National Park Service
U.S. Department of the Interior

National Capital Region
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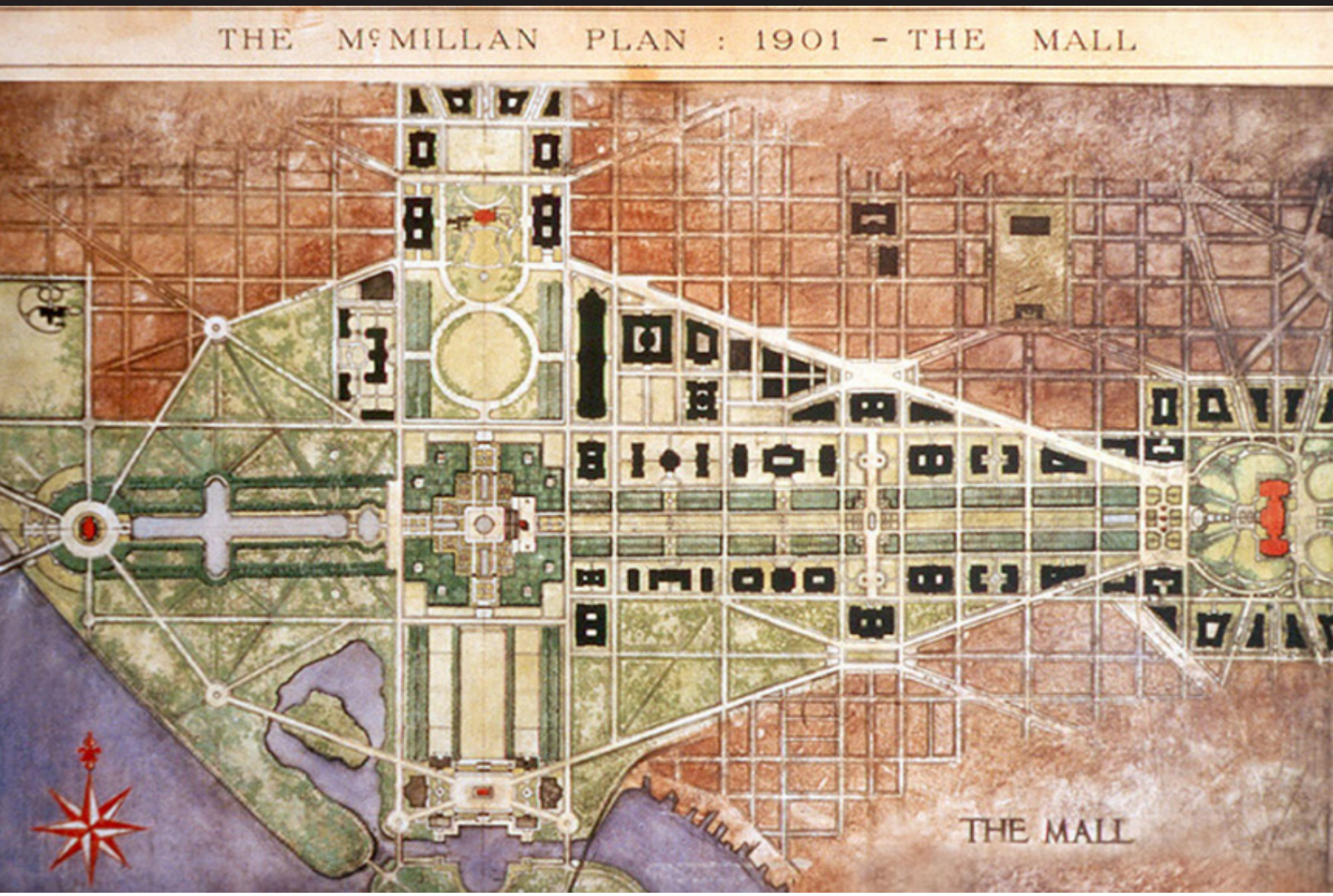

Preliminary Visual Impact Analysis
National Mall and Memorial Parks & President's Park

April 2018

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OVERVIEW

The National Park Service Organic Act states that the purpose of establishing the NPS is to "…conserve the scenery and the natural and historic objects and the wild life therein and to provide for the enjoyment of the same in such manner and by such means as will leave them unimpaired for the enjoyment of future generations." With this central mission the NPS has been entrusted with some of the most spectacular and historically significant landscapes throughout the country. Each area in the national park system has special visual characteristics that are often central to the park area's management and visitor experience, and visitors consistently identify scenic views as major reason for visiting parks. In a review of nearly 100 surveys performed at a wide variety of parks from 1998-2011, scenic views were identified as important or extremely important by 90% of visitors.

The National Park Service seeks to establish regulations addressing the visual effects of potential temporary structures that may be proposed to be erected in acceptable-use areas within the National Mall and President's Park. Visual effects or impacts were assessed using Geographic Information Systems (GIS) and depicted in both map form (viewshed analysis) and ground-level scenes (3D visualizations) that include a simple block, virtual structure at specified locations and standing heights. The viewshed analysis was used to demonstrate in the map visitor view points from which a proposed temporary structure may be seen. The 3D visualizations simulate potential observable, actual surroundings with a proposed structure included. Proposed structure models were generated in GIS and modeled in Google Earth Pro, Street View. Data and methods used were be documented to facilitate future visual impact studies.

SIGNIFICANT VIEWS OF CONCERN

Scenic views and vistas that contribute to the significance of historic properties within the study area are identified in the National Register of Historic Places nomination forms and described as attributes of each component landscape or site. These include planned views along the principal north-south and east-west axes of the National Mall, reciprocal views between major memorial sites, extended views along contributing streets and avenues, multi-directional views across component landscapes, and periodic views of resources from circulation routes, among others.

Pierre Charles L'Enfant developed his 1791 plan for the city of Washington with keen attention to visual relationships among the sites he dedicated to public buildings and monuments.

Nowhere was that concept more important than along the Mall, where views west from the U.S. Capitol and south from the White House intersected at a proposed equestrian statue of George Washington. The primary vista west from the U.S. Capitol along L'Enfant's "Grand Avenue" to the site for a proposed equestrian statue of George Washington intersected with views south from the White House. L'Enfant's planned views also extended beyond the statue to the Potomac River. The L'Enfant Plan is itself listed in the National Register of Historic Places.

The McMillan (Senate Park) Commission Plan of 1901-02 also focused on visual relationships, adapting L'Enfant's visual corridor as the basis for their planning for the Mall and advancing it to take in new memorial sites. The McMillan Commission conceived of sites ultimately occupied by the Lincoln and Thomas Jefferson memorials as the termination of principal views from the U.S. Capitol and the White House, respectively – creating the great cross axis of today's National Mall. The McMillan Plan also established a setback for new buildings to ensure that views along the east-west axis remained unimpeded, and subsequent development honored the National Mall's principal views.

The construction of the Washington Monument itself established significant new views across the Mall, the city of Washington, and the developing region, and became the focus of important views from beyond the Mall. Other significant views were established as the landscape developed and incorporated into the principal view sheds or developed as new monuments, memorials, and buildings were constructed. These and many other views and visual relationships contribute to the significance of the National Mall.

Significant views within the study area

The National Mall

The historic Mall consists of the linear landscape that stretches from the U.S. Capitol grounds to the Washington Monument Grounds between Constitution Avenue on the north and Independence Avenue on the south, encompassing the monumental buildings of the Smithsonian Institution, the National Gallery of Art, and the U.S. Department of Agriculture.

The grass panels and allées of trees in the central portion of the Mall between Madison and Jefferson Drives and 3rd and 14th streets, NW-SW, were designed and developed as a single environment comprised of six U.S. reservations. The Mall greensward was purposefully designed to reinforce the vista between the U.S. Capitol and the Washington Monument. The buildings north and south of the greensward each have their own landscape scheme, many of which were designed in relation to the larger setting of the Mall. The museum buildings of the Smithsonian Institution and National Gallery of Art flanking the Mall's central greensward represent the work of American master architects of the nineteenth and twentieth centuries and contribute to the Mall's significance as the setting for congressionally sanctioned repositories of the country's cultural, historical, and technological heritage. Rows of elms along the Mall a frame views and strengthen the formal quality of the landscape.

Views and visual relationships that contribute to the significance of the Mall include the north-south vistas along 4th Street, SW, and 4½ Street, NW, toward Judiciary Square; the vista along 6th Street, NW, toward the National Gallery of Art; the vista along 8th Street, NW-SW, toward the National Archives; and the vista along 10th Street, NW-SW, toward the National Museum of Natural History and the Smithsonian Institution Building. Other contributing visual relationships include the views to the elms and the buildings along the Mall from its walks and central grass panels. All of these views contribute to the significance of the Mall landscape. The National Mall is an integral component part of the National Mall Historic District which is listed in the National Register of Historic Places.

President's Park South

The creation of planned views and vistas between and among notable sites was an important design principle of both the L'Enfant and McMillan plans, and major axial vistas and reciprocal views between memorial sites within the park are elements that add to the qualities of the President's Park South landscape. These include views north from the First Division Monument to the Eisenhower Executive Office Building and south to E Street, NW, the view from Sherman Park north to the U.S. Treasury Building, and the view from Constitution Avenue north to the Second Division Memorial.

American elms (*Ulmus americana*) line the Ellipse and associated roads and the placement of these trees comprised a part of the design proposed by Andrew Jackson Downing in 1851. The groves of canopy, shade, and evergreen trees to the south, east, and west of the Ellipse helps to frame the central north south vista between the White House and the Jefferson Memorial, while also emphasizing the open character of the Ellipse lawn.[1] President's Park South is listed in the National Register of Historic Places and is a contributing property in the National Mall Historic District.

The Washington Monument and Grounds

The Washington Monument, which stands 555 feet, 5 1/8 inches tall, was designed to resemble an unadorned Egyptian obelisk with a pointed pyramidion. The monument rises from the center of a circular plaza on top of a grass-covered knoll. The current plaza around the monument is composed of alternating concentric rings of light Ash Rose and darker Mesabi Black granite with eight built-in, curved, white marble benches near the outer edge. Surrounding the monument at the outer edge of the plaza are fifty aluminum flagpoles displaying American flags. A broad flat lawn continues beyond the knoll to the edges of the site. Street trees, consisting mostly of elms, delineate the site's perimeter along the public thoroughfares. Gaps in the elms on 14th and 17th streets maintain the vista between the Capitol, the Washington Monument and the Lincoln Memorial. Groves of trees – including elm, chestnut, linden, and maple species – mark other locations. The Washington Monument and Grounds Historic District is individually listed in the

[1] 2010 Cultural Landscape Inventory, President Park South.

National Register of Historic Places and is a contributing property in the National Mall Historic District.[2]

The topography of the Washington Monument Grounds is primarily defined by the man-made grass covered knoll, which supports the monument, and creates an attractive approach from the open turf lawn that characterizes the remaining ground plane, and allows for unobstructed views to other major landmarks and across the site. Primary views and vistas associated with the Washington Monument Grounds that have historically contributed to the site's significance include views of the Washington Monument from the city and surrounding region, views from the top of the Washington Monument to the surrounding city and important sites, vistas of the Washington Monument from the Lincoln Memorial, White House, Thomas Jefferson Memorial, and the U.S. Capitol, screened views of the site features, and axial views through the Jefferson Pier of the White House and the Thomas Jefferson Memorial.[3]

Constitution Gardens

The park's high tree canopy allows for transparency across the grounds and for open views to the Washington Monument and other important sites. Views east to the Washington Monument are prominent throughout the park. Also significant are views from within the park to the Vietnam Veterans Memorial and views from the Vietnam Veterans Memorial to the Washington Monument, views to the Lincoln Memorial and the Lincoln Memorial Reflecting Pool area, views to the District of Columbia War Memorial, periodic views looking north of the buildings along Constitution Avenue and looking east of the buildings on or near the Mall, and internal views of the lake and the 56 Signers Memorial and from the overlook terrace.[4]

Lincoln Memorial and Grounds

The Lincoln Memorial, constructed with a Colorado-Yule marble exterior and an Indiana limestone interior, appears as a majestic peripteral Greek temple and is surrounded by a peristyle of 38 fluted Doric columns, one for each of the 36 states in the Union at the time of Lincoln's death.[5] Today, the broad open turf lawn within the Lincoln Circle creates a verdant setting for the memorial structure. Plant materials include evergreens around the base of the monument, as well as boxwood and yews along the retaining wall on the east side and at the southeast and northeast corners. The west side of the lawn surrounding the memorial features conifers and evergreens planted in distinct groupings to preserve views from the northwest and southwest.[6] The Lincoln Memorial is part of a larger designed landscape within West Potomac Park that in-cludes the Reflecting Pool, Rainbow Pool, radial roads, and Watergate area. The Reflecting Pool captures images of both the Lincoln Memorial and the Washington Monument on the surface of the water. Two avenues of elms, planted on terraced levels in parallel rows, delineate this pool and outline a smaller transverse pool. The Lincoln Memorial is individually listed in the national Register of Historic Places and is a contributing property in the National Mall Historic District.

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2 2016 National Register of Historic Places Registration Form, Washington Monument and Grounds Historic District.

3 Ibid., 34.

4 Ibid., 41.

5 1981 National Register of Historic Places Inventory - Nomination Form, Lincoln Memorial at 3.

6 Ibid., 45

The distinct formal landscape of the Lincoln Memorial grounds occupies a highly symbolic site within the National Mall, and the designed vistas between the Lincoln Memorial and other memorial sites and landscape features are important elements of the landscape character. Principal planned vistas include the view looking east along the axis of the National Mall from the Lincoln Memorial to the Washington Monument and the U.S. Capitol beyond and the reciprocal view looking west from the U.S. Capitol and the Washington Monument toward the Lincoln Memorial. The Lincoln Memorial grounds are also characterized by the vista looking west across the Arlington Memorial Bridge from the Lincoln Memorial to the Arlington National Cemetery and Arlington House, The Robert E. Lee Memorial and the reciprocal vista looking east. Other important views include the axial and radial vistas between the memorial and Parkway Drive, between the memorial and the radial roads from Lincoln Circle, between the memorial and the Ericsson Monument, and between the memorial and Constitution Avenue along 23rd Street, NW. The sweeping vista from the Lincoln Memorial west to the Virginia shoreline and the reciprocal vista from the Virginia shoreline to the memorial are also important.[7]

DC War Memorial Grounds

The District of Columbia War Memorial was constructed in West Potomac Park in 1931 as an open-air, circular Greek temple with fluted Doric columns supporting a round dome. The columns sit atop a raised base with two sets of steps leading up to the floor level of the structure. It was designed with the dual purpose of being both a war memorial and a bandstand, and is large enough to accommodate an eighty-piece band. The Memorial is surrounded by a circular terrace of bluestone paving with parallel bluestone paths bordering lawn panels, extending north to Ash Road and south to Independence Avenue. The structure is surrounded by open lawn, flanked on the east and west sides by Ash Woods, a large grove of trees that consists primarily of elm, maple, beech, and oak. It is individually listed in the National Register of Historic Places and is a contributing property in the National Mall Historic District.[8]

Primary views and vistas associated with the grounds include the views looking north to the Lincoln Memorial Reflecting Pool and south to the Tidal Basin and views from the surrounding paths toward the memorial. A rehabilitation of the District of Columbia War Memorial grounds by the National Park Service in 2011 eliminated encroaching trees and understory plantings from the open lawn area surrounding the memorial and cleared vegetation bordering the north and south approach paths to re-establish the historic north-south vistas.[9]

The Tidal Basin

Multiple views and vistas characterize the Tidal Basin area. These include the periodic views from various locations along the Tidal Basin's circumferential path of the surrounding Japa-nese cherry trees and nearby memorials and reciprocal views between the memorials, such as the views between the Thomas Jefferson Memorial and the Martin Luther King, Jr., Memorial, among others. A pedestrian path around the basin affords views of adjacent memorials and their reflections in the water's surface.[10]

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7 Ibid., 44.

8 2014 National Register of Historic Places Registration Form, District of Columbia War Memorial, p. 9.

9 Ibid., 49.

10 Ibid., 52.

The Thomas Jefferson Memorial

The Thomas Jefferson Memorial landscape is comprised of 19.2 acres of land immediately south of the Tidal Basin. With the neoclassical white marble memorial modeled after the Roman Pantheon as its focal point, this component landscape forms the southern end of the kite-shaped design plan for the city proposed by the McMillan Commission in 1902. The planting within the encircling roadway, now used solely by pedestrians, is predominantly evergreen with some small flowering trees and shrubs. Beyond the circular roadway, there are tall shade trees and cherry trees that are part of the ring of flowering cherries that encircles the Tidal Basin. The ring of cherry trees are the characteristic for which the landscape is most noted, and that which attracts thousands of visitors each spring. The Memorial was sited and designed to have a strong visual relationship with existing government buildings and memorials along both the east-west cross axis and the north south cross axis of the National Mall.[11] The Memorial is individually listed in the National Register of Historic Places and is a contributing property within the National Mall Historic District.

METHODOLOGY

Identification of Visitor View Locations

Through consultation with staff from the National Mall and Memorials Parks, President's Park/ White House Liaison, regional cultural resources staff and GIS technical staff from the National Capital Region and the Denver Service Center 33 visitor viewpoints were developed to use as locations to analyze the visibility of temporary structures. The visitor view points were selected based on where a visitor's experience might be affected. Viewpoint locations are typically locations based on historic or iconic views (Appendix A). In addition to these viewpoints, three sight lines (Lincoln Memorial to the Capitol, White House to Jefferson Memorial, and Virginia Avenue to the Washington Monument grounds) were identified.

[11] 2004 National Park Service Cultural Landscape Inventory, Thomas Jefferson Memorial at 70-73.

VIEW POINT	LOCATION DESCRIPTION	VIEW POINT	LOCATION DESCRIPTION
V01	White House: South Side, Ground Level	V18	Washington Monument: East Side
V02	Zero Milestone	V19	Washington Monument: South Side
V03	Constitution Ave & 17th St	V20	Washington Monument: West Side
V04	Constitution Ave & 15th St	V21	Independence Ave & 15th St
V05	Lincoln Memorial: Chamber Level West Side	V22	Mall & 14th Street
V06	Lincoln Memorial: Chamber Level, East Side	V23	Mall & 3rd Street
V07	Lincoln Memorial	V24	Union Square: West of Grant Statue
V08	Lincoln Memorial: “”I Have a Dream”” Speech Stone	V25	U.S. Capitol: Base of Steps
V09	Lincoln Memorial: Steps at Memorial Circle	V26	U.S. Capitol: Top of Steps
V10	Reflecting Pool: Northwest Corner	V27	Tidal Basin: At MLK Memorial
V11	Reflecting Pool: West Side	V28	Tidal Basin: FDR Vantage 2
V12	Reflecting Pool: Southwest Corner	V29	Outlet Bridge
V13	Reflecting Pool: Southeast Corner	V30	Jefferson Memorial: Ground Level at Tidal Pool
V14	Reflecting Pool: Northeast Corner	V31	Jefferson Memorial: Chamber Level, North Side
V15	WWII Memorial at 17th St	V32	Jefferson Memorial: Chamber Level, South Side
V16	Constitution Gardens, West Side	V33	Tidal Basin: East Side, close to Swan Boats
V17	Washington Monument: North Side		

Identification of Temporary Structures Locations

Through consultation with staff from the National Mall and Memorials Parks, President’s Park/ White House Liaison, regional cultural resources staff and GIS technical staff from the National Capital Region and the Denver Service Center 25 temporary structure points were developed to identify areas where temporary structures of different heights could be evaluated to understand where they could be seen from the visitor viewpoints (Appendix B).

The temporary structure points locations were selected based on locations where a temporary structure would be permitted, such as the area to the east and west of Thomas Jefferson Memorial, or what has been proposed or placed in the past and been determined to have previously affect visitor experience. Several of the locations are on hardscape due to turf guidelines that limit the amount of time temporary structures can be placed on turf, and impose other resource protection conditions on temporary structures. This is not an exhaustive list, but a representation of reason-able sample possibilities. Figure 1 (page 8) shows the locations of both structures and viewpoints used in this analysis.

Figure 1. Locations of modeled structures and visitor viewpoints.

Structure Point	Location Description	Structure Point	Location Description
S01	Ellipse	S14	North Monument Grounds
S02	Ellipse	S15	North Monument Grounds
S03	Ellipse	S16	WAMO Lodge
S04	Ellipse	S17	Hardscape on 12th St
S05	Lincoln Memorial	S18	Mid Mall Hardscape
S06	Lincoln Memorial	S19	Staging Area
S07	West of Constitution Gardens	S20	Hardscape at 7th St
S08	West Constitution Gardens	S21	Construction Staging Area
S09	1st Amendment Area	S22	Paddle Boat Parking Lot
S10	Field Adjacent to Reflecting Pool	S23	Paddle Boat Parking Lot
S11	Field Adjacent to Reflecting Pool	S24	Jefferson Memorial: East
S12	North Monument Grounds	S25	Jefferson Memorial: Southwest
S13	North Monument Grounds		

Viewshed Analysis Process

Viewshed analysis was conducted for potential temporary structures standing at 15 to 50 feet height at 5 foot increments and for each of the temporary structure points. The analyses was performed using the Digital Elevation Model (DEM) noted earlier.

Preparing Elevation Data for Analysis

Two different types of elevation raster datasets were used as part of the viewshed analysis: a bare earth digital elevation model (DEM) and a first return digital surface model (DSM). Bare earth DEMs are representations the elevation at ground level. First return DSMs represent the top elevation of features on the landscape, such as trees and buildings. The term "first return" comes from the fact that this data is the first laser hit to return to the instrument during the collection of Light Detection and Ranging (LiDAR) data making that object the highest point. Due to the process of LiDAR data collection, many different levels of elevation data are acquired allowing for the creation of highly-detailed bare earth and first return models as well as the modeling of vegetation and structures.[12] The output collected during the acquisition process is a "point cloud" consisting of hundreds of the thousands of three-dimensional points which are then processed into the aforementioned raster models for analysis.

For the purposes of this viewshed analysis, the bare earth DEM was used as the base elevation for the creation of the viewer and temporary structure points so that these features would have elevation, or z, values. The first return DSM was the basis for the viewshed analysis so that vegetation, buildings, bridges, and other features that sit on top of the base elevation would be taken into consideration during the viewshed analysis.

[12] For more information on LiDAR see the National Oceanic and Atmospheric Administration website "What is LIDAR?": https://oceanservice.noaa.gov/facts/lidar.html.

On April 2015, the District of Columbia Office of the Chief Technology Officer collected aerial LiDAR data.[13] The raw point cloud data was processed into both bare earth and first return models. The bare earth DEM was generated at a 2-foot resolution and the first return DSM was generated at a 1-foot resolution. For security reasons, the 2015 LiDAR data collection did not include the areas around the White House and U.S. Capitol buildings. In order to create seamless coverage for the viewshed analysis, LiDAR data collected in winter 2014 by the U.S. Geological Survey (USGS) as part of a wider data collection project were used to patch the gaps.[14]

Since the USGS's 2014 LiDAR data already had an existing 1-meter resolution bare earth digital elevation model, the existing raster was clipped to the missing areas around the White House and the U.S. Capitol to create the patches. These patches were then merged into the 2015 data. The end result was a seamless bare earth digital elevation model.

The patches for the first return digital surface model required more preparation as none was available for the 2014 USGS LiDAR data. The original 2014 point cloud data was first processed for obvious outliers using ERDAS IMAGINE software. The point cloud data was then grouped into two subsets that covered only the areas needed for the patches. Using ESRI ArcGIS Pro, the point cloud data was filtered by first return and converted into raster datasets with a 1-foot resolution. Those patches were then merged into the 2015 first return DSM to create a seamless first return digital surface model.

Running the Viewshed Analysis

Viewsheds were calculated using ESRI ArcGIS Pro v2.1.2. Visibility toolset.[15] A python script was used to automate viewshed calculations for each of the 25 temporary structures at each of the five foot height increments resulting in 200 individual viewshed results. The Intervisibility toolset[16] was used to generate output tables summarizing viewpoints falling within each of the modeled viewsheds (Appendix D). The analyses account for ground-level views using an average human height of 1.75 meters (about 5' 9").

Viewshed Analysis Output

The viewshed analysis output overlaid on a base map with shading in locations from which the potential temporary structure is visible (Appendix C). Buildings and other existing structures in the DEM may block views from some locations and the analysis results will reflect this.

Maps were developed that show the results of the viewshed analysis for each identified potential temporary structure location (25 maps total). The results are symbolized the same on all of the maps in the series and includes a point to represent the potential location of a temporary structure as well as points to indicate popular visitor viewing locations.

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13 DC LiDAR – Bare Earth – 2015 online documentation: https://dcgis.maps.arcgis.com/home/item.html?id=ce6ca4535c684ac0aff8b1a55fa1eb8c. DC 2015 Classified Point Cloud LiDAR Information: https://aws.amazon.com/public-datasets/dc-lidar/.

14 Documentation and original data can be downloaded at: ftp://rockyftp.cr.usgs.gov/vdelivery/Datasets/Staged/Elevation/LPC/Projects/USGS_LPC_MD_VA_Sandy_NC R_2014_LAS_2015/.

15 http://pro.arcgis.com/en/pro-app/tool-reference/3d-analyst/visibility.htm.

16 http://pro.arcgis.com/en/pro-app/tool-reference/3d-analyst/intervisibility.htm.

The red shading indicates the areas where a person would likely be able to see a 15-feet structure at the identified potential temporary structure point. If the temporary structure were 20-feet tall, that viewable area expands to include the orange shaded areas. A 20-foot temporary structure would likely be visible to a person in the areas covered by both red and orange. If the temporary structure were 25-feet tall, the viewable area would expand to include the yellow shaded areas in addition to the red and orange. This accumulation of visible areas continues to where a 50-foot temporary structure would be likely be visible from all the colored areas, as indicated in the legend on each map. The viewable area is aggregated with each new color being added onto the viewable area so that taller structures are visible to a larger area than the shorter structures. Outputs from viewshed analysis was also tabulated into a series of matrices (Appendix D). The matrices summarize the visibility of temporary structures, at each of the modeled heights and for each of visitor view point. Nine matrices were developed, one for each height and one that summarizes the temporary structures for each visitor point for all heights. The summary matrix was developed to quickly evaluate significant visitor points and temporary structure locations using numerical values. A value of "8" in the summary matrix indicates that each of the modeled heights of the temporary structure are visible from that viewpoint. A value of "7" indicates that seven of the modeled heights are visible and so forth.

Viewshed analysis considerations and assumptions

There are important considerations when interpreting the results. The viewshed analyses are "line-of-sight" calculations between the modeled structures and all points in the surrounding landscape. The surrounding landscape in terms of the analysis is the digital elevation model (DEM) and includes all buildings and other structures that were present when the LiDAR data were collected (see Preparing Elevation Data for Analysis above). The DEM also includes trees and other standing vegetation in a "leaf on" condition since the data were collected during the summer season. This may have a significant impact on some results if examined in fine spatial detail (scales of around 3 meters or less).

The viewshed analyses apply an average human height of 1.75 meters to each location in the DEM including buildings and treetops. For purposes of visual impact assessment, results are best interpreted for locations where a person is more likely to be standing and not at specific locations such as treetops.

The "line-of-sight" calculations do not account for average human sight acuity. Actual visibility may be affected by light attenuation, viewed object size, color and movement (movement of an object may increase its visibility) of the observed object. Of course, individual viewer eyesight is also an important factor in case-by-case view-ability assessment.

Ground Level Visualizations

Ground-level scenes of the temporary structures were generated to complement the viewshed analysis. ArcGIS v10.5 was used to generate the 3D models of the temporary structures as 10ft x 10ft columns centered on each of the structure locations. Models for each of the specified heights from 15 feet to 50 feet were created and exported as Keyhole Markup Language (KML or KMZ

(if compressed)) files for viewing in Google Earth Pro Desktop.[17] A detailed process for generating the scenes was developed (Appendix E) and applied to each viewpoint.

Scenes were captured using Google Earth Pro and Streetview[18] where available. Modeled structures heights of 20 feet and 45 feet were captured in the scenes (Appendix F). Horizontal lines visible on the structures in some scenes represent five foot height increments starting at fifteen feet above ground level.

Ground level visualization considerations and assumptions
Google Earth Pro "ground level" scenes are based on models and landscape provided by Google. The "ground level" scenes are recreations of views whereas Street View scenes are actual 360 degree photographs provided by Google.

Structure labels (S01, S02, etc.) in the scenes are generated in Google Earth Pro. Due to virtual distances in some scenes the labels and the structures themselves may be difficult to see. Modeled structures are colored to enhance on-screen visibility.

The viewshed results were considered for each ground level scene however due to spatial variation and 3D model differences between viewsheds modeled in ArcGIS and Google Earth Pro / Street View, some scenes may include structures not included in the viewshed results. Appendix G compares ground level scenes with the viewshed results.

To provide context, Street View scenes were generated to compare to the Google Earth model scenes. Street View imagery is not available for all viewpoints in this analysis. In some cases, 3D models of structures do not render in Street View due to limitations in the Google software. It's important to note that modeled trees in Google Earth Pro differ from trees included in the digital elevation model and may affect visibility results.

RESULTS / FINDINGS

The viewshed analysis illustrates three key findings:

Visitor Points Locations to which no temporary structures at any height are visible There are three visitor point locations to which none of the temporary structures were visible regardless of the height of the structure. These were:

White House: South Side, Ground Level (V01)
Zero Milestone (V02)
Jefferson Memorial: Chamber Level, South Side (V32)

[17] https://www.google.com/earth/desktop/
[18] https://www.google.com/streetview/

Visitor Points Locations that are within key viewsheds to which multiple temporary structures are visible at any of the modeled heights
Eighteen of the visitor point locations afford views of multiple structures at each of the modeled heights. These are:

Zero Milestone (V02),
Lincoln Memorial: Chamber Level West Side (V05)
Lincoln Memorial: Chamber Level, East Side (V06)
WWII Memorial at 17th St (V15)
Washington Monument: North Side (V17) Washington Monument: East Side (V18) Washington Monument: South Side (V19) Washington Monument: West Side (V20)
Mall & 14th Street (V22)
Mall & 3rd Street (V23)
Union Square: West of Grant Statue (V24)
U.S. Capitol: Base of Steps (V25)
U.S. Capitol: Top of Steps (V26)
Tidal Basin: At MLK Memorial (V27)
Tidal Basin: FDR Vantage 2 (V28)
Outlet Bridge (V29)
Jefferson Memorial: Ground Level at Tidal Pool (V30)
Jefferson Memorial: Chamber Level, North Side (V31)

Temporary Structure Locations that are visible at multiple visitor points at any of the modeled heights
Eighteen of the modeled structure locations are visible at all modeled heights from at least two of the visitor viewpoints. These are S01, S06, S07, S10, S11, S12, S13, S14, S15, S16, S17, S18, S19, S20, S21, S22, S23 and S25.

OPTIONS FOR FURTHER ANALYSIS

Separate and beyond the analysis completed as part of this report, there are some suggested follow-up steps that the region and the parks can discuss to explore to further understand the view points of concern and the effects of temporary structures on visitor experience.

Develop Visual Resource Protection Plan

The Air Resources Division of the Natural Resource Stewardship and Science Directorate has developed a Visual Resource Protection Plan (VRPP) to help address visual resource issues throughout the National Park Service. The VRPP is a comprehensive inventory, planning and park assistance program covering visual resource management. There are four major components to the planning and while each has its own distinct purpose and tasks they present an integrat-ed approach to addressing visual resources. The plan helps parks identify and understand their visual resources to better enable them to develop conservation strategies

through best management practices and collaboration efforts with stakeholders such as federal, state, and local agencies and private landowners.

The VRPP components are:

- **Inventory** – A systematic method to describe views, assess scenic quality and other view values, and understand the risks to changes in the views
- **Planning** – Provide support to parks for incorporating visual resources into NPS planning framework documents including Foundation Plans, State of the Park reports and Resource Stewardship Strategies.
- **Technical Assistance** – Provide assistance to parks in understanding the potential visual impacts of proposed projects and land management actions, develop comments on environmental documents, and identify mitigation measures that may help reduce impacts.
- **Policy and Guidance** – Develop policy to help assure consistency across the NPS in addressing visual resource management, and guidance to aid park resource managers implement a visual resource management program in their parks and to proactively engage with others to preserve important park scenery for the enjoyment of current and future generations.

Additional GIS Work

One possible future avenue of analysis would be to replicate the ground level views currently done in Google Earth in ESRI ArcGIS Pro. Google Earth was used to capture ground level views with potential temporary structures inserted into the scene. Google products excel at these representations and make for a visually appealing and easily interpreted result. However, Google Earth uses its own elevation model whereas ESRI ArcGIS Pro allows the user to define the elevation being used. This allows the user to choose the most accurate, most current elevation model for the specific region being studied instead of relying on a model of unknown origin that is adequate for the entire globe. As a consequence of this the elevation model used to perform the viewshed analyses in ESRI ArcGIS Pro is different than the elevation model used in Google Earth and could affect the results. There are some options to replicate the ground level views in ArcGIS Pro so that these views could be examined using the same elevation model.
The resulting rendered images may not include the photo-realistic building models provided by Google might provide valuable information about the visibility of potential structures.

Another option for further analysis would be to run line of sight analyses from individual viewer points to individual structure points. Line of sight analysis produces a line between points segmented and symbolized by the places where an object would be visible or not. This could provide more targeted information based on the specific viewer locations identified. However, since this analysis is limited to specific points, the results are also limited. If a point is shifted a little bit one way or another, the results could vary. It could provide useful information if there is a specific structure or viewer location in question, however it has limited value for a wider understanding the viewshed.

Winter (leaf-off) viewshed analysis

The DEM that was used in the analysis included trees in full leaf in order to take into account the effect that vegetation contributes to views of temporary structures. To further understand the effects of temporary structures on visitor experience in the winter, a new DEM that does not include the trees could be developed and the analysis re-run. The expectation is that temporary structures already visible with leaf-on would be even more visible and that there would be some additional temporary structures that are currently screened by vegetation that would become visible.

Include additional views in adjacent areas

This study was limited to selected views within the National Mall, Ellipse, and Tidal Basin. To more fully understand the effects of temporary structures on visitor experience, there are additional view points outside these areas that should be evaluated. Views should include but not be limited to views of and within the East and West Potomac Parks. The process outlined above should be used in order to comparable results.

Custom ground-level scenes

Accurate models depicting proposed structures could be created and added to ground level scenes using either ArcGIS Pro or Google Earth. Geo-positioned 360° cameras could be used to capture specific views where Street View is unavailable or not ideal. Photo scale could be controlled and modeled structures added to achieve a more realistic rendering of proposed structures.

Appendix A – Map of Visitor Viewpoint Locations

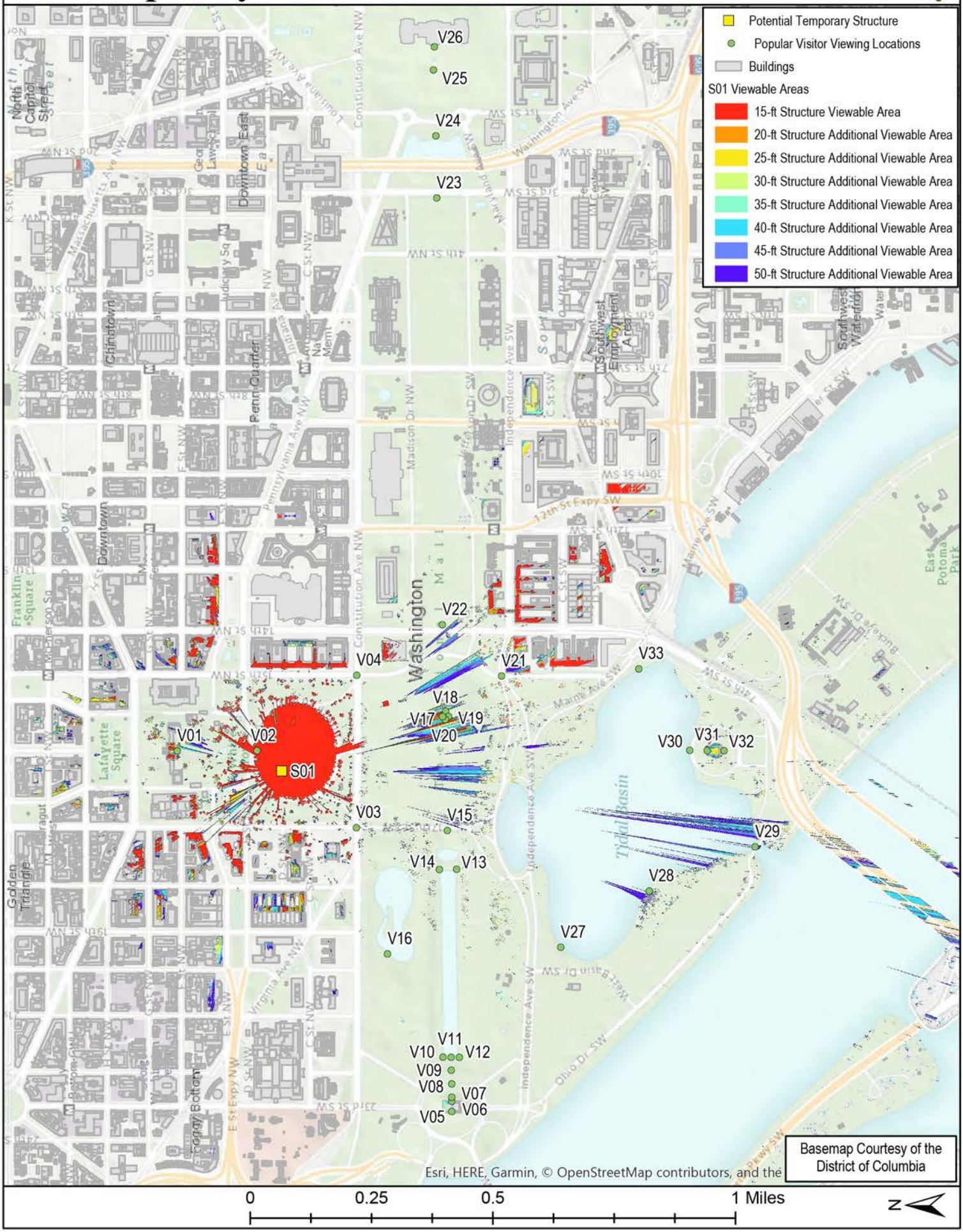
Popular Visitor Viewing Locations of Concern

Appendix B – Map of Temporary Structure Locations

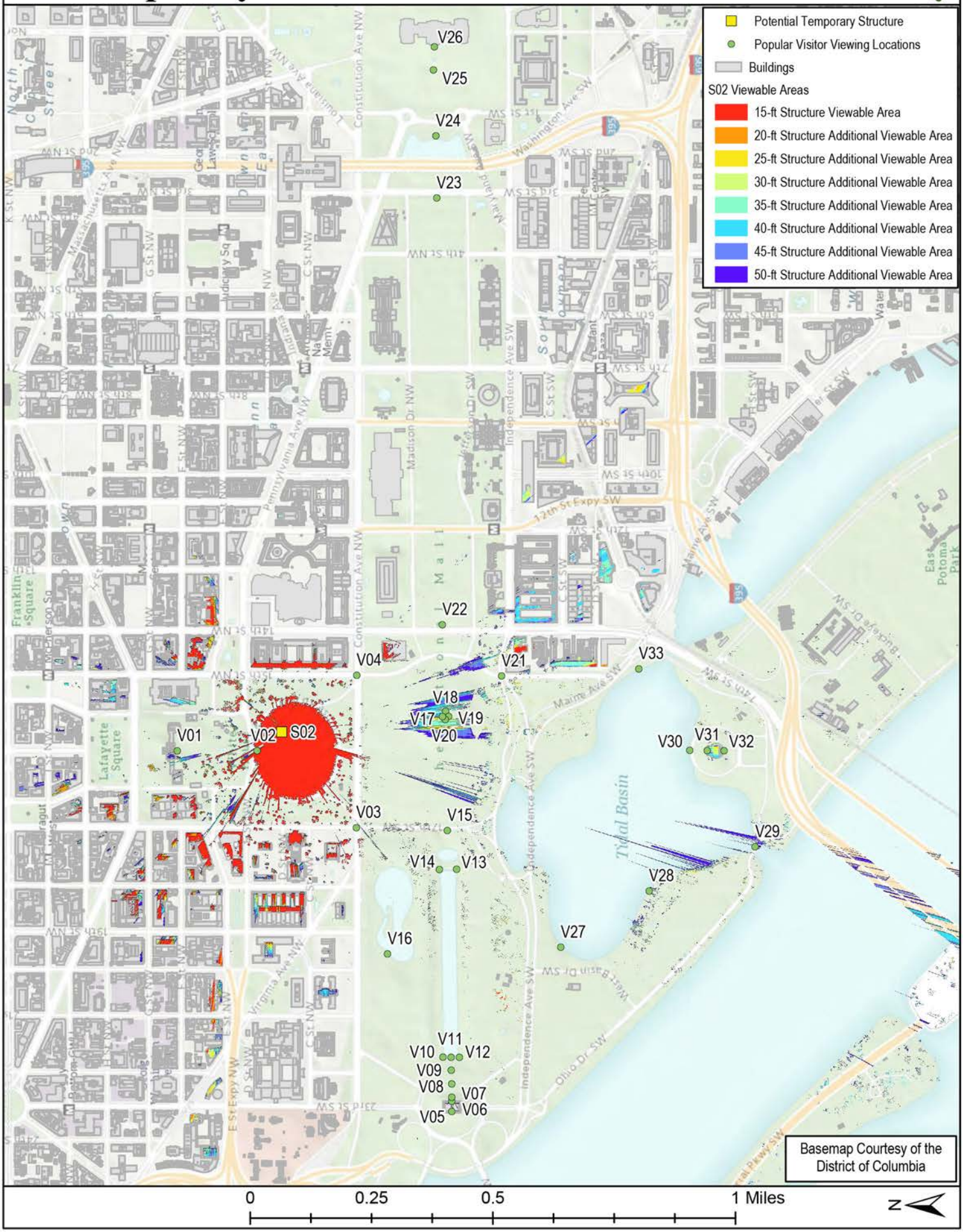
Temporary Structure Locations for Analysis

