



## SUMMARY

GSKY is currently being delivered through an in-house program, **TerriaMap**<sup>1</sup>. As such, it is fine tuned for displaying the GSKY Map Services. However, there is not a wider user base for TerriaMap and hence to attract more users for the GSKY service we must provide more common GIS software as clients of GSKY server. The QGIS is one of many being considered.

This Word/PDF document is an expanded version of the Power Point presentations that describe the same software and service. The latter are quicker and easier to get a basic understanding, whereas this document gives more in-depth knowledge into the workings.

## DISCLAIMER

While this document is more detailed, it is by no means a comprehensive documentation for either QGIS or GSKY. You must consult the [QGIS Training Manual](#) and/or the [GSKY Manual](#) for more details. While every effort has been made to acknowledge the original sources of information, via back links, omissions may exist. This document is based on the author's current understanding of QGIS and GSKY and may evolve over time.

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<sup>1</sup> TerriaMap is a derivative of the public domain program, TerriaJS, developed by CSIRO for use as a GSKY client software for two specific organisations, viz. GEOGLAM and GeoScience Australia.

## INTRODUCTION

The NCI-developed **GSKY** service provides a new approach to online analysis and visualisation of environmental data. GSKY provides an ability for users to interact with datasets and the information they contain using standard community protocols. [[Ref 1](#)]

GSKY accesses and analyses the big geospatial data on NCI's cloud and high-performance computing systems, and then delivers it to a user device or website. For example, hundreds of time series and geospatially overlapping data can be seamlessly merged together, allowing researchers to focus on the information rather than dealing with data files. Furthermore, using GSKY's processing capability, that data can be analysed on the fly using user-provided algorithms to extract new information over both space and time. [[Ref 1](#)]

Behind the scenes, GSKY works out how to manipulate the datasets so that they seamlessly work together. For example, in large-scale environmental analyses, the images from different satellites can be in different shapes and sizes, environmental survey data can come in many different formats, and even urban boundary maps need to be considered. As a user of GSKY, working with data is as easy as choosing from a list of available datasets, specifying a region and time frame, and asking GSKY to analyse the information as harmonised data. GSKY then returns the results of the data required, which can be accessed over the network to the client application or for visualisation in an online map. [[Ref 1](#)]

The CSIRO-developed **TerriaMAP** is derived from **TerriaJS** which is an open-source framework for web-based geospatial catalogue explorers. TerriaJS is an innovative open source solution enabling publishers to efficiently get their spatial data on the web, including 3D and 4D data. [[Ref 2](#)]

Assemble catalogues of spatial datasets with a combination of hand curation and live querying of online data services. TerriaJS powers world-leading platforms such as Australia's NationalMap and the Australian Renewable Energy Mapping Infrastructure (AREMI), and facilitates the exploration of satellite imagery from Digital Earth Australia. [[Ref 2](#)]

**QGIS** is a user-friendly Open Source Geographic Information System (GIS) licensed under the GNU General Public License. QGIS is an official project of the Open Source

Geospatial Foundation (OSGeo). It runs on Linux, Unix, Mac OSX, Windows and Android and supports numerous vector, raster, and database formats and functionalities [[Ref](#) <sup>3</sup>]

## RATIONALE

QGIS is a much more widely used GIS software and as such its user-base would be considerably larger than that of TerriaMap. More organisations may be inclined to use the GSKY service if QGIS can be demonstrated as its client. Besides the ubiquity of QGIS, the various functions and settings available in this software may become useful for analysing the GSKY-provided data in a much more meaningful way. It may also lead to adding more functions into GSKY itself.


## SCOPE OF THIS DOCUMENT

This document is primarily intended to be a beginner's resource to learn the use of QGIS as a GSKY client software. It is based on the Power Point Presentations of the same material, with added explanations and different methods of navigation. Together with the PPTX this document is expected to give the necessary basic understanding to use QGIS as a GSKY client. While the PPTX is a 10-minute study resource, this document may require 2 – 3 hours to learn fully. It will be more useful as a reference document after you have started using QGIS.

## STRUCTURE OF THE DOCUMENT

The pages that follow will display each slide in the PPTX with descriptive text for the steps in each slide. The graphics and text that are animated in the PPTX are displayed here as static images and text. To prevent cluttering, some sections may be hidden.

## Slide 2



# SUMMARY

In this tutorial we address the following:

- Introduction to QGIS and Technical Specifications.
- Install and configure a desktop version.
- Use QGIS as a GSKY client.
- Advanced usage of QGIS.

**NOTE:**

This slide show is a quick way to learn the basic usage of QGIS in relation to using it as a GSKY client. The intention is to reduce the learning time from several hours to a few minutes, but it will not make you an expert in the use of QGIS or GSKY through QGIS. For those who wish to learn deeper, see the PDF document which gives both pictorial and textual description of all that in this slide show and more.

- Slides 3 - 7 describe the use of QGIS as GSKY client.
- Slides 8 - 11 describe the advanced usage of QGIS.

Animated slides that follow will describe the usage stop-by-step. It is important to run as a slideshow to see the full pictures.


**Slide show will start in 5 sec.**

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This is a summary slide that says what to expect in the PPTX presentation.

