

QGIS USER GUIDE



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1. INTRODUCTION



1. The spatial data used for storymap are delivered in the form of GeoPackage. GeoPackage is an open, standards-based, platform-independent, portable, self-describing, compact format for transferring geospatial information. It has the extension *.gpkg* and can be accessed using most GIS software such as ArcGIS and Quantum GIS (QGIS). A GeoPackage can hold both vector (including points, lines, and polygons) as well as raster dataset.
2. This user guide presents simple instructions to access, view, and edit data layers in GeoPackage using QGIS. QGIS is a free and open-source cross-platform desktop geographic information system application that supports viewing, editing, and analysis of geospatial data.
3. This user guide has been simplified to only include the processes that are relevant to Greensand Country Landscape Partnership. This guide was written based on QGIS version 3.8 Zanzibar. For newer versions, please refer to the latest documentations on QGIS website as the interface may be different.
4. Some GIS definitions:
 - a. Data Layer (or simply Layer). References a dataset within GeoPackage. It can be either vector or raster dataset.
 - b. Features. Geographical items within a vector data layer. On the map, features are represented as points, lines or polygons.
 - c. Attributes. Attributes provide characteristics (e.g. soil type, village population) about the data layer and are appended in tabular format. In attribute table, each row represent a feature while each column is a field (i.e. characteristics).

2. INSTALLING QGIS

1. QGIS can be downloaded from <https://qgis.org/en/site/forusers/download.html>

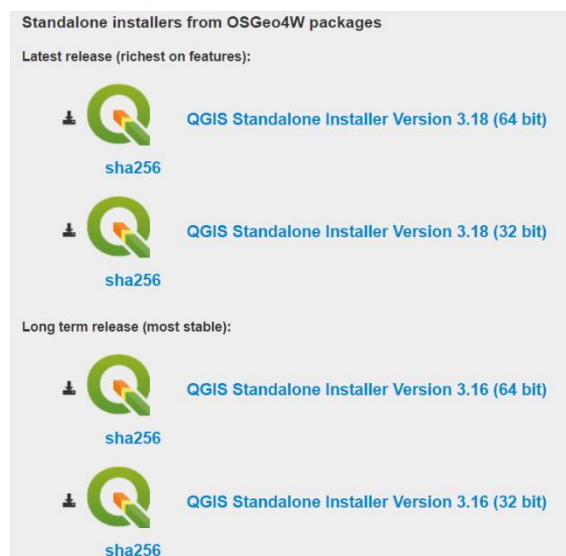
2. Select the appropriate operating system.

Download for Windows

Download for macOS

Download for Linux

3. For windows, there are 2 installation options. Choose 'QGIS Standalone Installer' under 'Standalone Installers from OSGeo4W packages'. Note that the version number may be different.

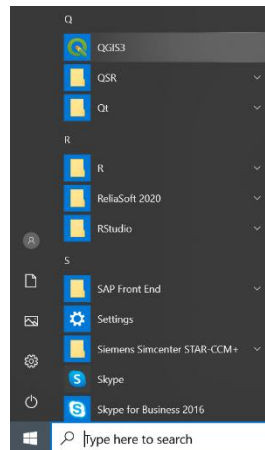


4. Once downloaded, run the installer and follow the on-screen instructions.

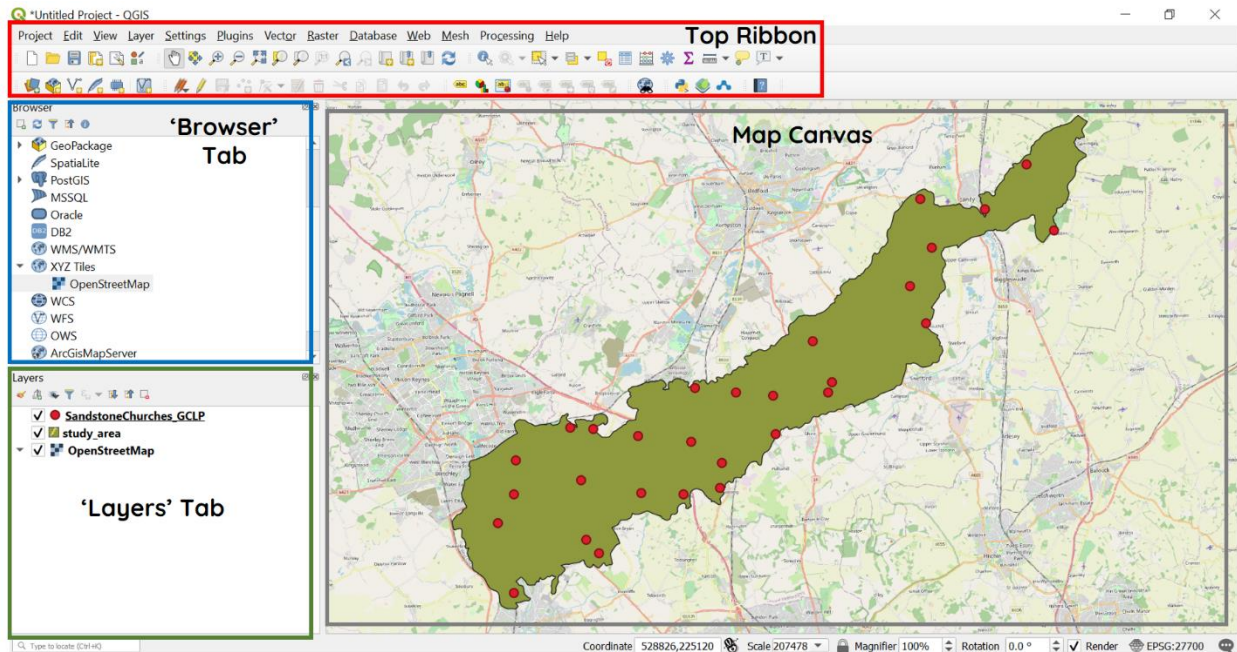
3. GETTING STARTED

3.1 QGIS INTERFACE

1. Launch QGIS from Start Menu.



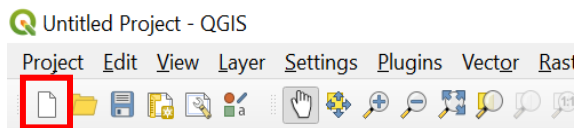
2. The QGIS window will appear. The interface includes 'Top Ribbon', 'Browser' tab, 'Layers' tab and 'Map Canvas'. Note that the arrangement of the tabs may be different in some cases.
 - a. Top Ribbon. This is where most of the GIS functions can be found.
 - b. Browser Tab. The browser tab contain the databases and allows user to access them.
 - c. Layers Tab. The layers tab list the layers that are currently loaded in the project.
 - d. Map Canvas. This is where the maps and layers will be displayed.



