



at&t

**SN4998 Quilceda
RF Justification**

SERVICE OBJECTIVES & TARGETED SERVICE AREA

AT&T is proposing to build a new wireless communication facility (“WCF” and/or “Facility SN4998 Quilceda, at 11435 38th Dr NE, Marysville, WA 98271 in the city of Marysville.

Service Objectives—Generally

AT&T strives for a network design that provides high radio frequency (“RF”) signal strength and signal-to-interference-plus-noise ratio (“SINR”) resulting in quality service inside buildings and vehicles. To support this network design there are two main drivers that prompt the need for a new cell site—coverage and capacity.

“Coverage” is the need to expand wireless service into an area that either has no service or bad service. “Capacity” is the need for more wireless resources. Cell sites have a limited amount of resources to handle voice calls, data connections, and data volume. When these capacity limits are reached, user experience quickly degrades. Capacity issues for LTE networks are identified by using SINR metrics to measure the network’s signal quality when there is a high traffic load condition. High traffic areas in the network experience poor SINR due to the increased amount of signal noise/interference generated by the interfering strength of the simultaneous transmissions.

Service Objectives—Proposed New Facility

The proposed new Facility is a service coverage and capacity site. Currently, Commercial and residential portions to East of I-5 and around 116th St NE in Marysville have minimal to no 4G voice service and AT&T’s existing coverage in the area is at or near its capacity and is insufficient for the volume of traffic (*i.e.* though this area already has AT&T coverage, additional capacity is needed to service the volume of users).

The Objective of this proposed new facility to Offload the Existing WCF in West and to improve coverage to NE of premium outlets . This new WCF will also improve coverage to East of I-5 residential and commercial area. This service objective and Targeted Service Area was determined by AT&T’s RF engineers through a combined analysis of market demand, customer complaints, service requests, and RF engineering design (including SINR metrics).

The proposed new Facility meets AT&T’s service objectives to provide sufficient continuous and uninterrupted outdoor, in-vehicle, and in-building wireless service within the Targeted Service Area, resulting in fewer dropped calls, improved call quality, and improved access to additional wireless services the public now demands (this includes emergency 911 calls).

