Phase 2: Broadband Infrastructure Site Modeling / Initial Recommendations Custer County, Colorado

Prepared For
Custer County Economic Development Board

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Executive Summary

The Custer County Economic Development Corporation (CCEDC) desires to improve broadband availability and wireless service throughout Custer County. Because the County is rural and sparsely populated, commercial entities hesitate to invest capital to improve service due to low return on investment concerns. CCEDC wishes to proactively encourage expansion by providing the tower assets needed to serve all its constituents. This report builds on the previous Broadband Assessment by modeling the Line of Sight (LOS) coverage from existing and proposed sites.

To estimate those addresses potentially covered from existing sites with the incumbent carriers, coverage was modeled at 360 degrees from the current sites at existing elevations. Coverage distance was limited to 7 miles Line of Sight (LOS), both as a compromise between the two link budgets given by the carriers previously and also because this distance is a common industry standard. Additionally, it is assumed that a subscriber's antenna can be mounted at 20 feet Above Ground Level (AGL), which is a common height for a roof peak of a single-story residence. Finally, the model assumes that immediate obstructions such as large rocks, unusually large trees and manmade structures will not block the antenna's LOS.

Coverage from proposed locations and some existing locations was modeled at 100 feet AGL. Final antenna height will be determined as a function of exact tower placement and final design. Except for the antenna height, the assumptions used for the existing sites—as stated previously—all apply for this analysis, as well, with the most important assumption being that the address count per site as given is exclusive of coverage from other sites.

The next step in the analysis was to evaluate incremental gain in overall addresses covered above and beyond the existing coverage. For this analysis, all existing sites were modeled using the assumptions stated above, then incrementally adding the proposed sites to gain the addresses covered by the additional sites. This approach illustrates the value of the proposed site over the potential coverage from existing sites. This correlates with the value offered to the existing wireless operators in the county.

The sites that would require connectivity were evaluated for feasible links against all sites in the surrounding area. Hub sites for each incumbent carrier were chosen as primary targets for backhaul.

Based on the aforementioned methods and criteria, six sites were chosen as the primary locations for possible towers. These sites are:

- Buck/Beddows
- West Rosita
- East of Domingo
- Junkins (Loop) High Point
- Centennial
- San Isabel

Project Overview

The Custer County Economic Development Corporation (CCEDC) desires to improve broadband availability and wireless service throughout Custer County. Because the County is rural and sparsely populated, commercial entities hesitate to invest capital to improve service due to low return on investment concerns. CCEDC wishes to proactively encourage expansion by providing the tower assets needed to serve all its constituents.

Currently, two Wireless Internet Service Providers (WISPs) are operating in Custer County: DD Wireless (recently acquired by SECOM) and Hilltop Wireless. Both provider's systems were modeled assuming 360-degree (omni) coverage.

Three visits were made to the County, including a kickoff meeting and a comprehensive drive of the county. During the second and third visits, all WISP sites and Centerline-selected potential sites were mapped out, and the drive included seeing as many of these as possible. The Centerline-selected sites were based on possible locations that had good line of sight (LOS) to addresses provided by the county.

Existing WISP Coverage

To estimate those addresses potentially covered from existing sites with the incumbent carriers, coverage was modeled at 360 degrees from the current sites at existing elevations. Coverage distance was limited to 7 miles Line of Sight (LOS), both as a compromise between the two link budgets given by the carriers previously and also because this distance is a common industry standard of coverage. Additionally, it is assumed that the subscriber antenna can be mounted at 20 feet AGL, which is a common height for a roof peak of a single-story residence. Finally, the model assumes that local obstructions such as large rocks, unusually large trees and manmade structures are cleared by the antenna.

Table 1 gives the sites used for existing carrier coverage along with the number of addresses covered. The addresses given in the table are exclusive of any other coverage and provide a good reference point of the coverage over addresses from that location. The total addresses column gives the total number of addresses provided in the County database. The county database provides all registered addresses in the county with an approximate latitude and longitude. In some cases, the structure is not located exactly as indicated by the database, but it was beyond the scope of this project to adjust all the data to match satellite imagery. Also, some of the addresses issued have not been built yet, but it was agreed that the addresses should be considered for future growth.

Name	Addresses Covered	Addresses Percentage	Total Addresses	Comments
Clay Tower 20	1,514	23.1	6,553	Assumes clears all local obstructions
JJ Courtyard at 30 ft Hilltop	1,118	17.06	6,553	Many addresses at distance. Local coverage obsructed
Arlie30	987	15.06	6,553	
Transmitter Hill D at 20 ft	955	14.57	6,553	
Stoneman Tower 20	708	10.8	6,553	
Democrat Mt 20	650	9.92	6,553	
Toms Tower 20	513	7.83	6,553	
Horn Creek 30 Hilltop	503	7.68	6,553	
Hilltop Hermit 30 Hilltop	484	7.39	6,553	
Anderson Tower 20	368	5.62	6,553	
South Colony Tower 20	333	5.08	6,553	
Antelope Tower 20	293	4.47	6,553	
Rosita Tower at 20 ft	233	3.56	6,553	
Gene Tower20	223	3.4	6,553	
Hal Tower at 20 ft	195	2.98	6,553	
Centenial at 20	160	2.44	6,553	
Wetmore 20	91	1.39	6,553	

Table 1. Addresses Covered by Existing Towers

Coverage from proposed locations

Coverage from those proposed locations and some existing locations was modeled at 100 feet AGL. Final antenna height will be determined as a function of exact tower placement and final design. Except for the antenna height, the assumptions used for the existing sites—as stated previously—all apply for this analysis, as well, with the most assumption important being that the address count per site as given is exclusive of coverage from other sites. The exception to this is the extra column that has been added to the table for those sites that have been modeled with higher antenna structures at existing locations. This column provides the difference between the new coverage and the existing coverage.

Name	Addresses Covered	Addresses Percentage	Total Addresses	Exsting covered addresses	Add Addresses	Comments
West Rosita Tower 100	1,039	15.86	6,553		1039	Did not compare against Rosita, Toms, Anderson
Water Tank 100	983	15	6,553		983	Did not compare against JJ Courtyard
Buck Mountain 100	915	13.96	6,553		915	
Beddows 100	851	12.99	6,553		851	Alternate to Buck
Sperry Peak 100	654	9.98	6,553		654	Coverage into Antelope Butte (S. of Rosita) at distance
Junkins High Point	651	9.93	6,553		651	
East of Domingo 100	647	9.87	6,553		647	
East of Domingo 2 100	631	9.63	6,553		631	Alternate to East of Domingo
Gene Tower 100	704	10.74	6,553	223	481	Overlap with Sperry but in better position
Verdemont Tower 100	443	6.76	6,553		443	Some overlap with Beddows and Buck
South Ranch 100	348	5.31	6,553		348	
Mld 255 Tower at 100 ft	316	4.82	6,553		316	
Toms Tower 100	788	12.03	6,553	513	275	
Bullard Mountain 100	227	3.46	6,553		227	
Centennial Tower 100	197	3.01	6,553		197	
Transmitter HIll 100	1,150	17.55	6,553	955	195	Includes Population to the West
Move Toms Tower 100	695	10.61	6,553	513	182	
Myron Mountain 100	161	2.46	6,553		161	
Rosita Tower 100	370	5.65	6,553	233	137	
North 255 100	129	1.97	6,553		129	
Antelope Tower 100	417	6.36	6,553	293	124	
San Isabele 100	118	1.8	6,553		118	
Anderson Tower 100	478	7.29	6,553	368	110	
Arlie 100	1,053	16.07	6,553	987	66	Secom Microwave Hub, may build second tower
Horn Creek 100	564	8.61	6,553	503	61	Site not yet active. Arlie covers into this area.
South Colony Tower 100	394	6.01	6,553	333	61	
Clay Tower 100	1,574	24.02	6,553	1,514	60	Assumes existing tower clears local obstucitons
Hermit Basin 100	540	8.24	6,553	484	56	Arlie covers into this area
Hal Tower at 100 ft	240	3.66	6,553	195	45	
Wetmore 100	124	1.89	6,553	91	33	
Stoneman Tower 100	735	11.22	6,553	708	27	
North 165 100	13	0.2	6,553		13	

Table 2. Addresses Covered by Proposed Towers

Of note here is that some of the sites show great coverage (i.e. Transmitter Hill, Arlie and Clay), but raising the site provided relatively few additional addresses. The implications of this are detailed later in this report.

Progressive Analysis of New and Existing Coverage

The next step in the analysis was to evaluate incremental gain in overall addresses covered above and beyond the existing coverage. For this analysis, all existing sites were modeled using the assumptions stated above, then incrementally adding the proposed sites to gain the addresses covered by the additional sites. This approach illustrates the value of the proposed site over the potential coverage from existing sites. This correlates with the value offered to the existing wireless operators in the county.

Because coverage from the proposed sites will interact with the existing sites and the other proposed sites that might be built before it, an iterative process was used to determine the overall incremental gain of each site add. This process also revealed the diminishing returns of the less-effective sites on the overall percentage covered in the county. Appendix A provides the iteration sequences that were performed for this analysis, with the final recommended sequence provided in Table 3.

