Raster Analysis in Wellesley and Linwood

The procedure to gain the final layers, View_A and View_B, was short yet challenging. Firstly, the layer, Wellesley_forest15, is created, filtering the Landcover layer to only project the forested area within the town of Wellesley. Then, buildings_Wellesley was created using the clip tool, clipping buildings from the Wellesley boundary layer filtered to only show buildings. After clipping, the layer bldgs10 is created using the reclassify tool, which is also used for filtering building cells to equal 10 m high, and all others to equal 0. Finally, the elevation raster is created using the tool Raster Calculate. DEM25M_Wellesly, Wellesley_forest15, and bldgs10 are added to get the elevation view layer.

The second part of the procedure to get View_A and View_B is to use the viewshed tool. The tool is applied to Turbines A and B, where the Turbines layer acts as an observer and the elevation view layer is used as the input. The results are the layers, View_A and View_B, which are used to see the visible areas for the turbine locations. To finalize each layer, each layer's attribute table contains a calculation where the count is added to the cell size of the landcover layer (m^2). The number of buildings for each layer is also calculated, 6554 of 6556 for view_A and 6555 of 6556 for view_B, via the tool and selected by location. Of the two (compared in figure 3), the best place for the turbines is Turbine A (figure 1) because it is in a better area. The number of buildings the turbine is visible to is fewer, and the area it covers is smaller, which is essentially better visually.

In contrast, Turbine B (figure 2) is in a larger area, near Waterloo as well, which is worse visually, and the number of buildings that can see the turbine is also greater than Turbine A, which makes it worse for other factors, such as building innovations. The advantages of this approach are seen through the quantitative comparison of the different locations for the turbines.

For example, the approach compares the total visible area and the number of buildings, which allows for a more informed and data-driven conclusion. One challenge in this approach was the lack of tree height or any other plant/building heights, which would drastically change the elevation view layer if updated. Challenges within this assignment were more related to small steps being ignored, yet after a few tries, it was successful.

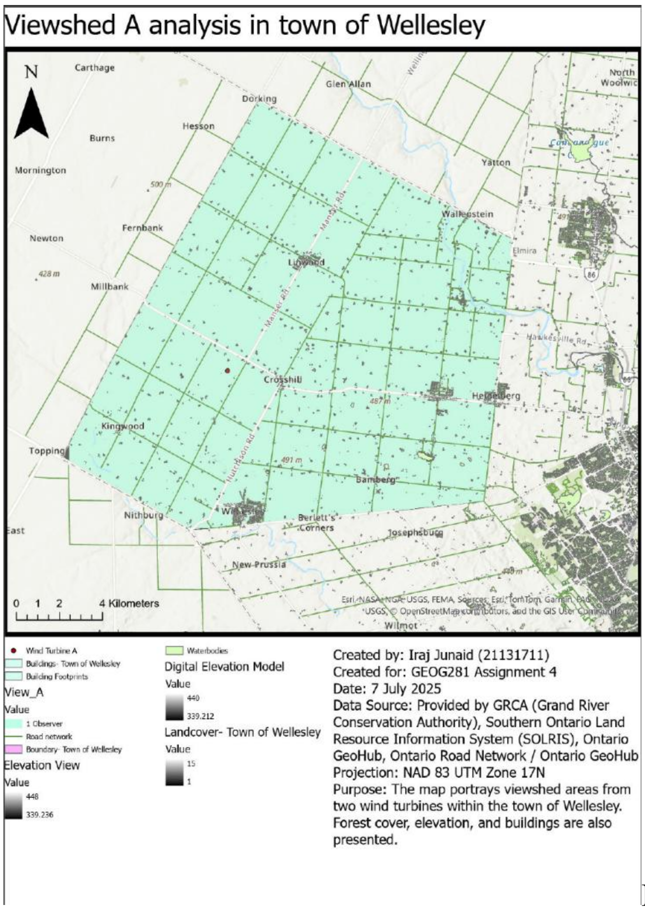

Figure 1: Turbine A map in town of Wellesley; green area shows border of Wellesley boundary and red dot is location of Turbine

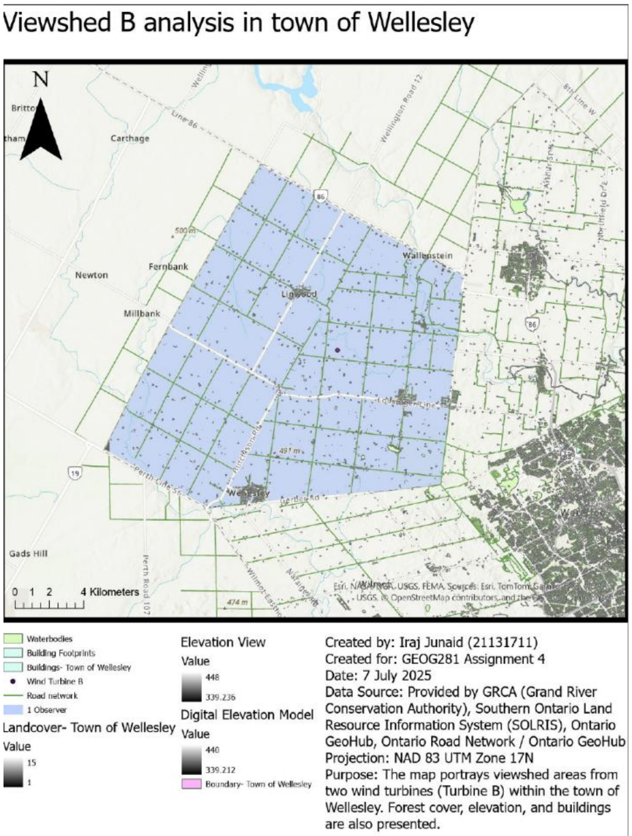

Figure 2: Turbine B map in town of Wellesley; blue area shows border of Wellesley boundary and blue dot is location of Turbine.