Appendix C – Viewshed Maps

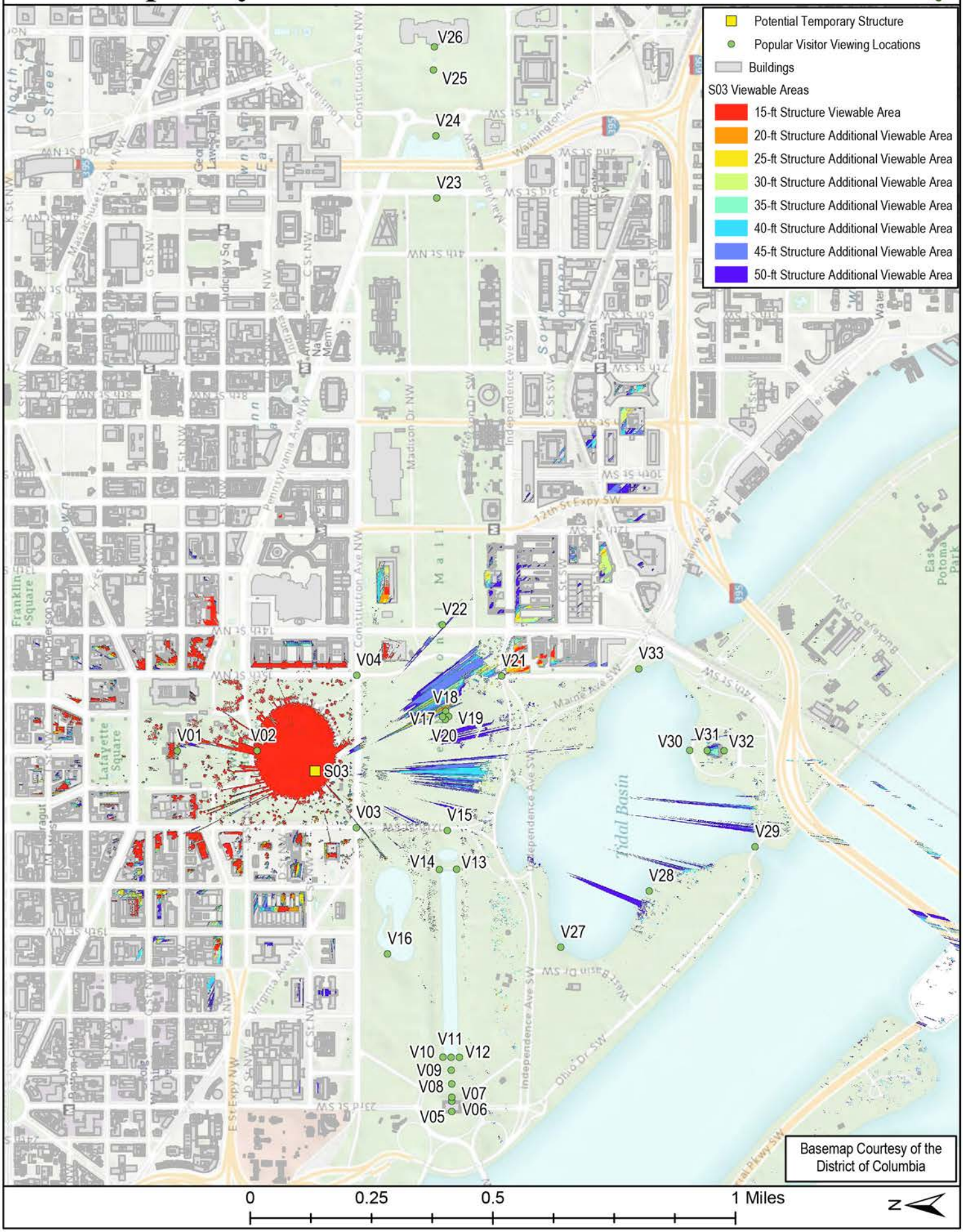
S01 Temporary Structure Viewable Area



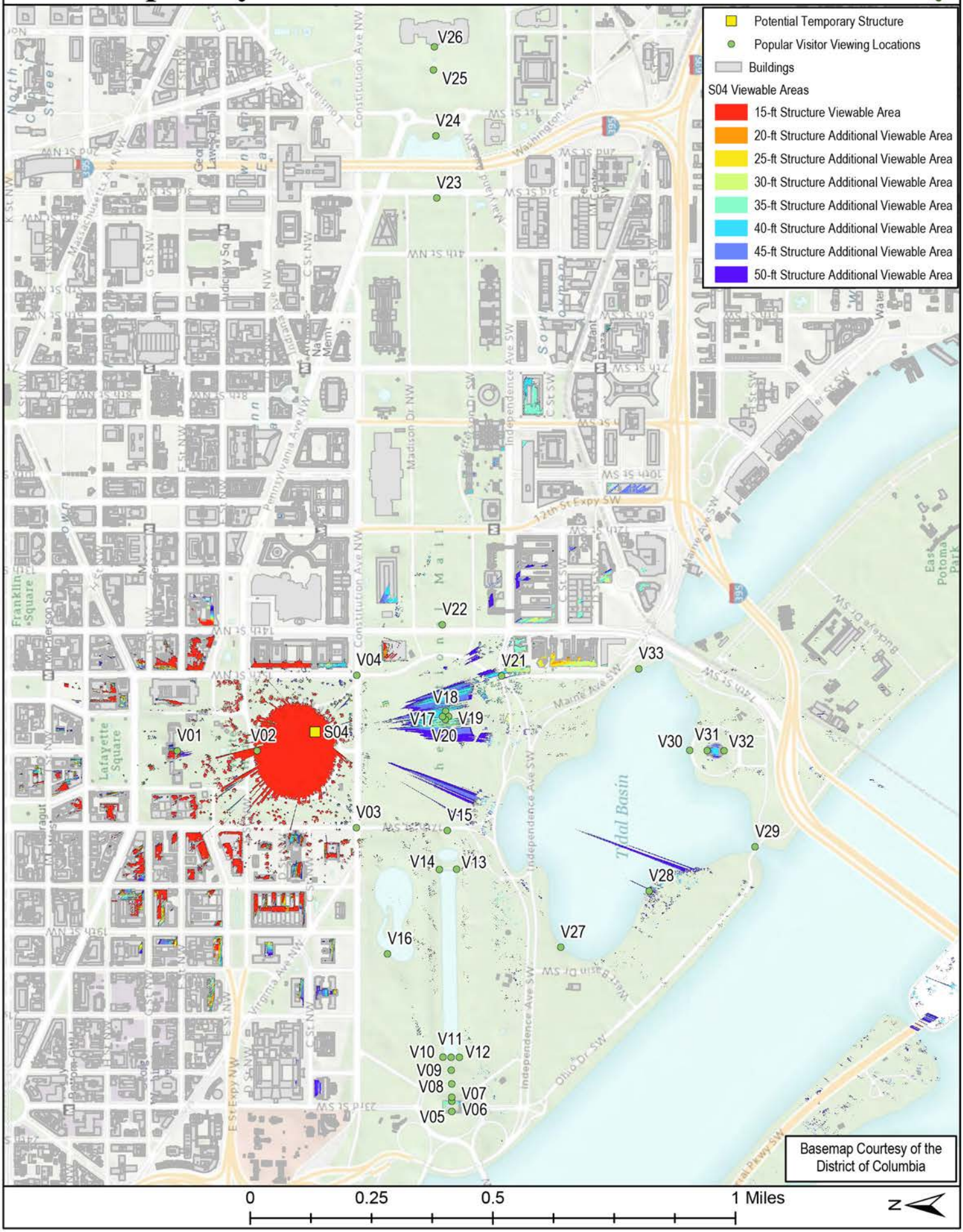
S02 Temporary Structure Viewable Area



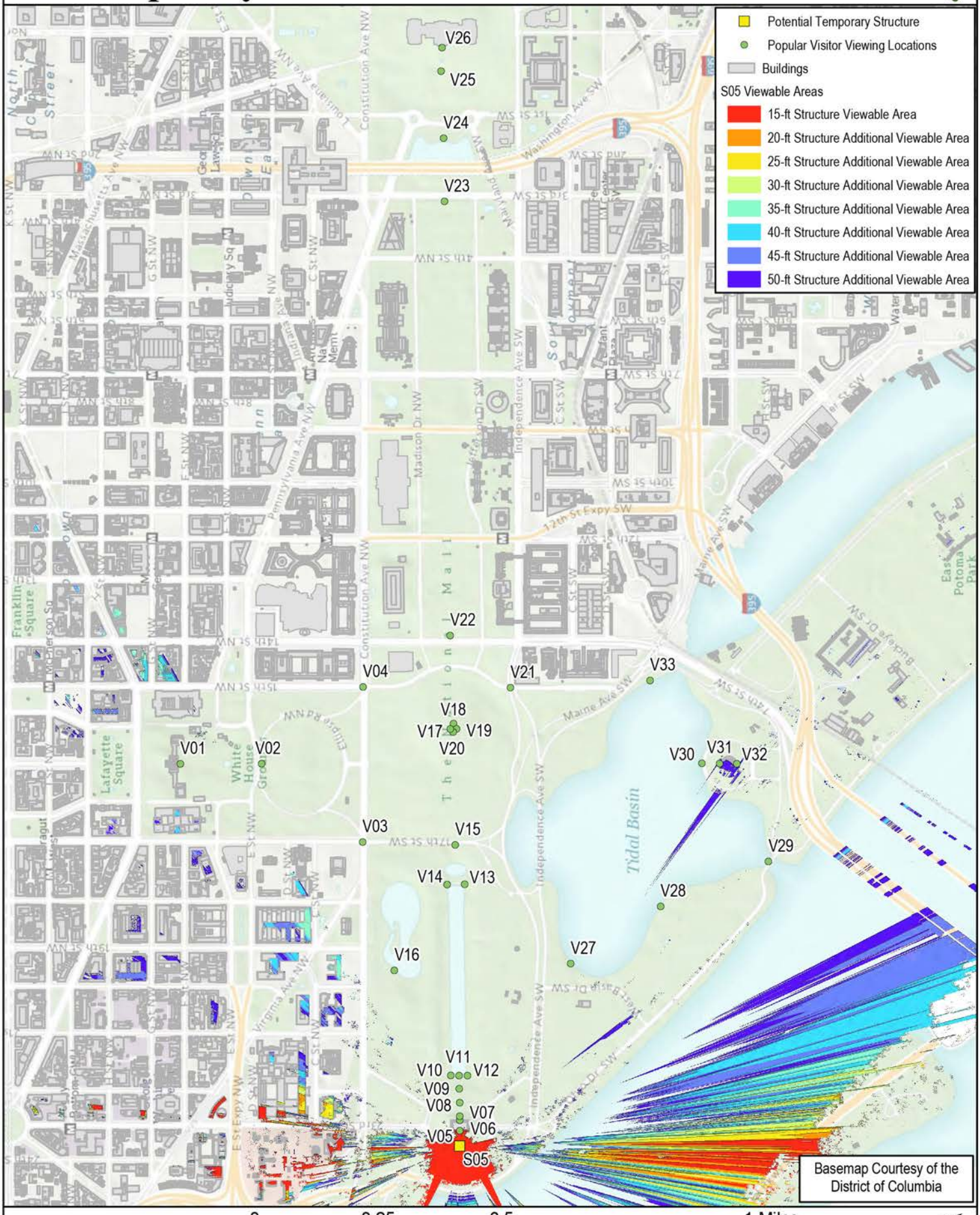
S03 Temporary Structure Viewable Area



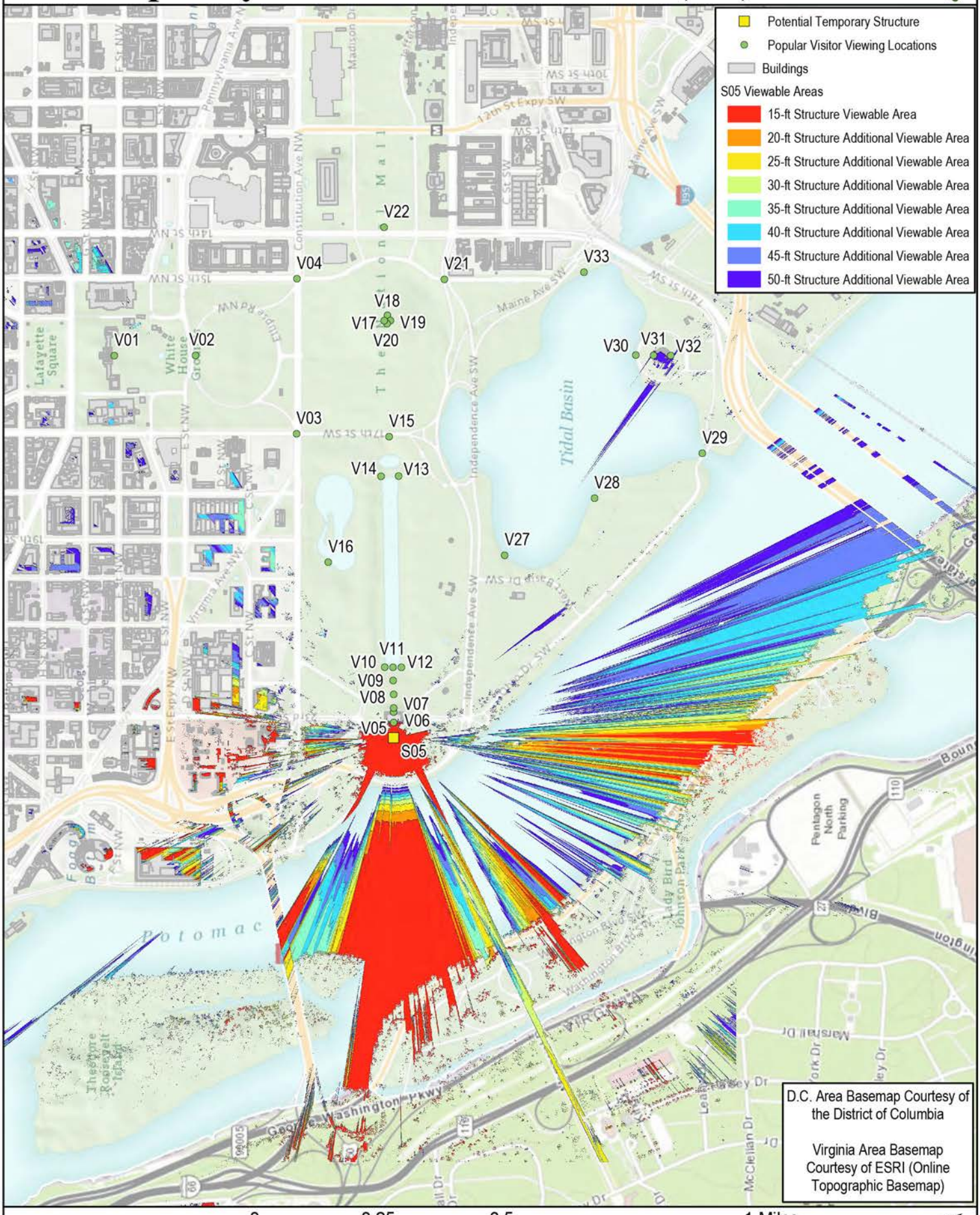
S04 Temporary Structure Viewable Area



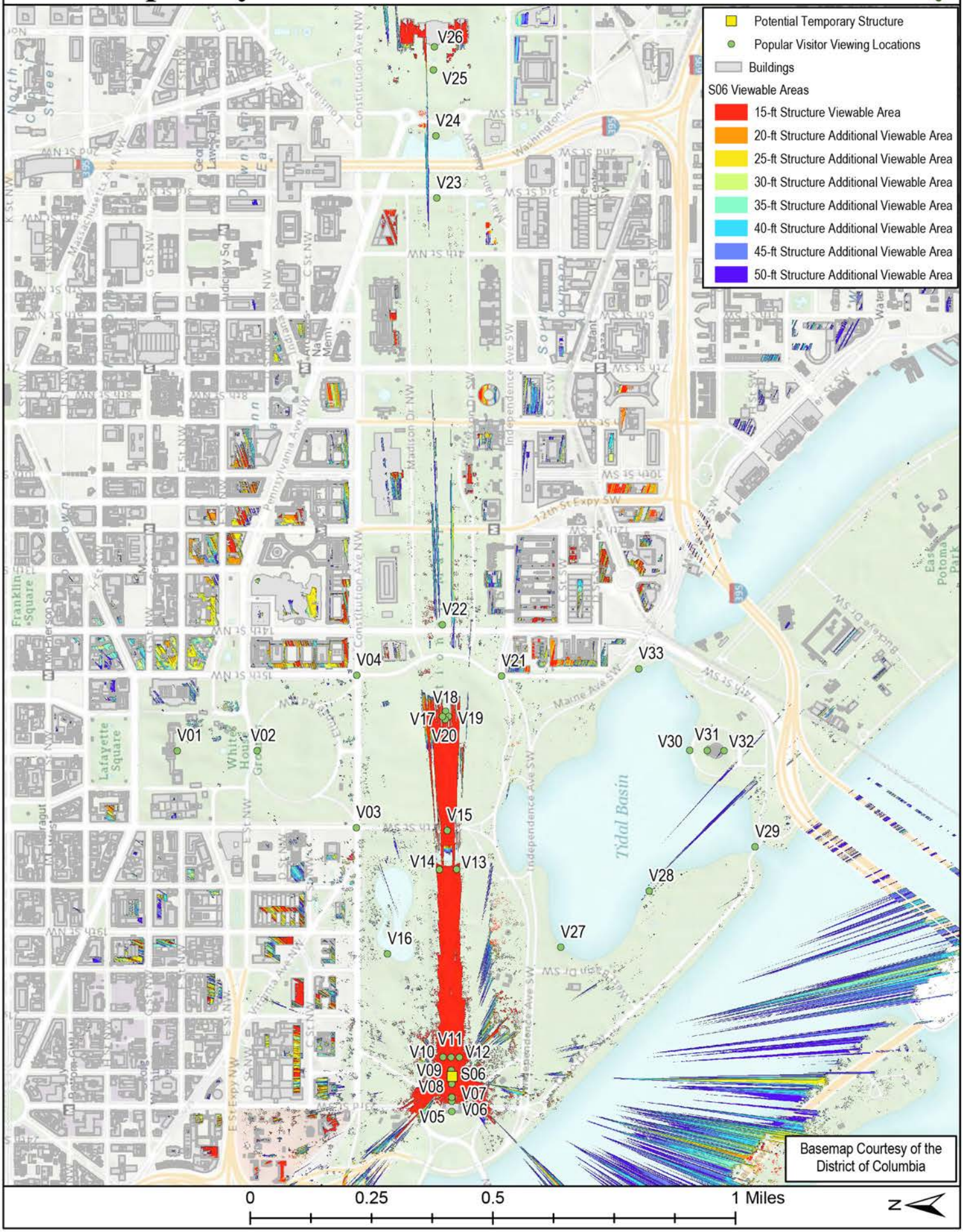
S05 Temporary Structure Viewable Area



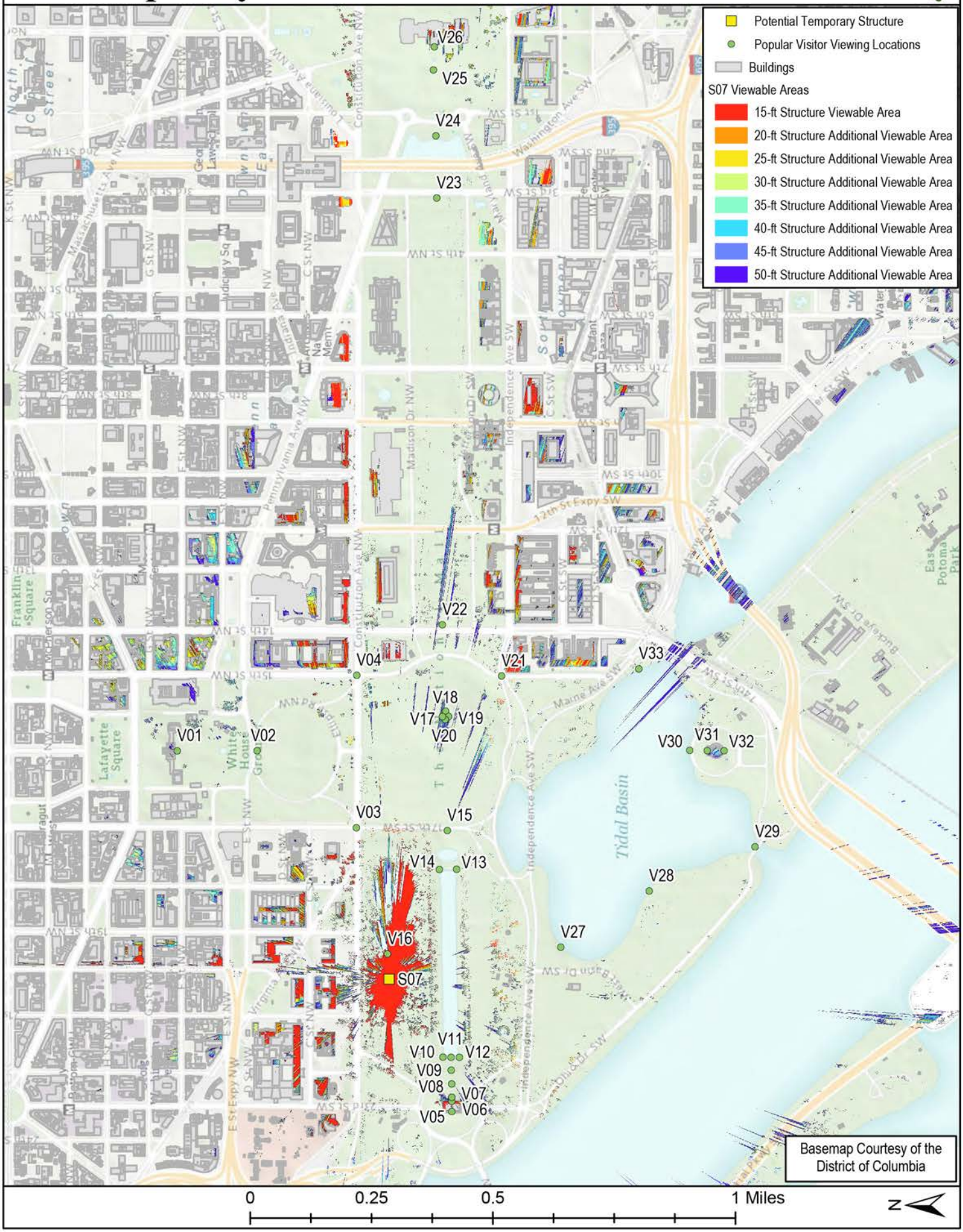
S05 Temporary Structure Viewable Area (Alt)