Name	Addresses Covered	Addresses Percentage	Total Addresses	Incremental increase	Incremental percentage
Both Systems	4,140	63.18	6,553		
Both System Plus Buck	4,309	65.76	6,553	169	2.58
Both Systems Buck Cent	4,448	67.88	6,553	139	2.12
Both Systems Buck Cent Mid255	4,597	70.15	6,553	149	2.27
Both Systems Buck Cent Mid255 SanIs	4,715	71.95	6,553	118	1.8
Both Systems Buck Cent Mid255 SanIs WRosit	4,816	73.49	6,553	101	1.54
Both Systems Buck Cent Mid255 SanIs WRosit Dom	4,886	74.56	6,553	70	1.07
Both Systems Buck Cent Mid255 SanIs WRosit Dom Junkins	4,958	75.66	6,553	72	1.1
Both Systems Buck Cent Mid255 SanIs WRosit Dom Junkins Sranch	5,010	76.45	6,553	52	0.79

Table 3. Optimal Incremental Addition Analysis

For reference, the site names are abbreviated for practicality and are as follows:

- Buck: Buck Mountain
- Cent: Centennial Tower
- Mid255: Mid 255 Tower (located on CR 255 midway between Silver Cliff and county line)
- Sanis: San Isabelle
- WRosit: West Rosita Tower
- Dom: East of Domingo
- Junkins: Junkins High Point
- SRanch: South Ranch

After going through the exercise, the eight sites listed provide the greatest additional coverage over addresses in the county.

Site Connectivity

The sites that would require connectivity were evaluated for feasible links against all sites in the surrounding area. In choosing the best practical method to backhaul a site, the following assumptions and considerations were applied:

- Dense trees and foliage in the area will be no higher than 50’ AGL.
- Reasonable tower heights will be available for each location, not to exceed 80’ AGL.
- Spacing exists or will exist at each site to accommodate the new link antennas.
- The terrain profiles were generated with 1/3 arc second terrain and 2011 NLCD clutter data.
- The Fresnel Zones for 6 GHz will suffice to determine antenna height required.
- Any path beyond 25 miles will be determined as non-feasible for 6 GHz.
- Climatic Factor and Terrain Roughness will not generate a C factor higher than 0.25.
- K factor will not refract beyond the range of 1.333 (4/3) to 1.0.
- Co-channel interference will be a non-issue because of availability of licenses for upper and lower 6 GHz in the service area.

- Transmitter Hill acts as a backup service point for both the Hilltop Hermit Basin and Arlie sites.
- The area seems very arid, drastically reducing the concern for multipath and reflection. For those feasible links where this could be an issue, potential reflection is adequately blocked by tree lines and practical design.

Against these considerations, feasible microwave paths were found for each of the sites in question. Figure 1 is the representation of these optimal paths:

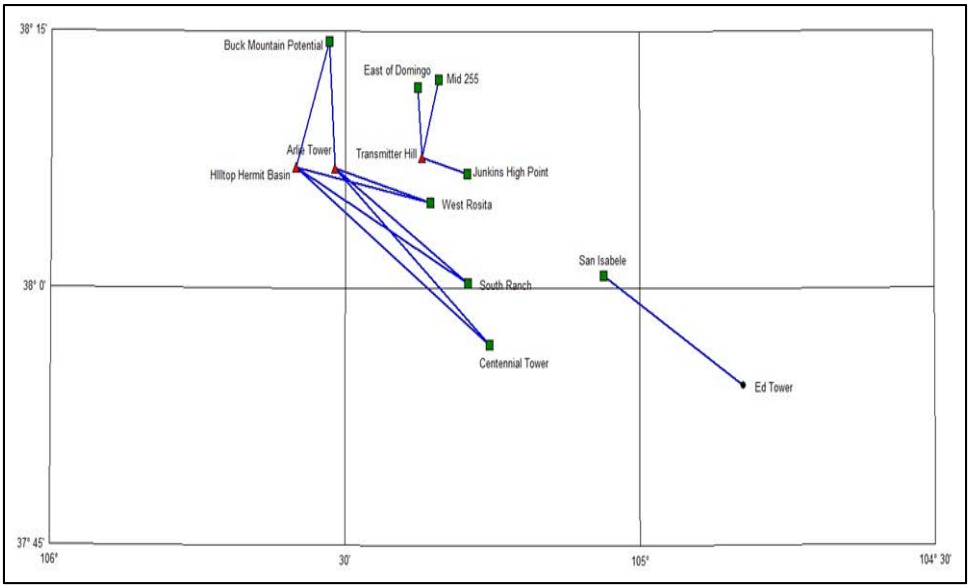

Figure 1. Overall Connectivity Feasible Network

Each subsequent site was evaluated against terrain and clutter, and these profiles can be found in the following section, “Site Recommendations”.

San Isabel Isolation

Issues arose when attempting to connect San Isabel to the primary Points of Presence (Hermit Basin, Arlie Tower, Transmitter Hill), or even to any point West of the site. Refer to the following Figure 2, of which RED links are not feasible.

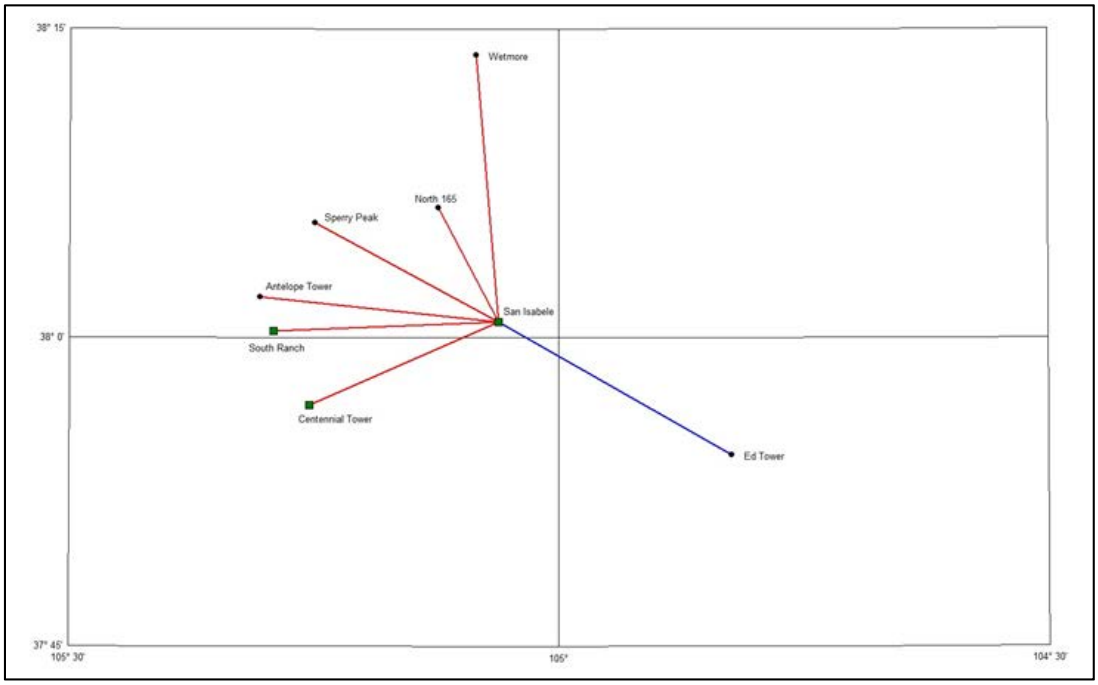

Figure 2. San Isabel Isolation

The primary driver for determining that a nearby site was non-feasible was the required antenna height to attain any form of Line of Sight. Table 4 is a breakdown of the required heights for the sites described above, illustrating the reasoning for them having no practical consideration:

Site 1	Required Height (ft. AGL)	Site 2	Required Height (ft. AGL)
San Isabel	2333.3	Centennial Tower	1195.0
	2913.0	South Ranch	1583.6
	2930.1	Antelope Tower	937.9
	1958.8	Sperry Peak	738.7
	681.3	North 165	110.8
	1560.7	Wetmore	924.0

Table 4. Antenna Height for Connectivity to San Isabel

The best available path for connectivity to San Isabel was determined to be Ed Tower. Reasonable antenna heights would be required for this path to be feasible, as seen in Figure 3:

Figure 3. San Isabel Feasible Path

Site Recommendations

The analysis of total covered addresses gave us good insight to the visibility of the site to potential subscribers, which in turn provides value to the operator. The incremental addresses analysis shows us which sites will help us attempt to reach the goal of 80 percent of the addresses covered in the county. Finally, subjective criteria must be considered, such as:

- Constructability
- Accessibility
- Marketability
- Connectivity
- Industry Experience

The following site recommendations are based on all the above criteria.

Site 1: Buck/Beddows

Buck Mountain is given as the primary site, with Beddows Mountain as a backup. Construction may be difficult on Buck, and Beddows will require leasable property. These two sites (shown in Figure 4) were third on the list of total covered addresses and first on the list of incremental addresses. In addition, potential subscribers and incumbent providers in this area have expressed demand for new infrastructure. All these factors combined make this and easy choice for the first site to pursue.

