## Visual Assessment \& Photo-Simulations

"DOCK SHOPPING CENTER" 200 EAST MAIN STREET REAR STRATFORD, CT

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Prepared for
Barrett Outdoor Communications, Inc.
TECHNOLOGY CORPORATION

## VISUAL ASSESSMENT \& PHOTO-SIMULATIONS

Barrett Outdoor Communications, Inc. ("Barrett") is seeking approval for the development of a relocated wireless communications facility (the "Facility") at 200 East Main Street, Rear in Stratford, Connecticut (the "Host Property"). At the request of Barrett, All-Points Technology Corporation, P.C. ("APT") completed this assessment to evaluate the potential visual effects of the proposed Facility from within a 2-mile radius (the "Study Area"). The Study Area includes portions of the neighboring municipality of Milford to the east. Interstate 95 ("I-95") bisects the Study Area in an east-west direction. The Housatonic River bisects the Study Area in a northsouth direction.

## Project Setting

The Host Property consists of a $\pm 4.37$-acre parcel located east of East Main Street, south of the Metro North rail line, north of I-95, and west of the Housatonic River. It is a cleared, primarily undeveloped parcel used as a boat storage yard associated with the Boardwalk Marina. Commercial development and the auto and rail transportation corridors dominate the surrounding area. Residential development is located to the north, northwest, and southwest beyond the commercial developments.

The topography within the Study Area consists of relatively level terrain. Ground elevations range from sea level in the southern portion of the Study Area along the Long Island Sound shoreline to approximately 160 feet above mean sea level ("AMSL") in its northwestern portion. Tree cover within the Study Area (consisting primarily of mixed deciduous hardwoods) occupies approximately 1,599 acres (or $\pm 19.88 \%$ ) of the 8,042-acre Study Area. Open water over Long Island Sound and the Housatonic River occupies approximately 927 acres ( $\pm 11.53 \%$ ) of the Study Area.

## Project Undertaking

Barrett plans to construct the proposed Facility on the north central portion of the Host Property (the "Site"). The proposed Facility would be located at a ground elevation of approximately 12.3 feet AMSL and include a 125 -foot tall monopole with an omni-directional whip antenna extending to a height of 145 ' above ground level ("AGL") and associated ground equipment on a raised steel platform within an irregularly shaped $\pm 4,650$-square foot fenced compound. Access to the Site would be gained over the existing paved driveway and parking lot associated with the boatyard. Please refer to the current Site Drawings prepared by APT, dated October 7, 2021, and provided under separate cover, for details regarding the proposed installation.

## Methodology

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

## Preliminary Computer Modeling

To conduct this assessment, a predictive computer model was developed specifically for this project using ESRI's ArcMap GIS ${ }^{1}$ software and available GIS data. The predictive model incorporates Project and Study Area-specific data, including the Site location, its ground elevation and the proposed Facility height, as well as the surrounding topography, existing vegetation, and structures (the primary features that can block direct lines of sight).

A digital surface model ("DSM"), capturing both the natural and built features on the Earth's surface, was generated for the extent of the Study Area utilizing State of Connecticut 2016 LiDAR $^{2}$ LAS ${ }^{3}$ data points. LiDAR is a remote-sensing technology that develops elevation data by measuring the time it takes for laser light to return from the surface to the instrument's sensors. The varying reflectivity of objects also means that the "returns" can be classified based on the characteristics of the reflected light, normally into categories such as "bare earth," "vegetation," "road," "surface water" or "building." Derived from the 2016 LiDAR data, the LAS datasets contain the corresponding elevation point data and return classification values. The Study Area DSM incorporates the first return LAS dataset values that are associated with the highest feature in the landscape, typically a treetop, top of a building, and/or the highest point of other tall structures.