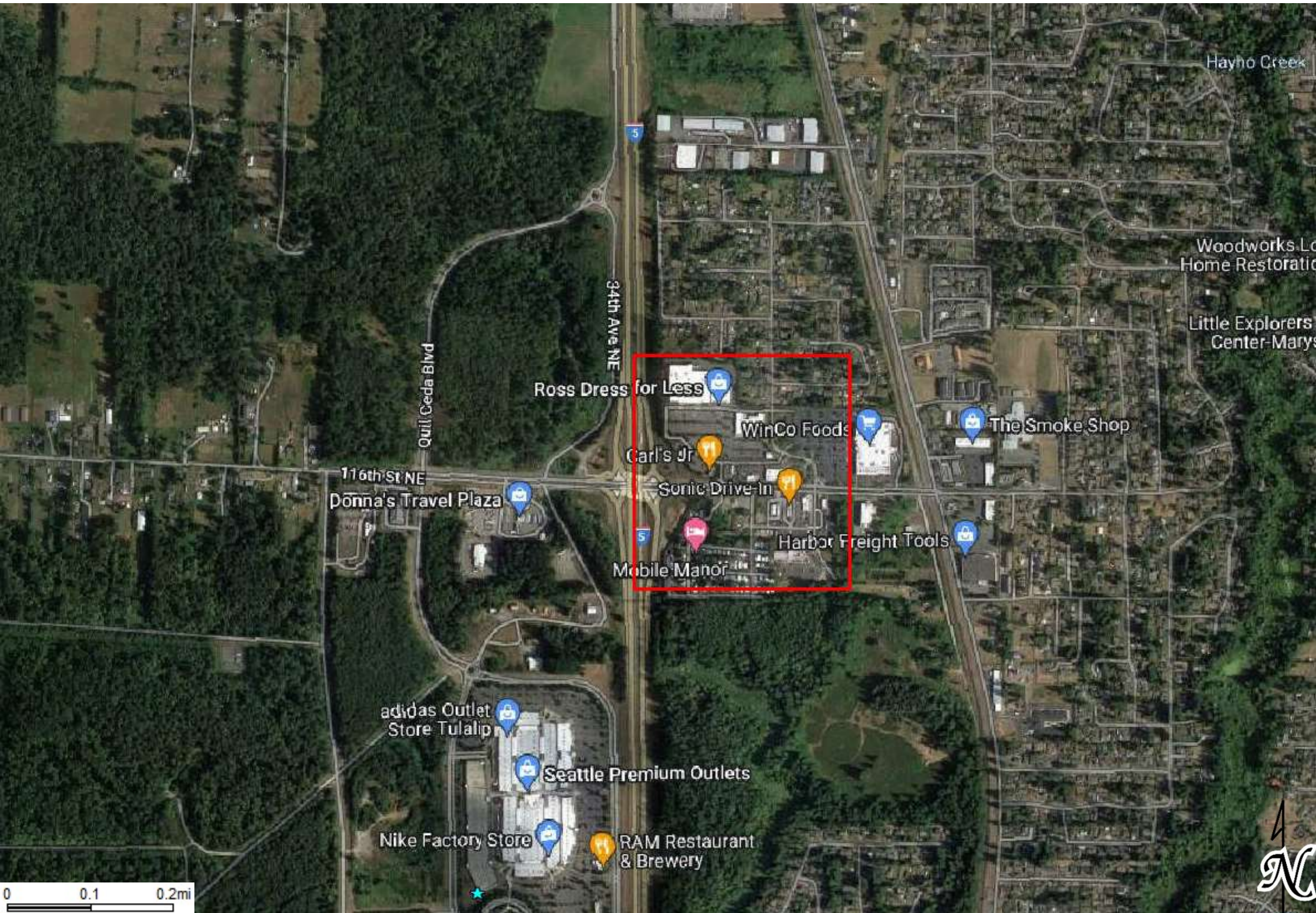
SEARCH RING

AT&T's RF engineers performed an RF engineering study—considering multiple objectives—to determine the approximate site location and antenna height required to best fulfill the noted service objectives within the Targeted Service Area. From this study, AT&T's RF engineers identified a “search ring” area where a new wireless facility may be located to provide effective service in the Targeted Service Area.

As this is a service capacity and coverage site intended to offload capacity/improve coverage in a specific area, the proposed new Facility must be located within the identified search ring to be able to establish a dominant signal within the Targeted Service Area—i.e. the proposed new Facility will provide service to users' handsets and prevent them from communicating with AT&T's existing facility, thereby relieving some of the burden on the existing facility by offloading users' data requirements to the proposed new Facility.

Figure A—Targeted Search Ring, below, indicates the search ring AT&T's RF engineers established for this proposed site. A discussion of the methodology AT&T's RF engineers used to identify the search ring is included at the end of this RF Justification document.

Figure A—Targeted Search Ring



PROPOSED NEW AT&T FACILITY

Antennas and Equipment

To meet AT&T's service objectives within the Targeted Service Area, AT&T is proposing to install up to twelve (12) eight foot (8ft) panel antennas and twelve (12) remote radio head (RRH) units, together with all associated equipment with an 130ft antenna tip height.

Required Height

As the proposed new Facility is intended to provide new coverage and enhance existing capacity, height and location play an important role. The proposed antenna tip height was determined by considering various factors such as the height of surrounding wireless sites, ground elevation, obstructions to the signal, and the surrounding terrain. Accordingly, the proposed 130ft antenna tip height is the minimum necessary to best meet AT&T's service objectives within the Targeted Service Area. A lower antenna tip height at this location would not provide as effective capacity improvement within the Targeted Service Area as compared to the alternative site's antenna tip heights. The proposed antenna tip height is also the height where an AT&T wireless device can be reliably used to make and receive telephone calls and use data service in the presence of varying signals.

Projected New Coverage

Based upon the above proposed equipment and antenna tip height, AT&T's RF engineers project that the proposed Facility will provide the following new AT&T coverage.

Figure B—Existing AT&T Coverage shows existing AT&T wireless services in the general area of the proposed new site, which demonstrates the current gap in coverage in the targeted service area. The red star indicates the location of the proposed new WCF, Sky blue star indicates the location of Planned AT&T WCF. The pink diamond indicates the location of existing AT&T WCF sites; coverage from AT&T's existing WCF sites is shaded in green. As can be seen, there is a coverage gap in all areas not shaded in green. Currently, the target coverage area has minimal to no 4G voice service and does not have adequate 4G LTE service.