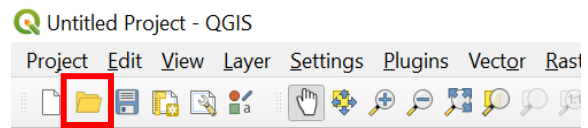
3.2 LOADING PROJECT

3. To start a new project, click on 'New Project' button. To open an existing project (.qgz), click on 'Open Project' and navigate to the appropriate folder.

Start New Project



Open Existing Project

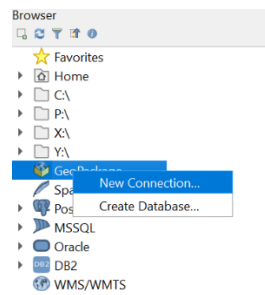


4. To save the project, click on the 'Save Project' button and navigate to the desired folder. It is recommended to save the project regularly.

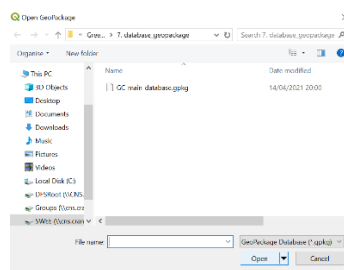


3.3 LOADING GEOPACKAGE

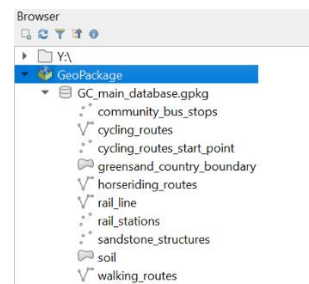
5. To load an existing GeoPackage, go to 'Browser' tab, right click on 'GeoPackage' and select 'New Connection'. In the new window that appears, navigate to the folder containing the GeoPackage and click 'Open'. After that, the GeoPackage selected should appear in the 'Browser' tab. If need be, click on the black triangle beside the selected GeoPackage to show the layers within.



Adding new connections

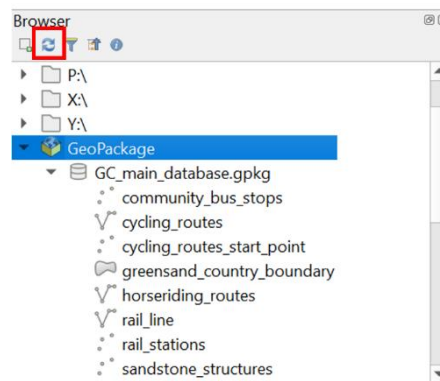


Selecting GeoPackage to load

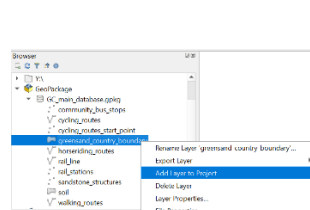


Selected GeoPackage appears in 'Browser' tab

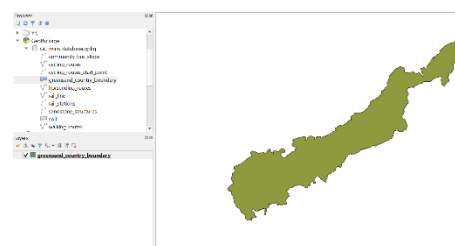
6. If the layers does not show completely in 'Browser' tab, click on the 'Refresh' button.



7. To add layers from GeoPackage to project, right click on the layer in 'Browser' tab and select 'Add Layer to Project'. The layer will be added to be 'Layers' tab and Map Canvas.



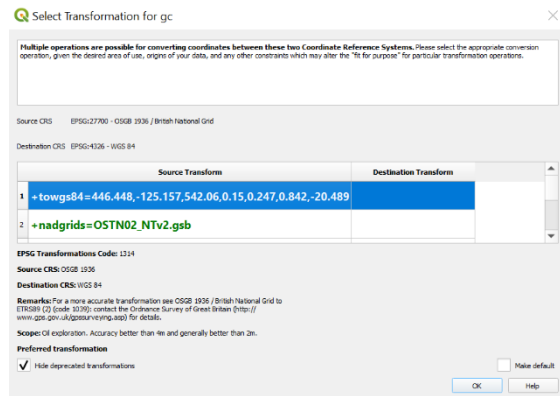
Adding layers to project



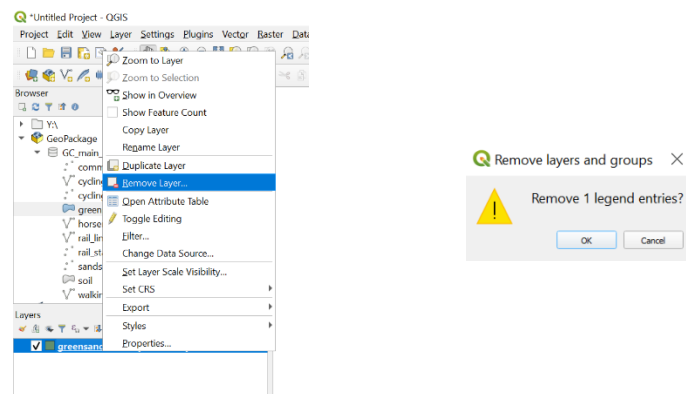
Layers appear on 'Layers' tab & Map Canvas

8. A message on coordinate transformation¹ may appear. Click 'OK' to continue. The data layers from GeoPackage are now loaded and ready for visualisation or editing.

¹ By default, the project coordinate system is in WGS84. The data layers in GeoPackage are in British National Grid. As such, coordinates transformation is required and is done by the system.



9. To remove data layers, right click on the layer under 'Layers' tab and select 'Remove Layer'. Click 'OK' when prompted for confirmation.



4. VIEWING DATA LAYERS

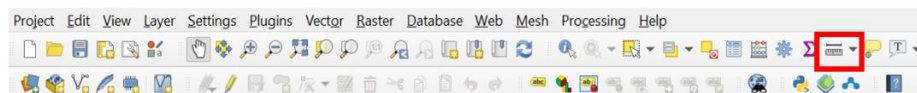
4.1 GENERAL TOOLS

1. Pan Map. Click on the hand button on the top ribbon to select the 'pan map' button. Click and drag anywhere on the map to pan it.

