

Created November 2012
for use with:
eTrex Legend CX, QGIS v.1.7

Collecting and Working with GPS Data



Supplemental QGIS Exercise: Collecting and Working with GPS Data

In this exercise you will learn how to collect data using an *eTrex Legend Cx* GPS unit. You will then learn how to load data from the GPS unit into QGIS and display it on a map. The instructions may vary slightly depending on your operating system and hardware.

SECTION A: Collecting Data with a GPS Receiver

Introduction: What is GPS?

Step 1: Learn more about GPS and get familiar with receiver unit.

Step 2: Learn how to get a clear signal and the importance of locking onto an adequate number of satellites.

Step 3: Understand the unit setup.

Step 4: Collect location data.

SECTION B: Displaying GPS Data on a Map

Step 1: Connect the GPS unit to your computer using the proper cables.

Step 2: Run the download program by using the properly installed plugin.

Step 3: Download your waypoints to a file and display them in a new layer.

Step 4: Examine your points along with some area background data displayed from the internet.

Step 5: Save the data properly.

SECTION A: Collecting Data with a GPS Receiver

Introduction to GPS

GPS stands for “Global Positioning System”. It refers to a collection of 24 satellites placed in orbit all around the earth with very precise clocks on board. By locating the signals from at least 4 of these satellites from a point on the earth using a GPS receiving unit, you can pinpoint your exact location at any given time.

Step 1: Familiarize yourself with the eTrex unit and turn it on.



- ☐ The Up and Down buttons on the left will allow you to select options on pages and menus, adjust the display contrast, zoom in and out on the Map Page, and cycle through data on the Pointer Page.
- ☐ The Enter button (Joystick) will confirm data entry and menu selections. Pressing and holding this button activates the Mark Waypoint Page
- ☐ The Page button will switch between pages and back you out of pages. If you start to do something and don't want to continue, you can stop by pressing this button.
- ☐ The Antenna should be kept unobstructed at all times in order to receive a clear signal from as many satellites as possible. It is best to hold the unit at chest-height, out in front of you so that your body does not block the signals.

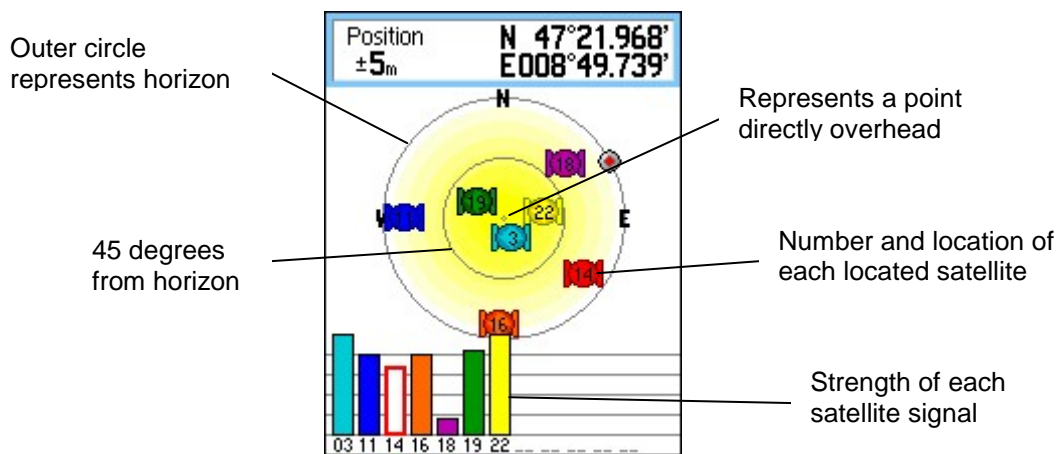
This is the rear of the unit:



- ☐ The unit requires 2 AA batteries to operate. A data cable will be needed in order to transfer data to a computer after collection.