Figure C—Projected New AT&T Coverage identifies the projected coverage from the proposed new WCF with the requested antenna tip height of 130 ft. The proposed antenna tip height is the minimum necessary to help fill the coverage gap relative to nearby complementary wireless facilities and to support the FirstNet Network. This is also the height where an AT&T wireless device can be reliably used to make and receive telephone calls and use data service in the presence of varying signals

PROPOSED NEW AT&T FACILITY

Figure C.1—Projected New AT&T Coverage identifies the projected coverage from the proposed new WCF with the requested antenna tip height of 120 ft. As seen coverage footprint is reduced in all direction specially in North & South. As shown in Table 1, with a Tip height at 130', coverage increases by 10% more in the target area as compared to Tip height of 120'.

Figure C—Projected New AT&T Coverage

Coverage AFTER Proposed AT&T Facility On-Air—130 ft Antenna Tip Height

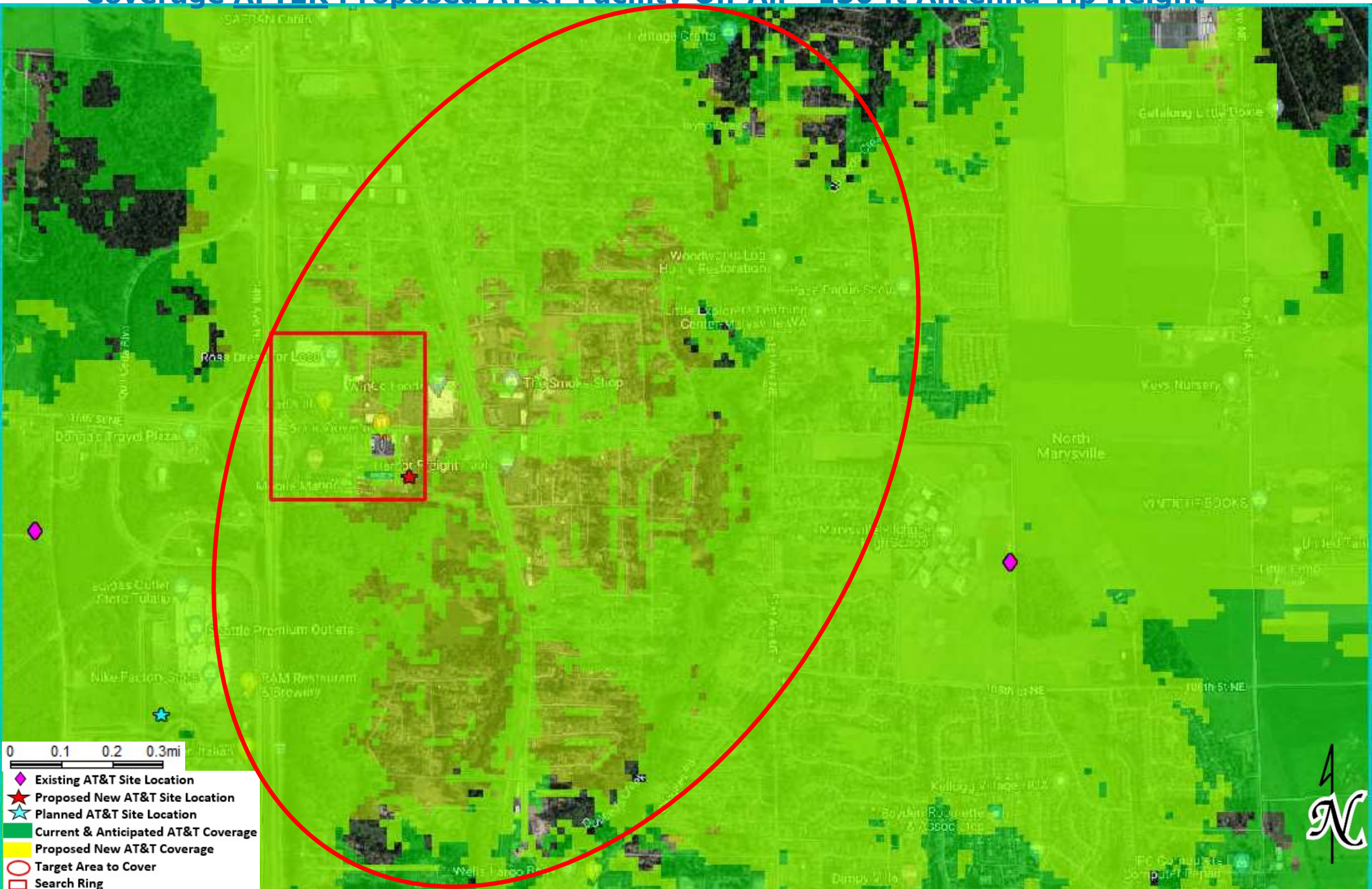
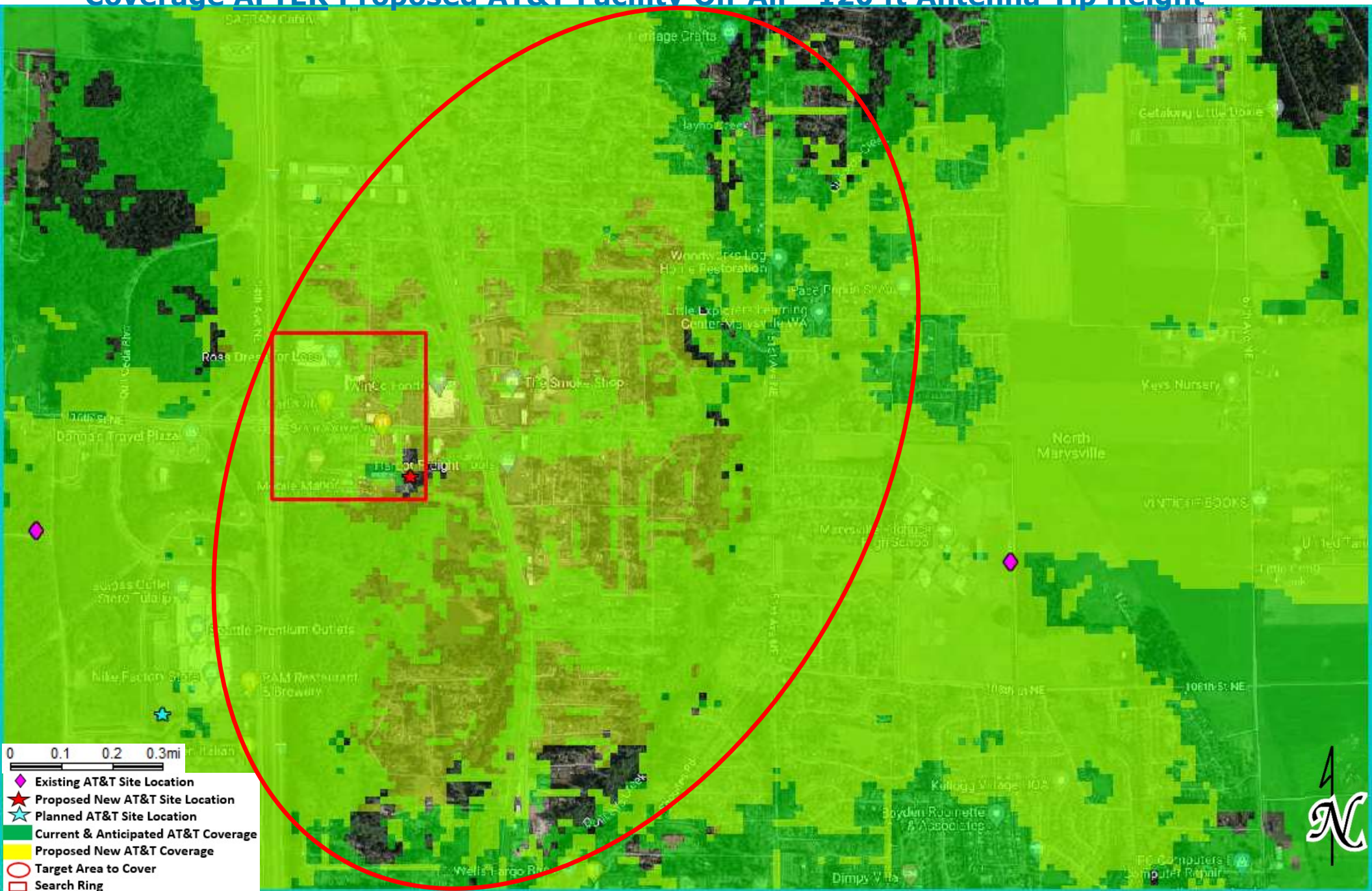


