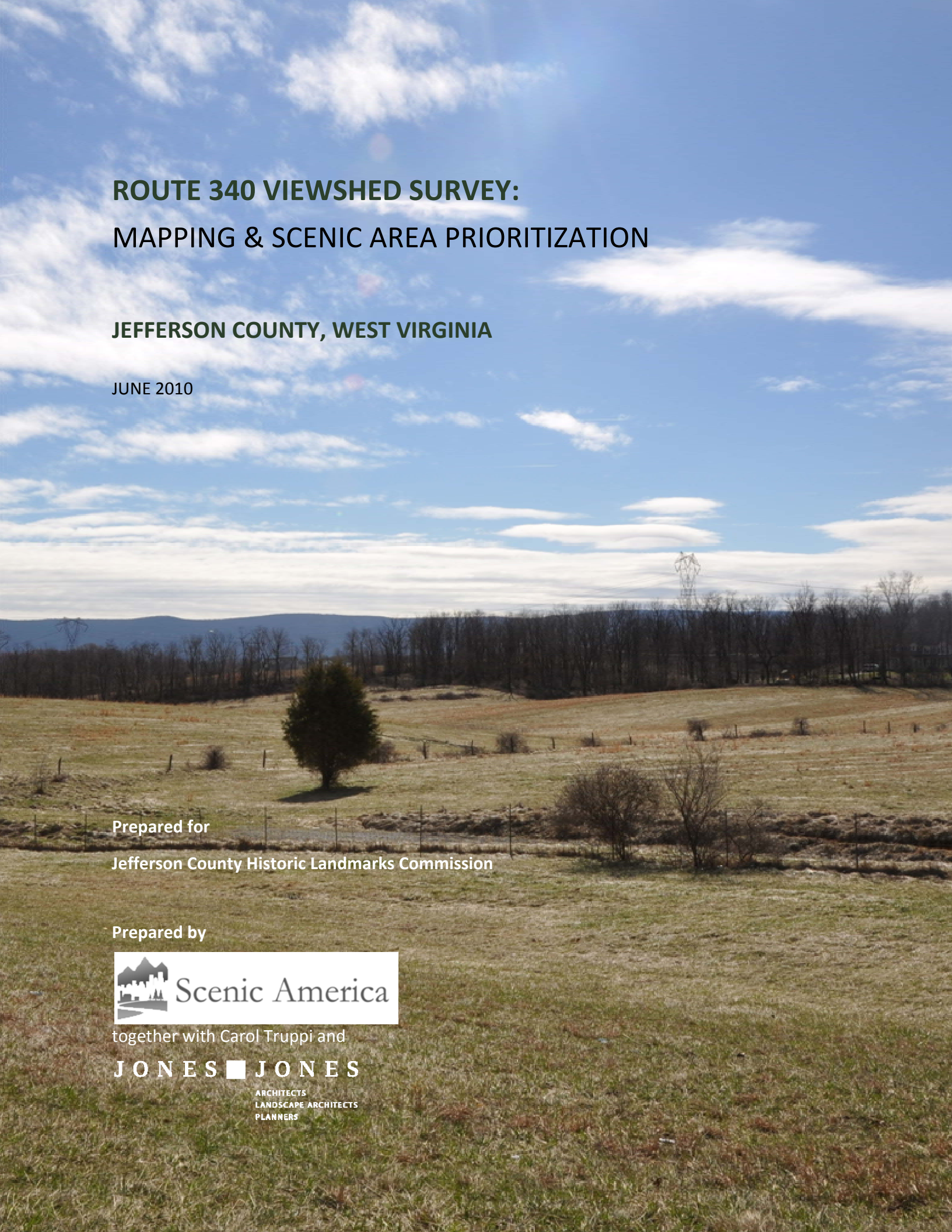

ROUTE 340 VIEWSHED SURVEY:

MAPPING & SCENIC AREA PRIORITIZATION

JEFFERSON COUNTY, WEST VIRGINIA

JUNE 2010

Prepared for

Jefferson County Historic Landmarks Commission

Prepared by

Scenic America

together with Carol Truppi and

JONES ■ JONES

ARCHITECTS
LANDSCAPE ARCHITECTS
PLANNERS

ACKNOWLEDGEMENTS

Scenic America/Carol Truppi/Jones & Jones would like to thank the Jefferson County Historical Landmarks Commission for spending time driving the roads in the county and providing the opportunity for us to share the landscape of Jefferson County recommendations for preserving and protecting the wonderful landscape character of Jefferson County West Virginia.

