C Squared Systems, LLC
65 Dartmouth Drive
Auburn, NH 03032
Phone: (603) 644 2800
support@csquaredsystems.com

# RF Report

## Proposed Wireless Facility
## Call Road
## Colrain, MA 01340

January 21, 2025

# TABLE OF CONTENTS



# LIST OF TABLES



# ATTACHMENTS

# 1. Overview

This RF Report has been prepared on behalf of Verizon Wireless in support of the Tarpon Towers III, LLC (Tarpon) proposal to the Town of Colrain for the installation and operation of a wireless facility located on Call Road. Verizon Wireless' component of the proposed facility would consist of ground-based equipment cabinets along with antennas and associated equipment mounted on the proposed 125' monopole tower.

This report concludes that the proposed site will provide improved coverage and additional capacity to southern Colrain to improve deficient service areas along Route 112 (Main Road) and the surrounding roads, residences, and businesses in the proximity of the proposed site.

Included in this report is: a brief summary of the site's objectives, maps showing Verizon Wireless' current network plan, and modeled Radio Frequency coverage of the subject site and the surrounding sites in Verizon Wireless' network.

# 2. Introduction

Verizon Wireless provides digital voice and data communications services using 4th Generation (4G) voice and data services over LTE technology in the 700 MHz, Cellular (800 MHz), PCS (1900 MHz), and AWS (2100 MHz) frequency bands as allocated by the FCC, along with the CBRS band (3.5-3.7 GHz). It is also deploying advanced 5th generation (5G) NR services in its cellular, C-band (3.7-3.98 GHz) and 28 GHz licensed frequency bands. These 4G and 5G networks are used to provide high-speed wireless connections used by mobile devices for fast web browsing, media streaming, video conferencing, and other applications that require broadband connections. The mobile devices that benefit from these advanced networks include typical smartphones, tablets, laptops, and Wi-Fi hot-spots. With the continual advancement of its networks, Verizon Wireless customers will enjoy even faster connections to people, information, and entertainment in a day and age when reliable wireless connectivity is an indispensable part of daily personal and business life.

As explained within this report, Verizon Wireless has identified the need to add a new facility to its existing network of sites to improve coverage and capacity to a significant gap in service that exists in southern Colrain, in order to support reliable communications and meet the growing demand in the area.

To maintain a reliable and robust communications system for the individuals, businesses, public safety workers and others who use its network, Verizon Wireless deploys a network of cell sites (also called wireless communications facilities) throughout the areas in which it is licensed to provide service. These cell sites consist of antennas mounted on structures, such as buildings and towers, supported by radio and power equipment. The receivers and transmitters at each of these sites process signals within a limited geographic area known as a "cell."

Mobile subscriber handsets and wireless devices operate by transmitting and receiving low power radio frequency signals to and from these cell sites. Handset signals that reach the cell site are transferred through land lines (or other means of backhaul transport) and routed to their destinations by sophisticated electronic equipment. In order for Verizon Wireless' network to function effectively, there must be adequate overlapping coverage between the "serving cell" and adjoining cells. This not only allows a user to access the network initially, but also allows for the transfer or "hand-off" of calls and data transmissions from one cell to another and prevents unintended disconnections or "dropped calls."

Verizon Wireless' antennas also must be located high enough above ground level to allow transmission (a.k.a. propagation) of the radio frequency signals above trees, buildings, and other natural or man-made structures that may obstruct or diminish the signals. Areas without adequate radio frequency coverage have substandard service, characterized by dropped and blocked calls, slow data connections, or no wireless service at all, and are commonly referred to as coverage gaps.

The size of the area potentially served by each cell site depends on several factors including the number of antennas used, the height at which the antennas are deployed, the topography of the surrounding land, vegetative cover, and natural or man-made obstructions in the area. The actual service area at any given time also depends on the number of customers who are on the network in range of that cell site. As customers move throughout the service area, the transmission from the phone or other device is automatically transferred to the Verizon Wireless facility with the best reception, without interruption in service, provided that there is overlapping coverage between the cells.

Each cell site must be primarily designed to strike a balance between the overall geographic coverage area it will serve, and the site's capacity to support the usage within the coverage footprint. In rural areas, cell sites are generally designed to have broader coverage footprints because the potential traffic is sparser and distributed over a larger area. In more densely populated suburban and urban environments, the capacity to handle calls and data transmissions is of increasing concern, and cell sites must limit their coverage footprint to an area where the offered network traffic can be supported by the radio equipment and resources. Due to the aggressive historical and projected growth of wireless data consumption (nearly doubled from 2021-2023 for wireless data traffic in the U.S.[1]), instances arise where the usage demand can no longer be supported by the site(s) serving an area, and new facilities must be integrated to provide capacity relief to the overloaded sites.

We have concluded that with the proposed monopole located on Call Road at an antenna centerline height of 120' AGL (above ground level), Verizon Wireless will be able to provide improved coverage and additional capacity to southern Colrain that are currently located within a gap in service of Verizon Wireless' network.