## Slide 3



## Introduction to QGIS

**QGIS** is a Free and user friendly Open Source Geographic Information System (GIS) licensed under the GNU General Public License. QGIS is an official project of the Open Source Geospatial Foundation (OSGeo). It runs on Linux, Unix, Mac OSX, Windows and Android and supports numerous vector, raster, and database formats and functionalities. The latest release is QGIS 3.4 [\[Ref\]](#)

In this tutorial we plan to explore the installation of **QGIS 3.4.x**, its basic usage and the use of QGIS as a GSKY client.

The last released older version of QGIS, probably deprecated soon, is 2.18.28.

The one integrated into NCI's VDI is v 2.14.8. There are problems with the older versions to use them as GSKY clients, but we are investigating how to overcome those.

<https://download.qgis.org/>  
**Download QGIS** for your platform.  
 Binary packages (installers)

**Next: First and/or Clean Installation**

**TECHNICAL**

- The current released version of QGIS is 3.4.4.
- We are working on 3.5-Master. It will go into feature freeze on 2019-01-18 12:00:00 UTC and be released as 3.6 on 2019-02-22 12:00:00 UTC.

Event	Latest	Repo	Phase	Date	#	Weeks
LTM/PS	3.4.0	2.18.28		2018-10-28	43	4
PS/FF	3.4.4	2.18.28	3.5	2018-01-18	5	5
L/PPS	3.6.0	3.4.0		2019-02-22	8	4

**Event** Description

- LTM Long term release, begin of new development phase
- LT Regular release, begin of new development phase
- FF Feature freeze, end of development phase
- SP Soft freeze with bi-monthly vote
- PR Point release of latest release and LTM branch
- EPS Extra Point release

QGIS is developed using the [Qt toolkit](#) and C++.

QGIS supports a number of raster, vector and mesh data formats, with new support easily added using the plugin architecture.

[Read](#) more about QGIS and the supported data formats.

[Clone the GitHub Repo](#)

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This slide gives a basic description about QGIS and its Release Roadmap. The latest stable version at the time of writing this document was QGIS 3.4.4-3. However, the public [download link](#) led to v 3.4.4-1 instead of [3.4.4-3](#) that is available in the background. Both appeared to be identical in all the tested areas and are not expected to differ in the next release. The release [roadmap](#) states that 3.4.4 will be released as v 3.6.0 on 22 Feb, 2019 but may not replace 3.4.0 until an unspecified time in the future.

QGIS is developed using the [Qt toolkit](#) and C++.

[Read](#) more about QGIS and the supported data formats.

[Clone the GitHub Repo](#)

<https://download.qgis.org/>

**Download QGIS** for your platform. Binary packages (installers)

## Slide 4

1. Download the installation package and double click the saved file.

2. Launch the software

**Next: Configure the project properties**

**TIP:** For a clean start, delete the cache and previous settings, if any. This is useful if you re-install QGIS. It can be done at any time to discard previously cached images and settings for a clean start.


Delete `C:\Users\userID\AppData\Roaming\QGIS`

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This is an animated slide that shows the process of downloading and installing QGIS 3.4.4.x. Just by looking at the slide it is not possible to see all controls and processes. It must be run as a slide show to see the process in action.

To run slide-show:

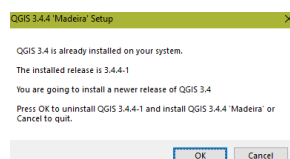
- Top menu bar: Click 'Slide Show | From Current Slide'
- Bottom status bar: The slide-show icon (  )
  - Will run the show automatically.
  - Turn off the 'Use Timings' for manual control.
  - Left arrow to stop and rewind to beginning.
  - Right-arrow to forward manually.
  - Esc to cancel the slide show.

## Download and Install



- Double-click the saved file to start the installation. Requires administrator privilege.

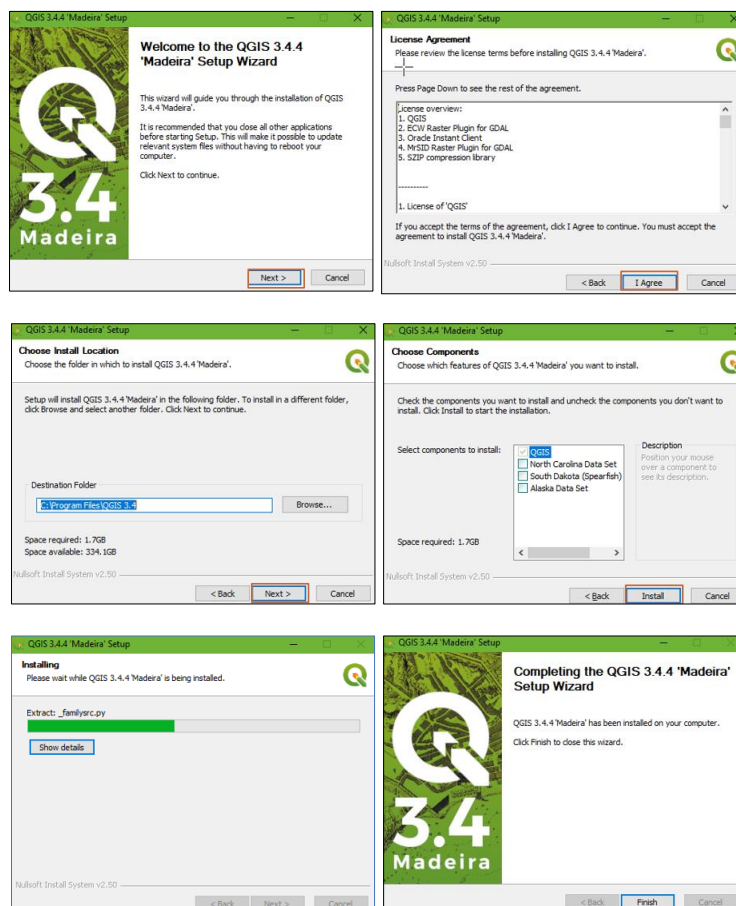
If you have previously installed the software, it will ask whether to uninstall it first. Say OK to uninstall.



