QGIS-EX01 v3.0: QGIS Essentials - Exercises

10. QGIS Essentials: Exercises

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An Astun Technology QGIS Training Module

Code	QGIS-EX01
Title	QGIS Essentials - Exercises
Description	A set of exercises to support the QGIS Essentials course.
Required Software	QGIS v 3.0 or later
Target Audience	QGIS Desktop users
Updated	23 Aug 2018
Updated by	Antony Scott
Status	Complete

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These exercises are designed to give you hands-on experience of the main techniques covered in the course notes and slides. Explore other features of QGIS, and don't hesitate to ask if you need help.

10.1. Getting Started

10.1.1. Objective

Get familiar with the QGIS interface, layer management, customisation and configuration, plugins.

10.1.2. Get started and tidy up

1. Start QGIS.
2. Arrange the toolbars and panels, switching off toolbars you don't need for now (keep **Attributes**, **Data Source Manager**, **Label**, **Map**, **Project**)
3. Go to **Settings > Options > General** and review the settings, making any changes which are helpful - ' e.g. icon sizes, paths, language
4. Go to **Settings > Options > CRS** and change **Default CRS for new projects** to **British National Grid**, and the **CRS for new layers** to **Use project CRS**

10.1.3. Open a project and arrange layers

1. Go to **Project > Open**, and open the project file .../**QGIS Training/Essentials 3/Projects/essentials_01_gettingstarted.qgs** and save with a new name - create a new folder under **Projects** for your own work
2. The project will open with a set of point, line and polygon layers
3. Rearrange the layers so that they are ordered in a way that they are all visible in the map
4. Create a group using the **Add Group** button in the **Layers** panel , and put some of the layers in it
5. Go to **Project > Properties > General** and give the project a title
6. **Right-click > Rename** to make layer names more readable
7. Zoom to a scale where the layers are all readable

10.1.4. Manage plugins

1. Go to **Plugins > Manage and Install Plugins**
2. In the **Settings** tab, check **Show also experimental plugins**
3. In the **All** tab, browse the plugins, and install **QuickMapServices**
4. Load this plugin (it should now be in the Web menu), for example by adding the **OSM Standard** layer
5. Install any other plugins which look useful

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10.2. Working with Vector Data

10.2.1. Objective

Load vector layers from various sources, create a table join with some non-spatial data.

10.2.2. Add Layers

> **Data location**
> All vector data is in **...\QGIS Training\Essentials 3\Data\vector.** You may find it helps to use the file filter to look for only files of a certain type.

1. Open the project from the previous exercise
2. Using the **Data Source Manager**, add file-based data:
    1. Shapefile: add **wind_turbines_point.shp**
    2. MapInfo: add **aonb_wales.mif**
    3. CSV: add **playgroundsdata.csv** - note that this data is in WGS84
3. Add PostGreSQL data
    1. Create a connection to the database: **Data Source Manager > PostgreSQL > New**
    2. Complete the connection details as below, using the Basic tab under authentication - note the user credentials are **pgis/pgis**