Once the DSM was generated, ESRI's Viewshed Tool was utilized to identify locations within the Study Area where the proposed Facility may be visible. ESRI's Viewshed Tool predicts visibility by identifying those cells ${ }^{4}$ within the DSM that can be seen from an observer location. Cells where visibility was indicated were extracted and converted from a raster dataset to a polygon

[^0]feature which was then overlaid onto aerial photograph and topographic base maps. Since the DSM includes the highest relative feature in the landscape, isolated "visible" cells are often indicated within heavily forested areas (e.g., from the top of the highest tree) or on building rooftops during the initial processing. It is recognized that these areas do not represent typical viewer locations and overstate visibility. As such, the resulting polygon feature is further refined by extracting those areas. The viewshed results are also cross-checked against the most current aerial photographs to assess whether significant changes (a new housing development, for example) have occurred since the time the LiDAR-based LAS datasets were captured.

The results of the preliminary analysis are intended to provide a representation of those areas where portions of the Facility may potentially be visible to the human eye without the aid of magnification, based on a viewer eye-height of five (5) feet above the ground and the combination of intervening topography, trees and other vegetation, and structures. However, the Facility may not necessarily be visible from all locations within those areas identified by the predictive model, which has its limitations. For instance, the computer model cannot account for mass density, tree diameters and branching variability of trees, or the degradation of views that occurs with distance. As a result, some areas depicted on the viewshed maps as theoretically offering potential visibility of the Facility may be over-predictive because the quality of those views is not sufficient for the human eye to recognize the Facility or discriminate it from other surrounding or intervening objects.

## Seasonal Visibility

Visibility also varies seasonally with increased, albeit obstructed, views occurring during "leafoff" conditions. Beyond the variabilities associated with density of woodland stands found within any given Study Area, each individual tree also has its own unique trunk, pole timber and branching patterns that provide varying degrees of screening in leafless conditions which, as introduced above, cannot be precisely modeled. Seasonal visibility is therefore estimated based on a combination of factors including the type, size, and density of trees within a given area; topographic constraints; and other visual obstructions that may be present. Taking into account these considerations, areas depicting seasonal visibility on the viewshed maps are intended to represent locations from where there is a potential for views through intervening trees, as opposed to indicating that leaf-off views will exist from within an entire seasonally-shaded area.

## Crane Test and Field Reconnaissance

To supplement and fine tune the results of the computer modeling efforts, APT completed infield verification activities consisting of a crane test, vehicular and pedestrian reconnaissance, and photo-documentation. The crane test and field reconnaissance were completed on March 23, 2021. The field activities consisted of positioning a crane at the proposed Facility location
and extending the crane boom with a brightly-colored flag to a height of $\pm 135$ feet AGL. ${ }^{5}$ This provided a fixed object unaffected by the wind. Weather conditions were favorable for the infield activities with mostly clear skies.

APT conducted a Study Area reconnaissance by driving along local and State roads and other publicly accessible locations to document and inventory where the flag could be seen above and through the tree canopy and other visual obstructions. 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.

## Photographic Documentation and Simulations

During the Study Area reconnaissance, APT obtained photo-documentation of representative locations where the crane boom and flag were - and were 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 ${ }^{6}$ and Canon EF 24 to 105 millimeter ("mm") zoom lens. APT typically uses a standard focal length of 50 mm to present a consistent field of view. On occasion, photos are taken at lower focal lengths to provide a greater depth of field and to provide context to the scene by including surrounding features within the photograph. During this evaluation, two (2) photographs were taken at a 24 mm focal length and four (4) photographs were taken at a 35 mm focal length as noted in Table 1 - Photo Locations.

Photographic simulations were generated to portray scaled renderings of the proposed Facility from 22 locations presented herein where the Facility may be recognizable above or through the trees. Using field data, site plan information and 3-dimensional (3D) modeling software, spatially referenced models of the Site 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, which were ultimately composited and merged with the existing conditions photographs (using Adobe Photoshop image editing software). The scale of the subjects in the photograph (the crane boom/flag) and the corresponding simulation (the Facility) is proportional to their surroundings.

