



Zoning: Technical Guidance Note 1

Digitising Considerations

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1 Introduction

ZWS commissioned the development of a Polygon Divider tool in 2017. In the interests of making this freely available and open it is hosted in the QGIS Plugin Repository and the source code is available on Github¹. The Polygon Divider can only be accessed via QGIS. Where this presents issues for Duty Bodies or Statutory Undertakers wishing to complete their zoning work, Zero Waste Scotland will carry out the division and share the resulting layers.

To ensure equal access, free from licencing restrictions, this guidance has been written based on QGIS software. Many organisations used licenced software with ongoing costs. The steps described in the technical guidance notes can be replicated in other software except where the Polygon Divider is required.

Technical Guidance Note 1 provides an overview of some of the key considerations when digitising data that is intended to be divided by the 'Polygon Divider' software. It then offers some brief technical advice with regards to these considerations.

The document is focussed on a small number of considerations by design. Specific queries which are not addressed within these Technical Guidance Notes should be raised with Zero Waste Scotland at litter.monitoring@zerowastescotland.org.uk.

2 Data Availability

Digitising data can be a time-consuming, resource intensive activity. It is therefore worthwhile thoroughly investigating existing data availability before committing to a large-scale digitisation project.

3 Key Considerations

GIS packages work on the assumption that the feature's geometry follows certain specifications. When the processing algorithms encounter data that does not follow the specifications, the software can return errors or crash. Alternatively, the operation may succeed without apparent problem but the result may be incorrect. The following sections will provide advice on specific data errors that can arise in the digitisation process.

3.1 Topology Considerations

Topology expresses the spatial relationships between connecting or adjacent vector features (points, polylines and polygons) in a GIS. Topological errors break the relationship between features, and thus every effort should be made to avoid such errors during the digitisation process.

3.1.1 *Polygons Should Not Overlap*

Polygons should not overlap. The reason for this rule is two-fold: overlapping polygons will result in erroneous area calculations (i.e. land will be counted multiple times); and the 'Polygon Divider' algorithm will divide both polygons, leading to multiple survey areas for the same piece of land. An example of how this would look is provided in Figure 1:

¹ <https://github.com/jonnyhuck/RFCL-PolygonDivider>



Figure 1: Example of the output when the plugin is run on overlapping polygons

3.1.2 *Avoid Unnecessary Sliver Polygons*

Unnecessary gaps (slivers) between polygons should be avoided due to the impact they have on the 'Polygon Divider'.

The Polygon Divider aims to split all polygons into approximately 1,000m² areas, with a lower bounding of 800m². It is evidently not possible for it to divide a polygon to a 'Target Area' that is larger than itself (i.e. if the polygon has an area of 500m², it clearly cannot be divided into 800m² - 1,000m² sections). Likewise, if you have lots of separate adjoining polygons which are slightly larger than the 'Target Area', you are likely to get more divided polygons that are larger than they would be if the input layer had been a single polygon (this is because the 'Target Area' would be increased to avoid offcuts). Therefore, unnecessary gaps between adjoining polygons should be avoided, as they will lead to an increase in offcuts and an increase in survey areas that are larger than the 'Target Area'.

A secondary reason for avoiding unnecessary slivers is that they will also affect the accuracy of area calculations across a large dataset.

3.1.3 *Consider Whether Separate Layers Are Needed*

Ordinarily we would advise that you use separate layers to represent different sets of geographic data. However, as our ultimate aim is to produce 1000m² survey areas, it is worth considering whether by separating data you are creating offcuts (areas <800m²) that could be avoided. Figures 2 & 3 illustrate an instance where adjacent layers are more useful as a single layer (please note this example is purely for illustrative purposes and may not be appropriate in practice).