Viewshed A and B comparison

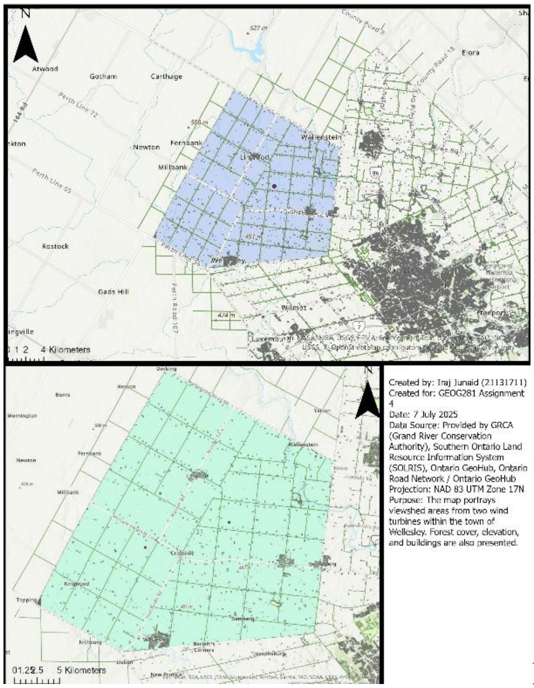

Figure 3: Comparison between Viewshed A and Viewshed B.

Part B

To get the least cost trail within the points of Wellesley and Linwood, two parts go into getting the final result, considering cost rasters for each factor and analyzing the cost distance. In part 1, cost rasters are created for each factor that all come together to create the least cost trail. Firstly, a base cost layer is created using the create constant raster tool, setting its value to 1, to get the base cost of every cell. Secondly, the slope tool is used on the DEM25M_Wellesley layer, which was then classified into four quantiles, class 1 being the flattest, low cost, and class 4 being the steepest, high cost. Then the CostLandCov layer is created, essentially the landcover_wellesley layer reclassified, so crop lands are one class and cost, and the same for water + wetlands, industrial/residential and others. The last layer, costRoads, is created by converting roads from vector to raster. Then the roads are reclassified, where roads are of class 5, and anything else is 1. Lastly, for part 1, the raster calculator tool is used to get the total cost surface, through the sum of CostBase, CostSlope, CostLandCov, and CostRoads.

The run cost distance is presented through the cost distance and cost path. The cost distance tool is used to create the layers, costDistance and the backlink layer, through Trailend (Linwood) and the cost raster, CostCombined. The cost path tool is used to get the final trail path, through the input Trailhead (Wellesley) and the cost distance and backline layer. The analysis is solid for multifactor decision making. It is efficient and repeatable, but it ignores many factors such as constraints like private properties, or the way it assumes all costs are the same. Seasons or zones that are not available to the public, being considered, help improve the data and the overall analysis.

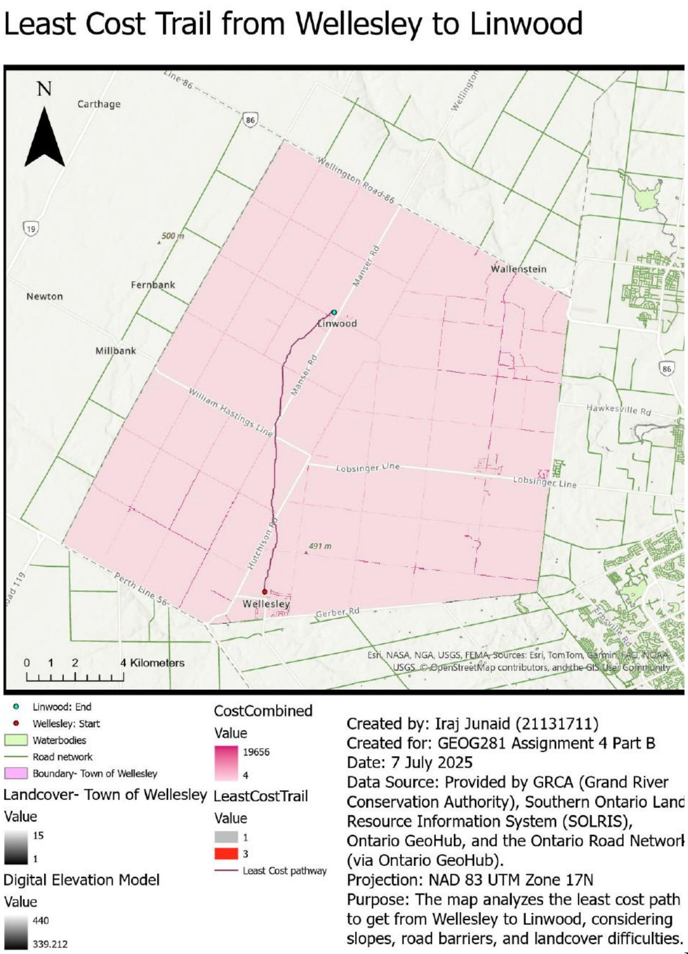

Figure 4: Least cost trail map from Wellesley to Linwood

Citations

Grand River Conservation Authority. *2017 Landcover Data*. Provided by the Grand River Conservation Authority.

Region of Waterloo. *Roads, Building Footprints, and Regional Boundary Datasets*. 2023. Provided by the Region of Waterloo.

DEM25M_Wellesley Raster Dataset. Elevation data projected in NAD83 UTM Zone 17N.