This report was funded through a contractual services agreement with the Jefferson County Historic Landmarks Commission. The observations and recommendations provided represent the opinions of Scenic America and are commensurate with the amount of time available for site assessment and GIS-based analysis.

About the Jefferson County Historic Landmarks Commission:

The Jefferson County Historic Landmarks Commission (JCHLC) is a governmental agency in Jefferson County, West Virginia. The five landmarks commission members are appointed by the Jefferson County Commission and serve three-year terms. The Landmarks Commission is a certified, tax-exempt local government. It is not affiliated with the Jefferson County Historical Society (text courtesy JCHLC website).

About Scenic America:

Scenic America is the only national nonprofit organization dedicated solely to preserving and enhancing the visual character of America's communities, countryside and public lands. Through national advocacy efforts and technical assistance services, local and national projects, and the support of its state affiliates, Scenic America fights to: eliminate billboard blight, mitigate the visual impact of cell towers and overhead utilities, promote scenic easements and open space, protect the scenic character of our public landscapes, promote context sensitive solutions to roadway planning and design, and build a national scenic conservation movement.

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INTRODUCTION

In September 2007, Scenic America was contracted by the Jefferson County Historic Landmarks Commission (JCHLC) to develop a visual assessment report. The report was intended as a preliminary visual assessment and list of general observations based on a windshield survey and driving tour of primary roadways within Jefferson County.

Prior to the 2007 visual assessment survey, the commission had already compiled a list of historic properties of significance as part of the three-tier landmark properties process. In addition, the JCHLC had recently indicated the areas along roadways in the county in which they felt were important for viewshed protection, many of which coincided with the proximity to historic properties and/or views from such properties.

Scenic America was tasked with these services in order to obtain a professional opinion about the visual character of the area. The scope of work for these services included the preparation of a preliminary scenic resources assessment/ viewshed inventory for primary public roadway corridors and priority viewsheds within the county. The analysis was to consist of a windshield survey and driving tour of key historic resources and views of concern, led by representatives from the JCHLC. Scenic America was tasked with providing a preliminary report to the JCHLC consisting of: documentation of notes and initial observations from the site visit; a preliminary list of important scenic resources, views and/ or scenic conservation issues; digital photography from site visit; and draft recommendations for moving forward with a more comprehensive scenic resources protection strategy or assessment for the areas of concern.

As a follow-up to the Preliminary Viewshed Assessment completed September 2007, Scenic America was asked by JCHLC to prepare a proposal for additional work, based upon several of the recommendations provided in the preliminary report. Specifically, the areas of interest for subsequent work included the following priorities:

- *Documentation of visual character for all of Jefferson County*
- *Development of a baseline GIS layer that could be added to the Green Infrastructure Assessment Layers*
- *Identification of the uninterrupted views of natural scenery or agriculture fields within the county*

It was determined that these follow-up priorities might be structured in a manner to serve as a pilot for securing funding and approval to do a more comprehensive viewshed project subsequently, as funding was not sufficient to complete an analysis for the entire county. Thus, the scope of the proposal and the attached report does not address the entirety of Jefferson County, but rather, assumes a specific limit on the total corridor mileage that is

included for detailed analysis.

The analysis for this phase of the project consists primarily of a geographic information system (GIS)-based visibility analysis and viewshed mapping of seen areas along Route 340 running from the Virginia state line county border to county border (approximately 15 miles). During the site visit performed by Jones & Jones, Carol Truppi and John Allen Jr on March 16th 2010, issues were discussed regarding the plans for the Potomac-Appalachian Transmission Highline (PATH). Even though this portion of the project was outside of the scope of the contract, Scenic America/Jones & Jones performed a viewshed mapping analysis of the PATH line given assumed tower locations and proposed tower heights supplied in the PATH documentation.