[1] "2024 Annual Survey Highlights", September 10, 2024, CTIA. https://www.ctia.org/news/2024-annual-survey-highlights

# 3. The Proposed Facility

Verizon Wireless' plan for this proposed facility consists principally of the following elements:

1) Telecommunications equipment cabinets with utility connections and diesel fueled back-up power generator on a concrete pad within Tarpon's proposed 50' x 25' fenced compound.
2) Six (6) panel antennas (2 sectors, 3 antennas per sector) mounted on a platform near the top of the proposed 125' monopole at a centerline elevation of 120' AGL.
3) Remote Radio Heads (RRHs) with accessory junction boxes and surge suppressors, mounted nearby the antennas.
4) An ice bridge from the proposed equipment cabinets to the proposed monopole to protect cabling between Verizon's equipment and the cable entry ports near the bottom of the monopole.

# 4. Coverage and Capacity Objectives

As mentioned above, Verizon Wireless is in the process of advancing its 4G LTE high-speed wireless broadband system in the 700 MHz, Cellular, PCS, AWS and CBRS frequency bands, in accordance with its applicable licenses from the FCC. Verizon is also deploying a 5G NR system in its licensed cellular, C-Band, and 28 GHz frequency bands. In order to expand and enhance its wireless services throughout New England, Verizon Wireless must fill in existing coverage gaps and address capacity, interference, and high-speed broadband issues. As part of this effort, Verizon Wireless has determined that significant gaps in service exist in and around sections of southern Colrain as described further below.

Verizon Wireless currently operates wireless facilities similar to the proposed facility within Colrain and the surrounding cities/towns. Due in large part to the distances between the existing sites, the intervening topography, and volume of user traffic in the area, these existing facilities do not provide sufficient coverage and capacity to portions of southern Colrain. Specifically, Verizon Wireless determined that much of southern Colrain is without reliable service in the following areas and town roads[2], including but not limited to:

- Route 112 (Main Road)
    - Serves ~ 1,200 vehicles per day as measured north of Adamsville Road (2023)
- The surrounding roads, residences, and businesses in area.

The proposed site located on Call Road ("MA1231") is needed to fill in these targeted gaps in service, in order to improve network quality and reliability for Verizon Wireless subscribers traveling along these roads, as well as to the numerous residents, businesses, and visitors in this area.

[2] Traffic counts are sourced from Massachusetts Department of Transportation, Transportation Data Management System. https://mhd.public.ms2soft.com/tcds/tsearch.asp?loc=Mhd&mod=

# 5. Site Search and Selection Process

To find a site that provides acceptable coverage, adequate capacity, and fills the gaps in service, computer modeling software is used to define a search area. The search ring identifies the area within which a site could be located (assuming sufficient height is considered) that would have a high probability of addressing the significant coverage gap and/or meeting the capacity objectives established by the Verizon Wireless RF (Radio Frequency) engineers.

Once a search ring is determined, Verizon Wireless' real estate specialists search within the proximity of the defined area for existing buildings, towers, and other structures of sufficient height that would meet the defined objectives. If none are found, then the focus shifts to "raw land" sites. A suitable site must satisfy the technical requirements identified by the RF engineers, must be available for lease, and must have access to a road and be otherwise suitable for constructing a cell site of the required size and height. Every effort is made to use existing structures before pursuing a "raw land" build to minimize the number of new towers throughout the cities and towns being served.

Since no suitable existing structures in the area have been identified, Verizon Wireless concluded that collocating on the proposed Tarpon monopole on Call Road is necessary to address its targeted coverage and capacity objectives.

# 6. Pertinent Site Data

Table 1 below details the site-specific information for the on-air, and proposed Verizon Wireless macro-sites used to perform the coverage analysis and generate the coverage plots provided herein.

| Site Name | Address | City/Town | Latitude | Longitude | Structure Type | Antenna Height (ft AGL) | Status |
|---|---|---|---|---|---|---|---|
| Florida | 9-25 Moores Road | Florida | 42.6933 | -73.0231 | Monopole | 140 | On-Air |
| Florida South | South Street | Drury | 42.6396 | -72.9923 | Self-Support | 160 | On-Air |
| Hawley N | 66 Thunder Mountain Road | Hawley | 42.6149 | -72.8666 | Self-Support | 140 | On-Air |
| Plainfield | Off Union St | Plainfield | 42.5260 | -72.9149 | Self-Support | 80 | On-Air |
| Shelburne | Cooper Ln | Shelburne Falls | 42.5977 | -72.7116 | Self-Support | 185 | On-Air |
| Colrain | Off Greenfield Rd | Colrain | 42.6725 | -72.6850 | Self-Support | 145 | On-Air |
| Shelburne SE | 128 G Old Albany Rd | Shelburne Falls | 42.5709 | -72.6448 | Monopole | 180 | On-Air |
| Greenfield S | 277 Main St | Greenfield | 42.5878 | -72.6014 | Rooftop | 63.8/62.9 | On-Air |
| Montague | 136 Turnpike Rd | Montague | 42.5874 | -72.5548 | Monopole | 138 | On-Air |
| Greenfield | 182 Country Club Rd | Greenfield | 42.6192 | -72.5947 | Monopole | 164 | On-Air |
| Greenfield E | 37 Butternut St | Greenfield | 42.6279 | -72.5565 | Monopole | 155 | On-Air |
| Greenfield N | 1385 Bernardston Rd | Greenfield | 42.6517 | -72.5615 | Monopole | 180 | On-Air |
| Bernardston | 250 Brattleboro Rd | Bernardston | 42.6868 | -72.5518 | Monopole | 160 | On-Air |
| Bernardston N | 888 Brattleboro Rd | Bernardston | 42.7240 | -72.5771 | Monopole | 148 | On-Air |
| Vernon S | 129 Princesses Ln | Vernon | 42.7718 | -72.5626 | Monopole | 98 | On-Air |
| Vernon W | 246 Laurel Ledges | Vernon | 42.8043 | -72.5483 | Self-Support | 110 | On-Air |
| Brattleboro S | 47 Eli Way | Brattleboro | 42.8285 | -72.5996 | Self-Support | 188 | On-Air |
| Wilmington East | 288 Old Hogback Rd | Wilmington | 42.8553 | -72.7935 | Monopole | 123 | On-Air |
| Wilmington | 119 Boyd Hill Rd | Wilmington | 42.8602 | -72.8757 | Monopole | 117 | On-Air |
| Ashfield 2 | 1450 Spruce Corner Rd | Ashfield | 42.4976 | -72.8419 | Monopole | 116 | On-Air |
| **MA1231** | **Call Road** | **Colrain** | **42.6466** | **-72.7130** | **Monopole** | **120** | **Proposed** |

