Proposed Charles County Compressor Station:

Catastrophic Fire Potential - Mount Vernon Visibility Assessment

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Prepared by:

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Methodology

Best Available Data

Lidar point clouds represent the best available elevation data in Charles and Prince George's Counties. These datasets contain millions of points that include a latitude, longitude, and elevation and can be processed into a number of high-resolution, high-accuracy derivative datasets, including a "bare-earth" digital elevation model (DEM), representing the elevation with all natural and anthropogenic features removed, and a "first-return" digital surface model (DSM), representing the tops of trees and buildings as well as open ground.

The area around the proposed project has lidar data available that was collected in winter 2014. Lidar data takes into account small changes in topography, as well as natural and man-made features, which can have dramatic impacts on visibility. Additionally, because this data was flown in winter, it provides a "leaf-off" dataset, which will show a more conservative tree canopy and could be considered "maximum visibility" conditions. While it is unlikely that there will be conditions increasing the visibility of the landscape in existing conditions, visibility can be expected to be reduced during other seasons where tree canopy plays a larger role in screening development from Mount Vernon.

Using this elevation data allows for the creation of 1m resolution datasets that reflect the actual heights of trees and buildings, as opposed to estimated heights, providing a more representative elevation model.

Technical Methodology

In preparation for the analysis, two layers were created from the lidar elevation data, a digital elevation model (DEM), representing bare-earth conditions, and a digital surface model (DSM), representing the maximum elevation of features on the ground, using Esri's ArcGIS software.

- *DEM* - To create the DEM, a classified Lidar point cloud was filtered to only include ground points, which excludes all points classified as vegetation, buildings, water, bridge decks, or power lines as well as unclassified points. The remaining points were converted into a 1-meter resolution raster elevation surface with the elevation derived from the mean value of all Lidar points within each pixel.
- *DSM* – To create the DSM, all points in the Lidar point cloud were used to create a 1-meter resolution raster elevation surface. Elevation values were derived from the maximum elevation value in each pixel.

It should be noted that this model does not determine the likely extent of a forest fire caused by an explosion at the proposed compressor station; that analysis is outside of the scope of this project.

Instead, this model displays the potential visual impacts of a catastrophic forest fire on the surrounding landscape to show the maximum potential effect on the landscape. Assumptions built into the model include: all trees were cleared from the landscape on privately owned land, even if that land has an easement; buildings were left in place as determined by the Charles and Prince George's County building footprint layers; and trees were left on publicly owned lands, assuming that even if they burned down, they would be replanted.

For the purposes of this analysis, elevations on privately owned lands, outside of building footprints, were set to the DEM elevation. Elevation on publicly owned lands and inside building footprints were set to the DSM elevations. These two datasets were combined to create a new "burned conditions" elevation dataset, which was used for all visibility modeling.

To compare visibility of the landscape in pre- and post-burn conditions, the Visibility tool in ArcGIS Pro 2.1 was used to evaluate the visibility from twenty-two locations around Mount Vernon's East Lawn. Observer elevations were offset 5ft above ground level at each point and two visibility analyses were run, one on the original DSM and one on the modified "burned conditions" dataset. The outputs of each analysis were compared to determine which landscapes are visible during existing conditions and which landscapes would become visible without tree cover on the landscape due to a catastrophic fire.

To determine the visibility of buildings throughout the landscape, the zonal statistics tool was used to calculate the total number of pixels within each building's footprint that were considered "visible." A building was counted if it had at least 10 pixels that were classified as visible to minimize the impact of noise in the elevation data or locations where only a small portion of a building was visible. The building visibility layers for the two elevation datasets were also compared to identify the buildings that are not currently visible but would become visible in a post-fire landscape. Buildings that were marked as visible in the existing conditions model were compared to a panoramic image of the viewshed collected in 2013 and were found to match.

Considerations and Limitations

One of the largest considerations that must be taken into account is that this analysis represents the maximum impact that could be considered and does not represent the likely coverage of a forest fire based on landscape conditions and commonly used forest fire models. Additionally, this model assumes that all trees will be removed by fire and there will be no replanting on privately owned land, which is an unlikely scenario. Finally, the model maintains existing building footprints in a post-fire setting where the buildings would likely also be impacted by the fire. It should also be noted that the lidar data was collected in 2014 and there is the potential for trees to have grown or been cut down, and some landscapes may have been cleared and developed. All of these events could have an impact on the visibility of the landscape and this analysis should be considered a best representation of the impacts in a worst case scenario.