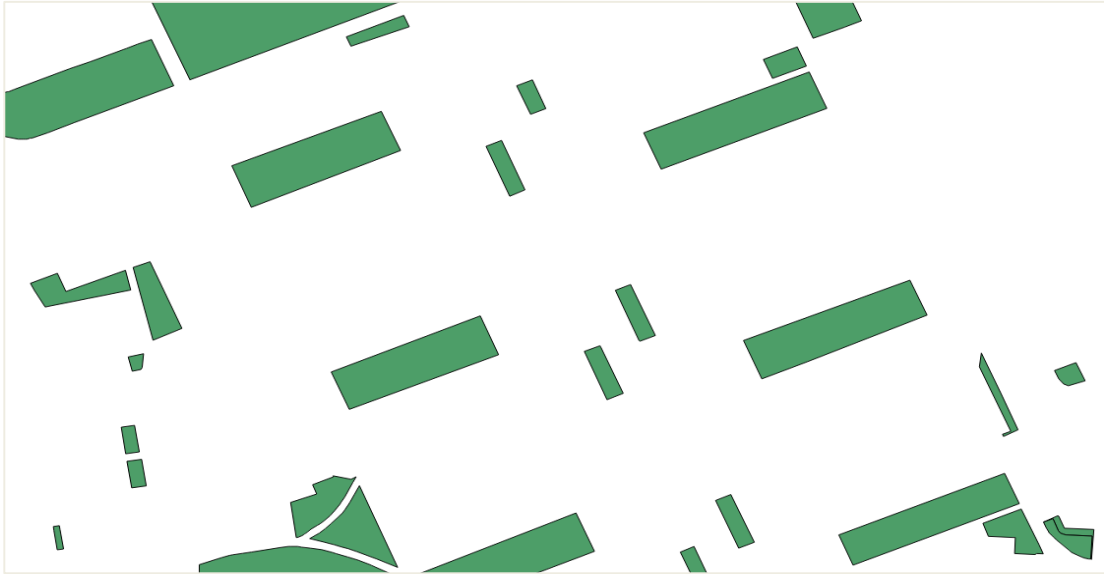


Figure 2: Example of a layer with many small, islanded (sliver) polygons



Figure 3: Example of a layer where combining two layers would reduce offcuts

It is recognised that in many cases it will not be practical to combine adjacent layers, as it will affect your ability to accurately zone your land. We are simply suggesting you bear it in mind, particularly if adding a new dataset that is likely to include lots of small islanded parcels of land that often abuts a larger and sufficiently related existing layer.

3.1.4 Avoid Unnecessarily Complex Polygons

It is recognised that many existing datasets will be justifiably complex. However, if digitising a new layer specifically for this project, it is worth considering the balance between the level of detail required for zoning against the benefits that come from dividing a simpler layer.

Figures 5 to 8 illustrate the benefit of dividing a simpler layer.



