

Attachment 1

Radio Frequency Analysis Report

SR1038 – State Armory Site
284 New Canaan Avenue, Norwalk, CT



September 11, 2013



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Table of Contents

1. Overview..... 1

2. Coverage Objective..... 1

3. Conclusion..... 6

4. Statement of Certification 6

5. Attachments 7

List of Tables

Table 1: Estimated Existing Coverage Gap Statistics 3

Table 2: Coverage Statistics..... 5

List of Attachments

Attachment 1: 3-D Terrain Map..... 7

Attachment 2: Map of Distance to Neighbor Sites – State Armory Site 8

Attachment 3: Neighbor Site Data and Distance to Proposed Site..... 9

Attachment 4: “Existing Coverage” for the Current AT&T network 10

Attachment 5: “Existing & Proposed Coverage” for the AT&T network with State Armory site 11

Attachment 6: Connecticut DOT Average Annual Daily Traffic Data - Norwalk..... 12

Attachment 7: Connecticut DOT Average Annual Daily Traffic Data – New Canaan 13

1. Overview

C Squared Systems was retained by New Cingular Wireless PCS, LLC (“AT&T”) to investigate the extent of coverage that could be potentially obtained by constructing the proposed wireless communications facility at 284 New Canaan Avenue, Norwalk, CT at 137 feet AGL.

AT&T is licensed by the FCC to provide wireless communications services throughout the State of Connecticut including the City of Norwalk where the proposed facility would be located.

This report addresses AT&T’s need for a facility in this area and analyzes the proposed site to address the coverage gaps in their wireless communications network. C Squared Systems has reviewed and conducted this coverage analysis that confirms AT&T has a gap in reliable service that exists in the City of Norwalk and Town of New Canaan, and that the Proposed Facility provides AT&T with coverage in that service gap. Included as attachments in this report are coverage maps detailing the existing network and expected coverage from the proposed facility, along with additional terrain and network layout maps.

2. Coverage Objective

There is a significant coverage deficiency in the existing AT&T wireless communications network along State Highway 15 (Merritt Parkway), State Highway 123 (New Canaan Avenue), and the surrounding roads and areas in the City of Norwalk and the Town of New Canaan. A deficiency in coverage is evidenced by the inability to adequately and reliably transmit/receive quality calls and/or utilize data services offered by the network. Seamless reliable coverage provides users with the ability to successfully originate, receive, and maintain quality calls and/or utilize data applications throughout a service area. Overlapping coverage is required for users to be able to move throughout the service area and reliably “hand-off” between cells to maintain uninterrupted calls.

Due to terrain characteristics and the distance between the targeted coverage area and the existing sites, AT&T’s options to provide services in this area are quite limited (maps of the terrain in this area and the distance to neighboring AT&T sites from the proposed site are included as Attachments 1 & 2, respectively.) AT&T’s network requires deployment of antennas throughout the area to be covered, which are connected to receivers and transmitters that operate in a limited geographic area known as a “cell.” AT&T’s wireless network, including their wireless handsets and devices, operate by transmitting and receiving low power radio frequency signals to and from these cell sites. The signals are transferred to and from the landline telephone network and routed to their destinations by sophisticated electronic equipment. The size of the area served by each cell site is dependent on several factors, including the number of antennas used, the height at which the antennas are deployed, the topography of the land, vegetative cover and natural or man-made obstructions in the area. As customers move throughout the service area, the transmission from the portable devices is automatically transferred to the AT&T facility with the best connection to the device, without interruption in service provided that there is overlapping coverage from the cells.

Evolution of AT&T Design Philosophy

Until recently, AT&T's network design was based on its 850 MHz 3rd Generation (3G) UMTS system and driven primarily by capacity needs in high density areas and coverage expansion to other suburban and rural areas. PCS (1900 MHz) UMTS sites cover a smaller footprint compared to the 850 MHz UMTS sites, and have been deployed as part of a capacity overlay to the 850 MHz system. The main purpose of the UMTS PCS network is to offload as much traffic as possible from the 850 MHz system, however the design and need for new sites has been typically based on 850 MHz coverage, in most cases.

As technology advances and mobile usage trends shift to a more data-centric model, the service provider networks must also evolve to support the forecasted growth and customer bandwidth demands. In an effort to position their networks to support these trends, AT&T's design philosophy has recently transitioned to a network design based on 1900 MHz 4G Long Term Evolution (LTE).