For presentation purposes in this report, the photographs were produced in an approximate 7inch by 10.5 -inch format. When reproducing the images in this format size, we believe it is

[^1]important to present the largest view while providing key contextual landscape elements (existing developments, street signs, utility poles, etc.) so that the viewer can determine the proportionate scale of each object within the scene. Photo-documentation of the field reconnaissance and photo-simulations of the proposed Facility are presented in the attachment at the end of this report. The field reconnaissance photos include the crane boom in the view to provide visual reference points for the approximate height and location of the proposed Facility relative to the scene. All simulations were created to represent the proposed 125 -foot-tall monopole and antennas (extending to a top height of $145^{\prime}$ AGL). The photo-simulations are intended to provide the reader with a general understanding of the different view characteristics associated with the Facility from various locations. Photographs were taken from publicly accessible areas and unobstructed view lines were chosen wherever possible.

Table 1 - Photo Locations summarizes the photographs and simulations presented in the attachment to this report, and includes a description of each location, view orientation, distance from where the photo was taken relative to the Site, and the general characteristics of the view. The photo locations are depicted on the photolog and viewshed maps provided as attachments to this report.

Table 1 - Photo Locations

| Photo | Location | Orientation | Distance <br> to Site | Visibility |
| :---: | :---: | :---: | :---: | :---: |
| 1 | Brookside Drive** | Southeast | $\pm 0.45$ Mile | Not Visible |
| 2 | Bittersweet Lane | Southeast | $\pm 0.36$ Mile | Not Visible |
| 3 | Platt Street | Southeast | $\pm 0.28$ Mile | Seasonal |
| 4 | Avery Street | Southeast | $\pm 0.26$ Mile | Year Round |
| 5 | Laughlin Road | Southeast | $\pm 0.35$ Mile | Seasonal |
| 6 | Patterson Avenue | East | $\pm 0.34$ Mile | Year Round |
| 7 | Patterson Avenue | East | $\pm 0.46$ Mile | Seasonal |
| 8 | Frog Pond Lane | East | $\pm 0.32$ Mile | Year Round |
| 9 | Stop \& Shop Parking Lot - Adjacent to | East | $\pm 0.10$ Mile | Year Round |
| 10 | Host Property** | Joey C's Boathouse Cantina \& Grill - |  |  |
| Adjacent to Host Property |  |  |  |  |
| East Main Street | Northwest | $\pm 490$ Feet | Year Round |  |
| 11 | Northeast | $\pm 0.26$ Mile | Year Round |  |
| *Photograph was taken at 24 mm focal length. <br> **Photograph was taken at 35 mm focal length. |  |  |  |  |

Table 1 - Photo Locations Continued

| Photo | Location | Orientation | Distance to Site | Visibility |
| :---: | :---: | :---: | :---: | :---: |
| 12 | Barnum Avenue Cutoff** | North | $\pm 0.25$ Mile | Year Round |
| 13 | Bridgeport Avenue - Milford | Northwest | $\pm 0.32$ Mile | Year Round |
| 14 | Bridgeport Avenue - Milford | Northwest | $\pm 0.45$ Mile | Year Round |
| 15 | Riverside Drive - Milford | Northwest | $\pm 0.38$ Mile | Year Round |
| 16 | Riverside Drive at Sachem Street Milford | West | $\pm 0.35$ Mile | Seasonal |
| 17 | Spring Street at Bridgeport Avenue Milford* | Northwest | $\pm 0.53$ Mile | Not Visible |
| 18 | Crescent Drive - Milford | Northwest | $\pm 0.48$ Mile | Year Round |
| 19 | Edgemont Road - Milford | Northwest | $\pm 0.61$ Mile | Year Round |
| 20 | Housatonic Drive - Milford | Northwest | $\pm 0.66$ Mile | Not Visible |
| 21 | Cowles Street at Strathmore Avenue Milford | West | $\pm 0.82$ Mile | Not Visible |
| 22 | Elbon Street - Milford | West | $\pm 0.65$ Mile | Year Round |
| 23 | Housatonic River State Boat Launch Milford | West | $\pm 0.28$ Mile | Year Round |
| 24 | Naugatuck Avenue - Milford | Southwest | $\pm 0.50$ Mile | Seasonal |
| 25 | West Avenue at Naugatuck Avenue Milford | Southwest | $\pm 0.58$ Mile | Not Visible |
| 26 | Naugatuck Avenue - Milford | Southwest | $\pm 0.92$ Mile | Not Visible |
| 27 | Oronoque Road - Milford | Southwest | $\pm 1.34$ Miles | Not Visible |
| 28 | Bronson Drive at Bridgeview Place* | South | $\pm$ 1.14 Miles | Not Visible |
| 29 | Highland Avenue** | Southeast | $\pm 1.34$ Miles | Not Visible |
| 30 | Glendale Road at Charlton Street, Long Brook Park | East | $\pm 0.69$ Mile | Not Visible |
| 31 | North Avenue | East | $\pm$ 1.27 Miles | Not Visible |
| 32 | Main Street | Northeast | $\pm 1.01$ Miles | Not Visible |
| 33 | LA Fitness - Parking Lot | Northeast | $\pm 0.77$ Mile | Year Round |
| 34 | Ferry Boulevard | Northeast | $\pm 0.91$ Mile | Not Visible |
| 35 | Bond's Dock | Northeast | $\pm 1.33$ Miles | Seasonal |
| 36 | Birdseye Street Boat Launch | Northeast | $\pm$ 1.77 Miles | Year Round |
| 37 | Milford Point Road - Milford | Northwest | $\pm 2.00$ Miles | Not Visible |
| *Photograph was taken at 24 mm focal length. **Photograph was taken at 35 mm focal length. |  |  |  |  |

