Verizon Wireless Communications Facility

Engineering Necessity Case – “Electric Blanket”

City of Beacon
Project Location “Electric Blanket”
Beacon DT
Town of Fishkill
Mt. Beacon Existing Site

Prepared by: Michael R. Crosby

Project: The project is the installation and operation of a rooftop tower co-located wireless telecommunications site in the City of Beacon (the “Project Facility”).

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October 7, 2019

Introduction

The purpose of this subsequent 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.

Project Need Overview

The project area, centrally located within the City of Beacon is currently served by two sites. These sites are overloaded requiring capacity relief. Additionally the project area is impacted by the significant terrain difference between these two serving sites relative to the project area. This excessive difference in terrain combined with distance and area morphology prevents effective capacity and coverage capability of Verizon's RF signals in this area.

The primary serving site is **Mt. Beacon** located in the neighboring town of Fishkill, which is approximately one and one half miles south east (of the project location) situated on a mountain top tower located off Mt. Beacon Monument Rd (near Breakneck Ridge Trail). While this site provides coverage (on low band 700MHz) throughout the project area, it does so from such a great difference in elevation that the site is not capable of efficiently or effectively providing the necessary capacity due to Mt. Beacon itself causing excessive interference in and around the project area. This site also provides high band (AWS) service to portions of the project area but again due to the excessive difference in elevation combined with distance to objectives Mt. Beacon is not capable of efficiently or effectively providing the necessary capacity relief and actually degrades area performance and capacity capabilities due to excessive interference in and around the project area (caused by overlapping/overshooting footprint). In order to mitigate the overlapping footprint and improve interference and capacity conditions, Mt. Beacon requires deactivation as it can no longer function properly as an LTE serving site for this area. Regardless of the need to deactivate Mt. Beacon (LTE), additional capacity is currently required even with Mt. Beacon on the air.

The second serving site is **Beacon DT** which is co-located on the roof of a multi-story apartment building off Rt. 9D near South Ave. This site is also requiring capacity relief. While this site is more appropriate for the area than Mt. Beacon, by itself it can not provide the necessary coverage and capacity required to serve the project area.

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 are to increase capacity and improve high band coverage in the main street Beacon area including but not limited to portions of Main Street, Fishkill Ave, Tioronda Ave, South Street, Schenck Ave as well as the surrounding residential and commercial areas. In order to offload capacity from Mt. Beacon and Beacon DT a new dominant server must be created. This new dominant coverage will effectively offload the existing overloaded sites as well as provide improved high band in building coverage.

Following the search for co-locatable structures to resolve the aforementioned challenges several suitable candidates were identified (see site selection analysis on p26 for further detail). Unfortunately, several of these building owners were unwilling to entertain co-location efforts and in some cases there were constructability issues preventing co-location. As a result, Verizon proposes the current application to attach it's antennas to Fire Department rooftop mounted tower. Verizon's antennas will utilize 63' and 57' for the ACL's (Antenna Center Lines) with a top of antenna height of 65'. This solution will provide the necessary coverage and capacity improvements needed.

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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]

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

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 23, 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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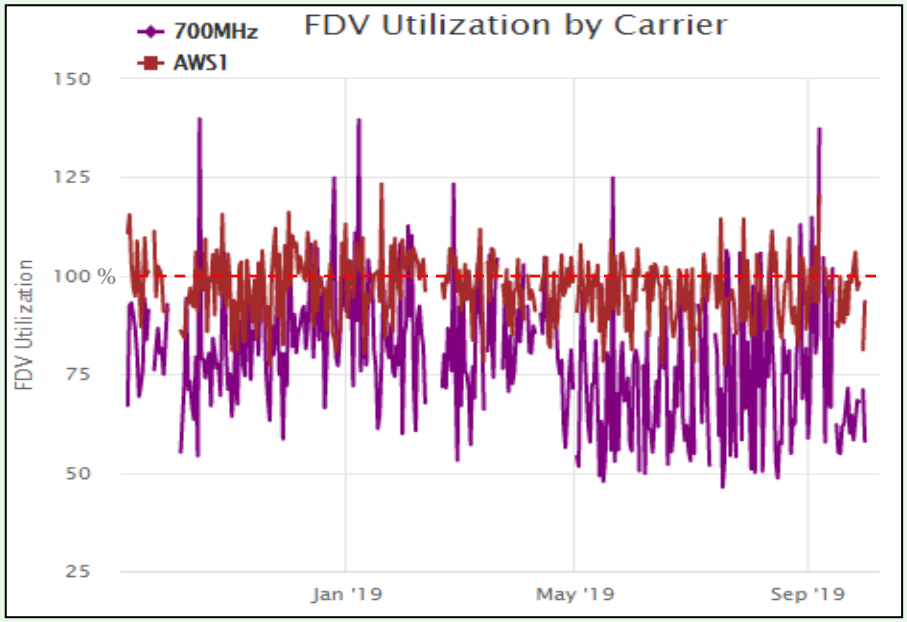
Capacity Utilization FDV (Mt. Beacon Gamma)



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 on the **Gamma** sector of the **Mt. Beacon** site. The dark red line represents the daily max busy hour 2100MHz (AWS) utilization on the **Gamma** sector of the **Mt. Beacon** 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.

Displaying the FDV separately by carrier reveals the inability of high band (AWS) to resolve the capacity issues from existing sites described in this case. High band (AWS/PCS propagation characteristics prevent proper FDV utilization between carriers in coverage challenged areas like the **Electric Blanket** project area. Network densification is required.

Detail: The existing **Mt. Beacon Gamma** sector shown above has exceeded it's capability of supporting FDV requirements as shown by the purple and dark red lines exceeding the max utilization threshold (red dashed line). FDV is one of three metrics used in this presentation to evaluate capacity capability in this area.

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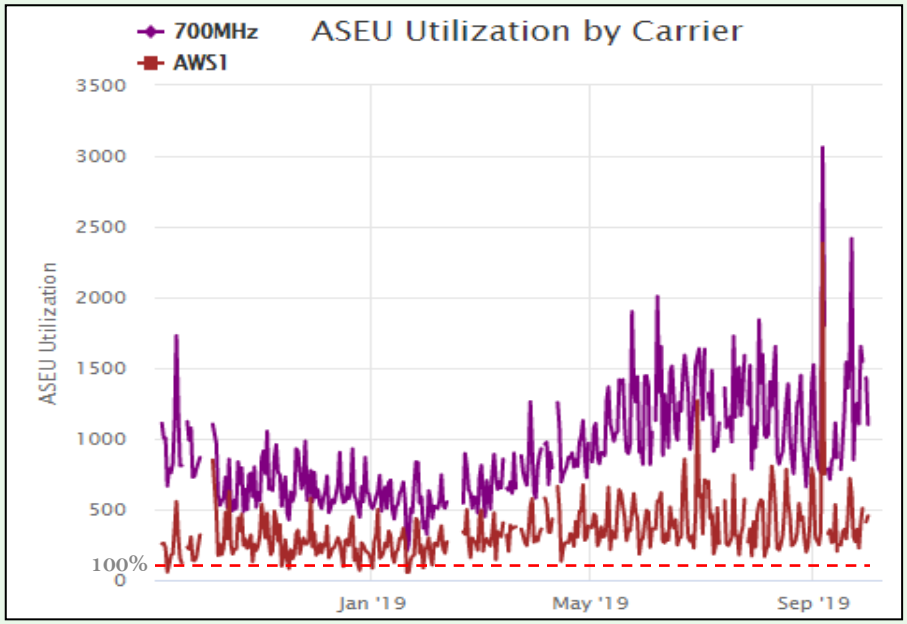
Capacity Utilization ASEU (Mt. Beacon Gamma)



Summary: This graph shows ASEU (**A**verage **S**chedule **E**ligible **U**ser). ASEU is a measurement of the loading of the control channels and systems of a given site. The ASEU load is heavily impacted by distant users or those in poor RF conditions.

The purple line represents the daily max busy hour 700MHz utilization on the **Gamma** sector of the **Mt. Beacon** site. The dark red line represents the daily max busy hour 2100MHz (AWS) utilization on the **Gamma** sector of the **Mt. Beacon** 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.

Displaying the ASEU separately by carrier reveals the inability of high band (AWS) to resolve the capacity issues from existing sites described in this case. High band (AWS/PCS propagation characteristics prevent proper ASEU utilization between carriers in coverage challenged areas like the **Electric Blanket** project area. Network densification is required.

Detail: The existing **Mt. Beacon Gamma** sector cannot support the data traffic demand throughout the extents of the excessively large area it covers. **Mt. Beacon Gamma** is already overloaded, as shown by the purple and dark red actual use lines exceeding the red dashed exhaustion threshold line. Cell edge (weak/variable) conditions create the disparity between high and low bands due to propagation challenges which more significantly impact (limit) high band (AWS). The **Mt. Beacon** site is too far away to effectively serve this portion of the City of Beacon.

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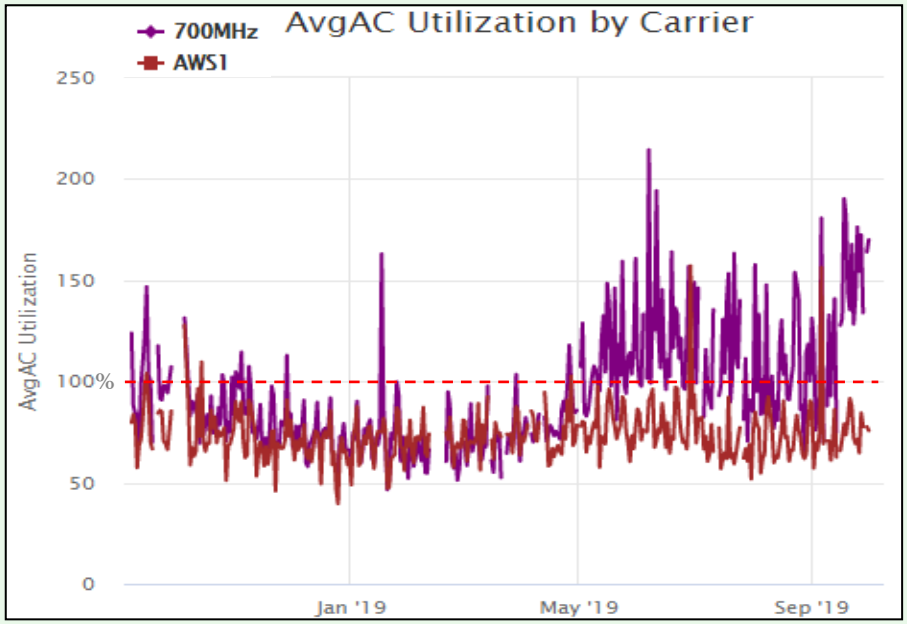
Capacity Utilization AvgAC (Mt. Beacon Gamma)



Summary: This graph shows AvgAC (**A**verage **A**ctive **C**onnections). AvgAC utilization by carrier is a measurement of max active connection capacity per sector in any given time slot. When this limit is reached, no additional devices will be able to connect to the site, resulting in connection failures and dropped calls.