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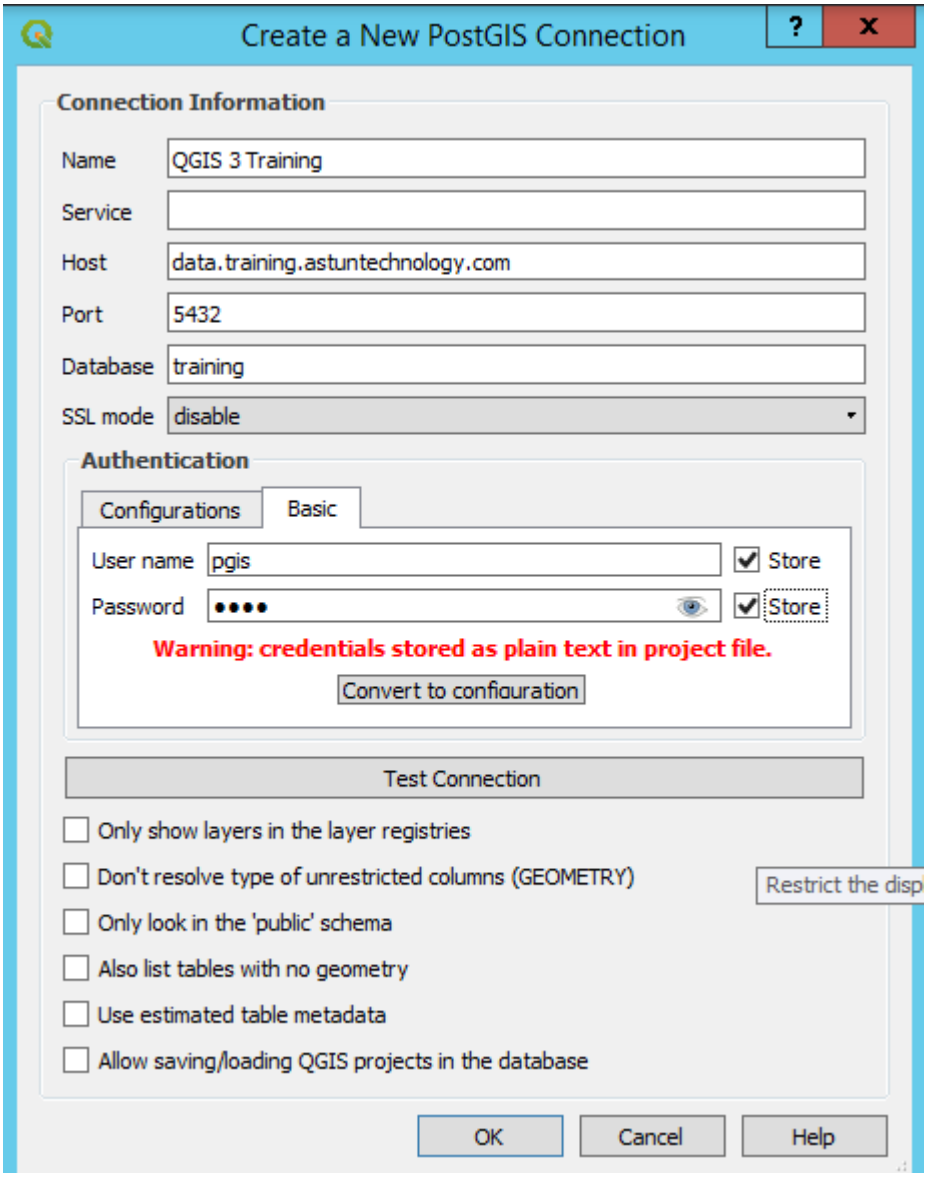

3. Click Test Connection to make sure you can connect to the database - if successful, you will see a confirmation message
4. Click **OK**, then **Connect** to open the connection
5. Browse to **boundaryline > county_region** and click Add, then Close

4. Add WFS data
    1. Create a WFS connection **Data Source Manager > WFS > New**
    2. Complete the credentials as below (you may find it easier to search for the link on http://data.gov.uk)