Mobile data traffic has greatly outpaced both the spectrum growth allocated for use by these networks and the increased spectral efficiency supported by the evolving technologies. As data demand continues to grow, the spectrum licensed to AT&T must be used as efficiently as possible to handle the increased customer demand. This is the basis for the AT&T's recent design philosophy transition.

In terms of coverage, the weakest link in AT&T's spectrum portfolio is PCS and AWS (2100 MHz). Providing continuous coverage at these frequencies will allow maximum use of AT&T's available spectrum resources. In the long term, by maximizing use of available spectrum, this design philosophy will allow the network to serve subscriber demand with the smallest practicable number of sites (as opposed to depending only on 850 MHz and 700 MHz to carry the load).

Lead times for new site builds are considerable. The process of identifying the need for a new site, determining new site location, identifying viable candidates, negotiating leases, designing the facilities, coordinating with local government, applying for and obtaining Siting Council approvals and finally constructing the site and integrating it with the rest of the network can take several years from start to finish. Given the tremendous rate of growth in data usage (with no decrease in voice usage), AT&T must plan site builds years in advance to insure that sites are ready in time to meet projected future demand.

In order to define the extent of the coverage gap to be filled, both propagation modeling and real-world drive testing has been conducted in the area of Norwalk and New Canaan. Propagation modeling uses PC software to determine the network coverage based on the specific technical parameters of each site including, but not limited to, location, ground elevation, antenna models, antenna heights, and also databases of terrain and ground cover in the area. Drive testing consists of traveling along area roadways in a vehicle equipped with a sophisticated setup of test devices and receivers that collect a variety of network performance metrics. The data are then processed and mapped in conjunction with the propagation modeling to determine the coverage gaps.

Analysis of the propagation modeling and drive testing in Norwalk and New Canaan reveal that AT&T's network is unreliable throughout much of the area due to gaps in coverage, and that there is a service deficiency as a result. In order to fill in these coverage gaps and improve the network reliability to Norwalk and New Canaan, a new facility is needed in the area.

Table 1 below approximates the current coverage gap in the vicinity of the proposed site.

		Existing Coverage Gap
Population:¹	"In-Building" (≥ -74 dBm)	1901
	"In-Vehicle" (≥ -82 dBm)	422
Area (mi²):	"In-Building" (≥ -74 dBm)	1.6
	"In-Vehicle" (≥ -82 dBm)	0.4
Roadway (mi):	Main:	0.8
	Secondary:	3.0
	Total:	3.8

Table 1: Estimated Existing Coverage Gap Statistics

¹ Population figures are based upon 2010 US Census Block Data

Included with this report are Attachments 1-6, which are explained below to help describe AT&T's network in and around Norwalk and New Canaan, and the need for the proposed facility.

- Attachment 1: *3D Terrain Map* details the terrain features around the area of deficient service being targeted by the proposed site in Norwalk. These terrain features play a key role in determining site designs and dictating the unique coverage achieved from a given location. This map is included to provide a visual representation of the ridges and valleys that must be considered when siting a wireless facility. The darker green and blue shades correspond to lower elevations, whereas the yellow and orange shades indicate higher elevations.
- Attachment 2: *Map of Distance to Neighbor Sites – State Armory Site* provides an overview of AT&T's network of sites in the area, with distances shown from the proposed State Armory site to the existing and proposed sites in the surrounding area.
- Attachment 3: *Neighbor Site Data and Distance to Proposed Site* provides site specific information of existing neighboring sites used to perform the coverage analysis provided in Attachments 4 and 5.
- Attachment 4: *“Existing Coverage”* depicts coverage from existing sites and demonstrates that there are currently gaps in coverage effecting service along on State Highway 15 (Merritt Parkway), State Highway 123 (New Canaan Avenue), and the surrounding neighborhoods. The coverage gaps are where the signal strength is < -82 dBm required for reliable in-vehicle coverage and < -74 dBm for in-building reliability. In an effort to provide the required level of coverage to these areas, AT&T is proposing to install a wireless facility at the proposed location.
- Attachment 5: *“Existing & Proposed Coverage with State Armory site”* shows how this proposed site would fill in the existing coverage gaps and improve AT&T's network in this area).
- Attachment 6: *Connecticut DOT Average Annual Daily Traffic Data - Norwalk* shows the available vehicular traffic volume data for the subject area from the Connecticut Department of Transportation. This data shows as many as 16400 vehicles per day passing through the subject area on State Highway 15 (Merritt Parkway).
- Attachment 7: *Connecticut DOT Average Annual Daily Traffic Data – New Canaan* shows the available vehicular traffic volume data from the Connecticut Department of Transportation for the portion of New Canaan that is just over the town border.

