Therefore, building middle mile fiber to internet exchanges and between communities greatly reduces the backhaul and transport costs for internet service providers.

Examples of Local Governments who have invested in Middle Mile Infrastructure

Giving access to existing conduit or middle mile fiber owned either by Region 9 stakeholders or by the State can be leveraged to attract potential partners that may be willing to deploy an all-fiber network. Through this study, NEO discussed ways to work with CDOT to install conduit when work is being done in the public right-of-way along major highways. The Counties should continue to work with CDOT and/or power companies and others to partner in the middle mile builds. Implementing a shadow conduit policy that requires installation of additional conduit whenever work is being done within the right of way will further reduce the cost of middle mile fiber construction. By creating and implementing a shadow conduit policy, the Counties will gain additional conduit that can be used to leverage further investment. A carefully-written shadow conduit policy or dig once policy should not force entities who have paid for an open trench to be required to let their competitors place conduit or fiber in the open trench. A shadow conduit or dig once policy should not create a disincentive for private providers to dig trenches to homes and neighborhoods, as their take-rate models are usually based on some level of assumed exclusivity for the conduit they pay to put in.

There are hundreds of examples of municipalities and counties that are using smart conduit construction, joint build agreements and shadow conduit policies to gain assets and attract potential partners. In Centennial, CO, the City began a fiber optic and conduit initiative in 2008 as a public works effort connecting city buildings, traffic signals and other public facilities. The City implemented a dig once policy that required additional conduit be installed when work was being done in the right of way. To date, the City has installed more than 60 miles of conduit and fiber optic infrastructure suitable for broadband deployment while spending less than $600,000. This network is currently valued well over $6 Million. The City recently engaged in a formal process to incent providers to deploy a Gigabit-enabled fiber network to every home and business within the city limits. The City announced an agreement with Ting, where Ting would be able to use existing conduit and fiber to roll out its Gigabit services to the community.

El Dorado County has applied for and was awarded grant funding through EDA to build out middle mile fiber in three communities – Cool, Georgetown and Garden Valley as these areas were designated priority areas through a broadband planning effort with NEO. NEO created a business plan that identified twenty priority areas that had significant population that lacked access to broadband services. The County has also decided to use its ARPA funding for final design and engineering for its densely populated and priority areas to build out a Fiber to the Premise network.

A group of 15 cities in Los Angeles County, California, managed by the South Bay Cities Council of Governments (SBCCOG) are building a middle mile fiber network connecting key government and anchor institutions through a public-private partnership with American Dark Fiber (ADF). The network will support smart city applications, traffic signal coordination, as well as telehealth services and remote learning and working. The network will connect the cities of Carson, El Segundo, Gardena, Hawthorne, Hermosa Beach, Inglewood, Lawndale, Lomita, Manhattan Beach, Palos Verdes Estates, Rancho Palos Verdes, Redondo Beach, Rolling Hills, Rolling Hills Estates, and Torrance in Los Angeles County. Local institutions and government authorities are also participating in the fiber project, including the Beach Cities Health District, Los Angeles County Metropolitan Transportation Authority (LA Metro), Los Angeles County Department of Public Works, Lundquist Institute, South Bay Workforce Investment Board, and West Basin Municipal Water District.

In this partnership, ADF will own the network, and an ISP, Race Communications, will provide services to subscribers. The network was designed to include various exit points built into the contract so that the various South Bay cities can use to opt out of the partnership and work with other providers.

As the community of Mesa, Arizona, began to grow, community leaders recognized that telecommunications would be a key element to its success. Mesa was an early adopter of "dig once" policy, placing conduit whenever streets were excavated for any other infrastructure purpose. Mesa has also taken advantage of non-traditional existing infrastructure, placing fiber in abandoned conduit that had been used for other utility purposes. This resulted in a network of 150 - 200 miles of fiber throughout the community. The investment has paid off in a number of ways over time and helped the city establish a broadband-friendly environment for economic development, allowing private sector companies to use the existing conduit and fiber to reduce their overall costs of infrastructure deployment.

Bozeman, MT invested in multi-duct conduits, making it possible for nonprofit Bozeman Fiber, who leases the conduit, to reach more residences and businesses with service. Lincoln, Nebraska invested $700,000 to install a conduit system in 2012. Since then, their conduit network has grown to more than 300 miles and has served as a key component to attracting multiple (six) private carrier providers who lease the conduit, helping to pay off the initial investment.

Local governments and state agencies have been connecting their community anchor institutions with fiber optic networks for over twenty years. Community anchor institutions are state, county and local government offices and buildings, schools and libraries, hospitals, medical facilities and first responders. In fact, in the U.S., thousands of schools, libraries, community centers, and public health and safety providers obtain their broadband connectivity from local government and state non-profit networks, including state research and education networks.

Connecting these anchor institutions with fiber allows each location to receive very high-speed Internet and data connectivity while eliminating or drastically reducing the monthly lease or access costs paid to the private sector service providers. Anchor institutions often cannot afford to purchase high-capacity circuits from the private sector service providers and therefore, simply cap their bandwidth purchased. Capping their bandwidth requires the anchor institutions to choose which applications to deploy and limits their ability to use applications that require high bandwidth. Building a municipally-owned fiber network to anchor institutions allows these critical key facilities to have the bandwidth they need to support all of their applications and once these networks are in place, additional bandwidth needs can easily be met without additional capital cost for construction.

