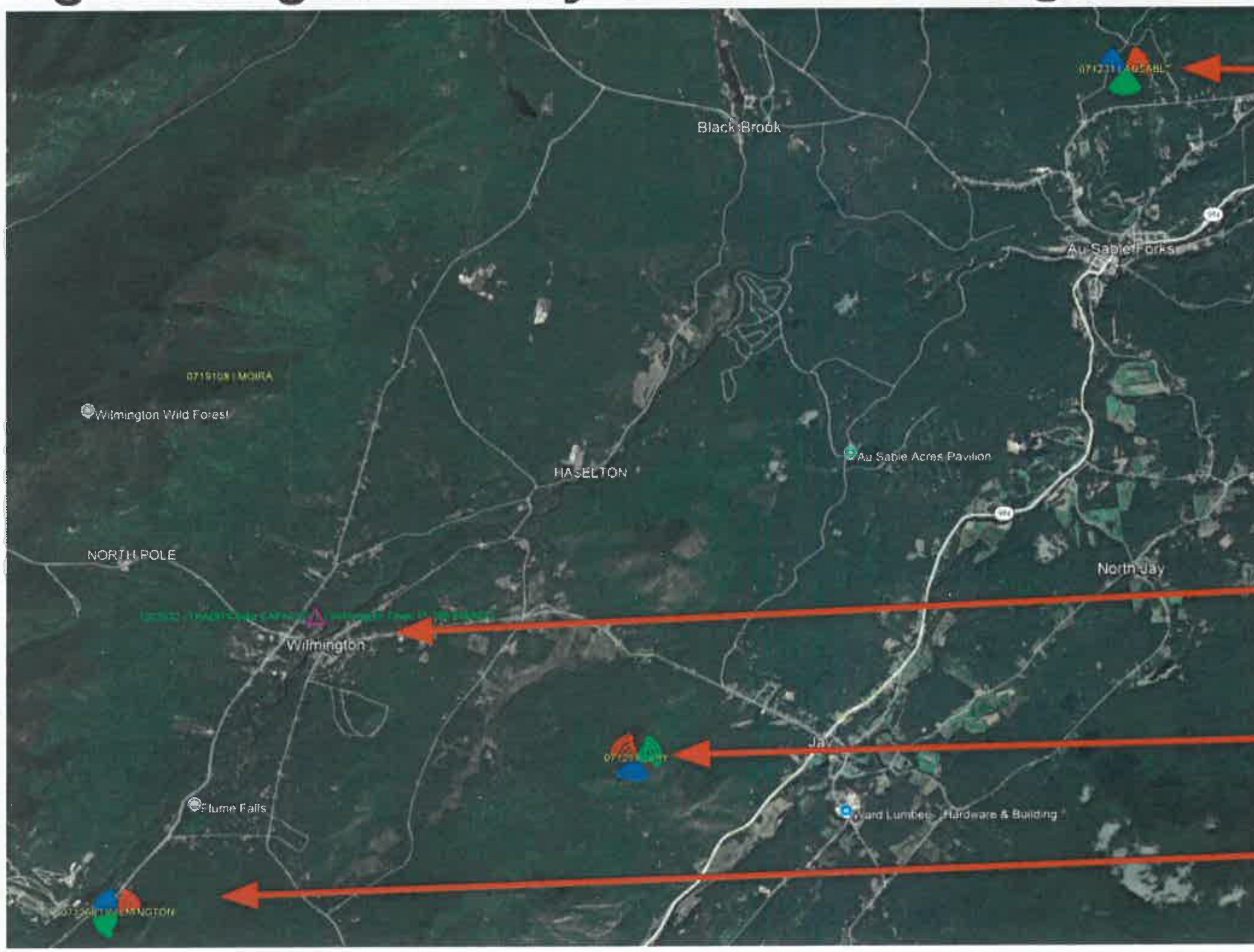
Verizon Wireless Communications Facility

Engineering Necessity Case – "Wilmington Town"



Ausable site

Project location

Jay site

Wilmington site

Project: The project is the installation and operation of a new tower wireless telecommunications site in the Town of Wilmington (the "Project Facility").

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January 15 , 2025

Introduction

The purpose of this analysis is to summarize and communicate the technical radio frequency (RF) information used in the justification of this new site.

Coverage and/or capacity deficiencies are the two main drivers that prompt the need for a new wireless communications facility/site. All sites provide a mixture of both capacity and coverage for the benefit of the end user.

Coverage can be defined as the existence of signal of usable strength and quality in an area, including but not limited to in-vehicles or in-buildings.

The need for improved coverage is identified by RF Engineers that are responsible for developing and maintaining the network. RF Engineers utilize both theoretical and empirical data sets, propagation maps and real world coverage measurements. Historically, coverage improvements have been the primary justification of new sites.

Capacity can be defined as the amount of traffic (voice and data) a given site can process before significant performance degradation occurs.

When traffic volume exceeds the capacity limits of a site serving a given area, network reliability and user experience degrades. Ultimately this prevents customers from making/receiving calls, applications cease functioning, internet connections time out and data speeds fail. This critical condition is more important than just a simple nuisance for some users. Degradation of network reliability and user experience can affect emergency responders and to persons in a real emergency situation can literally mean life or death.

**Note that, while Verizon Wireless provides sufficient evidence to establish the existence of a coverage gap and capacity need in this case, the FCC has confirmed that federal law does not require a provider to establish the existence of a coverage/capacity gap to establish the need for a site. There are several ways by which an applicant can establish site need. See Accelerating Wireless Broadband Deployment by Removing Barriers to Infrastructure Investment," FCC 18-133, 85 FR 51867, at ¶ 37 (October 15, 2018) (confirming that the test for establishing an effective prohibition is whether "a state or local legal requirement materially inhibits a provider's ability to engage in any of a variety of activities related to its provision of a covered service," and this test is met "not only when filling a coverage gap but also when densifying a wireless network, introducing new services or otherwise improving service capabilities") (emphasis added).*

Project Need Overview

The project area, located in the Town of Indian Lake is currently lacking coverage. The project area is subject to significant terrain and foliage challenges for RF (signal) propagation. This terrain and foliage combined with long distance prevent effective propagation of Verizon's RF signals into this area creating significant gaps in coverage. There are three sites around the project area, but due to terrain challenges and distance, they are not able to provide adequate coverage at the project location.

The first neighboring site is **Jay**, located in the Town of Jay , is approximately 3 miles to the southeast, (of the project location) situated on an existing tower located at 1 mile SW of the intersection of Ausable Dr and SR 86. While this site provides weak/variable coverage in portions of the project area, it does so from a terrain and foliage as well as distance challenged position making the site not capable of efficiently or effectively providing adequate coverage or capacity.

The second neighboring site is **Wilmington**, located in the Town of Wilmington, is approximately 3.2 miles to the southeast (of the project location) on an existing tower located at 5022 NYS Route 86. While this site provides weak/variable coverage in portions of the project area, it does so from a terrain and foliage as well as distance challenged position making the site not capable of efficiently or effectively providing adequate coverage or capacity.

The third neighboring site is **Ausable**, located in the Town of Ausable Forks, is approximately 8.75 miles to the northeast (of the project location) on an existing tower located at 190 Tower Road. While this site may provide weak/variable coverage in portions of the project area, it does so from a terrain and foliage as well as distance challenged position making the site not capable of efficiently or effectively providing adequate coverage or capacity.

Available (mid band AWS) carriers at these and other area sites are not capable of effectively serving/offloading the project area due to inherent propagation losses from distance, challenging terrain and in building coverage losses negatively impacting mid band coverage and capacity offload capabilities. There are other Verizon sites in this general area but due to distance and terrain they also do not provide any significant overlapping coverage in the area in question that could allow for increased capacity and improved coverage from other sources.

The primary objectives for this project is to increase capacity and improve coverage to the town of Wilmington, more specifically along State Route 86, including any residential and commercial areas.