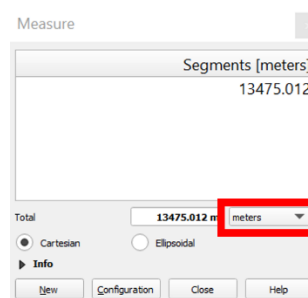


2. Zoom In/Out. With cursor on the map canvas, use the mouse scrolling wheel to zoom in or out.

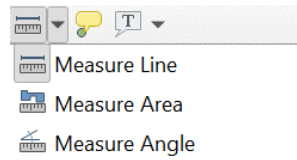
3. Measure. Click on the 'Measure Line' button. To begin measurement, left click on the starting point. A line will automatically extend out from the starting point. Move to the ending point and left click on it to complete the line segment. If there are multiple line segments, continue the process to left click at all the points. To end measurement, right click anywhere on the map canvas. The length will appear in the 'Measure' window. To start a new measurement, click on 'New' on the 'Measure' window.



- a. Unit of Measurement. By default, the unit of measurement is in metres. To change it, select the desired unit of measurement from the drop down list.

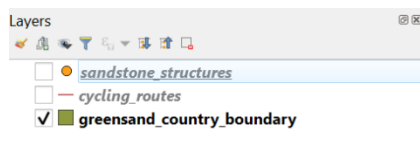


- b. Other Measurements. The button can measure area and angle as well. Click on the black triangle beside the 'Measure' button on the top ribbon and select the desired item.

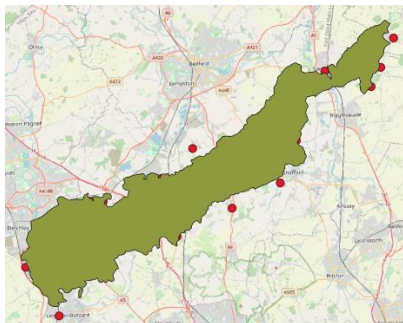
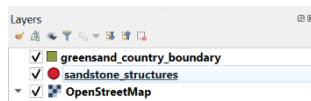


4.2 MANIPULATING DATA LAYERS

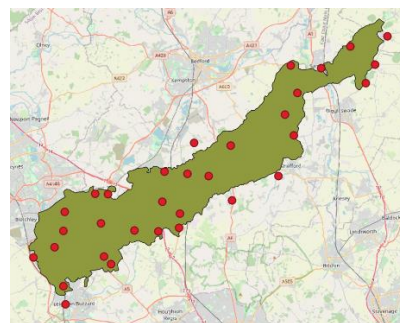
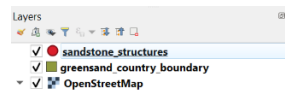
4. Switching Layers On/Off. Layers on the map can be switched on/off by (un)checking on the corresponding boxes beside the layers under 'Layers' tab.



5. Arranging Layers. To view the data layers correctly, they have to be arranged in this order (top to bottom): Points, Lines, Polygons, Raster. To move layer(s) up or down, go to 'Layers' tab, click and drag the layer(s) of interest to the desired location. To move multiple layers, hold down the Shift key while dragging.



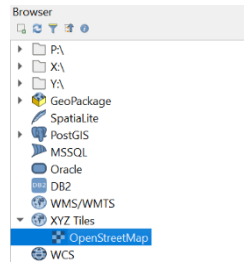
Under 'Layers' tab, 'sandstone_structures' point layer is above 'greensand_country_boundary' polygon. On the map canvas, some of the points are covered by the polygon.



Under 'Layers' tab, 'sandstone_structures' point layer is moved to the top (click and drag). On the map canvas, all the points can now be seen.

4.3 ADDING BASEMAP

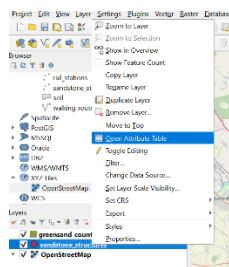
6. Having basemap is useful as it provides context to the data layers. On QGIS, there is an option to add topographic basemap. To add basemap, go to 'Browser' tab, expand 'XYZ Tiles' and double click on 'OpenStreetMap'. The basemap will be added to the project. Move the 'OpenStreetMap' layer to the bottom.



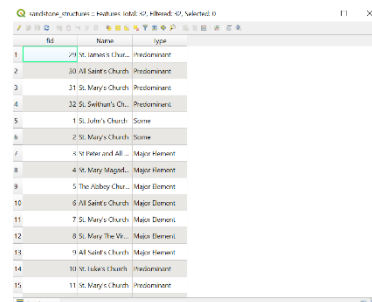
4.4 ATTRIBUTE INFORMATION

7. Attributes provide characteristics (e.g. soil type) about the data layer and are appended in tabular format. There are two ways to view the attributes:

a. Data Layer Attributes. Under 'Layers' tab, right click on the data layer and select 'Open Attribute Table'. The attribute table for that layer will appear as a new window.



Opening attribute table

A screenshot of the QGIS Attribute Table window. The table has three columns: 'id', 'Name', and 'Type'. It contains 15 rows of data, including church names and their types.

id	Name	Type
1	St. James Church	Protestant
2	St. Mary's Church	Protestant
3	St. Mary's Church	Protestant
4	St. Mary's Church	Protestant
5	St. John's Church	Some
6	St. Mary's Church	Some
7	St. Mary's Church	Some
8	St. Mary's Church	Some
9	St. Mary's Church	Some
10	St. Mary's Church	Some
11	St. Mary's Church	Some
12	St. Mary's Church	Some
13	St. Mary's Church	Some
14	St. Mary's Church	Some
15	St. Mary's Church	Some

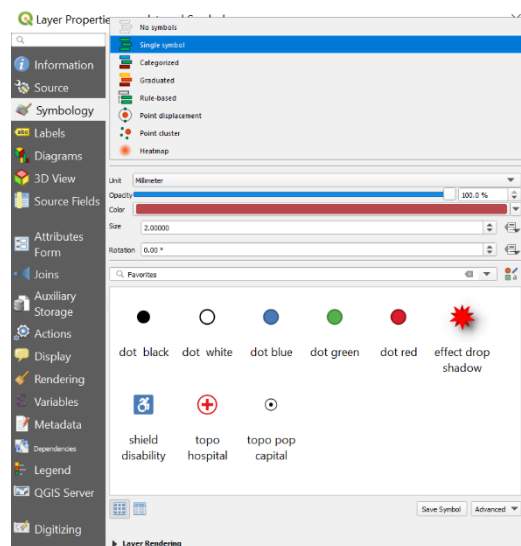
Attribute table

b. Feature Attributes. Under 'Layers' tab, click to highlight the layer of interest. On the top ribbon, select the 'Identify Features' button and click on the features of interest on the map canvas. A new tab will appear with the attributes for that feature.