The purple line represents the daily max busy hour 700MHz utilization on the **Gamma** sector of the **Mt. Beacon** site. The dark red line represents the daily max busy hour 2100MHz (AWS) utilization on the **Gamma** sector of the **Mt. Beacon** 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.

This graph helps to reveal foliage impact affecting variable coverage areas which result with a decline in AWS utilization while 700MHz utilization increases at the time of increased springtime foliage. This further complicates capacity offload capability for high band carriers. Network densification is required.

Detail: The existing **Mt. Beacon Gamma** sector shown above has exceeded it's capability of supporting AvgAC requirements as shown by the purple and dark red lines exceeding the max utilization threshold (red dashed line).

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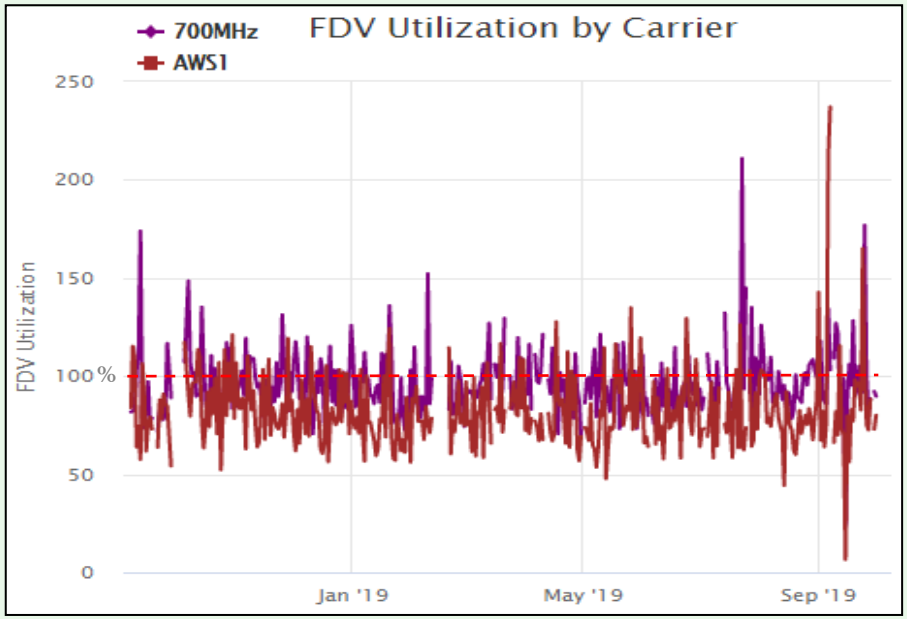
Capacity Utilization FDV (Beacon DT Alpha)



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 on the **Alpha** sector of the **Beacon DT** site. The dark red line represents the daily max busy hour 2100MHz (AWS) utilization on the **Alpha** sector of the **Beacon DT** 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.

Displaying the FDV separately by carrier reveals the inability of high band (AWS) to resolve the capacity issues from existing sites described in this case. High band (AWS/PCS propagation characteristics prevent proper FDV utilization between carriers in coverage challenged areas like the **Electric Blanket** project area. Network densification is required.

Detail: The existing **Beacon DT Alpha** sector shown above has exceeded it's capability of supporting FDV requirements as shown by the purple and dark red lines exceeding the max utilization threshold (red dashed line). FDV is one of three metrics used in this presentation to evaluate capacity capability in this area.

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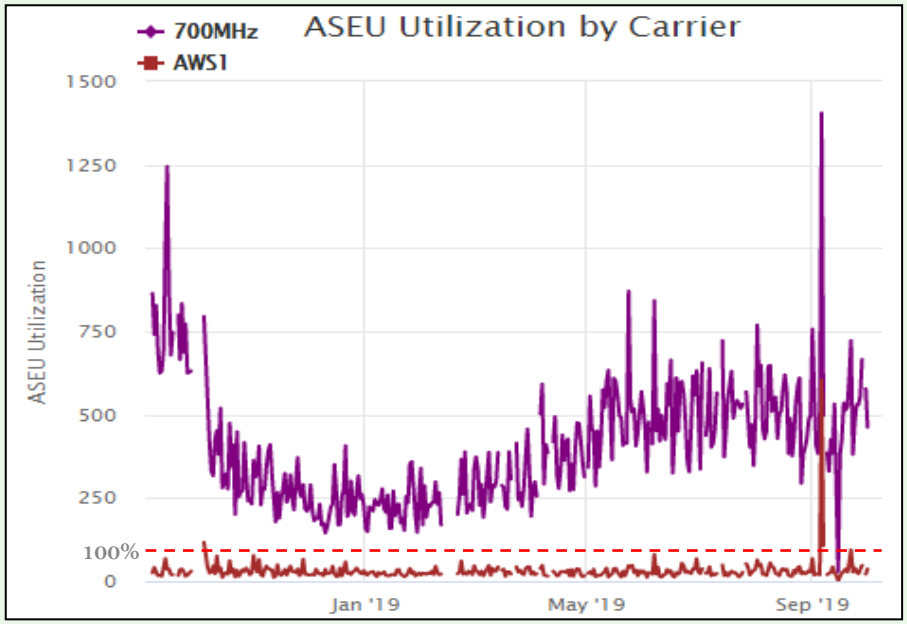
Capacity Utilization ASEU (Beacon DT Alpha)



Summary: This graph shows ASEU (**A**verage **S**chedule **E**ligible **U**ser). ASEU is a measurement of the loading of the control channels and systems of a given site. The ASEU load is heavily impacted by distant users or those in poor RF conditions.

The purple line represents the daily max busy hour 700MHz utilization on the **Alpha** sector of the **Beacon DT** site. The dark red line represents the daily max busy hour 2100MHz (AWS) utilization on the **Alpha** sector of the **Beacon DT** 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.

Displaying the ASEU separately by carrier reveals the inability of high band (AWS) to resolve the capacity issues from existing sites described in this case. High band (AWS/PCS propagation characteristics prevent proper ASEU utilization between carriers in coverage challenged areas like the **Electric Blanket** project area. Network densification is required.

Detail: The existing **Beacon DT Alpha** sector cannot support the data traffic demand throughout the extents of the area it covers. **Beacon DT Alpha** is already overloaded, as shown by the purple actual use line exceeding the red dashed exhaustion threshold line. Cell edge (weak/variable) conditions create the disparity between high and low bands due to propagation challenges which more significantly impact high band (AWS). The **Beacon DT** site requires network densification throughout it's serving footprint.

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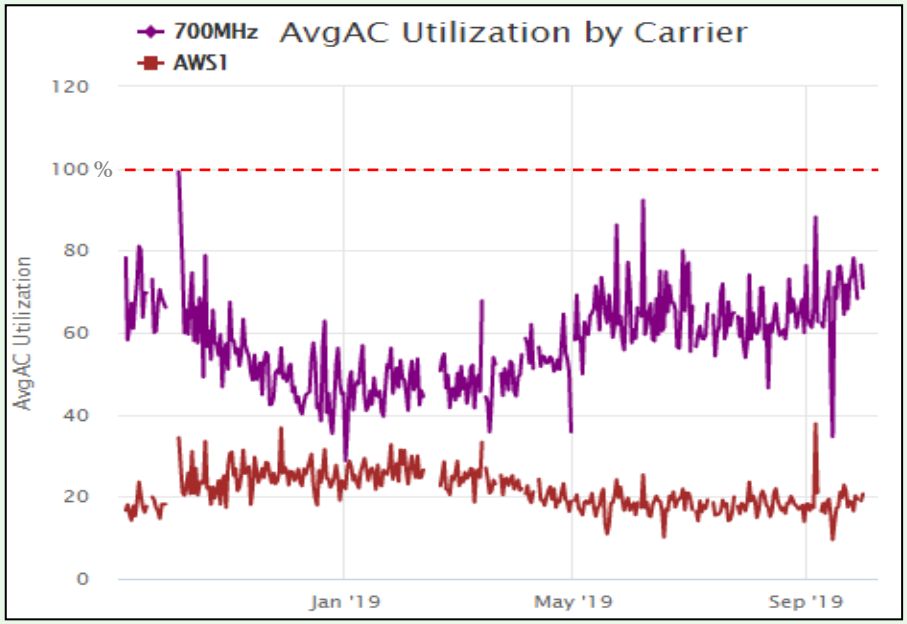
Capacity Utilization AvgAC (Beacon DT Alpha)



Summary: This graph shows AvgAC (**A**verage **A**ctive **C**onnections). AvgAC utilization by carrier is a measurement of max active connection capacity per sector in any given time slot. When this limit is reached, no additional devices will be able to connect to the site, resulting in connection failures and dropped calls.

The purple line represents the daily max busy hour 700MHz utilization on the **Alpha** sector of the **Beacon DT** site. The dark red line represents the daily max busy hour 2100MHz (AWS) utilization on the **Alpha** sector of the **Beacon DT** 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.

This graph helps to reveal foliage impact affecting variable coverage areas which result with a flat line or decline in AWS utilization while 700MHz utilization increases at the time of increased springtime foliage. This further complicates capacity offload capability for high band carriers. Network densification is required.

Detail: The existing **Beacon DT Alpha** sector is currently performing normally for this metric but is at risk for overloading at any time and is expected to reach consistent exhaustion in the near future if network densification solutions are not implemented in time.