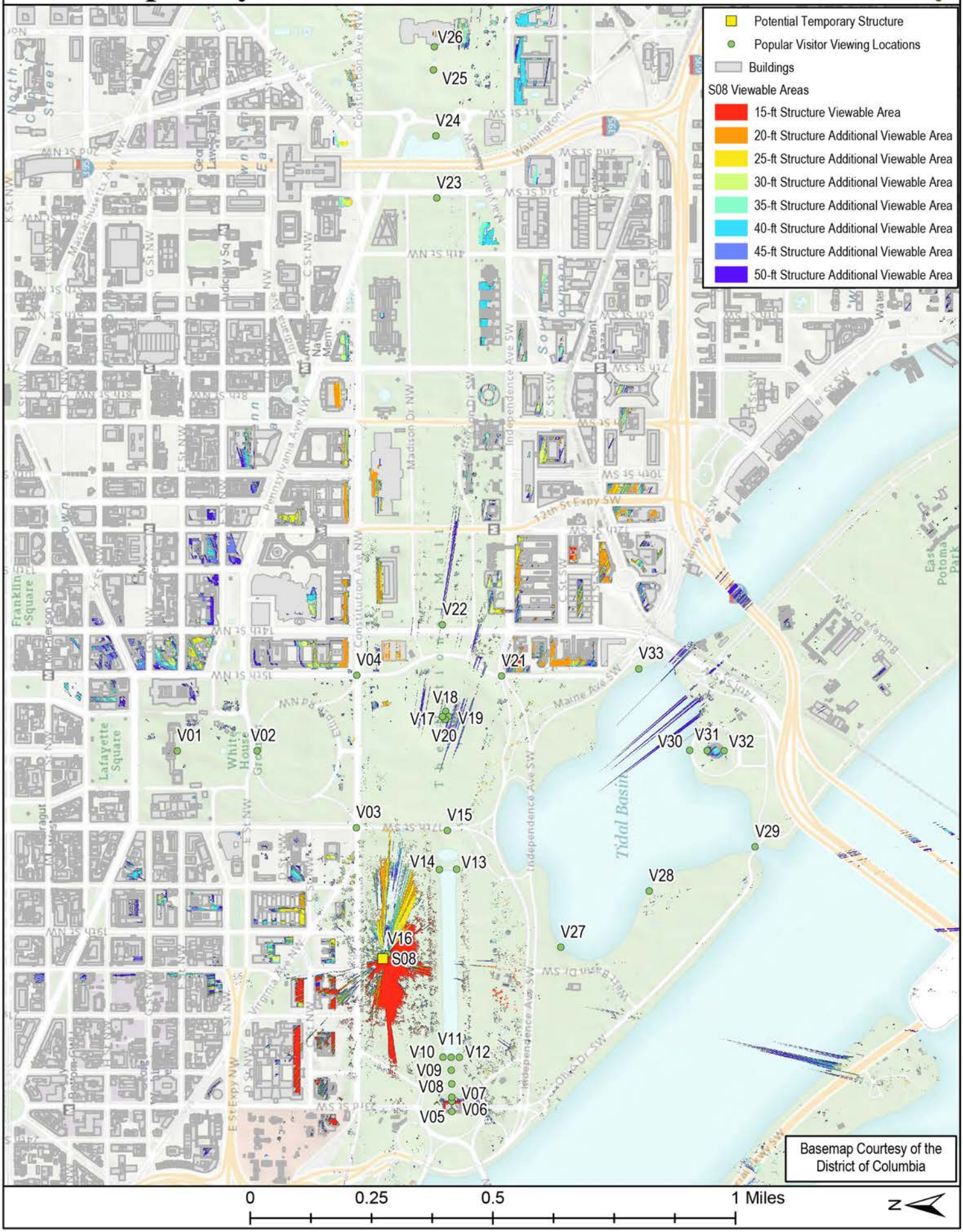
S06 Temporary Structure Viewable Area



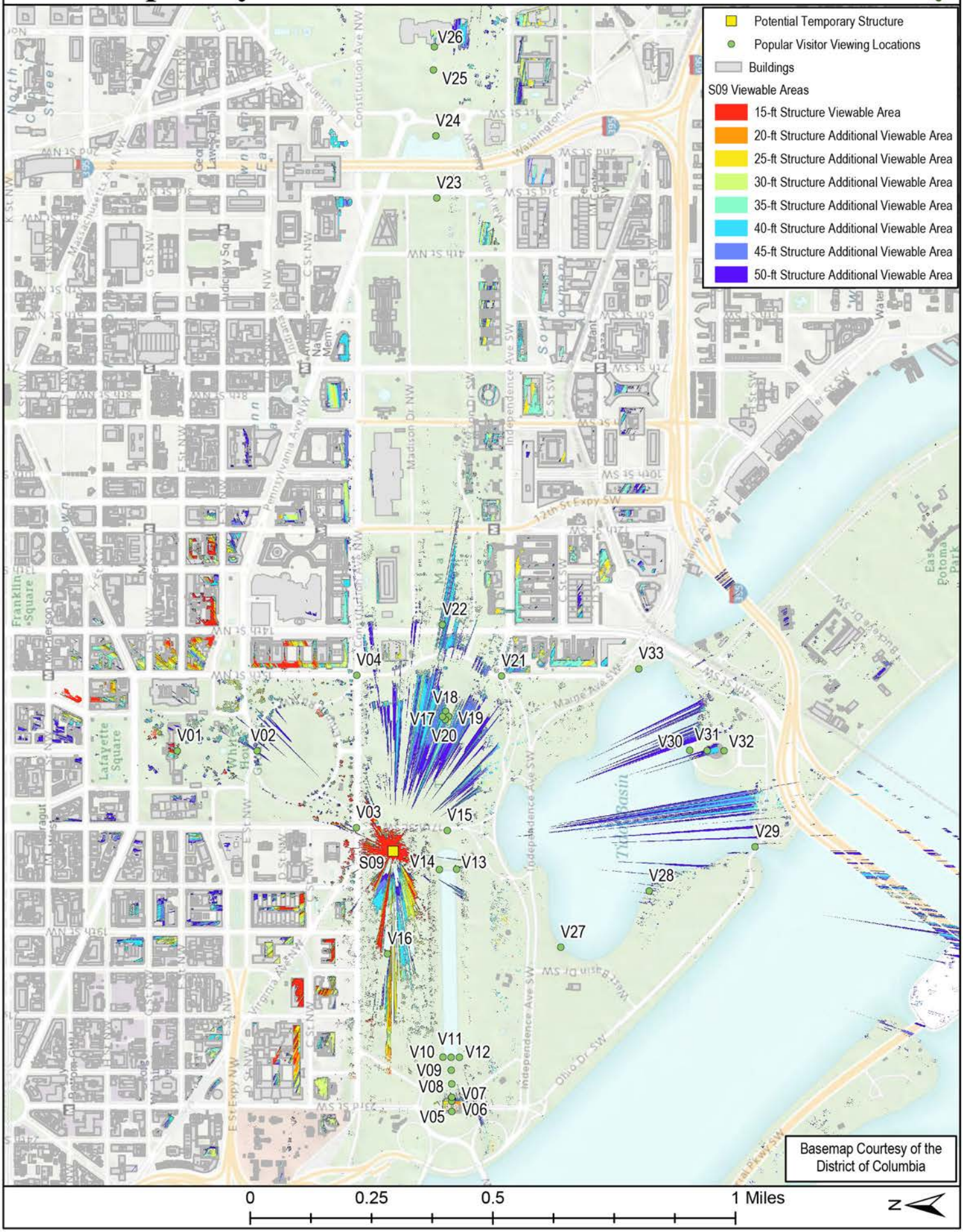
S07 Temporary Structure Viewable Area



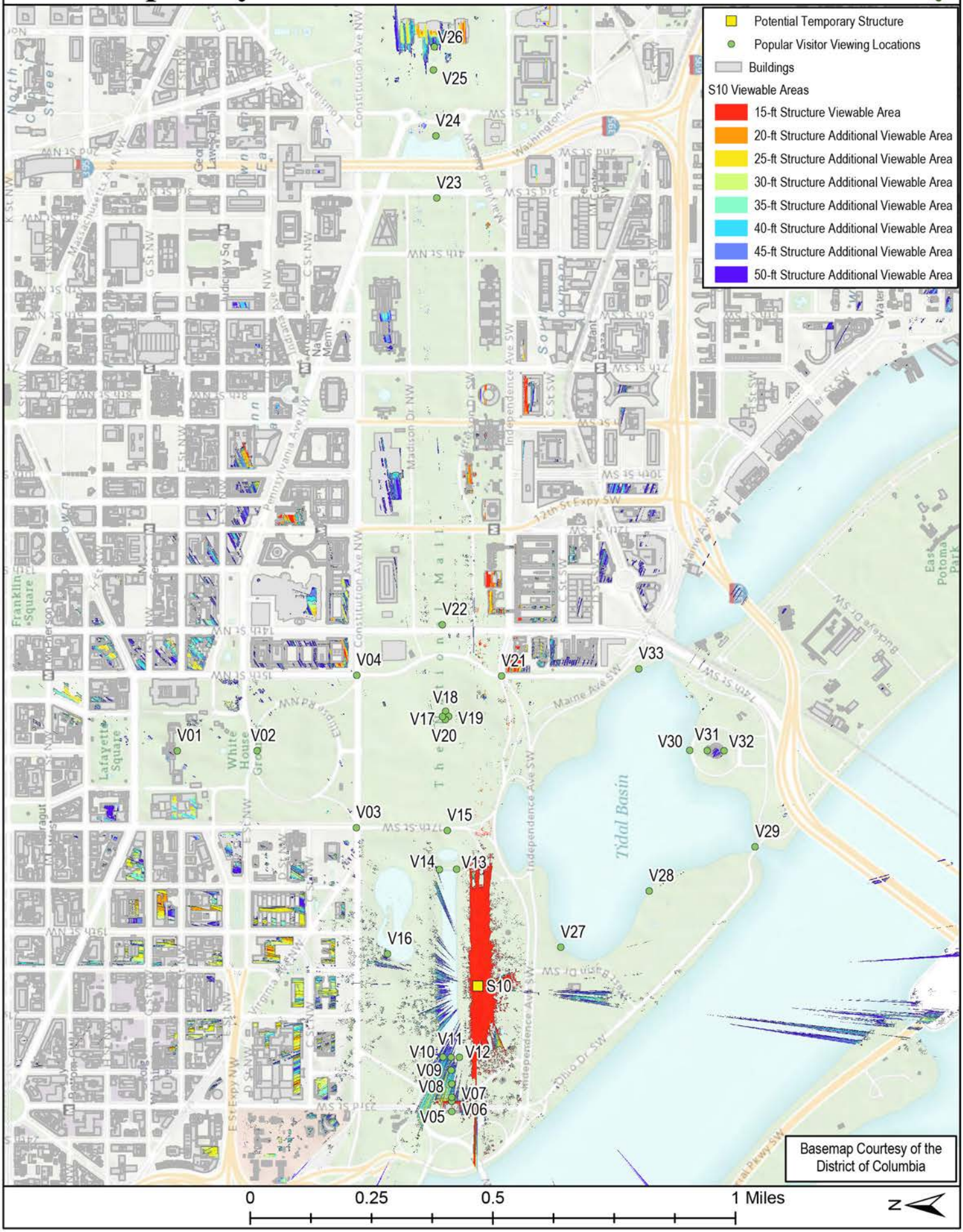
S08 Temporary Structure Viewable Area



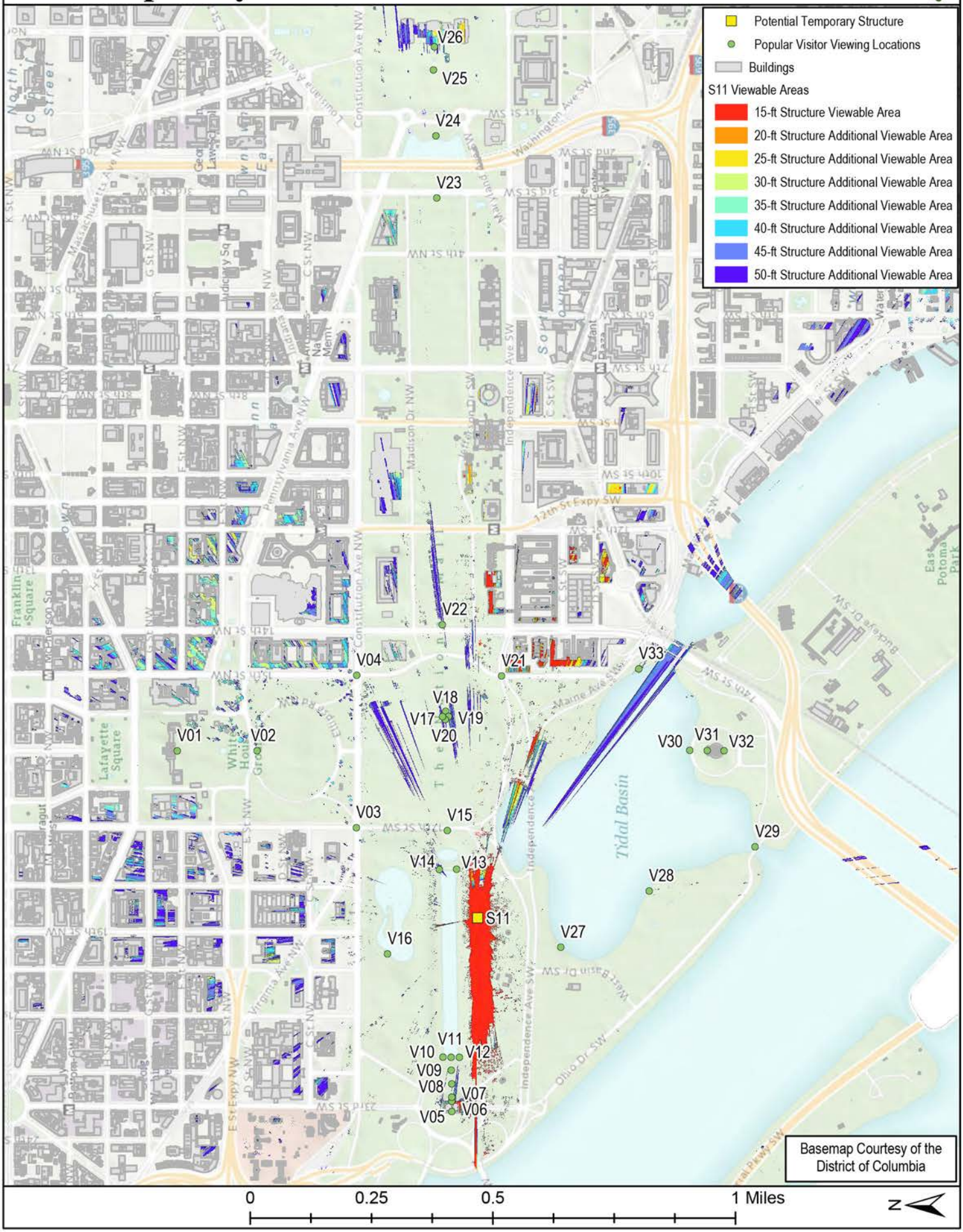
S09 Temporary Structure Viewable Area



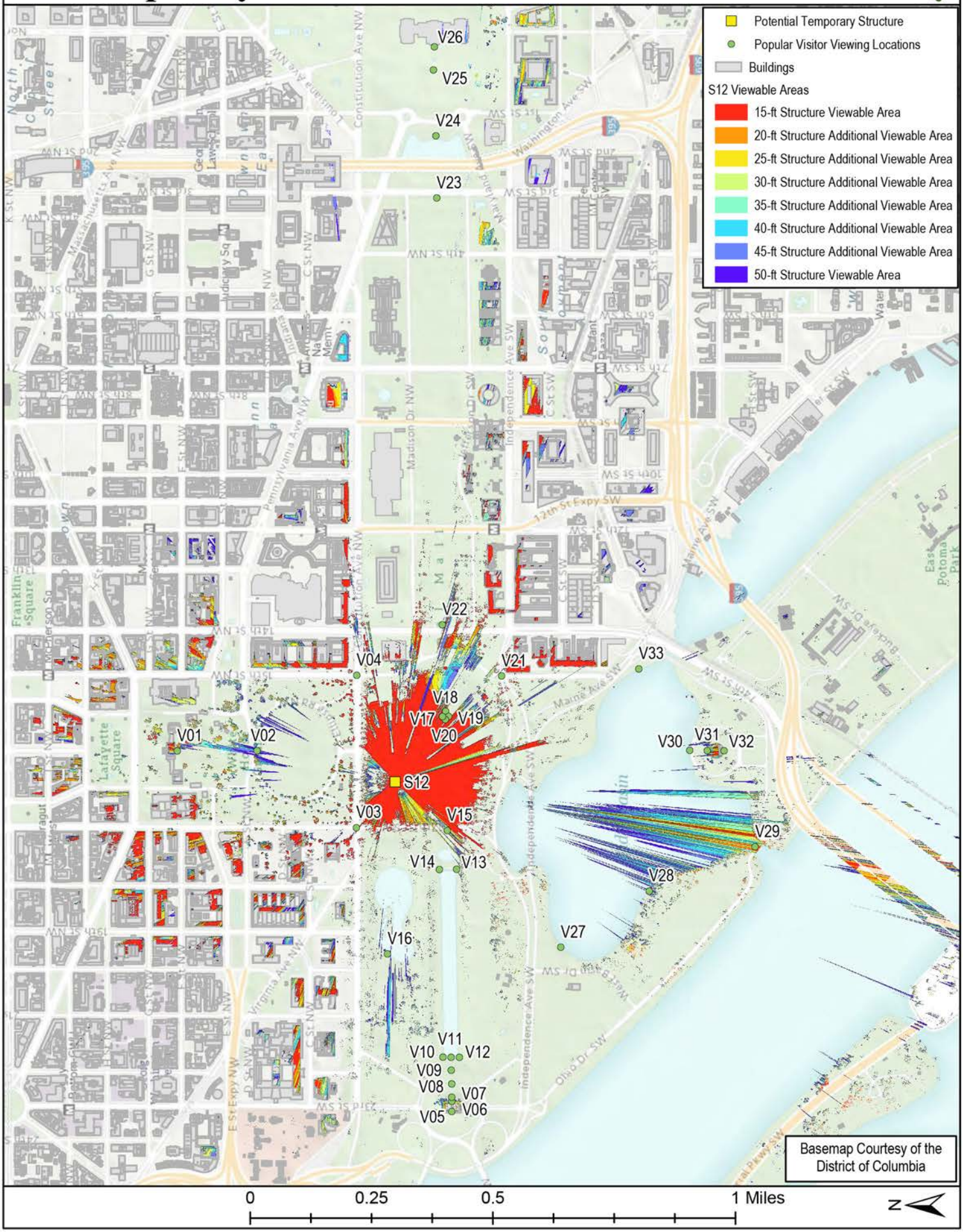
S10 Temporary Structure Viewable Area



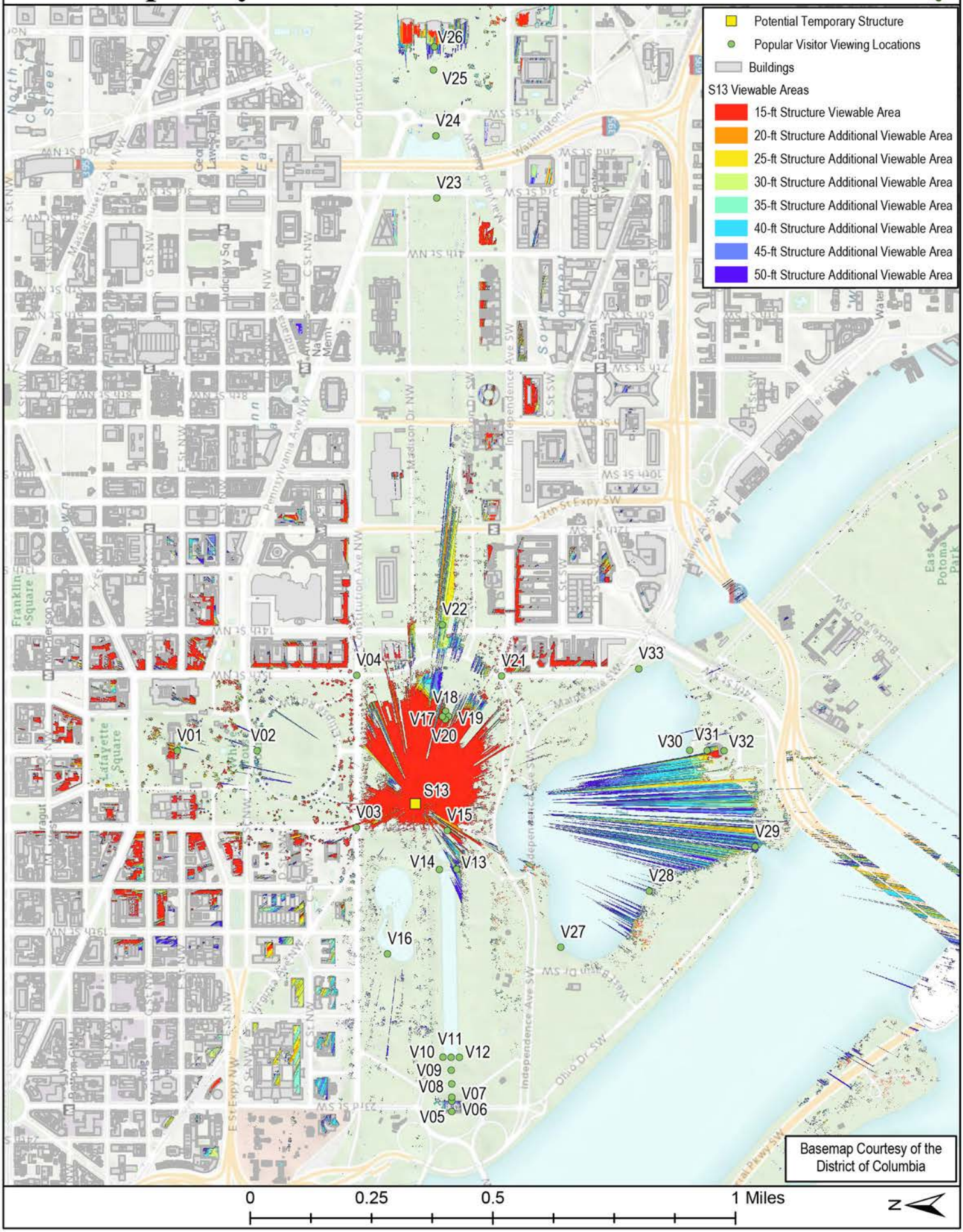
S11 Temporary Structure Viewable Area



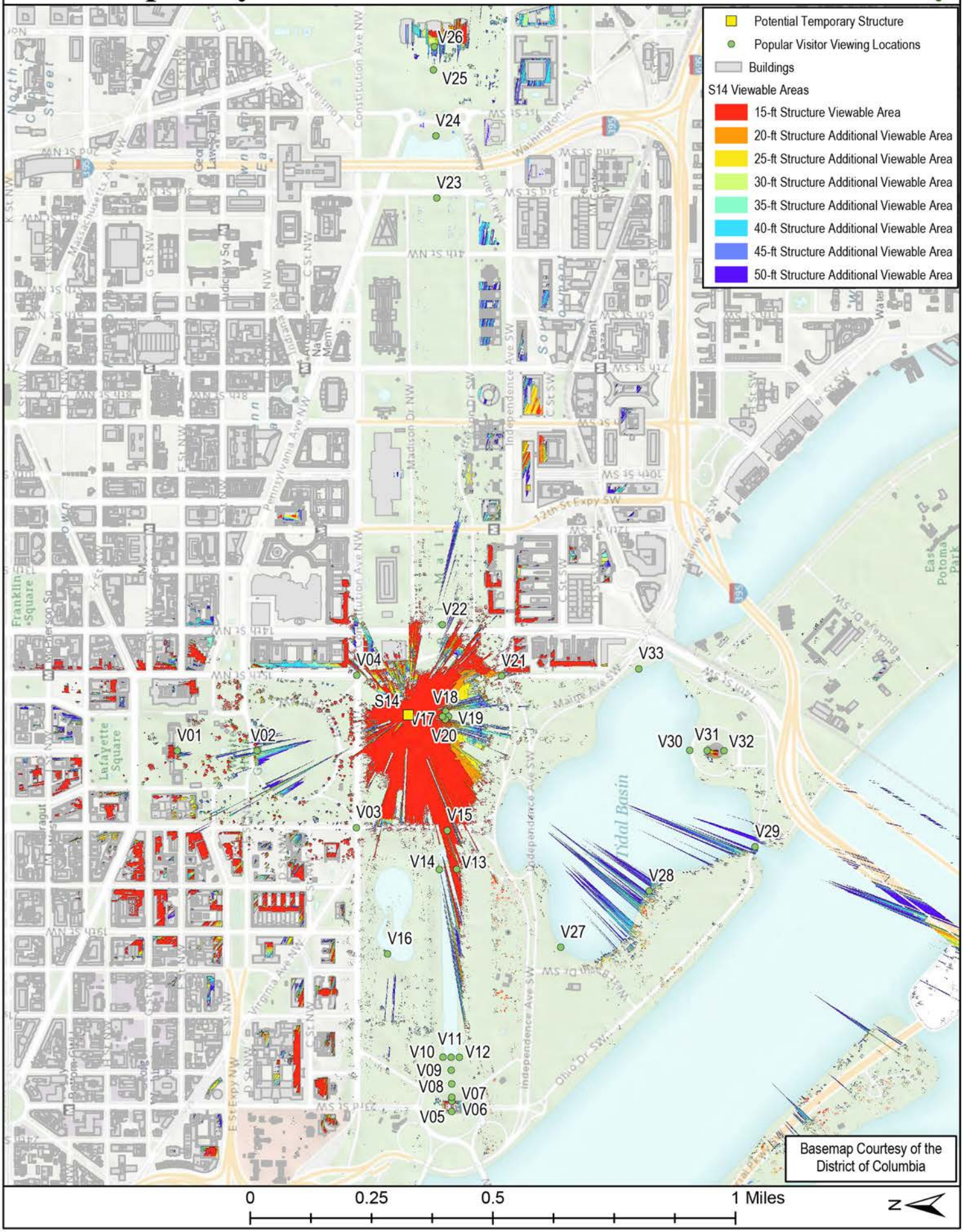
S12 Temporary Structure Viewable Area



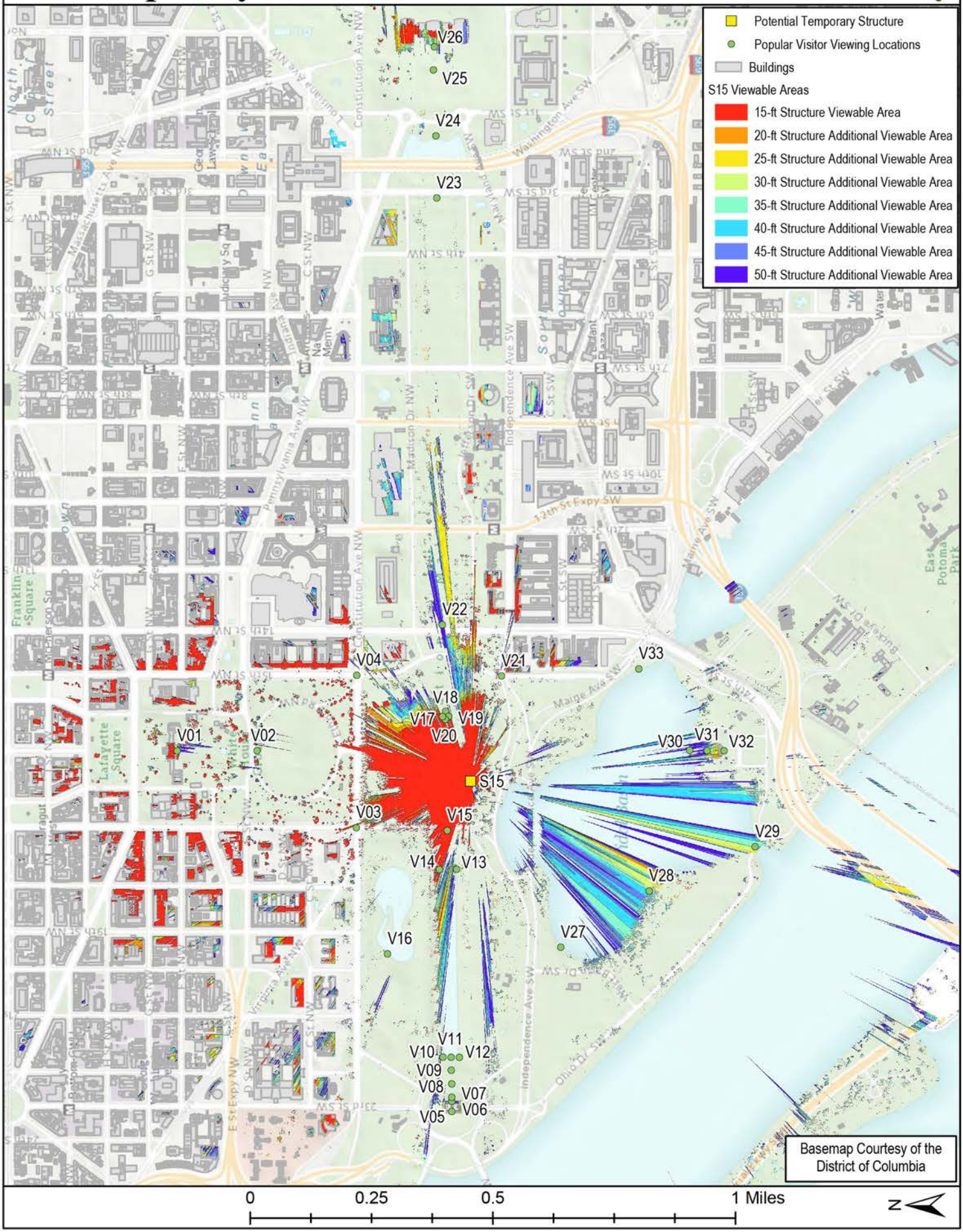
S13 Temporary Structure Viewable Area



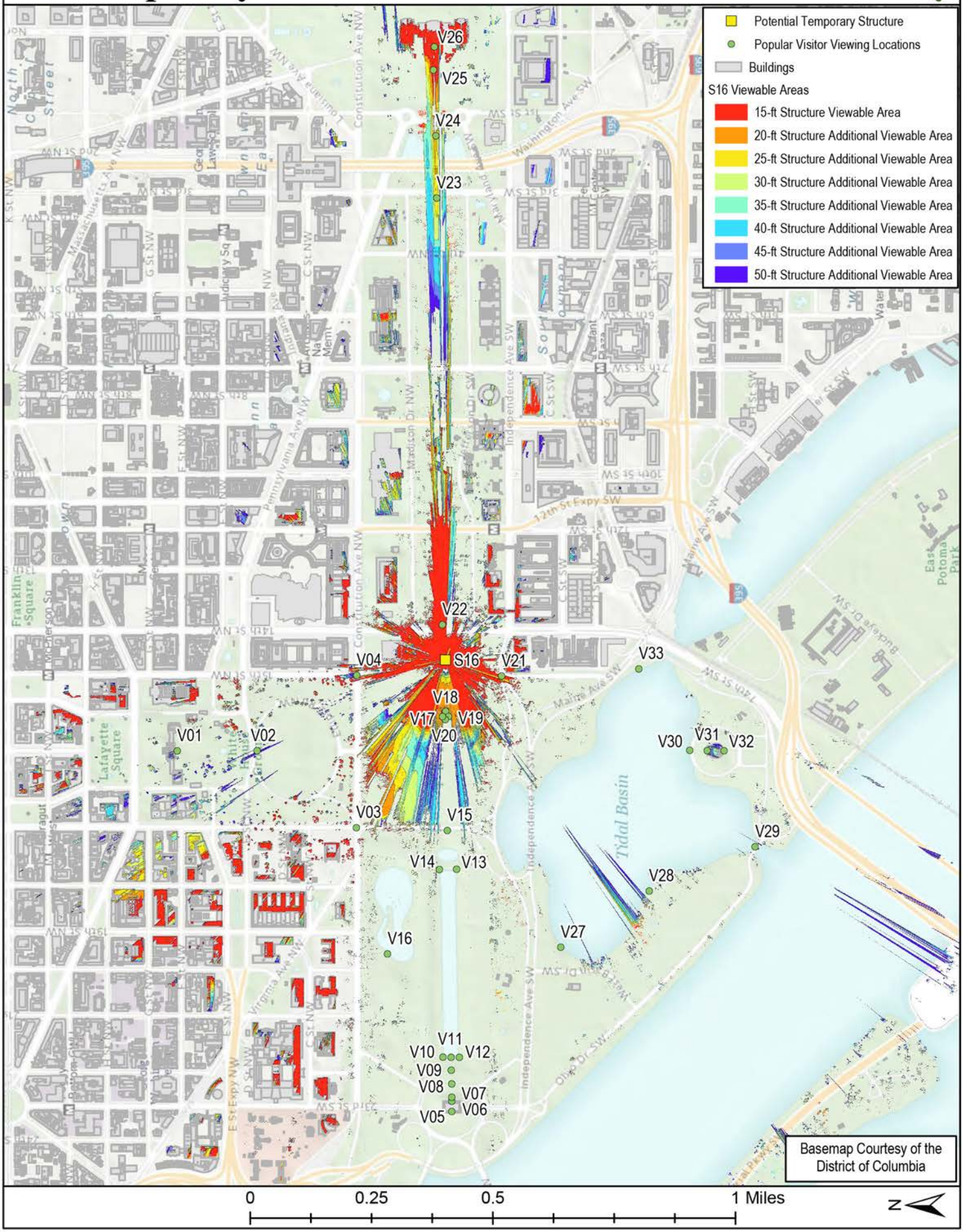
S14 Temporary Structure Viewable Area



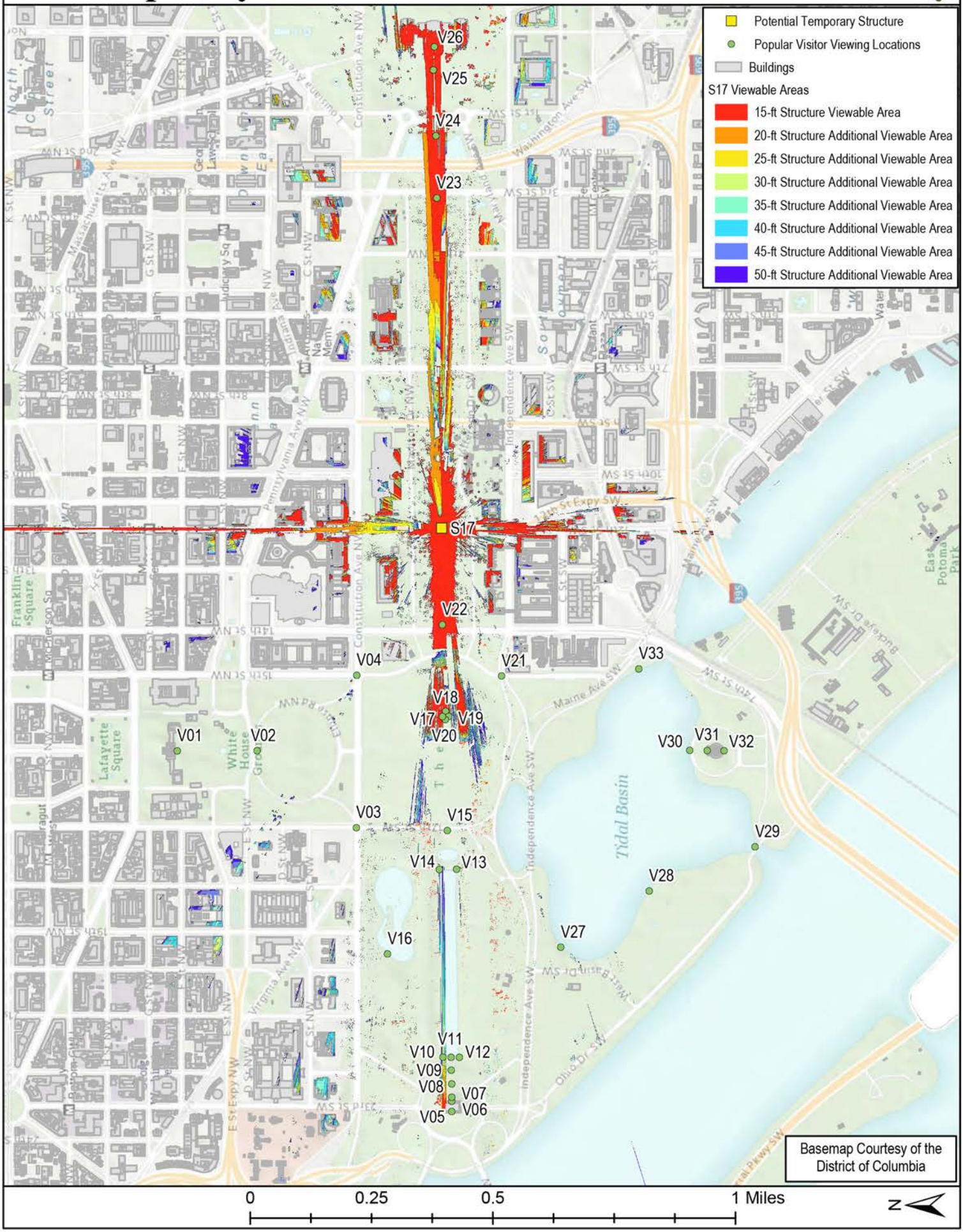
S15 Temporary Structure Viewable Area



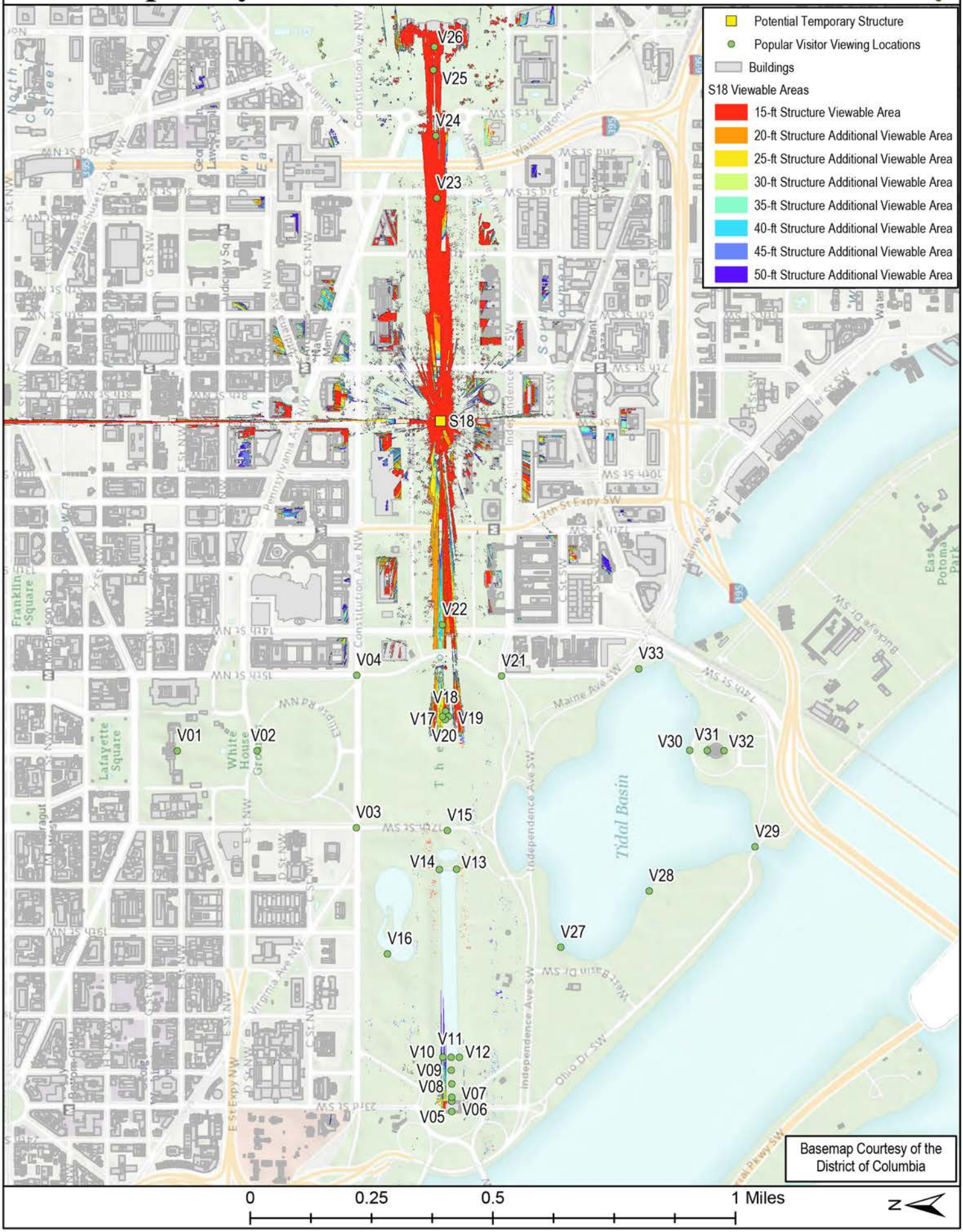
S16 Temporary Structure Viewable Area



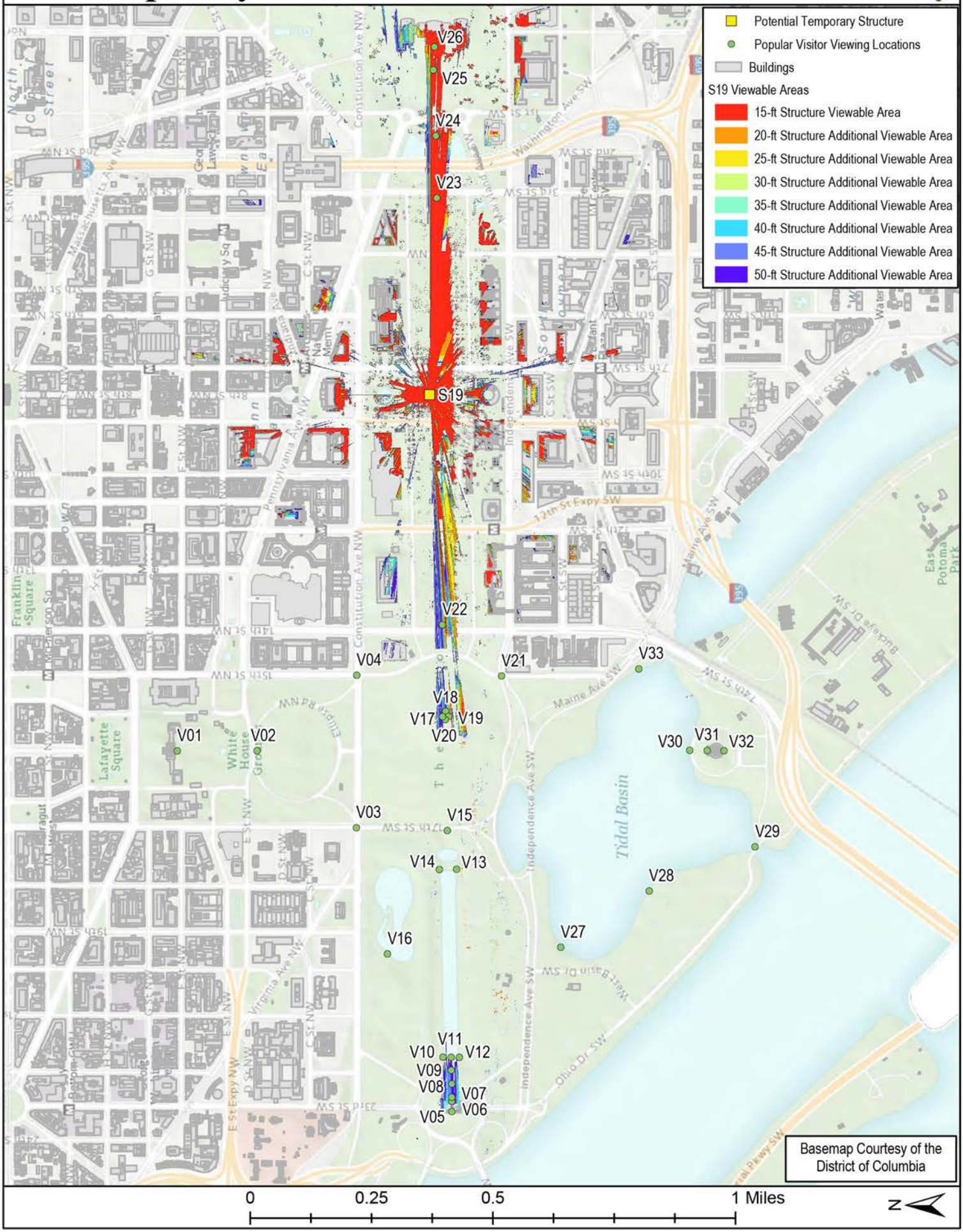
S17 Temporary Structure Viewable Area



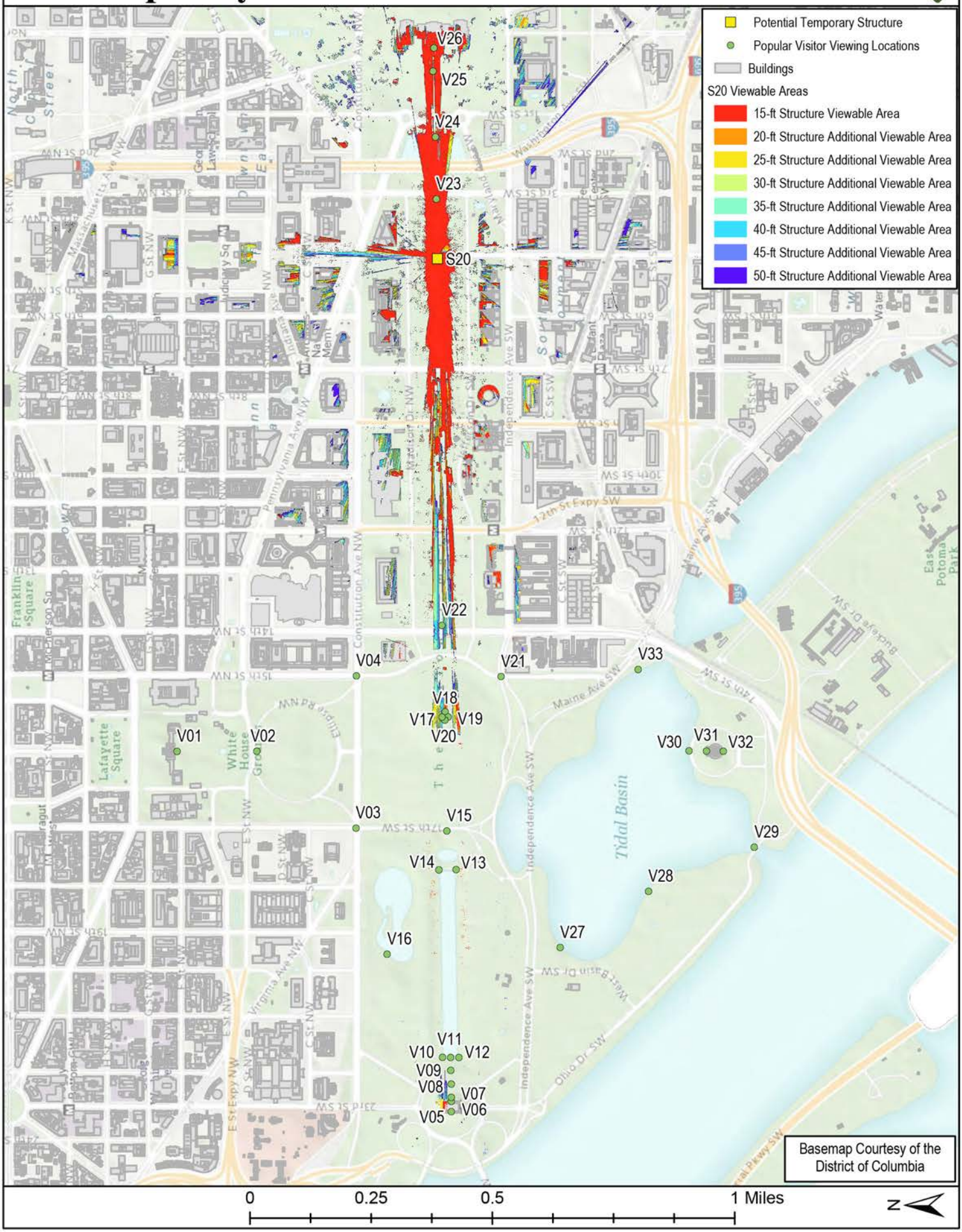
S18 Temporary Structure Viewable Area



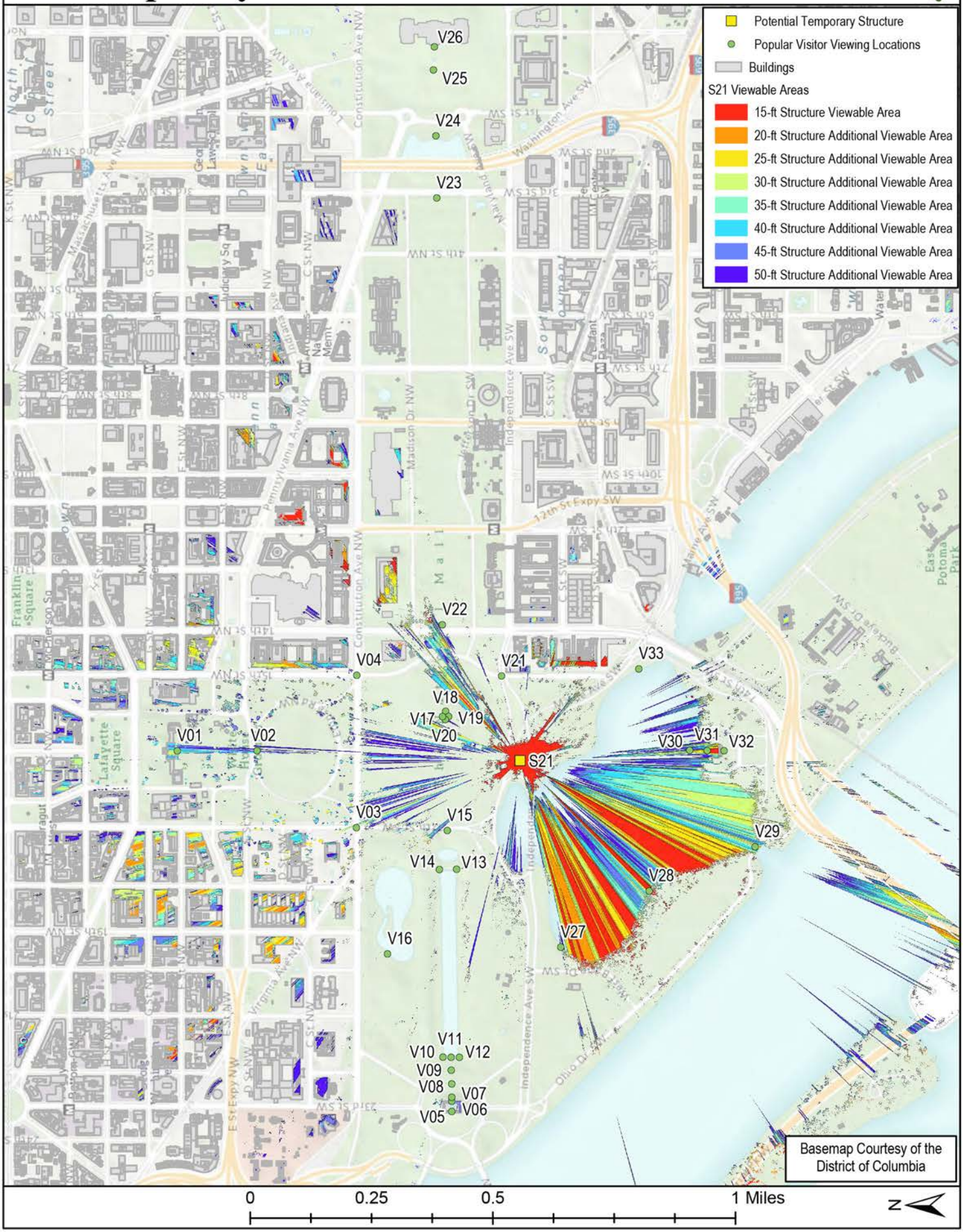
S19 Temporary Structure Viewable Area



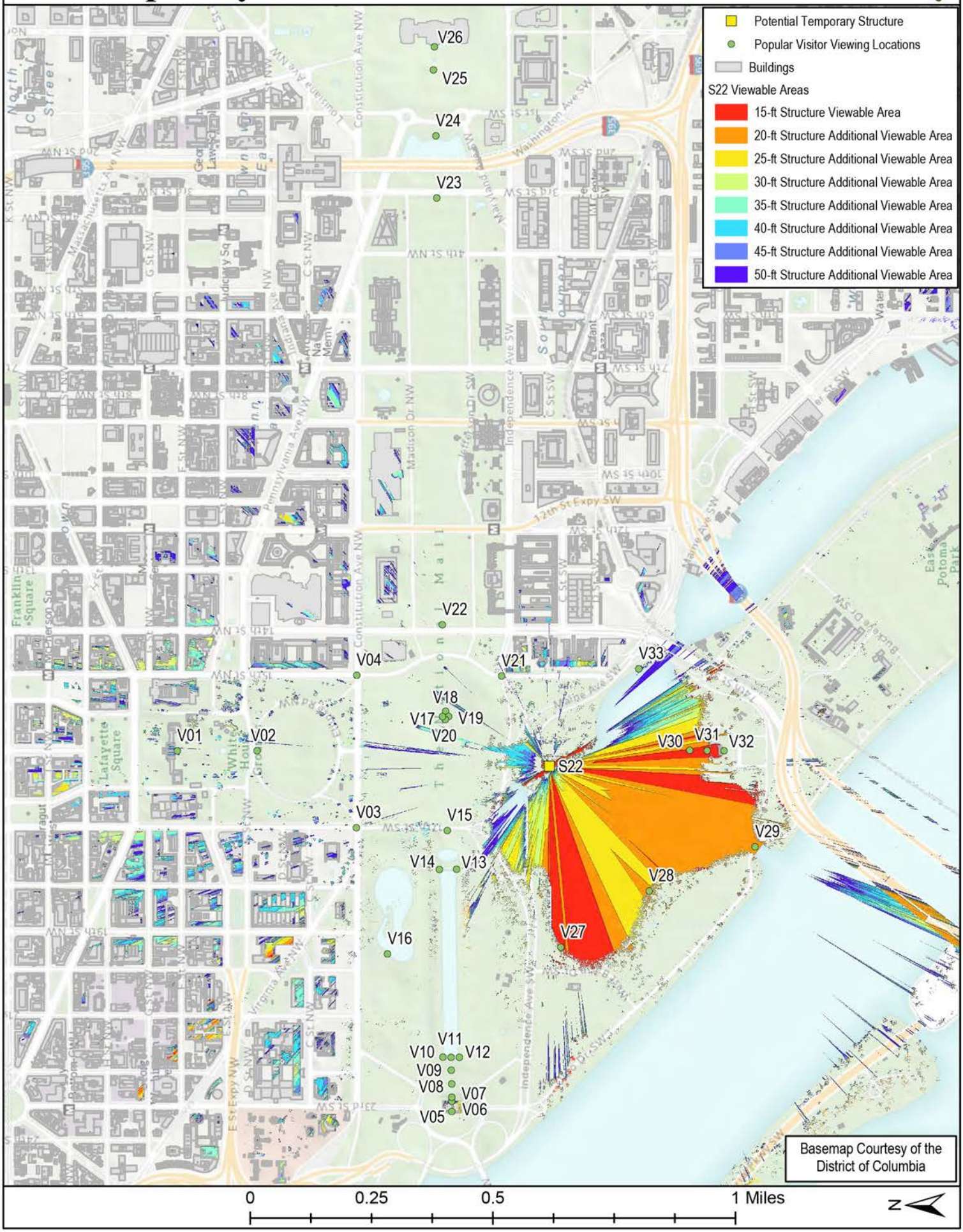
S20 Temporary Structure Viewable Area



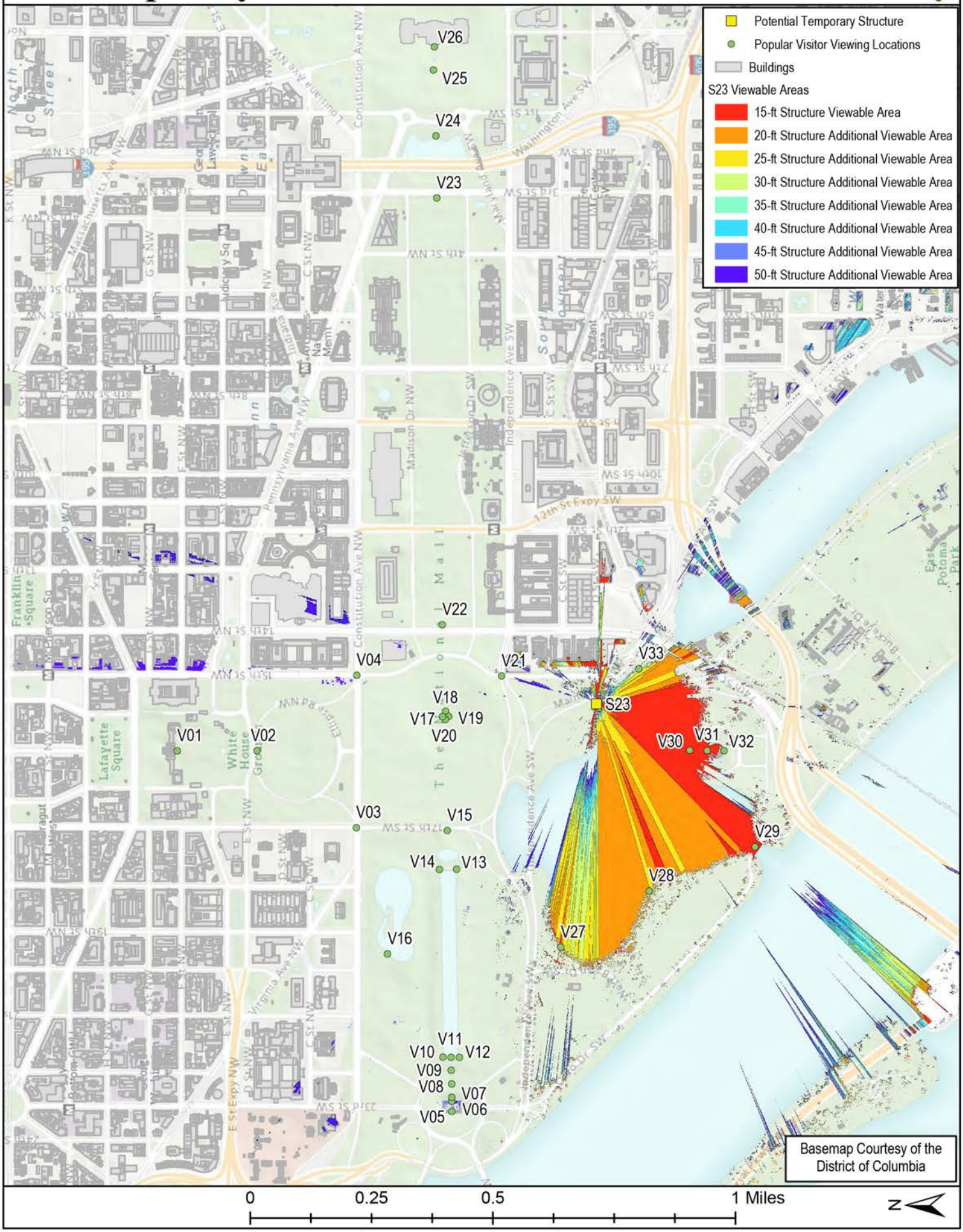
S21 Temporary Structure Viewable Area



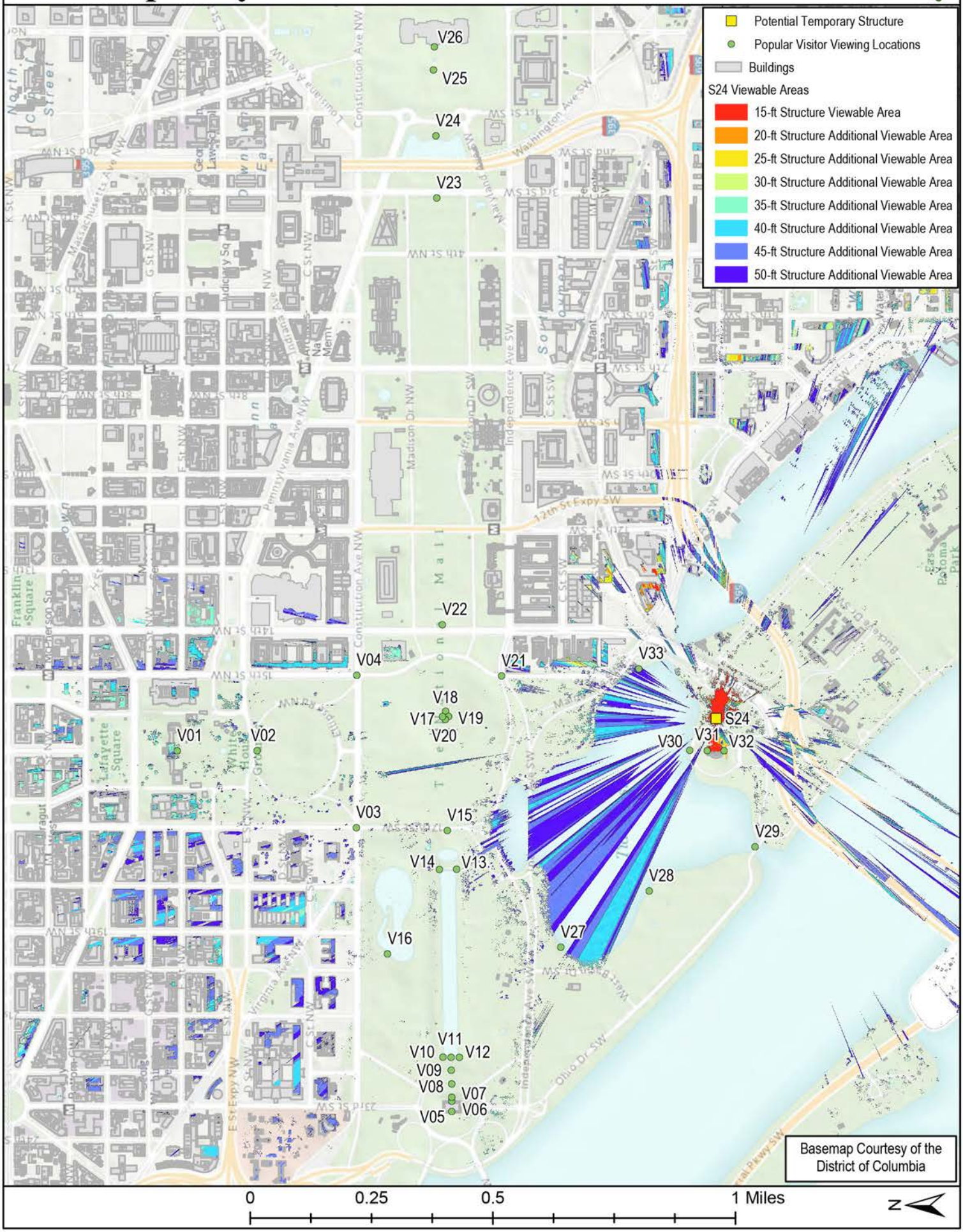
S22 Temporary Structure Viewable Area



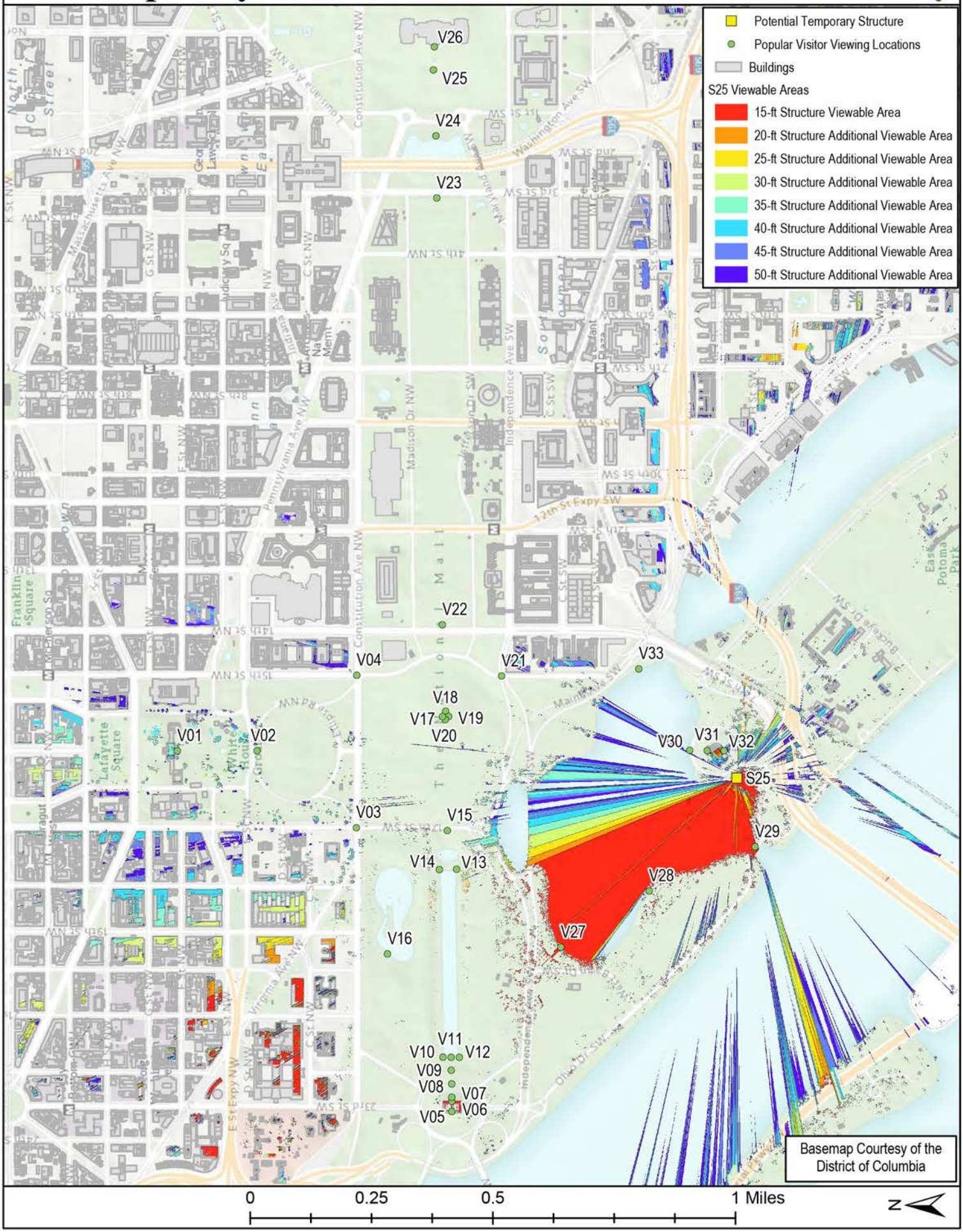
S23 Temporary Structure Viewable Area



S24 Temporary Structure Viewable Area



S25 Temporary Structure Viewable Area



Appendix D – Viewshed Matrices

Summary of Visitor Points that are able to see Temporary Structures at various heights.

	V01	V02	V03	V04	V05	V06	V07	V08	V09	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33
S01	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	5	0	0	0	0	0	0	0	0	1	0	1	0	0
S02	0	8	0	0	0	2	0	0	0	0	0	0	0	0	0	0	6	6	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0
S03	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0
S04	0	8	0	0	0	5	0	0	0	0	0	0	0	0	0	0	4	4	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0
S05	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
S06	0	0	0	0	0	8	8	8	8	8	8	8	8	8	8	0	8	0	8	8	0	0	0	0	0	0	0	0	0	0	0	0	0
S07	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	8	5	0	8	3	0	0	0	0	0	0	0	0	0	0	0	0	0
S08	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	1	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S09	0	2	0	0	0	7	3	0	0	0	0	0	0	0	0	0	4	0	1	3	0	0	0	0	0	1	0	0	0	0	2	0	0
S10	0	0	0	0	0	8	6	4	3	3	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S11	0	0	0	0	0	8	1	0	0	0	0	0	0	1	0	0	2	0	8	1	0	1	0	0	0	1	0	0	0	0	0	0	2
S12	0	3	0	0	0	5	1	0	0	0	0	0	0	0	7	0	8	0	0	8	0	0	0	0	0	0	0	1	8	0	0	0	0
S13	0	0	0	0	0	3	0	0	0	0	0	0	6	0	8	0	8	0	8	8	0	5	0	0	0	0	0	2	6	0	0	0	0
S14	0	0	0	0	0	7	0	0	0	0	0	0	0	0	8	0	8	8	0	8	2	0	0	0	1	3	0	0	0	0	0	0	0
S15	4	0	0	0	0	7	0	0	0	0	0	0	1	0	8	0	0	0	8	0	0	1	0	0	0	0	0	4	5	0	3	0	0
S16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	8	0	0	8	8	6	7	8	8	0	0	2	0	0	0	0
S17	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	8	8	0	0	0	8	8	8	8	8	0	0	0	0	0	0	0
S18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	8	0	0	0	4	8	8	8	8	0	0	0	0	0	0	0
S19	0	0	0	0	0	3	3	3	3	1	1	0	0	0	0	0	4	3	0	0	0	4	8	8	8	8	0	0	0	0	0	0	0
S20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	8	0	0	0	0	8	8	7	8	0	0	0	0	0	0	0
S21	0	1	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	8	3	0	0	0	0	0	0	0	8	6	5	7	0	0
S22	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	0	0	0	0	0	8	7	7	8	8	0	2
S23	0	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	8	8	8	8	0	5
S24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0	0	0	0	0	0	0	0	0	2
S25	0	0	0	0	0	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	8	1	0	0	0

*** Number in cell indicates how many different heights a particular temporary structure can be seen from a certain visitor point. There are a total of 8 different heights.**

Temporay Structures at 15ft tall

	V01	V02	V03	V04	V05	V06	V07	V08	V09	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33
S01	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S02	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S03	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S04	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S05	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S06	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S07	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S08	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S09	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S10	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S11	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
S13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S15	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	1	0	0	1	1	0	0	0	0	0	0	0
S17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0
S21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0
S22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	0	0	1	1	0	0
S23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0
S24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S25	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0

Temporay Structures at 20ft tall

	V01	V02	V03	V04	V05	V06	V07	V08	V09	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33
S01	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S02	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S03	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S04	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S05	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S06	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S07	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S08	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S09	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S10	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S11	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
S13	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S14	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S15	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	0	1	1	1	0	0	0	0	0	0	0
S17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	1	0	0
S22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0
S23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0
S24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S25	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0

Temporay Structures at 25ft tall

	V01	V02	V03	V04	V05	V06	V07	V08	V09	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33
S01	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S02	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S03	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S04	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S05	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S06	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S07	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S08	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S09	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S10	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S11	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
S13	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0
S14	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S15	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0
S17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0
S22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0
S23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0
S24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S25	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0

Temporay Structures at 30ft tall

	V01	V02	V03	V04	V05	V06	V07	V08	V09	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33
S01	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S02	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S03	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S04	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S05	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S06	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S07	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S08	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S09	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S10	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S11	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S12	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
S13	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0
S14	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S15	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	0	0
S16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0
S17	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0
S22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0
S23	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1
S24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S25	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0

Temporay Structures at 35ft tall

	V01	V02	V03	V04	V05	V06	V07	V08	V09	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33
S01	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S02	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S03	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S04	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S05	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S06	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S07	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S08	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S09	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S10	0	0	0	0	0	1	1	1	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S11	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S12	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
S13	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0
S14	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S15	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	0	0	0
S16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0
S17	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S21	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	1	1	1	0	0
S22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0
S23	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1
S24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S25	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0

Temporay Structures at 40ft tall

	V01	V02	V03	V04	V05	V06	V07	V08	V09	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33
S01	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S02	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S03	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
S04	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S05	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S06	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S07	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S08	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S09	0	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S10	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S11	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S12	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
S13	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	0	0	0	0	0	1	0	0	0	0
S14	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	0	0	0	0	0	1	0	0	0	0	0	0	0
S15	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0
S16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	0	0	0	0	0	0	0
S17	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S19	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S21	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	0	0
S22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	0
S23	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1
S24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S25	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0

Temporay Structures at 45ft tall

	V01	V02	V03	V04	V05	V06	V07	V08	V09	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33
S01	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S02	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S03	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
S04	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S05	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S06	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S07	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S08	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S09	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	0
S10	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S11	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
S12	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	0
S13	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0
S14	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	0	0	0	1	0	0	0	0	0	0	0
S15	1	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	1	1	0	1	0	0
S16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	0	0	1	0	0	0	0
S17	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S19	0	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S21	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	0	0
S22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	1
S23	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1
S24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
S25	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0

Temporay Structures at 50ft tall

	V01	V02	V03	V04	V05	V06	V07	V08	V09	V10	V11	V12	V13	V14	V15	V16	V17	V18	V19	V20	V21	V22	V23	V24	V25	V26	V27	V28	V29	V30	V31	V32	V33
S01	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	1	0	1	0	0
S02	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S03	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
S04	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S05	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0
S06	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S07	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	1	1	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
S08	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S09	0	1	0	0	0	1	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0	0	0	1	0	0	0	0	1	0	0
S10	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S11	0	0	0	0	0	1	1	0	0	0	0	0	0	1	0	0	1	0	1	1	0	1	0	0	0	1	0	0	0	0	0	0	1
S12	0	1	0	0	0	1	1	0	0	0	0	0	0	0	1	0	1	0	0	1	0	0	0	0	0	0	0	1	1	0	0	0	0
S13	0	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	1	0	1	1	0	1	0	0	0	0	0	1	1	0	0	0	0
S14	0	0	0	0	0	1	0	0	0	0	0	0	0	0	1	0	1	1	0	1	1	0	0	0	1	1	0	0	0	0	0	0	0
S15	1	0	0	0	0	1	0	0	0	0	0	0	1	0	1	0	0	0	1	0	0	1	0	0	0	0	0	1	1	0	1	0	0
S16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	0	0	1	0	0	0	0
S17	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S19	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
S20	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	1	1	1	1	0	0	0	0	0	0	0
S21	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0	0	1	1	1	1	0	0
S22	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	1	1	1	1	1	0	1
S23	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	1
S24	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	1
S25	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	0

Appendix E – Ground Level Scenes Visualization Process

NAMA 3D Scene Process, April 2018

Preparation:

1. Google Earth Pro installed
2. Add KML files from P drive: P:\NAMA\NAMA3D\KMZs to My Places in gEarth (just drag into main window in gEarth). Visitor view points included.
3. Copy of map
4. Copy of scene processing spreadsheet
5. Tools--Options: under Terrain, check off ***Use 3D Imagery*** --- should not be checked
6. Terrain in Layers list should be checked ON
7. 3D Buildings and all sublayers should be checked ON

Scene Generation (starting with a viewpoint…)

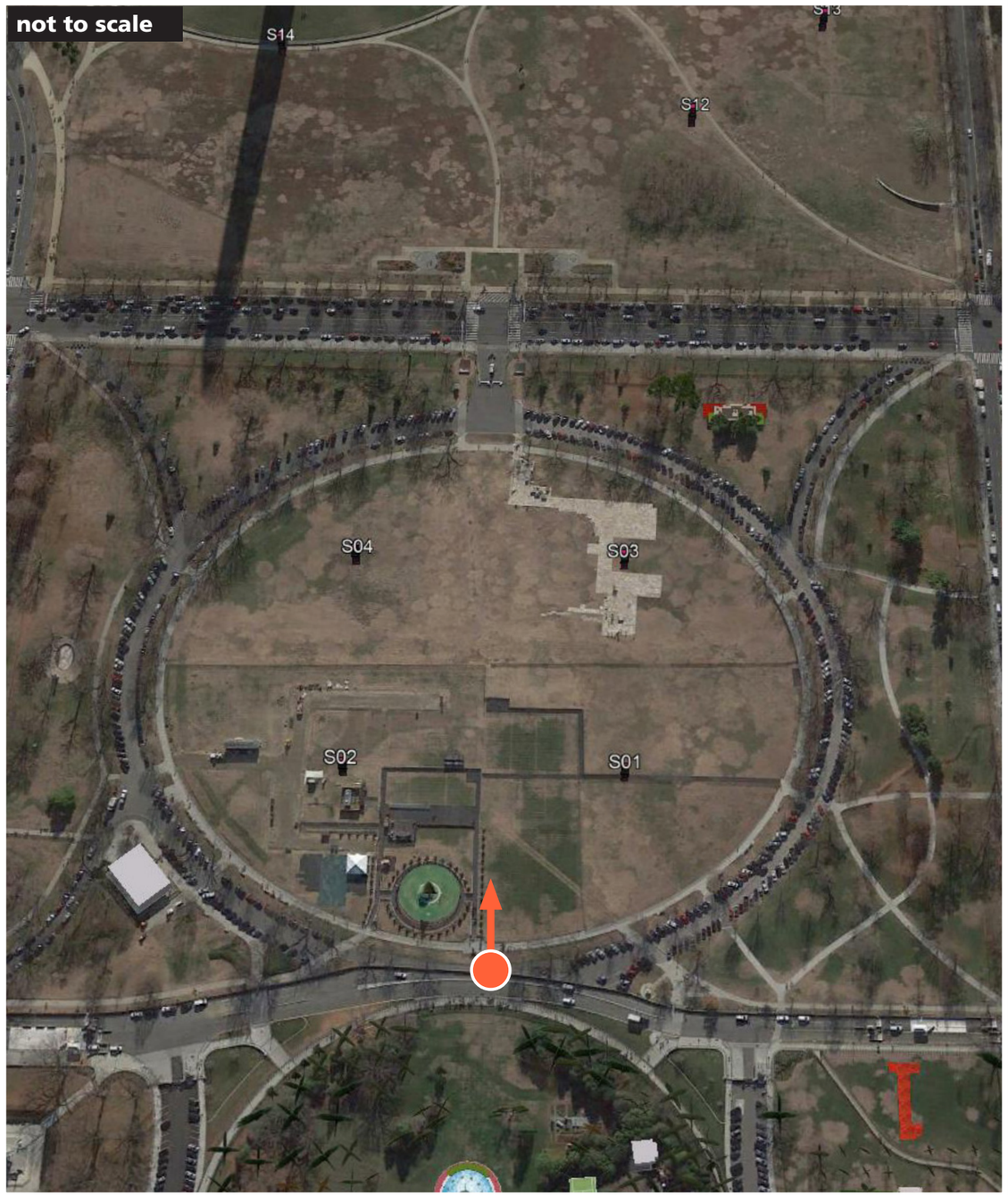
1. Consult spreadsheet to see which structures are visible at viewpoint
2. In the gEarth My Places, ensure that structure heights from 45' down to 15' are checked (turned on). Do not turn on the 50' height at first. You will be capturing scenes at two principle heights: 45' and 20'. Start with 45' (leave all heights below 45' checked on).
3. Look at map to see where structures are in relation to viewpoint to get an idea which direction to take the screen capture.
4. In gEarth, dropdown Visitor View Points KML in layer list to see individual viewpoints.
5. Find viewpoint label in the Places list in gEarth; double click to center view on that viewpoint. A popup opens. Verify the viewpoint number in the popup.
6. Use mouse wheel to zoom into viewpoint to an eye alt of about 300ft or less (closer).
7. Drag street view man to viewpoint (red pin); view changes to ground level view or street view.
8. Ensure view is set to ground level view (building icon near upper right next to street view man icon).
9. Pan (turn) view toward structure(s); use keyboard arrows.
10. If street view available, toggle view to street view. You will save a view in both street view and ground level view. Adjust the view if needed to get a better view of structures.
11. Click save image button.
12. Set resolution to 1080 HD.
13. Click to edit Title and Description.
14. Set title to viewpoint number and viewed structure height. e.g. "V02 45ft". If taking multiple view directions (captures) at same viewpoint, include direction in description. E.g. Looking Southeast".
15. If capturing street view, add image date to description. e.g. "Imagery Date: 6/2013".
16. Move title box if needed (to not block significant parts of view).
17. In image save mode, go to Map options and turn off the legend.
18. Ensure nothing is highlighted (selected with a purple hue) in view.
19. Save image with filename...e.g. "V02_45ft" for ground level view and "V02_45ft_sv" for street view.
20. TURN ON NEXT STRUCTURE HEIGHT (20ft). DO NOT CHANGE VIEW. LEAVE ALL HEIGHTS UP TO THE ONE YOU'RE TAKING A CAPTURE OF TURNED ON SO YOU CAN SEE THE 5 FT HEIGHT INCREMENTS
21. Update title and description if needed.
22. Save image with appropriate filename. Continue for all views (screen captures) needed for that viewpoint.