**Table 1: Verizon Wireless Site Information Used in Coverage Analysis** [3]

[3] Some sites listed in this table are outside the plot view but are included for completeness of information.

# 7. Coverage Analysis and Propagation Plots

The signal propagation plots provided in this report were produced using deciBel Planner™, a Windows-based RF propagation computer modeling program and network planning tool. The software considers the topographical features of an area, land cover, antenna models, antenna heights, RF transmitting power and receiver thresholds to model coverage and other related RF parameters used in site design and network expansion.

The coverage plots included as attachments show coverage based on RSRP signal strengths of -105 dBm and above. All other areas (depicted in white) fall within coverage areas characterized by poor service quality, low data throughput, and the substantial likelihood of unreliable service. The shaded areas are categorized by the following thresholds: green indicates coverage greater than -85 dBm, yellow represents coverage between -85 dBm and -95 dBm, gray indicates coverage from -95 dBm to -105 dBm, and areas with coverage less than -105 dBm are shown in white.

Attachments A - G are discussed below:

**Attachment A** titled "*MA1231– Existing 700 MHz LTE Coverage*" illustrates the current 700 MHz LTE coverage provided by the existing "On-Air" macro-sites listed in Table 1. As depicted in this plot and described in the Coverage and Capacity Objectives section of this report, most of southern Colrain is in an area of deficient coverage. These deficient areas, particularly in the gray and white areas, highlight the areas in need for improved coverage to ensure reliable service.

**Attachment B** titled "*MA1231- 700 MHz LTE Coverage with Proposed Site*" shows the composite 700 MHz LTE coverage with the proposed "MA1231" facility. As shown by the additional areas of coverage, the proposed facility will provide coverage to:

| Incremental Coverage from Proposed Site (700 MHz) | | |
|---|---|---|
| **Category** | **(≥ -85 dBm)** | **(≥ -95 dBm)** |
| **Population:** | ~ 200 | ~ 260 |
| **Business:** | ~ 60 | ~ 60 |
| **Structures:** | ~ 240 | ~ 280 |
| **Roadways (~ mi):** | | |
| Route 112 (Main Road) | 2.2 | 2.6 |
| Call Road | 1.8 | 1.9 |

**Table 2: Incremental Coverage [4] [5] (700 MHz)**

[4] Residential population counts referenced here and elsewhere within this report are based upon the 2020 U.S. Census data.

[5] Employee population counts referenced here and elsewhere within this report are based upon the 2020 U.S. Census Bureau LEHD database.

**Attachment C** titled "*MA1231– Existing 2100 MHz LTE Coverage*" illustrates the 2100 MHz coverage provided by the existing "On-Air" macro-sites listed in Table 1. Because of the inferior propagation characteristics of 2100 MHz relative to 700 MHz, the extent of the coverage gaps shown here impact a much larger area than depicted in Attachment A.

**Attachment D** titled "*MA1231- 2100 MHz LTE Coverage with Proposed Site*" shows the composite 2100 MHz coverage with the proposed "MA1231" facility. As shown by the additional areas of coverage in this map, the proposed facility will provide coverage to:

| **Incremental Coverage from Proposed Site (2100 MHz)** | | |
|---|---|---|
| **Category** | **(≥ -85 dBm)** | **(≥ -95 dBm)** |
| **Population:** | ~ 90 | ~ 150 |
| **Business:** | ~ 20 | ~ 50 |
| **Structures:** | ~ 120 | ~ 180 |
| **Roadways (~ mi):** | | |
| Route 112 (Main Road) | 0.9 | 1.7 |
| Call Road | 0.6 | 1.3 |

**Table 3: Incremental Coverage (2100 MHz)**

**Attachment E** titled "*MA1231– Existing 700 MHz LTE Sector Footprints"* depicts the areas primarily served by the sectors (a.k.a. signal "footprints") of the surrounding Verizon Wireless macro sites in the area, which are shown by the unique color for each particular sector of interest. For clarity, all other sectors of less interest with respect to the proposed site are shown in grey. As demand for wireless voice and data services continues to grow, Verizon Wireless manages the footprint of each sector so that it can support the demand within the area it is primarily serving. In addition to improving coverage to the area, the proposed site will also serve existing and anticipated demand in the vicinity and thereby offload some of the burden experienced by the surrounding sites. In that way, those sites will be able to more adequately serve the demand for service in the areas nearer to those surrounding sites. Please note that the outer parts of each sector footprint may include areas that presently have signal strength below the targeted value required for reliable service to Verizon Wireless' customers. The fact that low-level signal may reach these areas does not mean that these areas experience adequate coverage. These unreliable areas of low signal level can impose a significant capacity burden on the sites primarily serving the area.