Following the search for co-locatable structures to resolve the aforementioned challenges and finding none available, Verizon proposes to attach the necessary antenna(s) to a new 105' tower located on Bonnieview Rd, Wilmington NY 12997. Verizon's antennas will utilize 100' for the ACL (Antenna Center Line) with a top of antenna height of 104'. This solution will provide the necessary coverage and capacity improvements needed.

Wireless LTE (Voice and Data) Growth

- Wireless smart city solutions are being used to track available parking and minimize pollution and wasted time.
- These same solutions are being used to track pedestrian and bike traffic to help planning and minimize accidents.
- Smart, wireless connected lighting enables cities to control lighting remotely, saving energy and reducing energy costs by 20%.
- 4G technology is utilized to track and plan vehicle deliveries to minimize travel, maximize efficiency, and minimize carbon footprint.
- 4G technology is also used to monitor building power usage down to the circuit level remotely, preventing energy waste and supporting predictive maintenance on machines and equipment.
- Wireless sensors placed in shipments are being used to track temperature-sensitive medications, equipment, and food. This is important for preventing the spread of food-borne diseases that kill 3,000 Americans each year.

Source: Verizon Innovation Center, February. 2018

Wireless is a critical component in schools and for today's students.

- **20,000 learning apps are available for iPads. 72% of iTunes top selling educational apps are designed for preschoolers and elementary students.**
- **600+ school districts replaced text books with tablets in classrooms.**
- **77% of parents think tablets are beneficial to kids.**
- **74% of school administrators feel digital content increases student engagement.**
- **70% of teens use cellphones to help with homework.**

Source: CTIA's Infographics Today's Wireless Family, October, 2017

The average North American smartphone user will consume 48 GB of data per month in 2023, up from just 5.2 GB per month in 2016 and 7.1 GB per month in 2017 .[1]

55% Of American homes are wireless only.[2]

In North America, the average household has 13 connected devices with smartphones outnumbering tablets 6 to 1.[3]

1. Ericsson Mobility Report. November 2017
2. CDC's 2018 Wireless Substitution: Early Release of Estimates From the National Health Interview Survey, January-July, 2018
3. IHS Market Connected Device Market Monitor. Q1 2016. June 7, 2016

A wireless network is like a highway system...

US, mobile data traffic was 1.3 Exabytes per month in 2016, the equivalent of 334 million DVDs each month or 3,687 million text messages each second according to Cisco VNI Mobile Forecast Highlights, 2016-2021,Feb 2017

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Wireless facilities and property values.

Cell service in and around the home has emerged as a critical factor in home-buying decisions.

National studies demonstrate that most home buyers value good cell service over many other factors including the proximity of schools when purchasing a home.

75% More than 75% of prospective home buyers said a good cellular connection was important to them.[1]

83% The same study showed that 83% of Millennials (those born between 1982 and 2004) said cell service was the most important fact in purchasing a home.

90% 90% of U.S. households use wireless service. Citizens need access to 911 and reverse 911 and wireless may be their only connection.[2]

1. RootMetrics/Money, The Surprising Thing Home Buyers Care About More than Schools, June 2 2015
2. CTIA, June 2015

80%+ With over 80% of 9-1-1 calls now coming from cell phones...[1]

240 million 911 calls are made annually. In many areas, 80% or more are from wireless devices.[1]

1. National Emergency Number Association, Enhancing 9-1-1 Operations With Automated Abandoned Callback & Location Accuracy (Motorola Solutions) (August 21, 2018)

Explanation of Wireless Capacity

Capacity in this analysis is evaluated with up to three metrics further explained below. These metrics assist in determining actual usage for a given site as well as are used to project when a site is expected to run out of capacity (i.e. reach a point of exhaustion where it can no longer process the volume of voice and data requested by local wireless devices, thus no longer providing adequate service).

- Forward Data Volume ("**FDV**"), is a measurement of usage (data throughput) on a particular site over a given period of time.
- Average Schedule Eligible User ("**ASEU**"), is a measurement of the loading of the control channels and systems of a given site.
- Average Active Connections ("**AvgAC**") is a measurement of the number of devices actively connected to a site in any given time slot.

Verizon Wireless uses proprietary algorithms developed by a task force of engineers and computer programmers to monitor each site in the network and accurately project and identify when sites will approach their capacity limits. Using a rolling two-year window for projected exhaustion dates allows enough time, in most cases, to develop and activate a new site. It is critical that these capacity approaching sectors are identified early and the process gets started and completed in time for new solutions (sites) to be on air before network issues impact the customers.

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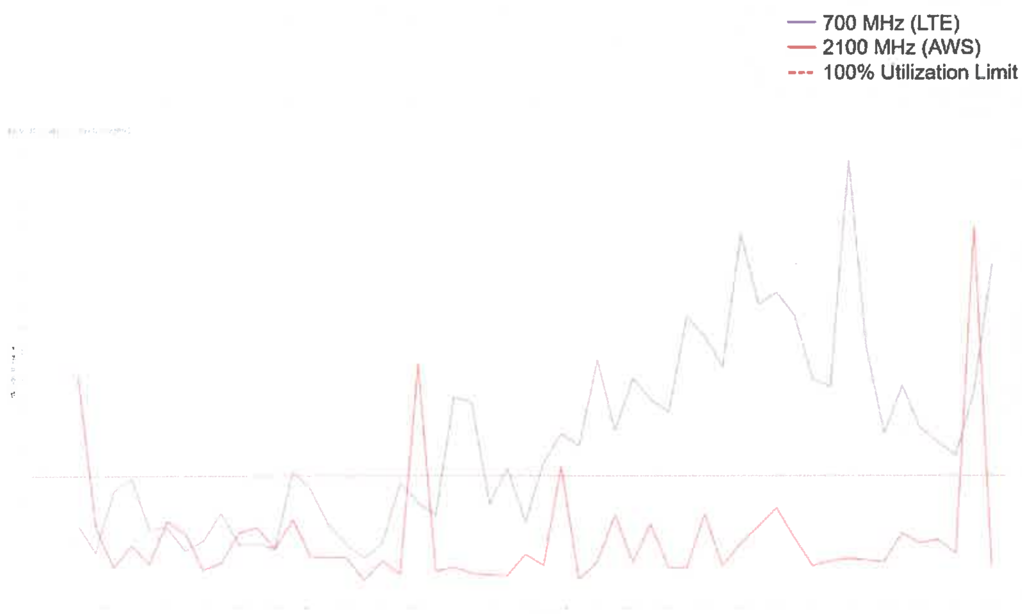
Capacity Utilization
FDV (Jay Alpha)



Summary: This graph shows FDV (**F**orward **D**ata **V**olume) which is a measurement of the customer data usage that this sector currently serves. As this limit is approached, data rates slow to unacceptable levels, potentially causing unreliable service for Verizon Wireless customers.

The purple line represents the daily max busy hour 700MHz utilization and the dark red line is daily max busy hour AWS utilization on the **Alpha** sector of the **Jay** site. The red dashed line is the limit where the sector reaches exhaustion and service starts to significantly degrade. The point in time where we see the purple or dark red lines reach or exceed the red dashed line is when service quickly degrades as usage continues to increase.

Detail: The existing **Jay** sector shown above has exceeded its capability of supporting FDV requirements as shown by the purple and dark red lines exceeding the max utilization threshold (red dashed line). In order to provide adequate and reliable service to **Wilmington Town** and the surrounding project area, network densification is required.