Region 9 could consider connecting their community anchor institutions with fiber to ensure that they have the highest-quality broadband connectivity. This could be done in collaboration with the other agencies to share in the cost of construction. Then, once these networks are built, the Counties could also consider leasing excess capacity of conduit or of fiber to the private sector for last mile build out and use. Once a network is built that serves schools, government offices, fire districts and the like, generally, this network reaches deep into neighborhoods and past business parks. These networks can then serve as an opportunity to allow the private sector to lease excess capacity and in turn serve homes and businesses with high-speed fiber. This trend is fast accelerating as hundreds of municipalities make available spare fiber optic capacity to private sector companies at rates designed to incentivize new private sector investment and opportunity.

An additional benefit of building a community anchor institution network for municipalities is it will be equipped to support "smart city" applications when the time comes for city service innovation. Smart city applications may include connecting traffic lights, traffic management, and smart journey planning. Smart journey planning systems use open city data in order to recommend how individuals can best navigate from one place to the next. The systems are becoming sophisticated enough to take into consideration personal preferences such as cost, safety concerns and CO2 footprint, as well as real-time traffic congestion and traffic patterns.

Other smart city applications may include connecting smart parking meters, automated meter reading and utilities management. Street lights are often connected with fiber and applications are emerging that allow active safety; increasing light levels in city centers when the light system detects individuals or motion, at bus stops or along walkways.

Another top smart city application is environmental monitoring, where a city that uses monitoring stations for pollution or weather conditions can now connect and use these systems for real time data collection and can pinpoint potential sources of pollution or weather issues and quickly react and efficiently deal with potential problems.

Other smart city applications are emerging around transport sharing, whether it is sharing bikes or cars or rideshare. Smart cars and electric cars will be a key enabler for wider adoption of city center car sharing, providing information to individuals about location and availability of shared cars and up-to-date information of pickup times for rideshare applications.

Section 4, Implement Broadband Friendly Policies and Ordinances

Often a municipality or a Tribe does not have the capital to invest in a comprehensive broadband network, but it will have the ability to provide in-kind contributions, tax and other economic incentives, use of existing assets, and to enact policies and ordinances that are broadband-friendly. All of these strategies have the effect of lowering the cost for a private provider to deploy a fiber or wireless network within a community, with little to no investment directly from the municipality.

Dig Once and Shadow Conduit Policies

Sixty to eighty percent of a fiber optic network's capital costs are in opening a trench or in burying conduit that will house fiber optic cable. Policies that encourage placement of conduit or fiber optic cable when a trench is open eliminate much of the capital costs for network deployment. By coordinating with other City, Tribe or State capital projects such as sidewalk improvements, establishment of trails, implementation of street lighting, road construction and road widening projects, additional conduit can be placed within the trench when other work is being performed in the right of way. Coordination with other utility projects can substantially decrease the costs of broadband infrastructure.

A Dig Once Policy typically has the following components:

- All public works or installation of other telecom, cable or utility infrastructure allows for conduit to be placed on behalf of the local or State government and any other entities that want to participate. If there is an open trench, the policy provides for coordination of street cuts and excavations with utilities, public works, developers and other interested parties. This maximizes the opportunity for broadband-specific conduit installation, while minimizing cost, community disruption and damage to existing infrastructure.
- A notice period informing other entities that an open trench will be available for placement of their conduit and/or fiber optic facilities.
- Allows for shadow conduit to be placed on behalf of the local and/or State government. The installation of empty and/or spare conduit by a public agency when excavations occur in the public right of way, with the local government agency's costs limited to the incremental costs of the conduit only.

A standard, conduit-specification document can be developed that addresses capacity, separation of facilities, proper sizing and placement. The specification document also addresses access to the conduit with detailed provisions for vaults and all access points. Cost sharing or cost recovery stipulations can be put in place for materials and labor assignment. Engineering specifications and drawings that address conduit sweeps, bend radius and physical placement requirements can be provided with the standard conduit specification.

Additionally, various government agencies can establish Joint Trench Agreements and Joint Build Agreements with other telecommunications, cable or utility providers. Cost for placement of conduit or fiber will be shared amongst all entities, allowing each to take advantage of the other's trenching. Standardization of these agreements across all potential owners of underground infrastructure can be established to ensure all parties are aware of the joint trenching opportunities as they become available.

Streamlined Permitting Processes and Abandoned Fiber and Conduit Policies

A slow permitting process can add uncertainty in the construction timeline as well as significant costs. Crews can sit idle while waiting for permitting approvals and this adds to the overall cost of construction. A Streamlined Permitting Process can be implemented placing the responsibility for approval of broadband infrastructure projects solely in the public works department via an encroachment permit processes. Limiting this process to one department can reduce delays in the approval process. Additionally, a bulk permitting process can enable a single approval for multiple sections, further streamlining the overall process.

Create an Abandoned Fiber and Conduit Policy to regain control of abandoned facilities. Any abandoned fiber and/or conduit that is left vacant, and is not claimed by the owner within a designated time period, would revert to the local government agency.

One-touch Make Ready Processes

One of the most unpredictable and costly components of fiber optic construction is the "make-ready" process. "Make-Ready" refers to the inspections, engineering, and rearrangements necessary to accommodate the installation of multiple cables on a utility pole. Make-ready engineering for placement of fiber optic cables needs to comply with the National Electric Safety Code (NESC). Compliance may include moving existing fiber optic cable, increasing the load bearing ability of poles and/or the transfer or

replacement of existing poles required to accommodate the attachment of new fiber optic cable. At times, the make-ready process can require multiple companies to dispatch crews with specialized equipment and bucket trucks to move their physical attachments on the communications portion of utility poles, causing slowdowns and duplicate expense for deployments.