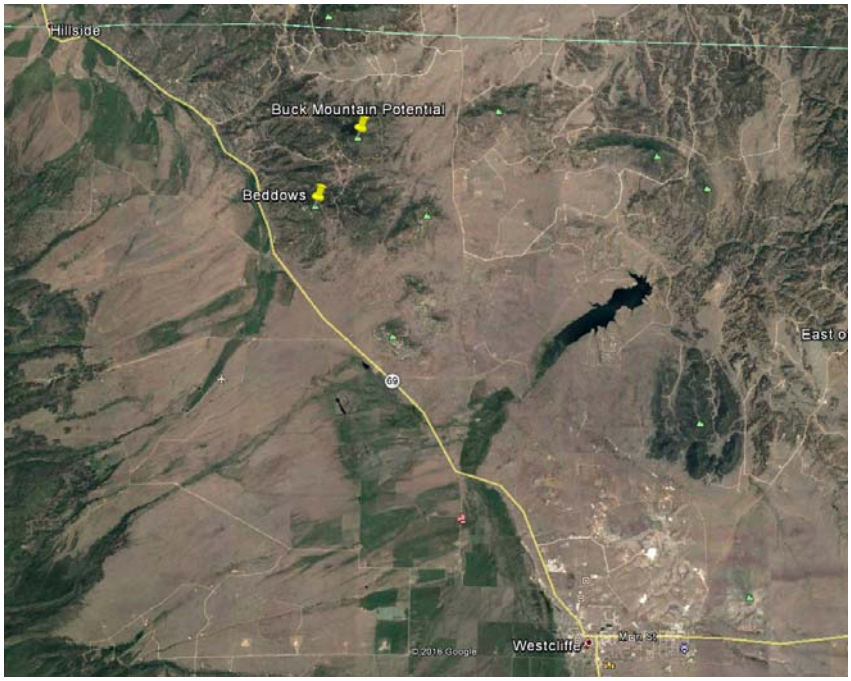

Figure 4. Location of Buck and Beddows

Coverage for Buck, shown in Figure 5, extends beyond the immediate area of difficult terrain to both the east and the west. The following coverage plot shows Line of Sight (LOS) for Buck at a 7-mile radius. The blue circles indicate addresses from the county data base.

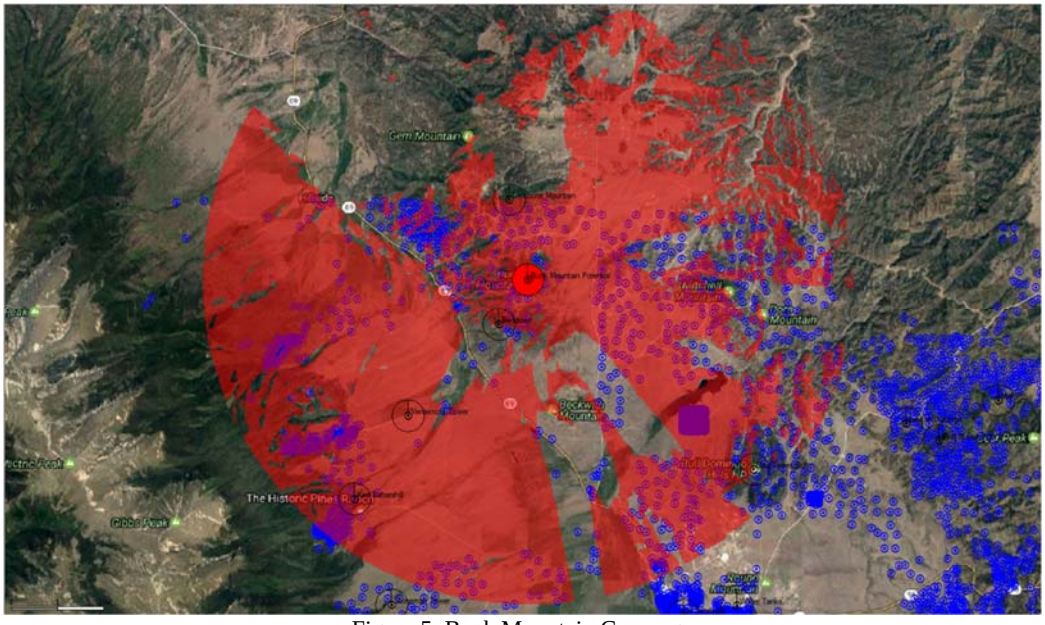
Figure 5. Buck Mountain Coverage

Connectivity to each provider's networks is provided through existing sites located at Hermit Basin and the Arlie tower. Figure 6 and Figure 7 show potential connection links for the respective carriers to the target sites.

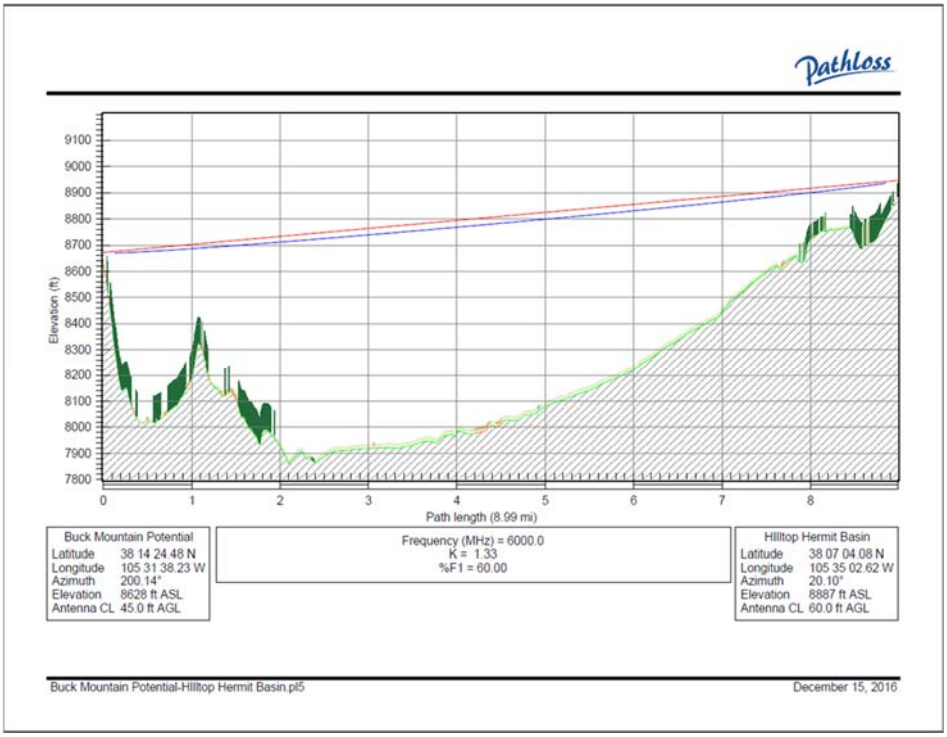

Figure 6. Microwave connectivity for Hilltop Wireless

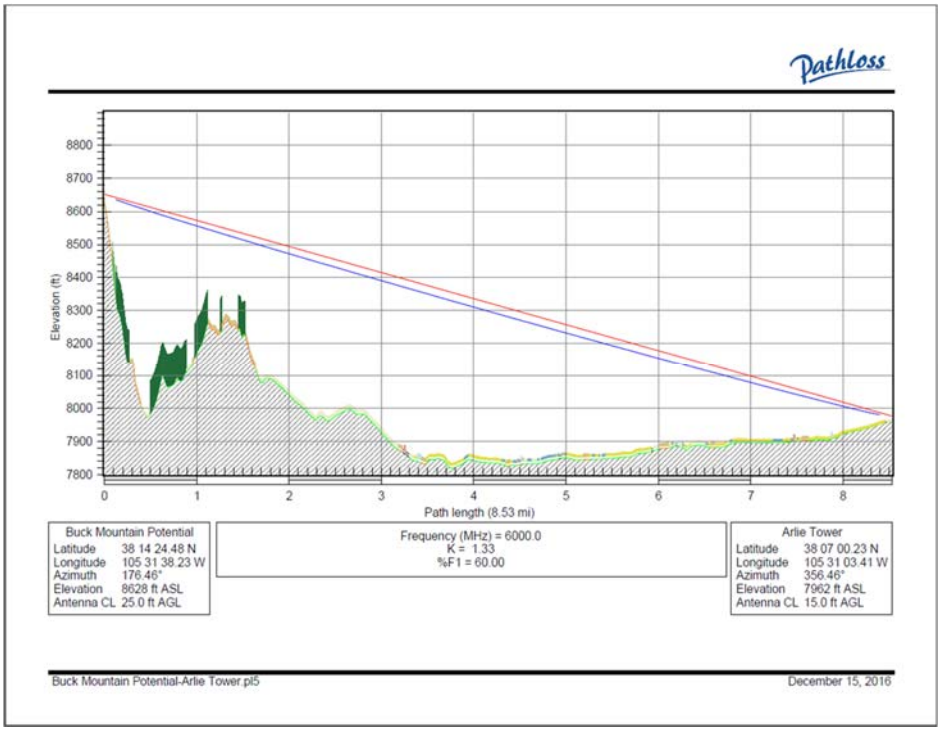

Figure 7. Microwave connectivity for SECOM

Site 2: West Rosita

The West Rosita site will provide new coverage to an area along Rosita road, leading in from the west near the intersection with CR 318. The approximate location of this site is shown on Figure 8. The site was the top contributor on the address covered list sees many addresses and was a strong contributor to the incremental address list. The site can also add a redundant connection over a large area as indicated by the coverage plot shown in Figure 9.