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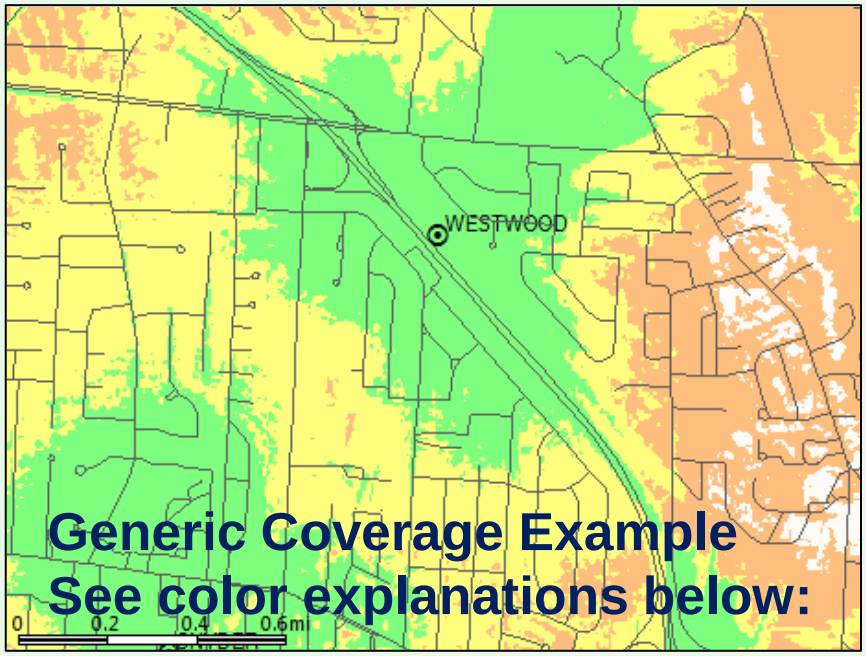
Explanation of Wireless Coverage



Coverage is best shown via coverage maps. RF engineers use computer simulation tools that take into account terrain, vegetation, building types, and site specifics to model the RF environment. This model is used to simulate the real world network and assist engineers to evaluate the impact of a proposed site (along with industry experience and other tools).

Many Verizon Wireless sites provide 3G CDMA at 850 MHz and 4G LTE at 700 MHz. As capacity requirements increase, higher frequency PCS (1900 MHz) and AWS (2100 MHz) carriers are added. In some mountaintop situations the high band AWS and PCS carriers are not effective due to excessive distance from the user population.

Coverage provided by a given site is affected by the frequencies used. Lower frequencies propagate further distances, and are less attenuated by clutter than higher frequencies. To provide similar coverage levels at higher frequencies, a denser network of sites is required (network densification).

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 etc.)
Green = -85dBm RSRP, typically serves suburban residential and light commercial buildings (stronger coverage levels may be needed for proper evaluation in urban applications or where more substantial building construction exists)
Yellow = -95dBm 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

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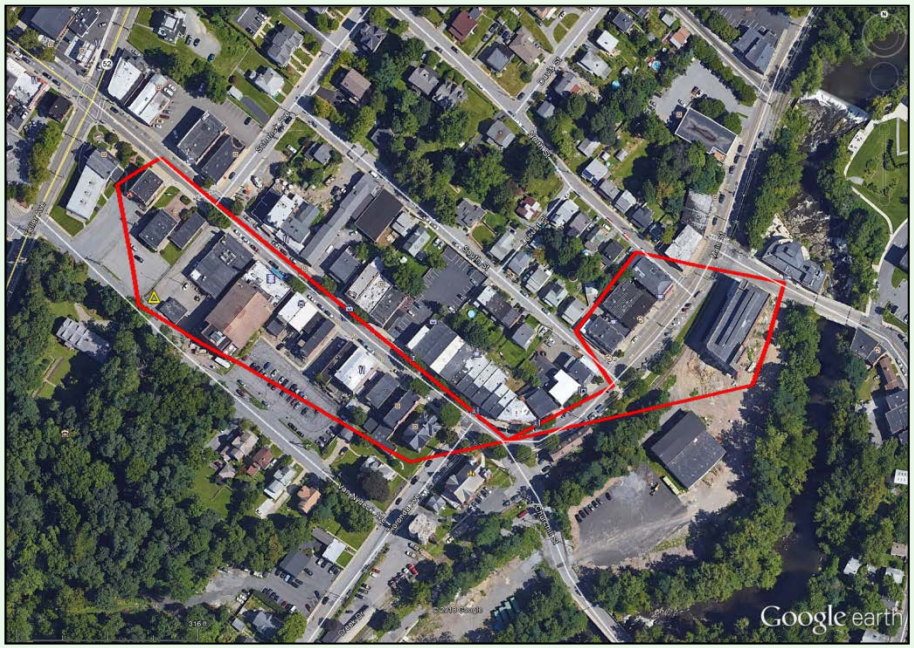
Explanation of this Search Area



Electric Blanket 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 and capacity deficiencies previously detailed, Verizon Wireless is seeking to add one new 'macro' cell facility within or as near as possible to this centrally and strategically located area to improve wireless service capacity and coverage. By offloading Beacon DT and displacing traffic from Mt. Beacon with the proposed site, adequate and reliable service will be provided. The new **Electric Blanket** site will provide dominant and dedicated signal to portions of Beacon helping to improve not only the commercial district and roads but also adjacent populated areas.

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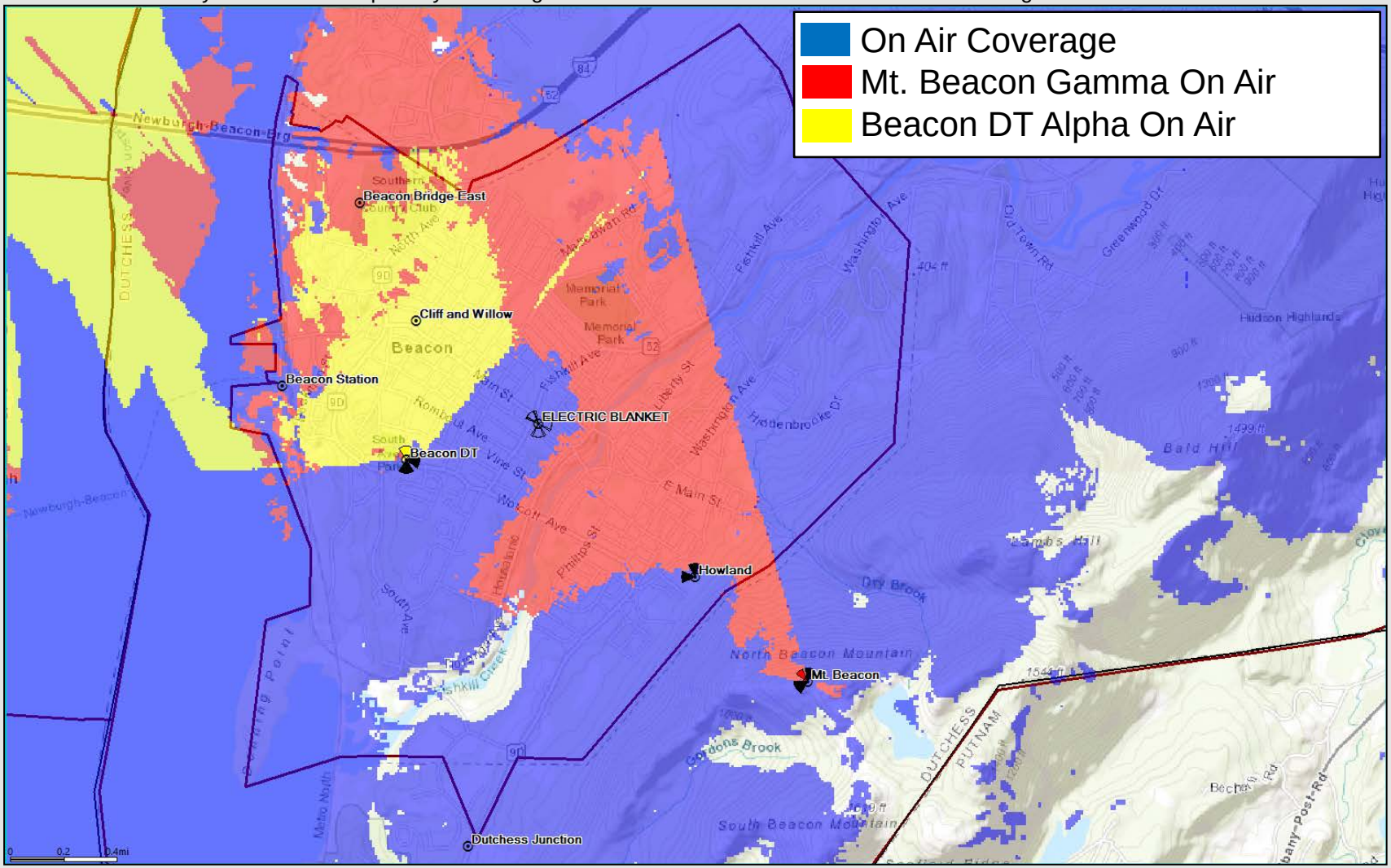
Existing 700MHz Best Server -95dBm RSRP

Best Server plots depict the actual best server or dominant footprint of each sector in question. The following map shows one threshold so the viewer can accurately evaluate where primary offloading will occur as a result of the new site's dominant signal area.



The map above represents coverage from existing sites/cells, with the cells in need of capacity offload in red (Mt. Beacon Gamma) and yellow (Beacon DT Alpha), Blue coverage is from other on air sites/sectors.

