

Mantra ArcGIS Data Management Practical – Exercise 2.
Derive new datasets from inputs and carry out Multi-criteria analysis in order to identify the fieldwork sites.

In order to follow this exercise you need to have completed exercise 1.

Contents of Exercise 2: Derive new datasets from inputs and carry out Multi-criteria analysis in order to identify the fieldwork sites.

Part 1: Use Spatial Analysis to find sites visible from West Highland Way.

Part 2: Use Spatial Analysis to find sites which are also within 1km of West Highland Way.

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Part 1: Use Spatial Analysis to find sites visible from West Highland Way.

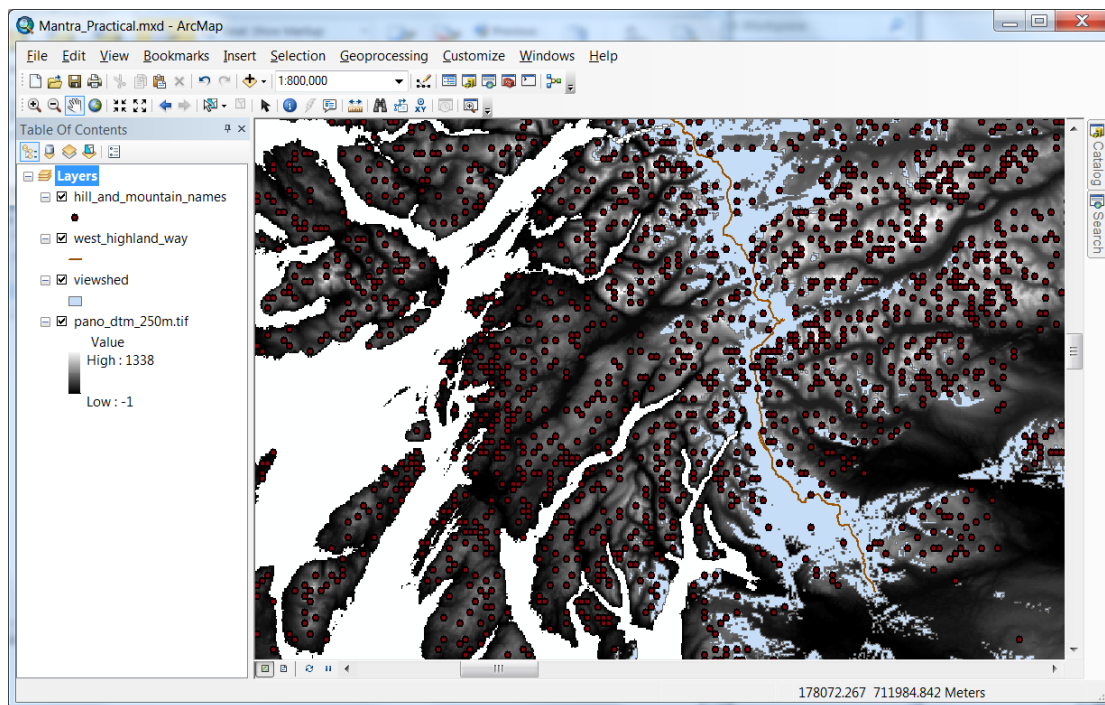
Let's remind ourselves of our objective. We are interested in identifying field study sites in the North-West Highlands of Scotland. In particular we want to identify a set of fieldwork sites that meet the specific criteria of being visible from and falling within distance of a section of the West Highland Way long distance footpath. This analysis will be undertaken under a methodology known broadly as Multi-Criteria Evaluation (MCE). MCE is an analytical means of making selections based on specific criteria. MCE does not need to be applied within GIS. **Here though, our criteria are that the fieldwork sites:**

- appear as a named hill on the Ordnance Survey placename gazetteer. The rationale being that such features are culturally significant and represent important landscape features.
- are visible from the path of the West Highland Way long distance footpath.
- are within a certain distance (1km) of the West Highland Way long distance footpath. The rationale being that we do not want to have to walk far from the footpath if we are carrying specialised and perhaps cumbersome fieldwork equipment as part of the research, especially as we are carrying this equipment on the leeward slopes of hills and mountains.