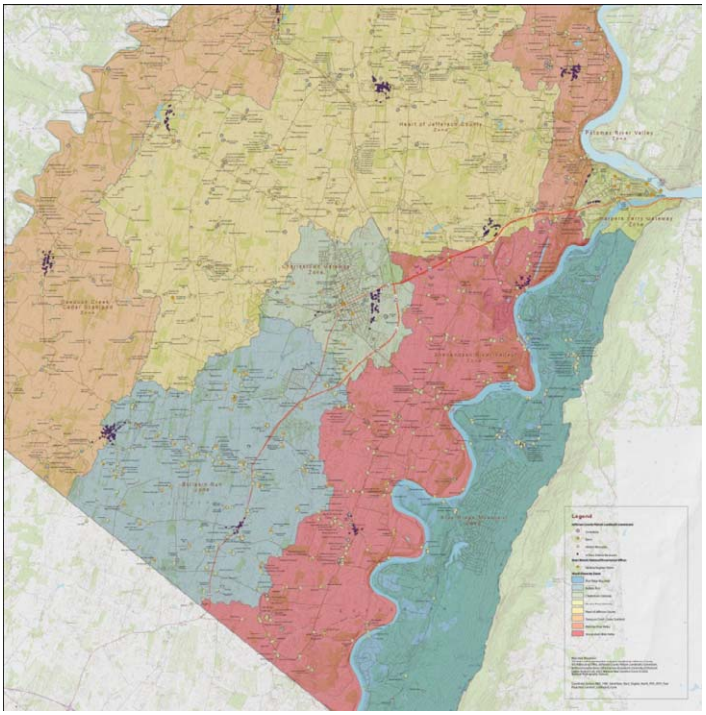
LANDSCAPE CHARACTER

The landscape along Route 340 through Jefferson County can be divided into a series of intrinsic landscapes, which are areas with distinct landscape character and/or spatial enclosure that forms a discrete unit. Each intrinsic landscape has its own sense of place and is visually different than neighboring landscapes. The boundary of an intrinsic landscape is based upon the visual perception a motorist traveling along the 340 corridor would have, and on the overall visual character of the landscape. Many of these boundaries also are consistent with those that define watersheds and subwatersheds. The project team used a tool called ArcHydro to develop a series of smaller and smaller watershed-based landscape units and then determined an appropriate scale based on landcover, viewshed reach and site reconnaissance work performed by Brad Cownover.

Landscapes result from the combination of the physical, cultural and biological processes in which they were created. These properties are clearly evident in Jefferson County. The physical landscape is present in the form of the mountain geology and river geomorphology that helps define the both the visual and geographic eastern boundary of the county. Cultural processes manifest in the form of human manipulation and uses of the landscape over time. In this area, aside from the developed townships, this is most evident in the form of past agricultural practices that have resulted in distinct patterns of farm fields and open areas across the landscape, as well as the presence of the historic structures throughout. As is true with most places, newer structures and development across the county contrasts significantly with the overall character conveyed by the older historic dwellings and landscape patterns, a disconnect is apparent. Biological processes are evident with the visual patterns, forms, and colors created by the variety of agricultural crops in the farming fields and tree species that varies with geology from those present in the uplands compared with vegetation growing in the river bottom and lowlands.

The county is geographically bound in many ways by rivers and ridges. The visual character of the county is influenced by these geographic features as well. Most notably, the visible backdrop of the Blue Ridge Mountains to the east and the Potomac and Shenandoah River valleys in which roads follow and wind along a more densely wooded landscape. In general, the northern portion of the county is characterized by more tightly incised drainages and wooded hills, offering less opportunity for wide open vistas along the roadways. Rather, the views and traveler attention along the roadways in these areas is directed to the finer details in the immediate foreground, such as the individual character of the vegetation, fences and structures. In the southernmost reaches of the county, the views along the primary and secondary roadways are probably the most open as in any location. Here, wide vistas of farmland and distant hills and ridges (to the east) are prominent until the roads descend in elevation towards the Long Marsh Run. To the west, the area north of Highway 9 is similar to the tightly nestled hills and hollers around the Scrabble area. South of Highway 9, the western-most edge of the county changes in character to a drier, flatter, rockier landscape in which the vegetation is shorter and cedar trees are more prevalent. The heart of the county is

characterized by gently rolling series of corn and soybean fields, bordered by windrows of trees. Structures are scattered (both historic and otherwise) throughout these areas, not always in patterns that seem to reflect the corresponding landscape character. Finally, the three primary population centers each have unique visual character and could be considered gateway zones into and from the other areas within the county.