Figure 4: Example complex layer

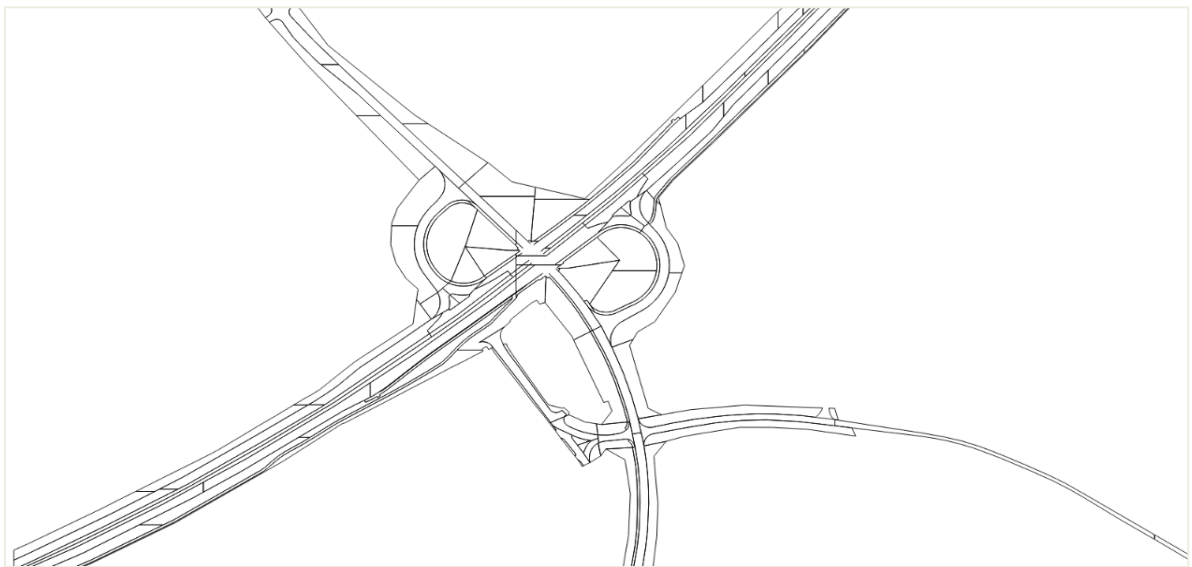


Figure 5: Example of a complex layer which has been divided

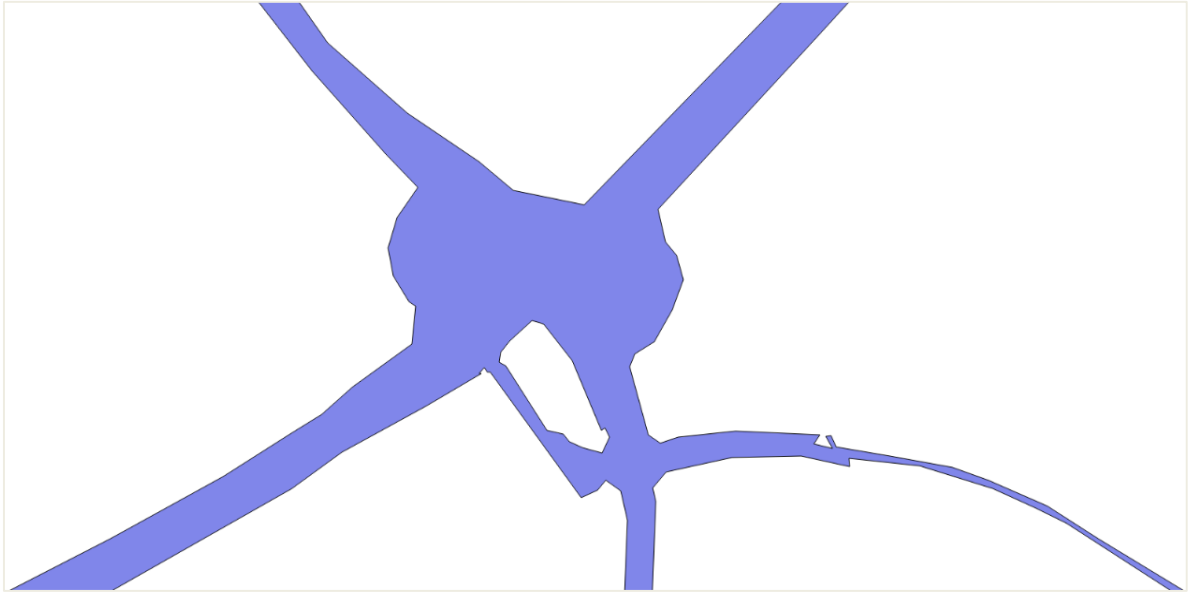


Figure 6: Example simple layer

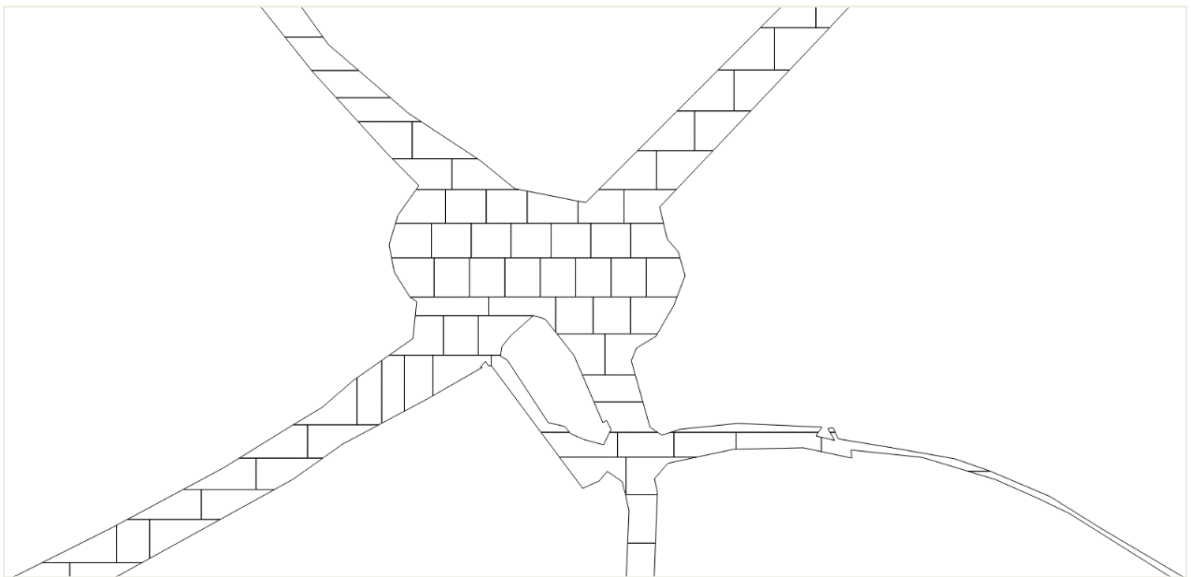


Figure 7: Example of a divided simple layer

Whilst there may be good reason to keep the level of detail provided in the complex example (Figure 5), there are areas where the use of multiple polygons will have a significant impact on the dividing process. This is particularly notable near the junctions of road sections

3.2 Geometry Considerations