**Attachment F** titled "*MA1231- 700 MHz LTE Sector Footprints with Proposed Site*" shows the composite coverage with the overall footprint of the proposed facility in dark green. As shown in this map, the proposed "MA1231" facility is an effective solution to provide capacity relief to the area. The proposed facility is centrally located in the area of deficient coverage making it particularly suited to distribute the traffic load across multiple sectors and provide a dominant server to this section of the town.

**Attachment G** titled "*MA1231– Area Topography Map*" details the topographical features around the proposed "MA1231" site. These terrain features play a key role in dictating both the unique coverage areas served from a given location, and the coverage gaps within the network. This map is included to provide a visual representation of the terrain variations that must be considered when determining the appropriate location and design of a proposed wireless facility. The blue and green shades correspond to lower elevations, whereas the red, grey and white shades indicate higher elevations.

## 8. Certification of Non-Interference

Verizon Wireless certifies that the proposed facility will not cause interference to any lawfully operating emergency communication system, television, telephone or radio, in the surrounding area. The FCC has licensed Verizon Wireless to transmit and receive in specific frequency blocks of the 700 MHz band, the Cellular band, the PCS band, the AWS band, the CBRS band, the C-band, and 28 GHz band of the RF spectrum. As a condition of the FCC licenses, Verizon Wireless is prohibited from interfering with other licensed devices that are being operated in a lawful manner. Furthermore, no emergency communication system, television, telephone, or radio is licensed to operate on these frequencies, and therefore interference is highly unlikely.

## 9. Summary

In undertaking its build-out of 4G LTE and 5G NR service in Franklin County, Verizon Wireless has determined that an additional facility is needed to provide reliable service and additional capacity throughout areas of southern Colrain. The proposed wireless communications facility located on Call Road in Colrain will provide additional coverage and capacity needed in the targeted coverage areas including key roadways such as Route 112 (Main Road), and to the surrounding roads, residences, and businesses in the proximity of the proposed site. Without the installation of the proposed site, Verizon Wireless will be unable to improve and expand its wireless communication services in this area of southern Colrain; therefore, Verizon Wireless respectfully requests that the Town of Colrain act favorably upon the proposed facility.

## 10. Statement of Certification

I certify to the best of my knowledge that the statements in this report are true and accurate.

Keith Vellante

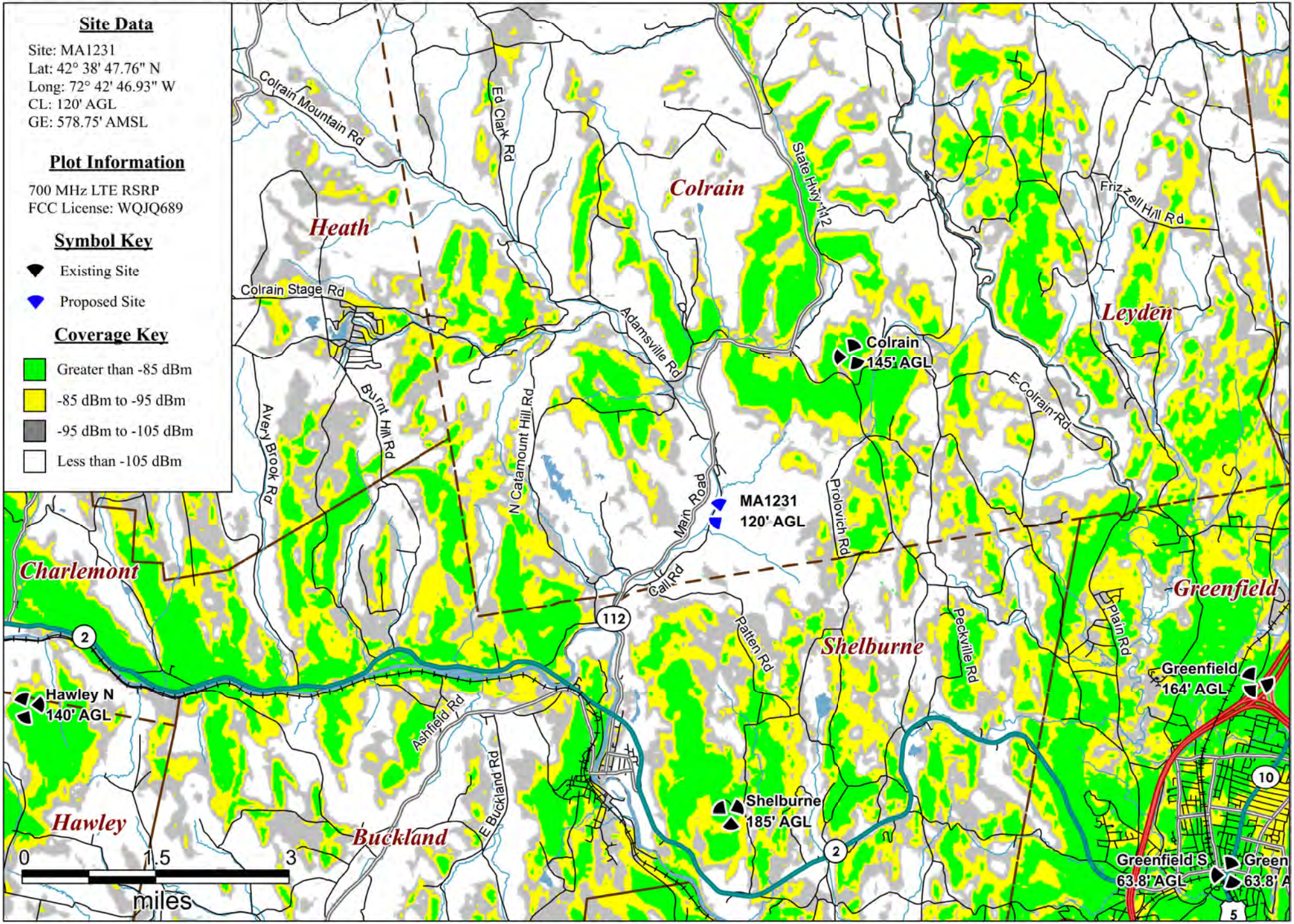
Keith Vellante
RF Engineer
C Squared Systems, LLC