Visual Character Zones
- o Potomac River Bluff Zone
- o Blue Mountain Ridgeline Zone
- o Shepherdstown Gateway Zone
- o Charlestown Gateway Zone
- o Scrabble North Zone
- o Shenandoah River Valley Zone
- o Potomac River Valley Zone
- o Bullskin Run Zone
- o Heart of Jefferson County Zone
- o Opequon Creek- Cedar Scabland Zone
- o Harpers Ferry Gateway Zone (note: above zone could be divided into two)

METHODOLOGY

INTRODUCTION

The methodology used on this project is based on the analytic process called viewshed analysis. There are two basic components to the viewshed analysis process – 1) the observer point and 2) the viewshed. For the purpose of this report, the **observer point** is defined as:

The fixed vantage point from where a view is seen from.

"**Viewshed**" is defined as:

The physical area of land, air or water that is visible to the human eye from a fixed vantage point.

In more general terms, viewsheds refer to all the areas that are visible from a section of highway or other corridor. The boundaries of viewsheds are usually high points in the landscape such as ridges and hills, similar to the boundaries of a watershed. This information can aid in determining what the experience of driving the corridor will be.

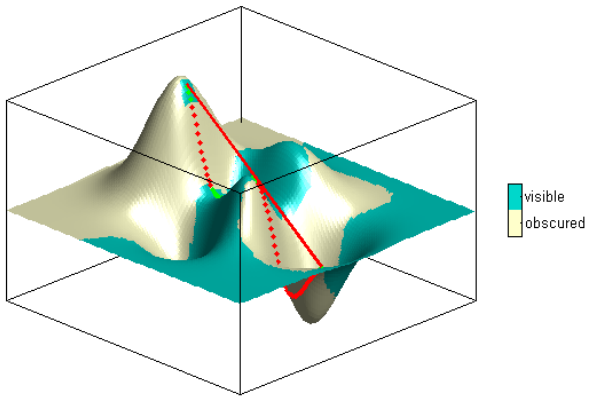


Figure 1 - Viewshed (www.mathworks.com)

Geographic Information Systems (GIS) analyze digital elevation or surface models by estimating the difference of elevation from one cell (the observer point) to the next adjacent or target cell. To determine the visibility of a target cell, each cell between the viewpoint cell and target cell is examined for line of sight. Where cells of higher value are between the viewpoint and target cells the line of site is blocked. If the line of sight is blocked then the target cell is determined to not be part of the viewshed. If it is not blocked than it is included in the viewshed.

The last concept to be introduced is "**viewshed magnitude**". For the purpose of this project viewshed magnitude is defined as:

The scalar product of a target cell that can be seen from the largest number of observer points.

Essentially, if a cell or target can be seen from multiple observer points its viewshed magnitude will be higher than just from one observer point.

DATA CATALOG DEVELOPMENT

The first phase of the project was the development of a data catalog. A data catalog is the assembly of all relevant GIS data that is available in electronic format needed to perform a

viewshed analysis. This would include, particularly, a detailed digital elevation model (DEM), high-resolution aerial DOQ, hydro, roads, land cover and parcels, as well as the most recent Green Infrastructure data such as the areas of contiguous agriculture identified in the Jefferson County Green Infrastructure Plan dated September 2008. In addition, the data catalog includes spatial information available for list of historic properties and park areas assembled by the JCHLC.
See Appendix A for the complete data catalog organized by source.

All derived analysis for the project has been supplied on a CD-ROM accompanying this report.

DIGITAL SURFACE MODEL DEVELOPMENT

In order to identify areas to be considered for land use protection based on viewshed magnitude, a specific methodology was used based on a lidar (LIght Detection And Ranging) based digital surface model (DSM) created by the University of Vermont (UofV) in 2008 for Jefferson County. The UofV digital surface model was a “first return” digital surface model meaning the first laser pulse measures the range of to the first object encountered (i.e. vegetation and buildings). Using the first return DSM allowed the resulting viewshed analysis to factor in visual barriers such as trees and buildings into the viewshed analysis.

DISTANCE ZONES

Distance zones define the viewing distances of the traveler. The zones are noted as foreground, middleground, and background. The viewing distances are based on the amount of details that the observer can perceive. Within the rural and natural landscape the highway should blend in. As the roadway approaches communities such as Charlestown, the design of the interstate shapes and influences the urban form of the community.

Distance zones help determine what portions of the landscape are more critical in establishing the highway’s visual character and what areas are more sensitive to change. For example, travelers along SR-340 will be more aware of changes to the foreground (defined in Figure X) of the landscape rather than the background.