In order to better streamline this time consuming and high-cost element, a One-touch Make-Ready Process or One Truck-Roll Procedure can be established to enable and encourage all of this work to be done by one company rather than by many.

Encourage standards for placement of conduit and/or fiber in new developments

The integration of broadband "utility" codes into land development policies and City/Tribe ordinances ensures uniform and standardized placement of conduit and/or fiber optic facilities. These land development codes would require all new commercial and residential developments to install fiber optic infrastructure. New building codes could describe the specific and compatible communications components and architectures of all new construction. Further, theses codes could describe the development and use of City/Tribe rights-of-way for communications connectivity, and could specify standardized wiring requirements for new buildings.

Standardize Pole Attachment Rates for Placement of Aerial Fiber, Reducing the Operational Costs for Pole Rental Rates

Pole attachment rates vary dramatically across various jurisdictions and utility companies for attaching aerial fiber on existing utility poles. Rates are typically charged per pole per year and can range from $4 per pole up to $26 per pole. Standardizing the pole attachment rates to a reasonable annual fee per pole per year will reduce the operating expenses for placement of fiber optic cable. Deploying fiber using existing utility poles is less expensive than placement of fiber in a conduit where a trench would need to be opened. Standardizing and minimizing the pole attachment rates can eliminate uncertainty and operational expenses.

Set up funding mechanisms or Set-asides to allow for adoption of these policies.

Conduit is not expensive. However, if the funding mechanism does not exist to place conduit, often opportunities to take advantage of open trenches or joint builds do not occur. A funding set-aside or budget process must be put in place to allow for implementation of these policies. The funding mechanism will allocate monies to build broadband infrastructure when opportunities arise and the fund would maintain a reserve or set-aside for unanticipated projects.

Keep a GIS database of all infrastructure, and provide for a process to submit plans.

Develop a policy that all construction permits issued would require the submission of final as-built drawings. This policy would define all planning and construction documentation requirements for utilities, developers, contractors and others in an appropriate GIS format.

These policies can be implemented to facilitate investment from the private sector and can also be used to gain substantial assets owned by Region 9 that can be leveraged for future broadband deployment.

Other municipal facilitation to encourage and support investment could include removing roadblocks and creating efficiencies that a private company cannot achieve on its own.

Use of Existing Assets

Existing assets can include tower facilities, water towers, land, rights of way, existing conduit and existing fiber. Sixty to eighty percent of a fiber optic network's capital costs are in opening a trench or in burying conduit that will house fiber optic cable. Using existing conduit therefore, substantially reduces the capital costs of network deployment. If a municipality has existing conduit or fiber, these assets can be leveraged to entice further deployment of investment by the private sector. New networks can and are built on the foundation a community's already existing fiber and/or conduit as well as available land.

Economic Incentives

Economic incentives as well as logistic assistance from a Tribe can help pave the way for more powerful broadband service. Most tax incentives are implemented at the State-level, but the municipality could influence the State's consideration of providing tax incentives in the form of accelerated depreciation, reduced property taxes and reduced sales taxes.

Section 5, Leverage Funding and Grant Programs

There are several strategies local governments have used to finance municipal broadband networks. Counties can sometimes appropriate funds available through the general fund, to cover the capital costs of network builds. Funds can be appropriated either on a one-time or multi-year basis.

If there is not sufficient funding available in the general fund, a number of counties have used general obligation bonds, revenue bonds, or certificates of participation to finance the network build-out. Other financing options include New Market tax credits, for which allocations would have to be secured; economic development retail sales tax funds, internal loans, TIF, economic development financing programs, and crowd sourcing.

There is also a growing interest among private financial institutions willing to invest in municipal networks. Local governments may be able to find alternative means of financing government anchor networks using private capital.

Traditional Grant Funding Programs for Broadband

Grant funding is available from a number of state and national sources. At the federal level, E-rate and the Rural Healthcare Grants are provided through the Universal Service Administrative Company (USAC). USAC is an independent, not-for-profit organization, designated by the FCC to administer the Universal Service Fund. This fund receives approximately $10 billion annually and is used to deliver funding through four programs (E-rate, the Rural Healthcare Program, Lifeline Program and the High-Cost Program). The E-rate program will pay for 40-60% of the capital costs to build fiber to schools and libraries. The Rural Healthcare Program will pay for 60-65% of the capital costs to build fiber to qualifying medical facilities. Although there are strict rules through USAC and the E-rate Program regarding the use of excess fiber

deployed through the grant, there may be opportunities to obtain a waiver of this rule, allowing the Counties to partner with the school district on portions of their build.

Another federal program for financing broadband is the Economic Development Administration (EDA). EDA will fund development for partnership planning, local technical assistance and economic adjustment assistance. EDA will fund implementation and construction of broadband networks for public works projects and economic adjustment assistance projects. Other federal programs are offered through the US Housing and Urban Development. A variety of funding sources and funding mechanisms are available through HUD for planning and implementation of broadband networks.