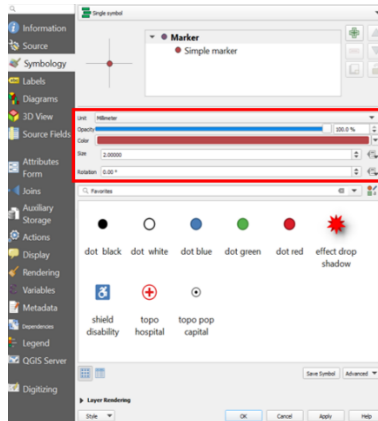


4.5 SYMBOLOGY

8. The symbology of the individual layers determines how it appears on the map (e.g. size, colour). Under 'Layers' tab, right click on the layer and choose 'Properties'. A new window will appear and choose 'Symbology' on the left tab. From the top drop down arrow, choose the appropriate symbology methods:

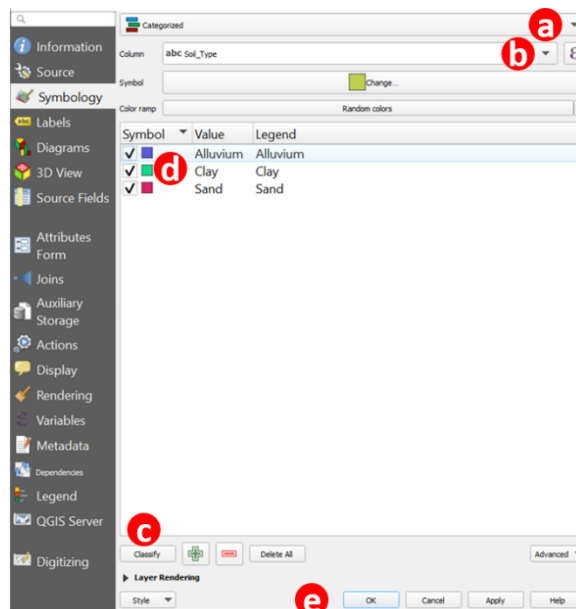


- a. Single Symbol. The same symbology will be applied to all features in the selected layer.
 - b. Categorised. For visualising features with categorical data (e.g, soil type).
 - c. Graduated. For visualising features with numerical data (e.g. rainfall) using graduated colours.
9. Single Symbol.
- a. Choose 'Single Symbol' from the top drop down arrow.
 - b. Select the opacity (transparency), colour and size as required.
 - c. Click on 'OK' to apply the changes.



10. Categorised.

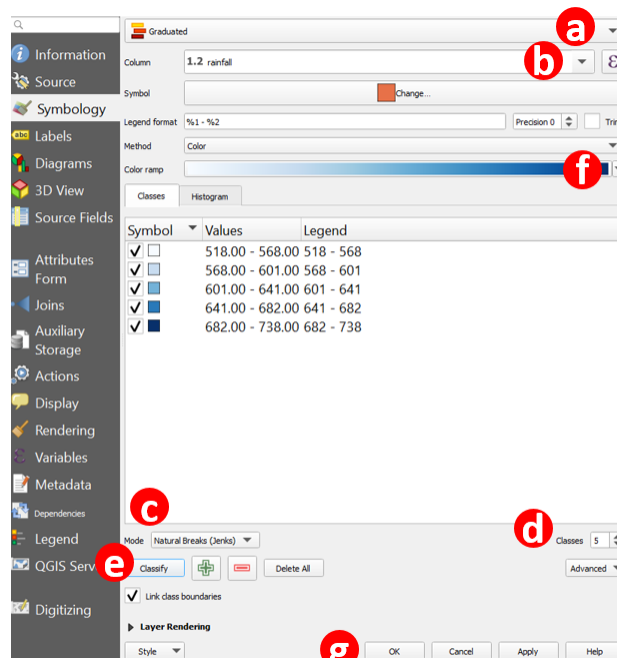
- Choose 'Categorised' from the top drop down arrow.
- Under 'Column', select the field containing the categorical data
- Click Classify to populate the 'Value' field (empty by default).
- Random colours will be assigned to each category. To change colour, double click on the entries under 'Symbol' field. The opacity, size (for points) or width (for lines) can be changed as well.
- Click 'OK' to apply the changes.



11. Graduated.

- Choose 'Graduated' from the top drop down arrow.

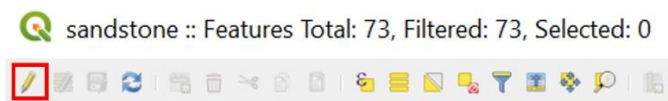
- b. Under 'Column', select the field containing the numerical data.
- c. Under 'Mode', choose the appropriate classification mode. Manual classification can be done at step e.
- d. Under 'Classes', define the number of classes
- e. Click Classify to populate the 'Value' field (empty by default). To manually edit the classification range, double click on the entries under Value field and input accordingly.
- f. Under 'Colour Ramp', choose the appropriate colour for the symbology
- g. Click 'OK' to apply the changes.



5. EDITING DATA LAYERS

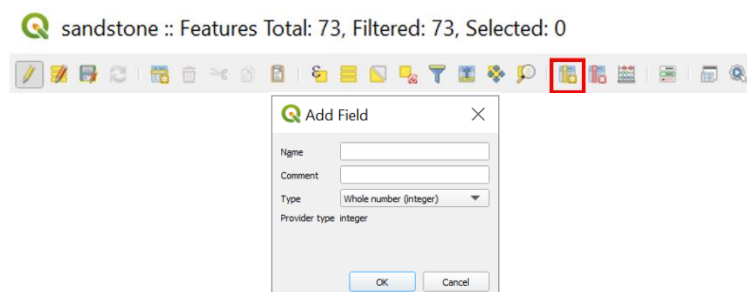
5.1 EDITING ATTRIBUTES

1. Start Editing. Under 'Layers' tab, right click on the layer of interest and select 'Open Attribute Table'. The attribute table for that layer will appear as a new window. Click on 'Toggle Editing Mode' button to start editing. Several kinds of editing can be done to the attribute table, including updating attributes, adding new fields and deleting existing fields.

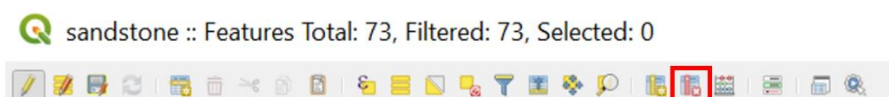


2. Update Attributes. On the attribute table, click on the entry that needs to be edited. The entry will be highlighted and can be edited. Press enter (or click anywhere outside the attribute table) when done.