We will first carry out this analysis interactively using tools within ArcMap. Remember that the hill_and_mountain_names featureclass represents candidate locations for the fieldwork sites as these are locations which appear as named locations on Ordnance Survey's series of 1:50,000 Landranger maps. We will need to use ArcGIS to select all features from the hill_and_mountain_names featureclass which fall within the viewshed i.e. only those that are visible from the West Highland Way footpath. We will then need to further refine the candidate sites – to include only those sites that are within a certain distance (1km) of the footpath. Let's take this one step at a time:

- Use ArcMap to re-open the ArcMap Document file you created in Exercise 1: "Mantra_Practical.mxd".

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From the ArcMap menu bar choose **Selection > Select By Location...** Doing so will bring up the **Select By Location** dialogue. If you've not used this ArcMap tool before, it allows us to define which layers to make selections from and how these selections should be made.

- For our purposes set the dialogue so that it reads:

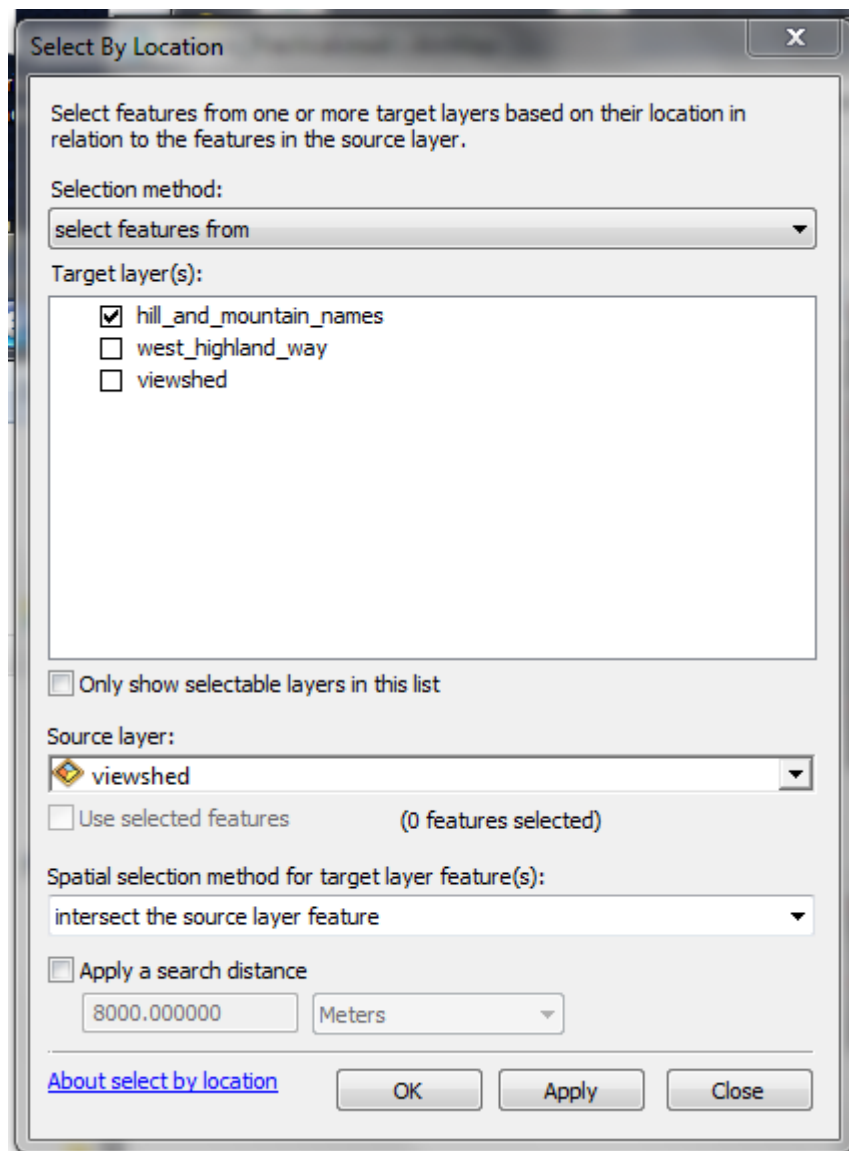
Selection method: **select features from**

Target layer(s): make sure that only **hill_and_mountain_names** is ticked

Source layer: **viewshed**

Spatial selection method for target layer feature(s): **intersect the source layer feature**