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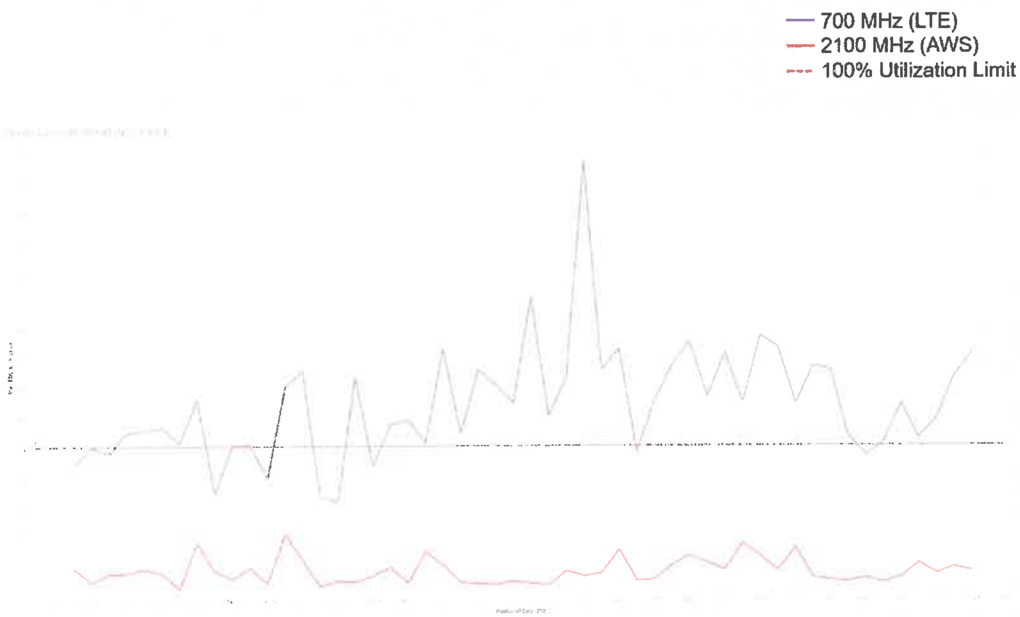
Capacity Utilization
FDV (Wilmington Alpha)



Summary: This graph shows FDV (**F**orward **D**ata **V**olume) which is a measurement of the customer data usage that this sector currently serves. As this limit is approached, data rates slow to unacceptable levels, potentially causing unreliable service for Verizon Wireless customers.

The purple line represents the daily max busy hour 700MHz utilization and the dark red line is daily max busy hour AWS utilization on the **Alpha** sector of the **Wilmington** site. The red dashed line is the limit where the sector reaches exhaustion and service starts to significantly degrade. The point in time where we see the purple or dark red lines reach or exceed the red dashed line is when service quickly degrades as usage continues to increase.

Detail: The existing **Wilmington** sector shown above has exceeded its capability of supporting FDV requirements as shown by the purple and dark red lines exceeding the max utilization threshold (red dashed line). In order to provide adequate and reliable service to **Wilmington Town** and the surrounding project area, network densification is required.

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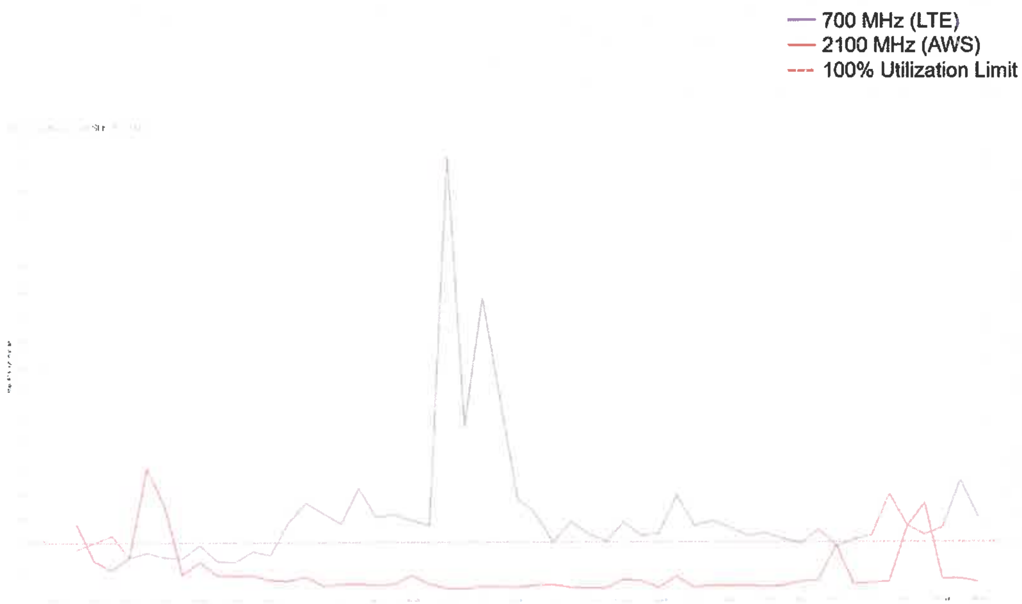
Capacity Utilization FDV (Ausable Beta)



Summary: This graph shows FDV (**F**orward **D**ata **V**olume) which is a measurement of the customer data usage that this sector currently serves. As this limit is approached, data rates slow to unacceptable levels, potentially causing unreliable service for Verizon Wireless customers.

The purple line represents the daily max busy hour 700MHz utilization and the dark red line is daily max busy hour AWS utilization on the **Beta** sector of the **Ausable** site. The red dashed line is the limit where the sector reaches exhaustion and service starts to significantly degrade. The point in time where we see the purple or dark red lines reach or exceed the red dashed line is when service quickly degrades as usage continues to increase.

Detail: The existing **Ausable** sector shown above has exceeded its capability of supporting FDV requirements as shown by the purple and dark red lines exceeding the max utilization threshold (red dashed line). In order to provide adequate and reliable service to **Wilmington Town** and the surrounding project area, network densification is required.

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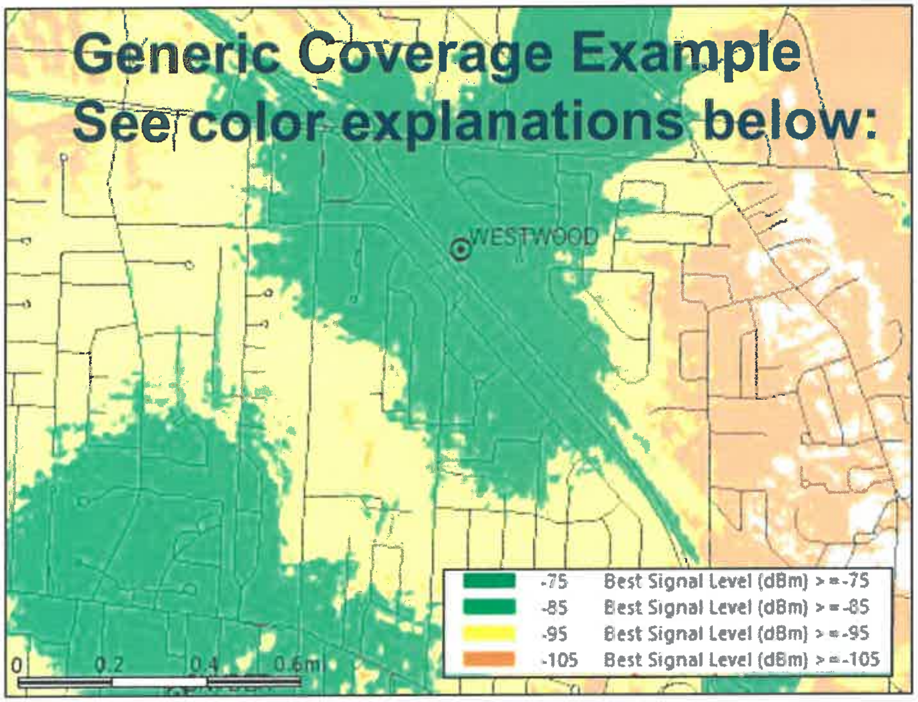
Explanation of Wireless Coverage



Note the affect of clutter on the predicted coverage footprint above

**Dark Green >/= -75dBm RSRP, typically serves dense urban areas as well as areas of substantial construction (colleges, hospitals, dense multi family etc.)
Green >/= -85dBm RSRP, typically serves suburban single family residential and light commercial buildings
Yellow >/= -105dBm RSRP, typically serves most rural/suburban-residential and in car applications
Orange >/= -105dBm RSRP, rural highway coverage, subject to variable conditions including fading and seasonality gaps
White = <-105dBm RSRP, variable to no reliable coverage gap area

More detailed, site-specific coverage slides are later in the presentation

Signal strength requirements vary as dictated by specific market conditions
*** Not displayed in example map, layer not used in all site justifications*

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Coverage is best conveyed via coverage maps. RF engineers use computer simulation tools (in this case Verizon uses Forsk Atoll) which takes into account terrain, vegetation, building types, and other site/network specifics to model the RF environment. This prop model is used to simulate the real world network and assist RF Engineers to evaluate the impact of a proposed site (along with industry experience and other tools). Network design, performance evaluation and development needs have become far too complex for drive test data and dropped call records which for a long time now have been antiquated and simply not effective in visually communicating gaps in coverage or capacity capability for 4 and 5G networks.