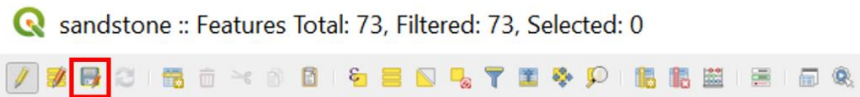
3. Add New Fields. To add new fields (i.e. column) to the attribute table, click on the 'Add Field' button. Input the Name, Comment and Type in the new window that appears. Click 'OK' when done and a new field will be added to the attribute table.



4. Delete Fields. Existing fields (i.e. columns) can be deleted by clicking on the 'Delete Field' button and selecting the desired field(s) in the new window that appears. Click 'OK' when done and the chosen field(s) will be deleted from the attribute table. To delete multiple fields, hold down shift key when selecting the fields to be deleted.

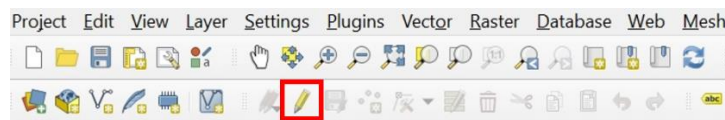


5. End Editing. To finish editing, click on the 'Toggle Editing Mode'. A window may appear prompting edits to be saved. Click on 'Save' to continue. To save edits without ending editing mode, click on the 'Save Edits' button.



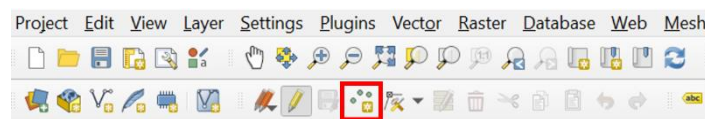
5.2 ADDING & DELETING FEATURES

6. Adding Features. Under 'Layers' tab, left click to highlight the layer to be edited. Click on 'Toggle Editing Mode' on the top ribbon to start editing.



a. In editing mode, more buttons are available for selection. To add new features, click on 'Add Point Feature' button.

[Note: If the selected layer is line or polygon, the 'Add Point Feature' button will be replaced by 'Add Line Feature' or 'Add Polygon Feature' respectively.]



b. The cursor will turn into a crosshair symbol. Click on the map canvas to start digitising.

i. Points. On the map canvas, click on the location where the point feature should be created.

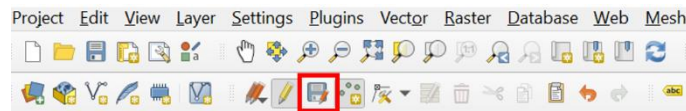
ii. Lines. On the map canvas, click on the starting point of the line feature. Continue the process until the ending point (click on ending point as well). There may be multiple points if the line is made up of multiple line segments. After clicking the ending point, right click anywhere on the map canvas to stop digitising.

iii. Polygon. On the map canvas, start by clicking anywhere along the polygon boundary. Continue the process by going one round along the boundary and clicking on it at regular interval (for irregular shaped polygon, points will need to be digitised at closer interval). After clicking the last point (just before returning to starting point), right click anywhere on the map canvas to stop digitising.

- c. Once a feature (point, line or polygon) has been digitised, a new window will appear. Populate the feature attributes and click 'OK' when done.

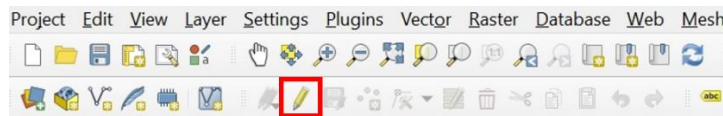
*[Note: The attributes can be populated or edited later by following the steps under the section **'Editing Attributes'**.]*

- d. To save edits, click on the 'Save Layer Edits' button on the top ribbon.

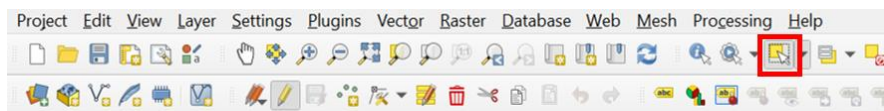


- e. Continue the process (b to d) if more features need to be digitised. Else, click on 'Toggle Editing Mode' again to end editing.

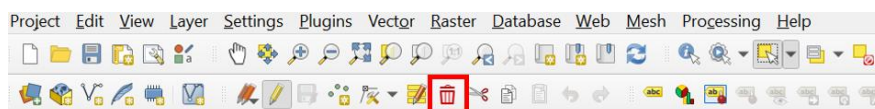
7. Deleting Features. Under 'Layers' tab, left click to highlight the layer to be deleted. Click on 'Toggle Editing Mode' on the top ribbon to start editing.



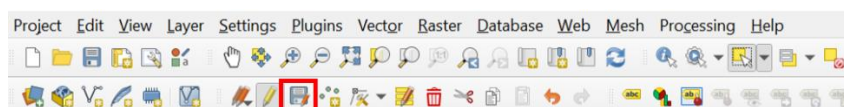
- a. Click on the 'Select Features by Area or Single Click' and select on the map canvas the features to be deleted. For multiple features, click and drag a rectangle to include all features to be deleted.



- b. Click on 'Deleted Selected' button and the selected features will be deleted.



- c. To save edits, click on the 'Save Layer Edits' button on the top ribbon.

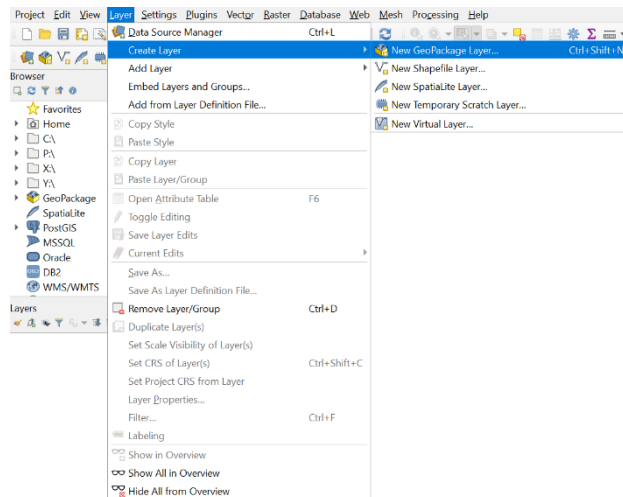


- d. Continue the process (b to d) if more features need to be deleted. Else, click on 'Toggle Editing Mode' again to end editing.