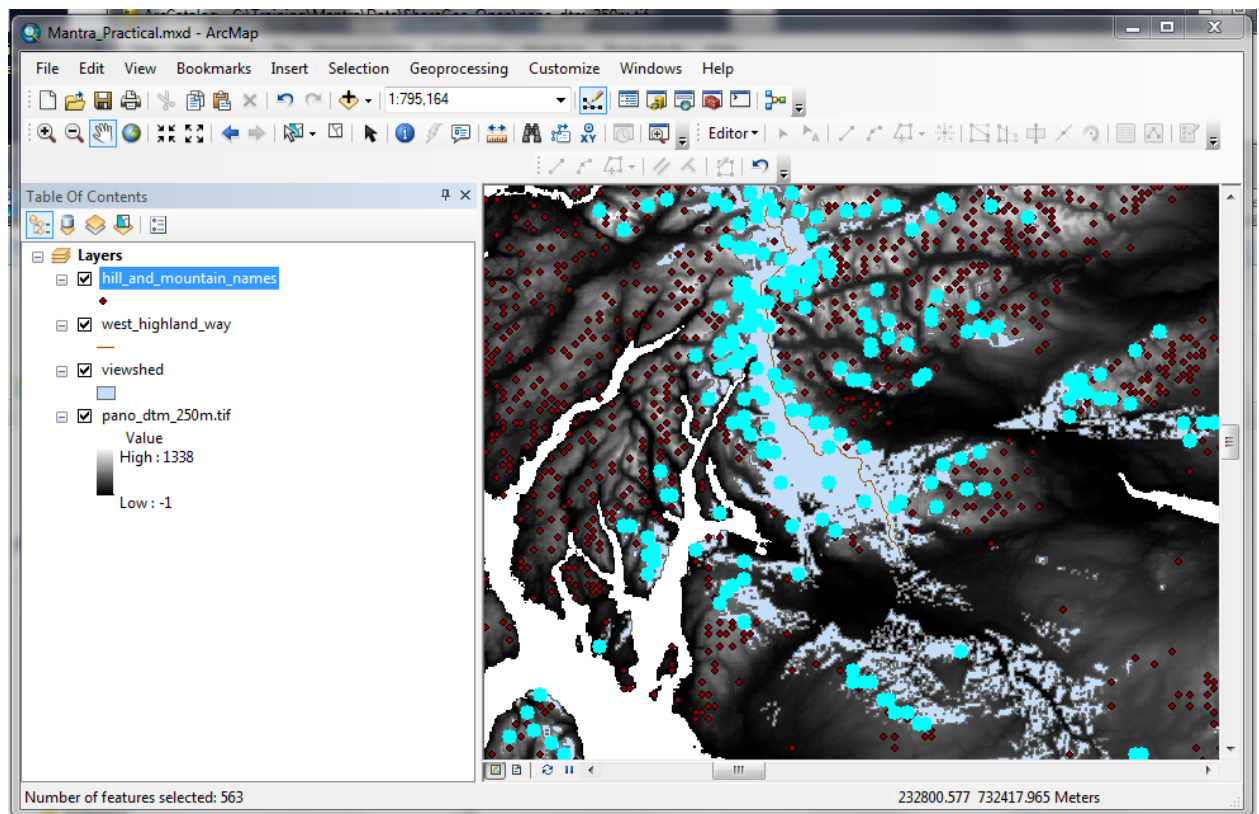
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Click OK.

ArcMap will make the selections and highlight (with turquoise dots) those features within the hill_and_mountain_names layer that fall within the viewshed and thus are visible from the West Highland Way footpath.

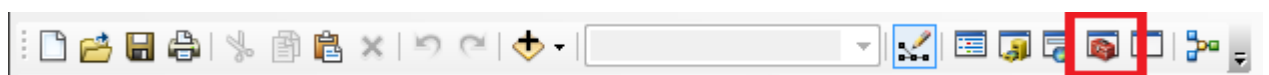
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Part 2: Use Spatial Analysis to find sites which are also within 1km of West Highland Way.

We now want to limit this set further to only those selected features which are also within 1km of the footpath. In order to do this we'll create a buffer geometry around the West Highland Way polyline and then use the features in this buffer geometry to further refine the selected features. To create the buffer geometry we'll use ArcToolbox.

