GIS.XL

User manual of Excel add-in for spatial data analysis and visualization

http://gisxl.com

Content

1 Introduction

Excel is a good tool for management, analysis, visualization and storage of diverse data types. In practice, it is the most widely used software for data processing in tabular form. Estimates state that MS Excel has about one billion worldwide users, and further analysis reveals that 80% of the data we have and use has a spatial character. Therefore, global users have billions of data-sets that can be visualized or analyzed in relation to their spatial characteristics.

Despite this, Excel offers few options for spatial data. Most existing solutions are geared to basic data display on Bing or Google Map backgrounds, and if you need something more, you always have to add another large external piece of software; even when you only need a simple function or feature. Moreover, data transfer between Excel and the added external program consumes 80% of your running time, and this time is extended if you transfer data often or if your dataset is updated on a regular basis. I faced this problem in my practice as a hydrogeologist; and I was so frustrated at not being able to find an existing solution that met my expectations that I created my own. All my colleagues gave positive reactions, so I decided to finish this solution and release it publicly. Today, you can use this solution too, and you will find that it saves you a lot of time

The result is application level add-in for MS Excel which is released under the name GIS.XL. In a sentence, GIS.XL can be described as an add-in for spatial data analysis and visualization. Add-in contains complete GIS interface, plus a variety of features for working with spatial data. It lets you quickly display your tabular data in a map and also receive additional data for your tables from external maps which can be imported into the program as ESRI Shape Files.

This manual provides all the comprehensive information you need to be able to fully utilize GIS.XL functionality. For more information, together with the installation file, visit the http://gisxl.com website which also provides links to video tutorials and instruction videos for GIS.XL add-in.

2 Requirements

Add-in GIS.XL was developed with the condition that it does not require additional software, libraries or web services. The Installation package is less than 13 MB and it contains everything you need for installation and running. When you begin the installation process the program downloads all necessary libraries (.NET Framework 4.5) via the Internet (microsoft.com website) and installs them automatically. This is a great help if your computer is not updated regularly with libraries and the latest available tools. Your computer only needs the following:

- OS: Windows Vista or higher
- MS Office: desktop version of MS Excel 2005 or higher

Your computer may be 32 or 64-bit, and the same for your Office; and this program is operational in all combinations.

3 Installation

Installation of GIS.XL add-in is very simple. You just follow the assistant who takes care of everything for you. If something is missing in your computer (a library), the installation program automatically downloads and installs it. After installation, you can use add-in immediately.

The first step is, download the installation package from http://gisxl.com/Downloads website.
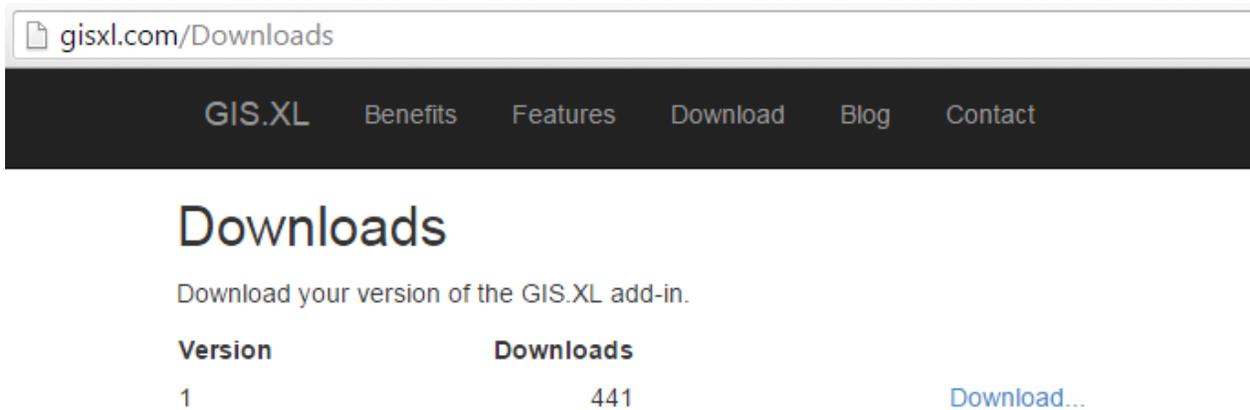
The installation package is a compressed zip file you can open after the download. Just run **setup.exe** file in the directory, and follow the instuctions.
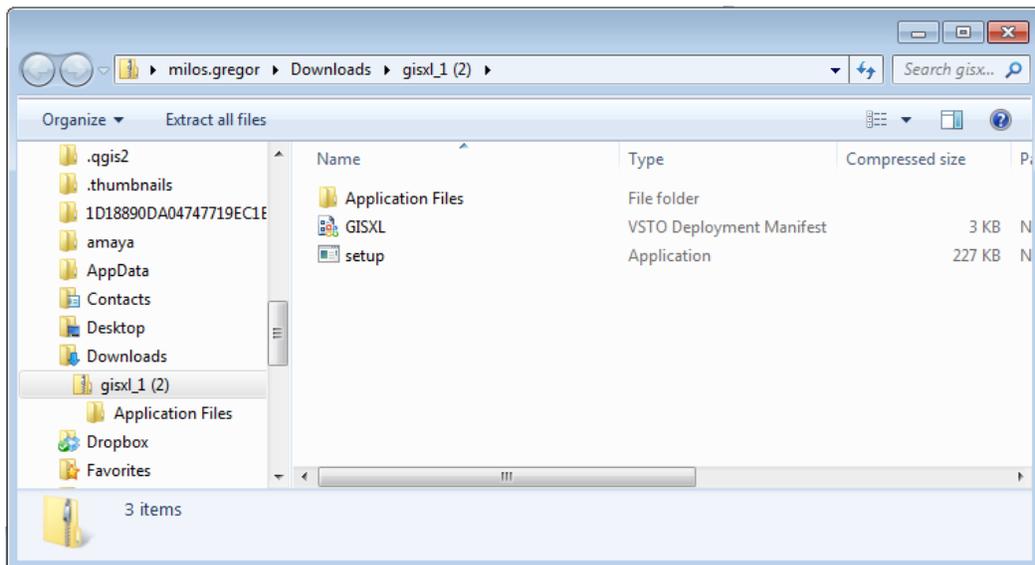

After running **setup.exe**, a control dialog is displayed that asks if you want to run the installation program.
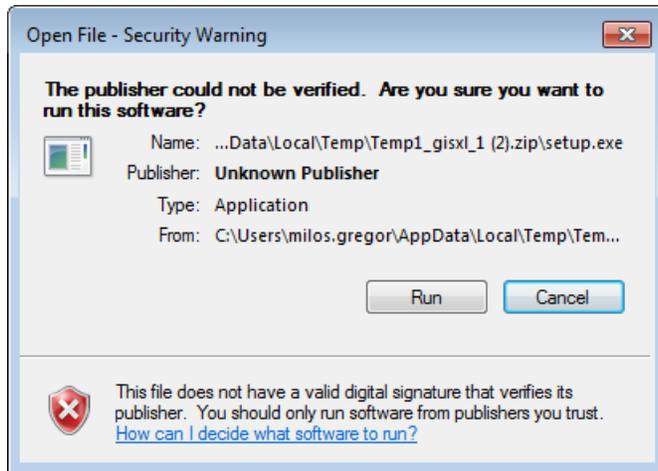
If you click on the **Run** button, add-in installation begins. The actual installation starts when you click the **Install** button.
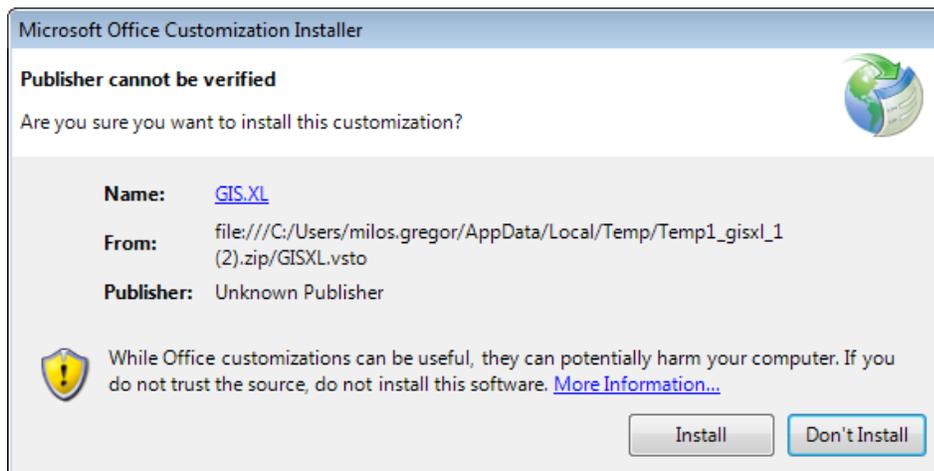
The progress bar in the next dialog displays installation status and progress.
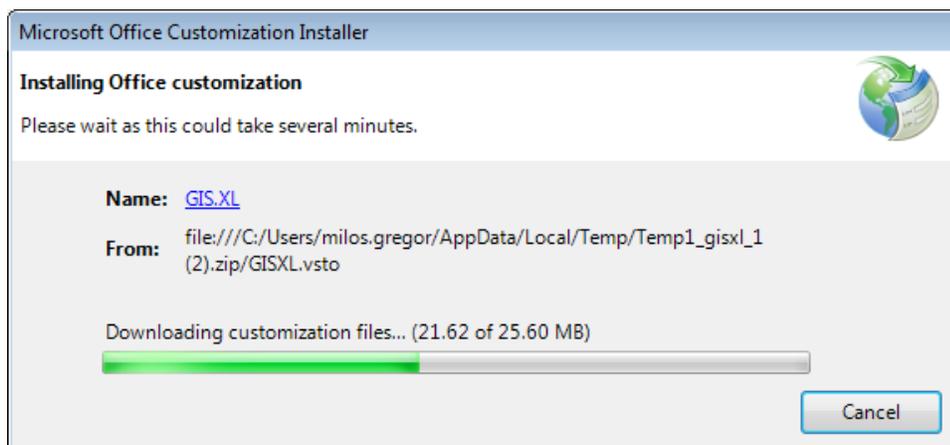
The final dialog informs you if the software is installed successfully,
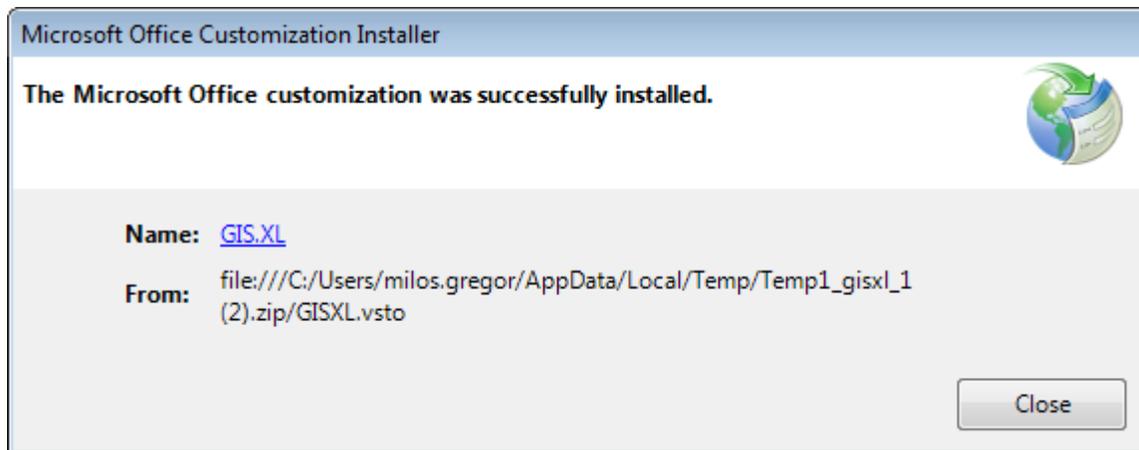
The installation is complete after clicking the **Close** button, and you can immediately use add-in. If you start MS Excel, you will find a new tab called **GIS [demo]** at the end of the ribbon toolbar. You can now use add-in to test it and familiarize yourself with it. If you want to use the add-in without limitations, you must activate your license. This procedure is described in chapter **6 Licensing**.
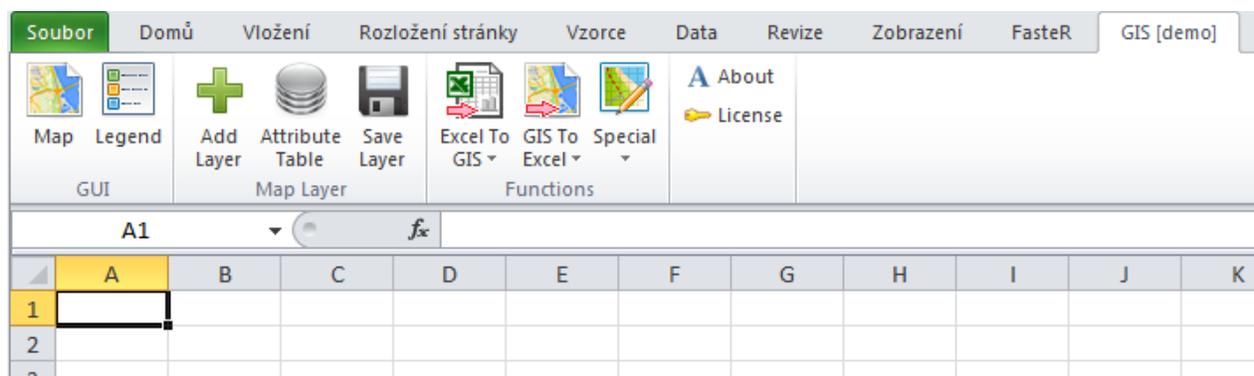
TIP

If an error occurs during installation(security excepted), one step is required before instaling again. Copy the installation package you downloaded to the directory you have full adminitrative rights to,(such as "My Documents" folder). Once you have copied the package install it again, and installation takes place correctly. After the installation, you can delete the package from"My Documents"

4 Uninstallation

If you want to update or remove add-in from your computer, it is easy. Add-in is uninstalled exactly the same as you remove other programs from your computer. Firstly, open the **Control Panel – Programs – Programs and Features** window. Find **GIS.XL** in the list of programs, double-click on it, or right-click on it and choose **Uninstall** from the context menu. Uninstalling removes add-in from your computer.
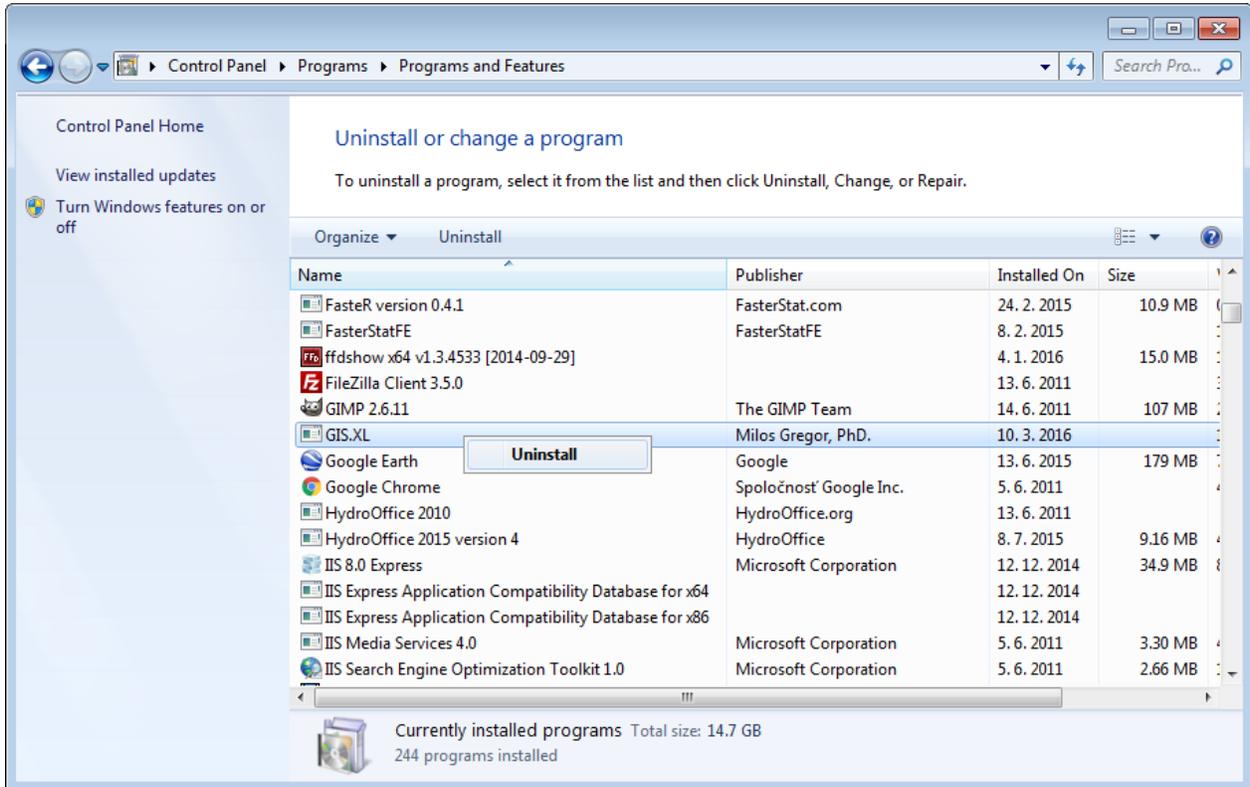
> **WARNING**
>
> *If you have activated your commercial add-in license, you must detach it before uninstalling the program. Otherwise, you can not activate your commercial license on another computer and it will remain on your current computer. See--Chapter 6 Licensing--to detach your license.*

