# Publishing GIS services in eLiteGIS

Manual on publishing and managing GIS services via GIS server of CoGIS platform

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# 1. Preamble

## 1.1. CoGIS platform components

CoGIS platform consists of the following software components:

- CoGIS Designer – a constructor for creation of interactive maps and fully functional web map applications based on map services, geoprocessing and analyses tools;
- CoGIS SOE (SOE, an abbreviation for Server Object Extension) – a module providing support for advanced methods to work with the map services layers and objects;
- CoGIS Portal – a geoportal consisting of catalog of published interactive maps and map apps, tools for searching and navigation, and web pages with reference information which structure and content are set in accordance with the users' needs;
- CoGIS Mobile – mobile applications for work with interactive maps and map apps on iOS and Android devices and mobile service for operation of these applications;
- eLiteGIS – a GIS server for publishing data and tools as web services.

## eLiteGIS components

- Sever components provided for publishing of services and arranging web access to these services via REST API;
- Web console eLiteGIS Server Manager with graphic interface for publishing GIS services and setting GIS server.

eLiteGIS supports the following types of services:

- Map services (dynamic and tile services; available for view and/or edit only; with vector and raster layers);
- Geoprocessing services, including map printing services;
- Geocoding services;
- Network analysis services;
- Geometry services.

The given manual provides instructions on publishing and customizing the above mentioned services. The only exception is the geometry service that is the embedded functionality of eLiteGIS supporting the following platform operations:

- Projecting geometries to other coordinate systems
- Applying additional transformations and transformation chains between coordinate systems during projecting or spatial calculations
- Calculating distances and areas
- Reducing geometry to geometry without self-intersections (geometry simplification)
- Topology operations:
    - Intersection of two geometries
    - Subtracting geometry from other geometry
    - Joining multiple geometries.

The geometry service cannot be additionally customized via the eLiteGIS Server Manager interface and so it is not considered in the given document.

The complete list of available manuals is provided in section Ошибка! Источник ссылки не найден..

## 1.2.Additional information

Additional information about GIS server eLiteGIS and about CoGIS platform can be viewed in the following documents and manuals:

- General description of CoGIS platform, including description of GIS server eLiteGIS;
- Manual on installing and setting eLiteGIS;
- Manual on creating map projects in QGIS;
- Manual on creating map applications in CoGIS;
- Manual on working in mobile applications CoGIS Mobile.

## 2. Getting started with eLiteGIS Server Manager

To get access to eLiteGIS Server Manager, you need to be authorized, see Figure 1.

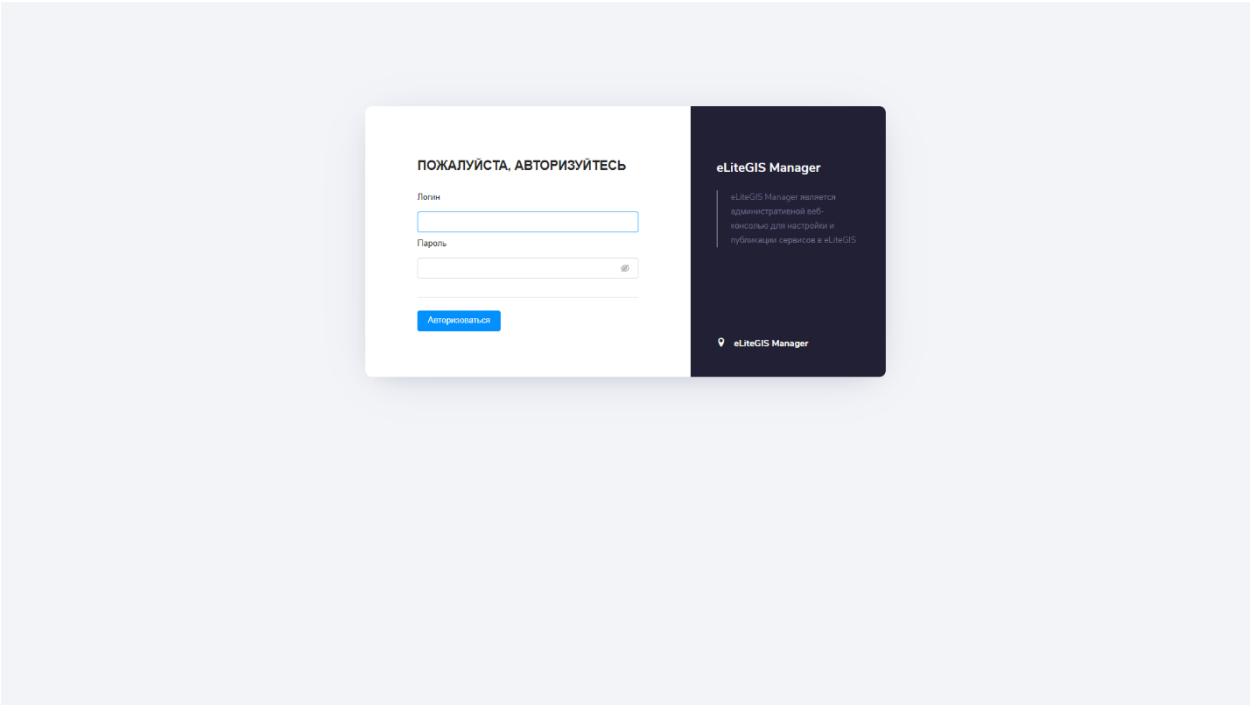



Figure 1 – eLiteGIS Server Manager authorization window

After authorization, the web console with the following sections will appear, see Figure 2:

- *Services (open by default)* - includes catalog of published services, catalog navigation tools and tools for adding new services. See 'Publishing GIS services in eLiteGIS' manual for more details (section 3-7).
- *Settings* - includes tools for setting up GIS server, paths to related recourses and local directories for saving files, authorization parameters for access to databases, general parameters for publishing of map services, geoprocessing services, OGS services, and other settings. See more details in 'Installing and setting eLiteGIS' manual.
- *Users and groups* - includes tools for managing users and user groups. See details in 'Installing and setting eLiteGIS' manual.
- *Licensing* – includes information about eLiteGIS license. See details in 'Installing and setting eLiteGIS' manual.
- *User account* - the section includes information about the current user with the ability to edit it.

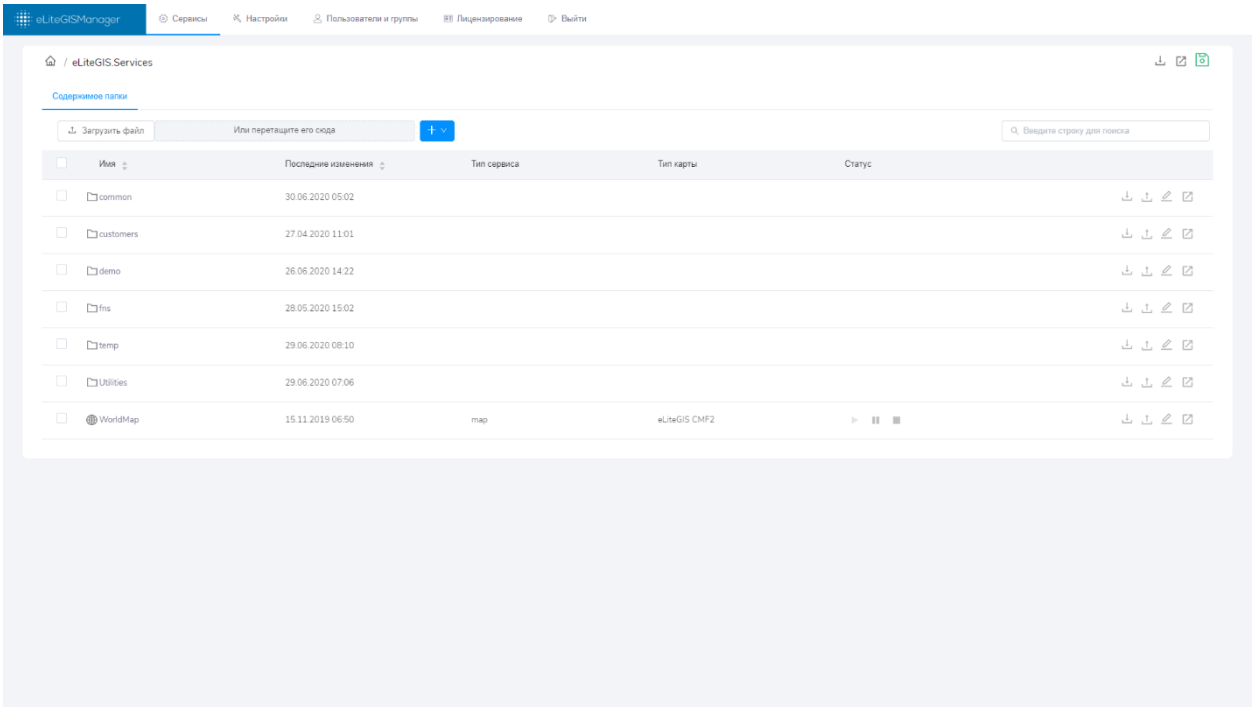



Figure 2 – Services section of eLiteGIS Server Manager web console

The panel contains 

button for exit the application and buttons to switch language 

.

# 3. Services catalog

## 3.1. General information

Services catalog located in *Services* section of the web console is the hierarchical list of different types of services, see Figure 3.

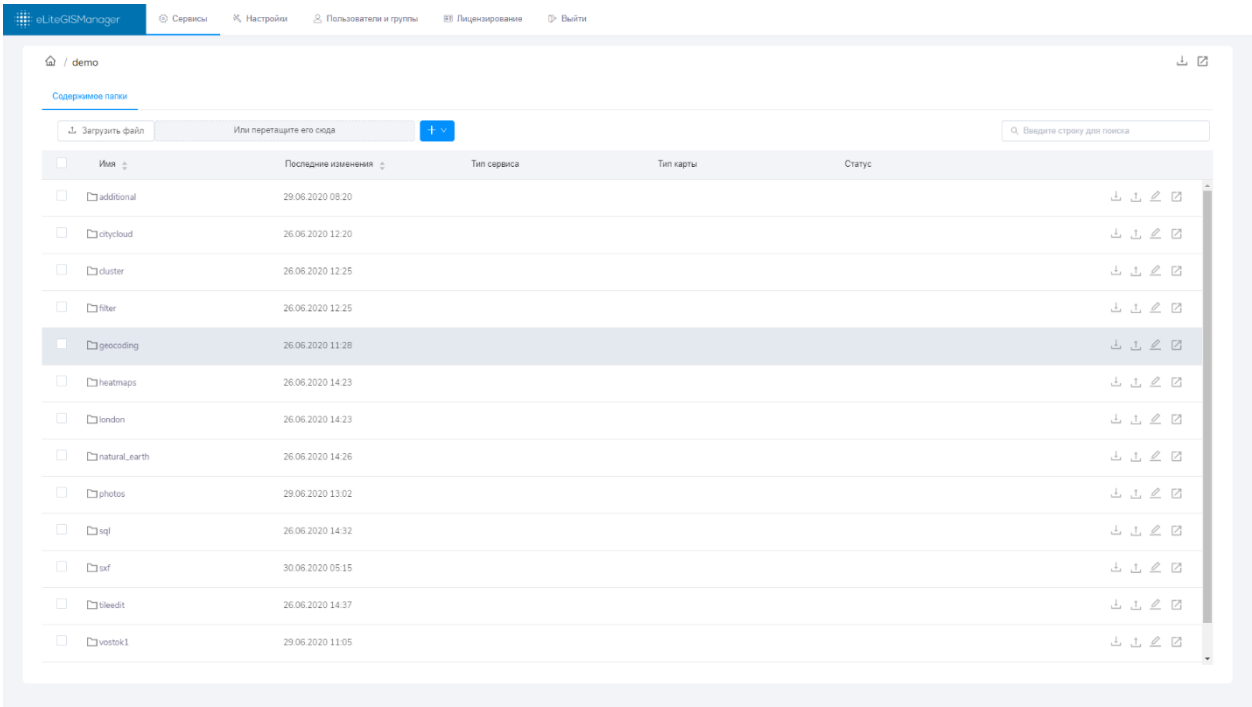



Figure 3 – Services catalog

Services can be grouped to folders with unlimited nesting level. List of services and their groups correspond to list of files and their grouping to folders in specified directory on the server. That is, the list of services can be managed (create new, delete, change structure) as following:

- via eLiteGIS Server Manager web console interface;
- manually, by downloading file to specific directory.

Instructions on work with services catalog via web console interface are provided in sections below.

## 3.2. Viewing information about service or folder

Services catalog is a table containing the following information:

about service:

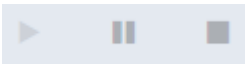
- Name
- Date and time of last change
- Type
- For map services – map type (format of map project file or raster file based on which the service has been published)
- Status (see details in section 3.3);

about folder:

- Name
- Date and time of last change.

All the table elements can be sorted by name and date/time of last change.

## 3.3. Changing service status

In the *Status* field of the service there is the panel with controls:  .

With these controls you can pause the service work ('Pause' mode  ), stop the service work ('Stop' mode  ), or restart it ('Start' mode  ).

Note that services are available in Start mode only.

In Pause mode the service project file remains in the sever RAM and can be restarted by pressing  less than in 1 second.

In Stop mode the service is fully stopped. To restart it, press  , but note that after that the project file should be downloaded to the server RAM which may take from 1 second to several minutes depending on the project.

The same controls for managing service status are available for each service in its properties window.

## 3.4. Updating service from file

On the right of the service name there is the toolbar:  .

To update service, press  . The standard operation system window to select file for download will appear.

This toolbar is available for each service in its properties window.

## 3.5. Uploading service file

On the right of the service name there is the toolbar:  .

To upload service file, press  . The standard operation system window to save service file will appear.

This toolbar is available for each service in its properties window.

## 3.6. Editing service name

On the right of the service name there is the toolbar:  .

To rename service, press  . The standard operation system window to enter new service name will appear, see Figure 4.

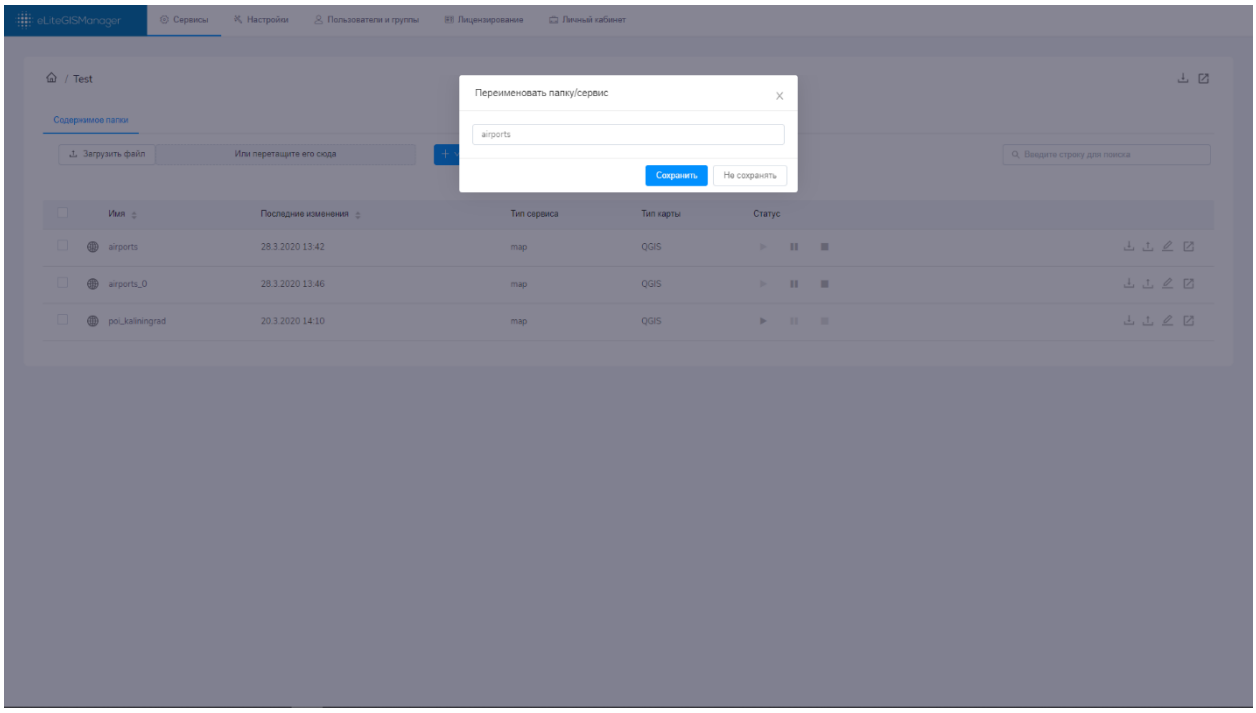
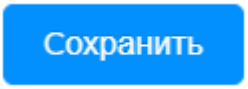
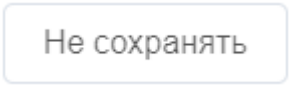



Figure 4 – Editing service name

To save made changes press 

. To cancel changes, press 

. This toolbar is available for each service in its properties window.

## 3.7.Requesting JSON description and REST API address for selected service

On the right of the service name there is the toolbar:  .

To request JSON description of the service, press  . A separate tab with the service description will be opened in your browser, see Figure 5.

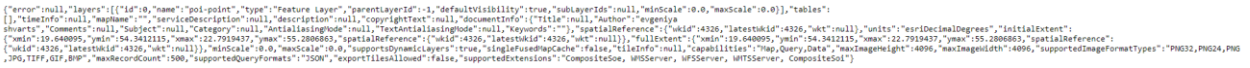



Figure 5 – Requesting JSON description of selected service

For example, the JSON description of the map service may include the following information about the service:

- List of layers and tables
- Supported coordinate systems
- Extent
- Supported operations and functionality
- Supported image formats, etc.

REST API address for selected service (for example, https://cogisdemo.dataeast.com/elitegis/rest/services/common_osmde_ru/identify/MapServer) can be copied from the web browser address line. This address can be used to connect service in CoGIS map application (see details in 'Creating map applications in CoGIS' manual) or to address to service via program interfaces.

## 3.8. Navigating through catalog

You can navigate through catalog as following:

- Click the required service or folder name to get to the properties of the service or to the list of services of the selected folder. On hovering over the service or folder name the correspondent line in the catalog is highlighted with grey color, and the service or folder name is marked blue, see Figure 6.

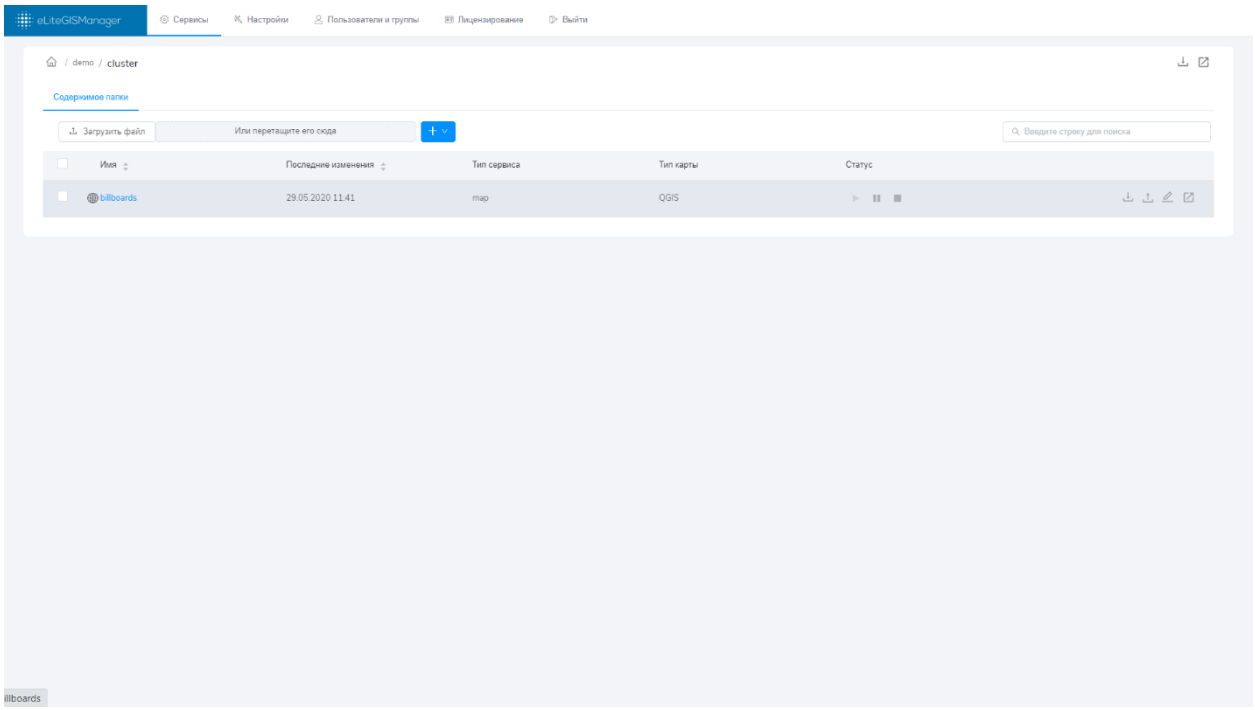
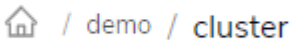



Figure 6 – Navigation through catalog: going to selected service or folder

- Use the path to the current folder specified in the lower left corner of the catalog as bread crumbs, see Figure 7. With the bread crumbs you can go to any folder specified in the path. For example, using  path, you can either go to the home page with the list of all published services, or to the folder 'demo'.

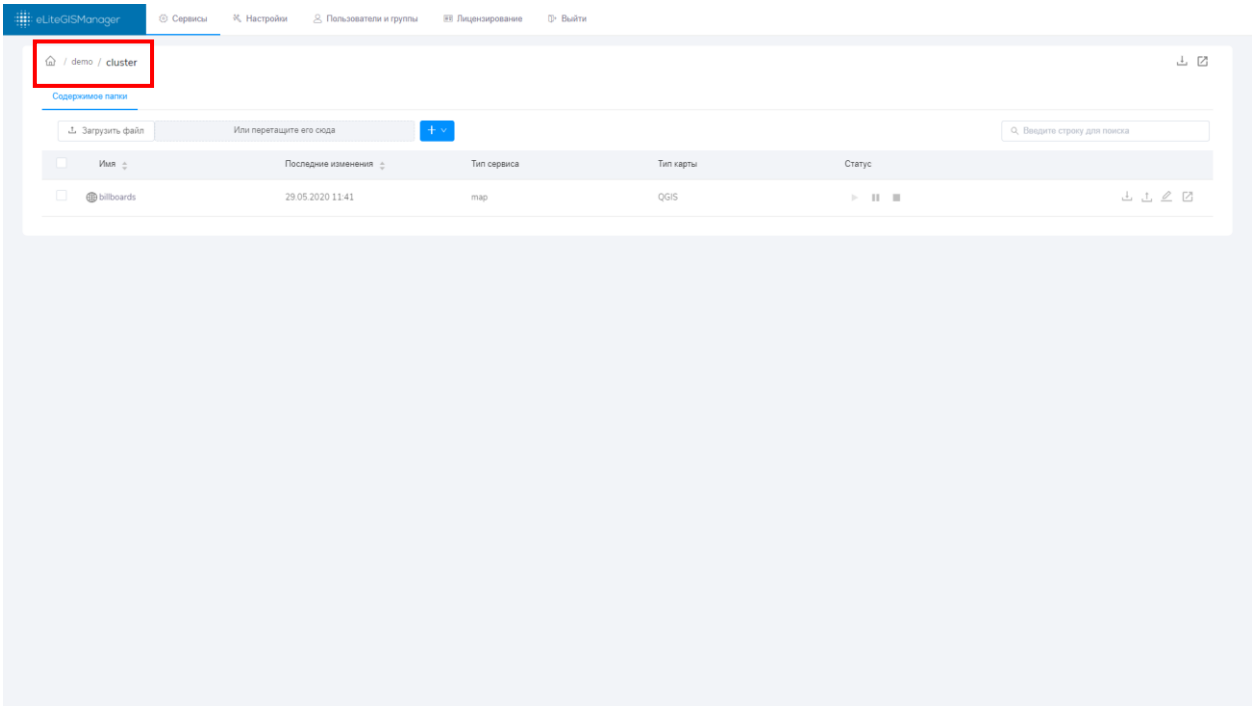



Figure 7 – Navigation through catalog using bread crumbs

## 3.9.Adding new folder

To add new folder to the catalog, press  in the upper part of the table and select *Add folder* from the drop-down list, see Figure 8.