Appendix F – Ground Level Visualizations

Viewpoint 1 Page 1

Viewpoint 1 Page 2

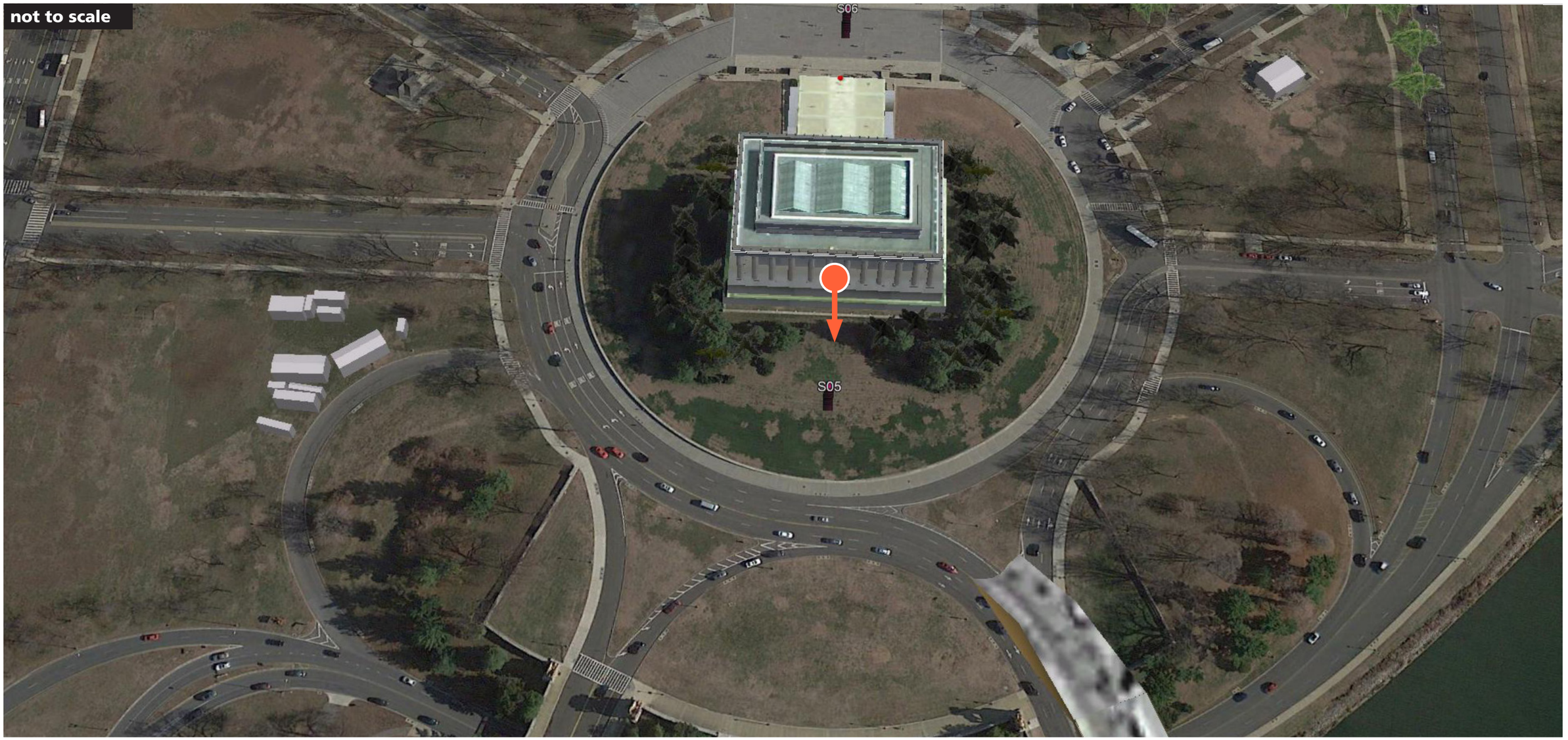
Viewpoint 2 Page 1



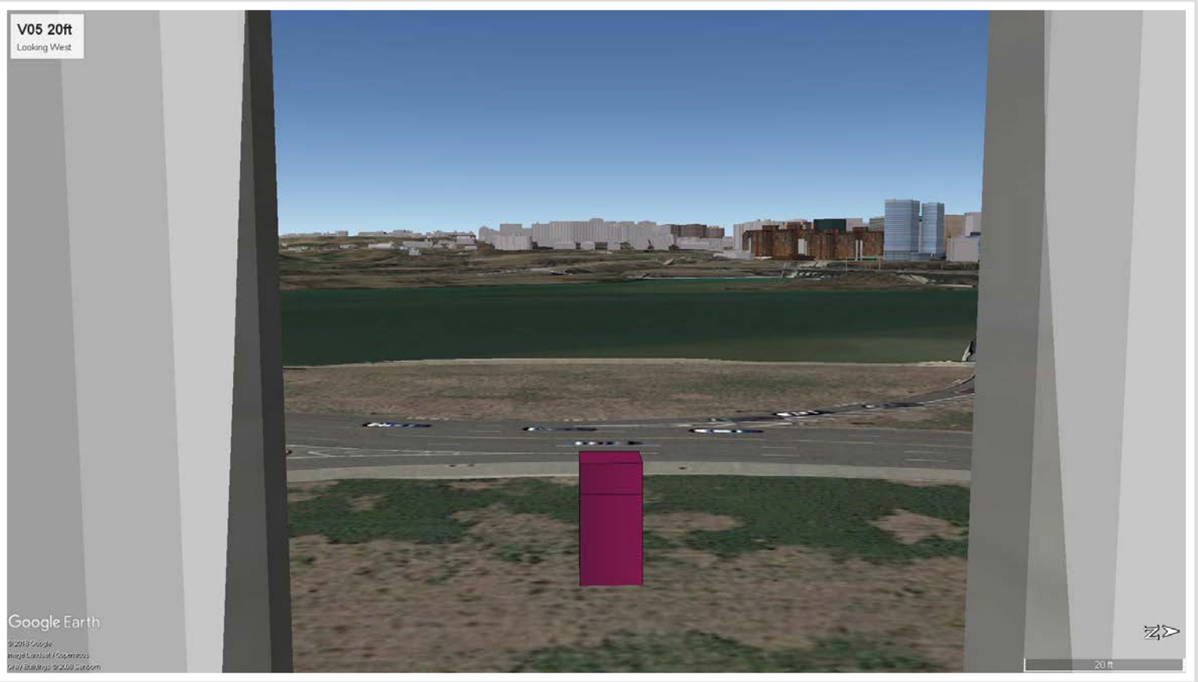
Viewpoint 2 Page 2

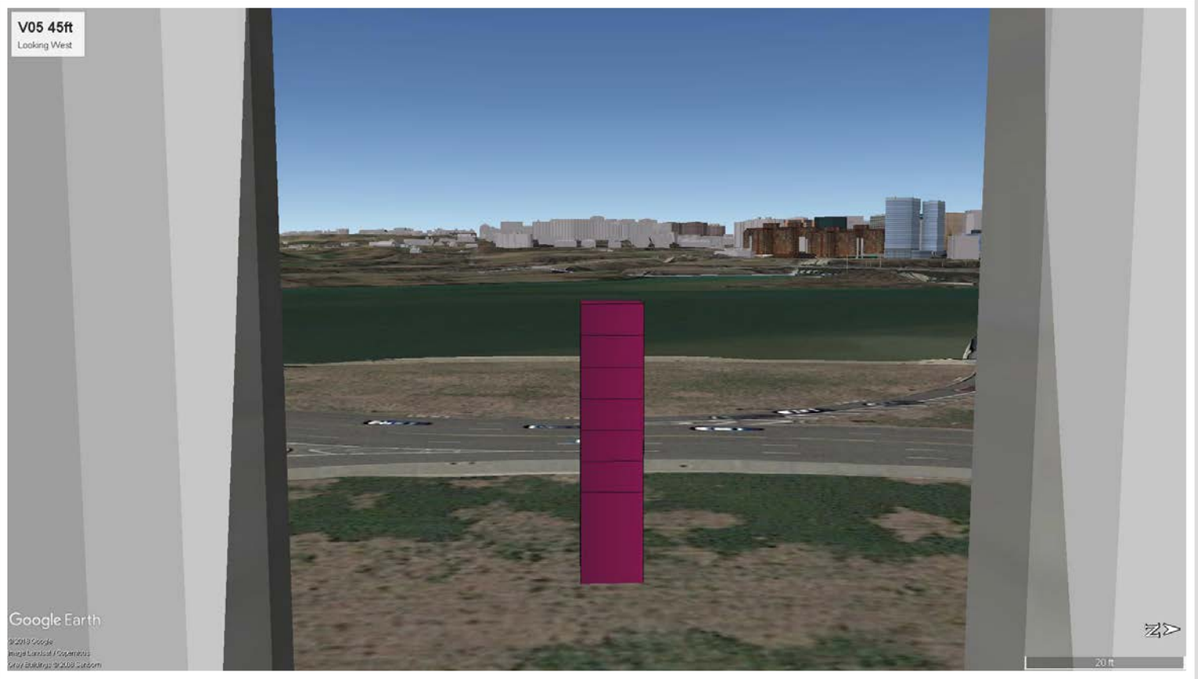
No Viewshed Results for Viewpoint 3 & 4

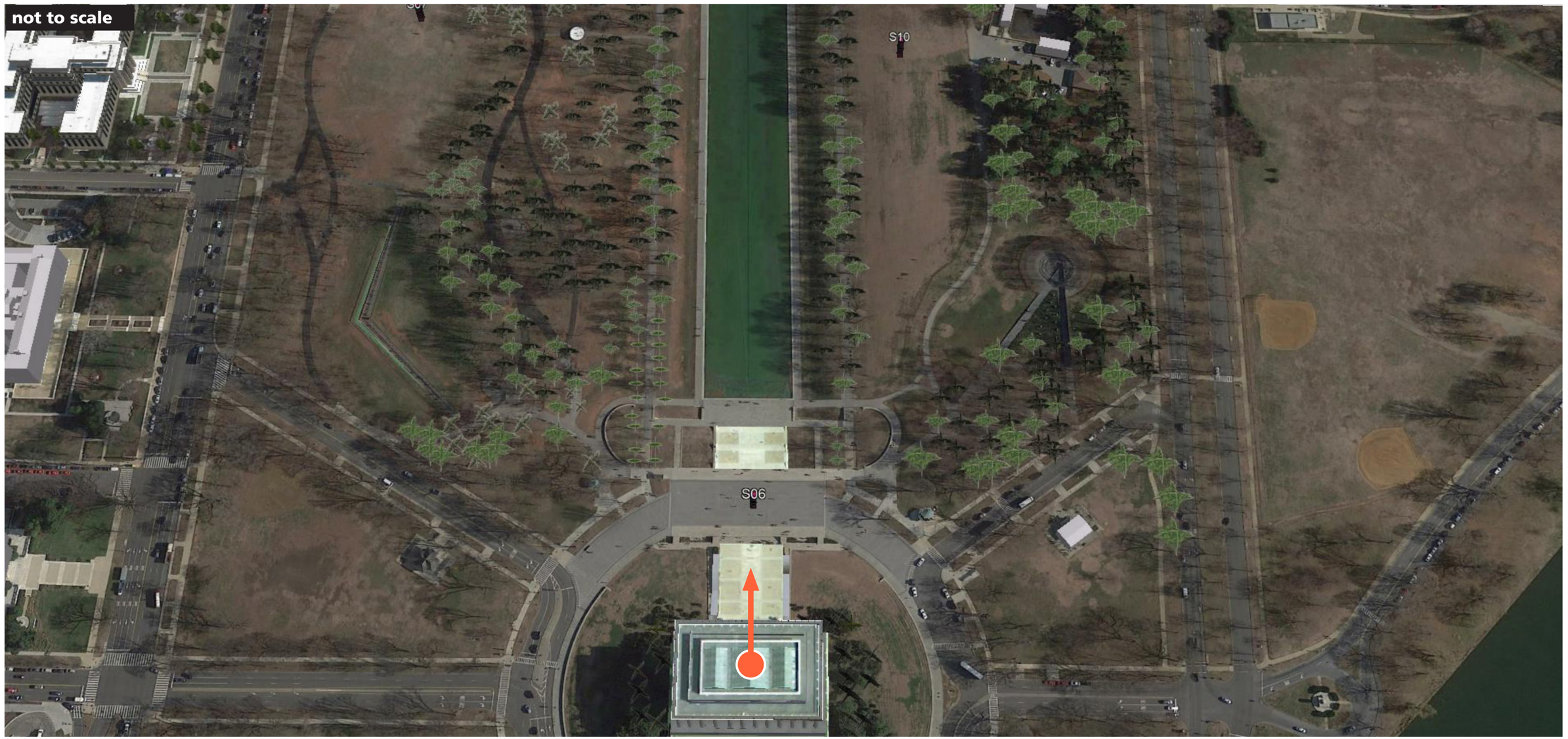
Viewpoint 5 Page 1



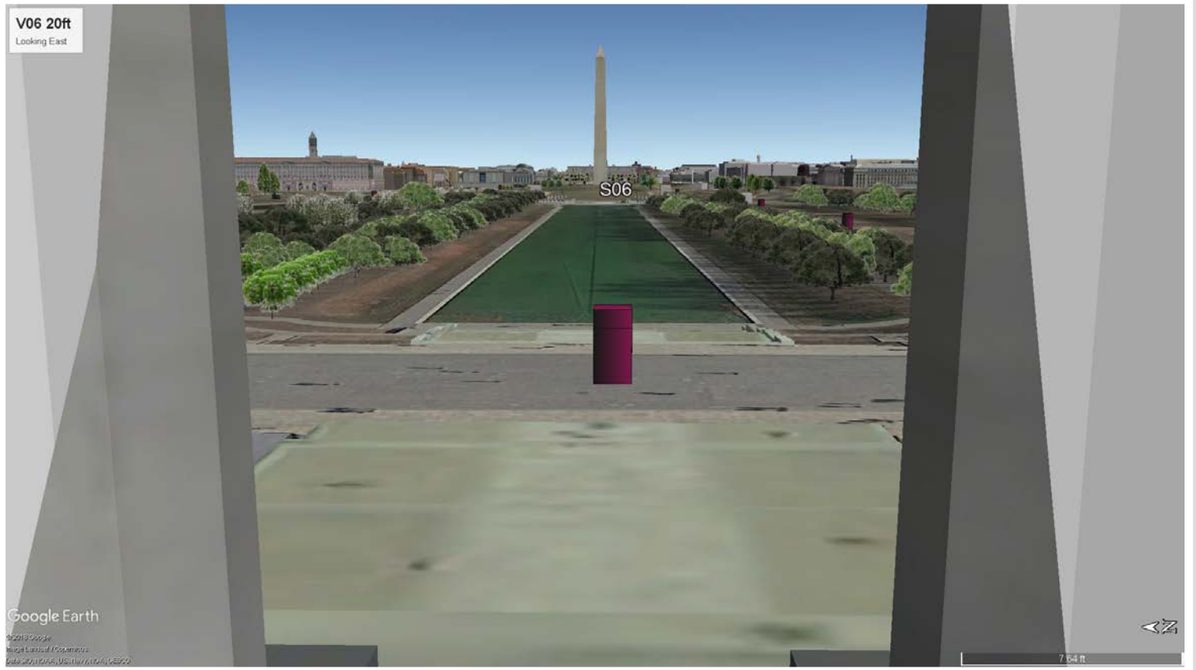
Viewpoint 5 Page 2

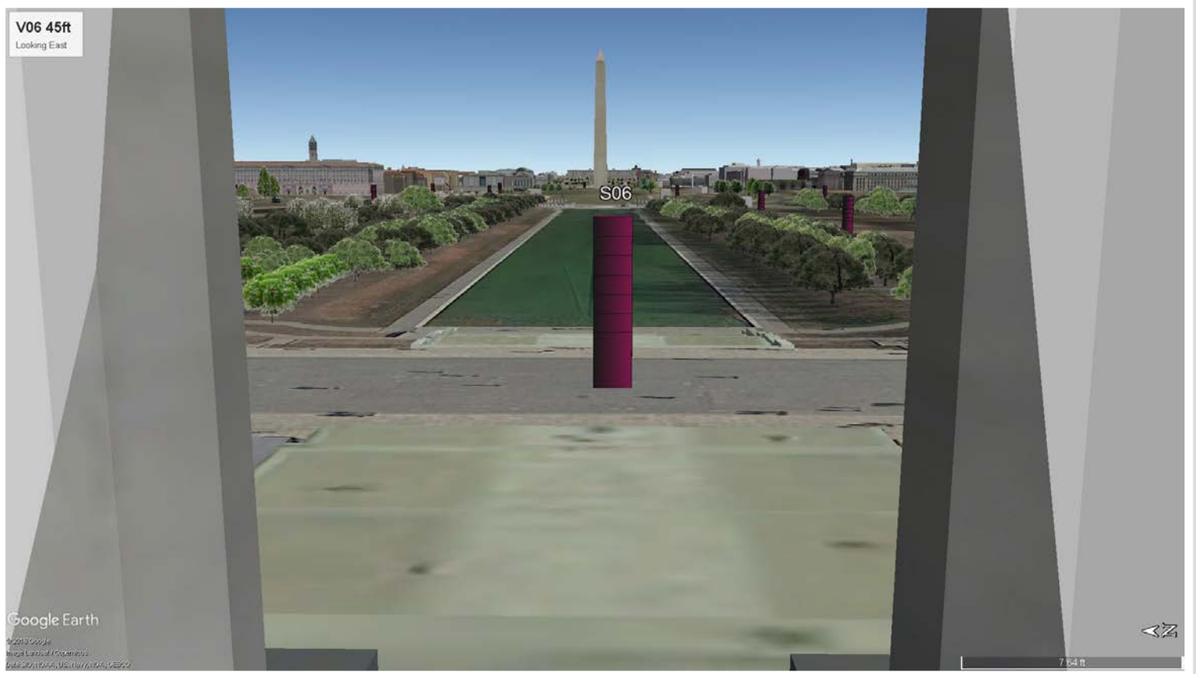




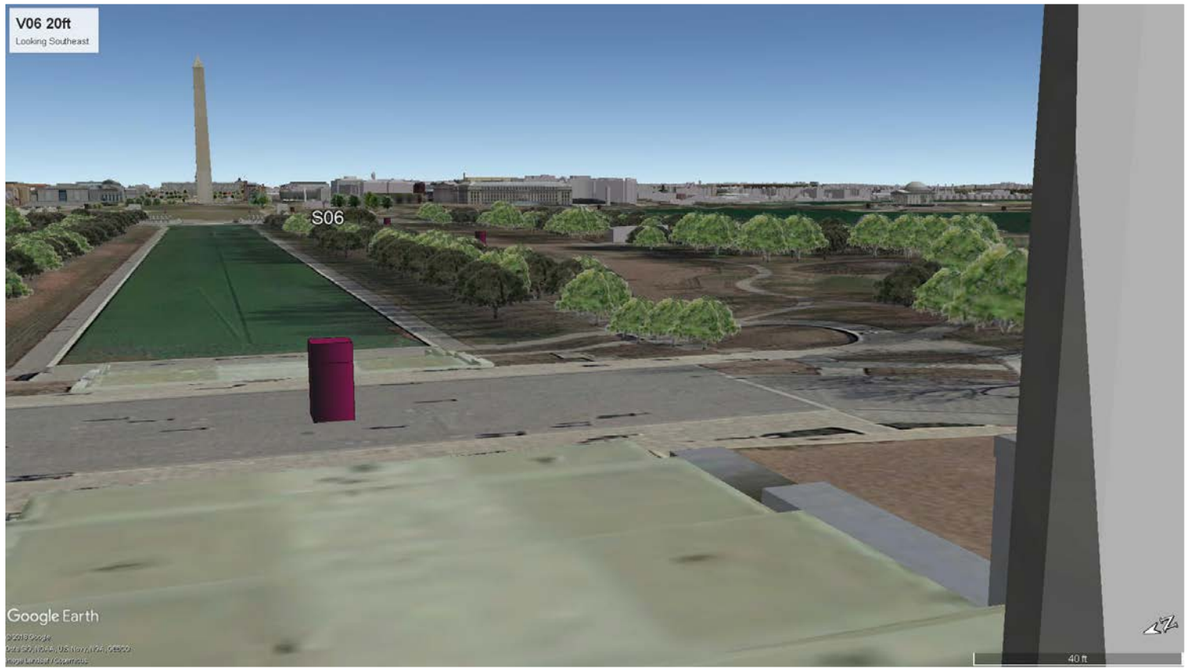

not to scale
S10
S06

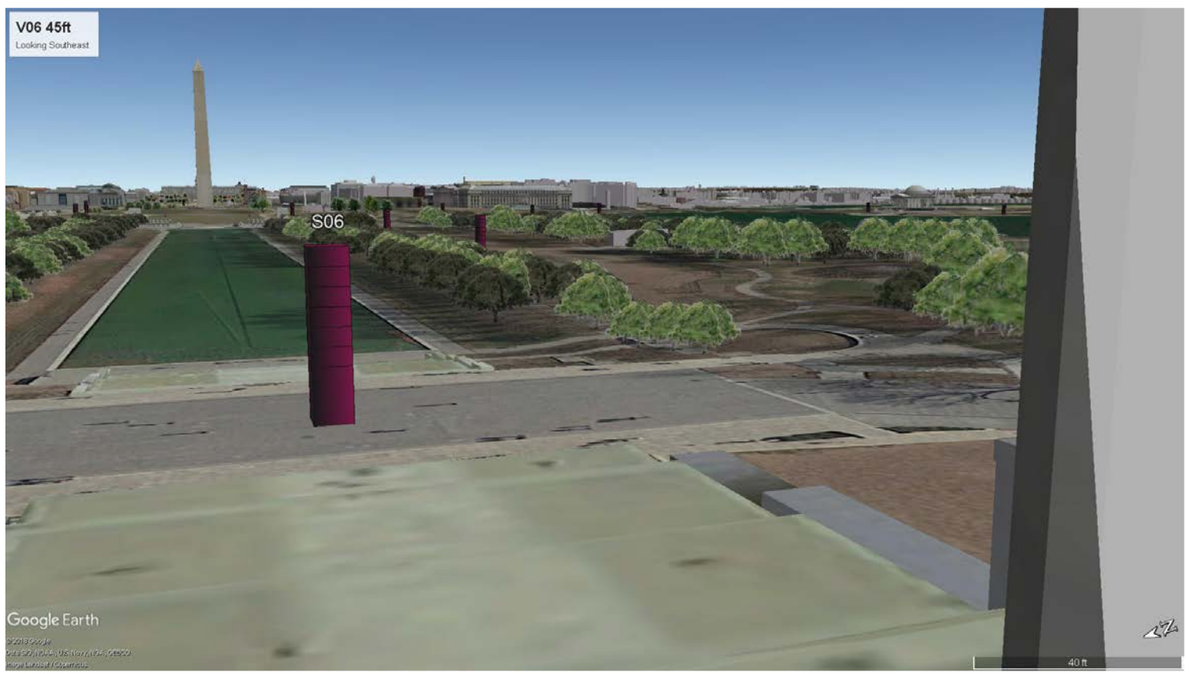
Viewpoint 6 Page 2

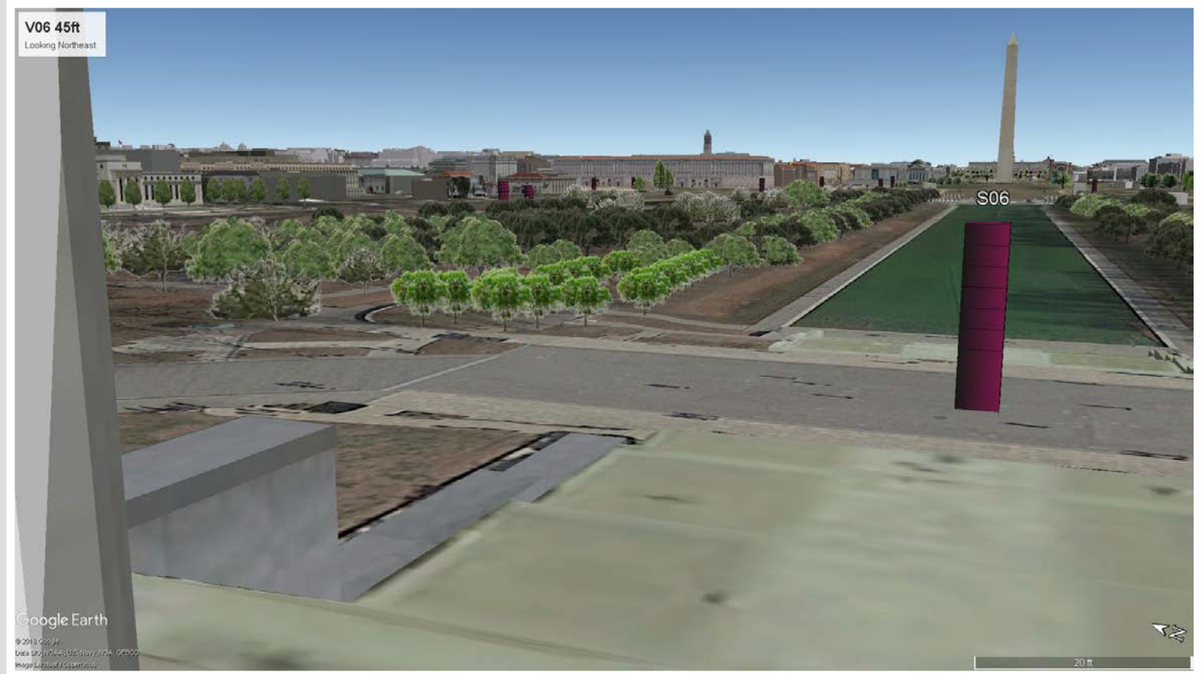




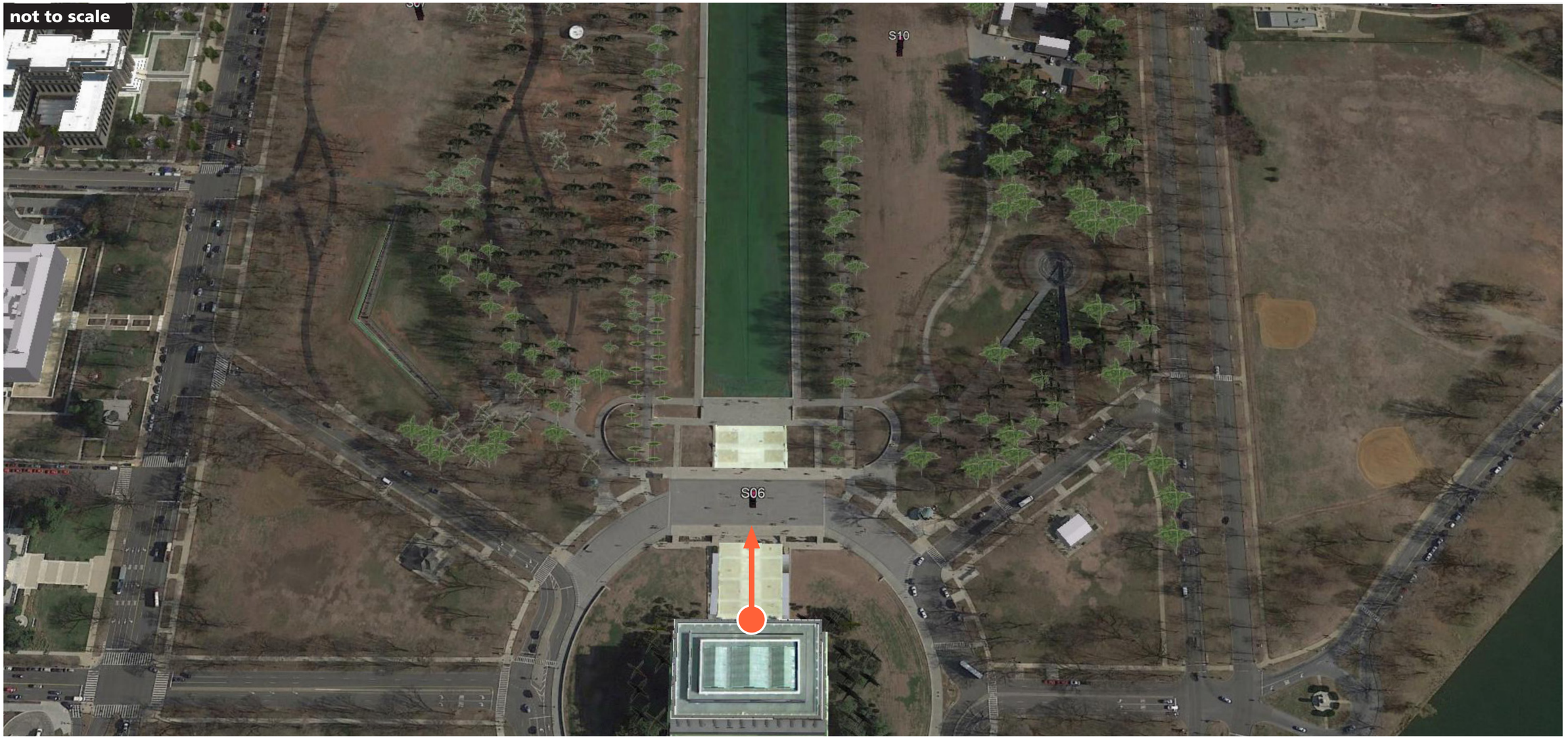
Viewpoint 6 Page 3





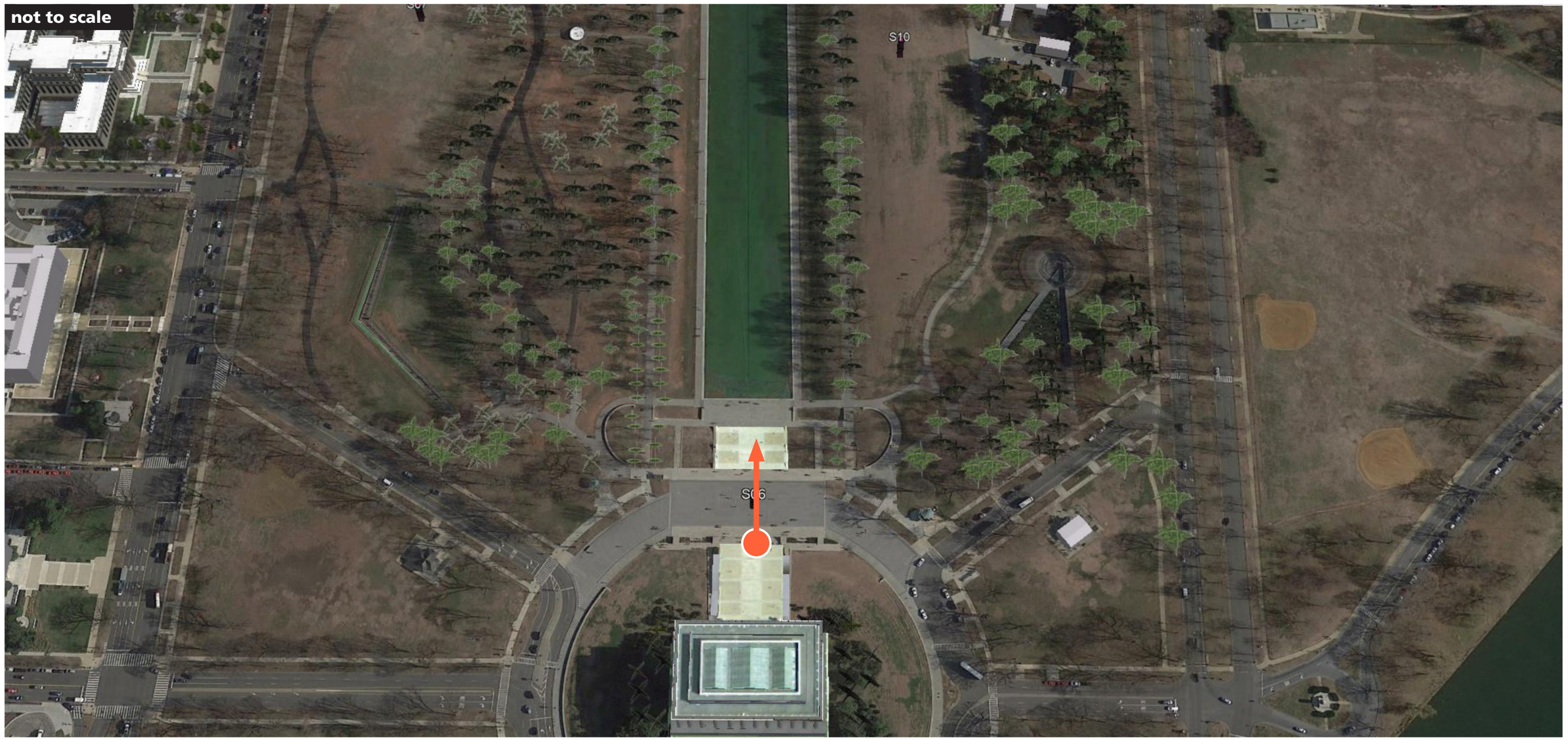


Viewpoint 7 Page 1

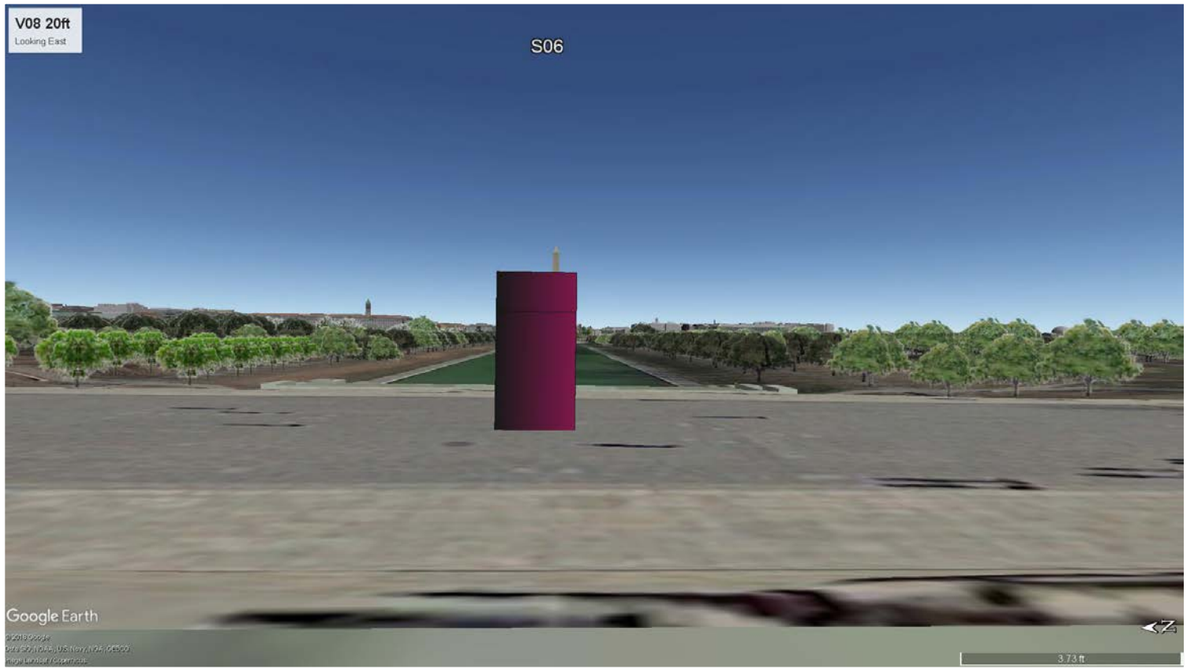


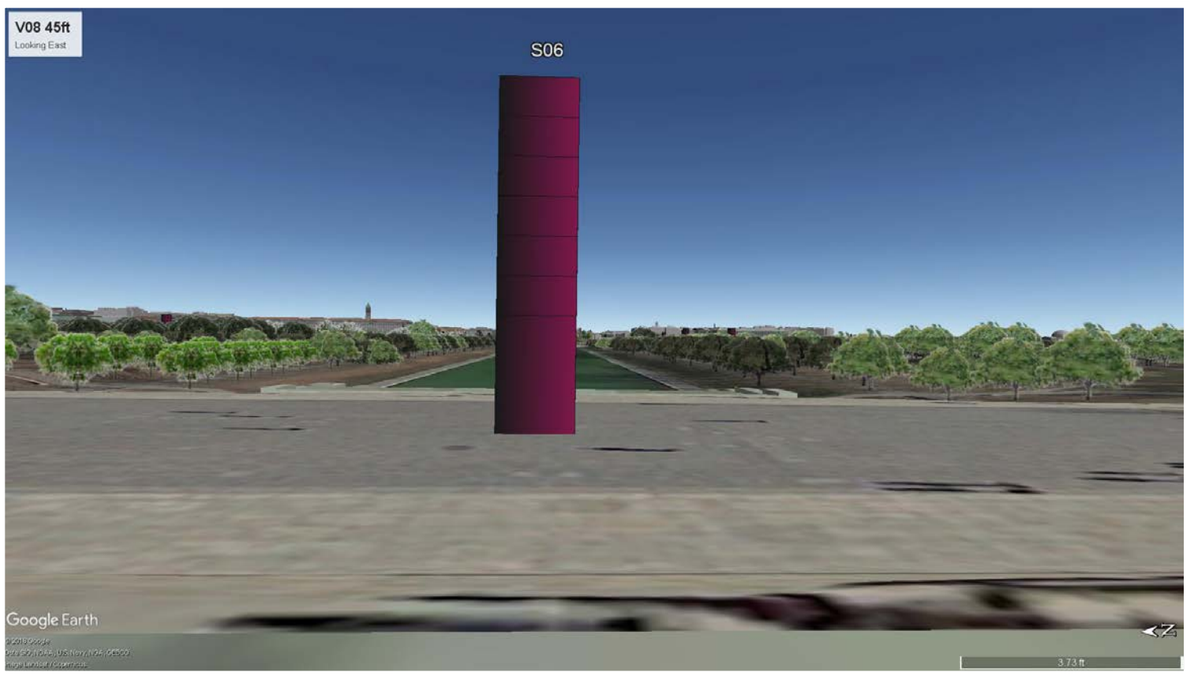
Viewpoint 7 Page 2

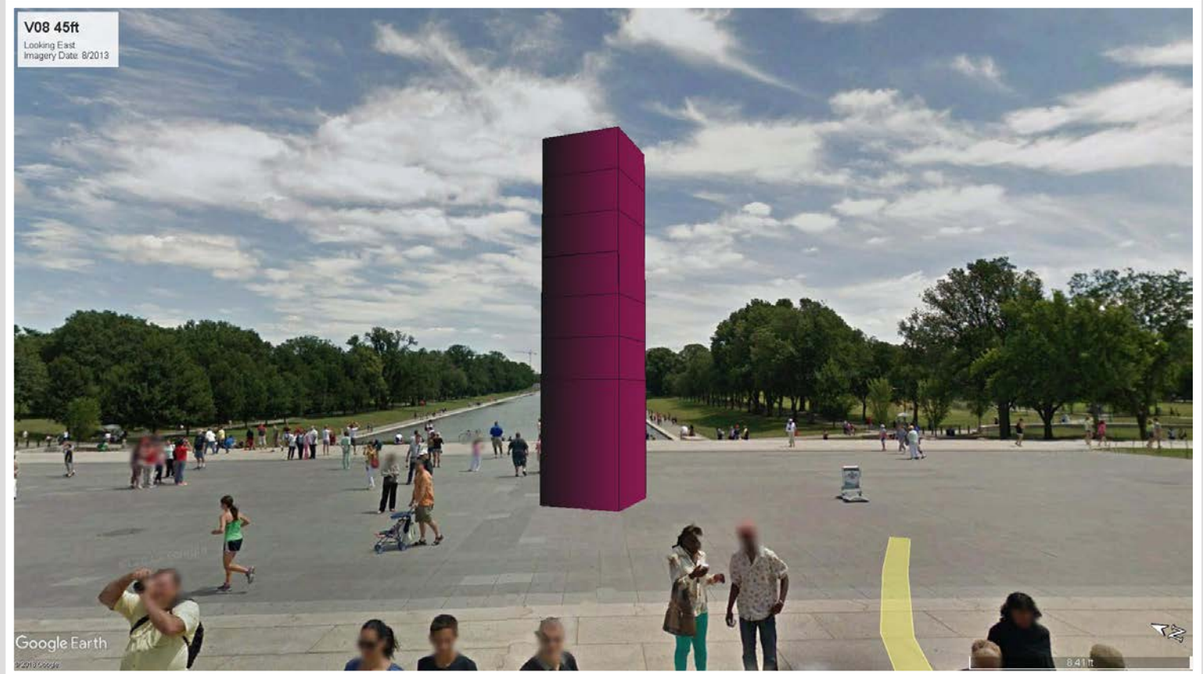
Viewpoint 8 Page 1



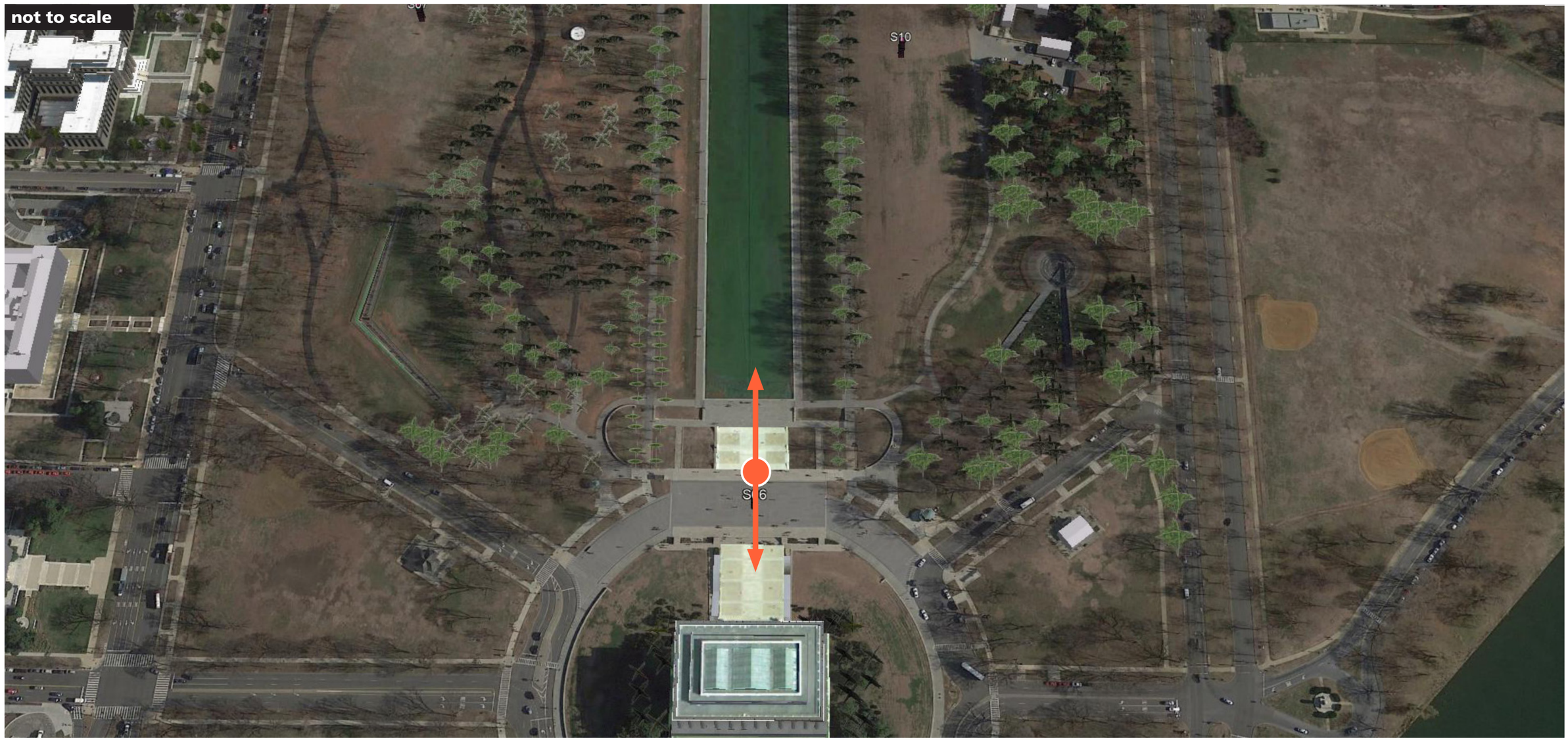
Viewpoint 8 Page 2



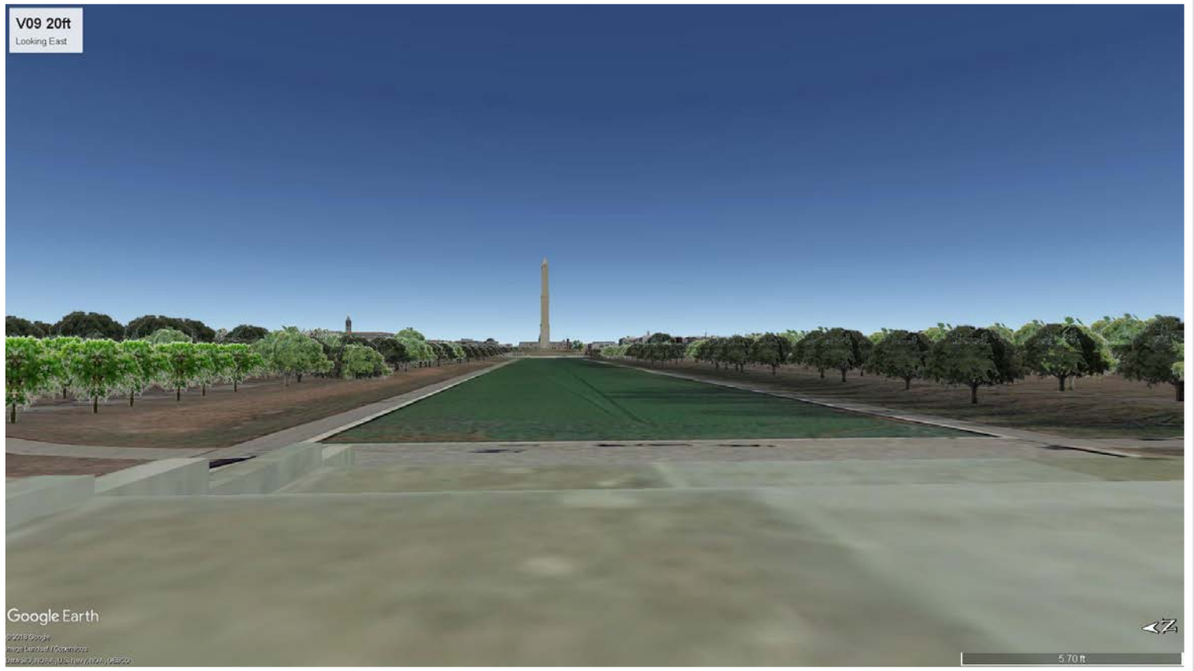


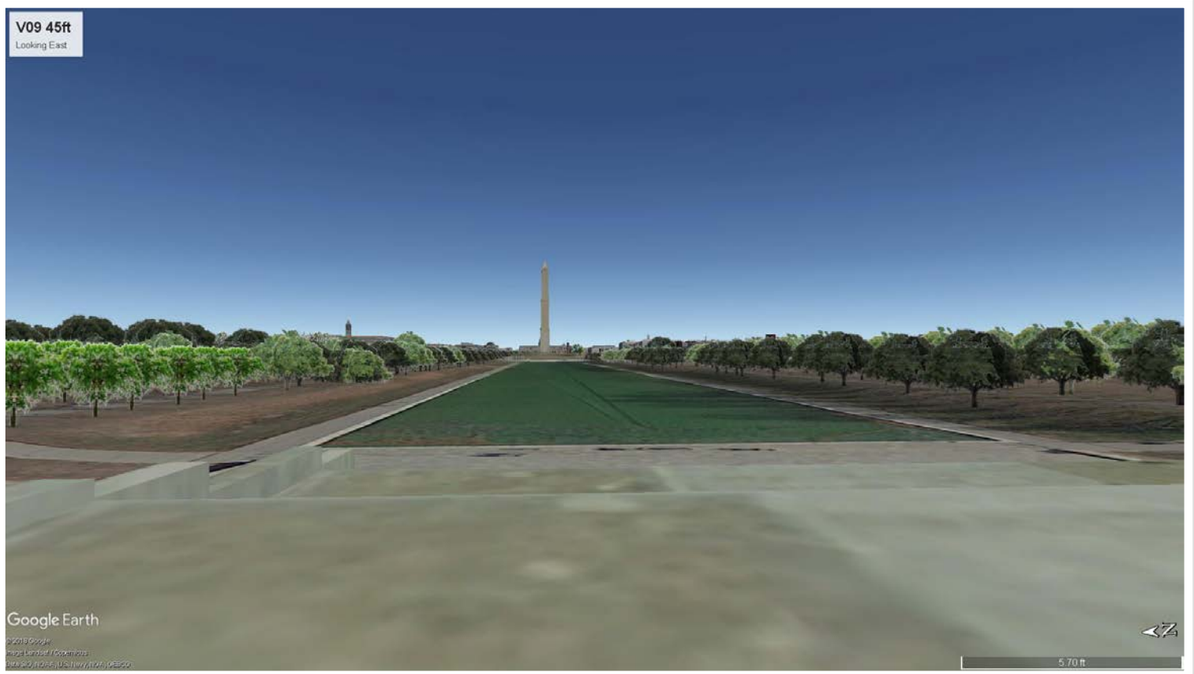


Viewpoint 9 Page 1

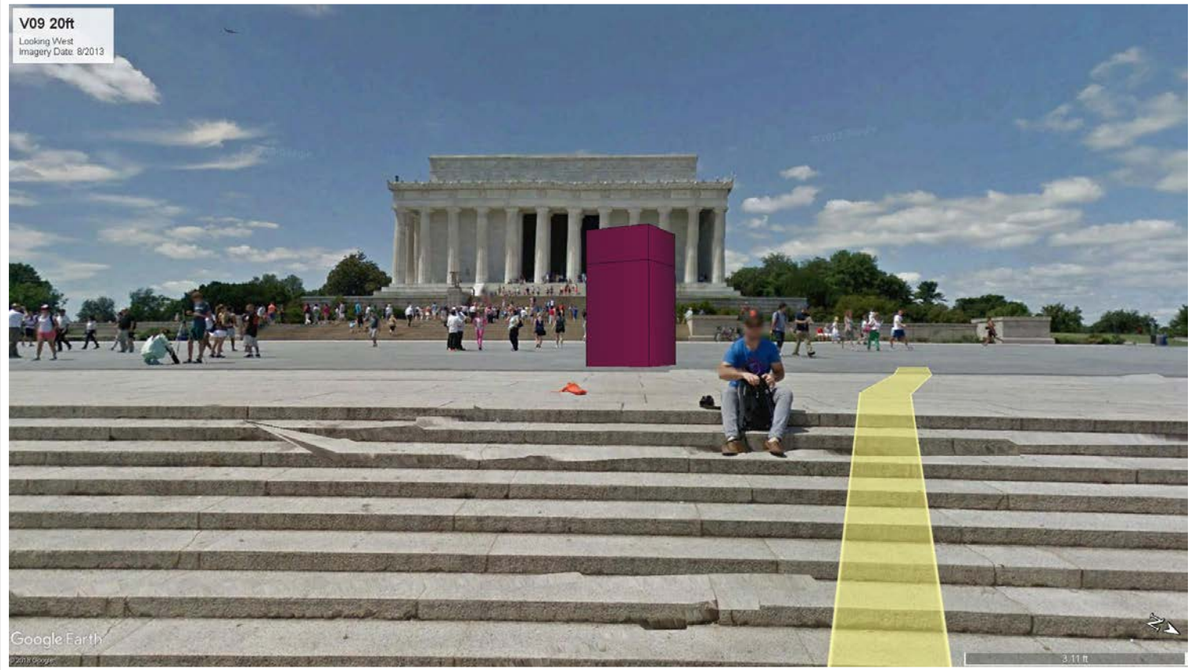


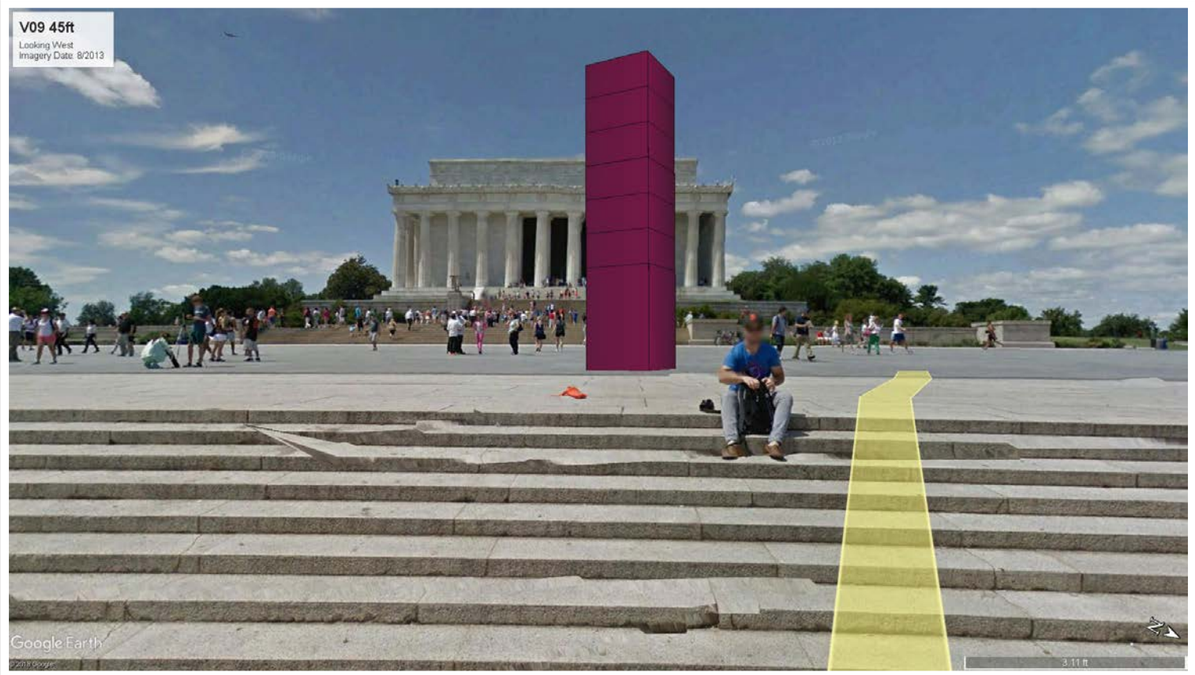
Viewpoint 9 Page 2

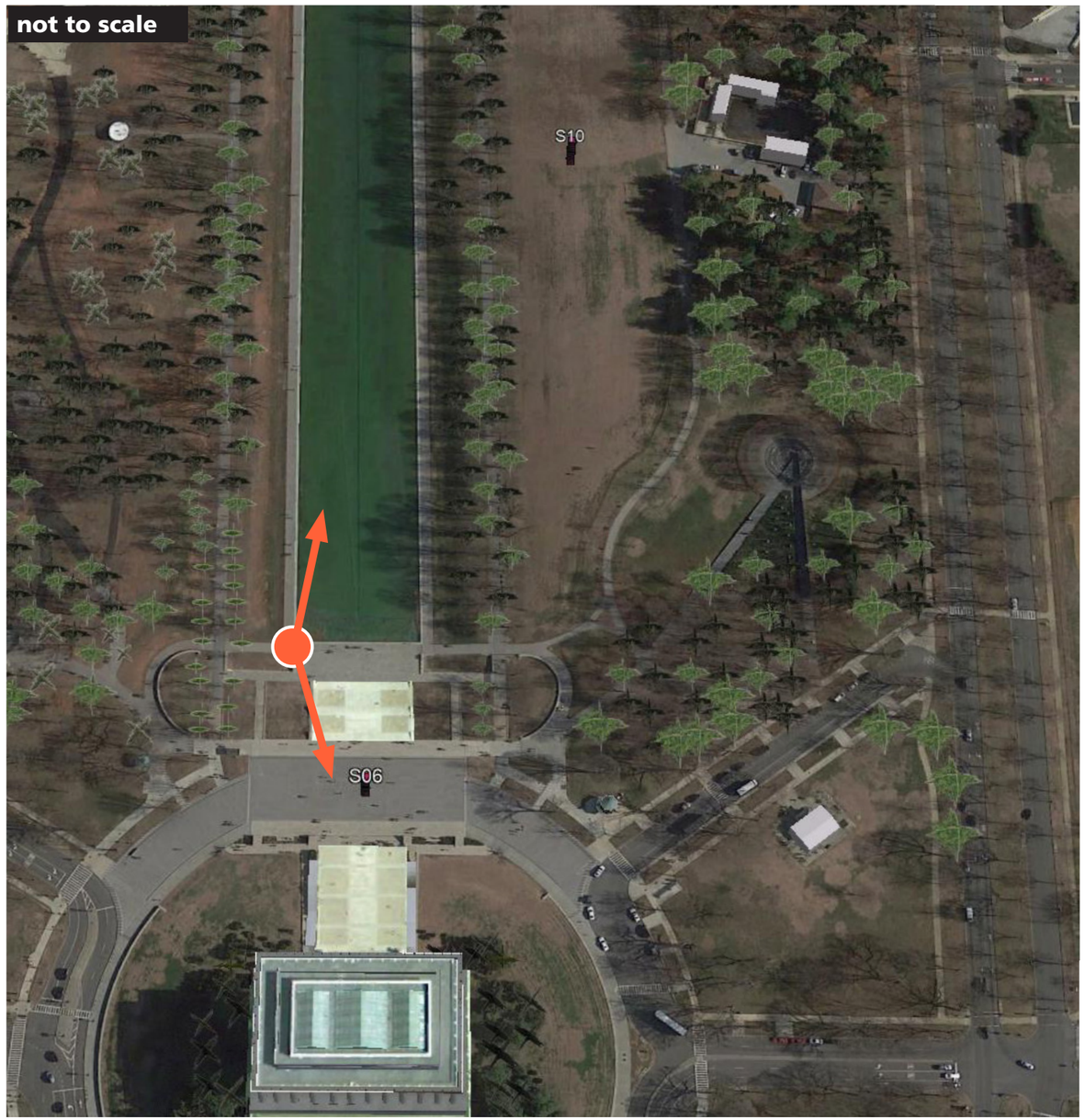




Viewpoint 9 Page 3



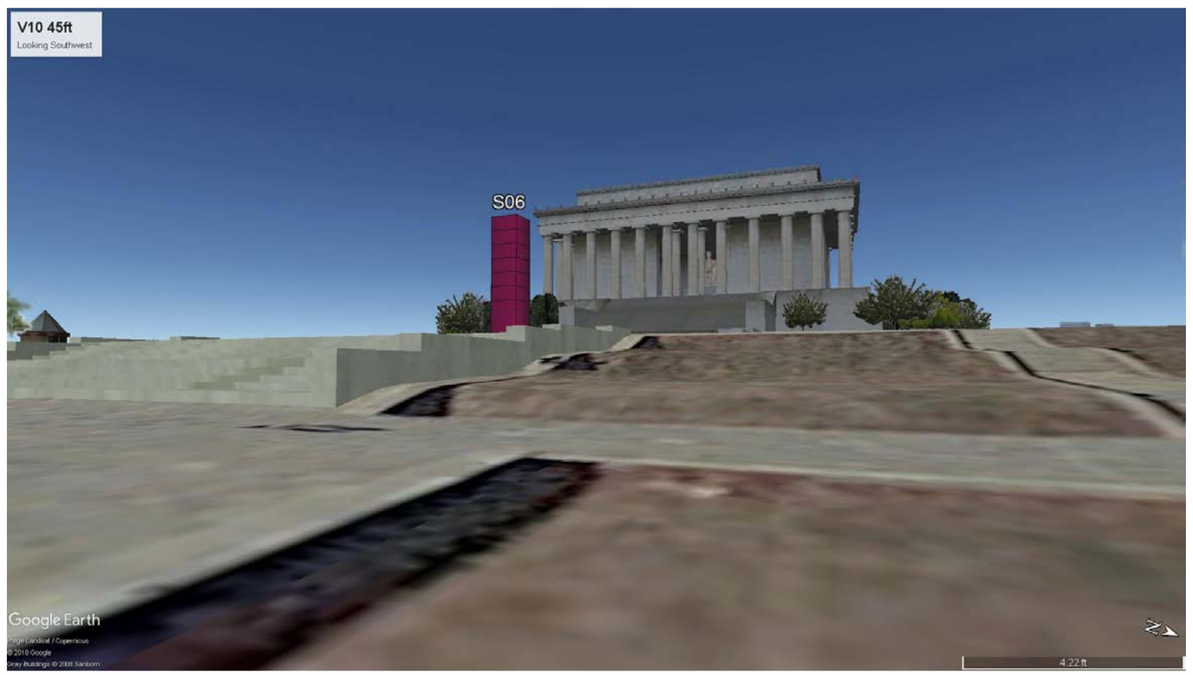


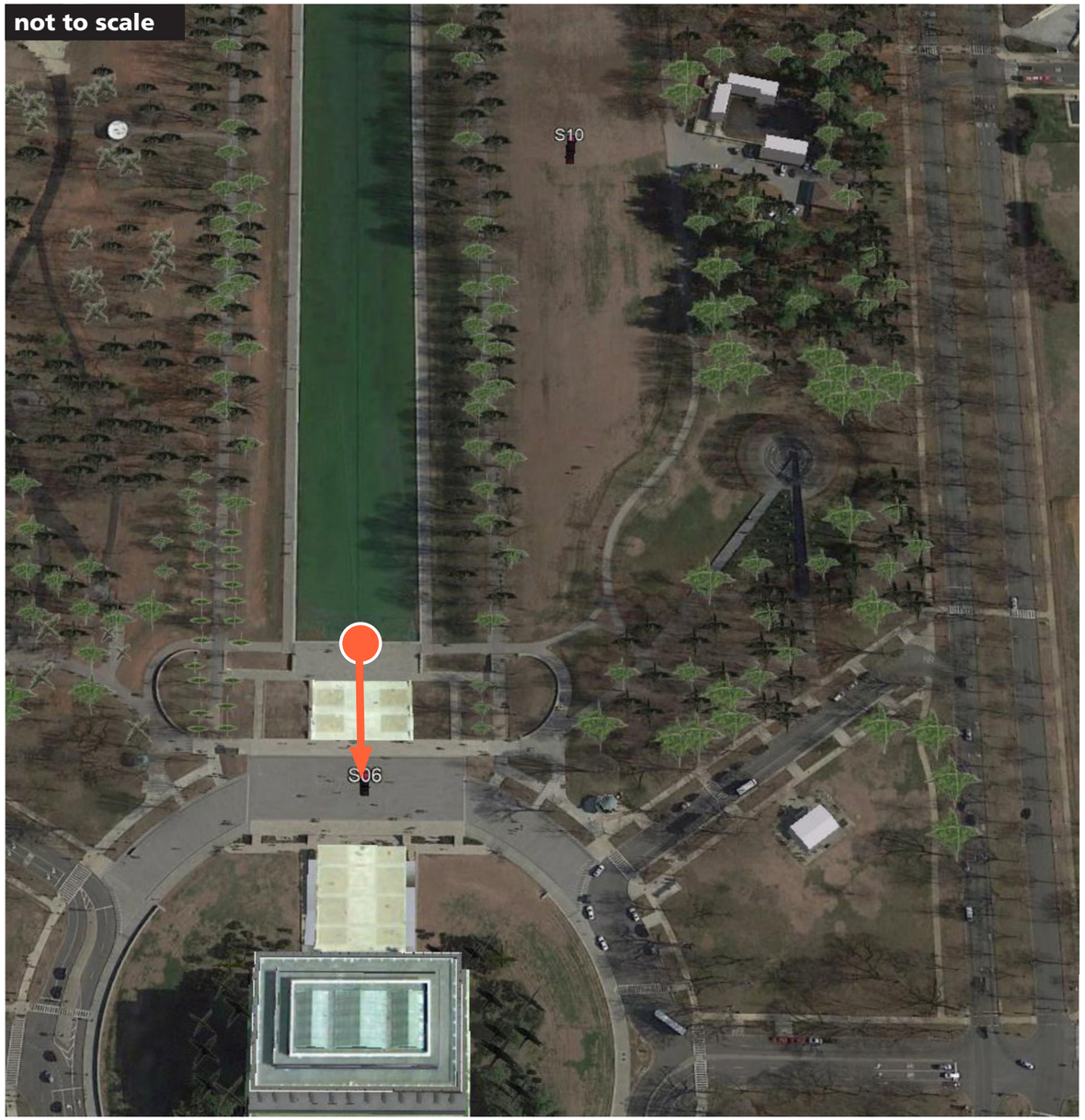

not to scale
S10
S06


V10
Looking East
Imagery Taken 8/2013
Google Earth


V10
Looking Southwest
Imagery Date: 8/2013
Google Earth

Viewpoint 10 Page 2




not to scale
