## **GIS Practical Session**

## Projections, Queries and Importing Data Layers (GPS and WMS)

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27 November, 2015

The practical has been tailored to QGIS 1.8.0, as this is the version of the software available on the computers in the lab. Should you wish to download and use QGIS on your own computer, the latest version of the software will look a bit different than 1.8.0, but the concepts and tools will be similar (though they may need to be done in a different way).

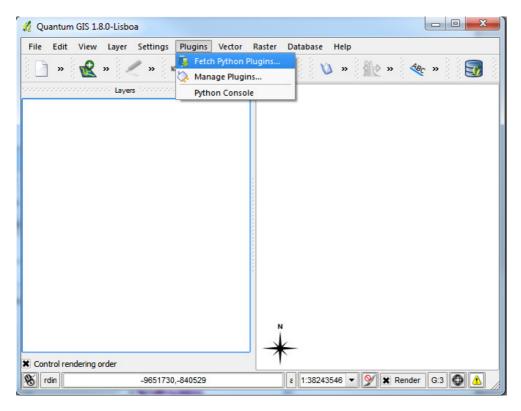
### **Spatial Projections**

-Download the files for the practical from <u>www.patrickrickles.com/tutorial/files/QGIS/Practical\_2/Practical\_2\_data.zip</u>. Unzip them, and store them in a location of your choice.

-Open QGIS Desktop (1.8.0)

-If it's not already available, fetch the plugin for the Google Maps layers by going to Menu Bar > Plugins > Fetch Python Plugins

(Note: This may take a little bit and there may be some error messages from repositories that may not be accessible; close these error messages and the window for the plugins will open)



-In the Filter space, type: "google"

-Select OpenLayers Plugin

-Click Install plugin

(Note: if the plugin has already been installed, this will say Upgrade or Reinstall Plugin. If that is the case, simply click Close, as we only want to ensure the Plugin is installed.)

Filter: goog	gle		all repositories	-	any status	
Status	Name	Version	Description			

-Load the Basemap from the plugin

-Menu Bar > Plugins > OpenLayers plugin > Add Google Physical Layer

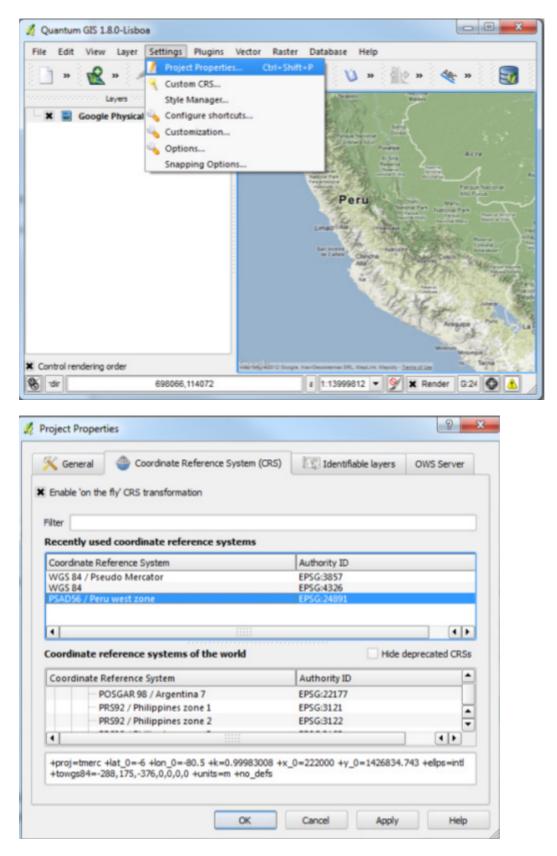
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		Add OCM Landscape layer
		Add OCM Public Transport layer
		😢! Add Yahoo Street layer
		😢! Add Yahoo Hybrid layer
	*	1 Add Yahoo Satellite layer
		o Add Road layer
		o Add Bing Aerial layer
		Add Bing Aerial with labels layer
		C Add Apple iPhoto map layer
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-Please also import a raster image layer for the area,

/Raster/peru\_vegatation\_and\_weather\_map\_motified.tif, which can be done by selecting Layer >
Add Raster Layer.

-QGIS allows you to define a CRS (Coordinate Reference System) for layers as well as for the entire project. You will need to define the CRS for layers without a pre-defined one, which can happen if this information has not been set yet or has been lost. To define the project-wide CRS, select

Settings > Project Properties> CRS and select PSAD56. Similarly, you can select WGS 84 for the project-wide CRS.



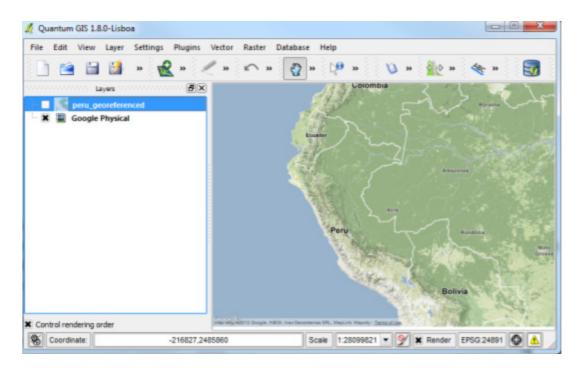
(Note: Sometimes the find function doesn't work. You can find PSAD56 in projected coordinate systems or may search for it via the Filter by inputting PSAD56 or EPSG:24891)

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WGS 84 / Pseudo Mercator		EPSG:3857		
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-At this point you may not be in a familiar view, right click the

peru\_vegetation\_and\_weather\_map\_modified.tif layer and select "Zoom to Layer Extent" to go to it.

-At the bottom of QGIS window, you will notice the label "Coordinate". As you move your cursor over the map, it will show you the X,Y coordinates at that location. At the bottom-right corner you will see EPSG:24891. This is the code for the current 'Project CRS' PSAD56.



-Now switch back to WGS84 / Pseudo Mercator EPSG:3857 in the same way as you just did to change the Coordinate Reference System to PSAD56.

-Load a vector layer to the map. Select Layer-> Add Vector Layer. Select peru\_administrative from the files downloaded earlier. To determine the layer's projection, right click on it and select Properties.

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-In the Properties dialog, click on the Metadata tab. You will see the projection definition of the layer under 'Layer Spatial Reference System'. You can see that the layer's projection is WGS84.

Abstract		
General: Storage type of this	s layer: ESRI Shapefile	
Source for this lay	er: C:\Users\nnikolova\Desktop\PERU\peru	_administrative.shp
	he features in this layer: Line tures in this layer: 2930	
	of this layer: Add Features, Delete Feature	es, Change Attribute Values, Add
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-Let's say you need to use data with no pre-set projection - what are the steps for setting a vector layer in the right projection? Open the layer peru\_highway\_no\_projection from the folder /Vaster/peru\_highway\_no\_projection/peru\_highway\_no\_projection.

