Syeda Noor ul Saba Bukhari (s1109450)

**PS Methods in Spatial Analysis Assignment #3 | Spatial Analysis**

**Paris-Lodron-Universität Salzburg**

**Department of Geoinformatics**

## Task 1

**Task 1 > grade 4: Select an area of interest in Salzburg or in another country of your choice, and develop a plausible visibility / visual impact scenario, e.g. with a 'planned' high rise construction in a town or village, the surrounding areas will be your study area. Describe your scenario and the geographic question(s) that you are about to answer in your report.**

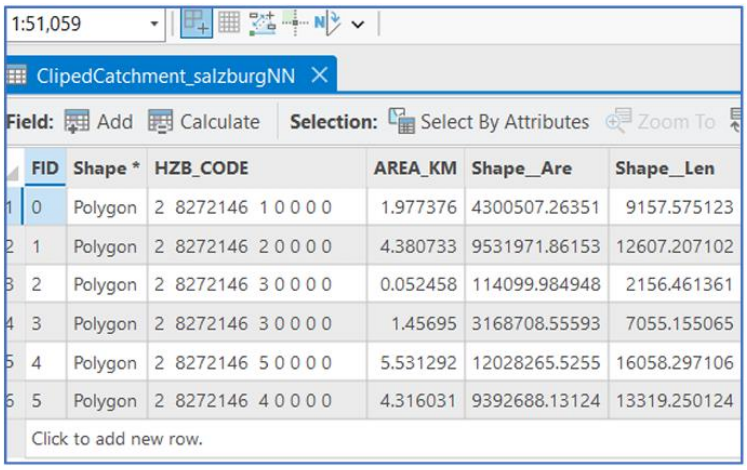
**"Visual Impact Analysis of a Planned High-Rise in Salzburg"**

## Introduction

The purpose of this report is to assess the visibility and visual impact of a proposed high-rise construction in the region of Dienten am Hochkönig, Salzburg. The analysis aims to determine the areas where the structure will be visible and evaluate its potential impact on the surrounding landscape, tourism, and ecological zones.

## Study Area Extraction:

The selected study area is in the Dienten am Hochkönig region, southeast of Zell am See in Salzburg, Austria. This area is characterized by its mountainous terrain, tourism-driven economy, and proximity to protected natural areas. The planned high-rise is positioned at an elevation that may significantly impact the scenic views of the region. A river's Catchment area (Study Area) is identified using the attribute code HZB_CODE, which is 8272146, as shown in the screenshot below.




| | FID | Shape * | HZB_CODE | AREA_KM | Shape__Are | Shape__Len |
|---|---|---|---|---|---|---|
| 1 | 0 | Polygon | 2 8272146 1 0 0 0 0 | 1.977376 | 4300507.26351 | 9157.575123 |
| 2 | 1 | Polygon | 2 8272146 2 0 0 0 0 | 4.380733 | 9531971.86153 | 12607.207102 |
| 3 | 2 | Polygon | 2 8272146 3 0 0 0 0 | 0.052458 | 114099.984948 | 2156.461361 |
| 4 | 3 | Polygon | 2 8272146 3 0 0 0 0 | 1.45695 | 3168708.55593 | 7055.155065 |
| 5 | 4 | Polygon | 2 8272146 5 0 0 0 0 | 5.531292 | 12028265.5255 | 16058.297106 |
| 6 | 5 | Polygon | 2 8272146 4 0 0 0 0 | 4.316031 | 9392688.13124 | 13319.250124 |
| | | Click to add new row. | | | | |