Care should be taken to avoid self-intersections (bowties for example), duplicate nodes and polygons with less than 3 nodes. These represent three common errors that impact on the validity of the data.

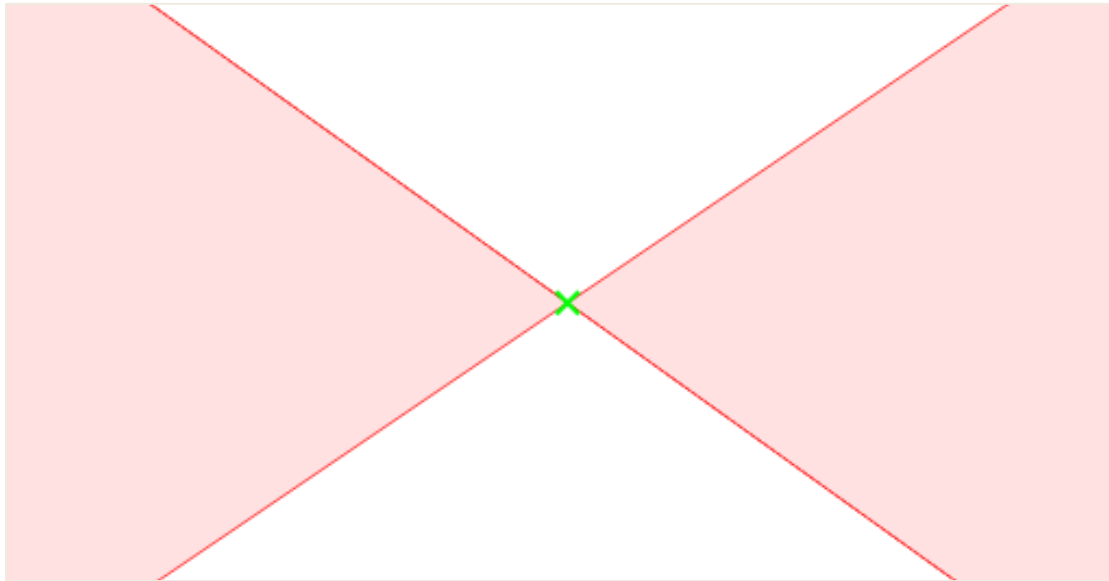


Figure 8: Example of a bowtie polygon. The green cross marks the point where the polygon self-intersects

4 Technical Advice

This section details some of the digitisation options that are available in QGIS. It is primarily focusses on the advanced snapping options and how they can be used with respect to some of the key considerations detailed in Section 3.

