ATTACHMENT 8

ALL-POINTS TECHNOLOGY CORPORATION

VISIBILITY ANALYSIS

MANCHESTER RISLEY
701 LYDALL STREET
MANCHESTER, CT 06042

Prepared for:

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and
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Project Introduction

American Tower Company ("ATC") proposes to construct and operate a wireless telecommunications facility ("Facility") on a portion of the property located at 701 Lydall Street in the Town of Manchester, Hartford County, Connecticut. (referred herein as the "Host Property"). All-Points Technology Corporation, P.C. ("APT") prepared this Visibility Analysis to evaluate views associated with the proposed Facility from within a two-mile radius ("Study Area"). In addition to the Town of Manchester, portions of the adjoining municipalities of Vernon and Bolton are also included within the Study Area.

Site Description and Setting

The Host Property is identified in Manchester Tax Assessor records as Map-Block-Lot Number 133-3700-701 and consists of approximately 66 acres of land, located along the north side of Lydall Street. The Host Property is characterized by mixed agricultural hay fields, complexes of upland and wetland forested blocks, and a small quarry operation. The surrounding land-use consists primarily of residential development, agricultural fields and forest.

The Facility would be located in the northwest corner of a mowed grass area adjacent to mature upland forest (the "Site") at a ground elevation of approximately 431 feet above mean sea level ("AMSL"). The Facility would include a 104-foot tall monopole surrounded by a 50-foot by 50-foot fence-enclosed compound area. The 2,500 square foot, gravel-base compound will include an equipment shelter, emergency power generator, and associated utility backboard and demark equipment. Access to the Facility would initially follow an existing dirt road originating off Lydall Street, through a hay field (adjacent to the woods line) and continue over a new, 12-foot wide, gravel based drive. Utilities would extend underground along the access drive for a total length of approximately 1,600 feet.

The topography within the Study Area is characterized by rolling hills with ground elevations that range from approximately 142 feet AMSL to nearly 852 feet AMSL. The tree cover within the Study Area (consisting primarily of mixed deciduous hardwoods) occupies approximately 3,790 acres of the 8,042-acre study area (47%). The central and eastern portions of the Study Area are fairly well wooded; the western portion transitions into more suburban development. The average tree canopy is estimated to be approximately 65 feet.

Methodology

APT used the combination of a predictive computer model and in-field analysis to evaluate the visibility associated with the proposed Facility on both a quantitative and qualitative basis. The predictive model provides a measurable assessment of potential visibility throughout the entire Study Area including private properties and other areas inaccessible for direct observations. The in-field analyses included a reconnaissance of the Study Area to record existing conditions, verify results of the model, inventory visible and nonvisible locations, and provide photographic documentation from publicly accessible areas. A description of the procedures used in the analysis is provided below.

Preliminary Computer Modeling

Two computer modeling tools were used to calculate those areas from which at least the top of the proposed Facility is estimated to be visible: IDRISI image analysis program (developed by Clark Labs, Clark University) and ArcGIS®, developed by Environmental Systems Research Institute, Inc. Project- and Study Area-specific data were incorporated into the computer model, including the Facility's location, height, and ground elevation, as well as the surrounding topography and existing vegetation which are two primary features that can block direct lines of sight. Information used in the model included LiDAR[1]-based digital elevation data and customized land use data layers developed specifically for this analysis. The LiDAR-based Digital Elevation Model ("DEM") represents topographic information for the state of Connecticut that was derived through the spatial interpolation of airborne LiDAR-based data collected in the year 2000 and has a horizontal resolution of ten (10) feet. In addition, multiple land use data layers were created from National Agricultural Imagery Program (USDA) aerial photography (one-foot resolution, flown in 2012) using IDRISI image processing tools. The IDRISI tools develop light reflective classes defined by statistical analysis of individual pixels, which are then grouped based on common reflective values such that distinctions can be made automatically between deciduous and coniferous tree species, as well as grassland, impervious surface areas, water and other distinct land use features. This information is manually cross-checked with the recent USGS topographic land characteristics to quality assure the imaging analysis.

Once the data layers were entered, image processing tools were applied and overlaid onto USGS topographic base maps and aerial photographs to achieve an estimate of locations where the Facility might be visible. First, only the topography data layer (DEM) was incorporated to evaluate potential visibility with no intervening vegetative screening. The model is queried to determine where the top of the Facility can be seen from any point(s) within the Study Area, given the intervening existing topography. The initial omission of the forest cover data layer results in an excessive over-prediction, but provides an opportunity to identify and evaluate those areas with potentially direct sight lines toward the Facility.