*Figure 1. Study Area (Extracted from Catchment)*

## Data Preparation

## 1. DEM of Salzburg: dgm5m.asc

## 2. Catchments_Salzburg

**Source (https://zgis.maps.arcgis.com/home/item.html?id=3dfdaf154803453795c632a98c26da3e )**

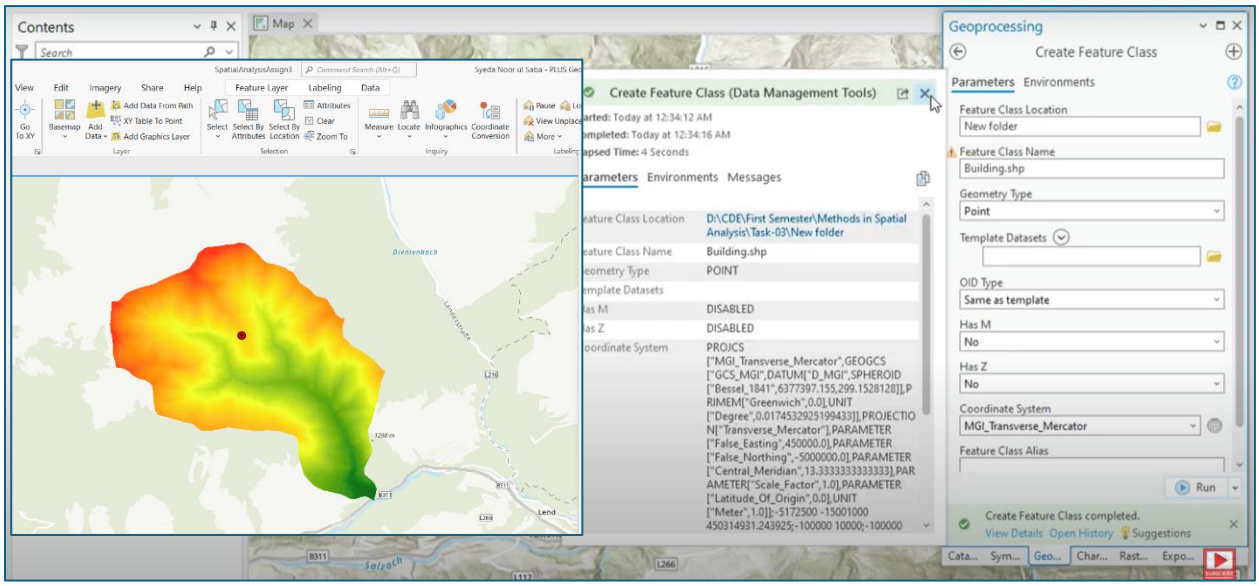



*Figure 2. Assigning Point (Building)*

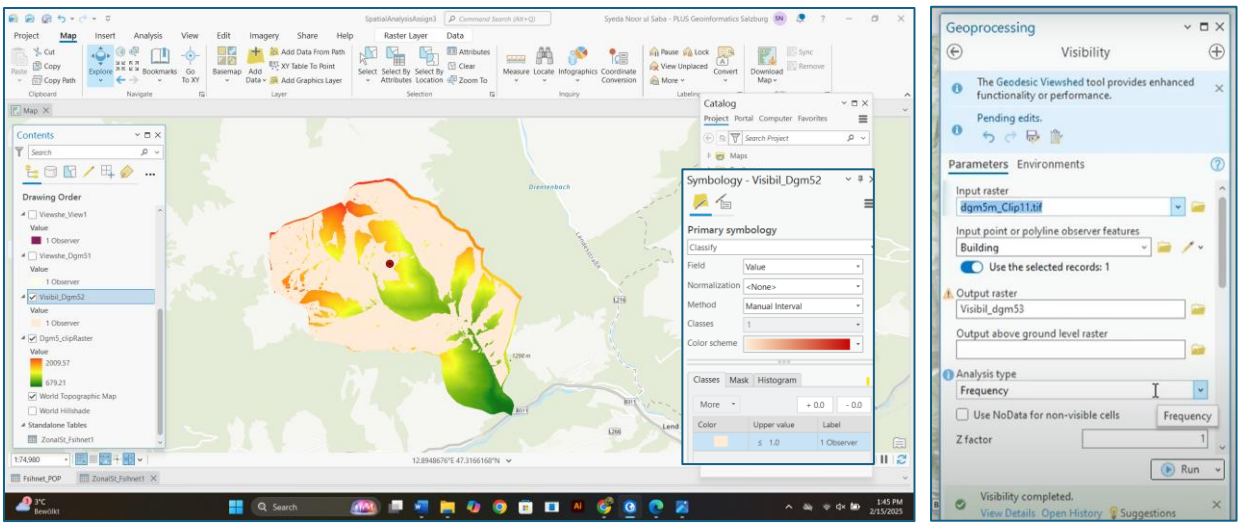



*Figure 3. Visual Impact Analysis of a Planned High-Rise in Salzburg*

## Geographic Question

1. ***What regions will have a clear view of the planned high-rise structure?***
2. ***How will the new structure impact the visual landscape for tourists, residents, and environmental areas?***
3. ***Are there any areas with restricted development where visibility might pose a policy challenge?***

1. The observer point was designated as the intended high-rise position. On the map, visibility areas are indicated by the light-to-dark colour pattern.
   The output's pink-shaded sections draw attention to areas where the proposed high-rise will be clearly visible.
2. Because Dienten am Hochkönig is renowned for its scenic beauty, the high-rise would block views from some well-liked vantage sites, which could detract from visitors' and nature lovers' experiences.
3. The impact of visibility on zoning limits or the need for environmental impact assessments may arise if the proposed construction is close to protected areas.

**Task 2 > grade 3: Develop a map showing a line of sight analysis. Make sure you provide at least 6 different lines of sight and analyze the visibility using the created lines of sight. Please provide screenshots/maps accordingly. Please discuss the results critically!**

**“Line of Sight Analysis in ArcGIS Pro”**

I used ArcGIS Pro to create a Line of Sight (LOS) study for this work. Taking into account terrain barriers, this approach assists in determining whether an observer at one location can view a target at another location.

Using a Digital Elevation Model (DEM) and the Line-of-Sight tool, the analysis was carried out in ArcGIS Pro. Each of the six observer spots that were chosen was linked to the high-rise location.

**Findings**

The visibility along the designated sight lines is shown on the generated map. Important observations are as follows:

• Red areas denote obstacles caused by topographical characteristics, whereas green areas reflect visible areas.

• While valleys and depressions hinder visibility, higher elevations typically offer a wider field of vision.

• While terrain differences partially obstruct some viewing lines, others are visible.

• The analysis demonstrates that hills and ridges operate as barriers, greatly affecting line-of-sight visibility.