Table 2 below lists the coverage statistics that were compiled for the proposed site:

		Incremental Coverage from Proposed Site
Population Coverage:²	"In-Building" (≥ -74 dBm)	1048
	"In-Vehicle" (≥ -82 dBm)	424
Area Covered (mi²):	"In-Building" (≥ -74 dBm)	0.8
	"In-Vehicle" (≥ -82 dBm)	0.4
Roadway Coverage (mi):	Main:	0.6
	Secondary:	2.9
	Total:	3.5

Table 2: Coverage Statistics

² Population figures are based upon 2010 US Census Block Data

3. Conclusion

AT&T has identified deficient coverage affecting significant portions of the City of Norwalk and the Town of New Canaan and major State thoroughfares. The proposed State Armory facility provides AT&T with needed coverage to this deficient area, including significant portions of State Highway 15 (Merritt Parkway) and State Highway 123 (New Canaan Avenue).

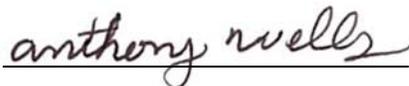
No existing structures were identified and available that would be able to satisfy the coverage requirements needed for this area. The location and the minimum height selected were chosen to achieve an optimal balance between meeting coverage objectives, overcoming the tree line for signal propagation, minimizing the aesthetic impact to the community, and future collocation.

As discussed in this report and depicted in the attached plots, the proposed AT&T site will provide the public need for service in this area, by providing an appropriate coverage footprint for the Norwalk and New Canaan communities along with effective connectivity to the rest of AT&T existing network.

Without a site in this area, at the height requested, significant gaps in service will exist within the City of Norwalk and the Town of New Canaan, and the identified public need for reliable wireless services in this area will not be met.