6. CREATING DATA LAYERS

6.1 CREATING NEW GEOPACKAGE LAYER

1. On the top ribbon, go to Layer > Create Layer > New GeoPackage Layer.

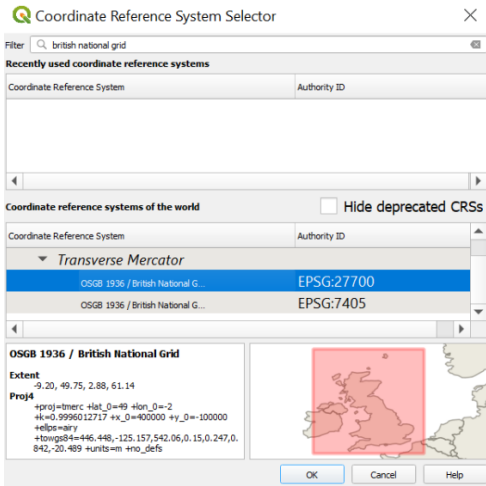


2. A new window will appear. Populate the entries as follows and click 'OK' when done.

 A screenshot of the 'New GeoPackage Layer' dialog box. It contains fields for 'Database' (with a browse button), 'Table name', 'Geometry type' (set to 'No geometry'), 'Include 2 dimension' and 'Include M values' checkboxes, a CRS dropdown (set to 'EPSG:4326 - WGS 84'), a 'New Field' section with 'Name', 'Type' (set to 'alphanumeric'), and 'Maximum length' fields, and a 'Fields List' table with columns 'Name', 'Type', and 'Length'. At the bottom are 'Advanced Options', 'OK', 'Cancel', and 'Help' buttons.

Table 1: Populating Entries for Creating New Data Layer

Entry	Description	Steps
Database	Can be either an existing or new GeoPackage	<u>New GeoPackage</u>: Click on the '...' button, navigate to the folder where the GeoPackage is stored and select the appropriate GeoPackage file. <u>Existing GeoPackage</u>: Click on the '...' button, navigate to the folder where the GeoPackage

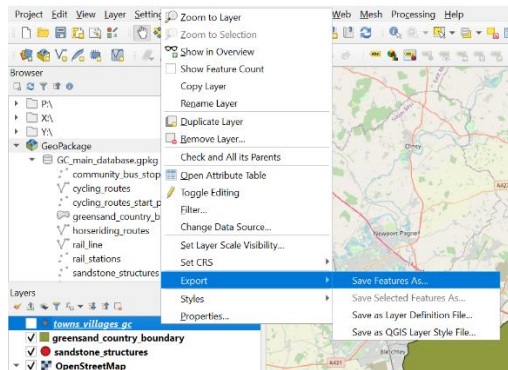
		will be stored and enter the filename of the GeoPackage.
Table Name	Name of the new data layer	
Geometry Type		- Select from the drop down list. The common types are points, lines and polygons. - Leave the 'Include Z Dimension' and 'Include M Dimension' unchecked.
Coordinate Reference System	This is the field just below 'Include Z Dimension';	- Click on the globe button and a new window will appear - In the search bar, enter 'British National Grid' - Select 'EPSG:27700' and click 'OK' 
New Field	Each field is a column in the attribute table of the new data layer	<u>Name</u>: Name of field <u>Type</u>: Data type (e.g. integers, decimals, text) <u>Maximum Length</u>: Maximum characters/length allowed for that field (Optional) - When done, click 'Add to Fields List' - Repeat the process for other fields. Note: fields can still be added/edited after data layer creation (see section on 'Editing Attributes') - To remove field, select the field under 'Field Lists' and click 'Remove Field'

3. The new data layer will appear under 'Layers' tab. To add features to the data layer, see section on '**Adding & Deleting Features**'.

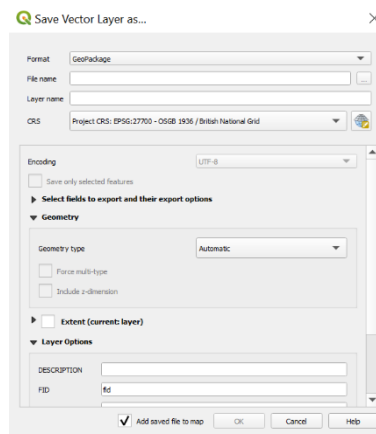
6.2 EXPORTING LAYERS TO GEOPACKAGE

4. Apart from creating a GeoPackage layer, one can also export existing layers to GeoPackage. This is required when one wish to add data layers from other databases to the GeoPackage.

5. On 'Layers' tab, right click on the layer to be exported. Select 'Export' > 'Save Features As ...'



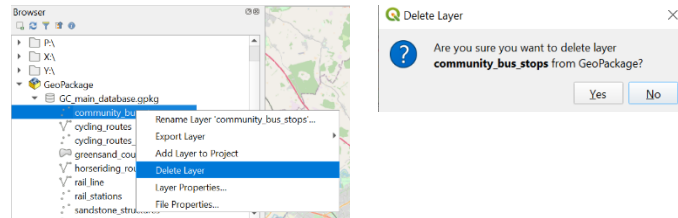
6. In the new window, populate the field as follows:



- Format: Choose GeoPackage from the drop down list.
 - File Name: Click on '...' on navigate to the desired GeoPackage.
 - Layer Name: Provide a name for the layer to be exported.
 - CRS: Choose British National Grid (EPSG:: 27700 – OSGB 1936) from drop down list.
 - Leave the rest of the field unchanged. Click 'OK' when done.
7. The layer will be exported to the desired GeoPackage. To check, load the GeoPackage (see **Section 3.3**) and refresh if need be.

6.3 DELETING LAYERS FROM GEOPACKAGE

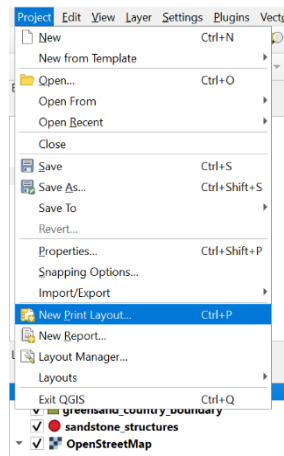
8. To delete layers from GeoPackage, first load the GeoPackage and expand the layers within it (see **Section 3.3**). On the 'Browser' tab, right click on the layer to be deleted and select 'Delete Layer'. Click 'Yes' when prompted for confirmation.