Figure C.1—Projected New AT&T Coverage

Coverage AFTER Proposed AT&T Facility On-Air—120 ft Antenna Tip Height



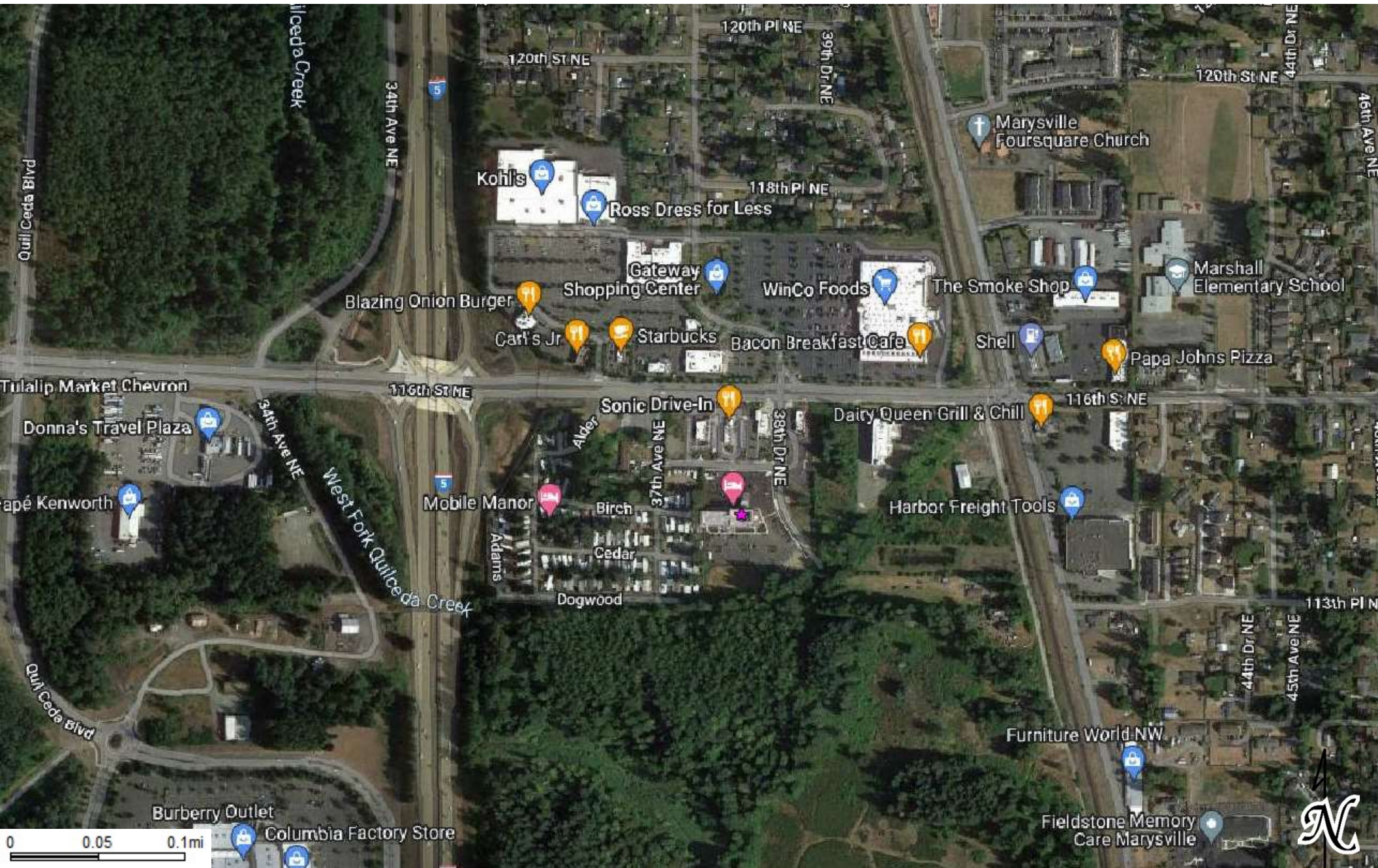
Alternative Site Analysis

AT&T's RF engineers evaluated one alternative site locations within the targeted search ring as possible locations for the proposed new WCF.