Findings

It was determined that a catastrophic forest fire would substantially increase the visibility of the landscape and a number of buildings that are currently screened by trees in Prince George's and Charles Counties, Maryland (Figure 2, Attachment A).

Visual impacts are distributed throughout the landscape, but the increase in building visibility would be most noticeable in areas where development is concentrated, particularly in the Strawberry Hills subdivision, the neighborhood reached by Old Marshall Hall Road, and the neighborhood between Bryan Point Rd and Old Marshall Hall Road (Attachments B, C, and D).

These landscapes are located at the top of bluffs where there are small differences in elevation and buildings are primarily screened by the fronting rows of trees at the tops of the bluffs. If a catastrophic fire were to remove all of the trees from the landscape, however, large portions of the previously screened area would be exposed including the vast majority of buildings that are built on the tops of these hills (Attachments E, F, and G).

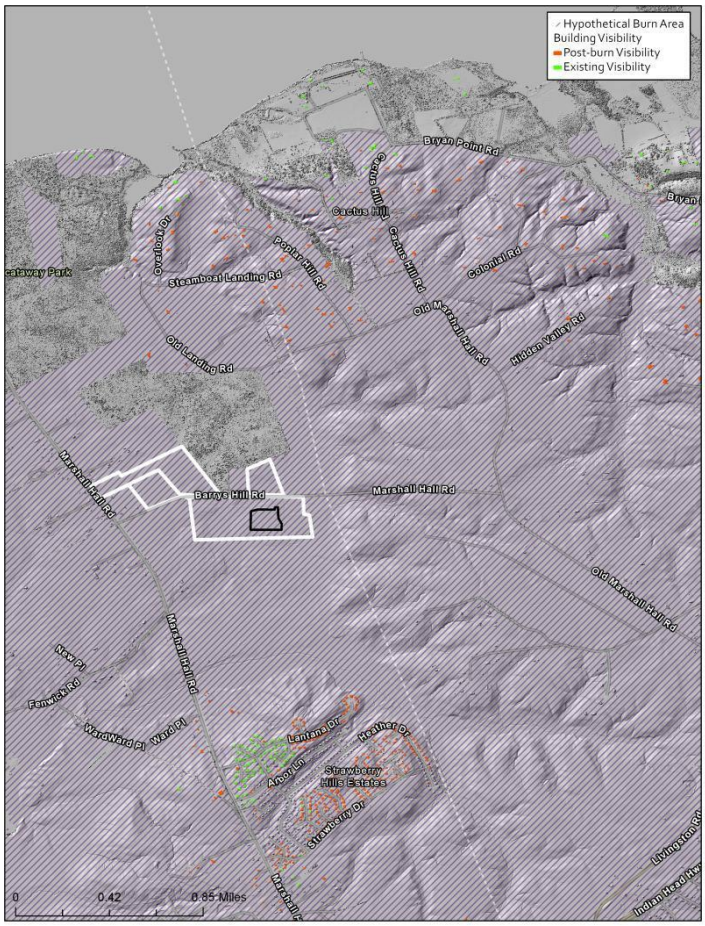
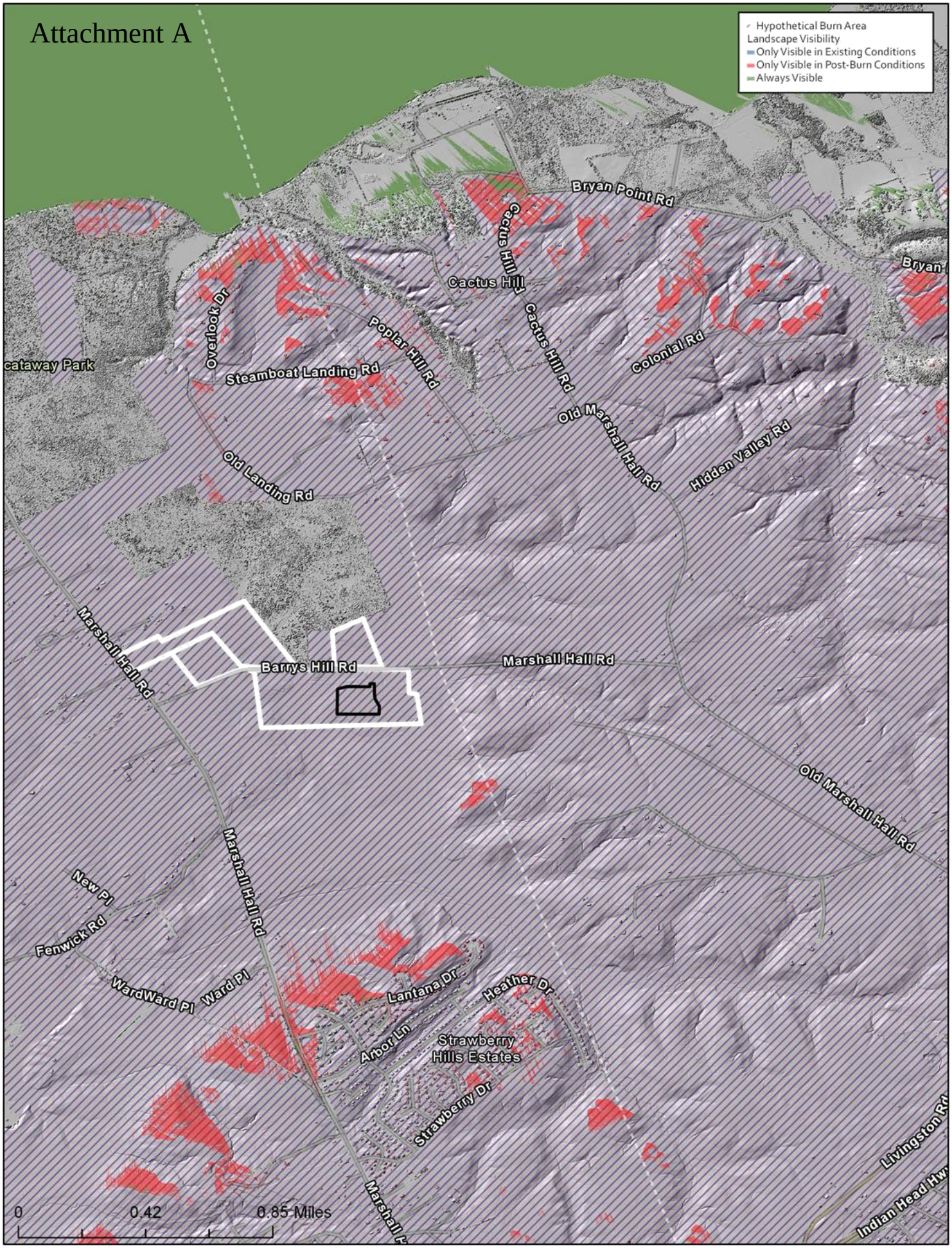