4. Statement of Certification

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

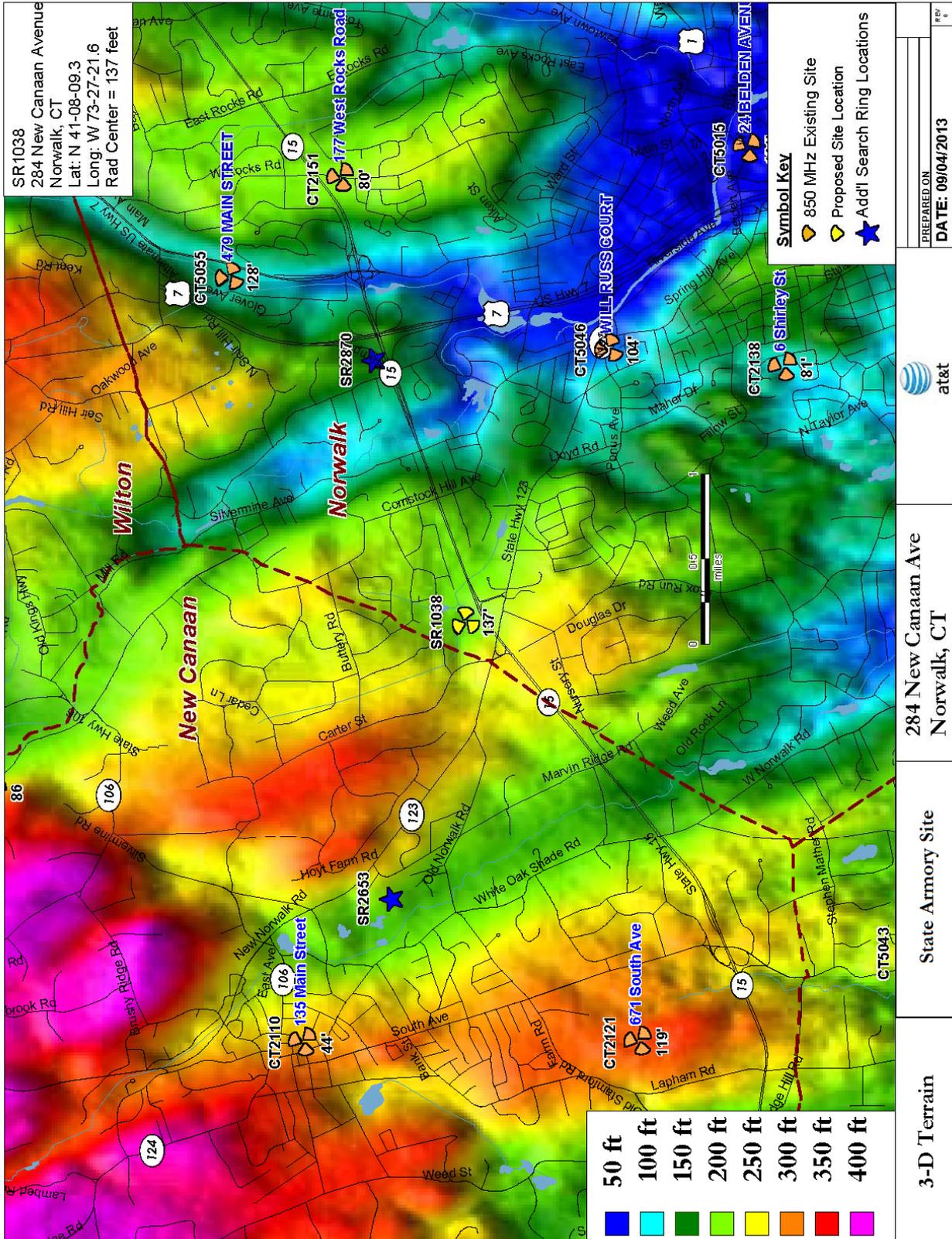


Anthony Wells