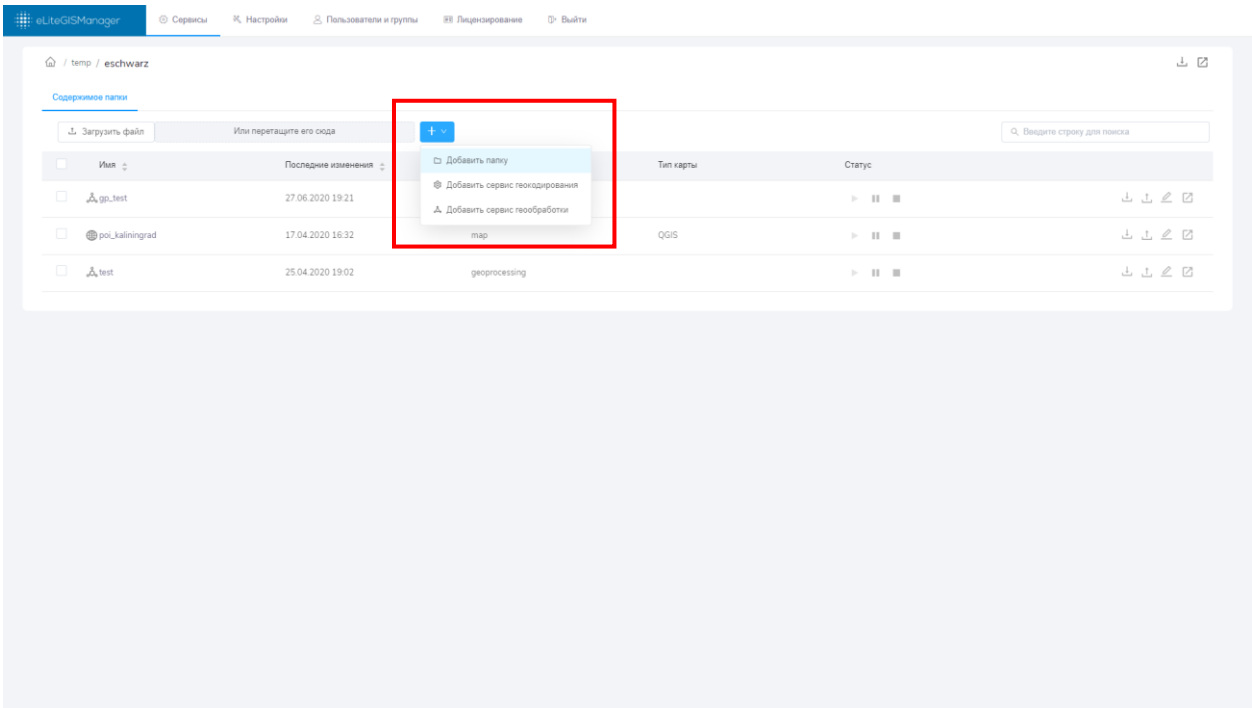



Figure 8 – Adding new folder to catalog

In the appeared window enter the folder name and access permissions for users, see Figure 9. The following parameters are specified by default:

- Name: New folder

- Availability: For all

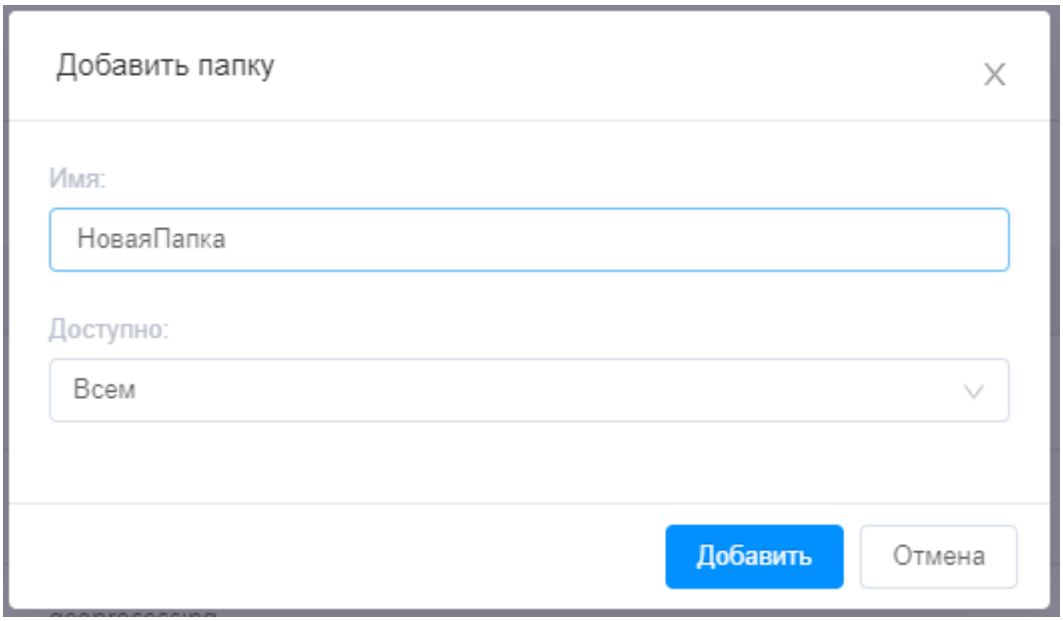


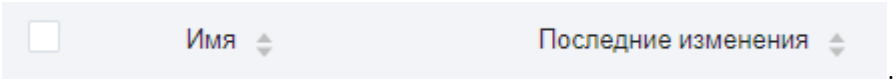

Figure 9 – Adding new folder to catalog: folder parameters

Available access permission levels:

- For all
- For authorized
- For selected users
- For selected user groups
- No web access.

*Note: these access permission levels are the same as permissions set for specific services.*

## 3.10. Deleting and copying service or folder

To delete, copy or cut (deletion with saving to clipboard) service or folder, select it in the catalog first. To do so, check the check box  on the left of the service or folder name. You can select multiple services or folders sequentially checking the appropriate check boxes. You can also select all services or folders in the current folder, checking the box on the left of the table names: 

.

As soon as at least one element in the catalog is selected, the buttons of additional tools appear in the upper part of the catalog:

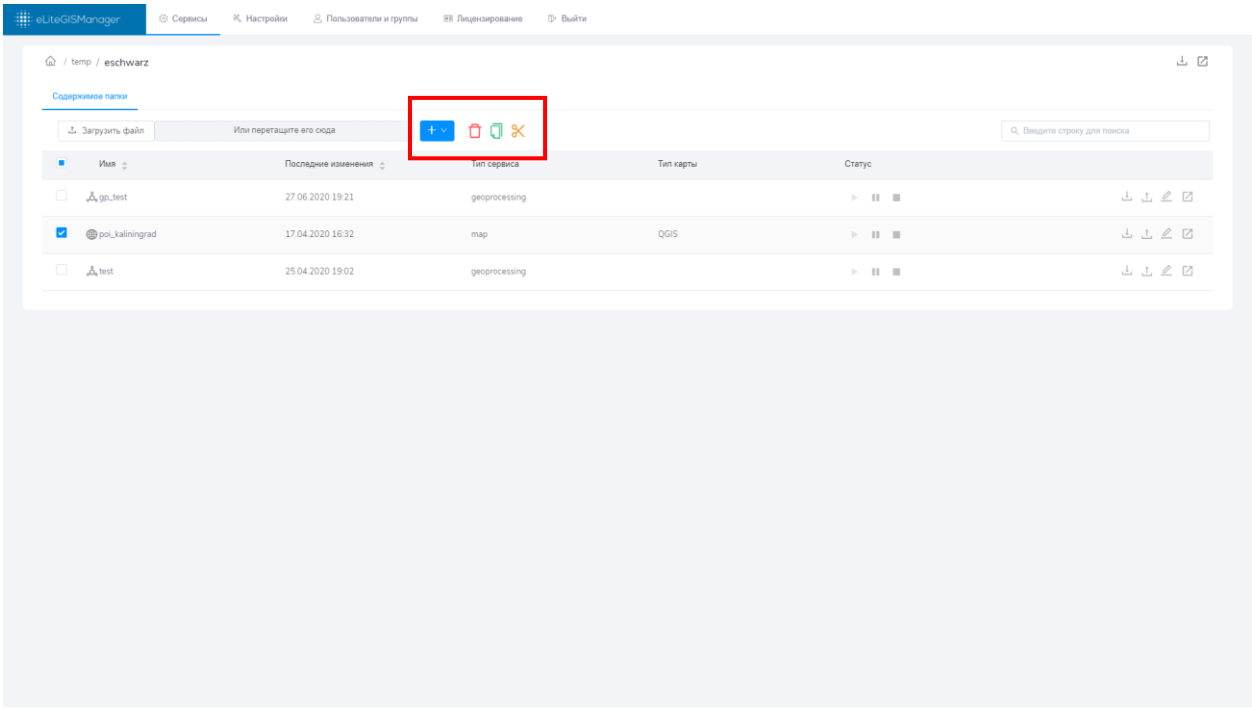



Figure 10 – Tools for work with selected service (folder)

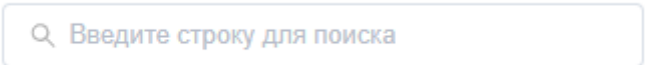
To delete selected service (folder), press  and confirm your choice in the pop-up window.

To copy selected service (folder), press  . The service or folder will be copied to clipboard and the additional button  for pasting the copied item to the catalog folder will appear near the delete and copy tools buttons. This button will be available during navigation through catalog.

To cut selected service or folder (deletion with saving to clipboard), press  . The selected service or folder will be deleted and at that copied to clipboard, and the additional button  for pasting the copied item to the catalog folder will appear near the delete and copy tools.

## 3.11. Searching through catalog

To search through the catalog, use the search field located in the upper right part of the catalog:




. Enter the search request to the field and the search will be done by names of services and folders, see the example below.

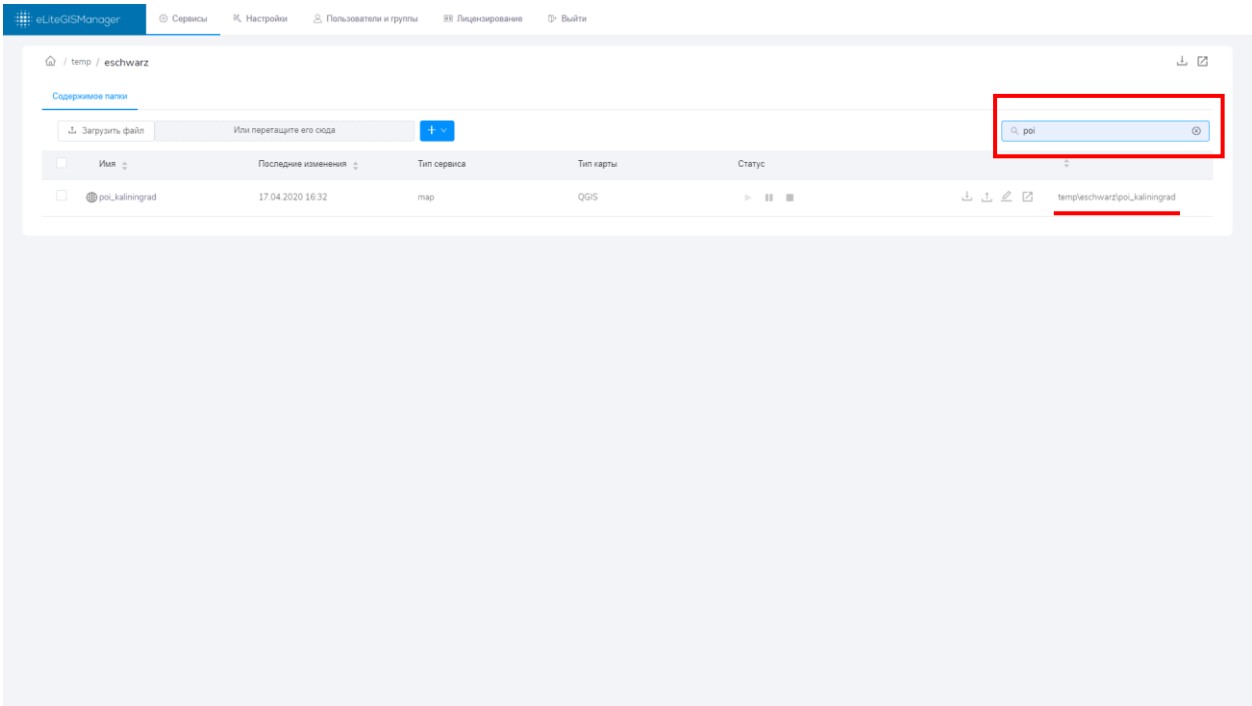



Figure 11 – Searching through catalog

The search results will be shown as the table. The path to each found service or folder will be shown in the rightmost column of the table (for example, Test\poi_kaliningrad ).

The search results can be sorted by name, date/time of last change, or by path. To clear search results, press ⊗ in the search field.

# 4. Publishing map services

## 4.1. General information

eLiteGIS supports publishing of map services in accordance with the following standards and protocols:

- ArcGIS Server REST API MapServer10.x and FeatureServer10.x (ArcGIS REST API);
- OGC WMS 1.3.0 (WMS);
- OGC WMTS 1.0.0 (WMTS);
- OGC WFS 2.0.0 (WFS);
- OGC TMS (TMS).

The data in the following formats can be the data sources for the above services:

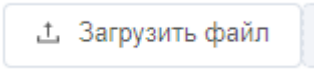
- Data sources of vector layers:
  - QGS/QGZ (map project QGIS/QuantumGIS);
  - KML/KMZ.
- Data sources of raster layers:
  - CMF2 (map project CarryMap);
  - GeoTIFF.

The scope of functionality available by publishing of map services depends on the data source format.

More details about available settings for QGIS map projects supported by eLiteGIS GIS server can be viewed in the 'Creating map projects in QGIS' manual.

## 4.2. Creating new service

To add a new map service to catalog, go to the appropriate catalog folder. Press




button located in the upper left part of the catalog window, see Figure 122.

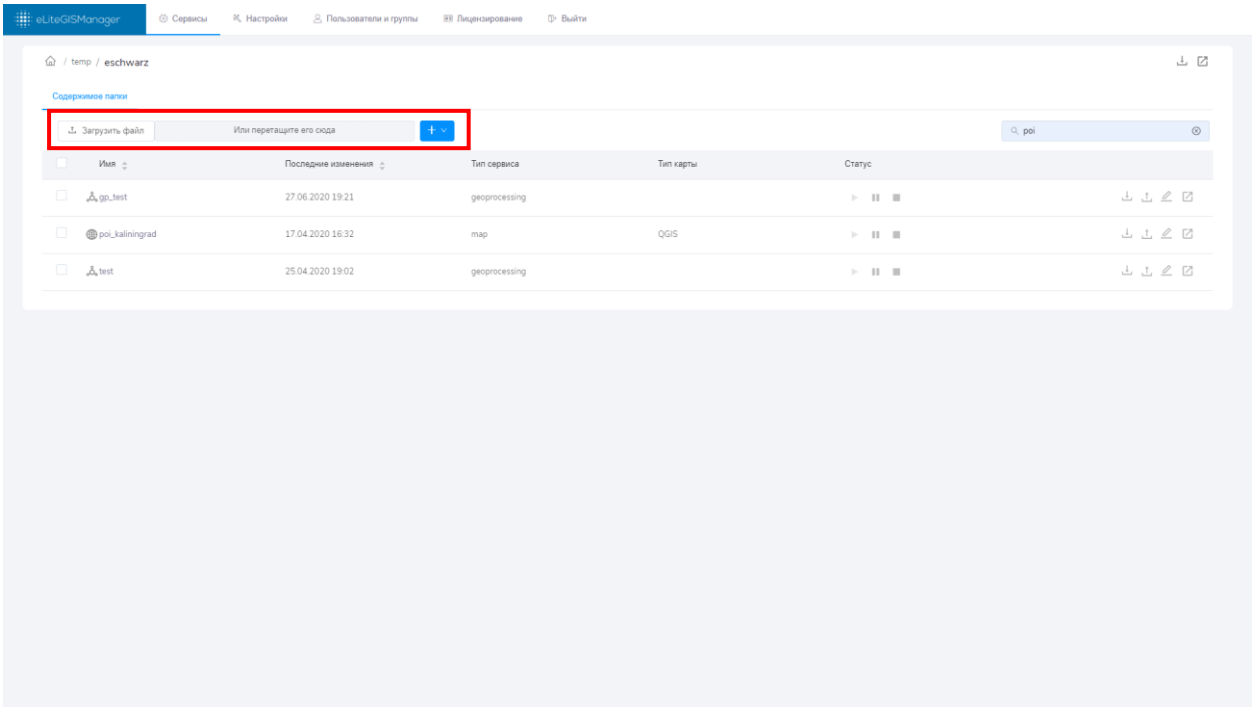
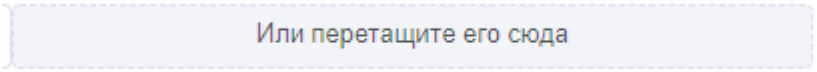



Figure 12 – Creating new service

A standard dialog for selection of map project file will appear. This map project file you can also drag to the 

field located on the right of the download button.

The map service will be published automatically after successful download of the map project file.

## 4.3.Setting access rights

To proceed with the service setting, press its name in the services list.

The service settings window will appear, where *Access rights* section will be opened by default, see Figure 13.

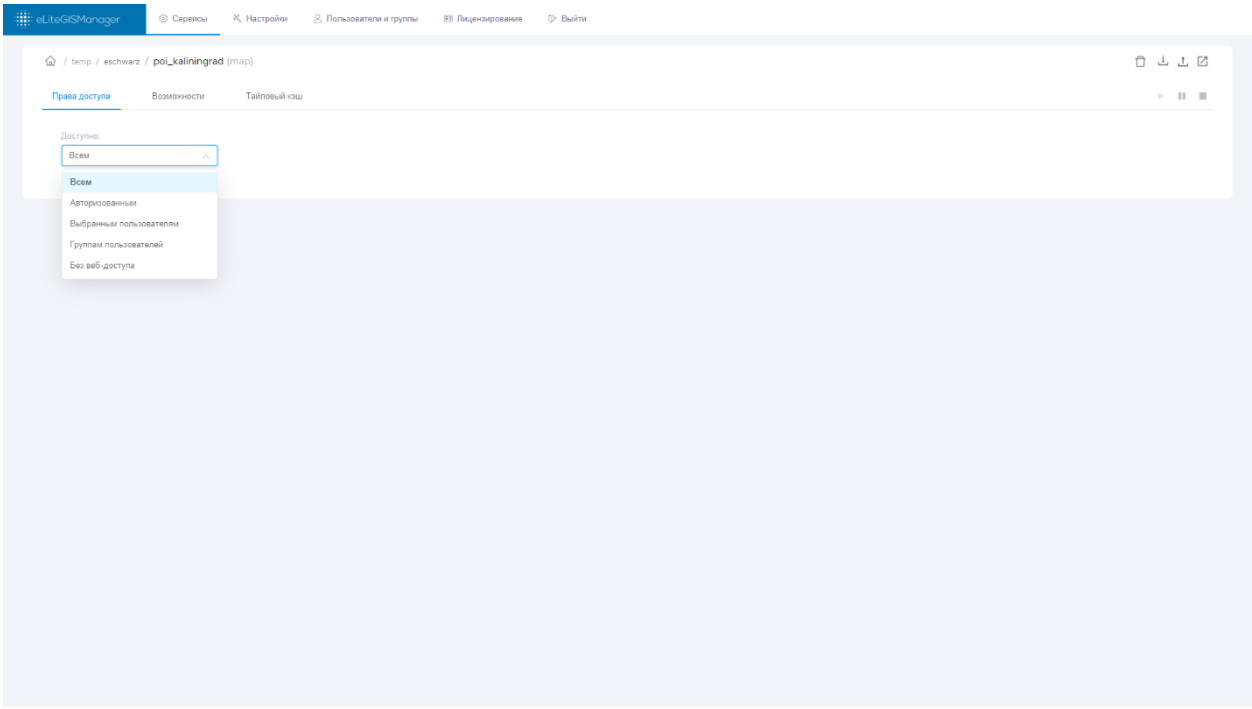



Figure 13 – Setting service access rights

By default the access to published service will be allowed for all users, but you can change this setting selecting one of the provided options:

- For all;
- For authorized;
- For selected users;
- For selected user groups;
- No web access.

## 4.4.Setting service operations

To get to the setting of service operations, press its name in the services list. The service settings window will appear. Go to *Permitted operations* tab, see Figure 14.

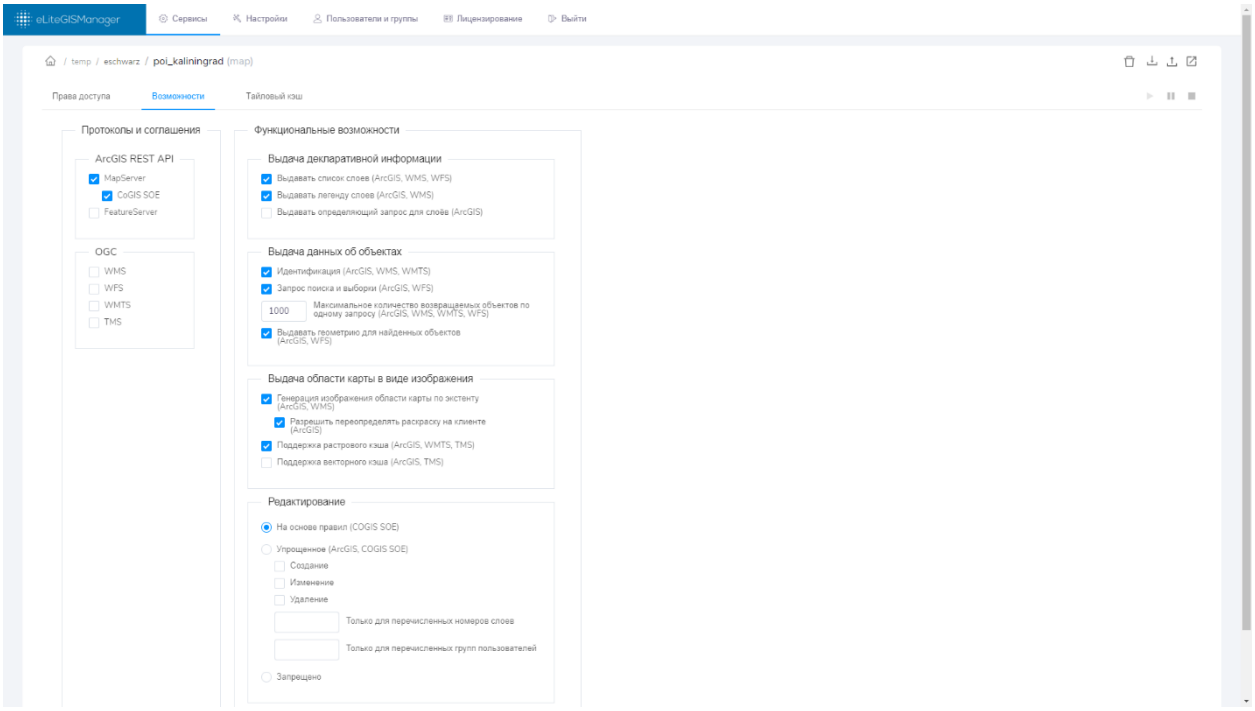



Figure 14 – Setting permitted operations of selected map service

The tab consists of the following blocks:

- Protocols and agreements;
- Functionality
- Service start.