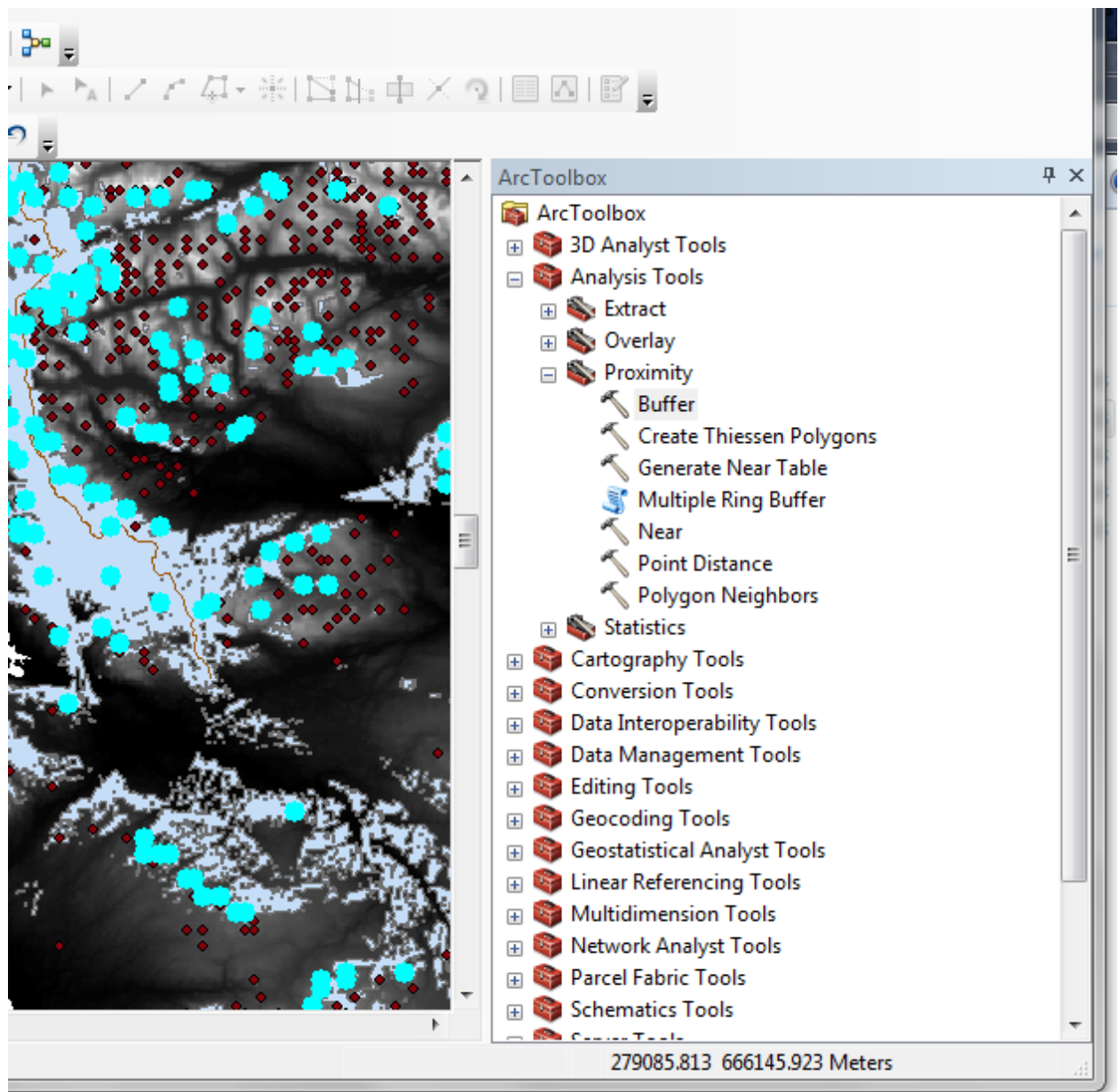
- If it's not already shown click on the ArcToolbox button on the ArcMap menu bar.



ArcToolbox will be added to ArcMap to the right of the main map window.