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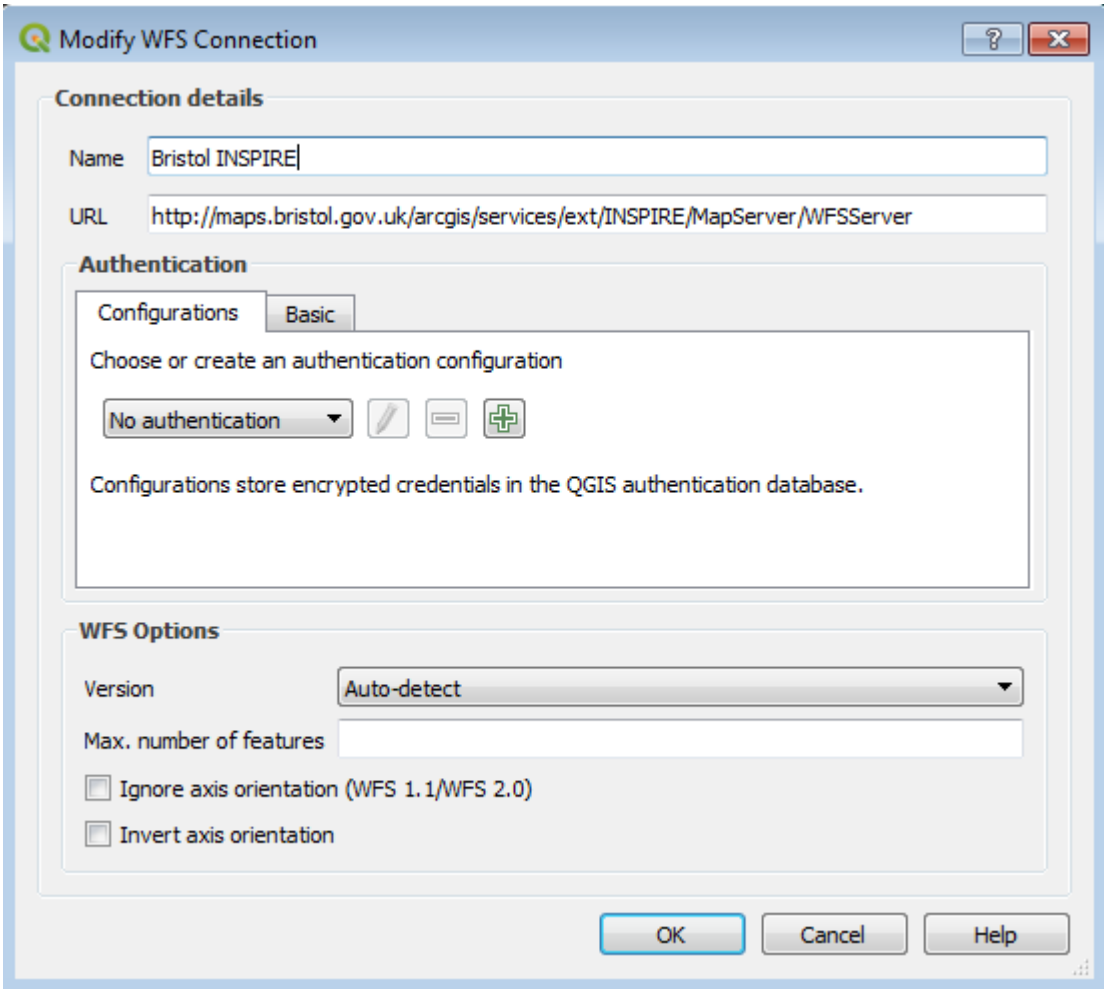

3. Click **OK** then **Connect**
4. Click on the layer you want to load, then **Add** and **Close**

10.2.3. Attribute Tables

1. Open the attribute tables for some of the layers, and see how the data in the attribute tables relates to the features on the map
2. Select an item in the attribute table by clicking on the row number - it will also be selected on the map
3. Click on the column headers to sort the table using that column

10.2.4. Add Non-spatial Tables and Create a Join

1. Go to **Data Source Manager > Delimited Text**
2. Browse to **Index_of_Multiple_Deprivation_December_2015_Lookup_in_England.csv** and load it - you will need to set the Geometry Definition to **No geometry**
3. Go to **Data Source Manager > GeoPackage > New**
4. Select **LLSOA_Dec_2011_England_Wales.gpkg**
5. Click **Connect**, then select the table and **Add**
6. Open the attribute tables for both **Index_of_Multiple_Deprivation_December_2015_Lookup_in_England** and **LLSOA_Dec_2011_England_Wales** - notice that **LSOA11CD** in the former has a one-to-one relationship to **lsoa11cd** in the latter
7. Follow the course notes to create a join between these two layers
8. Check the attributes of **LLSOA_Dec_2011_England_Wales** to ensure the data has been joined correctly

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9. Save the project

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10.3. Styling Maps

10.3.1. Objective

Add styling to the data you have been working with, replacing the QGIS default styling, and add some annotations and labels.