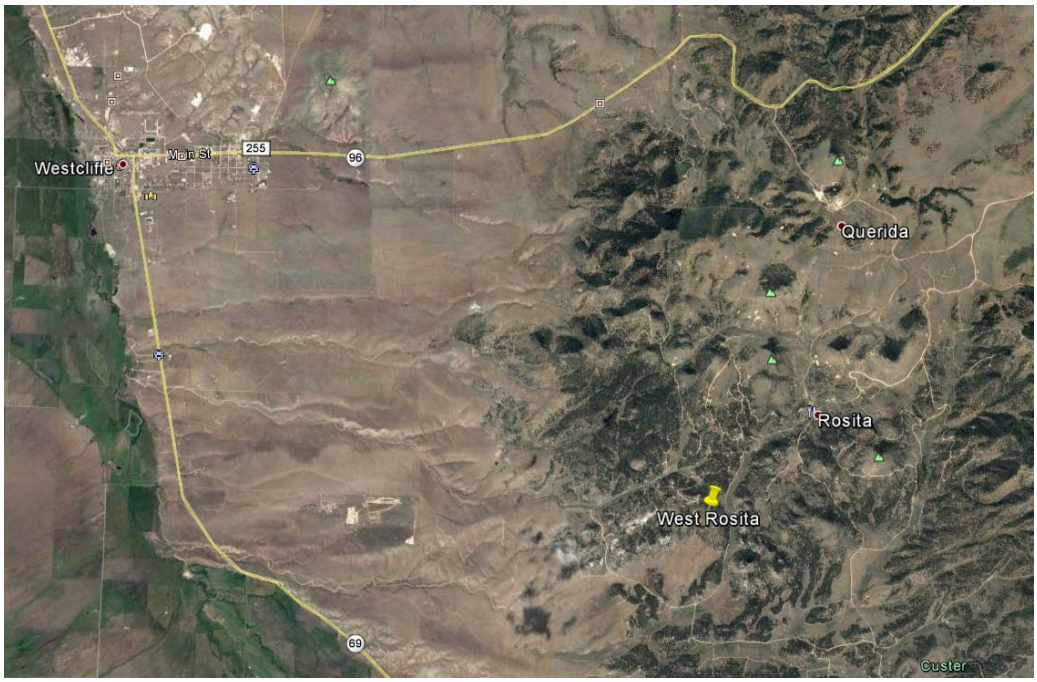

Figure 8 West Rosita Site Location (approximate)

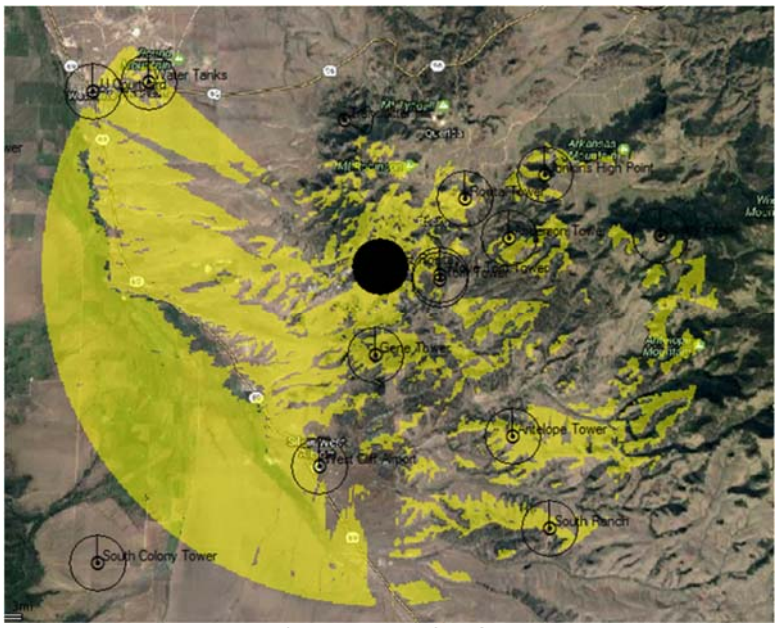

Figure 9. West Rosita Site Coverage

Figure 10 and Figure 11 show microwave connectivity into both SECOM's and Hilltop Wireless' existing hubs. In addition, Hilltop may be able to connect directly to Westcliffe.

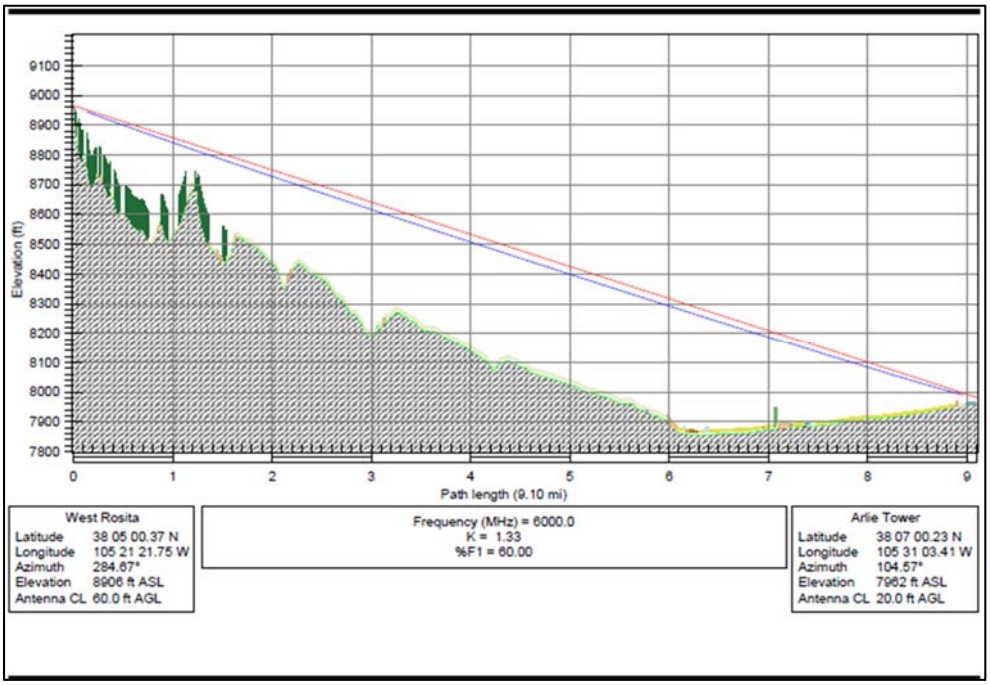

Figure 10. Microwave connectivity SECOM

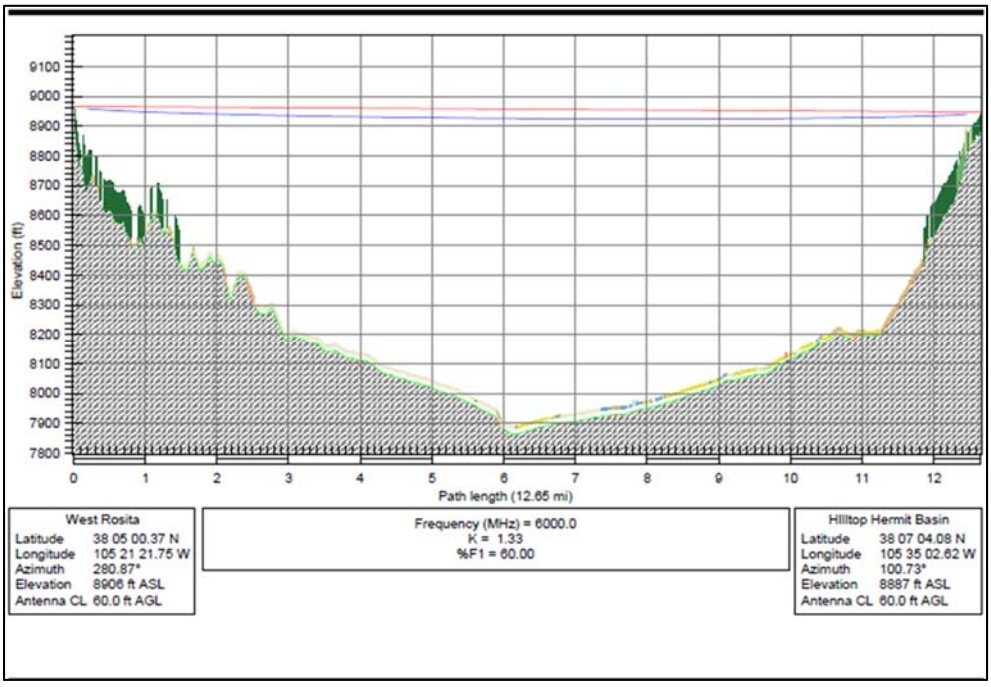

Figure 11. Microwave connectivity Hilltop

Site 3: East of Domingo

This proposed site is east of Domingo High Point in the North-East part of the county. Coverage in this area is made difficult by terrain. The site is sixth on the number of list of covered addresses for the candidates we analyzed and was a strong contributor to the incremental number of addresses covered in the county. There are two good identified locations for this site that have good access and power. Figure 12 shows the approximate locations of those two sites in relation to Westcliffe.