5 Add-in Setup

The first version of the program contains only one configuration option. You can set whether you want add-in to start automatically at MS Excel boot or on user request. The Auto-Start option doesn't slow Excel start. If you want to turn add-in on OR off manually, click on the main ribbon button **File** and then click the **Options** menu item. You click on the **Add-ins** item in the displayed dialog and then select **COM Add-ins** in the right panel of the combo box and press the **Go** button.
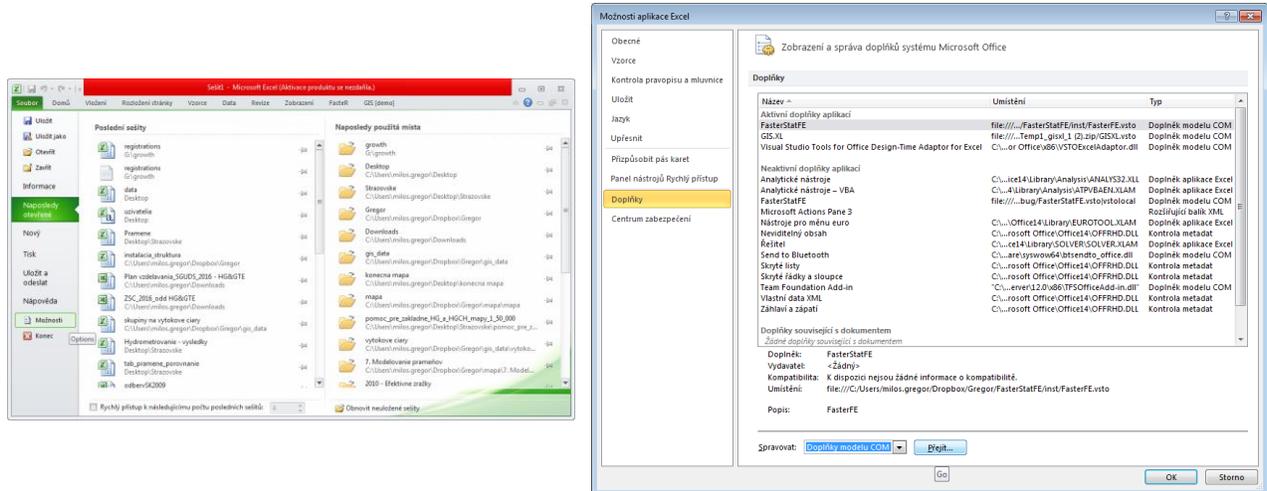
This next dialog display lets you enable or disable selected add-ins in the installed list. This list also contains our GIS.XL add-in.
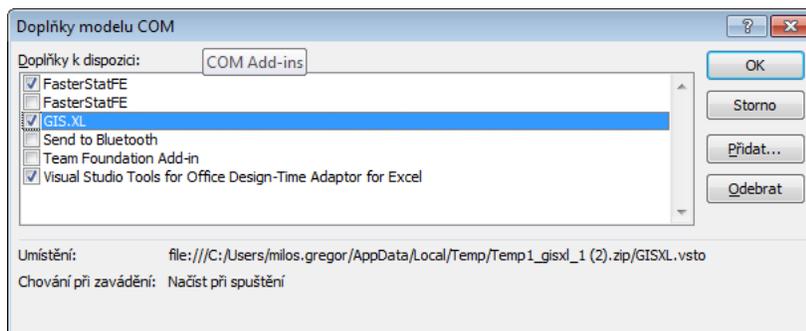
6 Licensing

After installing add-in, you can immediately use the demo version. This version includes all functions; but some are limited. You will find limited functions in the **Functions** group in the ribbon toolbar tab. If you want to use the full version of add-in, you must activate your commercial license (described in chapter **6 Licensing)**. An auxiliary dialog appears when you click the **License** ribbon button and this enables activation. Your computer must be connected to the internet to activate your license.
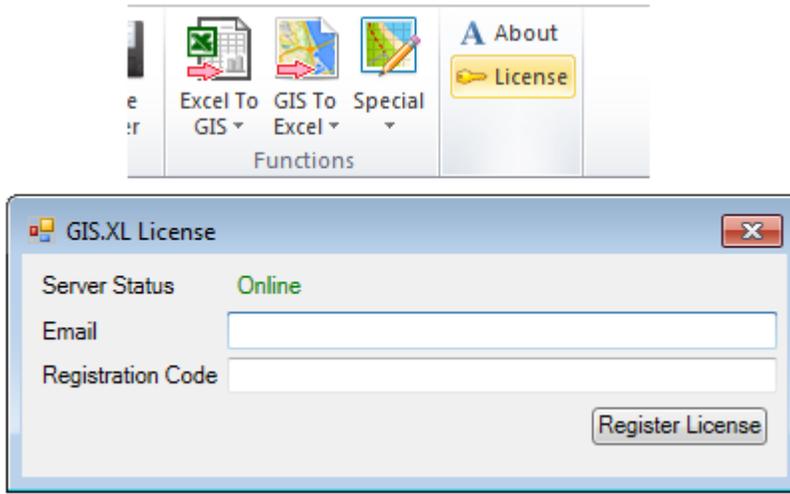
Add-in firstly verifies connectivity to the installation server. Then you can install the license which you purchase in the http://gisxl.com/Licensing site. After purchasing the license you get a **registration code** you insert into the text box. After license activation, you can use the full version immediately, and without restrictions.

> **WARNING**
>
> If you want to activate your license on another computer, or upgrade to a higher add-in version, you must first deactivate your license on your current computer. Click on the License button in the ribbon toolbar, enter the registration code in that window and click the **Detach License** button. Then you can use your license on another computer.

7 User Interface

The GIS.XL add-in user interface has three main parts. The first is the ribbon toolbar tab, named **GIS**. This toolbar contains everything you need to work with add-in. The first two buttons display the map and legend panels. The second group of buttons is used to work with external map layers in the ShapeFile form and the third group is for working with spatial data. Using these functions, you can combine the powerful features of Excel spreadsheet and GIS interface. Finally, the last two buttons display information about add-in and commercial license activation/deactivation.
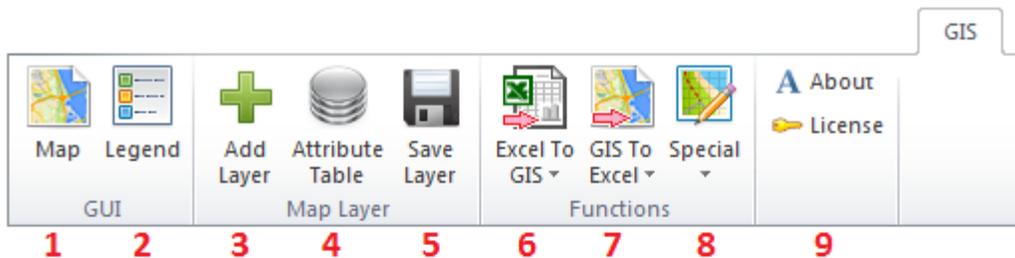
1   Show map panel
2   Show legend panel
3   Add Shape File layer to map
4   Show map layer attribute table
5   Save layer
6   Excel to Map features
7   Map to Excel features
8   Special features
9   Add-in management

These individual functions on the ribbon toolbar are described in the following manual sections. Only the first two buttons are important in this chapter. The first button, called Map, displays the **Map panel**. This panel shows your data in the form of maps, and you can import your data from the Excel table into this panel and open external layers from ESRI Shape Files (*.shp). The panel is anchored to the right part of the Excel window, but you can change its position. You can exclude it entirely from the Excel window, move it on the external monitor or resize it to fullscreen mode. The info bar in the bottom of the Map panel displays the X and Y coordinates on the mouse cursor and also the coordinate system you are using.

If you want to change the map layers' visual properties, you use features in the panel which appear when you click the second ribbon button **Legend**. Invidual features of the GIS interface are described in the following chapter; **8. GIS Features**.
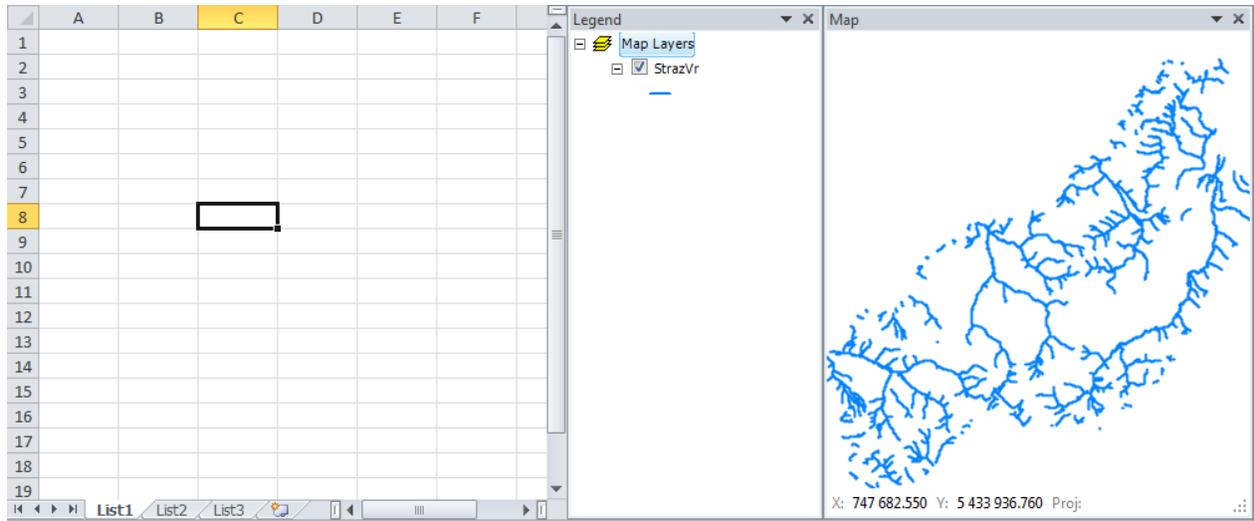
8 GIS Features

GIS interface functionality is mostly controlled by the first five buttons in the ribbon toolbar. As discussed in the previous chapter, the first two buttons display the Map and Legend panels.
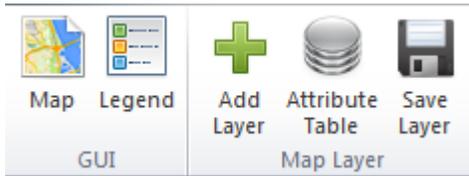
Another button, named the **Add Layer**, allows you to insert layers stored on your hard disk into the map. These map layers can be in vector or raster formats. Lines or polygons stored in **ESRI ShapeFiles** (*.shp) can be inserted into the map points under the vector format.
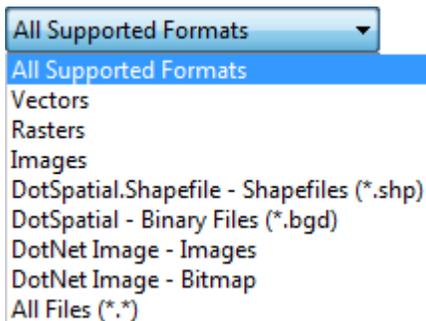
You can import images or rasters (grids) from raster formats. As example is DEM—the digital elevation model. The current version of Add-in only lets you work with rasters stored as "Binary Grids" (*.bgd). If you have rasters in another format, you must convert it in other software. For example, I use the SAGA open source tool.

