IMPROVING GROUNDWATER KNOWLEDGE IN SELECTED TRANSBOUNDARY AQUIFERS

Groundwater Information System:

(User Manual)

September 2018

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ORASECOM SECRETARIAT

Groundwater Information System: User Manual

Approved by the Consultant:

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OASECOM SECRETARIAT

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GROUNDWATER INFORMATION SYSTEM: USER MANUAL

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DOCUMENT INDEX

Index Number	ORASECOM Report Number	Report Title
1		Inception report
2		Draft final report with updated groundwater recharge estimates in the main recharge areas in the Karroo Sedimentary and the Khakhea/Bray Dolomite Aquifers
3		Monitoring Background Report
4		Monitoring Framework Report
5		Report indicating inputs made at the stakeholder's workshop
6		Final Recharge report
7		User manual of the established groundwater information system.
8		Report on the joint survey

EXECUTIVE SUMMARY

An outline of the structure and functionality of the existing ORASECOM Water Information System (WIS) is provided in this report. The report further describes the developed ORASECOM GIS Server and its functionality. The GIS server contains geospatial datasets and interactive maps on 3 transboundary aquifer systems located in the Orange-Senqu River Basin. Finally, the report provides the detailed user manual for accessing and uploading of ORASECOM geospatial datasets and related documents. The manual also shows how to create your own interactive maps and how to publish or share these maps.

TABLE OF CONTENTS

LIST OF ABBREVIATIONS AND DEFINITIONS

Abbreviation or Acronym	Definition
GIS	Geographical Information System
Layer	Layers are the mechanism used to display geographic datasets in applications such as ArcMap and QGIS. Each layer references a dataset and specifies how that dataset is portrayed using symbols and text labels. Each map is assembled by adding a series of layers. Layers are displayed in a particular order displayed in the map's table of contents.
ORASECOM	Orange-Senqu River Commission
OGIS	ORASECOM Geo-spatial Information Server
Raster Data	Geo-spatial data represented by grids, such as GeoTiff data files.
SADC	Southern African Development Community
Shapefile	The shapefile format is a popular geospatial vector data format for geographic information system (GIS) software. It is developed and regulated by ESRI as a (mostly) open specification for data interoperability among ESRI and other GIS software products
STAS	Stampriet Transboundary Aquifer System
SWI	Shared Watercourse Institutions
Vector Data	Geo-spatial data represented by lines, points or polygons such as shapefiles.
WIS	ORASECOM Water Information System

1 INTRODUCTION

1.1 Background

ORASECOM is one of the first Shared Watercourse Institutions (SWIs) established in 2000, under the SADC Protocol on Shared Watercourses. ORASECOM provides technical advice to its State Parties on matters relating to the development, utilisation and conservation of the water resources in the Orange-Senqu River System. ORASECOM comprises of the Council of Commissioners, the Secretariat, the Groundwater Hydrology Committee (GWHC) and four Task Teams responsible for technical, communications, finance and legal issues. There is also a working group responsible for water resources quality management in the Basin, which meets on an ad-hoc basis. The 2000 ORASECOM Agreement is also being revised to include a Committee of Ministers Responsible for Water in the Basin, known as the Forum of the Parties.

The management and development of the water resources of the basin essentially takes place at three levels:

- **National level**: The basin states have the primary responsibility for the development and management of water resources within their territory. The ORASECOM Agreement obliges the parties to:
- utilise the resources of the River System in an equitable and reasonable manner with a view to attaining optimal and sustainable utilisation thereof, and benefits therefrom, consistent with adequate protection of the River System;
- take all appropriate measures to prevent the causing of significant harm to any other Party
- exchange available information and data regarding the hydrological, hydrogeological, water quality, meteorological and environmental condition of the River System
- notify the ORASECOM Council and provide all available data and information on any project that may have a significant adverse effect upon any one of the parties.
- **Bilateral level**: Several bilateral agreements pre-date ORASECOM. Bilateral agreements and institutions have come into existence for a specific reason, essentially to implement or manage a project. They include:
- The Lesotho Highlands Development Authority (LHDA) in Lesotho and the Trans-Caledon Tunnel Authority (TCTA) in South Africa supervise and coordinate the work on the Lesotho Highlands Project
- The Permanent Water Commission (PWC), formed by Namibia and South Africa in 1992, advises both governments on the development possibilities of the Lower Orange, the section of the river that forms their mutual border
- **Transboundary level**: At the regional level, the SADC Water Division has been tasked with creating an enabling environment for the integrated management of shared watercourses. Supporting this integrated approach are the Revised Protocol on Shared Watercourses and the Regional Strategic Action Plans. The ORASECOM Agreement is strongly influenced by the SADC Protocol.

This project falls under the ambit of this third transboundary level.

The ORASECOM Integrated Water Management Plan lists as a Strategic Action:

- Improve reliability, usefulness, transboundary confidence areal coverage of groundwater monitoring networks at the transboundary and national (sub-catchment) levels

The objective of establishing the Groundwater Information System at ORASECOM is to improve the usefulness and the sharing of transboundary aquifer information, particularly monitoring information. A software system was developed for the processing, storage and sharing of the transboundary aquifer features and characteristics, and groundwater quantity and quality data and information.

2 ORASECOM GIS

2.1 Objectives

This task set out to:

- Develop a web-based interface on the ORASECOM Water Information System (WIS) with a selected open-source spatial database (GeoNode) for monitoring data and the characteristics and features for the transboundary aquifers accessible from the WIS and the ORASECOM Website.
- Develop a user manual describing the design philosophy and the functioning of the system

2.2 ORASECOM Water Information System (WIS)

The ORASECOM WIS was developed during a GEF/UNDP project done for ORASECOM in the mid-2000's. The WIS is a blog-based information system which categorises, and shares documents, data and models as generated for ORASECOM through donor-funding organisations. The WIS allows any administrator approved user to contribute information and data relevant to the functions of ORASECOM. It also hosts media such as publications and photos as well as link to member states' information sources.

2.3 Structure of the WIS

Figure 1 provides the structure of the WIS and how the new geo-spatial database, developed as a groundwater information system, relates to the WIS.

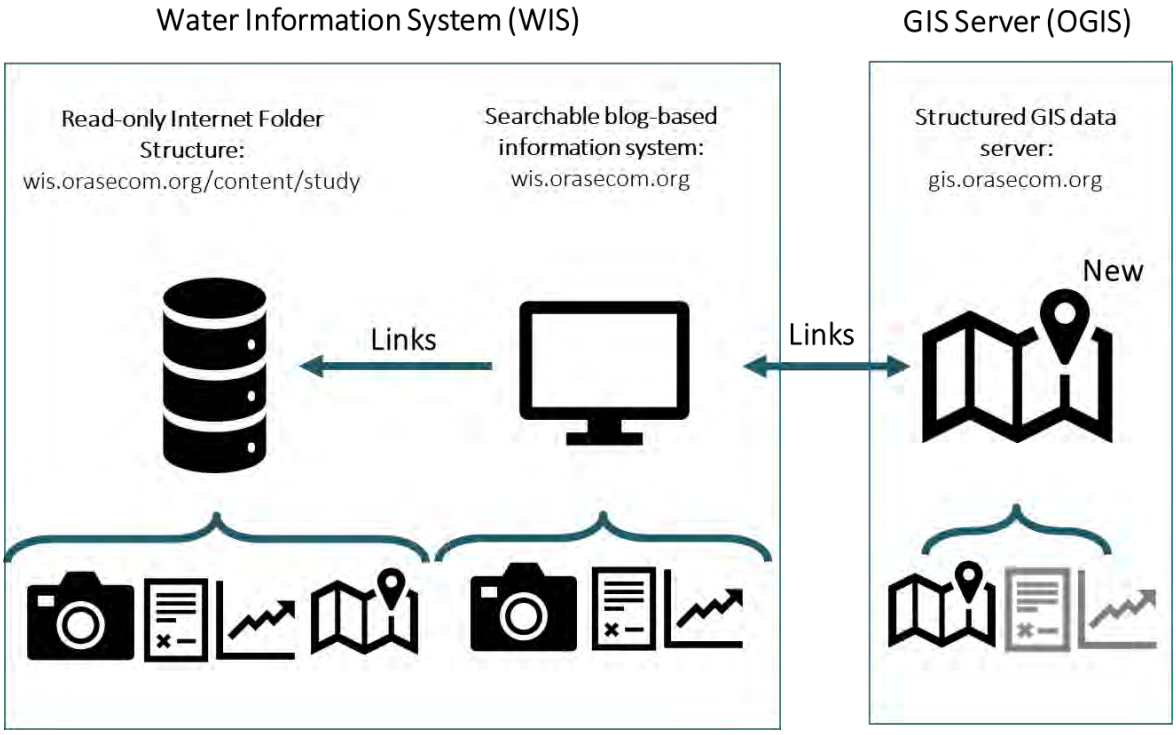


Figure 1: Structure of the WIS and the GIS

Currently the ORASECOM WIS consists of two main elements:

- Read-only raw data repository: The data repository is in the form of a typical intranet folder structure where ORASECOM, Member State and Donor-Funder Consultants can upload all ORASECOM Study related data and information via controlled FTP access. This might include documents, databases, model configurations, raw GIS data as well as other types of media. The total folder database can be accessed from here: http://wis.orasecom.org/content/study/. See **Figure 2** for the root structure of this repository.

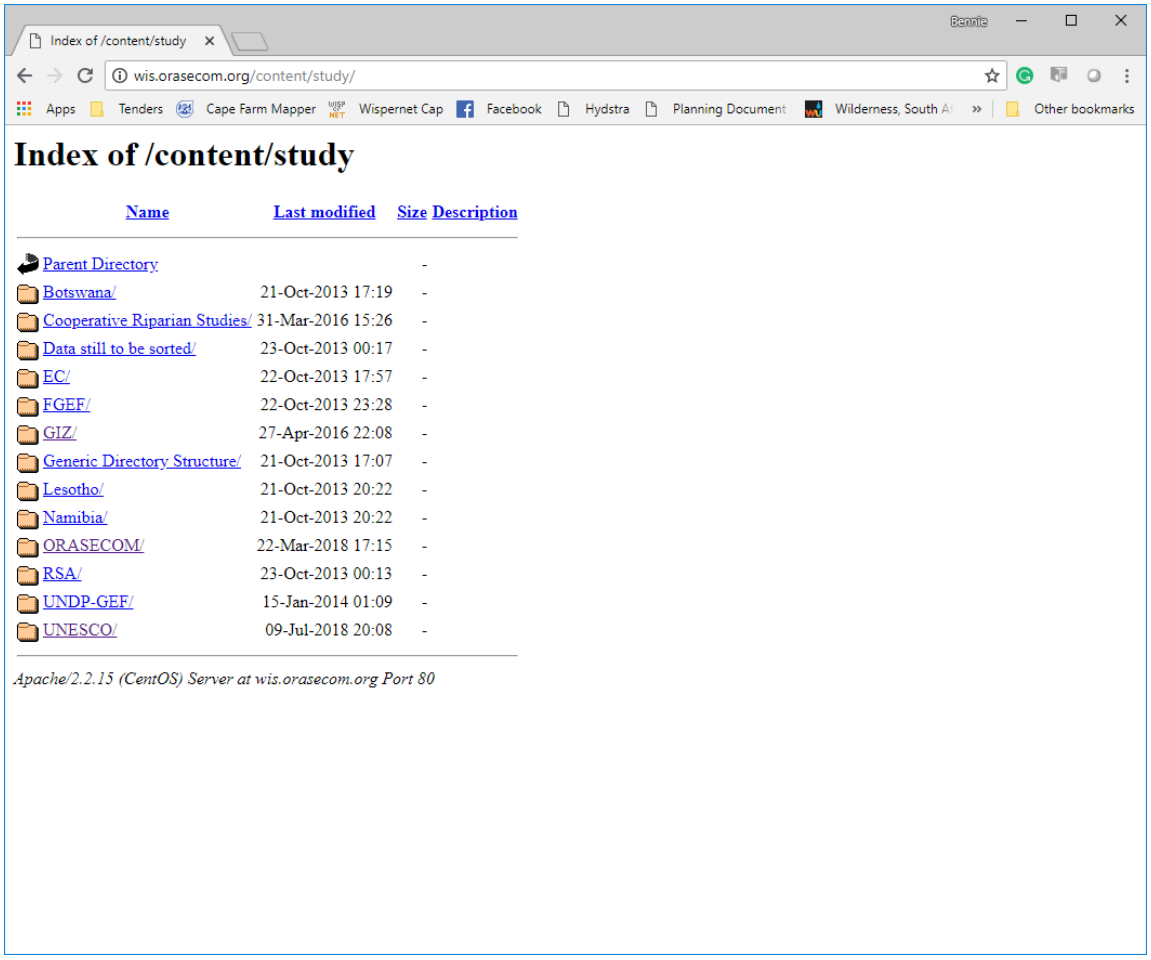


Figure 1: Root structure of the WIS read-only raw data repository.

- The searchable blog-based information system: The WIS (www.wis.orasecom.org) makes all ORASECOM Study data, documents and map data available through a blog-based information article system. Each new project that ORASECOM undertakes requires that an information article is published, and all relevant data linked to the article. Currently all the articles are searchable through the site, but the search functionality is currently being upgraded to include context related searches inside of reports and other electronic media. Anyone can register on the system, and administrator approval contribute Orange-Senqu River basin information and data via an article. Data, reports and other media can be uploaded and attached to the information articles. All articles are moderated. See **Figure 3** for the WIS landing page

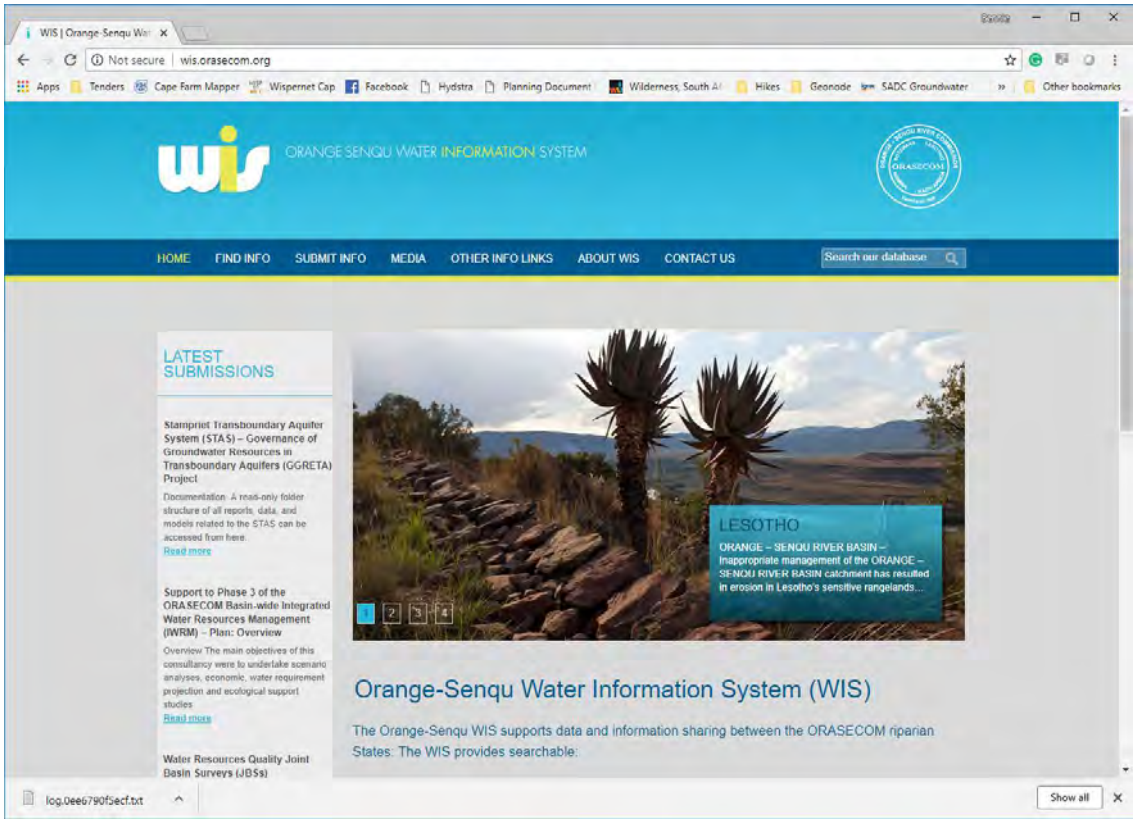


Figure 2: WIS landing page.

2.4 Development and functionality of the OGIS

For the ORASECOM geospatial database the opensource Geonode software (www.geonode.org) was used and customised for ORASECOM and is now referred to as the ORASECOM GIS Server (OGIS). Geonode is a Django interface to GeoServer (and opensource geospatial database) which is also mobile-friendly. Due to the use of GeoServer access to the spatial data is provided to 3rd party software such as ESRI ArcMap or the opensource QGIS application (www.qgis.org). Access to each dataset can be specified by the owner or by administrators. Groups and members can also be specified by administrators which will have management functions of layers assigned to the group.

The OGIS can be accessed via www.gis.orasecom.org . All future ORASECOM spatial data will be uploaded to the server and made available to the public for reuse. The server also allows registered individuals to add their own data and build live maps with the data from the server. These live maps can be linkable to the WIS articles or shared via a URL. See Section 3 for more detail on the OGIS.

In summary, the OGIS provides internet-based access to shared:

- Geospatial data layers (also via 3rd party software access) including:
    - Vector data: ESRI shapefiles
    - Raster data: GeoTiff
- Documents and data:
    - Data from shapefile dbf file in numerous formats
    - External links or uploading of data and documents
- Created interactive maps based on the layers available in the OGIS that can be shared via:

- web interface with a fixed URL, or
- html code which published the map on a website, such as WIS

GeoNode is known to work on all modern web browsers. This list includes (but is not limited to):

- Google Chrome.
- Apple Safari.
- Mozilla Firefox.
- Microsoft Edge.
- Microsoft Internet Explorer.

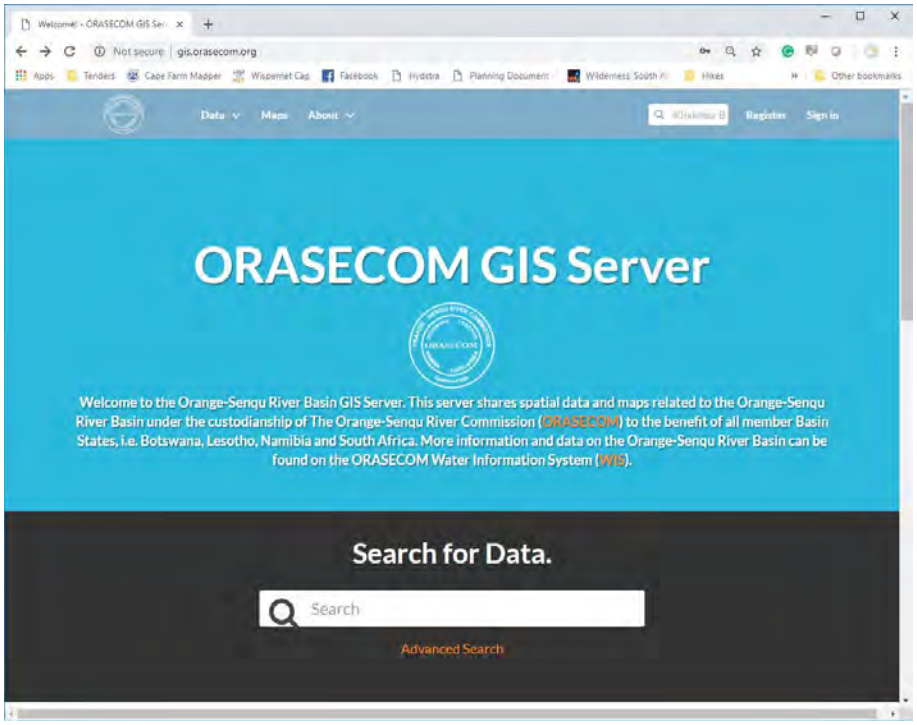
2.5 Transboundary Datasets

The OGIS has been populated with several transboundary aquifer datasets as generated by related projects. Not all the datasets will be publicly accessible until approval has been given by the appropriate authorities.

3 OGIS USER MANUAL

3.1 Online landing page

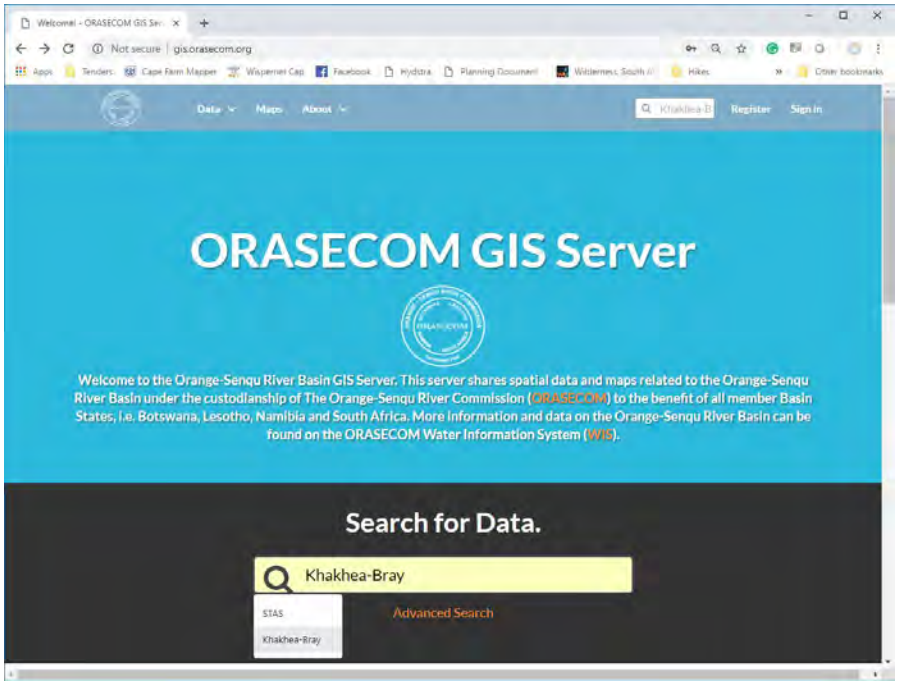
The OGIS can be access from http://gis.orasecom.org and the landing page is shown below:



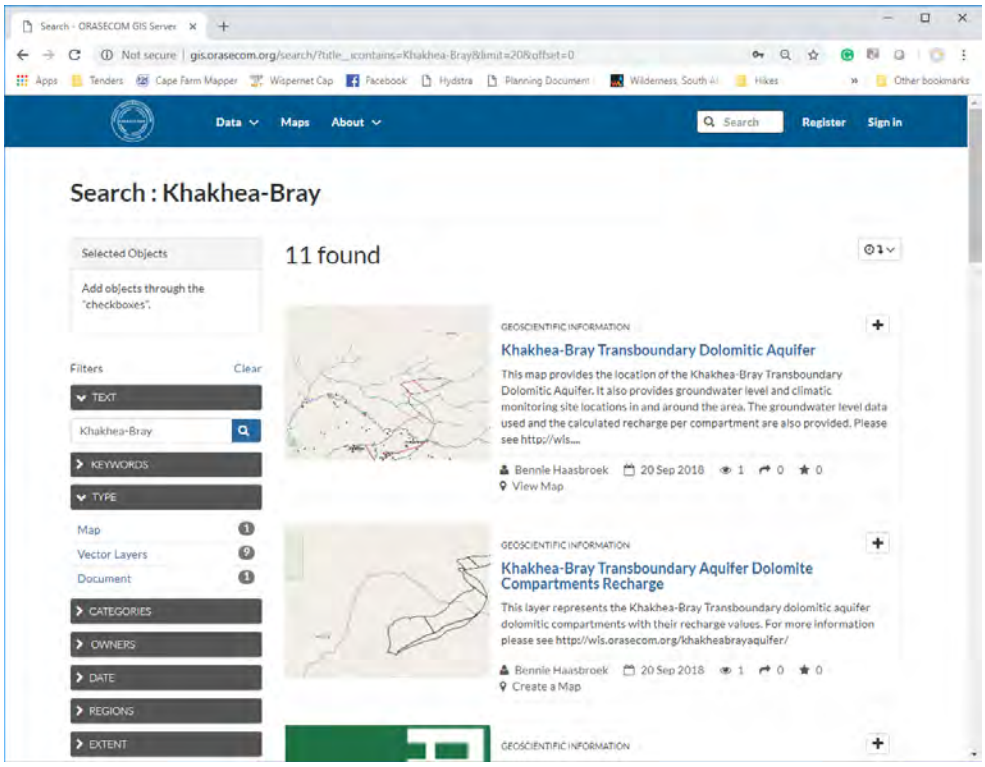
3.2 Online search, browsing and access to layers, documents and maps

3.2.1 Search all content

All content on the system can be search according to the layer, map or document title in either of the two search bars. Advanced search features are also available by selected Advanced Search below the bottom search bar on the landing page.