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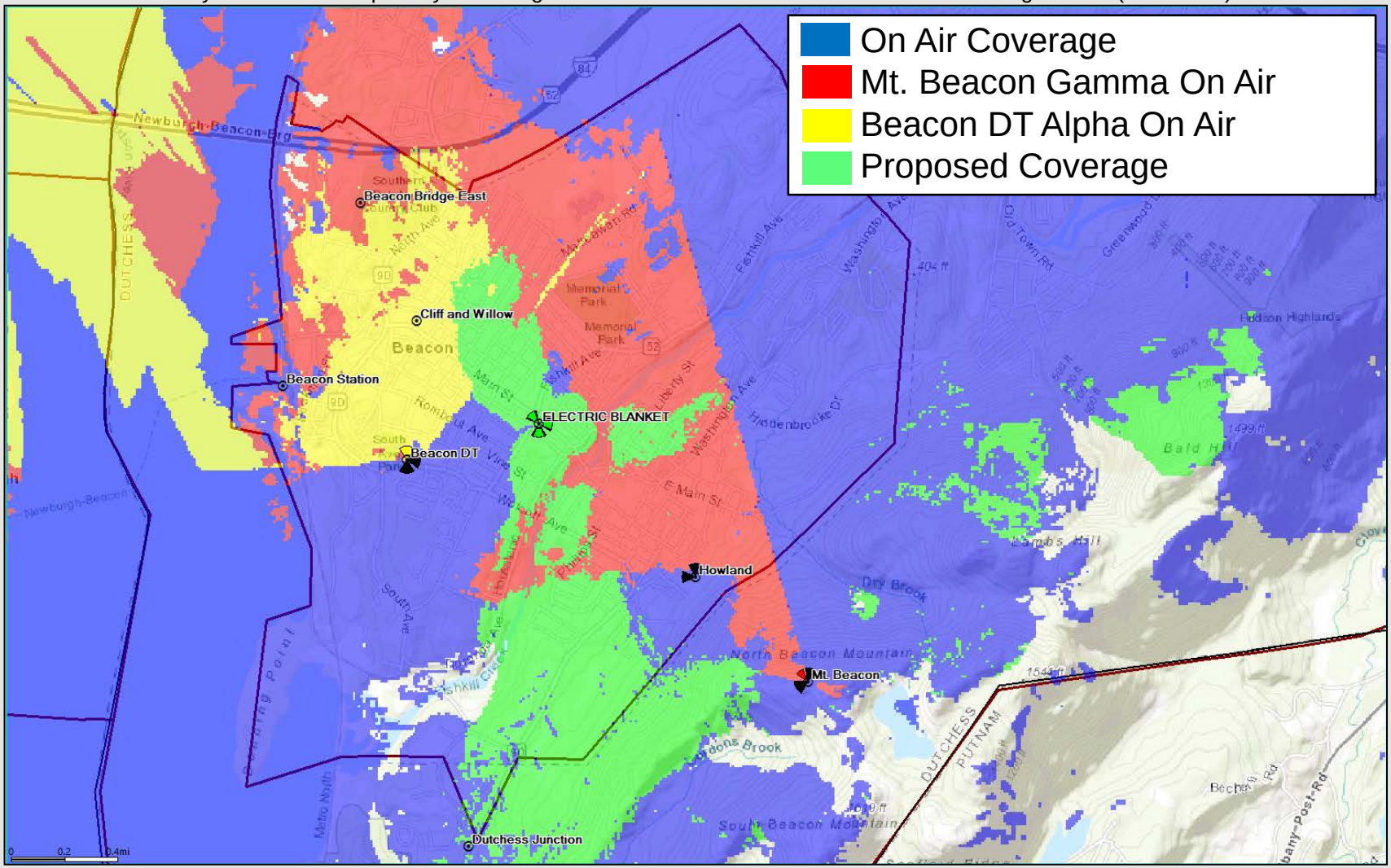
Proposed 700MHz Best Server -95dBm RSRP

Best Server plots depict the actual best server or dominant footprint of each sector in question. The following map shows one threshold so the viewer can accurately evaluate where primary offloading will occur as a result of the new site's dominant signal area (at 63' ACL).



The map above adds the footprint of the proposed Electric Blanket site in green. The green best server footprint significantly overlaps the red and yellow cells helping to offload weak and distant users improving capacity and coverage.

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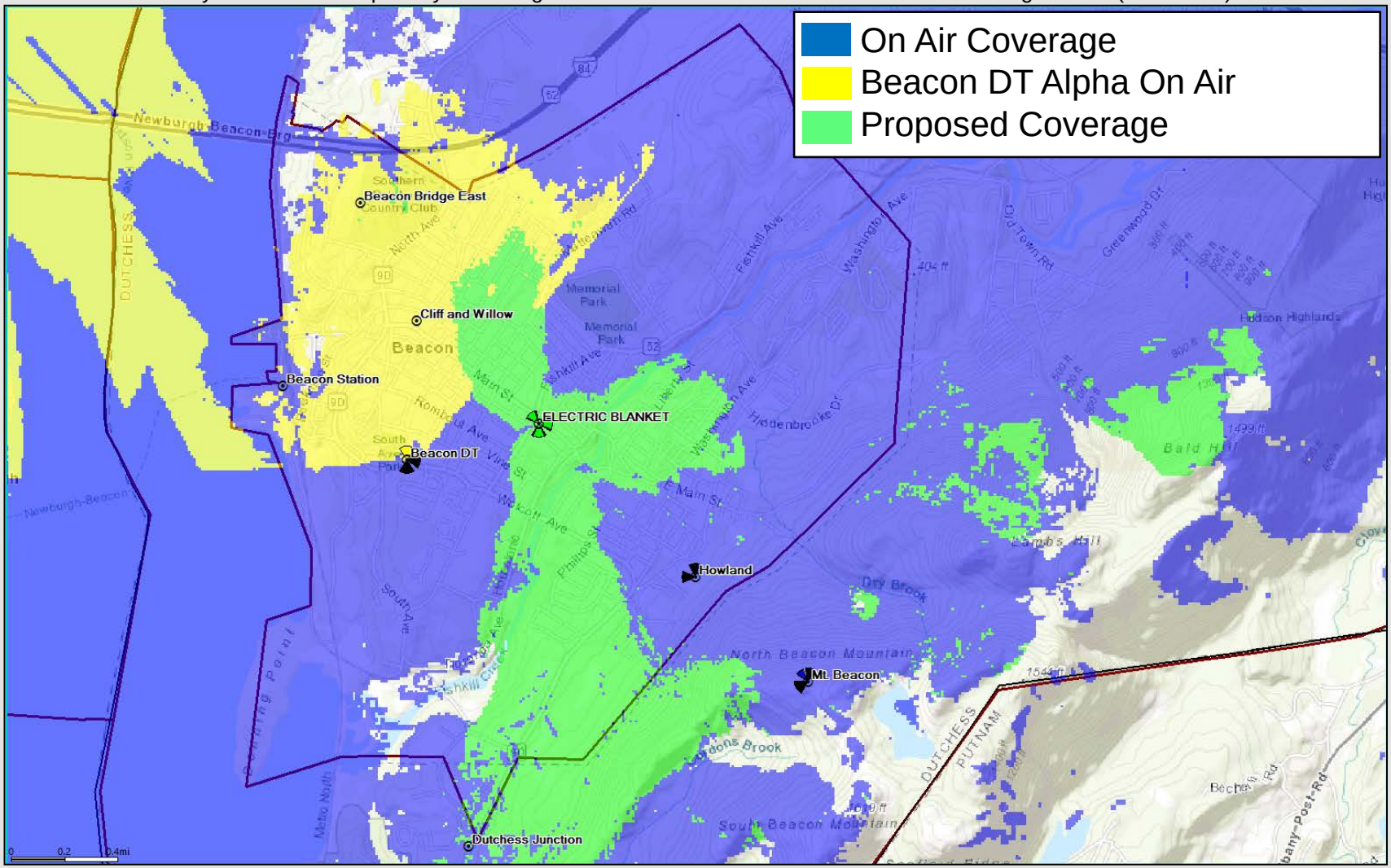
Mt. Beacon LTE OFF 700MHz Best Server -95dBm RSRP

Best Server plots depict the actual best server or dominant footprint of each sector in question. The following map shows one threshold so the viewer can accurately evaluate where primary offloading will occur as a result of the new site's dominant signal area (at 63' ACL).



The map above removes the footprint of the existing Mt. Beacon site showing the improved benefit and coverage footprint of the proposed Electric Blanket site (green coverage).