Eliminating the tree canopy altogether, as performed in the preliminary analysis exaggerates areas of visibility because it assumes unobstructed sight lines everywhere but in those locations where intervening topography rises above the height of the proposed Facility. However, using this technique not only allows for an initial identification of direct sight lines, but also to gain some insight regarding seasonal views when the leaves are not on the trees. This preliminary mapping is especially useful during the in-field activities (described below) to further evaluate "leaf-off" scenarios.

[1] LiDAR is an acronym for Light Detection and Ranging. It is a technology that utilized lasers to determine the distance to an object or surface. LiDAR is similar to radar, but incorporates laser pulses rather than sound waves. It measures the time delay between transmission and reflection of the laser pulse.

Visibility varies through the year as the leaves drop from deciduous trees. During “leaf on” conditions, individual trees that are grouped proximate to one another form a near opaque wall of vegetation that, once beyond a certain distance, cannot be seen through. Conversely, visibility increases seasonally with obstructed, views occurring during “leaf-off” conditions. Thus two forest data layers are created to represent both year-round (“leaf-on”) and seasonal (leafless or “leaf-off”) conditions. These data layers are incorporated into the model, analyzed separately and then merged to produce the visibility maps. Calculations resulting from the leaf-on forest data layer depict areas where at least the top of the Facility may be present above the intervening tree canopy. Similarly, computations from the “leaf-off” data layer also depict areas where the top of the Facility is predicted to be visible but it accounts for the increased transparency due to lack of vegetative screening. The Study Area includes mature vegetation with a unique composition and density of woodlands, with mast or pole timber and branching providing the majority of screening in leafless conditions. Beyond the density of woodlands found within the Study Area, each individual tree has its own unique trunk, pole timber and branching pattern characteristics that provide varying degrees of screening in leafless conditions which cannot be precisely modeled. Because tree spacing, dimensions and branching patterns as well as the understory differ greatly over even small areas, the Study Area has its own discrete forest characteristics. To approximate seasonal visibility, a conservative set of values was incorporated into the model, including the assumptions that each deciduous tree is simply a vertical pole with no distinct branching pattern. Given these conservative assumptions, the resultant modeling still over-predicts visibility in “leaf-off” conditions but does provide a better representation than the initial map using topography only.

A purposely low average tree canopy height of 50 feet was then incorporated into the forest data layers and added to the DEM for a second iteration of the visibility map. The model was queried again to determine where the top of the Facility may be seen from any point(s) within the Study Area, given both the intervening existing topography and forest data layers. The results of the preliminary analysis provide a representation of those areas where portions of the Facility could potentially be visible to the human eye without the aid of magnification, based on a viewer eye-height of 5 feet above the ground and the combination of intervening topography and tree canopy (year-round) and tree trunks (seasonally, when the leaves are off the deciduous trees) using an average tree height of 50 feet. This iteration provides a conservative assessment of intervening vegetation for use during the in-field activities to compare the outcomes of the initial computer modeling with direct observations of the balloon float.

The forested areas were then extracted from the areas of visibility, using a conservative assumption that a person standing within the forest will not be able to view the proposed Facility beyond a distance of approximately 500 feet. Depending on the density of the intervening tree canopy and understory of the surrounding woodlands, it is assumed that some locations within this distance could provide visibility of at least portions of the proposed Facility at any time of the year. In “leaf-on” conditions, this distance may be overly conservative for most locations. However, for purposes of this analysis, it was reasoned that forested land beyond 500 feet of the proposed Facility would consist of light-impenetrable trees of a uniform height.

Additional data was reviewed and incorporated into the visibility analysis, including protected private and public open space, parks, recreational facilities, hiking trails, schools, and historic districts. The nearest hiking trail system is associated with Risley Pond, located approximately 0.5 mile east of the Host Property. Based on a review of publicly-available information, no designated state or local scenic roads exist within the Study Area.

In-Field Activities

To supplement and fine tune the results of the computer modeling efforts, APT completed in-field verification activities consisting of a balloon float, vehicular and pedestrian reconnaissance, and photo-documentation.