Step 2: Locate Satellites

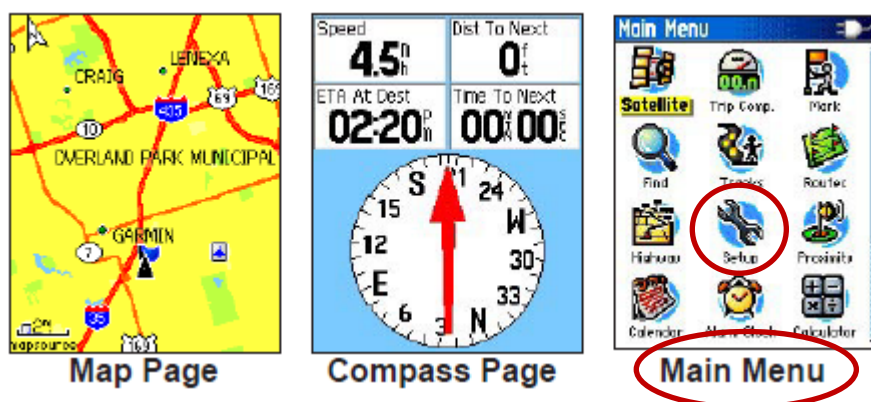
- ☐ Press the On button (on the right side of the unit). The unit will start to look for satellites and will display the satellite acquisition page. You will see the messages “Locating Satellites”, and “Acquiring Satellites”. This process normally takes several minutes, so be patient. (The satellite signals do not go through walls, so this cannot be done from inside a building).



- ☐ This page will provide more information about the position of the satellites in the sky and each one's signal strength. It can help you identify possible obstacles blocking the signal (such as buildings, trees, mountains, etc.) Preferably the satellites locations will be a mix of high and low on the horizon, in several different directions.
- ☐ If the unit cannot establish a satellite fix, a list of solutions will appear. Highlight the appropriate one and press Enter.
- ☐ Once enough satellites have been located, the unit will say "Ready to Navigate" and provide an estimate of accuracy. The exact number is not crucial, just know that it can be influenced by a number of factors, mostly the number and location of available satellites, and that you don't want the number to be excessively large (such as 100 meters or 300 feet). Also be aware that the location accuracy from an inexpensive hand-held GPS unit is somewhat limited.

Step 3: Check the unit setup.

- ☐ Press the Page button (right side of unit) several times, until you reach the Menu page. (The 3 main pages are shown below). Highlight "Setup" and press Enter (push down on the Joystick key on the front of the unit).



On the Setup Menu there is an icon that says “Units”. Using the *Joystick* button, highlight this item and press it to *Enter*. **Take a note of the Position Format and the Map Datum.** The correct position units are important to record as part of your data collection so that when you bring the points into a GIS they can be properly displayed. A common mistake when copying data is to leave off a direction sign (N, E, S, or W) or a negative sign (which can also denote latitude south of the equator) or to leave off too many decimal places. It is important to record all of the data with complete decimal and directional information, especially if transferring to a paper form or re-typing.

NOTE: The default settings for coordinates taken with the eTrex Legend are decimal minutes and WGS84 datum. Other common GPS waypoint settings include degrees, minutes, and seconds and decimal degrees.

WGS 84 is the most common map datum; for most projects you will want to make sure it is being used. *It's not likely you will want to change these settings, just make a note of them,* especially the first time you start using your GPS unit.

Step 4: Collect waypoints

- ☐ Press the Page button (right side of unit) until you reach the Menu page, as above. This time highlight the word Mark and press Enter.

You will see the following screen:

Mark Waypoint	
Waypoint ID	002
Note	24-OCT-05 4:51:07PM
Location	N 38°51.394' W 094°47.949'
Elevation	1199'
From Current Location	NW 2'
Avg	Map OK

- ☐ The Waypoint ID is important to note on your survey spreadsheet or data table as this is what will link it to all information collected at that point, such as facility name or other information. (You can highlight this number by scrolling up to it and pressing Enter if you'd like to change it.) Then highlight the word OK (this is the default, as shown above) and press Enter to record the point.

NOTE: You can collect your data either as a series of waypoints (most common for health survey data collection) or as a “track”, which connects a series of waypoints.

- ☐ Continue to collect a series of waypoints while walking around to different locations and pressing “Enter” at each location. The Map view screen will

show you your progress. Pressing the Up and Down buttons will zoom you in and out on this screen.

- ☐ Finally, turn off the unit to save batteries. (Turning off the unit will not cause you to lose any data you have entered). You now have a data file you'll be able to view in QGIS, in the next section of this exercise.