4.1 Snapping Tolerance

Snapping tolerance is the distance used to search for the closest vertex and/or segment you are trying to connect to when digitising. A segment is a straight line formed between two vertices in a polygon or polyline. If you aren't within the snapping distance, QGIS will leave the vertex where you release the mouse button.

It is important, for accuracy, and for any tools that work with tolerance, that snapping tolerance is set prior to the commencement of digitisation. The snapping tolerance can be set at a global level (i.e. project-wide) and at a layer-based level (section 4.1.1).

4.1.1 *Layer-based Snapping Tolerance*

Layer-based snapping allows adjustment of snapping mode and tolerance for individual layers. The snapping options include 'Current layer', 'All layers' and 'Advanced'.

'Advanced' is particularly useful if you want to edit a layer and snap its vertices to another layer. Using advanced snapping tolerances helps avoid topographical errors such as slivers or overlapping polygons.

The layer-based snapping tolerance is set via Settings > Snapping Options > Advanced from the 'Snapping mode' pulldown menu (Figure 9).

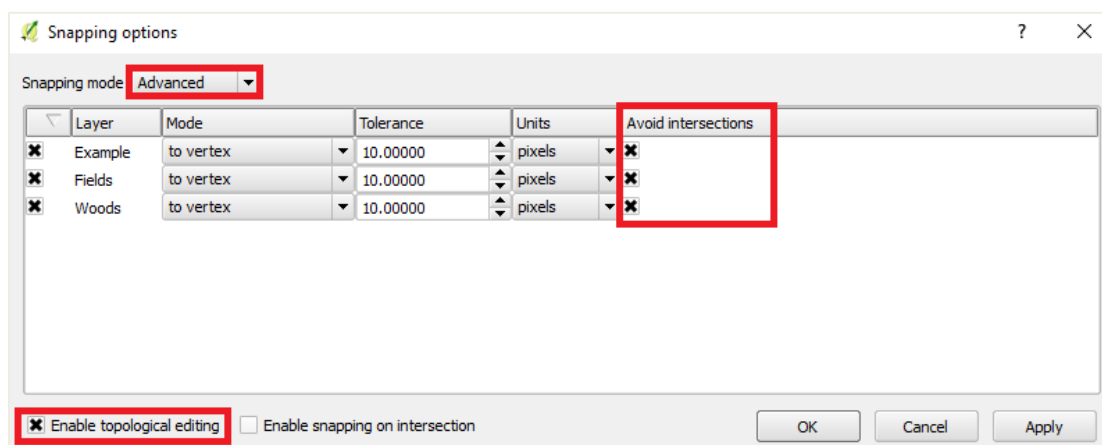


Figure 9: Accessing the snapping options

Checking the 'Enable topological editing' ensures that the common boundaries are maintained correctly. QGIS detects shared boundaries by the features, so you only have to move a common vertex/segment once and it will update the neighbouring feature.

Checking 'Avoid intersections' prevents you from drawing new features that overlap an existing one. It is very useful when digitising complex boundaries, as it requires less precision whilst still producing topologically correct polygons. The example below (Figure 10) illustrates how a new layer can be very quickly and crudely drawn, whilst remaining topologically correct.