Verizon Wireless sites provide customers service using several FCC licensed frequencies including 700 and 850MHz. To resolve capacity congestion for these coverage layers higher frequency (and bandwidth) PCS (1900 MHz), AWS (2100 MHz) and C-Band (3700MHz) mid band carriers are added however due to differences in propagation characteristics, many gaps in coverage and capacity still remain requiring network densification to resolve. In some mountaintop or long distance situations the mid band (higher frequency) AWS, PCS and C-Band carriers are either not or not fully effective due to excessive distance (path loss). This is because the site is located too far from the user population to provide adequate and reliable service. Although exclusively regulated by the FCC and subject to market adjustment as needed, it is worth noting that all of the propagation slides in this RF Justification are generated using the max power (320w) LB, MB and C-Band Samsung radio capabilities.

Signal strength throughout a given site's coverage area is subject to the limitations of the frequencies used. Lower frequencies with narrower bandwidth propagate further distance, and are less attenuated by clutter than higher frequencies with wider bandwidth. Unfortunately due to relatively narrow spectrum available these low bands can become quickly overloaded especially where similar signal strength from mid band carriers are not available. Similar coverage levels from mid band carriers are needed to resolve capacity issues (including the ability to make and receive voice calls). In order to provide similar coverage levels using the higher capacity/higher frequencies, a denser network of sites is required (network densification). Modern 4G and 5G networks are designed and intended to combine or use more than one frequency band at a time. This is called carrier aggregation which is not effective when the mid band signal is too weak or nonexistent. This means that site justification including ACL requirements must be derived from mid band capabilities. It is critical to understand the relationship between low band capacity and mid band coverage especially when reviewing the need for new suburban and rural morphology sites.

Explanation of this Search Area

Wilmington Town Search Area

A **Search Area** is the geographical area within which a new site is targeted to solve a coverage or capacity deficiency. Three of the factors taken into consideration when defining a search area are topography, user density, and the existing network.

- **Topography** must be considered to minimize the obstacles between the proposed site and the target coverage area. For example, a site at the bottom of a ridge will not be able to cover the other side from a certain height.
- In general, the farther from a site the **User Population** is, the weaker the RF conditions are and the worse their experience is likely to be. These distant users also have an increased impact on the serving site's capacity. In the case of a multi sector site, centralized proximity is essential to allow users to be evenly distributed and allow efficient utilization of the site's resources.
- The existing **Network Conditions** also guide the design of a new site. Sites placed too close together create interference due to overlap and are an inefficient use of resources. Sites that are too tall or not properly integrated with existing sites cause interference and degrade service for existing users.
- Existing co-locatable structures inside the search area as well as within a reasonable distance of the search area are submitted by site acquisition and reviewed by RF Engineering. If possible, RF will make use of existing or nearby structures before proposing to build new towers.

To resolve the coverage deficiencies previously detailed, Verizon Wireless is seeking to add one new cell facility within this area to improve wireless service capacity and coverage. The new Wilmington Town site will provide dominant and dedicated signal to the identified portions of the town of Wilmington, more specifically along State Route 86, including any residential and commercial areas.

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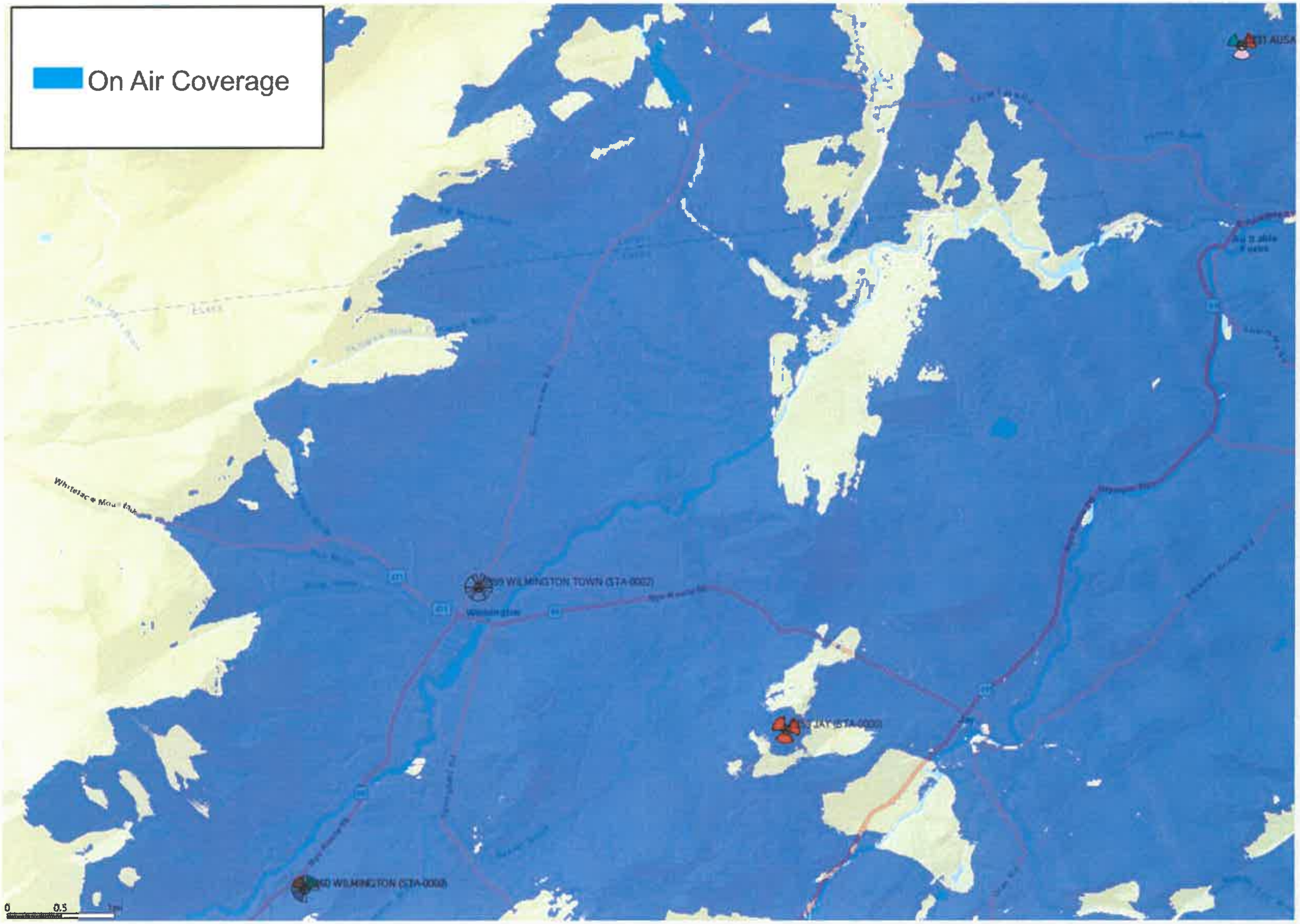
Existing 700MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new sites dominant signal area.