January 21, 2025
Date

# 11. Attachments

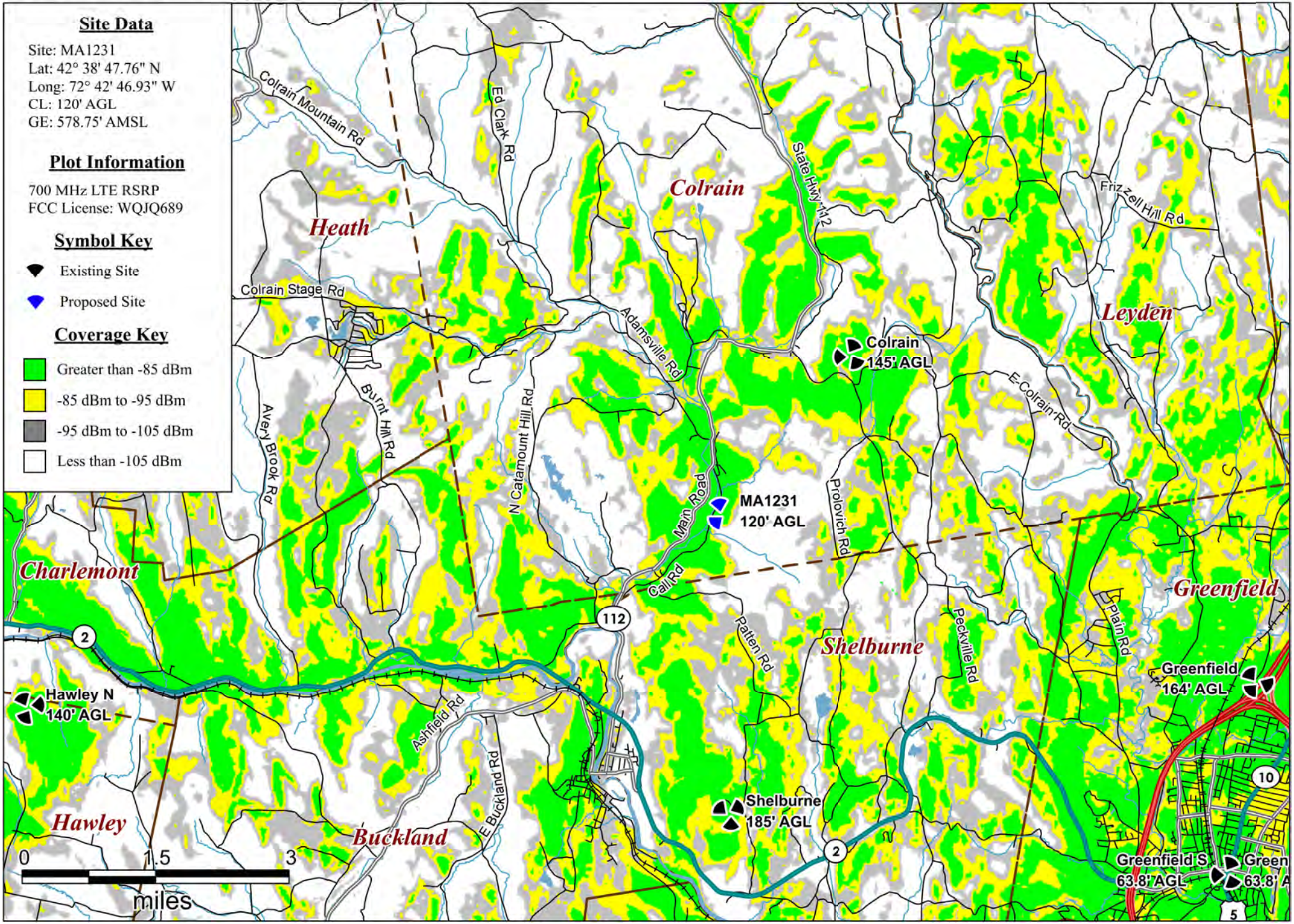
**Attachment A:**
**MA1231 - Existing 700 MHz LTE Coverage**