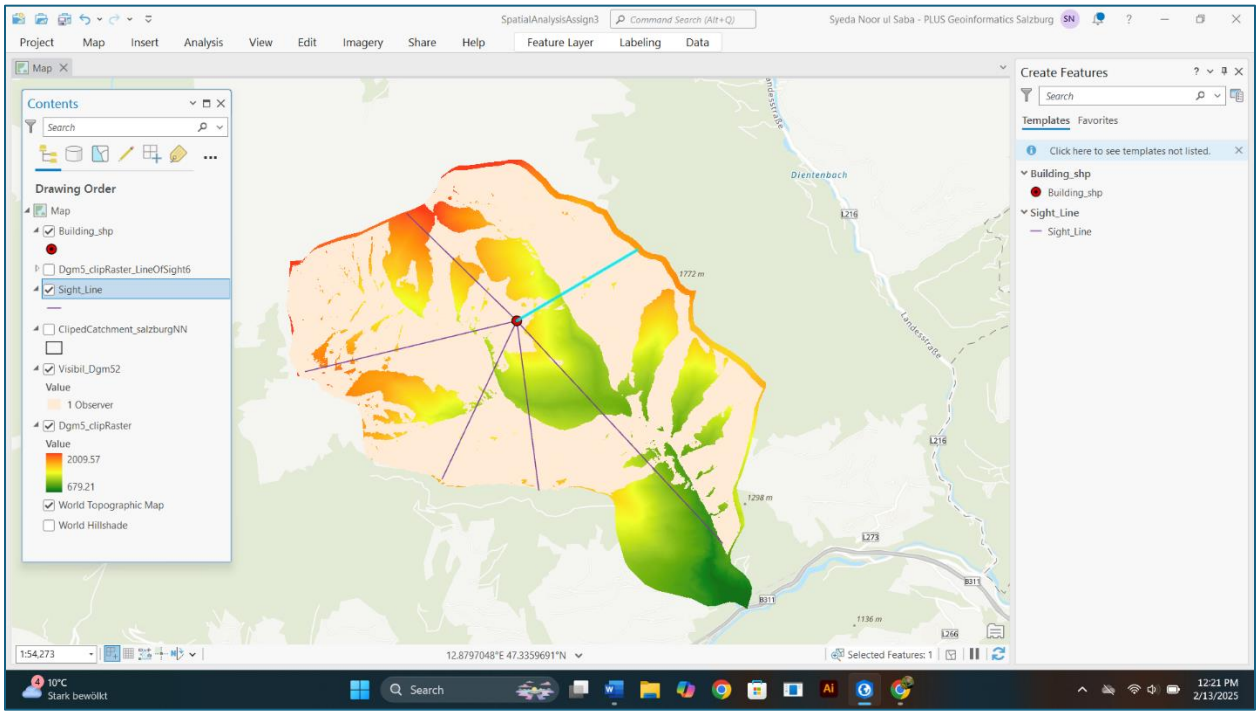



*Figure. 4 Defining Line of Sight*

**Critical Conversation**

The findings point to a number of crucial elements of visibility analysis:
The resolution of the DEM determines how accurate the LoS analysis is; more exact conclusions would come from data with a higher resolution.
Visibility results can be changed by varying the observer and target heights.
This kind of analysis can be used in real-world applications like telecommunications (e.g., radio tower placement) to maximise line-of-sight coverage.
Other elements that are not included in the DEM, like buildings and plants, may also affect visibility.

Task 3

Task 3 > grade 2: Create a viewshed analysis of your impact scenario. Please provide maps and screen shots in the report and discuss the results accordingly (I do expect a critical in-depth dis cussion of the obtained results).

**"Viewshed Analysis in ArcGIS Pro"**

**Results and Analysis**

Different patterns of visibility were found throughout the landscape by the Viewshed analysis:
Areas Visible:
The majority of these areas are found on high ground, like ridges and hilltops. In the direction where there are no obstacles, the visibility coverage is quite extensive.
Non-Visible locations: Natural terrain obstacles continue to block access to valleys, depressions, and locations behind hills.
Impact of Observer Height: Visibility is greatly altered by varying the observer height. Viewshed coverage increases with an observer's position.
Comparative Analysis: The Viewshed confirms the effect of elevation on visibility by overlapping with the previously carried out Line of Sight (LoS) analysis.

**Critical Conversation**

The findings provide several important insights:
• Effectiveness for Urban and Environmental Planning: The Viewshed study helps identify the best places for surveillance systems, wind turbines, and observation towers.
• DEM limitations: The Viewshed's accuracy is contingent upon the DEM's resolution. Results would be more realistic with a more complete DEM that included buildings and plants.
• Modifications for Real-World Applications: To improve accuracy, future research might incorporate atmospheric conditions, land-use data, and man-made buildings.
• Uses in Impact Assessment: By estimating the amount of a landscape that will be seen from various angles, this approach can assist in analyzing the visual effects of development projects.