C Squared Systems, LLC

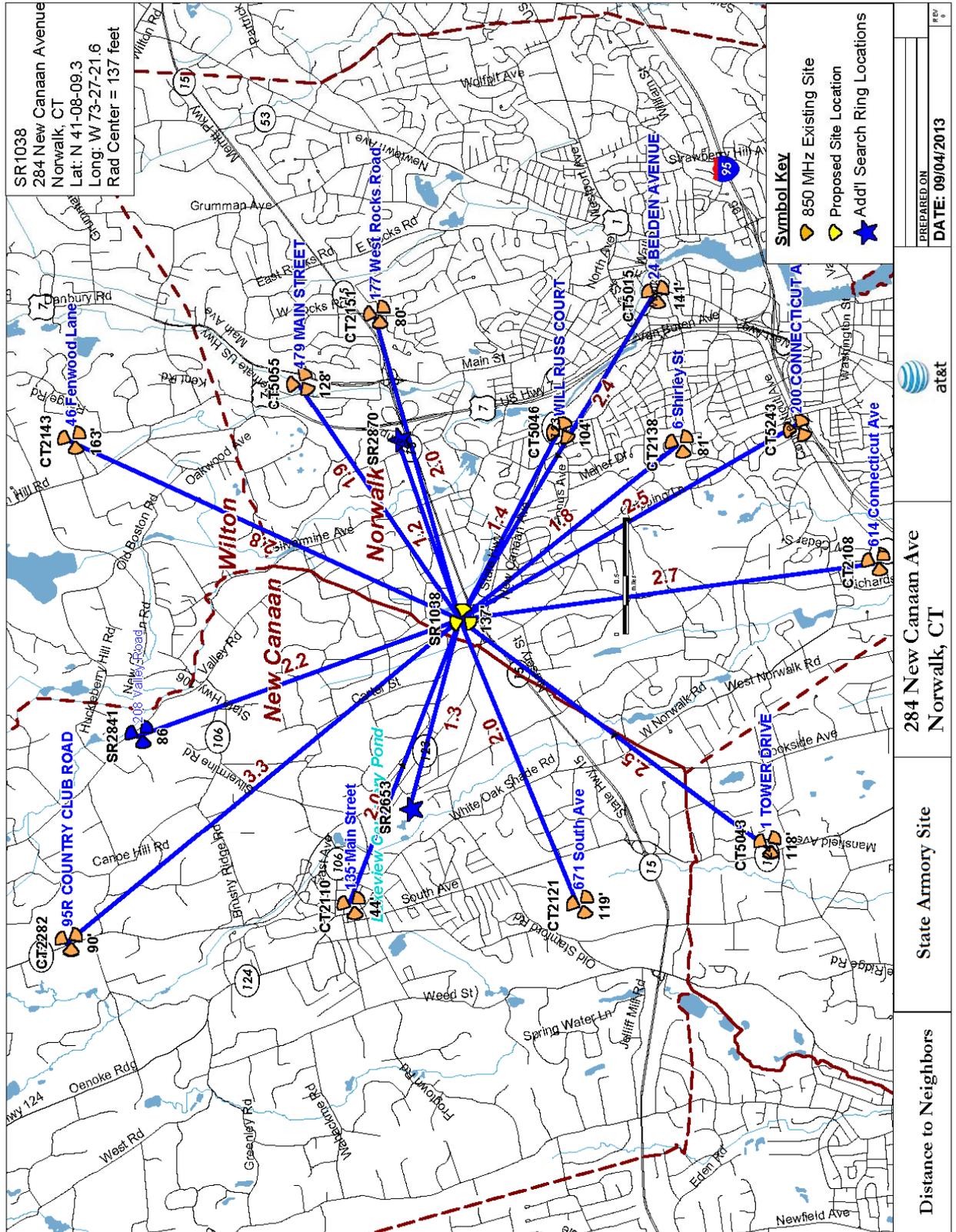
September 11, 2013

Date

5. Attachments



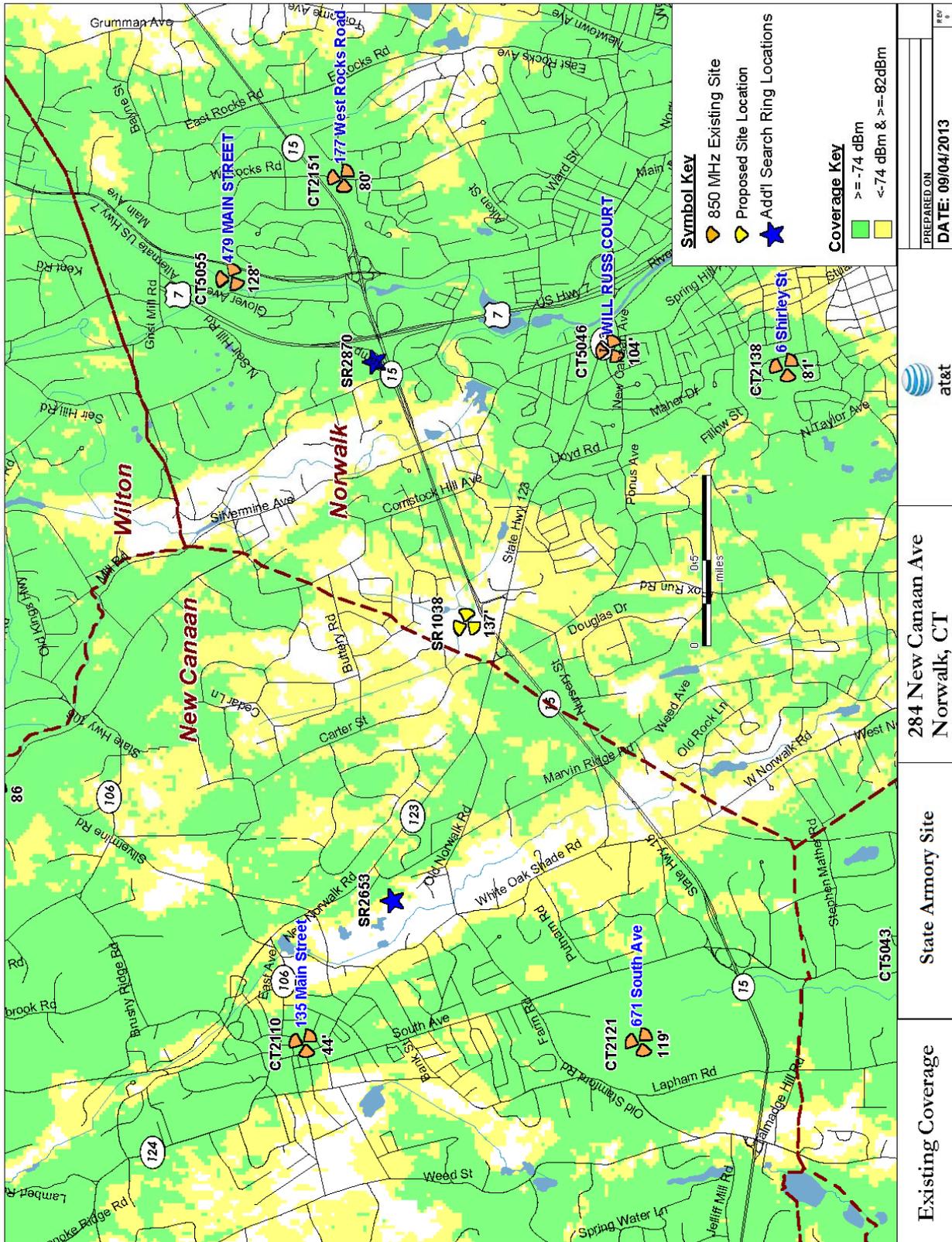