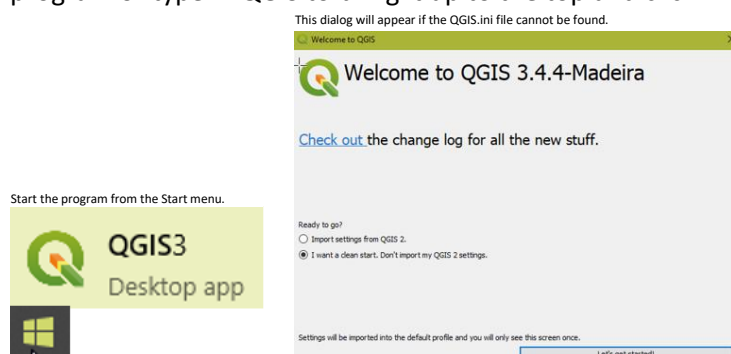
If you do not wish to retain previous settings and caches of images and data, you can force a clean installation. Instructions are given later in this slide.



After the Uninstall, if required, it will confirm to install the software. Go through the normal process of installing any Windows software, accepting all defaults.



After the program is installed, it can be launched from the Start menu. Though it adds to the start menu, a desktop icon is not created as is normal with others. To launch, click Start and locate the program or type in QGIS to bring it up to the top and click.

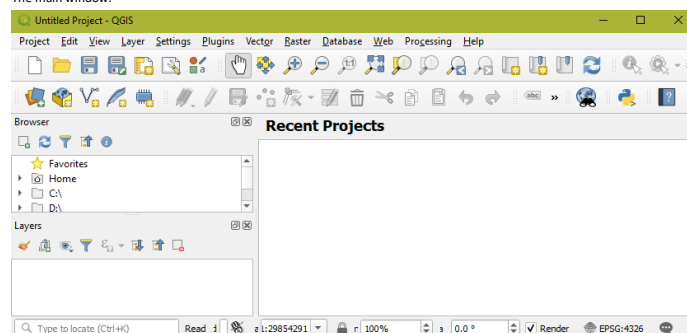


If this is a first-time installation, the start window will ask to confirm a clean installation. If not, it will use the previously set configurations and cached data. If you want to discard all previous settings and data, and force a clean start, then delete or rename the following directory on your PC before launching the software.

> This PC > OS (C:) > Users > avs29 > AppData > Roaming > QGIS >  
 where 'avs29' is your user ID.



The main window.



Configuring project properties and adding layers will be demonstrated in the next slide onwards.



## Slide 5

This step is required only once after a clean installation.

1. Choose Project | Properties from top menu and click CRS.
2. Type in 3857 in 'Filter'
3. Click 'WGS 84 / Pseudo-Mercator' and click Apply/OK.
4. Set the view panels

Next: Add a Base Map

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By default, the Coordinate Reference System (CRS or SRS) in QGIS is set as EPSG:4326. It sends the Lat/Lon coordinates as degrees, whereas GSKY expects them in meters. Hence, it is necessary to change this into EPSG:3857

The main menu. Set the properties first.