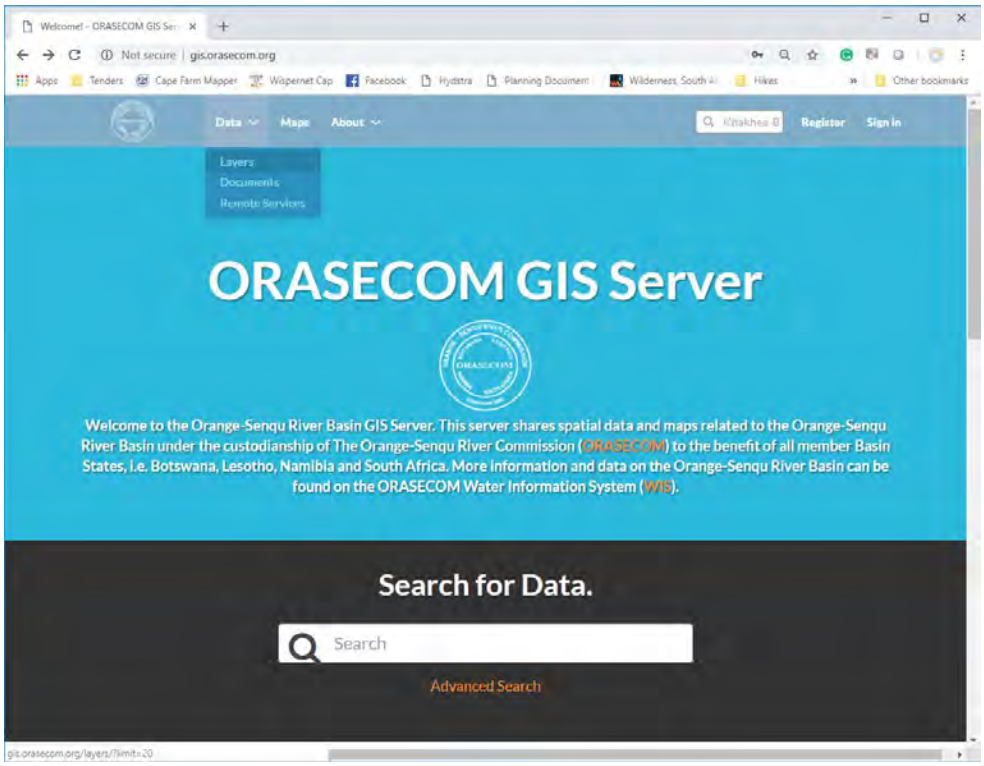


The typical search result is shown below:

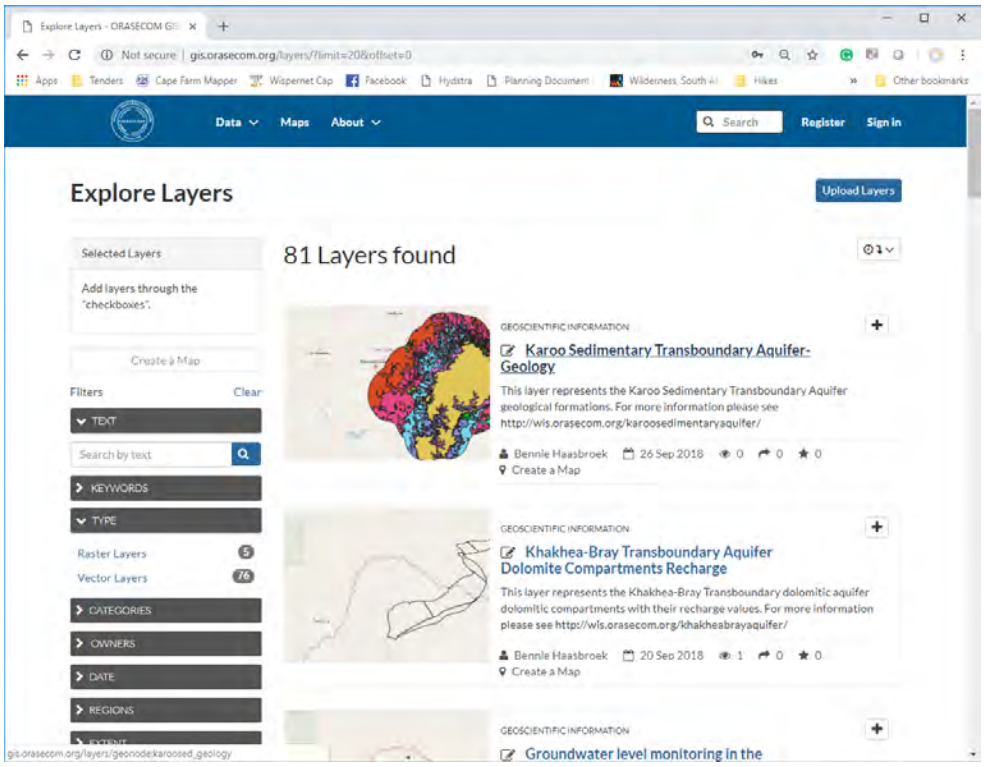


3.2.2 *Browse Layer Information*

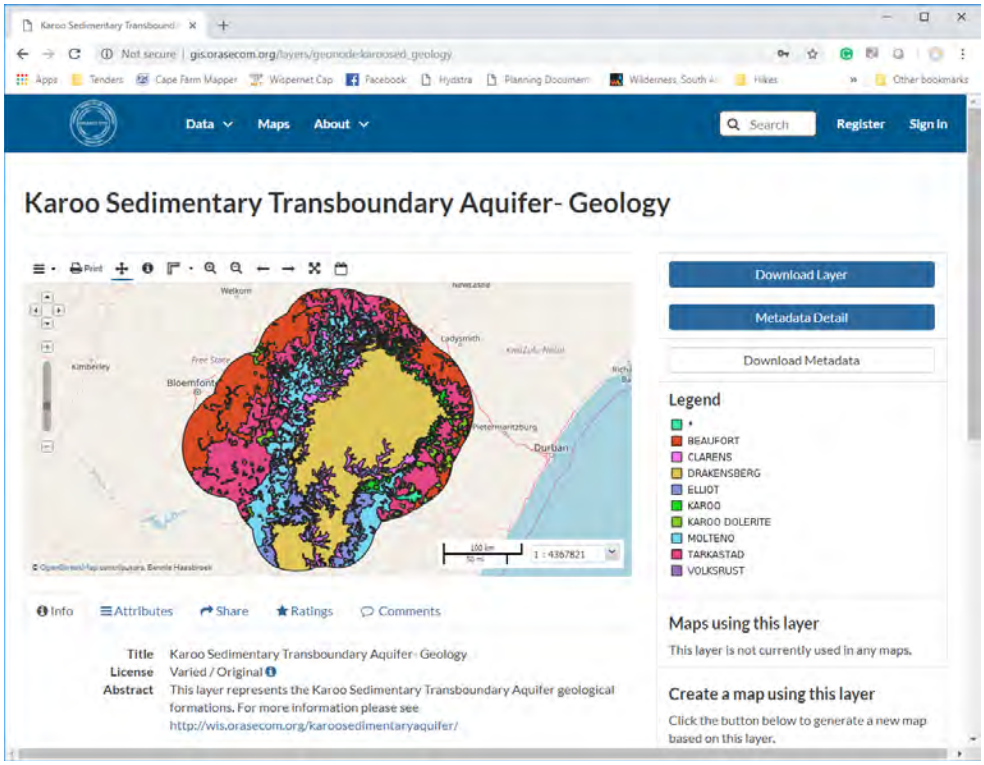
All layers available on the system can be viewed by selecting Data|Layers on the top menu bar as seen below:



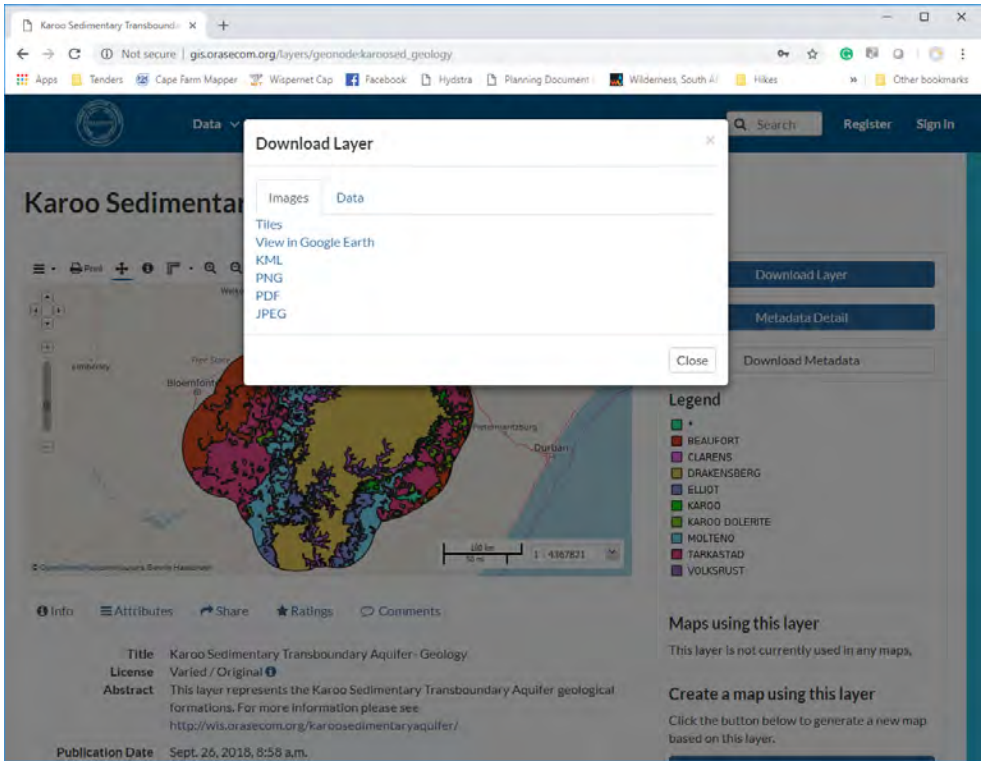
A typical listing of 20 available layers per page is presented below:



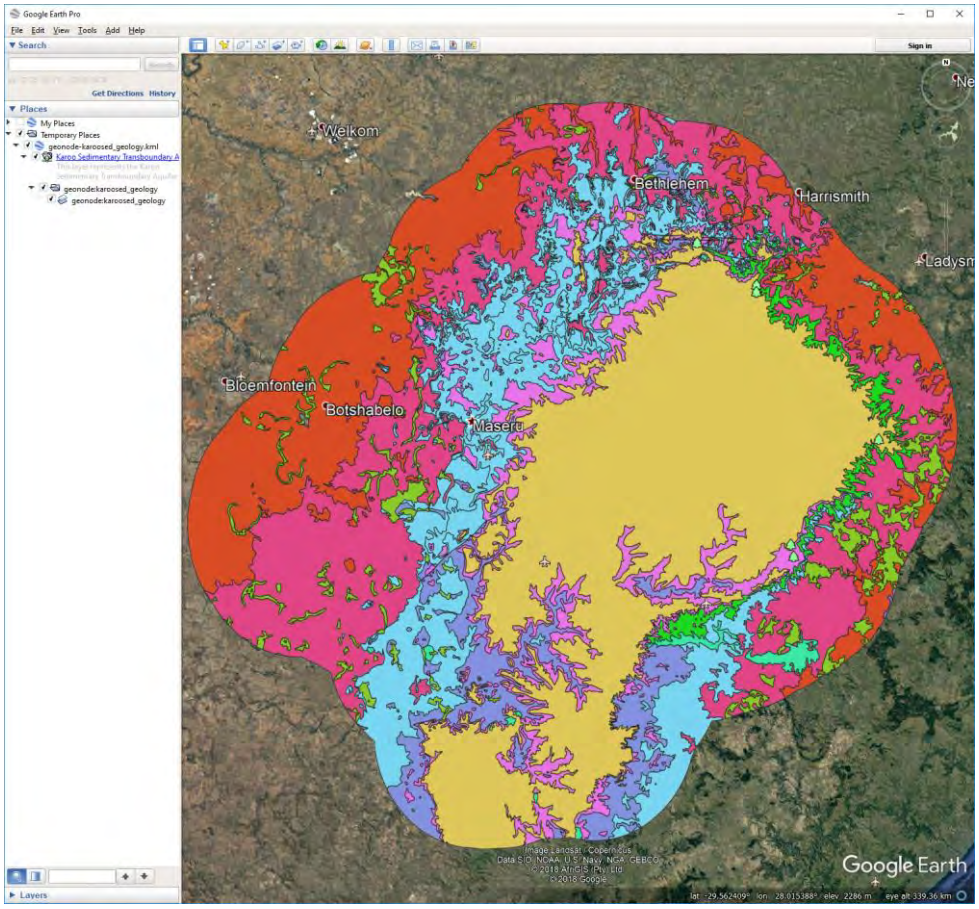
By clicking on the name of a layer a detailed description and options for accessing the data are provided, as shown below. Button for downloading the data and viewing of the metadata for the layer can be found at the top-right of the page. Links to related documents and maps are also provided on the right-hand side of the map.



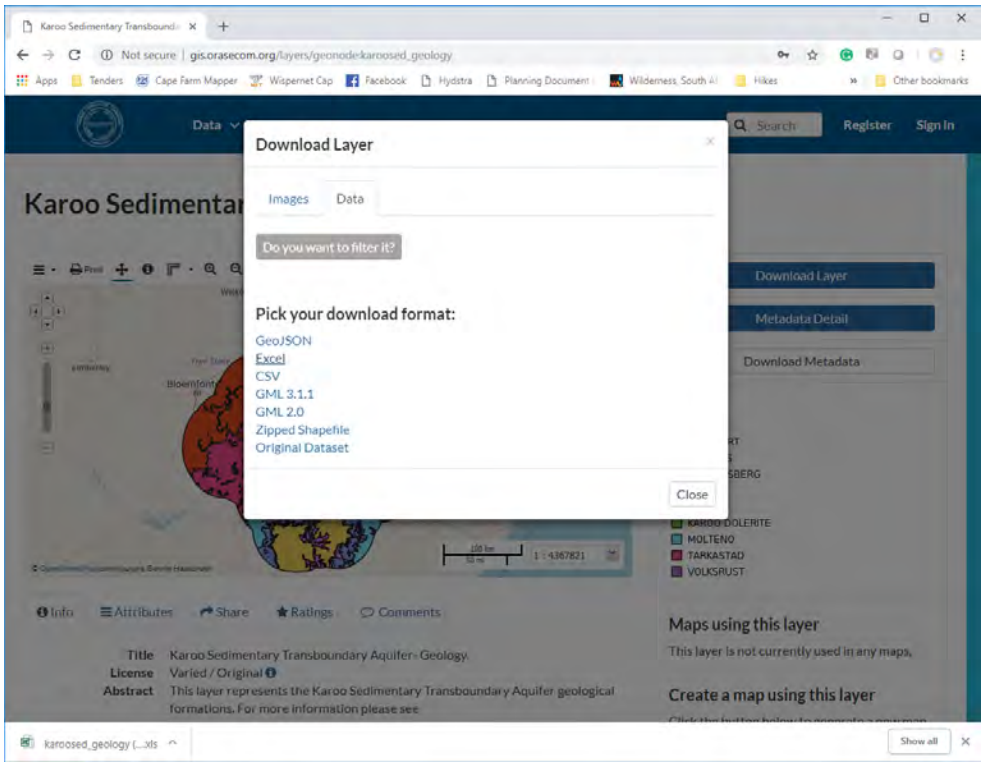
The layer data can be downloaded in several formats as shown below. By selecting Download Layer, a list of image formats (under the Images Tab) is provided, as listed below.



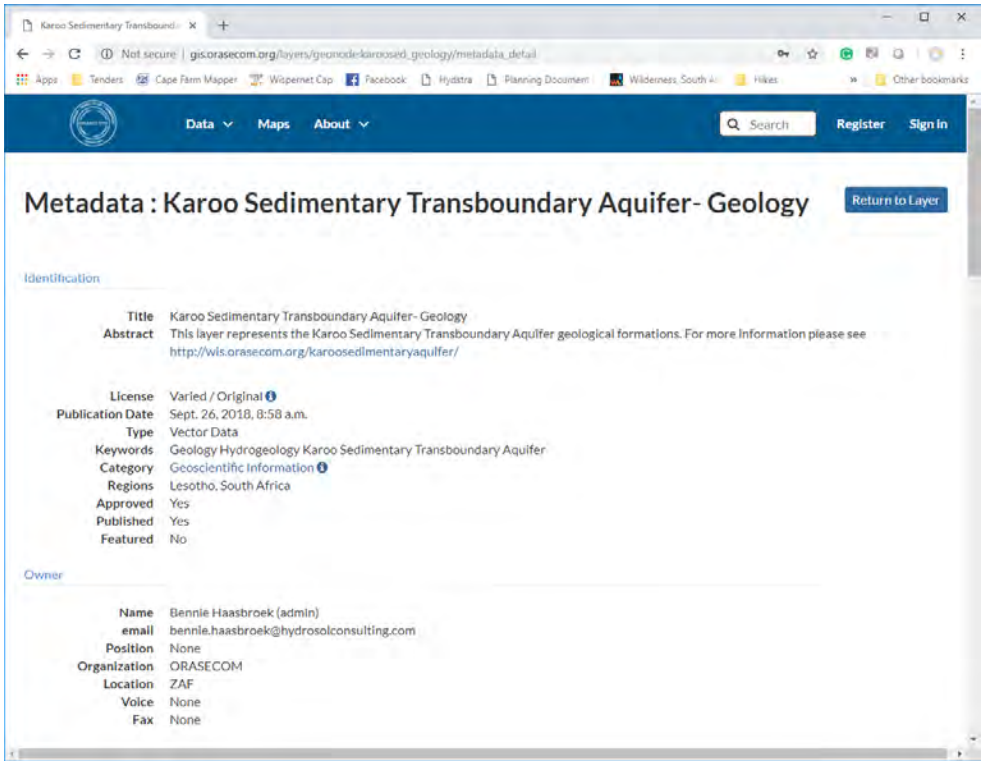
By downloading the KML file – the selected layers data can be viewed in Google Earth as shown below:



By selecting the Data Tab, the layer data download options are provided, as sown below. A useful link is the Excel option, which automatically converts the shapefile's dbf file into a downloadable Excel format.

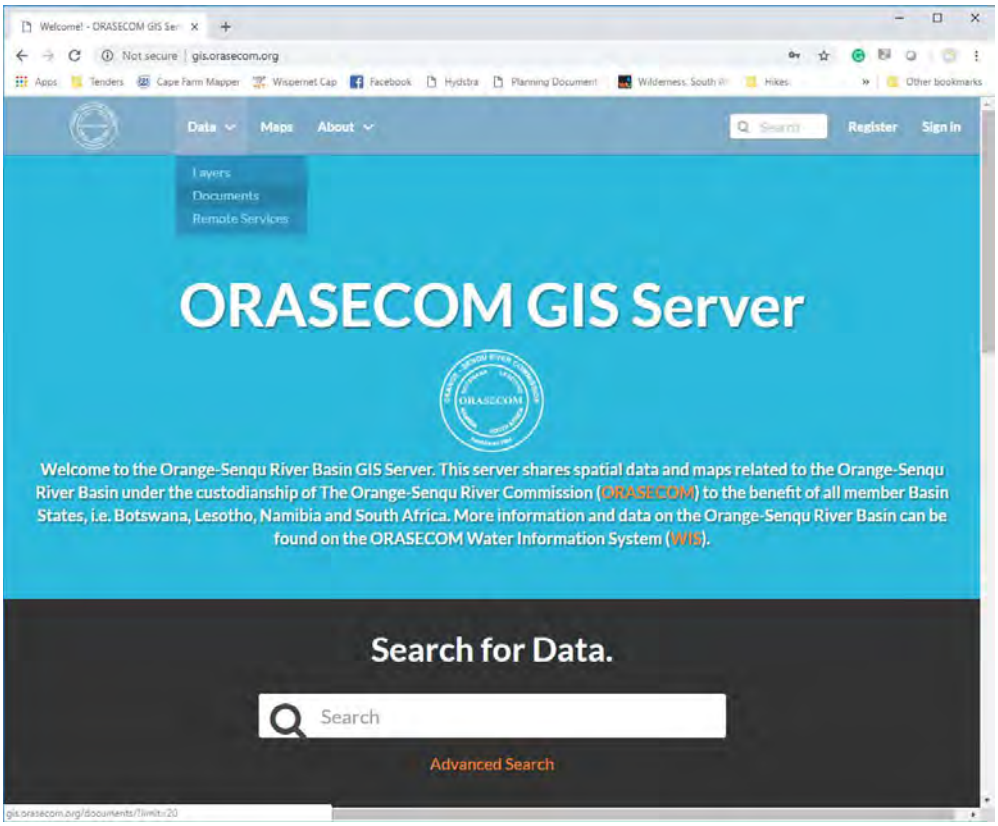


By selecting Metadata Detail from the layer detail page, a detailed breakdown of provided metadata for the layer is provided. See typical results below:

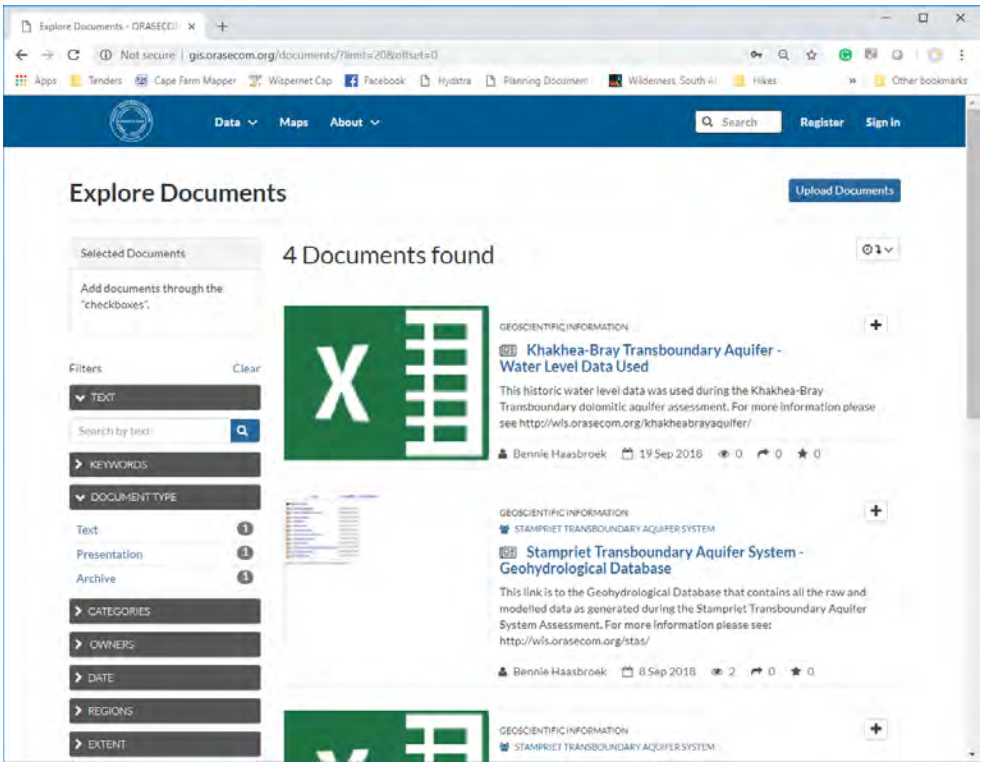


3.2.3 *Browse Document Information*

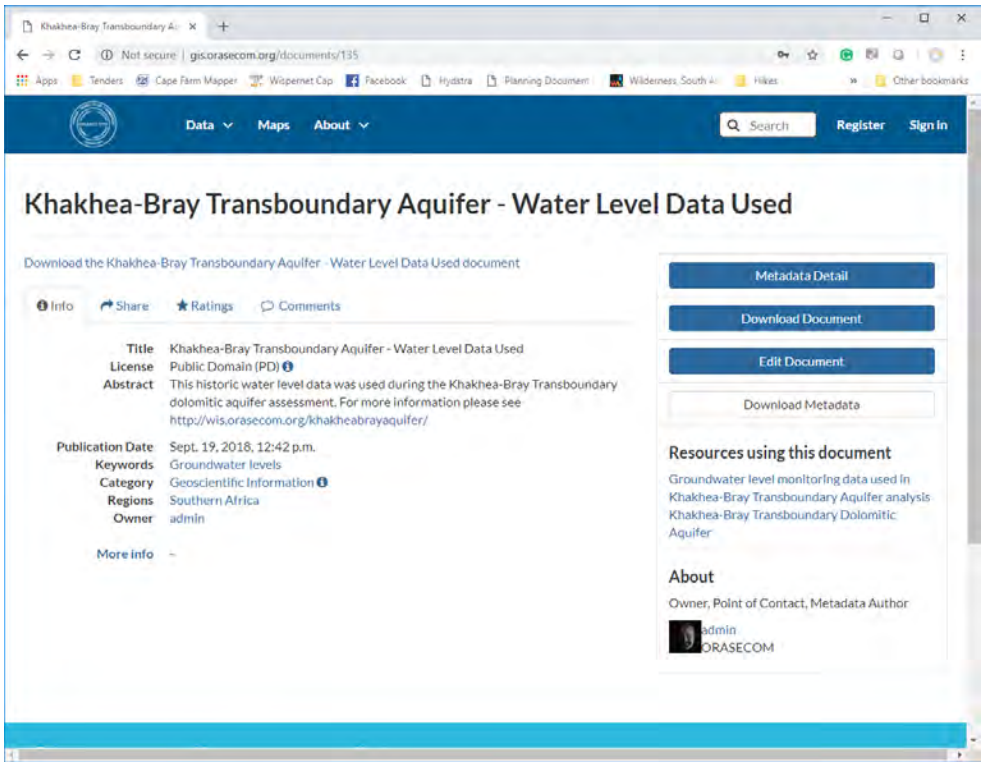
All documents and datasets available on the OGIS can be accessed for browsing by selecting Data|Document on the main menu bar. See image below:



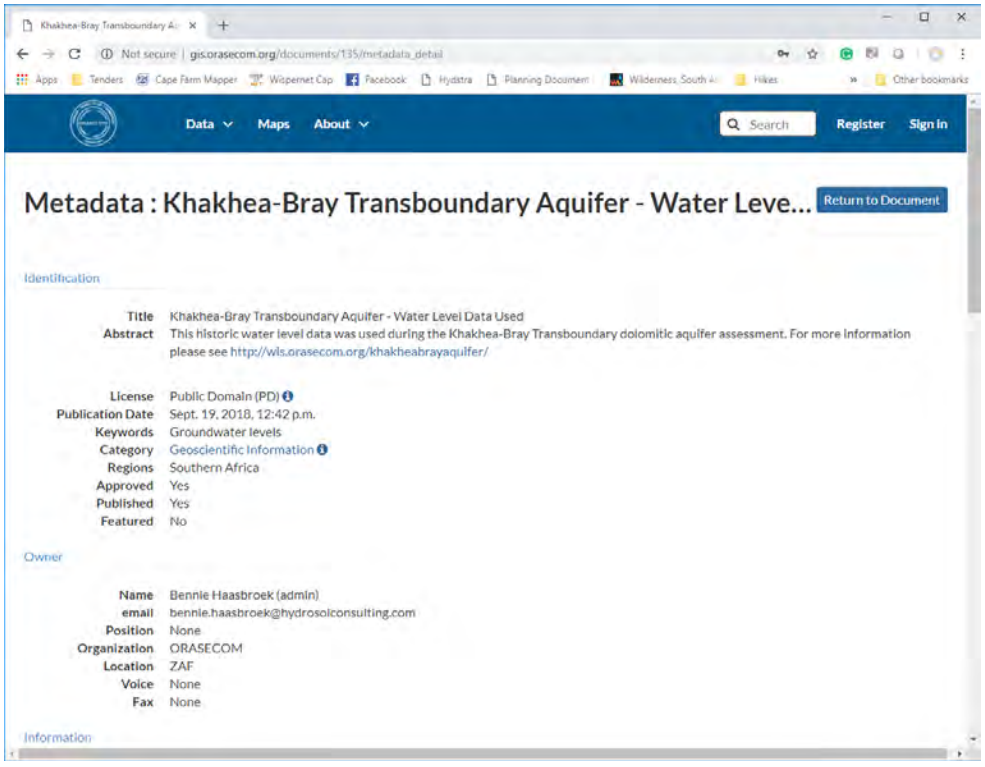
Typical listing of documents and dataset are represented below:



When selecting a specific document/dataset's name a more detailed description will be provides as shown below. Metadata detail and download options can be accessed from the blue buttons on the right hand of the screen. The detail page also provides links to layers and maps that refers to the document/dataset.