Balloon Float and Field Reconnaissance

A balloon float was conducted on June 17, 2014 to obtain photographs for use in this report. The balloon float consisted of raising an approximately four-foot diameter, red helium-filled balloon, tethered to a string height of 104 feet above ground level ("AGL") at the proposed Facility location. At the time of the balloon float, the air temperature was warm (above 90° F) and winds calm.

Once the balloon was secured, APT conducted a Study Area reconnaissance by driving along the local and State roads and other publicly accessible locations to document and inventory where the balloon could be seen above/through the tree mast and canopy. Visual observations from the reconnaissance were also used to evaluate the results of the preliminary visibility mapping and identify any discrepancies in the initial modeling.

During the balloon float, several trees were randomly surveyed using a hand-held infrared laser range finder and Suunto clinometer to ascertain their heights. Numerous locations were selected to obtain tree canopy heights, including along roadways, wooded lots, and high- and low-lying areas to provide for the irregularities associated with different land characteristics and uses found within the Study Area. The average canopy height was developed based on measurements and comparative observations, in this case approximately 65 feet AGL. Throughout Connecticut, the tree canopy height varies from about 55 feet to in excess of 80 feet (where eastern white pine becomes a dominant component of the forest type, average tree heights may be even slightly higher). This general uniformity is most likely the result of historic state-wide clear cutting of forests to produce charcoal and fuel wood, not only for home use, but also for the local brick, brass, and iron industries from the late 1800s to early 1900s[2]. Approximately 69% of Connecticut's forests are characterized as mature[3].

Photographic Documentation

APT drove the public roads within the Study Area during the balloon float and photo-documented representative areas where the balloon was and was not visible. At each photo location, the geographic coordinates of the camera's position were logged using global positioning system ("GPS") technology. Photographs were taken with a Canon EOS 6D digital camera body and Canon EF 24 to 105 millimeter ("mm") zoom lens, with lens set to 50 mm. A 50mm focal length best approximates the relation of sizes between objects similar to what the human eye might perceive.

[2] Ward, J.S., Worthley, T.E. Forest Regeneration Handbook. A guide for forest owners, harvesting practitioners, and public officials. The Connecticut Agricultural Experiment Station and University of Connecticut, Cooperative Extension. Pg. 5.
[3] USDA Resource Bulletin NE-160, 2004.

"The lens that most closely approximates the view of the unaided human eye is known as the normal focal-length lens. For the 35 mm camera format, which gives a 24x36 mm image, the normal focal length is about 50 mm.[4]"

Final Visibility Mapping

Information obtained during the field reconnaissance was incorporated into the mapping data layers, including observations of the balloon float, the photo locations, areas that experienced recent land use changes and those places where the initial model was found to over-predict visibility. The revised average tree canopy height data (65 feet AGL) was merged with the DEM and added to the base ground elevations of the forested areas data layer. Once the additional data was integrated into the model, APT re-calculated the visibility of the proposed Facility from within the Study Area to assist in producing the final viewshed map.

Photographic Simulations

Photographic simulations were generated to portray scaled renderings of the proposed Facility from 15 representative locations where the proposed Facility would be visible either on a year-round or seasonal basis. Using field data, site plan information and 3-dimension (3D) modeling software, spatially referenced models of the site area and Facility were generated and merged. The geographic coordinates obtained in the field for the photograph locations were incorporated into the model to produce virtual camera positions within the spatial 3D model. Photo simulations were then created using a combination of renderings generated in the 3D model and photo-rendering software programs[5].

Photo-documentation of the balloon float and photo-simulations of the proposed Facility are presented in the attachment at the end of this report. For presentation purposes in this report, the photographs were taken with a 50 mm focal length and produced in an approximate 7-inch by 10.5-inch format. The balloon float photos provide visual reference points for the approximate height and location of the proposed Facility relative to the scene. The photo-simulations are intended to provide the reader with a general understanding of the different views that might be achieved of the Facility. It is important to consider that the publicly-accessible locations selected are typically representative of a "worst case" scenario. They were chosen to present unobstructed view lines (wherever possible), are static in nature and do not necessarily fairly characterize the prevailing views from all locations within a given area. From several locations, moving a few feet in any direction will result in a far different perspective of the Facility than what is presented in the photographs. In several cases, a view of the Facility may be limited to the immediate area of the specific photo location.