The default CRS is EPSG:4326. GSKY needs EPSG:3857

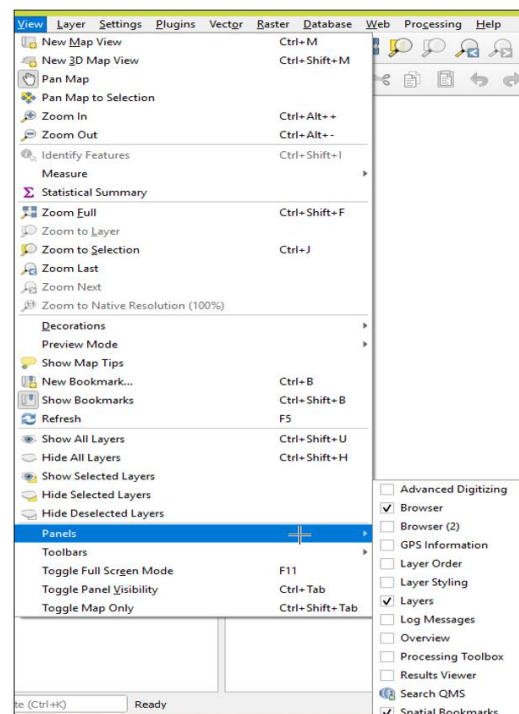
Change the CRS to EPSG:3857

### To set EPSG:3857

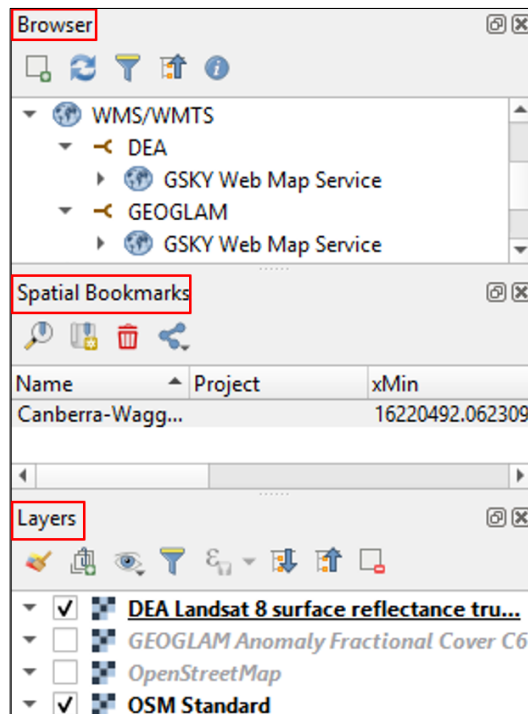
- Click 'Properties | CRS'
- Type in 'Filter:3857'
- Click 'WGS 84 / Pseudo-Mercator'
- Click 'Apply' and 'OK'

The quick access panels on the left border are useful to add/view/mask the layers and views. At a minimum, have three panels – Browser, Layer and Bookmarks – turned on as below.

The main menu




Panels on the left.



The panels above are showing the layers and bookmarks that are not yet added. Next slide will show how they are added. Before that, we need to add a base map so that the added layers will make sense.

Slide 6




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## Add a Base Map

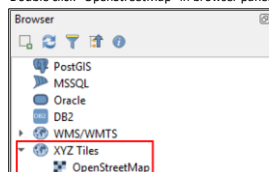
A basic street map is included by default, which is all that you require. Fancy maps can be installed as plugins. Most of them will require API Keys from their providers.

- Show the OpenStreetMap Layer:  
- Double click "OpenStreetMap"
- Add Quick Map Services
- Change a base map

Next: Add GSKY Map Services



Double click "OpenStreetMap" in browser panel



By default, an OpenStreetMap is included in QGIS. You can add it as a base map and do not need another. However, there are plugins to add others.

- Double click 'XYZ Tiles | OpenStreetMap'

Zoom in to your required view



In addition to the default street map, more can be added as plugins. Most of these will look just as basic as OpenStreetMap unless an API key is obtained from the third-party providers.

[illegible]

There are several maps and data layers in this plugin. The OSM Standard is the closest to Open Street Map. With the right API keys the others may show more aesthetic maps.

## Slide 7

Now that we have all the necessary settings and base map, we can add the WMS/WMTS layers that will support the GSKY Map Services.

In this step we will add the WMS layers to implement the GSKY service.

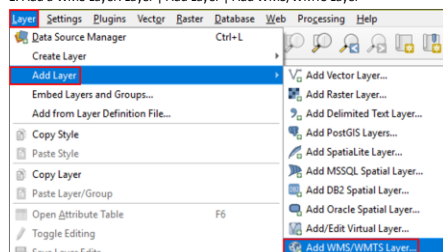
For demonstration, the GEOGLAM and DEA Landsat 8 layers are added through the GSKY Map Service.

- Add the WMS Layer(s)
- Display layers(s)
  - Double click the layer name
  - Drag to top in layers' list.

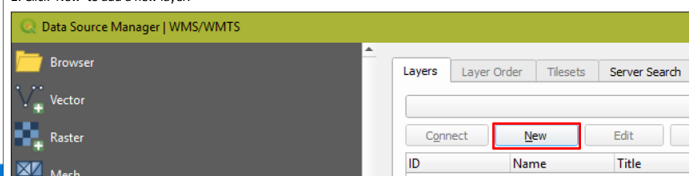
**Next: Advanced Usage of QGIS**



1. Add a WMS Layer: Layer | Add Layer | Add WMS/WMTS Layer



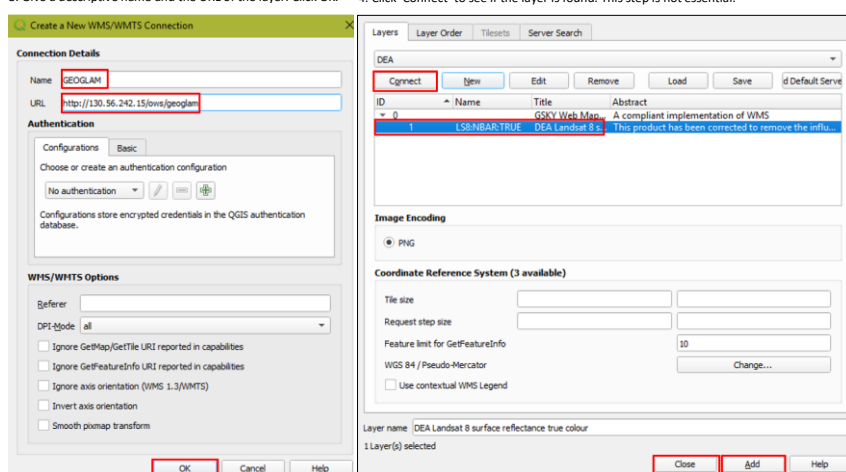
2. Click 'New' to add a new layer.