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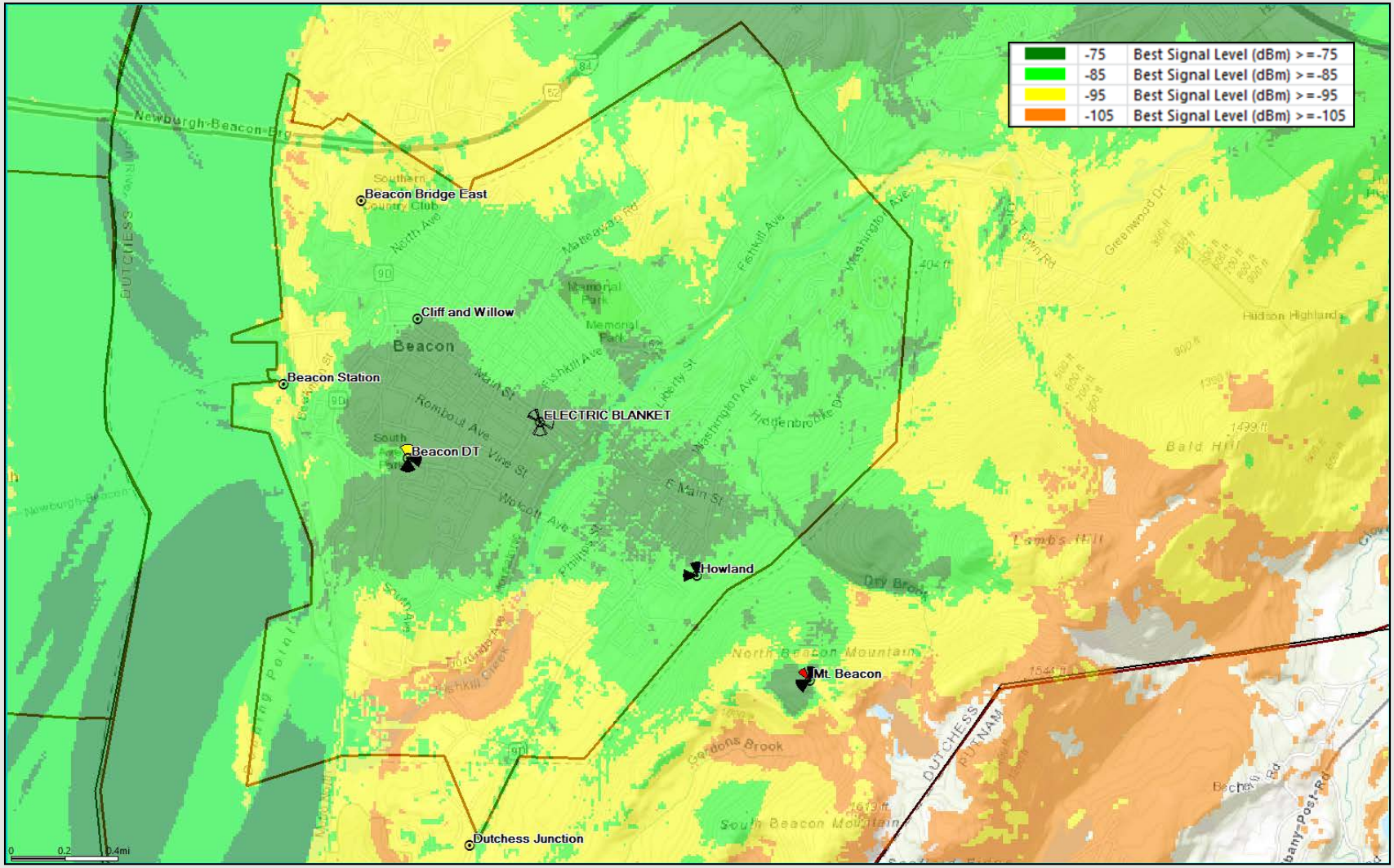
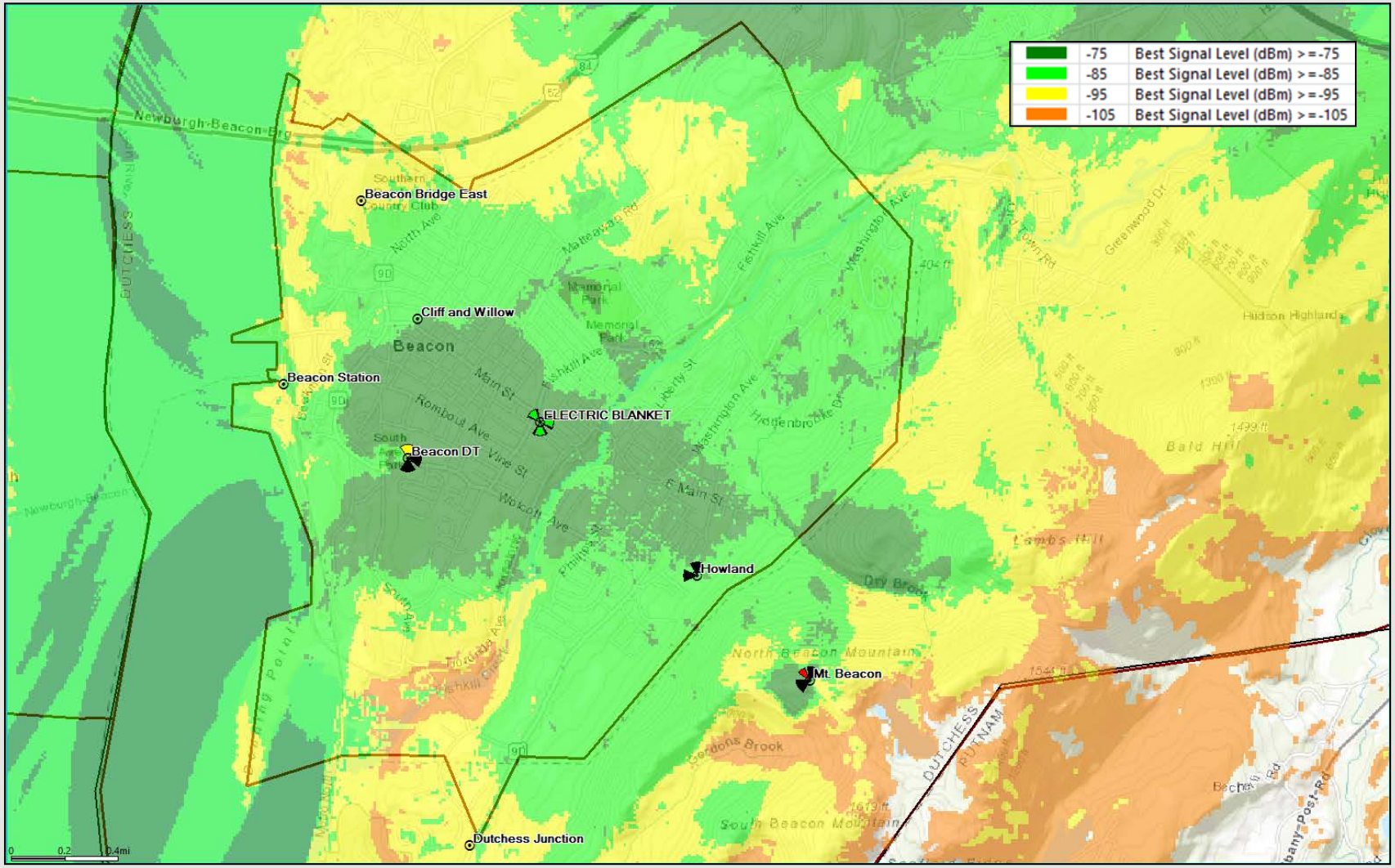
Existing 700MHz Coverage

This coverage map shows existing low band RF conditions in and around the Electric Blanket site area.



Proposed 700MHz Coverage

This coverage map shows future low band RF conditions in and around the Electric Blanket site area (at 63’ ACL).



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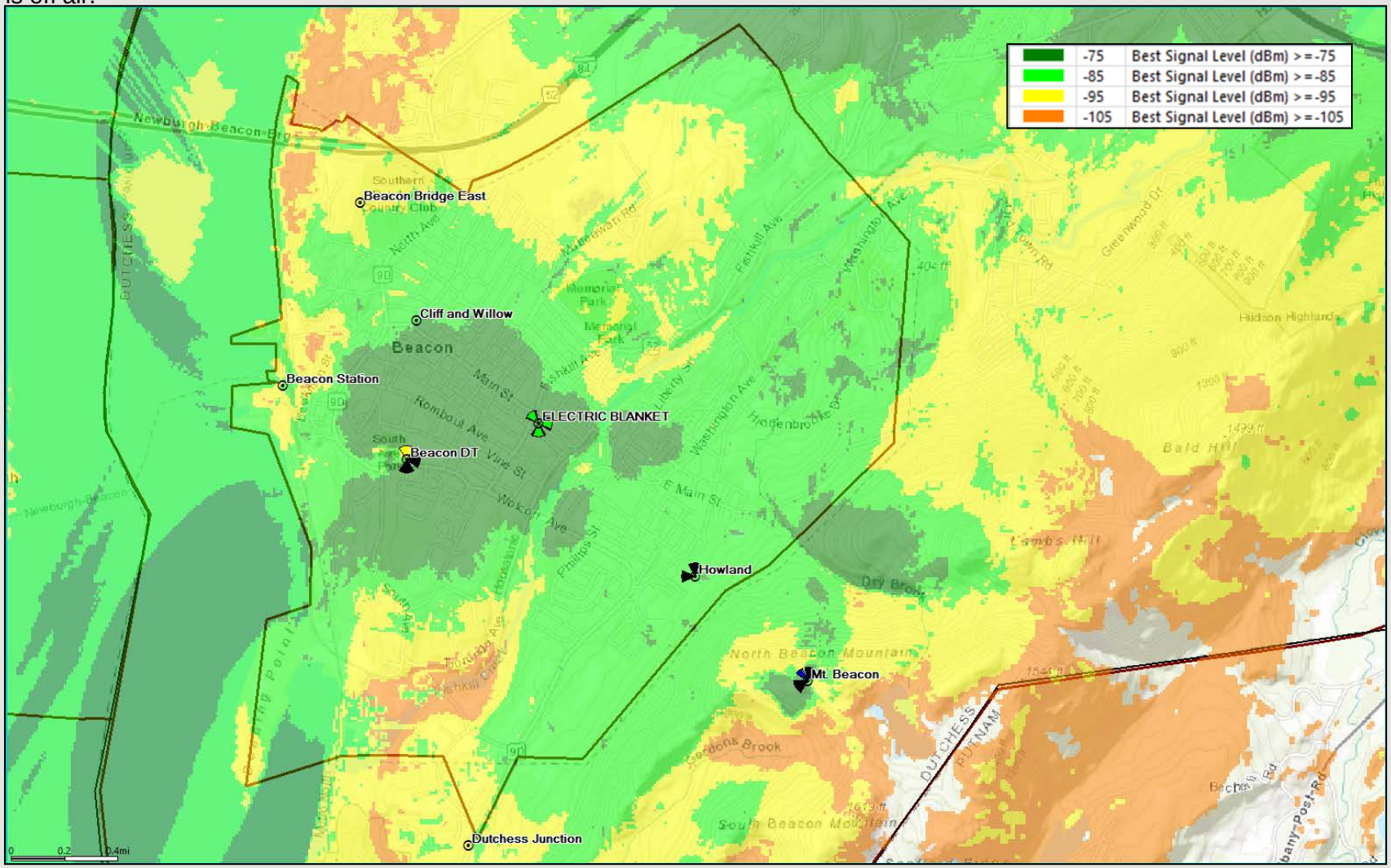
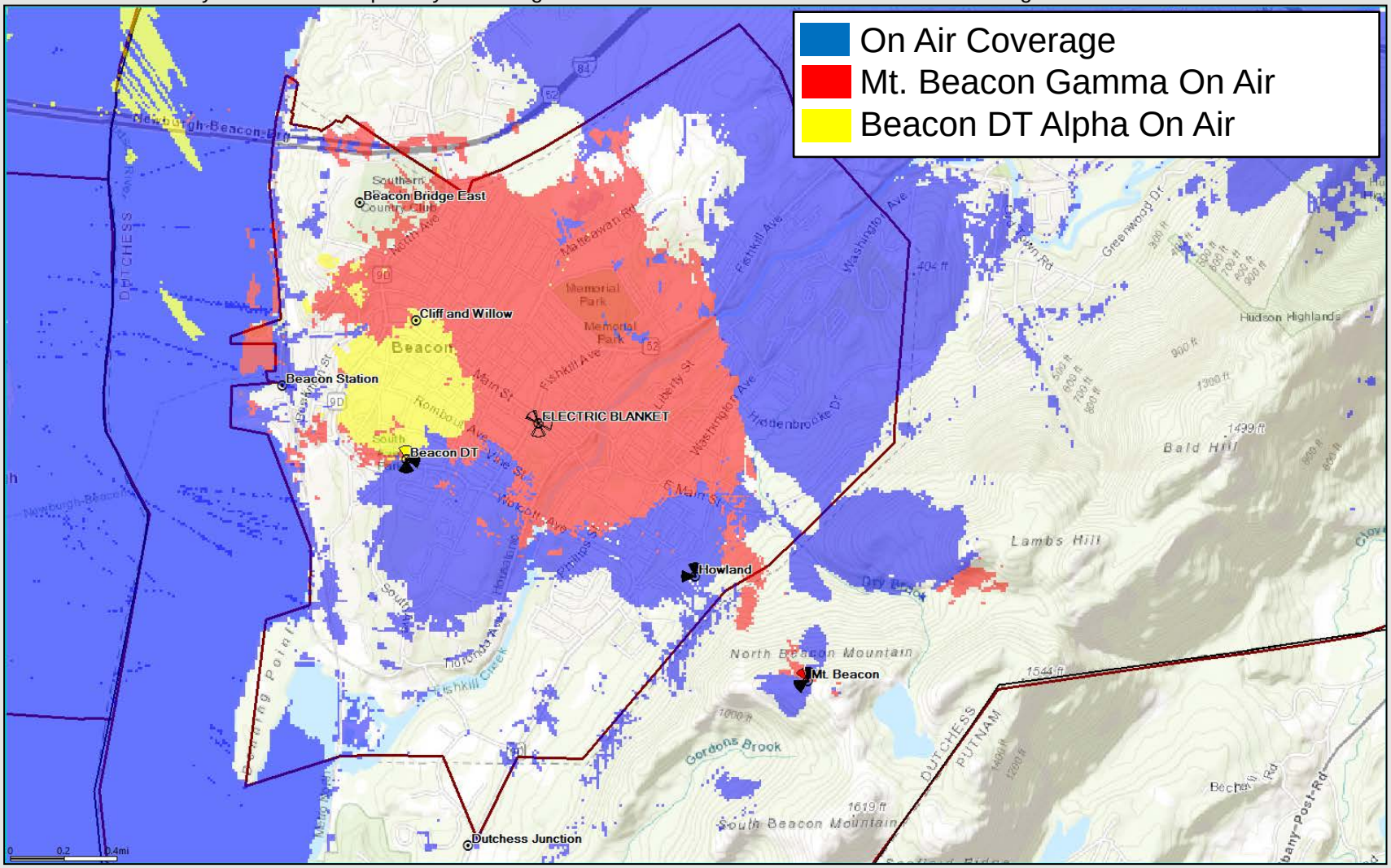
Existing 700MHz Coverage (Mt. Beacon OFF AIR)