The USDA offers grant funding and loan program for broadband infrastructure through its Rural Utility Service and ReConnect. State programs in Colorado that provide funding are the High-Cost Support Mechanism grant, which is sunsetting in 2023 and the Department of Local Affairs (DOLA) Energy and Mineral Impact Assistance Funding. This program will fund middle mile broadband infrastructure and costs to establish carrier neutral location facilities.

Congressional Funding

Local governments have the ability to apply for congressional funding and broadband is a top priority for this type of funding.

Other Potential Sources of Funding, Supplemental Tax Revenues, Streaming and Over-the-Top Services

Across the U.S., cable companies are seeing their customers cancel their traditional broadband TV services and choose to receive their entertainment through over-the-top services or streaming services such as Hulu, Amazon Video, Netflix and HBO Go. As cord-cutting increases, some counties have been trying to recoup lost franchise fees received from cable companies by charging taxes on over-the-top services.

Within the past year, approximately 45 cities in California are implementing or planning to implement a tax on streaming services and video games, using their city's existing tax rate for cable providers. Their tax rates on video services range from 4.5 to 11 percent. Already taxing these services at rates from 6% - 9.4% include communities in Pennsylvania, Minnesota and Chicago.

There has been push-back from content and streaming providers on this tax and it is likely that these taxes will be challenged in court. An argument can be made that taxes on Internet sales are not allowed without a physical address within states, and therefore, this streaming and gaming tax could be struck down as well.

Charging Fees for Use of Right of Ways

Cities in Oregon have started charging private and public entities for use of their right of ways as a means to fund infrastructure improvements. The fee amount varies based on the kind of utility and how many facilities are used in the right-of-way. Charging right of way fees may be another funding mechanism for cities to build broadband infrastructure.

Grant Funding in Response to the Pandemic

In response to the pandemic, there are billions of grant dollars that can be invested in broadband infrastructure. Some of these programs are currently underway and many of these programs are still being fleshed out.

The December 2020 Appropriations Act provided support for the Local Broadband Connectivity Program and the NTIA Broadband Infrastructure Program. These grant programs are underway and the deadline for submission has already passed. Announcements for funding will be made during the first part of 2022.

American Rescue Plan Act, $340 Billion Available in Broadband Funding

Below is a list of various programs and the agency administering the funds.

- Economic Development Administration (Department of Commerce): *$3 billion* in additional funding to the Public Works and Economic Adjustment Assistance (PWEAA) program through September 2022

- Coronavirus Capital Projects Fund (Department of the Treasury): *$10 billion* for "capital projects directly enabling work, education, and health monitoring, including remote options, in response to the public health emergency"; in addition to capital projects, eligible efforts include ancillary services (such as broadband mapping) to increase efficiencies of capital projects, and cost support efforts (such as subsidies). *The State of Colorado will receive $160 Million under this program for broadband implementation. The State will roll out the rules and requirements for application and administration of this funding in 2023.*

- Emergency Connectivity Fund (FCC): *$7.2 billion* for E-Rate support to reimburse schools and libraries for provision of eligible equipment and advanced telecommunications and information services during the pandemic, including for locations other than schools and libraries

- Coronavirus State Fiscal Recovery Fund: *$219.8 billion* for investments in water, sewer, or broadband infrastructure.

- Coronavirus Local Fiscal Recovery Fund: *$130.2* billion for rural community development block grants (CDBG) ($45.6 billion), rural areas ($19.5 billion), and counties ($65.1 billion, population-based), including for investments in water, sewer, or broadband infrastructure

- Local Assistance and Local Consistency Fund: *$500 million* (*$250 million* per year for 2022 and 2023) for Local use only "for any governmental purpose other than a lobbying activity"

President Joe Biden's multibillion-dollar Infrastructure Investment and Jobs Act includes $65 billion in broadband spending. Of this $65 billion, the bill provides $42.45 billion in grants, under the Broadband Equity, Access & Deployment Program (BEAD) to states to build out last-mile broadband infrastructure, improve broadband maps, or increase broadband adoption programs. The BEAD program will be administered by the National Telecommunications and Information Administration ("NTIA"). Each state will receive a minimum of $100 Million and must provide a 5-year plan to NTIA. The States will then award subgrants.

- State subgrants may be used to fund infrastructure:
    - Unserved service projects (75-80% of locations in the proposal area lack access to reliable 25Mbps/3Mbps)
    - Underserved service projects (75-80% of locations in the proposal area lack access to reliable 100Mbps/20Mbps service)
    - Community anchor institutions ("CAIs"), such as schools, libraries, and hospitals, lacking access to 1Gbps service
- Infrastructure funding prioritization: A State "must award funding in a manner that prioritizes unserved service projects." After certifying to NTIA that it "will ensure coverage" to "all unserved locations" in the State, the State must prioritize underserved service projects. After "prioritizing underserved service projects," the State may fund eligible CAIs.
- Projects must provide at least 100Mbps/20Mbps service to be eligible for funding.
- Entities that have received other federal, state, or local government broadband funding (RDOF, other ARPA programs, etc.) may receive subgrants under BEAD.
- The BEAD Program requires a 25 percent match for awarded projects, which may be provided by the State or the subgrantee.
- In addition to broadband infrastructure, States may use BEAD grants for data collection, broadband mapping, installing Internet infrastructure or providing reduced-cost broadband within a qualifying low-income multifamily residential building, broadband adoption (including provision of devices), and additional uses determined necessary by NTIA.
- Timing: The NOFO was released in the summer of 2022. The process is dependent on submission and evaluation of State five-year plans, and the broadband DATA maps being updated and published. It is anticipated that funding will not be awarded to subgrantees until 2023.