The simulations provide a representation of the Facility under similar settings as those encountered during the balloon float and reconnaissance. Views of the Facility can change substantially throughout the season and are dependent on environmental conditions, including (but not necessarily limited to) weather, light conditions, seasons, time of day, and the viewer location.

[4] Warren, Bruce. Photography, West Publishing Company, Eagan, MN, c. 1993, (page 70).

[5] As a final step, the accuracy and scale of select simulations are tested against photographs of similar existing facilities with recorded camera position, focal length, photo location, and tower location.

Photograph Locations

The table below summarizes characteristics of the photographs and simulations presented in the attachment to this report including a description of each location, view orientation, the distance from where the photo was taken relative to the proposed Facility and the general characteristics of that view. The photo locations are depicted on the photolog and viewshed maps provided as attachments to this report.

View	Location	Orientation	Dist. To Site	Visibility
1	Bridle Path Lane	West	±0.30 Mile	Year-round
2	Leo J Lane	Southwest	±0.17 Mile	Year-round
3	Deer Run Trail	Southwest	±0.18 Mile	Year-round
4	Deer Run Trail	Southwest	±0.14 Mile	Year-round
5	Tufts Drive	Southeast	±0.34 Mile	Year-round
6	Tufts Drive	Southeast	±0.39 Mile	Year-round
7	Vernon Street at Meadowbrook Drive	Southeast	±0.55 Miles	Year-round

Visibility Analysis Results

Results of this analysis are graphically displayed on the visibility analysis maps provided in the attachment to the end of this report. As depicted on the visibility analysis maps, visibility appears to be limited to areas extending just beyond 0.5 mile of the Host Property. The proposed Facility would be visible above the tree canopy year-round over approximately 50± acres. When the leaves are off the trees, seasonal views through intervening tree mast and branches are anticipated to occur over 198± additional acres.

Year-round, partial views of the Facility appear to be limited to locations on and abutting the Host Property and extending to areas generally north, including portions of neighborhoods to the east and west along Tufts Drive and Deer Run Trail. The majority of views would be limited to those times of the year when the leaves are off the deciduous trees. Most views would be partially obstructed by intervening trees.

In general, the visibility of the proposed Facility would be minimized by the combination of its relatively low height and dense mature tree canopy found within the vicinity of the Host Property.

Proximity to Schools and Commercial Child Day Care Centers

No school or commercial child day care facilities are located within 250 feet of the Host Property. The nearest school (Lake Street Elementary School in Vernon) is located approximately 0.77 mile to the northeast. The nearest commercial child day care center (Indian Valley YMCA, Latchkey) is also located on Lake Street in Vernon, approximately 0.77 mile to the northeast. Neither of these locations would have views of the proposed Facility.

LIMITATIONS

The viewshed maps presented in the attachment to this report depict areas where the proposed Facility may potentially be visible to the human eye without the aid of magnification based on a viewer eye-height of 5 feet above the ground and intervening topography and an assumed tree canopy height of 65 feet. This analysis may not necessarily account for all visible locations, as it is based on the combination of computer modeling, incorporating 2012 aerial photographs, and in-field observations from publicly-accessible locations. No access to private properties was provided to APT personnel. This analysis does not claim to depict the only areas, or all locations, where visibility may occur; it is intended to provide a representation of those areas where the Facility is likely to be seen.

The simulations provide a representation of the Facility under similar settings as those encountered during the balloon floats and reconnaissance. Views of the Facility can change throughout the seasons and the time of day, and are dependent on weather and other atmospheric conditions (e.g., haze, fog, clouds); the location, angle and intensity of the sun; and the specific viewer location. Weather conditions on the day of the balloon floats included partly cloudy skies and, combined with the leaf-off conditions, the photo-simulations presented in this report provide an accurate portrayal of the Facility during comparable conditions.