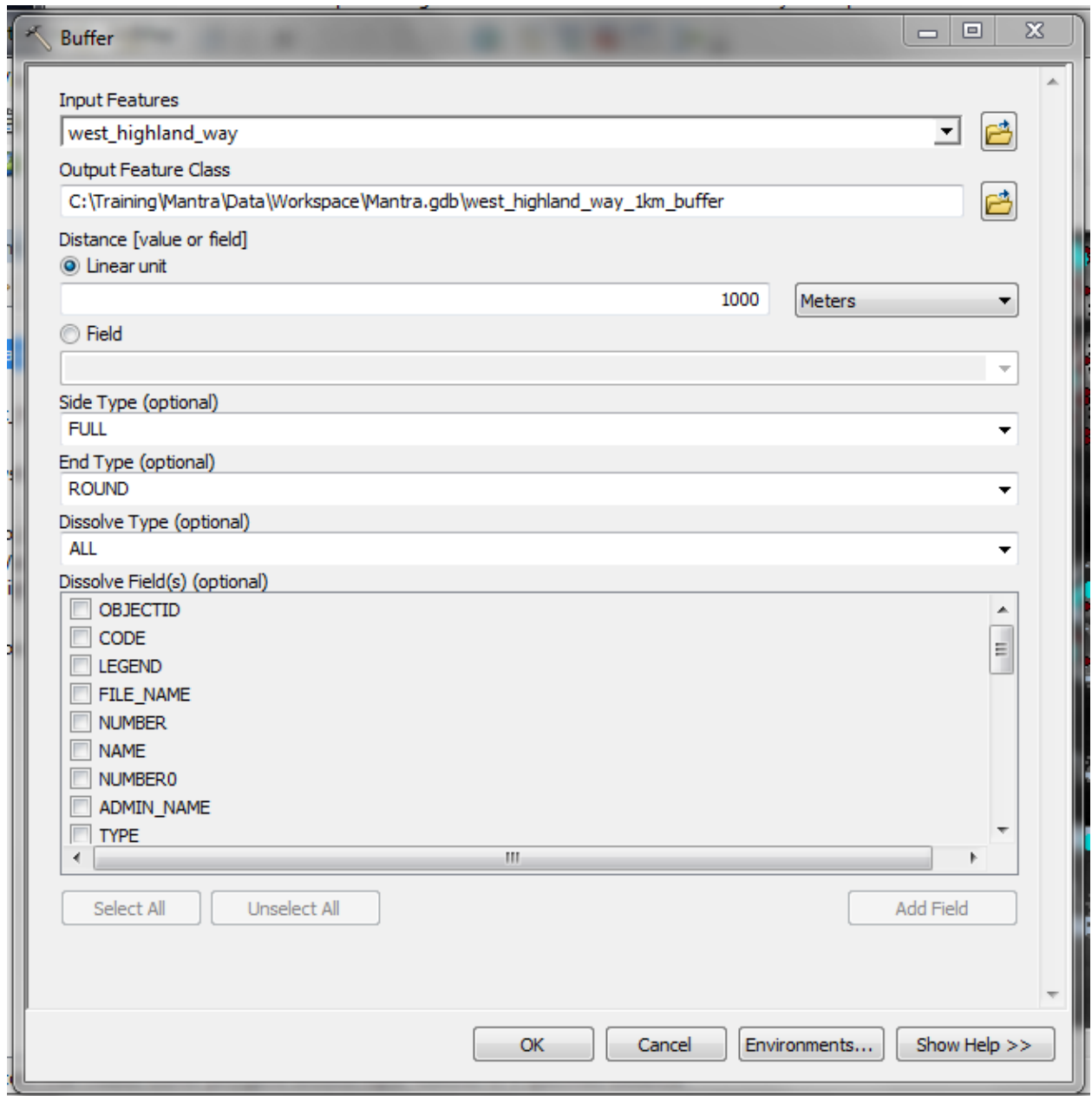
Once open the **Buffer** tool is to be found within the **Proximity** toolset of the **Analysis Tools** toolbox.

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- Double-click the **Buffer** tool to open up the Buffer dialogue. Clicking the “**Show Help >>**” button will display ArcGIS contextual Help for this tool.

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- We need to set the input features that the buffer geometry will be based on: this is the West Highland Way dataset, the **west_highland_way** featureclass in our geodatabase.
- We also need to define the name of the buffer geometry that will be created, and where this will be created: we have to use the Output Feature Class field to specify that we want to create a dataset called **west_highland_way_1km_buffer** within our geodatabase.
- The only other mandatory parameter that we need to supply to ArcGIS is how big the buffer should be and the unit of measurement that this is provided in. In the British National Grid co-ordinate system the map measurement units are