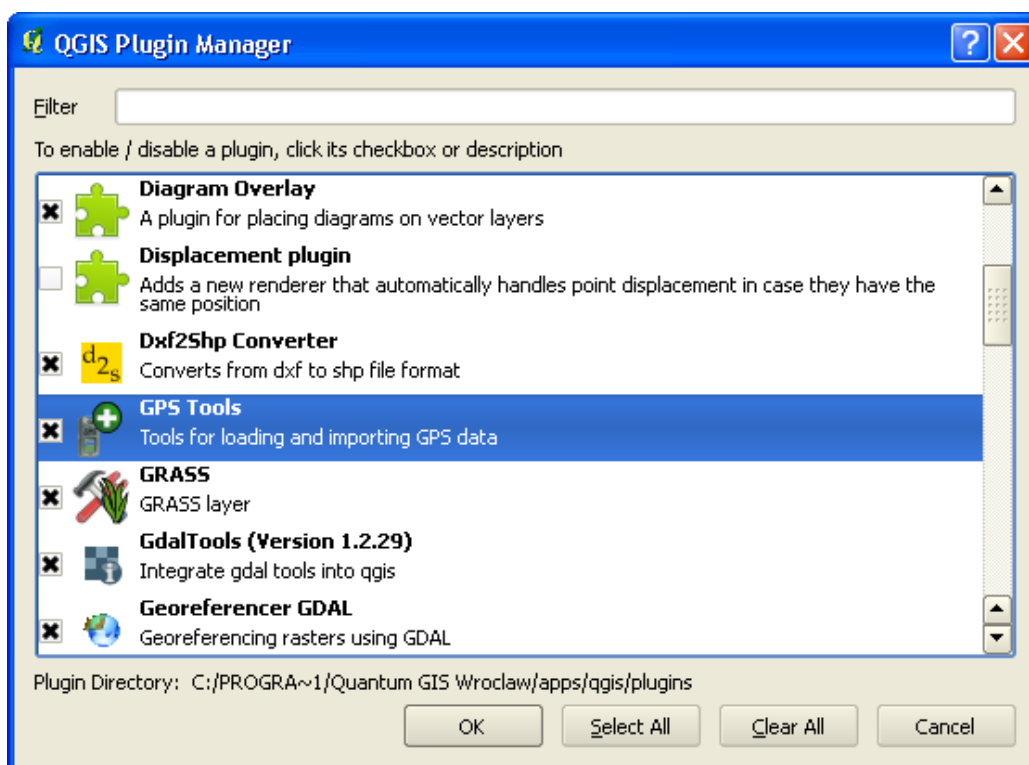
SECTION B: Displaying GPS Data on a Map

Step 1: Connect the GPS unit to your computer.

- ☐ Flip up the rubber cover on the back of the GPS receiver unit near the top and insert the data download cable. The opposite end of the cable will be a USB connector.
- ☐ Turn on the GPS unit. (Don't worry what the screen says; you can bypass the screen which searches for satellites at this point.)
- ☐ Plug in the cable to the USB port on your computer.

