

An elevation raster based viewshed analysis was employed in the area to help Beaver Creek Archaeology, Inc. investigate the inter-visibility relationship between the wind turbines from the wind farm and three observer points, the city center of Granite Falls and two observation points (OP 1 & OP 2) on the Upper Sioux Reservation. The viewshed was calculated using a standard wind turbine offset height of 130 m (426.5') (tip of blade) and observer's eye level height of 1.83 m (6') for each observer point (city center, OP 1 & OP 2). The viewshed analysis showed that the wind farm would be visible from all three observer points.

The inter-visibility between the observer points and the wind turbine locations were also analyzed using Line of Sight (LOS) tool. The LOS is a straight line comprising of two vertices representing observer point and the target location for which visibility was determined. The LOS were created by adding offset heights for observer and wind turbine to the surface elevation. The areas visible from the observer points are shown in green while the areas not visible due to the obstructions from topography are shown in red on the viewshed map (see Figures 1 & 2).

According to Sullivan, et al. (2012), in an ideal setting, under optimal viewing conditions (e.g., flat ground, clear skies), a wind farm is visible to the unaided eye at a distance of 36 miles and a major visual focus at distances up to 12 miles. The proposed impact threshold distances in the Sullivan, et al. (2012) report indicate that the wind farm would not be visible at distances greater than 36 miles. At 30-34 miles, the wind farm would have a minimal visual impact (Sullivan, et al. 2012). At 20-23 miles, the wind farm would have a low to moderate visual impact (Sullivan et al. 2012). And at 10 to 12 miles, the wind farm would have a high visual impact (Sullivan et al. 2012).

Looking to the Sullivan, et al. (2012) model and applying it to the proposed Palmers Creek Wind project, Figures 1-3 show areas where portions of the wind farm would be visible from either the city center of Granite Falls and/or from two observation points (OP 1 & OP 2) on the Upper Sioux Reservation.

Figure 1 is a viewshed analysis between the three observation points and the proposed wind farm with 426' wind turbines. In Figure 1, areas that are visible from the three observation points are colored in green, whereas areas that are not visible from the observation points are colored red.

Figure 1 is a viewshed analysis between the three observation points and the proposed wind farm. In Figure 2, areas in green are areas that are visible from all the proposed wind turbines, while areas in red are not visible from all of the proposed wind turbines. Moreover, this indicates that the city center of OP 2 could potentially see all of the proposed wind turbines.

Figure 3 is a viewshed analysis between the three observation points and the proposed wind farm. Areas color-coded in red are areas of the landscape that are not visible from any of the observation points. Areas color-coded in green are areas of the landscape that are visible from OP1. Areas color-coded in blue are areas of the landscape that are visible from OP 2. Areas color-coded in purple are areas of the landscape that are visible from the city center. Areas color-coded in yellow are visible from at least two of the three observation points.

Additional support to this model is supplied by the original Thomas Matrix (Table 1), which has been converted and applied to this project and illustrates similar results.

Figure 4 shows the location of the proposed wind farm (survey area and wind turbines), the location of the Upper Sioux Reservation, the viewshed analysis boundary (red and green areas), and the visual impact zones of the proposed Palmer Creek Wind project. Areas color-coded in dark green is the high (0-12 mi) visual impact range. Areas color-coded in yellow is the moderate

to low (12-23 mi.) visual impact range. Areas color-coded in white is the low to no (23-36 mi.) visual impact range.

Table 1. The original Thomas Matrix applied to a 426.5' wind turbine (Sullivan et al 2012: Table 1).

Descriptors	Approximate Distance Range
Dominant impact due to large scale, movement, and proximity	0-3.47 mi
Major impact due to proximity; capable of dominating landscape	3.47-5.49 mi
Clearly visible with moderate impact; potentially intrusive	5.49-7.22 mi
Clearly visible with moderate impact; becoming less distinct	7.22-10.69 mi
Less distinct; size is reduced, but movement still is discernible	10.69-17.92 mi
Low impact, movement noticeable in good light; becoming noticeable components in the overall landscape	17.92-21.69 mi
Becoming indistinct with negligible impact on the wider landscape	21.69-32.36 mi
Noticeable in good light, but negligible impact	32.36-35.83 mi
Negligible or no impact	35.83 mi
Suggested radius for zone of visual impact analysis	26.87 mi

In summary, several wind turbines would be visible from the city center of Granite Falls. Several wind turbines would be visible from observation point 1 on the Upper Sioux Reservation. And several wind turbines would be visible from observation point 2 on the Upper Sioux Reservation. A more in-depth viewshed analysis, visual impact assessment, and ground truthing will be provided in the cultural resource report.