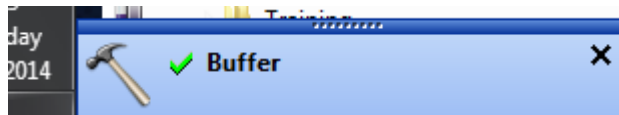
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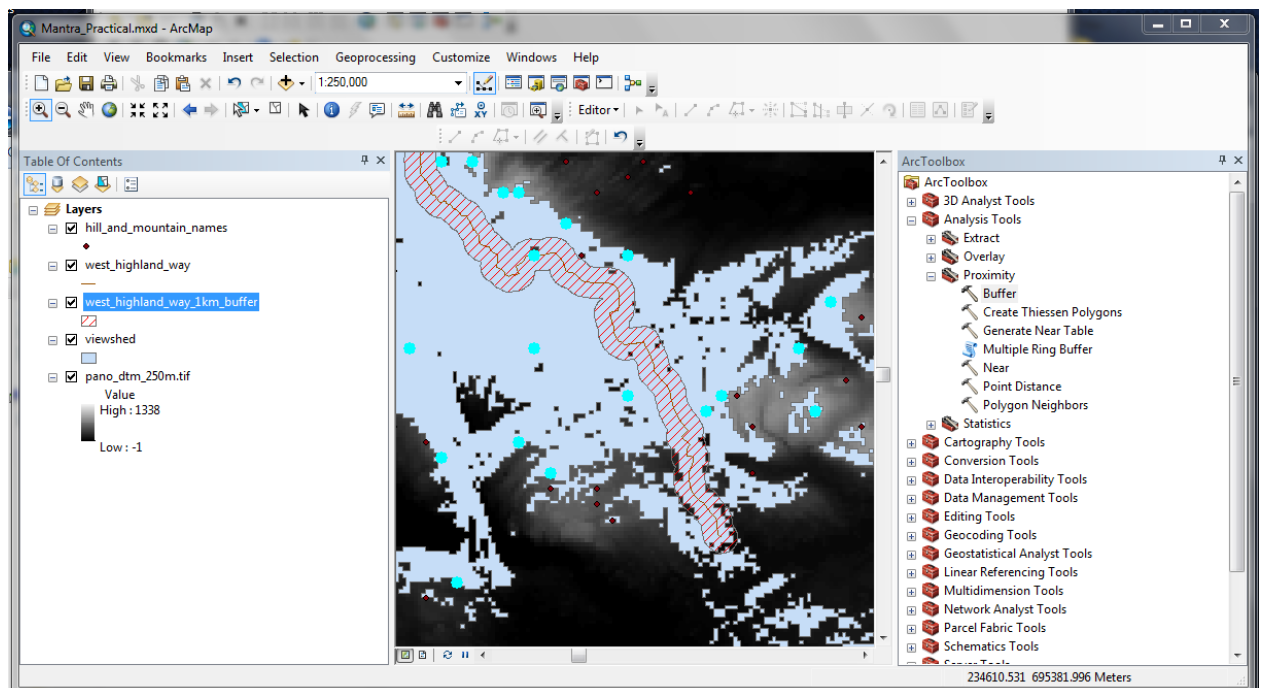
set to be metres. We want the buffer to extend 1km either side of the West Highland Way. We therefore enter the value of 1000 ensuring that “meters” is selected (note the American spelling of meters). (You can also enter a distance in different units and specify the unit type in the buffer dialogue.)

- There is an optional parameter that is worth changing from the default setting. This is the **Dissolve Type**. Set this to **ALL**. Our **west_highland_way** featureclass contains multiple line features. When ArcGIS creates the buffer it will create a new polygon for every input polyline. Where we have 2 or more input polylines which are located beside one another we may end up creating overlapping polygons. Setting **Dissolve Type** to **ALL** tells ArcGIS to merge neighbouring polygons into a single feature. Once you’ve filled in the form click the **OK** button.

When finished, ArcGIS will pop up a notification:



and add a new polygon layer called **west_highland_way_1km_buffer** to the map. It's a good idea to change the symbology of this polygon layer so that it is displayed with a transparent fill, something like this:



We can close the ArcToolbox panel now by clicking on the X at the top-right corner:

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Now that we have a buffer geometry of 1km around the route of the path we can use this to refine further our fieldwork sites. Within the hill_and_mountain_names layer ArcMap has already selected those features that fall within the viewshed. We can compare those selected features with the buffer geometry to find those that are within 1km of the path.

- Select **Selection > Select By Location...** again.