-As the layer has no pre-defined projection, you will be asked to specify a coordinate reference system. Select WGS84 / Pseudo Mercator and click OK.

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pecify CRS for layer peru_highway	
Filter	
Recently used coordinate reference	systems
Coordinate Reference System	Authority ID
PSAD56	EPSG:4248
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WGS 84	EPSG:4326
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WGS 84 / Pseudo Mercator WGS 84 / Simple Mercator	
WGS 84 / Pseudo Mercator WGS 84 / Simple Mercator	

-Right-click on the peru\_highway layer and select Zoom to Layer Extent; then zoom out. The layer will appear in the wrong place – South of Western Africa in the Atlantic Ocean.

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-This is a common problem when working with data, as a projection may not have been set when the file was created. Ideally you would like to see the layers overlaid on top of each other in the same coordinate-space. In order to do this, first remove the layer you import and load it again. In the coordinate reference system selector, choose a different projection (WGS84) and click OK. You can see the layer is in the right place.

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PSAD56	EPSG:4248			
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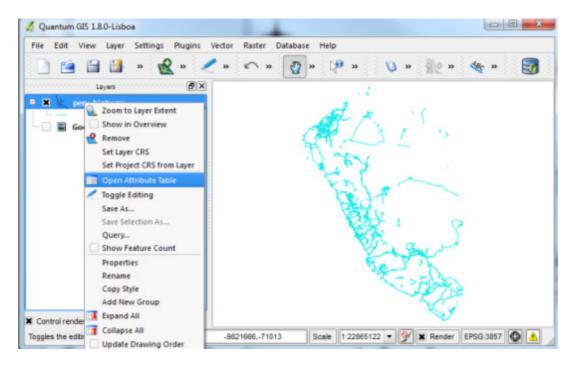
-In order to ensure that a dataset with no projection shows up in the right place, you may need to do this a few times and try a different coordinate reference system. Common ones for your work will be: WGS84 (e.g. GPS), WGS84 / Web Mercator (e.g. Google Maps), and PSAD56 (e.g. local Peruvian

datasets). Should any agencies give you data without a coordinate reference system, you should be able to set that properly now.

## **Attribute Queries**

-Vector layers in GIS have two parts - features (each geographical element in the layer is a feature) and attributes (tabular information about each of the features, which are stored in what's called the attribute table). Here you will carry out some basic operations on the attribute table using Quantum GIS. Using the layer peru\_highway, the task is to find all tertiary roads which are one-way in the Peru road network.

-Right-click on the layer name and select 'Open Attribute Table'.



-We are interested in the type of each feature, so TYPE is one of the fields we are looking for. You can click on the field header to sort the column in ascending or descending order.

-The other field you need is ONEWAY - it has information whether a road is one-way.

esidential econdary esidential	2 DE JUNIO Gonzales Prada	NULL	NULL				
	Gonzales Prada	VPS					
sidential		1	NULL				
	NULL	NULL	NULL				
esidential	CAQUETA	NULL	NULL				
esidential	31 DE ENERO	NULL	NULL				
esidential	Mariscal Lamar	yes	NULL				
esidential	HERMILIO VAL	NULL	NULL				
esidential	NULL	NULL	NULL				
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-In the bottom-right corner type "tertiary", select TYPE as the column to search in and press Search.

	TYPE V	NAME	ONEWAY	LANES	
37567	residential	2 DE JUNIO	NULL	NULL	
37568	secondary	Gonzales Prada	yes	NULL	
37569	residential	NULL	NULL	NULL	
37570	residential	CAQUETA	NULL	NULL	
37571	residential	31 DE ENERO	NULL	NULL	
37572	residential	Mariscal Lamar	yes	NULL	
37573	residential	HERMILIO VAL	NULL	NULL	
37574	residential	NULL	NULL	NULL	
37575	residential	NULL	NULL	NULL	
37576	residential	NULL	NULL	NULL	
37577	residential	NULL	NULL	NULL	
37578	residential	NULL	NULL	NULL	
37579	residential	Gaspar De Jovel	NULL	NULL	
37580	residential	HERMILIO VAL	NULL	NULL	
37581	residential	NULL	NULL	NULL	
37582	residential	INAMBARI	NULL	NULL	
37583	residential	NULL	NULL	NULL	
37584	residential	NULL	NULL	NULL	
37585	residential	2 DE JUNIO	NULL	NULL	
37586	tertiary	NULL	NULL	NULL	
37587	residential	NULL	NULL	NULL	

You will see the selected records highlighted in the attribute table. You can click the 'Move selection to top' button on bottom-left to bring all selected records to the top.

	TYPE 🗸	NAME	ONEWAY	LANES				
0	tertiary	NULL	NULL	NULL				
1	tertiary	Domingo Orue	yes	NULL				
2	tertiary	NULL	NULL	NULL				
3	tertiary	Av. 24 de Mayo	yes	NULL				
4	tertiary	Av. 24 de Mayo	yes	NULL				
5	tertiary	Av. De La Indep	NULL	NULL				
6	tertiary	Av. Lomas	NULL	NULL				
7	tertiary	Domingo Orue	yes	NULL				
8	tertiary_link	NULL	yes	NULL				
9	tertiary	Jr. Morro de Arica	NULL	NULL				
10	tertiary	Las Palmas	yes	NULL				
11	tertiary	Av. Amazonas	NULL	NULL				
12	tertiary	NULL	NULL	NULL				
13	tertiary	NULL	NULL	NULL				
14	tertiary	Prol. Av. Marica	NULL	NULL				
15	tertiary	Av. Virgen del C	yes	NULL				
16	tertiary	Av. 24 de Mayo	no	NULL				
17	tertiary	Av. Los Andes	yes	NULL				
18	tertiary	Carlos Tosi Siri	NULL	NULL				
19	tertiary	Jr. Cangallo	NULL	NULL				
20	tertiary	Av. Los Andes	yes	NULL				
		2 🗞 🖊 🛛		Look for	tertiary	in TYPE	• (	Search
Sho	w se Move selection	to top (Ctrl+T) pnly	X Case sensitive	Advance	ed search	?		Close

-If you look at the map area, the selected roads will be highlighted in yellow.

(Note: It may be difficult to see the highlighted features, in which case, you may wish to switch some layers off to better see them.)

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-Now, let's refine the query to select only those roads which are one-way. The field containing this data is ONEWAY. In the attribute table, check the box 'Search selected records only' and type "yes" in ONEWAY and click Search.