The next image shows an example of elevation lines imported from a ShapeFile. The new layer is displayed in a single color when you import it. In addition to the Map panel, there is also a Legend panel (where one item has been added for display purpose). The Legend panel lets you change the position of individual layers using drag-&-drop features.
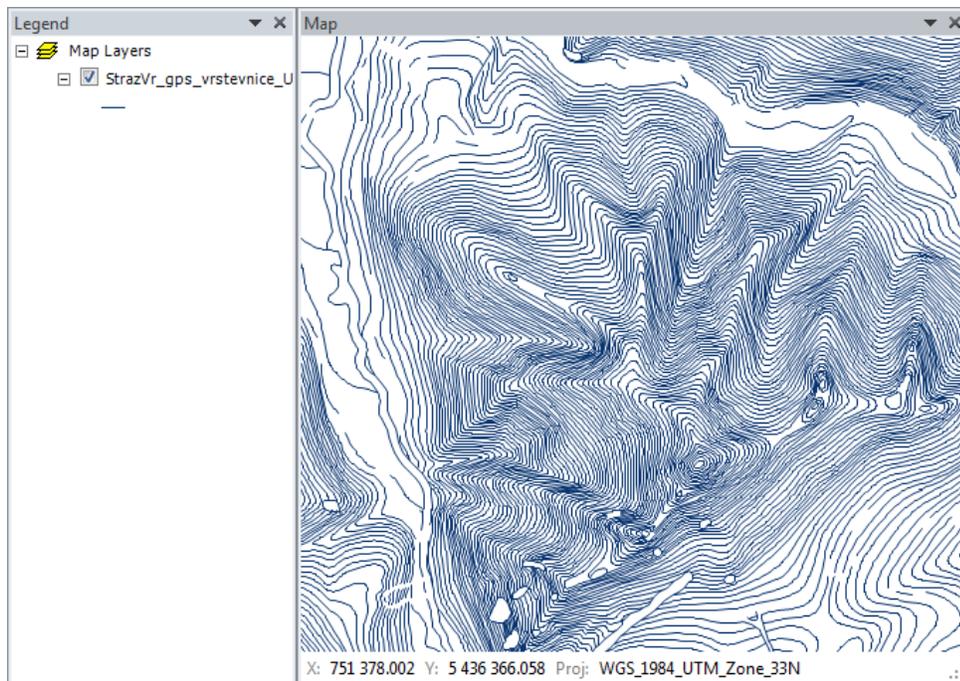
If you select one layer in Legend and then click on the Attribute table button in the ribbon toolbar, a window displays data from the ShapeFile attribute table. You can select, filter or edit this data in different ways.
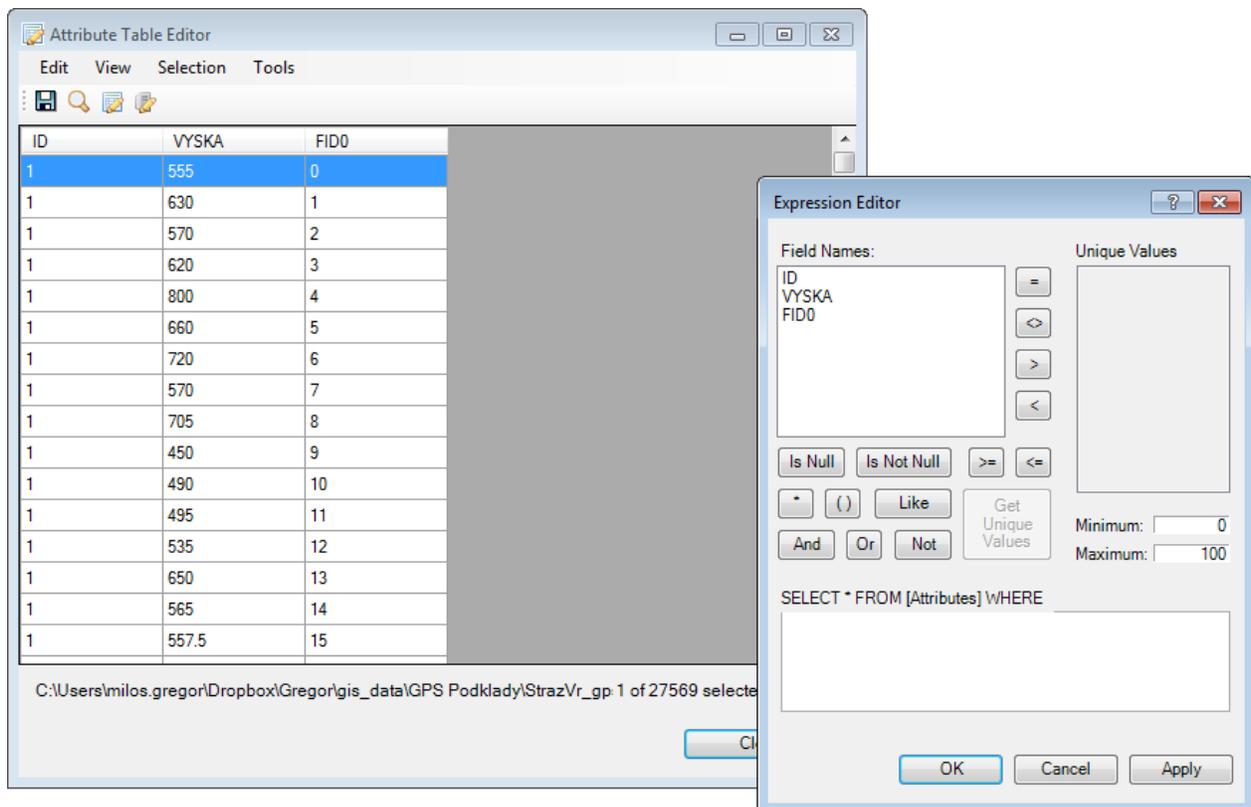
If you want to edit the visual properties of the map layer, use the functions in the Leged panel. In the example, I have opened the elevation lines. When you double-click on an item in **Legend**, a dialog appears where you can edit visual properties of all the features in the layer. In the following example, I changed the line color and opacity.
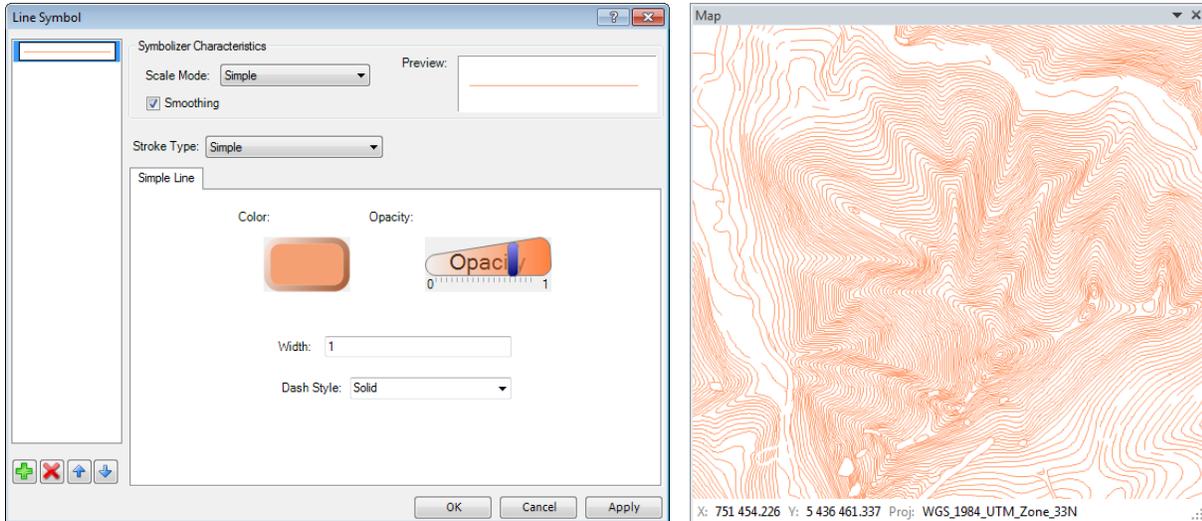
Additional visual features can be set by right-clicking an item in the Legend panel. A context menu is displayed and you can choose your option. For example, you can use this to remove layers from the map, zoom to the entire layer extent, export layer attribute data or set feature labels. Comprehensive setup options for layer properties can be found under the **Properties** menu item.
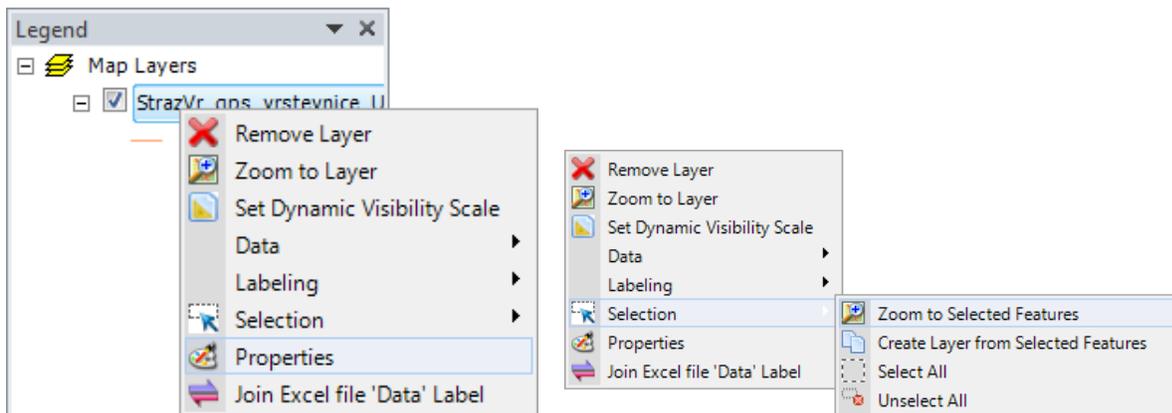
If you want to display labels for elevation lines, click on the **Labeling – Label Setup** item in the context menu. You will see a dialog where you can set labels for the map layer. You can also enter values stored in the ShapeFile Attribute Table as labels.
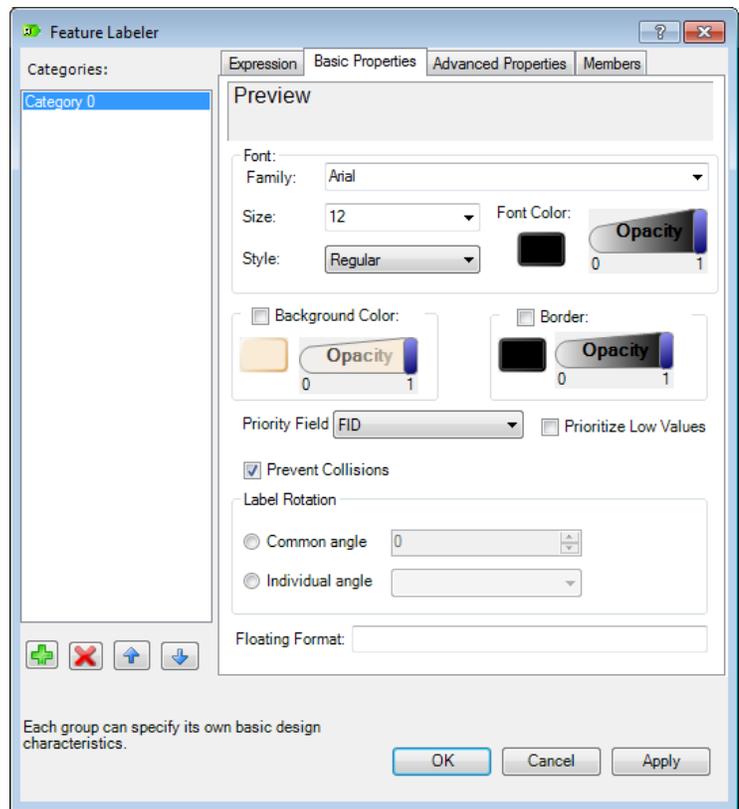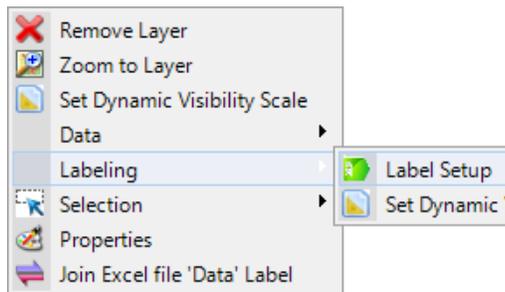
You can also set a number of parameters for your labels; such as font, size, transparency, rotation and other things you want to use. An example of displayed labels is shown in the following image.
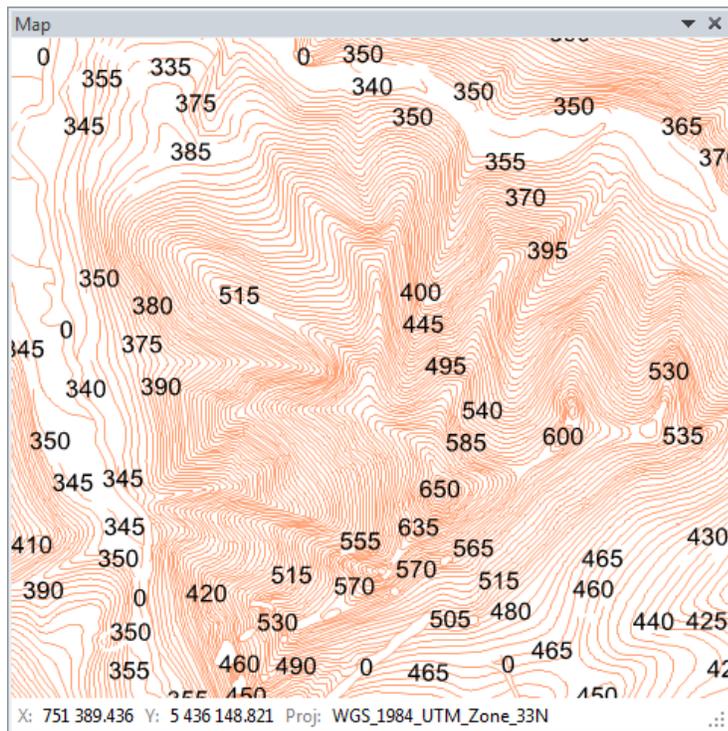
In addition to labels, you can also set visual characteristics of each feature (line) in the map layer according to the attribute table data. When you click on the **Properties** item, a dialog appears where you can set-up multiple features, such as symbols.
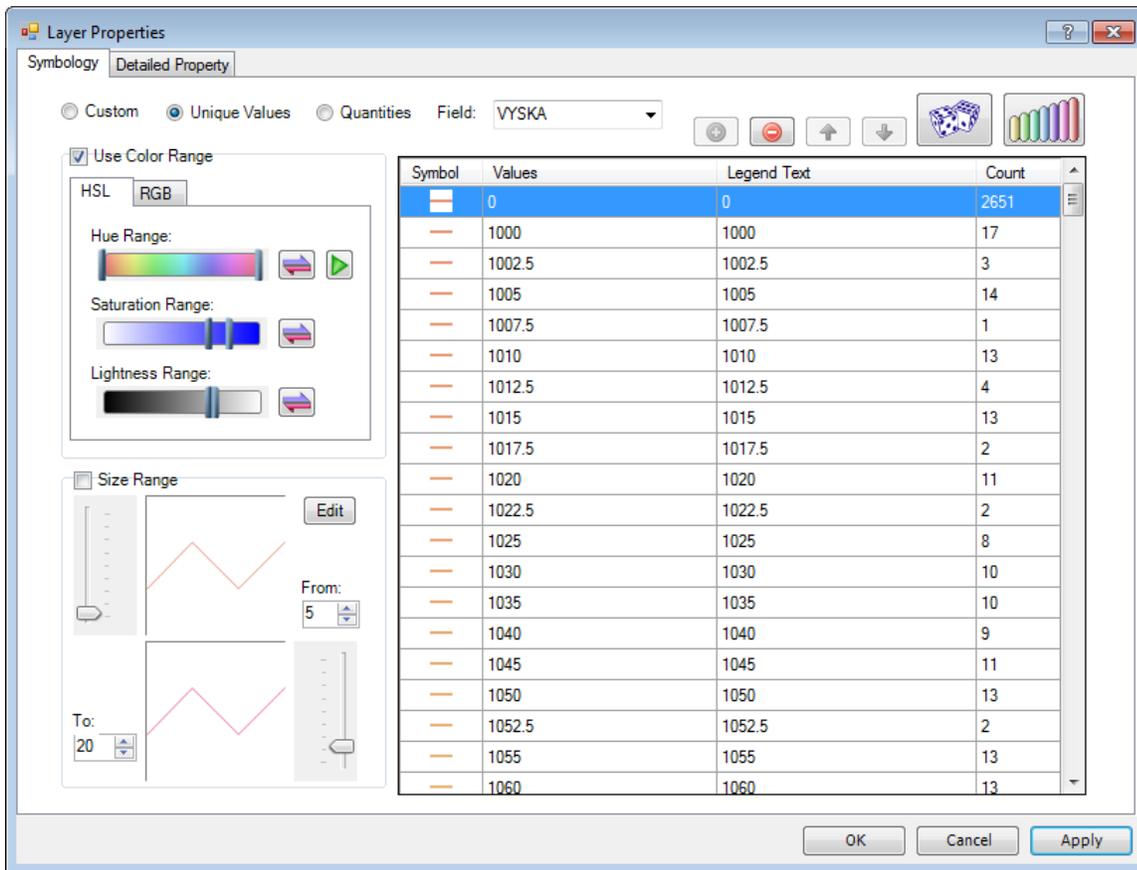
In the example below, we set line colors related to the "VYSKA" column in the attribute table (vyska = altitude in English). The map is much easier to read when you use this set-up, and you can set multiple parameters of map layers until your requirements are completed.
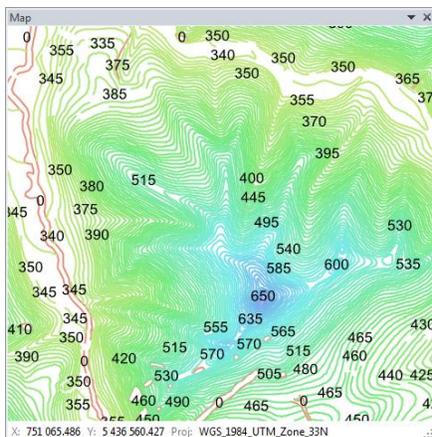
Other GIS functions can be found by right-clicking on the **Map Layers** root item in the Legend. A context menu displays the following additional features.
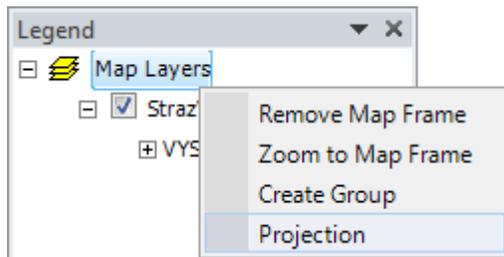
These features let you zoom the map to the maximum extent; or you can create groups of map layers. One of the most important feature is the last item – **Projection**. Click on this and you can either display information about the map projection you have used, or you can change it. This feature is particularly important if you want to use the function for data export into Google Earth. You need to use projection WGS84 for this function, and this is explained in detail in Chapter **11 – Special Features**.
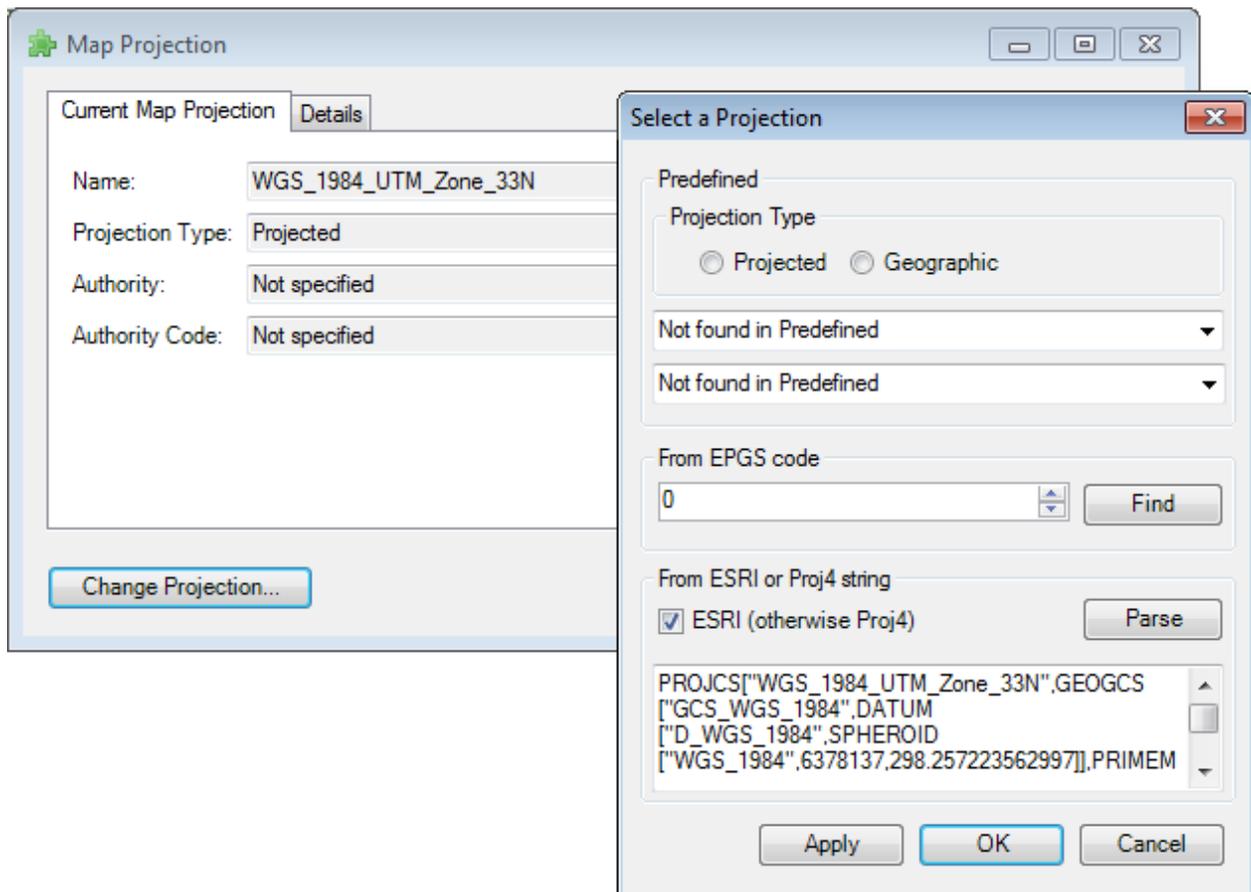
The last group of functions is contained in the Map panel context menu. You right-click on the map, and a group of functions is displayed in the menu.
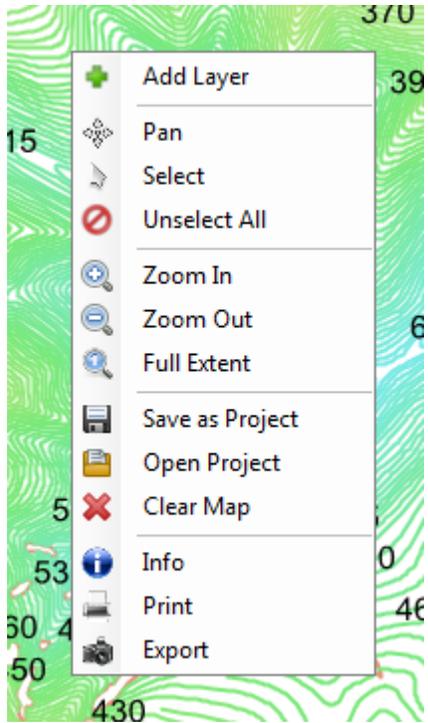
The **Add Layer** function lets you add new layers to the map from your computer disk. The **Pan** function allows you to scroll the map with your mouse. The **Select** option gives you the opportunity to select individual features from the map layer and **Zoom** and **Full Extent** functions scale the map. The **Open Project** and **Save as Project** options open and store information about current maps layer setups and properties. If you often open the same map layers with the same visual characteristics, you can save these proerpties together and automatically open them in bulk. This simplifies and speeds up your work. The **Clear Map** function removes all layers from both the Map and the Legend panel.

The last three features are the most interesting; the **Info** function activates your options to idenfity each feature on the map. Click on the map and an auxiliary dialog appears with all the data in the attribute table for the features you clicked.
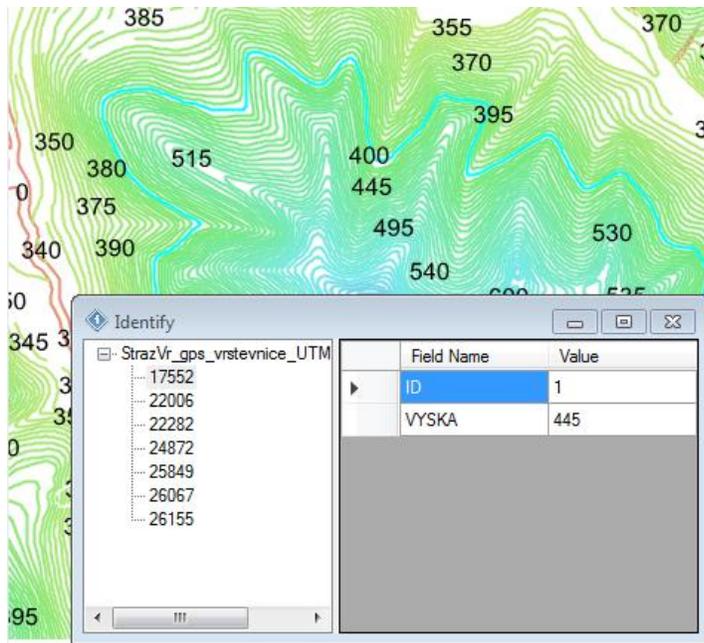
The penultimate function **Print** lets you print your map results easily in map sheet form. Your map will be inserted in the Map panel of your printed map. You can then add things on the paper. For example, you can insert the things you need including the legend, a north arrow, the scale and labels and custom images (logos) from your disk. Finally, you export your finished map as an image file.
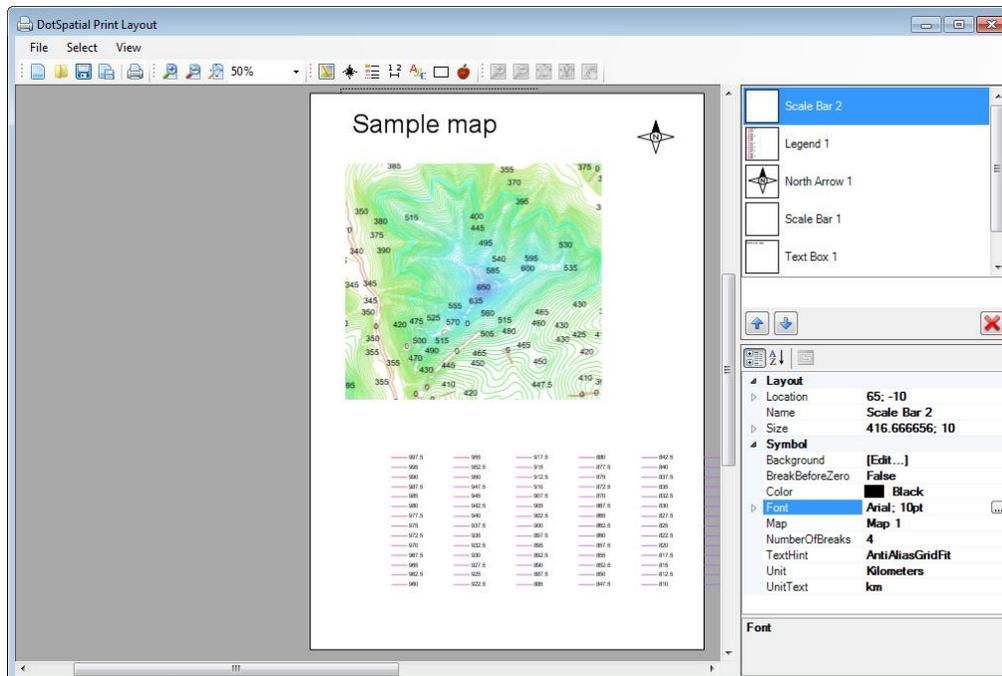
However, if you don't want to print, and only want to export your map from the Map panel, click on **Export –** the last item in the context menu. This saves your Map panel content in an image file.