## Final Visibility Mapping

Information obtained during the field reconnaissance was incorporated into the mapping data layers, including observations of the field reconnaissance, the photograph locations, areas that experienced recent land use changes and those places where the initial model was found to over or under-predict visibility. Once the additional data was integrated into the model, APT recalculated the visibility of the proposed Facility within the Study Area.

## Conclusions

As presented on the attached viewshed maps, views of the Facility would be limited primarily to the commercial areas immediately surrounding the Site, along I-95 within $\pm 0.5$ to $\pm 0.75$ mile of the Facility, and over open water and marshland to the north and south. Photo locations 9 and 10 depict representative year-round views from the nearest areas, at distances ranging from approximately 490 feet to 0.10 mile away. Photo locations 11,12 , and 13 depict representative year-round views from commercial areas slightly farther from the Site, at distances ranging from approximately 0.25 to 0.32 mile away. The nearest residential areas with views are represented in photo locations 4 and 6 , over 0.25 mile away.

Seasonally, when the leaves are off the deciduous trees, additional areas of obstructed visibility are predicted in the area surrounding the Facility and extending up to approximately 1.76 mile from the Site in the commercial development and residential area to the north and west of the Site, on the western shore of the Housatonic River north of the Site, and on the eastern shore of the Housatonic River south of the Site.

Predicted year-round visibility of the proposed Facility is estimated to include approximately 1,244 acres, of which $\pm 1,168$ acres occur over open water and the tidal wetlands associated with the mouth of the Housatonic River. Predicted seasonal visibility is estimated to include an additional $\pm 197$ acres. Collectively, the total acreage of visibility represents $\pm 17.9$ percent of the Study Area.

The maps provided as attachments to this report depict the areas of predicted visibility, but they do not address the character of those potential views. As shown in the photographs where the Site is visible, the surrounding area contains infrastructure associated with the rail line, raised sections of I-95, and electric transmission structures taller than the proposed tower, as well as large tracts of retail and commercial development.

## Proximity to Schools And Commercial Child Day Care Centers

No schools or commercial day care centers are located within 250 feet of the proposed Facility. Wilcoxson Elementary School is located approximately 0.52 -mile northwest of the Site at 600 Wilcoxson Avenue in Stratford. No visibility is predicted from the school grounds. The nearest commercial child care center is Mama $\mathrm{N}^{\prime}$ Cubs Playschool, LLC approximately 0.54 mile to the southeast of the Site at 604 Naugatuck Avenue in Milford. No visibility is predicted from or in the vicinity of the day care center.