Attachment 1: 3D Terrain Map



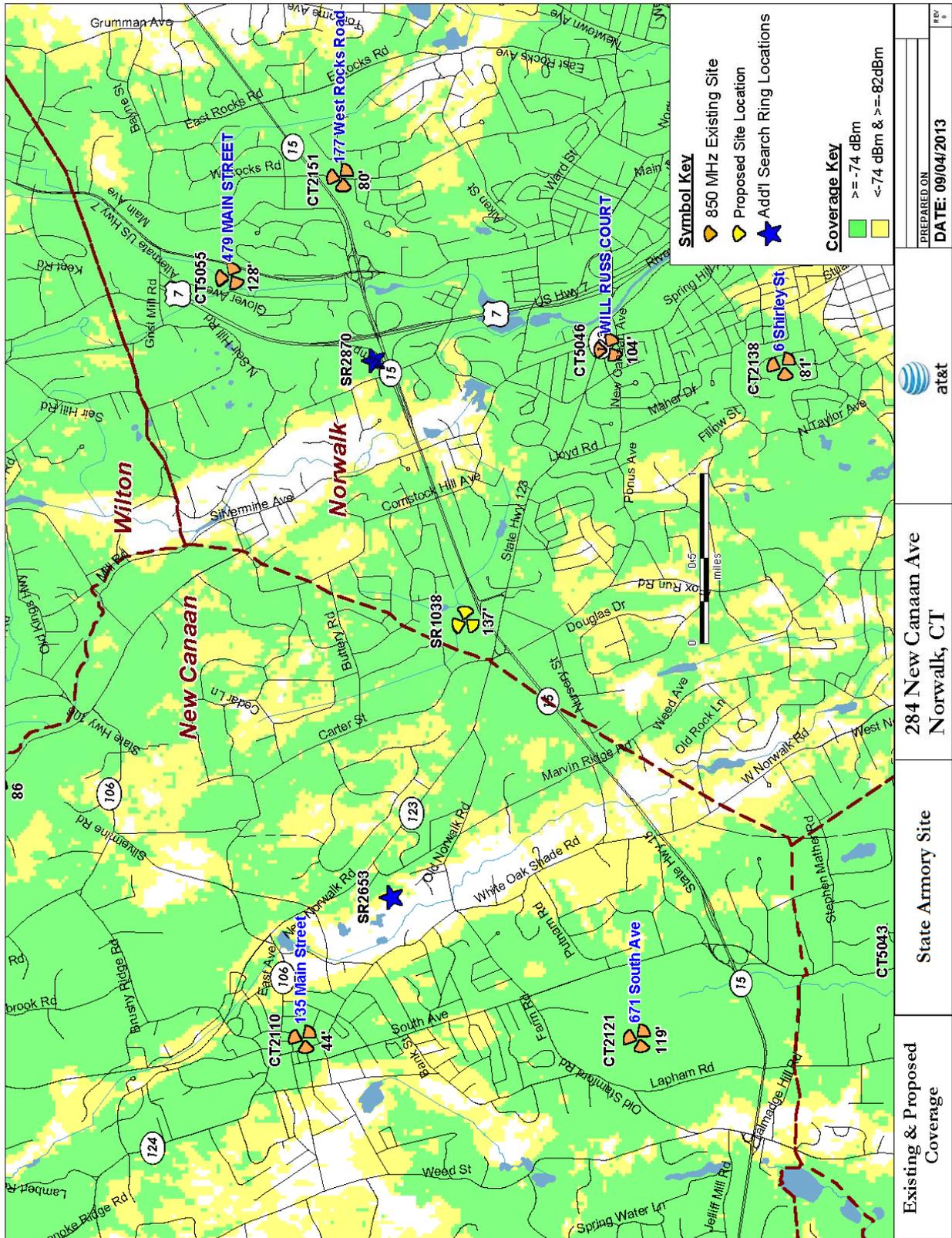
Attachment 2: Map of Distance to Neighbor Sites – State Armory site