verizon



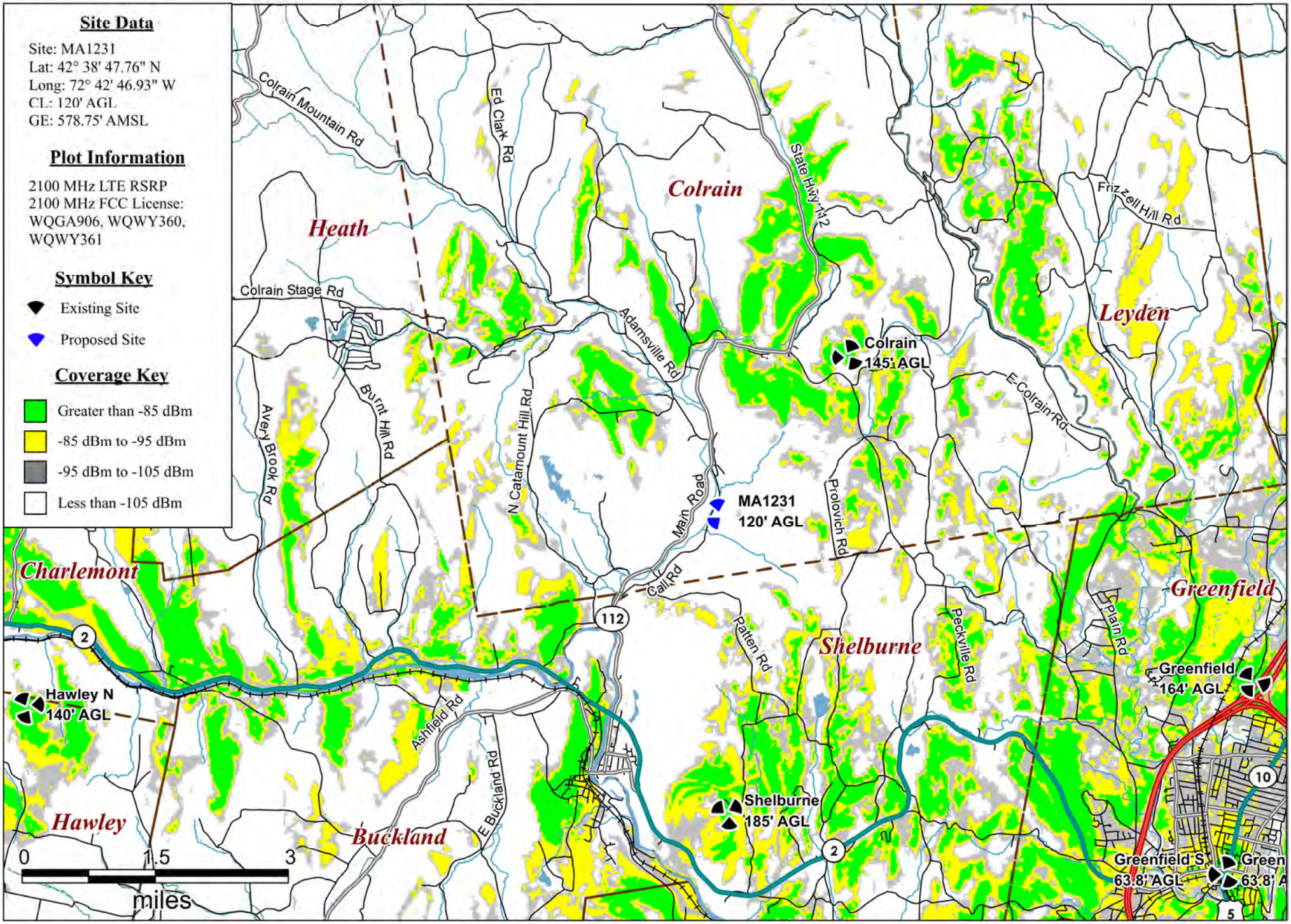
**Attachment B:**
**MA1231 - 700 MHz LTE Coverage with Proposed Site**