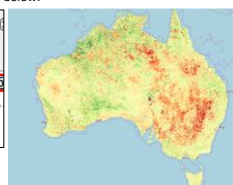
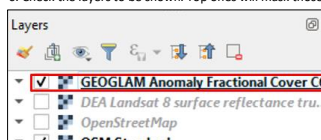
Add a name and the GSKY server URL and press OK. You can add multiple URLs in this way. They will be permanently recorded in the INI file to be used in QGIS subsequent sessions.

3. Give a descriptive name and the URL of the layer. Click OK.

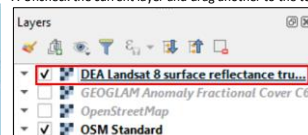
4. Click 'Connect' to see if the layer is found. This step is not essential.



6. Check the layers to be shown. Top ones will mask those below.



7. Uncheck the current layer and drag another to the top.

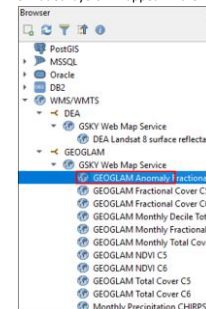


8. Zoom in until the layer shows up.

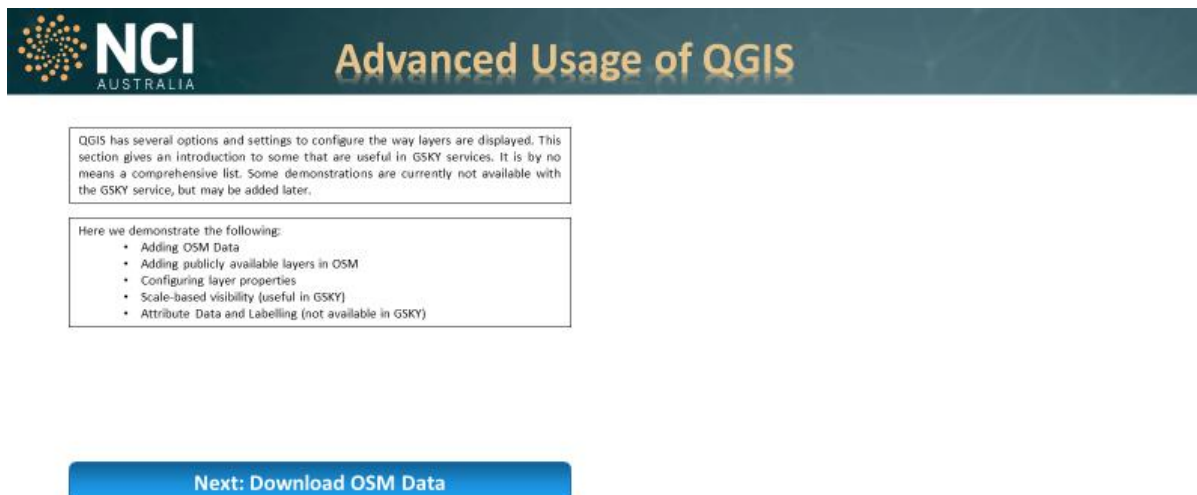


Connecting the GSKY service will list all layers in the dataset. This step is not necessary, as it is automatically done by QGIS in the background. You can simply close this dialog without connecting first.

5. Added layers will appear in the Browser panel



## Slide 8



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## Advanced Usage of QGIS

QGIS has several options and settings to configure the way layers are displayed. This section gives an introduction to some that are useful in GSKY services. It is by no means a comprehensive list. Some demonstrations are currently not available with the GSKY service, but may be added later.

Here we demonstrate the following:

- Adding OSM Data
- Adding publicly available layers in OSM
- Configuring layer properties
- Scale-based visibility (useful in GSKY)
- Attribute Data and Labelling (not available in GSKY)

Next: Download OSM Data

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Though it is not in the scope of this document to explore all the advanced features of QGIS, a basic understanding of using layers and its settings will help to visualise the GSKY layers more efficiently. To demonstrate this, we will use a publicly available dataset as a layer.

Here we demonstrate the following:

- Adding OSM Data
- Adding publicly available layers in OSM
- Configuring layer properties
- Scale-based visibility (useful in GSKY)
- Attribute Data and Labelling (not available in GSKY)



## Slide 9




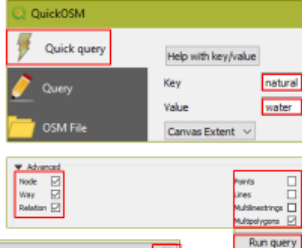
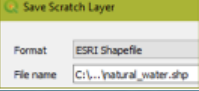
## Download OSM Data

**QuickOSM** is a plugin that allows you to find and download data layers corresponding to a large variety of things such as water ways, roads, land use, buildings, public transport and many more. You must be zoomed into an area that has data corresponding to the layer to be added. For example, zooming to the centre of Australia and asking to add buildings layer will return empty. [Ref 1]

**STEPS**

1. Install the QuickOSM plug-in
  - Plugins | Manage and Install Plugins
  - All | Search... | QuickOSM | Install
2. Add a layer
  - Zoom into the area (e.g. Canberra)
  - Vector | QuickOSM | QuickOSM...
  - Key = natural, Value = water
  - In: Canvas Extent
  - Advanced: Multipolygons
  - Run Query
3. Save as shape file
  - Click the save icon next to the layer name
  - Choose Format: ESRI Shapefile
  - Save in a directory.
    - Will create several files, including a \*.shp

Next: Add a Water Layer

NOTE: You have to download a layer for each of the zoom views. Thus, water bodies outside the area will not be filled.