Site Name	Address	Town	Latitude	Longitude	Antenna Centerline (feet)	Distance to Proposed Site (miles)	Ground Elevation (feet)
CT2108	614 Connecticut Ave	Norwalk	41.0971	-73.4491	153	2.7	77
CT2110	135 Main Street	New Canaan	41.1464	-73.4917	44	2.0	280
CT2121	671 South Ave	New Canaan	41.1248	-73.4917	119	2.0	322
CT2138	6 Shirley St	Norwalk	41.1155	-73.4344	81	1.8	101
CT2143	46 Fenwood Lane	Wilton	41.1725	-73.4339	163	2.8	343
CT2151	177 West Rocks Road	Norwalk	41.1439	-73.4183	80	2.0	206
CT2282	95R Country Club Road	New Canaan	41.1729	-73.4963	90	3.3	495
CT5015	24 Belden Avenue	Norwalk	41.1178	-73.4158	121	2.4	29
CT5043	1 Tower Drive	Darien	41.1072	-73.4842	118	2.5	244
CT5046	Will Russ Court	Norwalk	41.1267	-73.4328	104	1.4	79
CT5055	479 Main Street	Norwalk	41.1511	-73.4267	128	1.9	117
CT5243	200 Connecticut Avenue	Norwalk	41.1044	-73.4325	119	2.5	112
SR2841	208 Valley Road	New Canaan	41.1662	-73.4705	86	2.2	269
SR2653	77 Main St	New Canaan	41.1406	-73.4795	145	1.3	213
SR2870	Perry Avenue	Norwalk	41.1418	-73.4334	100	1.2	150

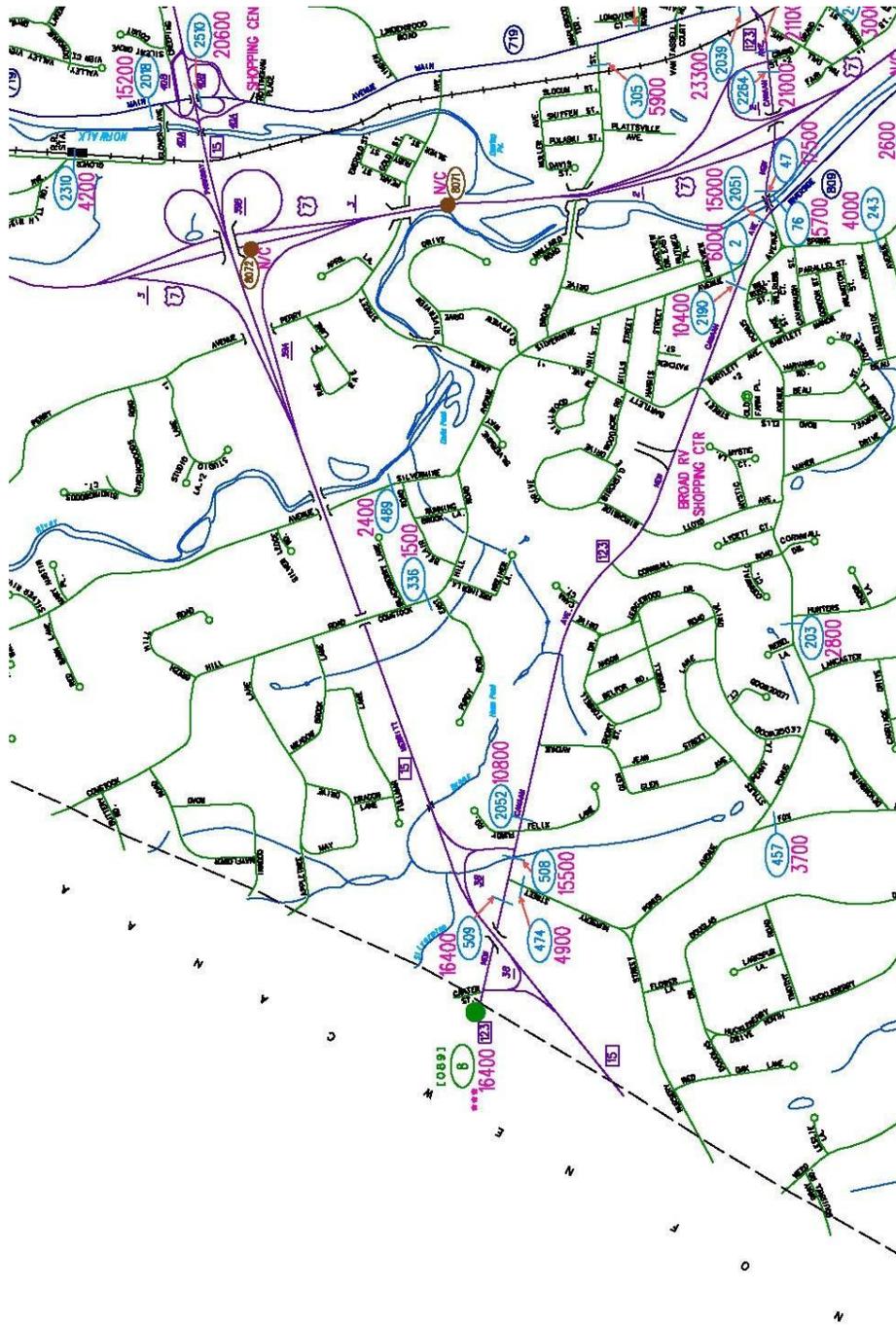
Attachment 3: Neighbor Site Data and Distance to Proposed Site