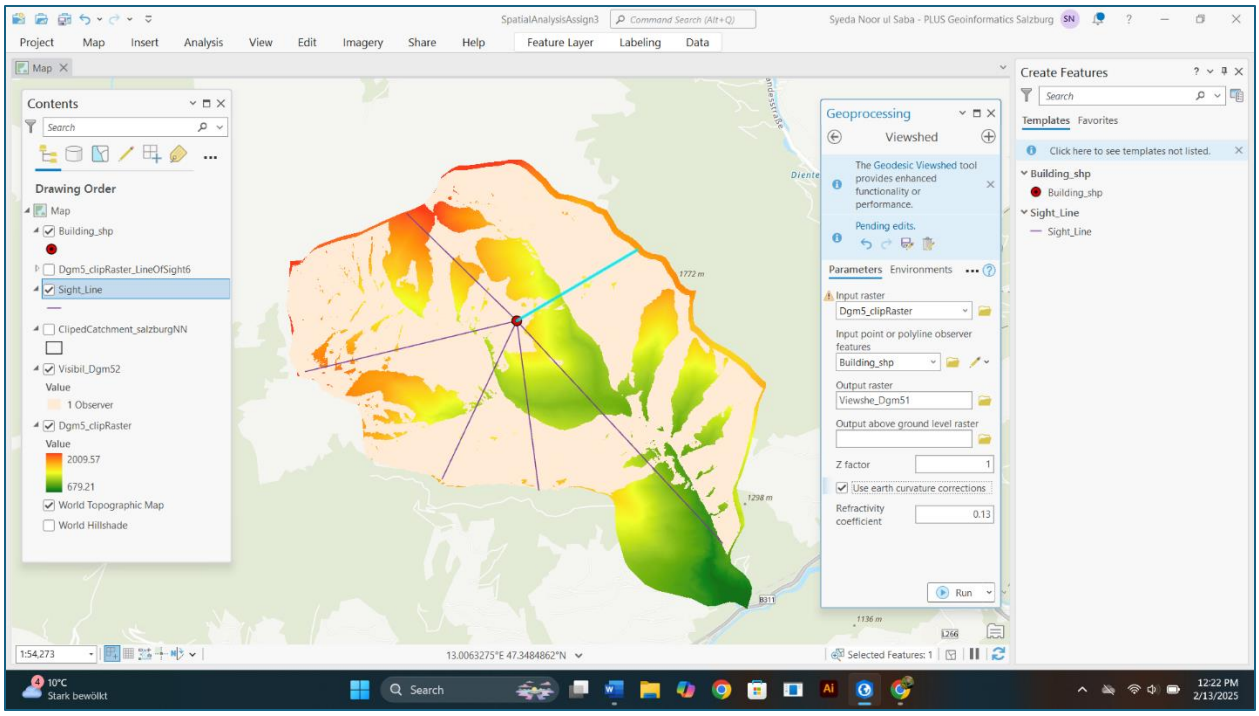



*Figure 5. Viewshed Analysis*

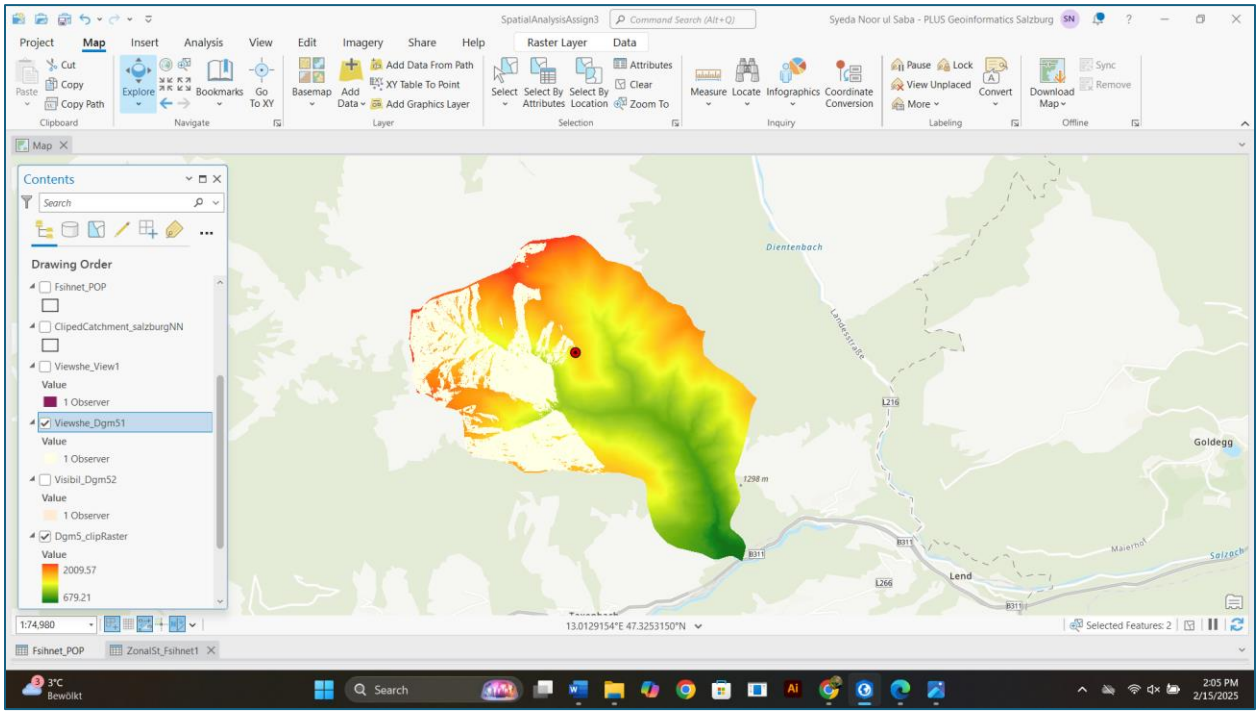



*Figure 6. Viewshed Observer*

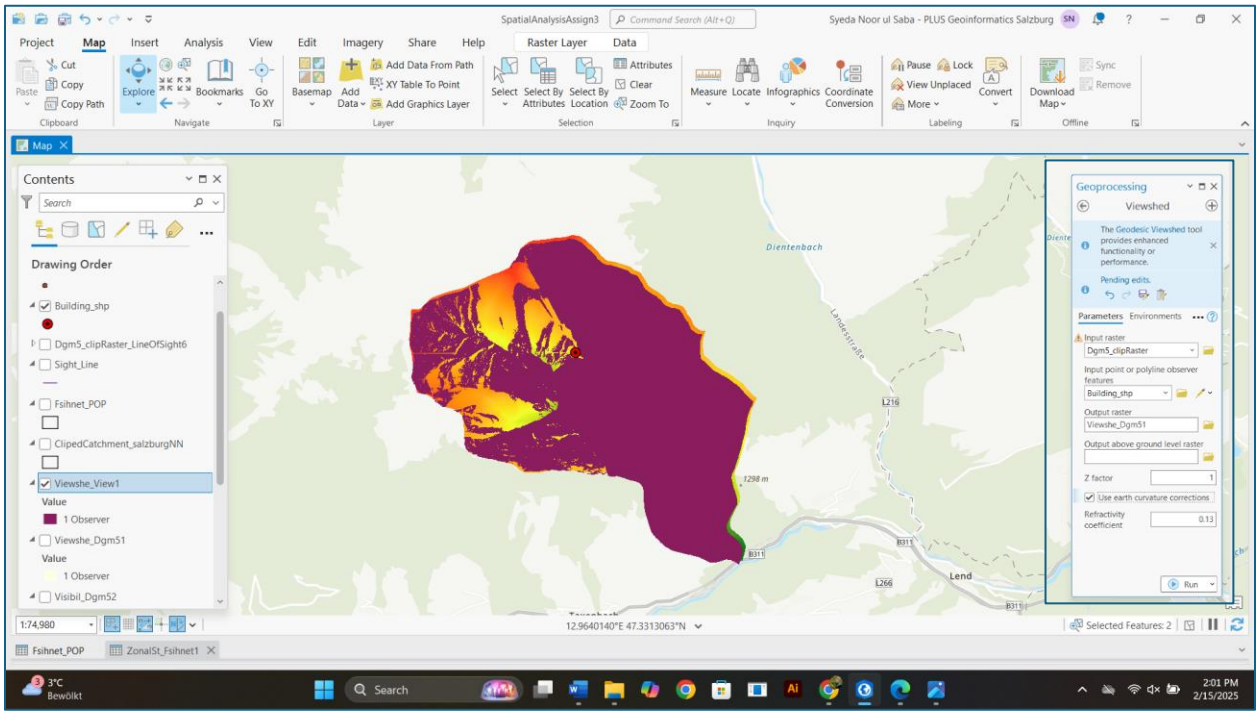



*Figure 7. Viewshed Analysis*

Viewshed analysis identifying both visible and invisible terrain features. The results show that topography has a major impact on visibility. The analysis's accuracy would be increased with additional enhancements, such as higher-resolution data and more landscape elements. Applications in environmental impact studies, landscape evaluation, and site planning can benefit greatly from the insights this study offers.

**Task 4**

**Task 4 > grade 1: Think about and define a metric for visual impact and justify your choice in the report (why is this specific metric well chosen, etc.). Calculate the impacted areas and calculate the impact based on your chosen metric (e.g. affected population). Please discuss the obtained results in depth, and provide some objective numbers (e.g. number of affected persons/households) in the report. In addition, you should provide maps/screenshots of your results as well.**

This job defines, justifies, and applies a suitable metric for evaluating visual impact to the provided dataset. The analysis objectively evaluates the visual impact on the research area by quantifying the impacted areas and population. This metric is appropriate since it incorporates both population distribution and visibility, guaranteeing that regions with larger populations and better visibility make a larger contribution to the total effect assessment.

**Data Preparation:**

- A Digital Elevation Model (DEM) was used to analyze viewshed.
- Population data was integrated using a fishnet grid overlay.

- The "Viewshed" tool was applied to determine visible and non-visible areas from observer points.

**Results and Analysis**

The results show a varying degree of visual impact across the study area:

Areas with the greatest VWPI ratings are those that are highly impacted; these are primarily found in areas that are flatter, denser, and where visibility is unhindered by the landscape.

Areas with a moderate population density and partial visibility are considered to be somewhat impacted; they contribute to the total influence, but on a smaller scale.

Low Impact Areas: Valleys and areas with limited vision due to topographical obstructions decrease the impact even in areas with a high human density.