Distance zones are delineated through a process developed by the US Forest Service and detailed in Forest Service Manual #2300 - Recreation, Wilderness, and Related Resource management. Distance zones are the landscape areas denoted by specified distances from the observer. Distance zones are used as a frame of reference in which to discuss landscape attributes to the scenic effect of human activities in the landscape. These zones are important because they relate the detail and importance of distance to the observer.

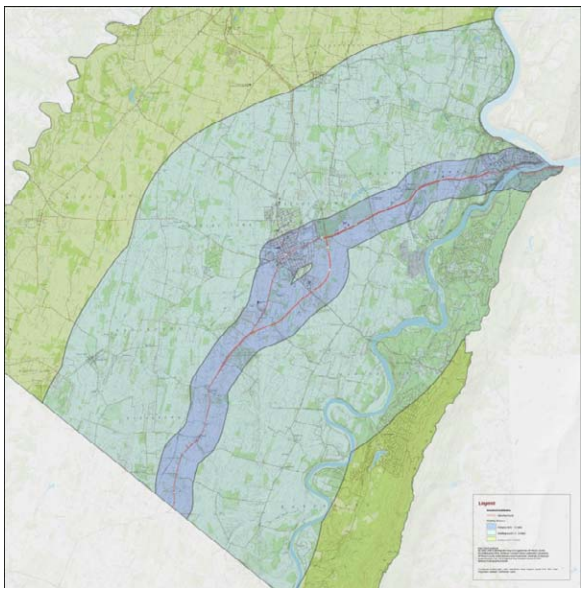


Figure 3 – Route 340 Viewshed Model

Foreground Zones (Dark Blue) – ¼ to ½ mile from observer
The viewer can perceive details such as forms, lines, and colors. It is located up to a ¼-½ mile distance from the viewer. Changes in the landscape view are most significant within the foreground view because they are most immediate to the viewpoint. This is the zone that can be most easily manipulated to improve the scenic quality along a corridor.

Middleground Zones (Light Blue) – From limit of foreground to 4 miles from the observer
The viewer can perceive details such as forms, lines, and colors in masses. It is located from between a ½ mile to 4 mile distance.

Background Zones (Light Green) – From the outer limit of middle ground to an infinite distance from the observer. The background zone essentially extends to the physical limit of the viewshed. For this project, the background zone was clipped at the edge of the county line. The viewer can perceive broad forms but cannot visually pick out textures, details nor colors.

VIEWSHED MODELING

The project team developed two specific viewshed models, one for the Route 340 corridor and the other for the PATH transmission line. The purpose for building the models was to automate the generation of the viewsheds. The model analyzes the viewshed from each observer point, generates a viewshed result, automatically moves to the next observer point, and continues until viewsheds have been generated for from each observer point.

Both models were built using Modelbuilder, a tool developed by ESRI allowing geosprocessing workflows to be created, visualized, edited, and executed, to use and reuse them, to share and apply them to different geographic areas. Both models are supplied on the accompanying CD-ROM.

DETERMINATION OF VIEWSHEDS

Viewsheds are determined by analyzing digital elevation or surface models in a geographic information systems (GIS) program. The viewsheds were calculated by determining what areas are visible from a given point along the highway or travel corridor. Terrain features, such as hills, may hide specific areas from the traveler's view.

All the areas that are visible from a given point along the highway are then combined to create the viewsheds. The viewshed maps generated for this project use observer points every 1/2 mile apart along the highway to determine the areas that can be seen.

The viewsheds generated for this project also factor in an observer height offset of 6', with corrections for earth curvature and light refraction. The 6' offset was used as it related to either a standing person or the average height between a person sitting in a car and a person sitting in a large truck.

VIEWSHED RANKING METHODOLOGY

Taking into account the above considerations, the following classification criteria was implemented on all the viewshed summations. The raw viewshed magnitude summations were reclassified according to a Jenks classification (see below for a detailed explanation of the Jenks system). A 9-class system was utilized to prioritize results. Using a scale of high-high to none-low, with 1 identifying the parcels of most significant concern for altering the viewshed, the ranking breaks down as follows:

RANK	PRIORITY
High	1
High-Medium	2
High-Low	3
Medium-High	4
Medium	5
Medium-Low	6
Low-High	7
Low-Medium	8
Low	9