S10
S06

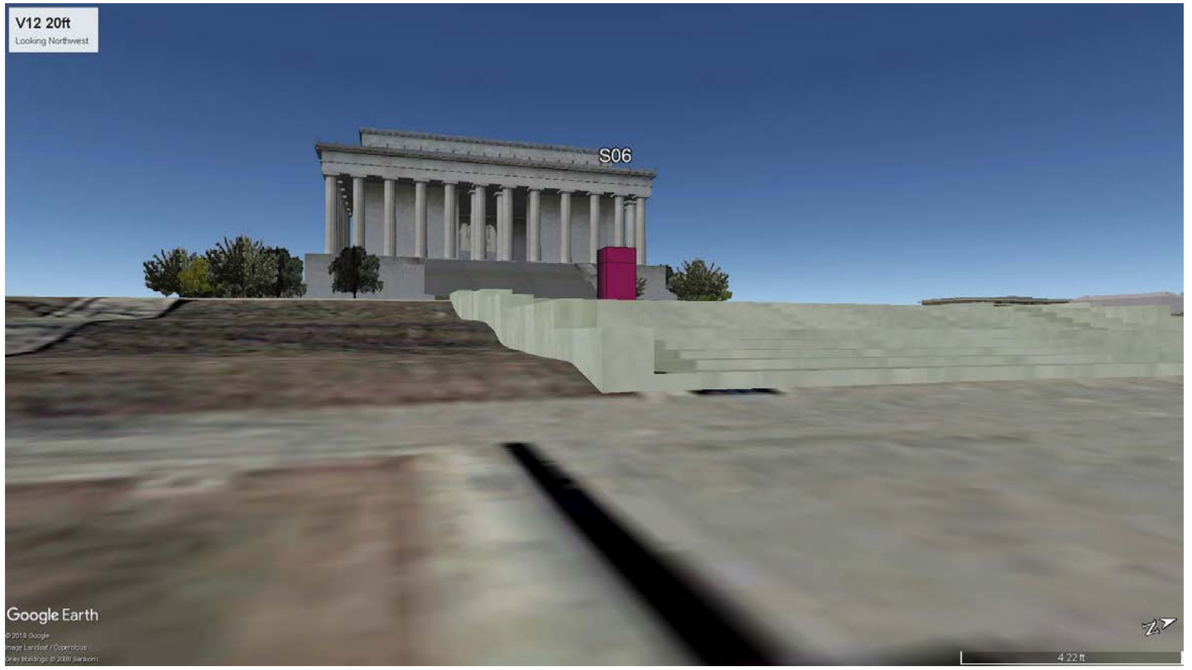

V11
Looking West
Imagery Date: 8/2016
Google Earth
4.14 ft

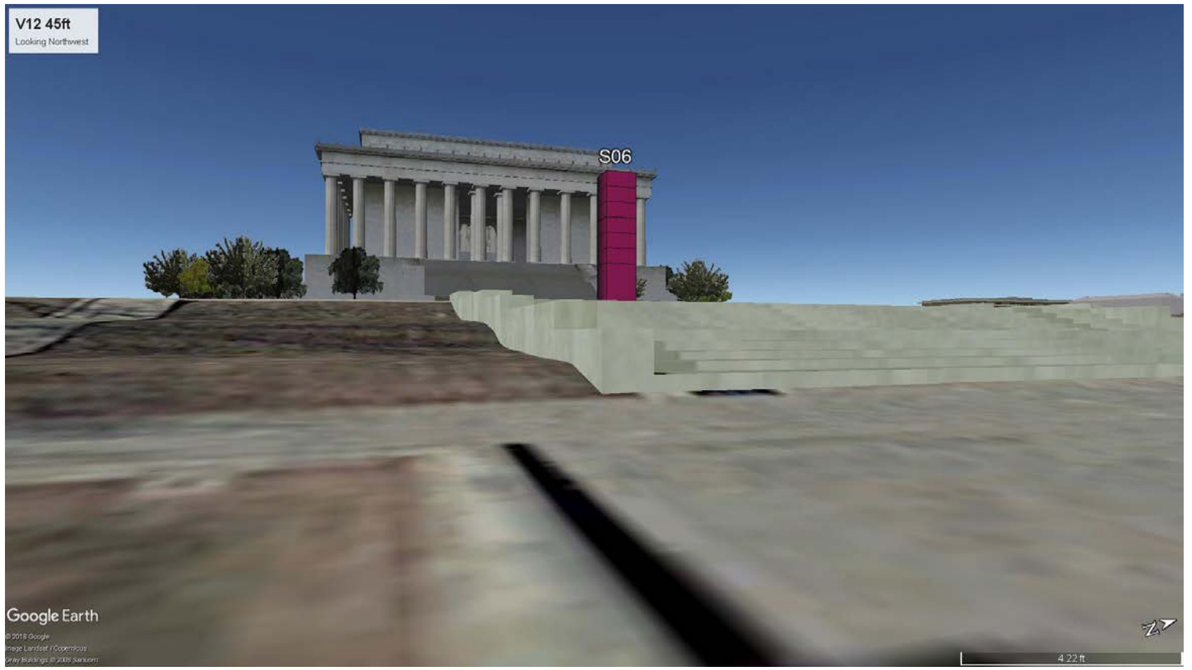
Viewpoint 11 Page 2

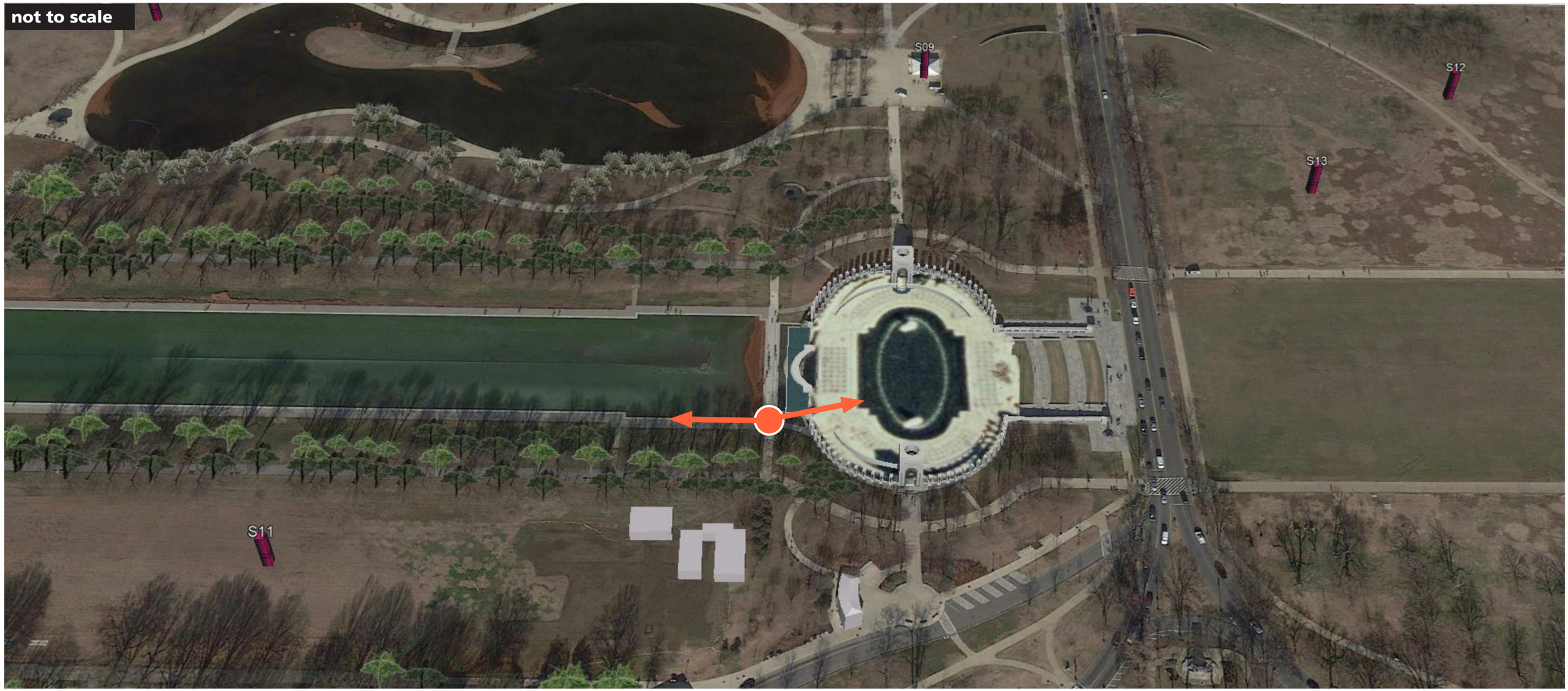

not to scale
S10
S06


V12
Looking Northwest
Imagery Date: 8/2013
Google Earth

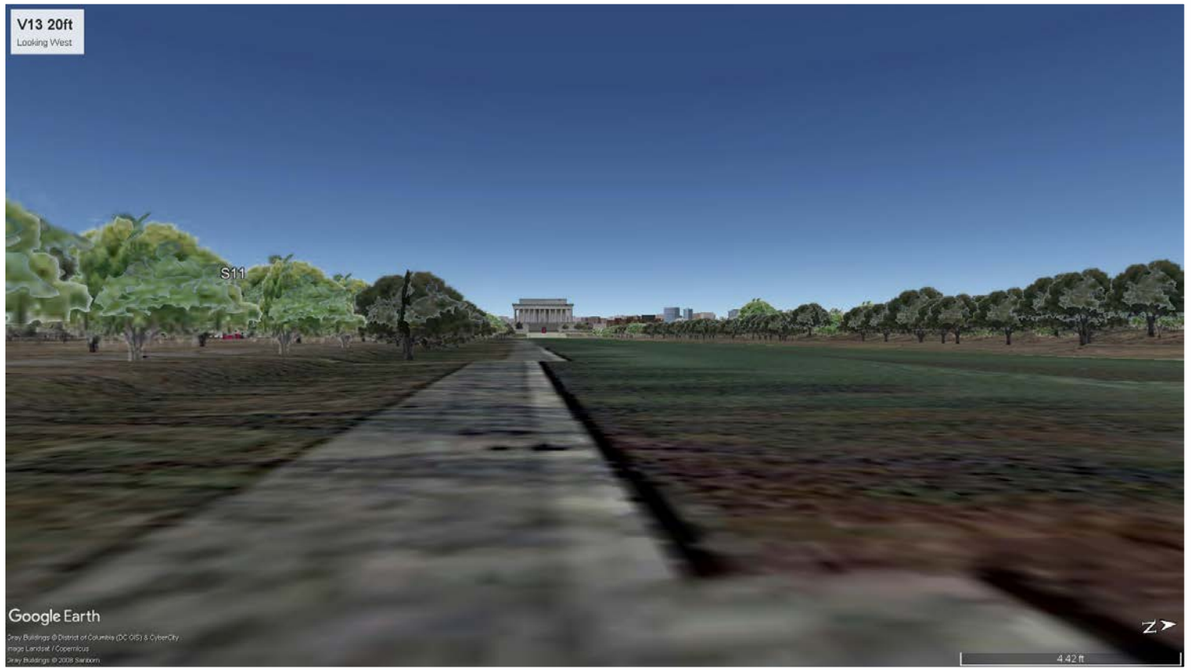
Viewpoint 12 Page 2

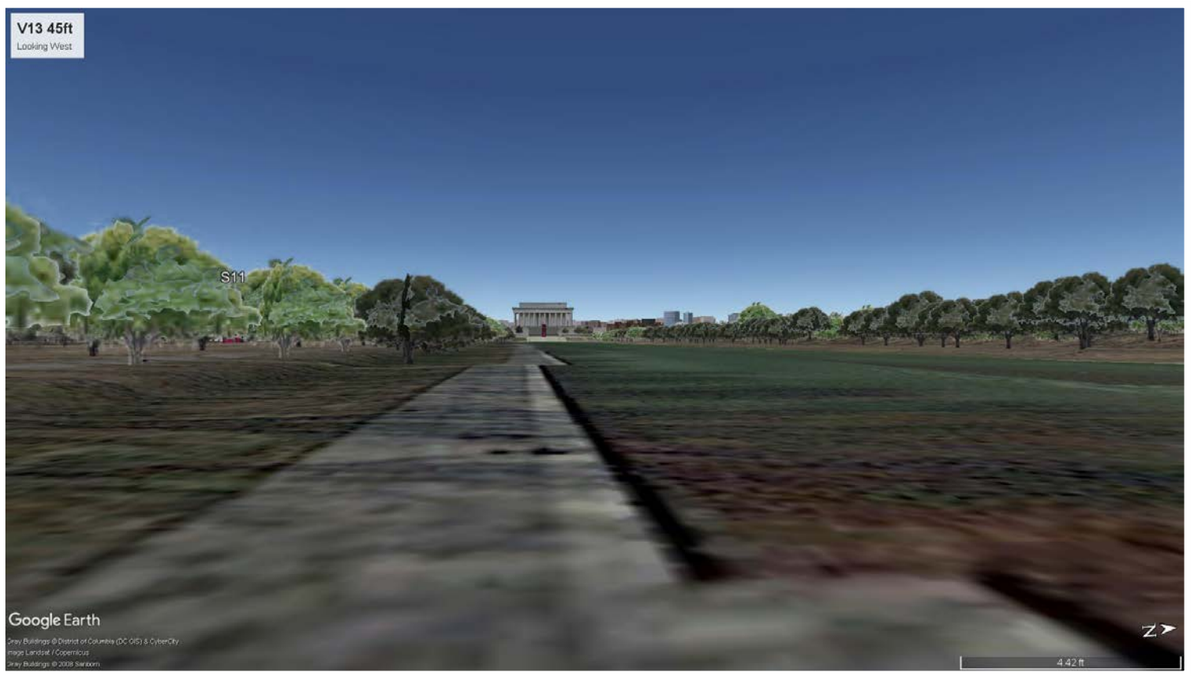




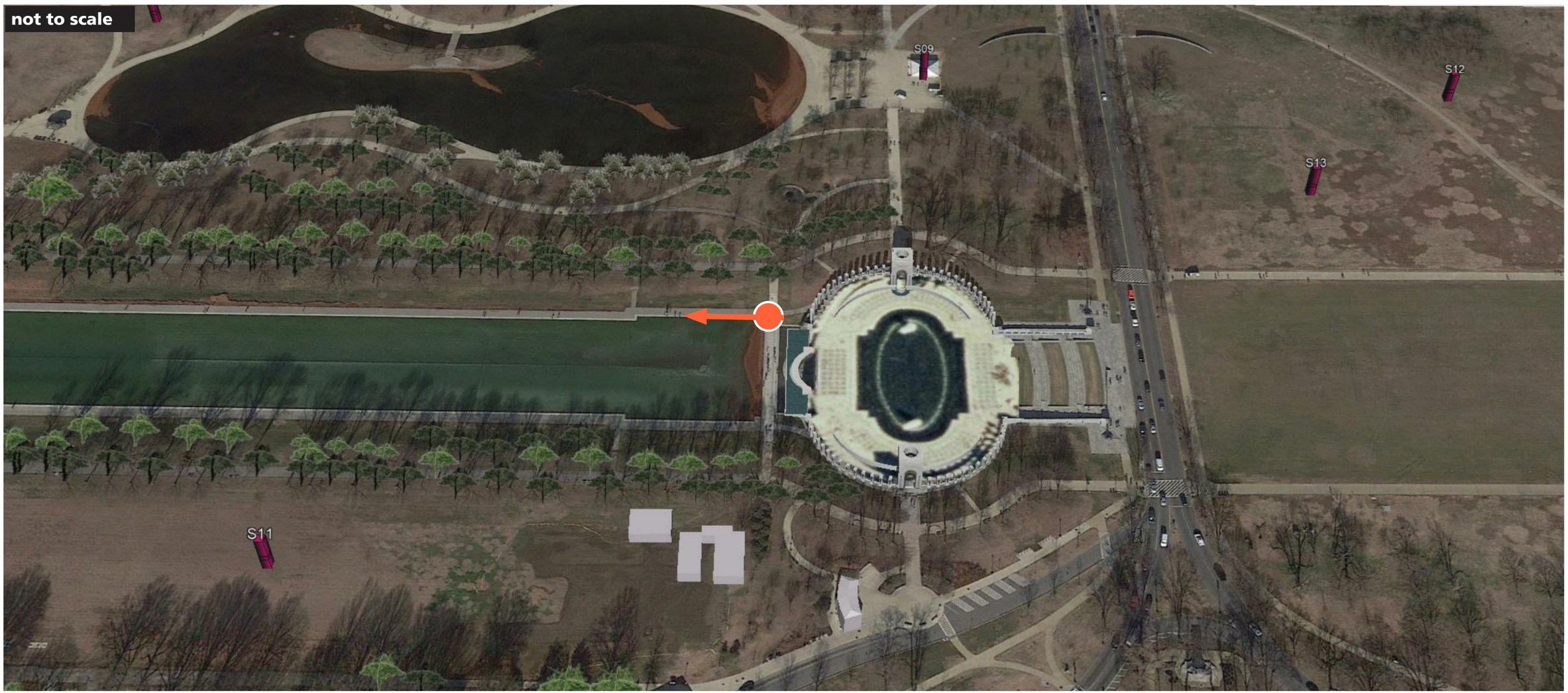

not to scale
S09
S12
S13
S11

Viewpoint 13 Page 2

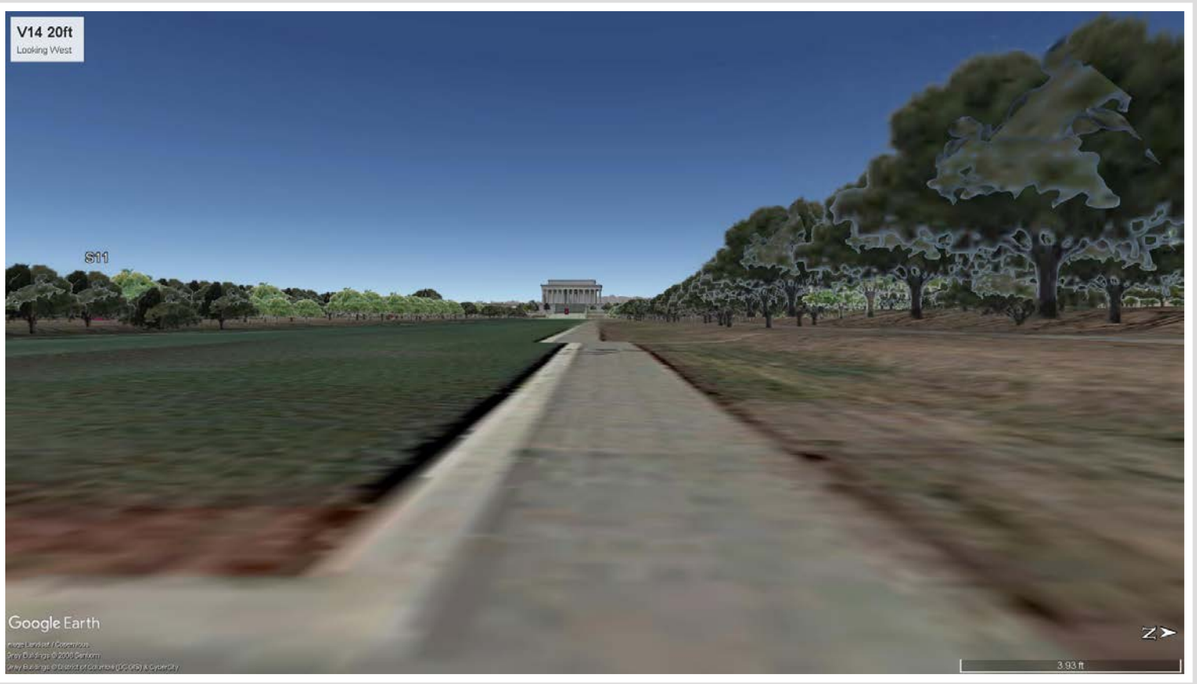


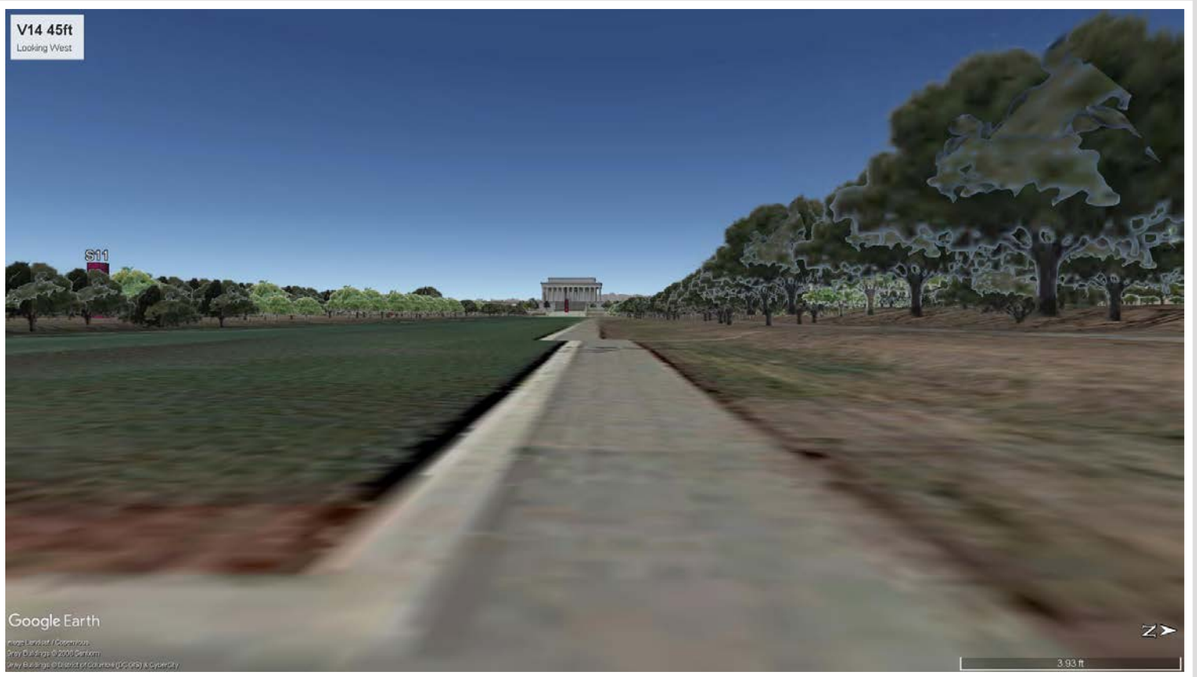


Viewpoint 14 Page 1



Viewpoint 14 Page 2






not to scale
S06
S07
S08
S09
S10
S11
S12
S13
S14
S15


V15
Looking West
Imagery Date: 8/2013
Google Earth


V15
Looking East
Imagery Date: 12/2016
Google Earth

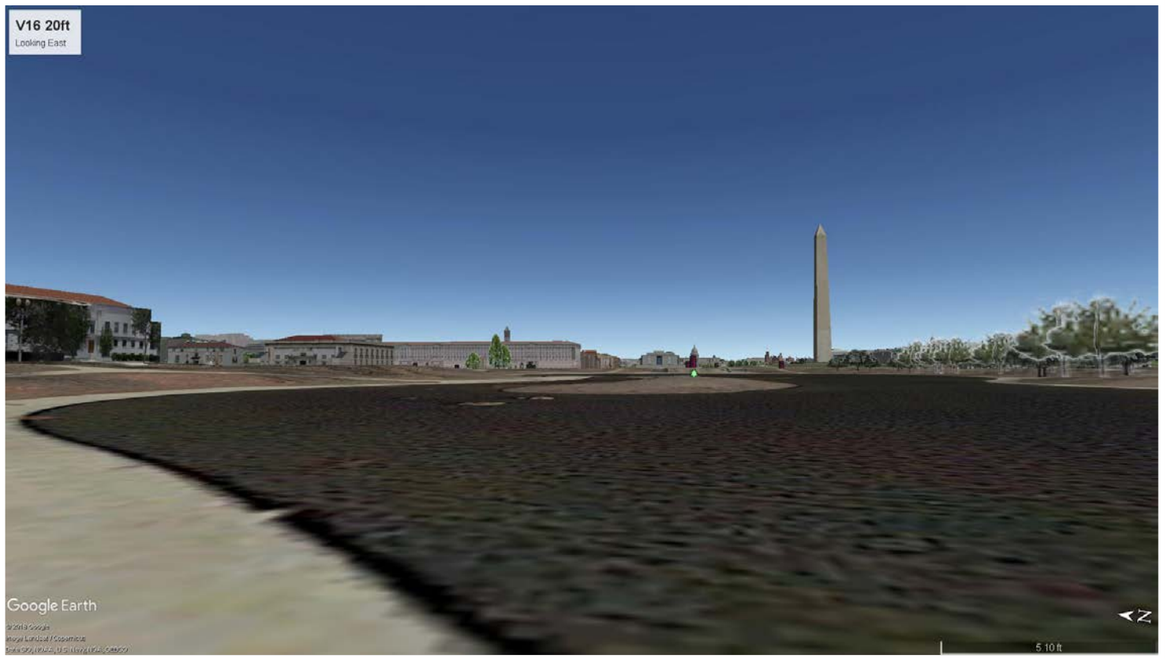
Viewpoint 15 Page 2

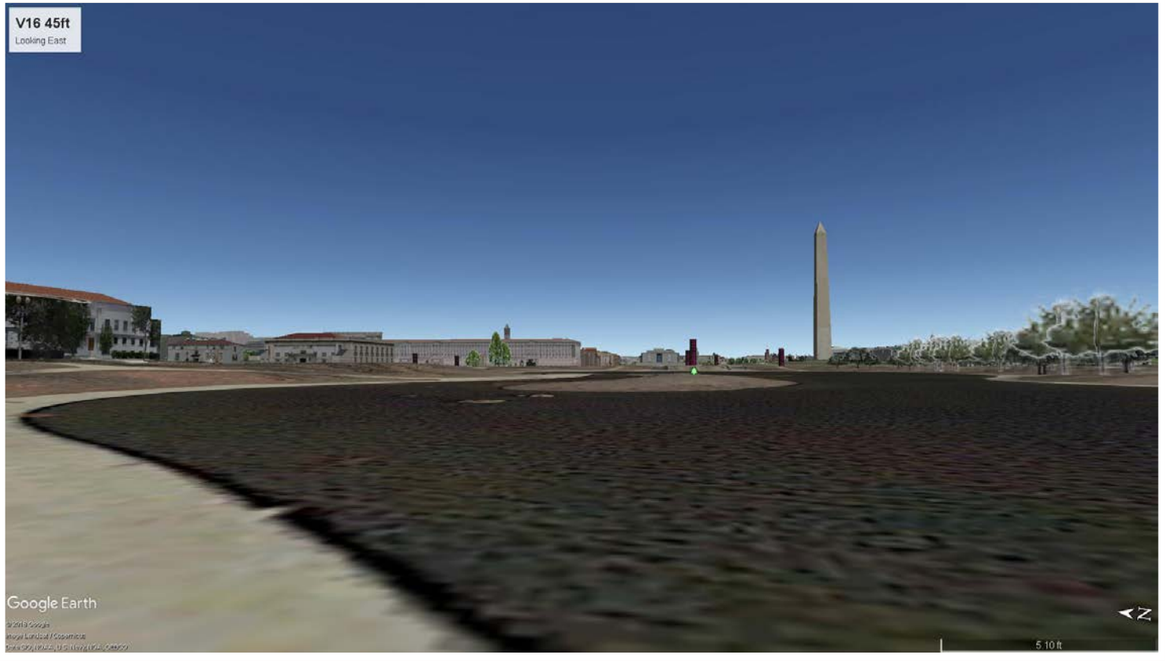

not to scale
S22
S21
S15
S13
S12
S09
S08
S07

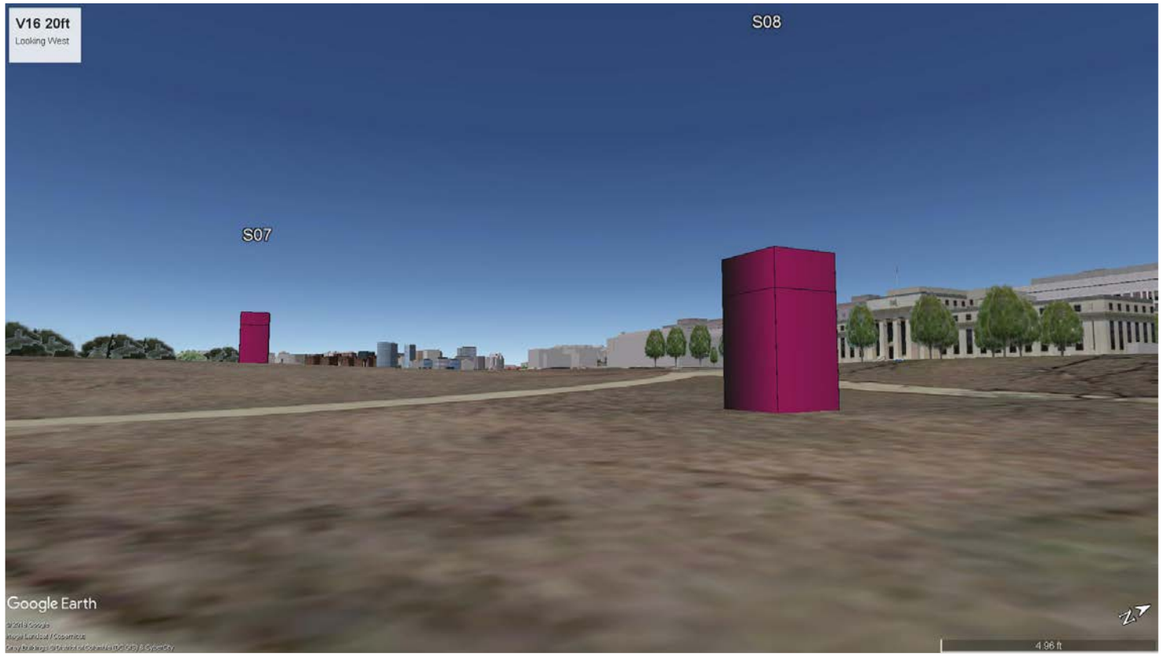

V16
Looking East
Imagery Date: 8/2013
Google Earth

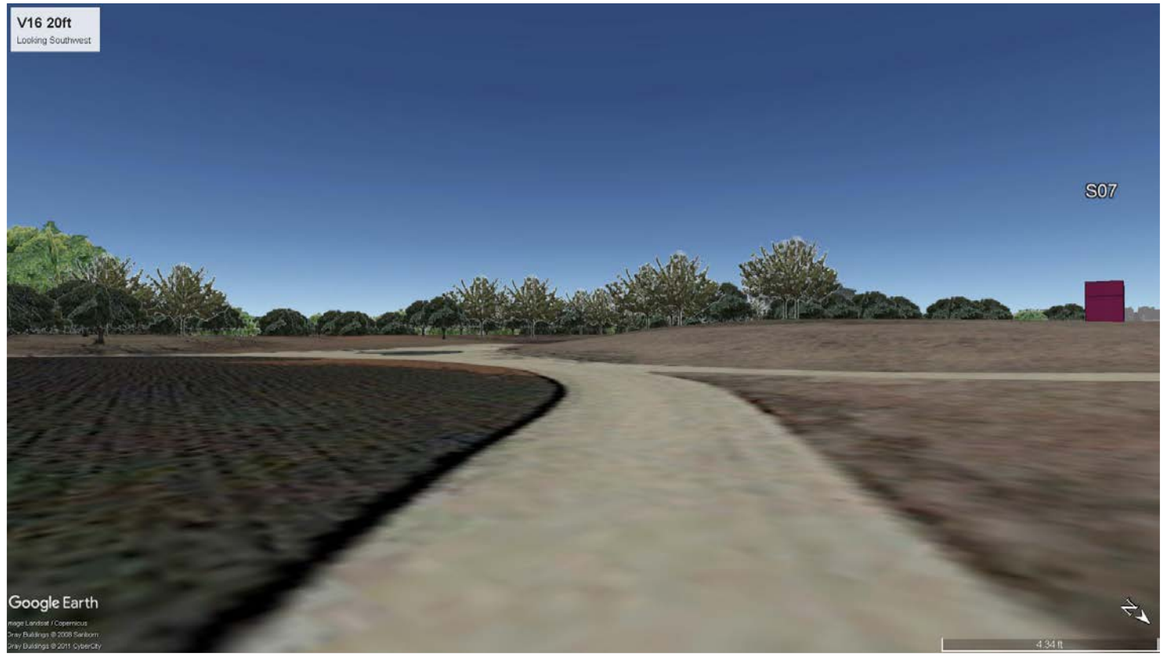

V16 45ft
Looking Southwest
Imagery Date: 8/2013
Google Earth

Viewpoint 16 Page 2

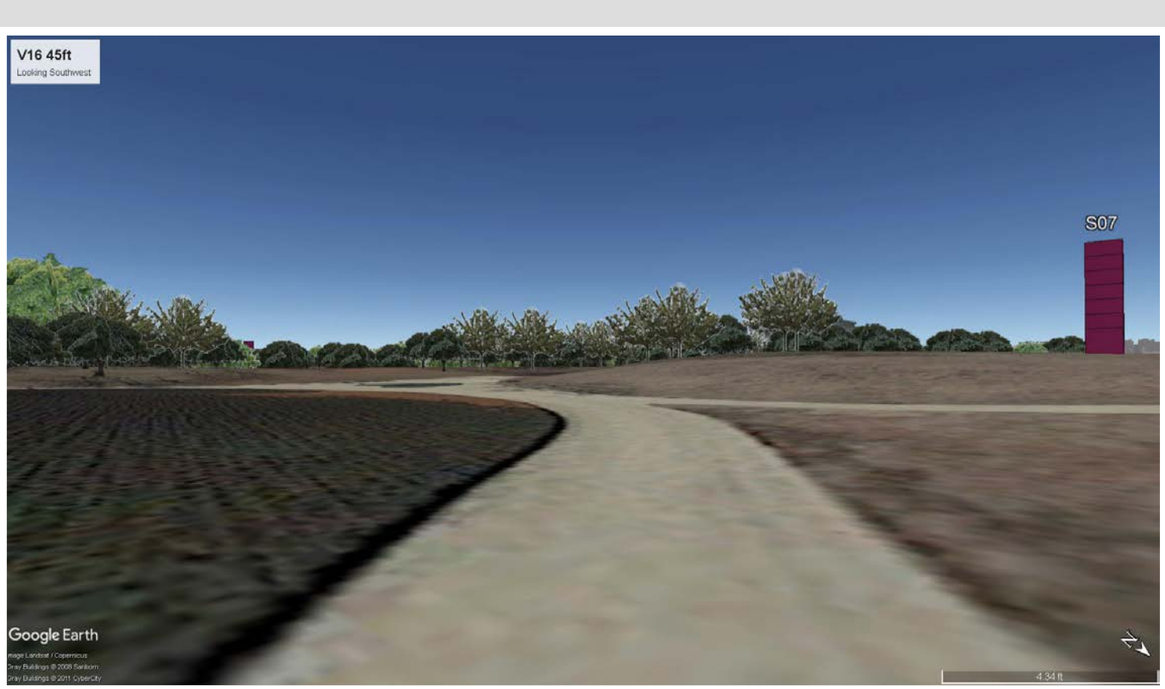




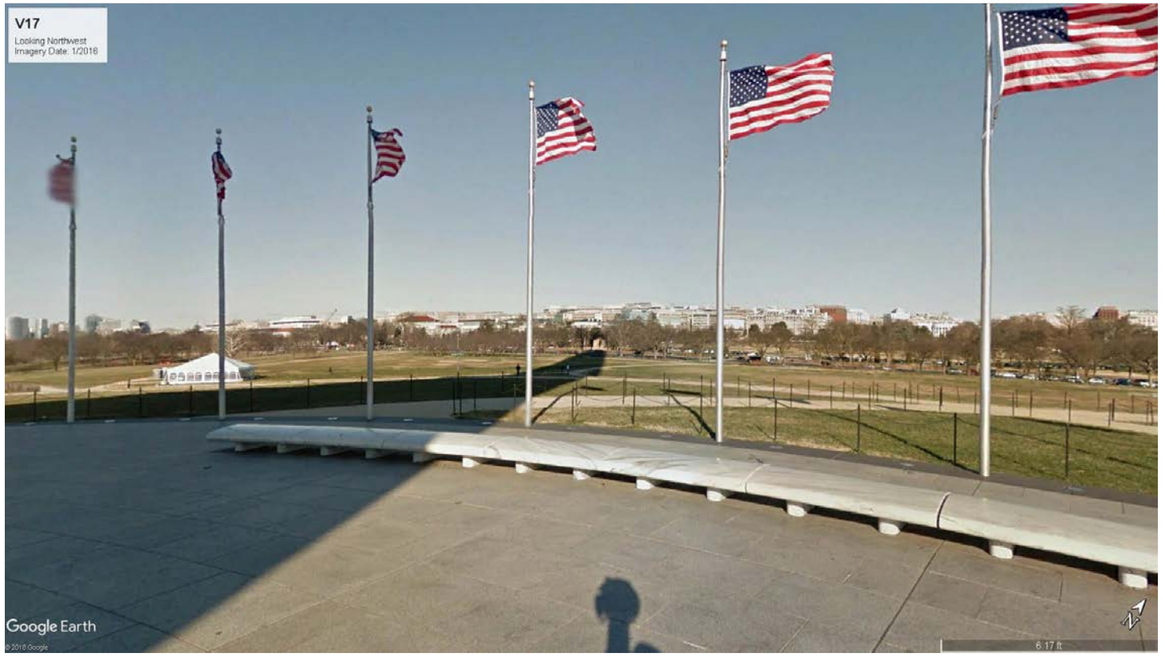

V16 20ft
Looking West
S08
S07
Google Earth
4.96 ft

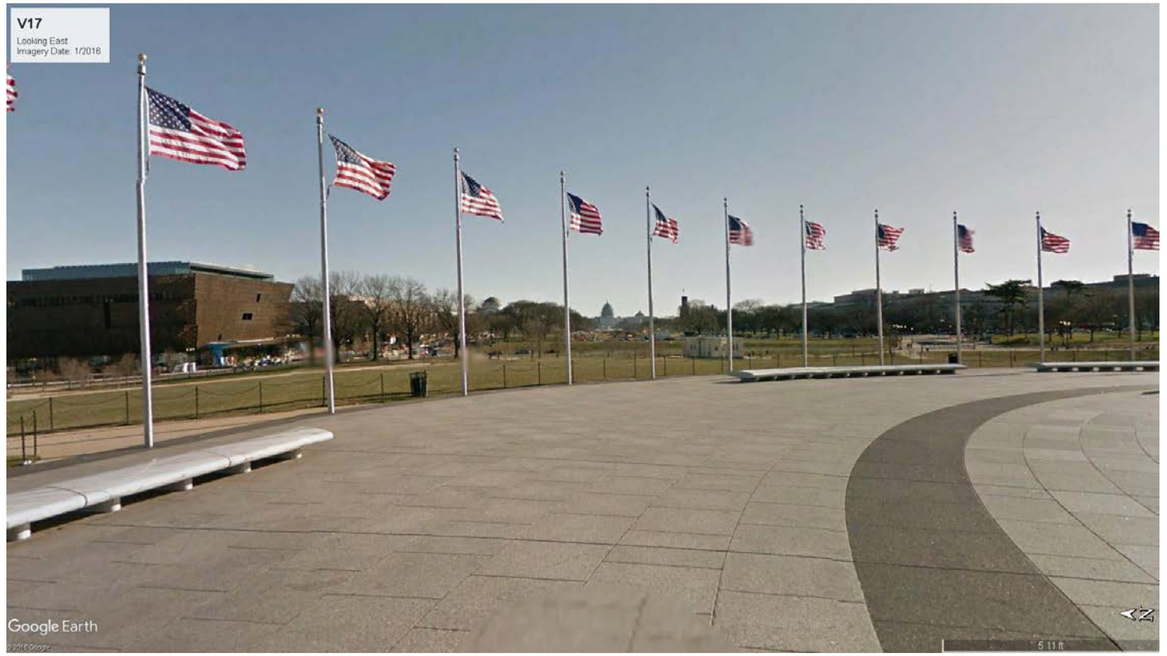

V16 20ft
Looking Southwest
S07
Google Earth
4.34 ft


V16 45ft
Looking West
S08
S07
Google Earth
4.94 ft


V16 45ft
Looking Southwest
S07
Google Earth
4.34 ft