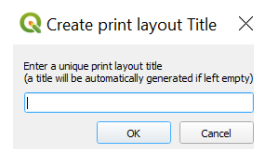
7. MAP LAYOUT

7.1 CREATING PRINT LAYOUT

1. There may be times where map sharing is required for presentation purpose. Sharing the GeoPackage or project file is not useful unless everyone has QGIS to open it. However, QGIS allows maps to be exported to a format that anyone's computer can read (e.g. PDF), as well as printing out the map if a printer is connected.
2. On the Map Ribbon, go to Project > New Print Layout. In the new window that appear, provide a title/filename and click 'OK'.

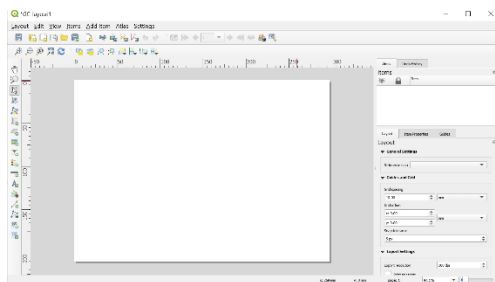


Creating new print layout

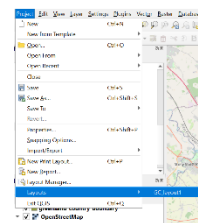


Provide title/file name to layout

3. A new window containing an empty print layout will appear. This new print layout can also be accessed by Project > Layouts. The center white portion of print layout window is known as the layout canvas.



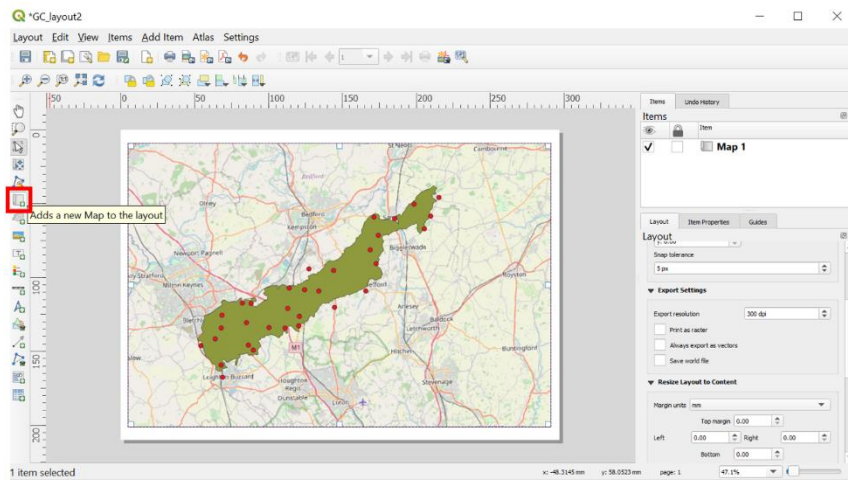
New print layout



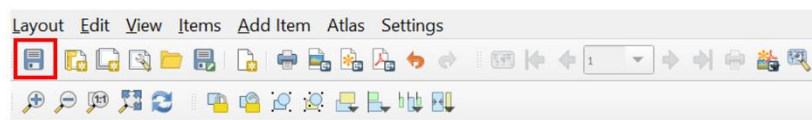
Accessing print layout from Project > Layouts

4. In the print layout, click on 'Add a new Map to Print Layout' (along left tab). Move cursor to the print layout map canvas. You will now have to define the size of the map on the canvas. Start at the top left hand corner, hold down the left mouse button and drag to the bottom right before releasing it. A map will now appear on

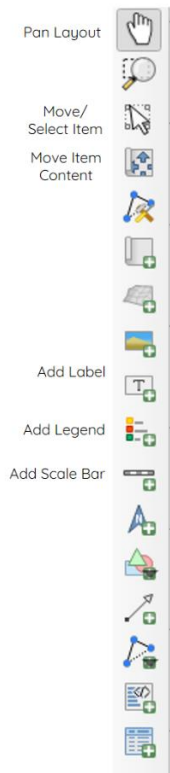
the map canvas. If there is a need to re-draw, click on 'Select/Move Item' (third button on left tab), select the map drawn on canvas and press 'Delete' button on keyboard. Repeat the drawing as above.



5. Save Layout. To save layout, click on the save button at the top ribbon of layout window. It is recommended to save layout regularly.



6. Basic Tools. On the left tab, there are various tools to assist in designing the print layout.

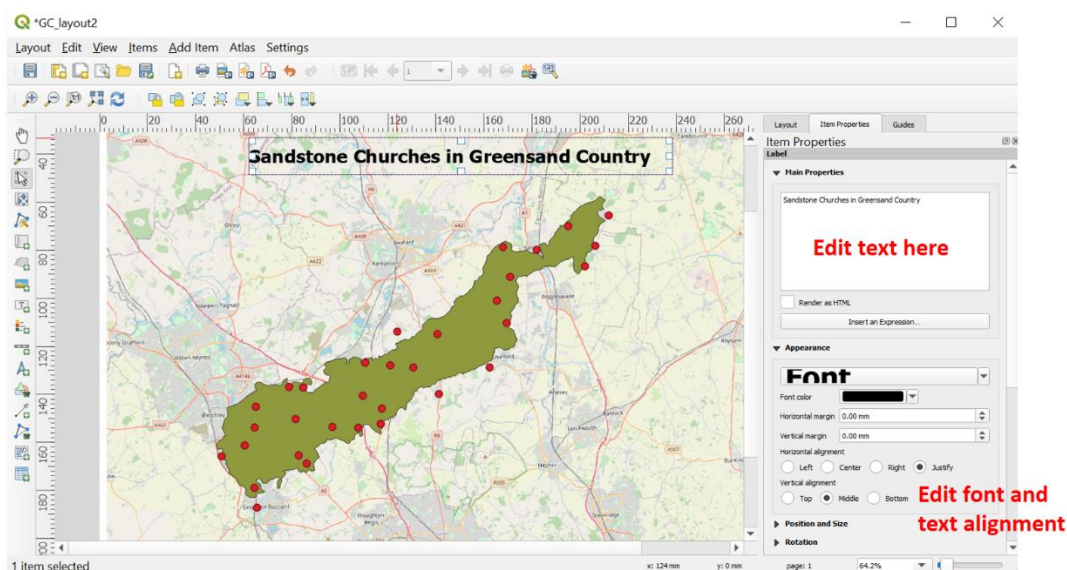


- a. Pan Layout. To pan print layout (not map). To pan map, use 'Move Item Content'.
- b. Move/Select Item. Use this to select item on layout canvas (e.g. map, text, legend, scale bar, etc.)
- c. Move Item Content. Use this to pan and zoom in/out map (not layout canvas)
- d. Add Label. To add title and other texts to layout canvas.
- e. Add Legend. To add legend to layout canvas.
- f. Add Scale Bar. To add scale bar to layout canvas
- g. Zoom. Use the mouse scroll to zoom in/out of the print layout (not the map). To zoom in/out of map, select 'Move Item Content', click on the map on layout canvas and use mouse scroll to zoom in/out.