	TYPE V	NAME	ONEWAY	LANES	<u></u>
0	tertiary	NULL	NULL	NULL	
1	tertiary	Domingo Orue	yes	NULL	
2	tertiary	NULL	NULL	NULL	
3	tertiary	Av. 24 de Mayo	yes	NULL	
4	tertiary	Av. 24 de Mayo	yes	NULL	
5	tertiary	Av. De La Indep	NULL	NULL	
6	tertiary	Av. Lomas	NULL	NULL	
7	tertiary	Domingo Orue	yes	NULL	
8	tertiary_link	NULL	yes	NULL	
9	tertiary	Jr. Morro de Arica	NULL	NULL	
10	tertiary	Las Palmas	yes	NULL	
11	tertiary	Av. Amazonas	NULL	NULL	
12	tertiary	NULL	NULL	NULL	
13	tertiary	NULL	NULL	NULL	
14	tertiary	Prol. Av. Marica	NULL	NULL	
15	tertiary	Av. Virgen del C	yes	NULL	
16	tertiary	Av. 24 de Mayo	no	NULL	
17	tertiary	Av. Los Andes	yes	NULL	
18	tertiary	Carlos Tosi Siri	NULL	NULL	
19	tertiary	Jr. Cangallo	NULL	NULL	-
20	tertiary	Av. Los Andes	yes	NULL	-

	TYPE	NAME	ONEWAY	LANES	
)	tertiary	NULL	NULL	NULL	
1	tertiary	Domingo Orue	yes	NULL	
2	tertiary	NULL	NULL	NULL	
3	tertiary	Av. 24 de Mayo	yes	NULL	
6	tertiary	Av. 24 de Mayo		NULL	
5	tertiary	Av. De La Indep	NULL	NULL	
5	tertiary	Av. Lomas	NULL	NULL	
1	tertiary	Domingo Orue	yes	NULL	
8	tertiary_link			NULL	
2	tertiary	Jr. Morro de Arica	NULL	NULL	
10	tertiary	Las Palmas	yes	NULL	
1	tertiary	Av. Amazonas	NULL	NULL	
12	tertiary	NULL	NULL	NULL	
3	tertiary	NULL	NULL	NULL	
14	tertiary	Prol. Av. Marica	NULL	NULL	
15	tertiary	Av. Virgen del C	yes	NULL	
16	tertiary	Av. 24 de Mayo	no	NULL	
17	tertiary	Av. Los Andes	yes	NULL	
18	tertiary	Carlos Tosi Siri	NULL	NULL	
9	tertiary	Jr. Cangallo	NULL	NULL	
20	tertiary	Av. Los Andes	yes	NULL	

-You can see that the selection changes to highlight only those roads that are both tertiary and one-way.

	TYPE 🗸	NAME	ONEWAY	LANES		
0	tertiary	Av. Rafael Escar	yes	NULL		
1	tertiary	AVENIDA B	yes	NULL		
2	tertiary	Puente Consuelo	yes	NULL		
3	tertiary	Av. Gral Moran	yes	NULL		
L	tertiary	Av. Santa Rosa	yes	NULL		
;	tertiary	Av. Santa Rosa	yes	NULL		
5	tertiary	General Ernesto	yes	NULL		
1	tertiary	Tumipamba	yes	NULL		
B	tertiary	Puente Consuelo	yes	NULL		
9	tertiary	JUAN DE ARONA	yes	NULL		
10	tertiary	Av. Loja	yes	NULL		
11	tertiary	BUENOS AIRES	yes	NULL		
12	tertiary	Reducto	yes	NULL		
13	tertiary	AVENIDA B	yes	NULL		
14	tertiary	Av. Mariano Co	yes	NULL		
15	tertiary	Manuel Villaran	yes	NULL		
16	tertiary	Manuel Villaran	yes	NULL		
17	tertiary	Santo Toribio	yes	NULL		
18	tertiary	Av. Gil Ramirez	yes	NULL		
19	tertiary	PEREZ SALMON	yes	NULL		
20	tertiary	Av. Isabel la Cat	yes	NULL		
		2 🗞 🖉 🛛		Look for yes	in ONEWAY 💌	Search
She	w selected only	Search selected only	X Case sensitive	Advanced search	,	Close

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Contraction Layer	e e e e e e e e e e e e e e e e e e e		
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	Properties Rename Copy Style Add New Group		3
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-Now let's export this selection to a new file. Right click on the layer and select 'Save selection as...'

-Browse to appropriate directory and name the output file as 'tertiary\_oneway\_roads.shp' and click OK.

Format	ESRI Shapefie
Save as	ra/Desktop/PERU/tertiary_oneway_roads.shp Browse
Encoding	System
CRS	Layer CRS
	WGS 84 Browse
OGR cre	ation options
Layer	

-Import the new layer in the map – you can see the concentration of one-way tertiary roads is along the coastline of Peru.

2 Quantum GIS 1.8.0-Lisboa	
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(Note: You may need to change the symbology to see the layer properly or turn off some layers)

-Now let's see how to do attribute queries based on numerical values. Open the vector layer peru\_administrative, right-click on the layer and open its attribute table.

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Layers 1000000000000000000000000000000000000	1 Take
Image: Section 2 and the section 2	
Open Attribute Table     Toggle Editing     Save As     Save Selection As     Query     Show Feature Count     Properties     Rename     Copy Style	
Add New Group Expand All Control rendering Collapse All Update Drawing Order	-9656236,-929383 Scale 1:23279709 V V Render EPSG:3857

-Let's look for administrative borders with administrative level equal or higher than 5. We need the column ADMIN\_LEVE. Click on Advanced search.

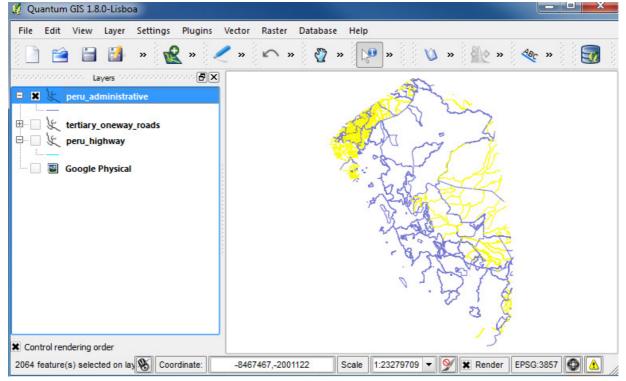
💋 Att	tribute table - peru_administrativ	/e :: 0 / 2930 feature(s) sele	cted	
	NAME $ abla$	ADMIN_LEVE		
512	RÃo Espindola	2		
513	RÃo Espindola	2		
514	RÃo Espindola	2		
515	RÃo Elvira	8		
516	RÃo Elvira	8		
517	RÃo Eluira	8		
518	RÃo El Ari	8		
519	RÃo del Bunque	8		
520	RÃo del Airo	8		
521	RÃo de Minas	NULL		
522	RÃo de la Ramada	8		
523	RÃo de la Ramada	8		
524	RÃo Déleg	6		
525	RÃo Cuyes	8		•
	🖸 🗾 🔝 🔍 💸	<	Look for in	▼ Search
Sho	ow selected only 📃 Search select	ed only 🗶 Case sensitive	Advanced search ?	Close

-When the search query builder window opens, double-click the field "ADMIN\_LEVE" in Fields. It will then appear in SQL where clause. Add the text ">= 5" and click OK.