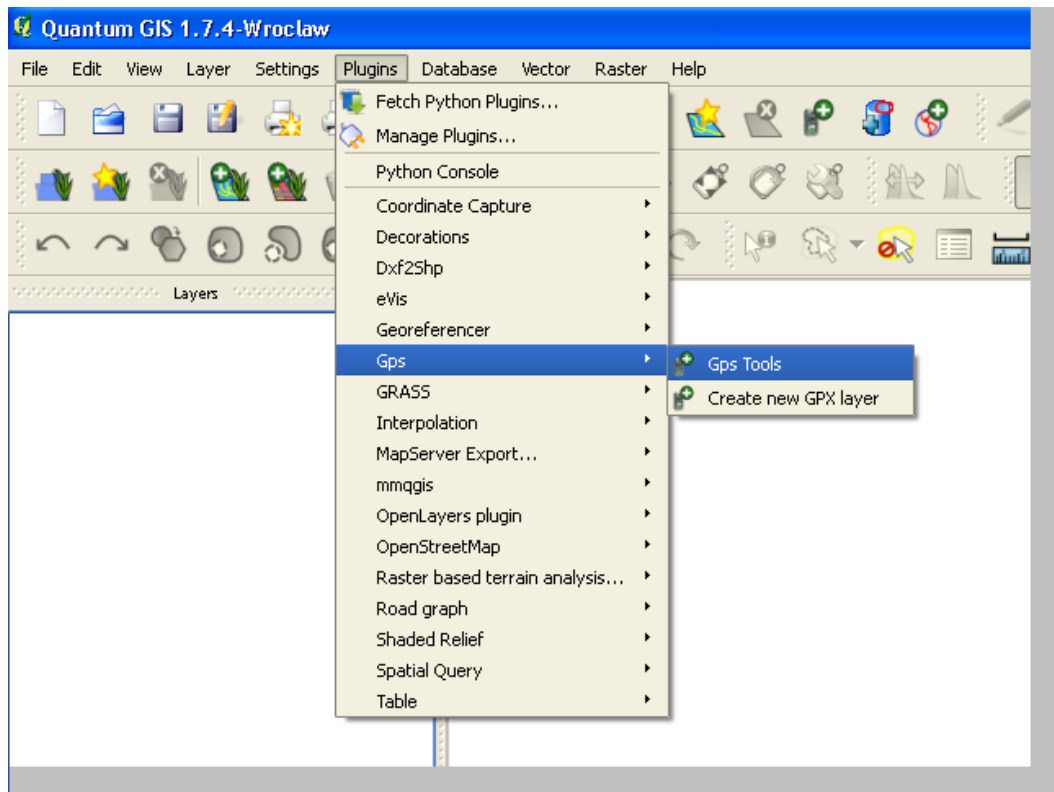
Step 2: Start up QGIS on your computer and check for the *GPS Tools* plugin.

- ☐ Double-click the QGIS icon on the desktop to start the program. Check your plugin manager to ensure that "GPS tools" is enabled. (See graphic below. If you need help with this step, or need to "fetch" the correct plugin from the internet, please return to *Exercise 2: Explaining plugins*. The GPS tools plugin is part of the main plugin installer that comes with version 1.7.4.)

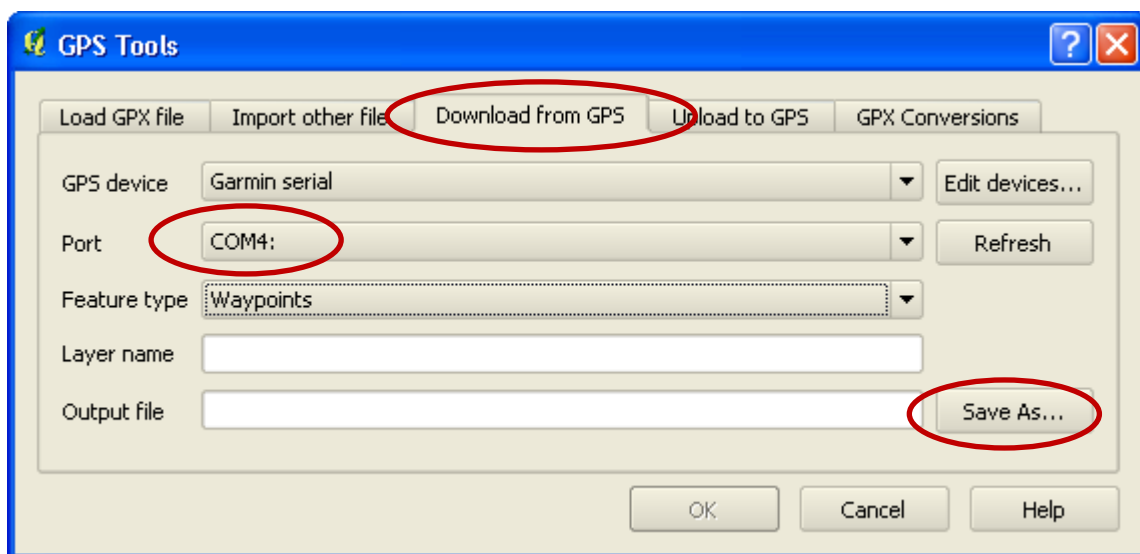


Step 3: Run the GPS Tools Plugin and download the points.

- ☐ From the menu, select *Plugins > Gps > Gps Tools*.
(NOTE: If you have QGIS versions 1.6 or 1.8, the GPS tools may be in a different menu or toolbar location.)