ATTACHMENTS

PHOTO LOG

Legend

Site Year-Round Visibility

N W E S

200 100 0 200 Feet

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AMERICAN TOWER

at&t

EXISTING

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
1	**BRIDLE PATH LANE**	**WEST**	**+/- 0.30 MILE**	**YEAR ROUND**

ALL-POINTS TECHNOLOGY CORPORATION

AMERICAN TOWER CORPORATION

PROPOSED

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
1	**BRIDLE PATH LANE**	**WEST**	**+/- 0.30 MILE**	**YEAR ROUND**

ALL-POINTS TECHNOLOGY CORPORATION

AMERICAN TOWER CORPORATION

EXISTING

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
2	**LEO J LANE**	**SOUTHWEST**	**+/- 0.17 MILE**	**YEAR ROUND**

ALL-POINTS TECHNOLOGY CORPORATION

AMERICAN TOWER CORPORATION

PROPOSED

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
2	**LEO J LANE**	**SOUTHWEST**	**+/- 0.17 MILE**	**YEAR ROUND**

ALL-POINTS TECHNOLOGY CORPORATION

AMERICAN TOWER CORPORATION

EXISTING

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
3	**DEER RUN TRAIL**	**SOUTHWEST**	**+/- 0.18 MILE**	**YEAR ROUND**

ALL-POINTS TECHNOLOGY CORPORATION

AMERICAN TOWER CORPORATION

PROPOSED

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
3	**DEER RUN TRAIL**	**SOUTHWEST**	**+/- 0.18 MILE**	**YEAR ROUND**

ALL-POINTS TECHNOLOGY CORPORATION

AMERICAN TOWER CORPORATION

EXISTING

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
4	**DEER RUN TRAIL**	**SOUTHWEST**	**+/- 0.14 MILE**	**YEAR ROUND**

ALL-POINTS TECHNOLOGY CORPORATION

AMERICAN TOWER CORPORATION

PROPOSED

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
4	**DEER RUN TRAIL**	**SOUTHWEST**	**+/- 0.14 MILE**	**YEAR ROUND**

ALL-POINTS TECHNOLOGY CORPORATION

AMERICAN TOWER CORPORATION

EXISTING

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
5	**TUFTS DRIVE**	**SOUTHEAST**	**+/- 0.34 MILE**	**YEAR ROUND**

ALL-POINTS TECHNOLOGY CORPORATION

AMERICAN TOWER CORPORATION

PROPOSED

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
5	**TUFTS DRIVE**	**SOUTHEAST**	**+/- 0.34 MILE**	**YEAR ROUND**

ALL-POINTS TECHNOLOGY CORPORATION

AMERICAN TOWER CORPORATION

EXISTING

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
6	**TUFTS DRIVE**	**SOUTHEAST**	**+/- 0.39 MILE**	**YEAR ROUND**

ALL-POINTS TECHNOLOGY CORPORATION

AMERICAN TOWER CORPORATION

PROPOSED

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
6	**TUFTS DRIVE**	**SOUTHEAST**	**+/- 0.39 MILE**	**YEAR ROUND**

ALL-POINTS TECHNOLOGY CORPORATION

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EXISTING

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
7	**VERNON STREET AT MEADOWBROOK DRIVE**	**SOUTHEAST**	**+/- 0.55 MILE**	**YEAR ROUND**

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PROPOSED

PHOTO	LOCATION	ORIENTATION	DISTANCE TO SITE	VISIBILITY
7	**VERNON STREET AT MEADOWBROOK DRIVE**	**SOUTHEAST**	**+/- 0.55 MILE**	**YEAR ROUND**