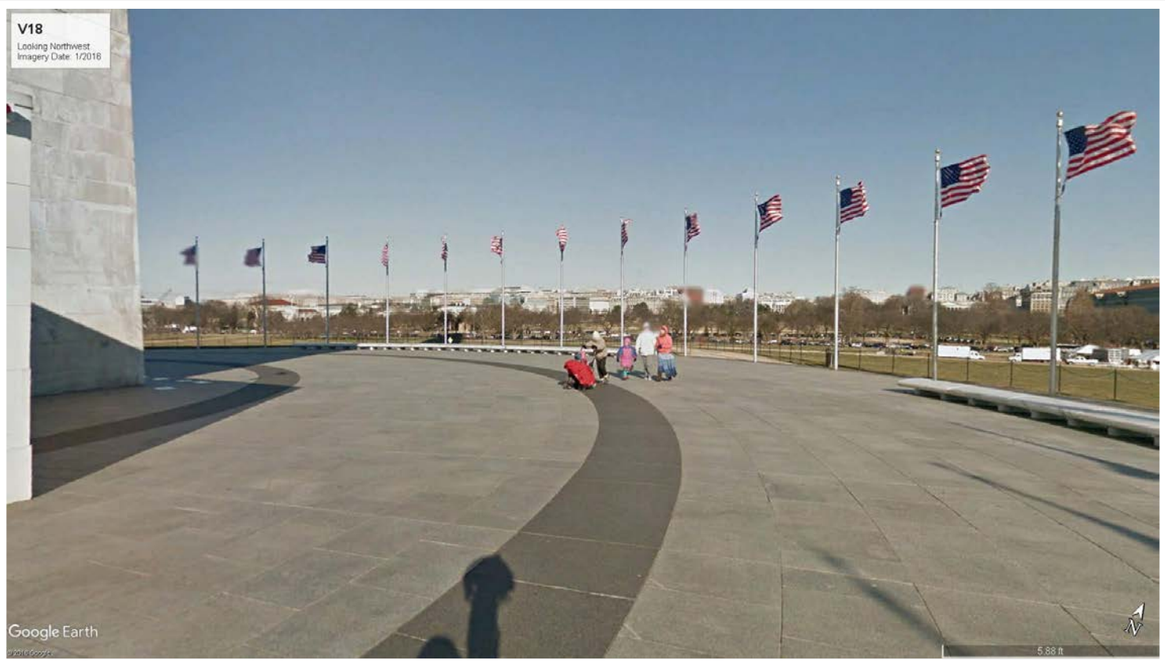
Viewpoint 17 Page 1

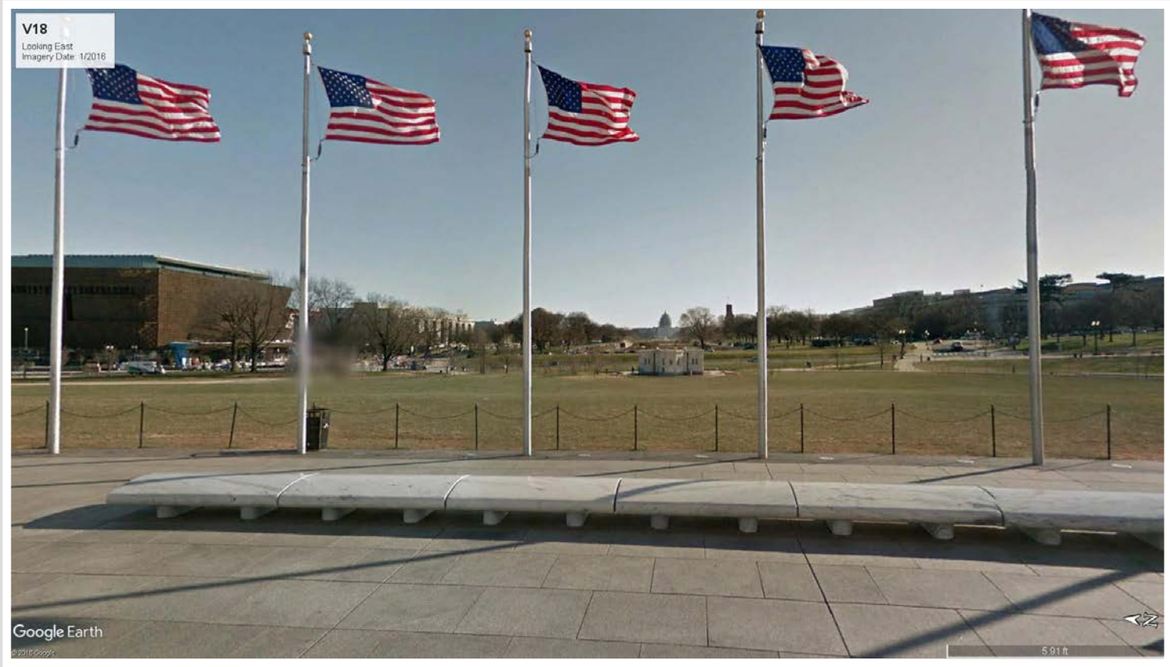




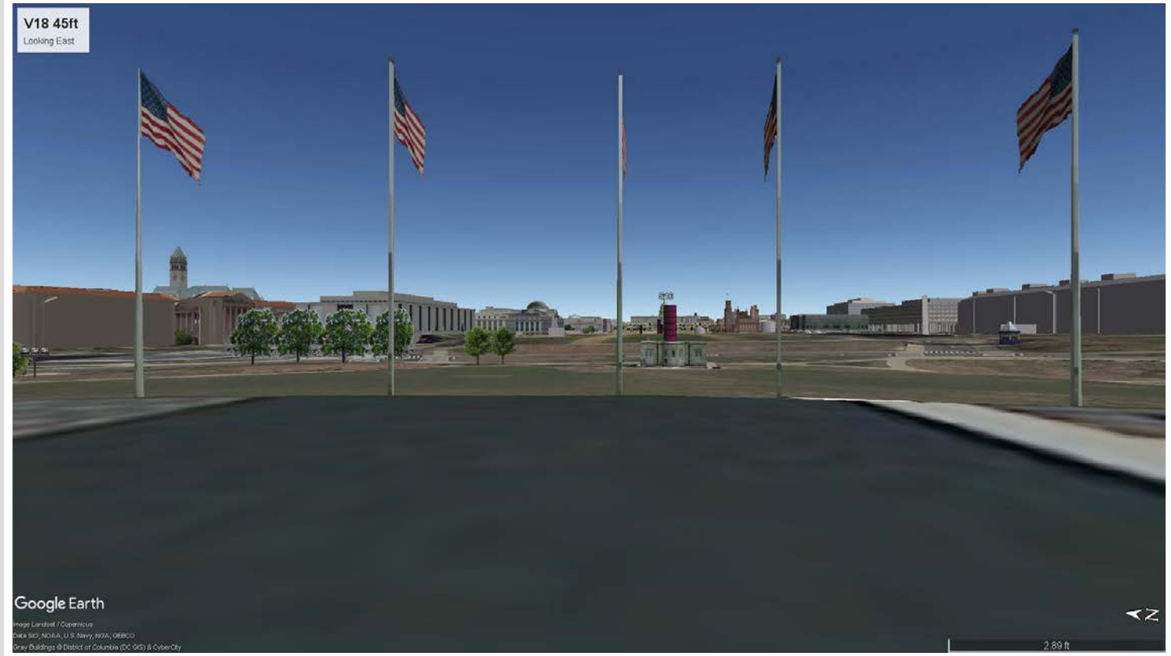
Viewpoint 17 Page 2

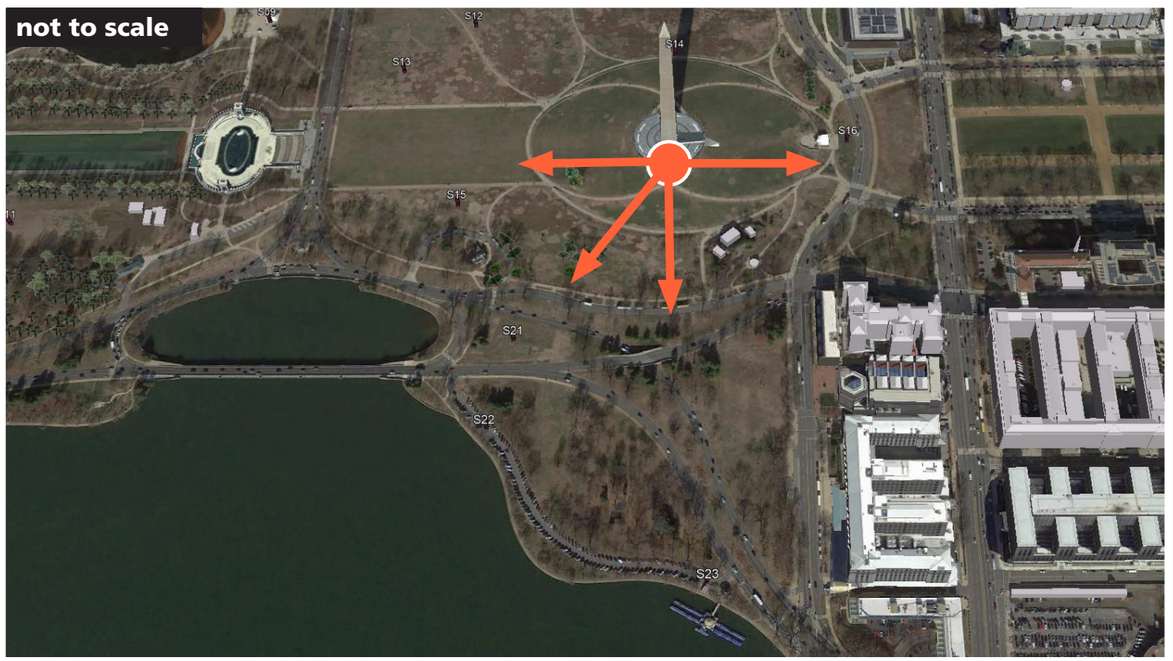

not to scale
S16
S14
S02
S04
S01
S03

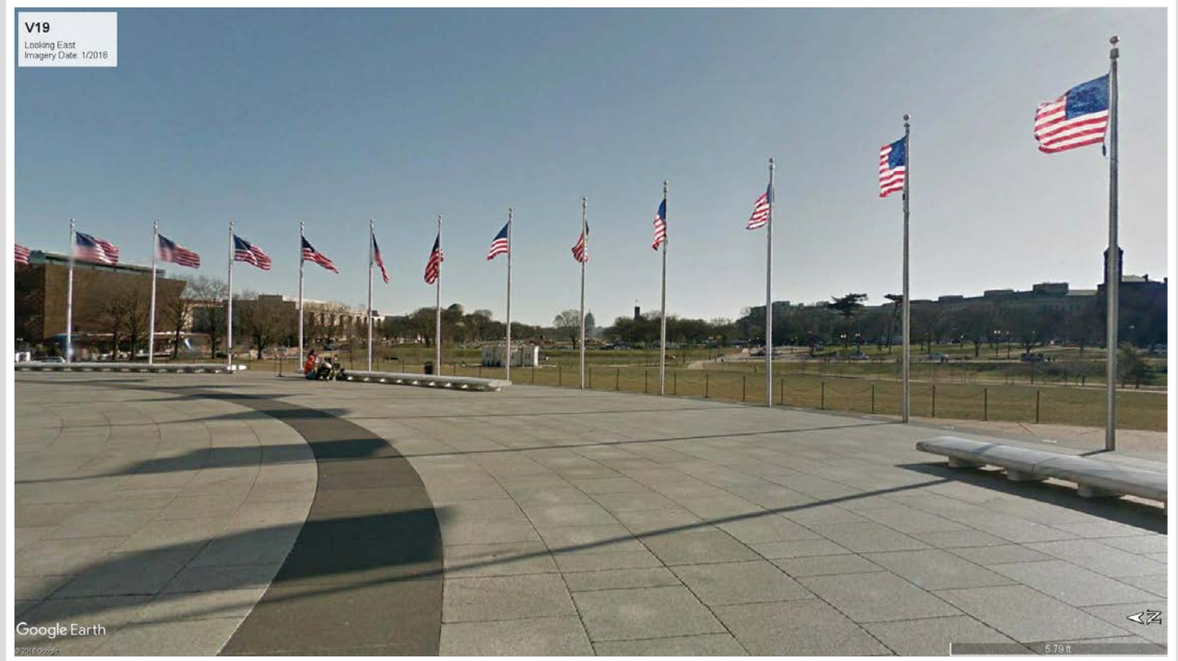

V18
Looking Northwest
Imagery Date: 1/2016
Google Earth
5.88 ft

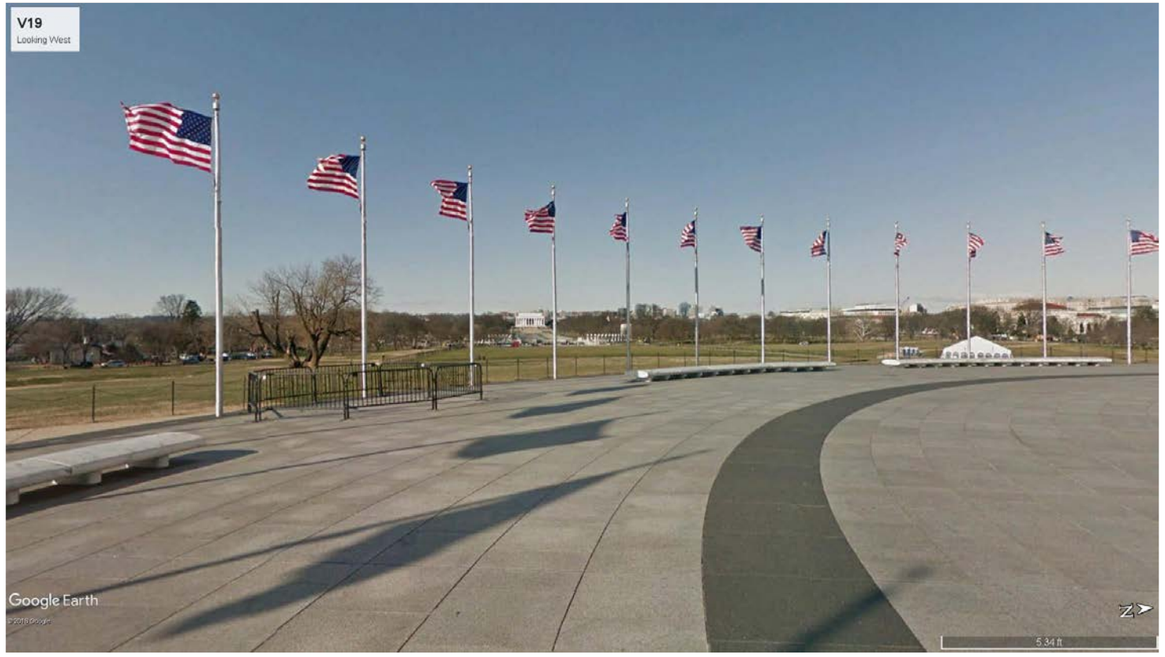

V18
Looking East
Imagery Date: 1/2016
Google Earth
5.91 ft

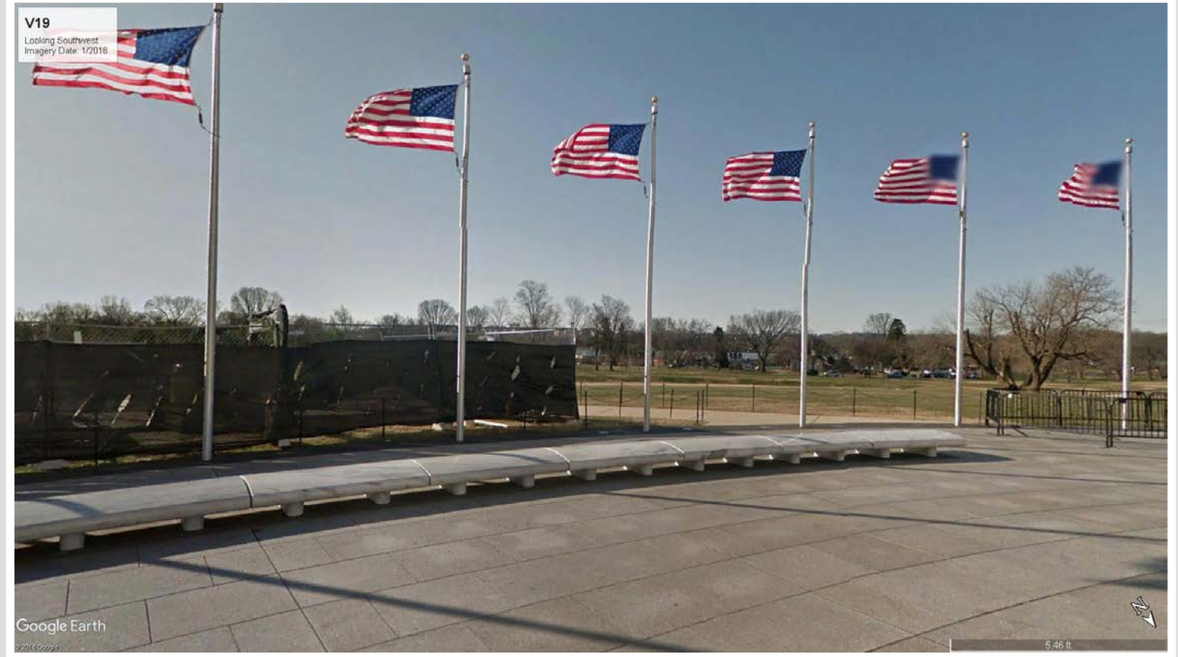
Viewpoint 18 Page 2




not to scale
S12
S13
S14
S15
S16
S21
S22
S23

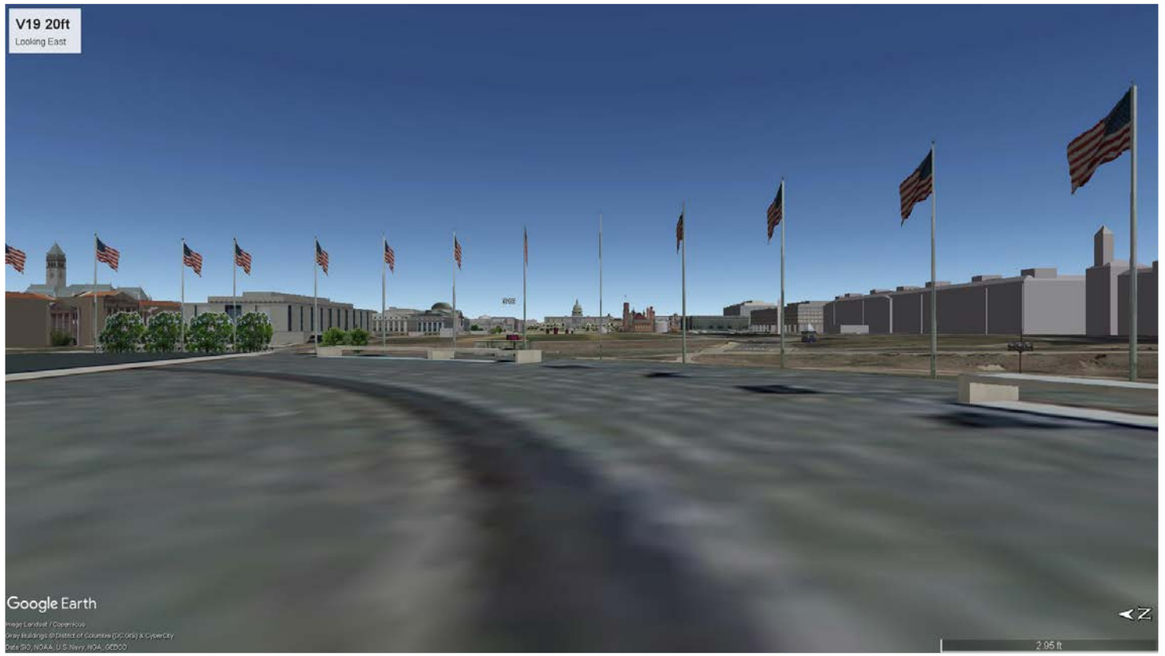

V19
Looking East
Imagery Date: 1/2018
Google Earth
5.78 ft

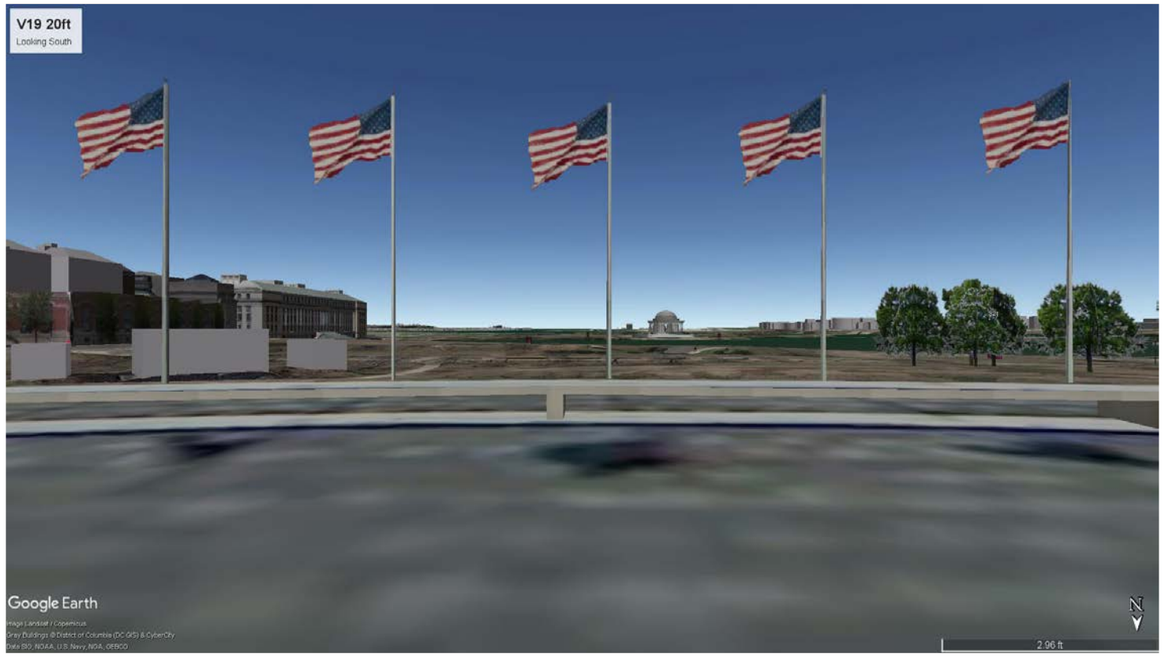

V19
Looking West
Google Earth
5.34 ft

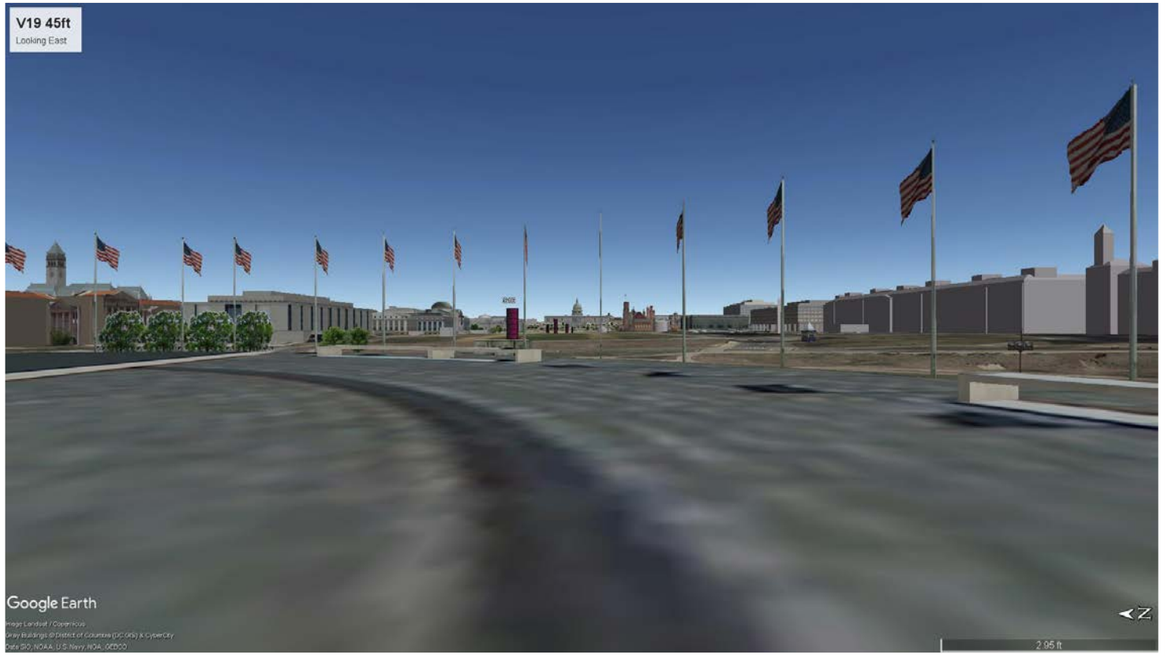

V19
Looking Southwest
Imagery Date: 1/2018
Google Earth
5.46 ft

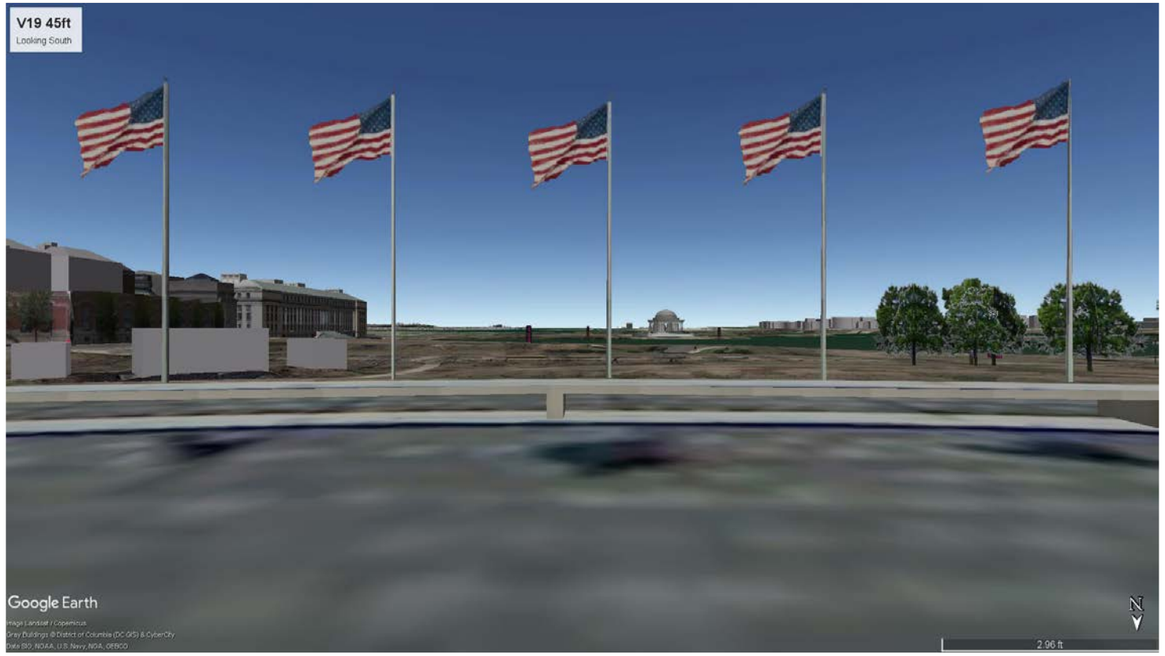
Viewpoint 19 Page 2

Viewpoint 19 Page 3

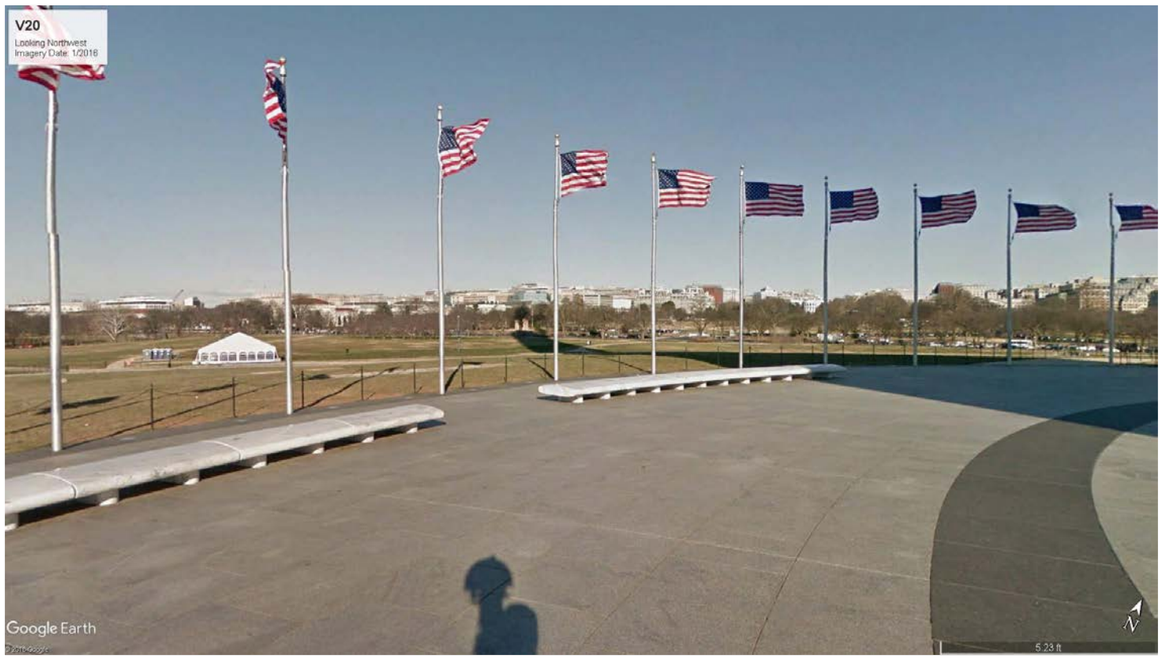


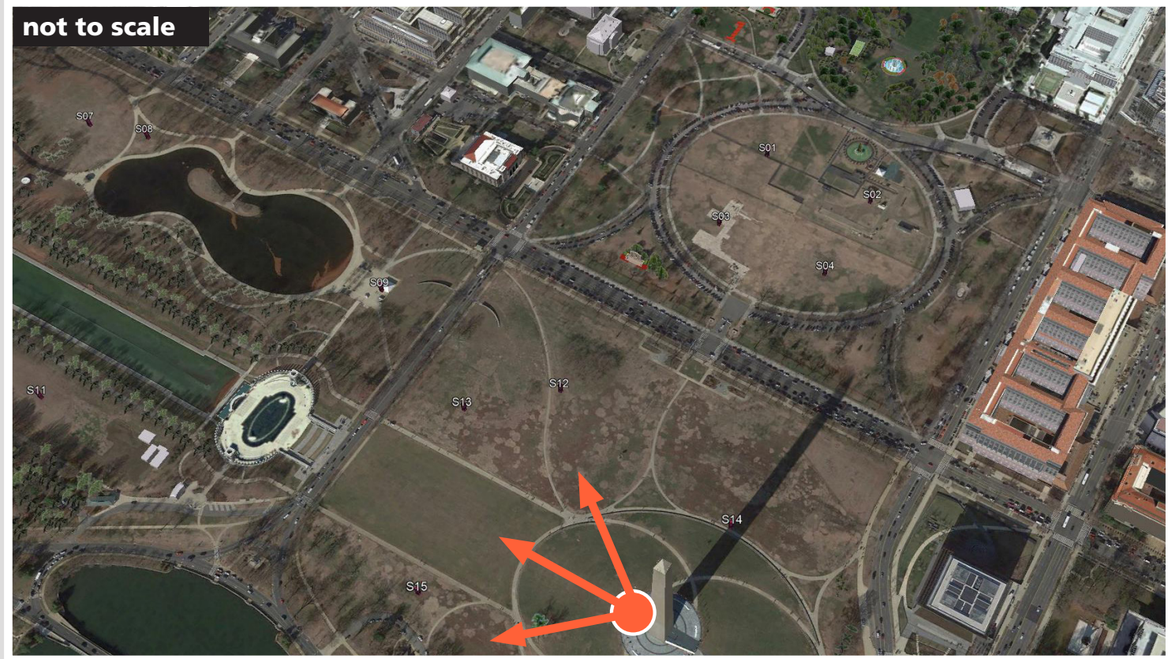


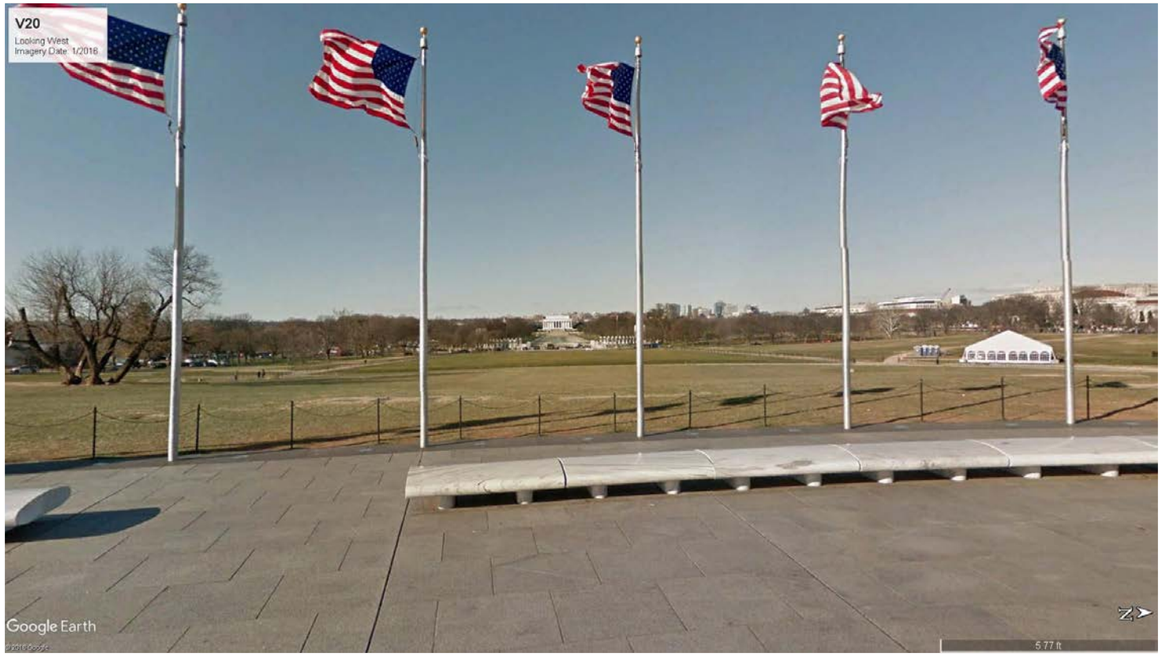


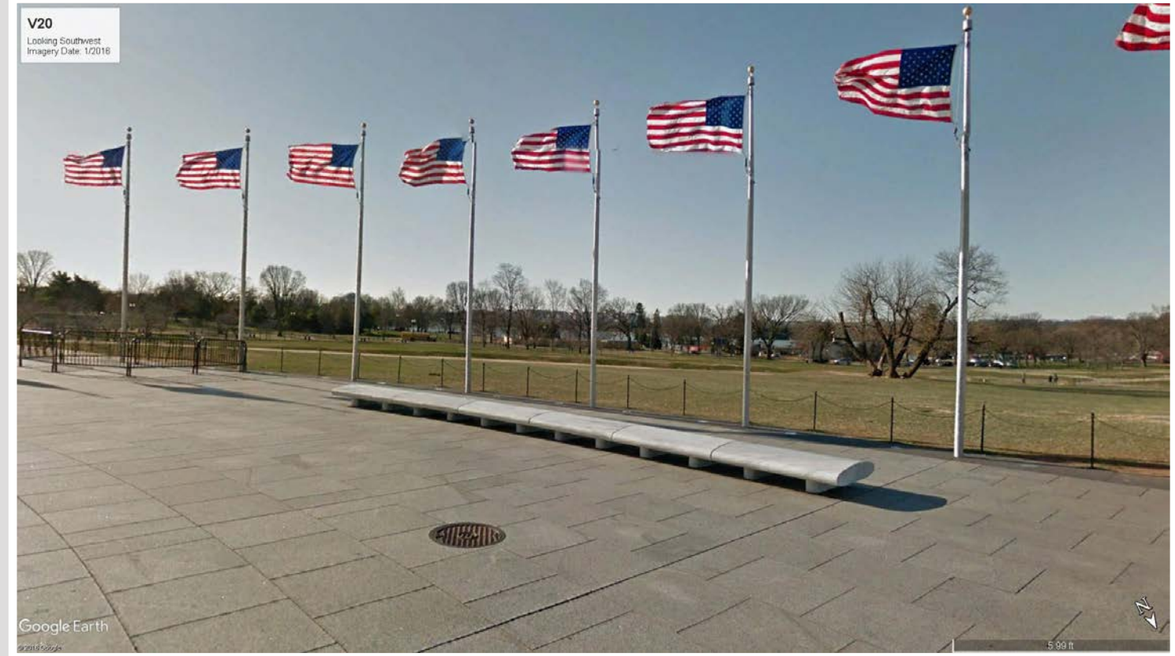


Viewpoint 20 Page 1

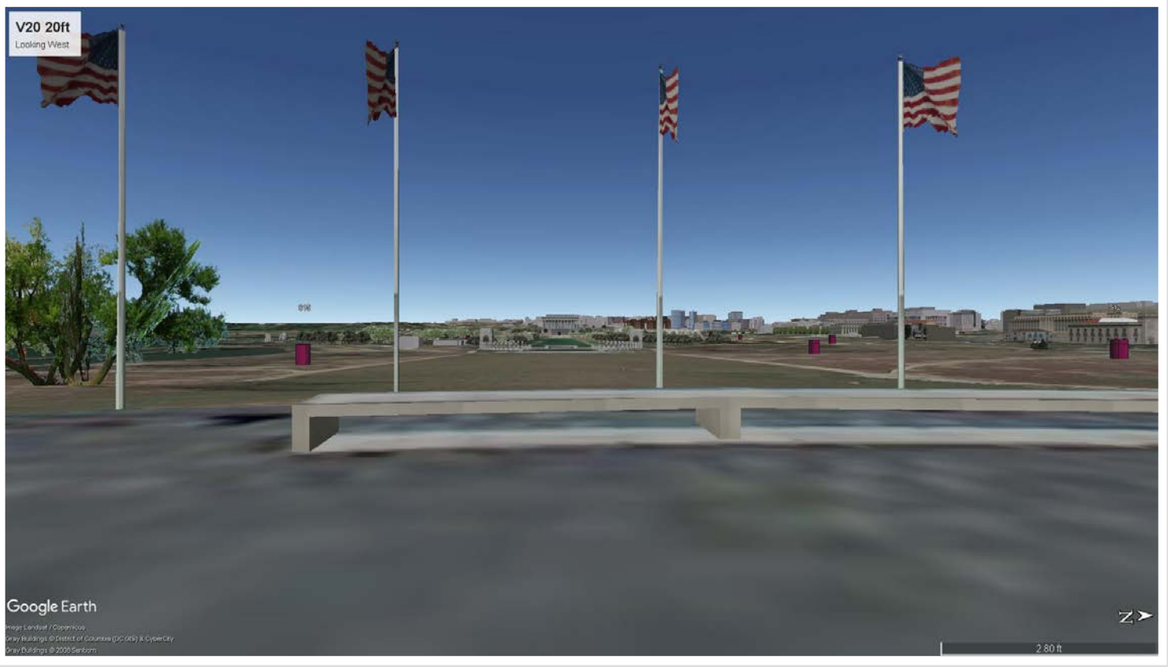


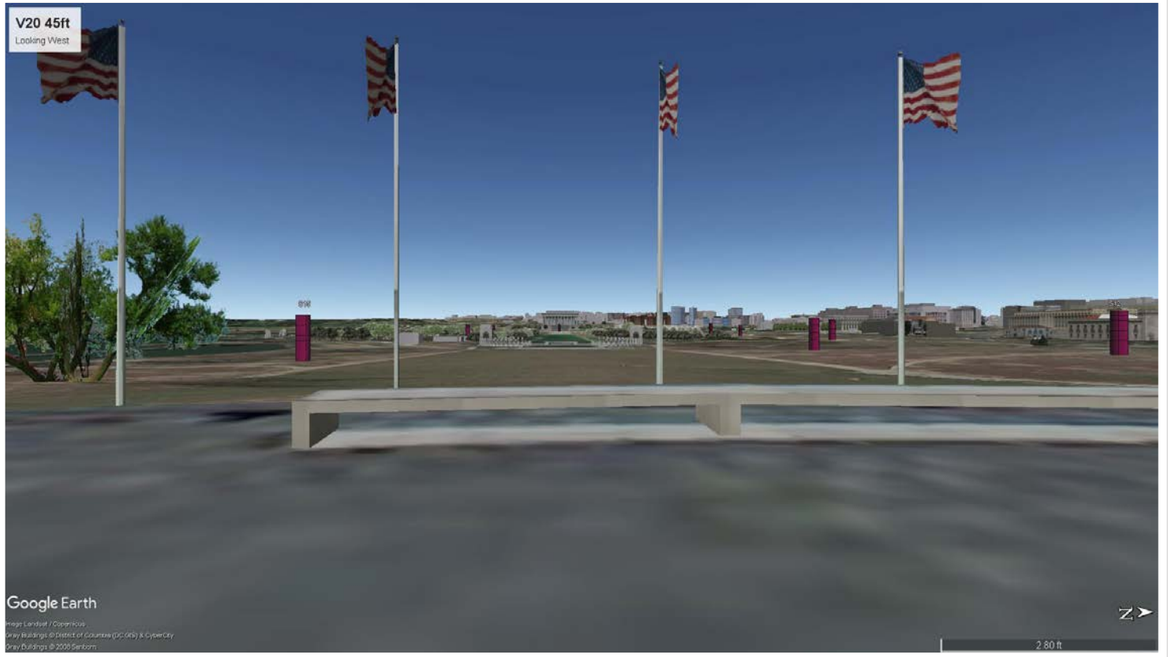






Viewpoint 20 Page 2





Viewpoint 20 Page 3

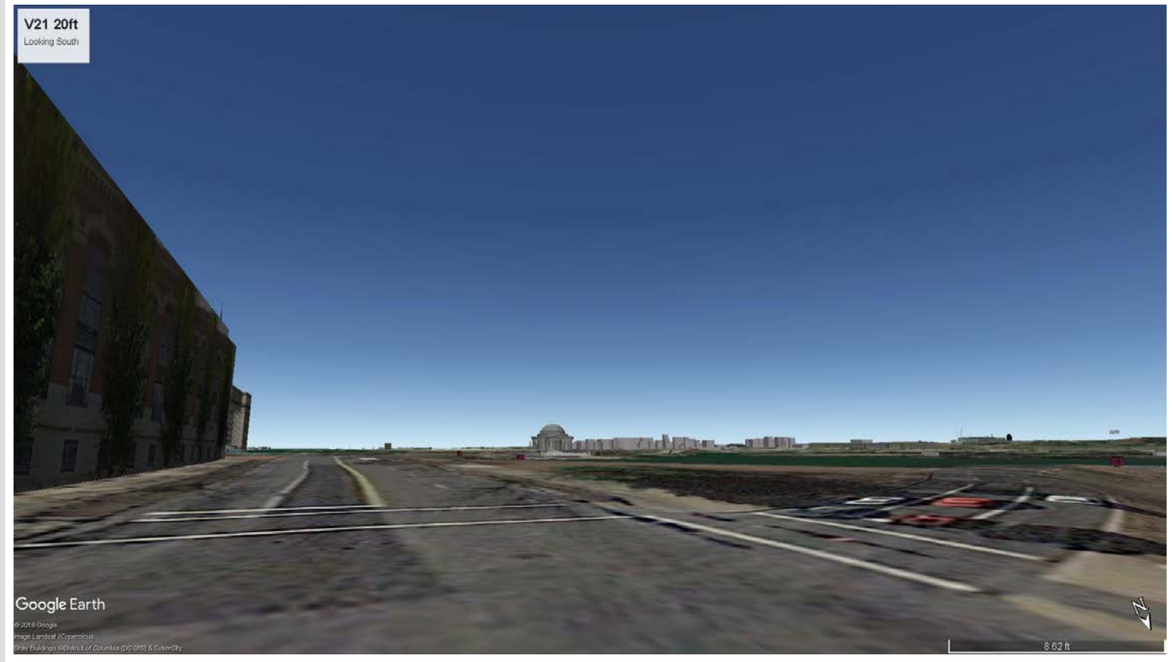

not to scale
S15
S22
S21
S14
S23
400 ft

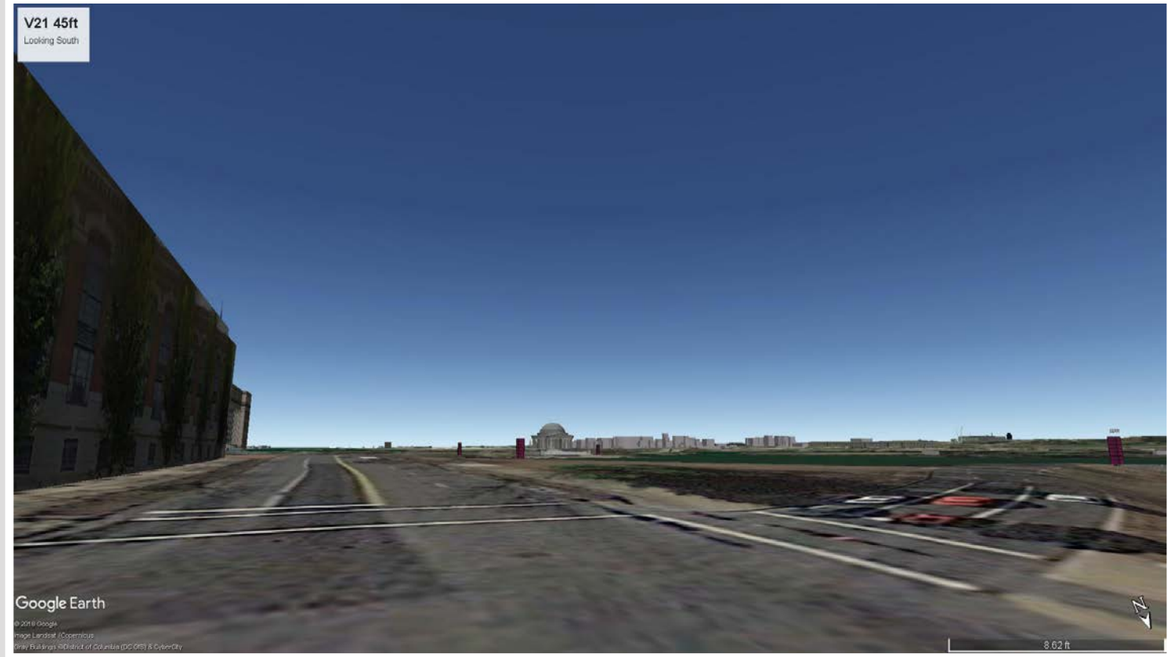

V21
Looking North
Imagery Date: 9/2017
Google Earth
5.75 ft


V21
Looking West
Imagery Date: 9/2017
Google Earth
8.20 ft


V21
Looking South