9 Excel to GIS

Functions in the **Excel to GIS** group transfer data between Excel spreadsheets and the GIS interface. In the current version, add-in has two functions in this group. The first is **Create New Layer**, which creates a new map layer from your Excel table; and the second, **Update Layer,** lets you update the attribute table in your selected existing map layer using data from an Excel table.
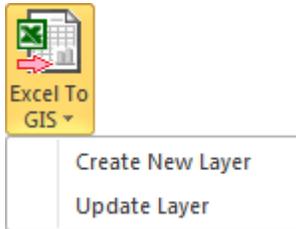
9.1 Data Selection

Data selection in your spreadsheet is essential when you are working with GIS.XL add-in. If you want to export Excel data into maps or update an existing map layer, you must know basic technical characteristics about **data selection**. If you want to select the entire table, just press **Ctrl+A**., but the first row must always contain descriptions (names) of the selected columns. If the first row has numeric values, the program understands them as labels. If the first selected row is empty, the program uses Excel column descriptors as labels (A, B, C)
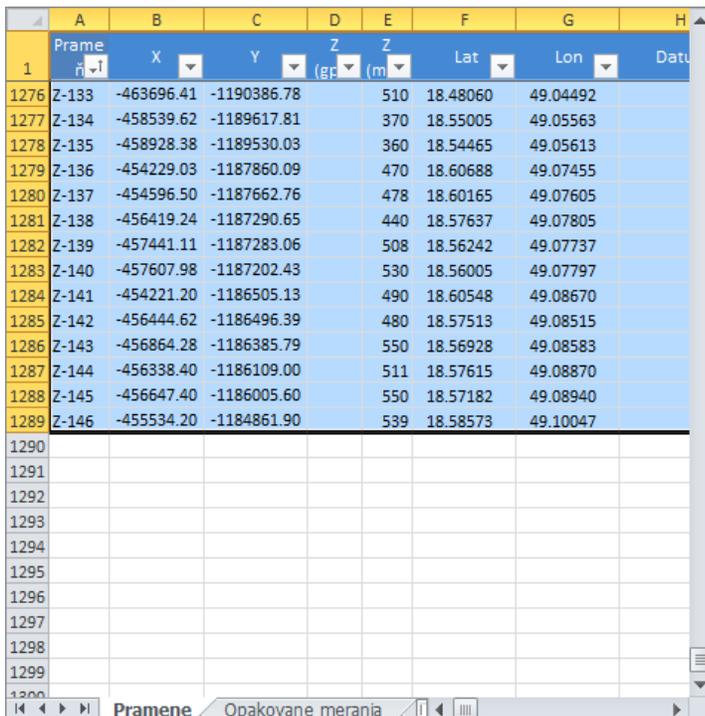
	Prameň	X	Y	Z (gp)	Z (m)	Lat	Lon	Datu
1276	Z-133	-463696.41	-1190386.78		510	18.48060	49.04492	
1277	Z-134	-458539.62	-1189617.81		370	18.55005	49.05563	
1278	Z-135	-458928.38	-1189530.03		360	18.54465	49.05613	
1279	Z-136	-454229.03	-1187860.09		470	18.60688	49.07455	
1280	Z-137	-454596.50	-1187662.76		478	18.60165	49.07605	
1281	Z-138	-456419.24	-1187290.65		440	18.57637	49.07805	
1282	Z-139	-457441.11	-1187283.06		508	18.56242	49.07737	
1283	Z-140	-457607.98	-1187202.43		530	18.56005	49.07797	
1284	Z-141	-454221.20	-1186505.13		490	18.60548	49.08670	
1285	Z-142	-456444.62	-1186496.39		480	18.57513	49.08515	
1286	Z-143	-456864.28	-1186385.79		550	18.56928	49.08583	
1287	Z-144	-456338.40	-1186109.00		511	18.57615	49.08870	
1288	Z-145	-456647.40	-1186005.60		550	18.57182	49.08940	
1289	Z-146	-455534.20	-1184861.90		539	18.58573	49.10047	
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You can have dynamic Excel formulas, such as *"=A2+B2/C2"* in your selection, as well as numbers and strings. Another add-in characteristic is the possibility to work with **filtered data**. If you only want to display selected lines in your map, you can use the Excel **Filters** built-in feature. If you want to work with filtered selection in your table, you can also use this command, because add-in supports this feature. You can still continue to use individual functions for selected data in your spreadsheet; and the first function described here is creating a new map layer.

9.2 Create new layer

You can create a new map layer from selected data in your spreadsheet. Just click the **Excel to GIS –Create New Layer** button in the ribbon toolbar. This displays the following dialog.
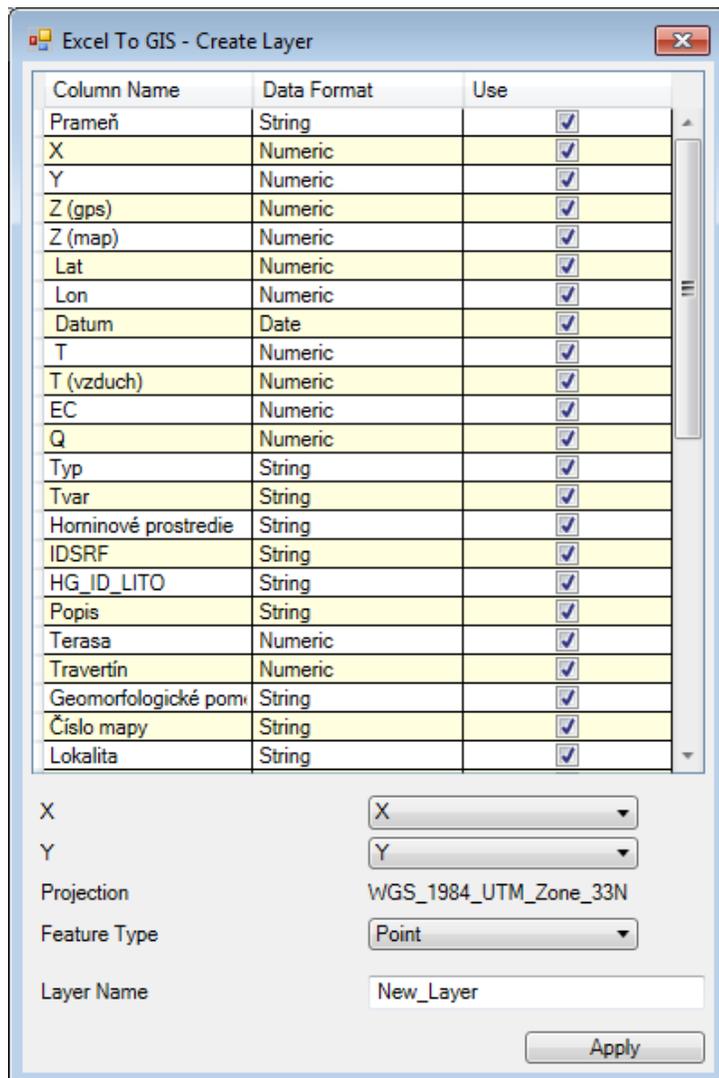
This dialog has two main parts. The upper part is a definition table describing the selected data. The first column displays the column names in the selection, and the second defines the data format in the individual columns. At this point, you can immediately see whether your data is correctly formatted.

For example, if you have string values instead of numeric values in columns that include coordinates, you see this fact directly. The map attribute layer is also created from the selection, and the last column of the table defines whether the selection column is to be inserted in the resultant ShapeFile attribute table.

The lower part of the dialog enables you to define the character of your new map layer. Although the basic settings for all types of features are identical, this dialog area changes depending on what type of feature you want to create.

First, you set-up columns that contain numerical values of your X and Y coordinate in the first two combo boxes. The coordinate system you used in your new ShapeFile is displayed in the next column. The coordinate system will always be the same as you defined in your map panel; but this row only has control purpose and it is not possible to change the coordinate system. You can change the coordinate system by using the Legend panel context menu features.

You then select the type of map features you want to create from the next combo box. This version of add-in gives you the choice of 8 types of features you can create from Excel data. However, the next settings in the dialog change when you change the feature type. Finally, you define the new map layer name in the last line.

When you have defined all parameters, you click **Apply** and the program automatically creates your new map layer from Excel data; exactly according to your chosen settings.

The following subchapters describe the options and settings for generating individual types of map layers.

9.2.1 Create point layer

The basic type of map layer you can create is composed of points. To use points, you choose the **Point** option in the **Feature Type** combo box. If you choose **Point,** you cannot define any other parameter, and a single line in the selected table defines one point in the map layer.
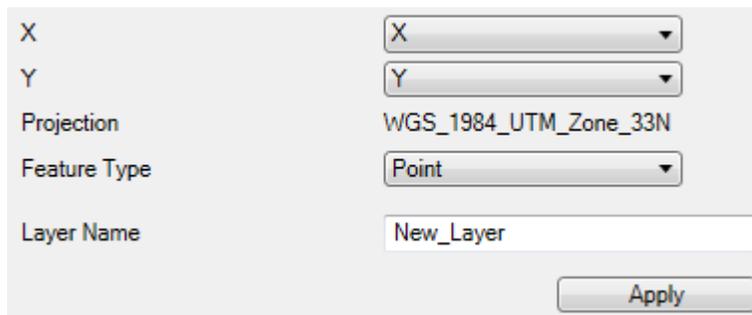
X	X ▾
Y	Y ▾
Projection	WGS_1984_UTM_Zone_33N
Feature Type	Point ▾
Layer Name	New_Layer
	Apply

If you want to create a new layer in add-in, you must remember one thing. Columns that contain X and Y coordinate values must not have any empty cells. If you have rows without coordinates in your table, hide them using **Filter** or remove them. An example of a new created point layer is shown in the following figure.

This new map layer is formed by simple points. You can change their visual character by substituting values stored in your Map Layer attribute table.

9.2.2 Create line layer

The next simple feature you can create with add-in is lines. As in the previous case, your coordinates are defined in the X and Y combo boxes.

When you choose the **Line** option in the **Feature Type** combo box, the **Grouping Column** parameter is displayed. If you leave this combo box empty, a one-line map layer will be created from the table. If you want to create multiple lines in a single layer, you must have a column in the table that separates each line. This column will contain your defined values. When the value in this column is changed, it begins to create a new line, and the points in the current line are inserted in the new line unless the value in the column changes. Attribute table values are always created for the first record for a given line in the table. An example of table structure with two lines to be given values is as follows.

X Coordinate	Y Coordinate	Grouping Column	Attribute data_1	Attribute data_2
23.7	12.3	Line_1	value	value
23.4	15.4	Line_1		
25.6	11.2	Line_1		
43.3	5.6	Line_2	value	value
54.2	5.9	Line_2		
55.8	12.4	Line_2		
94.5	22.5	Line_2		

The two lines, Line 1 and Line 2 in the **Grouping Column,** in the above table have defined coordinates. Coordinates are stored in the first two columns and the breakdown of each line is defined in the third column. Finally, the last two columns have data used for generating the attribute table layer. A generated line layer example is in the next figure.
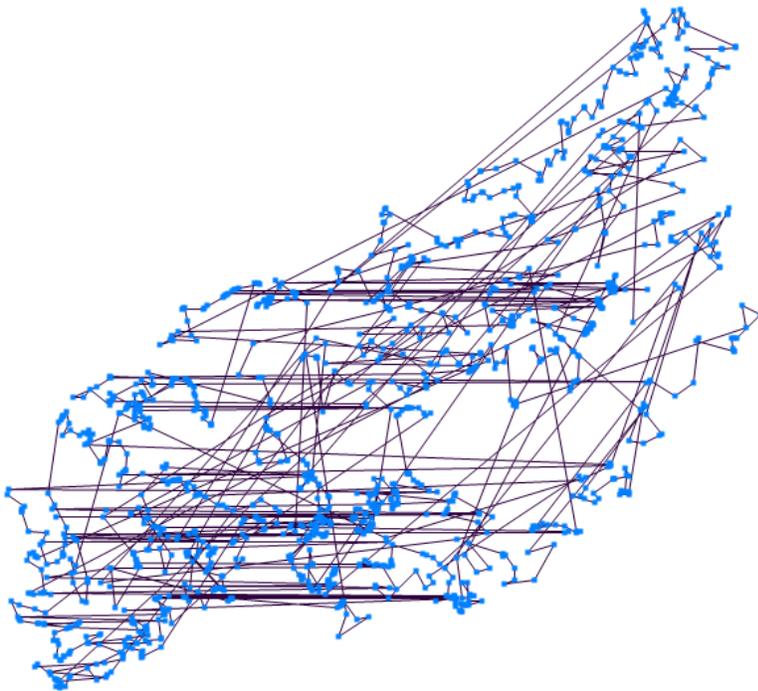
9.2.3 Create polygon layer

Another type of vector map you can create is a polygon layer. Its definition is the same as for the line layer.

Polygon vertex coordinates are defined by the first two combo boxes. You can create multiple polygons from the table using the **Grouping Column** parameter;-exactly the same way you did for lines. Again, if you leave this combo box empty, only one polygon will be created from selected data.The created polygon layer example is shown in the next figure.

Polygon attribute data is created from the first line of your selected Excel spreadsheet; the same as for lines

9.2.4 Create convex hull layer

Another feature you can create is a convex hull polygon layer. This encloses all coordinates from your Excel spreadsheet in a single polygon. No additional option or parameter setup is required for this map feature.

X	X ▾
Y	Y ▾
Projection	WGS84
Feature Type	Convex Hull ▾
Layer Name	New_La|
	Apply

An example of the convex hull layer is shown in the next figure.
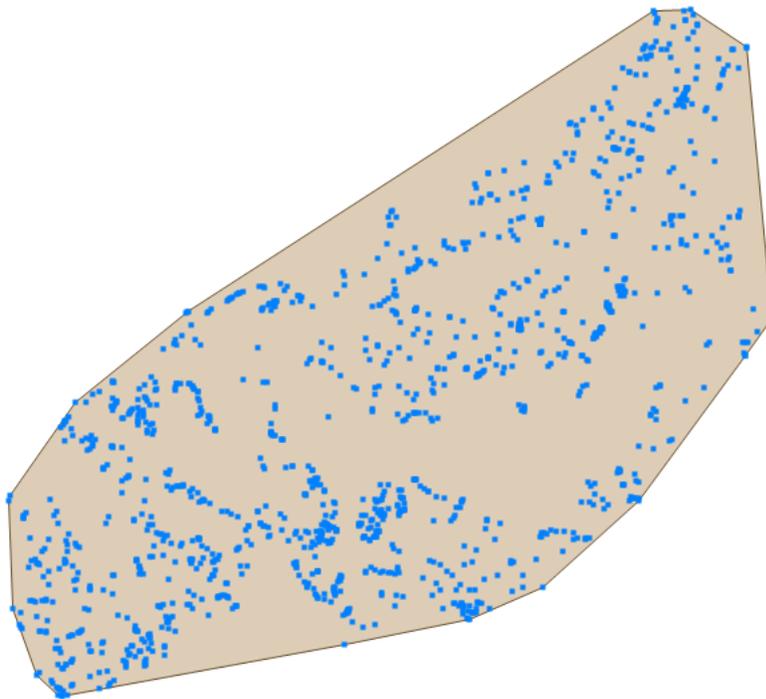
9.2.5 Create Delaunay polygon layer

Delaunay polygons can also be created from your data.

X	X ▾
Y	Y ▾
Projection	WGS84
Feature Type	Delaunay Polygon ▾
Layer Name	New_Laye
	Apply

You do not have to define any parameters when you create Delaunay polygons and the result looks like the following figure.
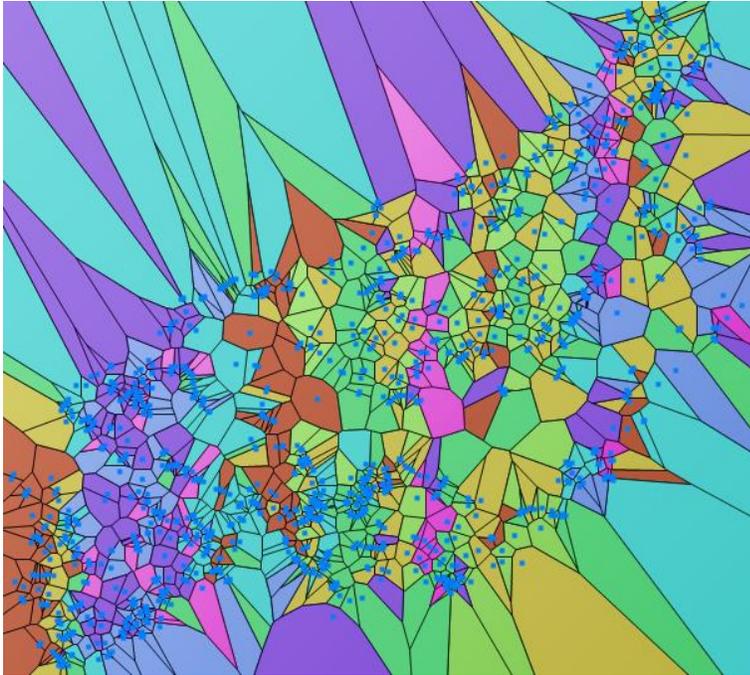
9.2.6 Create hexagon bins layer

The next polygon type you can create from Excel data is called hexagon bins. These polygons statistically summarize values in selected areas. Three configurable parameters are displayed when you select hexagon bins in the **Feature Type** combo box.

Explanation: First, you set the **Count** parameter. This defines the minimum number of poylgons in a row or column. If the coordinate range is smaller on the x-axis, this parameter will be applied to polygons rows. If the range of scale values is smaller on the y-axis, the minimum number of polygons will be used for the polygon columns.

The following figure gives an example of created heagonal polygons. It displays the number of points in the Excel spreadsheet which fall under the individual polygons. You also set a value for individual hexagon polygons. Here, you can use the **Count** of points, or you can use a selected statistical function you can apply to a selected column from your Excel table (For Example; Average value).