### 4.4.1. Protocols and agreements

By default the map service is published in accordance with ArcGIS REST API (MapServer) protocol.

Support for extended methods for work with layers and objects, CoGIS SOE (Server Object Extension), is also enabled for map service by default. Enabled CoGIS SOE for map service allows performing such operations as topology correction, creation of objects by address, turning on picture gallery for layer, upload of data to file, and more.

Enable/disable CoGIS SOE checking the appropriate checkbox . The further setting of CoGIS SOE rules is done in CoGIS Designer.

For published map service you can also enable support for the following protocols and agreements:

- FeatureServer;
- WMS;
- WFS;
- WMTS;
- TMS.

To enable/disable the protocol, check the box near its name .

### 4.4.2. Functionality

In eLiteGIS you can enable the following operations with map services:

*Availability of declarative information*

This group of operations includes the following settings:

- *Availability of layers list (ArcGIS, WMS, WFS)*
  This option allows getting the list of layers and tables in service, as well as detailed information about layer or table. It is available for map services with any combination of layers. The option is enabled by default.
- *Availability of layers legend (ArcGIS, WMS)*
  This option allows getting the layer's legend, it is available for vector layers only. The option is enabled by default.
- *Availability of definition query for layers (ArcGIS REST API)*
  This option allows getting the definition query set for layer at the map project level, it is available for vector layers only. The option is disabled by default.

To enable/disable the operation, check the box near its name.

*Availability of objects data*

This group of operations includes the following settings:

- *Identify (ArcGIS REST API, WMS, WMTS)*
  This option allows getting information about objects in specific location in all visible layers or in specific layers only. It is available both for vector and raster layers. The option is enabled by default.
- *One line search*
  This option allows performing objects search:
  - One line search of objects in specific fields of all visible layers or in specific layers only;
  - One line search of objects in map service layers with sorting by distance relative to specified coordinates;
- *Selection by sql condition (ArcGIS REST API, WFS)*
  Allows performing selection of objects:
  - Getting objects in layer filtered by specified definition query (attribute filter);
  - Spatial selection of objects in layer (geometry filter);
  - Support for storage and request of 3D coordinates (if Z coordinate is supported in the database);
  - Getting related objects in case of declarative relationship between layers;
  - Export of selected layer data to Shapefile, Excel, CSV files;
  - Getting file attachments for specific objects;
  - Getting file attachments with previews for all objects found in specific extent.

  For this option, the additional setting is available, namely setting of maximum number of objects returned per one request. The option is available for vector layers only and is enabled by default.
- *Availability of geometry for found objects (ArcGIS REST API, WFS)*

This option allows getting geometry for found objects. It is available for vector layers only. The option is enabled by default.

To enable/disable the operation, check the box near its name.

### *Availability of map as picture*

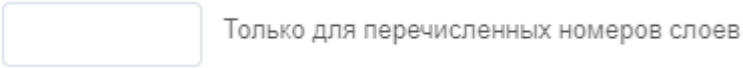
This group of operations includes the following settings:

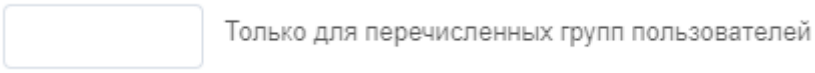
- *Generating image of map area by extent (ArcGIS REST API, WMS)*
  Allows generation of map image in specified format (supported formats are PNG32, PNG24, PNG, JPG, TIFF, GIF, BMP) in specified coordinate system by specified extent considering specified layers, scale ranges for layers visibility and definition queries (whereclause) set on the client.
  It is available both for vector and raster layers.
  For this option, the additional setting is available, namely, to allow or prohibit redefining layers coloring on the client (for such services as MapServer and FeatureServer). The option is enabled by default.
- *Raster cache support (ArcGIS REST API, WMTS, TMS)*
  Enables support of raster cache as tiles in PNG format. The tile cache parameters are set in the *Tile cache* section of the service settings (see details in section 4.5). The option is enabled by default.
- *Vector cache support (ArcGIS REST API, TMS)*
  Enables support of vector cache as collection of PBF files built by Mapbox Vector Tiles specification provided for transfer of compressed vector data, and JSON files built by Mapbox Style Specification for transfer of information about data design. The tile cache parameters are set in the *Tile cache* section of the service settings (see details in section 4.5). The option is disabled by default.

To enable/disable the operation, check the box near its name.

### *Editing*

This group of operations allows selecting the following options for editing map service:

- *Based on CoGIS SOE rules*
  This option allows using the advanced methods of work with layers and objects of map service in accordance with CoGIS SOE rules set in CoGIS Designer. The option is selected by default.
- *Simplified*
  The use of the advanced CoGIS SOE methods is not provided with this editing option. The available operations are creation, deletion, and editing objects only. To select the required operation, check the appropriate checkbox. Besides, it is possible to specify service layers for which these operation will be available. To do so, enter the numbers of needed layers to the field: 
  
  .
  Additionally you can specify the user groups for which these operations will be available. To do so, select the needed groups in the field:




- *Prohibited*
  This option prohibits editing objects in the map service.

### 4.4.3. Service start

In this section the following rules of starting the service are customized:

- *Redefine service start parameters* - this option allows you to enable the option to delay the start of the service at the first start. This is important when there are a large number of services, and allows you to postpone the launch of secondary services.
- *Redefine service start priority* – this option allows you to define the priority levels of service start: low/regular/high.
- *Redefine service lifetime without requests* – this option allows you to specify the lifetime of service without requests, after which the service stops automatically.
- *Isolate service* – this option allows you to run a separated process for specific service.

## 4.5.Setting tile cache

Support for creation of tile cache can be enabled for each map service.

If tile cache is created, GIS server would be able to output the preliminarily generated map images (tiles) in accordance with the extent specified in the web request. This, in turn, allows you to speed up the map image generation, in case if the default coloring and visibility settings are used in the request and if no filter is applied to layers by the user.

To enable support of raster and/or vector tile cache for map service, go to *Возможности* tab of the service settings window, see details in section Ошибка! Источник ссылки не найден. of the document.

To get to specific settings of the tile cache, open *Tile cache* tab of the service settings window, see Figure 15.

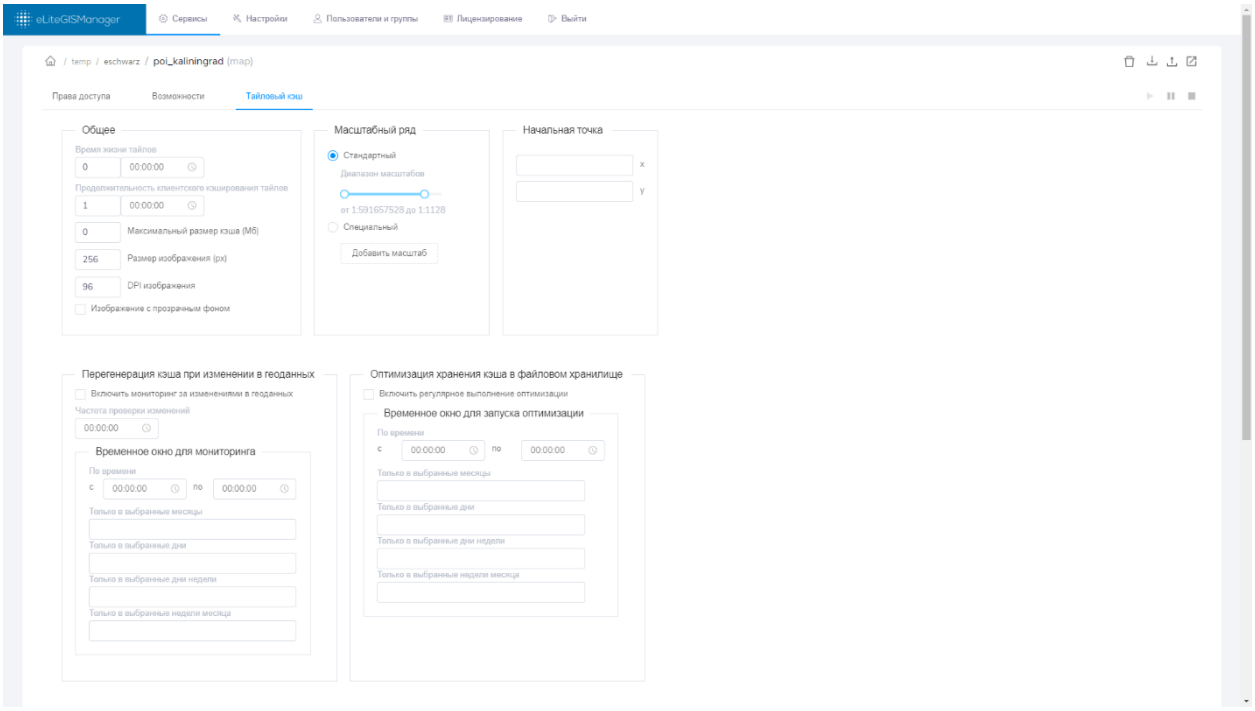



Figure 15 – Setting tile cache

The tile cache settings are grouped as following:

- Common parameters
- Scale range
- Origin point
- Parameters for regenerating cache on changes in geodata
- Parameters for optimizing cache storage in file storage
- Areas of initial interest
- Extent limits.

### 4.5.1. Common parameters

The group is shown on Figure 166.

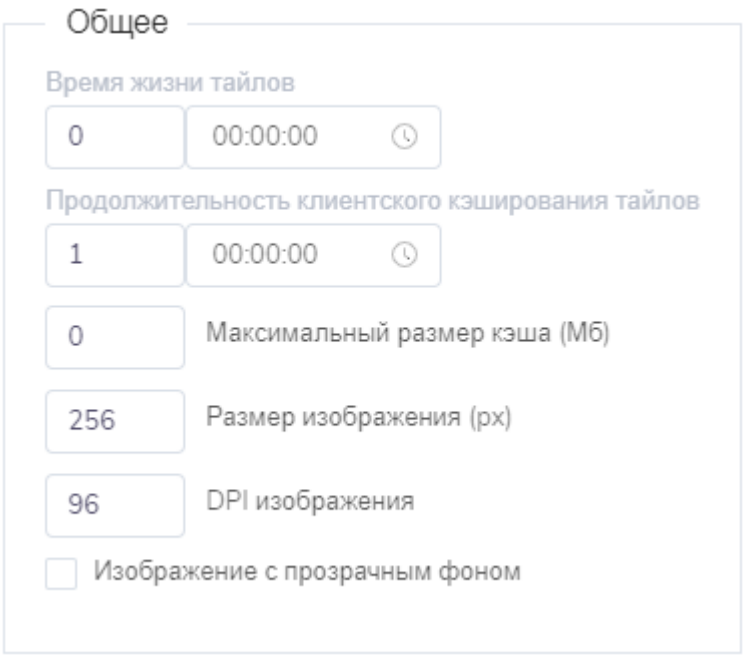
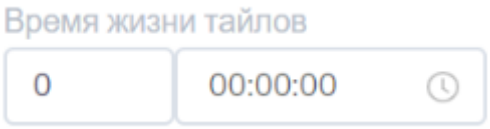
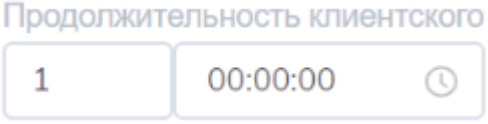
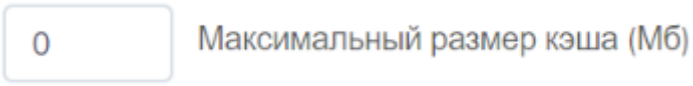
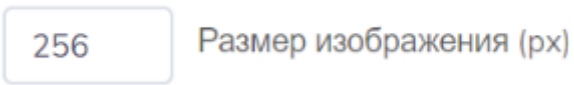
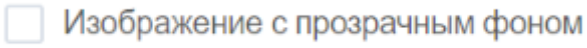



Figure 166 – Group of common tile cache parameters

The group contains the following parameters:

- *Tiles lifetime*
  Enter number of days, hours and minutes in the appropriate fields:
  
  
- *Lifetime of client tiles caching* (the period during which the client will be able to not request the updated tiles from the server, but to use the local cache of the browser instead)
  Enter number of days, hours and minutes in the appropriate fields:
  
  
- *Maximum cache size*
  Enter the cache size in Mb in the appropriate field:
  
  
- *Tile size*
  Enter the tile size in pixels in the appropriate field or use the default value of 256 px:
  
  
- *DPI*
  Enter the image resolution in dpi in the appropriate field or use the default value of 96 dpi:


- *Image with transparent background*
  If you need to use the tiles as non-transparent background for other data uncheck this option:

  If you need that the other data is visible under the tiles, keep this box checked.

### 4.5.2. Scale range parameters

The group is shown on Figure 177.

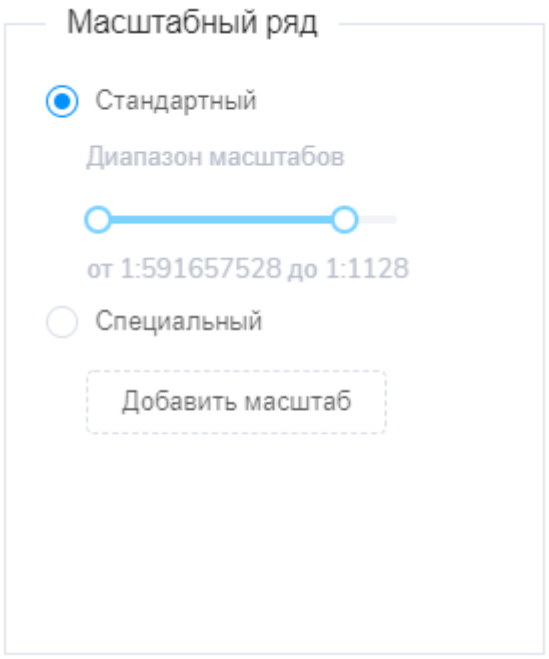
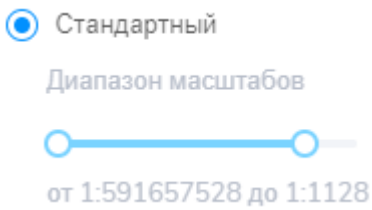



Figure 177 – Group of scale range parameters of tile cache

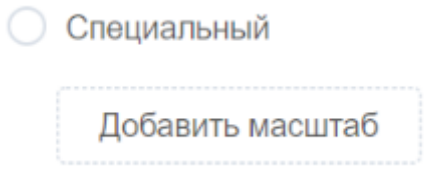
In this group of parameters you can select ether to use the standard scale range for creation of map service tile cache or to set your custom scale range.

To use the standard scale, check the *Standard* option:

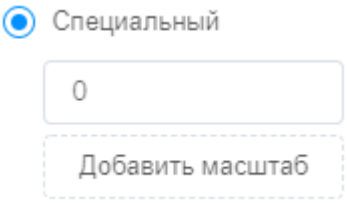



Additionally, with the slider you can specify the needed scale range from the standard scales, for which the tile cache should be generated.

To set your custom scale range, check the *Custom* option:



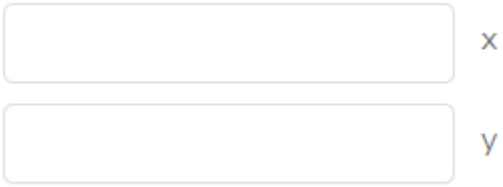

Press *Add scale* button and enter the needed value in the appeared field:




Repeat these steps for each scale.

### 4.5.3. Origin point parameters

In this group of parameters the values for the origin point of tiles creation are specified. Enter the origin X and Y coordinates in the appropriate fields:




The entered values should be in the units of the service coordinate system.

### 4.5.4. Parameters for regenerating cache on changes in geodata

The group is shown on Figure 188.

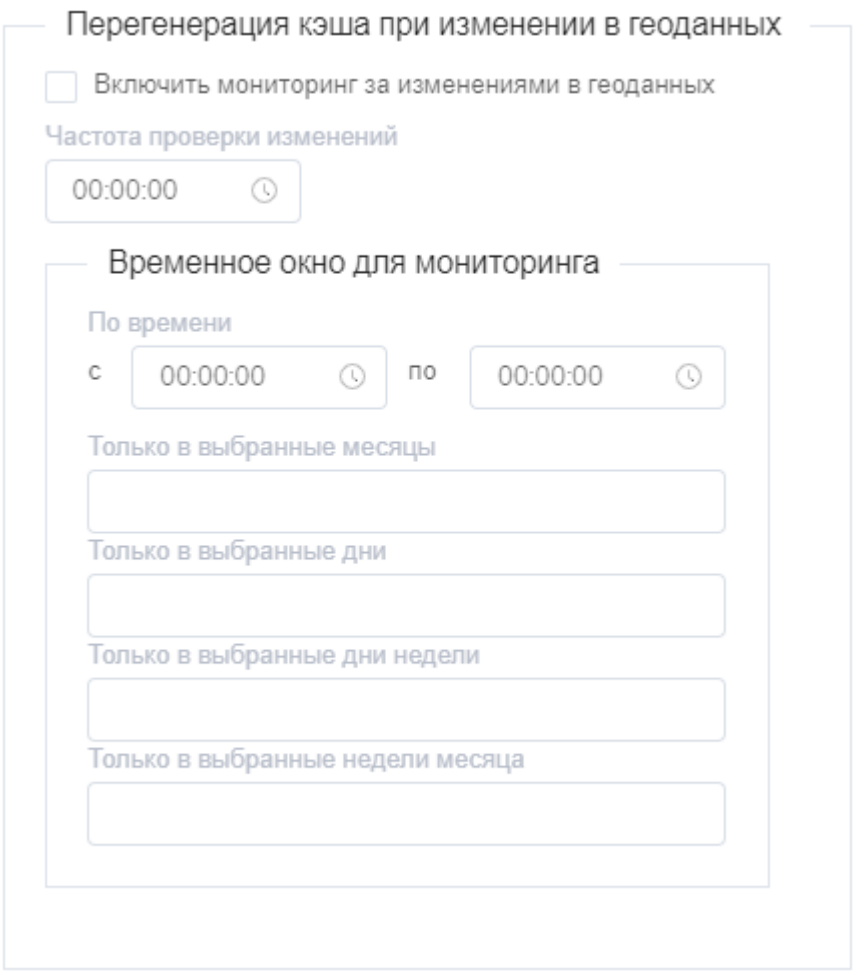
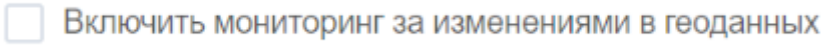


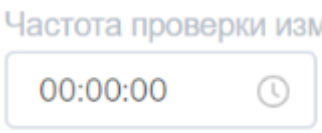

Figure 188 – Group of parameters for regenerating cache on changes in geodata

This group provides settings for monitoring changes made in geodata based on which the cache regeneration is done. To enable the changes monitoring option, check the appropriate field:

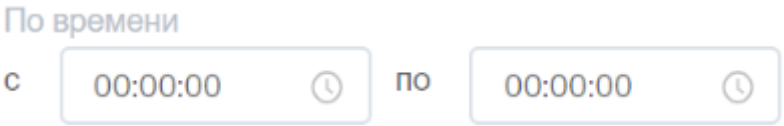



After that, the following monitoring parameters will be available for selection:

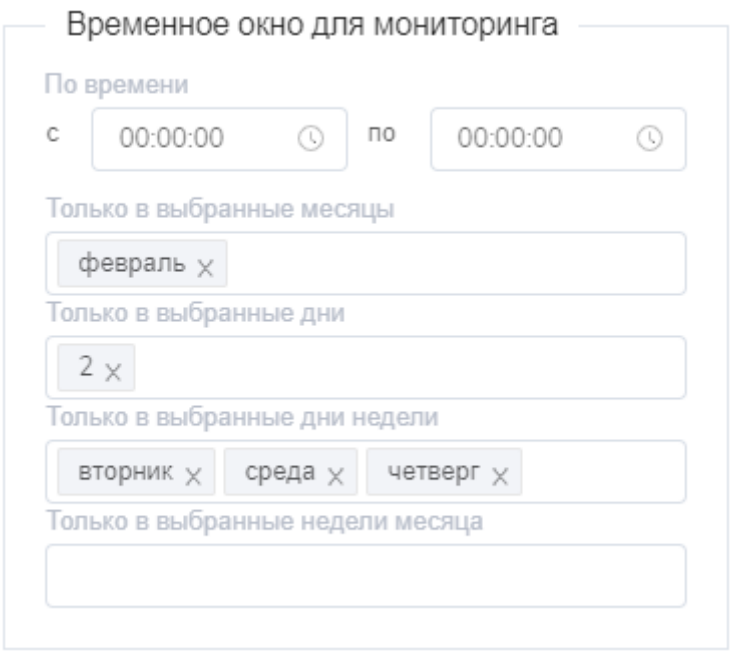
- *Changes check frequency*
  Specify the needed period in the field:

- *Time for monitoring*
  Specify periods during which you need to check for updates in your geodata. That is, you can enter the time in the appropriate fields:

  Additionally, you can enter specific months, days or weeks of the month:




### 4.5.5. Parameters for optimizing cache storage in file storage

The group is shown on Figure 19.