This coverage map shows what future low band RF conditions will be in and around the Electric Blanket site area after Mt. Beacon is off air.



Existing 2100MHz Best Server -95dBm RSRP

Best Server plots depict the actual best server or dominant footprint of each sector in question. The following map shows one threshold so the viewer can accurately evaluate where primary offloading will occur as a result of the new site's dominant signal area.



The map above represents coverage from existing sites/cells, with the cells in need of capacity offload in red (Mt. Beacon Gamma) and yellow (Beacon DT Alpha) Blue coverage is from other on air sites/sectors.

Note: Howland although not actually on air (at the time of this document) is shown as on air for planning purposes.

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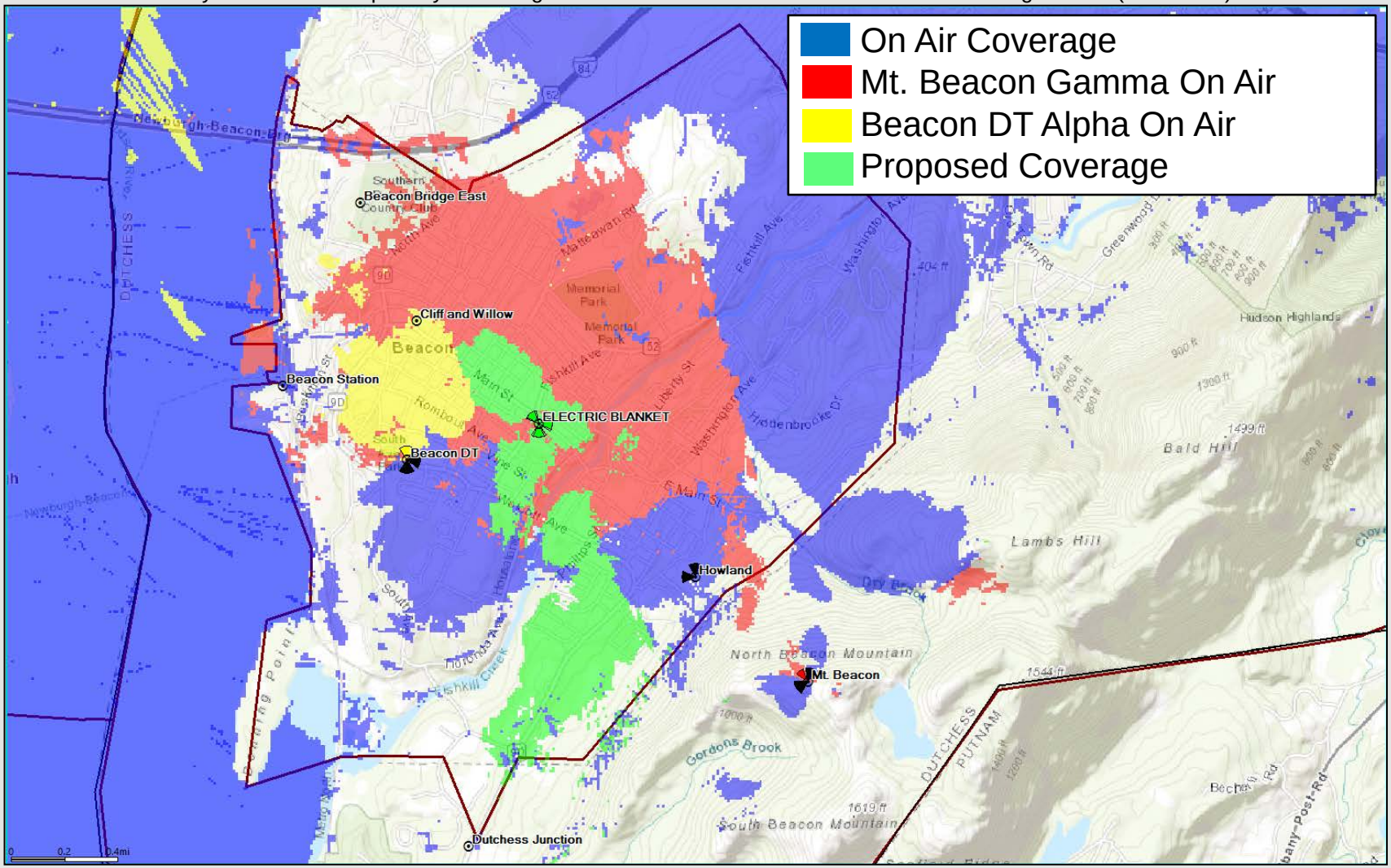
Proposed 2100MHz Best Server -95dBm RSRP

Best Server plots depict the actual best server or dominant footprint of each sector in question. The following map shows one threshold so the viewer can accurately evaluate where primary offloading will occur as a result of the new site's dominant signal area (at 63' ACL).



The map above adds the footprint of the proposed Electric Blanket site in green. The green best server footprint will significantly offload Mt. Beacon low and high band utilization which is part of the primary objectives for the new Electric Blanket site.

Note: Howland although not actually on air (at the time of this document) is shown as on air for planning purposes.

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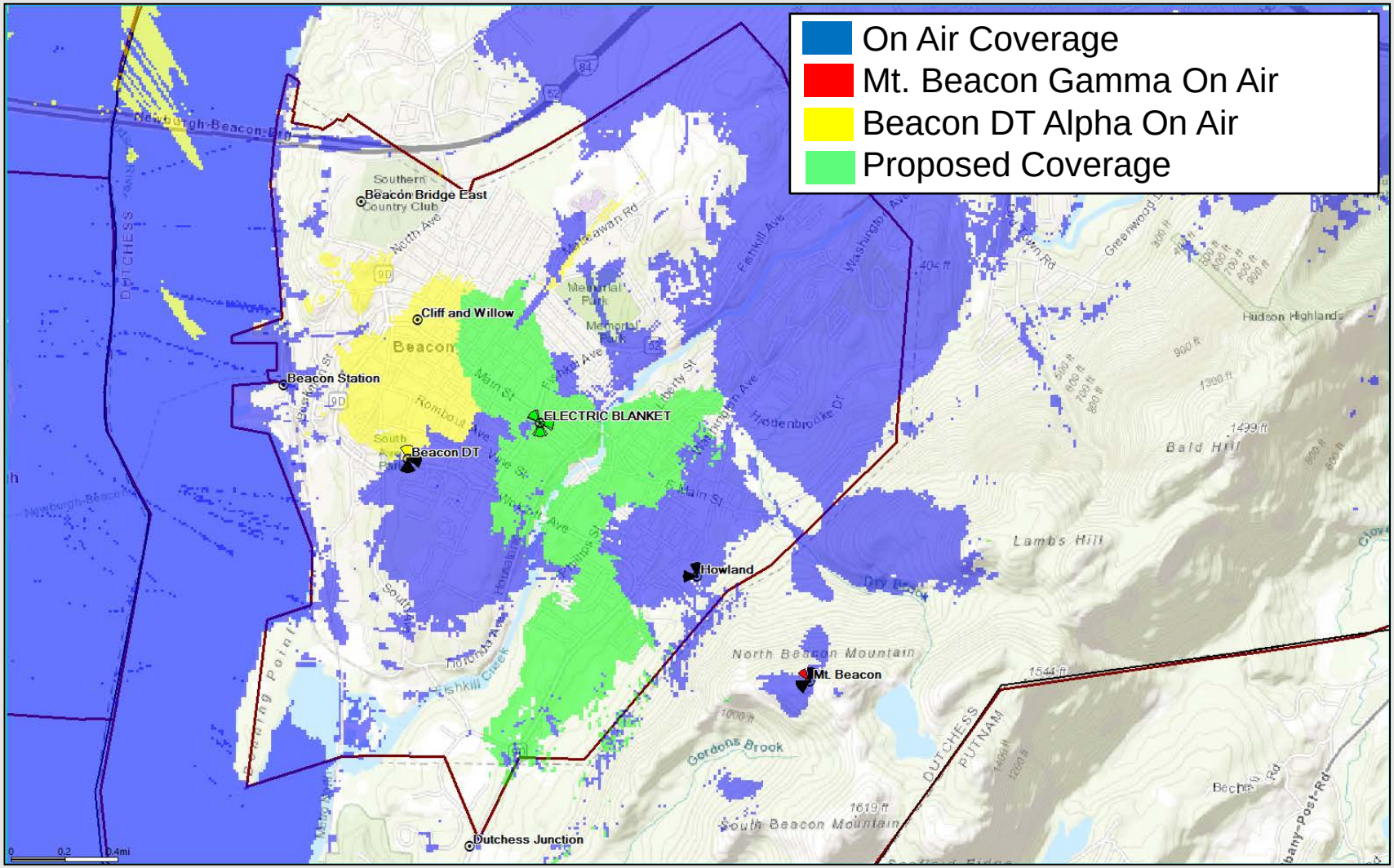
Proposed (Mt. Beacon Gamma Off) 2100MHz Best Server -95dBm RSRP

Best Server plots depict the actual best server or dominant footprint of each sector in question. The following map shows one threshold so the viewer can accurately evaluate where primary offloading will occur as a result of the new site's dominant signal area (at 63' ACL).