- Y: - Proj: WGS84
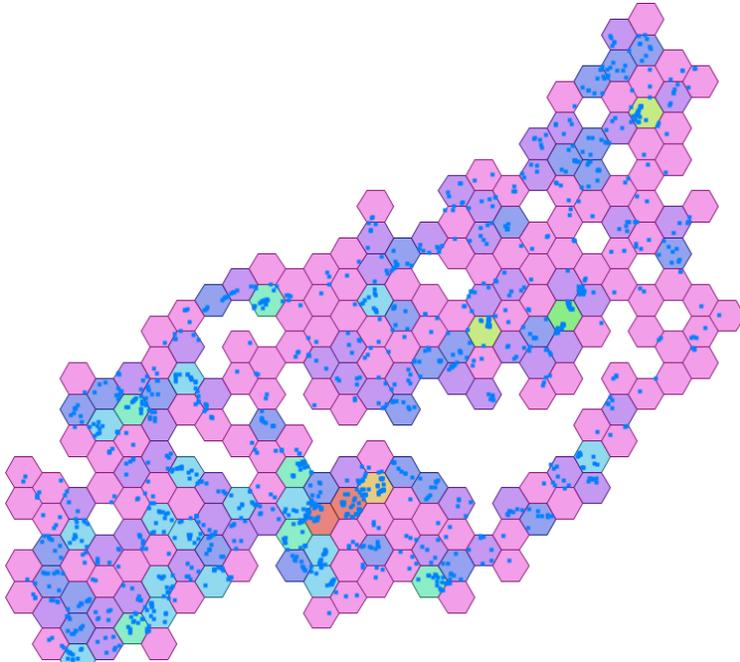
9.2.7 Create tiles layer

The penultimate map features you can create from Excel data are **Tiles** – rectangular polygons. Their character is similar to the previous hexagonal polygons; the only difference is their geometry. Tiles are actually simple squares, similar to rasters, and the only difference is that they are defined in vector form. You will see additional adjustable parameters when you select **Tiles** in the **Feature Type** combo box.

Explanation: The first two adjustable parameters define the number of generated Tiles. You set whether you want to generate tiles based on their minimum **number** (count) or **size** with the **Cells Definition** radio button. Then you enter the desired value in the **Value** text box.

You set the Excel table column from which the values will be processed similar to the hexagons, and you define the statistical function you want to use. Generating Tiles has more feature options than the previous feature types. Here, you can set if you want tiles created in areas where there are no points by using the **Allow Empty** check box. The Tile map layer example below did not allow empty tiles.
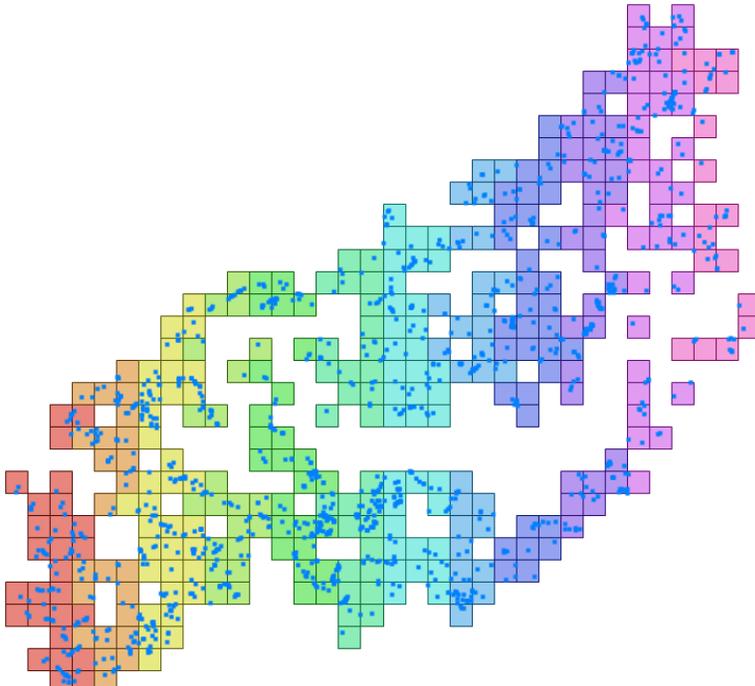
9.2.8 Create buffer polygon layer

The last feature type you can create with add-in are **buffer polygons**. If you choose this type, it is necessary to set the **distance** at which are polygons created. The values used for this distance are the same as you use for tiles; and are always defined in the same units as your coordinates. Therefore when you use the metric coordinate system, your values are in meters and when you use the WGS84 coordinate system your values are in degrees.

When you have defined your buffer **distance,** click **Apply**, and add-in will generate a new map layer as in the following figure. The buffer is generated for each individual record (point) from your Excel spreadsheet.

9.3 Update existing GIS layer

The second function from the **Excel to GIS** group will **update** the **attribute table** of your existing Map Layer – ShapeFile. The following example explains the feature functionality. I loaded a polygon layer of districts into the map panel, and I have a list of springs with their parameters, such as spring yield and temperature in the Excel table. This feature's functionality is explained by the following diagram and the text below it
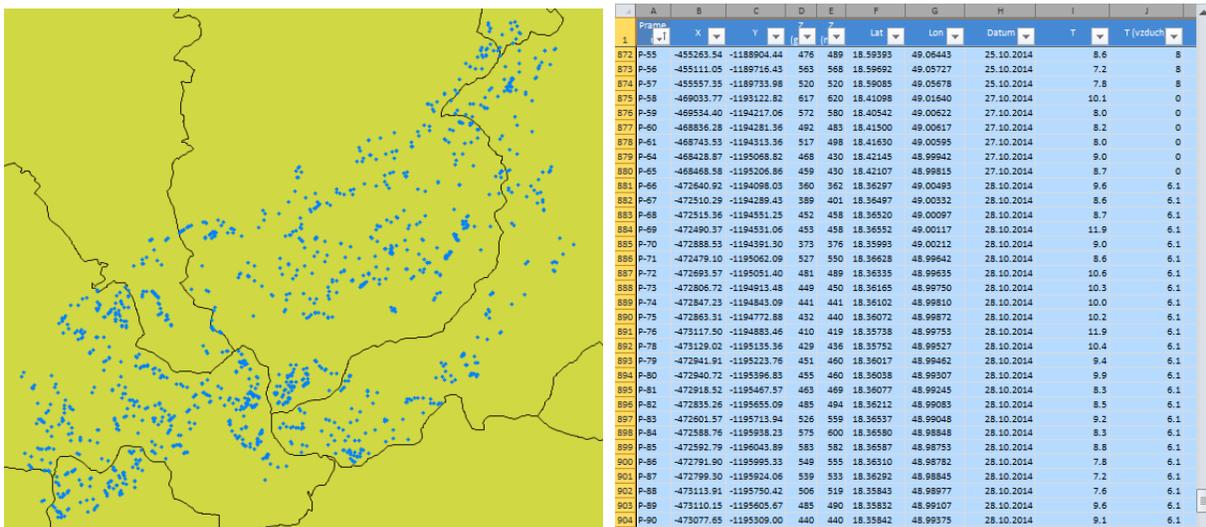
First you select the data in the Excel table you want to use in the Map Layer update. As in the previous examples, you can use Excel features such as **Filters.** After your Excel data selection, click on the ribbon button **Excel to GIS – Update Layer**; and the following dialog is displayed.
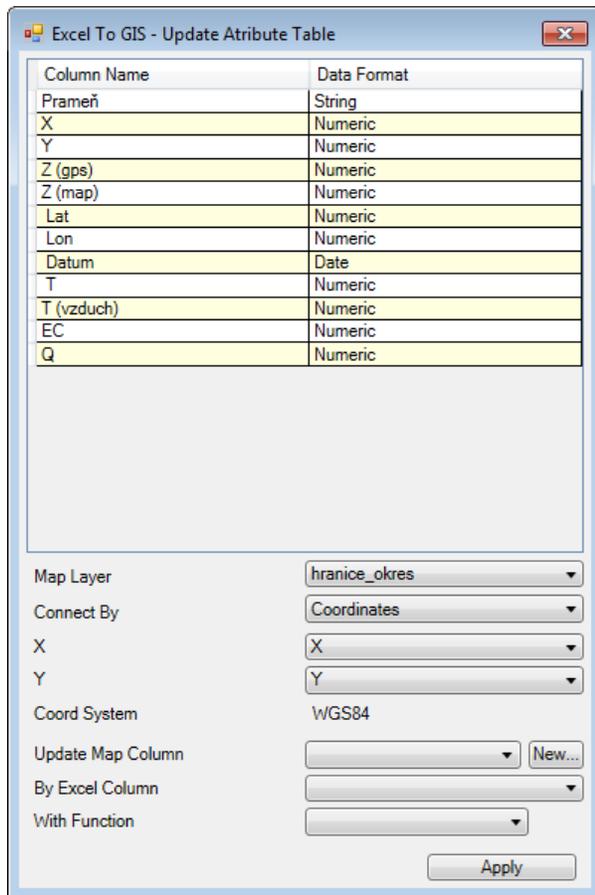
This dialog is similar to the previous one. The upper part of the window has the table characterizing selected Excel data. The nature of the function is defined in the bottom of the dialog. Select the map layer you want to update in the first **Map Layer** combo box
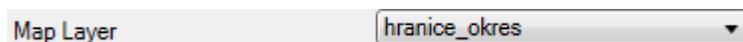
Then you must define the **connection** between the Excel table and the Map Layer. There are three connection methods. The first is to connect via **Coordinates**. If you choose this option, the map layer will be updated on the basis of spatial connections. The individual records from your Excel table updates the map layer features if the Excel table record intersects the map feature. If this happens, the row from the table will be used further in the algorithm.
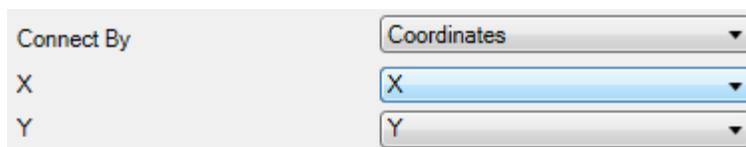
The second **connection** is **through** the **values in** the Excel **table** and values in the attribute table of the Map Layer. If the values from the selected columns in the tables are the same, the row from the Excel table will be used to update the feature in the Map Layer.

The last connection is called **ROW ID**. This is a specific link that has great importance during manual editing of the Map Layer attribute table. This connection assumes that a column exists in the Excel table that identifies the individual features in the Map Layer. This identifier is defined as an integer number that indicates the order of features in the Map Layer, and it begins by numbering the first feature 0 (zero). This connection can be used, for example, if you want to directly edit the whole Map Layer attribute table in the Excel spreadsheet. Here, you firstly export the whole attribute table to Excel through the **GIS to Excel – Eport Layer** function. You can easily export the Map Layer attribute table into the Excel spreadsheet, use powerful Excel features such as dynamic formulas or filters and then paste the calculated result back into the map layer attribute table. Exporting is explained in detail in chapter **10 GIS to Excel**

When you define the connection, you can continue with function setup. If the selected connection is defined through spatial coordinates, you will also see information about the coordinate system used. You then define a column in the Map Layer attribute table you want to update. In addition to the existing column, you can also create a new column here that will be added to the table.

Then press the **New** button and the small dialog **Create New Column** appears where you define your new column. Its definition is based on data type and name. Click **Apply** and the new column will be added to your attribute table and you can use it for Map Layer updating.
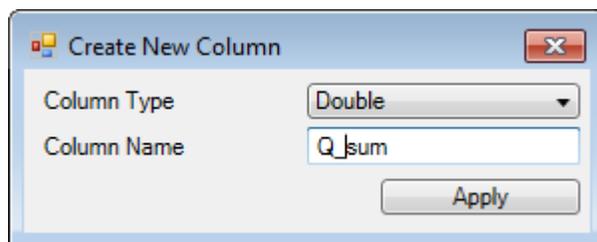
My example above created a new column for numerical values labeled "Q_sum". When you select your column for update, you must then select the column from the Excel table that will update the

attribute table. The above example used a column containing values for spring yields. Since one row in the attribute table can be linked with multiple rows in the Excel table, you have to determine the statistical function you want to use to pre-process the result for update. If the tables are linked 1:1, choose the **First** or **Last** item from the statistical functions. You can use also use these items if you want to update columns with string data type.
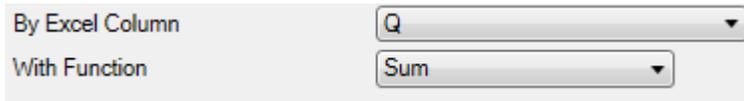
The following figure shows the entire dialog with all function parameters. Here, I am going to update a polygon map layer connected to my Excel table through coordinates. I update the newly created column Q_sum, where I want to insert the yields sum of all springs that intersect my polygons.
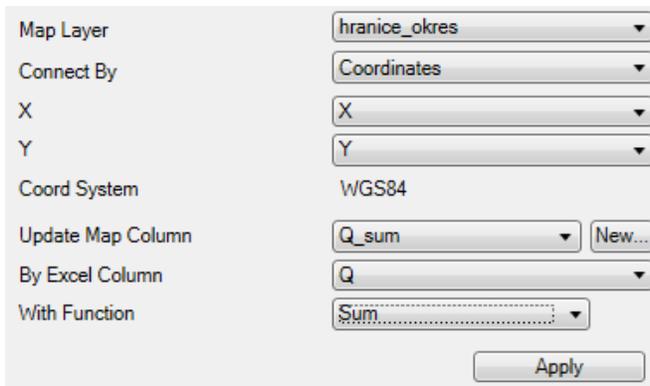
When you have set all parameters, click **Apply** and add-in automatically updates the Map Layer attribute table. This process can take longer, depending on the number of records in your Excel table and the number of features in the Map Layer. You are then advised that the update is completed in the next message box.
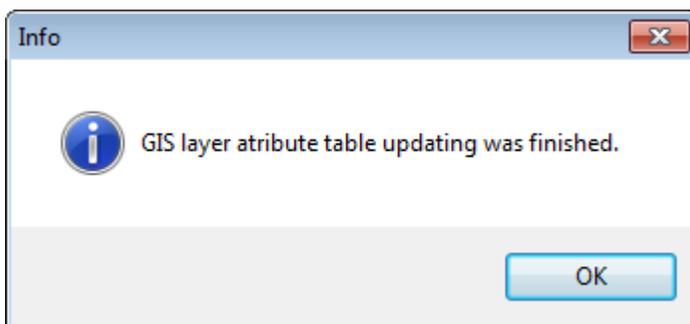
When the map layer updating is finished, you can use standard GIS interface features to visualize the results.
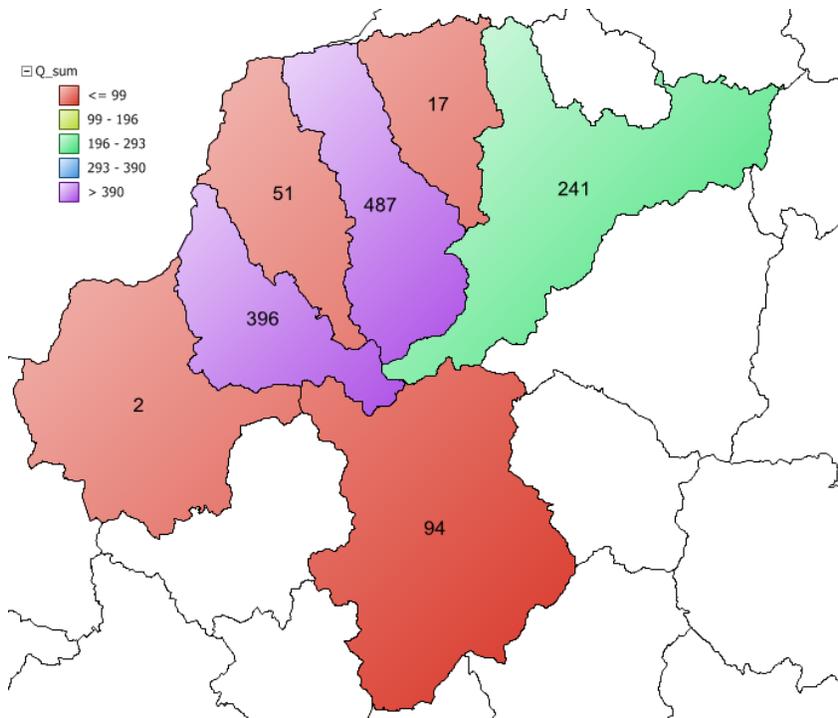
WARNING

*Changes you make in individual map layers are not automatically saved on computer disk. If you want to save, select the map layer in the Legend panel and then click the **Save Layer** button inthe ribbon toolbar. This refers to both Excel and GIS functions.*

10 GIS to Excel

The GIS to Excel functions have the reverse purpose to the previous **Excel to GIS** work. They allow you to create or update your Excel table with Map Layer data. This has two functions – exporting map data to your new Excel table, and updating your existing Excel table using the spatial data on your map.
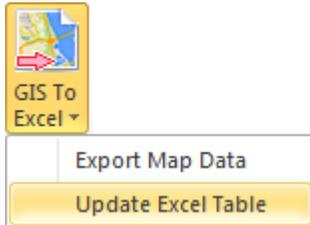
10.1 Export map data

This **Export Map Data** function exports your data from the selected map layer onto an Excel spreadsheet. My following extended example of how this funtion works begins with the illustation of digitalized water areas in Slovakia shown below.
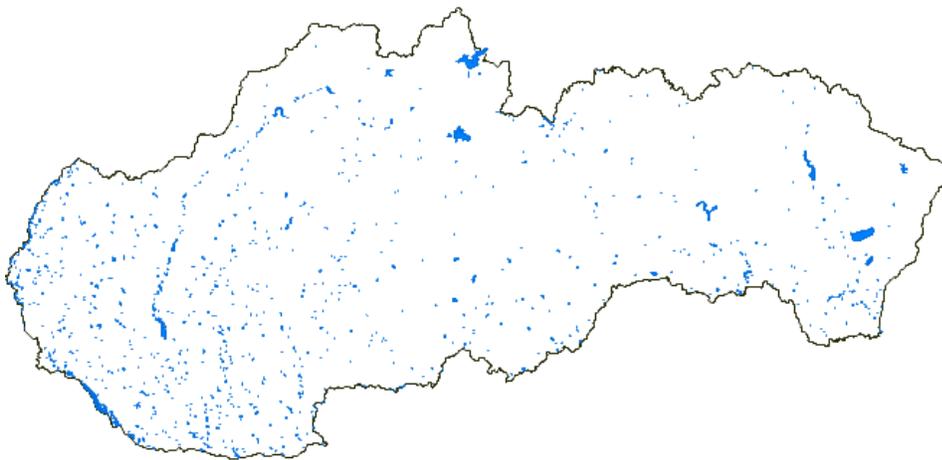
Here, I have a layer with 1,717 digitized surfaces. When I click-up the layer attribute table, I see that it contains multiple values. [One is the lake/water area name--under NAZVPL].

Now I want to export all named lakes from the described map layer, so I select them by clicking on the **Selection – Query** item in the menu. This displays the **Expression Editor** dialog where I can select the named lakes using the **SQL** dialog command (**S**election-**Q**uery **L**ine command [NAZVPL] gives me the lake names.