You should see the following dialog box:



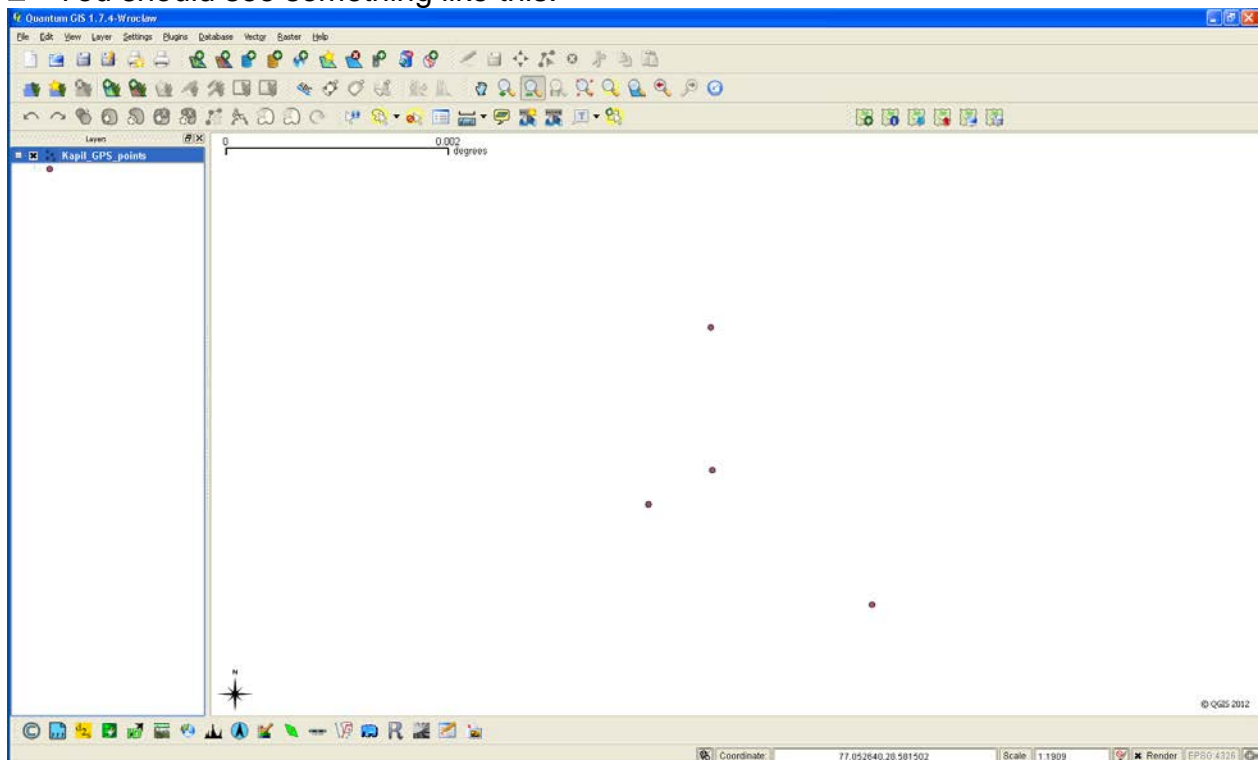
- ☐ With your GPS unit turned on and properly connected to your computer, choose the “Download from GPS” tab at the top.
- ☐ “Garmin serial” should be selected under *GPS device*.
- ☐ You will need to select the proper *port* in order for the computer to recognize where the device is located. “COM1:” is usually the best choice when your input port is the serial connector. If you have used a USB adapter you may need to

choose either “usb:” or “COM2:” or even, as shown above, “COM4”. This may take some experimentation and may require use of the “Refresh” button, if the device was not turned on when QGIS was started.

- ☐ The *Feature type* is “Waypoints”.
- ☐ Under *Layer name*, type in a name for the points layer you are about to create, such as “PHFI test points”.
- ☐ Under *Output file*, click on the “Save As. . .” button and choose a save location and file name. (The default extension for this file will be .gpx.)

Step 4: Examine the data points you collected with the GPS.