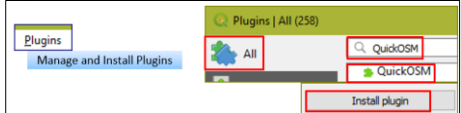
9

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**QuickOSM** is a plugin that allows you to find and download data layers corresponding to a large variety of things such as water ways, roads, land use, buildings, public transport and many more. You must be zoomed into an area that has data corresponding to the layer to be added. For example, zooming to the centre of Australia and asking to add buildings layer will return empty. [Ref 4]

The QGIS OpenStreetMap Plugin (QuickOSM) is a plugin for the desktop GIS application QGIS. It adds support for OpenStreetMap raw vector data, bringing it in as a layer either from .osm XML file or by direct download from the OpenStreetMap API. It also permits editing and upload back the OSM server. The plugin is at its early stages of development. As of QGIS it has been superseded by functionality in the QGIS core [Ref 5].

Main menu to add a plugin. Search for QuickOSM and install it.



**QuickOSM**

Download OSM data thanks to the Overpass API. A special parser, on top of the Overpass API, is available.

Execute custom Overpass queries in QGIS to get OSM data.

★★★★★ 148 rating vote(s), 251388 downloads

**Tags** osm, openstreetmap, overpass, download

**More info** [homepage](#) [bug tracker](#) [code repository](#)

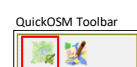
**Author** Etienne Trimaille

**Installed version** 1.11.1

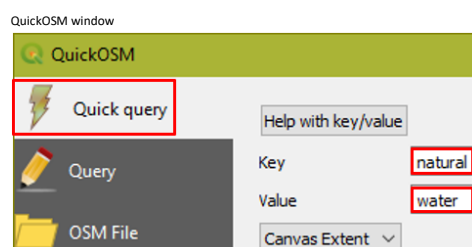
**Available version** 1.11.1

Upgrade All   Uninstall Plugin   Reinstall plugin   Close   Help

Upon installing the plugin, a new tool bar will appear showing the following icons. The first icon is the one to access the datasets in this plugin.



We will add a water layer that shows all waterways, lakes and reservoirs in the world.



- Click 'Quick Query'
- Type in key as 'natural'
- Type in value as 'water'
- Click 'Advanced' and check the items shown.
- Click 'Run Query'

Dropdown box for advanced settings. Make sure that only the ones shown below are checked.


Layer name in the layer panel. Icon is to save it as scratch layer.

Save the scratch layer as GeoPackage or ESRI Shapefile.

- The layer will be added in 'Layers' panel.
- Click the icon against it.
- A layer like this is added only to the visible view. If you zoom or pan out, then add again as described above.
- Save the added layer as a scratch layer so that it can later be added as a vector dataset.
- Save as GeoPackage (better) or ESRI Shape File

The next slide will show how to add the saved scratch layers as vector datasets.

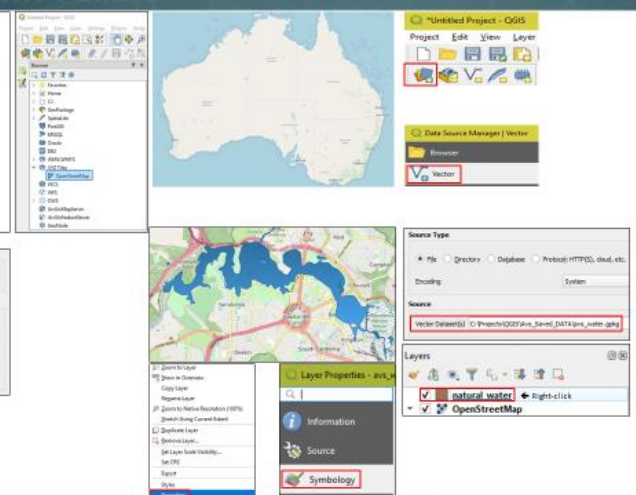
## Slide 10



## Add Layers

**STEPS**

1. Add a map layer. This must always be the last item in the Layers panel.
  - Browser | XYZ Tiles | OpenStreetMap
2. Zoom in to a small region (e.g. Canberra)
3. Add a water layer
  - Layer | Data Source Manager | Vector | File | Vector Datasets
  - Open a saved shape file (\* See slide #n for saving a file)
4. Change layer color
  - Double click on the layer name (e.g. avs\_water)
  - Symbology | Color or pick from displayed colors

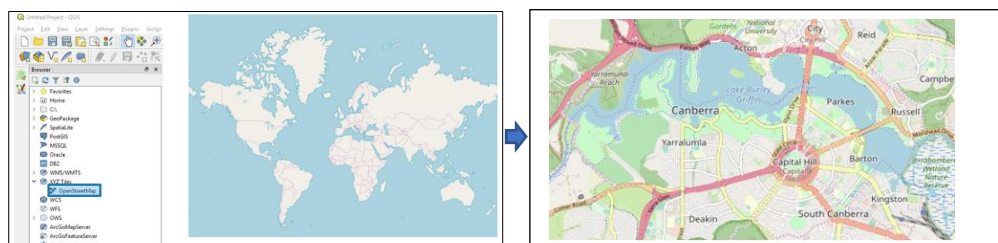


Next: Scale-based Visibility

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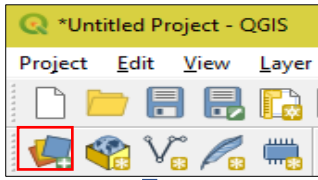
In this slide we will demonstrate the addition of vector dataset layers. Though currently there is no use of this feature for the GSKY data, in future we may support it.