I click the **OK** button, and all features with a name are selected. Then I close the attribute table window.
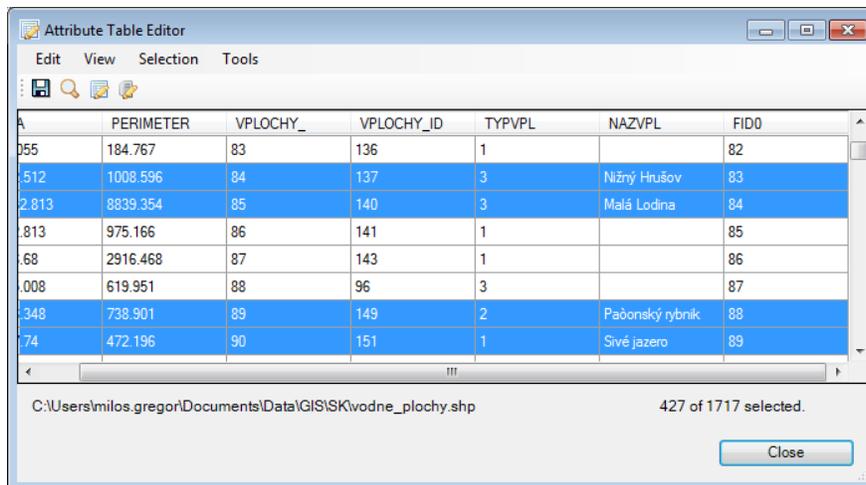
When I want to export only selected features, I create a new map layer using the **Selection – Create Layer from Selected Features** command in the Legend panel context menu
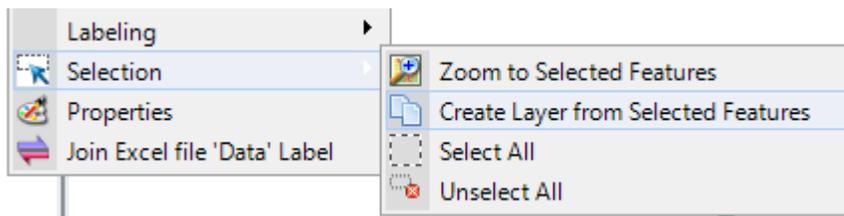
The new layer is created in both the Map and Legend panels, and it now contains only the named lakes. If I want to export these features to Excel, I click on the **GIS to Excel – Export Map Data** ribbon toolbar item to display the dialog in the following figure.
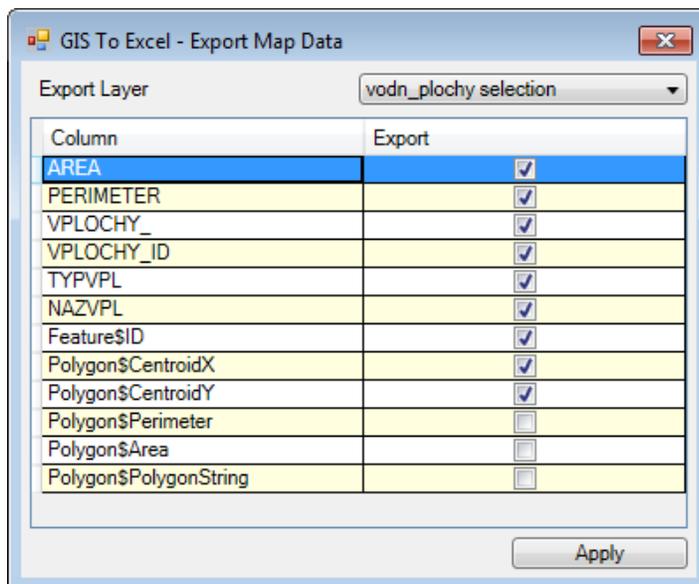
Now, you can choose the Layer you want to export in the **Export Layer** top combo box. After selecting the Map Layer, it automatically fills the bottom table. This table contains the values you can

export to the Excel table. The first data in the table shows the layer attribute table columns, and then you have the derived values that can be exported.

The **Feature$ID** indicates the first derived parameter for the vector Map Layer This feature identifier is in the format of an integer number, and it is unique for each feature in the Map Layer. For example, it can be used for connection, if you want to quickly import edited values back from the Excel table to your Map Layer attribute table (See chapter **9.3 Update Existing GIS Layer**). You can also link this value in the connection method named **RowID**.

The following exportable values vary depending on whether you choose to export layers of points, lines or polygons. If you choose points, you can export only the X and Y coordinates of each point, but for lines, you can also export the value of the selected line; and if you choose polygon layers, you can export the coordinates of the centroid feature, the polygon perimeter and also the area values.

Checking the box in the second column of the table defines the given values you want to add to the export. When you click **Apply**, your selected values are exported to the clipboard; and the next message box tells you this process is completed.
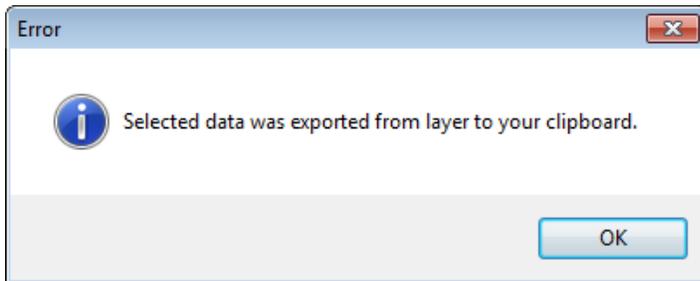
You can now insert your exported values in a spreadsheet by pressing **Ctrl+V**. After this, you can work with your values using conventional Excel features, including sorting, filtering, dynamic formulas and cell coloring.

	AREA	PERIMETER	VPLOCHY	ID	TYPVPL	NAZVPL	Feature$ID	CentroidX	CentroidY
2	23357.8	708.927	15	37	3	Úhorná	0	-304414.6906	-1238897.927
3	6344.309	308.177	17	40	1	Turzovské jazero	1	-287808.6569	-1222566.474
4	2857771	37768.984	22	49	3	Ružín	2	-277255.4187	-1222991.94
5	989487.7	8902.508	25	52	3	Bukovec	3	-273465.8358	-1239129.467
6	166170.3	1960.237	31	61	3	Pod Bukovcom	4	-270317.2546	-1241429.37
7	70378.59	1209.772	33	65	3	Seèovce	5	-235942.9382	-1242810.393
8	10340.58	404.516	34	66	3	Vyšná Kamenica	6	-245603.5136	-1232917.305
9	9462.073	406.509	38	72	3	Bidovce	7	-250502.9504	-1238582.769
10	13328.18	459.147	39	74	3	O¾šany	8	-254454.1206	-1237940.339
11	50175.91	1101.055	44	85	3	Kokošovce	9	-254599.0408	-1214458.848
12	39007.89	986.934	62	105	3	Rakovec	10	-223294.8275	-1236241.113
13	36242.51	1008.596	84	137	3	Nižný Hrušov	11	-223792.3992	-1231973.6
14	617532.8	8839.354	85	140	3	Malá Lodina	12	-273311.2654	-1222402.592
15	20356.35	738.901	89	149	2	Paòonský rybnik	13	-277878.0152	-1246499.558
16	10527.74	472.196	90	151	1	Sivé jazero	14	-278636.2862	-1247513.958
17	61707.22	1072.616	92	157	3	Lánec	15	-275065.1244	-1260960.537
18	46555.04	997.478	97	168	3	Po¾ov	16	-266967.0801	-1244778.727
19	975015.4	5909.442	103	177	1	Èanianské jazerá	17	-257649.0353	-1250933.6
20	399245.9	4924.128	106	181	1	Èanianské jazerá	18	-259866.5614	-1252706.361
21	35283.19	1106.626	108	184	3	Seòa	19	-262427.3836	-1256756.825
22	9210.709	370.764	111	188	3	Trstené	20	-257252.6637	-1257063.439
23	4067.627	239.748	113	192	1	Malá Izra	21	-247136.8634	-1256731.07
24	41643.31	795.983	114	193	1	Izra	22	-246215.2597	-1257069.388

If you want, you can also import your values back to the Map Layer after editting, using the **Excel to GIS – Update Layer** command.

10.2 Update Excel table

The second function from the **GIS to Excel** group enables you to enrich your existing Excel tables with new data from the Map Layer. An example is shown in the following Excel table. The table has a list of springs with their coordinates; you want to determine the geological unit for all the listed springs and you have stored all the information on the geological units in the evaluated area in your polygon Map Layer.

	Spring	X	Y	Geology ID
2	A-001	-477496.41	-1198314.24	
3	A-002	-476902.66	-1198733.27	
4	A-003	-477007.27	-1198824.78	
5	A-004	-477005.02	-1198884.47	
6	A-005	-476982.68	-1198895.75	
7	A-006	-476764.52	-1199582.10	
8	A-007	-476145.06	-1199644.23	
9	A-008	-476380.09	-1200044.59	
10	A-009	-476132.19	-1200714.92	
11	A-010	-475775.58	-1200613.17	
12	A-011	-475615.94	-1200464.95	
13	A-012	-475563.06	-1200391.32	
14	A-013	-475590.21	-1200292.37	
15	A-014	-475514.45	-1200021.62	
16	A-015	-475467.79	-1199430.42	
17	A-016	-475886.67	-1198682.38	
18	A-017	-476109.90	-1198283.89	
19	A-018	-475743.20	-1195850.52	
20	A-019	-475635.63	-1195751.90	
21	A-020	-475597.15	-1195630.51	
22	A-021	-475592.14	-1195586.30	
23	A-022	-475535.36	-1195594.81	
24	A-023	-475461.60	-1195476.55	
25	A-024	-475366.24	-1195865.90	
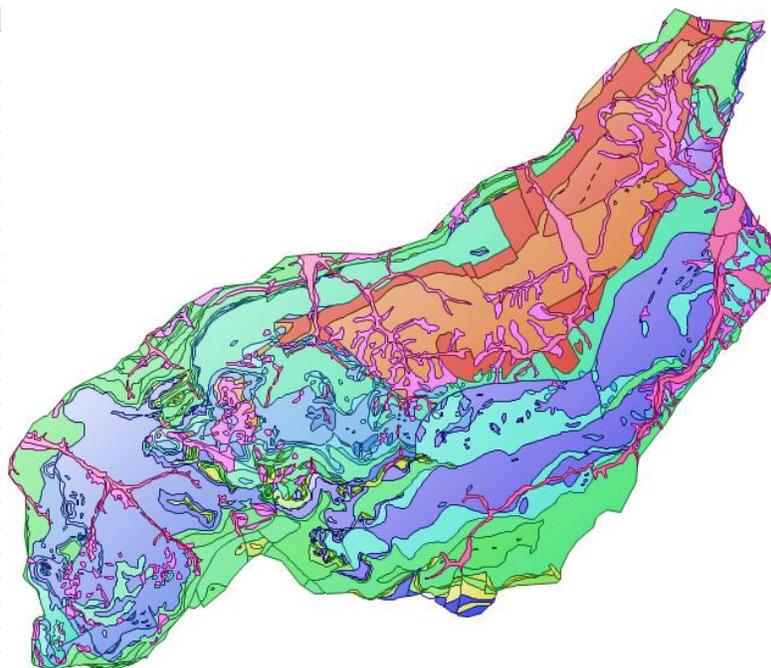
As in previous cases, first you select a table in the Excel spreadsheet with a column where you want to insert your geological information. Then you click on the **GIS to Excel – Update Table** ribbon button, and this displays the dialog. Its character is the same as in the previous cases. The top of the window has the names of the selected columns from the Excel spreadsheet and their data format; and you define all the parameters for function in the bottom of the window.

In the first combo box you choose the Map Layer with all your data. Then, you set the type of connection between the Excel table and Map layer, and their parameters. [Chapter **9.3--Update Existing GIS Layer** tells you all about connection options]. In my example, I connect through the spatial coordinates of the spring positions. Now, I define the Excel table column where I want to insert data. In this case, I can insert data from the map layer attribute table or from the spatial data. For example, I could insert the geological unit ID from the attribute table, or the polygon area, the line length or whatever I want. Finally, I define the function for data processing; if I define 1:1 link between the Excel table and map layer, it is sufficient to use function **First**. If I define link 1:N, select the most appropriate function for your work (**Sum**, **Average**, **Maximum**).
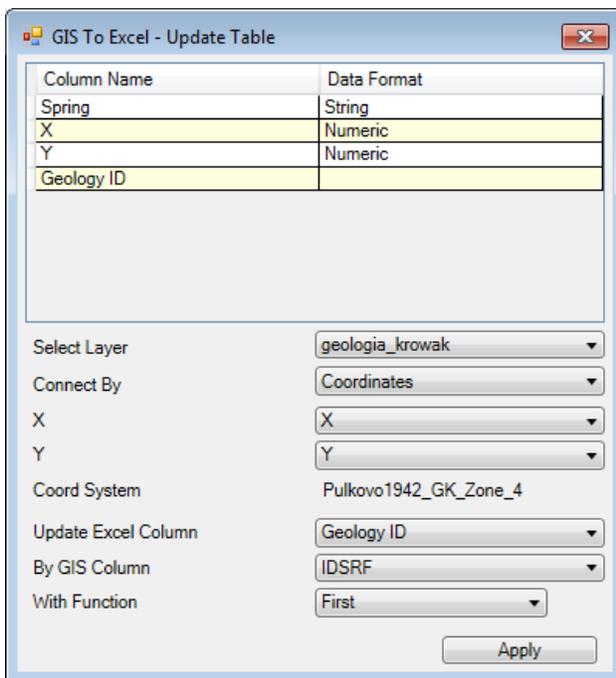
When you define all settings, click **Apply**; and add-in connects the data and updates the Excel table with your information. In my example, I inserted the geological units where each spring was located in the **Geology ID** column

	A	B	C	D	
1	Spring	X	Y	Geology ID	
1273	Z-130	-459873.11	-1190848.70	f154	
1274	Z-131	-458558.52	-1190784.01	q7	
1275	Z-132	-463949.01	-1190435.95	mk53	
1276	Z-133	-463696.41	-1190386.78	mk53	
1277	Z-134	-458539.62	-1189617.81	q7	
1278	Z-135	-458928.38	-1189530.03	q7	
1279	Z-136	-454229.03	-1187860.09	pg4b	
1280	Z-137	-454596.50	-1187662.76	q24	
1281	Z-138	-456419.24	-1187290.65	f150	
1282	Z-139	-457441.11	-1187283.06	q24	
1283	Z-140	-457607.98	-1187202.43	f150	
1284	Z-141	-454221.20	-1186505.13	q7	
1285	Z-142	-456444.62	-1186496.39	q24	
1286	Z-143	-456864.28	-1186385.79	f150	
1287	Z-144	-456338.40	-1186109.00	q24	
1288	Z-145	-456647.40	-1186005.60	f150	
1289	Z-146	-455534.20	-1184861.90	f154	

You can understand the **Update Excel Table** function by this example. Here, you have a table with a list of country districts and a map layer of polygons that spatiallybind the districts. Now you can update the **Area** column in your Excel table with area values for individual districts, as follows;.

	A	B	C
1	ID	Disctrict	Area
2	1	Námestovo	
3	2	Tvrdošín	
4	3	Bytèa	
5	4	Èadca	
6	5	Považská Bystrica	
8	7	Žilina	
9	8	Svidník	
10	9	Kysucké Nové Mesto	
11	10	Púchov	
12	11	Poprad	
13	12	Kežmarok	
14	13	Dolný Kubín	
15	14	Sabinov	
16	15	Martin	
17	16	Bardejov	
18	17	Stropkov	
19	18	Ilava	
20	19	Medzilaborce	
21	20	Liptovský Mikuláš	
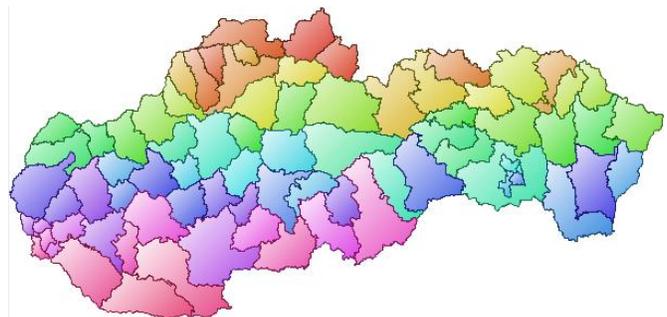
First, select Excel table columns in which you can operate. Then click on the **GIS to Excel – Update Table** ribbon button for the dialog in the next figure; below. You set the individual parameters in this window as you did in the previous example. In the first combo box, **Select** the Map **Layer** with district polygons. Your Excel table connects with the Map Layer via columns in the Excel table and the Map Layer attribute table. You specify that your data will be entered in the **Area** Excel table column. In the **By GIS Column** combo box, you select the **Polygon$Area** spatial function at the bottom of the list [Do not select a column from the map layer attribute table; because if add-in finds a line with the same district name in the Excel table as in the Map Layer attribute table, add-in automatically calculates the district area and this value will be used.]

Since this is a 1:1 connection – one unique district occurs in the Excel table and Map Layer only once; you select **"First"** in the **With Function** combo box. Then just click **Apply** and the algorithm starts. The settings program determines the necessary values and automatically inserts them in the table. As in previous cases, if you only want to update part of the Excel table, use the **Filter** Excel function to hide unnecessary rows; and only the visible rows will be updated.

|	A	B	C	D
1	ID	Disctrict	Area	
2	1	Námestovo	691 404 986.27	
3	2	Tvrdošín	479 377 782.84	
4	3	Bytèa	281 633 823.24	
5	4	Èadca	761 743 551.83	
6	5	Považská Bystrica	464 224 186.95	
8	7	Žilina	814 630 012.17	
9	8	Svidník	551 839 941.01	
10	9	Kysucké Nové Mesto	174 153 855.08	
11	10	Púchov	375 320 526.77	
12	11	Poprad	1 121 875 791.16	
13	12	Kežmarok	839 835 700.44	
14	13	Dolný Kubín	491 991 877.13	
15	14	Sabinov	482 932 494.84	
16	15	Martin	736 889 577.06	
17	16	Bardejov	935 595 422.41	
18	17	Stropkov	389 324 377.03	
19	18	Ilava	358 530 421.60	
20	19	Medzilaborce	425 791 106.78	
21	20	Liptovský Mikuláš	1 323 575 895.38	

11 Special Features

The **Special Features** function group includes 4 extra functions with special importance. The first function enables you to export selected Map Layers or the entire map to a KML file that can be opened in Google Earth. The second allows you to calculate various statistical analyses of selected map layers, and the last two features let you clip map layers and create buffer polygons from selected map layers.

11.1 Export to KML

The KML file is a specific file format for storing spatial data, and it can be opend in many programs. The most commonly is used in Google Earth. Add-in allows you to export your spatial data from Excel directly to Google Earth using the KML file.