🖞 Search query builder	? ×
peru_administrative         Fields         NAME         ADMIN_LEVE         Sample	
Operators	
= < > LIKE % IN	NOT IN
<= >= != ILIKE AND OR	NOT
SQL where dause	
ADMIN_LEVE >= 5	
OK Test Clear Save Load Cancel	Help

-All features with administrative level equal or higher than 5 are selected both in the table and the map.

💋 Att	tribute table - peru_administrativ	e (2064 matching features)	)	
	NAME $ abla$	ADMIN_LEVE		
670	RÃo Buenavista	6		
671	RÃo Buenavista	6		
672	RÃo Bono	8		
673	RÃo Bono	8		
674	RÃo Bono	8		
675	RÃo Bomboiza	8		
676	RÃo Bolo	8		
677	RÃo Boladel	NULL		
678	RÃo Boladel	8		
679	RÃo Boladel	8		
680	RÃo Bobonaza	8		
681	RÃo Bobonaza	8		
682	RÃo Bobonaza	8		
683	RÃo Blanco	2		
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#### **Attribute Joins**

-Let's say you have data for the street network in different vector files. One file is peru\_highway, which contains the name, type, number of lanes and direction of the streets. The other file is peru\_street\_length, which has information on the length of the streets.

- peru\_highway:

💋 Attrib	Attribute table - peru_highway :: 0 / 217580 feature(s) selected						
	TYPE 🗸	NAME	ONEWAY	LANES	ID		
0	residential	NULL	NULL	NULL	0		
1	residential	NULL	NULL	NULL	1		
2	residential	NULL	NULL	NULL	2		
3	residential	NULL	NULL	NULL	3		
4	residential	NULL	NULL	NULL	4		
5	residential	NULL	NULL	NULL	5		
6	residential	NULL	NULL	NULL	6		
7	residential	NULL	NULL	NULL	7		
8	residential	NULL	NULL	NULL	8		
9	residential	NULL	NULL	NULL	9		
10	residential	NULL	NULL	NULL	10		
11	residential	NULL	NULL	NULL	11		
12	residential	NULL	NULL	NULL	12	•	
Show :	selected only	earch selected only	X Case sensitive	Advanced se	earch ?	Close	

#### - peru\_street\_length:

💋 Attrib	ute table - peru_str	reet_length :: 0 / 21	17580 feature(s) selected	
	length1 $\nabla$	ID		<b></b>
0	0.001	0		
1	0.002	1		
2	0.003	2		
3	0.006	3		
4	0.001	4		
5	0.002	5		
6	0.001	6		
7	0.001	7		
8	0.001	8		
9	0.002	9		
10	0.001	10		
11	0.002	11		
10	0.002	12		Ľ
	i 📰 🔝 🤇	) 🗞 <	Look for in	Search
Show s	selected only Se	earch selected only	Case sensitive Advanced search ?	Close

-The task is – how to join the two tables in one? First, open both layers in QGIS.

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File Edit View Layer Settings Plugins Vector Raster	Database Help
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Layers Construction (P) ×	1. No.
E- 🕱 🎉 peru_street_length	the the stand
<ul> <li>peru_highway</li> <li>Zoom to Layer Extent</li> <li>Show in Overview</li> <li>Remove</li> <li>Set Layer CRS</li> <li>Set Project CRS from Layer</li> <li>Open Attribute Table</li> <li>Toggle Editing</li> <li>Save As</li> <li>Save Selection As</li> <li>Query</li> <li>Show Feature Count</li> <li>Properties</li> <li>Rename</li> </ul>	
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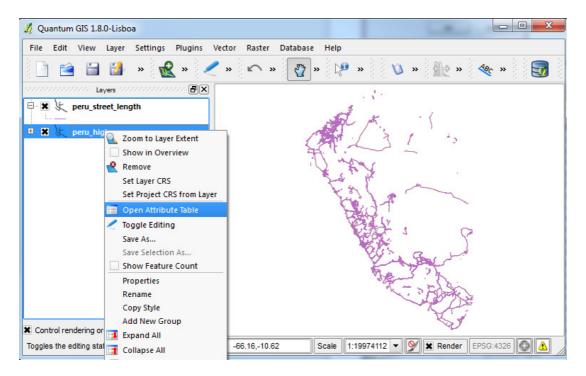
-Now we will join the two layers. Double-click on the peru\_highway layer to open Properties dialog. Go to the 'Joins' tab.

🖌 Style	📄 Labels	Fields	🔀 General	Metadata	Actions	• Joins	💌 Diagran
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Join layer	Join	field	Target field				
			_				
		_					
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-Click on the '+' to create a new join. Select peru\_street\_length as a join layer. The 'Join field' will be the unique identifier from the peru\_street\_length data- select ID. The target field will be the unique identifier from the peru\_highway layer- select ID. Click OK. Once the join is created, click OK and return to the QGIS canvas.