Jenks' Natural Breaks

The Jenks' natural breaks classification scheme determines the best arrangement of values into classes by iteratively comparing sums of the squared difference between observed values within each class and class means. The "best" classification identifies breaks in the ordered distribution of values that minimizes within-class sum of squared

differences. For datasets with many values, such as counties across the United States, the iterative nature of Jenks' natural breaks method can lead to long calculation times. This technique first orders the values from low to high. It then calculates the sum of squared difference (SSD) for the possible first breaks, calculating the SSD for every possible break. It then finds the SSD for each of the next possible breaks, as if a previous break had already happened. It determines the SSDs for all of the requested breaks, and then it chooses the best last break from the last list of SSDs, the best second to last break from the second to last list, etc. This provides the best set of breaks from the entire list of possible breaks.

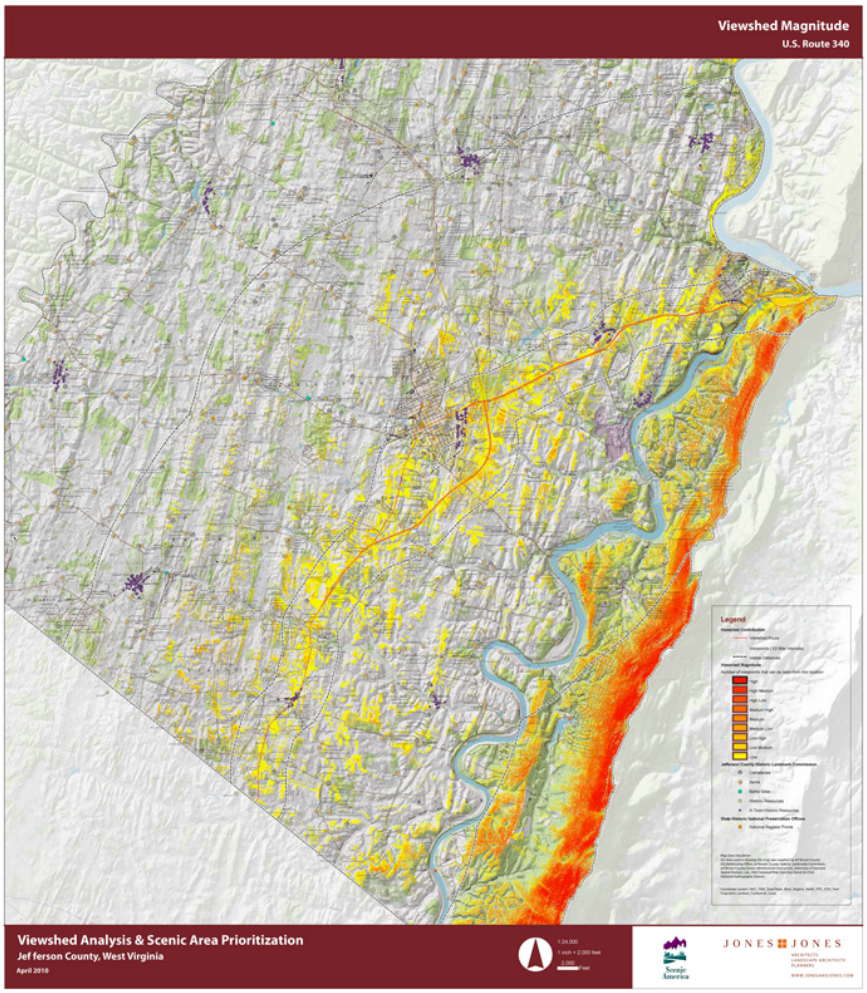
DESCRIPTION OF VIEWSHED MAGNITUDE MAPS

INTRODUCTION

The following section includes a description of the viewshed magnitude maps that were supplied to the JCHLC. There are two key viewshed magnitude maps, 1) The analysis follows the methodology previously described. All results visualize the prioritized viewshed magnitude of both Route 340 and the PATH line.