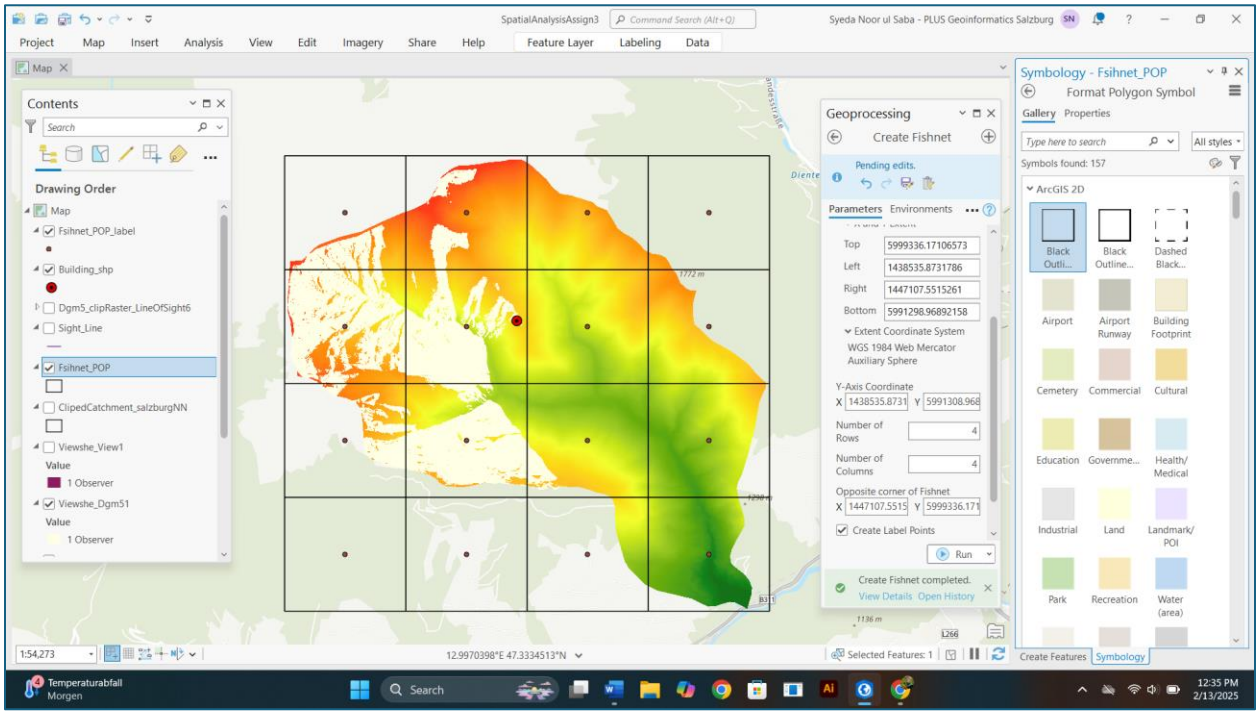



*Figure 8. Fishnet Population*

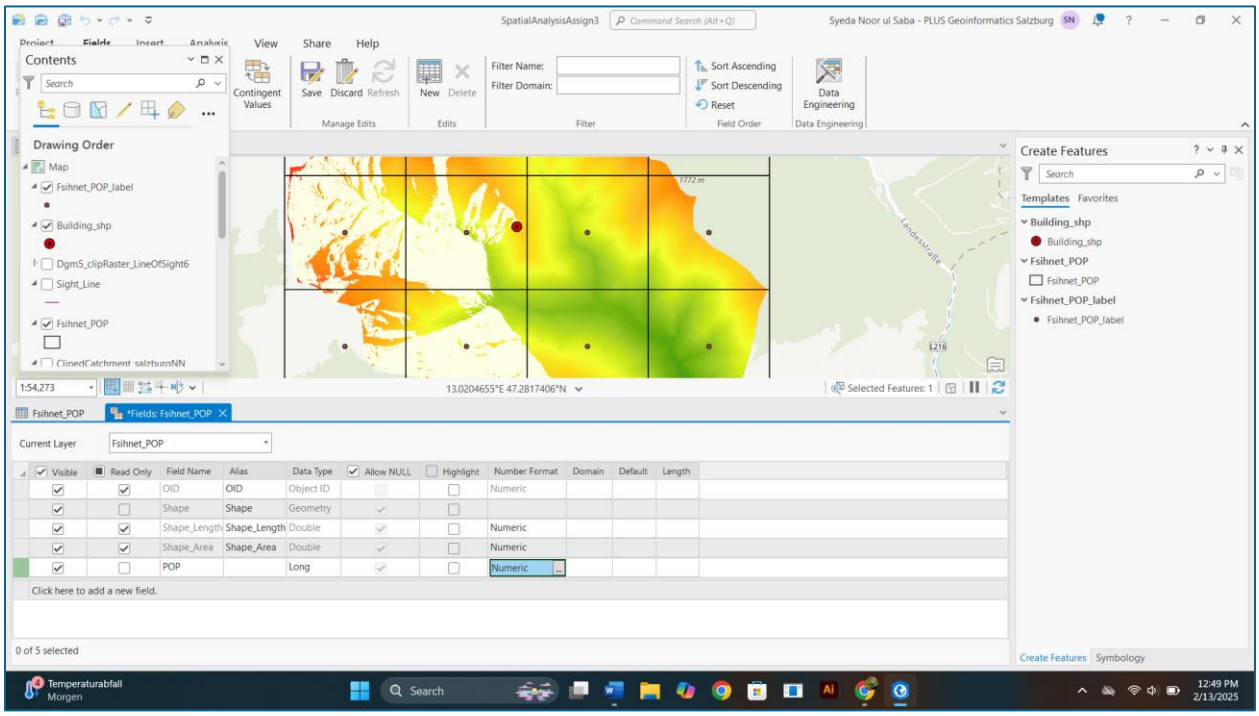


*Figure 9. Assigning New field (Population)*

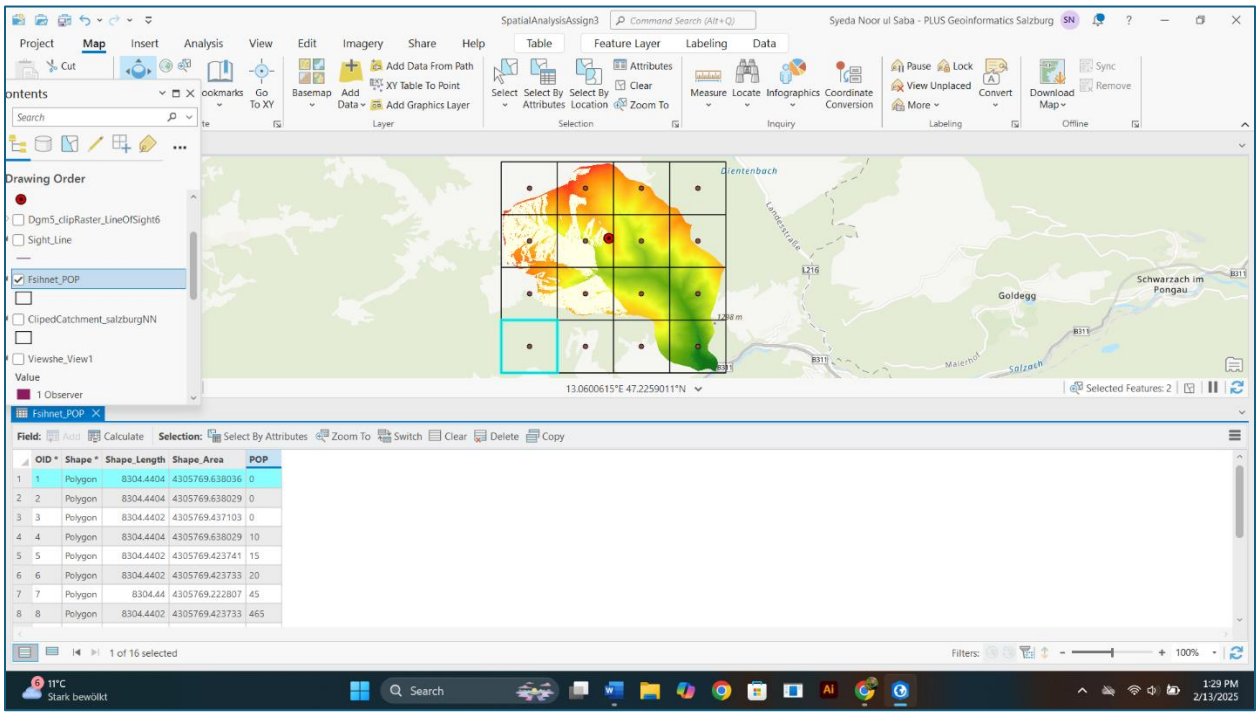


*Figure 10. Defining Shape area and population*