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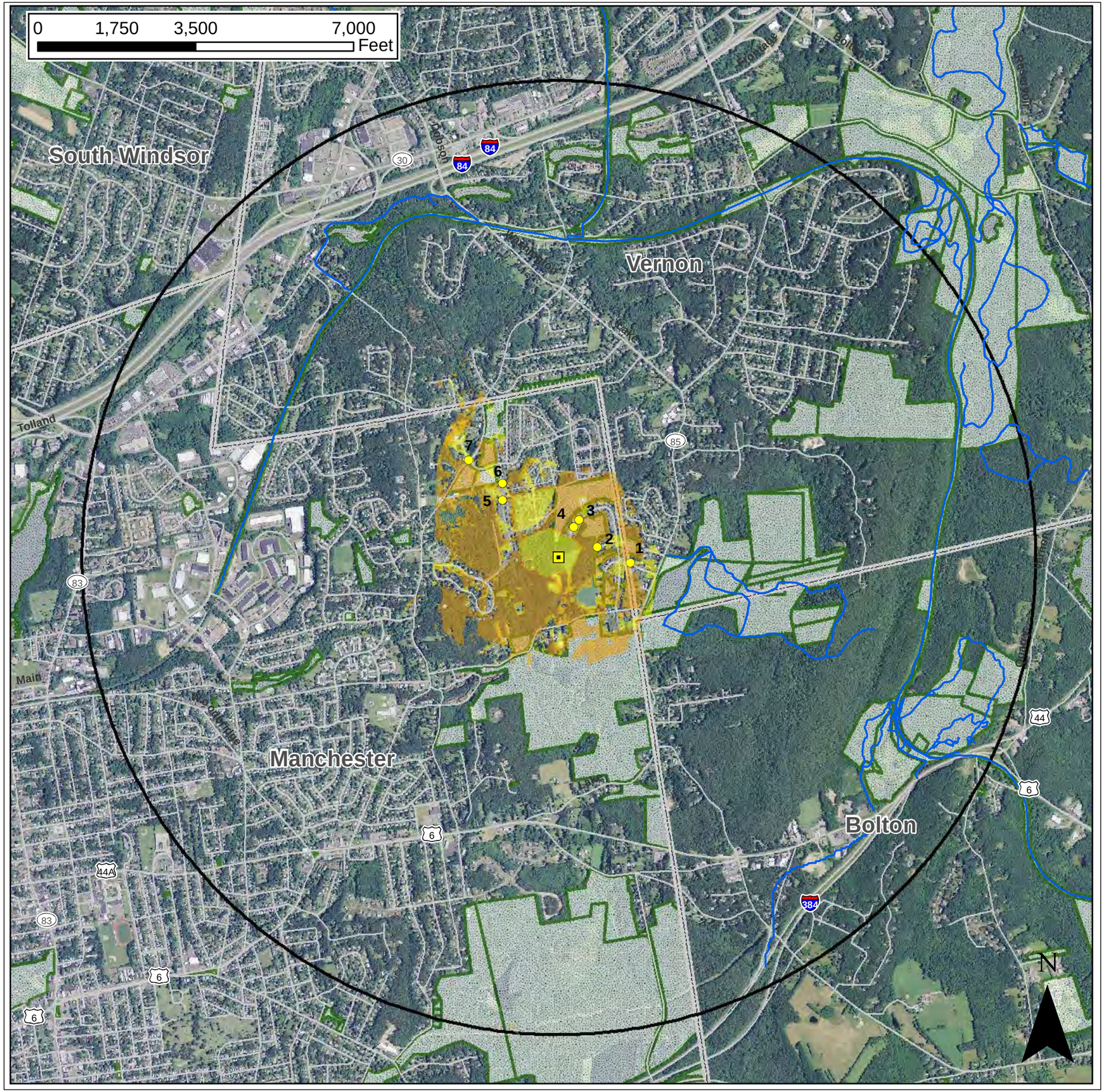
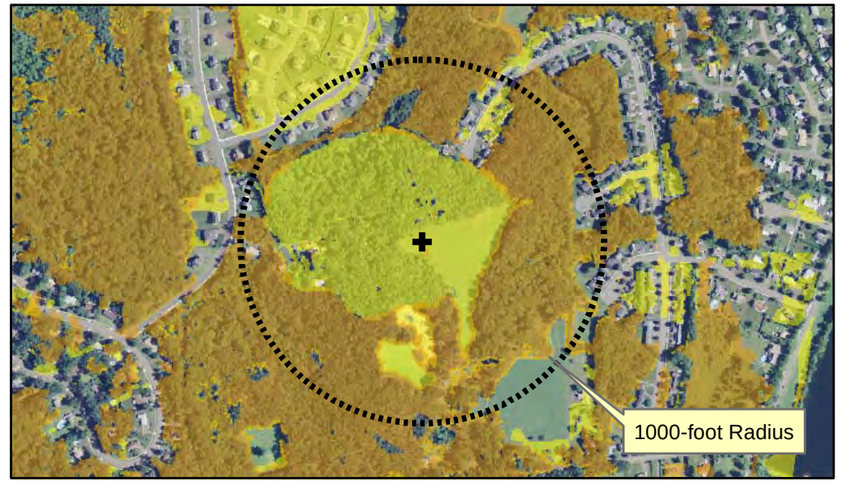




Viewshed Map – Aerial Base

Proposed Wireless Telecommunications Facility
S2020 – 701 Lydall Street, Manchester, CT

Proposed facility height is 104 feet AGL.
Existing tree canopy height estimated as 65 feet.
Study area encompasses a twp-mile radius and includes 8,042 acres of land.

Map compiled 7/16/2014

Map information field verified by APT on 6/17/2014.