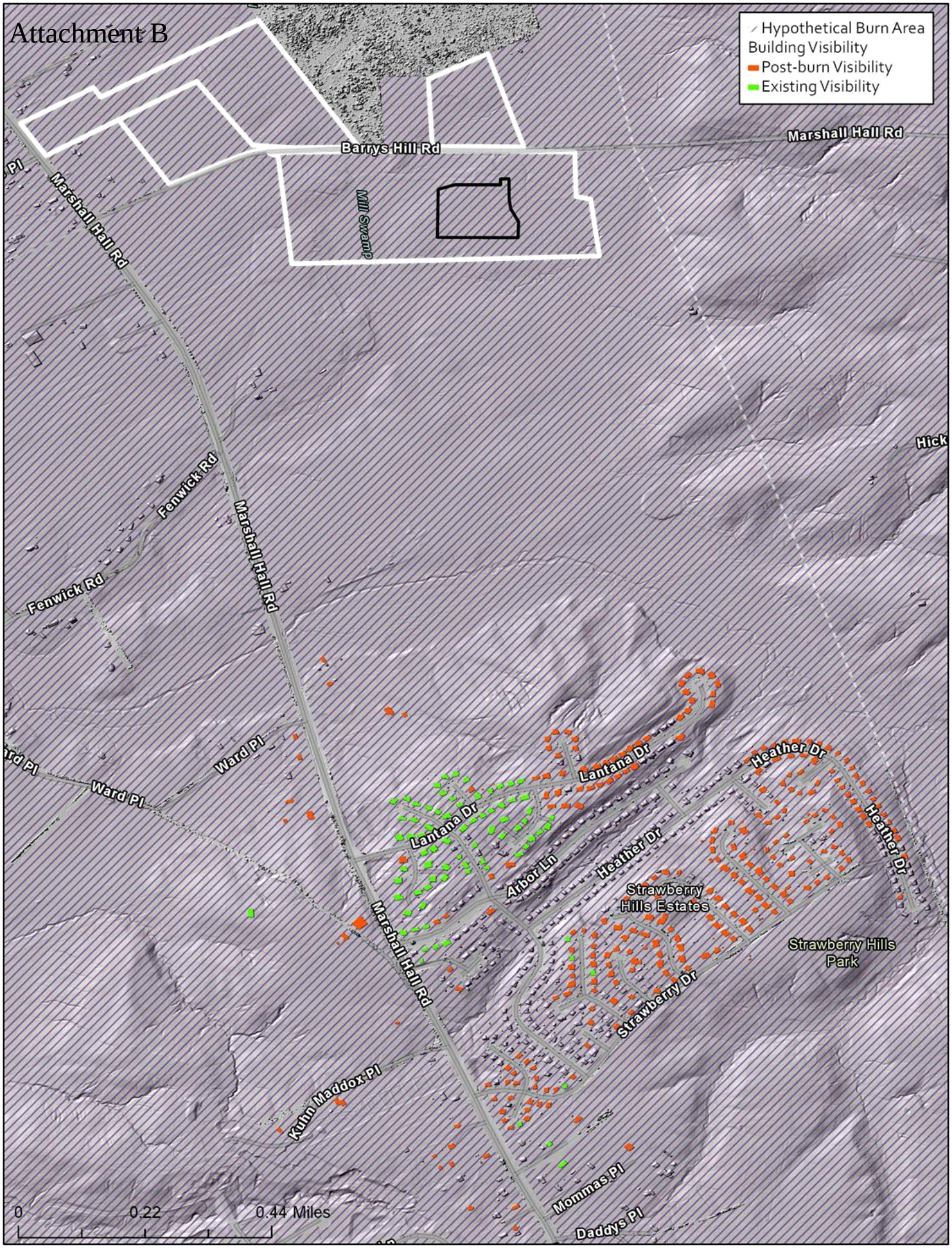
Figure 2: Map showing hypothetical burned areas and the increased visibility of buildings (red) as a result