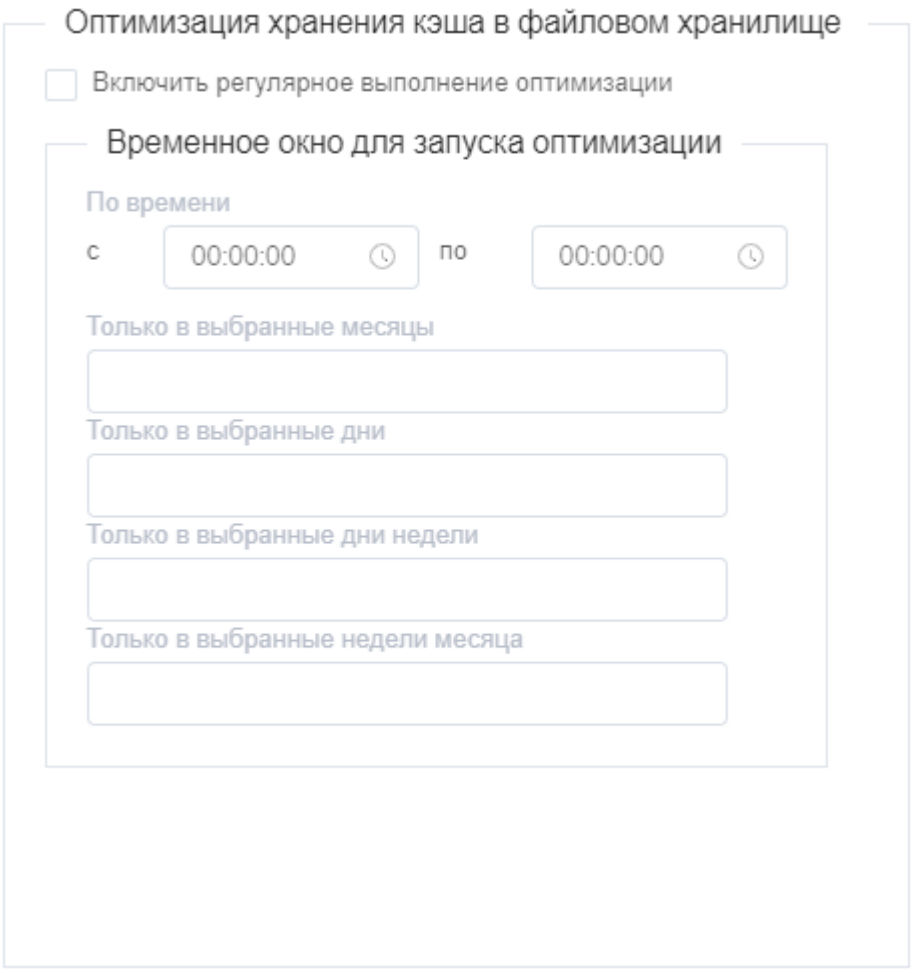
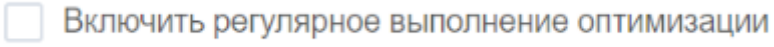


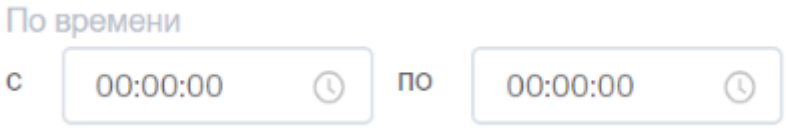

Figure 19 – Group of parameters for optimizing cache storage in file storage

This group contains settings to optimize cache storage in file storage.

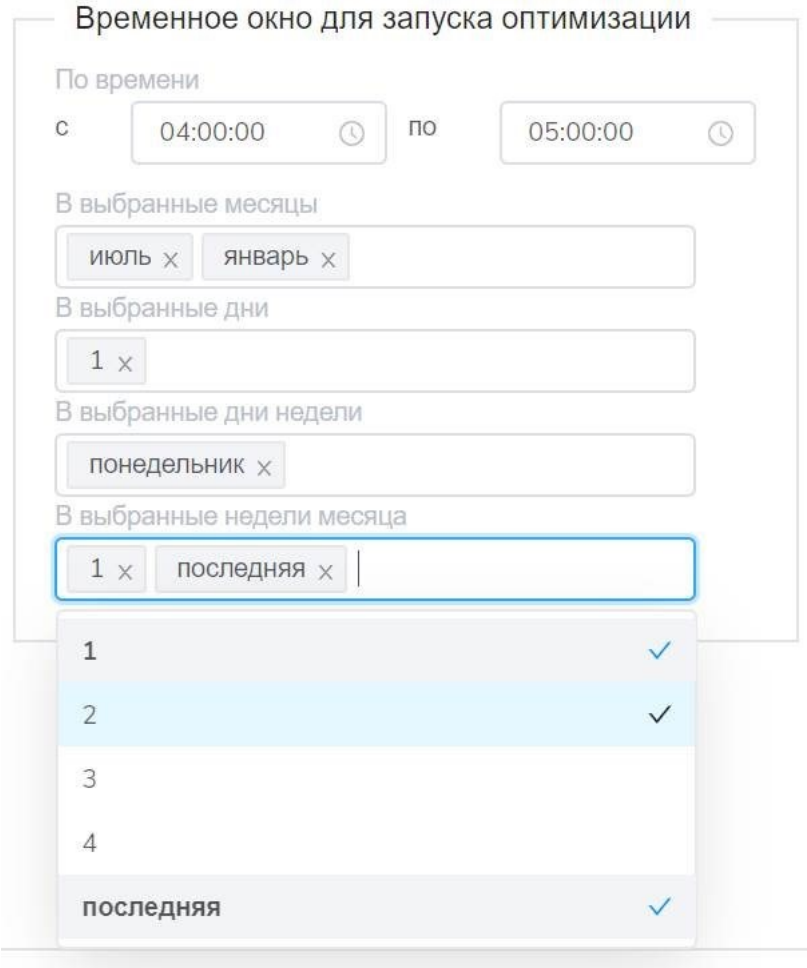
To enable regular optimization (to free the unused diskspace), check the box near the appropriate option:




After that, the optimization parameters will be available for selection. That is, you can specify the cache storage optimization period:




Additionally, for this period you can enter specific months, days or weeks of the month:




### 4.5.6. Areas of initial interest

The group is shown on Figure 200.

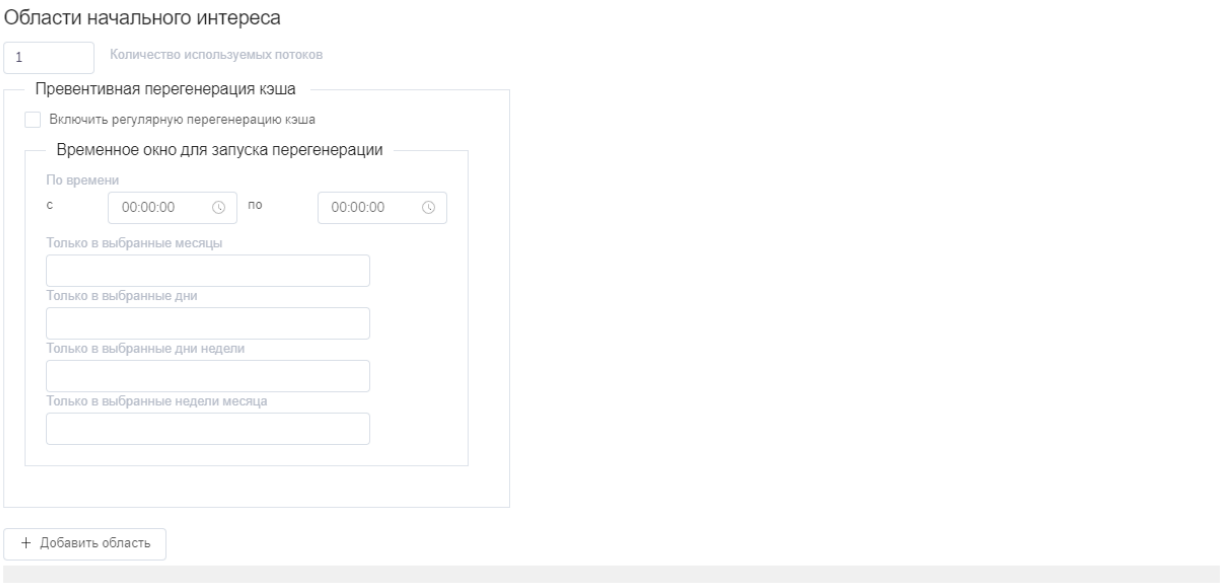
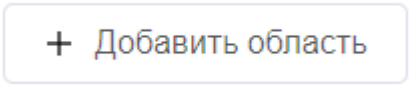



Figure 20 – Setting areas of initial interest

For the tile map service, you can specify one or more areas of initial interest for which the tile cache will be pre-generated.

To do so, press 

and specify the area parameters in the appeared window:

- Extent limitation;
- Coordinate system;
- Scale limitation, see Figure 211.

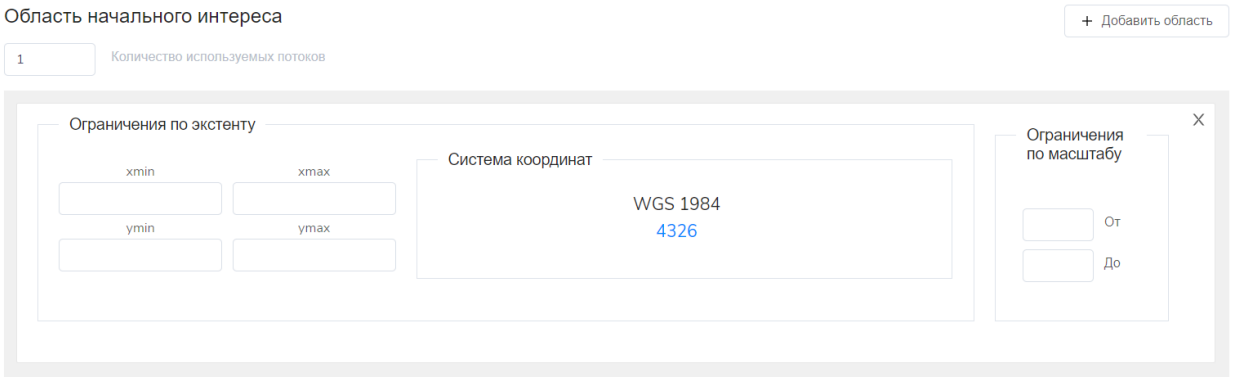
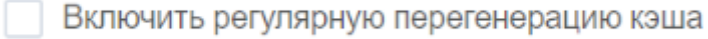



Figure 211 – Setting preliminary generation of tiles

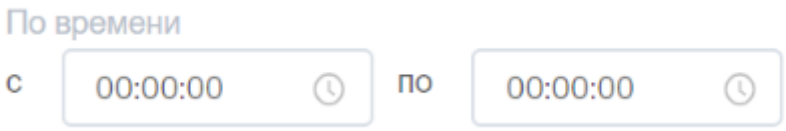
If the requested tile has not been generated before, it will be generated on the fly.

Additionally, for areas of interest, you can enable regular regeneration of the tile cache. To do so, check the appropriate box:

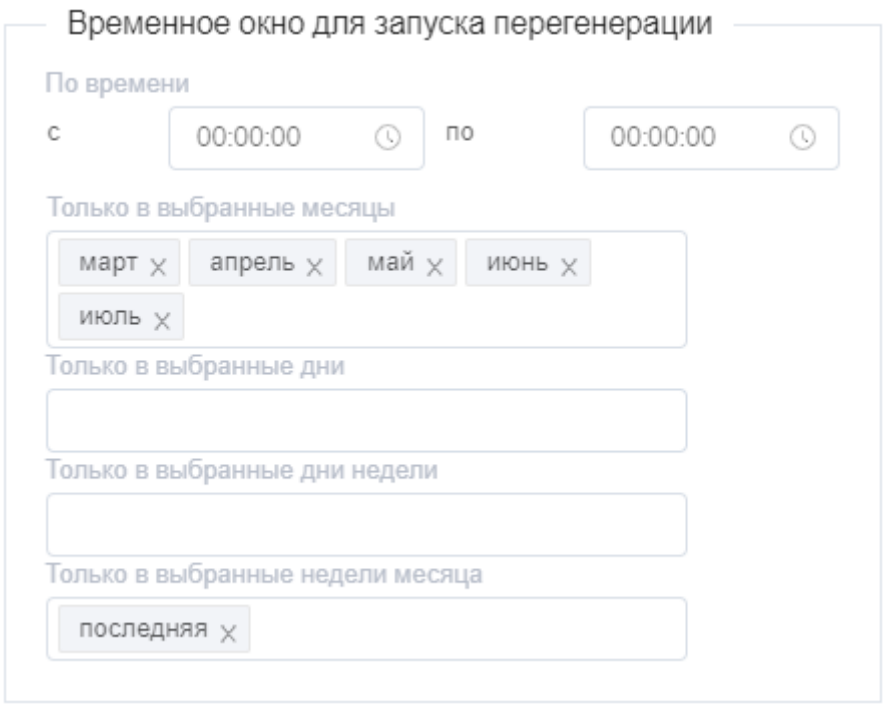


After that, the parameters of the temporary window will become available for setting regeneration start (regular rebuilding) of the tile cache.

In particular, in the corresponding input fields, you can specify the time range:




Additionally, you can specify specific months, days of the month, days of the week, or weeks of the month during which you can run regeneration. To do so, specify specific values in the corresponding input fields:




Possible values for months: January, February, March, April, May, June, July, August, September, October, November, December.

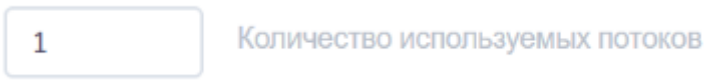
Possible values for days in a month: from 1 to 31. In this case, if there are less than 31 days in a month, then if the value 31 (or 30 and 29 for some months) is specified, the last day of the month is considered to be selected.

Possible values for days of the week: Monday, Tuesday, Wednesday, Thursday, Friday, Saturday, Sunday.

Possible values for weeks of the month: 1, 2, 3, 4, last.

In addition, you can limit the number of threads used for the cache regeneration task. The number of threads used is the maximum number of parallel runs of the caching task.

By default, the corresponding input field contains the value 1:



In order for there to be no restrictions on the number of parallel launches, specify the value 0.

# 5. Publishing geocode services

## 5.1. General information

GIS server eLiteGIS allows generating geocode service by map service. Generally, the geocode service in eLiteGIS can be used not only with address data for comparison of addresses and coordinates, but also with any other data as the general service for searching objects by free text.

Before publishing the geocode service, make sure that the source data is set appropriately:

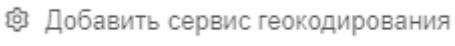
- The layers and the fields in these layers by which the search should be done, are specified in the database;
- For layers that should be searched for using multiple fields, the join fields' values operation is done;
- The index for selected fields is built;
- The map project from the selected layers is created;
- The display field matching with the fields by which the search should be done, is specified in the layers properties of the map project.

To publish the address geocoder, it is required that the layers with buildings and streets are present in the map project based on which the geocode service would be built.

See more details in 'Creating map projects in QGIS' manual.

## 5.2. Creating new geocode service

To add the new geocode service, go to the required catalog folder.

Now press  button located in the upper left part of the catalog window and select 

in the appeared drop down menu.

In the appeared window enter the service name and access rights, see Figure 22.

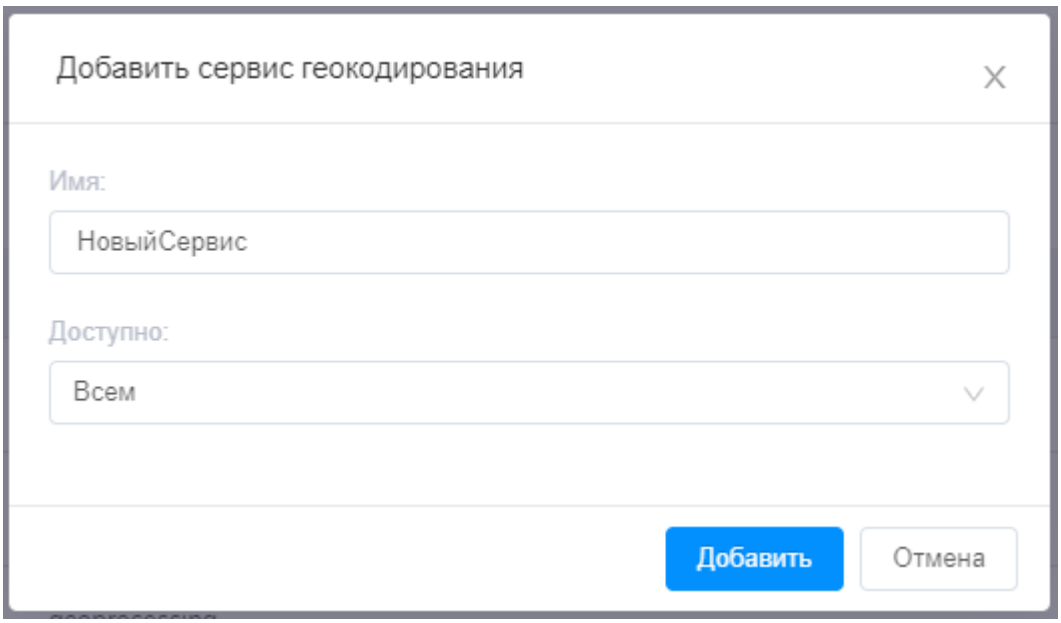



Figure 22 – Adding new geocode service

Selecting one of the provided options to set the service access rights:

- For all;
- For authorized;
- For selected users;
- For selected user groups;
- No web access.

Press Добавить and the service properties settings window will be automatically opened, see Figure 23.

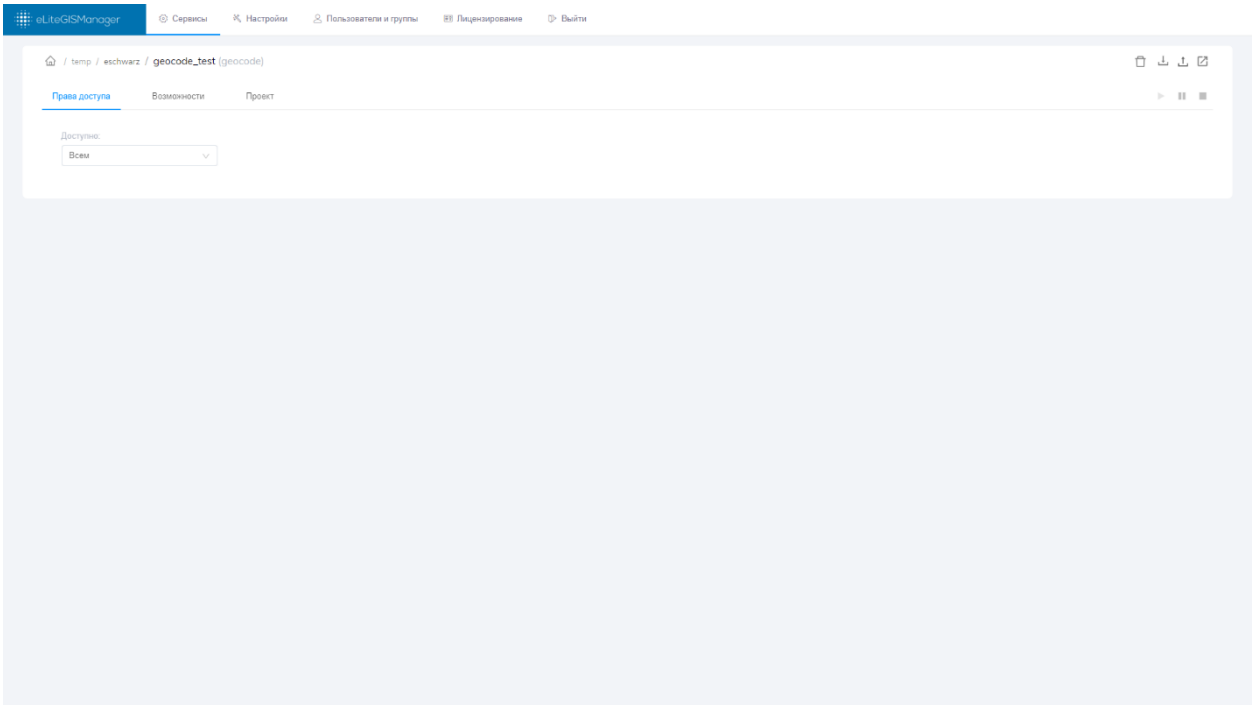


Figure 23 – Geocode service properties settings window

## 5.3.Setting service access rights

To proceed with the geocode service setting, press its name in the services list. The service settings window will appear, where *Access rights* section will be opened by default, see Figure 24.

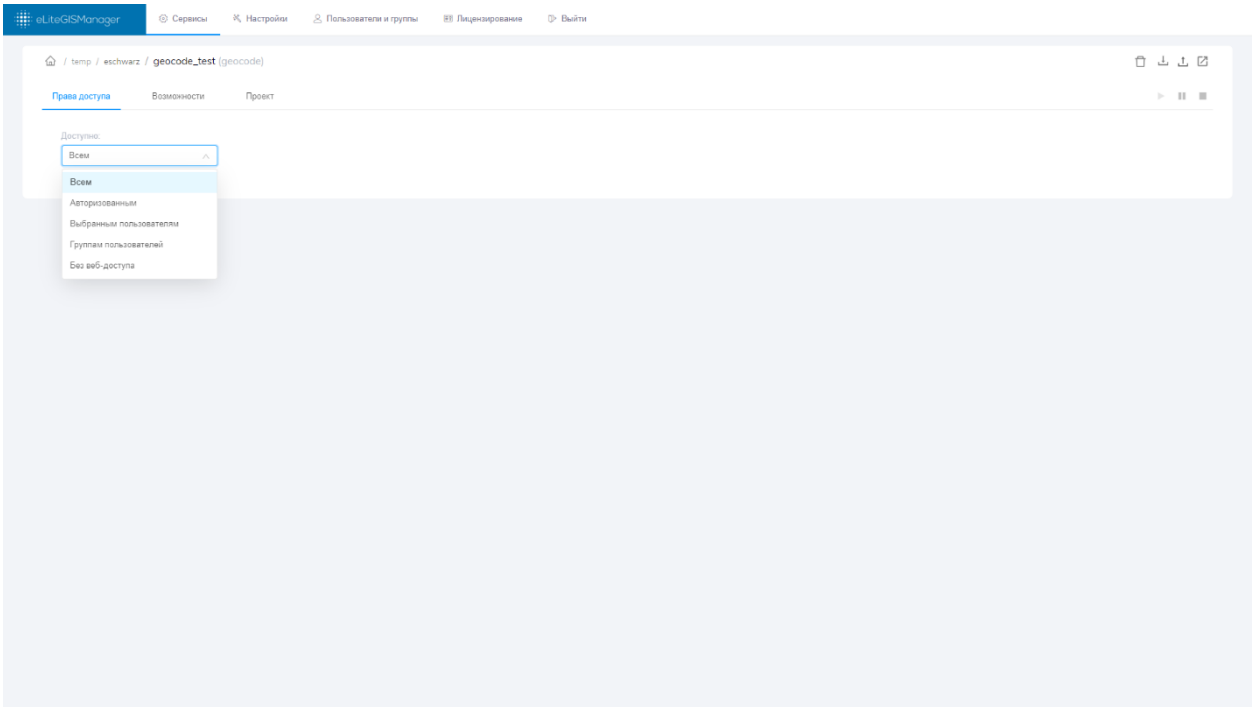



Figure 24 – Setting access rights for geocode service

By default the access to published service will be allowed for all users, but you can change this setting selecting one of the provided options:

- For all;
- For authorized;
- For selected users;
- For selected user groups;
- No web access.

## 5.4.Setting permitted operations for geocode service

To get to setting of the geocode service options, select its name in the services list. In the appeared window go to the *Permitted operations* tab, see Figure 25.