Display the OpenStreetMap and zoom in.

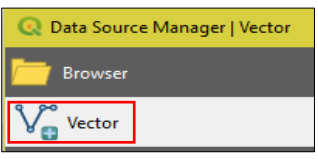


To add a vector layer to the map and change properties:

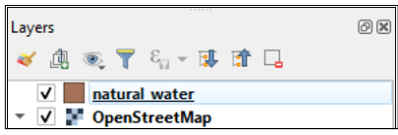
1. Click 'Open Data Source Manager (^L)'




2. Click 'Vector' and find the saved vector file.



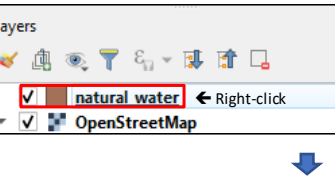
3. Click 'Add' the vector dataset.



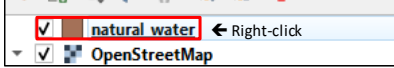
4. The water layer is now added to the map on right.



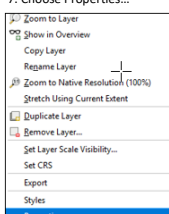
5. The water layer shows up as green.



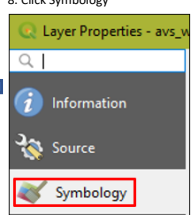
6. Change the properties of the added vector layer. Right click the layer.



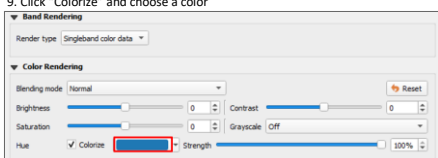
7. Choose Properties...



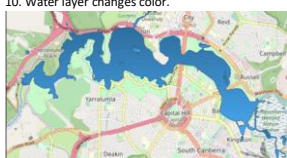
8. Click Symbology



9. Click 'Colorize' and choose a color



10. Water layer changes color.





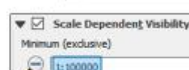
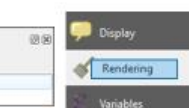
## Slide 11



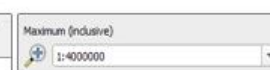
Sometimes you will find that a layer is not suitable for a given scale. For example, a dataset of all the continents may have low detail, and not be very accurate at street level. When that happens, you want to be able to hide the dataset at inappropriate scales. By setting a minimum scale for visibility, a layer will be masked when the zoom level is lower.



Scale 1:125158



The water layer will disappear when the zoom level is above 100,000.



Scale 1:250000

Next: Attribute Data and Labelling

11

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In this slide we demonstrate the scale-based visibility of the added layers. This is a very useful feature to hide/display items that may clutter the display at lower zoom levels or may take extremely long times to display. For example, street names can become cluttered at lower zoom levels. We can specify such that a layer will only be displayed above or below a certain zoom level, or within a specific range.

Examples:

☒ Scale Dependent Visibility

Minimum (exclusive)  Maximum (inclusive)

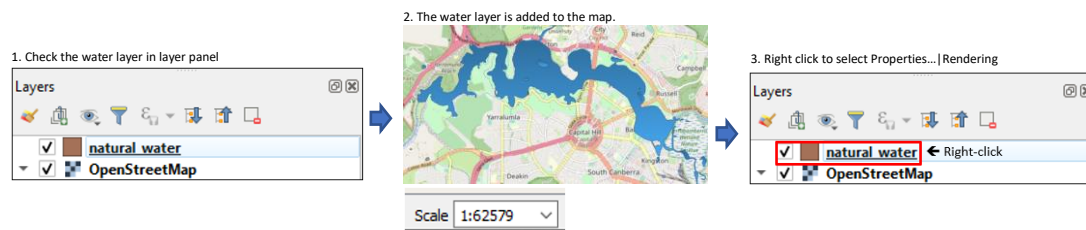
Layer will show when Scale is 1:29,999,999 or lower. Scale 1:15764324

Minimum (exclusive)  Maximum (inclusive)