verizon



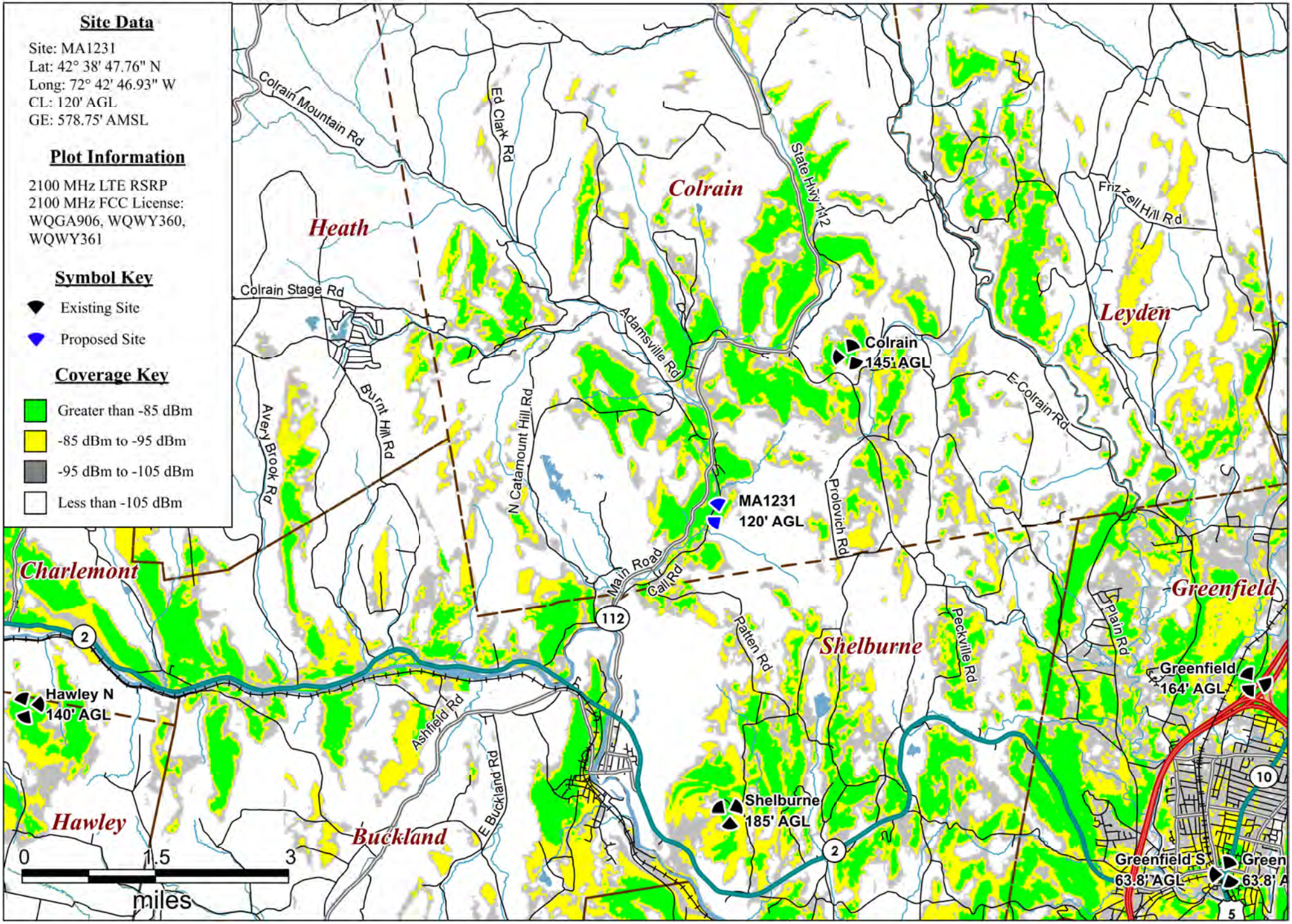
**Attachment C:**
**MA1231 - Existing 2100 MHz LTE Coverage**

verizon



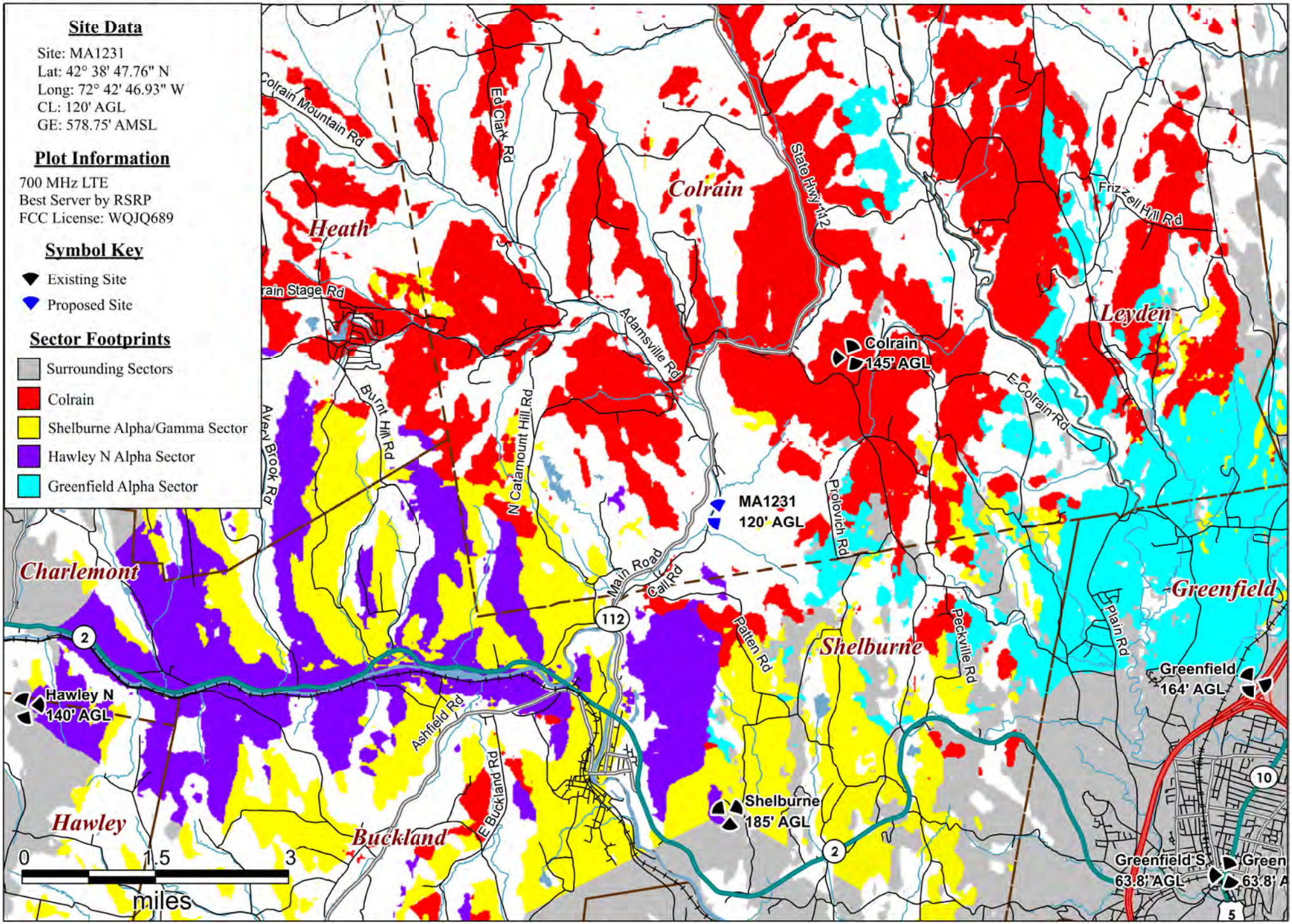
**Attachment D:**
**MA1231 - 2100 MHz LTE Coverage with Proposed Site**