The Infrastructure and Jobs Act bill provides approximately $14 billion toward a $30 monthly benefit to expand an existing program to help people with lower incomes pay for broadband service and requires internet service providers who take this federal money to offer lower-cost options. Additionally, the bill provides $2 billion in funding broadband infrastructure to tribes and additional monies available for middle mile expansion.

Region 9 has been assisting their member government agencies by providing information regarding the various funding programs and how to best leverage them to improve broadband services in the region.

Section 6: Last Mile Strategies, Public Private Partnerships

Public Private Partnerships

In addition to the above funding sources, there are a number of public-private partnership models that have recently emerged that allow the county to pursue a Gigabit-enabled network, while sharing in the risk, rewards and capital cost outlay of the network.

When evaluating public-private partnerships, counties need to balance the tension between control, risk and reward against the County's goals for the project. Control, in this context, refers to ownership of the network or how much capital the county is willing to invest. A local government must consider how much control or capital is needed to be invested to minimize risks and maximize rewards. Risks are associated primarily with financial risks such as debt and debt coverage, as well as implementation, execution and operational risks. Reward is often associated with where and how fast a network is constructed, coupled with what type of services will be offered and at what price. There may be other benefits that are classified under "reward" such as fiber built for the city's or county's benefit at no cost or construction and operational efficiencies gained from the potential partnership.

Partners can include private for-profit companies, local non-profits, other anchor institutions and even local residents. In some instances, the county may have a very limited role in a partnership and may only provide access to rights of way or other city or county infrastructure such as conduit, excess fiber, water or public safety towers, licensed spectrum, light poles or local government buildings. In other cases, a county may agree to become an anchor tenant and pay for service on the network for a contracted term, providing a guaranteed revenue source for the network project partner to justify the business plan to build out further in the community. In more extensive partnerships, the county can play a larger role, such as providing capital for part or all of the network construction. In some public partnership models, the private sector provides financing, while the county shares in some of the risk. In other models, the county pays for a substantial portion or all of the network build and contracts the operation of the network to the project partner. Sharing in the financial and operational risks and in the associated benefits of a project can allow communities to pursue broadband endeavors that may otherwise be unattainable.

Below are examples of three public partnership models that have been implemented by communities in the recent years.

Google Fiber, No Capital Outlay from the City or County

Perhaps the most coveted example of a public-private partnership is the Google Fiber project in the Kansas City area. Google chose Kansas City, KS and Kansas City, MO as the community to embark upon its first foray into building fiber infrastructure. Kansas City, KS committed to facilitate access to local infrastructure and conduit that it owned and provided access to its rights of way. Kansas City, MO committed to waive local permitting fees and provided Google with unfettered access to dedicated city staff to support the project.

In return, Google has agreed to build and operate a fiber-to-the-premise network and provide Internet access service with 1 Gbps speeds to homes at $70 per month and to businesses at $300 per month. Google Fiber did not commit to ubiquitous coverage in Kansas City, but agreed to build out fiber in neighborhoods (called "fiberhoods") that met a predetermined take rate percentage prior to construction.

Google Fiber used this same approach in Austin, TX and in Provo, Utah. Although in the past three years Google has announced plans to replicate this model in 35 other cities, Google has recently announced that it is pulling back its fiber-to-the-premise strategy and is experimenting with Gigabit wireless technologies. Currently Gigabit wireless technology is limited to 500 feet; meaning, fiber optic cable still needs to be installed very close to homes and businesses for the wireless technology to deliver Gigabit bandwidth. Nevertheless, Google's pull back has caused some trepidation in the industry. Google is evaluating other models for partnership with cities and their pause in fiber-to-the-premise implementation should not be taken as an indication of their appetite for collaboration with cities.

In the Google Fiber KS model, the local governments do not commit capital to build the network. This limits the cities' financial risk substantially, but it also curbs the control they have over how and where the network is built. The counties in the Google Fiber projects have no say over prices charged to the customers, how the network is built or how fast. Google makes all of the decisions regarding current and future operations, and whether or not they pull out of a market. Given their most recent announcements of pulling back their plans, this has proven to be a substantial risk to the communities. Critics of Google's

fiberhood approach claim that Google has "cherry-picked" more affluent neighborhoods to build its fiber and has left economically challenged neighborhoods off its build list.

Ting, County Builds the Fiber Network, Ting pays for Equipment and Operates the Network

Canada's Ting has recently made a name for itself as a private carrier that will deliver fiber-to-the-premises services over a city-owned network. Already underway in Westminster, MD, Santa Cruz, CA, and Huntsville, AL, Ting is now partnering with Centennial, CO to bring Gigabit fiber Internet access to Centennial's 107,000 residents and its local businesses.

In this model the county provides the capital to build, own and maintain the "dark" fiber throughout the community and to every home and business. Ting "lights" the fiber by providing capital for the equipment. Ting provides Gigabit services to homes for $89 per month and to businesses for $139 per month. In order for the city to pay down its debt associated with building the fiber network, Ting pays the city a fee for homes and businesses that are fiber-ready or have been passed with fiber and another fee when homes and businesses start subscribing to Internet services.