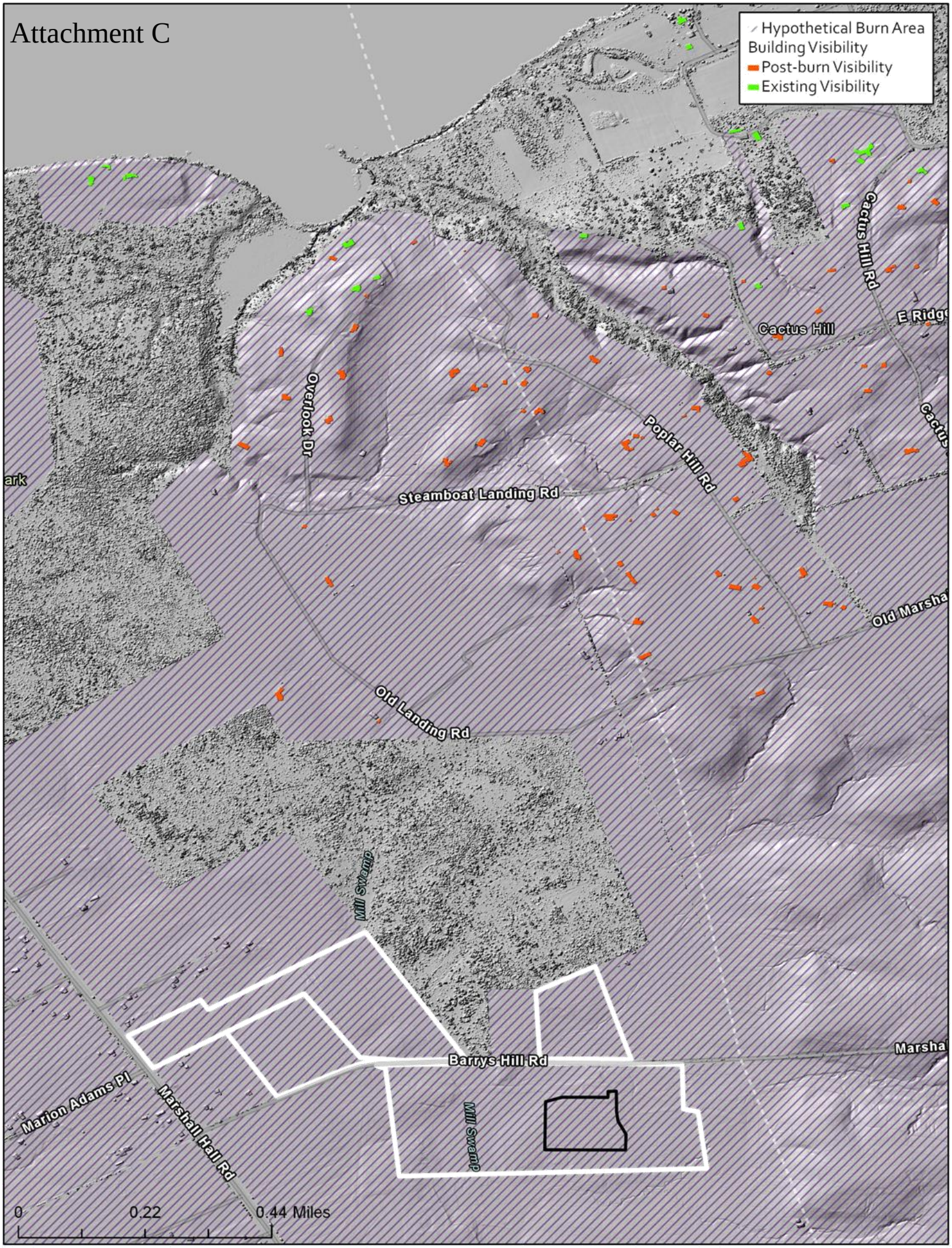
The proximity of the proposed compressor station to the Strawberry Hills subdivision and the neighborhood off Old Marshall Hall Road may also increase the likelihood that these landscapes could be impacted by a fire. However, a proper forest fire model will need to be completed to determine how likely it would be for a fire to reach these landscapes.