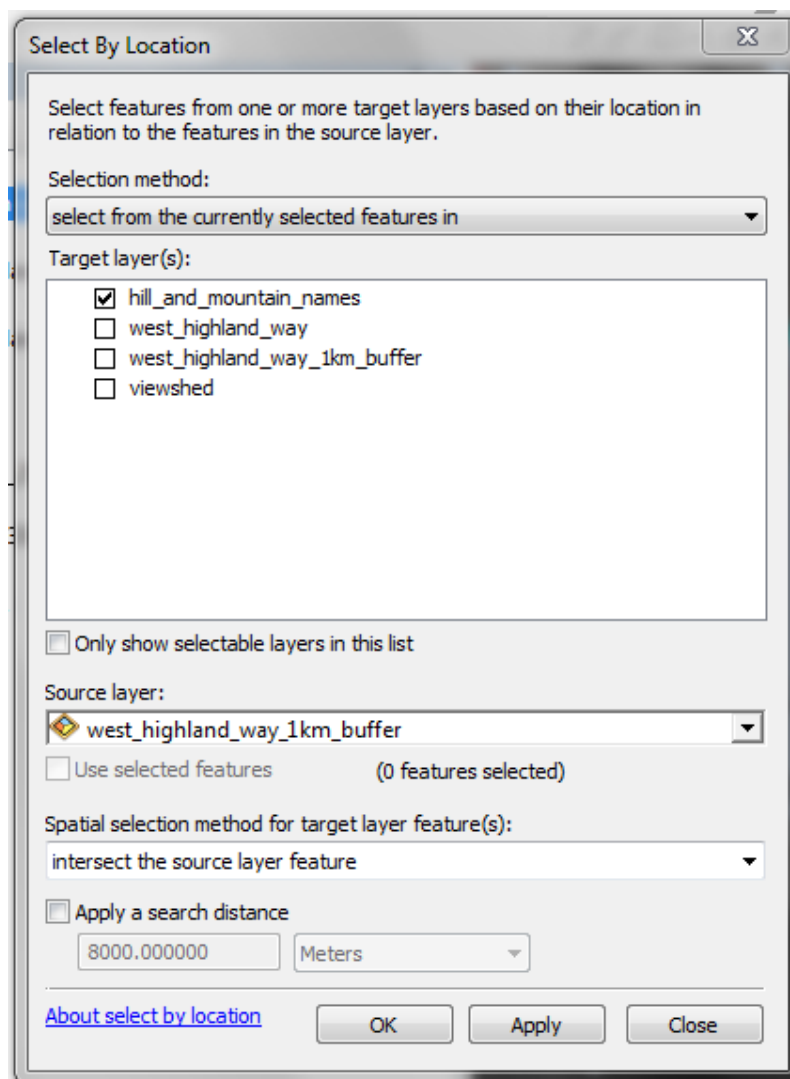
This time set the dialogue so that it reads:

Selection method: **select from the currently selected features in**

Target layer(s): make sure that only **hill_and_mountain_names** is ticked

Source layer: **west_highland_way_1km_buffer**

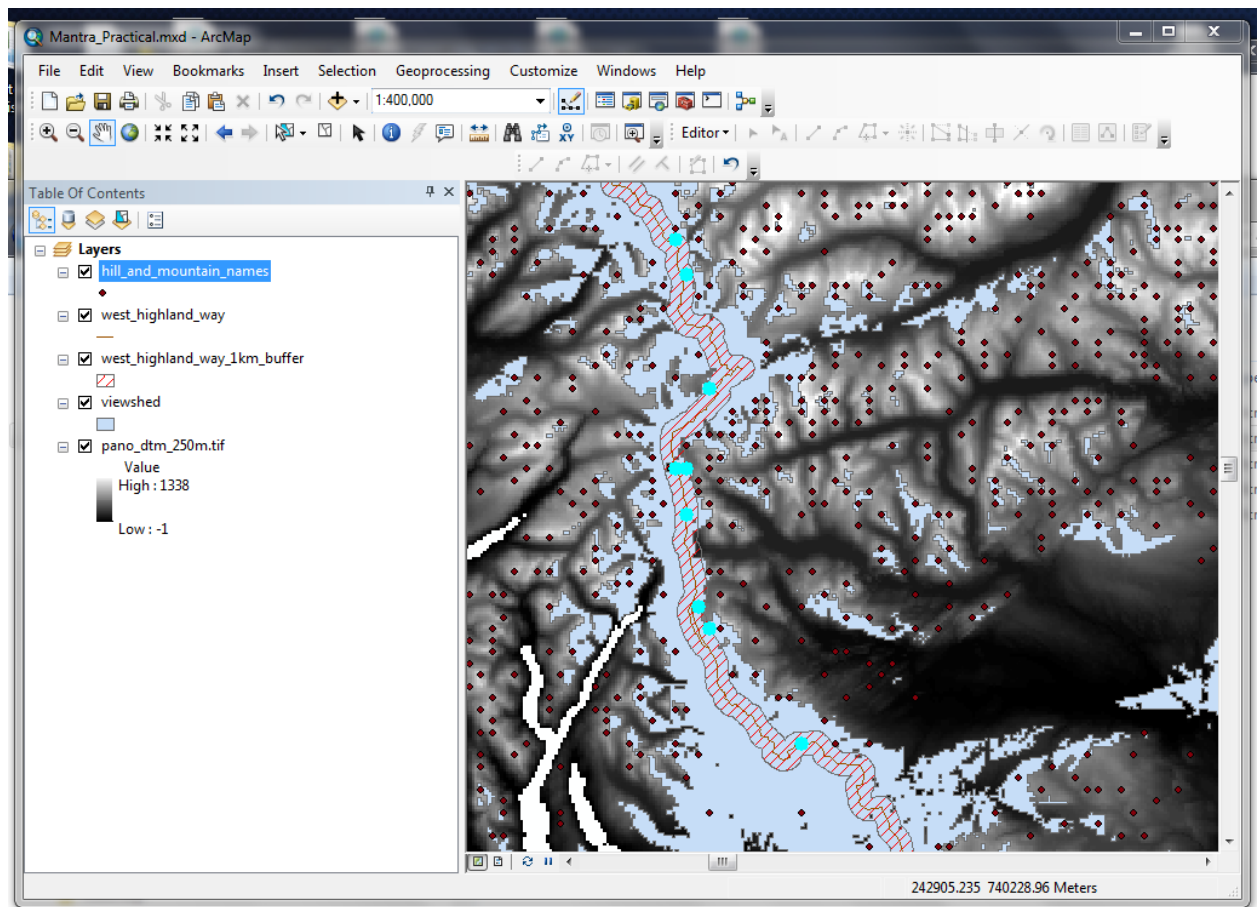
Spatial selection method for target layer feature(s): **intersect the source layer feature**