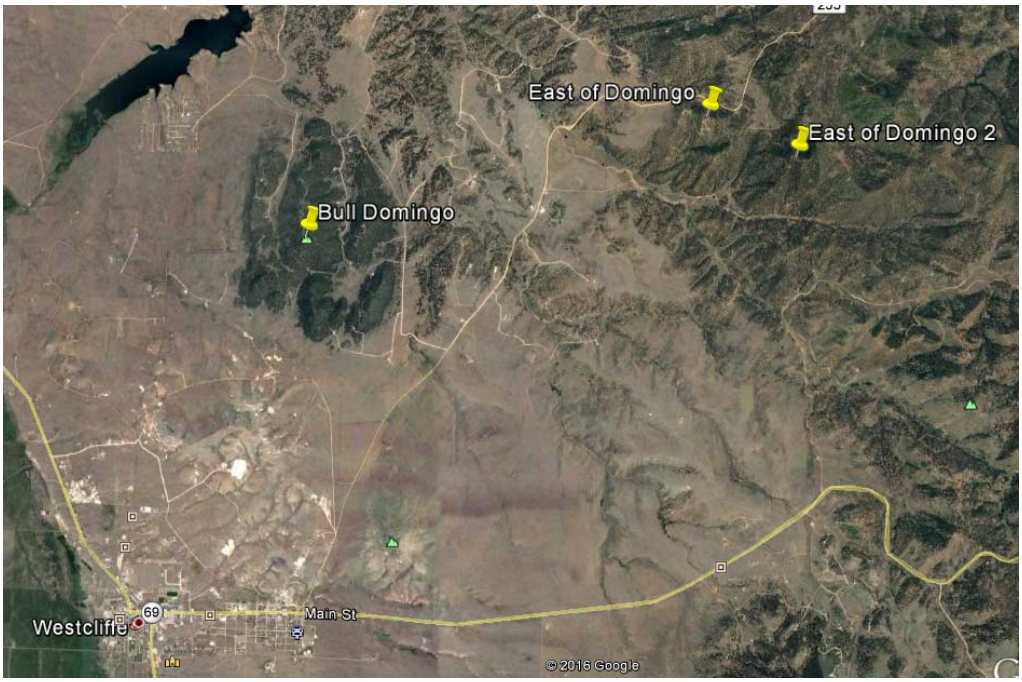

Figure 12. East of Domingo Locations

Coverage from this site adds many addresses that were not served due to terrain blockage. Figure 13 shows the 7-mile coverage radius from the primary site choice East of Domingo 1.

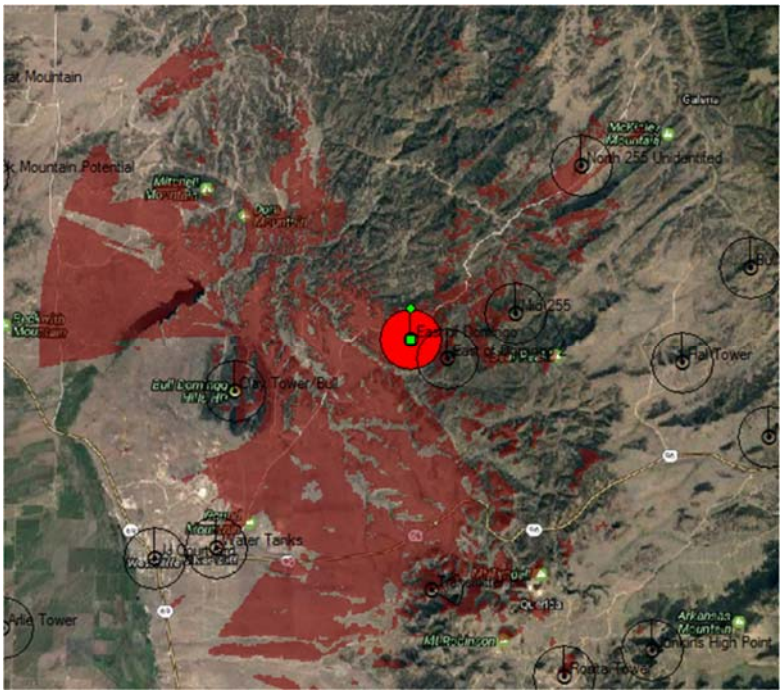

Figure 13. East of Domingo Coverage

Figure 14 shows connectivity for the site through Transmitter Hill, just east of Silver Cliff and Westcliffe. This location has existing towers with broadcast and commercial wireless along with both carriers. The incumbent carriers could elect to route through other existing sites that are LOS to East of Domingo.

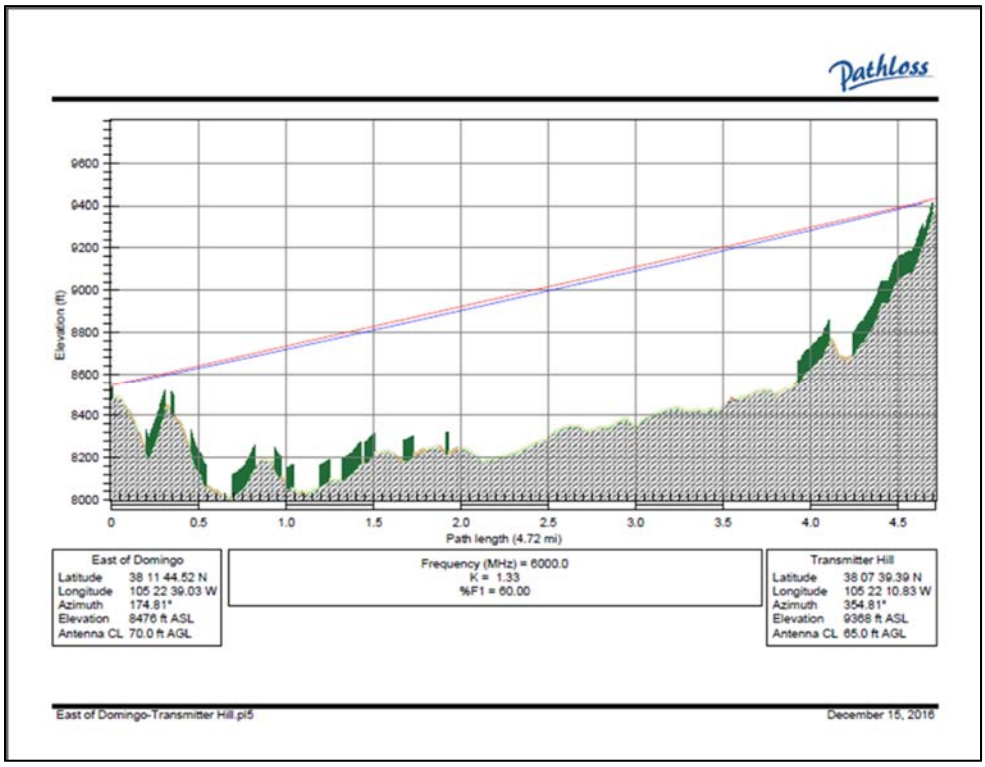

Figure 14. East of Domingo Microwave Connectivity

Site 4: Junkins High Point

Junkins High Point is another site that had a very high address coverage count, coming in 5th on that list, with a strong contribution to picking up uncovered addresses. There is a high density of addresses in the area, and both incumbent providers expressed interest in improving coverage in that area. Figure 15 shows the approximate location of the site in relation to Westcliffe and Silver Cliff.

Figure 15. Approximate location of Junkins High Point

The site provides coverage for the north Rosita and Querida areas extending west and north from the site. To the east, the site provides good coverage up CR 358 to several residences in that valley. Figure 16 shows the coverage from the site in a zoomed-in view. The spottiness of the coverage gives a good idea of the difficult terrain we are dealing with in this area.

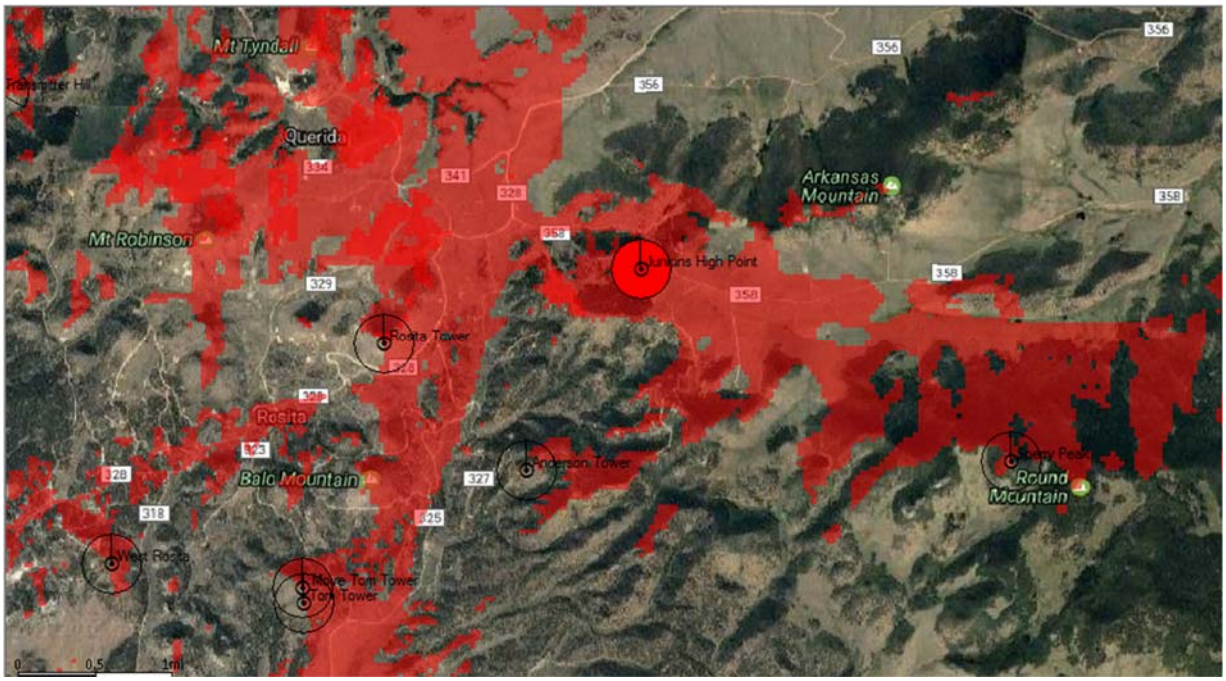

Figure 16. Zoomed coverage of Junkins High Point

Junkins has good connectivity to the existing network through the Transmitter Hill site. The path is only 4 miles, allowing for numerous types of solutions for backhaul.