💋 Add vector join	? ×				
Join layer	peru_street_length 💌				
Join field	ID 💌				
Target field	ID 🔹				
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•					
Join layer Join fi	eld Target field ID				
Restore Default Style	Save As Default	Load St	vle	Save Sty	
Restore Derault Style	Save As Delauit	OK	Cancel	Apply	Help

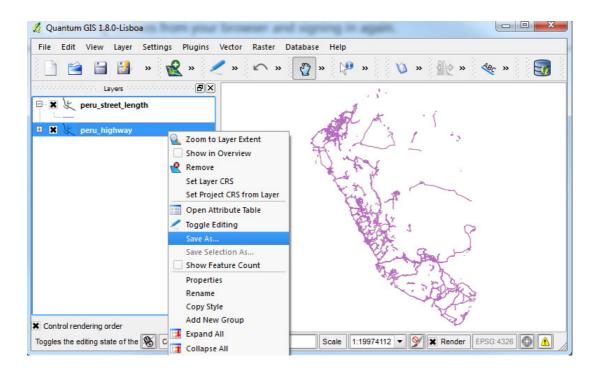
-Now right-click on peru\_highway to see its attribute table:



-You will notice that the table now contains additional fields taken from the street length file.

esidential	NULL	NULL	NULL	94468	0.004
			NOLL	94400	0.004
esidential	NULL	NULL	NULL	94469	0.004
esidential	Vicente Panizo	NULL	NULL	94470	0.002
esidential	FRAY AGUSTIN	NULL	NULL	94471	0.004
esidential	NULL	NULL	NULL	94472	0.001
esidential	S/N	NULL	NULL	94473	0
esidential	FRANCISCO EG	NULL	NULL	94474	0.003
esidential	NULL	NULL	NULL	94475	0.001
esidential	NULL	NULL	NULL	94476	0.001
esidential	MANUEL GALI	NULL	NULL	94477	0.001
esidential	Jr. Davalos	NULL	NULL	94478	0.003
esidential	LOS CLAVELES	NULL	NULL	94479	0
esidential	SAN LORENZO	NULL	NULL	94480	0.001
esidential	SAN MARTIN D	NULL	NULL	94481	0
esidential	CALLE 3	NULL	NULL	94482	0
esidential	ARHUA	NULL	NULL	94483	0
esidential	NULL	NULL	NULL	94484	0.002
esidential	URSULA PEREDA	NULL	NULL	94485	0.004
	esidential esidential esidential esidential esidential esidential esidential esidential esidential esidential esidential esidential esidential esidential	esidential FRAY AGUSTIN esidential NULL esidential S/N esidential FRANCISCO EG esidential NULL esidential NULL esidential MANUEL GALI esidential Jr. Davalos esidential LOS CLAVELES esidential SAN LORENZO esidential SAN MARTIN D esidential CALLE 3 esidential ARHUA esidential NULL	esidential FRAY AGUSTIN NULL esidential FRAY AGUSTIN NULL esidential S/N NULL esidential FRANCISCO EG NULL esidential NULL NULL esidential NULL NULL esidential MANUEL GALI NULL esidential Jr. Davalos NULL esidential LOS CLAVELES NULL esidential SAN LORENZO NULL esidential SAN MARTIN D NULL esidential CALLE 3 NULL esidential ARHUA NULL	InstantialFRAY AGUSTINNULLNULLesidentialFRAY AGUSTINNULLNULLesidentialNULLNULLNULLesidentialS/NNULLNULLesidentialFRANCISCO EGNULLNULLesidentialNULLNULLNULLesidentialNULLNULLNULLesidentialNULLNULLNULLesidentialMANUEL GALINULLNULLesidentialJr. DavalosNULLNULLesidentialLOS CLAVELESNULLNULLesidentialSAN LORENZONULLNULLesidentialCALLE 3NULLNULLesidentialARHUANULLNULL	InstantialFRAY AGUSTINNULLNULLNULL94471esidentialNULLNULLNULL94472esidentialS/NNULLNULL94473esidentialS/NNULLNULL94474esidentialFRANCISCO EGNULLNULL94474esidentialNULLNULLNULL94476esidentialNULLNULLNULL94476esidentialMULLNULLNULL94477esidentialMANUEL GALINULLNULL94478esidentialJr. DavalosNULLNULL94479esidentialLOS CLAVELESNULLNULL94480esidentialSAN LORENZONULLNULL94481esidentialCALLE 3NULLNULL94482esidentialARHUANULLNULL94483esidentialARHUANULLNULL94484

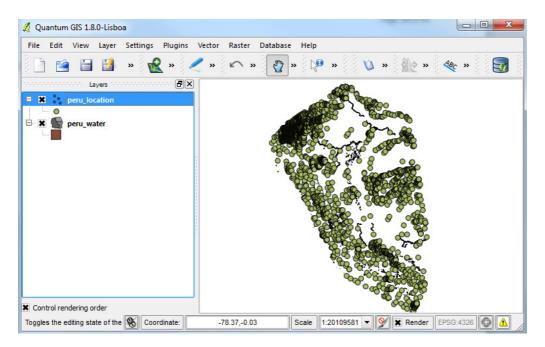
-Remember that this 'join' is temporary. It is not part of the attribute table for the peru\_highway layer, but just linked dynamically to the peru\_street\_length layer. If you want to permanently join the attributes, you must save it as a new layer. Right click on the peru\_highway layer, select "Save As ...". Name the new layer 'peru\_highway\_length.shp'



## **Spatial Queries**

-Spatial queries are core to many GIS analysis. The example here demonstrates how to do spatial queries. The question we will try to answer is, 'Which town centres in Peru are within 10 km of a water source?'.

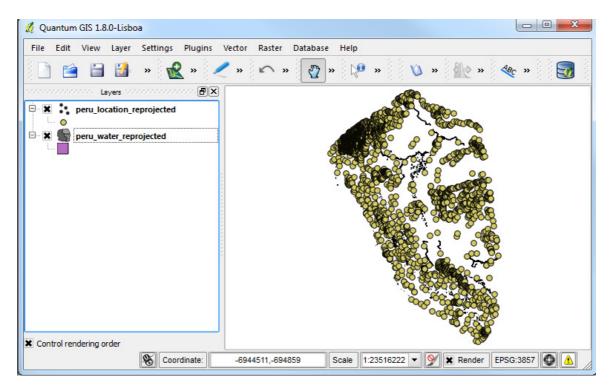
-Load the Vector layers 'peru\_location', which represents town centre information, and 'peru\_water', which represents water sources from the Vector folder, which will be where you originally downloaded and unzipped the files for this practical.



-These layers need to be reprojected to a coordinate system in metres, so we could run our queries in that instead of lat/long. Reprojection is part of the 'Save As' menu. This menu can be brought up by right clicking on a layer. In the 'Save as...' dialog, select 'PSAD56/Peru west zone' as the CRS and save the output file as 'peru\_location\_reprojected.shp'. Similarly save the other layer as 'peru\_water\_reprojected.shp'

🙎 Save ve	ector layer as	R ×
Format	ESRI Shapefile	•
Save as	Desktop/PERU/peru_location_reprojected.shp	Browse
Encoding	System	-
CRS	Selected CRS	-
CRS	PSAD56 / Peru west zone	Browse
OGR cre	ation options	
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Layer		
	attribute creation saved file to map	
	OK Cancel	Help

-Once the reprojection is done. Remove the existing layers and add the re-projected layers to your project.