Use the project you created in the last exercise, or if you don't have it, open **essentials_03_styling.qgs** an d save it with a new name.

10.3.2. Styling the Map

1. Create a **Single symbol** style for the **canal_crt** layer- use and amend one of the QGIS styles, or create your own from scratch
2. Create a **Single symbol** style for the **wind_turbines_point** layer, using a **SVG** or **Font** marker
3. Create a **Categorized style** for **aonb_wales**, with a suitable fill - use transparency or hatching to make the layers underneath visible
4. Create symbols and name labels for the **railway_naptan** layer
5. Create a **Graduated style** for the **LLSOA_Dec2011_England_wales** layer, using the **IMD15** field

10.3.3. Add Annotations

Add two or three text annotations to your map, indicating some points of interest from the OS OpenData layer, with appropriate text. Edit the formatting, and choose a different symbol for each annotation.

10.3.4. Loading a Style

This section covers the use of a ready-made style - for this you are going to use OS MasterMap, and load a saved style from a qml file.

1. Load the **osmm_topo_area** shapefile
2. Zoom to extents, noting the sample covers the city of Exeter
3. Load the style for MasterMap **osmmstyle.qml**
4. Have a look at the style, and how it is constructed

10.3.5. Additional Tasks

1. Apply a **Categorized** style to **wind_turbines_point**, using the **STATUS** field for example
2. Look at some of the fill styles for polygons under **Symbol** layer type - for example **Centroid fill**, **Sha peburst fill**
3. For a line or point, create a symbol with multiple components

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10.4. Selecting and Querying

In this exercise, you will work on selecting features, and writing and running queries to filter layers.

You can work with the same project as you were using for the previous exercise, or load a fresh version of it from **essentials_03_styling.qgs** and save it under a new name in your **Documents** folder.

10.4.1. Identify Features

1. Use the **Identify Features t**ool to look at attribute values on some of your layers
2. Have a look at the **Derived** section, and use the **Auto open form** option to see a forms dialog

> **Forms**
> Note that this dialog will only appear if you have selected a single feature - you may need to zoom in to do this.

10.4.2. Manual Selection

1. Use the selection tools to create some manual selections on the map, and compare the results in the attribute table for the layer
2. Make manual selections in the attribute table, and use the **Zoom map** and **Pan map** tools to view them in the map

10.4.3. Selection using an Expression

1. In the attribute table for **LLSOA_Dec_2011_England_Wales**, select the 100 LLSOAs with the highest Index of Multiple Deprivation - note that the **IMD15** field is a ranking, so the lowest number represents the highest IMD
2. Save the selection as a new GeoPackage file in your **Documents** folder
3. Using the new layer of top 100 LLSOAs, select those where the area is less than 100,000 hectares
4. Select all the LLSOAs in Tower Hamlets, using **ILIKE** (for a case-insensitive search) and the **%** wildc ard character

10.4.4. Field Calculator

1. Create a new field which contains the name without the code at the end - i.e. omitting the last five characters
2. You may want to do this in two steps - either by creating two columns, or by nesting the operators:
    1. Using the **String** operator **length** to get the length of each name
    2. Create a new field of datatype **string**, with a length which is five characters less than the original, using the **left** operator

10.4.5. Spatial Queries

1. In **LLSOA_Dec_2011_England_Wales**, use **Select Features by Value** on the **Attributes** toolbar to select LLSOAs in Tower Hamlets (you can use **Starts with** from the **Exclude field** dropdown on the right)
2. Use **Select by location** in the **Processing Toolbox** to find all railway stations which fall within these LLSOAs

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3. Use **Join attributes by location** to add the attributes of the containing LLSOA features to each of the the railway stations you have found in Tower Hamlets

10.4.6. Filter Layers

1. Use one of the queries you have already created - or create a new one - and apply to one of the layers on the map
2. Apply the same query as an attribute table filter

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10.5. Loading Raster Data

This exercise shows you how to add raster background mapping layers, and to add a set of raster images from a folder.