Imagery Date: 9/2017
Google Earth
10 ft

Viewpoint 21 Page 2





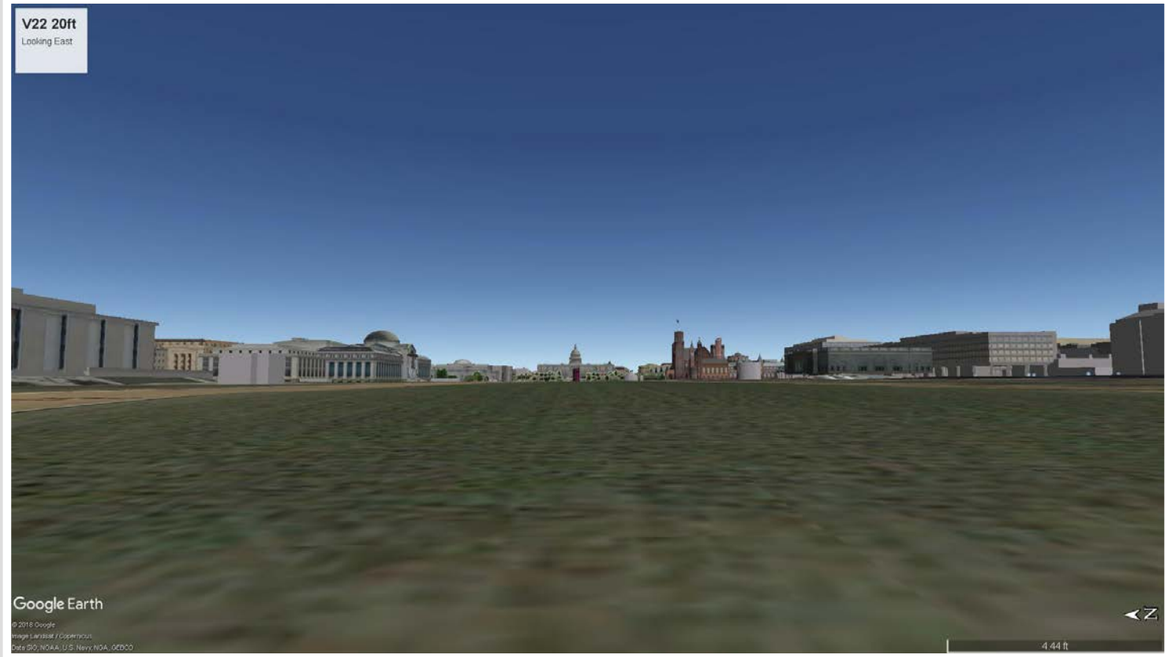
Viewpoint 21 Page 3

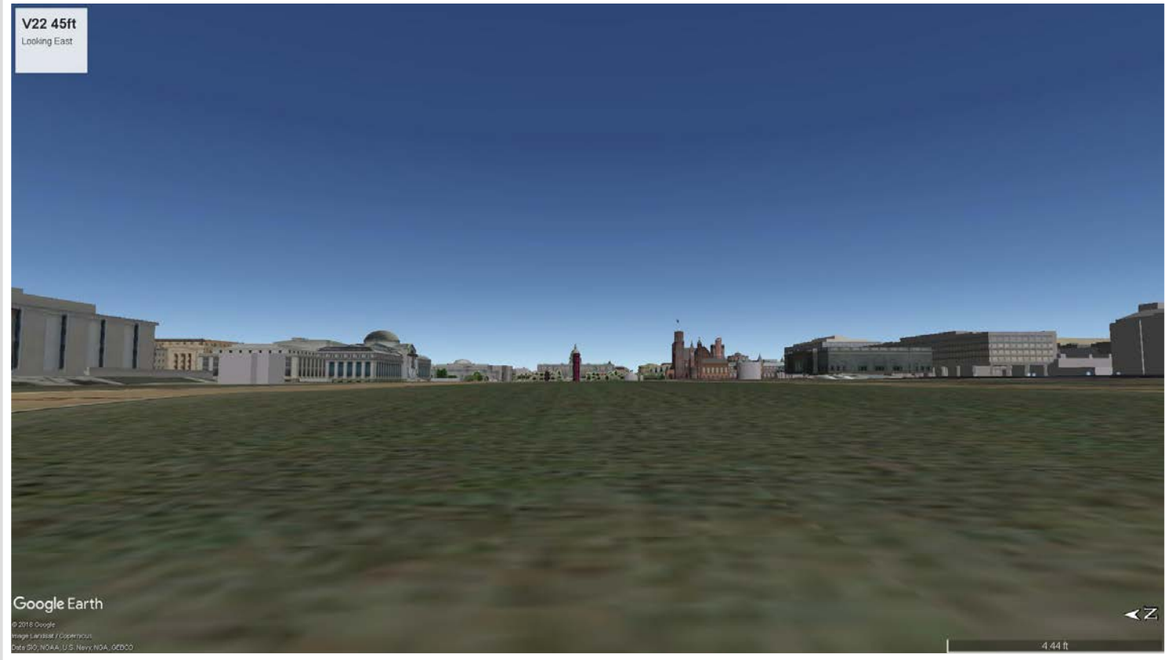

not to scale
S07
S08
S09
S10
S11
S12
S13
S14
S15
S16
S17
S18
S19
S20
S21
S22
S23

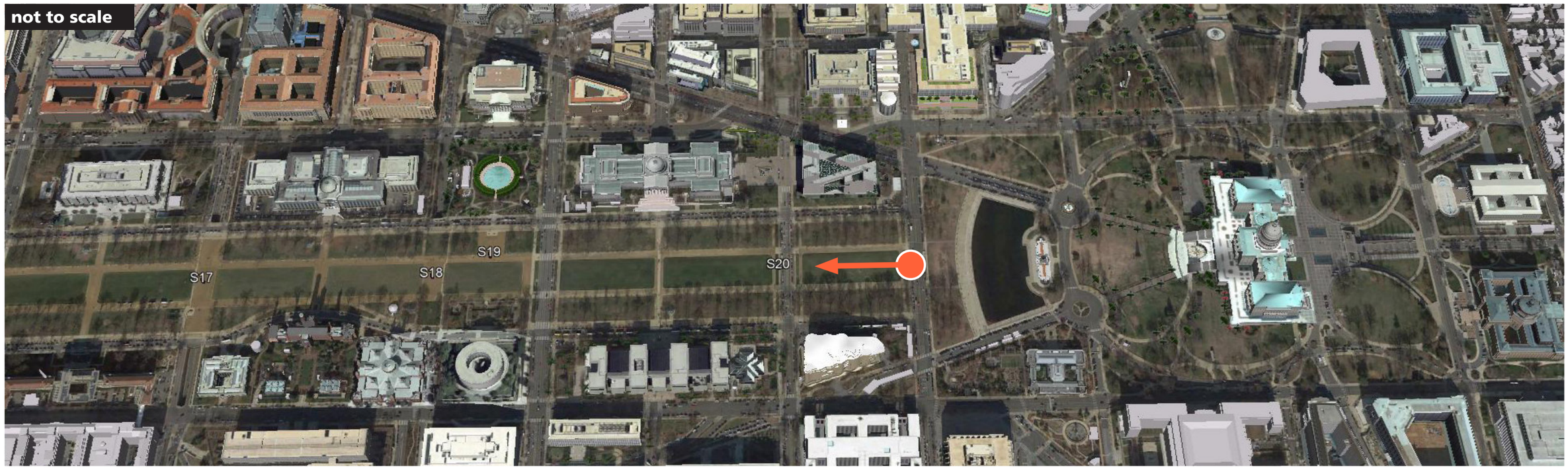

V22
Looking West
Imagery Date: 8/2013
Google Earth
5.64 ft


V22
Looking East
Imagery Date: 8/2013
Google Earth
4.31 ft

Viewpoint 22 Page 2

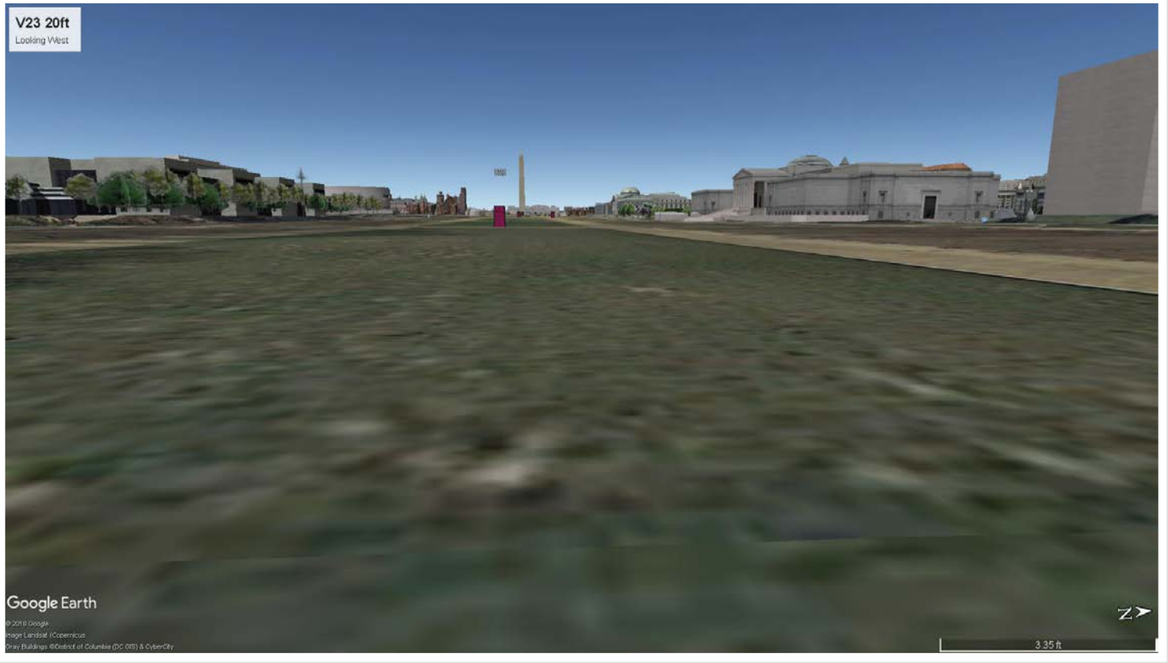


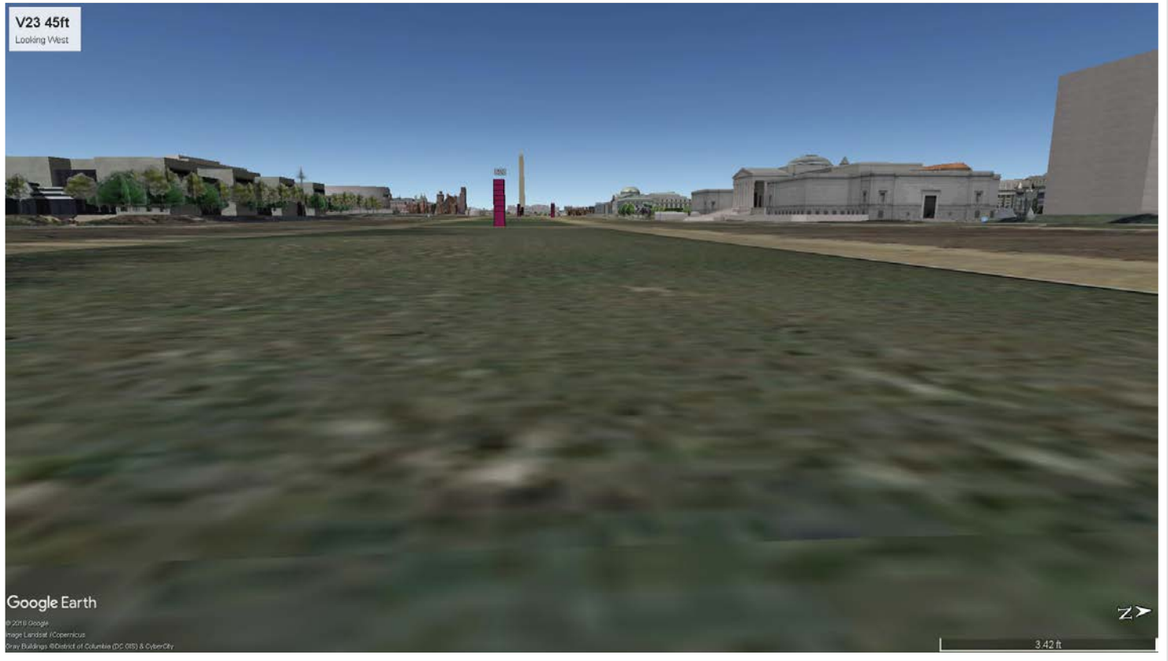


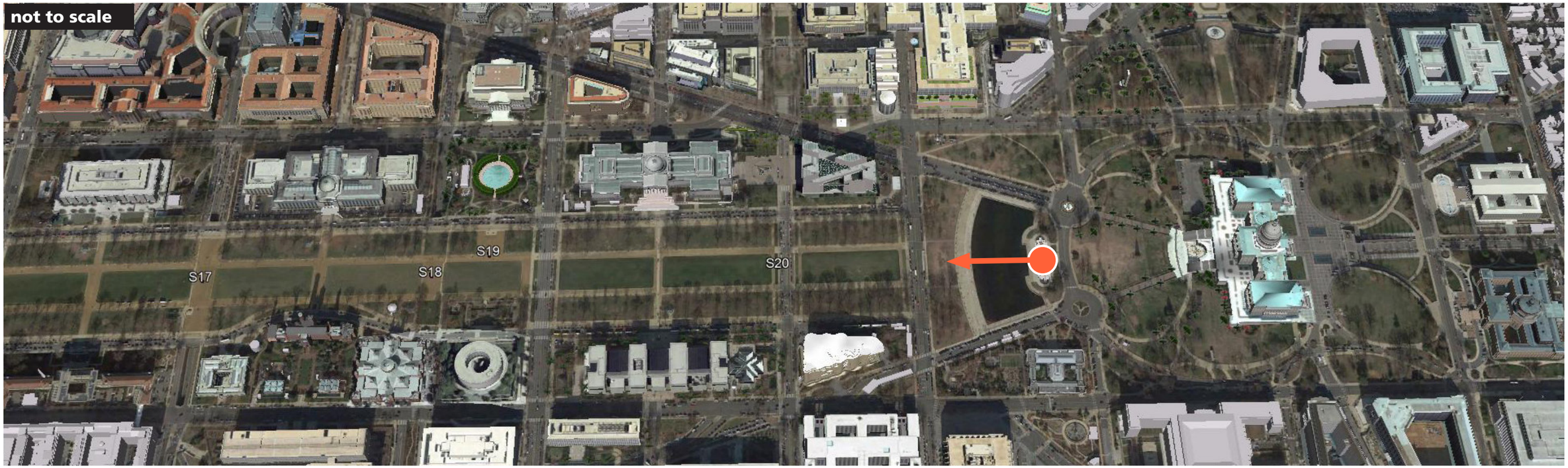

not to scale
S17
S18
S19
S20


V23
Looking West
Imagery Date 8/2013
Google Earth
5.59 ft

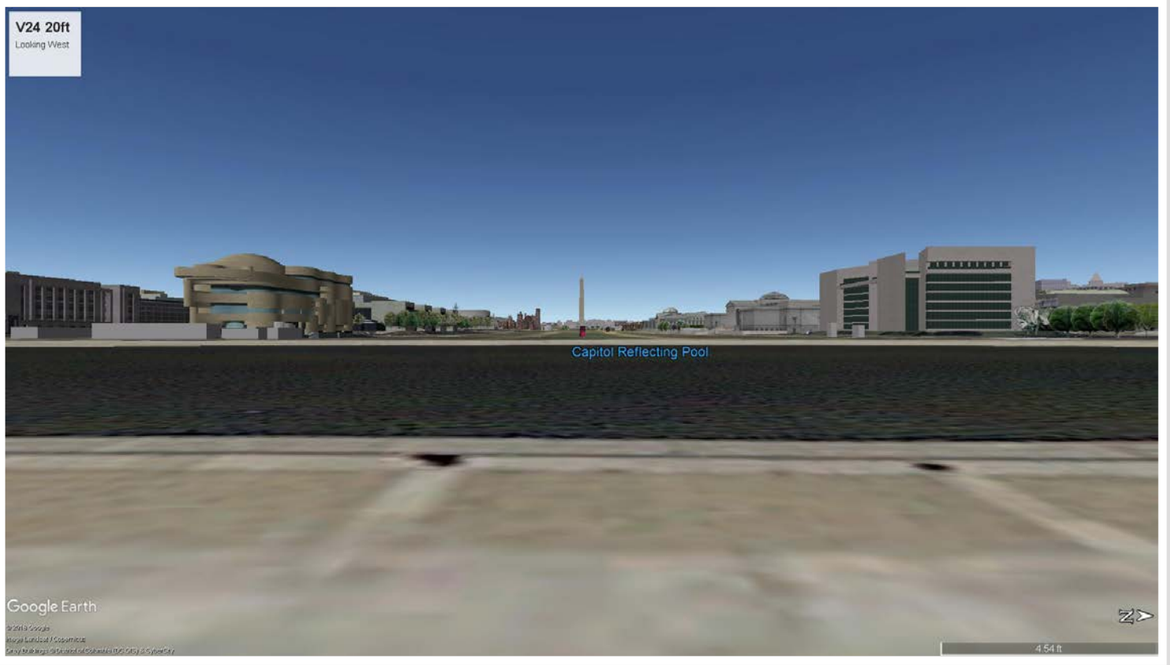
Viewpoint 23 Page 2

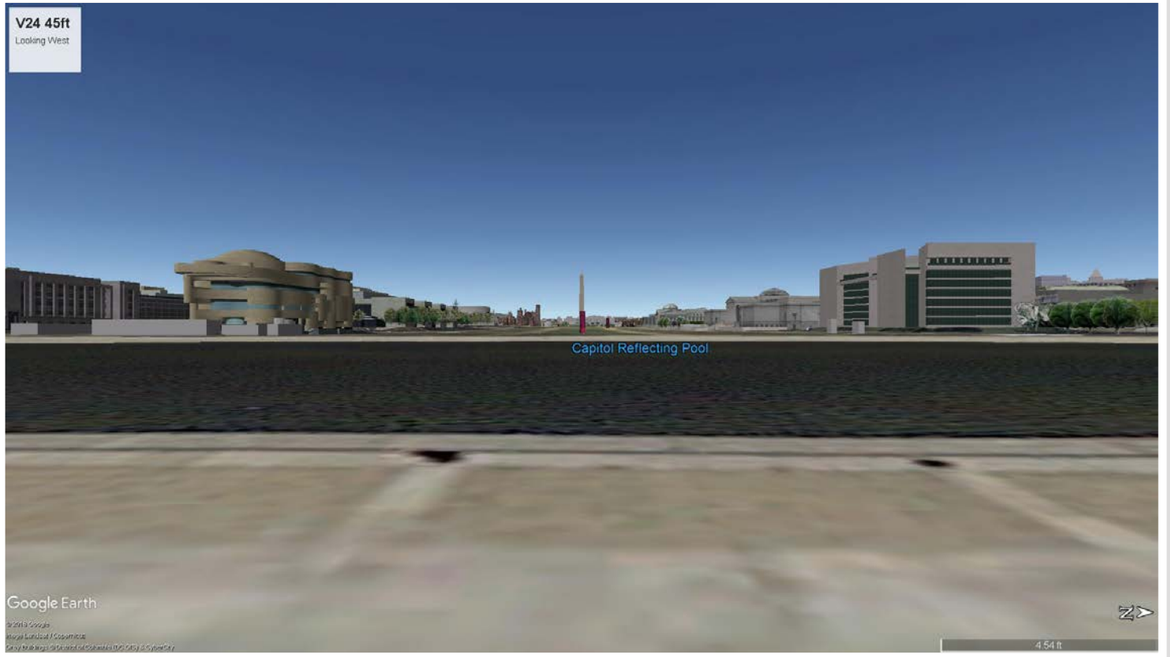


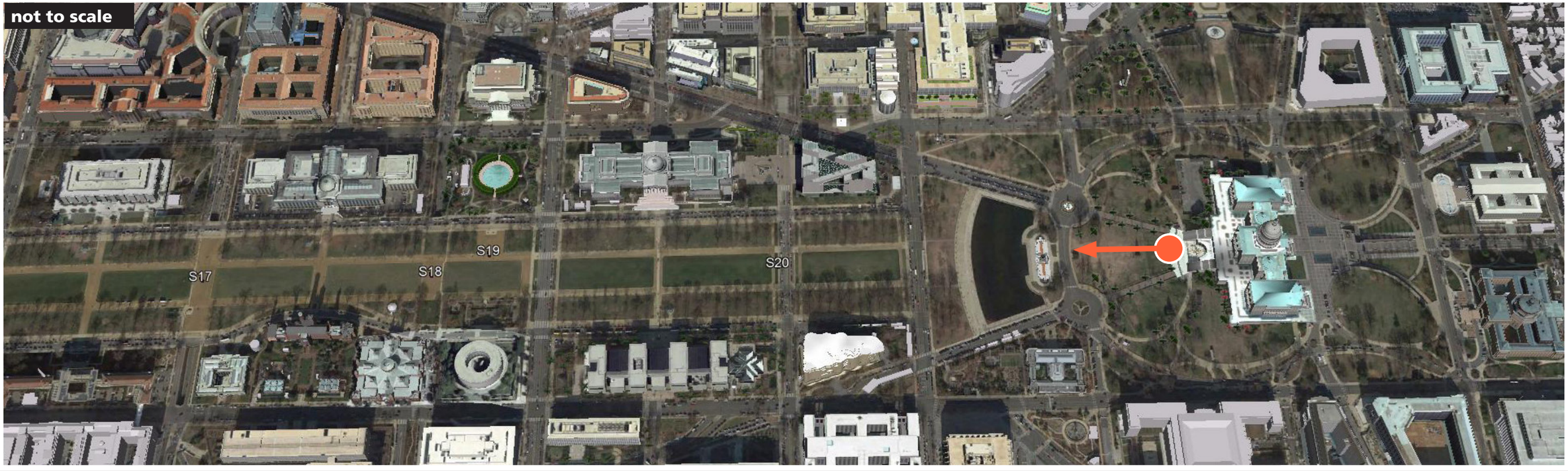



not to scale
S17
S18
S19
S20

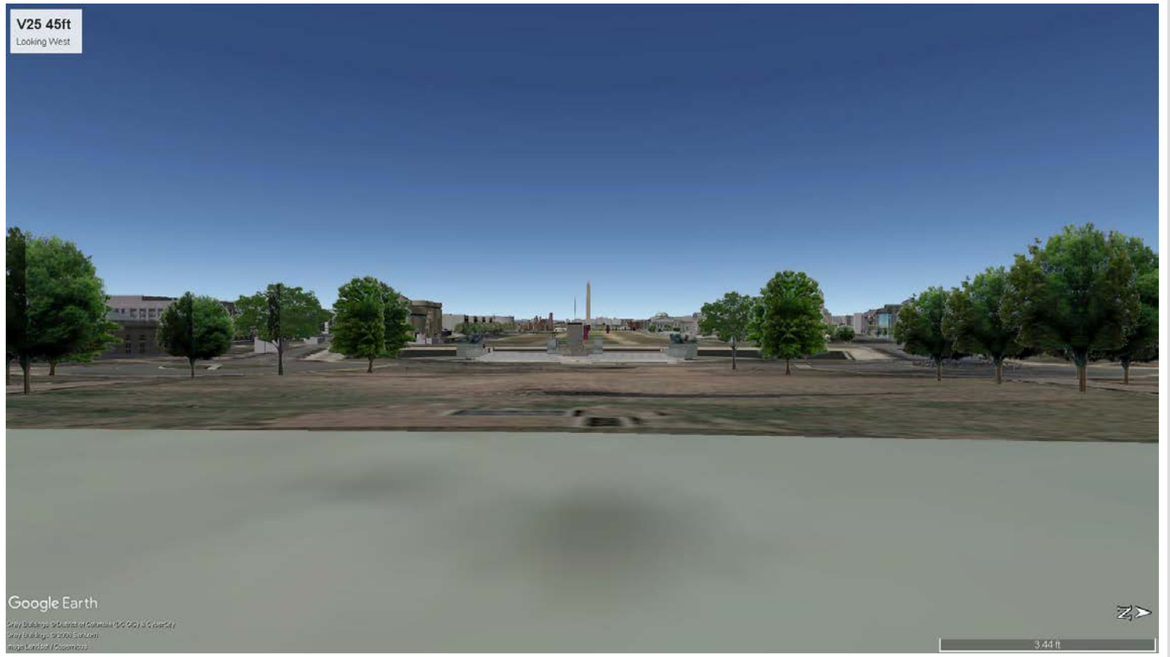
Viewpoint 24 Page 2

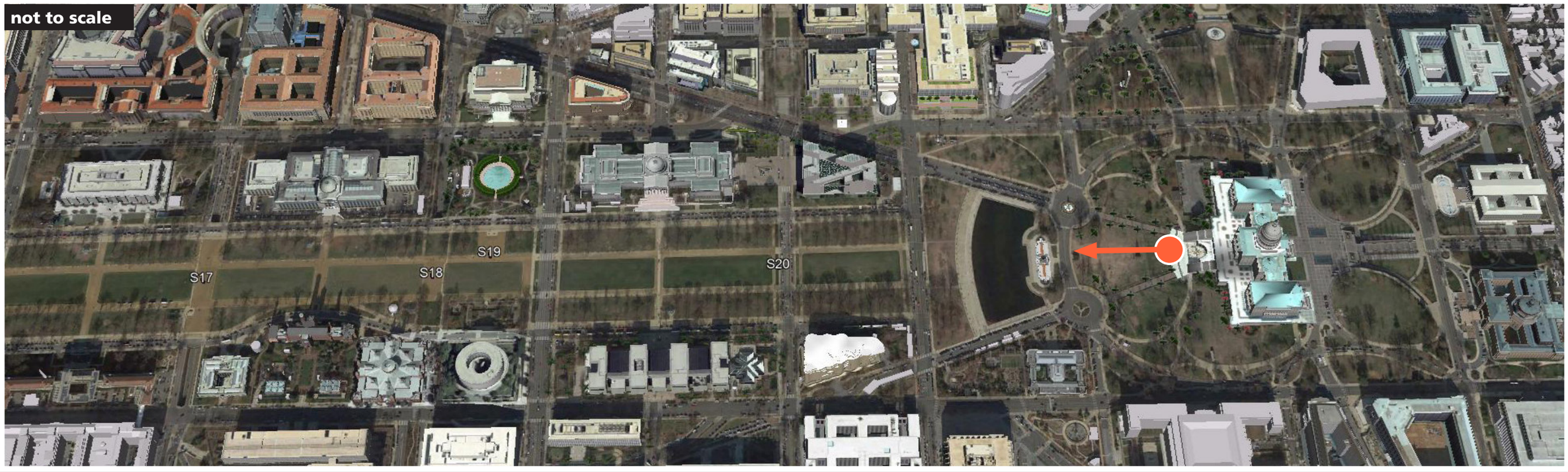




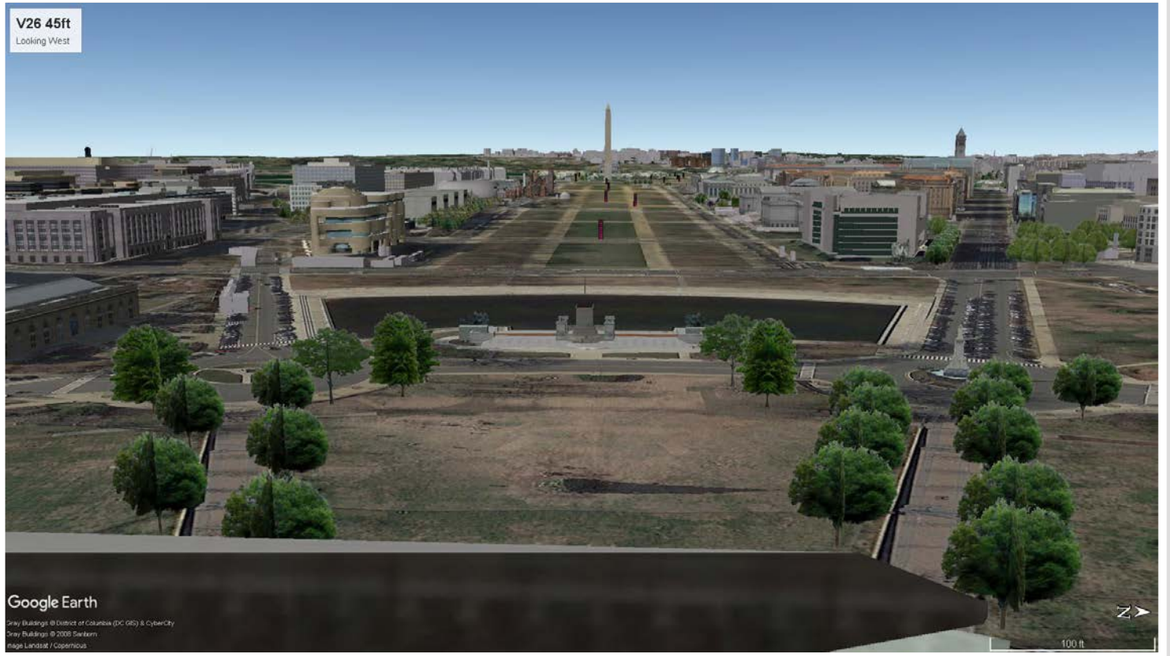

not to scale
S17
S18
S19
S20

Viewpoint 25 Page 2




not to scale
S17
S18
S19
S20

Viewpoint 26 Page 2




not to scale
S01
S02
S03
S04
S05
S06
S07
S08
S09
S10
S11
S12
S13
S14
S15
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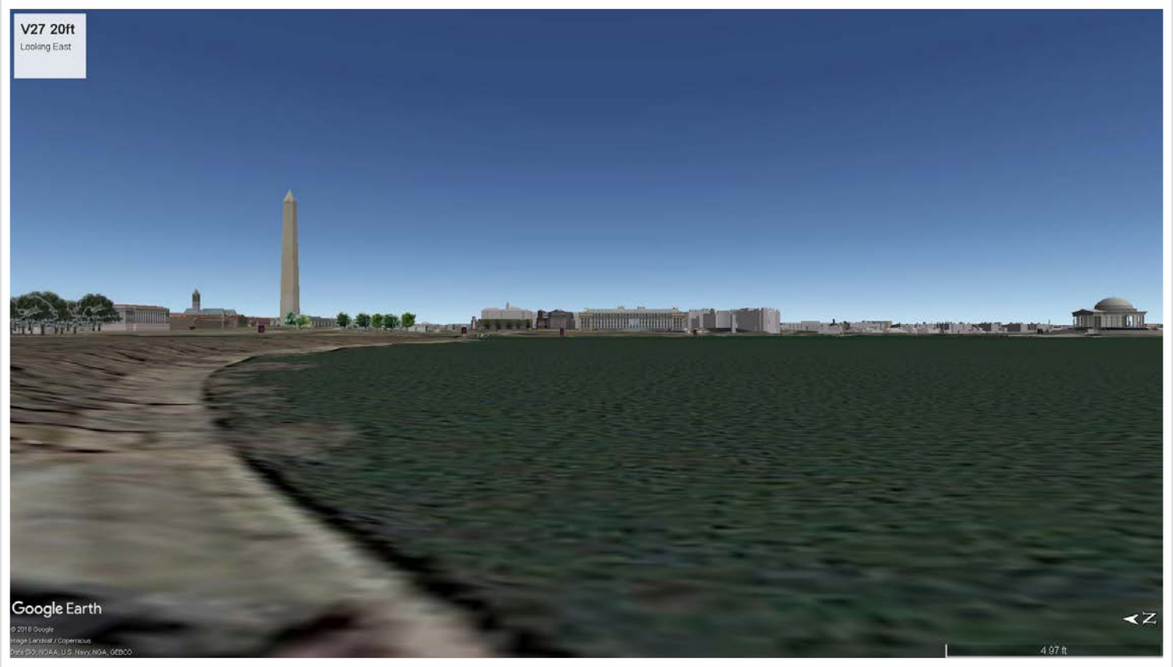
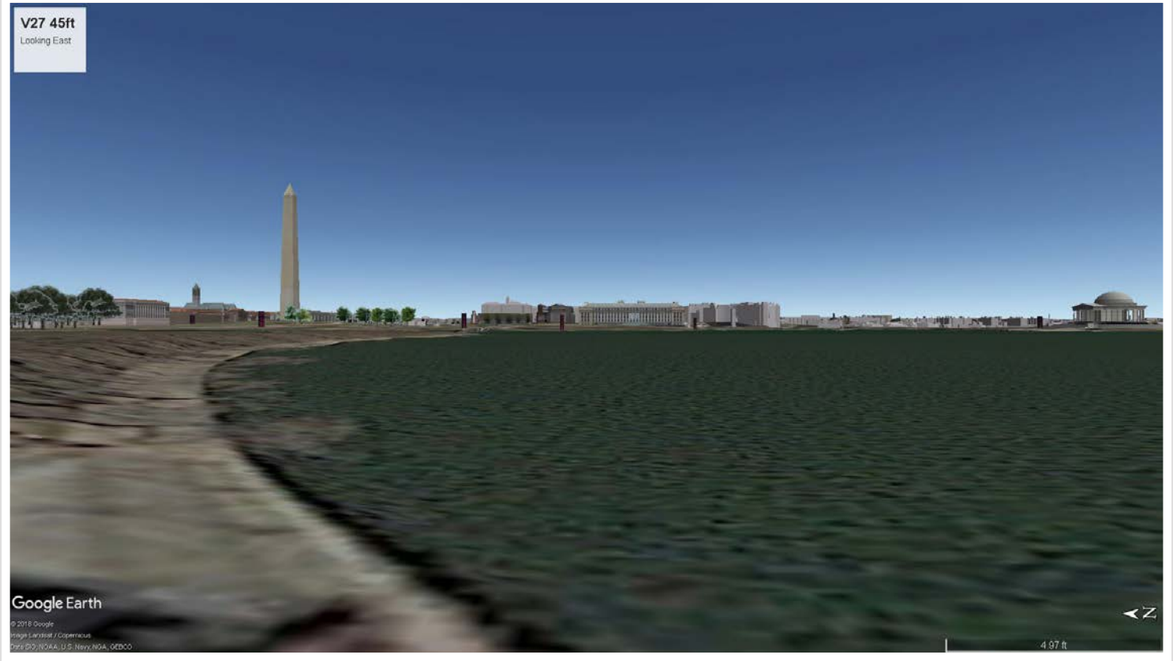
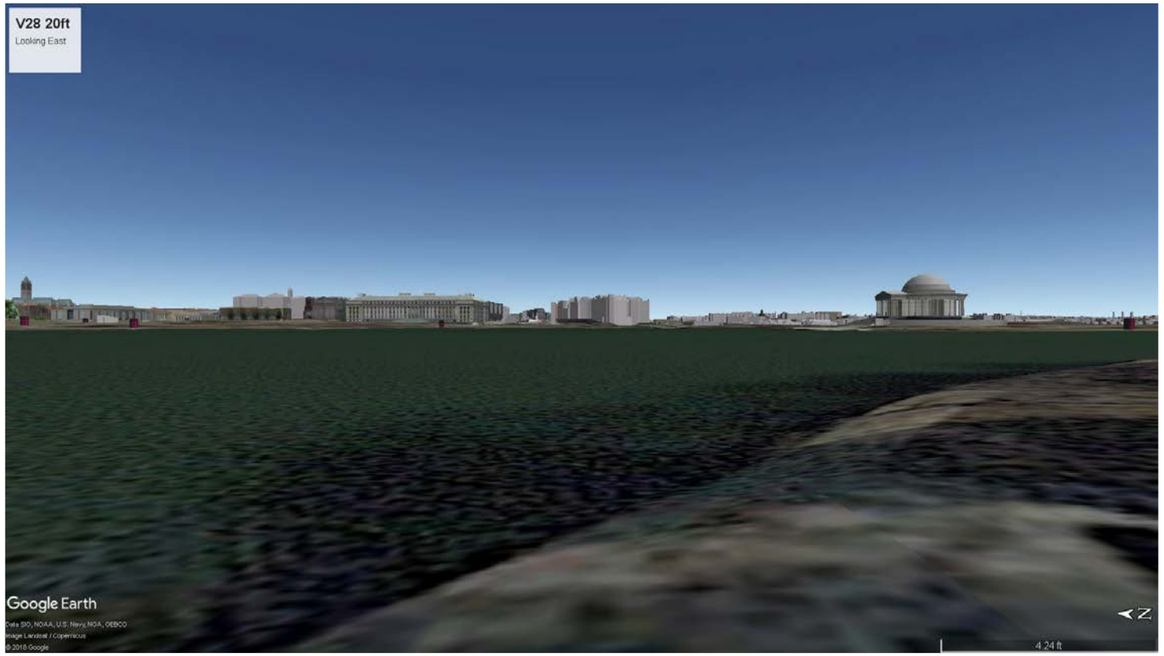
S17
S21
S22
S23

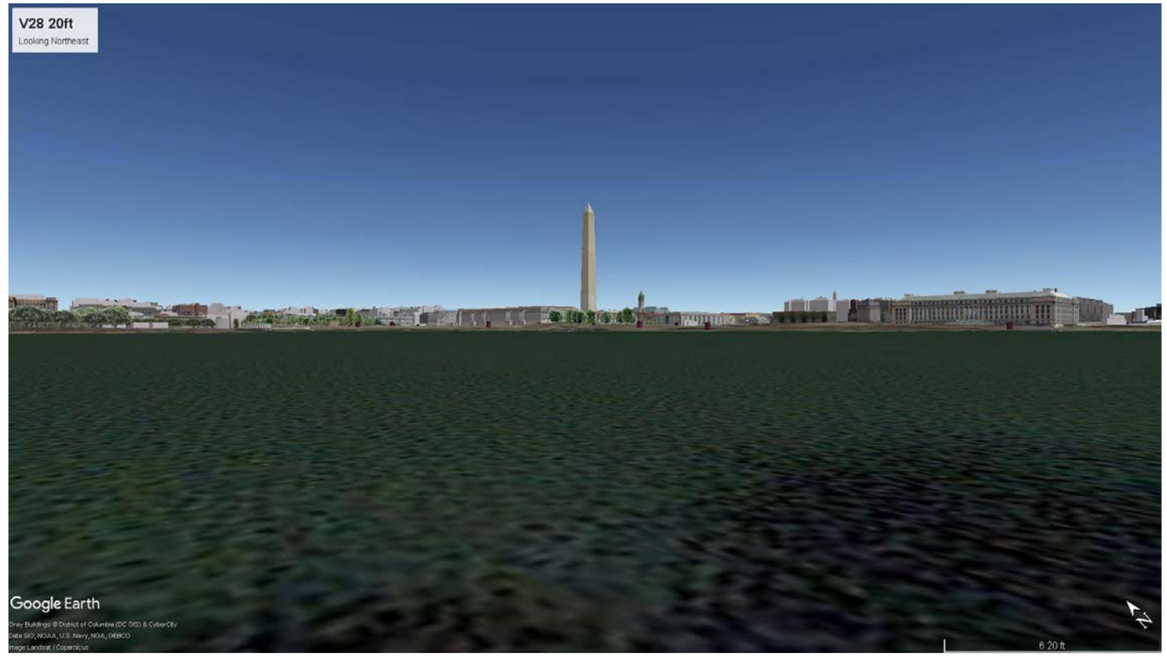
Viewpoint 27 Page 2






not to scale
S05
S06
S07
S08
S09
S10
S11
S12
S13
S14
S15
S16
S17
S18
S19
S21
S22
S23
S24
S25