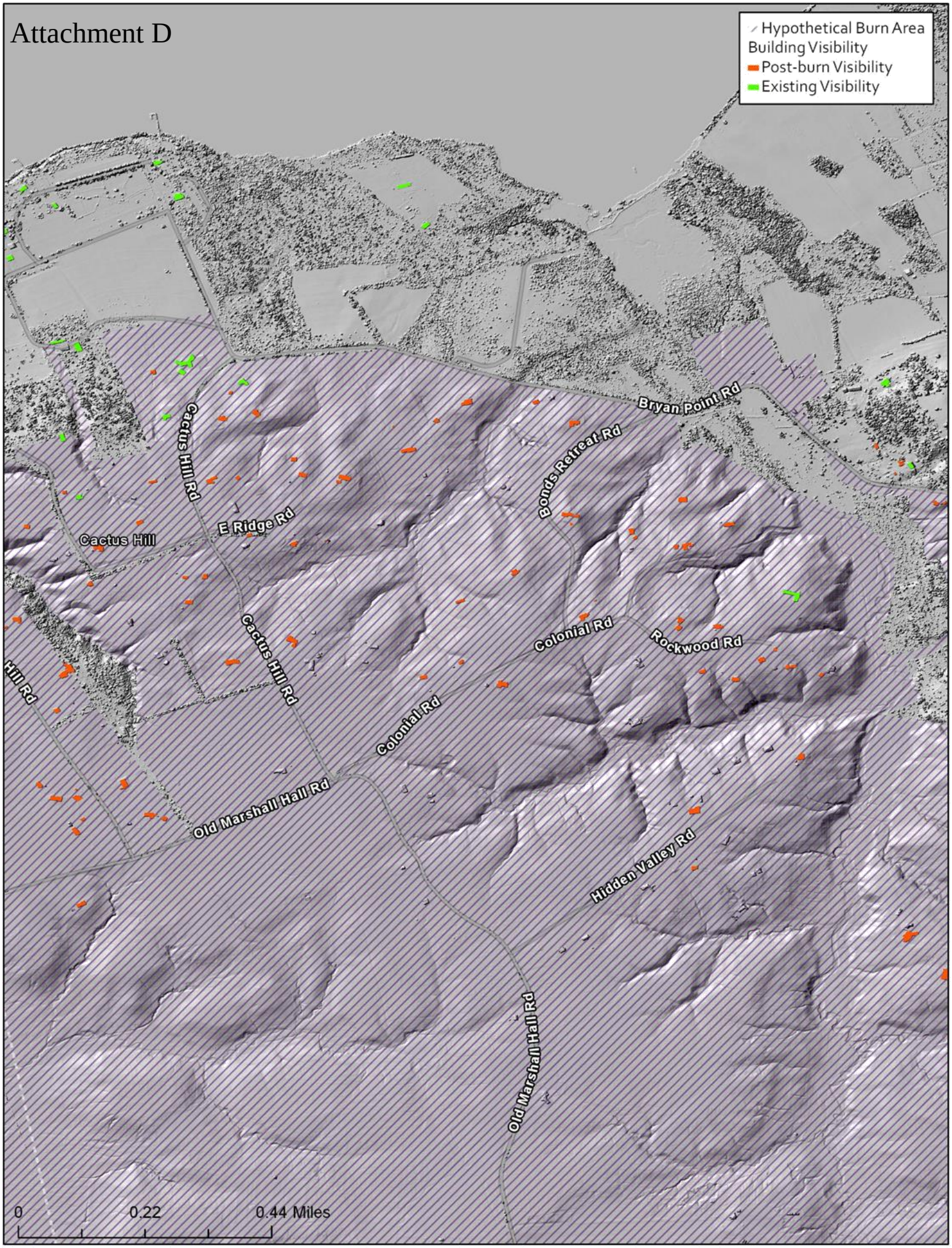
In conclusion, a catastrophic forest fire that led to the removal of trees on privately owned land in the vicinity of the proposed compressor station would result in a substantial increase in the visibility of buildings from Mount Vernon due to a combination of the region's underlying topography and concentrations of existing development in particularly visible areas.