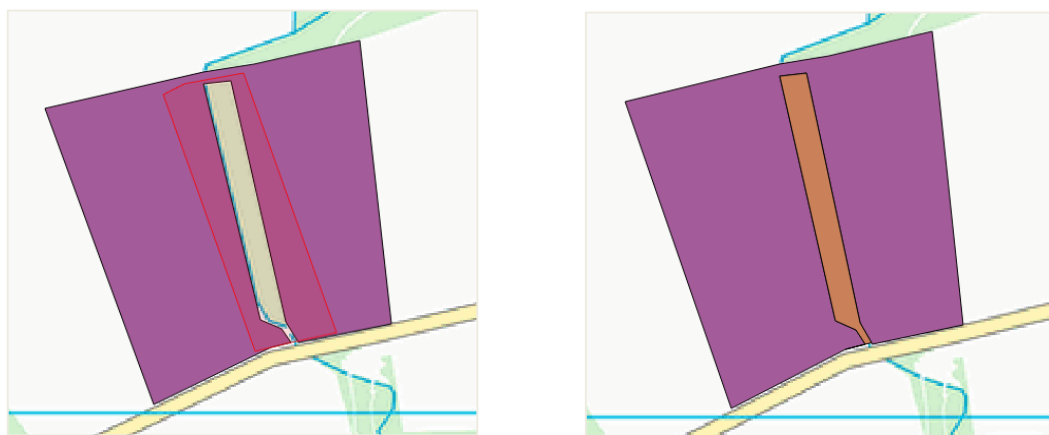


Figure 10: Illustration of the 'avoid intersections' function shrinking and snapping the boundary of the new layer to the existing layer

4.2 Difference

There may be instances where the new polygon layer you are creating would sit on top of part of an existing layer. In this instance you should cut the new layer from the existing layer to avoid creating overlap. This can be achieved using the geoprocessing tool 'Difference' (Vector > Geoprocessing Tools > Difference).

Snapping tolerances should be used when mapping the new features to avoid issues when cutting from the existing layer (i.e. to avoid slivers and/or fragments of land where the boundaries do not match).

Given the potential size of the datasets, there may be instances where it is beneficial to create a layer just for cutting as this would allow greater visibility of exactly what is being cut. Following the cut, use the snapping options detailed in 4.10 and 4.11 when mapping the new area to your new layer.

4.3 Data Type

An aim of zoning relevant land is to allow the generation of 1,000m² survey areas for monitoring purposes. In order for the 'Polygon Divider' to create these areas zoned land must be represented by polygons. Details on what to do if your data is not a polygon are provided in Technical Guidance Note 2.

4.4 Coordinate Reference System

It is recommended that the Coordinate Reference System of your layers is set to British National Grid (ESPG:27700 – OSGB 1936). This ensures all measurements are in metres, the unit of measurement used by the 'Polygon Divider'.

4.5 Attributes

The following attributes are required to be assigned to polygons. Please assign the headers exactly as presented (example in Table 1):

- Organisation responsible for the identified land (Header: **Org**);
- Land type (Header: **Land_Type**);
- Department (Header: **Department**);
- Zone number classification (Header: **Zone**);
- Health & safety or access issues present which prevent **monitoring** of the site (Header: **H_and_S and populate with 'Y'²**); and
- Named health & safety or access reason (Header: **Reason**).

Org	Ward	Identifier	Zone	H_and_S	Reason
Aberdeen Council	Hilton/Stockethill	Hilton Street	2	N	N/A
Scottish Canals	Falkirk South	Landform	5	Y	Steep embankment

Figure 11: Example attribute table REPLACE WITH UPDATED VERSION WHEN AVAILABLE

With respect to health and safety, please note that polygons should be drawn so that only land affected ('Y') should have this attribute included.

Custom Forms could be used to improve data consistency across newly created layers. Alternatively, fields could be assigned within the 'New Shapefile Layer' dialog box that pops up when a new layer is created.

It is anticipated that the Org (and potentially Land-Type and Department) fields will be populated via an attributes driven process (e.g. 'Spatial Join'). There may be some scope for attribute driven population of the zone field (see Technical Guidance Note 3), but it is expected that the process will predominantly rely on manual inputs.

² Polygons should be drawn so that only land affected has this attribute included. NOTE: this does not refer to areas which present health & safety or access issues for the **removal** of litter as there is still a requirement for these areas to be clear of litter and refuse or to be kept clean of detritus

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