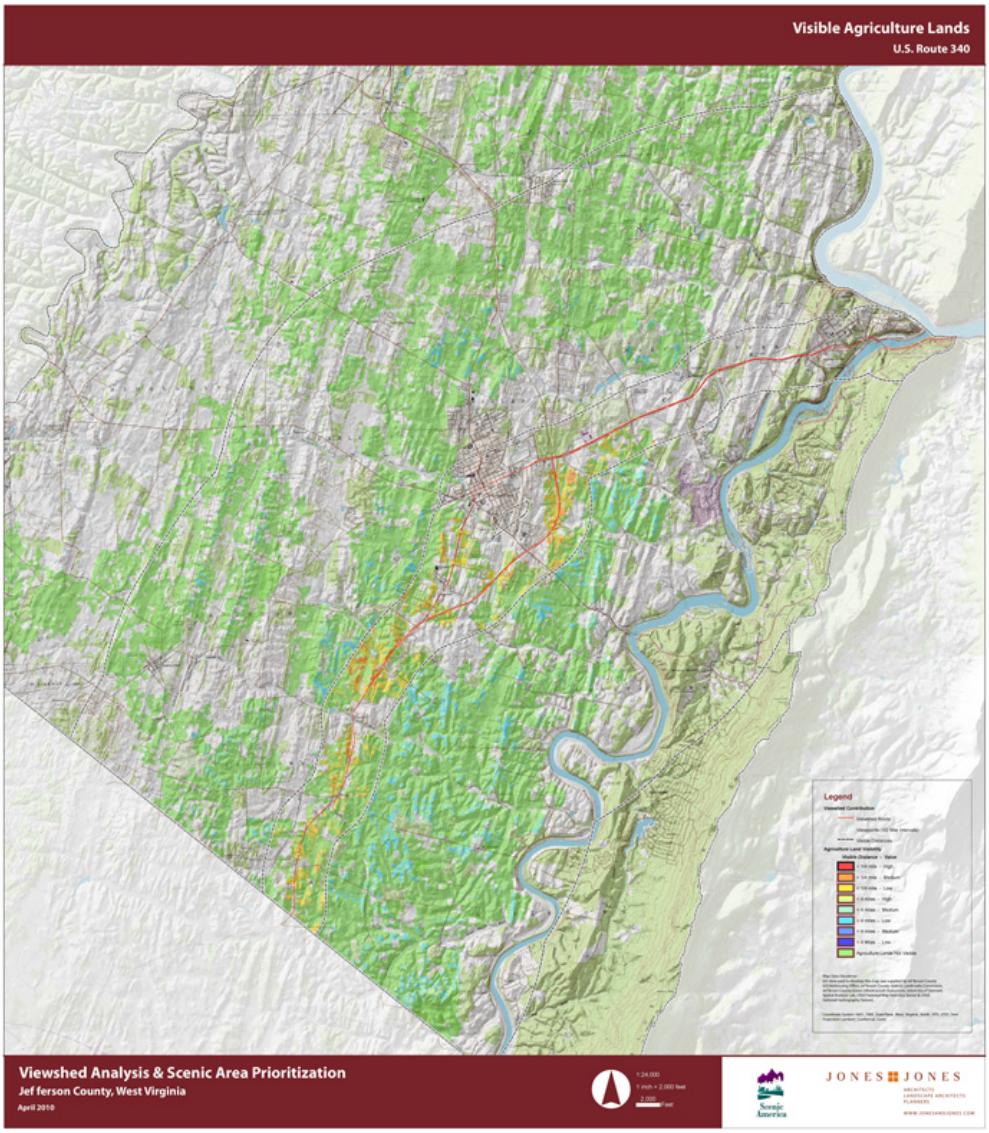
1. ROUTE 340 VIEWSHED MAGNITUDE

This map visualizes the viewshed magnitude generated along the Route 340 corridor. As expected, the hill slope toward the East contains the highest area of viewshed magnitude given that the majority of observer points can be seen from the higher elevations within the county. However most of this area ranked as high priority is contained in the background distance zone. Given the undulating topography common to Jefferson County, there are certain areas of medium-to-high viewshed magnitude that overlap with areas of contiguous agriculture lands.