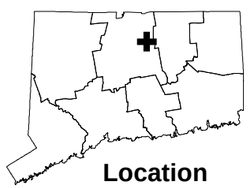
Only those resources located within the extent of the map are depicted. For a complete list of data sources consulted for this analysis, please refer to the Documentation Page.

Legend

- Proposed Tower

Photo Locations

- Year-round Views
- Trails
- Predicted Seasonal Visibility (198 Acres)
- Predicted Year-Round Visibility (50 Acres)
- Towns
- 2-Mile Study Area
- Open Space



Location

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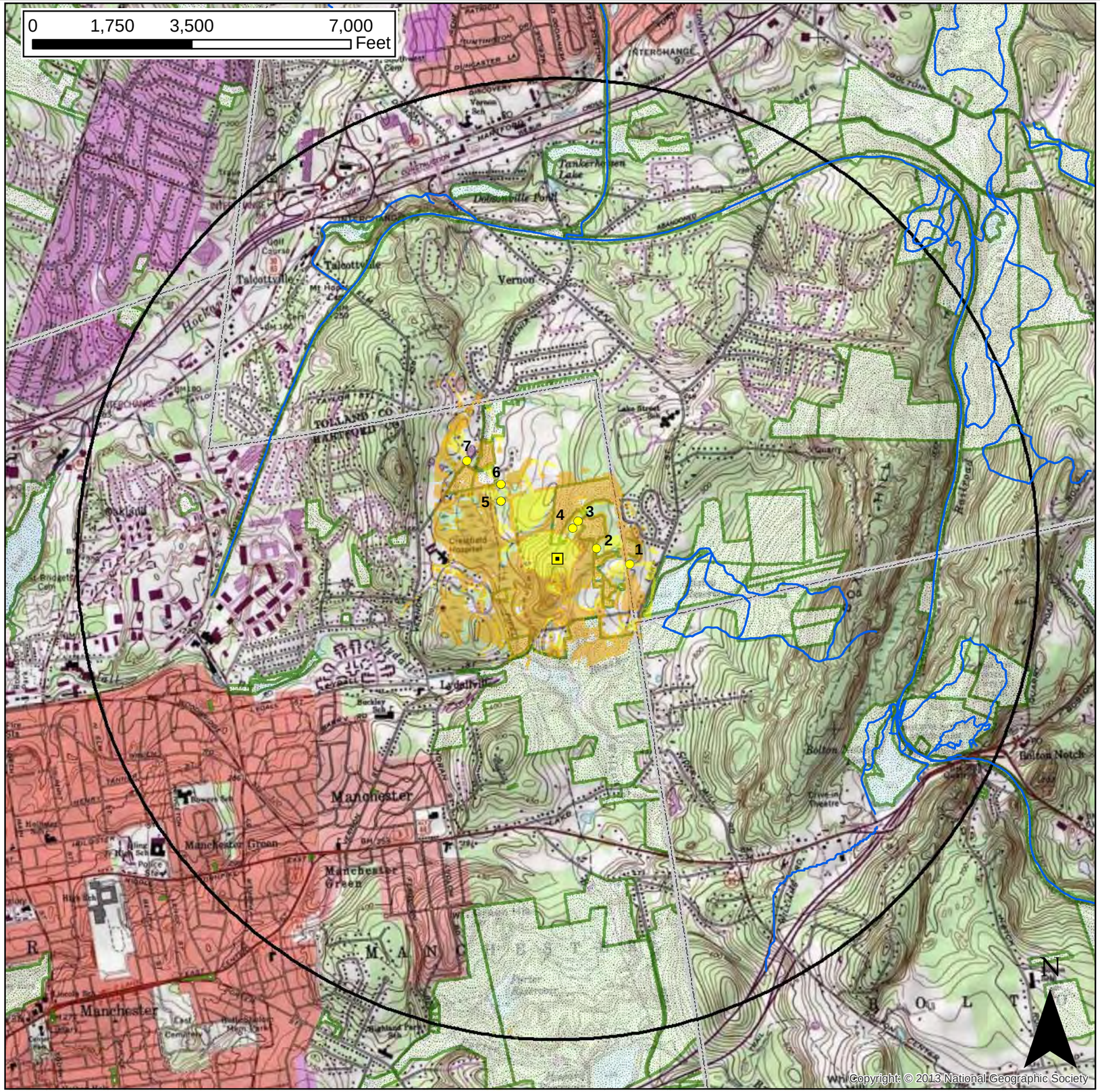