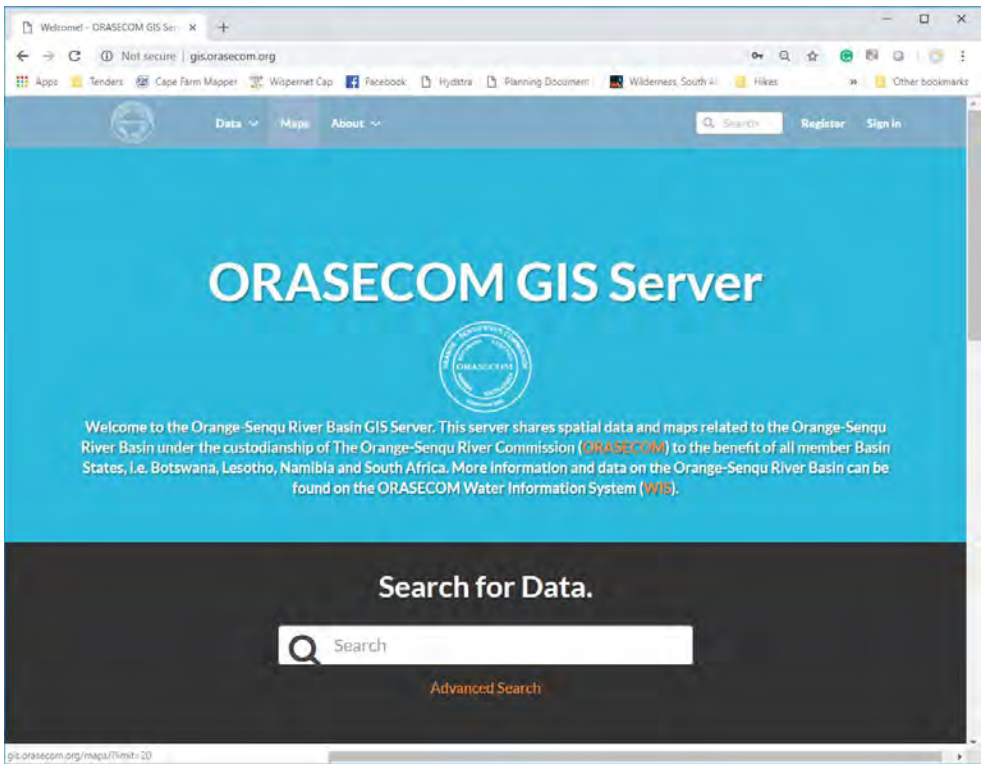


Selecting the Metadata Detail button provide more detailed information on the metadata for the document/dataset as shown below:

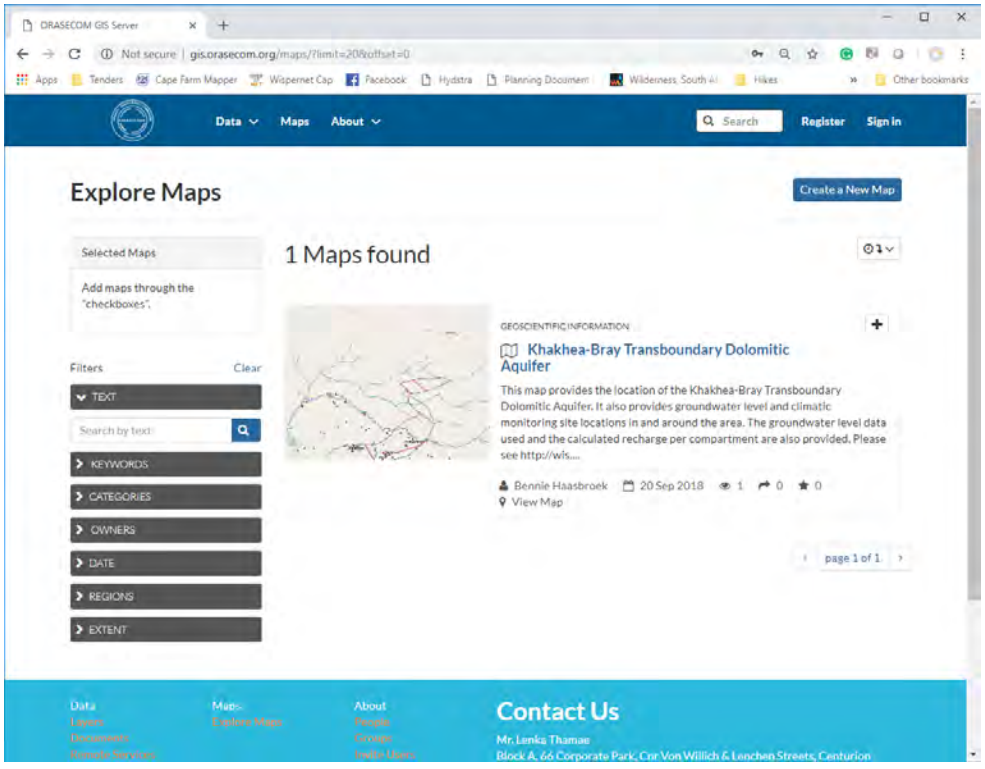


3.2.4 Browse Maps

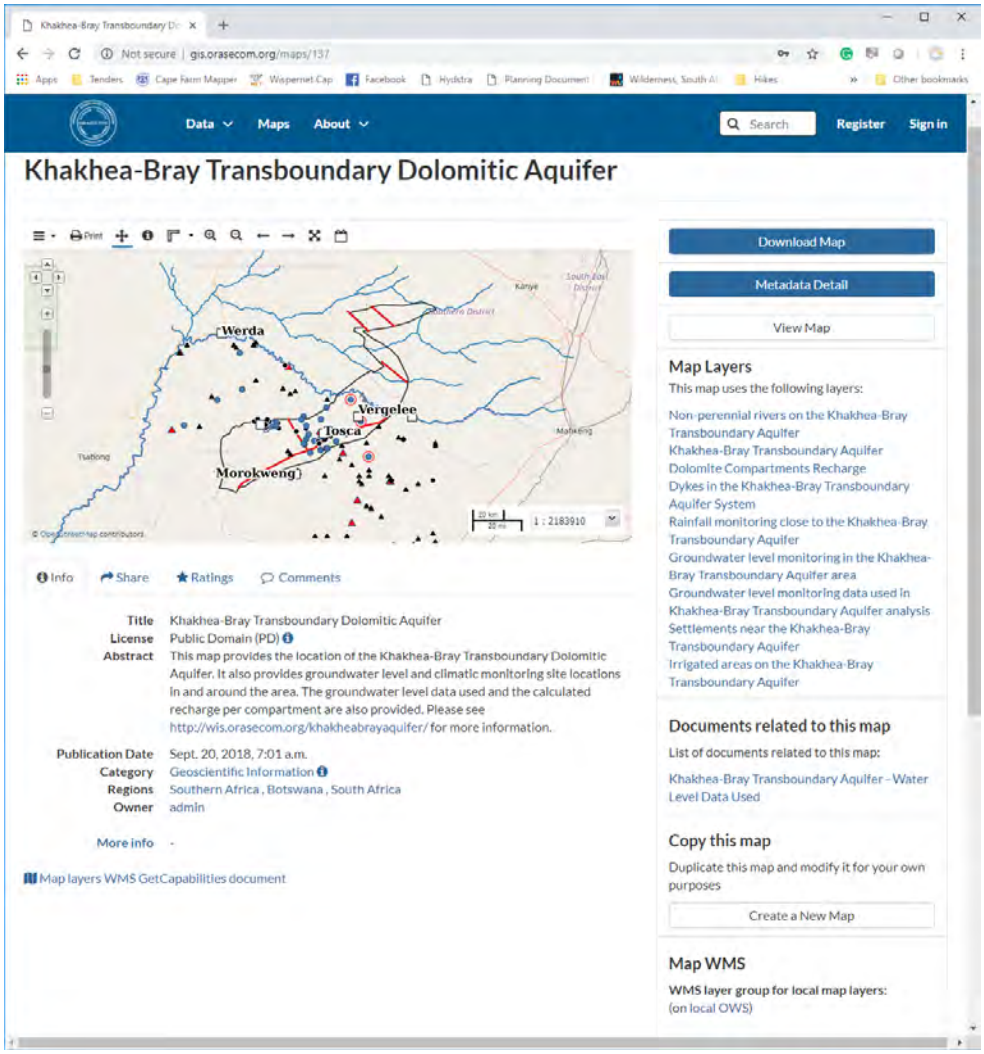
All created interactive maps can be access from the main menu by selecting Maps, as illustrated below:



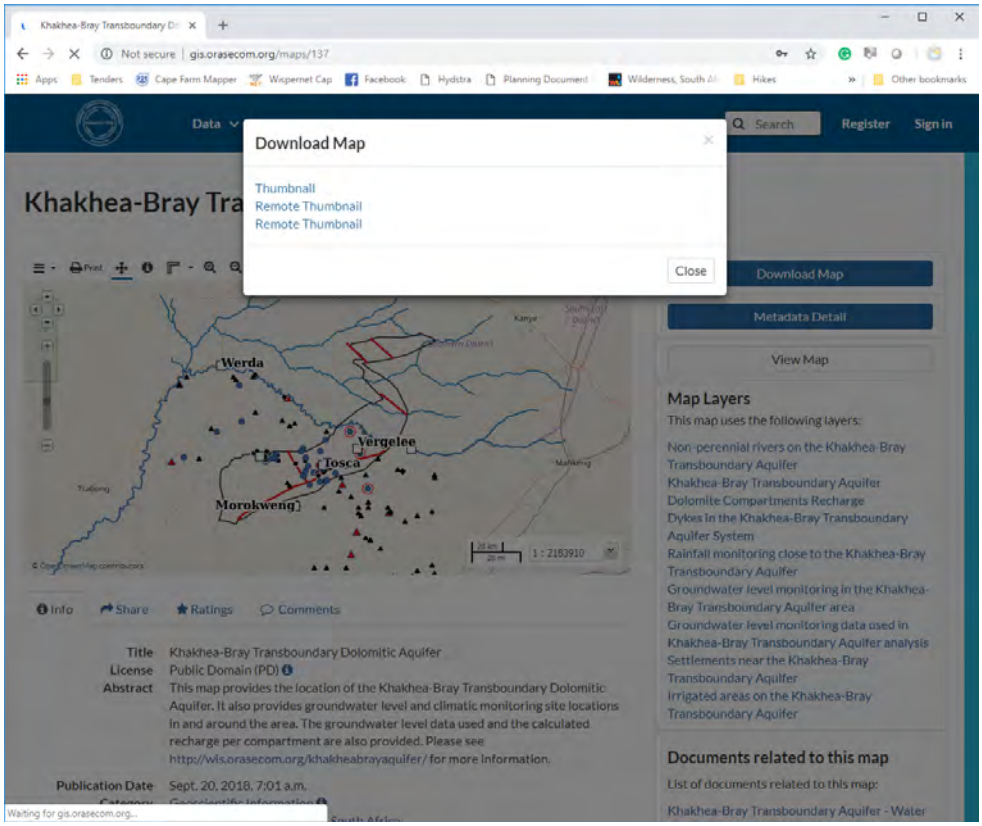
A typical browse listing is shown below:



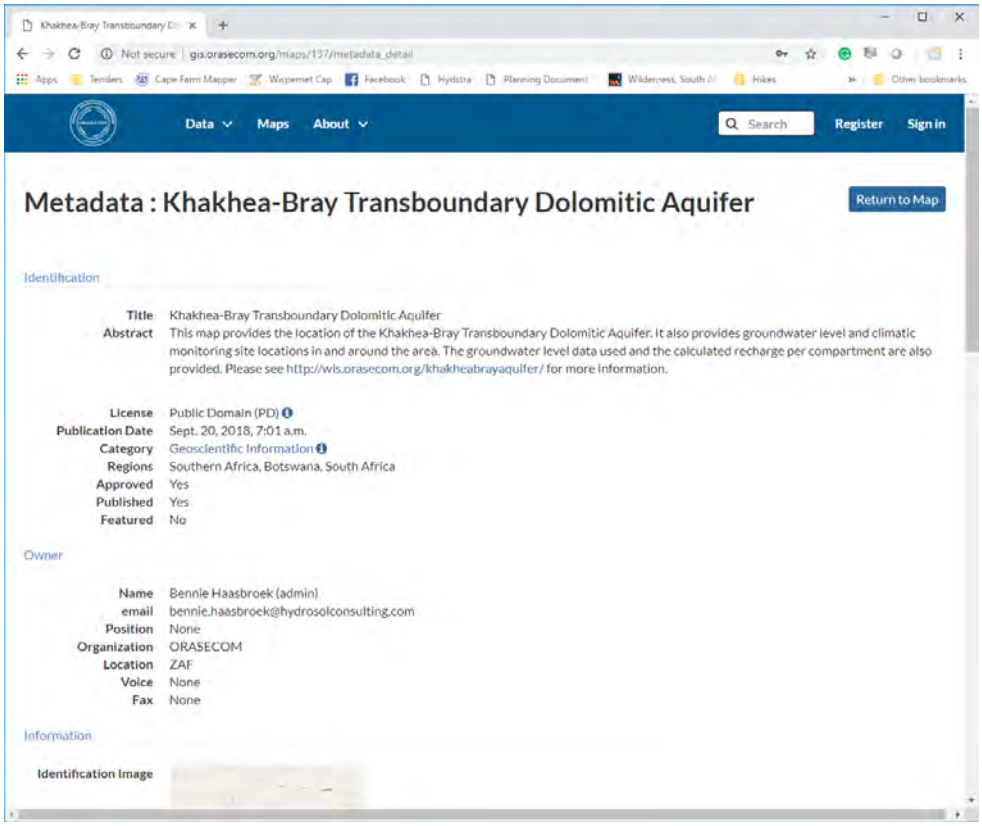
By selecting the name of the map, a more detailed view of the interactive map is provided as represented below. This page provides a summary of the metadata for the map with a links to all the layers and documents/datasets related to the map. Buttons for downloading the map, more detailed view of the metadata and for viewing the interactive map is also provided on this page.



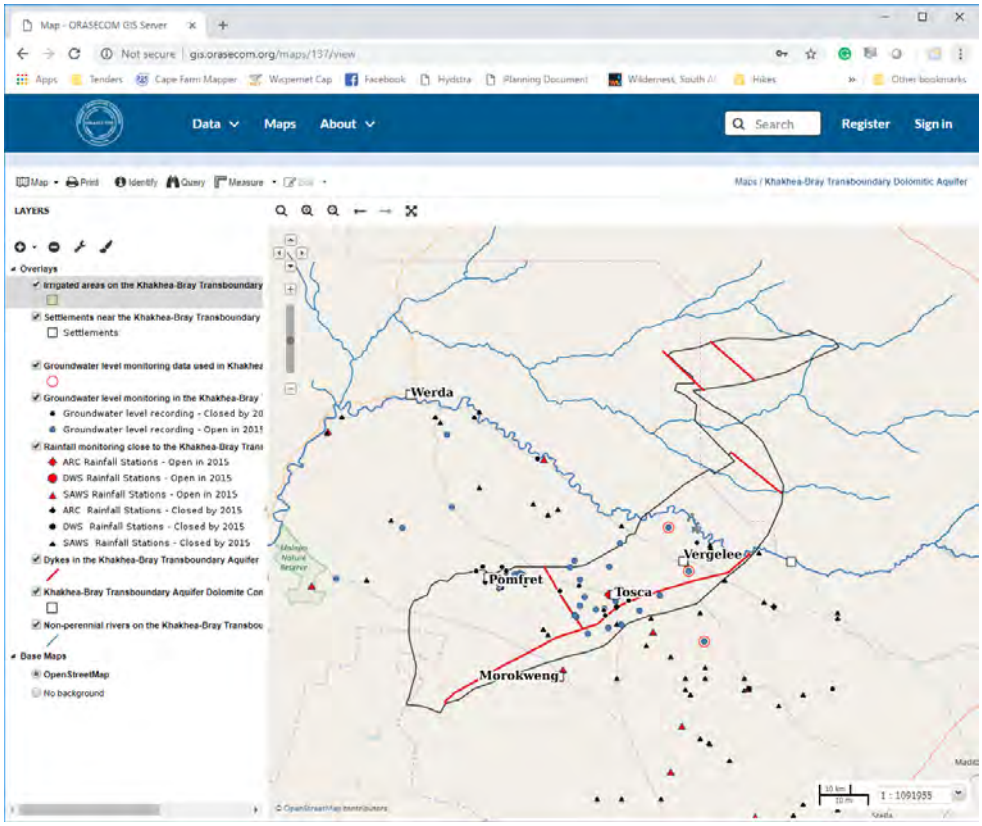
Selecting the Download Map provides the options as listed below. None of these options yield usable results and it is not recommended to be used.



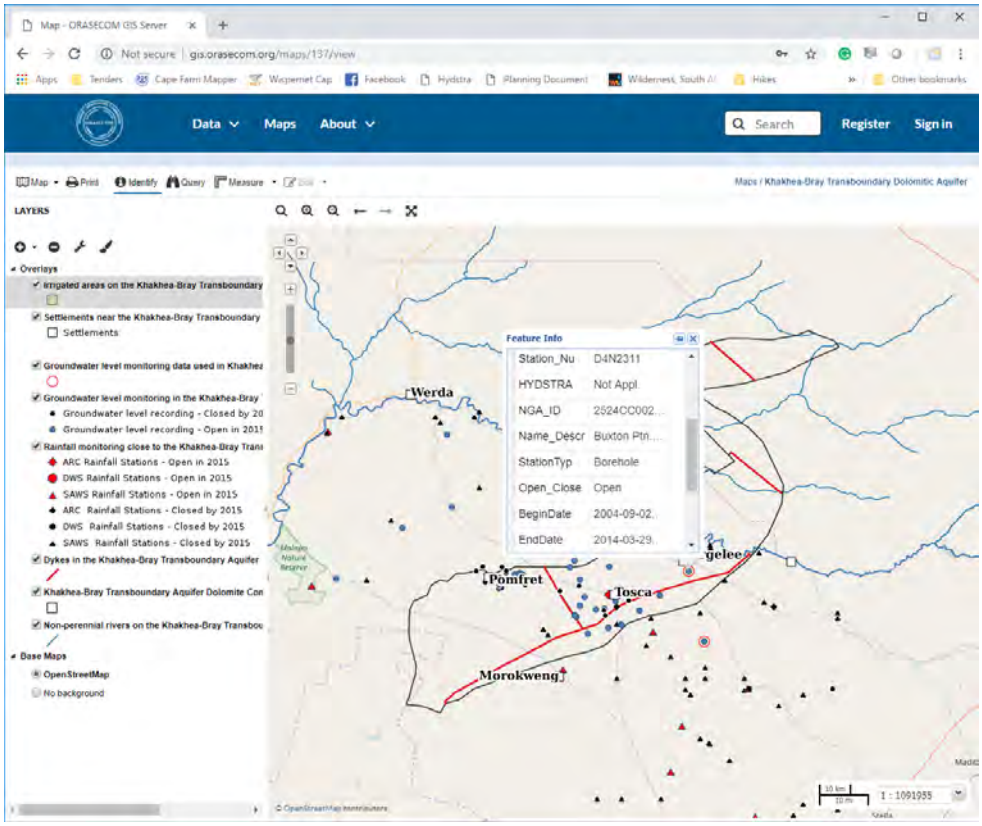
Selecting Metadata Detail button from the map detail page provides the typical output as illustrated below:



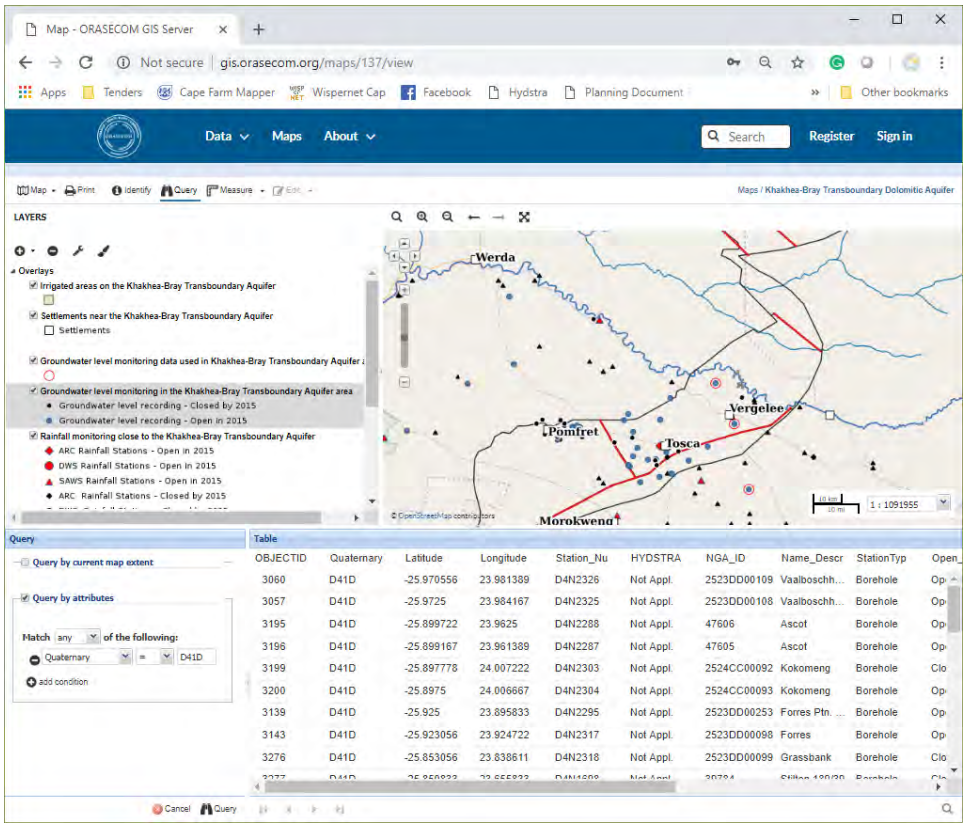
Selecting the View Map option on the map detail page provides the access to the interactive map. Each map has its own unique URL which can be shared. On the left menu bar the layers can be activated.



Using the Identify button on the top menu bar, each of the data layers can be interrogated as shown below:



By selecting the Query on the map's top menu bar brings up the data behind the layer which can be queried, as sown below:



3.3 Direct access to layers via 3rd party software

3.3.1 Introduction

The layers from the OGIS are contained in an online geodatabase which is publicly accessible. This means that one can access all the data on the OGIS and create your own map through applications such ESRI's ArcMap or the open-source application such as QGIS.

QGIS is a powerful open source geospatial application that is freely available over the internet and the following sections will describe the process of lining the OGIS layers to this application. Since ArcMap is not free, the process of connecting ArcMap to the OGIS will not be discussed any further, although it will be similar to the QGIS process. See the online article to follow the ESRI-ArcMap process:

http://desktop.arcgis.com/en/arcmap/10.3/manage-data/using-arccatalog/connecting-to-gis-servers.htm

3.3.2 Geodatabase services.

There are several services (protocols) that are available from Geoserver that allows communication between the 3rd party application and the OGIS in different ways. ArcMap can use WMS, WMTS, WCS and WFS services depending on the version of the application used. The most common services that are used are WMS/WMTS, WCS or WFS. The typical use of the differences is discussed below:

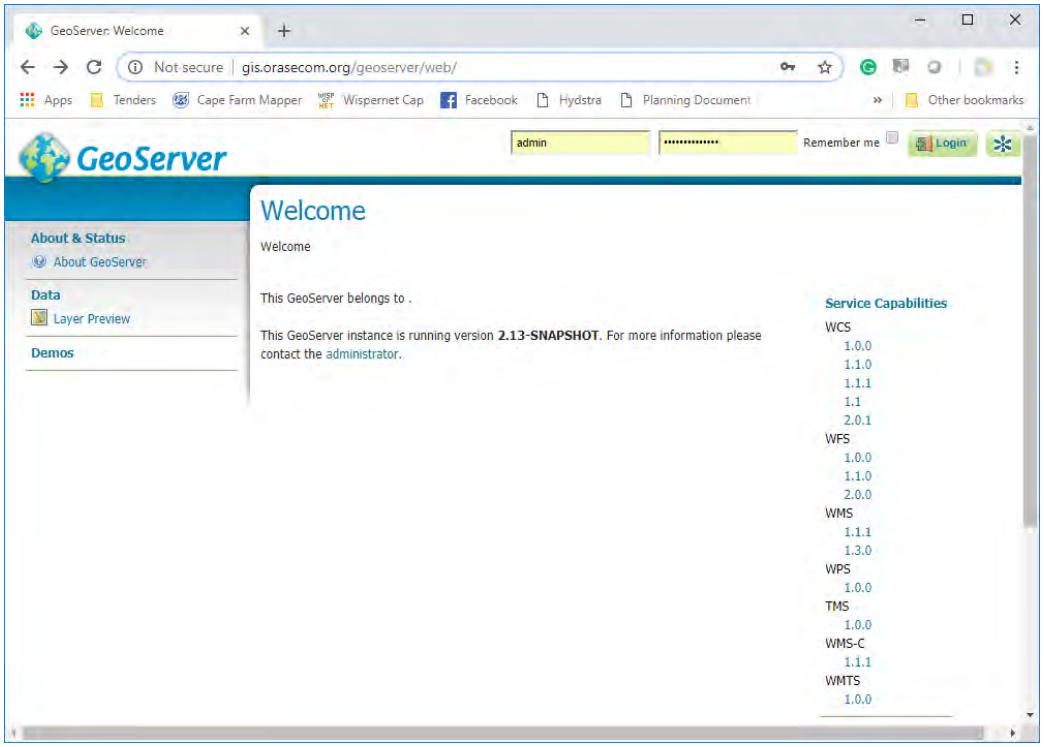
- Web Map Service (WMS): To share and render the map on the browser or create a custom map based application, OGC Web Map Service (WMS) is used. WMS is a simple and mostly used Map Service out there in the market. WMS will just render the Map in the form of the

image. One can view the map with limited functionalities like zoom, pan within the extent of the map layer created.

- Web Feature Service (WFS): WFS is used to query, update, delete the data of the map. This is used to share the vector data or metadata of the map over the web. This protocol is mostly useful in web-based client applications developed for GIS data editing. *This service provides full access to the original layer data however does not supply the styling of the layer as on the geodatabase.*
- Web Coverage Service (WCS): WCS is used to Publish the raster data like satellite imagery in image or TIFF or GeoTIFF formats. This is non-RESTful based service created using XML encoded in SOAP. If the image size is huge, this may take time in rendering the data which can slow down the performance of the application. To enhance the speed and performance of the application, it is suggested to use compressed images.

The list of protocols can be accessed from the following URL under Service Capabilities (see image below):

http://gis.orasecom.org/geoserver/web/



List of OGIS Services (protocols) for connecting to 3rd part applications.