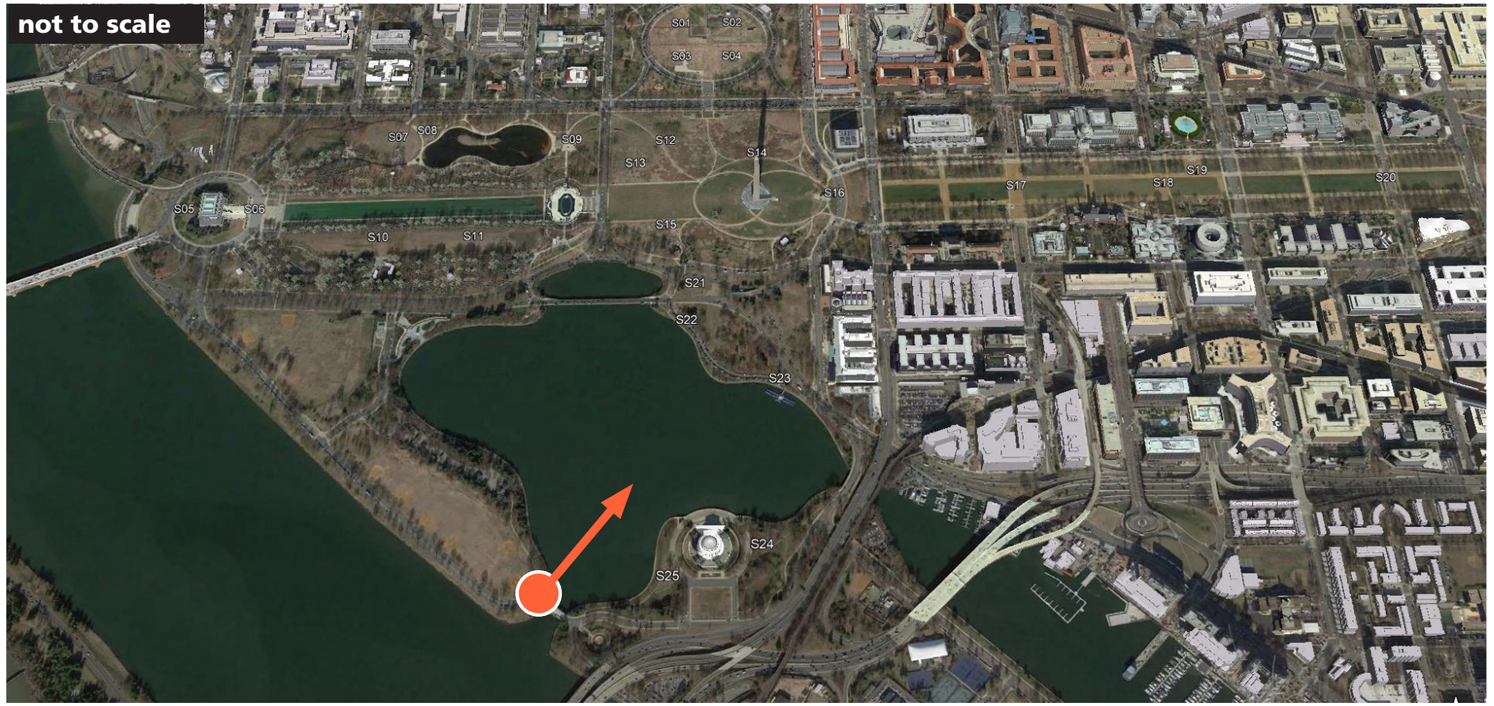

V28 20ft
Looking East
Google Earth
4.24 ft


V28 20ft
Looking Northeast
Google Earth
6.20 ft

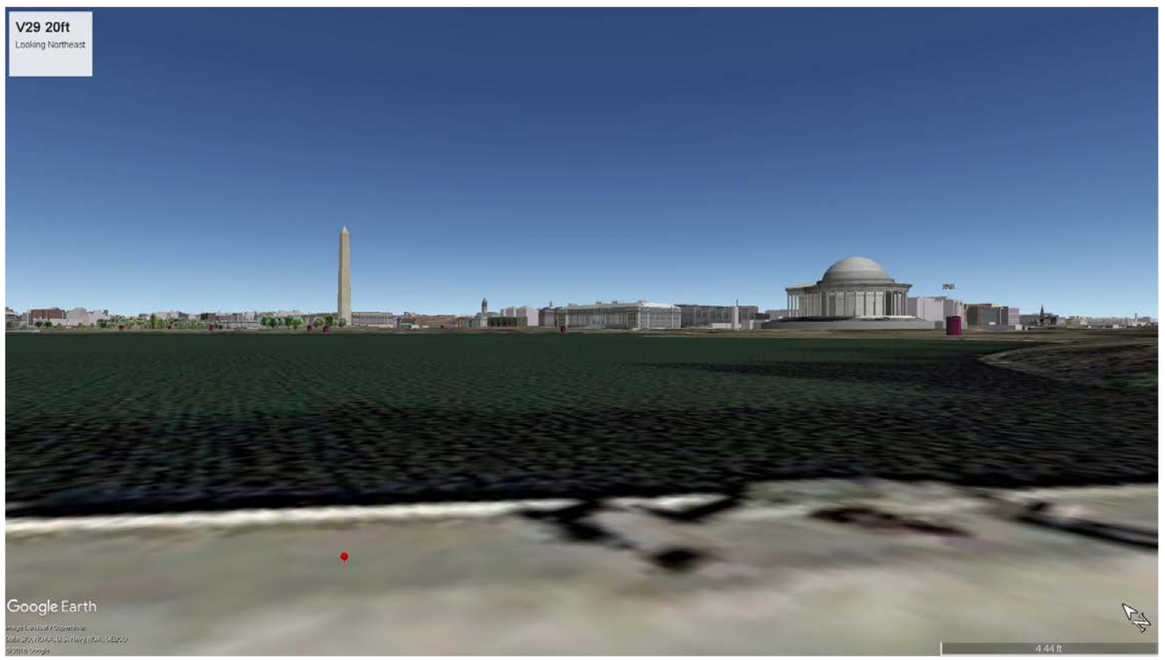
V28 45ft
Looking East
Google Earth
4.24 ft

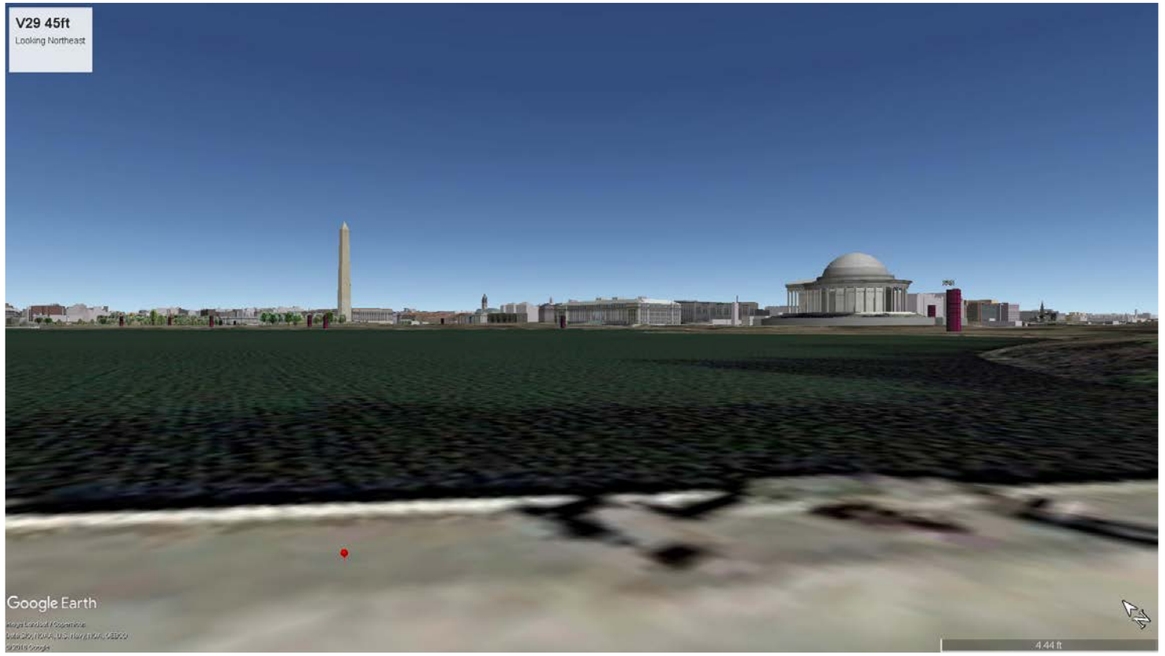
V28 45ft
Looking Northeast
Google Earth
5.82 ft

Viewpoint 29 Page 1



Viewpoint 29 Page 2

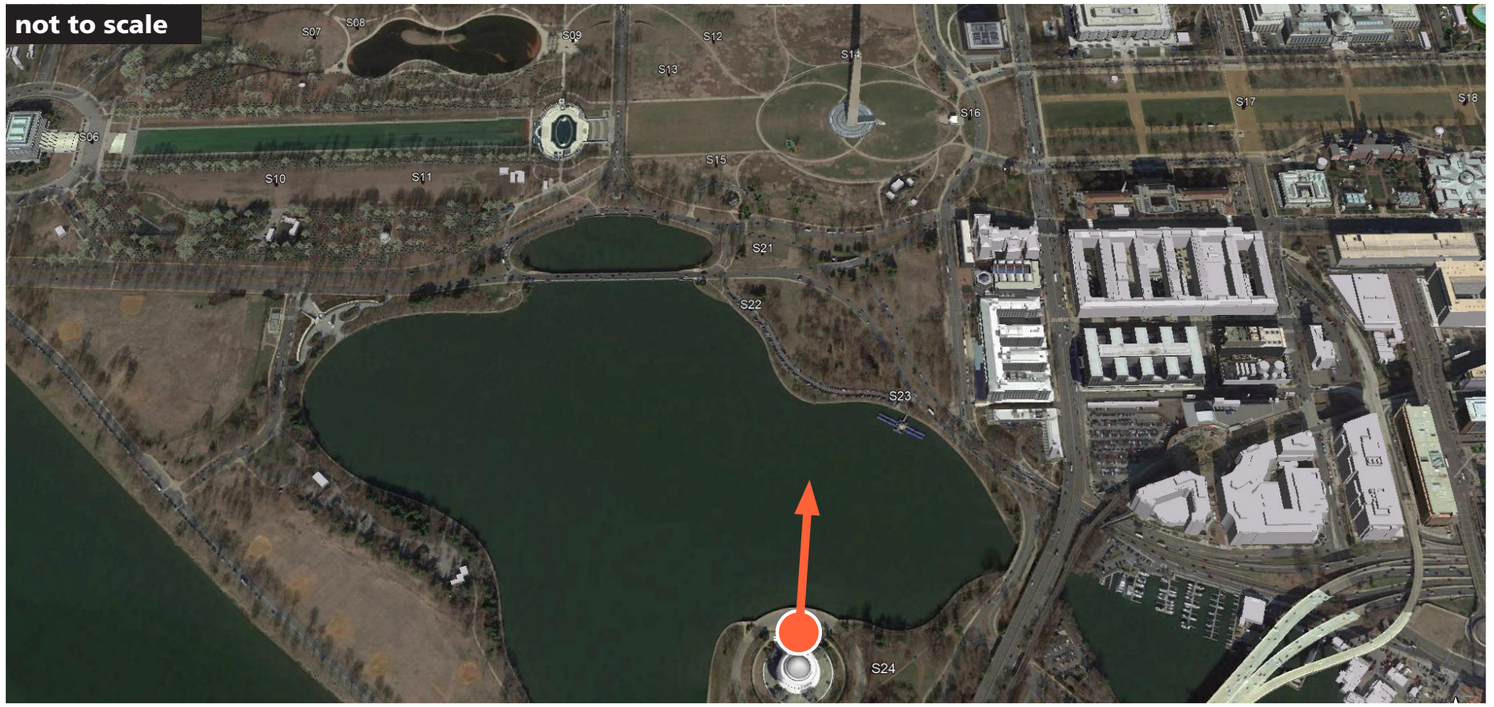




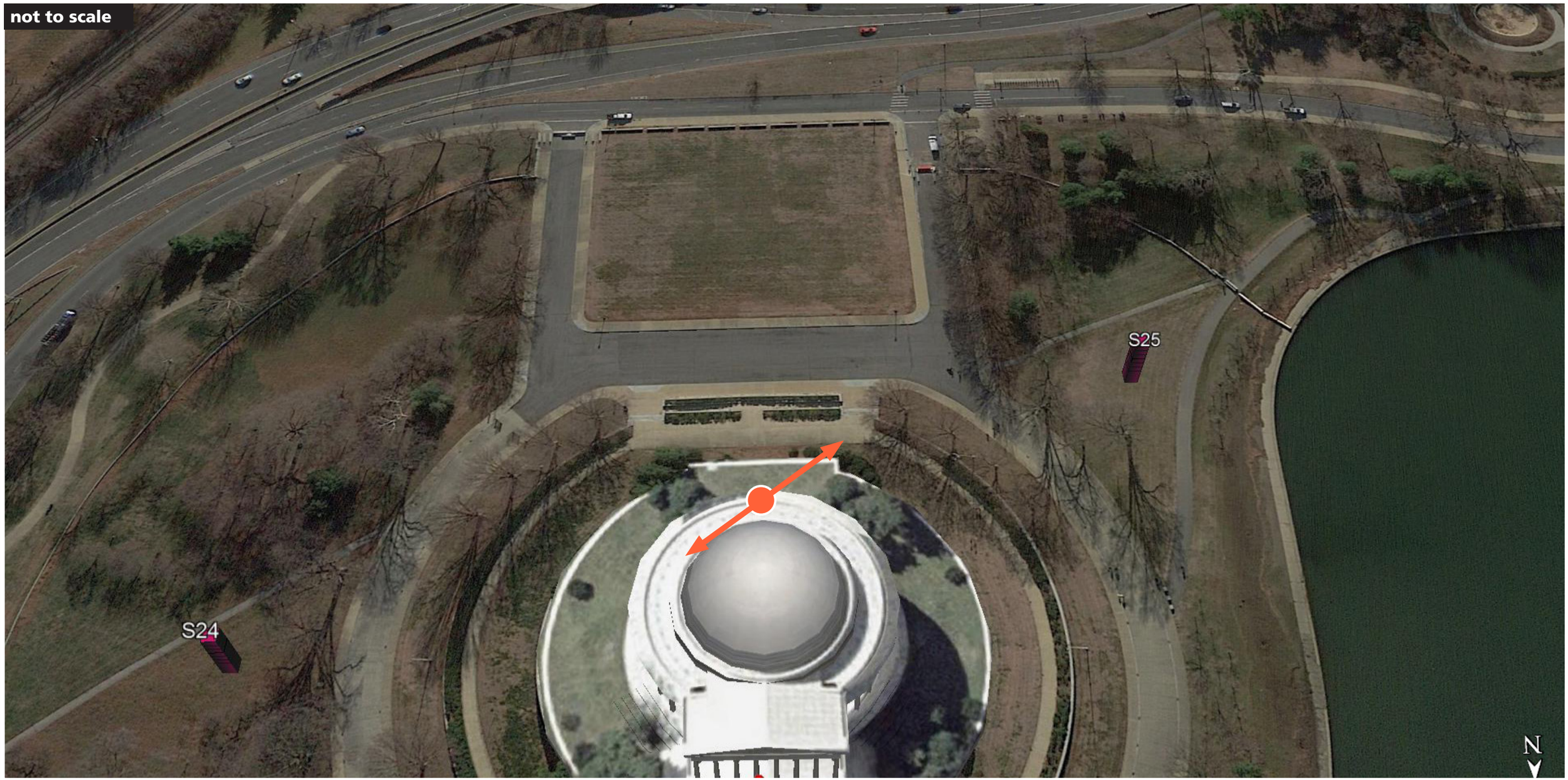
Viewpoint 30 Page 1

Viewpoint 30 Page 2

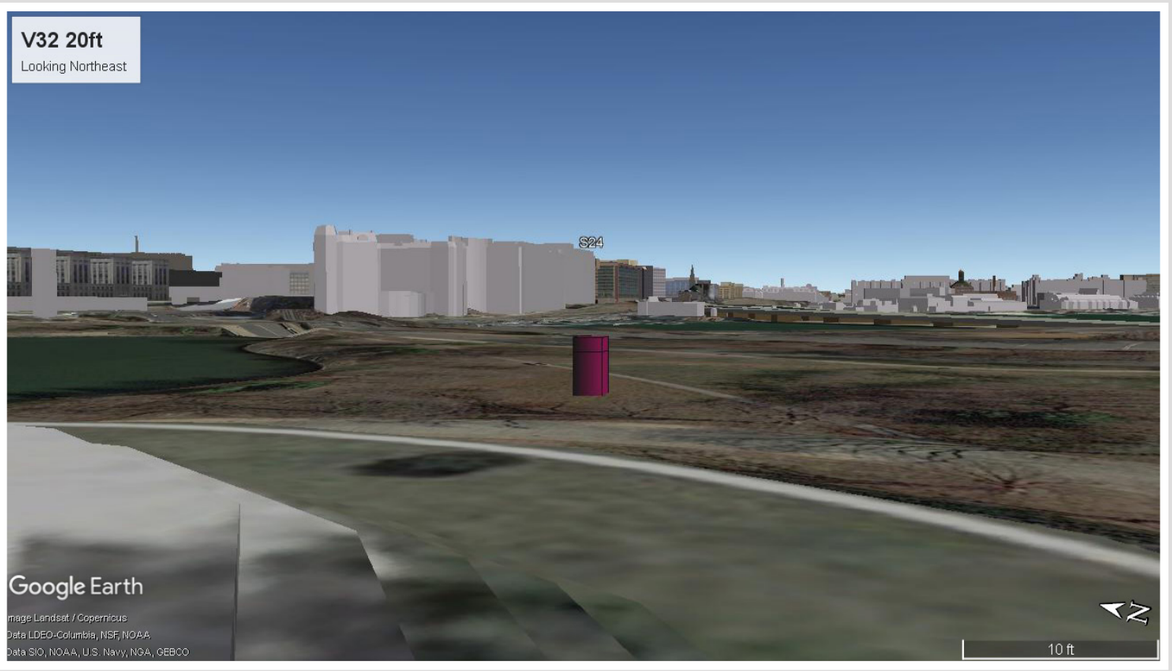
Viewpoint 31 Page 1

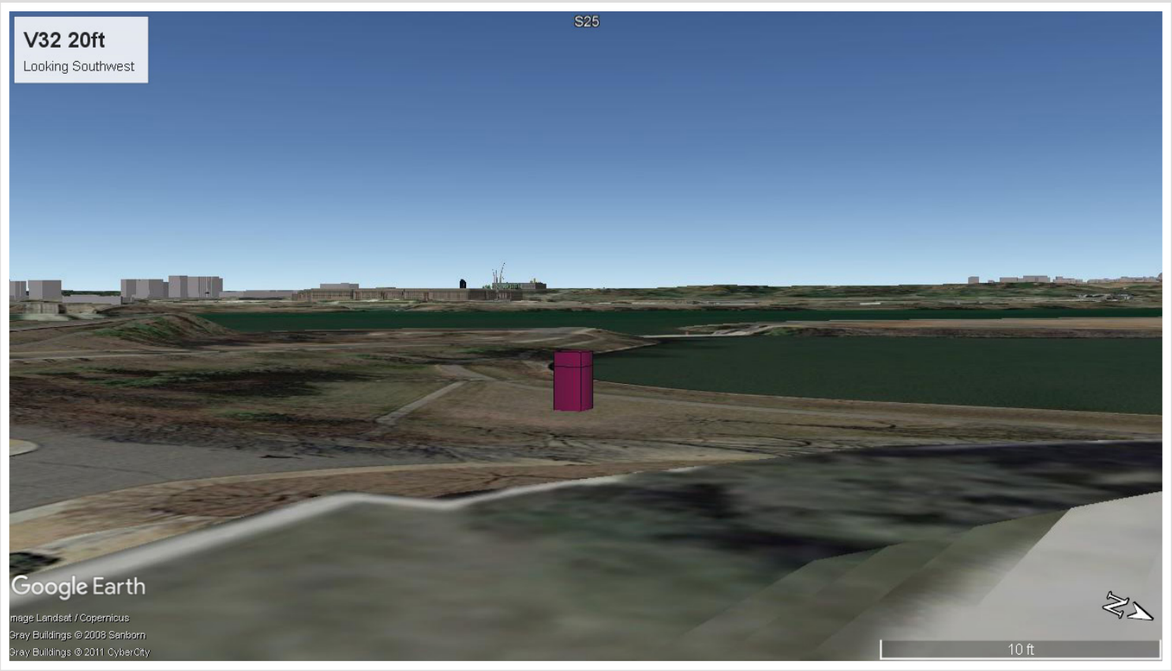


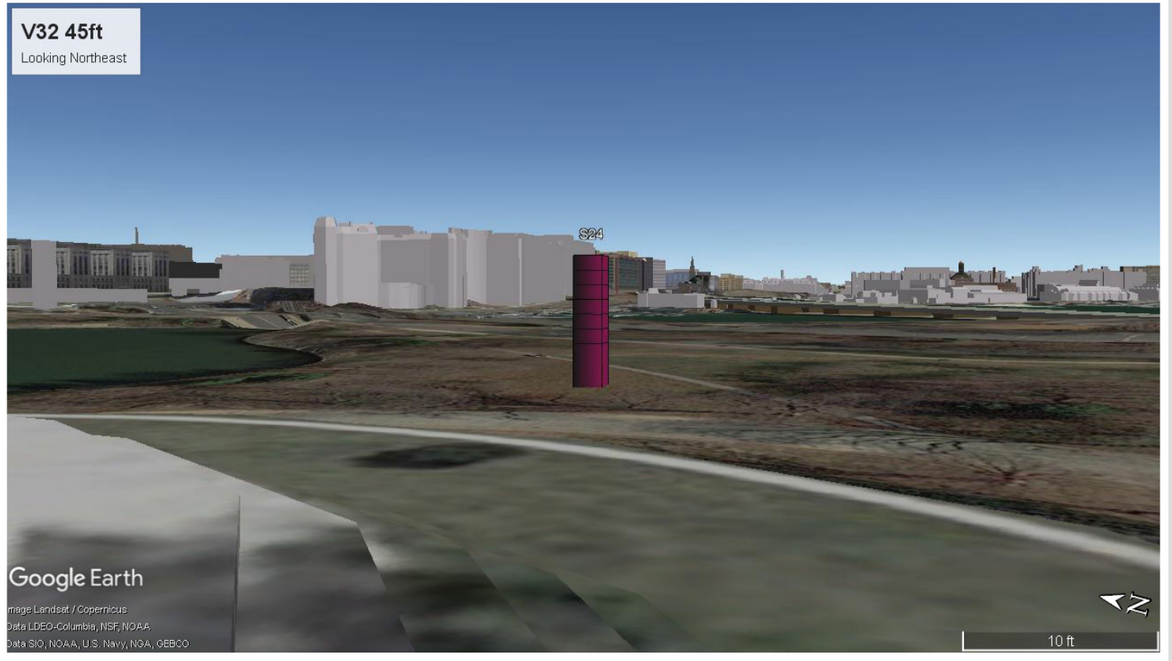
Viewpoint 31 Page 2

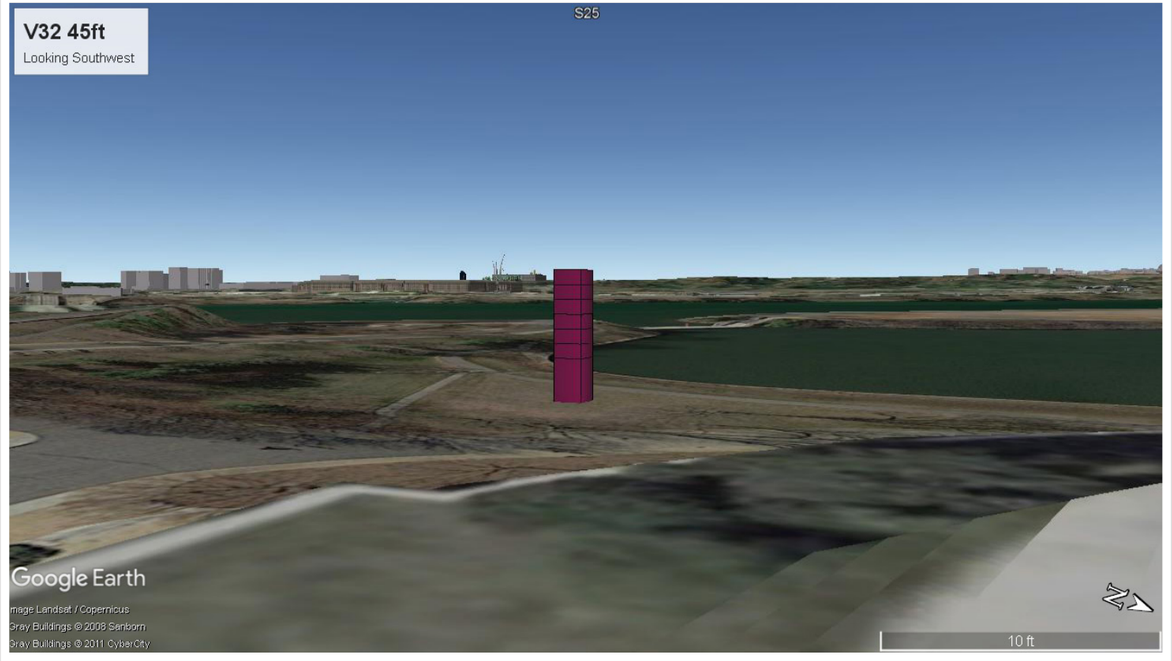

not to scale
S25
S24
N

Viewpoint 32 Page 2



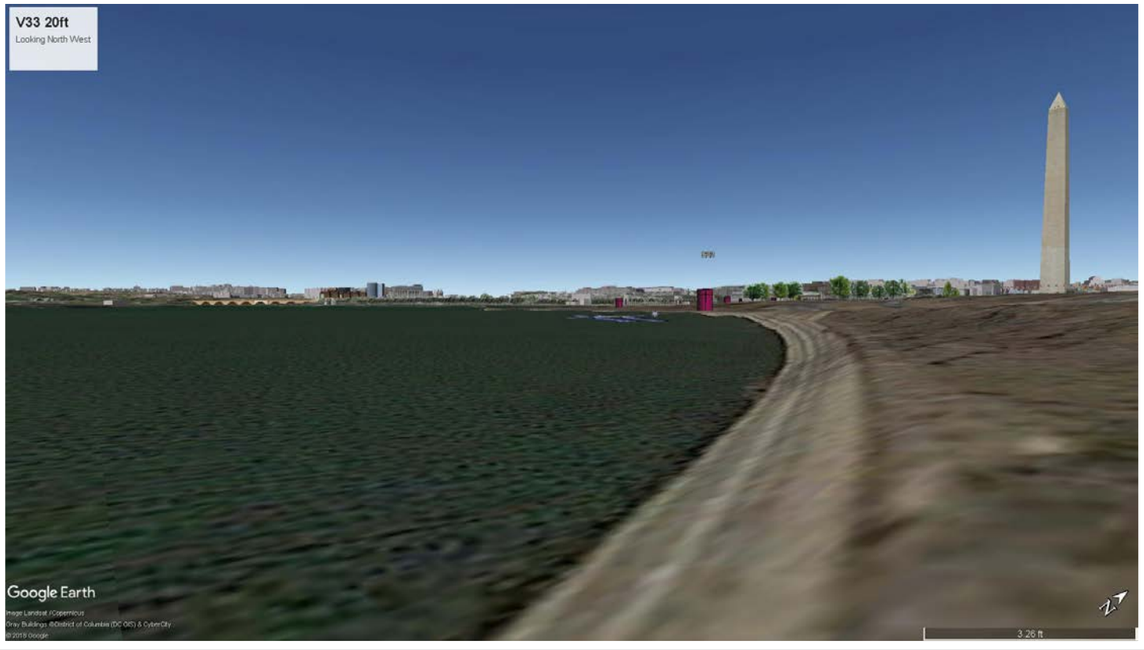


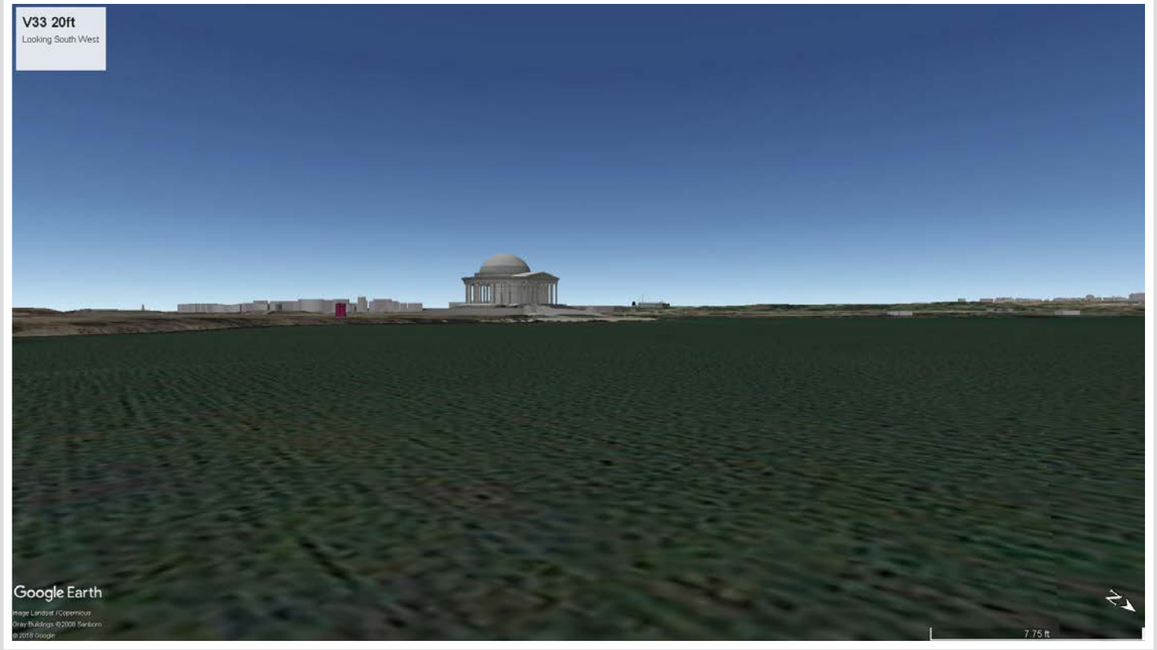


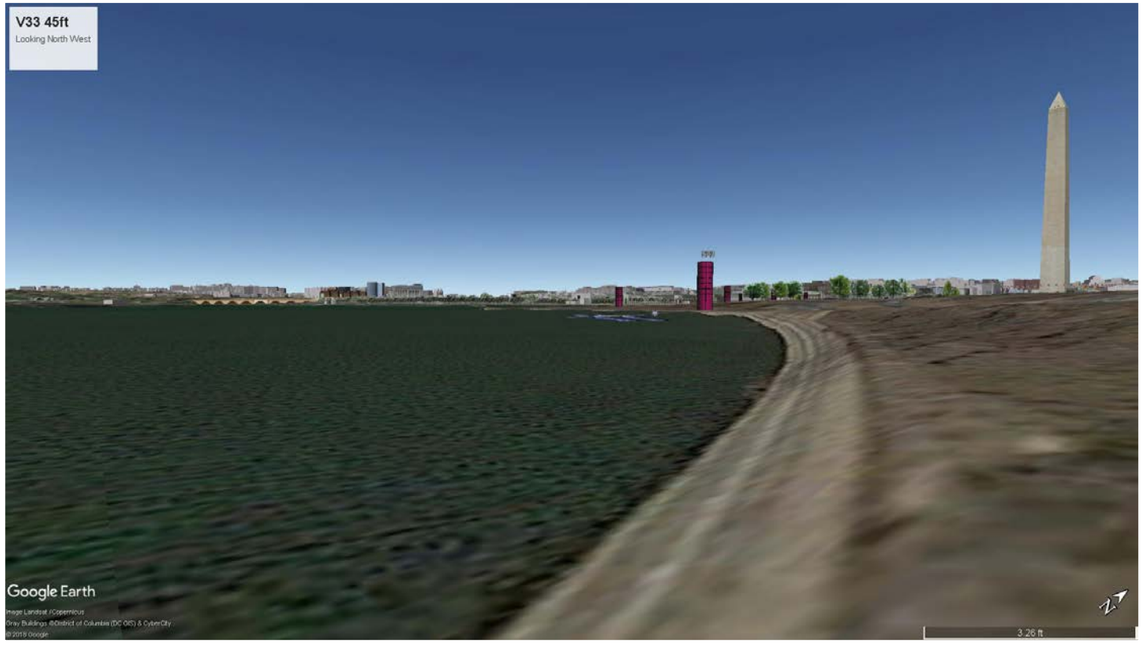


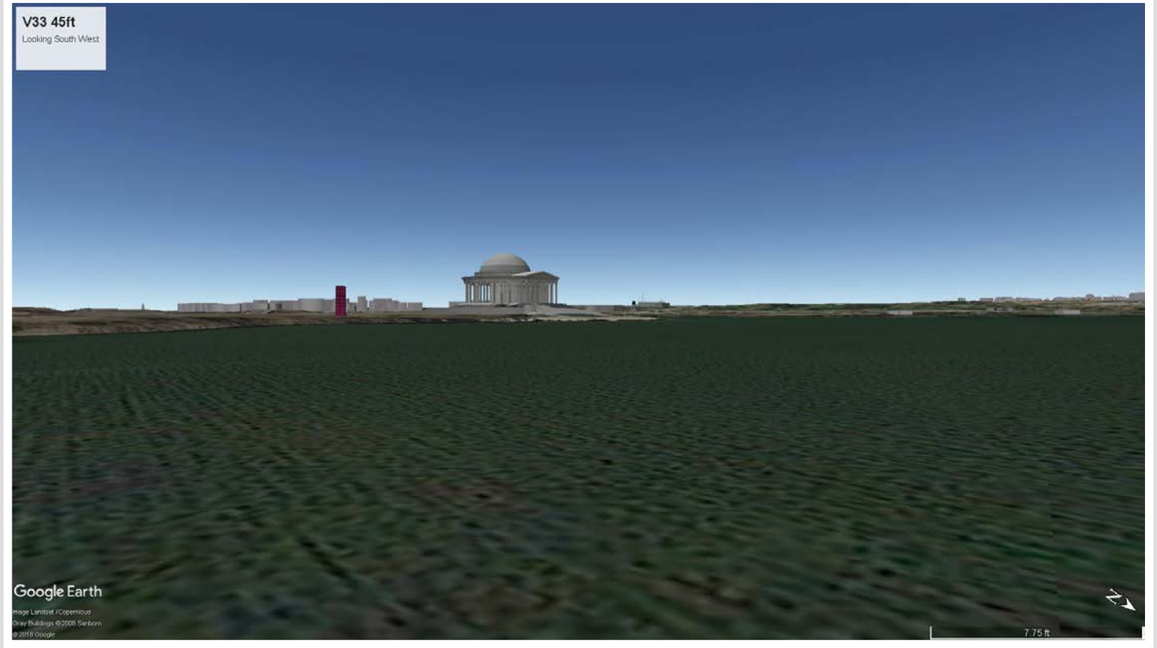

not to scale
S11
S09
S13
S15
S12
S22
S21
S25
S24
S23
S14
S16
N

Viewpoint 33 Page 2









NAMA 3D Scenes

Viewpoint	Height	Direction	Street View	Assigned to:	Structures Visible in Scene	Structures Visible in Scene, not in matrix	Notes / Likely cause of discrepancy
V01		S		MK	NA		Due to tree cover, no structures are visible from V01, But S15 shows in matrix
V01		S	SV	MK	NA		Due to tree cover, no structures are visible from V01, But S15 shows in matrix
V02		S	SV	JP	NA		
V02	20	S		JP	S01, S02, S03, S04, S09, S12, S14, S15	S14, S15	
V02	45	S		JP	S01, S02, S03, S04, S09, S12, S14, S15	S14, S15	
V05	20	W		MK	S05		
V05	45	W		MK	S05		
V06	20	E		MK	S06, S09, S10, S11, S13, S15, S19		
V06	20	NE		MK	S03, S04, S06, S07, S09, S12, S13		
V06	20	SE		MK	S06, S10, S11, S13, S15, S19, S22, S23, S24, S25		
V06	45	E		MK	S06, S09, S10, S11, S12, S13, S14, S15, S19, S21		
V06	45	NE		MK	S03, S04, S06, S07, S08, S09, S12, S13, S14, S15, S19	S03	
V06	45	SE		MK	S06, S10, S11, S12, S13, S14, S15, S19, S21, S22, S23, S24, S25	S24	
V07	20	E		MK	S03, S06, S10, S11, S15, S13, S23	S03, S10, S11, S15, S13, S23	Viewpoint is on steps of Lincoln Memorial. "fly in" view was required, likely from higher than the actual elevation of view point. Trees in model may be shorter than actuality.
V07	45	E		MK	S03, S04, S06, S07, S08, S09, S10, S11, S12, S13, S14, S15, S21, S22, S23	S03, S04, S07, S11, S12, S13, S14, S15, S21, S22, S23	Viewpoint is on steps of Lincoln Memorial. "fly in" view was required, likely from higher than the actual elevation of view point. Trees in model may be shorter than actuality.
V08	20	E		MK	S06		
V08	20	E	SV	MK	S06		
V08	45	E		MK	S06, S07, S10, S11,	S07, S11	
V08	45	E	SV	MK	S06		
V09		E	SV	MK	NA		
V09	20	E		MK	NA		
V09	20	W		MK	S06		
V09	20	W	SV	MK	S06		
V09	45	E		MK	S10		
V09	45	W		MK	S06		
V09	45	W	SV	MK	S06		
V10		SW	SV	MK	NA		
V10	20	SW		MK	S06		
V10	45	SW		MK	S06		
V11		W	SV	MK	NA		
V11	20	W		MK	S06		
V11	45	W		MK	S06		
V12		NW	SV	MK	NA		
V12	20	NW		MK	S06		
V12	45	NW		MK	S06		
V13	20	NE		ZW	S12, S13, S14	S12, S13, S14	Looking NE, structure 13 is visible in scene, 12 is not in results . Looking West, structure 6 and 11 is in scene, but 11 does not identified in the results
V13	45	NE		ZW	S12, S13, S14	S12, S14	
V13	20	W		ZW	S06, S11	S11	
V13	45	W		ZW	S06, S11	S11	
V14	20	W		ZW	S06, S11	S11	Looking W, structures 6 and 11 are visible in scene but structure 11 is not identified in the results
V14	45	W		ZW	S06, S11	S11	
V15		W	SV	ZW			Looking W, structure 6 is visible in scene. Looking East, structures 12-15 visible in scene
V15	20	W		ZW	S06		
V15	45	W		ZW	S06		
V15		E	SV	ZW			
V15	20	E		ZW	S12, S13, S14, S15		
V15	45	E		ZW	S12, S13, S14, S15		
V16		E	SV	DJ			Closest structures looking west are 8, 7; Streetview. Looking east are unlabeled 9, 13, 12. Imagery date 8/2013. The groundlevel scene looking east shows structures but there are no structures in the viewshed results. S08 is clearly in view but not in viewshed results.
V16		W	SV	DJ			

NAMA 3D Scenes

Viewpoint	Height	Direction	Street View	Assigned to:	Structures Visible in Scene	Structures Visible in Scene, not in matrix	Notes / Likely cause of discrepancy
V16		SW	SV	DJ			
V16	20	E			S03, S04, S12, S09, S14, S13	S03, S04, S12, S09, S14, S13	
V16	45	E			S03, S04, S12, S09, S14, S13, S16	S03, S04, S12, S09, S14, S13, S16	
V16	20	W			S07, S08	S08	
V16	45	W			S07, S08	S08	
V16	20	SW			S07		
V16	45	SW			S07, S10	S10	
V17		E	SV	DW			Images looking E and NW. Total 6 images. NW sv images show S14 but turned off since other structures do not show. Structures in views NW: 14, 12, 13, 9, 4, 3, 2, 1, 7, 8. E: 16, 17, 18, 19, strucutre 3 is not identified in the matrix
V17	20	E		DW	S16, S17, S18, S19, S20	S18, S19, S20	
V17	45	E		DW	S16, S17, S18, S19, S20		
V17		NW	SV	DW			
V17	20	NW		DW	S01, S02, S03, S04, S07, S08, S09, S12, S13, S14, S16, S17	S01, S02, S03, S04, S07, S08, S09	
V17	45	NW		DW	S01, S02, S03, S04, S07, S08, S09, S12, S13, S14, S16, S17, S18, S19, S20	S01, S03	
V18		E	SV	DW			Looking E: 16, 17, 18, 19, 20. Looking NW: 14, 12, 1, 2, 3, 4. Structure 12 is not identified in the matrix
V18		NW	SV	DW			
V18	20	E		DW	S16, S17, S18, S19, S20	S19	
V18	20	NW		DW	S01, S02, S04, S12 S14	S12, S04, S02	
V18	45	E		DW	S16, S17, S18, S19, S20		
V18	45	NW		DW	S01, S02, S03, S04, S14, S12	S12	
V19		E	SV	DW			Looking E: 16, 17, 18, 19, 20 are visible in scene but none of the strucutures are identified in the results. Looking SW: 15, 21, 25, 24, 23. Structures 25 and 23 are not identified in the results SV biew blocked by temporary fence.
V19		SW	SV	DW			
V19	20	E		DW	S16, S17, S18, S19, S20	S16, S17, S18, S19, S20	
V19	20	SW		DW	S21, S23, S24, S25	S23, S24, S25,	
V19	45	E		DW	S16, S17, S18, S19, S20	S16, S17, S18, S19, S20	
V19	45	SW		DW	S21, S15, S23, S24, S25	S23, S25	
V19	20	W		DW	S15, S11, S06, S07, S13		
V19	45	W		DW	S15, S11, S10, S06, S07, S08, S13,		
V19	20	S		DW	S23, S24, S25, S21	S21	S21 and S22 are near but blocked by trees. Would likely be visible in leaf-off conditions.
V19	45	S		DW	S23, S24, S25, S22	S22	S21 and S22 are near but blocked by trees. Would likely be visible in leaf-off conditions.
V20		NW	SV	DW			Looking W: 12, 13, 9, 7, 6, 11 (not in results),8,15. Looking SW: 21, not in results: 15, 22, 23, 25, 24. Looking NW: 14, 1, 2, 4 ,12,13,9 not in results: 3
V20		SW	SV	DW			
V20		W	SV	DW			
V20	20	NW		DW	S09, S03, S01, S04, S02, S12, S13, S14	S09, S03, S01, S04, S02	
V20	20	SW		DW	S15, S21, S25, S24, S23	S15, S21, S25, S24, S23	
V20	20	W		DW	S06, S13, S12, S15, S11, S07, S08, S09	S15, S11, S07, S08, S09	
V20	45	NW		DW	S01, S02, S03, S04, S09, S12, S13, S14	S03, S04	
V20	45	SW		DW	S15, S25, S24, S23, S21	S15, S25, S24, S23	
V20	45	W		DW	S07, S06, S13, S12, S09, S15, S11, S08	S15, S11, S08	
V21		N	SV	JP			Due to tree cover, the only structure that is actually visable from this V21 is S16
V21		S	SV	JP			
V21		W	SV	JP			
V21	20	N		JP	S16, S14, S04, S02	S14, S04, S02	
V21	20	S		JP	S24, S23, S25	S24, S23, S25	
V21	20	W		JP	S22, S21, S15, S09	S22, S21, S15, S09	
V21	45	N		JP	S01, S04, S02, S14, S16	S01, S04, S02,	
V21	45	S		JP	S24, S23, S25	S24, S23, S25	
V21	45	W		JP	S22, S21, S15, S09	S22, S21, S15, S09	
V22		E	SV	DJ			

NAMA 3D Scenes

Viewpoint	Height	Direction	Street View	Assigned to:	Structures Visible in Scene	Structures Visible in Scene, not in matrix	Notes / Likely cause of discrepancy
V22		W	SV	DJ			
V22	20	E		DJ	S17, S19	S19	Due to tree cover, the only structure that is actually visable from this V21 is S16
V22	20	W		DJ	S03, S16, S22	S03, S22	Due to tree cover, the only structure that is actually visable from this V21 is S16
V22	45	E		DJ	S17, S19	S19	
V22	45	W		DJ	S03, S16, S22	S03, S22	Closest structure is S16
V23		W	SV	JP			
V23	20	W		JP	S17, S18, S19, S20		
V23	45	W		JP	S16, S17, S18, S19, S20		S16 is barely visible
V24	20	W		DJ	S19, S20		Closest structures looking west are visible, but not labeled 20, 19, (18 is directly behind 20), same for both 45ft and 20ft. Viewshed Table lists 16, 17, & 18, but do NOT show in models. No Streetview.
V24	45	W		DJ	S19, S20		
V25	20	W		ZW	S16, S17, S18, S19, S20		
V25	45	W		ZW	S16, S17, S18, S19, S20		
V26	20	W		ZW	S12, S13, S14, S15, S16, S17, S18, S19, S20	S12, S13, S14, S15	S12-S15 are barely visible in scene, and will likely not show due to distance and vegetation cover.
V26	45	W		ZW	S12, S13, S14, S15, S16, S17, S18, S19, S20	S12, S13, S15	S12-S15 are barely visible in scene, and will likely not show due to distance and vegetation cover.
V27	20	E		DJ	S14, S15, S21, S22, S23, S24	S14, S15, S21, S24	Structures are likely visible in scene due to differences inactual landscape features and vegetation cover.
V27	45	E		DJ	S14, S15, S21, S22, S23, S24	S14, S15, S21, S24	Structures are likely visible in scene due to differences inactual landscape features and vegetation cover.
V28	20	E		DJ	S16, S21, S22, S23, S24, S25	S16, S24, S25	
V28	45	E		DJ	S16, S21, S22, S23, S24, S25	S16, S24, S25	
V28	20	NE		DW	S23, S22, S21, S16, S15, S12, S13	S16, S15, S12, S13	
V28	45	NE		DJ	S04, S09, S12, S13, S14, S15, S16, S21, S22, S23	S04, S09, S14	Structures S04, S09, S12, S13, and S14 are barely visible
V29		NE	SV	DJ			
V29	20	NE		DJ	S02, S04, S13, S15, S16, 21, 22, 23, 24, 25	S02, S04, S13, S15, S16, S21, S24	Structures S02, S04, S13, S15, S16 are barely visible
V29	45	NE		DJ	S02, S04, S13, S15, S16, 21, 22, 23, 24, 25	S02, S04, S24	Structures S02, S04, S13, S15, S16 are barely visible
V30		N	SV	ZW			
V30	20	N		ZW	S09, S12, S13, S14, S15, S16, S21, S22, S23	S09, S12, S13, S14, S15, S16, S21	
V30	45	N		ZW	S09, S12, S13, S14, S15, S16, S21, S22, S23	S09, S12, S13, S14, S15, S16	
V31	20	N		ZW	S09, S12, S13, S15, S16, S21, S22, S23	S09, S12, S13, S15, S16,	
V31	45	N		ZW	S9, S12, S13, S14, S15, S16, S21, S22, S23	S12, S13, S14, S15	
V32	20	NE		MK	S24	S24	Viewshed results block views of structures due to trees.
V32	20	SW		MK	S25	S25	Viewshed results block views of structures due to trees.
V32	45	NE		MK	S24	S24	Viewshed results block views of structures due to trees.
V32	45	S		DW	S24, S25	S24, S25	Aerial oblique at about 840ft agl. Viewshed results block views of structures due to trees.
V32	45	SW		MK	S25	S25	Viewshed results block views of structures due to trees.
V33	20	NW		JP	S09, S15, S21, S22, S23	S09, S15, S21, S22, S23	Structures are likely visible in scene due to differences inactual landscape features and vegetation cover.
V33	20	SW		JP	S24	S24	Structures are likely visible in scene due to differences inactual landscape features and vegetation cover.
V33	45	NW		JP	S09, S15, S21, S22, S23	S09, S15	
V33	45	SW		JP	S24	S24	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