While the fiber network is the property of the city and eventually an "open network," meaning several service providers can use it to offer services to homes and businesses, Ting partnerships typically feature an "exclusive right to operate network" for a minimum amount of time. While the build is the responsibility of the respective cities, Ting will lease and light the fiber and provide all equipment and Internet access. Cities partnering with Ting are mitigating risk and staying out of the challenging ISP business, but have more control over where, how and how fast the network is built. The cities also have control over pricing and services offered and can require that the network is available for others to use after an initial period of time.

Other companies are now replicating this model. Companies in Colorado that have stated they would enter into public-private partnerships similar to Ting's model include Cedar Networks, Allo, FastTrack and Vero. Others may also offer a similar model if asked to respond to a formal Request for Information or Proposal.

Long-term Lease, Shared Take Rate Risks or Utility Fee

Private firms will fund a network build, and will oversee design, engineering, construction and operation of the network with a 20-year exclusive lease agreement. These firms are forecasting that the subscription rates they receive will provide healthy returns on their investment. And for extra measure, they ensure a sufficient return by requiring cities to guarantee take rates, or pay the difference. The good news is that these potential city paybacks have a long ramp-up time before ever going into effect. Additionally, the guaranteed take rate is typically more than achievable at somewhere between 30-38%, depending on the negotiated terms. At the end of the negotiated years, the city owns the network free and clear but can continue to lease the fiber to their established partner(s).

Private firms will also work with communities to establish a fiber network using a similar model to that described above or with a utility fee structure model. This utility fee structure model was recently used to rescue Utah's Utopia network from its financial woes. In the Utopia project, Macquarie Capital charges a flat utility fee for every home and business that the network passes, whether the home or business signs

up for services or not. Terms of the deal were reported to be $22.60 per month for five cities. In terms of revenue sharing, each city is able to keep 75% of wholesale revenue after the first $2M per year. This arrangement is expected to wipe out Utopia's debt by 2021 if the network sees a 24% take rate for premium services

Macquarie Capital is also providing financing, design, engineering, construction and operations for an anchor institutions network for the State of Kentucky. This "concessionaire model" provides a long-term agreement of 30 years where Macquarie is the lead vendor coordinating all financing and implementation for the project and the State of Kentucky, in turn, shares in the risks and rewards of the project.

Next Steps, Engage with the ISPs

In light of the BEAD funding that will be available starting in 2022, NEO recommends Region 9 to start engaging with the ISPs now to establish partnerships while leveraging funding. Many local governments are issuing an Invitation to Negotiation or Request for Proposal (RFP) process to engage with the service providers.

Appendix 1, Glossary, Helpful Broadband Basics

Broadband Technologies

Below is a brief description of the various technologies used in broadband deployment:

DSL (Digital Subscriber Line) uses existing copper phone lines to deliver download and upload broadband speeds typically of 1.5 Mbps to 7 Mbps. DSL speeds diminishes as distance increases from the telephone company's central office. Homes or businesses located more than three miles from the central office will not receive as fast of speeds. There have been many improvements to DSL technologies to improve the speed available. In general, most forms of DSL service improvements support up to 10 Mbps. VDSL (Very High Bit Rate Digital Subscriber Line) can support up to 30 Mbps, but most Internet service providers do not support this type of service, including providers in the region.

Cable modem service uses coaxial cables already installed by the cable TV operators to provide broadband service. Most cable networks support speeds comparable to DSL. Cable operators are upgrading their cable networks by installing fiber optic cable closer to neighborhoods. These network improvements allow cable modem service to be able to support up to 30 Mbps. This connection type is a shared service, meaning, as more people are on the network within a neighborhood, the speed available to each customer diminishes.

Fiber optic technology converts electrical signals carrying data to light and sends the light through glass fibers about the diameter of a human hair. Fiber transmits data at speeds far exceeding current DSL or cable modem speeds, typically by tens or even hundreds of Mbps. Fiber is the best way to provide abundant broadband, but it often is the most capital-intensive to build. As fiber optic technology transmit pulses of light, more bandwidth can be delivered on a fiber optic network by adding various colors of light or additional spectrum. Fiber is unique because it can carry high bandwidth signals over long distances without signal or bandwidth degradation and it can provide that capacity in both directions – for both upload and downloading information.

Wireless broadband connects a home or business to the Internet using a radio link between the customer's location and the service provider's facility. Wireless technologies using longer-range directional equipment provide broadband service in remote or sparsely populated areas where DSL or cable modem service would be costly to provide or fiber network installations may be too capital intensive.

Wireless broadband can be mobile or fixed. Wireless speeds are generally comparable to DSL and cable modem. Wireless services can be offered using both licensed spectrum and unlicensed devices. Wi-Fi networks typically use unlicensed spectrum. Wi-Fi networks use wireless technology from a fixed point and often require direct line-of-sight between the wireless transmitter and receiver. Wi-Fi networks can be designed for private access within a home or business, or be used for public Internet access at "hot spots" such as restaurants, coffee shops, hotels, airports, convention centers, and city parks. Using licensed spectrum, greater amounts of bandwidth can be delivered and often do not require direct line-of-sight.

In some communities, especially sparse, geographically diverse rural communities, small providers build out a wireless solution since wireless infrastructure is not as capital-intensive as building out a fiber optic infrastructure. While wireless technology does have its limitations, needing to be designed to get around

"line of sight' requirements as well as to support "shared" bandwidth on the network, smart engineering can deliver good connectivity.