3.3.3 QGIS Installation

QGIS can be downloaded from the following site:

https://qgis.org/en/site/forusers/download.html

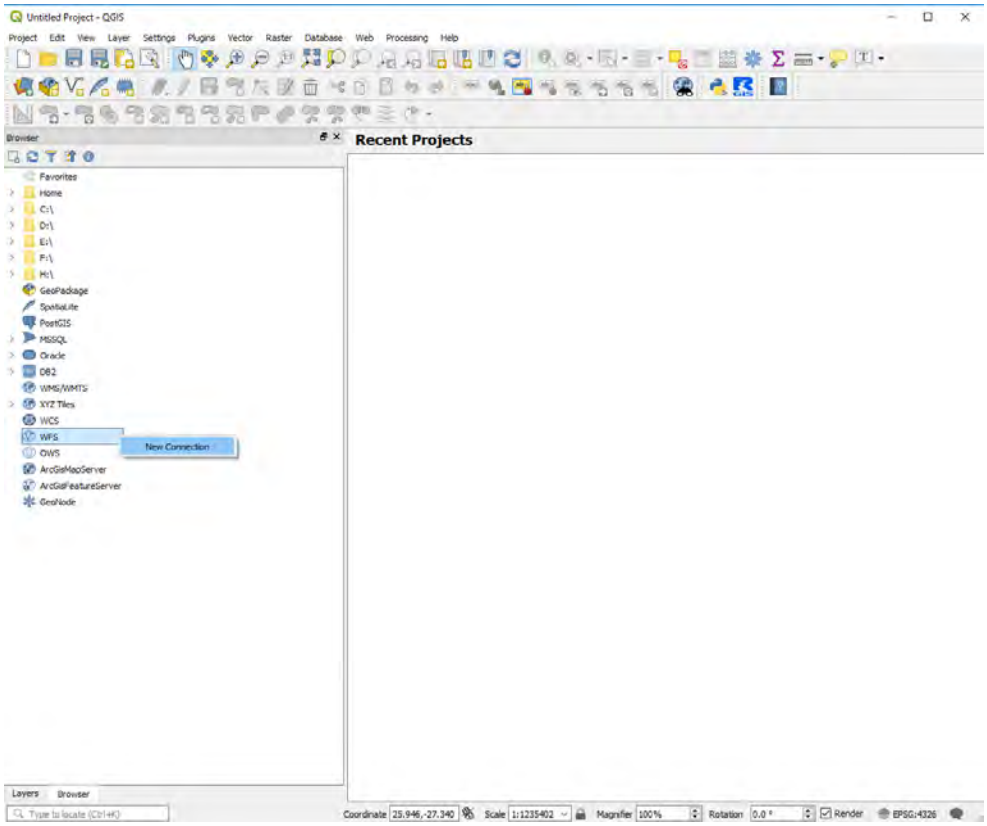
For most Windows users the QGIS Standalone Installer Version x.x (32bit) will be adequate. Please download and install the application.

If you are sure that you have a 64bit operating system you can install the 64bit version, which is faster at handling larger datasets. At the time of this publication the latest version of the software was 3.2.3. Instructions for later version might differ from the instructions below.

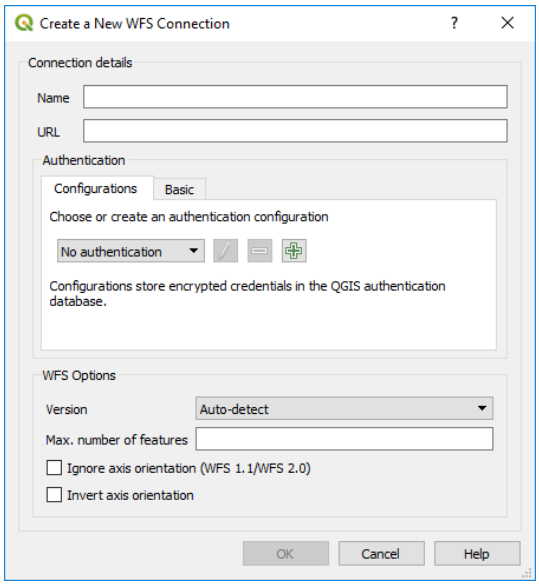
3.3.4 Accessing OGIS layers via QGIS

For the purposes of this User Manual, the WFS service will be used to illustrate the connection of the OGIS to QGIS. This is due to this service providing full access to the layer data from the OGIS, except for the styling information.

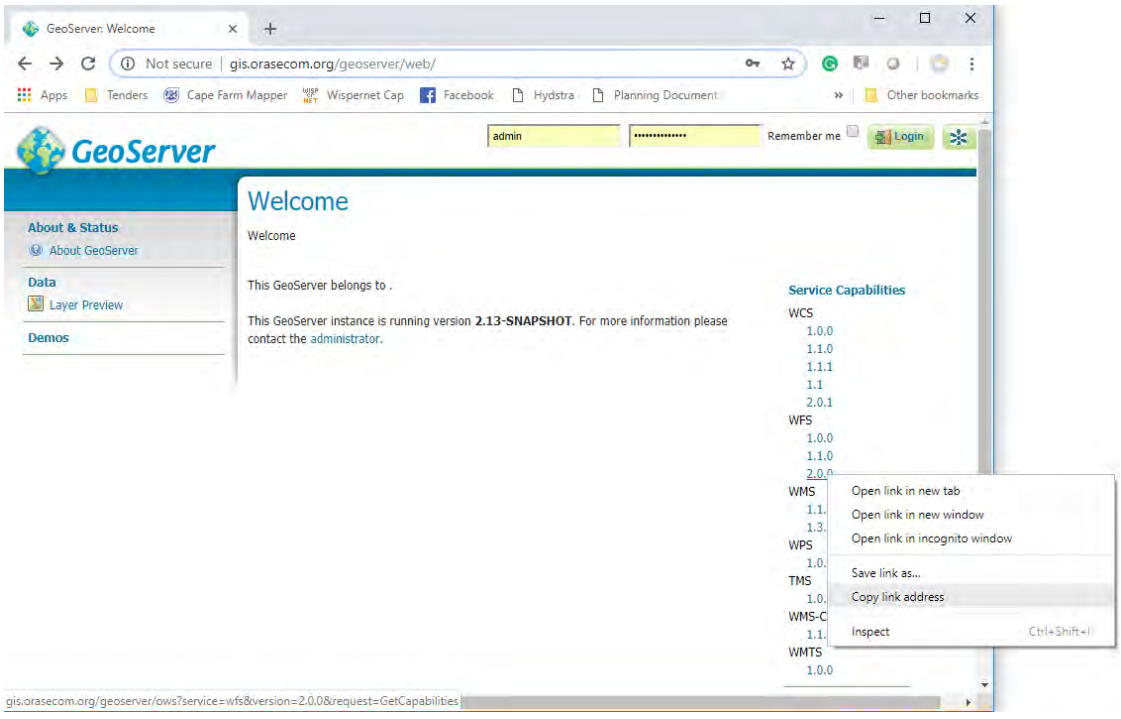
- After the installation of QGIS (see Section 3.3.3), find and launch the QGIS Desktop application under the Windows Start Menu.
- Select the Browser Tab in the left bottom corner of the application
- Right click on the WFS item under browser and select New Connection (see below).



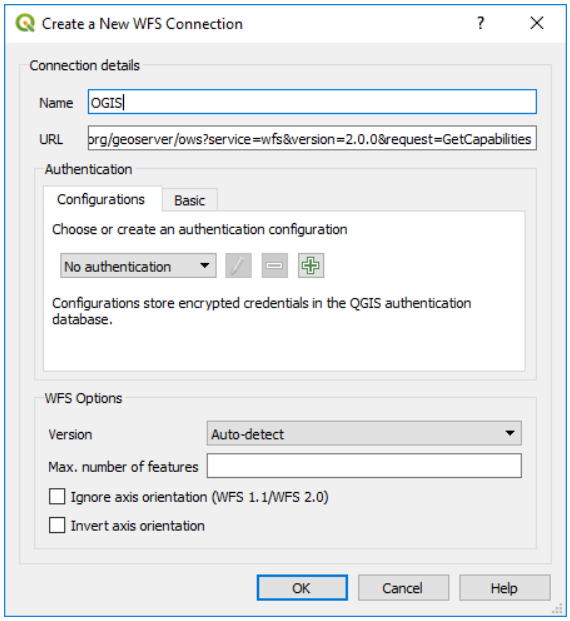
- The following form will open:



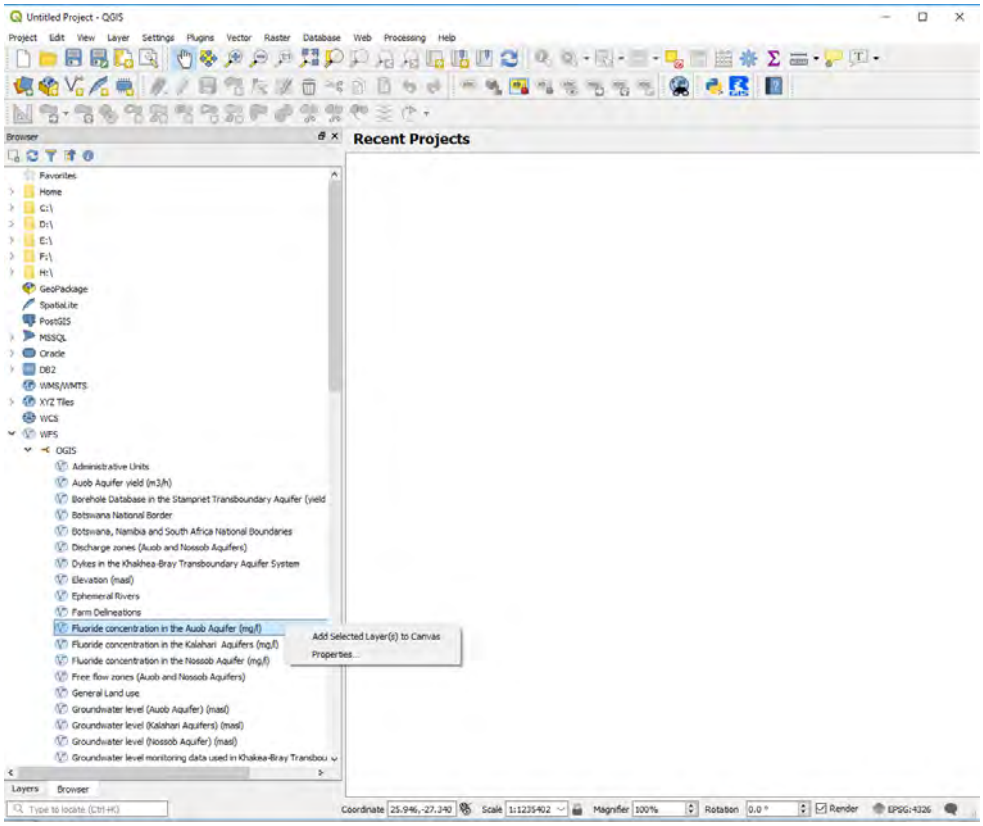
- Open the following link in a web browser: http://gis.orasecom.org/geoserver/web/
- Right click on WFS 2.0.0 and select Copy link address (in Chromo) or Copy link (MS Edge) – see below.



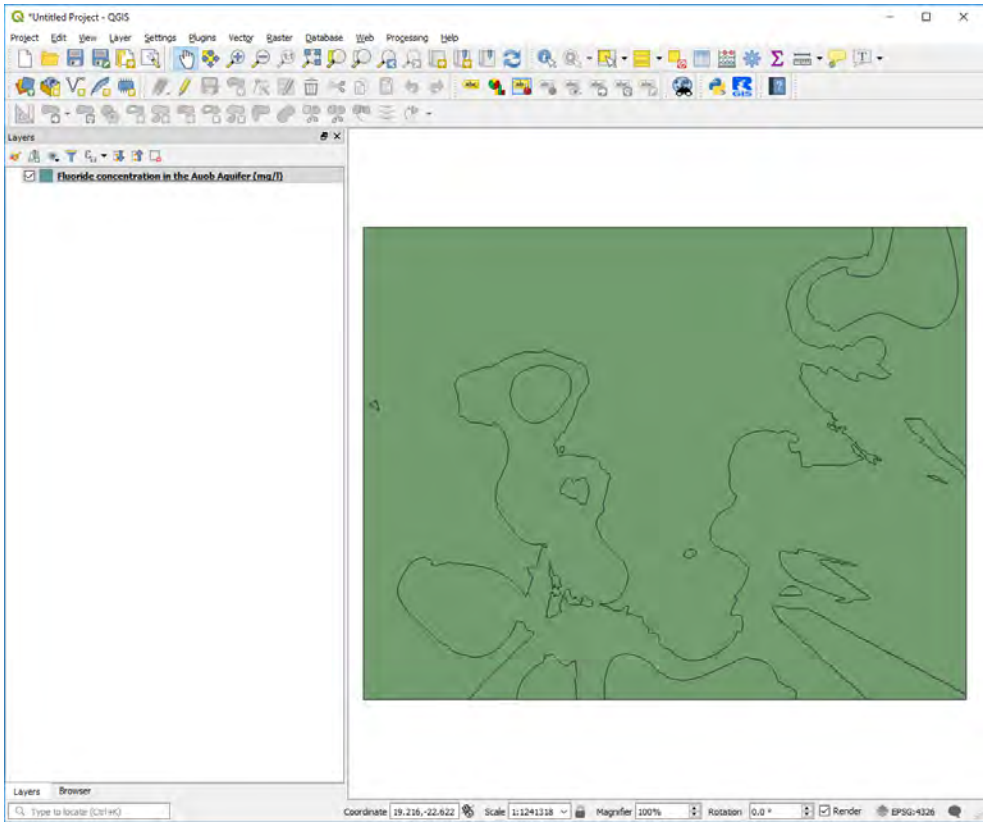
- Go back to the QGIS WFS form that you previously opened and paste the copied link into the URL section and enter a name for the server (OGIS). See below:



- Select OK
- Notice the OGIS (or what you called the server in the previous step) under the WFS item in the browser.
- Click on the right pointing arrow next to the OGIS
- A list of layers from the OGIS will be loaded.
- Right click on one of the layers and select Add selected layer(s) to Canvas (see below)



- Click on the Layers tab in the left bottom corner of the application to access the later data (see below)

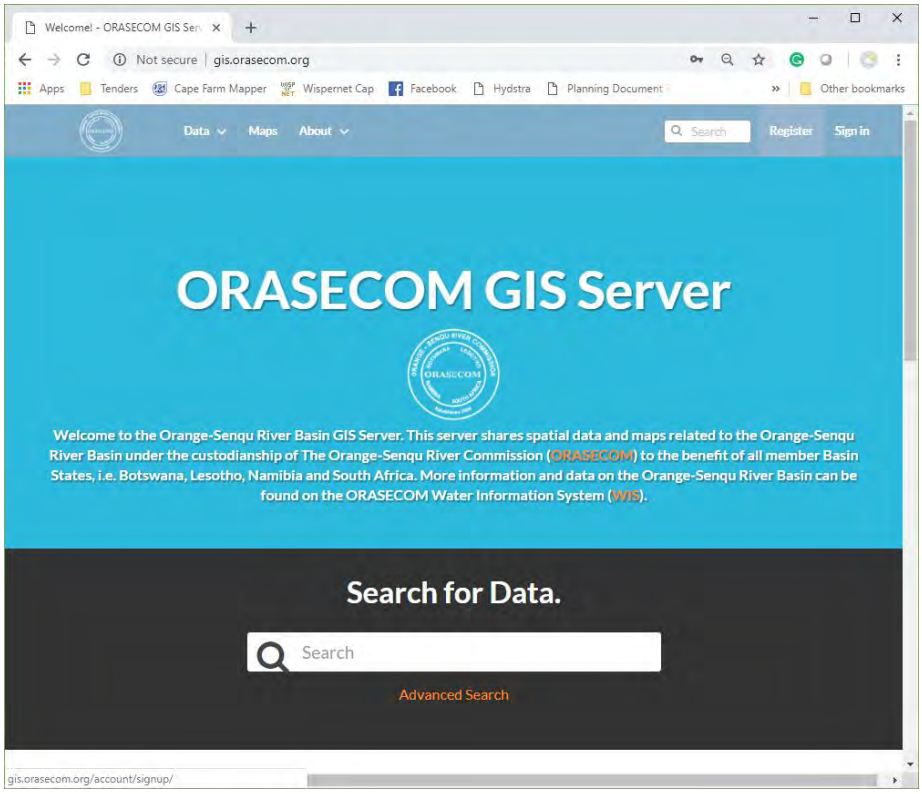


3.4 Register to contribute

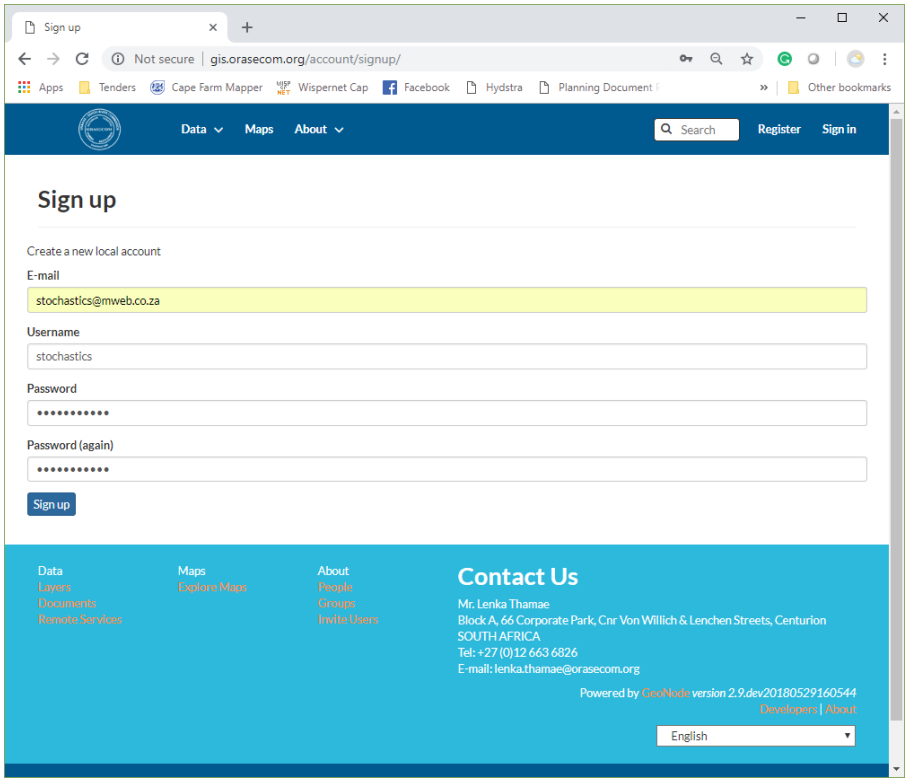
To upload documents and layers or safe maps, users need to register on the system

3.4.1 User Registration

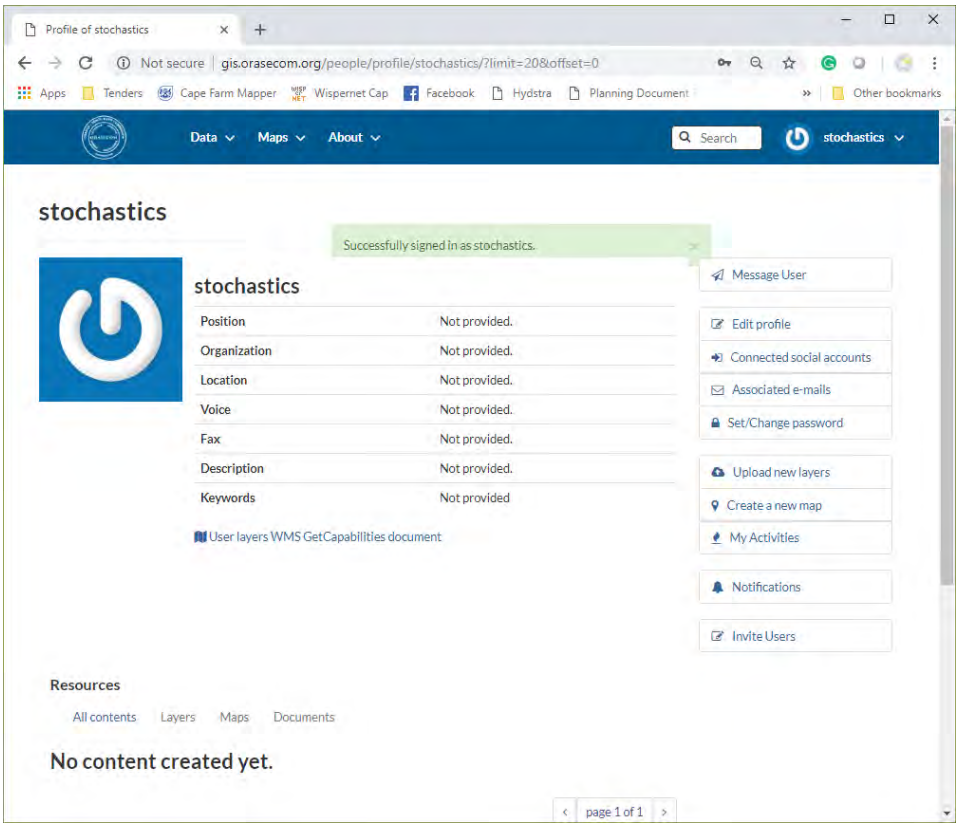
New users can register by selecting Register on the main menu bar as shown below:



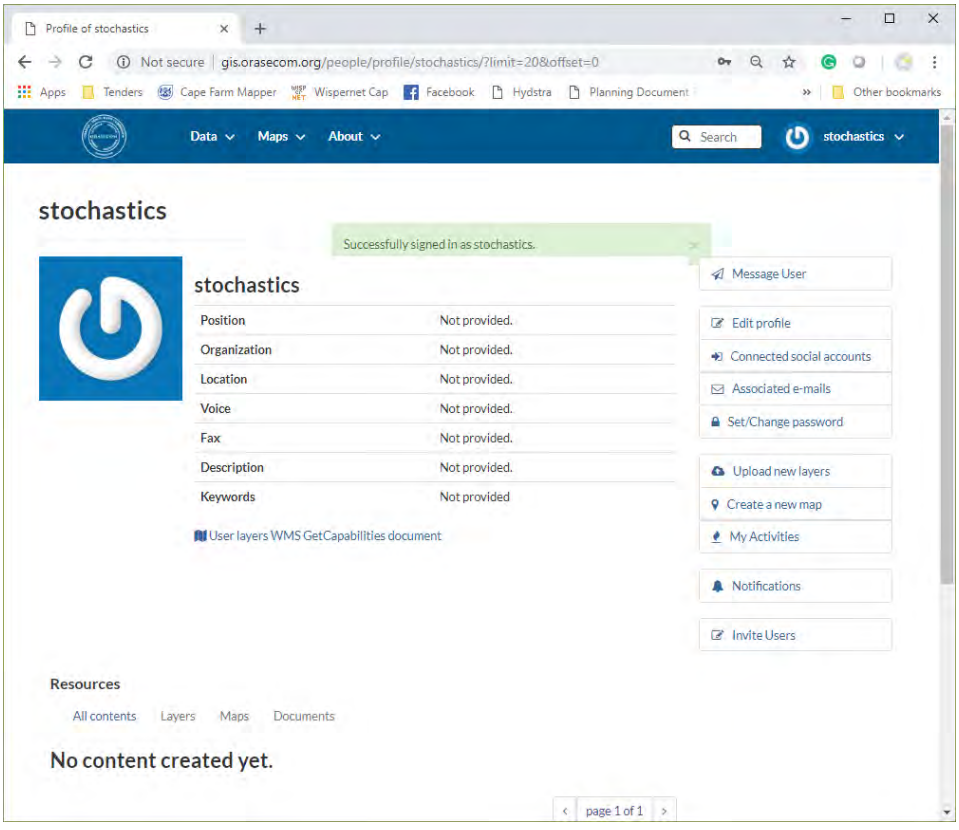
The subsequent registration form is illustrated below:



After successful registration a profile detail page will be displayed as shown below. Unfortunately, the current version of the system does not send any confirmation e-mails. In the detailed profile page, different profile editing tools are available as listed on the right-hand buttons on the page. For instance, the user can change their password or Edit their profile.

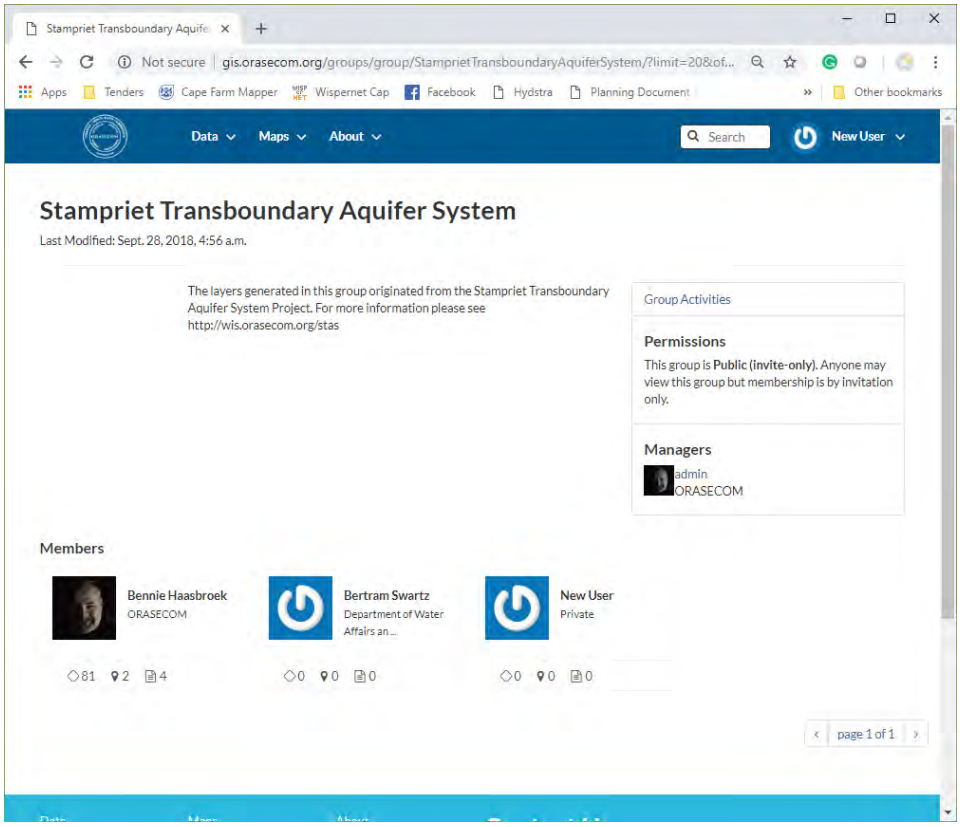


After a successful registration the users' credentials will be displayed on right corner of the main menu bar as shown below. Additional options for the user is available by clicking on the User Name.



3.4.2 Assignment to a Group

OGIS allows for administrators to create and assign groups. Registered users can be assigned to groups as members or as managers. You can see if you are a member or manager of a group by viewing your profile details via the About|Groups option on the main menu bar and selecting the applicable group. An example of group membership is shown below.



3.5 Uploading layers

The following section will provide an overview of how users can contribute layers and documents towards the OGIS. ***Please note the following***:

- Data should only be related to the Orange-Senqu River basin but could include any thematic data. Non-relevant data will be deleted.
- If no metadata is provided for uploaded layers or documents, and requests for uploading metadata are not responded to, the data will be deleted. The minimum metadata is listed in this document.
- It is not obligatory to style the layer or to update the thumbnail for the layer. Just note that the administrator may style the layer to conform with the server's look and feel, considering that the layer may be used in maps.