- ☐ You should see something like this:

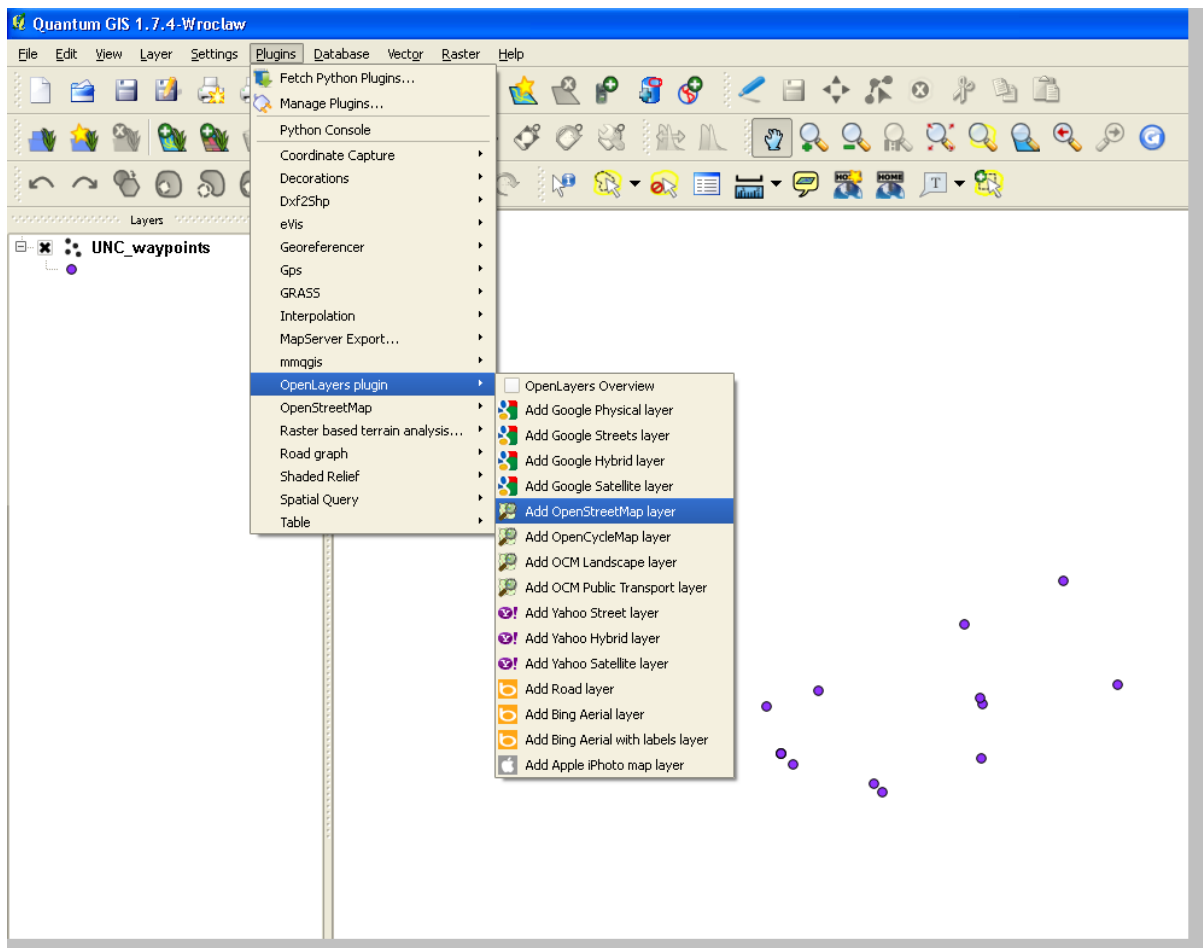


Right now you have very little in the way of a frame of reference, other than how the points are positioned relative to each other, which direction is North, and how far apart the points are from one another.

So let's add some base area information to put our points in context. QGIS has the ability to display data from other sources, such as Open Street Map, which is an organization of volunteers collecting spatial data and allowing it to be uploaded or downloaded for free on a Wiki. This data is self-regulated, meaning it may not always be accurate or complete, but it is often an easy way to get free local data that has not been otherwise updated or made available by other organizations or governments on the web.