Cellular 4G and LTE. Cellular service is often referred to as wireless service and it can be confused with Wi-Fi. Cellular and Wi-Fi are both wireless systems, meaning both use radio frequencies to transmit and receive data. But Wi-Fi has a radio transmitter and receiver that operates only at a range of 200 feet or so. The range of cellular is measured in miles. Wi-Fi's transmitter and receiver is called an access point. It is mounted in the corner of a room, or on a lamp post, or in a hotel lobby. A cellular transmitter and receiver are called a cell site, or a base station and can transmit for miles.

"4G" refers to the fourth and latest generation technology for data transmission over a cellular network. It can support greater data speeds than most public Wi-Fi networks and is used primarily when a customer is out of the range of a Wi-Fi network. LTE, which stands for "Long Term Evolution," is the fastest, most consistent variety of 4G.

To date, the cellular companies have charged for data usage either by the amount of data used or with a flat fee for unlimited data use.

Wireless Local Area Networks (WLANs) provide wireless broadband access over shorter distances and are often used to extend the reach of a "last-mile" wireline or fixed wireless broadband connection within a home, building, or campus environment. An in-home Wi-Fi network is a WLAN – it does not use spectrum, rather it sends radio waves at a limited range. Mobile wireless broadband services are also becoming available from mobile telephone service providers. These services are generally appropriate for highly-mobile customers and require a special wireless card with a built-in antenna that plugs into a user's laptop computer. Generally, they provide lower speeds, in the range of several hundred Kbps.

Satellite broadband is another form of wireless broadband, and is also useful for serving remote or sparsely populated areas. Typically, a consumer can expect to receive (download) at a speed of about 500 Kbps and send (upload) at a speed of about 80 Kbps. These speeds are slower than DSL and cable modem, but they are about 10 times faster than the download speed with dial-up Internet access. Service can be disrupted in extreme weather conditions and are typically oversubscribed.

As mentioned above, the "gold standard" in solving the last mile connectivity is in building more fiber out to homes and businesses. This methodology is currently the only reliable way of providing Gigabit or 1,000 Mbps of broadband services to end users. There have been dramatic improvements in wireless technologies and although we are now seeing the ability for wireless to support Gigabit speeds, the wireless access points need to be fed with fiber and have a Gigabit reach of less than 500 feet. Gigabit players, Google Fiber and AT&T have announced plans to trial Gigabit wireless services in select markets in the U.S. for serving homes and businesses, but are not yet commercially available. Siklu is a company that is currently providing wireless equipment that supports Gigabit capacity; again, wireless access points need to be fed with fiber.

Definitions

"Bandwidth" is the capacity of a telecom line to carry signals. The necessary bandwidth is the amount of spectrum required to transmit the signal without distortion or loss of information.

"Broadband" is a descriptive term for evolving digital technologies that provide consumers a signal switched facility offering integrated access to voice, high-speed data service, video-demand services, and interactive delivery services.
"Exclusive Access" refers to the situation where a single retail service provider (who may or may not be the network operator) has exclusive use of the FTTH/FTTB or FTTP network.
"Dark Fiber" is optical fiber infrastructure that is currently in place but is not being used. Optical fiber conveys information in the form of light pulses so the "dark" means no light pulses are being sent. To the extent that these installations are unused, they are described as dark. **"Lit"** services have equipment on both ends of the fiber and therefore is transmitting data; i.e., light pulses are being sent.
"FTTH, FTTB or FTTP" Fiber to the Home, Fiber to the Business or Fiber to the Premise, in other words, bring fiber optic cable all the way to the home, business or premise.
"Megabyte (MB)" a measure of amount of information used, for example, to quantify computer memory or storage capacity. There are (8) Megabits in a single Megabyte.
"Megabits Per Second (Mbps)" is an abbreviation for megabits per second. It refers to data transfer speeds as measured in megabits.
"Open Access (Packet)" refers to the situation where multiple retail service providers may use the FTTH Network on an equable base by connecting at a packet layer interface and compete to offer their services to end users.
"Open Access (Wavelength)" refers to the situation where multiple retail or wholesale service providers may use the FTTH Network on an equable base by connecting at a wavelength layer interface and compete to offer their services.
"Open Access (Fiber)" refers to the situation where multiple retail or wholesale service providers may use the infrastructure by connecting at a physical layer ("dark" fiber) interface and compete to offer their services.
"Open Access (Duct)" refers to the situation where multiple retail or wholesale service providers may share the use of infrastructure covering a substantial region by drawing or blowing their fiber cables through the shared ducts, and compete to offer their services.
"Indefeasible right of use (IRU)" is a contractual agreement between the operators of a communications cable, such as submarine communications cable or a fiber optic network and a client.
The IRU: shall mean the exclusive, unrestricted, and indefeasible right to use the relevant capacity (including equipment, fibers or capacity) for any legal purpose. It refers to the bandwidth purchased after the submarine cable system has sealed the Construction and Maintenance Agreement (C&MA) among the owners or after the system came into service and where the un-owned capacity is available. IRU may also be purchased from the existing owner. The right of use is indefeasible, so as the capacity purchased is also un-returnable and maintenance cost incurred becomes payable and irrefusable. "IRU user" can unconditionally and exclusively uses the relevant capacity of the "IRU grantor's" fiber network for the specified time period. In some cases, with an IRU, there are often restrictions imposed on the lessee by the lessor to not resell the fiber strands to other users.
"Internet/Data" refers to use of the Public Internet for exchanging email, web- browsing, etc.
"Shadow Conduit" placing another conduit within an open trench while work is being done in the right of way.
"Voice" refers to the exchange of human bi-directional, real time, full-duplex conversations (phone service)
"Video" refers to the exchange of visual material by use of **"IP" (IPTV), "RF"** (carried via a separate optical wavelength, overlay video) or **"Other"** encoding and transport protocols. (This category does not include Video carried over the Public Internet.)
"Quality of Service (QoS)" In the field of computer networking and other packet-switched telecommunication networks, the traffic engineering term quality of service (QoS) refers to resource