This version of the OGIS can import shapefiles and Geotiff raster data. Shapefiles consist on several files that should be uploaded. The minimum files required for uploading is the following:

- .shp — shape format; the feature geometry itself
- .shx — shape index format; a positional index of the feature geometry to allow seeking forwards and backwards quickly
- .dbf — attribute format; columnar attributes for each shape, in dBase IV format

- .prj — projection format; the coordinate system and projection information, a plain text file describing the projection using well-known text format

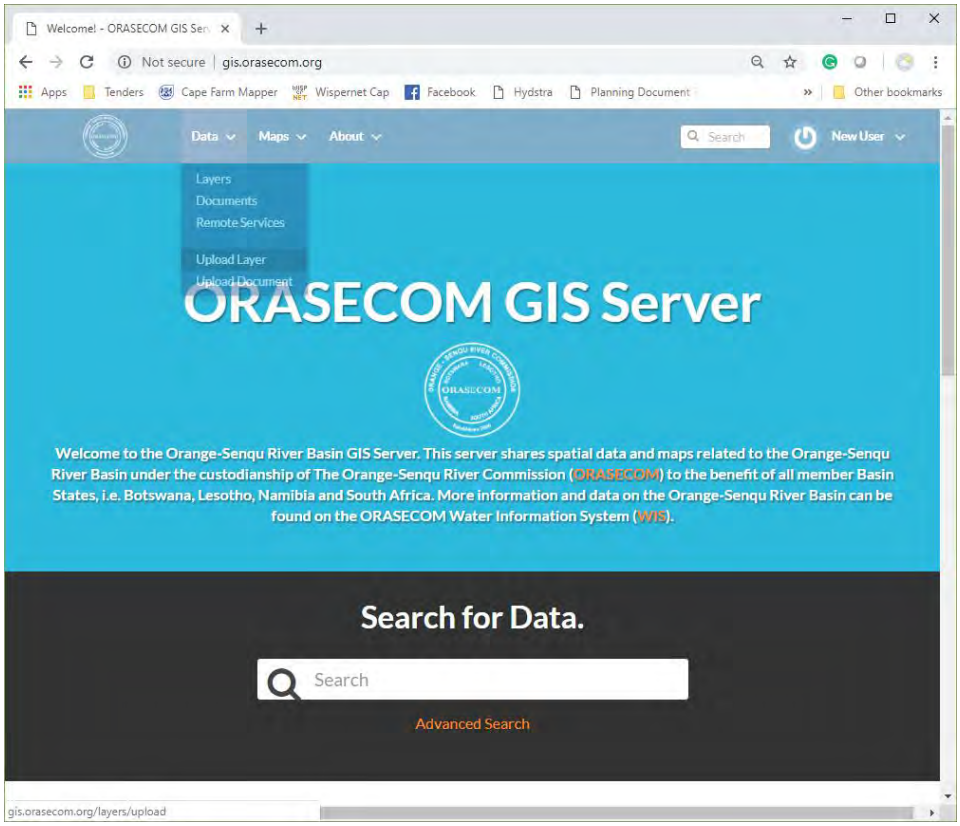
Other shapefile related files that can also be uploaded are:

- .sbn and .sbx — a spatial index of the features
- .shp.xml — geospatial metadata in XML format, such as ISO 19115 or other XML schema

Please note: Unless strict adherence to the ISO, FGDC, ebRIM, Dublin Core metadata is followed in a XML file, it is not worth uploading and preserving the XML files since much of the XML file will be lost during the uploading process.

3.5.1 Upload the layer data and setting access permissions

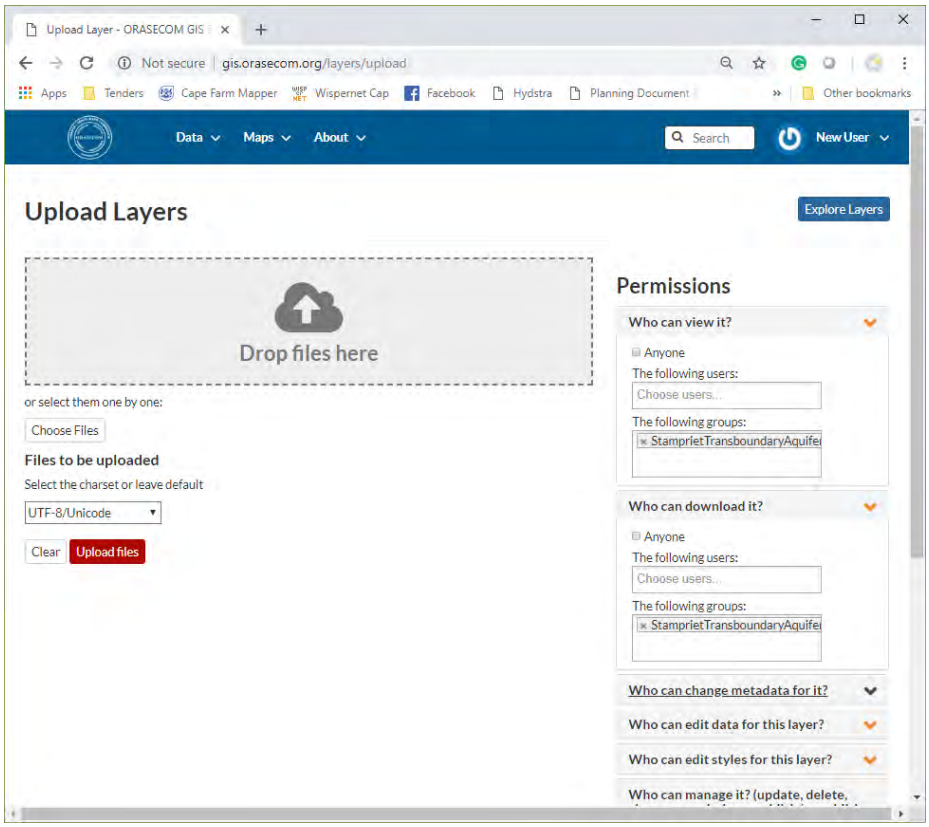
Once registered and signed in (See Section 3.4.1), GeoTiff files or shapefiles can be uploaded by selecting Data|Upload Layer from the top main menu as shown below:



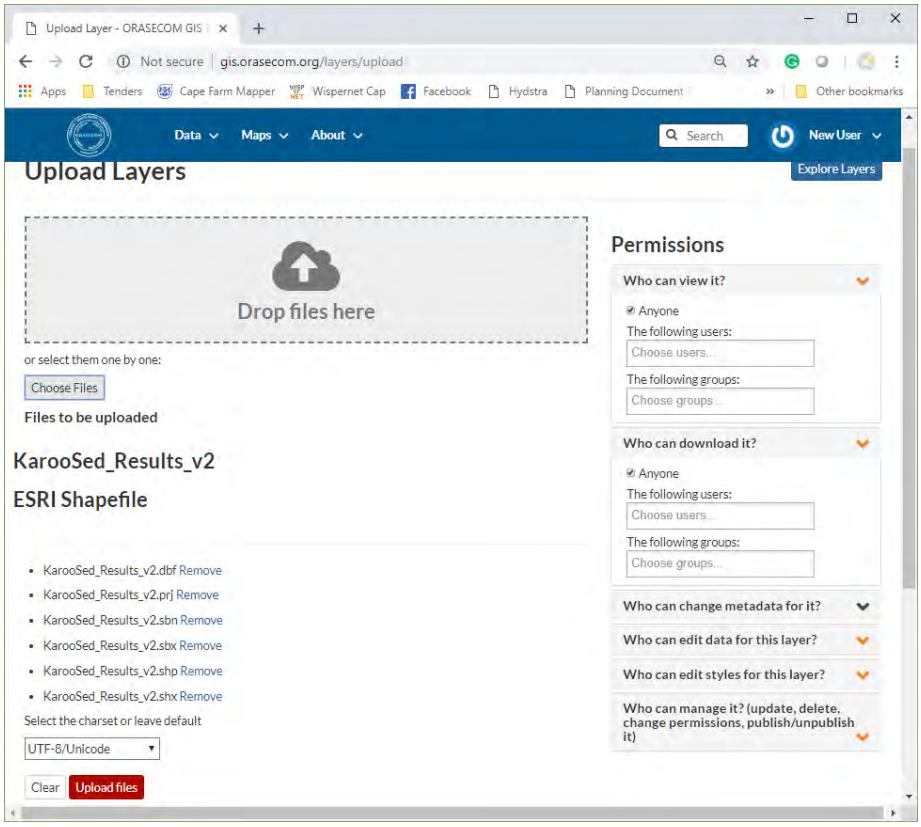
On the Upload Layers page, the shapefile datafiles or GeoTiff datafile can be selected from your PC. Before uploading the layer data files, it is also key to specify the permissions for the layer. Permission that can be set is based on individual users or groups. The permission settings include:

- Who can view the layer
- Who can download the layer
- Who can change the metadata for the layer
- Who can edit the data for the layer
- Who can edit the styles for the layer
- Who can update, delete, change permissions or publish/unpublish the layer.

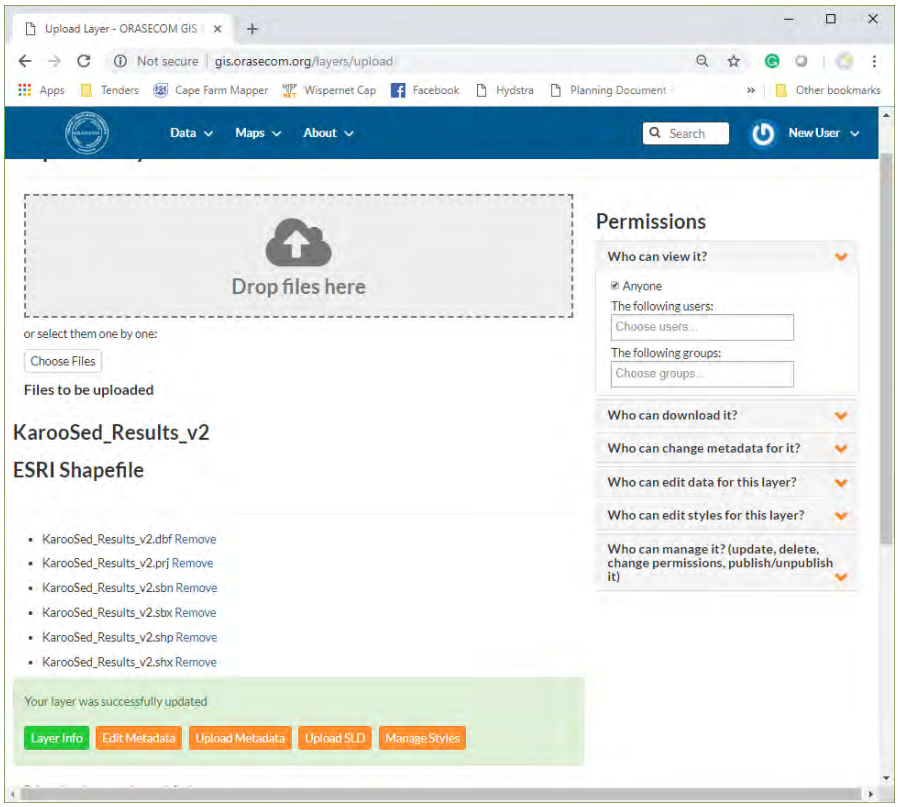
An example of setting the permission for a layer to only be viewed and downloadable by the Stampriet Transboundary Aquifer Group is provided below:



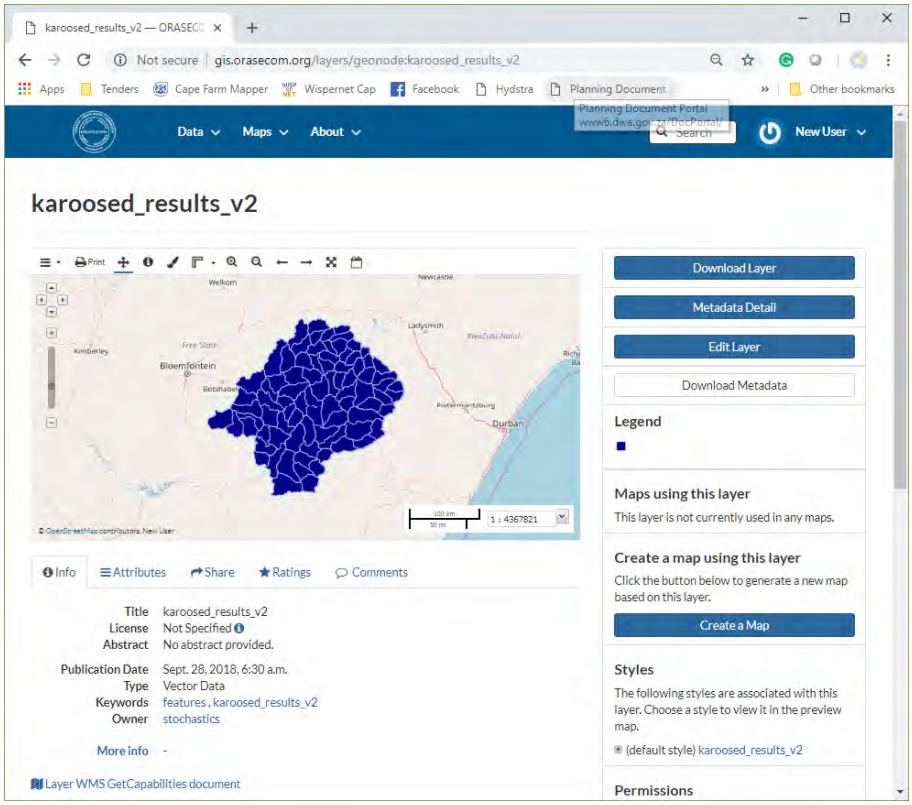
Uploading the data file can be done by selecting the Choose Files button, selecting the appropriate files from the user's PC and then selecting Open. A list of all the files to be imported and any error messages is shown below.



Select the Upload Files button to upload the datafiles. Once done an options menu will appear as at the bottom of each set of files uploaded as shown below:

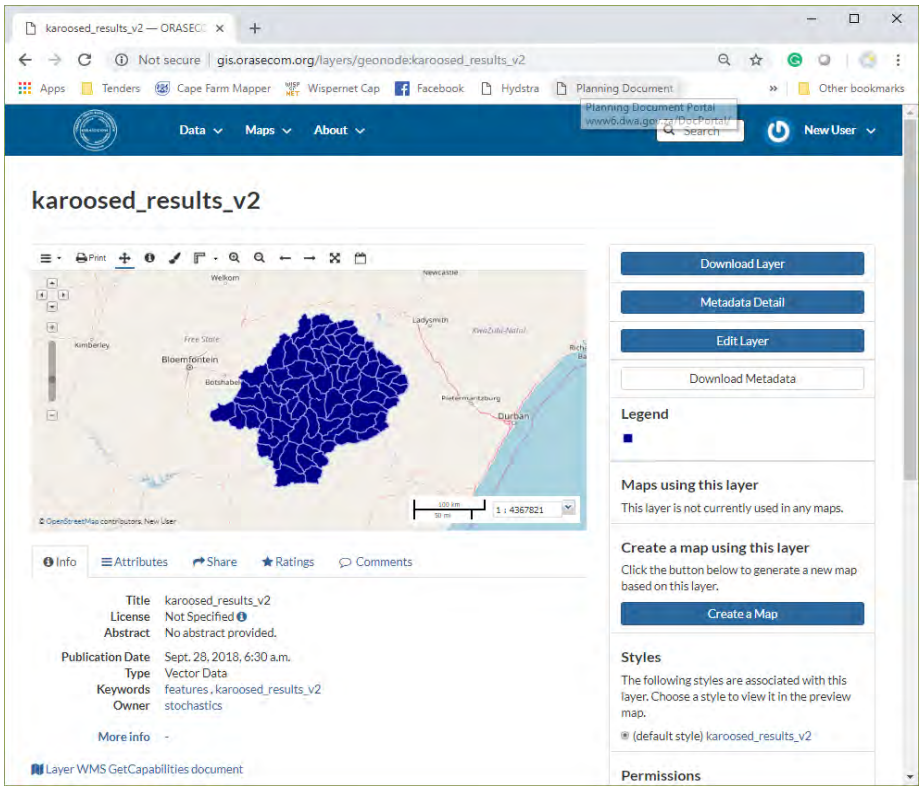


By selecting the Layer Info button, a summary of the properties and a view of the layer are provided as shown below:

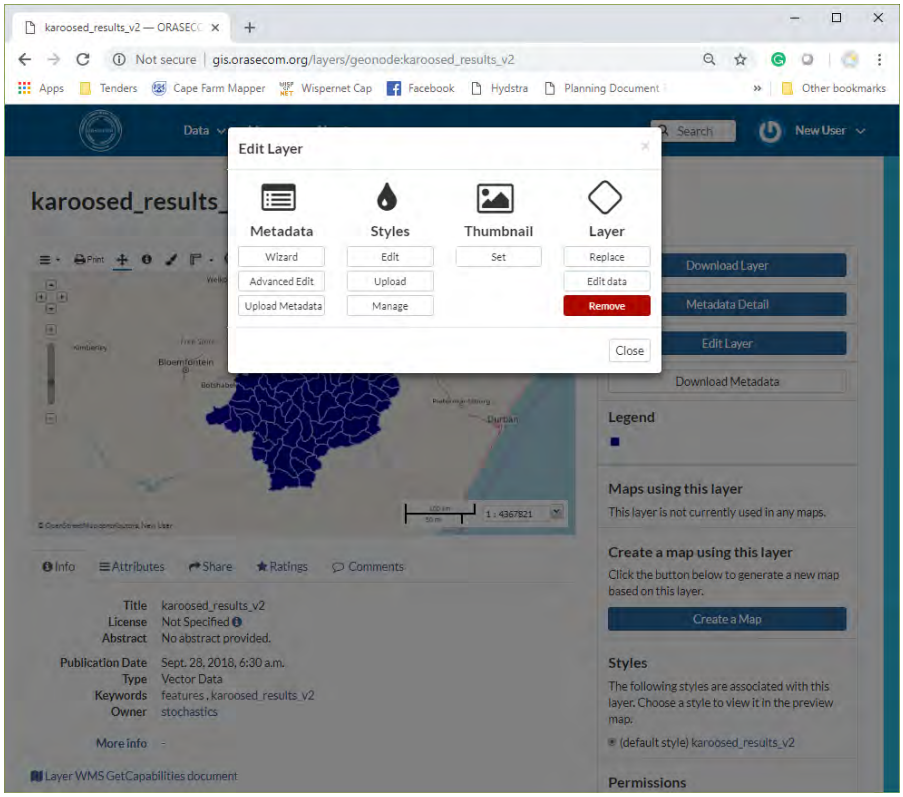


3.5.2 *Defining metadata for a layer (compulsory)*

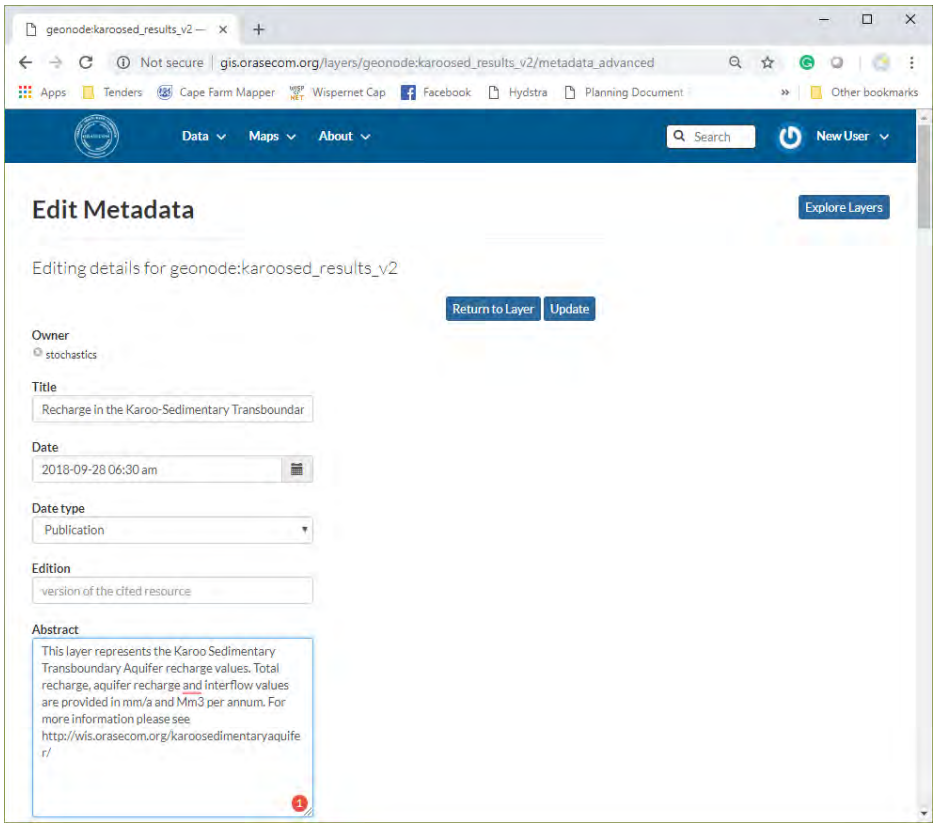
Access the layer's summary page by either searching or browsing for the layer via the Data|Layers main menu option and selecting the layer's name. Metadata can be changed by layer owners through selecting the right hand Edit Layer button as shown below:



A layer editing menu will appear as shown below. Metadata can be uploaded via XML file but is not recommended. It is recommended to use the Advanced Edit option under Metadata and not the Wizard.



The layout of the metadata editing screen is provided below. It is crucial to define the minimum amount of metadata fields which is discussed in more detail below.

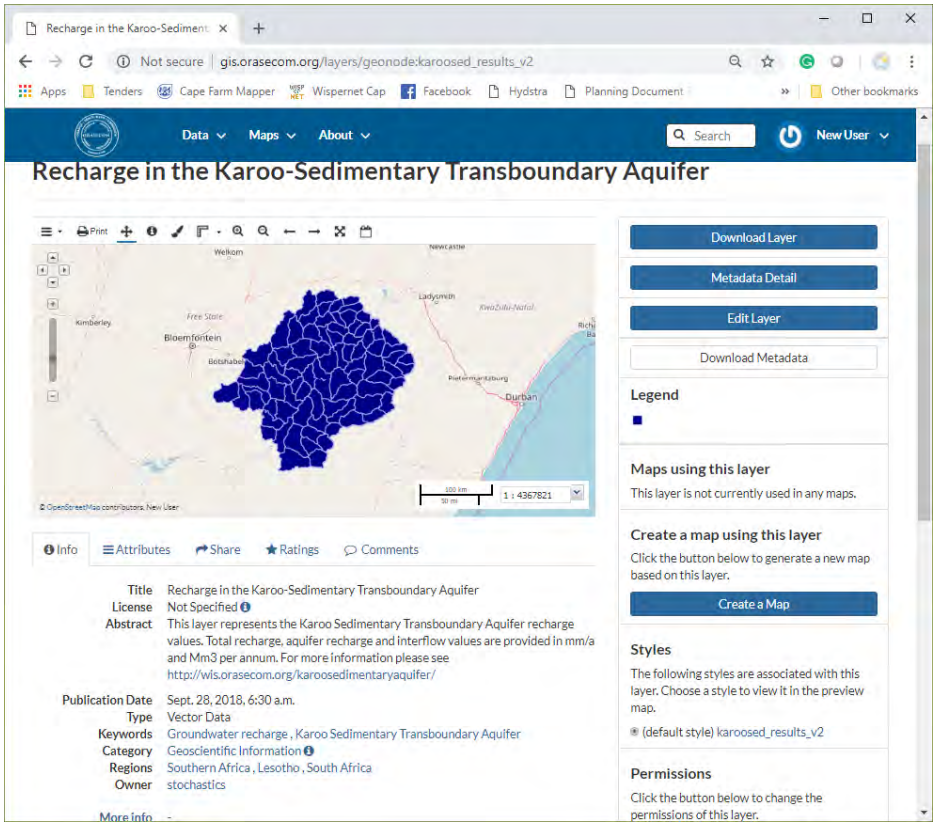


The minimum metadata fields that are required are listed below. Not adhering to this could lead to the deletion of the layer by an administrator.

- Title: The title is crucial and **compulsory**. This is the way in which the layer is reported not only in the web interface but also in all 3rd party application connected via geospatial service (see Section 3.3.4). The Title should at least include (a) a place or subject name such as Karoo-Sedimentary Transboundary Aquifer or Bloemfontein Area, and (b) what is contained in the data for example recharge values or assessment results.
- Abstract: The abstract is crucial and **compulsory**. A short description of the layer must be provided. It the original creator is know it should be provided. An URL link to the WIS or other internet sources should also be provided if available. If more than one variable is available in the layer they should also be listed.
- Purposed: This is optional
- Regions: This functionality is buggy, but Southern Africa is usually the description. Individual countries can be selected.
- Restrictions: If there are any restrictions on the use of the layer it should be specified. If it is in public domain then leave unspecified.
- License: Most licenses are Public Domain.
- Spatial representation: The only two applicable options are usually vector data or raster data representing geographical data.

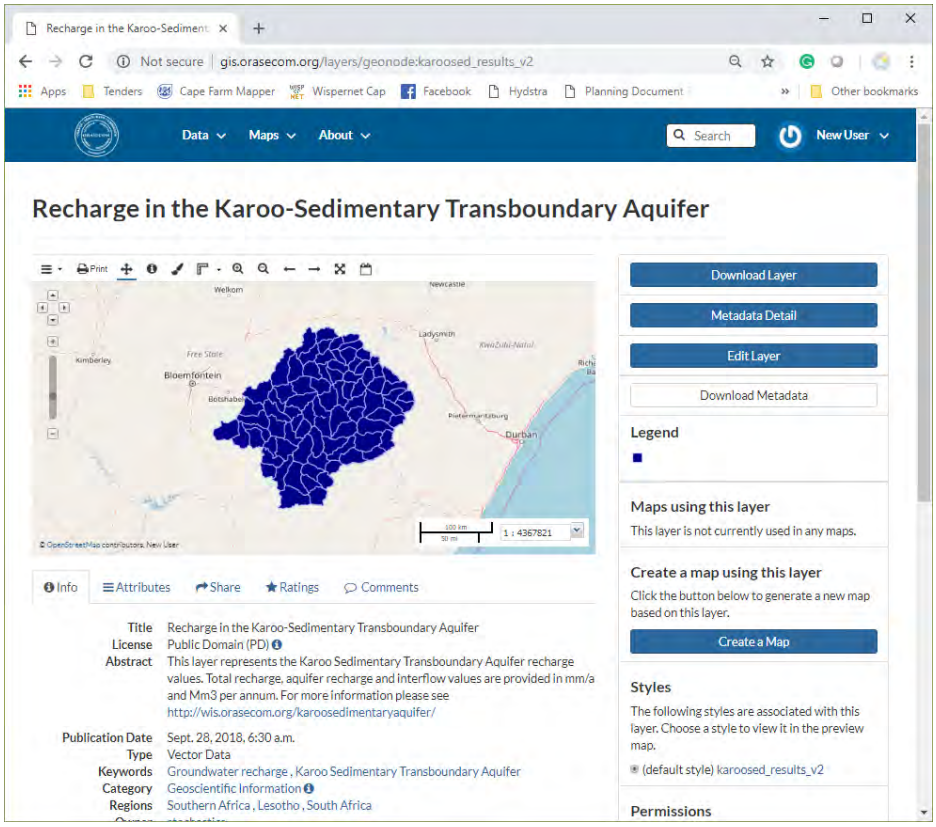
- Group: If this layer is part of a group's data and you have permission setting the layer's group settings (manager) then you can specify the group.
- Free-text Keyword: By default, the layer name is provided as a keyword. Add keywords such as the location or subject and the data that is represented by the layer
- Category: This is a **compulsory** field. Select the appropriate category icon. The types of data under each category is displayed by holding your mouse pointer over the category name.