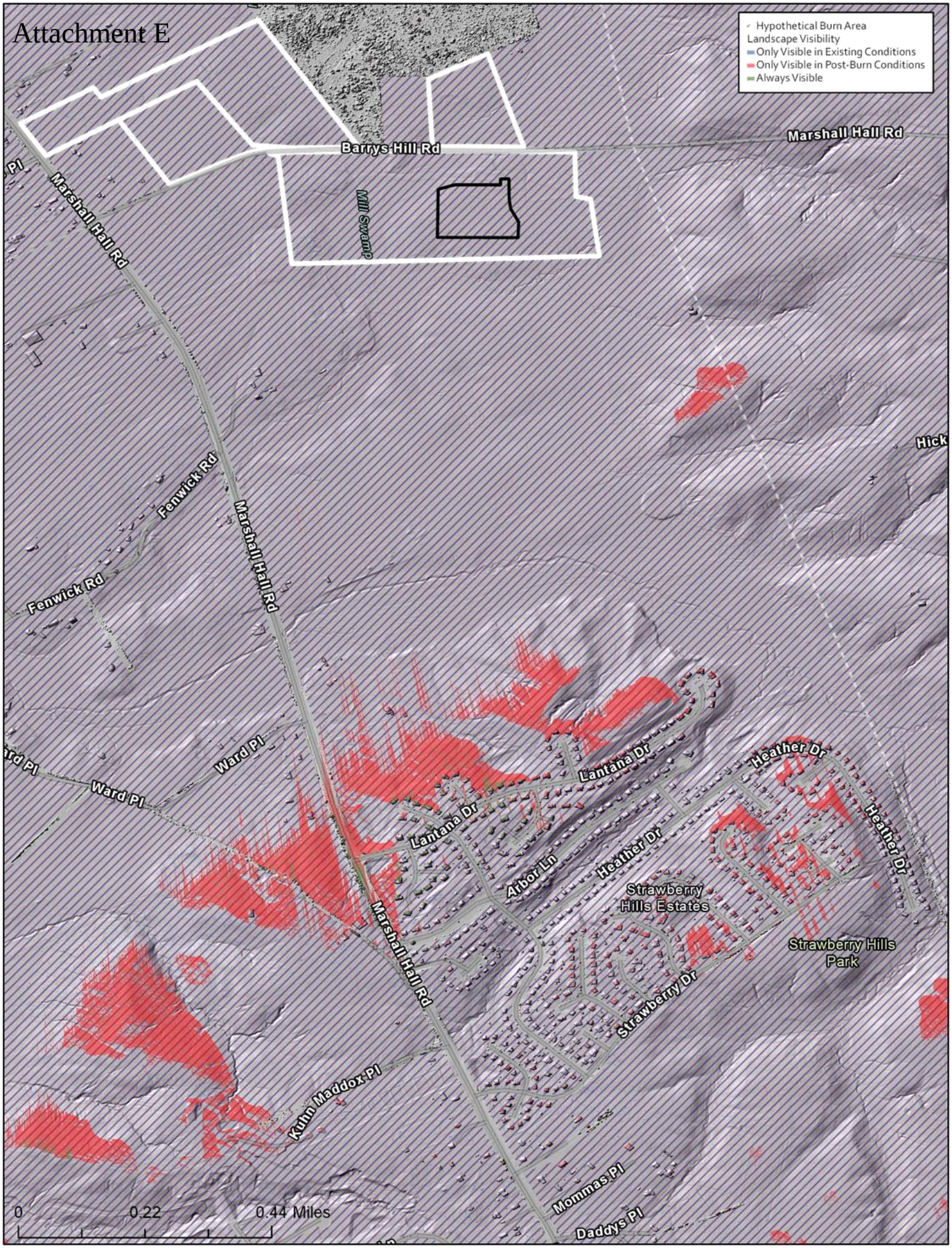
Requiring reforestation along the front of bluffs could significantly mitigate the impacts of a such a fire, however local partners will need to determine how to encourage these actions if property owners are not currently required by easements or other regulations to replant trees.