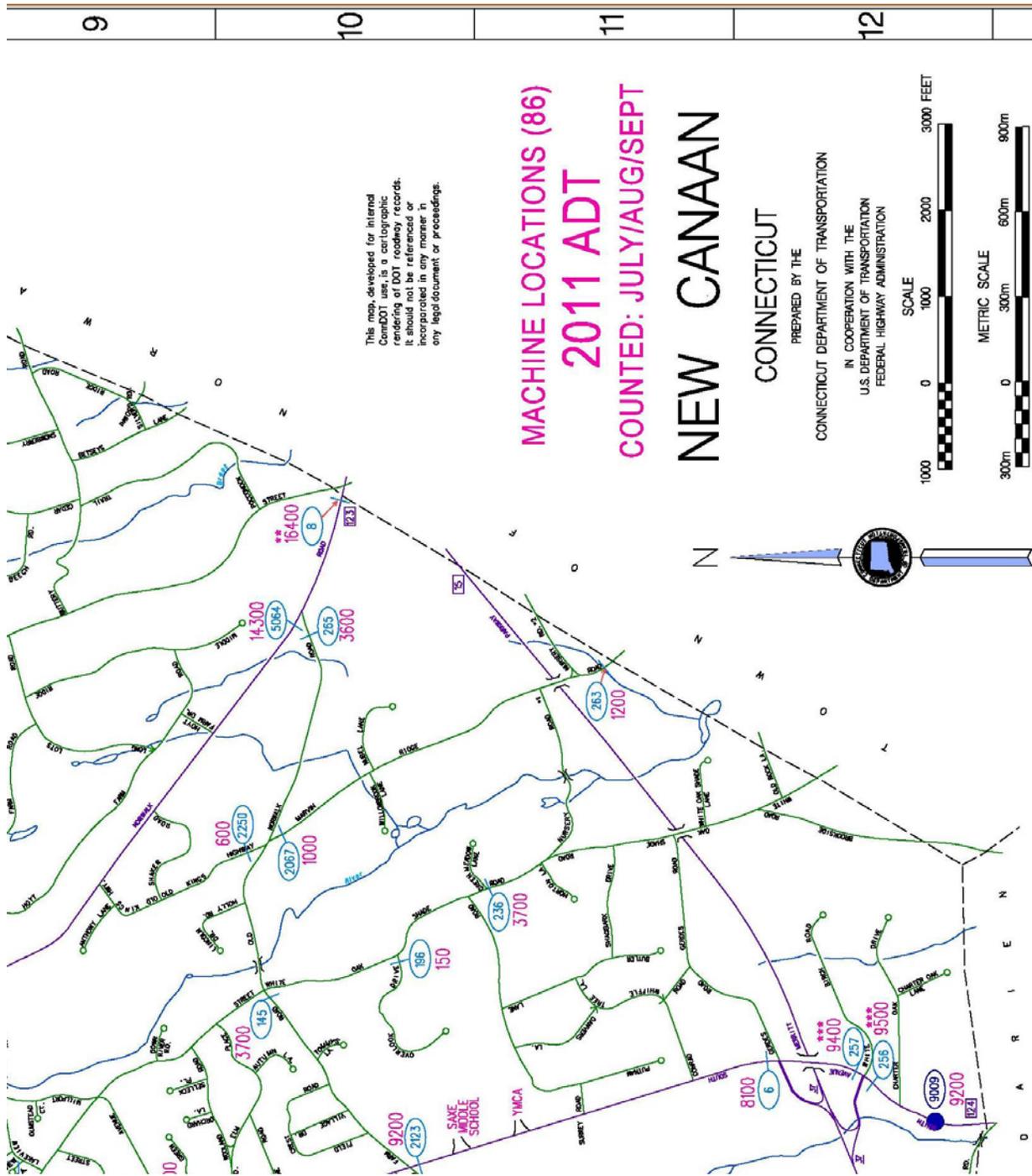
Attachment 4: "Existing Coverage" for the Current AT&T network



Attachment 5: "Existing & Proposed Coverage" for the AT&T network with State Army site



Attachment 6: Connecticut DOT Average Annual Daily Traffic Data – Norwalk



Attachment 7: Connecticut DOT Average Annual Daily Traffic Data – New Canaan