Selecting the Update button at the top or the bottom of the page will return you to the layer summary page as shown below:

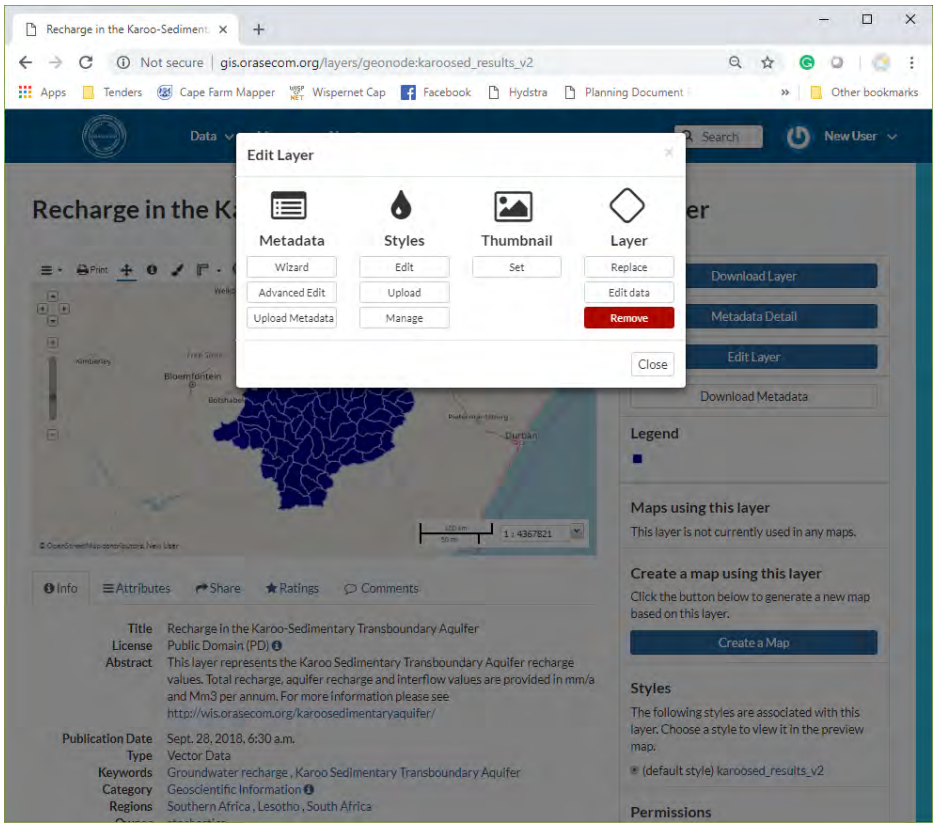


3.5.3 *Basic styling of a layer*

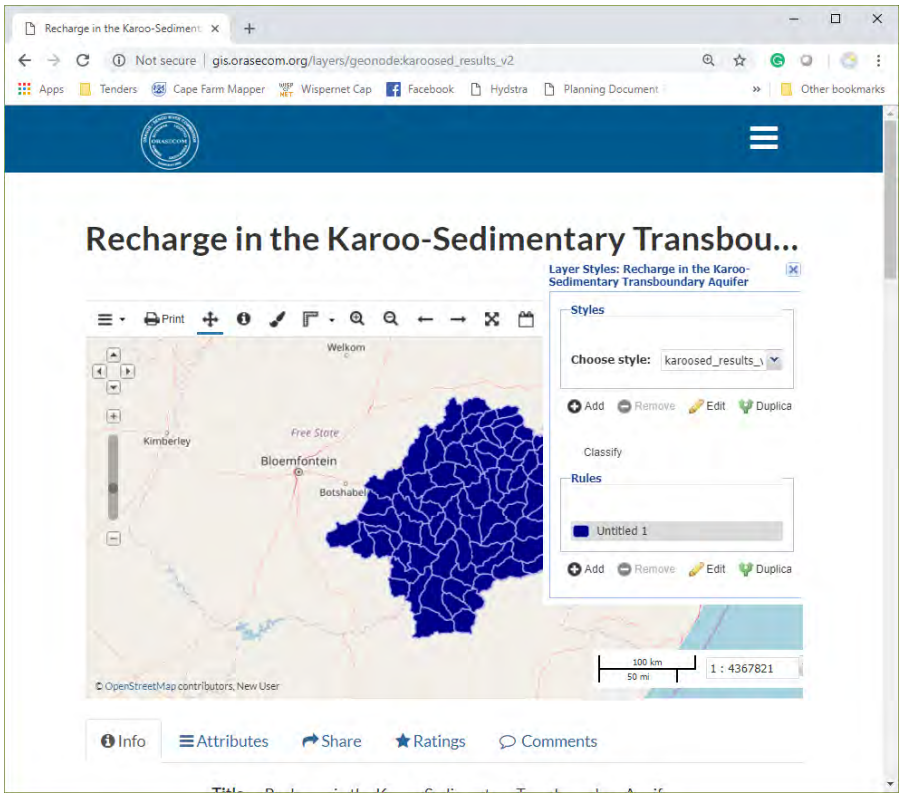
Access the layer's summary page by either searching or browsing for the layer via the Data|Layers main menu option and selecting the layer's name. Basic styling of the layer can be done by layer owners or having permission to change the layer styling (see Section 3.5.1) through the selection of the Edit Layer button on the right-hand side of the page as shown below:



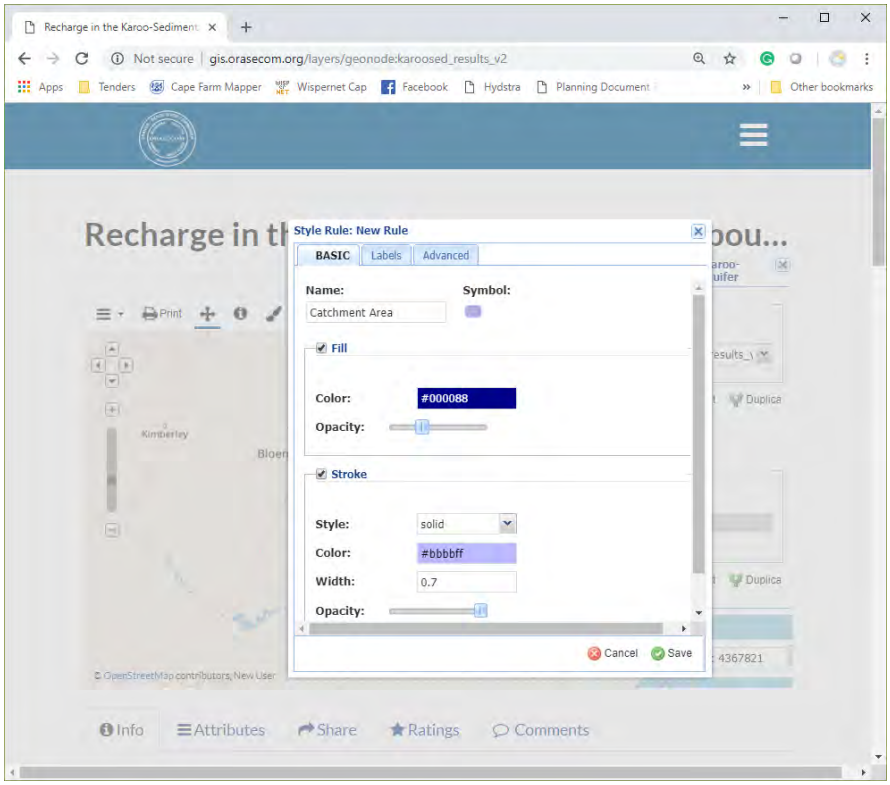
A layer editing menu will appear as shown below. Basic styling of the layer can be done by selecting the Edit button under the Styles header.



A Layer Styles window will appear as shown below. It has two section (a) Styles and (b) a Rules section. When uploading a layer, a default styling is applied and is given in the Styles section. The Rules are the actual style's formatting.

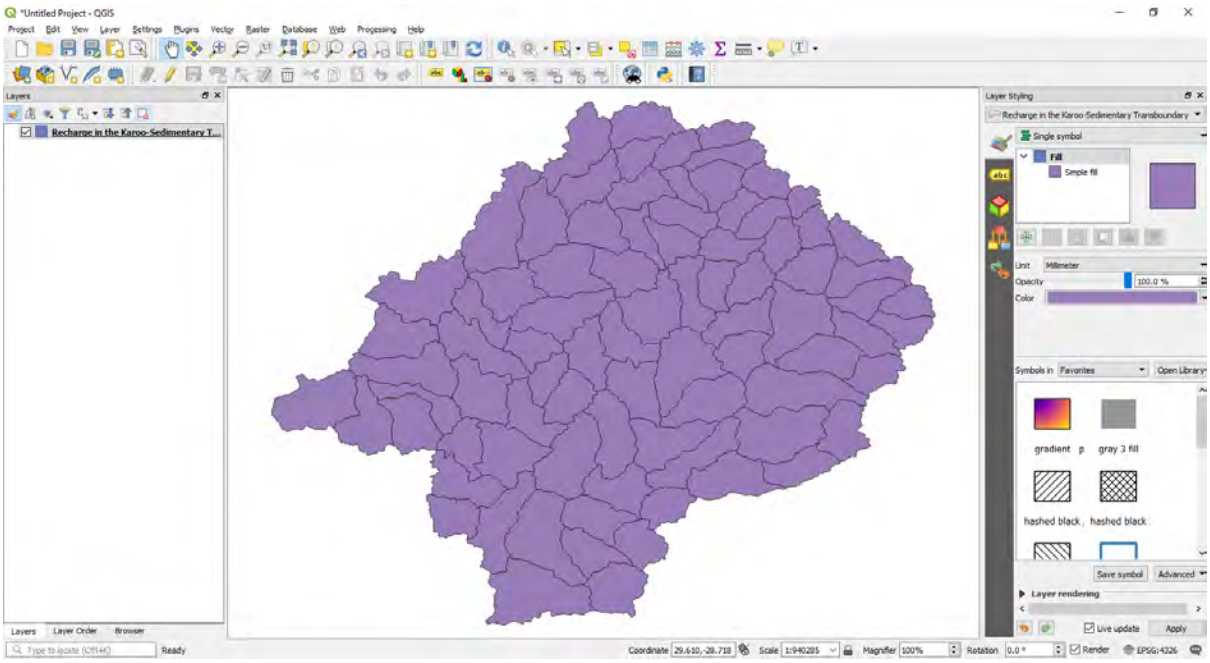


To change the formatting of the default style, select or add a new rule and then select Edit. Another menu for basic changes to the format of the style will appear as below. Adding a name will add a Legend to the layer. Labels can be added but caution should be used in changing detailed label settings as well as advanced settings. Press Save to implement the changes.

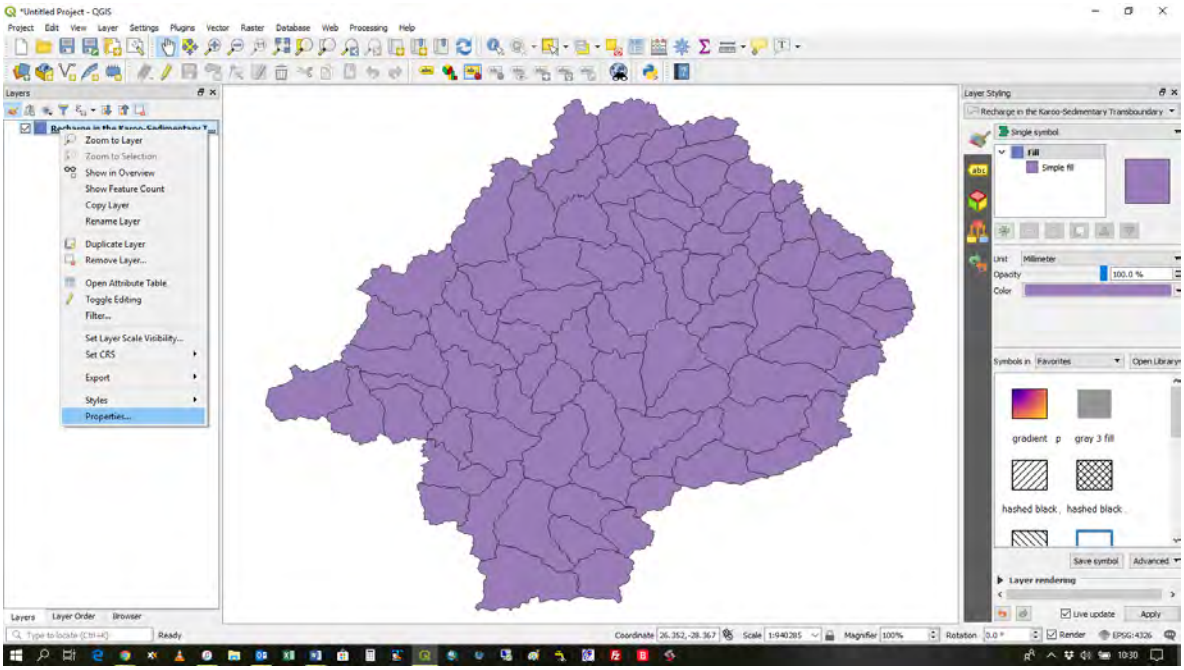


3.5.4 Advanced styling with SLD file

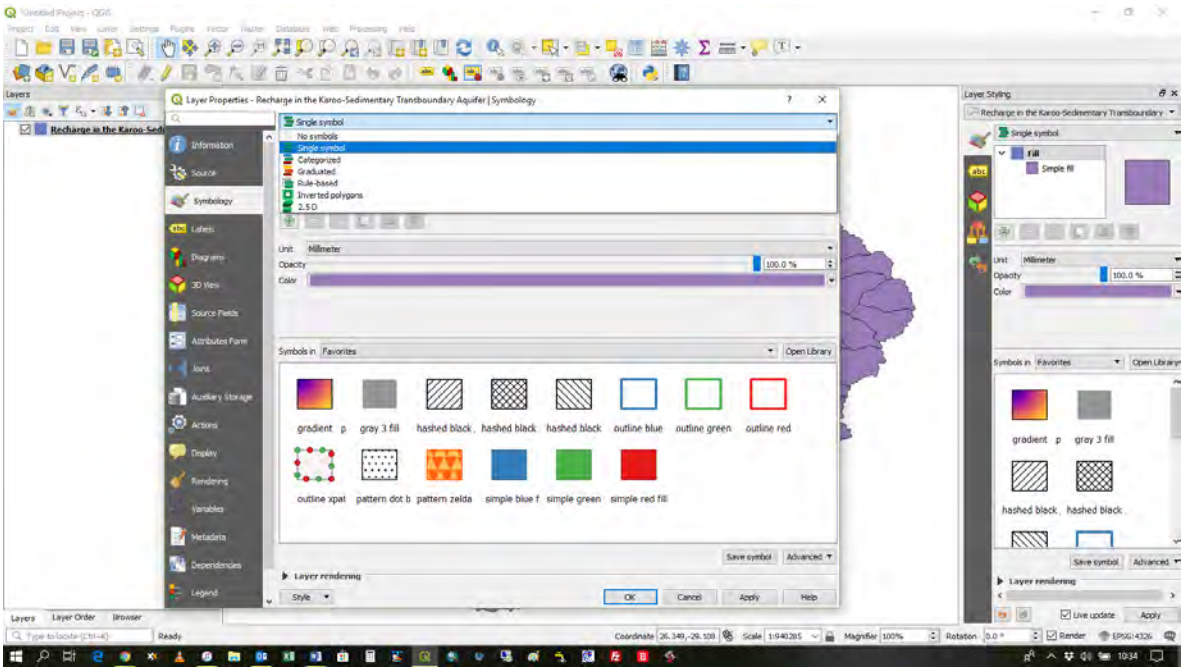
A layer can be styled by creating a SLD file that describes the layer style formatting. SLD files can best be created in QGIS. Section 3.3 provides an overview of how to connect QGIS directly with the OGIS. Using this connection or by simply opening the shapefile through the menu bar in QGIS a SLD file can be created. Multiple SLD files can be created for different data variables in the same shapefile. When opening the layer in QGIS, make sure that View|Panels|Layers Panel is activated, as shown below:



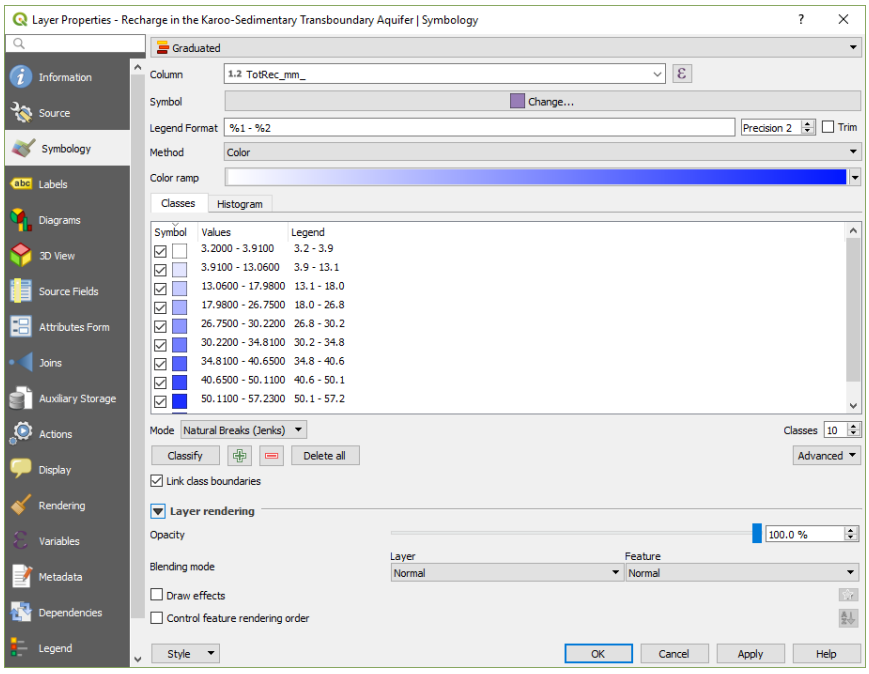
Right click on the Layer's name in the Layers panel and select Properties as shown below:



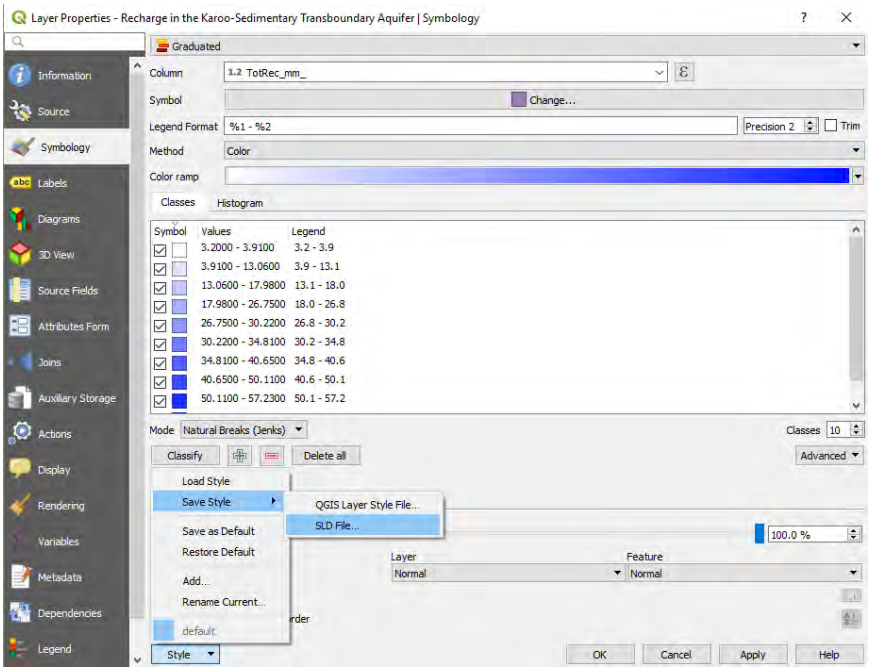
Then select Symbology in the Layer Properties screens' left-hand menu. At the top right hand panel of the Layer Propetries screen a drop down menu can be selected to choose the type of symbology, see below:



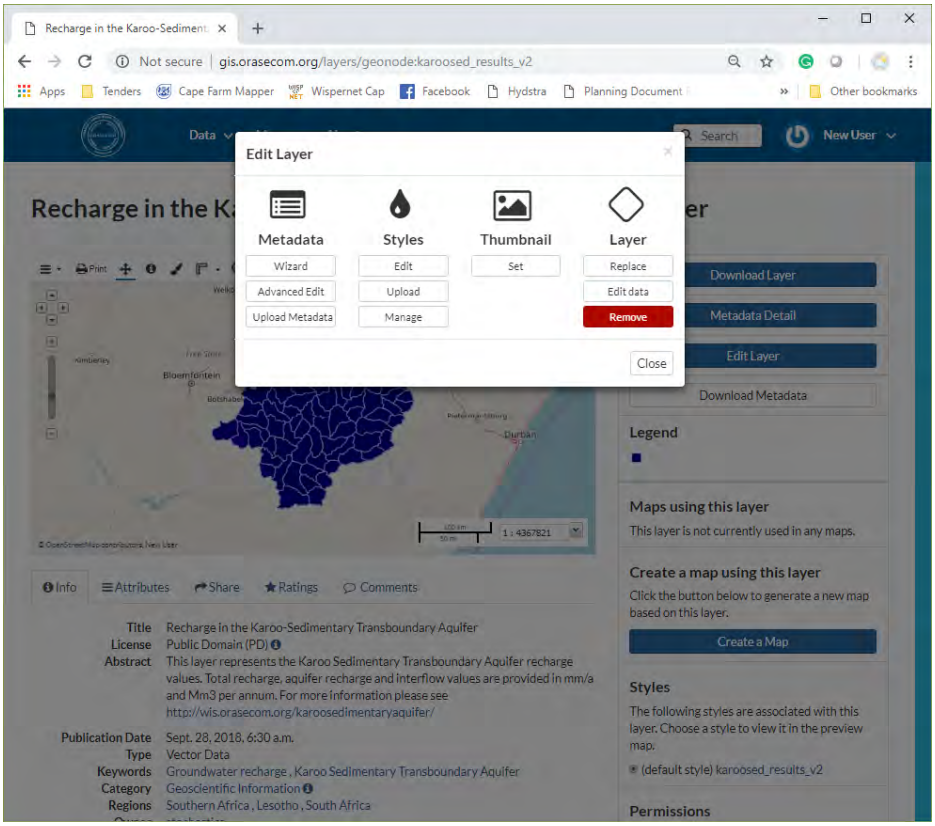
In this example graded Total Recharge values will be rendered by selecting graduated from the drop-down menu and specifying the settings as shown below:



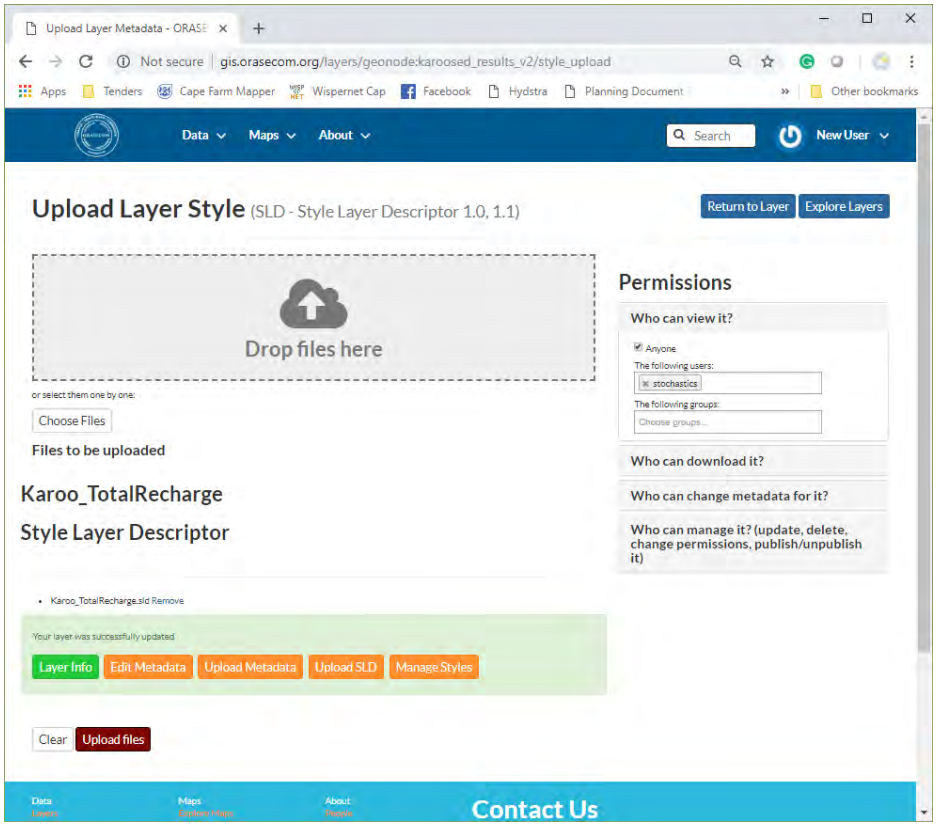
The rendered Style can now be saved as an SLD file by selecting Style at the bottom of the Properties Page (under Layer Rendering) and selecting Save Style|SLD File… as shown below:



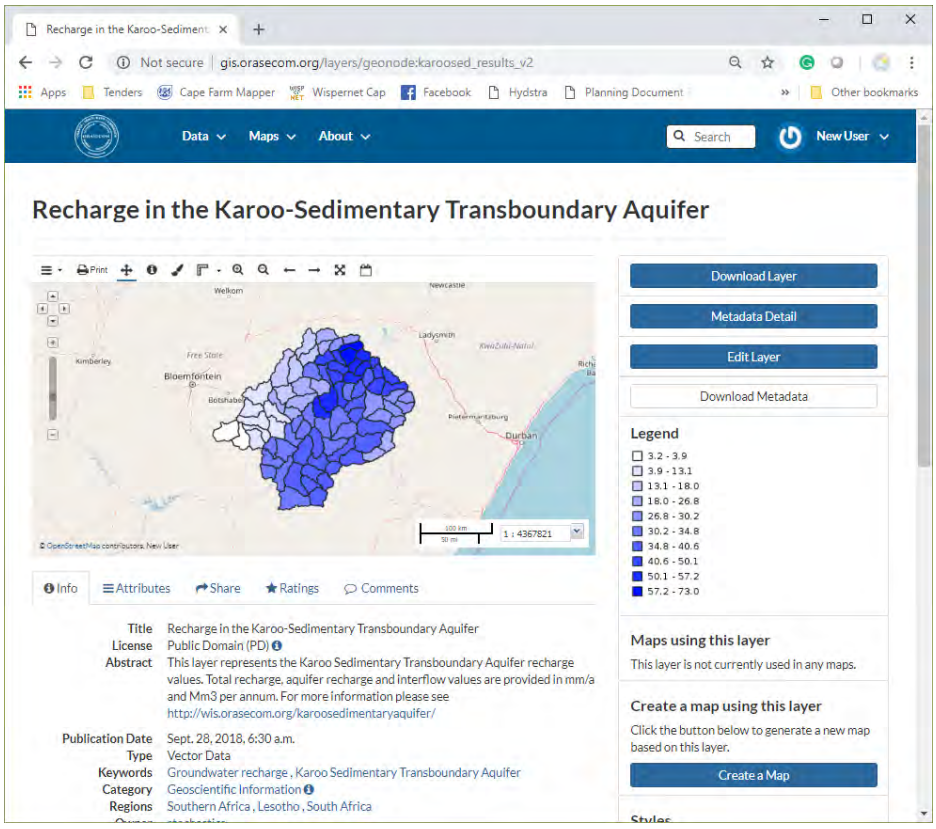
In the OGIS, go to the layer summary page and select Edit Layer (if you have permission to change the styling of the layer). The Editing toolbar will appear, then select Upload under the Style Header as shown below:



On the following screen select Choose File, navigate and select the created SLD file and choose Upload File: see below:

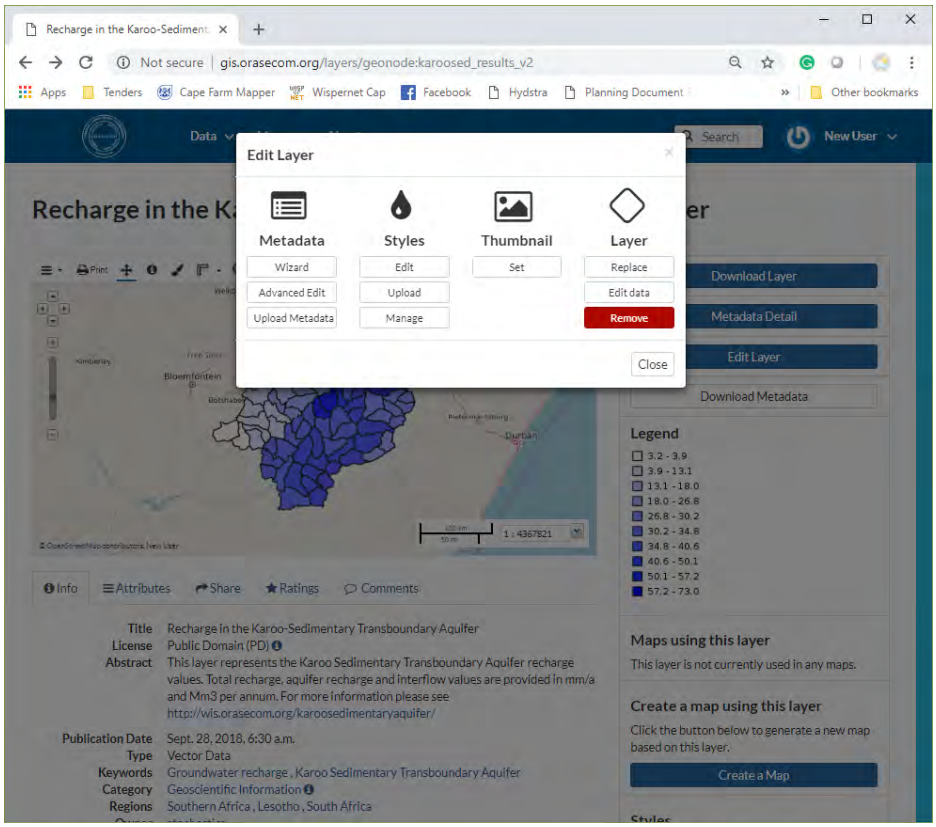


Selecting Layer Info will return you to the layer summary page with the uploaded style applied and the legend update as shown below:

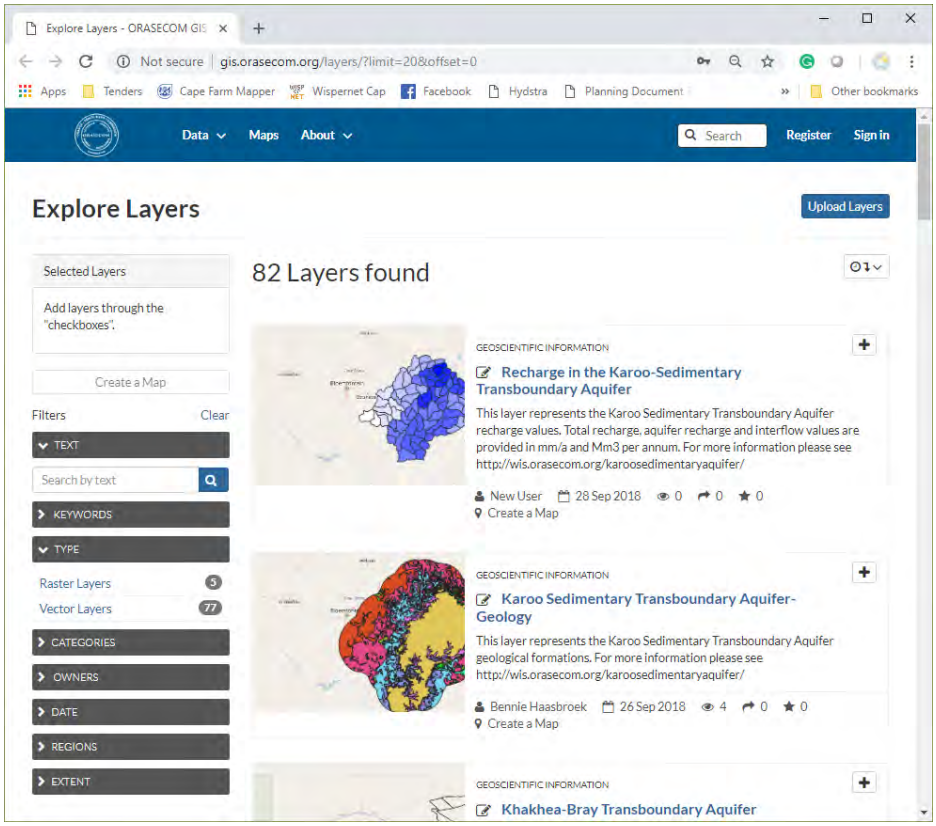


3.5.5 *Create a thumbnail*

A thumbnail is the picture that is displayed on the Web interface to the OGIS. It is not compulsory to create a Thumbnail, but the Administrator could update the thumbnails over time. Creating thumbnails are buggy and changing anything in the layer results that the thumbnail is reset to the default one and will need to be recreated. There is a trick to create a proper layer thumbnail: on the layer summary page zoom in on the map and then zoom out again before creating a Thumbnail. Then select the right-hand button called Edit Layer and then select Set under the Thumbnail header as shown below:

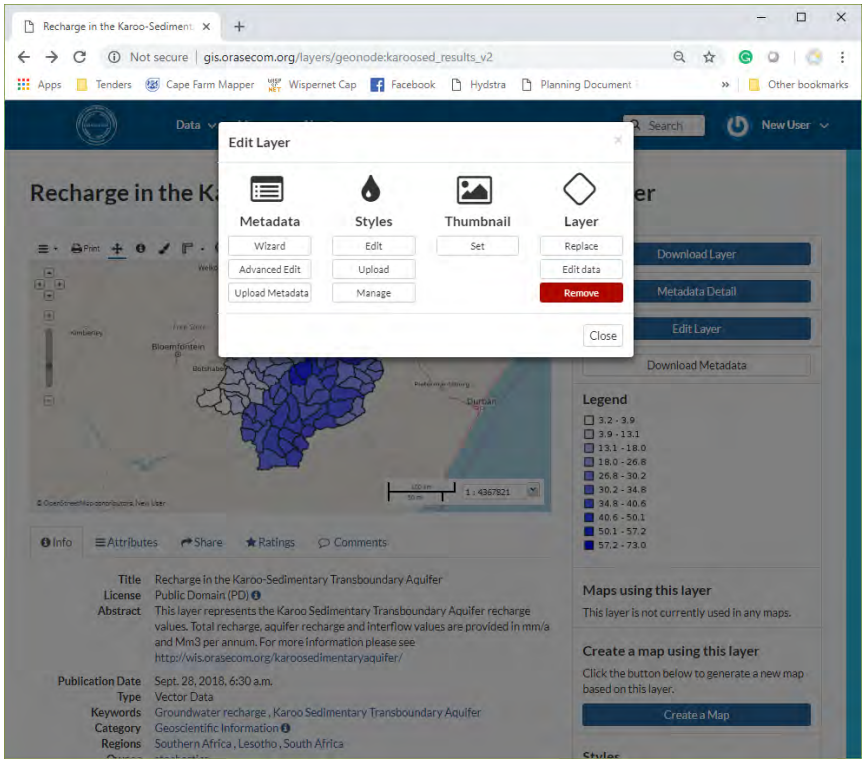


When you go back to browsing layers from the Data|Layers top menu item, you will notice that the thumbnail is still the default one. Clear your Browsers' cache data and refresh the page to see the updated thumbnail as shown below:



3.5.6 *Remove a layer*

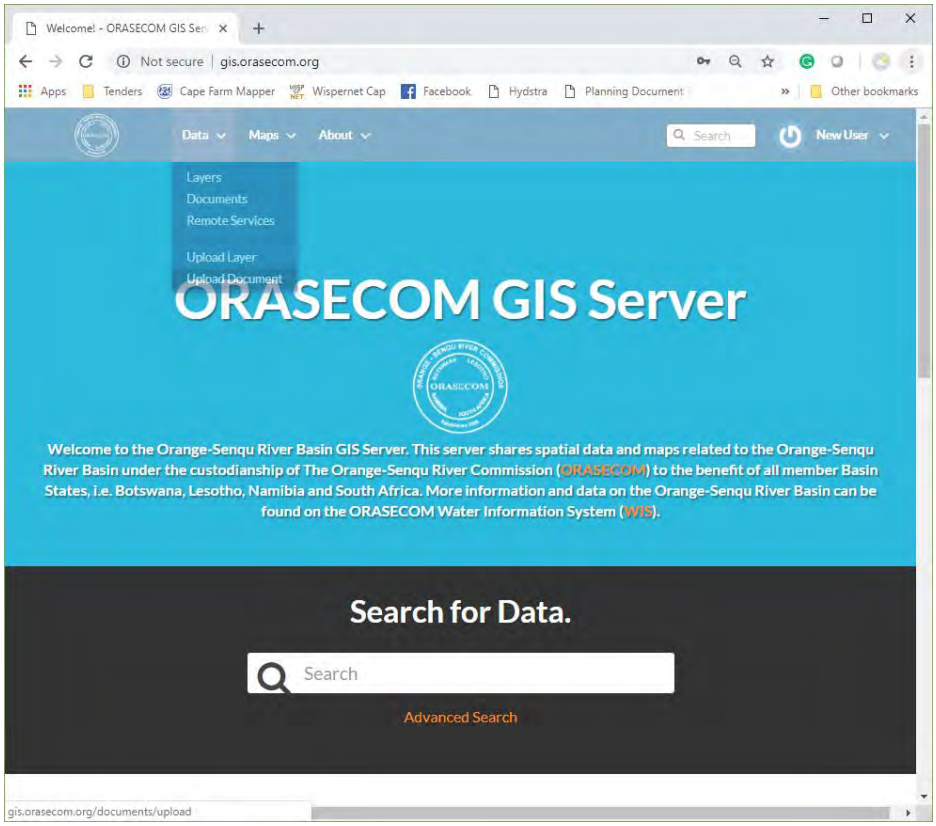
If you are the owner or have permission to manage a layer access the layer's summary page and select Edit Layer on the right-hand button. Under the Layer header select the Remove button (see below) and select Yes on the subsequent page. If there is a problem to delete the layer, request an Administrator to remove it for you.



3.6 Uploading documents

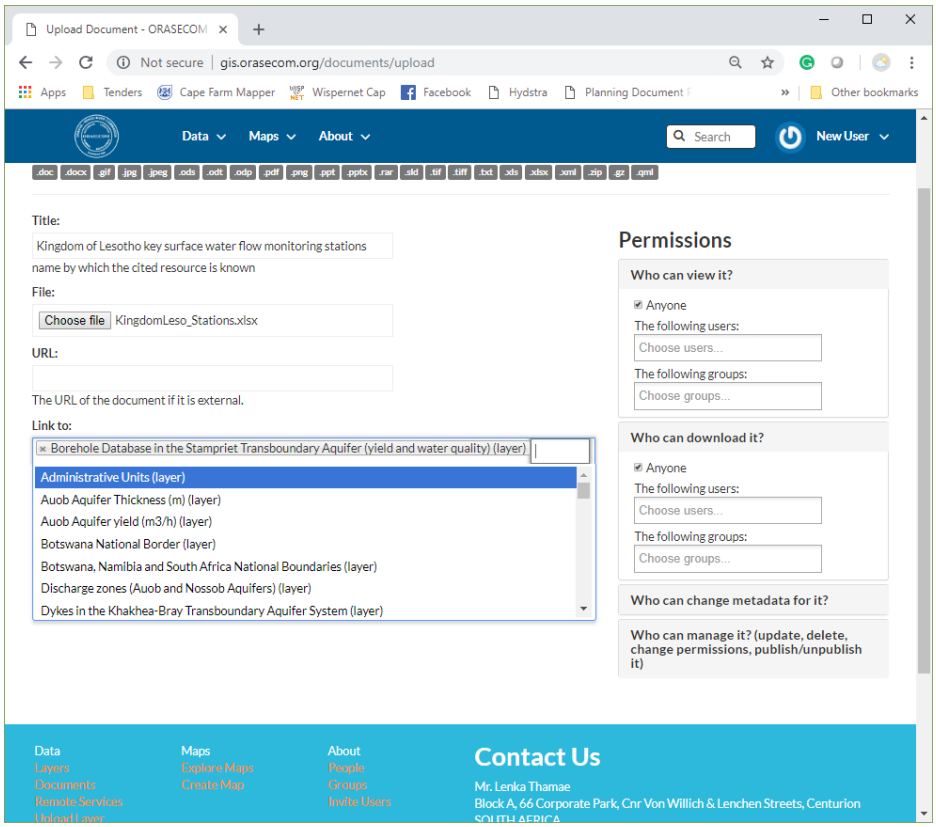
3.6.1 Uploading document data, setting permissions and linking document with layers and maps

After registering and singing into the OGIS, documents/datasets can be uploaded to the stystem by selecting Data|Upload Document from the main menu as shown below:

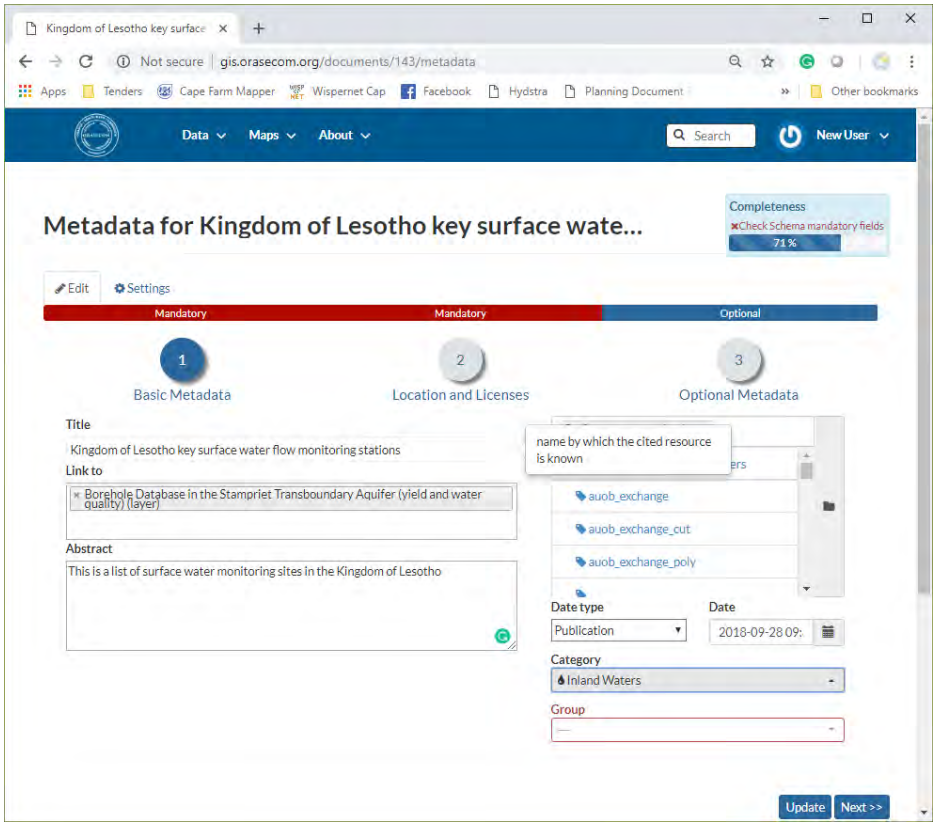


In the subsequent screen (see below) 23 different types of documents, images or datasets can be uploaded to the system. The following needs to be done on this screen:

- It is compulsory to add a descriptive name, including what the document contain and for what area or subject.
- A file must either be selected from the User's PC by selecting Choose File or by providing an external document's URL.
- It is very important is to link the document to all layers and maps that it relates to under Link to:
- Set all permissions in the right-hand Permissions menu.

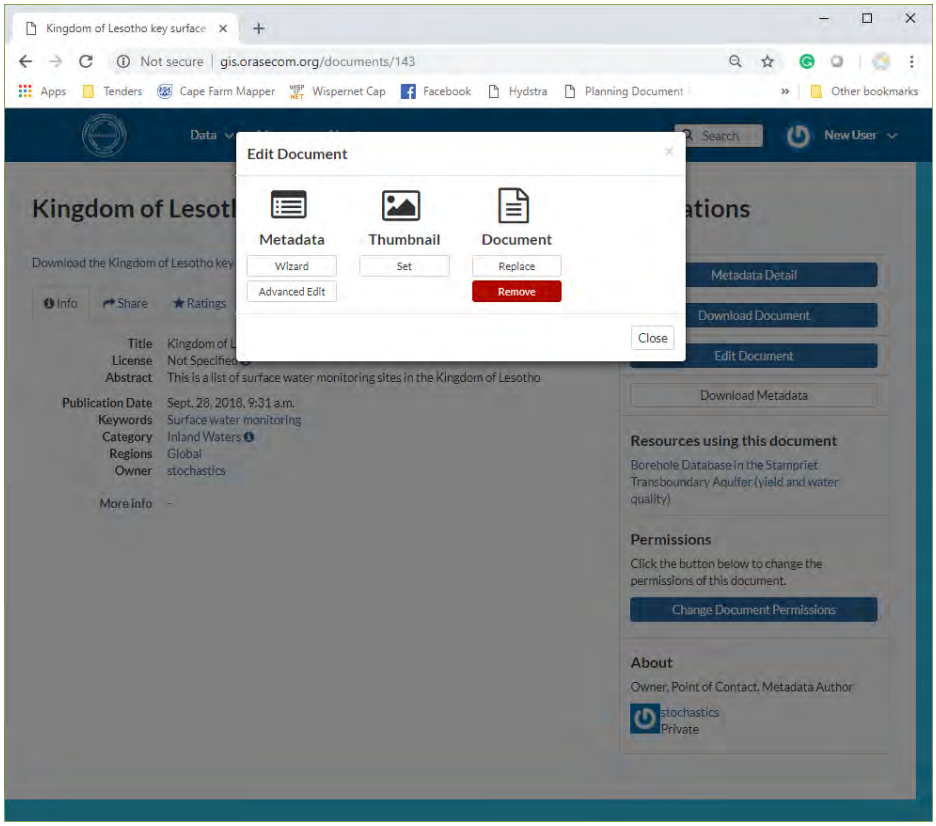


Select Upload to upload all the metadata and links to the OGIS. The subsequent screen is shown below, where extra metadata need to be added before the uploading is complete.



3.6.2 Editing metadata, setting a thumbnail, replacing or removing a document

Access the applicable document's summary page via the Data|Document main menu item and selecting the title of the document. Select Edit Document on the right-hand button as shown below. The document metadata can be edited from this menu, or the document can be removed or replaced. Setting of a thumbnail is optional.



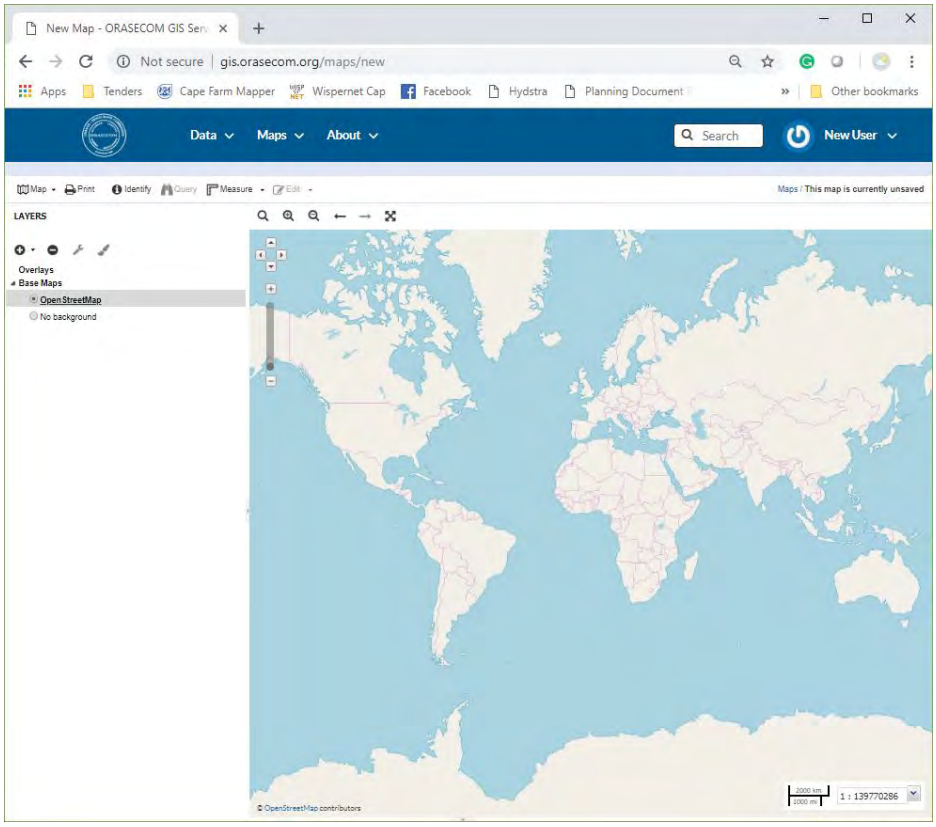
3.7 Create an interactive map

Please note the following:

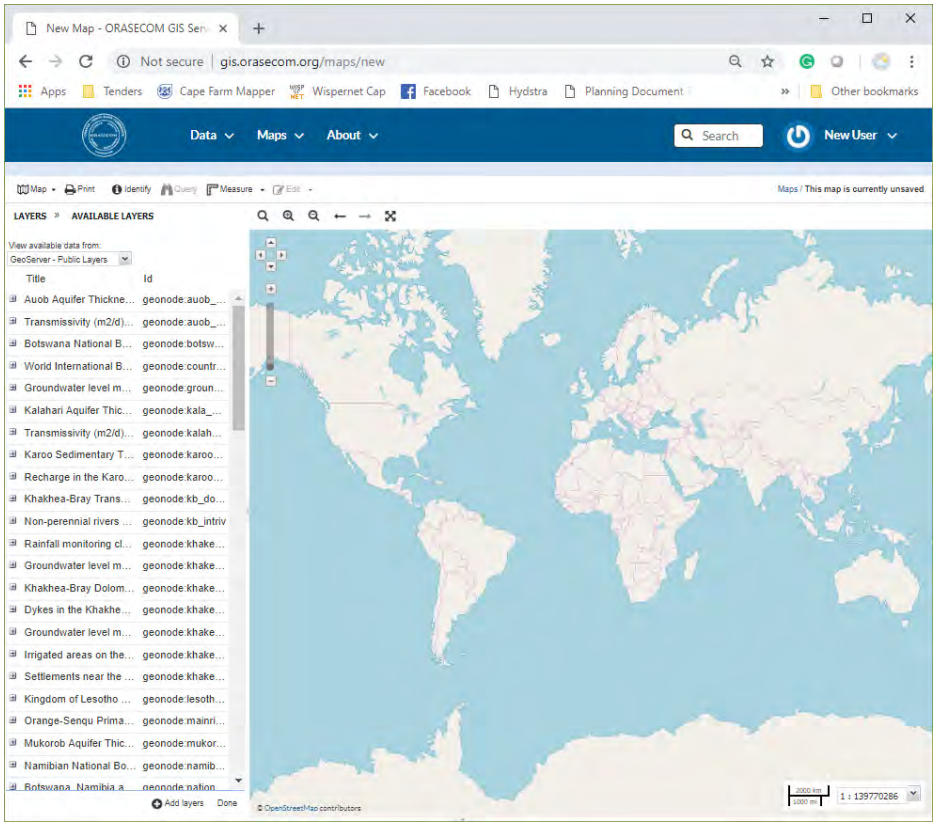
- Contributing maps should be related to the Orange-Senqu River basin but could include any thematic data. Non-relevant data will be deleted.
- If no metadata is provided for the map, and requests for uploading metadata are not responded to, the map will be deleted.
- It is okay to create temporary maps for some arbitrary reason, but please remember to delete the map once done.
- Administrators may style and layer maps if not done properly, with consent of the owner.