The map above removes the (red) footprint of Mt. Beacon Gamma as it is planned to be shut off due to excessive interference and inability to serve the intended area. The green best server footprint increases in size following the deactivation of Mt. Beacon Gamma revealing the true intended high band coverage area of the proposed Electric Blanket site.

Note: Howland although not actually on air (at the time of this document) is shown as on air for planning purposes.

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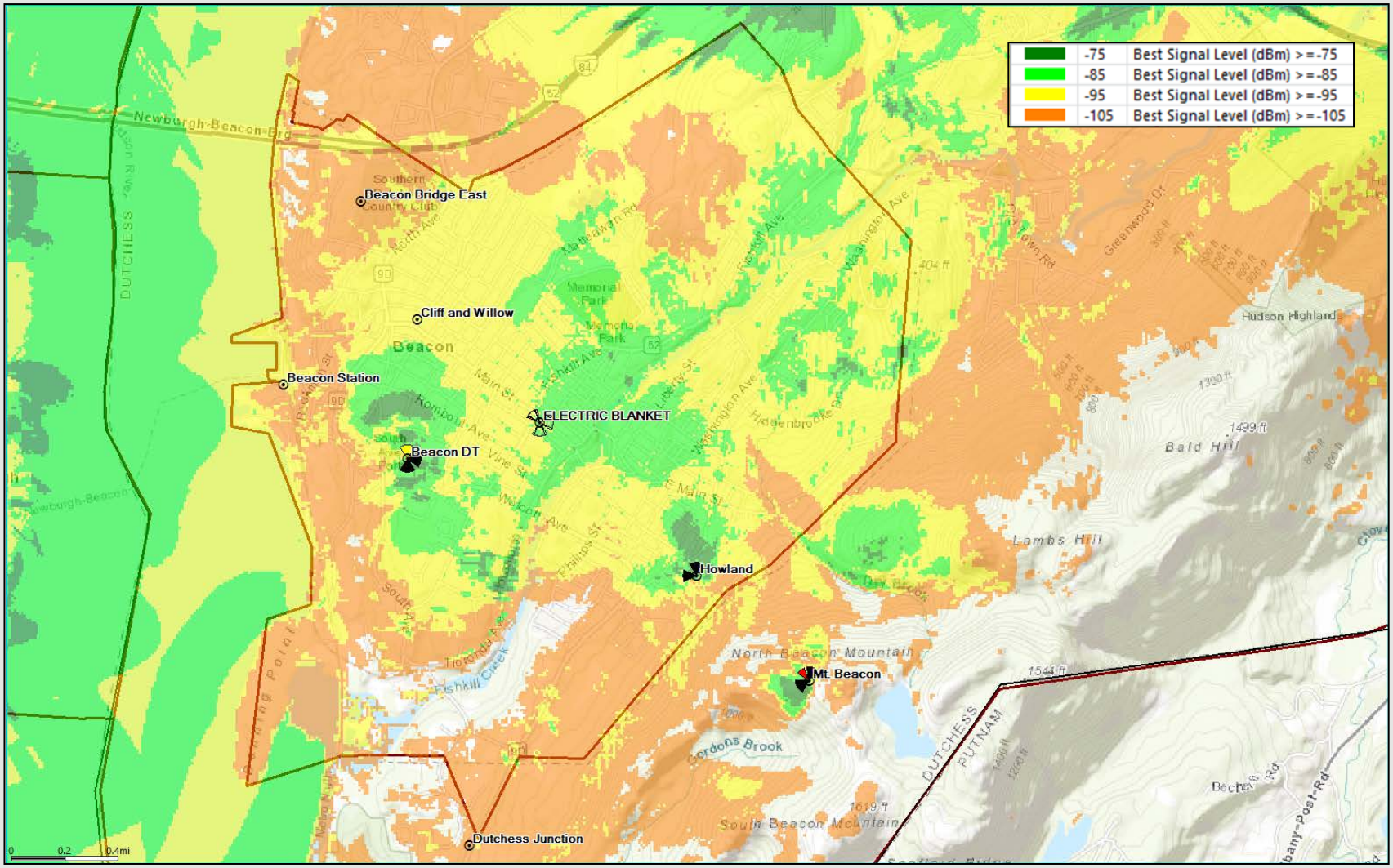
Existing 2100MHz Coverage

This coverage map shows existing high band RF conditions in and around the Electric Blanket site area.



Note: Howland although not actually on air (at the time of this document) is shown as on air for planning purposes.

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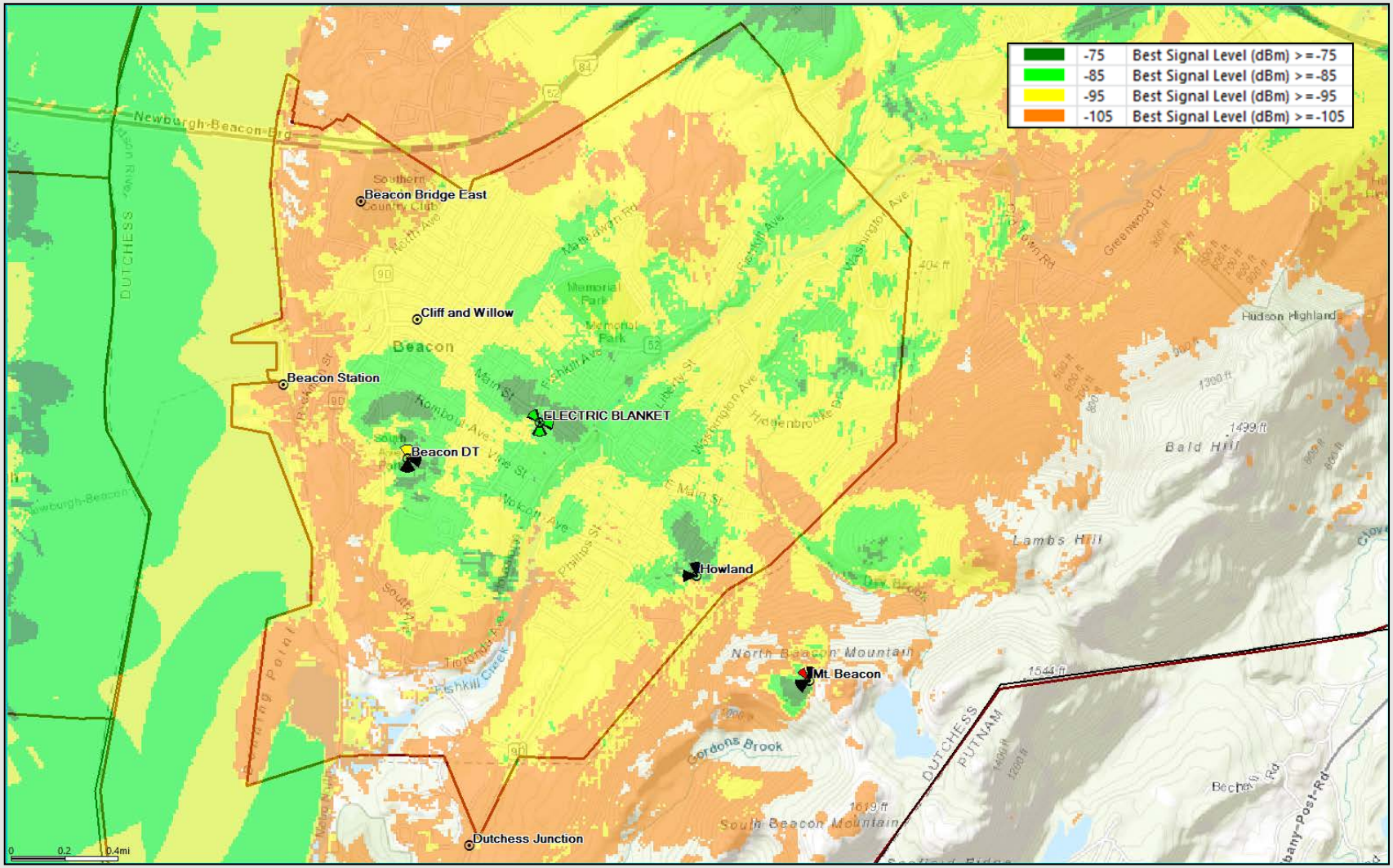
Proposed 2100MHz Coverage