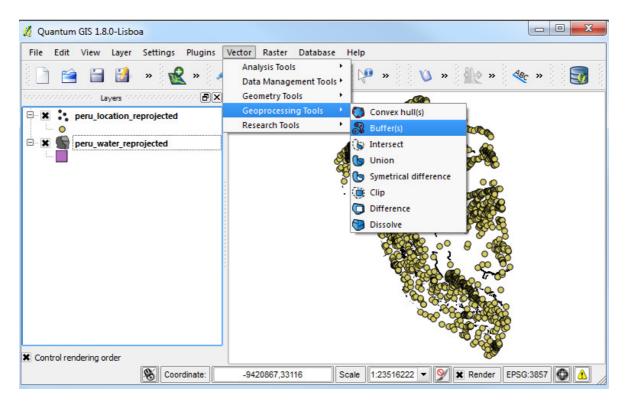
-To answer some spatial queries, further processing of the information may be needed in which we combine datasets or we extract parts common to both datasets (or perhaps the opposite) – this is commonly known as "geoprocessing". In the next part, we will buffer the existing dataset to highlight information that falls within this proximity; in the Geoprocessing Tools of QGIS, the functions are as follows:

- Convex Hull: Creates the smallest possible convex polygon enclosing a group of objects
- Buffer: Creates an equal zone around specific features at a specified distance
- Intersect: Creates a new layer based on the area of overlap of two layers

- Union: Melds two layers together into one while preserving features and attributes of both
- Symmetrical Difference: Creates a new layer based on areas of two layers that do not overlap
- Clip: Cuts a layer based on the boundaries of another layer
- Difference: Subtracts areas of one layer based on the overlap of another layer
- Dissolve: Merges features within a single layer based on common attributes in the attribute table

(Note: For further information on all of these functions, please review the following presentation - <u>http://www.slideshare.net/swethaashok28/geoprocessing-in-qgis</u>)

-Now that we are familiar with the terms, we will buffer both the peru\_water\_reprojected layer by 10,000 metres (10km). Use Vector > Geoprocessing Tools > Buffer for this operation.

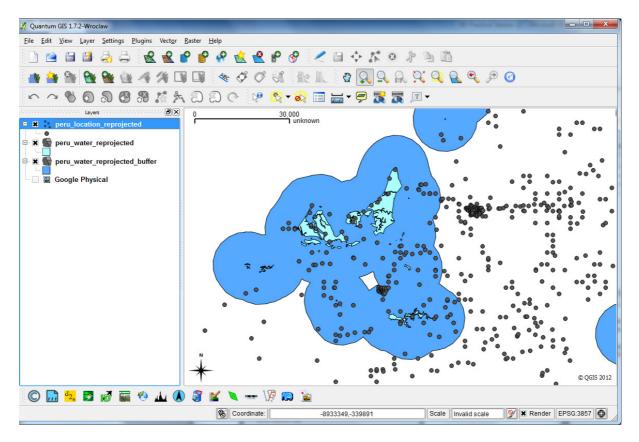


-Use 10,000 as the buffer distance since our projection uses 'metres' as units. Click the Dissolve buffer results button so that overlapping buffers are merged.

Input vector layer	
peru_water_reprojected	-
Use only selected features	
Segments to approximate 5	
Buffer distance     10000	
O Buffer distance field	
NATURAL	-
X Dissolve buffer results	
Output shapefile	
s/Desktop/Outputs/peru_water_reprojected_buffer.shp	Browse
0% OK	Close

-Save the layer as peru\_water\_reprojected\_buffer.shp.

-Once the buffering is done, add the layer to your project. You may wish to zoom in a bit to view some of the buffers better.



-Now we are ready to run the spatial query to find out our answer to "Which town centres in Peru are within 10km of a water source?".

-Open the plugin from Vector > Spatial Query.

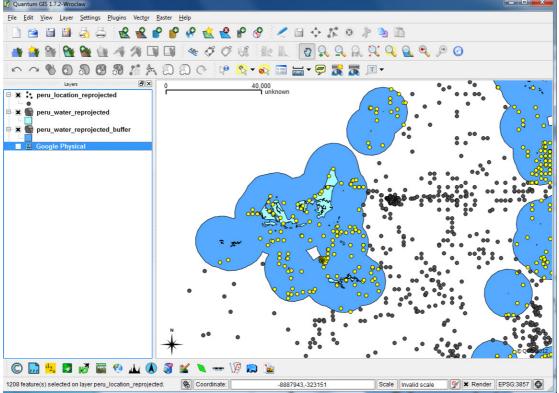
(Note: You may need to enable it from Plugins > Manage Plugins, if it is not there already.)

-We want to select all locations that intersect with the buffered water polygon. Select the options as shown below and click Apply.

🖞 Spatial Query 🛛 🔋 🔀
Select source features from
Selected geometries
Where the feature
Intersects 🔹
Reference features of
And use the result to
Create new selection 💌
Close Apply

-The new selection will highlight the regions that match the query. This is the answer we are looking for. Click Close and see the highlighted features from the location layer.

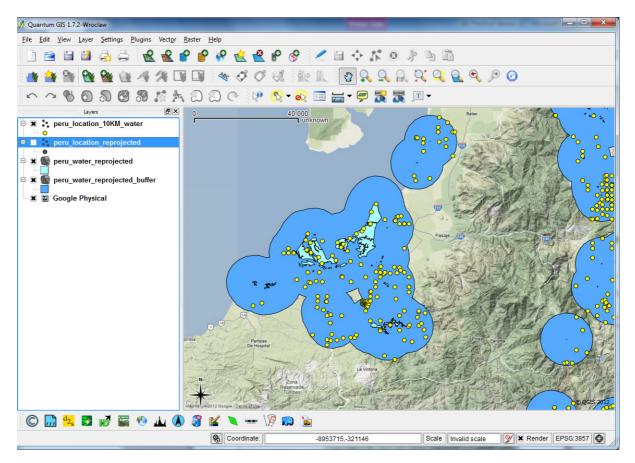
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• peru_location_reprojected	Result query	
■ 1208 selected geometries	28	4
/here the feature	64 74	
Intersects -		
Reference features of	83 84 86	
Serv_water_reprojected_buffer	103	
Selected geometries	104 108	
And use the result to	111 112	_
Create new selection	. 113 114	
	1208 of 4220 identified	M
Selected features	Zoom to item	
1208 of 4220 selected by "Create new selection"		
	Log messages	
	C	Close Apply



-Right-click the peru\_location\_reprojected layer and save selection as peru\_location\_10KM\_water

Format	ESRI Shapefile	
Save as	ktop/Outputs/peru_location_10KM_water.shp	Browse
Encoding	System	
CRS	Original CRS	Browse
OGR cre	eation options	
Data so	purce	
Layer		
	attribute creation	

-Now we can see all locations within 10KM of a water source.