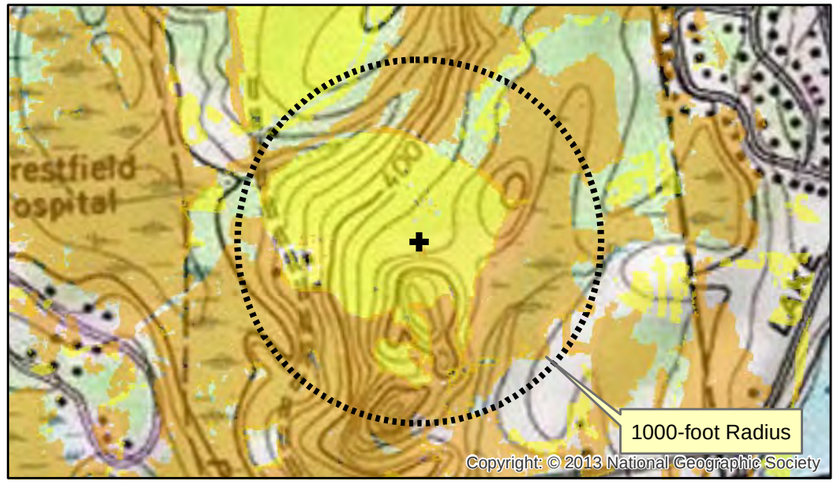

Viewshed Map – Topo Base

Proposed Wireless Telecommunications Facility
S2020 – 701 Lydall Street, Manchester, CT

Proposed facility height is 104 feet AGL.
Existing tree canopy height estimated as 65 feet.
Study area encompasses a twp-mile radius and includes 8,042 acres of land.

Map compiled 7/16/2014

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Photo Locations

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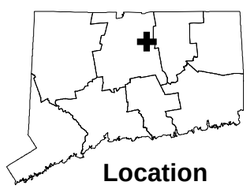

Location

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DOCUMENTATION

SOURCES CONSULTED FOR VIEWSHED MAPS
701 Lydall Street
Manchester, Connecticut

Physical Geography / Background Data

Center for Land Use Education and Research, University of Connecticut (http://clear.uconn.edu)
- *Land Use / Land Cover (2006)
- *Coniferous and Deciduous Forest (2006)
- *LiDAR data – topography (2000)

United States Geological Survey
- *USGS topographic quadrangle maps – Manchester/Rockville (1984)

National Resource Conservation Service
- *NAIP aerial photography (2012)

Department of Transportation data
- ^State Scenic Highways (updated monthly)

Heritage Consultants
- ^Municipal Scenic Roads

Cultural Resources

Heritage Consultants
- ^National Register
- ^ Local Survey Data

Dedicated Open Space & Recreation Areas

Connecticut Department of Energy and Environmental Protection (DEEP)
- *DEEP Property (May 2007)
- *Federal Open Space (1997)
- *Municipal and Private Open Space (1997)
- *DEEP Boat Launches (1994)

Connecticut Forest & Parks Association
- ^Connecticut Walk Book East – The Guide to the Blue-Blazed Hiking Trails of Western Connecticut, 19th Edition, 2006.

Other

- ^ConnDOT Scenic Strips (based on Department of Transportation data)

*Available to the public in GIS-compatible format (some require fees).
^ Data not available to general public in GIS format. Reviewed independently and, where applicable, GIS data later prepared specifically for this Study Area.

LIMITATIONS

The visibility analysis map(s) presented in this report depict areas where the proposed Facility may potentially be visible to the human eye without the aid of magnification based on a viewer eye-height of 5 feet above the ground and intervening topography and an assumed tree canopy height of 65 feet. This analysis may not necessarily account for all visible locations, as it is based on the combination of computer modeling, incorporating 2012 aerial photographs, and in-field observations from publicly-accessible locations. No access to private properties beyond the host Property was provided to APT personnel. This analysis does not claim to depict the only areas, or all locations, where visibility may occur; it is intended to provide a representation of those areas where the Facility is likely to be seen.

The photo-simulations in this report are provided for visual representation only. Actual visibility depends on various environmental conditions, including (but not necessarily limited to) weather, season, time of day, and viewer location.