The map above represents coverage from existing sites. Blue coverage is the on-air sites within the project area

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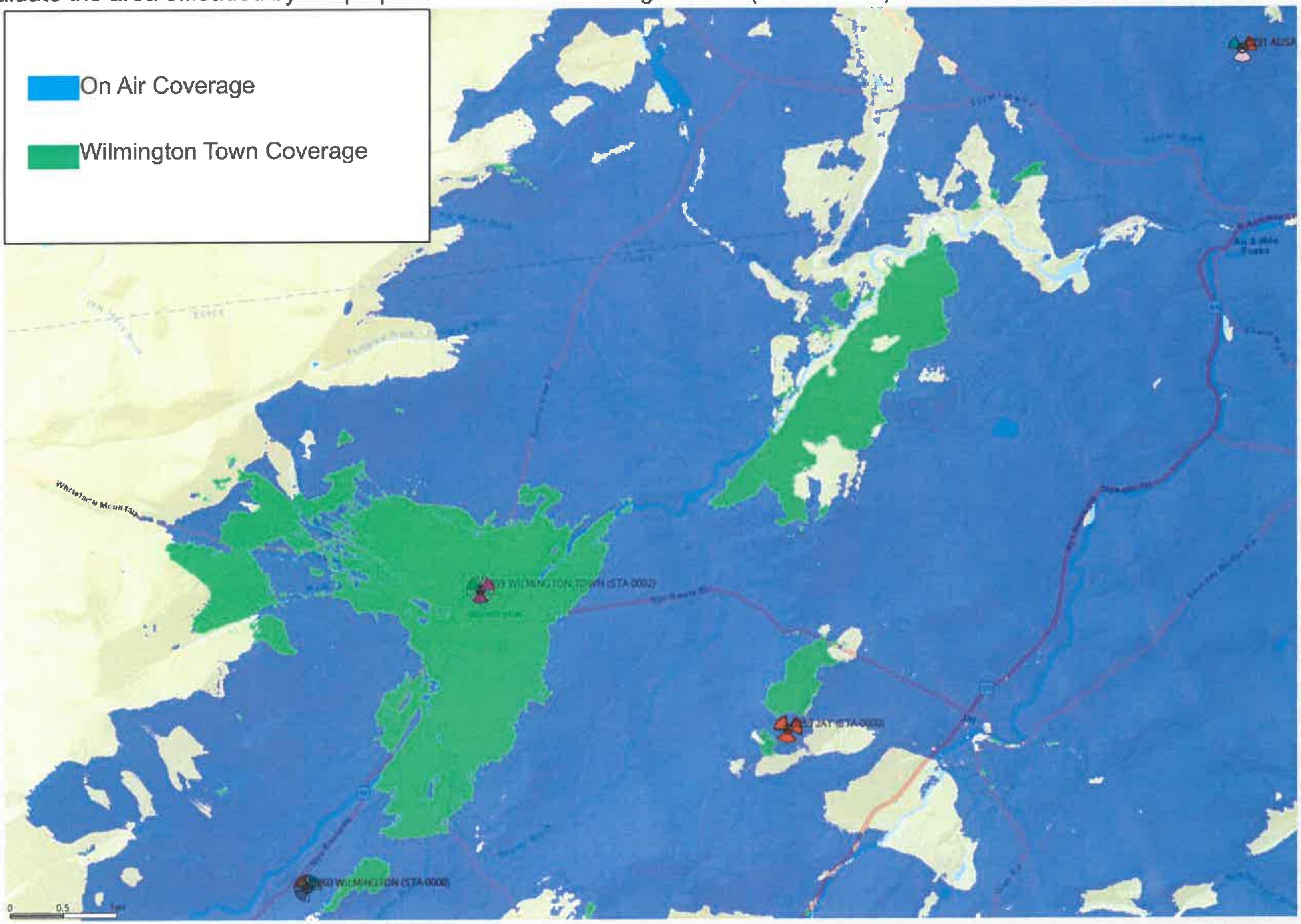
Proposed 700MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold. The viewer can accurately evaluate the area offloaded by the proposed site's dominant signal area (at 100' ACL).



The map above adds the footprint of the proposed Wilmington Town site in green. The green best server footprint provides improved coverage and capacity throughout the identified coverage area.

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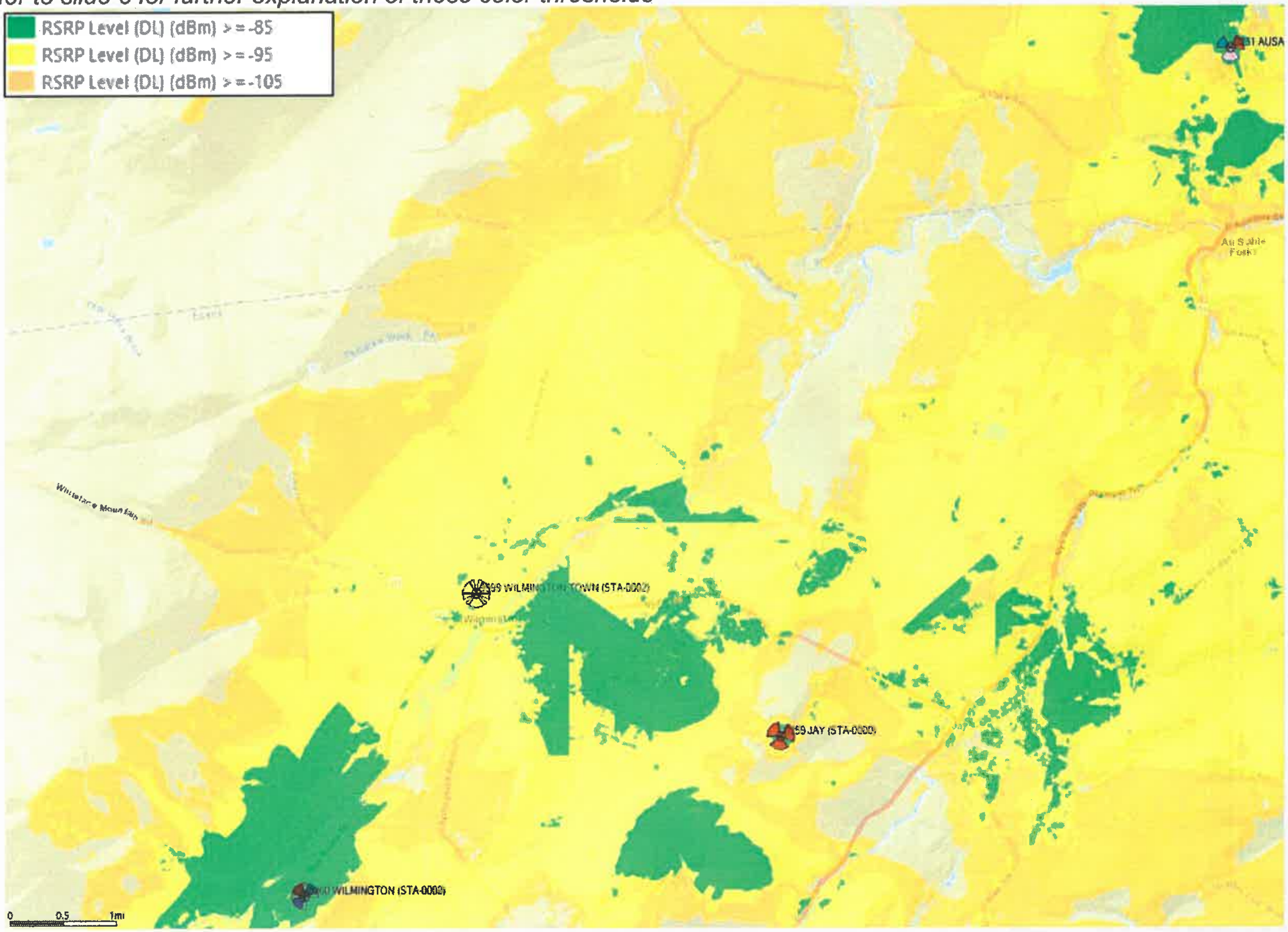
Existing 700MHz Coverage

This coverage map shows how weak the RF conditions are in and around the Wilmington Town site area.

Refer to slide 6 for further explanation of these color thresholds



The map above represents signal strength coverage from existing sites.