Figure D—Alternative Site Locations shows the location of each alternative site in relation to the proposed new site location.

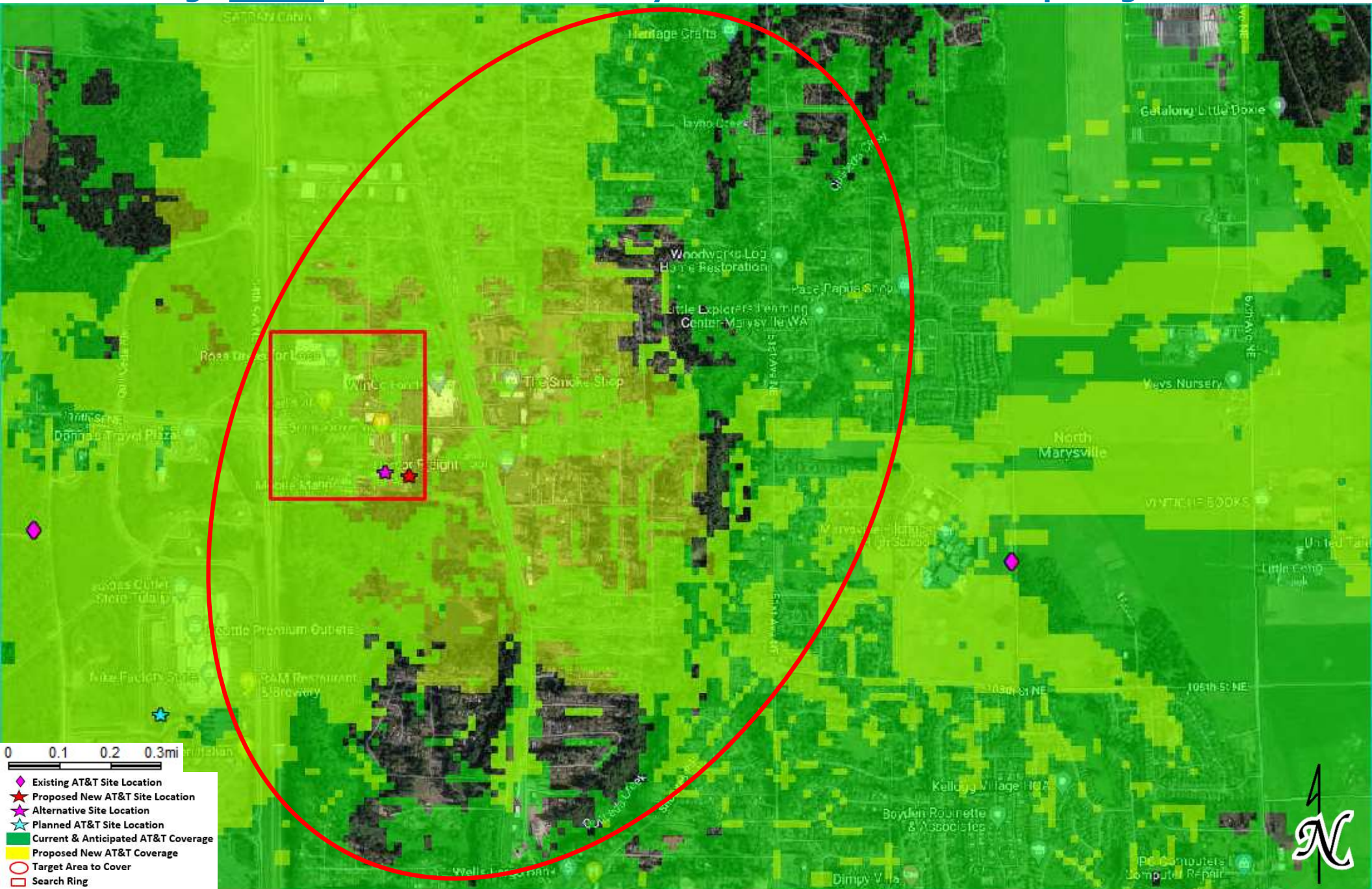
- **Alternative Site #1** (48.098661, -122.179762) : This would have been a new rooftop site across the street from the proposed site.
- **Figure E—Alternative Site #1—Projected New AT&T Coverage** demonstrates the projected coverage from an 80 ft antenna tip height centralized on the roof of the new LaQuinta Hotel, which is the highest available antenna tip allowed by code. As can be seen by the propagation map, this location is not able to cover the target areas in North as well as South. Also, higher RC is needed to surpass the tree lining in the area. As shown in Table 1, with a Tip height at 130', coverage increases by 40% more in the target area as compared to the Alternate Name with a Tip height of 80'.