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Once we click OK ArcGIS will carry out a further selection on the data and change those features that are highlighted:



- Since this selection represents the answer to our research question we better save it as permanent dataset. Right-click the **hill_and_mountain_names** item and select **Selection > Create Layer From Selected Features**. This will add a temporary item called **hill_and_mountain_names selection** to the layers list.

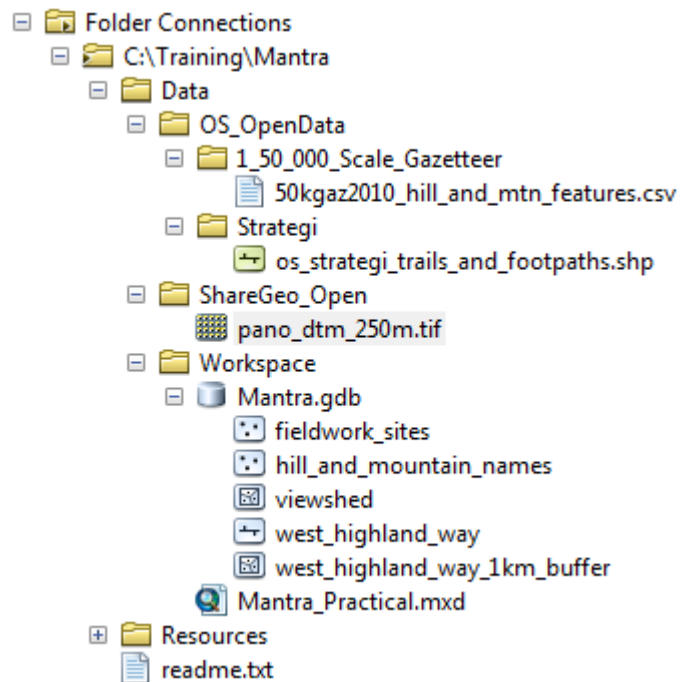
To create a dataset from this, right-click the **hill_and_mountain_names selection** item and select **Data > Export Data...** This will bring up the **Export Data** dialogue.

- Ensure that:
 - Export: is set to **All features**
 - and that **this layer's source data** is the option selected for coordinate system
 - Under Output feature class: set this to **fieldwork_sites** within the **Mantra.gdb**
 - Click **OK**.

ArcMap will ask if you want to add the exported data to the map as a layer. We don't, so click **No**.

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Go back to ArcCatalog, press the **F5** key on your keyboard to refresh the ArcCatalog Catalog tree. You should have something like this with our fieldwork_sites listed as part of our geodatabase.



You should already have seen the benefit that Geospatial metadata has in helping you understand the contents of datasets and how they were created. Towards the end of the practical we will look at creating a Metadata record for the fieldwork sites so that we and others can always be clear how the dataset was created.