10.5.1. Load individual rasters

1. Create a new project file and save it in your **Documents** folder
2. Click **Open Data Source Manager**, then **Raster**
3. Browse to and open the .tiff files in **Data/raster/1250K** (use Ctrl-click to select multiple files)
4. Create a group, and put these images in it

10.5.2. Create a Virtual Raster

> **Virtual Raster**
> Note that this exercise takes several minutes to run in the AppStream environment - you will need to wait for the processing to complete.

1. Go to **Raster > Miscellaneous > Build Virtual Raster**
2. Select the files you want to include in the raster - use the files in **Data/raster/VMD**
3. Uncheck **Place each input file into a separate band**, and set a location for the output file
4. Click **Run in Background** to create the virtual raster and load it into the map - this will take several minutes to complete
5. Set scale dependencies on the raster layers you now have loaded, so they appear at appropriate scales

10.5.3. Load WMS layers

1. Go to http://data.gov.uk (or another site with WMS data sources if you prefer)
2. Search the site for a WMS layer, and copy the link
3. Use the **Data Source Manager** to create the connection, and load layers from the site

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10.6. Data Creation and Editing

This exercise covers creating and editing vector data, both in the map and in the attribute table.

10.6.1. Create features

1. Create a new GeoPackage layer in your **Documents** folder. Ensure that it is a polygon type, and has the following attributes:
    1. **name** (text)
    2. **date** (date)
    3. **reference** (integer).
    4. Specify the CRS as **EPSG:27700**
2. Create two or three new features in the layer, populating the attributes when prompted
3. When this is done, open the attribute table for the layer, and make further edits

10.6.2. Edit features

1. Open one of the layers you have been using, and amend the geometry of some of the existing features, including lines, points and polygons
2. Use **Copy/Paste** to create new features
3. Use the tools in the **Advanced Digitizing** toolbar to amend the geometry, including
    a. **Split Features**: craw a line across a feature to split it into two
    b. **Extend Features**: draw an extension to a feature
    c. **Rotate Features**: turn features round
    d. **Add part**: add a new part to a multipart features

10.6.3. Snapping and tracing

1. Turn on the **Snapping Toolbar**, and activate snapping
2. Use the second button to go to **Snapping Options**, and set snapping to one of the layers - for example **railways_naptan** - with a tolerance of 50 metres
3. Create a new line layer, and draw lines between railway stations to create a representational map of part of the railway network, with vertices snapping to existing stations
4. Turn on **Enable Tracing** in the toolbar, and create a new AONB, which adjoins one of the existing AONBs, using tracing to make part of the boundary coincide
5. Tun on **Enable Topological Editing** in the toolbar, and adjust one of the common boundaries in a polygon layer, for example in **LLSOA_Dec_2011_England_Wales**

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10.7. GeoProcessing for Analysis

This exercise uses a combination of geo processing techniques to address some spatially-related questions.

10.7.1. Buffer and select points in polygon

1. Create a new project and save it
2. Open the **nat_parks_england** and **railway_naptan** layers
3. Create a 10km buffer round the Lake District National park
4. Use **Select by location** to find out how many railway stations are within 10km of the park

10.7.2. Create centroids and a distance matrix

1. Open the **county_region_england** layer
2. Use the **Centroids** process to create a layer of the centroid of each county
3. Use a **Distance Matrix** to find the three nearest railway stations to each centroid

10.7.3. Create a hexagon grid and a point count

This stage visualises the density of railway stations across Great Britain.