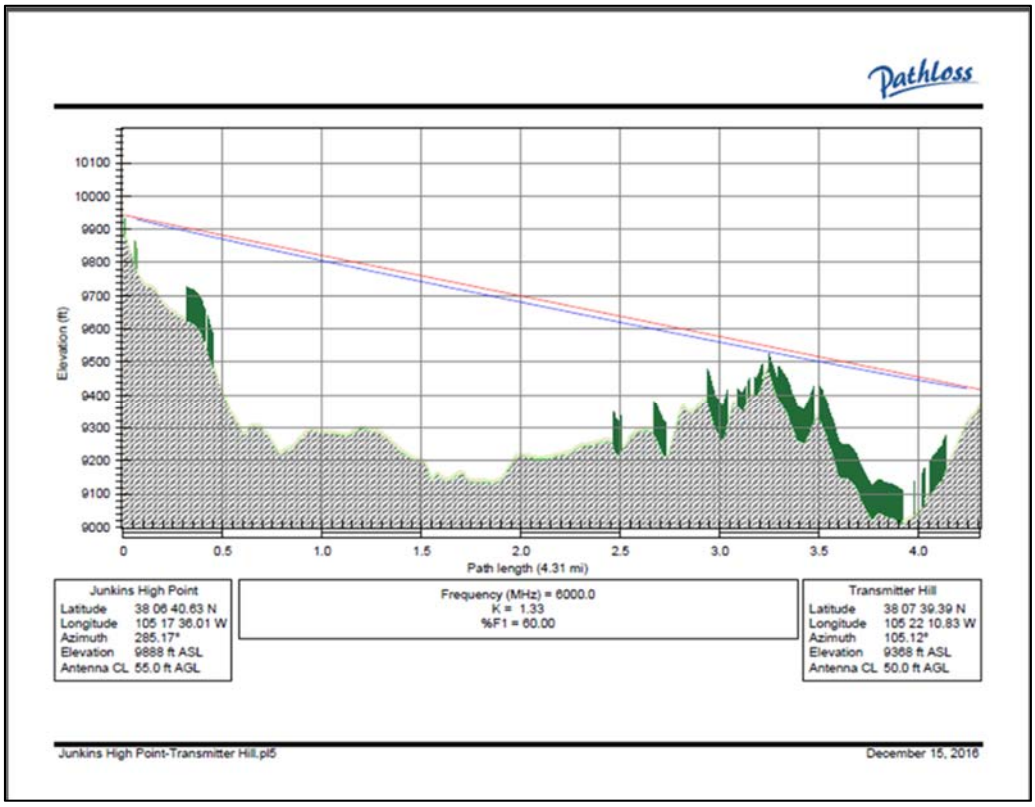

Figure 17. Microwave Connectivity Junkins High Point

Site 5: Centennial

Centennial was modeled from the existing SECOM site at a height of 100 feet AGL. This site provided coverage on the south end of the county, which has rolling terrain as shown in Figure 18. While not a particularly high address count site, the addresses covered were, for the most part, all new coverage. The counterpoint to this is that a higher percentage of these addresses are not yet built, as compared to other areas of the county. This assessment was made using satellite imagery from 2013 and new homes may have been built since then. Also, this area of the county is off the power grid and the homes rely on solar, generator, or other alternative means of power; this does not, however, preclude them from the need for broadband. While Centennial is part of the recommendation, it is moved to a lower priority due to the above factors.

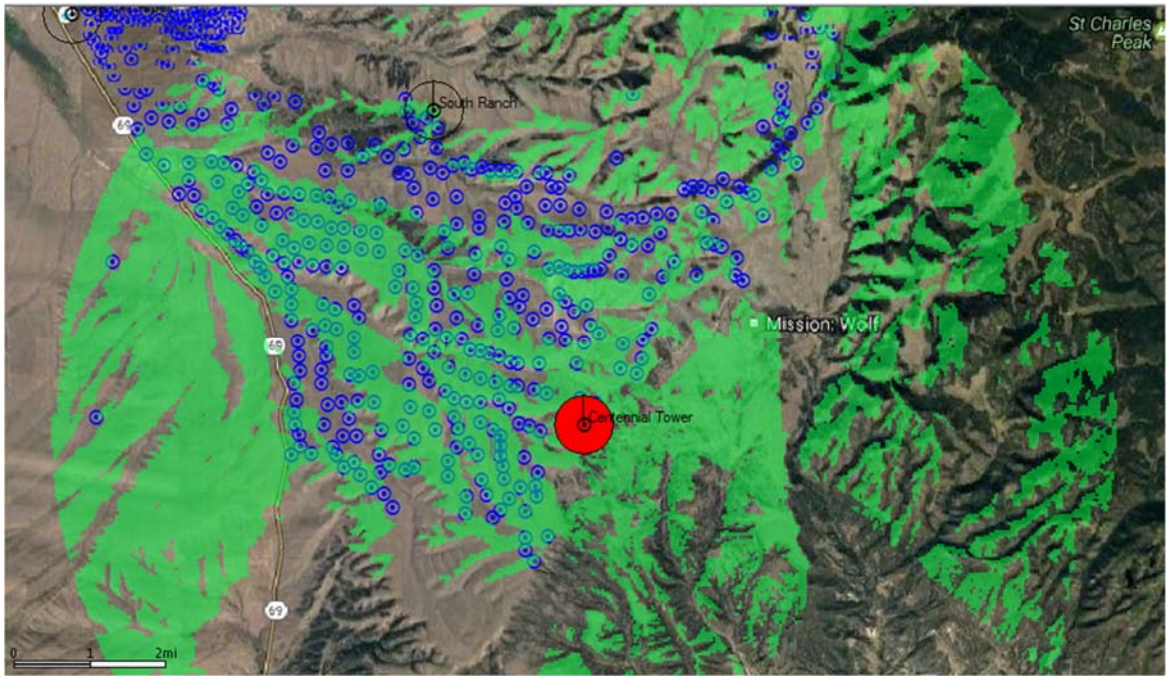

Figure 18. Coverage of the Centennial Site

Since this is an existing SECOM site, we did not assess their connectivity. For Hilltop, there is connectivity to Hermit Basin. Figure 19 shows the connectivity path for Hilltop to Hermit Basin.

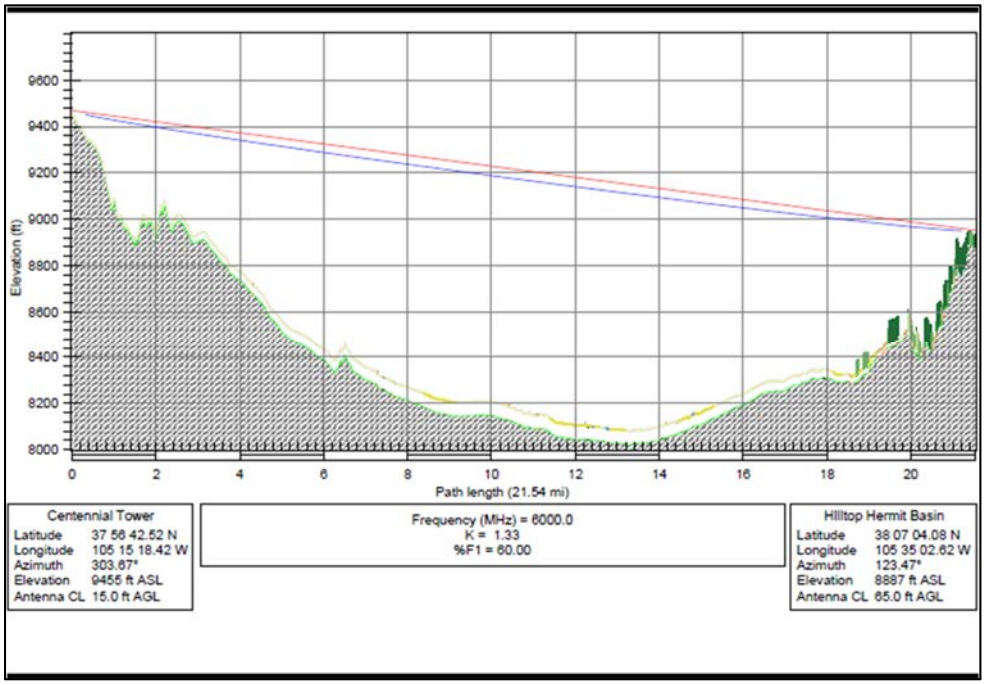

Figure 19. Microwave Connectivity Hilltop Centennial to Hermit Basin

Site 6: San Isabel

Two sites shown in Figure 20 were modeled for coverage in the San Isabel area, which shows a good concentration of addresses. The proposed San Isabel site provides coverage to the town, which is currently not covered by either of the incumbent providers. Because there is no coverage currently, a site in this area would add significantly to the overall percentage of addresses covered in the county. One of the challenges for this area is the difficult terrain, which limits coverage and makes connectivity especially tenuous. Figure 21 shows the coverage for the San Isabelle site.