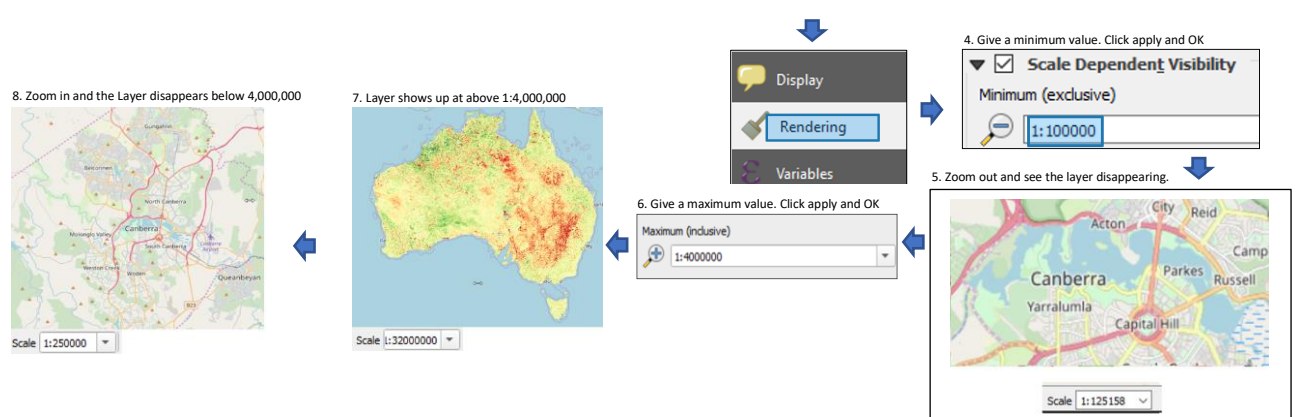
Layer will show when Scale is 1:30,000,000 or higher. Scale 1:31528647

Minimum (exclusive)  Maximum (inclusive)


Layer will show when Scale is between 1:30,000,000 and 1:69,999,999. Scale 1:31528647



By specifying the minimum and maximum scale values we can control the display of the layers.



## Slide 12

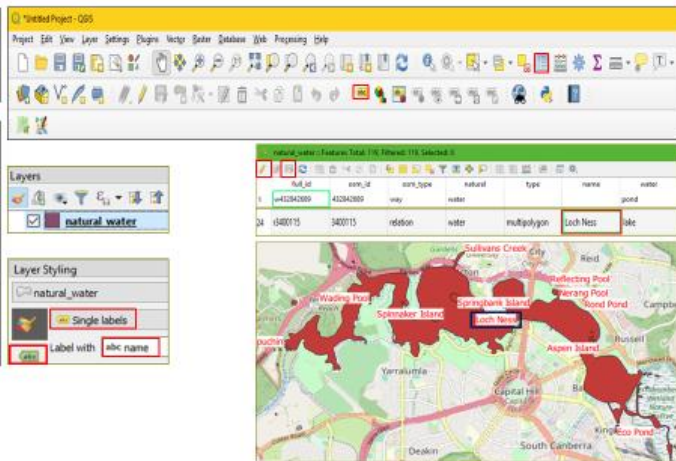


## Attribute Data and Labelling

All the objects that are visible on the map also have attributes. Maps in a GIS aren't just pictures. They represent not only objects in locations, but also information about those objects. The attribute data has info like ID, name, type, etc. for each feature. e.g. Lake Burley Griffin. These can be added to the map for clarity and information.

**STEPS**

- 1. View the attributes**
  - Select the layer
  - Click the "Open Attribute Table" or F6
- 2. Add Labels from the attributes**
  - Select the layer
  - Click the "abc" icon in the Label Toolbar and again on the window
  - Choose "Single Labels"
  - Choose "abs Name" under "Label With"
  - Choose a color under "Stroke Color"
- 3. Edit labels**
  - Bring up the attributes table as in (1)
  - Click the edit icon and type in the changes
  - Save



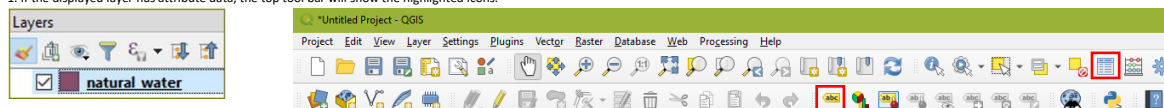
**End of Slide Show**

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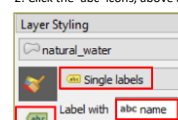
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In this slide we demonstrate the use of labelling on the layers. This requires an attribute table associated with the layer. Currently the GSKY layers do not provide it.

1. If the displayed layer has attribute data, the top tool bar will show the highlighted icons.



2. Click the 'abc' icons, above and below, and enter the details as shown below.



If the layer has an attribute table, you can display/edit it with F6 or the table icon on top toolbar.

4. Click F6 or the table icon in the top tool bar to bring up the data table.

natural_water :: Features Total: 57, Filtered: 57, Selected: 0					
	fid	full_id	osm_id	osm_type	natural
37	1	r3400115	3400115	relation	Lake Burley Grif...

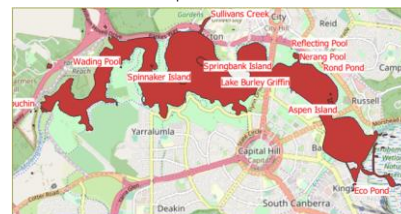
Edit the name in the attribute table.

5. Click the edit icon and change the text under the name column. Click the save icon.

natural_water :: Features Total: 57, Filtered: 57, Selected: 0					
	fid	full_id	osm_id	osm_type	natural
37	1	r3400115	3400115	relation	Loch Ness

The above will add labels to layer.

3. Labels are added to the map.



6. The changed label appears on the map.