1. Using the **Create grid** tool, create a hexagon grid to cover the extent of the railway stations layer
    a. Zoom to the extents of the railway stations layer
    b. Create a 30km hex grid for the extents of the layer, with settings something like:

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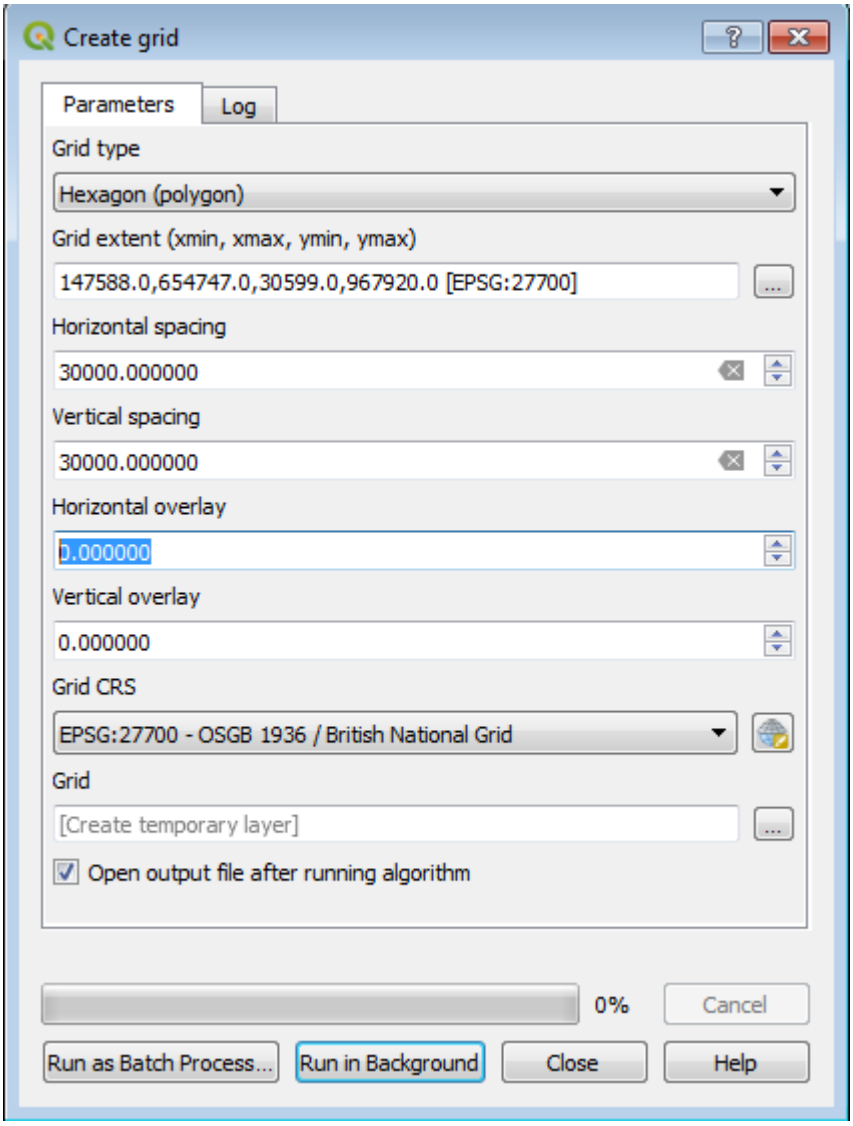

b. Use **Count points in polygon** with the grid as the polygon layer, and the railway stations as the poin ts layer
c. Create a style to visualise the results, using the field name specified in **Count field name** in the previous step (e.g. **NUMPOINTS**)

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10.8. Print Layouts

Use a project file from an exercise of your choice to create a Print Composer page. Use as many of the tools and features as possible, as covered in the course notes, including:

- **Legend**: including editing the legend in the Print Composer
- **Scalebar**: including adjusting settings
- **Image**: of your choice
- **Text**: try using some HTML, and/or an expression
- **Table**: change the settings to include a subset of the attributes
- **Overview map**: with an extent indicator on the main map, formatted as a red outline

When you have loaded all the elements onto the page, if you have time, fine-tune the layout to improve the quality and usability for the reader.

When you have finished, save the result as a PDF and also as a PNG image into a suitable location, with your name as part of the filename - we will review some of the final maps together.

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