## **Importing Data: Layers from Data Collectors (GPS)**

-GPS Units and other data collector programs/apps can be used to collect data in the field that can later be transferred to a PC for processing. From a GPS, the file formats will often be .gpx, .csv, .xml, or .txt; with other programs/apps, file formats may vary, though the process of importing is often the same.

-To add GPS waypoints/tracks/routes to QGIS, you will first need to move them to the computer; downloaded with the other files for this practical, a GPX file has been included as an example. Select Layer > Add Vector Layer and select the GPX file type from the list in the browse data box (GPS Exchange format (GPX)).

File Edit View Layer Settings Plugins	
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Source Dataset Open an OGR Supported Vector Layer Organize * New folder	ESRI Shapefiles [OGR] (*.shp *.SHP) Mapinfo File [OGR] (*.mi*.tab *.MIF *.TAB) Spatial Data Transfer Standard (SDTS) [OGR] (*catd.ddf *CATD.DDF) S-57 Base file [OGR] (*.000 *.000) Microstation DGN [OGR] (*.vir *.VRT) Atlas BNA [OGR] (*.snr *.BNA) Comma Separated Value [OGR] (*.srr *.CSV) Geography Markup Language [GML] [OGR] (*.gnl *.GML) Gips exchange Format [OGR] (*.gn *.GPX)
Source Dataset Open an OGR Supported Vector Layer Organize  New folder Favorites	Browse     Browse     ESRI Shapefiles [OGR] (*.shp *.SHP)     Mapinfo File [OGR] (*.ahp *.SHP)     Mapinfo File [OGR] (*.nmi *.tab :.MIF *.TAB)     Spatial Data Transfer Standard [SDTS] [OGR] (*.catd.ddf *CATD.DDF)     S-57 Base file [OGR] (*.ou0 *.000)     Microstation DGN [OGR] (*.dgn *.DGN)     VRT - Virtual Datasource [OGR] (*.vrt *.VRT)     Atlas BNA [OGR] (*.nst *.BNA)     Comma Separated Value [OGR] (*.csv *.CSV)     Geography Markup Language [GML] [OGR] (*.gmt *.GML)     Geography Markup Language [GML] [OGR] (*.gmt *.GML)     Geography Markup Language [KML] [OGR] (*.mmt *.KML]
Source Dataset Open an OGR Supported Vector Layer Organize  New folder Favorites Desktop Downloads Name GPS data Po 1MG	ESRI Shapefiles [OGR] (*.shp *.SHP) Mapinfo File [OGR] (*.mi*.tab *.MIF *.TAB) Spatial Data Transfer Standard (SDTS) [OGR] (*catd.ddf *CATD.DDF) S-57 Base file [OGR] (*.000 *.000) Microstation DGN [OGR] (*.vir *.VRT) Atlas BNA [OGR] (*.snr *.BNA) Comma Separated Value [OGR] (*.srr *.CSV) Geography Markup Language [GML] [OGR] (*.gnl *.GML) Gips exchange Format [OGR] (*.gn *.GPX)
Source Dataset Open an OGR Supported Vector Layer Organize  New folder Favorites Desktop Downloads Recent Places E	ESRI Shapefiles (OGR) (*.shp *.SHP) Mapinfo File (OGR) (*.mi *.tab *.MIF *.TAB) Spatial Data Transfer Standard (SDTS) (OGR) (*catd.ddf *CATD.DDF) S-57 Base file (OGR) (*.000 *.000) Microstation DGN (OGR) (*.dg *.DGN) VRT - Virtual Datasource (OGR) (*.vrt *.VRT) Atlas BNA (OGR) (*.snr *.BNA) Comma Separated Value (OGR) (*.srr *.CSV) Geography Markup Language (GML) (OGR) (*.sml *.GML) Comma Separated Value (OGR) (*.snr *.GVX) Keyhole Markup Language (SML) (OGR) (*.sml *.GML) GeoJSON (OGR) (*.geojson *.GEOJSON) Inistrative.shp Initer.LS1 (OGR) (*.tf *.xml *.ift F *.XML *.LL) Inne.shp Inter.LS2 (OGR) (*.tf *.xml *.ift F *.XML *.LL)
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-Chose /Vector/peru\_Health\_care.gpx from where you downloaded the files for the practical.

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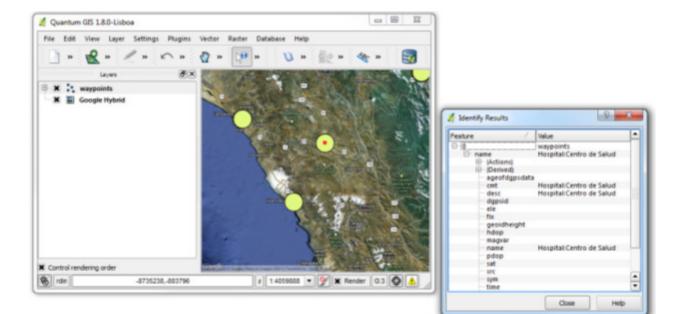
-Then, a window will come up asking you to choose which GPX sublayers to load. Waypoints is the one to import this houses in the collected information on healthcare points.

0 waypoints -1 Point 1 routes -1 LineString	
I router 1 LineString	
a routes -a cinesting	
- 2 tracks -1 MultiLineString	
- 3 route_points -1 Point - 4 track_points -1 Point	
-4 track_points -1 Point	

-A layer is added to the map holding all healthcare points in Peru. You can explore the attributes of the GPX data by right-clicking on its name and selecting Open Attribute Table.

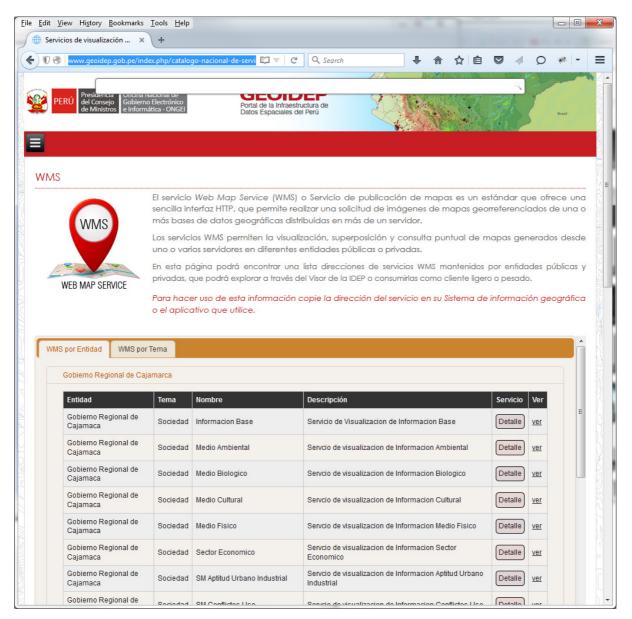
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-Alternatively, to identify the name of a particular point, select the Identify features button and click on the point. Then, a window with the results will come up.