7.2 ADDING TEXT

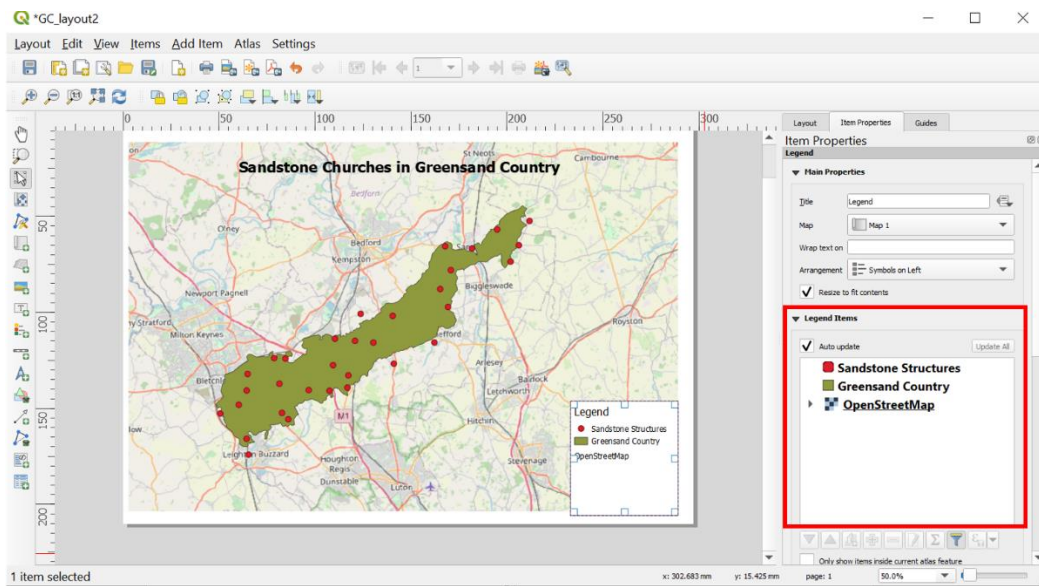
7. Use the 'Add Label' button on the left tab to add text to layout canvas. Click on it and move mouse cursor to within layout canvas. Click and drag to define a textbox. Upon releasing the mouse, a textbox should appear on layout canvas. To edit text, right click on textbox and select 'Item Properties'

8. A new tab will appear on the right. The text can be edited under 'Main Properties'. Under 'Appearance', the font and text alignment can be adjusted.



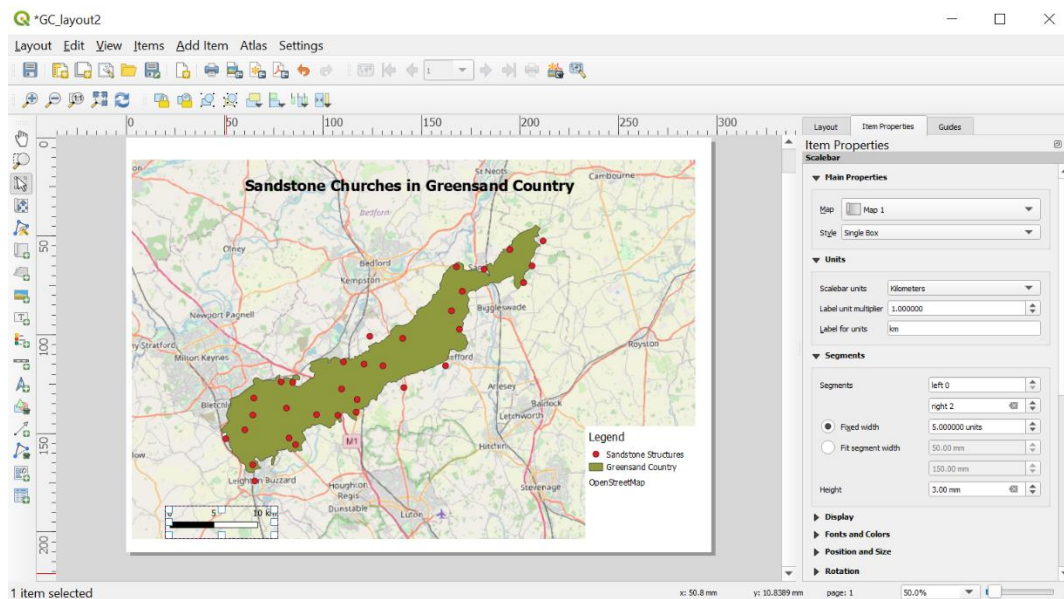
7.3 ADDING LEGEND

9. Use the 'Add Legend' button on the left tab to add legend to layout canvas. Click on it and move mouse cursor to within layout canvas. Click and drag to define a textbox. Upon releasing the mouse, a legend should appear on layout canvas. To edit, right click and select 'Item Properties'
10. A new tab will appear on the right. The layers' name in legend can be edited under 'Legend Items'. Double click on the layer to be edited and provide the desired layer name.



7.4 ADDING SCALE BAR

11. Use the 'Add Scale Bar' button on the left tab to add scale bar to layout canvas. Click on it and move mouse cursor to within layout canvas. Click and drag to define a textbox. Upon releasing the mouse, a scale bar should appear on layout canvas. To edit, right click and select 'Item Properties'. A new tab will appear on the right and necessary edits can be done.



7.5 PRINTING & EXPORTING TO PDF

12. The layout can be exported to PDF. Go to Layout > Export as PDF. Click 'Close' if a warning window appear. Save the PDF to the desired location.
13. The layout can also be printed out as hardcopy if there is a printer connection. Go to Layout > Print. Set up the printer settings accordingly.

8. RESOURCES



Additional resources can be found at:

- QGIS Tutorials: <https://www.qgistutorials.com/en/>
- QGIS User Guide: https://docs.qgis.org/testing/en/docs/user_manual/

9. ACKNOWLEDGEMENT



This QGIS Quick User Guide results from an MSc Group project undertaken by MSc students studying at Cranfield University who, in 2021, worked with Greensand Country Landscape Partnership to develop StoryMaps for public engagement.

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