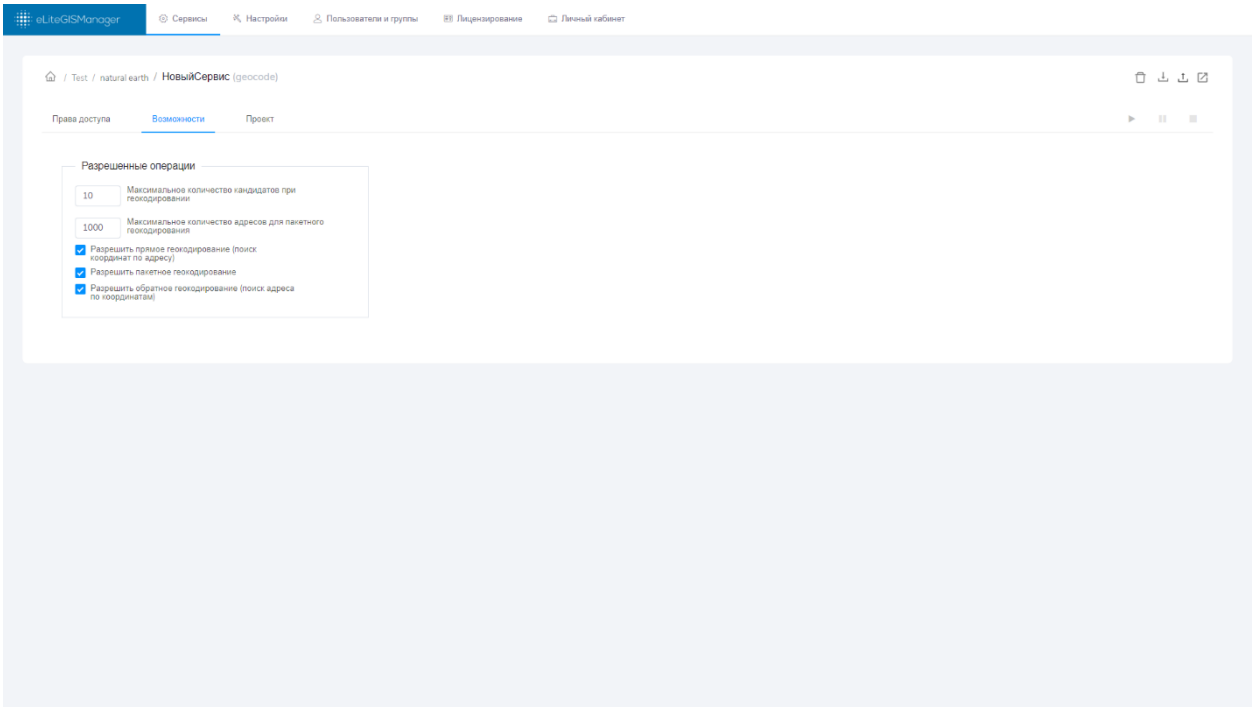



Figure 25 – Setting permitted operations for selected geocode service

eLiteGIS supports the following operations for geocode services:

- Allow direct geocoding (find coordinates by address);
- Allow batch geocoding;
- Allow reverse geocoding (search for address by coordinates).

In eLiteGIS you can also specify:

- Maximum geocoding candidates, the default value is 10;
- Maximum number of addresses for batch geocoding, the default value is 1000.

## 5.5.Selecting map project

To select map project based on which the geocode service will be published, select its name in the list. In the appeared service settings window go to the *Project* tab, see Figure 25.

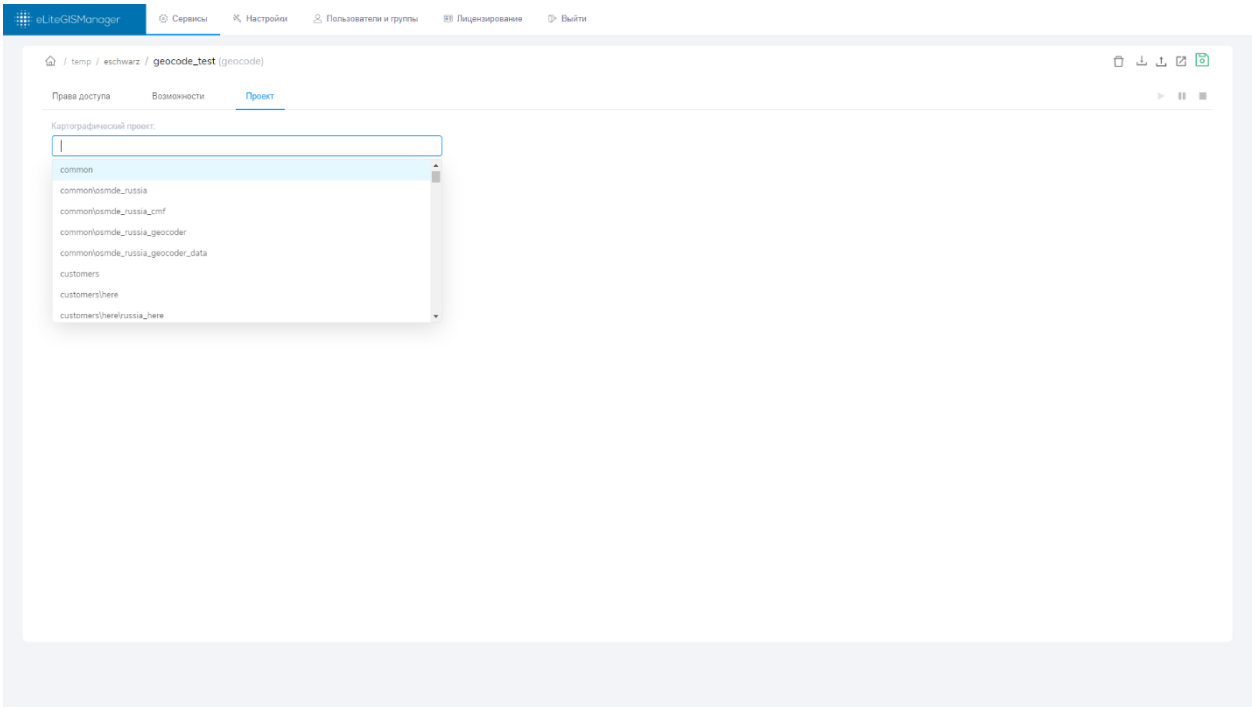



Figure 26 – Selecting map project for geocode service

In the appeared drop down list select the map project based on which the service will be published. The list contains map projects that have been loaded to eLiteGIS.

# 6. Publishing geocode services

## 6.1. General information

GIS server allows publishing geoprocessing services based on one or multiple geoprocessing models. Geoprocessing model is a visual representation of a workflow in which several geoprocessing tools are run in sequence. As the geoprocessing tool you can also use any other service model.

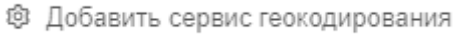
Geoprocessing tools can use maps and layers as input parameters. The full list of input parameters (variables) for geoprocessing models is as following:

- Integer
- Double
- Yes/No (Boolean)
- String
- Date and time
- File
- Geometry
- Coordinate system
- SQL expression
- Workspace
- Dataset (table)
- Layer (standalone table)
- Feature class
- Feature layer
- Map
- Image service
- Tile service
- Map service (dynamic service).

The ready-to-use tools that can be added to the geoprocessing model are listed in the Appendix A below.

## 6.2. Creating new geoprocessing service

To add the new geoprocessing service, go to the required catalog folder. Now press  button located in the upper left part of the catalog window and select




in the appeared drop down menu, see Figure 27.

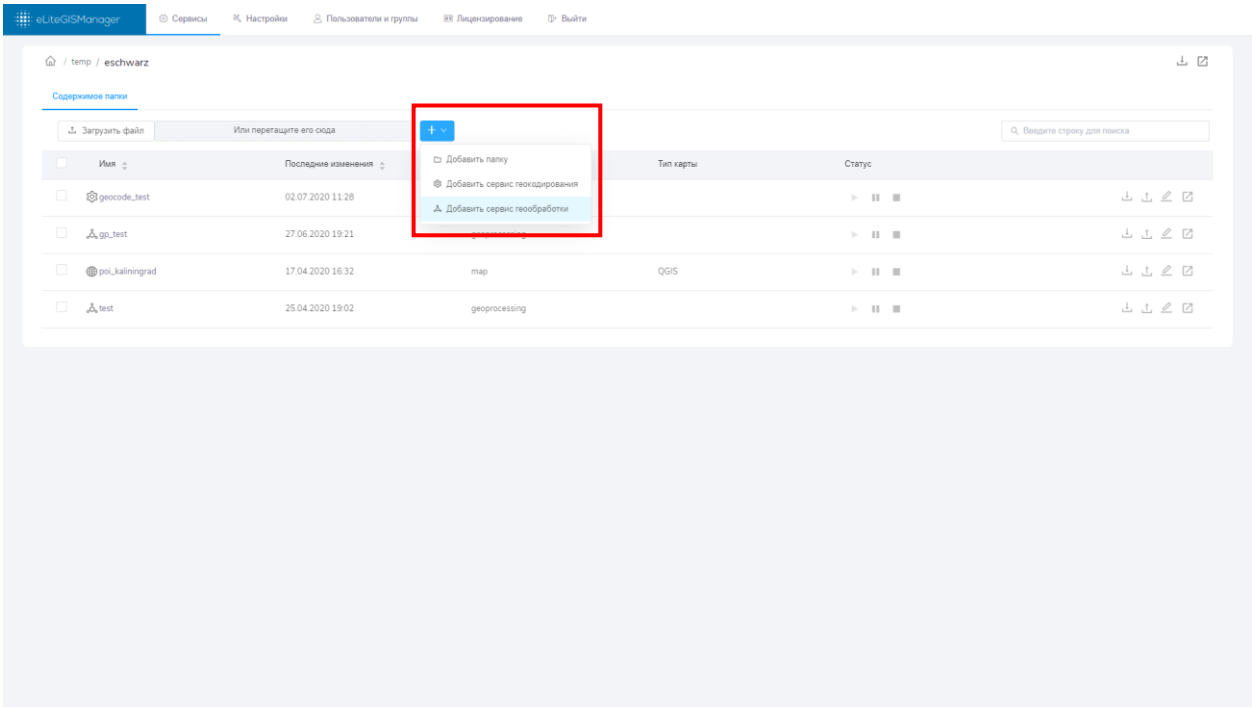



Figure 27 – Button for adding geoprocessing service

In the appeared window enter the service name and access rights, see Figure 28.

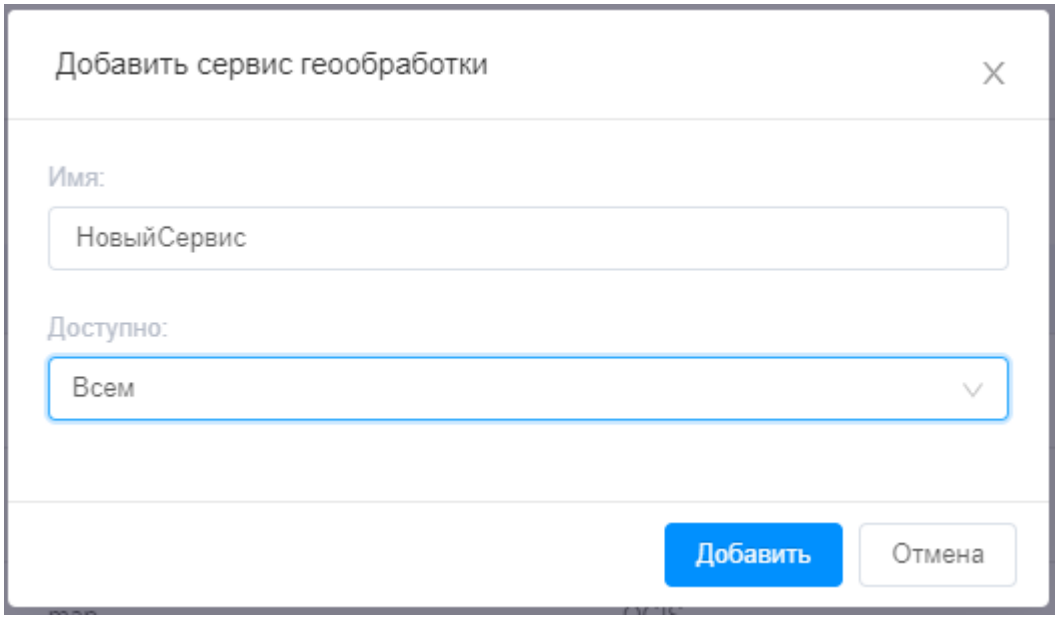



Figure 28 – Adding new geoprocessing service

You can select one of the provided access rights options:

- For all;
- For authorized;
- For selected users;
- For selected user groups;
- No web access.

## 6.3.Setting service access rights

To proceed with the geoprocessing service setting, press its name in the services list. The service settings window will appear, where *Access rights* section will be opened by default, see Figure 24.

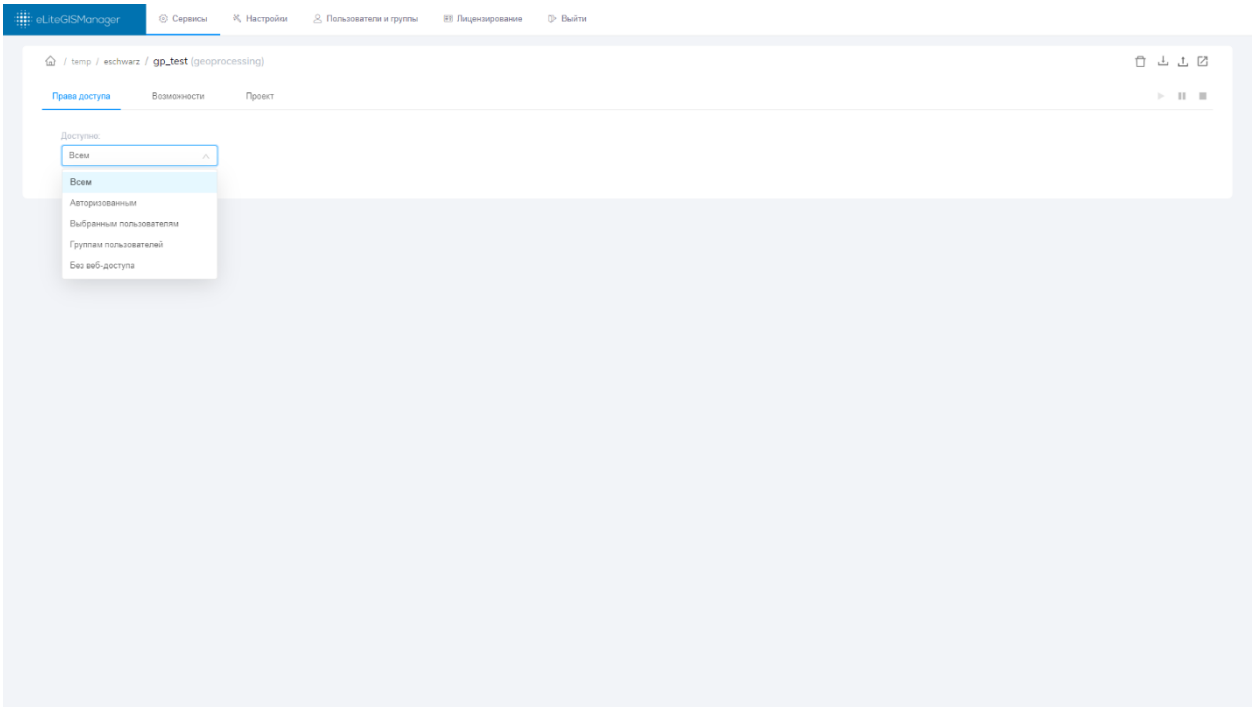



Figure 29 – Setting access rights for geoprocessing service

By default the access to published service will be allowed for all users, but you can change this setting selecting one of the provided options:

- For all;
- For authorized;
- For selected users;
- For selected user groups;
- No web access.

## 6.4.Setting permitted operations for geoprocessing service

To get to setting of the geoprocessing service options, select its name in the services list. In the appeared window go to the *Permitted operations* tab, see Figure 30.

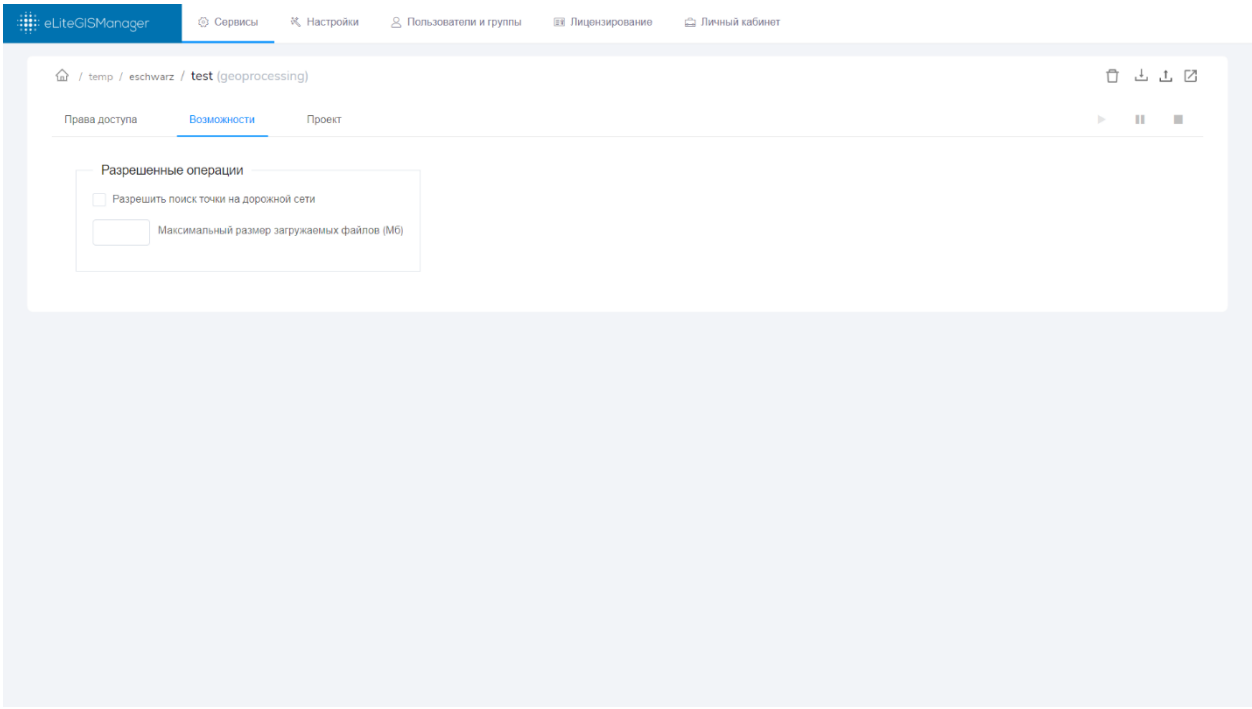
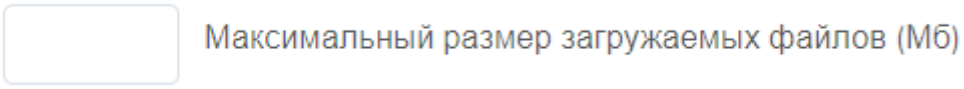



Figure 30 – Setting permitted operations for selected geoprocessing service

In this tab you can specify maximum size for files used as input variables for geoprocessing tools. To do so, enter the needed value in Mb in

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## 6.5.Setting geoprocessing models

Geoprocessing service can consist of one or multiple geoprocessing models. To get to setting of the geoprocessing models, select the required service name in the list. In the appeared service settings window go to the *Project* tab, see Figure 30.

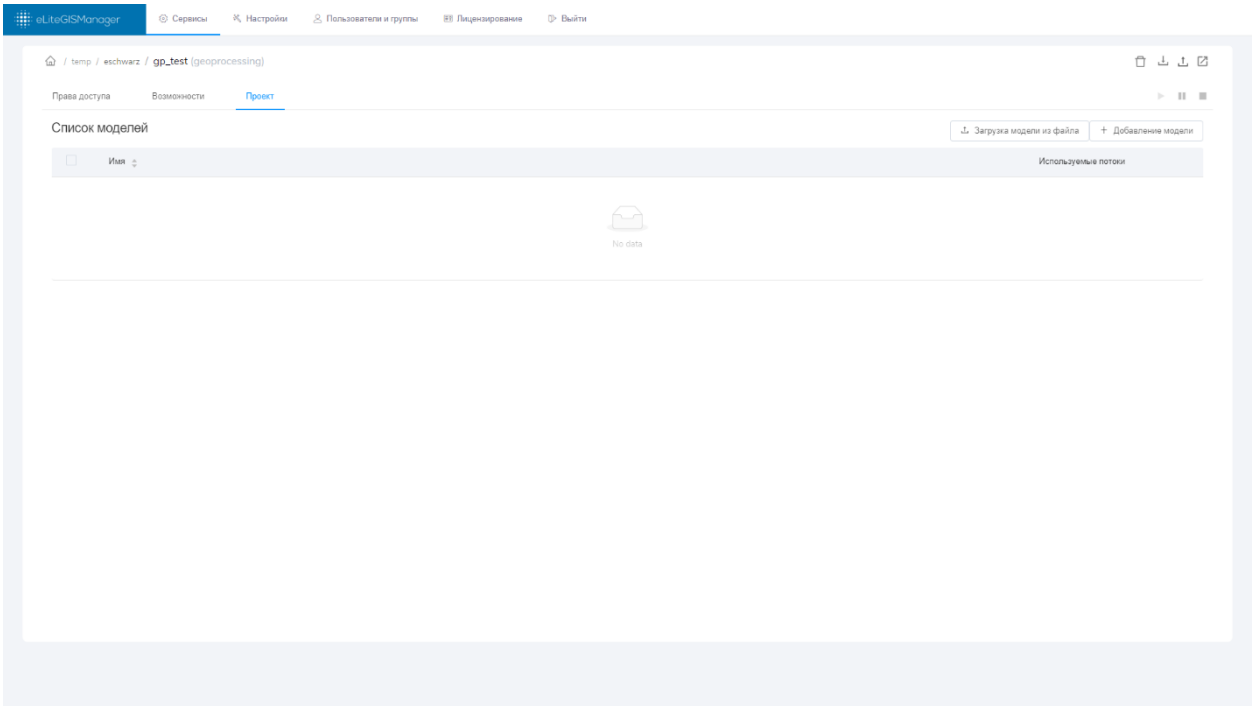



Figure 31 – Project tab of the geoprocessing service

The tab contains the list of models included to the service, see Figure 32.