3.7.1 Creating, saving and publishing a new map

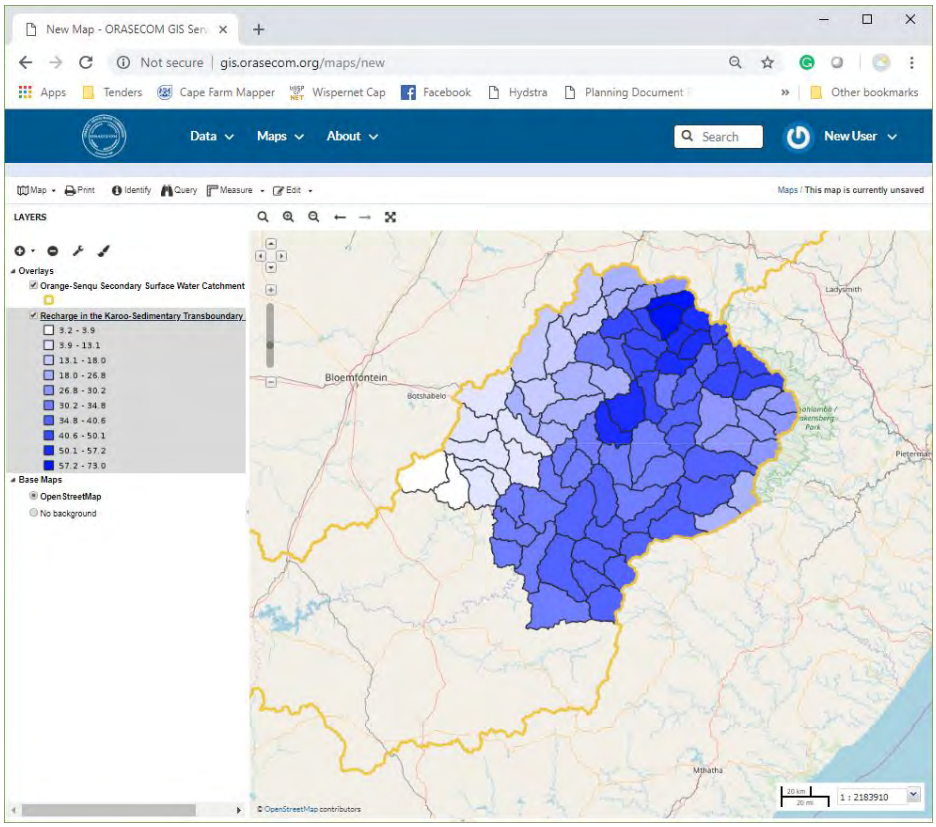
Once a user is registered and signed in, select Maps|Create Map from the main menu bar. A blank interactive map will be open as shown below:



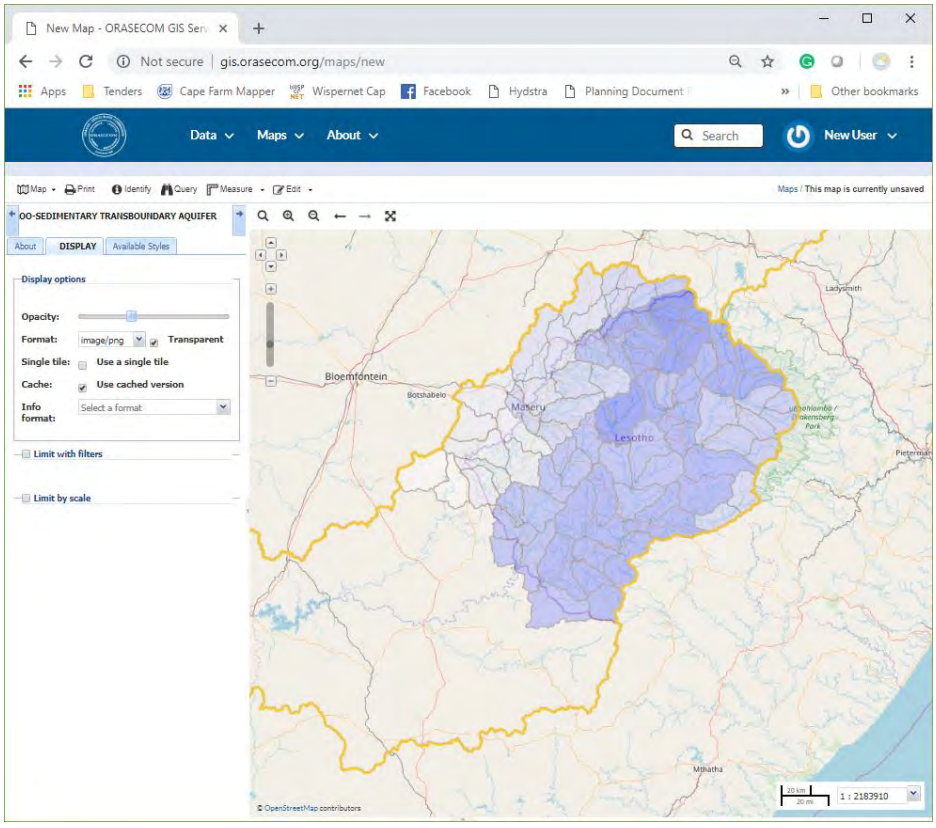
The first task is to add layers by selecting the + sign beneath layers. Layers can be added by browsing the whole list of available layers (as shown below) or by Finding layers according to a title search. Make sure that Geo-Server Public Layer is selected under the View available data from: drop down menu. Double clicking a layer adds it to the map. Once done adding layers select Done at the bottom on the screen.



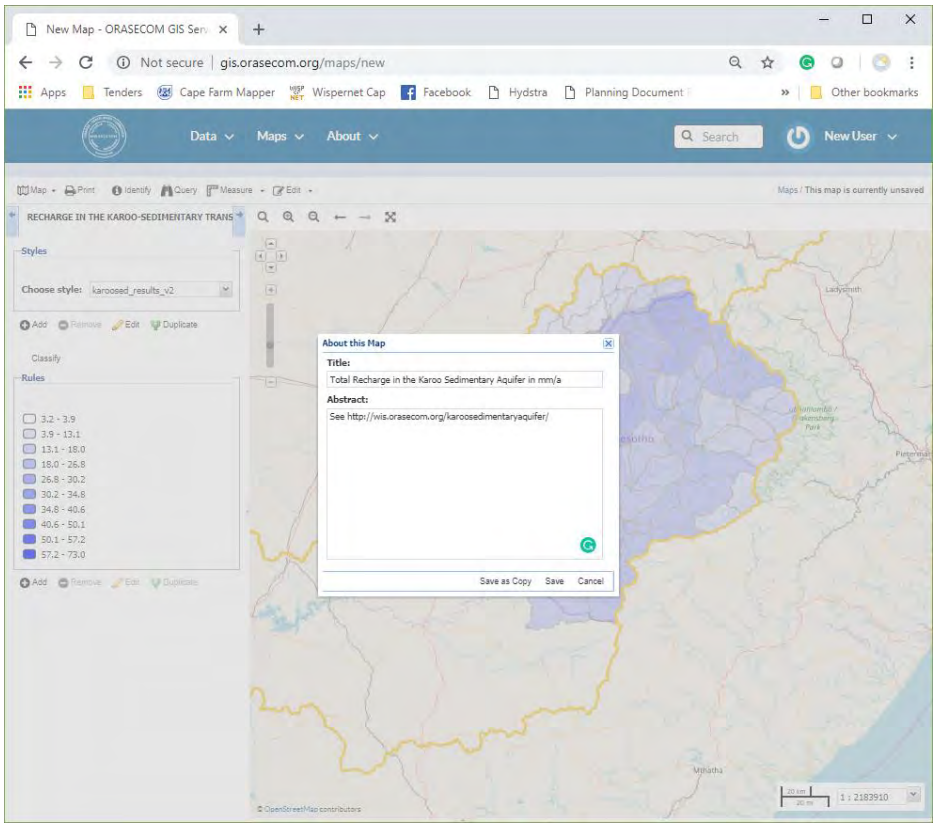
To order the layers select the layer's name under Overlays and drag it above or below other layer titels.



Layers can be deleted by selecting the layer and selecting the – sign. The spanner sign provides access to changing the map's layer's display options or styling. Below is an example of changing the main layer's transparency:



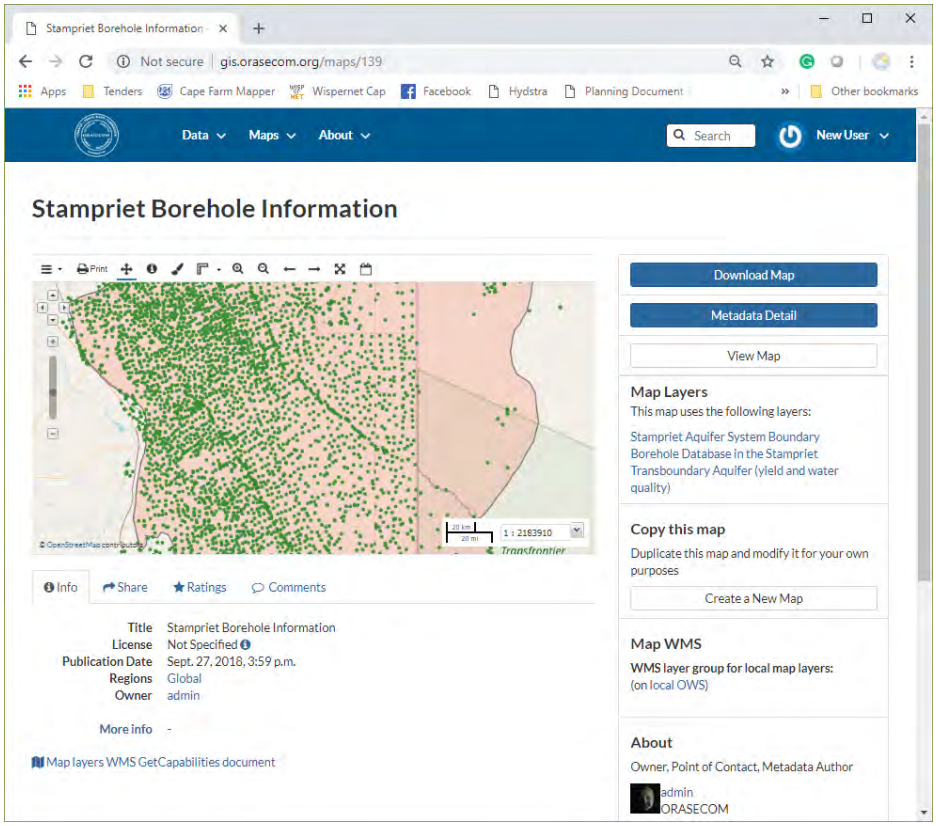
The paint brush icon can be used to change the Style formatting. Once done creating the map select Map|Save Map and complete a Title and Abstract for the map and press Save. See below:



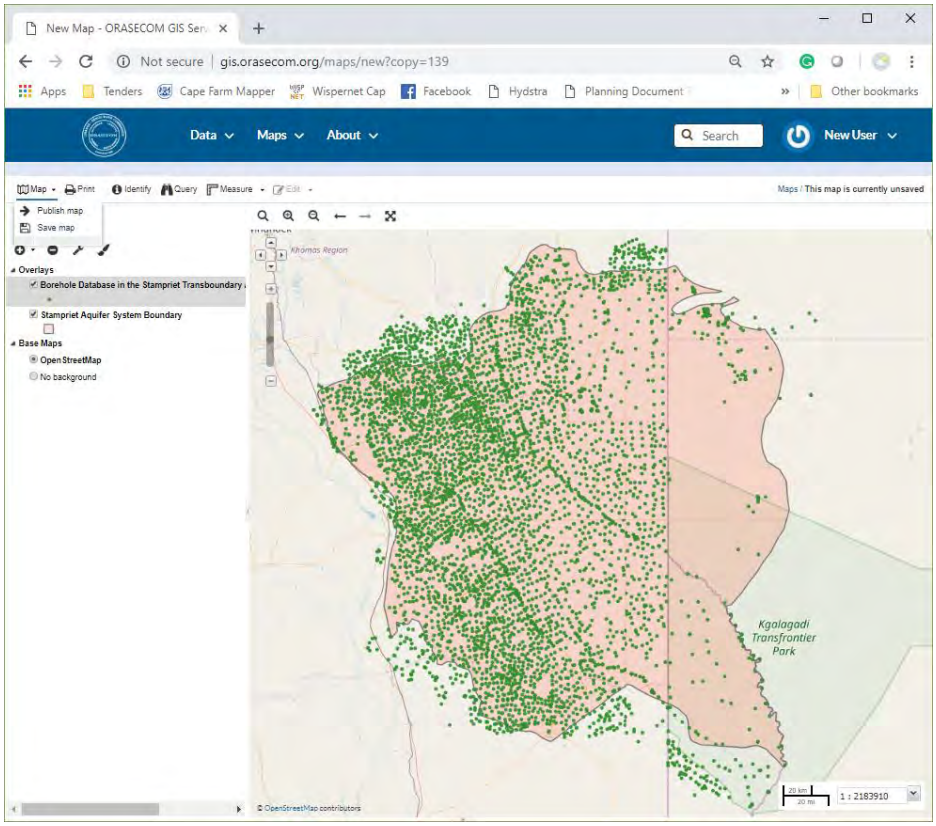
To publish the map, select Map|Publish to get the HTML code to embed a map in another website such as the WIS.

3.7.2 Cloning and editing an existing map

A list of maps can be viewed by selecting Maps|Explore Maps on the top main menu. Open the map summary page by selecting the map title that you want to use to clone the map from. On the map summary page there is a button on the right-hand menu bar called Create a New Map (as shown below)

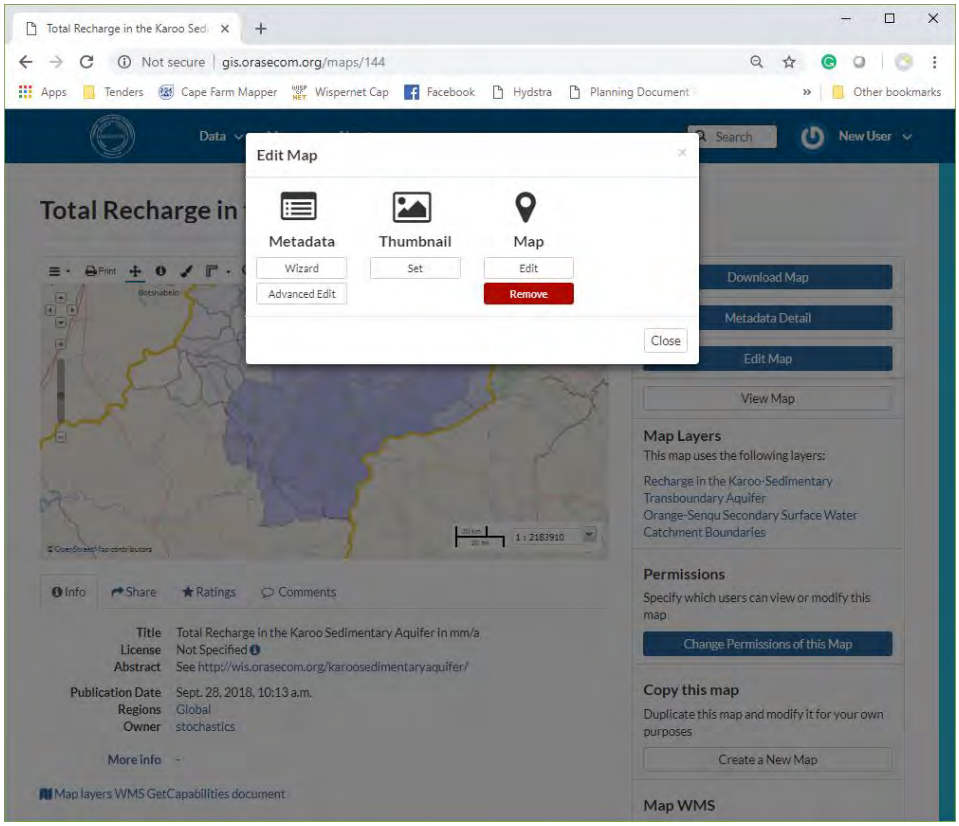


By selecting the Create a New Map button a copy of the existing map is opened and changes can be made to the map as shown below (see Section 3.7.2. on how to edit the map). When done editing the map select Map|Save Map and update the abstract and the map name to save the new map.



3.7.3 Editing an existing map

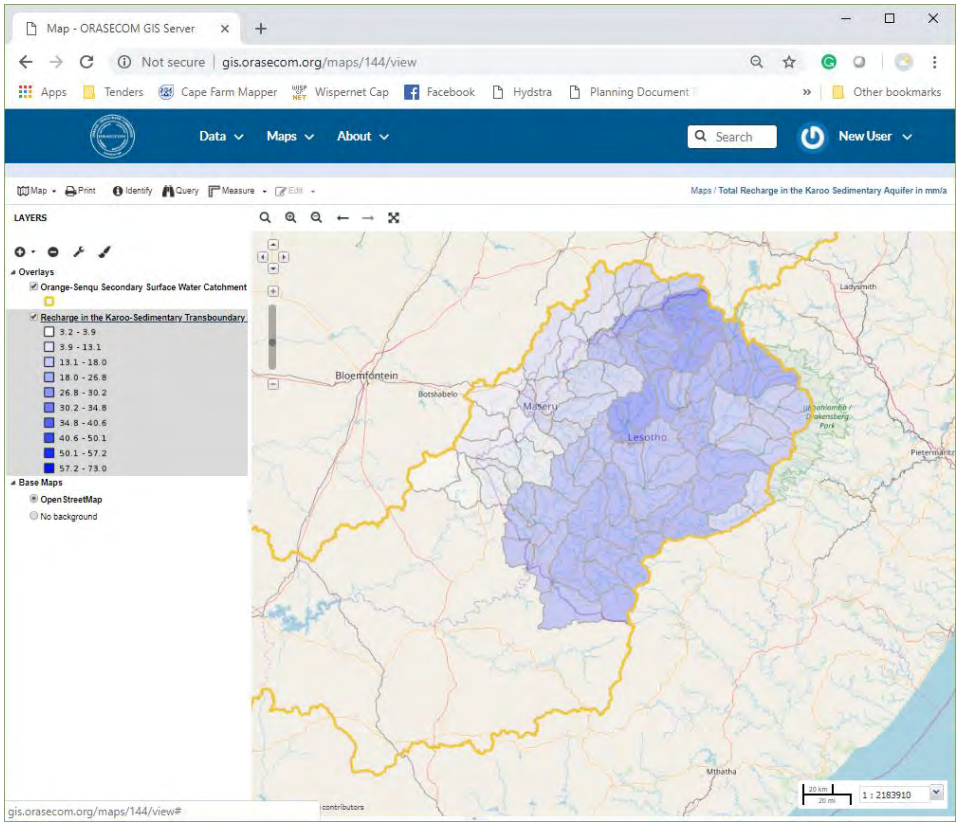
A list of maps can be viewed by selecting Maps|Explore Maps on the top main menu. Open the map summary page by selecting the map title that you want to edit. On the map summary page there is a button on the right-hand menu bar called Edit Map which should be selected. The Editing menu is provided below:



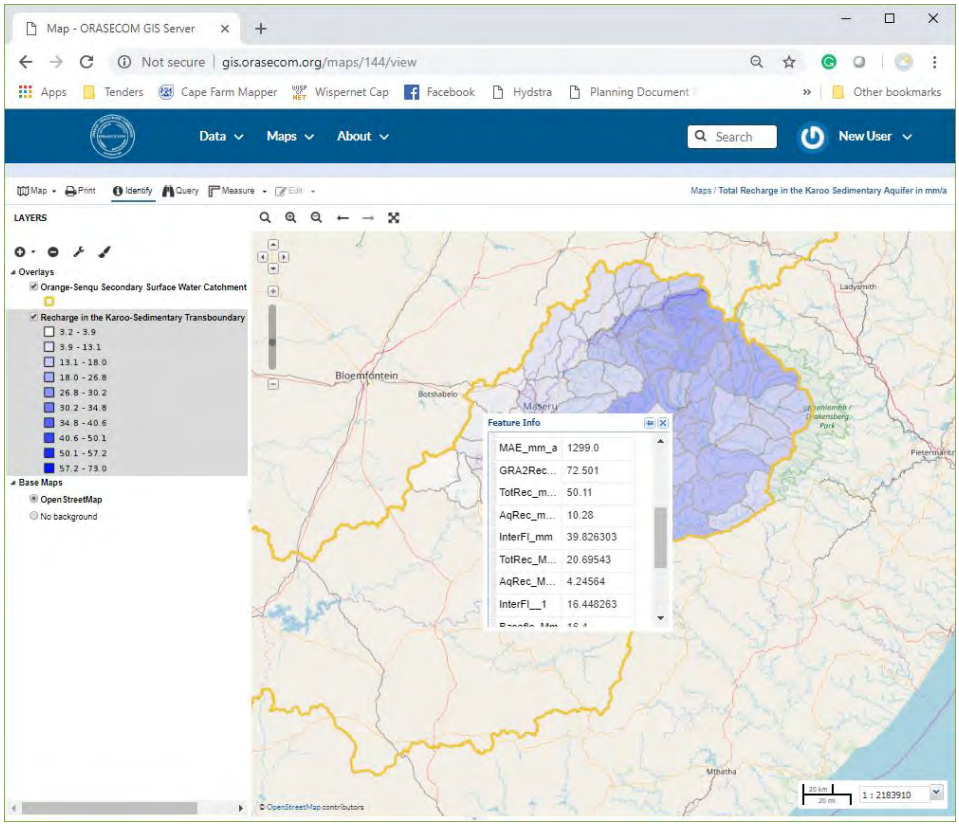
From this menu an existing map can be edited, as well as the metadata. To find out how to edit a map please see Section 3.7.1

3.7.4 Functionality of an interactive map.

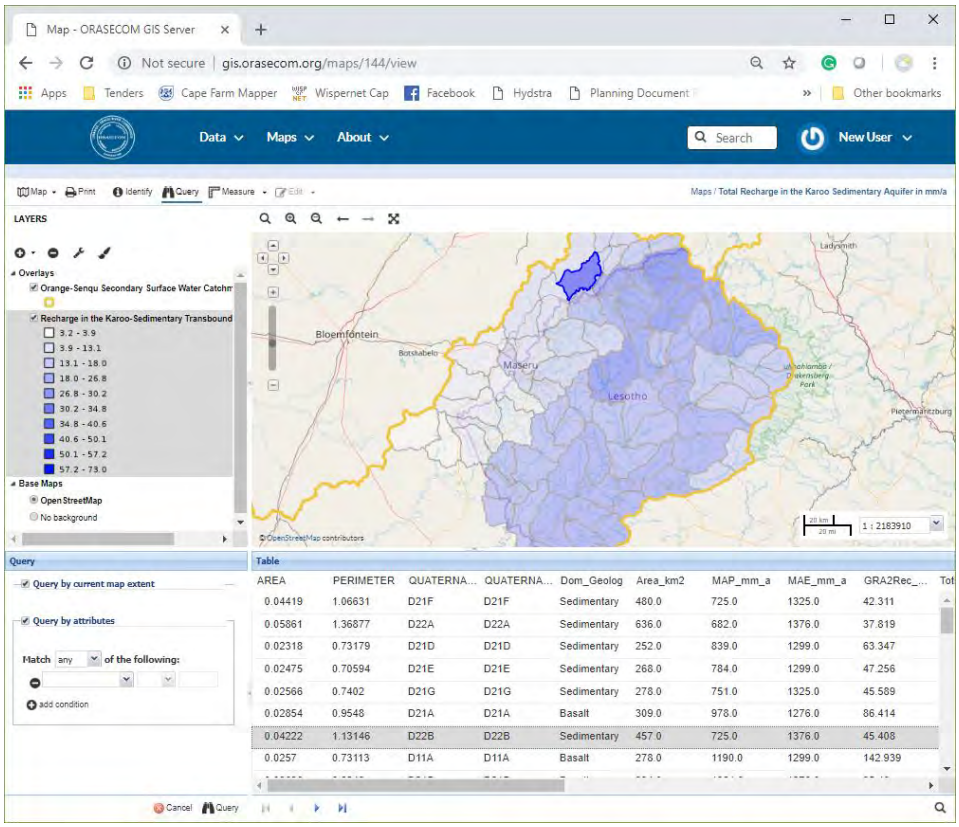
A list of maps can be viewed by selecting Maps|Explore Maps on the top main menu. Open the map summary page by selecting the map title that you want to edit. On the map summary page there is a button on the right-hand menu bar called View Map which should be selected. A typical map has its own URL that can be used to access it directly. The image below provides the typical map viewer image:



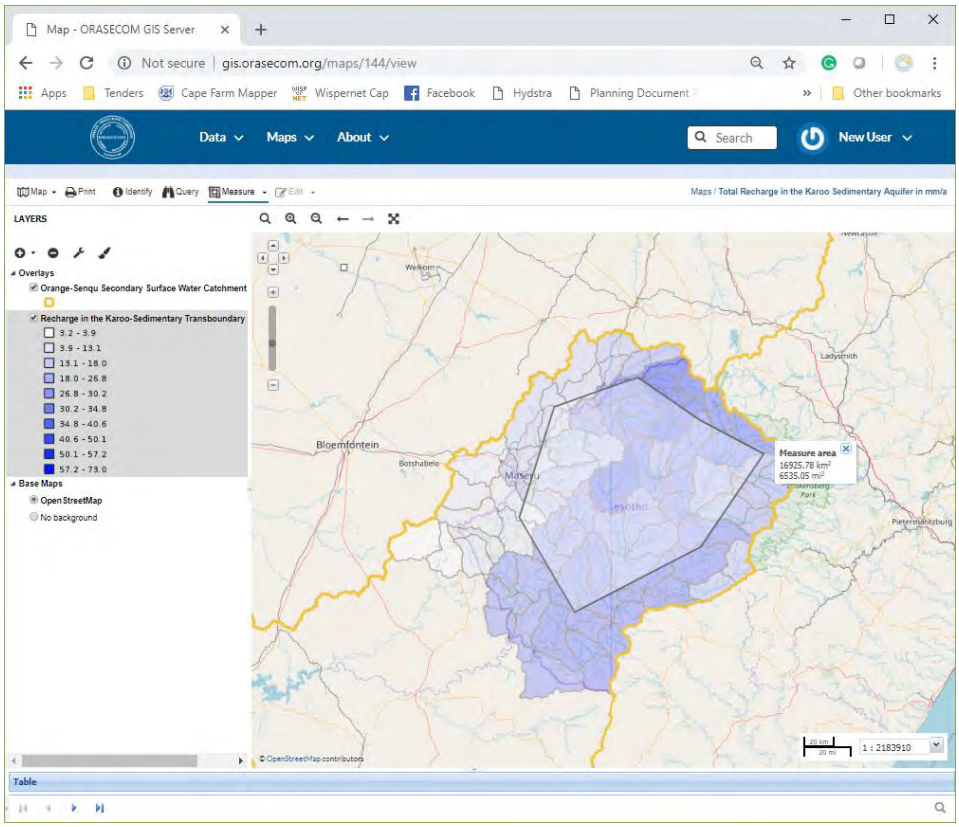
Editing tools are described under Section 3.7.1. Selecting the Identify menu item and selecting a feature on the map provides the features' data as shown below.



Selecting the Query menu item opens the database behind the selected layer. Queries can be specified, and elements inspected by selecting database items individually as shown below.



Selecting the Measure menu item allows the user to measure distances or areas as shown below.



4 APPENDIX A – COMMENTS REGISTER

Section	Report statement	Comments	Changes made?	Comment

Section	Report statement	Comments	Changes made?	Comment