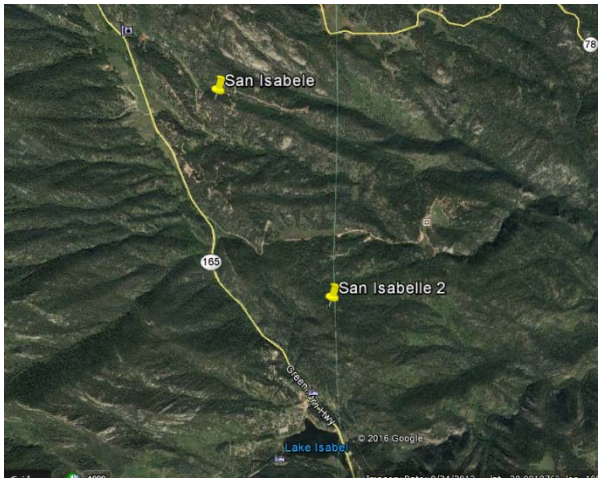

Figure 20. San Isabel Site Locations

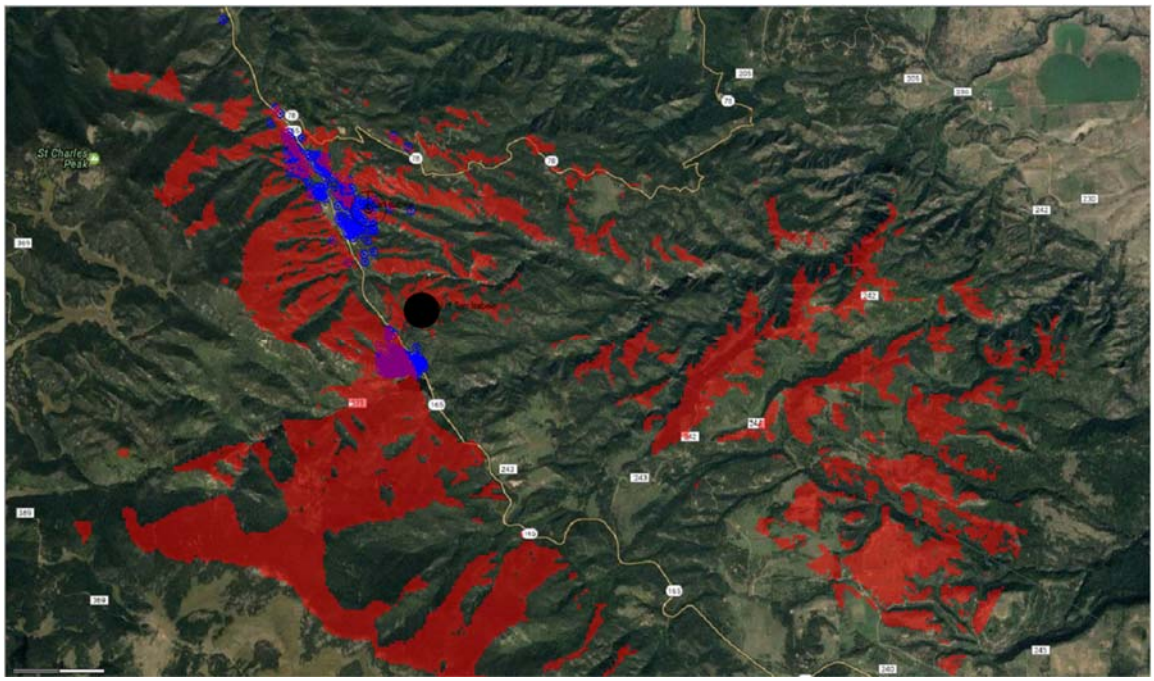

Figure 21. Coverage of the Centennial Site

Connectivity for the San Isabel site was described above as an exception to our original approach of tying into existing hub sites. Because of the area's isolation, we were unable to connect to the hub sites, but we did find connectivity to a location provided by SECOM in Huerfano County. Because there are no Hilltop facilities provided for that area, we cannot address connectivity for San Isabel to their system.

Figure 22. Microwave Connectivity San Isabel to Ed

Other Site Considerations

Wetmore

The town of Wetmore is located on the northeastern corner of Custer County and is one the primary routes into the county. Like San Isabel, it is isolated from the rest of the county by the Wet Mountains, but unlike its sister town, it currently has service through SECOM and others. We analyzed the existing site, which is located on a ridge to the south at 20 feet AGL. We modeled this site at 100 feet AGL and found that it gave us an additional 33 addresses. Figure 23 shows the difference in the coverage from both sites (red) and the additional coverage (green).

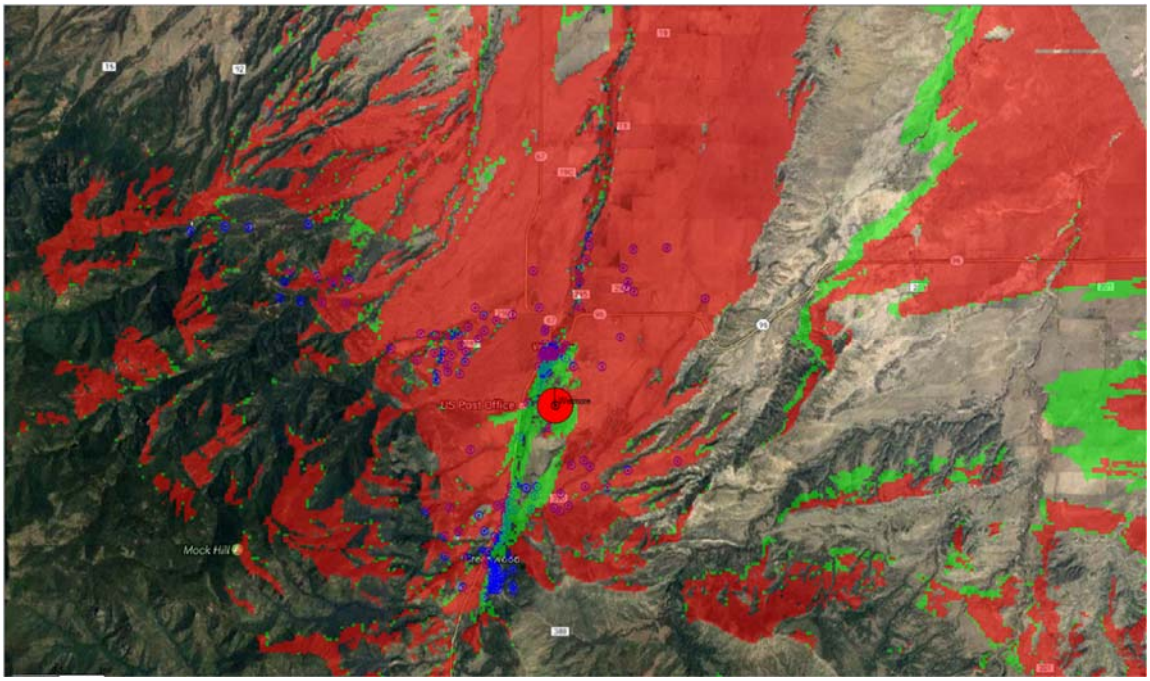

Figure 23. Coverage Difference Wetmore 20 ft. (red) and 100 ft. (green)

Because of the relatively few addresses gained and the fact that there is an existing carrier already providing service from the current sites, this site is not recommended for near-term consideration.

Water Tanks

The Water Tanks site was considered for its proximity and coverage potential for the towns of Westcliffe and Silver Cliff, especially those areas just outside the two towns. As we see in Figure 24, the site that is just to the north and east of the towns covers those areas well but does not see to the north and duplicates coverage of site such as Arlie and Transmitter Hill. Also, the aperture angle to most of the addresses covered by this site about 100 degrees. This means that all subscribers are in one area of coverage, which presents a problem to the providers, since each sector of the site has finite capacity. The typical sector for WISP application is about 60 degrees

but can go as low as 30 degrees with special antennas. A major consideration for this site was the fact that financial incentive exists for the incumbent carrier to invest in infrastructure in this area, because the density of addresses would meet the typical business case for return on investment. In this case, the use of public funds for wireless enhancement are better spent in more rural areas.