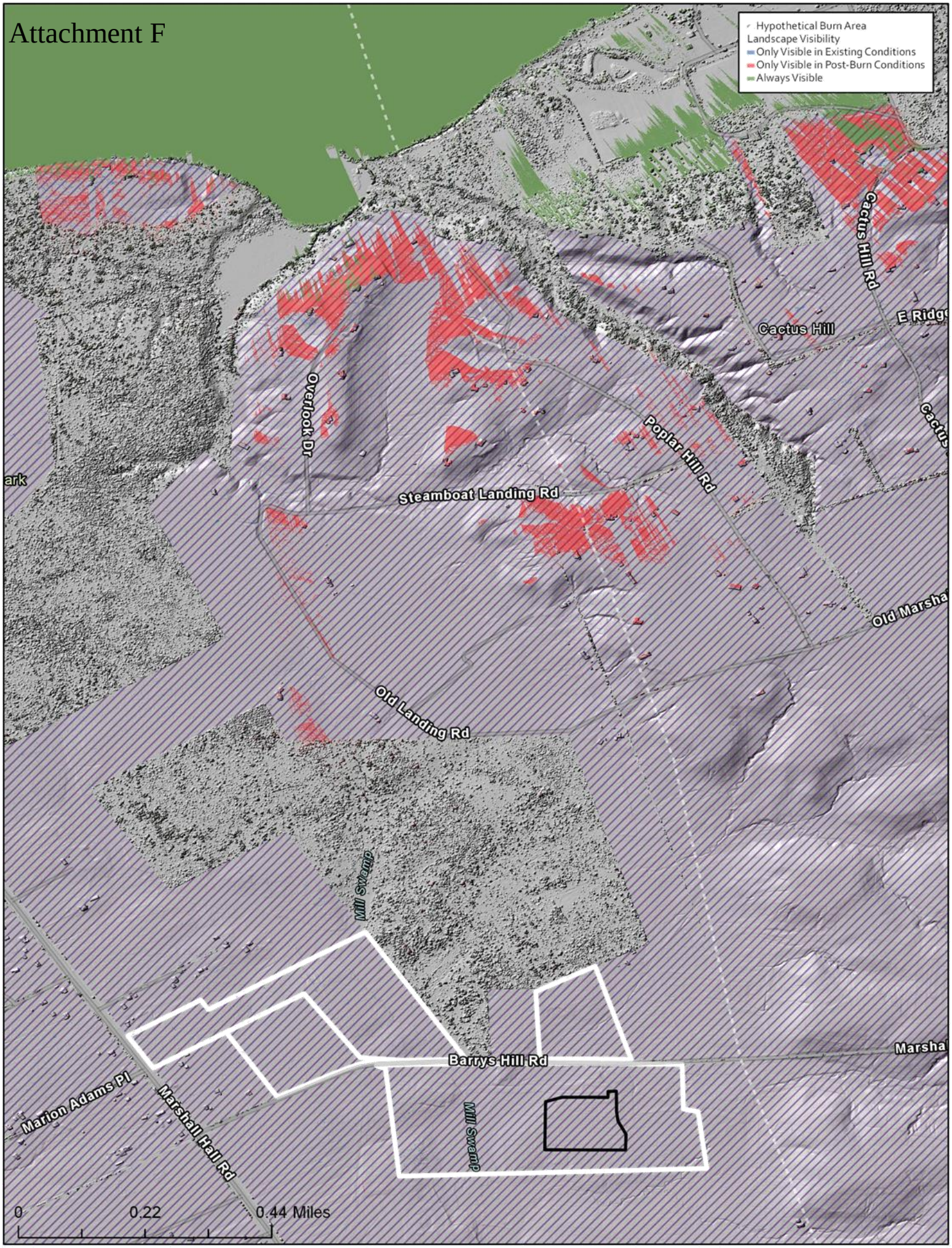

Attachment A
Hypothetical Burn Area
Landscape Visibility
Only Visible in Existing Conditions
Only Visible in Post-Burn Conditions
Always Visible
Bryan Point Rd
Cactus Hill
Cactus Hill Rd
Overlook Dr
Poplar Hill Rd
Steamboat Landing Rd
Colonial Rd
Old Marshall Hall Rd
Hidden Valley Rd
Old Landing Rd
Marshall Hall Rd
Barrys Hill Rd
Marshall Hall Rd
Old Marshall Hall Rd
New Pl
Fenwick Rd
WardWard Pl
Ward Pl
Lantana Dr
Heather Dr
Arbor Ln
Strawberry Hills Estates
Strawberry Dr
Livingston Rd
Indian Head Hwy
0
0.42
0.85 Miles


Attachment B
Hypothetical Burn Area
Building Visibility
Post-burn Visibility
Existing Visibility
Barrys Hill Rd
Marshall Hall Rd
Mill Swamp
Fenwick Rd
Ward Pl
Lantana Dr
Heather Dr
Arbor Ln
Strawberry Hills Estates
Strawberry Hills Park
Strawberry Dr
Kuhn Maddox Pl
Mommas Pl
Daddys Pl
0
0.22
0.44 Miles


Attachment C
Hypothetical Burn Area
Building Visibility
Post-burn Visibility
Existing Visibility
Cactus Hill Rd
Cactus Hill
E Ridgs
Overlook Dr
Poplar Hill Rd
Steamboat Landing Rd
Old Marshal
Old Landing Rd
Mill Swamp
Barrys Hill Rd