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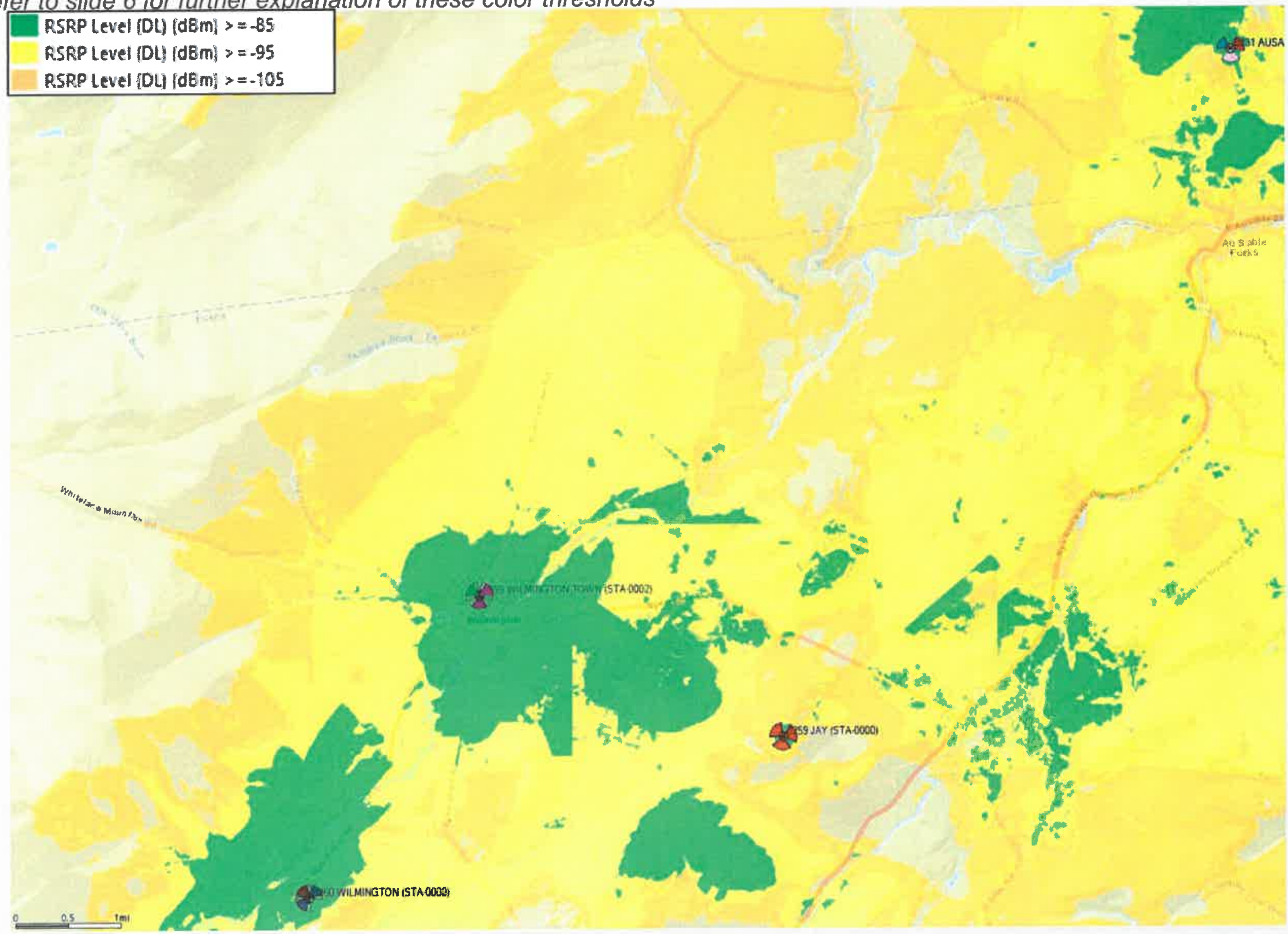
Proposed 700MHz Coverage

This coverage map shows how improved the RF conditions will be in and around the Wilmington Town Site area (100'ACL).

Refer to slide 6 for further explanation of these color thresholds



The map above adds the footprint of the proposed Wilmington Town site. The significantly improved signal strength corresponds to improved coverage, capacity and data speeds throughout the identified significant gap area. This will help to resolve the coverage and capacity issues in the Wilmington Town project area.

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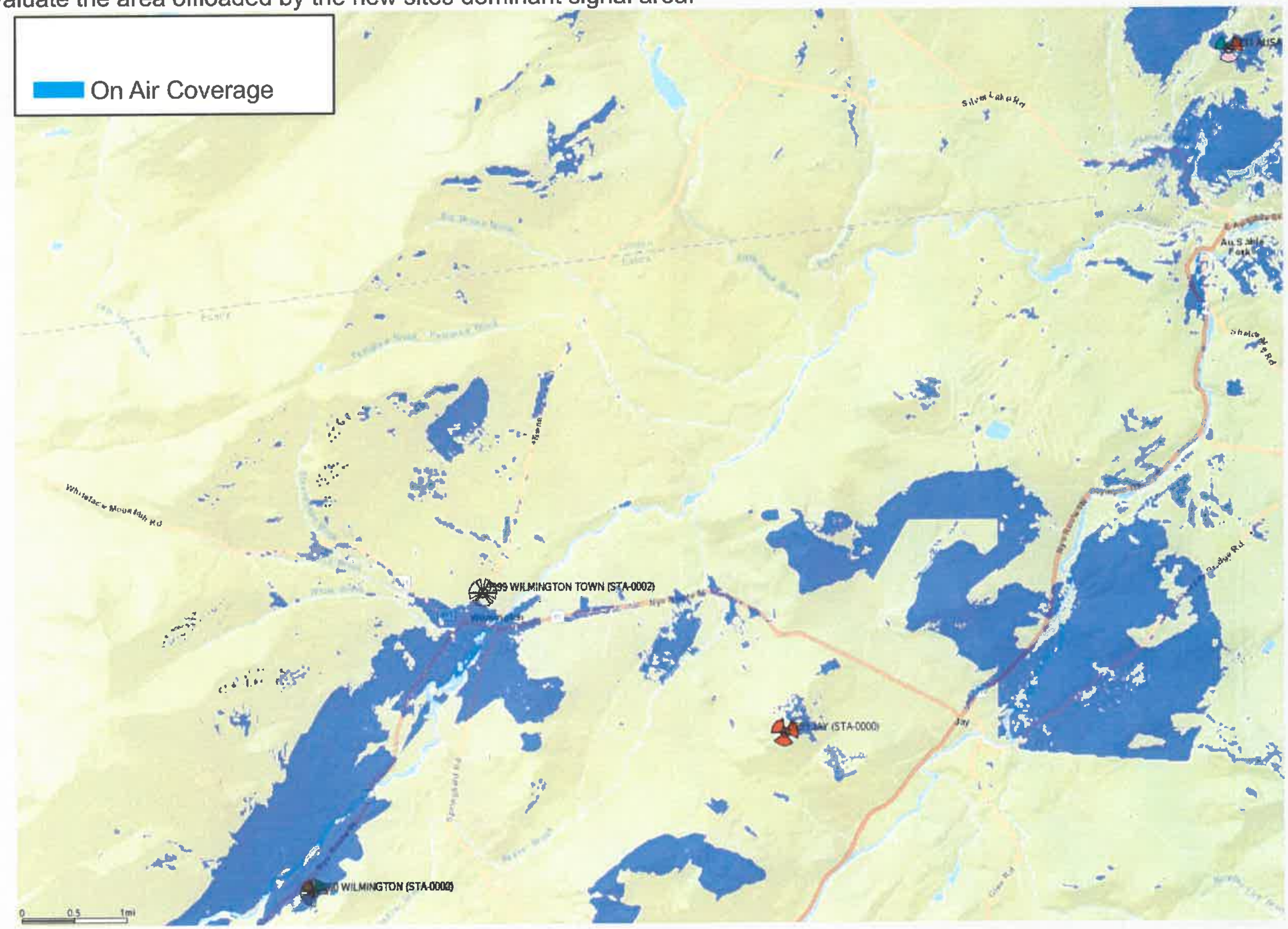
Existing 2100MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold so the viewer can accurately evaluate the area offloaded by the new sites dominant signal area.