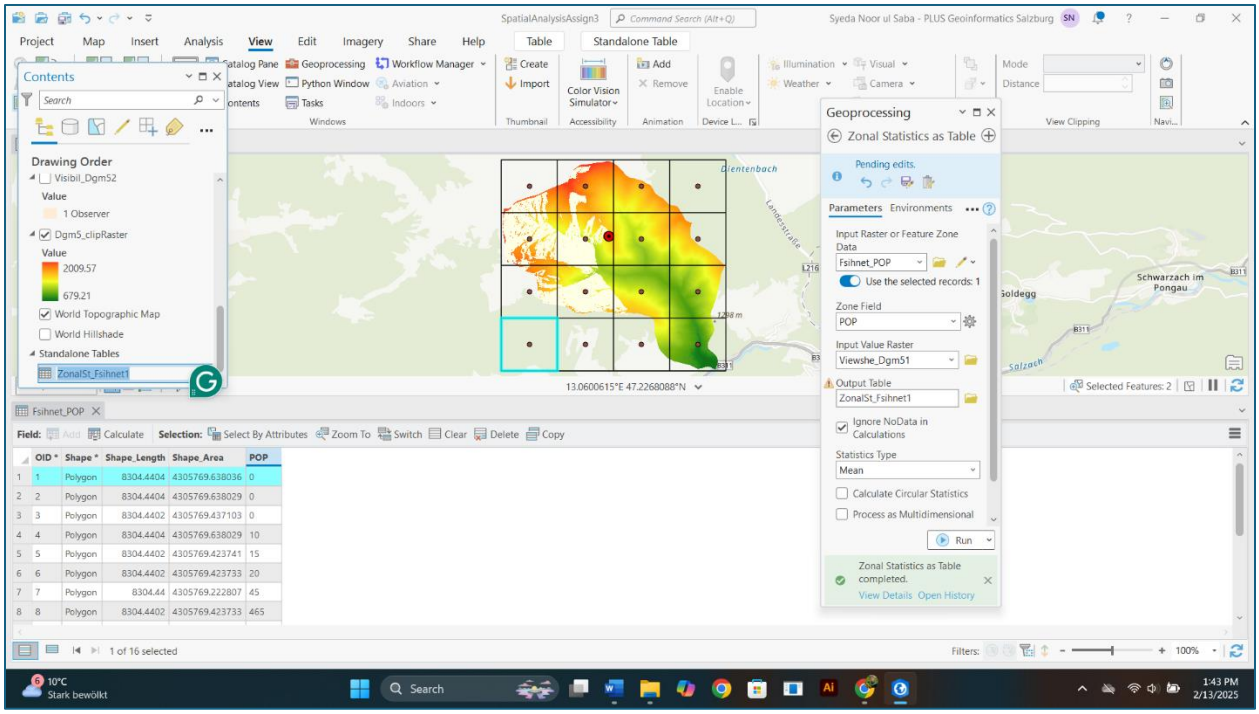



*Figure 12. Zonal Statistics as Table*

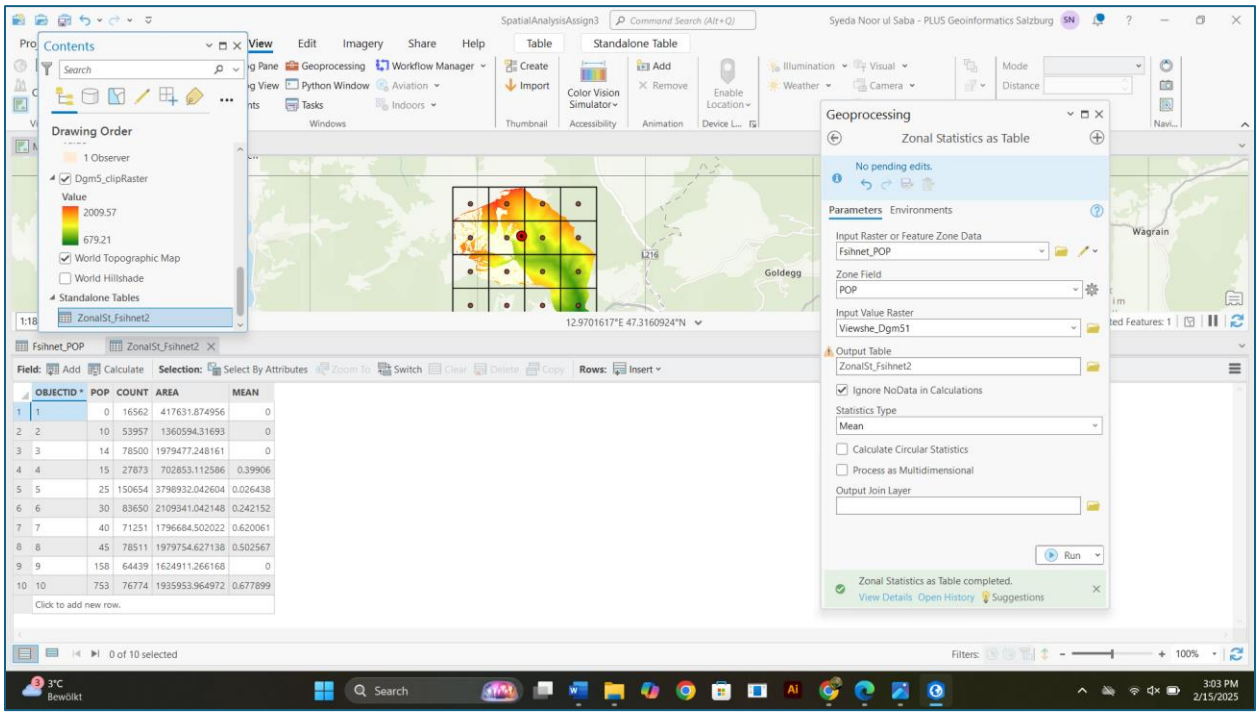



*Figure 13. Defining Mean Values*

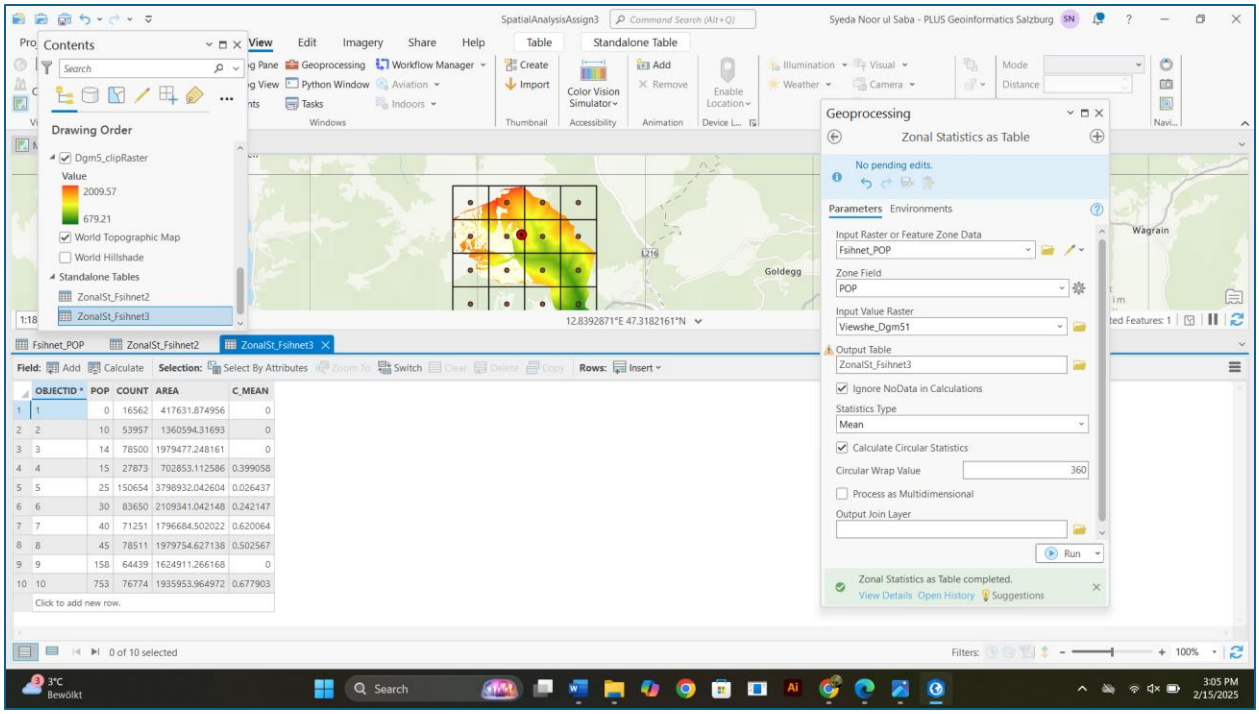



*Figure 14. Calculating circular statistics*

The suggested VWPI metric offers a reliable evaluation of visual impact by capturing the relationship between visibility and the impacted population. According to the findings, high-impact locations may be lessened with the use of mitigation techniques like vegetation buffers or construction height restrictions.