Figure D—Alternative Site Location(s)



★ Alternative Site Location

Figure E—Alternative Site #1—Projected New AT&T Coverage Coverage AFTER Alternative #1 Facility On-Air—80 ft Antenna Tip Height



- 0 0.1 0.2 0.3mi
- ◆ Existing AT&T Site Location
- ★ Proposed New AT&T Site Location
- ★ Alternative Site Location
- ★ Planned AT&T Site Location
- Current & Anticipated AT&T Coverage
- Proposed New AT&T Coverage
- Target Area to Cover
- Search Ring

Alternative Site Analysis

Table 1: Coverage

Site location	Coordinates	Tip height (ft)	Coverage surface (sq. mi)	Percentage
Proposed New Tower Location	48.0985080, -122.1786390	130	1.91	100
Proposed New Tower Location	48.0985080, -122.1786390	120	1.73	90.57
Alternative Location	48.098661, -122.179762	80	1.14	59.68

Search Ring Methodology

AT&T's RF engineers used coverage propagation software systems to predict the coverage provided by the proposed new WCF. The software and AT&T's RF engineers considered the general factors outlined below, as well as more project-specific factors such as the type of antenna, antenna tilt, etc.

Coverage. The antenna site must be located in an area where the radio frequency broadcasts will provide adequate coverage within the targeted service area. The RF engineer must take into consideration the coverage objectives for the site as well as the terrain in and around the area to be covered. Because radio frequency broadcasts travel in a straight line and diminish as they travel further away from the antennas, it is generally best to place an antenna site near the center of the desired coverage area. However, in certain cases, the search ring may be located away from the center of the desired coverage area due to the existing coverage, the surrounding terrain, or other features which might affect the radio frequency broadcasts, *e.g.* buildings or sources of electrical interference.

Clutter. AT&T's WCFs must "clear the clutter"—the WCF site must be installed above or close to RF obstructions (the "clutter") to enable the RF to extend beyond and clear the clutter. AT&T's radio frequencies do not penetrate mountains, hills, rocks, or metal, and are diminished by trees, brick and wood walls, and other structures. Accordingly, AT&T's antennas must be installed above or close to the "clutter" to provide high quality communications services in the desired coverage areas. Additionally, if the local code requires us to accommodate additional carriers on the support structure, the structure must be even taller to also allow the other carriers' antennas to clear the clutter.

Call Handoff. The WCF site must be in an area where the radio broadcasts from the site will allow seamless "call handoff" with adjacent WCF sites. Call handoff is a feature of a wireless communications system that allows an ongoing telephone conversation to continue uninterrupted as the user travels from the coverage area of one antenna site into the coverage area of an adjacent antenna site. This requires coverage overlap for a sufficient distance and/or period of time to support the mechanism of the call handoff.

Quality of Service. Users of wireless communications services want to use their services where they live, work, commute and play, including when they are indoors. AT&T's coverage objectives include the ability to provide indoor coverage in areas where there are residences, businesses and indoor recreational facilities.

Search Ring Methodology—Con't

Radio Frequencies used by System. The designs of wireless communications systems vary greatly based upon the radio frequencies that are used by the carrier. If the carrier uses radio frequencies in the 850 MHz to 950 MHz range, the radio signals will travel further and will penetrate buildings better than the radio frequencies in the 1900 MHz band. As a result, wireless communications systems that use lower radio frequencies will need fewer sites than wireless communications systems that use higher radio frequencies. AT&T's system uses only frequencies in the 1900 MHz so AT&T's system requires more sites in order to achieve the same coverage that is provided by the carriers which use the 850 MHz to 950 MHz frequency band.

Land Use Classifications. A&T's ability to construct a WCF site on any particular property is affected by state and local regulations, including zoning and comprehensive plan classifications, goals, and policies. AT&T's search rings take these laws and regulations into consideration.