The map above represents mid-band coverage from existing sites.

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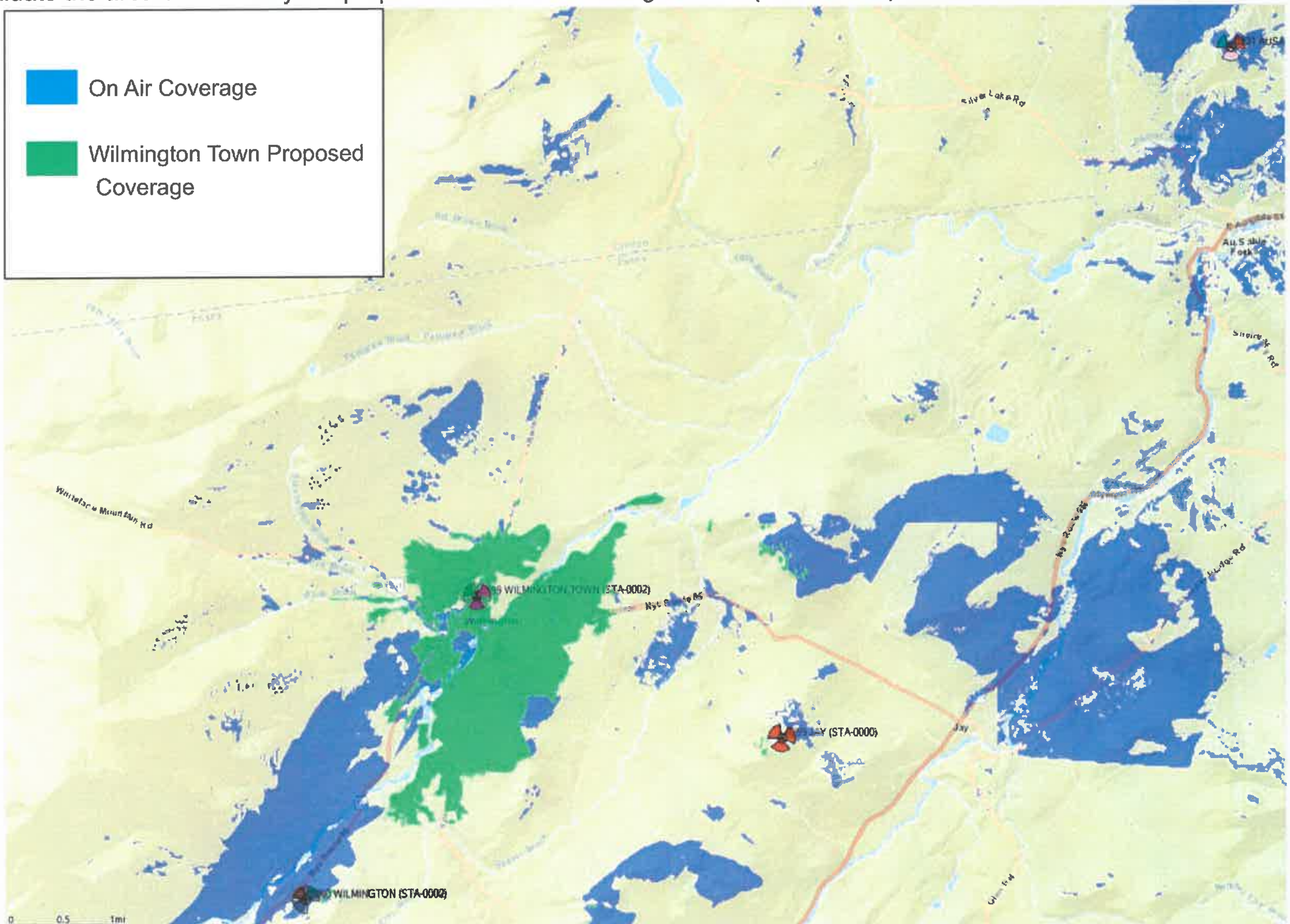
Proposed 2100MHz Best Server -105dBm RSRP

Best Server plots depict the actual footprint of each sector in question at one threshold. The viewer can accurately evaluate the area offloaded by the proposed site's dominant signal area (at 100' ACL).



The map above adds the footprint of the proposed Wilmington Town site in green. The green best server footprint provides improved mid-band coverage, capacity and data speed throughout the identified significant gap area. Mid-band frequencies provide much greater capacity and data speeds.

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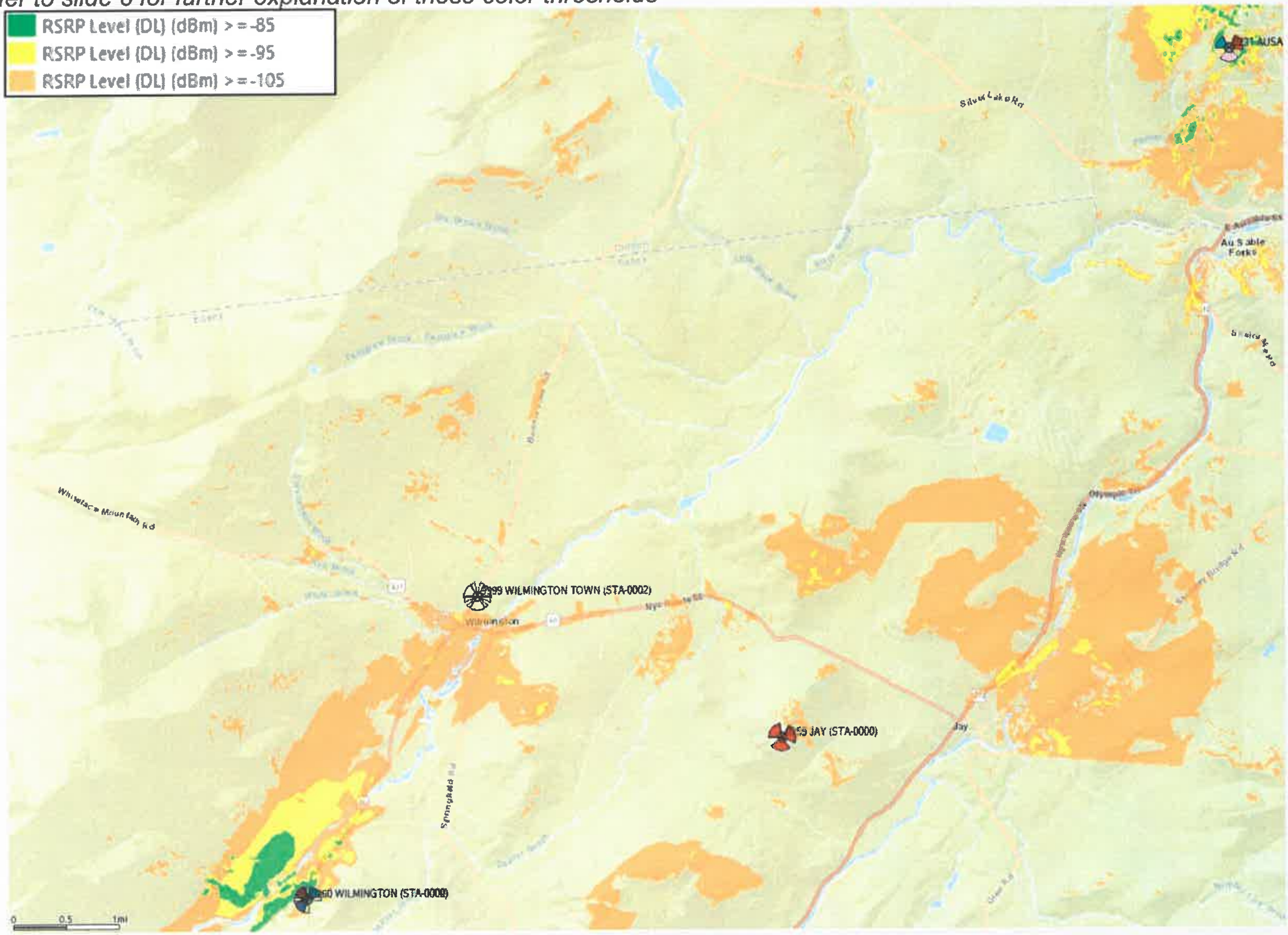
Existing 2100MHz Coverage

This coverage map shows the RF conditions in and around the Wilmington Town site area.