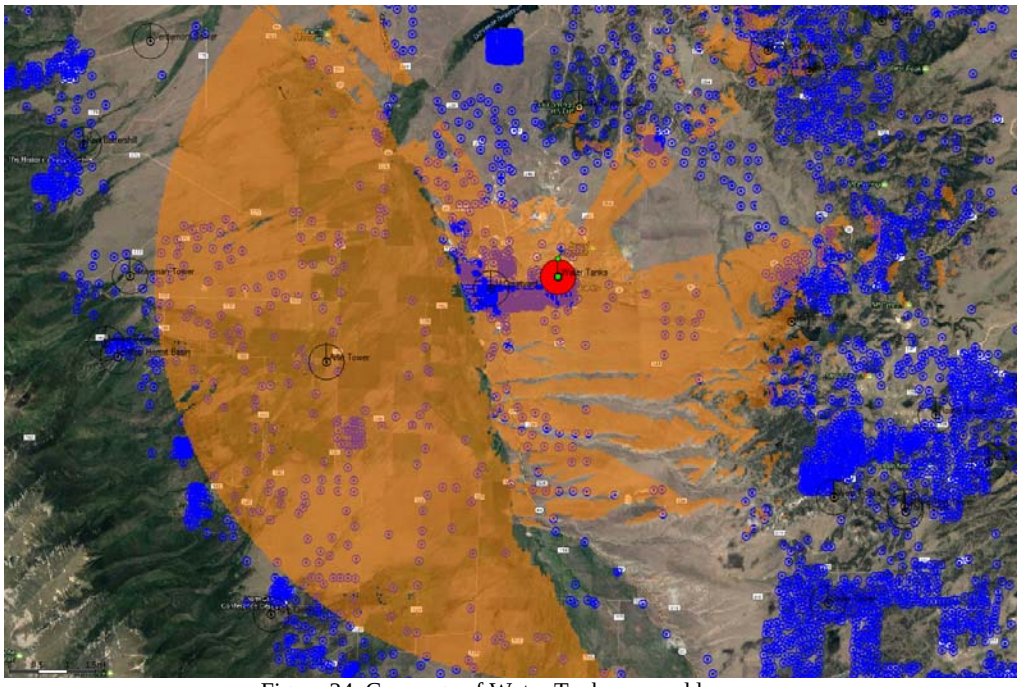

Figure 24. Coverage of Water Tanks over addresses

Coverage to Height Sensitivity Analysis

As stated previously, tower height will be determined by the final location of the site. Furthermore, sites that are located on places that have good height above average terrain (HAAT) generally don't require especially tall towers. These are the type of sites we have examined during this study. For the study, we assumed 100-foot tower heights as an equal point of reference for all site studies.

The determination for the final tower heights will be guided by the optimal number of addresses covered versus the cost to build the tower. The higher the tower goes, the more the tower costs, and the more visible it becomes due to its height and width.

We can certainly analyze the addresses that will be covered through our propagation model. In the table below, we varied the height of the antenna on an example tower and measured the number of addresses we gained and lost. While not dramatic, it gave us good reference points during the site costing process.

Name	Addresses Covered	Addresses Percentage	Total Addresses
Buck at 160	936	14.28	6,553
Buck at 140	931	14.21	6,553
Buck at 120	924	14.1	6,553
Buck at 100	915	13.96	6,553
Buck at 80	912	13.92	6,553
Buck at 60	905	13.81	6,553
Buck at 40	892	13.61	6,553

Table 5. Tower Height to Addresses Covered

In this analysis, we see that as we increase out height from 100 feet, we gain about 7 to 8 subscribers for every 20 feet AGL. The difference between 100 and 80 feet only loses three addresses.

A final consideration for the tower is minimum height. For this, we have considered it a good height to have all the antennas mounted above local obstructions such as trees, and to have enough room for all planned carriers to keep their antennas on separate elevations of the tower.

APPENDIX A – Additional Site Information

Candidate Site Locations and Elevations

Name	Longitude	Latitude	Altitude (ft)
Move Tom Tower	-105.3334432	38.08120389	[9,154.48]
Anderson Tower	-105.30683	38.092316	[9,361.12]
Antelope Tower	-105.305307	38.032577	[9,003.6]
Arlie Tower	-105.517614	38.11673188	[7,960.56]
Beddows	-105.5386472	38.22603056	[8,495.2]
Buck Mountain Potential	-105.5272861	38.24013333	[8,619.84]
Bullard Mtn	-105.2598722	38.21581944	[8,869.12]
Centennial Tower	-105.2551167	37.94514444	[9,449.68]
Clay Tower/Bull	-105.4377722	38.18118611	[8,675.6]
Democrat Mountain	-105.534851	38.26506	[8,541.12]
East of Domingo	-105.3775083	38.1957	[8,478.8]
East of Domingo 2	-105.3645306	38.19044722	[8,718.24]
Gene Tower	-105.357715	38.056867	[8,705.12]
Hal Tower	-105.283316	38.189688	[9,167.6]
Hermit Basin	-105.5881	38.121312	9,000
HIlltop Hermit Basin	-105.5840618	38.11779926	[8,882.24]
Horn Creek	-105.534914	38.05334937	[9,033.12]
JJ Courtyard	-105.4654	38.13568	[7,868.72]
Junkins High Point	-105.2933357	38.11128715	[9,885.92]
Ken Battershill	-105.5954	38.17118	[8,600.16]
Mid 255	-105.341258	38.203042	[8,901.92]
Myron Mtn	-105.2533444	38.16937778	[9,275.84]
North 165	-105.1233306	38.10490278	[9,758]
North 255 Unidentifed	-105.3186444	38.24336111	[8,462.4]
Rosita Tower	-105.323783	38.104091	9,555
San Isabele	-105.0614861	38.01251944	[9,213.52]
San Isabele 2	-105.0509462	37.99648555	[9,138.08]
South Colony Tower	-105.462785	37.994201	[8,547.68]
South Ranch	-105.291525	38.00515833	[9,124.96]
Sperry Peak	-105.249408	38.093231	[10,932.24]
Stoneman Tower	-105.58051	38.138348	[8,751.04]
Tom Tower	-105.333186	38.07980764	[9,147.92]
Transmitter Hill	-105.369675	38.12760833	[9,367.68]
Verdemont Tower	-105.5744444	38.19722222	[8,032.72]
Water Tanks	-105.4440833	38.13876667	[8,062.24]
West Cliff Airport	-105.3786969	38.02322282	[8,226.24]
West Rosita	-105.356041	38.083437	[8,905.2]
Wetmore	-105.084323	38.228865	[6,504.24]

Candidate Site Analysis

Name	Addresses Covered	Addresses Percentage	Total Addresses	Existing covered addresses	Add Addresses
West Rosita Tower 100	1,039	15.86	6,553		1039
Water Tank 100	983	15	6,553		983
Buck Mountain 100	915	13.96	6,553		915
Beddows 100	851	12.99	6,553		851
Sperry Peak 100	654	9.98	6,553		654
Junkins High Point	651	9.93	6,553		651
East of Domingo 100	647	9.87	6,553		647
East of Domingo 2 100	631	9.63	6,553		631
Gene Tower 100	704	10.74	6,553	223	481
Verdemont Tower 100	443	6.76	6,553		443
South Ranch 100	348	5.31	6,553		348
MId 255 Tower at 100 ft	316	4.82	6,553		316
Toms Tower 100	788	12.03	6,553	513	275
Bullard Mountain 100	227	3.46	6,553		227
Centennial Tower 100	197	3.01	6,553		197
Transmitter HIll 100	1,150	17.55	6,553	955	195
Move Toms Tower 100	695	10.61	6,553	513	182
Myron Mountain 100	161	2.46	6,553		161
Rosita Tower 100	370	5.65	6,553	233	137
North 255 100	129	1.97	6,553		129
Antelope Tower 100	417	6.36	6,553	293	124
San Isabele 100	118	1.8	6,553		118
Anderson Tower 100	478	7.29	6,553	368	110
Arlie 100	1,053	16.07	6,553	987	66
Horn Creek 100	564	8.61	6,553	503	61
South Colony Tower 100	394	6.01	6,553	333	61
Clay Tower 100	1,574	24.02	6,553	1,514	60
Hermit Basin 100	540	8.24	6,553	484	56
Hal Tower at 100 ft	240	3.66	6,553	195	45
Wetmore 100	124	1.89	6,553	91	33
Stoneman Tower 100	735	11.22	6,553	708	27
North 165 100	13	0.2	6,553		13

Existing Site Analysis

Name	Addresses Covered	Addresses Percentage	Total Addresses
Clay Tower 20	1,514	23.1	6,553
JJ Courtyard at 30 ft Hilltop	1,118	17.06	6,553
Arlie30	987	15.06	6,553
Transmitter Hill D at 20 ft	955	14.57	6,553
Stoneman Tower 20	708	10.8	6,553
Democrat Mt 20	650	9.92	6,553
Toms Tower 20	513	7.83	6,553
Horn Creek 30 Hilltop	503	7.68	6,553
Hilltop Hermit 30 Hilltop	484	7.39	6,553
Anderson Tower 20	368	5.62	6,553
South Colony Tower 20	333	5.08	6,553
Antelope Tower 20	293	4.47	6,553
Rosita Tower at 20 ft	233	3.56	6,553
Gene Tower20	223	3.4	6,553
Hal Tower at 20 ft	195	2.98	6,553
Centenial at 20	160	2.44	6,553
Wetmore 20	91	1.39	6,553