# Importing Data: Layers from Online (Web Mapping Services and Web Feature Services)

-Some layers of information already exist on remote servers that may be accessible if you know where they're at on the internet (and if you have the right username and password if it's required). These are known as Web Mapping Services (WMS) (if they serve raster information) or Web Feature Services (WFS) (if they serve vector information). One site that lists a series of these sources can be found here: <u>http://www.geoidep.gob.pe/index.php/catalogo-nacional-de-servicios-web/servicios-de-visualizacion-wms</u>



-Looking under the available WMSs on this site, we can see what's available. Find the WMS "Gobierno Regional de Cajamaca" under WMS por Entidad > Gobierno Regional de Cajamarca > Informacion Base and click on Detalle to open a pop up showing the WMS information, which has the URL:

#### <u>http://sigr.regioncajamarca.gob.pe:6080/arcgis/services/Map/Informacion\_Base/MapServer/WMSS</u> <u>erver?request=GetCapabilities&service=WMS</u>. If you go to that site, you will see the following:

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<country></country>								
<contactvoicetelephone></contactvoicetelephone>								
<contactfacsimiletelephone></contactfacsimiletelephone>								
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<accessconstraints></accessconstraints>								
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<maxheight>2048</maxheight>								
- <capability></capability>								
- <request></request>								
- <getcapabilities></getcapabilities>								
<format>application/vnd.ogc.wms_xml</format>								
<format>text/xml</format>								
- <dcptvpe></dcptvpe>								

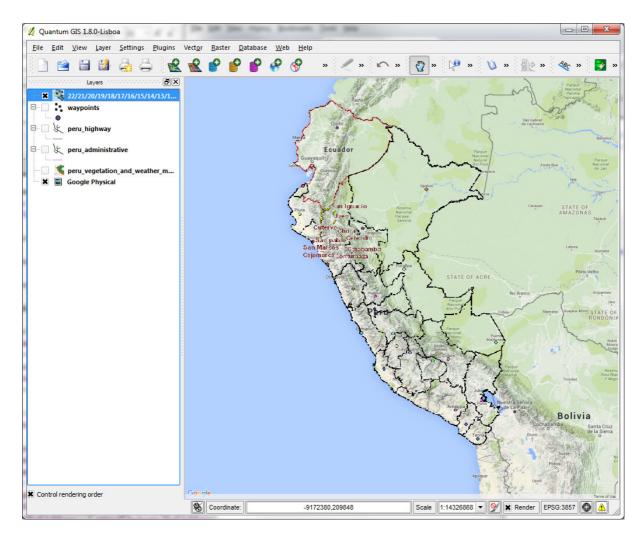
-Though this information may not be readable, it contains the information the GIS needs to connect to the remote server and load the information from it. Copy the URL from the WMS page, as this will be needed in a moment. In QGIS, select the menu option Layer > Add WMS Layer and the Add Layer(s) from a Server window will open up. Inside of this window, click the New button to add a new connection, which will open the Create a new WMS connection window. In this window, paste the URL from the WMS page in the URL field and let's Name this layer Informacion Base. Once done, click OK.

onnection	details
Name	Informacion Base
JRL	http://sigr.regioncajamarca.gob.pe:6080/arcgis/services/Map/Informacion_Bas
<b>5</b> .0	
f the serv	ice requires basic authentication, enter a user name and optional password
f the serv	ice requires basic authentication, enter a user name and optional password
<u>J</u> ser name	
<u>J</u> ser name Password	
<u>J</u> ser name Password Ignore	GetMap URI reported in capabilities
<u>U</u> ser name Password Ignore	

-With the information for the connection entered, you'll be taken back to the Add Layer(s) from Server window. Click the Connect button to connect to the server and get the information about the service inside QGIS. Select the layer Informacion\_Base (which is an amalgamation of all the layers) and click Add to add it to the map and once it's been added to the map, click Close to close the window.

Connect	<u>N</u> ew	Edit Delete		Load	Save	l default server
ID	A Name	Title	Abstract			-
⊟-0		Informacion Base		 		
± 1	0	Departamentos				
⊞ ·· 3 ⊞ ·· 5	1	Provincias Distritos				
±	2	Cascos_urbanos				
	2	Hidrografía				
	9	Topografía				
± 20		Infraestructura				6
·⊞·· 27	14	Centros Poblad				-
. <u>.</u>	15	Capitales Distrit				
Image encodi	ng					
PNG		GIF TIFF				
PNG Coordinate R	PNG8 JPEG		7/6/5/3/2/1/0			
PNG Coordinate R	PNG8 JPEG	3 available)	7/6/5/3/2/1/0			
PNG Coordinate R Layer name Tile size	PNG8 JPEG	3 available) 17/16/15/14/13/12/11/9/8/7	7/6/5/3/2/1/0			

-We can now see the Informacion Base layer added to the map.



-As the information is remotely controlled, we don't have the ability to change the colours representing the various classes of information in this layer. To find out further information about the layer, though, you can right click on the layer and select properties and check out the Metadata tab. If the WMS is being published by a reputable source, it will often have associated metadata recorded about it which can be reviewed and may provide further information on how the data were compiled, what the colour classifications are, and other information that may be helpful in determining if this is the information you need for your map.

Transparency	🛠 General 🕧 Metadata	
Title		
Abstract		
Driver:		
	rvice version 1.3 data provider	
Server Properties Se	elected Layers Other Layers Server Properties	
Property	Value	
WMS Version	1.3.0	
Title	WMS	
Abstract	WMS	
	WMS	
Keywords		
Online Resource	•	
Contact Person		
Fees		
Access Constraint	ts	
Image Formats	image/bmp	
	image/jpeg	
	image/tiff	
	image/png	
	image/png8	
	image/png24	
	image/png32 image/gif	
	image/syn	
Identify Formats	application/vnd.esri.wms_raw_xml	-
cachary romats	application/vnd.esri.wms_featureinfo_xml	-
	Style Save As Default Load Style	Save Style

-Loading a WFS is done in roughly the same way, but instead of selecting Layer > Add WMS Layer, select Layer > Add WFS Layer. The most difficult part of either will be to find (verifiable) resources that provide you the information you need for your map.