Refer to slide 6 for further explanation of these color thresholds



The map above represents coverage from existing sites. This 2100MHz signal is very weak throughout the project area. Additional mid band network densification is required to resolve these conditions.

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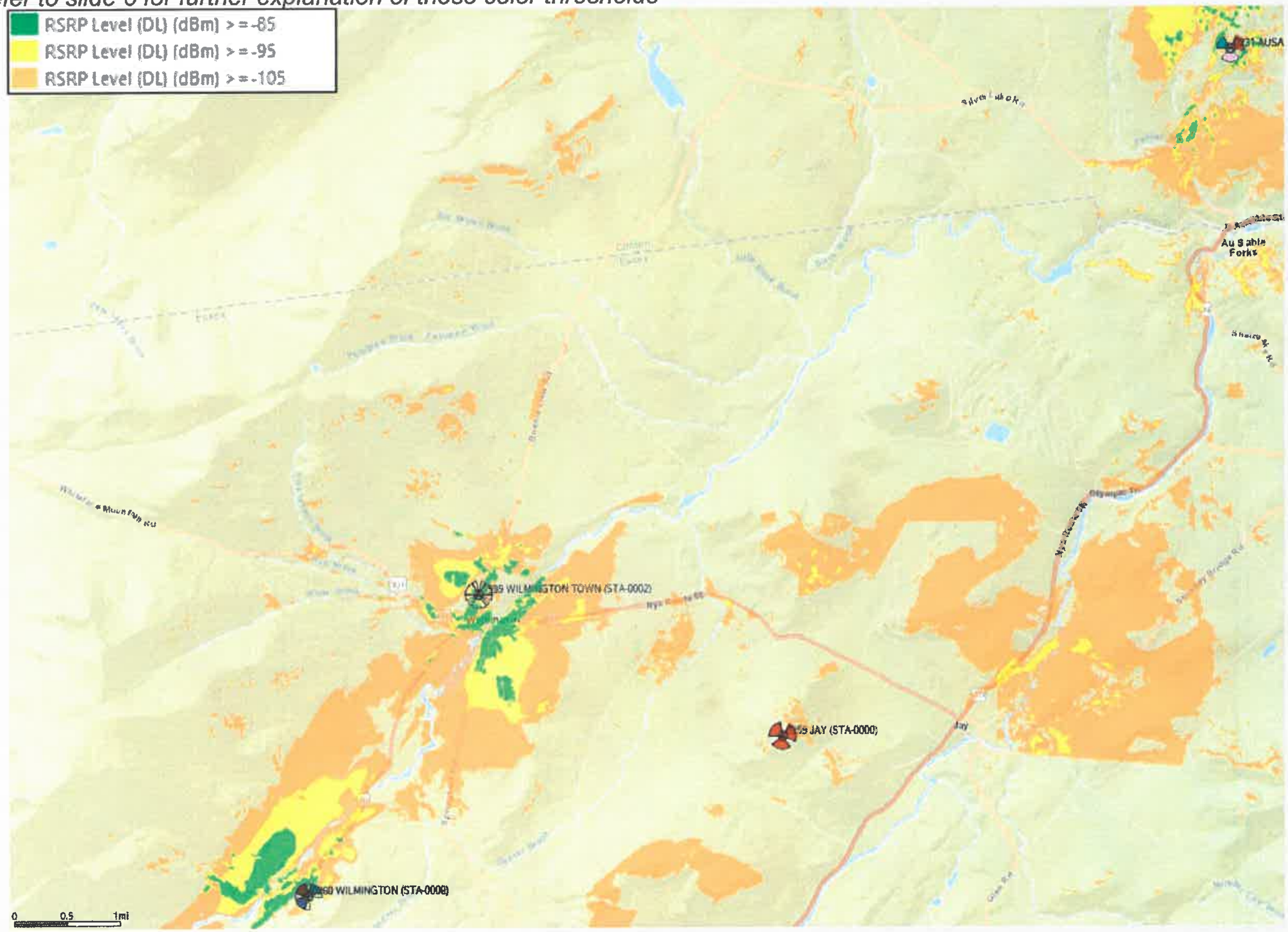
Proposed 2100MHz Coverage

This coverage map shows how improved the RF conditions will be in and around the Wilmington Town site area (100'ACL).

Refer to slide 6 for further explanation of these color thresholds



The map above adds the footprint of the proposed Wilmington Town site. The significantly improved signal strength corresponds to improved coverage, capacity and data speed throughout the identified significant gap area. Mid-band frequencies provide much greater capacity and data speeds. This will help to resolve the coverage and capacity issues impacting the Wilmington Town project area.

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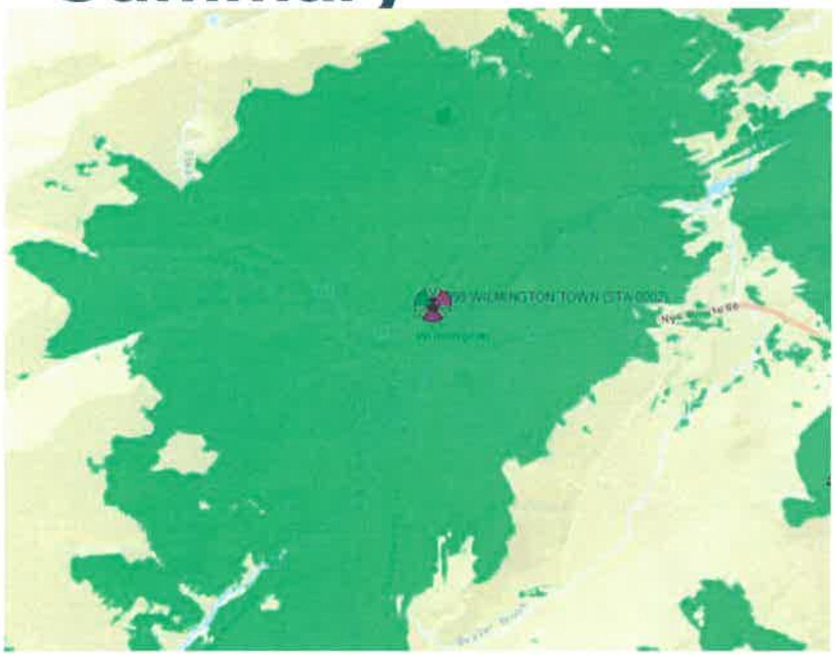
RF Justification Summary



The proposed site at 100'ACL resolves the substantial and significant gaps in coverage and capacity impacting the Wilmington Town project area.

The network was analyzed to determine whether there is sufficient **RF coverage and capacity** in portions of the **Town of Wilmington** and the immediate surrounding area. It was determined that there are significant gaps in adequate LTE service for Verizon Wireless in the 700 and 2100MHz frequency bands. Based on the need for additional coverage while considering the topography and specific area requiring service, any further addition of capacity to distant existing sites does not remedy Verizon's significant gap in reliable service.

With the existing network configuration there are significant gaps in service which restricts Verizon Wireless customers from originating, maintaining or receiving reliable calls and network access. It is our expert opinion that the proposed height will satisfy the coverage and capacity needs of Verizon Wireless and its subscribers in the Wilmington Town project area. The proposed location depicted herein satisfies the identified service gaps and is proposed at the minimum height necessary for adequate service.

Walt Chernosky

Walt Chernosky
RF Engineer – RF Design
Verizon Wireless

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