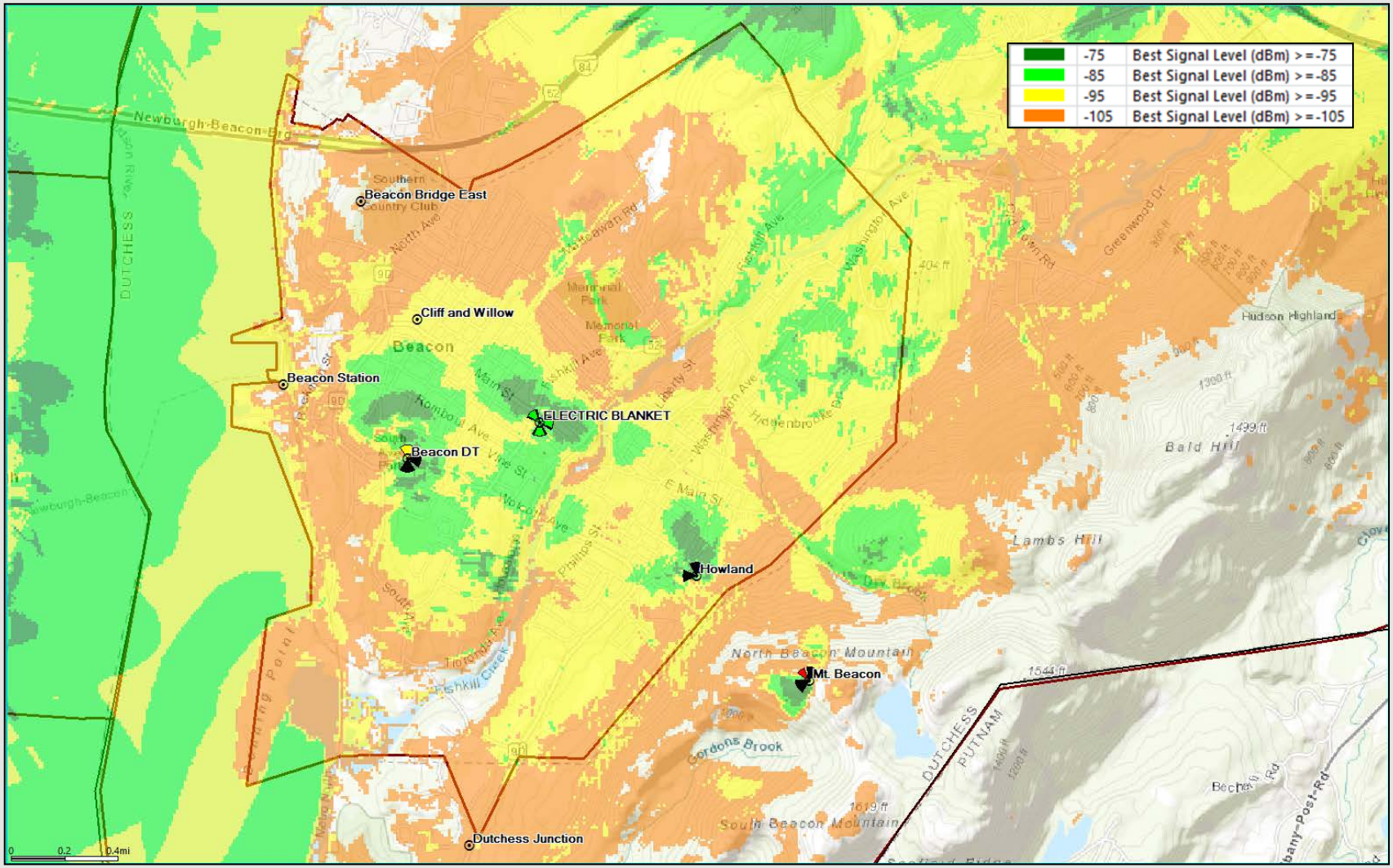
This coverage map shows future high band RF conditions (Electric Blanket on air) in and around the Electric Blanket site area (at 63’ ACL).



Note: Howland although not actually on air (at the time of this document) is shown as on air for planning purposes.

Proposed 2100MHz Coverage (Mt. Beacon Gamma Off Air)

This coverage map shows future high band RF conditions in and around the Electric Blanket site area after Mt. Beacon Gamma is off air.



Note: Howland although not actually on air (at the time of this document) is shown as on air for planning purposes.

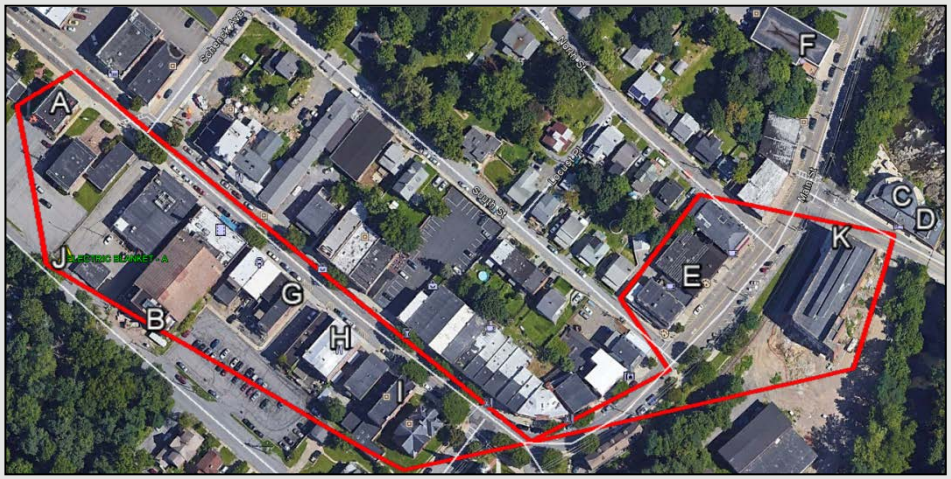
Site Selection Analysis

Several candidates were considered throughout the process of developing the Electric Blanket ring including:

A. **41.503010° , -73.966666°, (Fire Dept Roof/Tower Co-Lo) RF Approved (PRIMARY)**
B. 41.502189°, -73.966190°, (Theater) RF Approved, LL not interested
C. 41.502663°, -73.962359°, (10 Boulevard LLC opt A) RF Rejected, too low, blocked by clutter, outside search area
D. 41.502574°, -73.962230°, (10 Boulevard LLC opt B) RF Rejected, too low, blocked by clutter, outside search area
E. 41.502353°, -73.963472°, (506-512 Main Street) RF Rejected, too low, blocked by clutter
F. 41.503239° , -73.962872°, (544 Main Street) RF Rejected, too low, blocked by clutter, outside search area
G. *41.502286° , -73.965498°, (455-457 Main Street) RF Approved, constructability issues
H. *41.502118°, -73.965257°, (465 Main Street) RF Approved, constructability issues
I. *41.501913°, -73.964953°, (475 Main Street) RF Approved, constructability issues
J. 41.502422° , -73.966674°, (433 Main Street) RF Approved (BACKUP)
K. 41.502501° , -73.962693°, (1 East Main Street) RF Approved, LL not interested

Candidates A-K were formally submitted from Verizon's real estate team to Verizon's RF Engineering team for review prior to zoning.

- **Approved candidates include:** The "K" candidate was originally the preferred co-locatable existing structure, however the LL was not interested. The "B" candidate was RF approved but the LL was never interested. Candidates "G", "H" and "I" were all RF Approved and investigated however each suffered from constructability issues rendering these locations not usable. Some of these issues include lack of antenna mounting location, rooftop structural loading capacity, lacking necessary ground space, rooftop OSHA related access issues etc…
- **Rejected candidates include:** The "C", "D", "E" and "F" candidates were RF rejected due to being too low and blocked by area clutter failing to meet the project needs. Some of these candidates were outside the search area.
- **Zoning candidate:** The "A" candidate (Fire Dept) was RF Approved and is current primary candidate. The "J" candidate was identified as RF Approved, has a willing LL and is the backup candidate. The backup candidate does require the construction of a new 80' tall tower that will allow the antennas to be located in a fashion that will allow adequate and reliable coverage to the project area.



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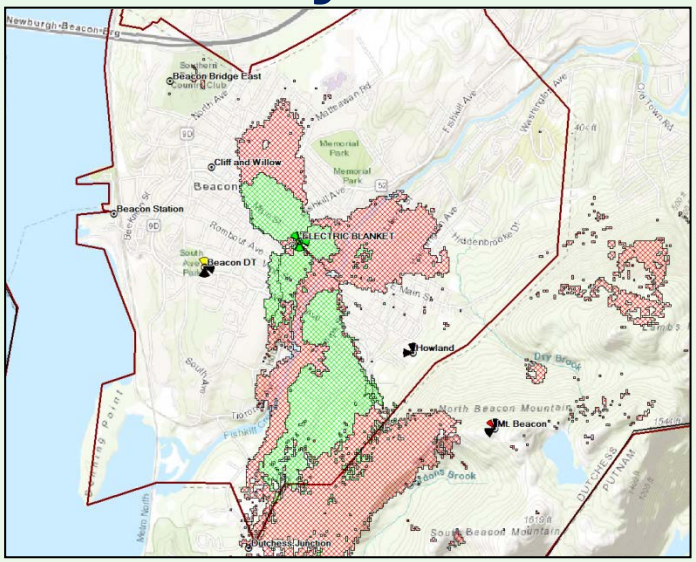
RF Justification Summary



The proposed site at 63' improves coverage and capacity within the entire green (high band) and red (low band) shaded areas shown above. The significant gaps within these areas which currently result with overburdened low band conditions as clearly shown on slides 7&10 will be significantly improved and are expected to be resolved in conjunction with other area activations (including Cliff & Willow, Howland and others) which further allow for deactivation of Mt. Beacon Gamma sector.

The network was analyzed to determine whether there is sufficient **RF coverage and capacity** in the City of Beacon. It was determined that there are significant gaps in adequate LTE service for Verizon Wireless in the 700 and 2100MHz frequency bands. In addition to the coverage deficiencies, Verizon Wireless' network does not have sufficient capacity (low band or high band) to handle the existing and projected LTE voice and data traffic in the area near and neighboring the proposed Electric Blanket facility ("targeted service improvement area"). Based on the need for additional coverage and capacity while considering the topography and wide area requiring service, any further addition of capacity to long distance existing sites does not remedy Verizon's significant gap in reliable service. Therefore, the proposed facility is also needed to provide "**capacity relief**" to the existing nearby Verizon Wireless sites, allowing the proposed facility and those neighboring sites to adequately serve the existing and projected capacity demand in this area.

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 this portion of Beacon and the Electric Blanket project area. The proposed location depicted herein satisfies the identified service gaps and is proposed at the minimum height necessary for adequate service.

Michael R. Crosby

Michael R. Crosby
Engineer IV – RF Design
Verizon Wireless

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