control mechanisms rather than the achieved service quality. Quality of service is the ability to provide different priority to different applications, users, or data flows, or to guarantee a certain level of performance to a data flow. For example, a required bit rate, delay, jitter, packet dropping probability and/or bit error rate may be guaranteed. Quality of service guarantees are important if the network capacity is insufficient, especially for real-time streaming multimedia applications such as voice over IP, online games and IPTV, since these often require fixed bit rate and are delay sensitive, and in networks where the capacity is a limited resource, for example in cellular data communication.

"Universal Service" The financial mechanism that helps compensate telephone companies or other communications entities for providing access to telecommunications services at reasonable and affordable rates throughout the country, including rural, insular and high costs areas, and to public institutions. Companies, not consumers, are required by law to contribute to this fund. The law does not prohibit companies from passing this charge on to customers. The Universal Service Fund, which is administered through the FCC is currently being revised. In the past, the Universal Service Fund was used to help build out telecommunications phone service to rural or underserved areas. The Universal Service Fund may be used to help build out Internet access to underserved or unserved areas.

"Common Carrier" The term used to describe a telephone company. It is a telecommunications company that is available for hire on a nondiscriminatory basis to provide communication transmission services, such as telephone and telegraph, to the public.

"Internet Service Provider (ISP)" A company that provides access to the Internet. For a monthly fee, the service provider gives you a software package, username, password and access phone number. Equipped with a modem, you can then log on to the Internet and browse the World Wide Web and USENET, and send and receive email.

"Service Provider" A telecommunications provider that provides internet, voice, data or video services.

"Transport Networks" Transport networks are defined as network infrastructure that provides connectivity and bandwidth for customer services. They are characterized by their ability to support server layer provisioning and traffic engineering for client layer services, such that resource guarantees may be provided to their customers.

Benefits and Disadvantages of Aerial vs. Underground Construction of Fiber

Aerial deployments are normally faster and less expensive to deploy than underground-constructed networks. The ground may be undulating, rocky or both, making burying cable more difficult.

Here are the advantages and disadvantages of aerial and underground construction.

Advantages of Aerial/Overhead Utilities

- **Service Restoration** – Overhead or aerial fiber optic cable faults can be located easier and more quickly, resulting in reduced outage times. Underground fiber requires special equipment such as fault indicators and cable thumpers to locate and isolate cable cuts and cable faults. Once located, a splice pit must be opened to expose the damaged cable before repairs can be made. Underground utilities are more difficult to inspect, diagnose and repair increasing outage times.
- **Excavation** – There is no threat of damage to overhead utilities from excavators except at poles and guy wires.
- **Streetlights** – Streetlights can be easily installed on poles and maintained at a lower cost.

- Operating Temperatures – Overhead conductors can operate at a much higher temperature than underground conductors. Excessive heat in underground conductors may result in more cable failures.
- Subsurface Terrain Construction – Overhead utilities are not as adversely affected by terrain, rocks, water and existing sub-surface utilities.
- Capital Costs - Aerial or overhead utilities require less materials and labor to install resulting in lower construction costs as compared to underground utilities.

Disadvantages of Overhead Utilities

- Storms – Overhead utilities are more susceptible to outages associated with storms, lightning, wind and ice.
- Wildfires – Wildfire risk poses a challenge to aerial implementation of fiber. In fact, PG&E is in the process of burying much of their aerial electric lines to mitigate the risk of wildfire.
- Wildlife – Overhead lines are exposed to wildlife
- Vehicular Contact – The risk of motor vehicle contact with poles and guy wires is greater.
- Hazards – Contact with overhead lines from people and equipment is more likely with overhead utilities than underground facilities. Guy wires can be a danger to the public especially if there are no guy guards.

Advantages of Underground Utilities

- Joint-Use and Joint Builds – Underground utilities can utilize a joint-use trench or a joint-build to reduce the overall construction costs of a project. Construction costs can be shared by a number of utilities or entities, resulting in lower construction costs
- Increased Public Safety – Downed utility lines represent a hazard to the public. Often these downed lines are still energized with very high voltages and can cause harm to citizens and potential fires, as seen in California within the past two years.
- Aesthetics – A primary reason to bury overhead utilities is the aesthetic benefit received with more attractive streetscapes.
- Tree Trimming – Underground utilities do not require regular tree trimming/bush clearing.
- UV Exposure – Underground utilities are not exposed to the elements of animals or UV degradation.
- Vandalism – Burying utilities reduces vulnerability to vandalism. Interference – Burying utilities will reduce interference of vandalism to fiber optic cables.
- Maintenance Costs – Maintenance costs are lower for underground fiber utilities.

Disadvantages of Underground Utilities

- Costs – Underground utilities have higher installation and construction costs.
- Excavation – Disruption in service can occur as private property or lawns are excavated, or when a new real estate development is established.
- Cable Failures/Repair Costs – It is more difficult and time consuming to repair subsurface utilities as special equipment is needed to locate the fault or cable break.