You can also export data from ESRI Shapefiles or images to a KML by fulfilling two conditions. The first is, you must set the coordinate system in the Map panel to WGS84. Chapter 8 describes how to change the coordinate system if you want to use a different one. The second condition is, you must have at least one map layer displayed in the Map panel.
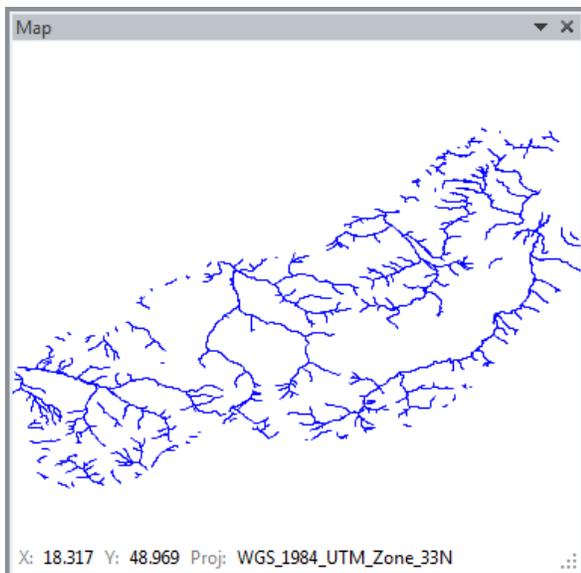
You can export one selected Map Layer to a KML file in vector format or all the layers shown in the Map panel as a bitmap. [First we describe how to export one selected layer in vector format]. When you have at least one layer displayed in the Map panel, click on the ribbon button **Special – Export to KML** to display the following dialog.
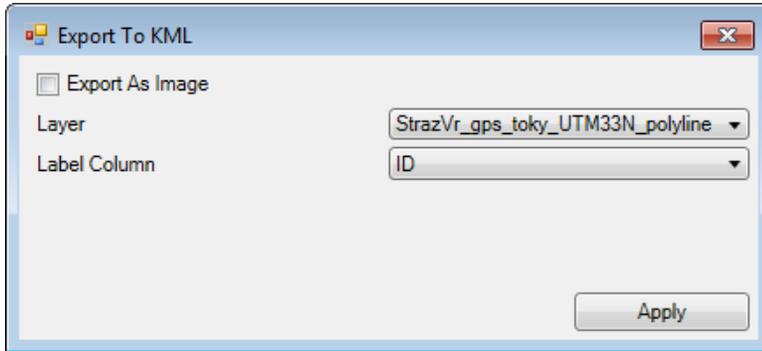

If you want to export only one layer, leave the first check box **Export as Image** unchecked, and choose the map layer you want to export in the **Layer** combo-box. You can export points, lines or polygons into Google Earth. After selecting your Map Layer, in the second combo box you select a column from the attribute table that appears in Google Earth map under **Label.** Finally, click **Apply** and add-in generates the KML file. After completing this process, which can take longer if you export a large set of features, a message box is displayed asking if you want to open the new layer in Google Earth (if Google Earth is installed in your computer)
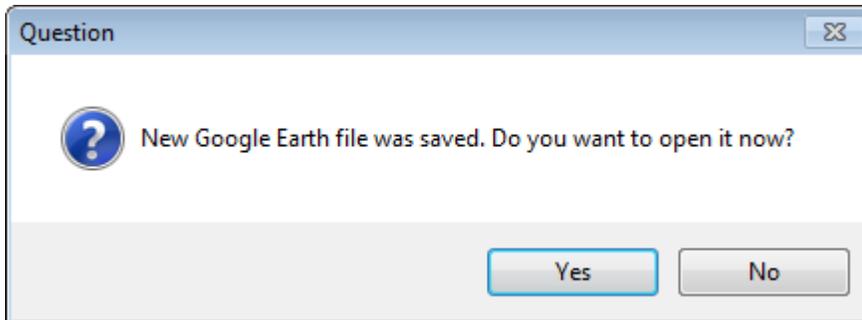
If you click **Yes** in message box, new KML file will automatically open in Google Earth.

In addition to your spatial data in vector format, all data from the attribute table is also exported into the KML file. Clicking on the selected object displays them in Google Earth.
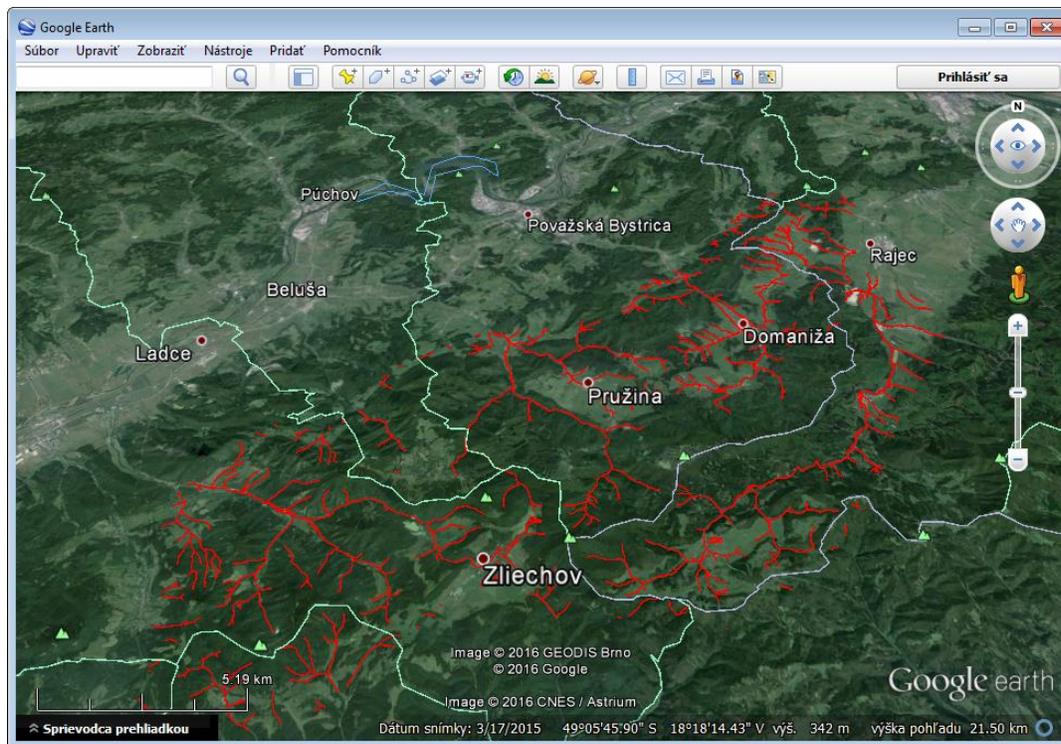
This way you can export individual Map Layers in vector format. Add-in also includes one more export option. Imagine that you have displayed multiple Map Layers with defined visual properties in the Map panel, and you can also see them in Google Earth.
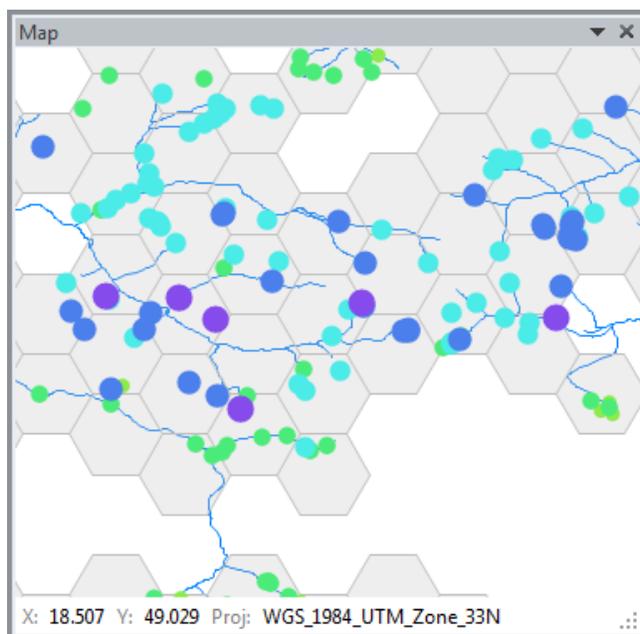
Click on **Special – Export to KML** to display this dialog.
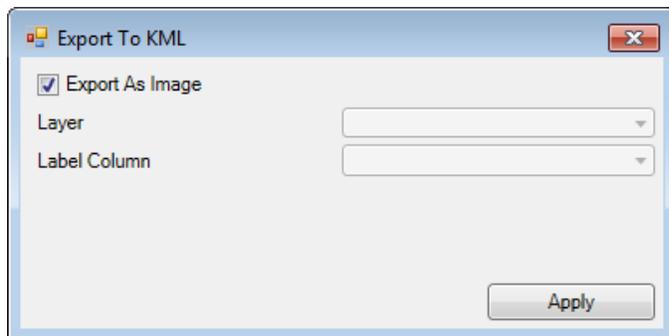
If you want to export all the map layers at once, click the first check box **Export as Image** and click **Apply**. This command exports theMap panel contents as a picture and displays it geo-referenced directly in Google Earth. The great things here are that the map is exported into the program with all visual settings that you made, and the map image is exported in the same resolution as shown in your Map panel.
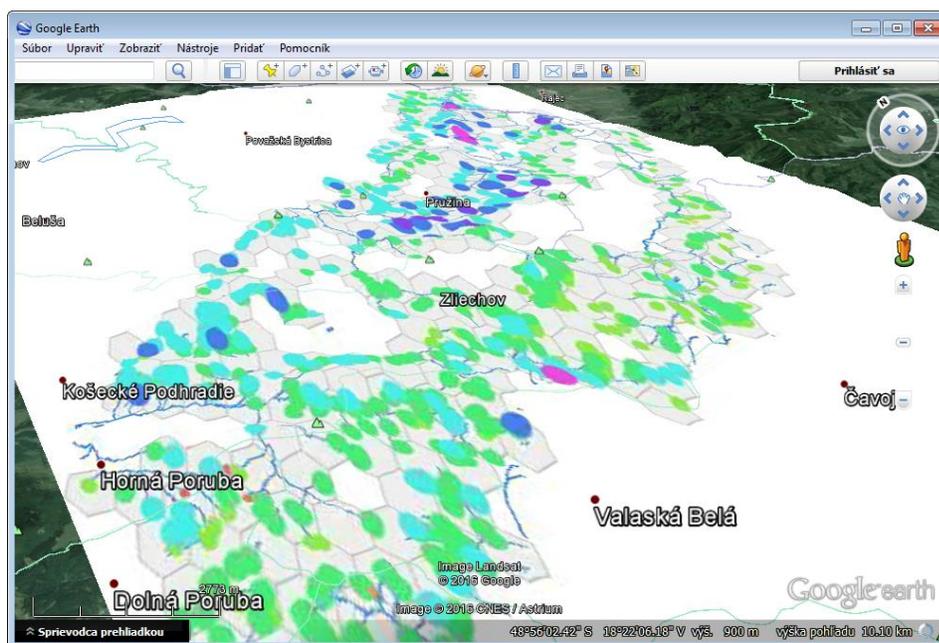
11.2 Stats in Polygons

Another interesting feature is under the button **Special – Stats in Polygons**. Using this feature, you can create statistical analysis and summaries from one map layer of polygons to a second layer. An example is shown in the following figure. One polygon layer displays districts and the second contains springs localized in the area of interest with data stored in the attribute table; such as water temperature, mineralization or the yield of the water sources. The column named **T_Kat** contains information of the spring's categorization; either above or below 10°C; and this parameter sets all points in the Map Panel in the appropriate color for < 10 °C and > 10 °C.
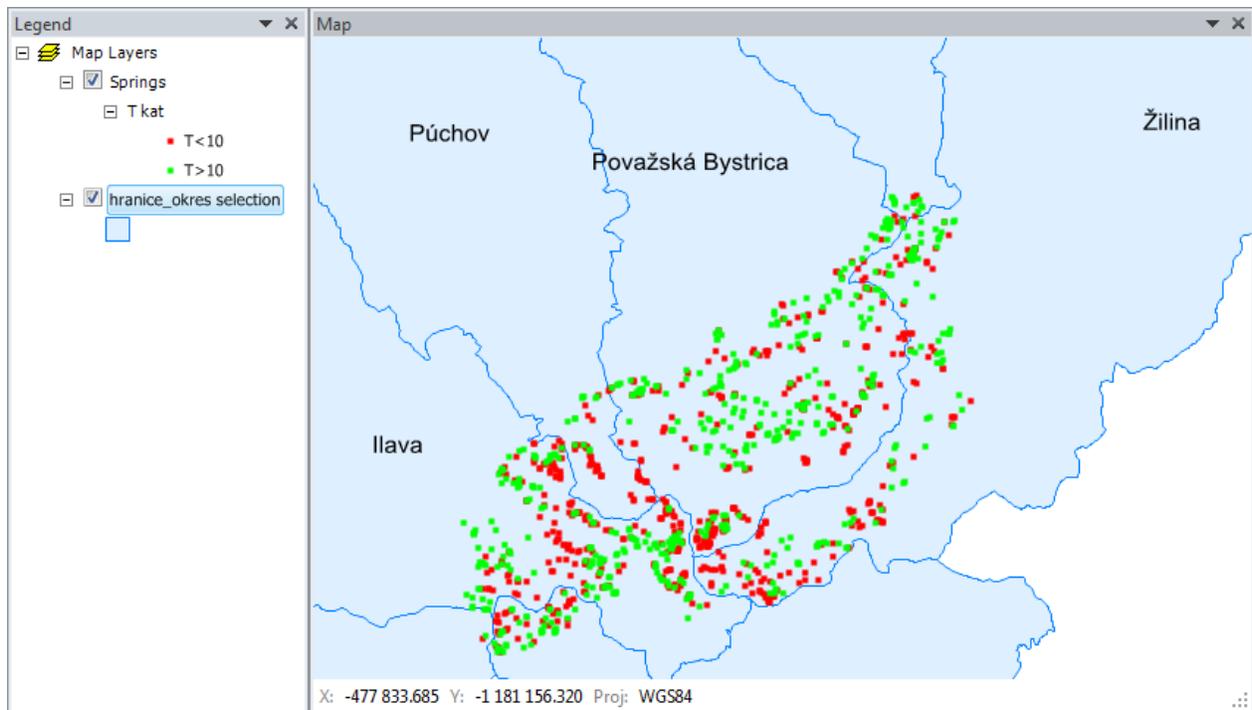
You can use **Special – Stats in Polygon** for the following imagined function. Imagine you want to find the summary of yields for all springs in individual districts, and want to calculate this sum individually for springs with temperature < 10 °C and springs with temperature > 10 °C. Now click **Special – Stats in Polygon** to display the following dialog.

Here, you define your parameters. First choose the **Stats for Layer** that contains district polygons which delineate the areas. Then define the column from the attribute table that **indentifies** the individual districts, such as the name of the district. Choose the layer you want to calculate your statistics from in **Data Layer**. In this example springs are stored in the layer named "Springs". If you want to

calculate the yield statistics for all the springs in the district, leave the **Group By** combo box empty. But, if you want to calculate the sum of yields individually for the < 10 °C and > 10 °C, put **T kat** in the **Group By** combo box.

In the **Stat Mode** combo box you have a choice "Attribute Data" or"Spatial Data". If you want to calculate statistics based on the data stored in attribute table, select the **Attribute Data** option; and then select the column you want to use for statistics in the **Processing Column** combo box. In this imaginary case, spring yields are stored in column **Q**. Finally, select the processing function. Next, choose the **Sum** function because you want the summary yield. After defining all these parameters, click **Apply** and add-in will compute your stastistical parameters. If you have a lot of data in the layers, this may take longer to process. The next message box informs you that your statistics results will be saved to the clipboard; and you can paste the result into the spreadsheet using the **Ctrl+V** command.
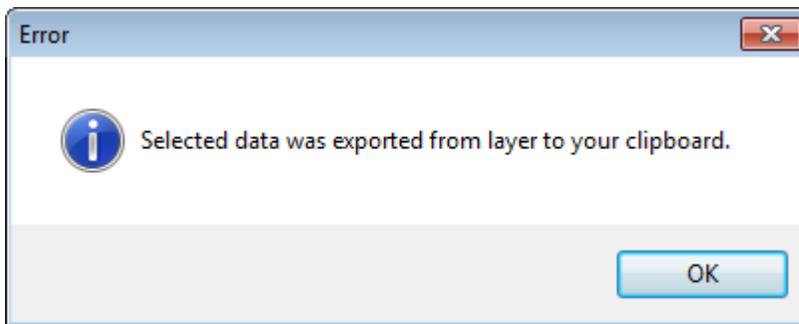

The example result is shown in the figure below. The **Item** column contains your district names which identify your polygons. When you define the **Group By** combo box, the **Group** identification is listed in the next column. Finally, the selected statistical parameter is in the last column under **Value**. The following example automatically counted the springs yields in individual districts and individually summed values for springs with temperatures above and below 10°C.

Item	Group	Value
Bytča	T>10	0.76
Bytča	T<10	0.13
Považská Bystrica	T>10	521.51
Považská Bystrica	T<10	818.67
Žilina	T>10	83.76
Žilina	T<10	179.66
Púchov	T>10	11.48
Púchov	T<10	56.17
Ilava	T>10	65.77
Ilava	T<10	23.45

The next example for your statistical analyses uses the spatial characteristics of layer features and the same district polygons (instead of values from the attribute table layer used in the previous

example). The statistical parameters are computed from the line layer that defines the area's river network.
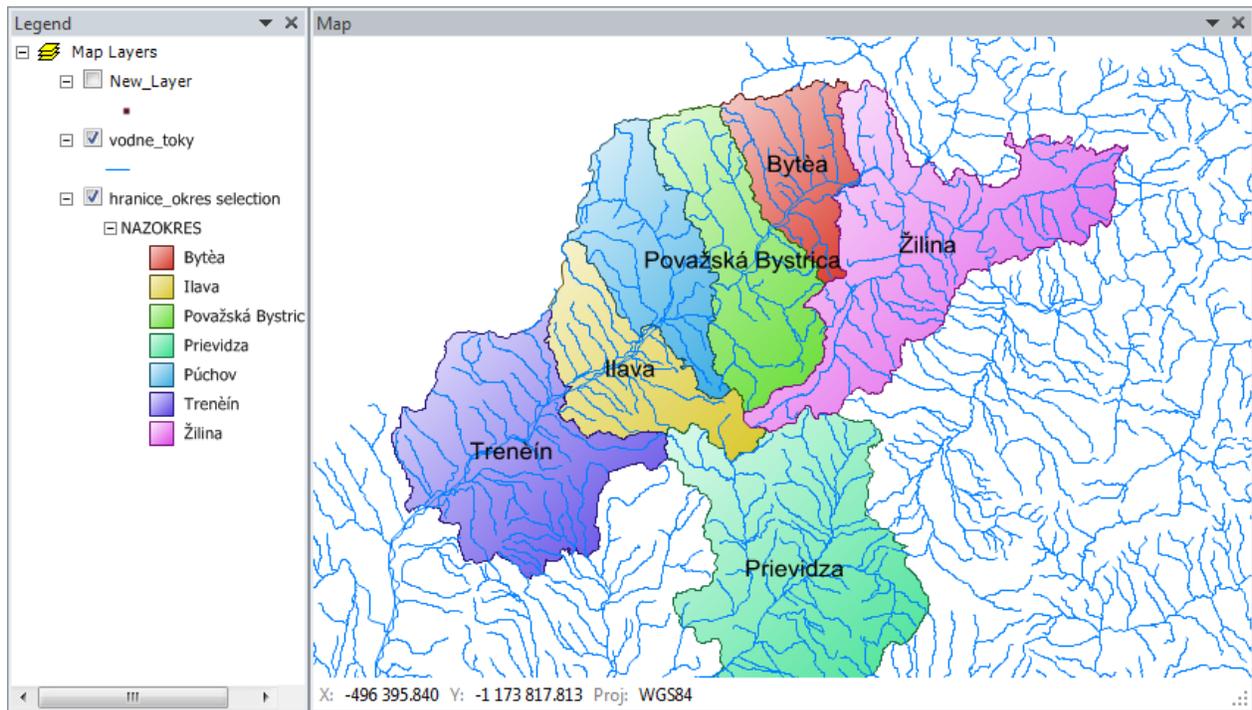
Your imagined task here is to calculate the lengths of all rivers and streams in individual districts. Select the layer for computing vodne_toky (= "water-flows") in the **Data Layer** combo box for your river network. There are no "groups of rivers" so leave the **Group By** combo box empty. Select the **Spatial Data item** in the **Stat Mode** combo box which enables you to calculate the spatial characteristics directly from individual features. Then choose the **Length** item in the **Function** combo box, and this automatically detects the length of each feature in your polygons. Finally click **Apply,** and add-in calculates the desired river/stream length values and save them to the clipboard.
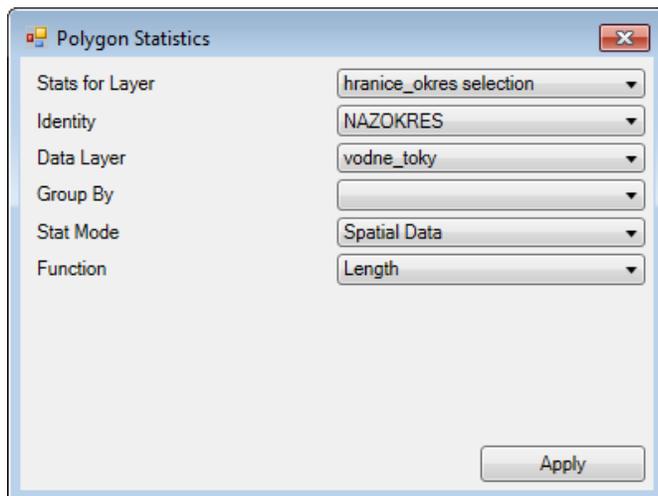

Pressing **Ctrl+V** keys then pastes the following table to the Excel spreadsheet

Item	Group	Value
Bytča		128 940.22
Považská Bystrica		197 027.94
Žilina		406 779.58
Púchov		155 069.92
Ilava		215 916.36
Trenèín		374 828.26
Prievidza		471 293.75

The **Item** column lists your districts. The **Group** column remains empty, and the last column contains the summary length of rivers and streams in each district. Be careful of the coordinate system you used here; because if you used WGS84, the length values are in degrees, and the metric coordinate system gives the lengths in meters. This described spatial analysis can be performed on lines, points and polygons; and you can calculate lengths, centroid coordinates, areas and the total number of features in the defined polygons.