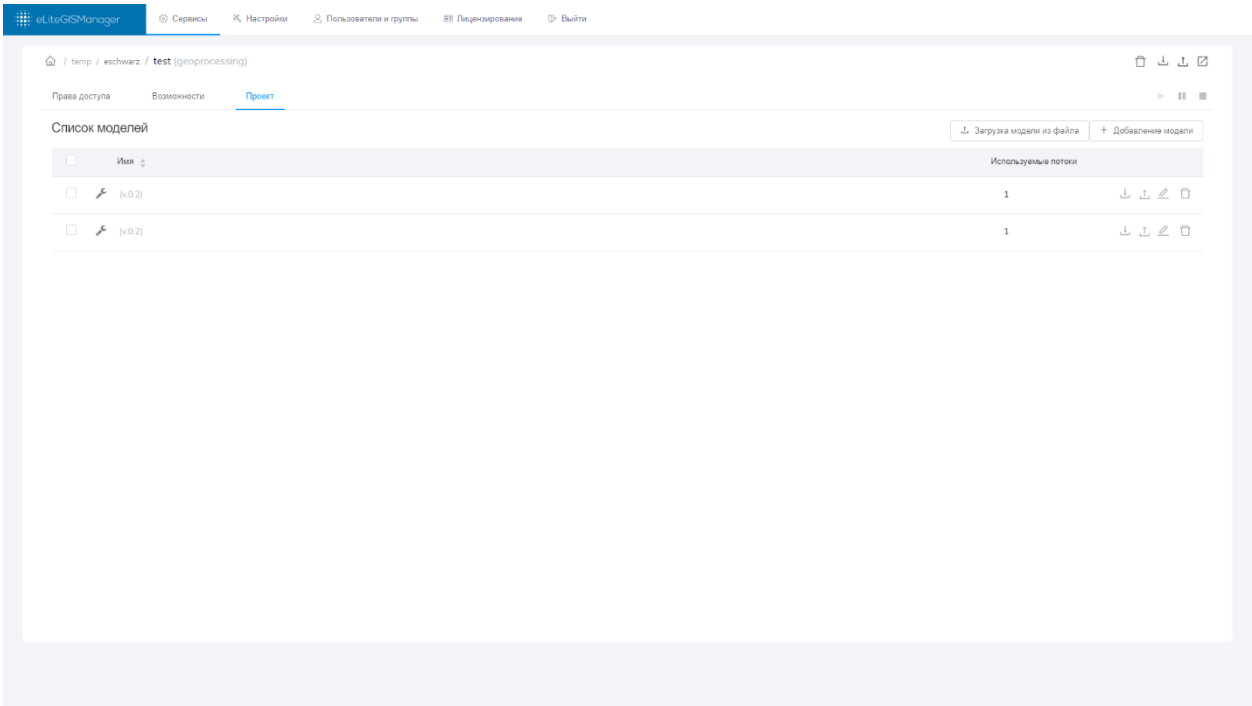



Figure 32 – List of geoprocessing service models

### 6.5.1. Viewing list of models

The list of available geoprocessing service models is shown as a table containing the following data about each model:

- Name
- Number of user threads.

The models in the table can be sorted by name. The recently added models locate on the top of the list by default.

### 6.5.2. Saving model to file

On the right of the model name there is a toolbar  .

To save your model to file, press  . The standard system dialog for saving JSON file with the model description will appear.

### 6.5.3. Updating model from file

To update the model based on JSON file, press  button located on the toolbar on the right of the model name  . The standard system dialog for selecting JSON file with the model description will appear.

### 6.5.4. Editing model parameters

To edit information about the model (but not the model itself), press  button located on the toolbar on the right of the model name  . The dialog with the model parameters will appear, see Figure 33.

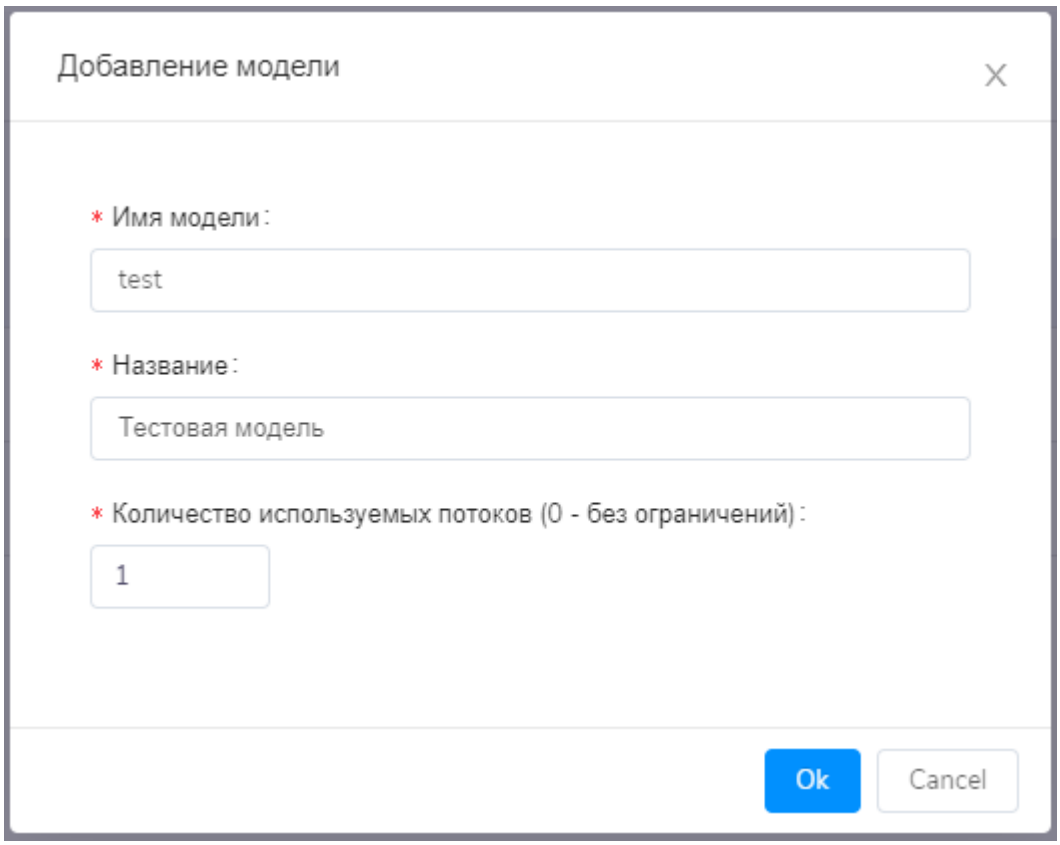


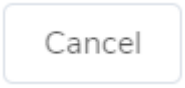

Figure 33 – Editing model parameters

The model parameters are as following:

- *Name* – system name that will be used in URL to access the model;
- *Alias* – model name displayed to the user;
- *Number of used threads (0 - no limit)* – maximum number of parallel runnings of one model. The default number is 1. If you need to set no limitations for running your model, enter 0.

To make edits in the model parameters, use the text fields near the parameter names.

Mandatory fields are marked with * . To save made changes, press 

. To cancel changes, press 

or close the model parameters window.

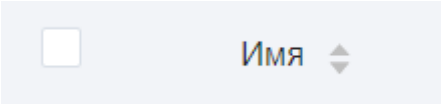
### 6.5.5. Deleting selected model

To delete the model, press  button located on the toolbar on the right of the model name 
.

### 6.5.6. Deleting, copying, and cutting multiple models

To delete, copy or cut (delete with saving to clipboard) the model, select it in the list of modes checking the box on the left of the needed name 
.

You can select multiple models if needed, subsequentially checking the appropriate checkboxes. Or, you can select all models of the service, checking the box on the left of the models list title:



.

After you select at least one model in the list, the buttons of additional tools for work with the models will appear on top of the list:

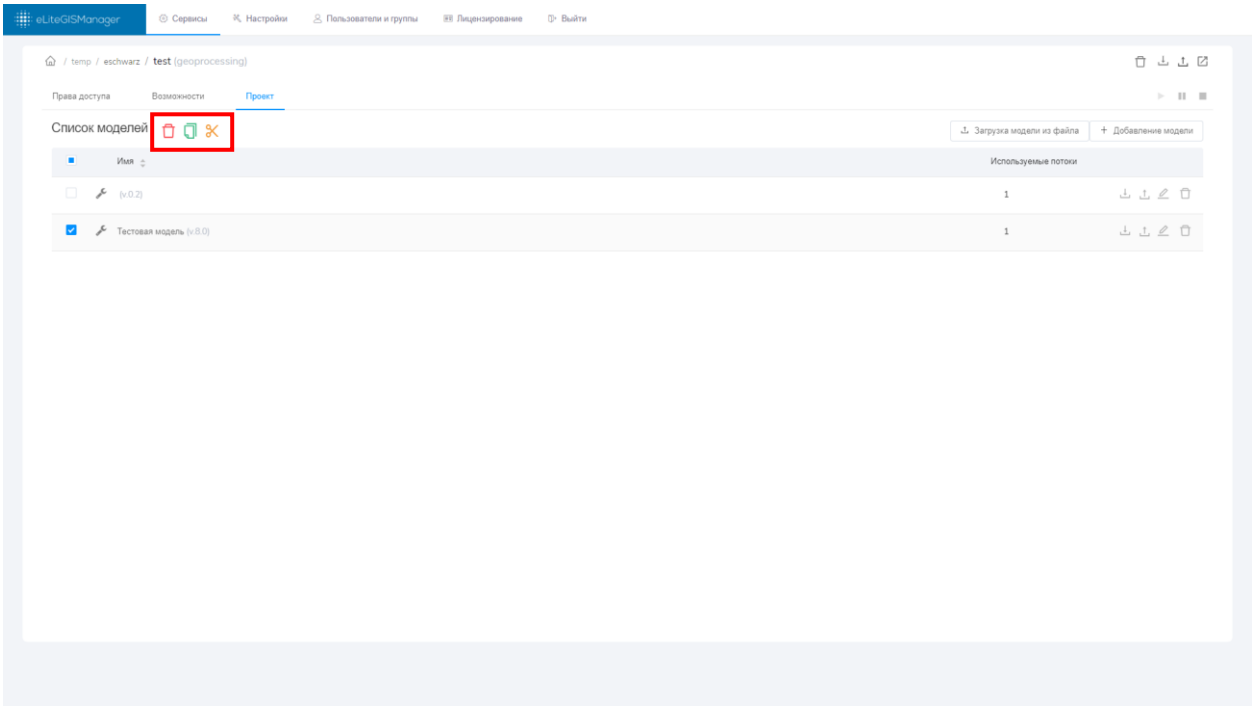



Figure 34 – Additional tools for work with selected model

To delete model, press  and confirm deletion in the pop-up window.

To copy model, press  . The model will be copied to clipboard and the additional button  provided to paste the copied model to the models list of the current or other service will appear near the deletion and copying buttons. This button will be available while you navigate on the services catalog.

To cut model (to delete with saving to clipboard), press  . The model will be deleted but saved to clipboard and the additional button  provided to paste the copied model to the models list of the current or other service will appear near the deletion and copying buttons. This button will be available while you navigate on the services catalog.

### 6.5.7. Uploading model from file

If you want to add geoprocessing model to service from file, press


, see Figure 35.

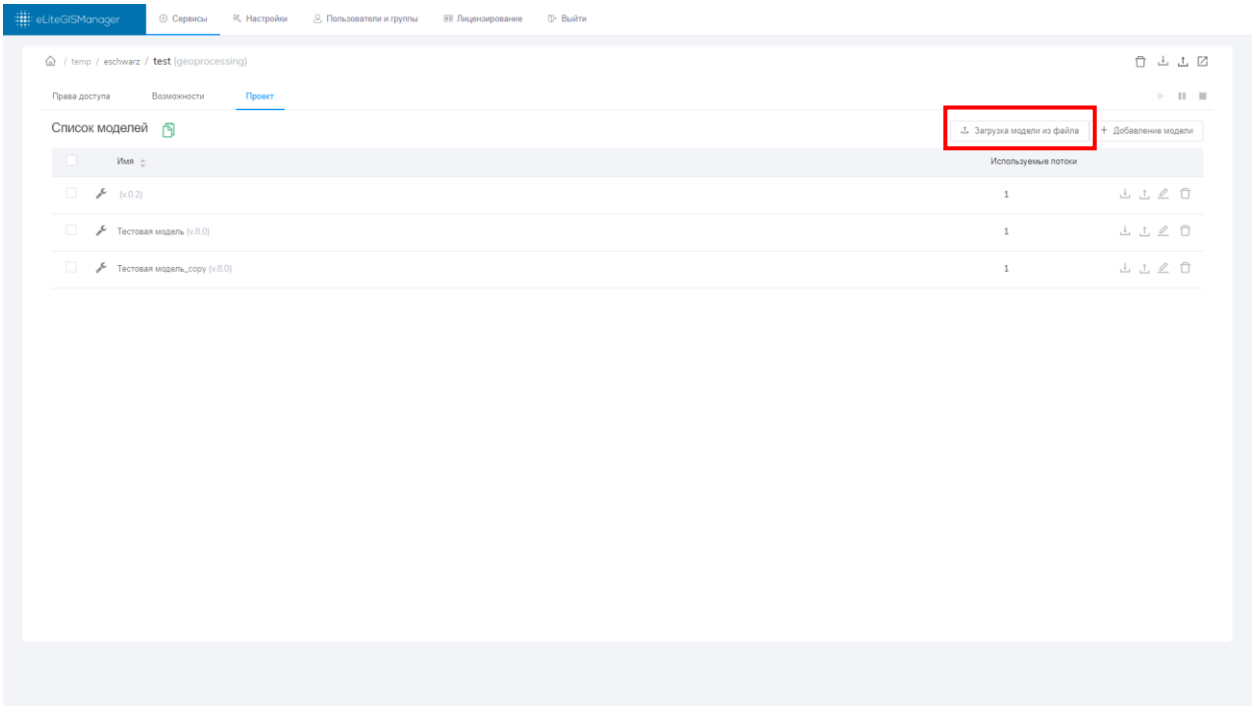
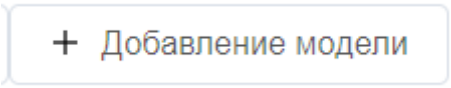



Figure 35 – Button for uploading model from file

The standard system dialog for selecting JSON files with the models description will appear. After selection of the needed files, the appropriate models will be added to the list.

### 6.5.8. Adding model

To add the new model that will be further customized in model designer, press




button located in the right part of the *Project* section, see Figure 36.

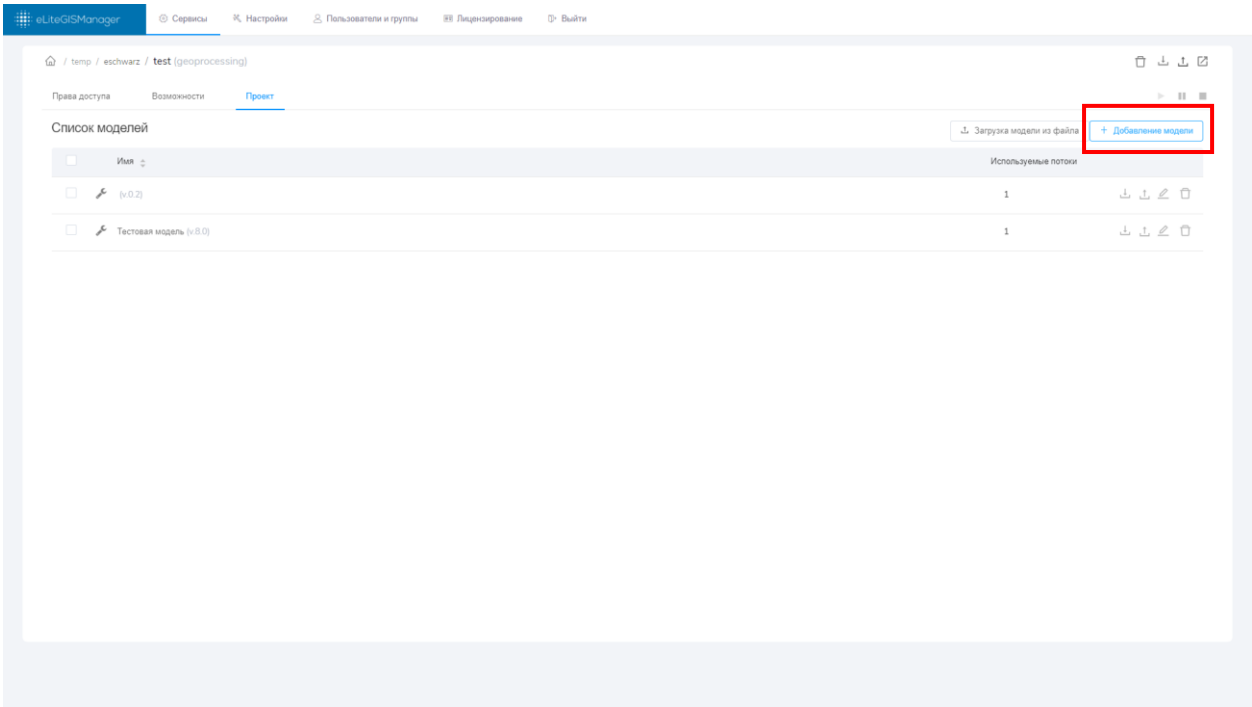



Figure 36 – Button for adding model for its further customization via model designer

The window to enter the model properties will appear, see Figure 37.

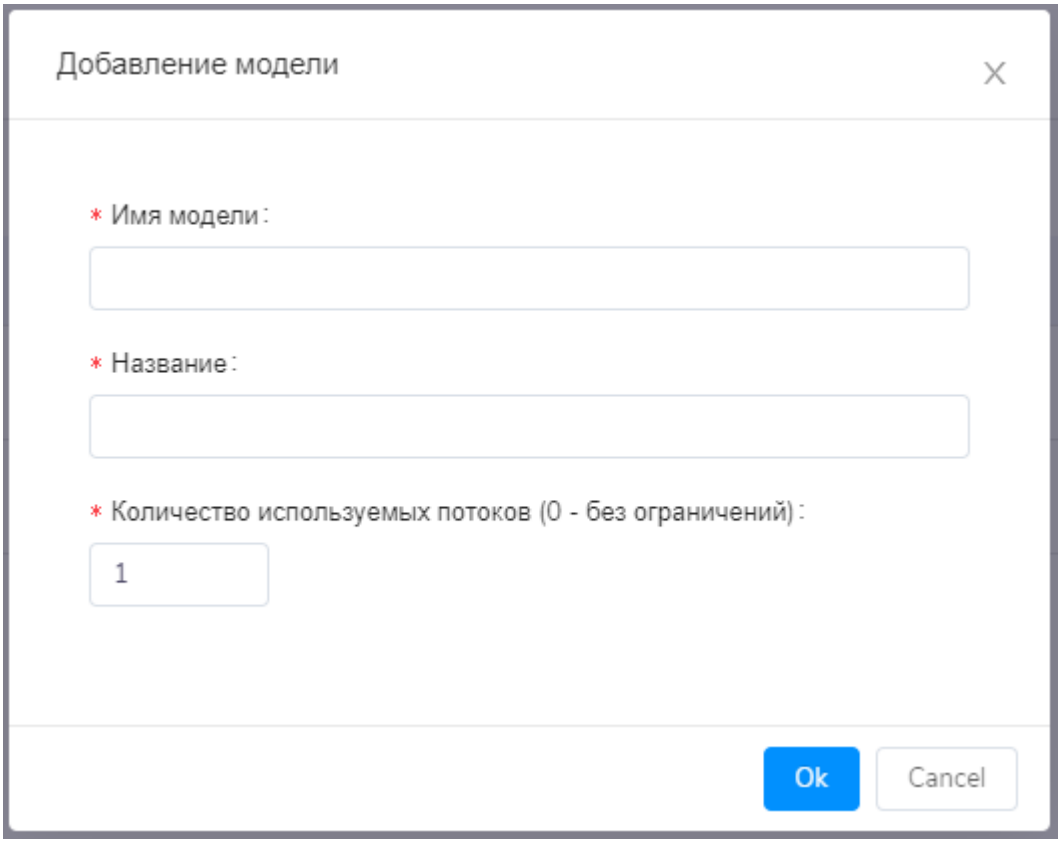



Figure 37 – Model properties window

The list of properties available during editing of the existent model (see section 6.5.4) and by adding of the new model is the same. Mandatory fields are marked with * .

To save changes, press Ok . To cancel changes, press Cancel or close the model properties window.

### 6.5.9. Customizing model in model designer

Customization of geoprocessing models (adding and deleting variables and tools, setting their parameters, connecting variables and tools) is done in a specific graphic editor, model designer.

#### 6.5.9.1. General elements of model designer

To start customizing the model using model designer, press the model name in the list. The model designer window will appear. For the newly created (empty) models the model designer window will look as shown on Figure 38.


Figure 38 – Model designer window for empty model

For models that include some tools and variables, the model designer window will look as shown on Figure 39.

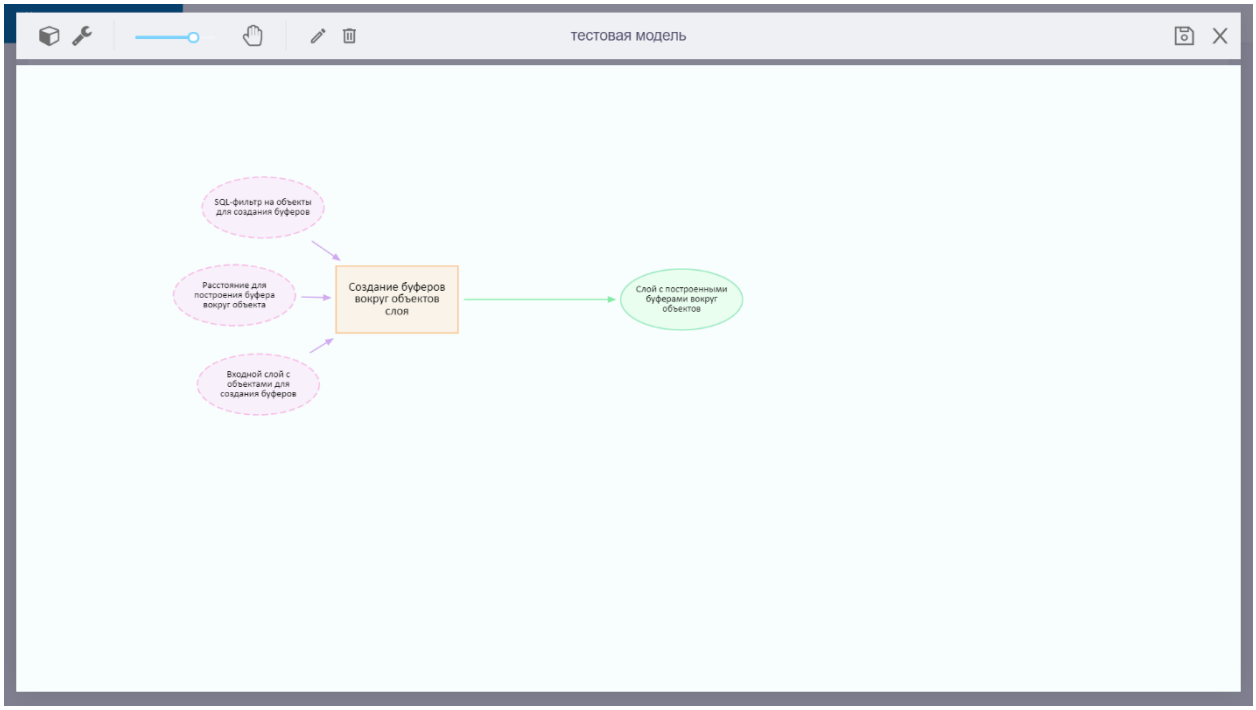



Figure 39 – Model designer window for working model

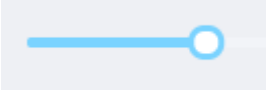
The model designer window consists of two parts:

- *Toolbar*
- *Workspace*

*The toolbar* provides general tools for work with models. The model name is displayed in the center of the toolbar. The tools are as following:

 – adding new variable (see details in section 6.5.9.2);

 – adding new tool (see details in section 6.5.9.3);

 – zooming workspace scale: to zoom in/out the workspace, pull the scale slider accordingly, or press ALT +/- on the keyboard;

 – panning workspace: press and hold this button to pan the workspace or use the arrows on your keyboard; the tool can be also enabled/disabled by pressing ALT/P on the keyboard;

 – enabling editing mode for variable or tool; this button appears only when one of the tools or variables is selected in the workspace (see more details in sections 6.5.9.4 and 6.5.9.5);

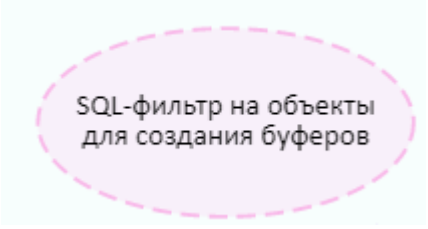
 – deleting selected variable or tool; this button appears only when one of the tools or variables is selected in the workspace; or you can press ALT/Del on the keyboard (see more details in section 6.5.9.7);

 – saving made changes; this button appears when changes made with the model have not been saved;

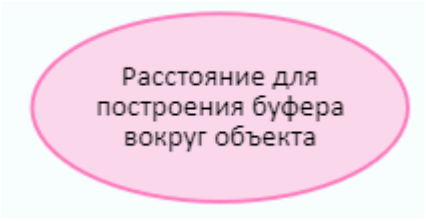
 – closing model designer window.