Marshal
Marion Adams Pl
Marshall Hall Rd
Mill Swamp
0
0.22
0.44 Miles


Attachment D
Hypothetical Burn Area
Building Visibility
Post-burn Visibility
Existing Visibility
Bryan Point Rd
Bonds Retreat Rd
Cactus Hill Rd
E Ridge Rd
Cactus Hill
Cactus Hill Rd
Colonial Rd
Rockwood Rd
Hill Rd
Colonial Rd
Old Marshall Hall Rd
Hidden Valley Rd
Old Marshall Hall Rd
0
0.22
0.44 Miles


Attachment E
Hypothetical Burn Area
Landscape Visibility
Only Visible in Existing Conditions
Only Visible in Post-Burn Conditions
Always Visible
Barrys Hill Rd
Marshall Hall Rd
Mill Swamp
Fenwick Rd
Ward Pl
Lantana Dr
Heather Dr
Arbor Ln
Strawberry Hills Estates
Strawberry Hills Park
Strawberry Dr
Kuhn Maddox Pl
Mommas Pl
Daddys Pl
0
0.22
0.44 Miles


Attachment F
Hypothetical Burn Area
Landscape Visibility
Only Visible in Existing Conditions
Only Visible in Post-Burn Conditions
Always Visible
Cactus Hill Rd
Cactus Hill
E Ridgs
Overlook Dr
Poplar Hill Rd
Steamboat Landing Rd
Old Marshal
Old Landing Rd
Mill Swamp
Barrys Hill Rd
Marshal
Marion Adams Pl
Marshall Hall Rd
Mill Swamp
0
0.22
0.44 Miles

Attachment G