11.3 Intersect Layer

A further interesting feature is hiden under the **Special – Intersect Layer** button. Imagine again, that you want to cut some items out of your existing rivers and streams map. For example, you want to cut all rivers and streams in one district from your complete rivers and streams map; and you have the district you want to cut ready in a polygon in another Map Layer.
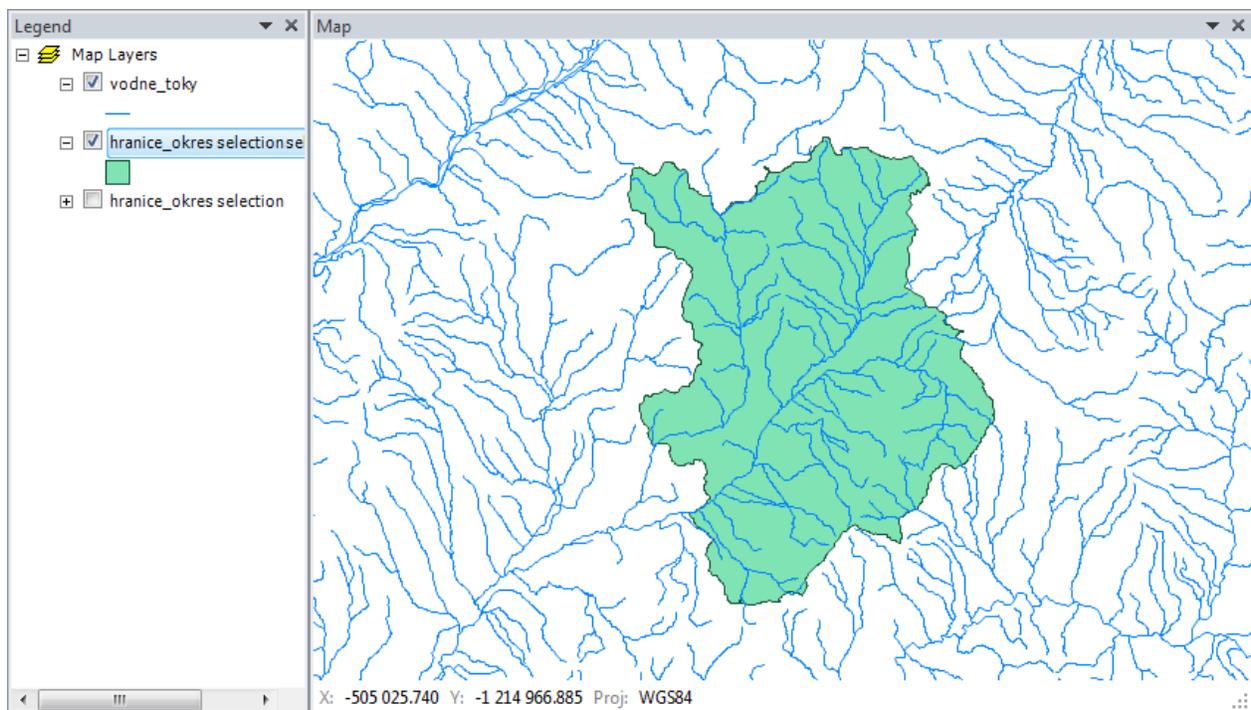

Clicking on the defined **Intersect Map Layer** button displays the dialog below. Choose the layer you want to cut in the first **Intersect layer** combo box. Select your polygon in the **By Layer** box and type the new layer name in the **New Layer Name** box. Be careful here, because if you leave the **Clip Layer** box

empty, add-in will select all the rivers that fall within the polygon, but it will not crop them along the polygon edges if they exceed the polygon area.
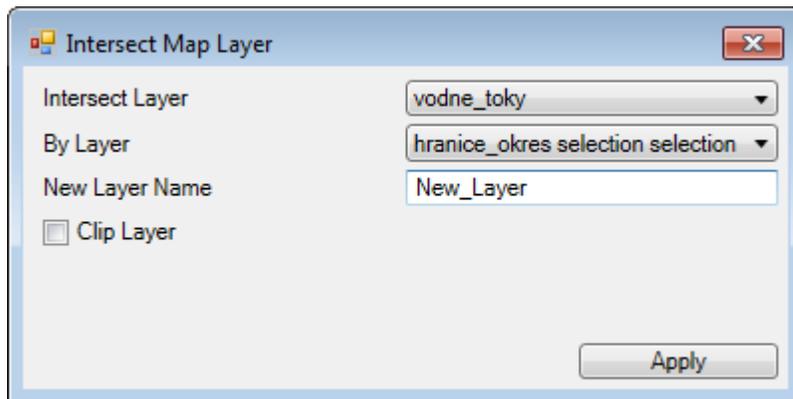
Finally, click **Apply,** and add-in processes the function, and advises you the number of features in your new layer; as below.
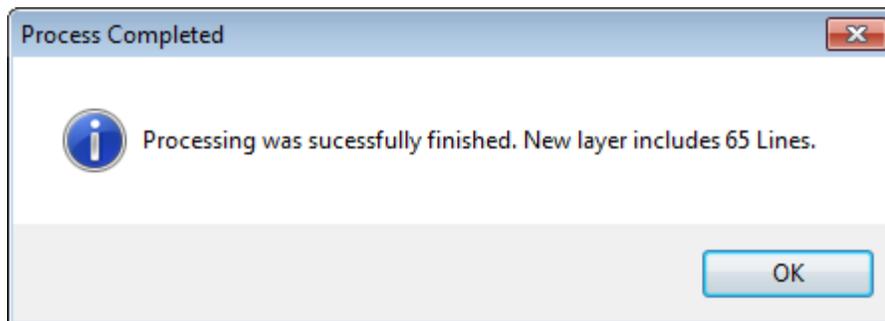

The result of your defined function is also shown in the following figure.
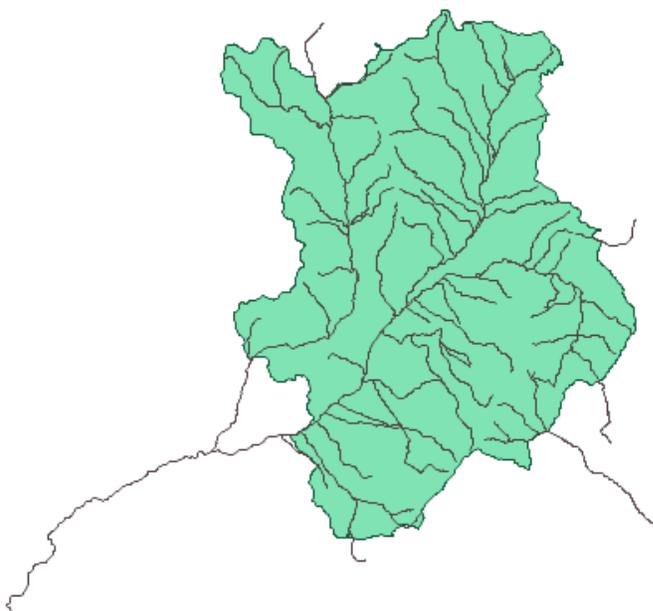
If you want to crop the rivers and streams along the edges of the polygon, check the **Clip Layer** combo box in the dialog.
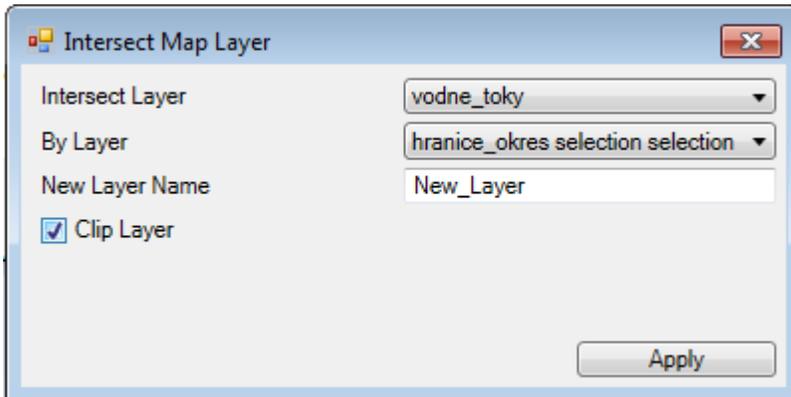

The river and stream lines are now trimmed at the polygon edges; as shown in the following figure.
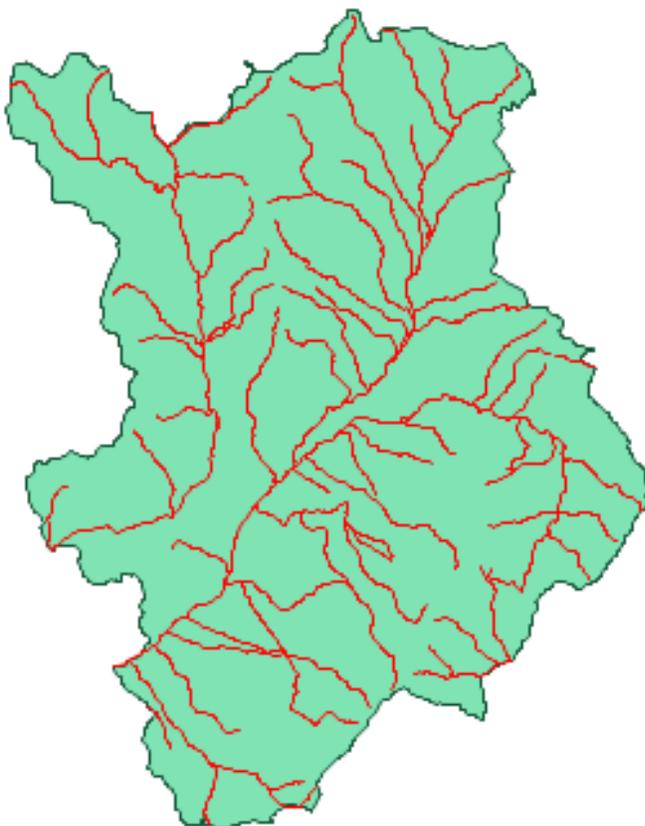

11.4 Create Buffer

Using the last function in the current version of add-in, you can create buffer polygons around features in a selected Map Layer.These buffers can be created for points, lines and polygons. This function is performed in the Map Layer of rivers.
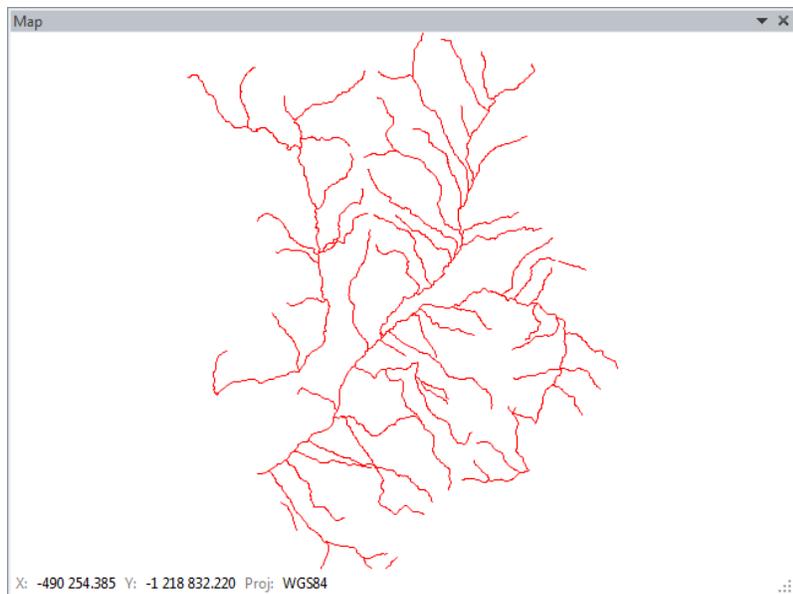
If you want to create a new Map Layer of buffer zones around the rivers click **Special – Create Buffer.** The add-in feature displays a dialog with three adjustable parameters. In the first combo box choose the map **Selected Layer** where you want to create buffers. Then type your numerical distance value in the **Buffer Distance** text box, in the same units as your coordinate system, and finally type the new Map Layer name.
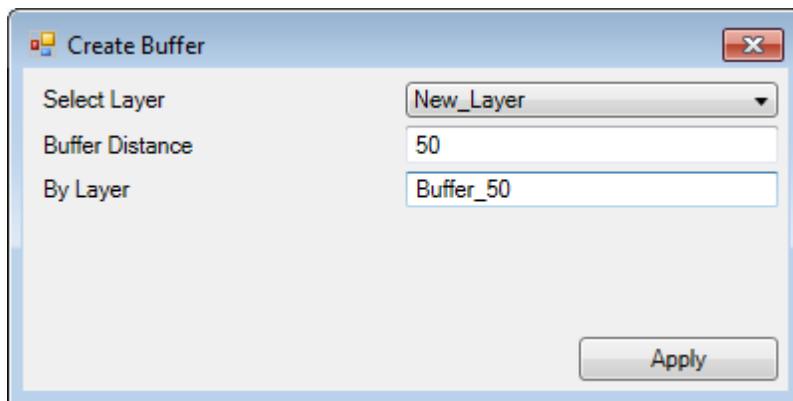
Clicking **Apply** creates a new layer in the Map panel that contains your defined buffer polygons. The following figure shows buffers created at 50, 200 and 600 meters.
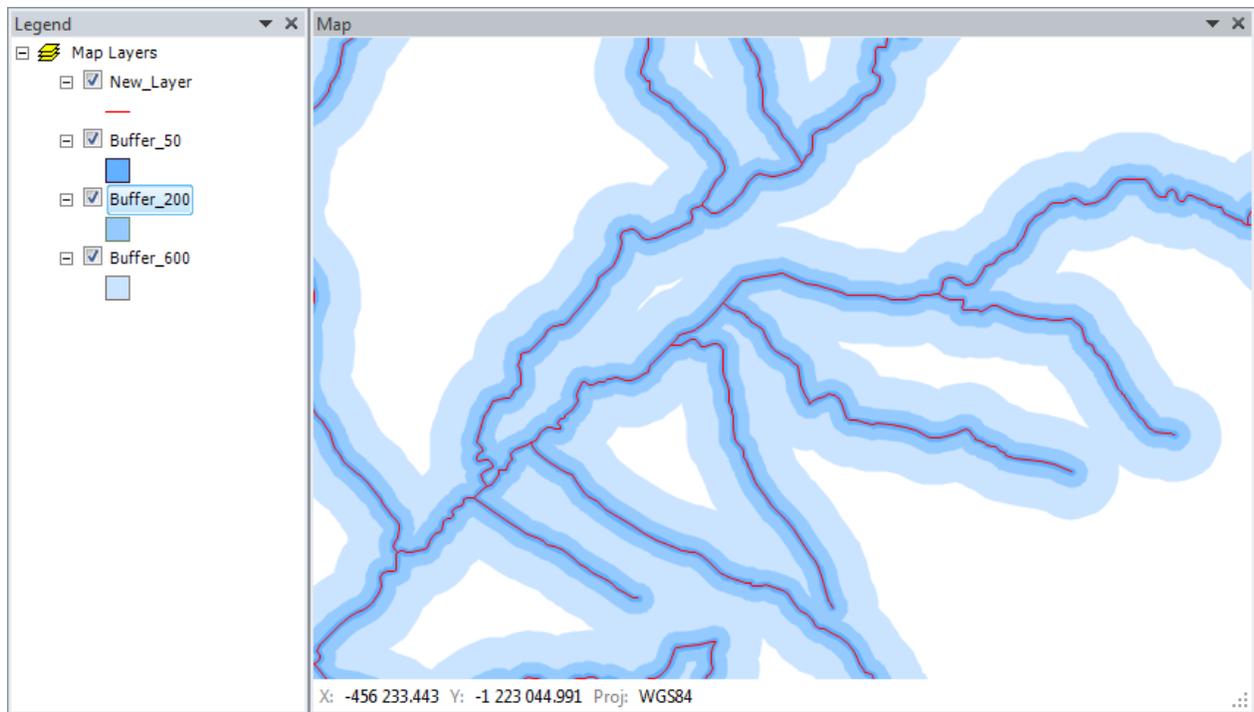
Remember that your newly created map layers exist only in computer memory. If you want to use them after you close Excel, be sure to save them on a disk.

12 Conclusion

The previous chapters defined the functionality of GIS.XL add-in. This add-in includes a number of features and functions that can save you a lot of time if you have stored data with spatial character in Excel spreadsheets. Add-in has been designed to be easy to use, and it contains a number of features to combine with Excel and other large software packages to make your overall work much simpler.

By definition, Add-in does not contain all the functionality we are accustomed to in large, robust GIS software solutions. The development of add-in features is still continuing, and in the future you can look forward to new features and improvements.

If you have any questions, comments or requests, I will be very happy to help, and Iappreciate all comments and suggestions. Please contact me via email at milos.gregor@gisxl.com.