*The model's workspace* is provided to display the model image, i.e. this is the place where tools, variables and connections between them are shown.

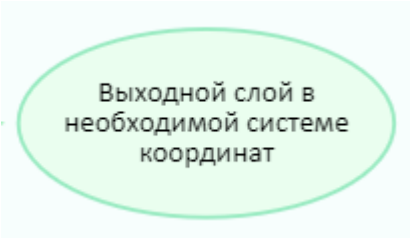
The following symbology is used to show model's elements:



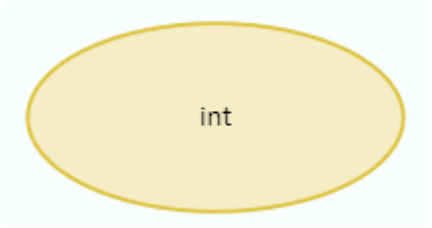

– Purple oval outlined with dashed line is used to show input variables for which no values are set.



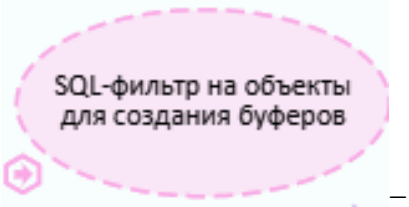
– Purple oval outlined with solid line is used to show input variables for which specific values are set.



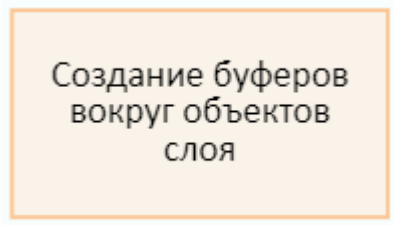
– Green oval outlined with solid line is used to show input variables.



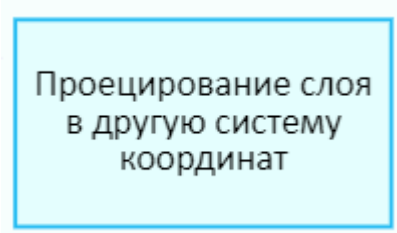
– Yellow oval outlined with solid line is used to show variables not related with any tool.



– Icon  is used to show variables that are public parameters.



– Yellow rectangle outlined with solid line is used to show tools.



– Blue color is used to mark currently selected tools or variables.


– Purple arrows are used to mark data threads from the input variables to the tool.


– Green arrows are used to mark data threads from the tools to the output variables.

#### 6.5.9.2. Adding variable

To add the new variable to model, press  button on the toolbar or press ALT and V on the keyboard. After that, the mouse cursor will look as following:



Left click on the place of the workspace where you want to locate your variable. The dialog for the new variable creation will appear, see Figure 40.

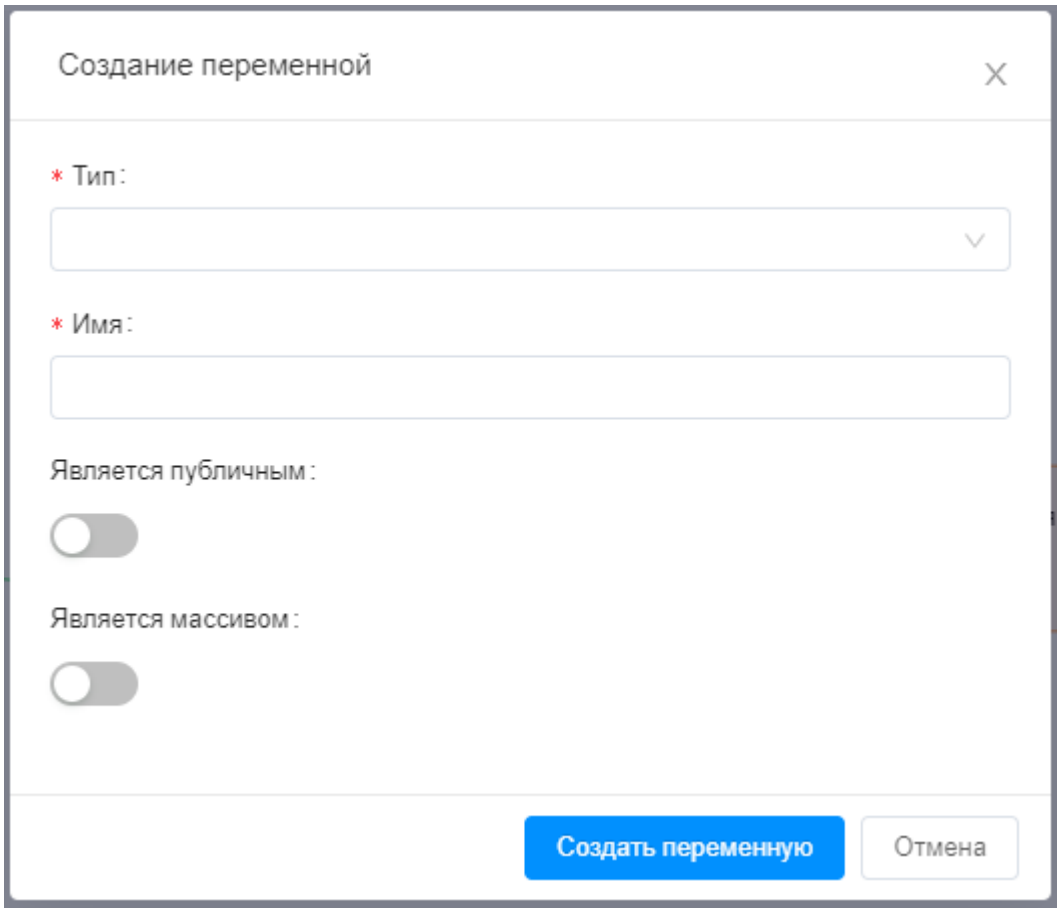



Figure 40 – Dialog for the new variable creation

The following parameters are specified for the variable:

- Type
- Name
- Public - whether it is accessible/inaccessible from other models/tools and via web.
- Array - whether it is the collection of variables of selected type.

The variable type can be selected from the drop-down list, see Figure 41:

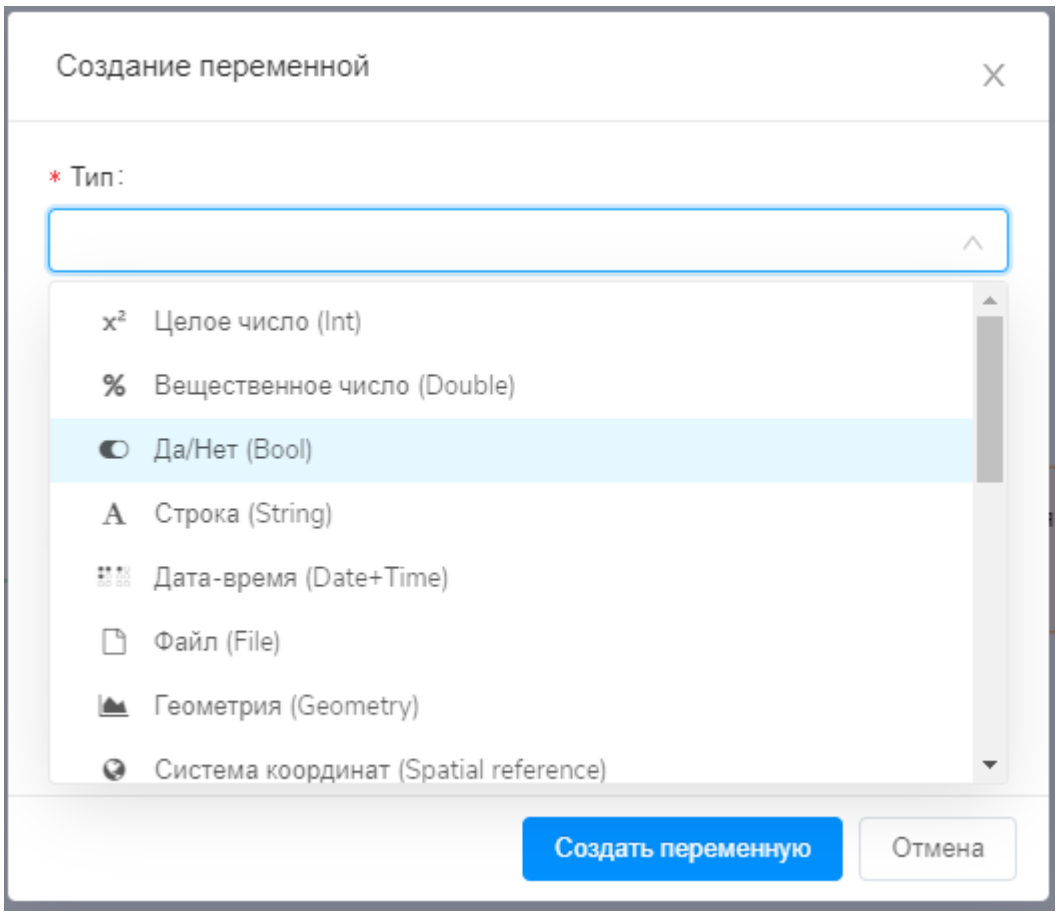



Figure 41 – List of available variable types

Specify the variable's name.

If your variable is public, press control  . The field to enter the public parameter name will appear, see Figure 42.

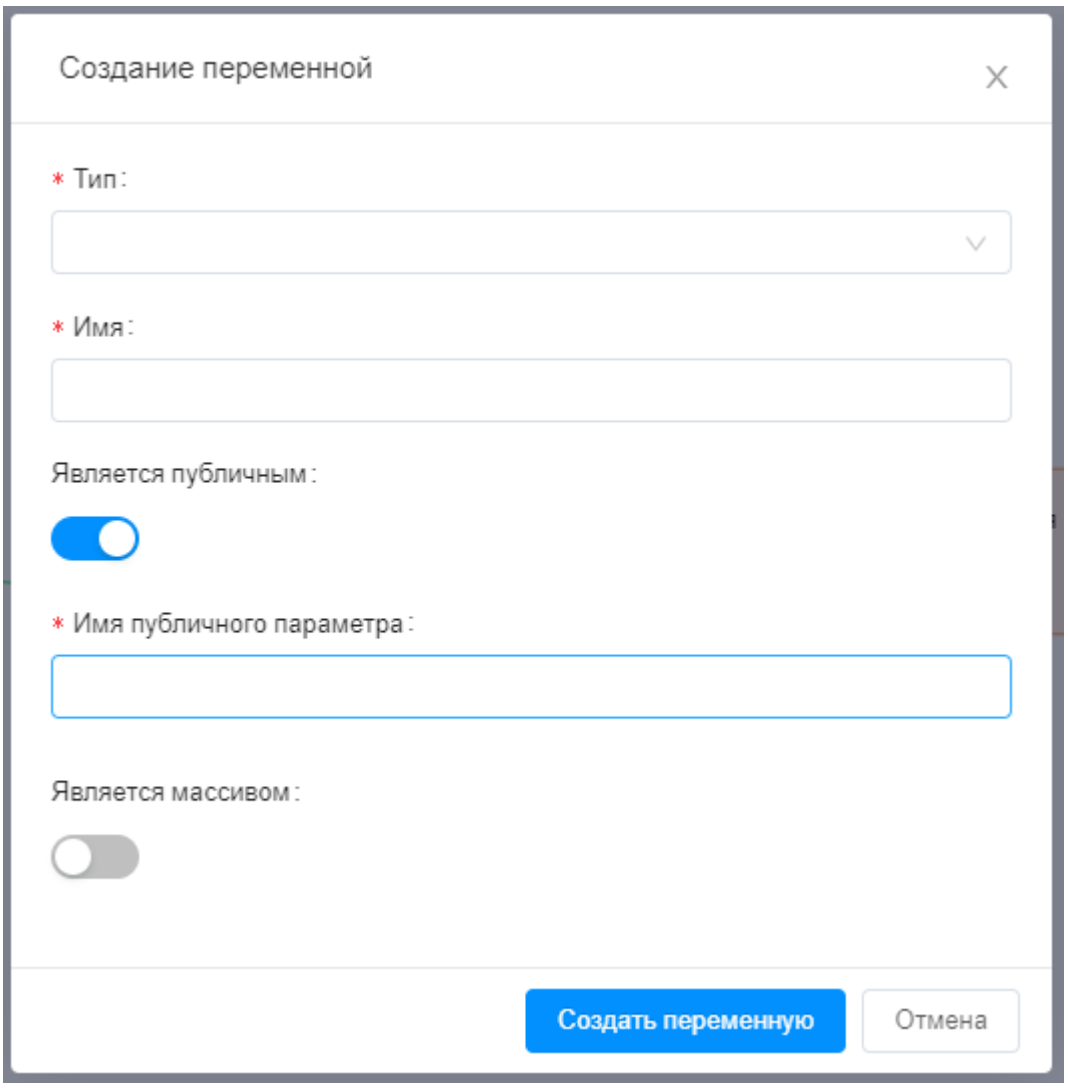



Figure 42 – Creating new public variable

If your variable is the array, press the appropriate control  . The button for adding value will appear  . Press this button as many times as many variables should be in the created array. If data type has been already selected for the array, you can set specific value for each variable of this array, see Figure 43.

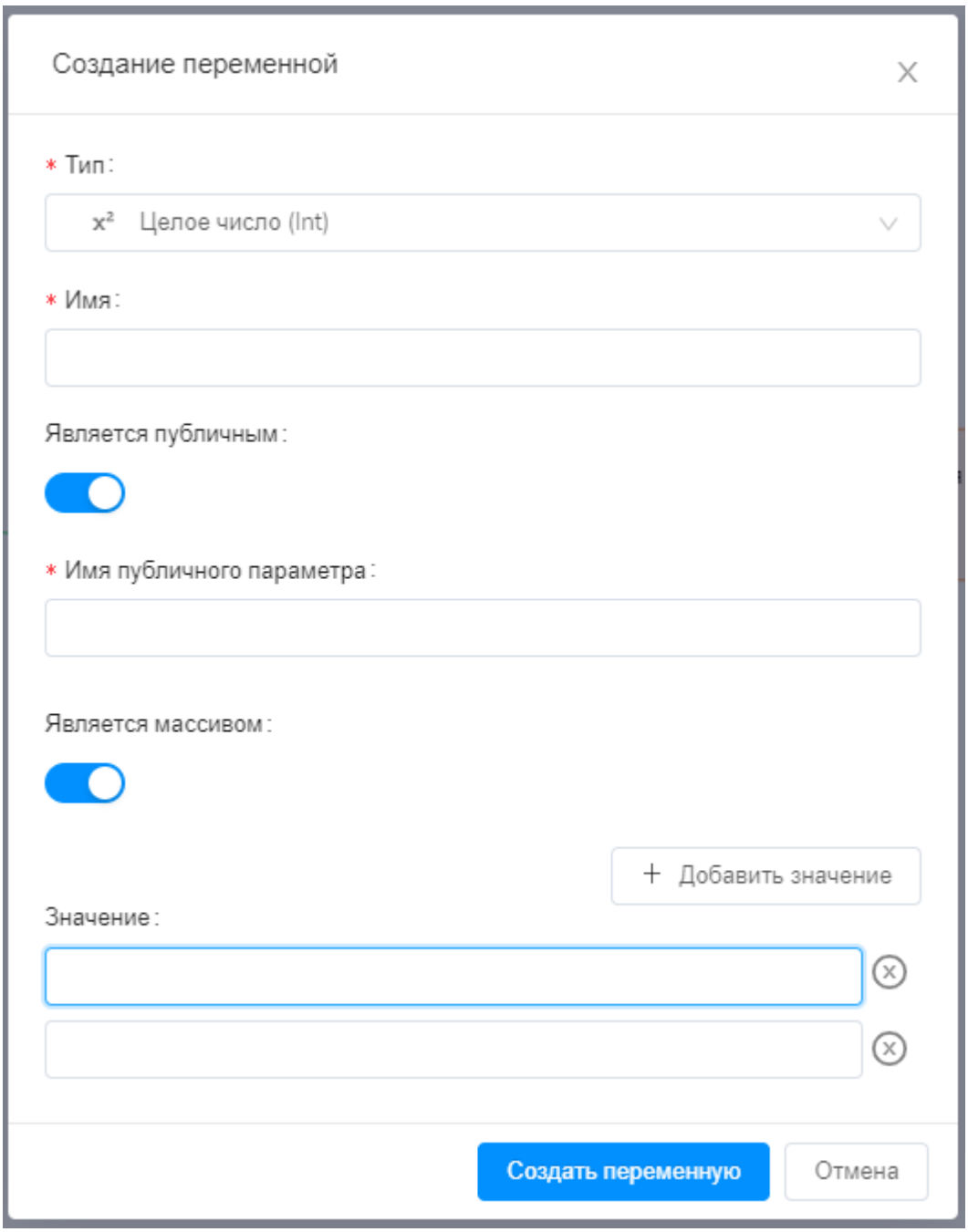
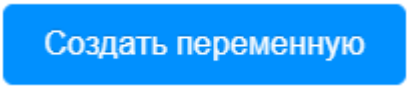
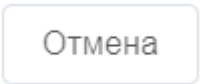



Figure 43 – Creating new variable as array of data

Fields marked with * are mandatory. To save made changes, press




.

To cancel creation of the variable, press 

or close the dialog.

#### 6.5.9.3. Adding tool

To add the new tool to the model, press  button on the toolbar or press ALT and T on the keyboard.

After that, the mouse cursor will look as following:



Left click on the place of the workspace where you want to locate your tool. The dialog for the new tool creation will appear, see Figure 40.

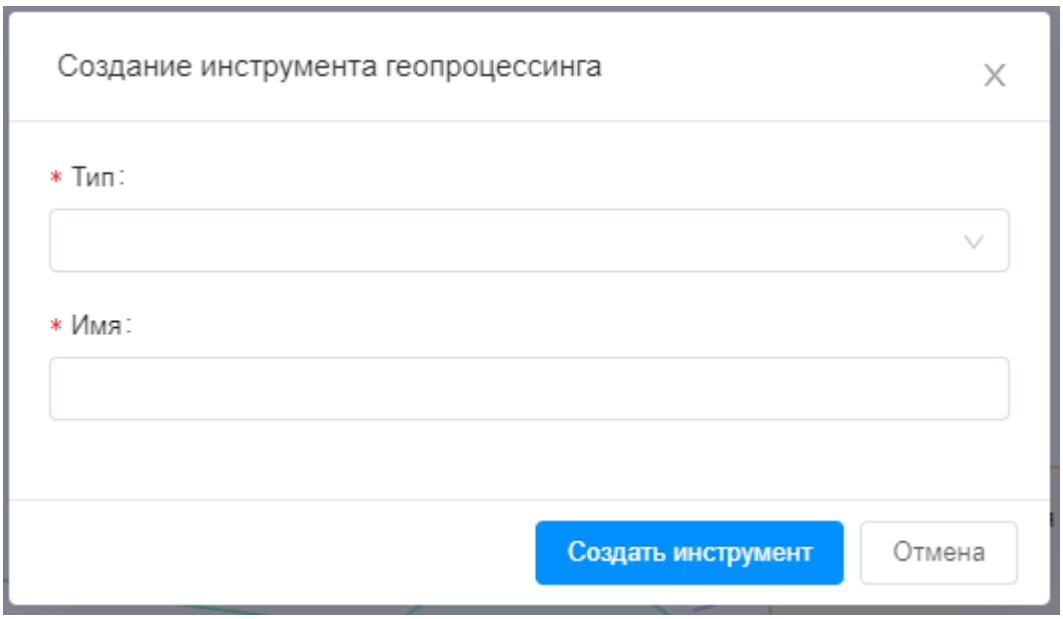



Figure 44 – Dialog for the new tool creation

The following parameters are specified for the tool:

- Type
- Name

The tool type can be selected from the drop-down list, see Figure 45.

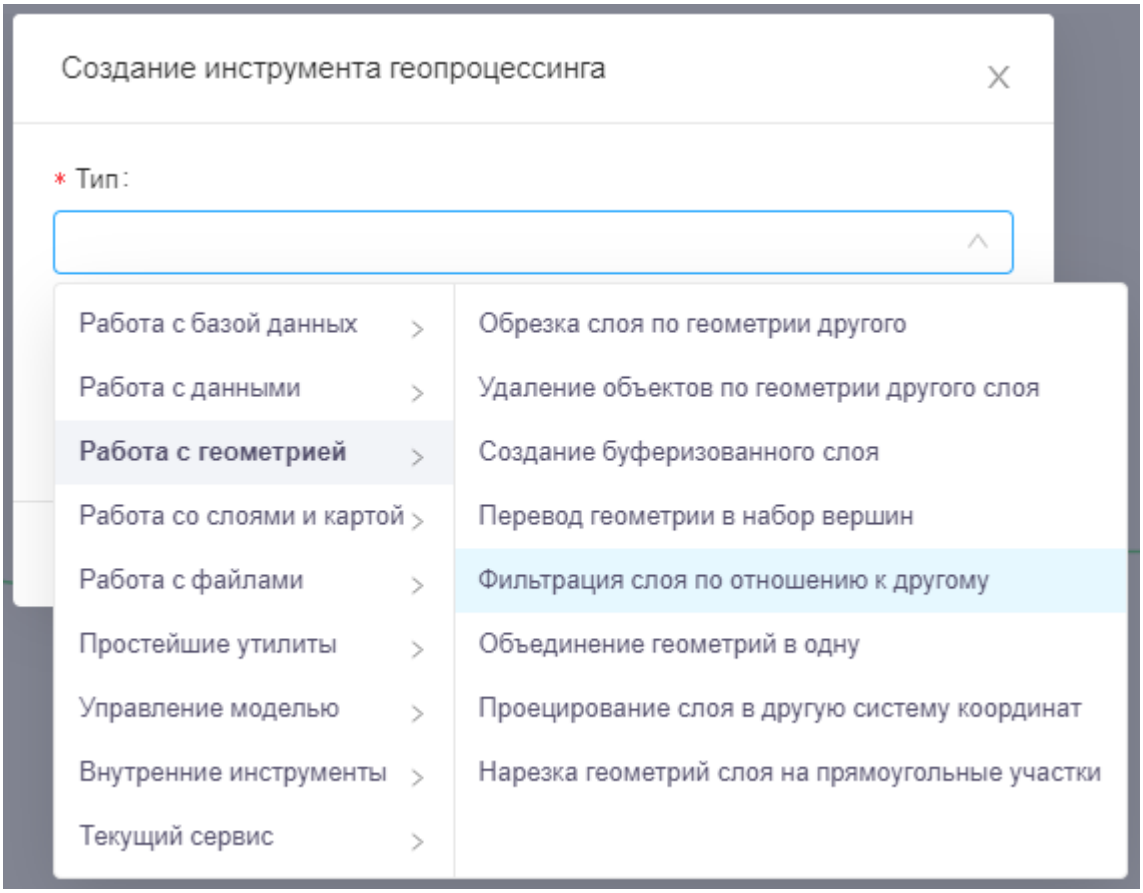



Figure 45 – Selecting geoprocessing tool type

The list of available geoprocessing tools and their parameters is provided in the 0.