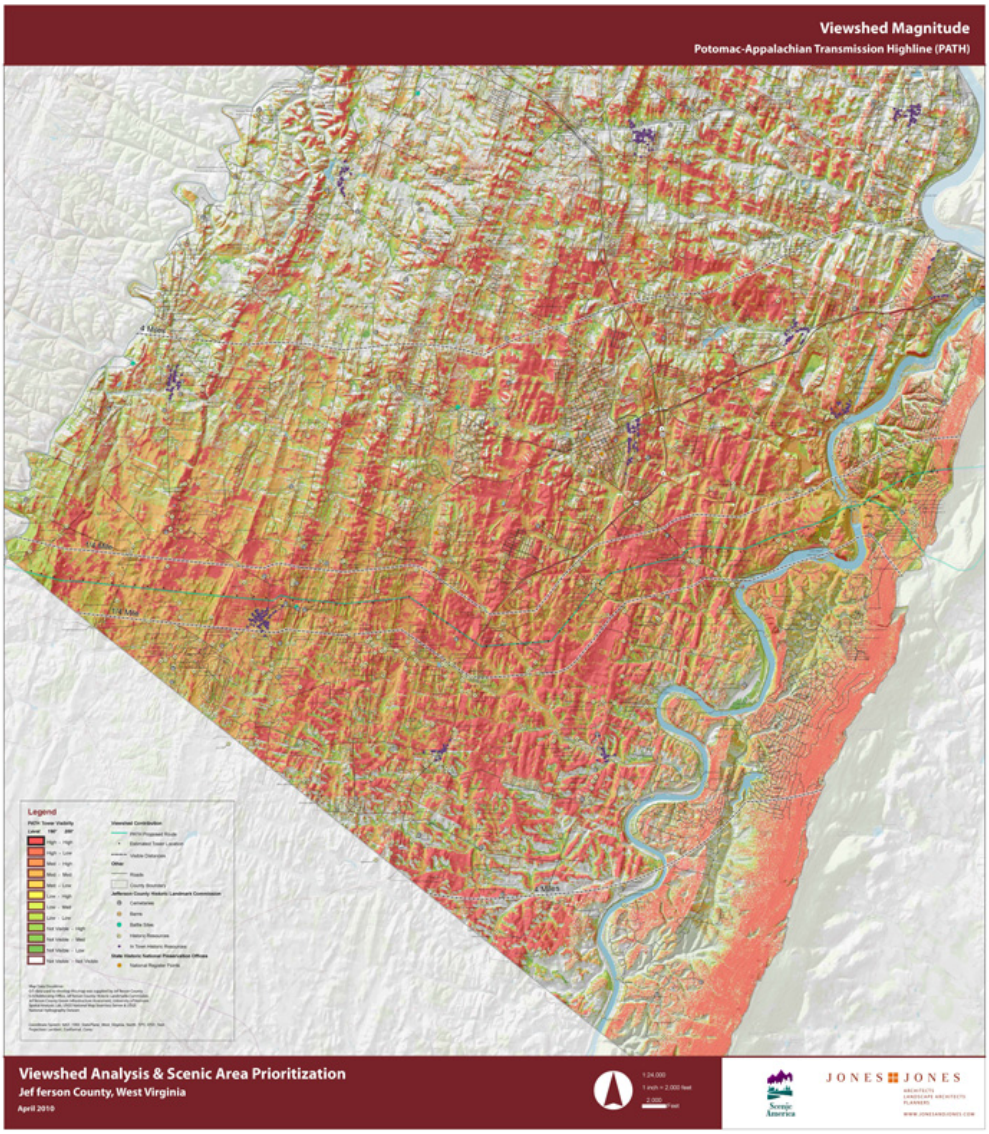
2. ROUTE 340 VISIBLE AGRICULTURE LANDS

This map visualizes the areas of visible agriculture lands along the Route 340 corridor and compares that with the overall viewshed magnitude. Agriculture lands most seen from the road corridor were also classified by which distance zone they were contained within. Agriculture lands noted as high priority for scenic prioritization is shown on the map as reds and yellows is primarily contained within the foreground distance zone. It should also be noted that a large majority of the agriculture lands contained within the County are not visible from the Route 340 corridor.



3. PATH VIEWSHED MAGNITUDE

This map visualizes the potential viewshed magnitude of the proposed PATH Towers. Assuming a height between 160-200' and the existing tower locations, the visual extent of the proposed tower project will be drastic. Areas shown in reds and oranges can see the largest number of tower locations. In general a large majority of the County will be able to see at least several towers. It has safe to say that the proposed towers will dominate the county visually and it will be increasingly hard to hide or screen the towers.



4. PATH VISIBLE AGRICULTURE LANDS

This map visualizes the areas of visible agriculture lands that will be affected by the proposed PATH towers. It should be noted that the map results are broken down and reclassified according to the distance zone they inhabit. A vast majority of the agriculture lands will be impacted visually by the towers. As described in Map #3, the PATH towers will visually dominate the viewshed of Jefferson County and will be a devastating visual element.