verizon



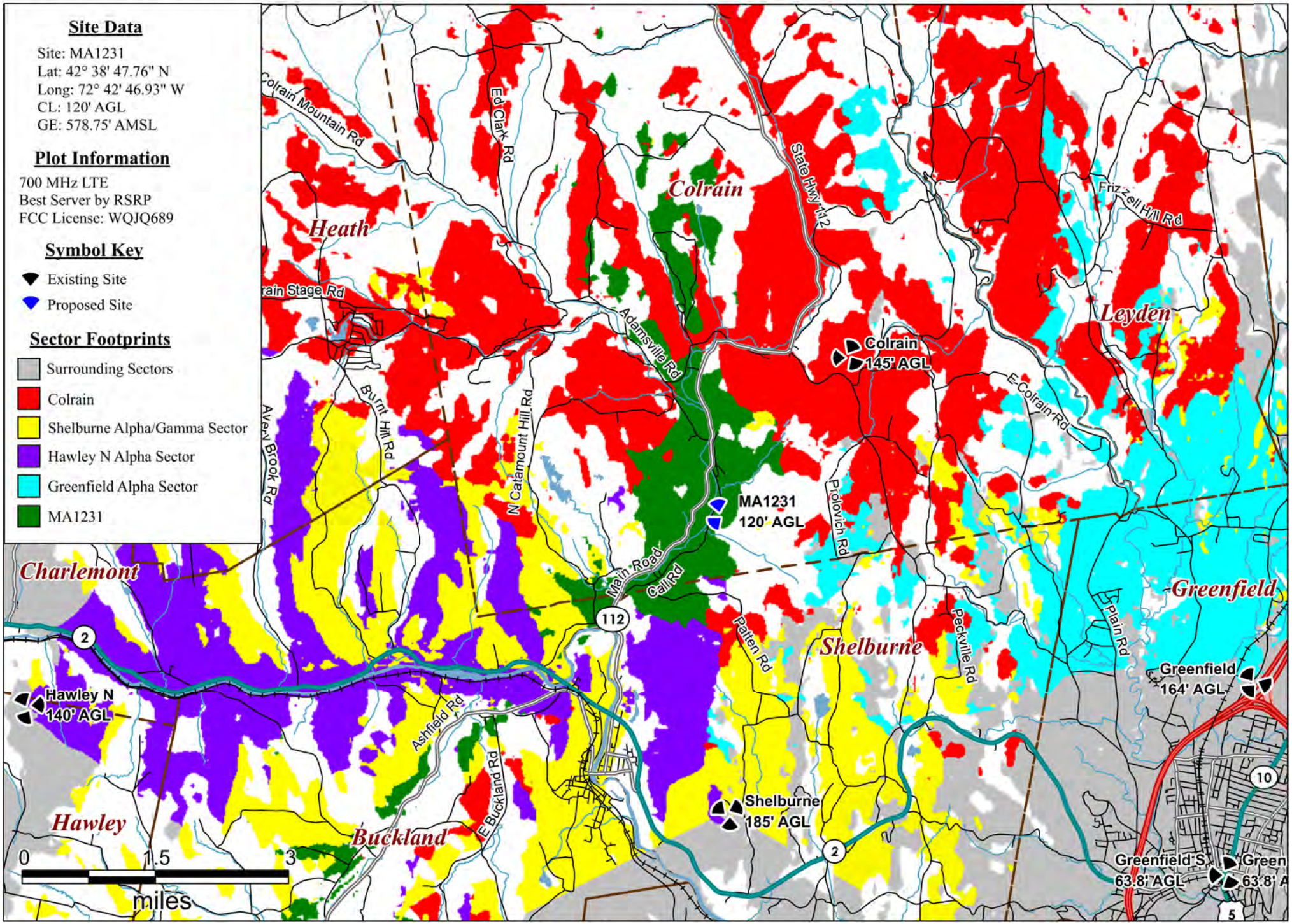
**Attachment E:**
**MA1231 - Existing 700 MHz LTE Sector Footprints**

verizon



**Attachment F:**
**MA1231 - 700 MHz LTE Sector Footprints with Proposed Site**

verizon



**Attachment G:**
**MA1231 - Area Topography Map**

verizon