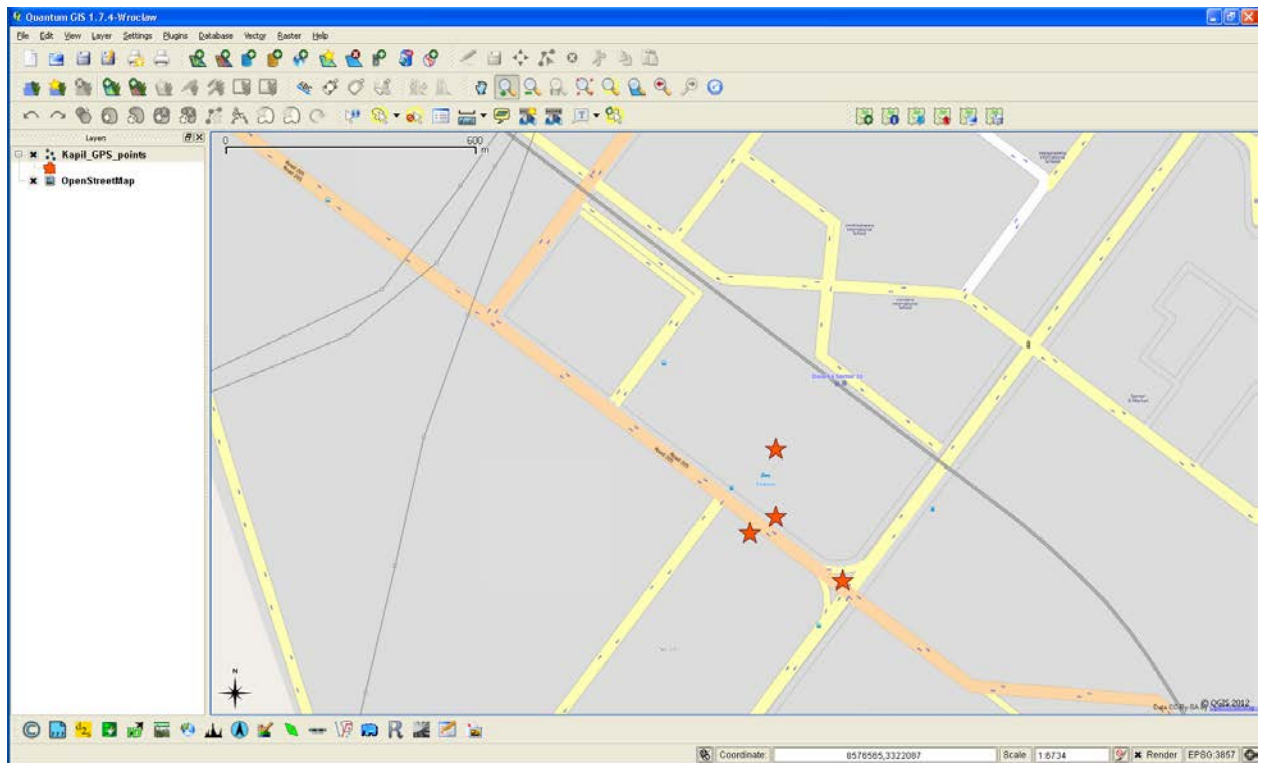
NOTE: We'll need a Plugin for this called "OpenLayers". Please fetch and install this plugin if it is not already available. (See *Exercise 2* for more instructions.)

- ☐ Go to the menus and choose *Plugins > OpenLayers plugin > Add OpenStreetMap Layer*



You should now see roads, buildings, and other points of interest near your data collection location. (Make sure your GPS point layer is on top.)

- ☐ Change your layer symbology, if desired, to make it more readable. Below, the points have been changed to orange stars. The yellow and orange linear areas denote streets and the grey line is a railroad. The points shown were collected by your instructor near the hotel.



Step 5: Save the project file and export the points to a shapefile.

- ☐ If you wish, you may save your project.

You may recall that saving a project does not save the files used to create the layers associated with it. Right now the points from the *.gpx* file are being displayed as a layer. We should save that layer as a *shapefile* so that we can use it in other projects.

- ☐ Right-click on the name of your points layer in the “Layers” box (i.e. “PHFI class GPS points”).
- ☐ Choose “export as. . .” and save it as a shapefile, in the location of your choice.

Exercise End

MEASURE Evaluation is funded by the U.S. Agency for International Development (USAID) and works globally with other agencies to promote a cycle of data demand, collection, analysis and utilization to measure progress toward addressing and confronting disease, population issues, and poverty. The information provided in this exercise is not official U.S. government information and does not necessarily represent the views of USAID or the U.S. government.