## 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 five (5) feet above the ground and intervening topography, tree canopy, and structures. This analysis may not account for all visible locations, as it is based on the combination of computer modeling, incorporating 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 photo-simulations provide a representation of the Facility under similar settings as those encountered during the field review 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 field review included partly cloudy skies.

## ATTACHMENTS





| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 2 | BITTERSWEET LANE | SOUTHEAST | +/- 0.36 MILE | NOT VISIBLE |




Finlifints B) BARRETT OUTDOOR


| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 4 | AVERY STREET | SOUTHEAST | $+/-0.26$ MILE | YEAR ROUND |



| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| $\mathbf{4}$ | AVERY STREET | SOUTHEAST | $+/-\mathbf{0 . 2 6 ~ M I L E ~}$ | YEAR ROUND |














©RANEATIT35"

| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBIIITY |
| :---: | :---: | :---: | :---: | :---: |
| 11 | EAST MAIN STREET | NORTHEAST | +/- 0.26 MILE | YEAR ROUND |



MONOPOLE DEPICTEDAT $125^{\circ}$
PROPOSED

| DISTANCE TO SITE | VISIBILITY |
| :---: | :---: |
| +/- 0.26 MILE | YEAR ROUND |








EXISTING
CRANEAT 735

| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 14 | BRIDGEPORT AVENUE - MILFORD | NORTHWEST | +/- 0.45 MILE | YEAR ROUND |

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BARRETT OUTDOOR











$\frac{\text { ALLL-POINTS }}{\text { TECHNOLOGY CORPORATION }}$
BARRETT OUTDOOR


| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| $\mathbf{2 1}$ | COWLES STREET AT STRATHMORE AVENUE - MILFORD | WEST | $+/-\mathbf{0 . 8 2}$ MILE | NOT VISIBLE |








EXISTING
©RANEAT $035^{\circ}$

| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 24 | NAUGATUCK AVENUE - MILFORD | SOUTHWEST | +/- 0.50 MILE | SEASONAL |



\footnotetext{


PROPOSED

| PHOTO | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| 24 | NAUGATUCK AVENUE - MILFORD | SOUTHWEST | +/- 0.50 MILE | SEASONAL |



|  |  |  |  |  |
| :---: | :---: | :---: | :---: | :---: |
| PHOTO | LOCATION | ORIENTATION | DISTANCETO SITE | VISIBILITY |
| $\mathbf{2 5}$ | WEST AVENUE AT NAUGATUCK AVENUE - MILFORD | SOUTHWEST | $+/-\mathbf{0 . 5 8}$ MILE | NOT VISIBLE |



| РНОТО | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| $\mathbf{2 6}$ | NAUGATUCK AVENUE - MILFORD | SOUTHWEST | $+/-\mathbf{0 . 9 2}$ MILE | NOT VISIBLE |









EXISTING
©RANEAT $135^{\circ}$

| РНОТО | LOCATION | ORIENTATION | DISTANCE TO SITE | VISIBILITY |
| :---: | :---: | :---: | :---: | :---: |
| $\mathbf{3 3}$ | LA FITNESS - PARKING LOT | NORTHEAST | $+/-\mathbf{0 . 7 7}$ MILE | YEAR ROUND |

BARRETT OUTDOOR











[^0]:    ${ }^{1}$ ArcMap is a Geographic Information System desktop application developed by the Environmental Systems Research Institute for creating maps, performing spatial analysis, and managing geographic data.
    ${ }^{2}$ Light Detection and Ranging
    ${ }^{3}$ An LAS file is an industry-standard binary format for storing airborne LiDAR data.
    ${ }^{4}$ Each DSM cell size is 1 square meter.

[^1]:    5 The originally proposed height of the monopole was 135 feet and subsequently reduced 10 feet.
    6 The Canon EOS 6D is a full-framed camera which includes a lens receptor of the same size as the film used in 35 mm cameras. As such, the images produced are comparable to those taken with a conventional 35 mm camera.