*Note: The tool can be also the existing geoprocessing model which is a part of the edited service. All the geoprocessing models of the service will be listed at the end of the tools list (Current service section). That is, eLiteGIS supports nested geoprocessing models and provides functionality for implementing complex geoprocessing algorithms.*

Enter the tool's name in the Name field. After selecting the tool's type, its name will be filled in by default but you can edit it if needed.

Fields marked with * are mandatory. To save made changes and complete the tool's creation, press Создать инструмент. To cancel tool's creation, press Отмена or close the dialog.

#### 6.5.9.4. Editing variable

To start editing variable:

- Double-click the variable;
- Or left click the needed variable in the model and then press  button on the toolbar.

The dialog for editing variable will appear, see Figure 46.

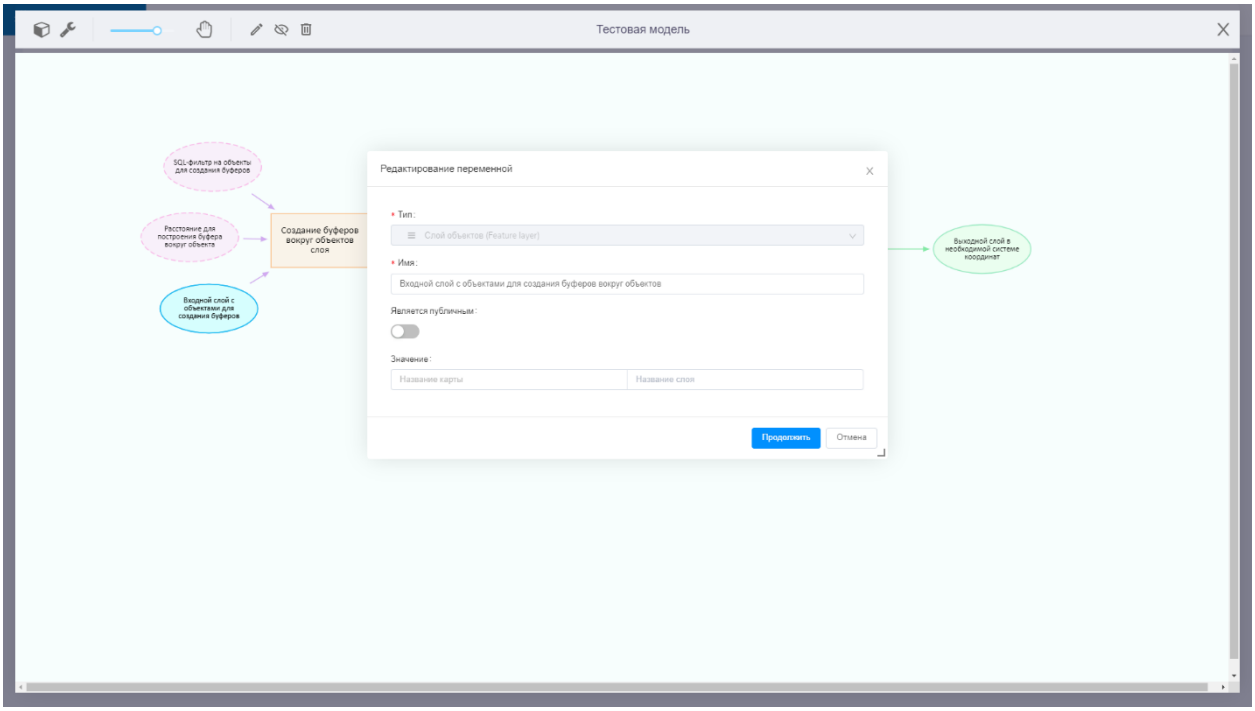



Figure 46 – Dialog for editing variable

As opposed to the new variable creation mode (see details in section 6.5.9.2), while editing variable you cannot change its type or specify that the variable is the array. But you can specify the variable's value in the appropriate field. Or, you can specify that your variable is public by pressing the control  . After that, the field for entering name of the public parameter will appear.

In case if during the variable creation it has been specified as public, you can disable this property when editing the variable.

To save made changes, close the variable editing dialog and press  button located on the toolbar on the right.

#### 6.5.9.5. Editing tool

To start editing tool:

- Double-click the tool;
- Or left click the needed tool in the model and then press  button on the toolbar.

The dialog for editing tool will appear, see Figure 47.

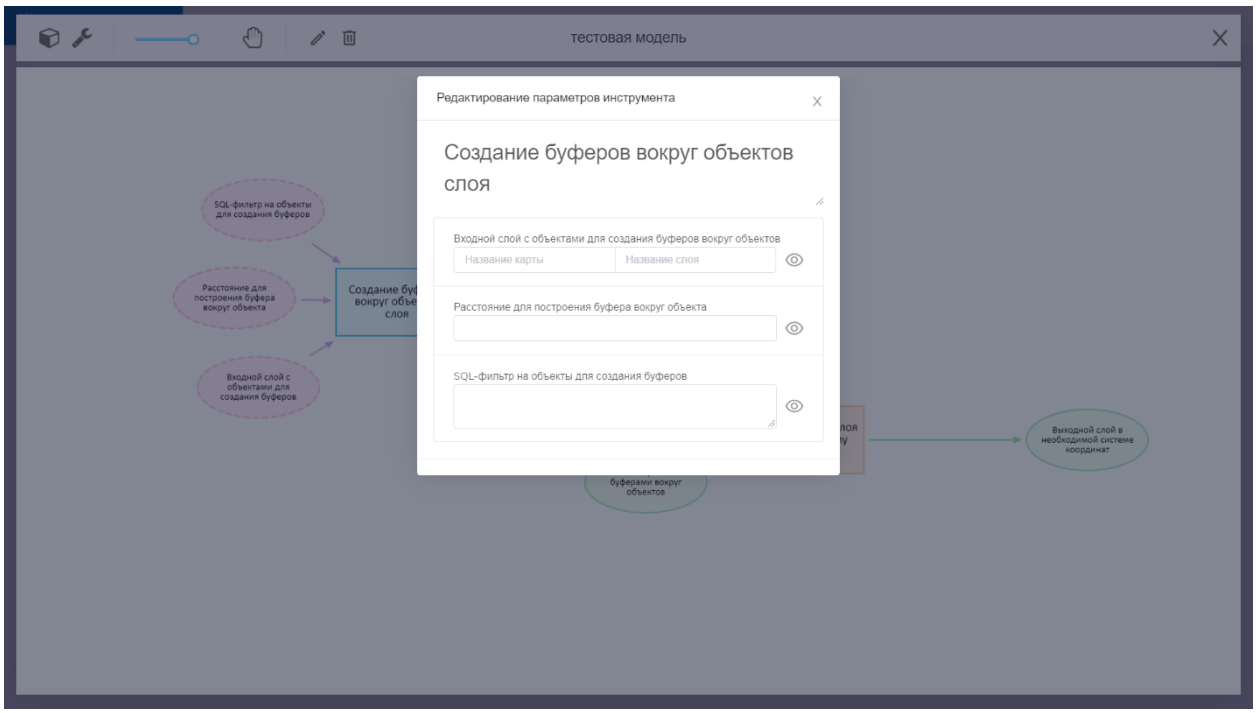



Figure 47 – Dialog for editing tool

As opposed to the new tool creation mode (see details in section 6.5.9.3), you cannot change the tool type during its editing.

But you can:

- *Edit tool name*
  Click on the tool name to make it editable. Now you can change the name as needed, see Figure 48.

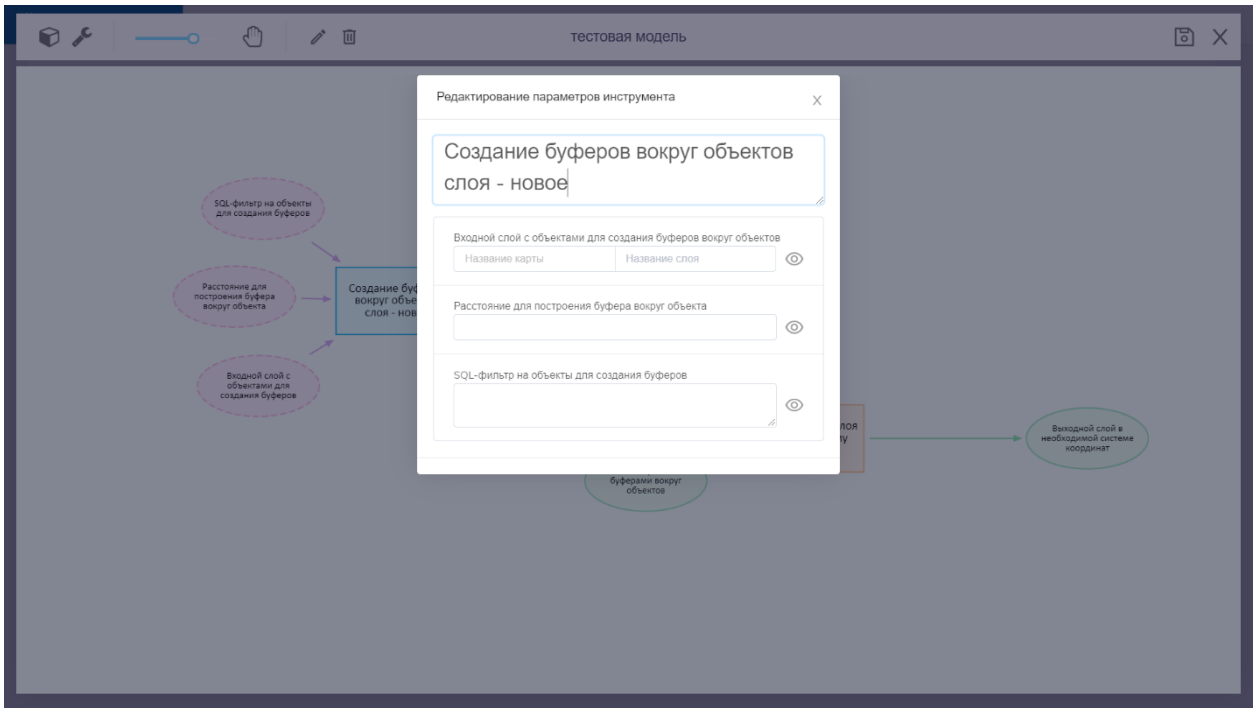



Figure 48 – Editing tool name

- *Specify values for input variables*

Type the needed values in the appropriate fields or select values provided in the drop-down lists. The values available in the lists correspond to the variable type.

*Note: specific map services published on GIS server, as well as layers included to these services can be used as input variables.*

- *Manage visibility of selected variables located in the workspace*

  Press button located near the variable name and it will be hidden on the workspace.

To save made changes, close the tool editing dialog and press button located on the toolbar on the right.

#### 6.5.9.6. Relating tools and variables

The tools in the model are related with each other via variables, that is, the output variables of one tool are the input variables for another tool.

To establish such relation, hold and drag the output variable to the needed input variable of the other tool to connect them. Note, if the related variables are of the same type, the input variable will change its color from purple to green, see examples below. Figure 49 and Figure 50 show that the output variable 'Layer with buffers built around objects' of the 'Buffers creation' tool became the input variable for the 'Projecting layer to other coordinate system' tool.

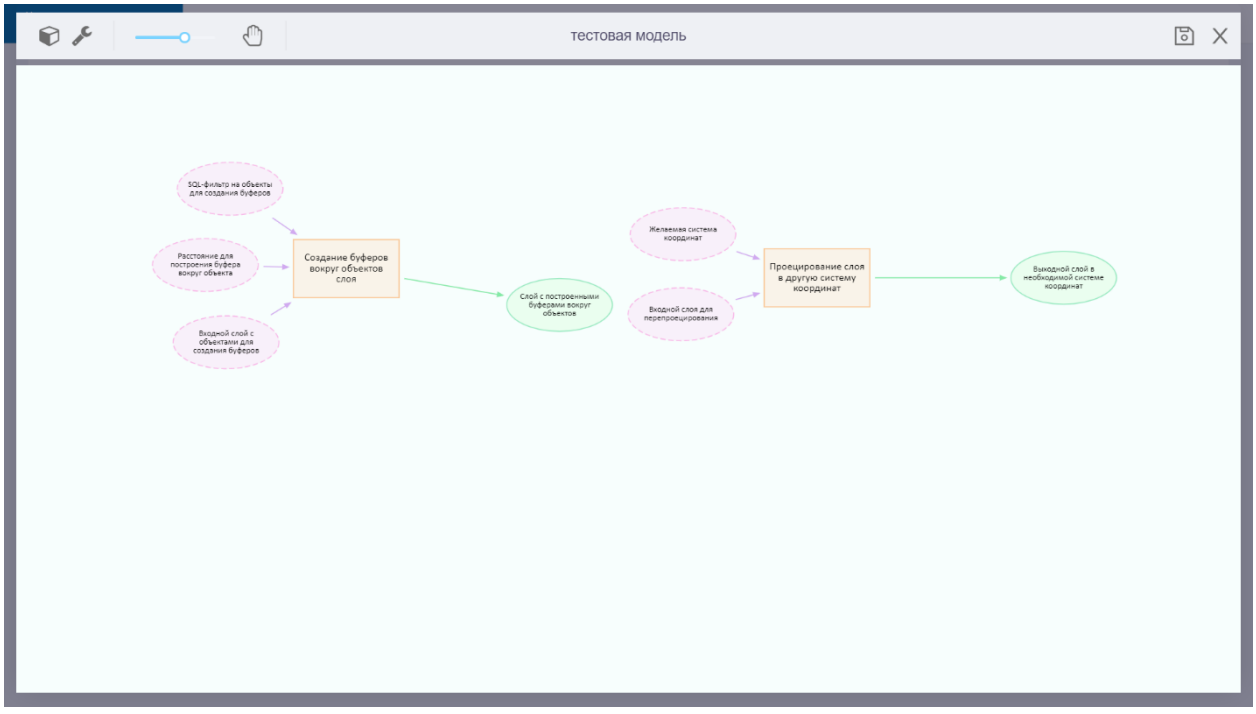



Figure 49 – Geoprocessing tools not related via variables

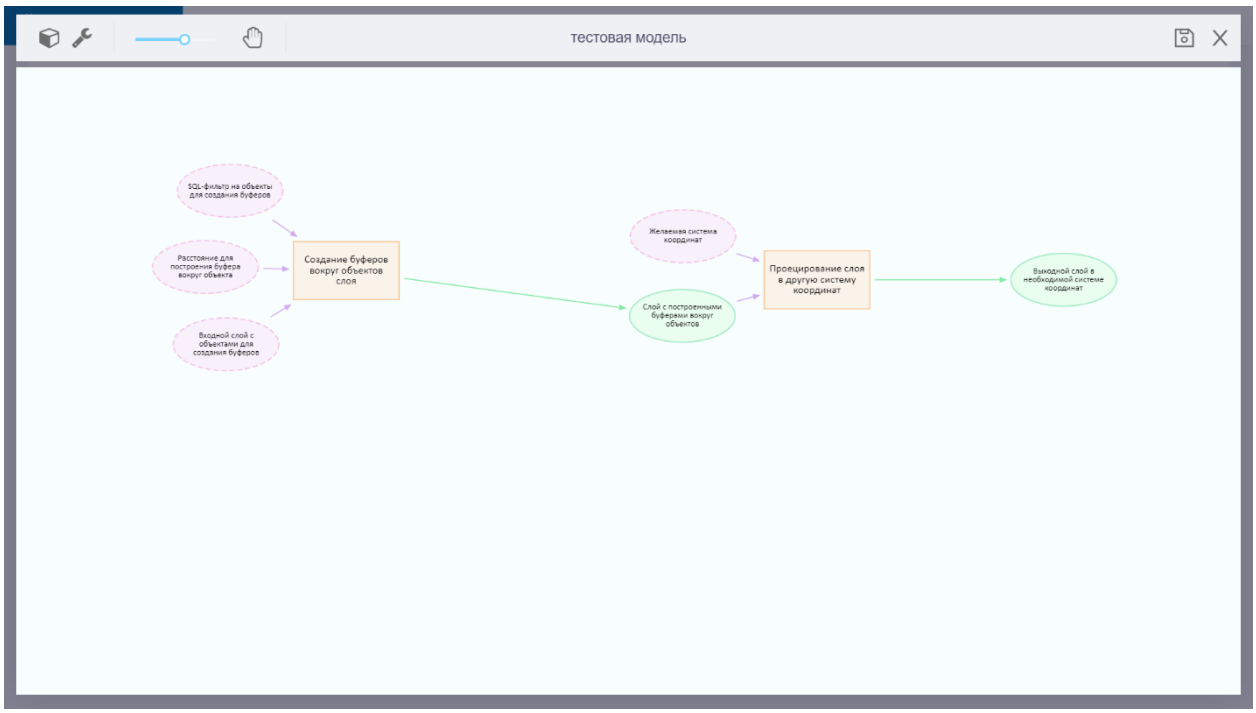



Figure 50 – Geoprocessing tools related via variables

To save made changes, press  button located on the toolbar on the right.

#### 6.5.9.7. Deleting selected variable or tool

To delete the variable or the tool, left click the item in the model. After that, the delete button  will appear on the toolbar. Press the button to delete selected variable or tool. The item can be also deleted by pressing ALT and DEL on the keyboard.

To save changes, press  located on the toolbar on the left.

## 6.6.Saving changes

When making any changes in the model properties, the save  button appears in the upper right corner of the dialog, see Figure 51.

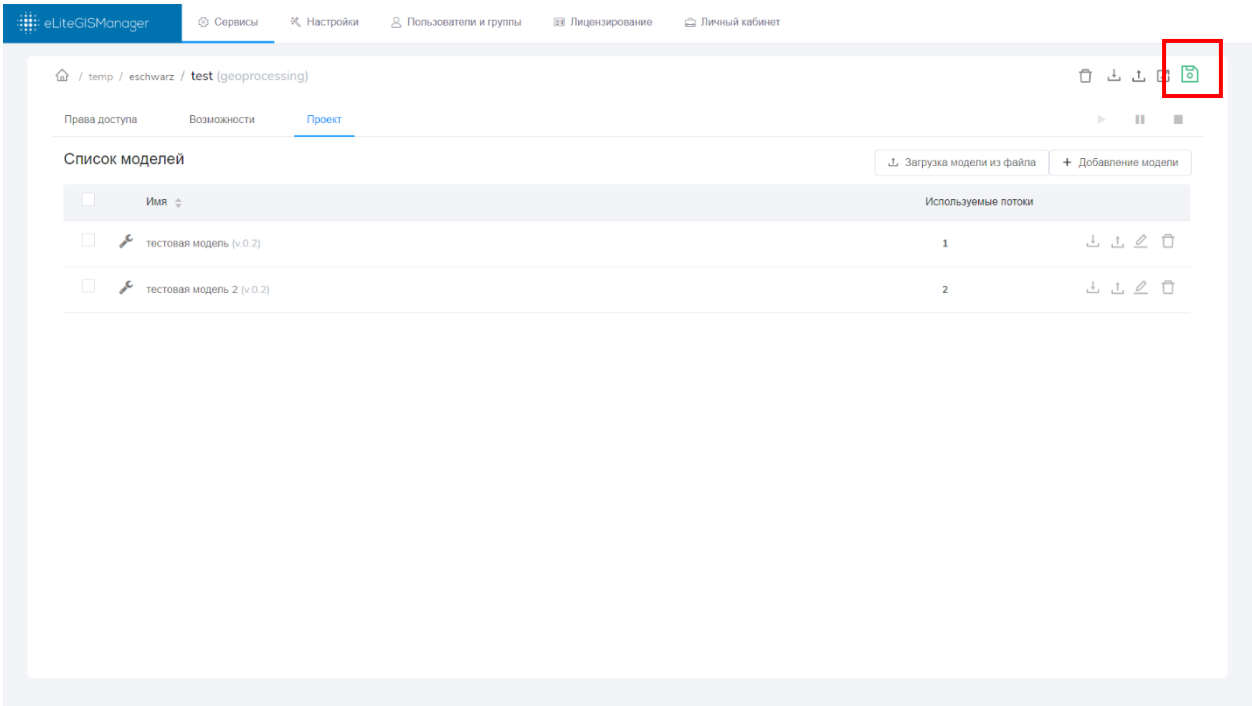



Figure 51 – Saving changes in the geoprocessing service

At that, when trying to get back to the services catalog or to go to another web console section without saving changes, you will see the appropriate warning message, see Figure 52.

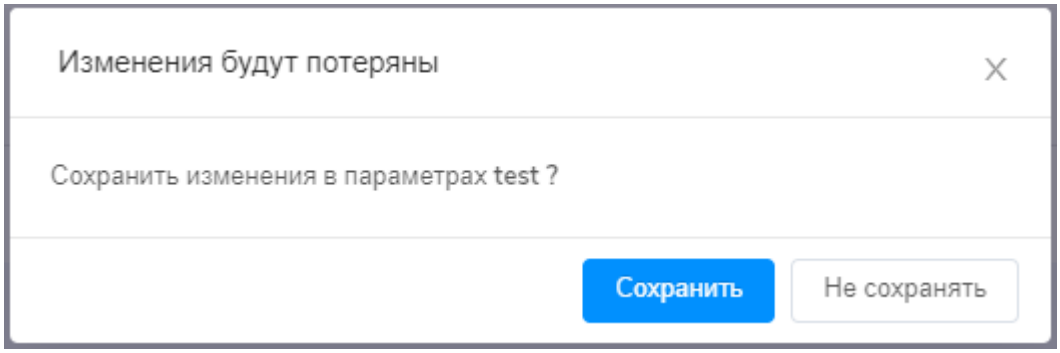
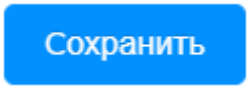



Figure 52 – Warning message appearing when you try to proceed without saving changes

Press 

button if you want to save made changes and to go to the catalog of services or to another web console section. If you do not want to save changes, press

or close the window.

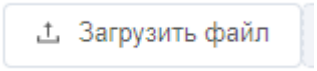
# 7. Publishing network analysis services

## 7.1. General information

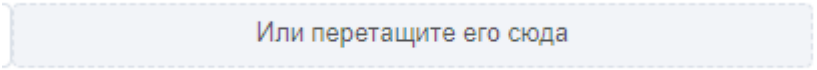
eLiteGIS allows you to create network analysis service based on index rotix file, that, in turn, is created using TrueDrive library. The index rotix file can be also created based on OpenStreetMap and Here data or based on any other data.

## 7.2. Creating new network analysis service

To add new network analysis service to catalog, go to the appropriate catalog folder. Now press




button located in the upper left part of the catalog window. The standard operation system dialog will appear where you need to select rotix file. The rotix file can be also dragged to the field




located on the right of the download button. The network analysis service will be published automatically after successful download of the rotix file.

## 7.3. Setting service access rights

To proceed with the service setting, press its name in the services list. The service settings window will appear, where *Access rights* section will be opened by default, see Figure 53.

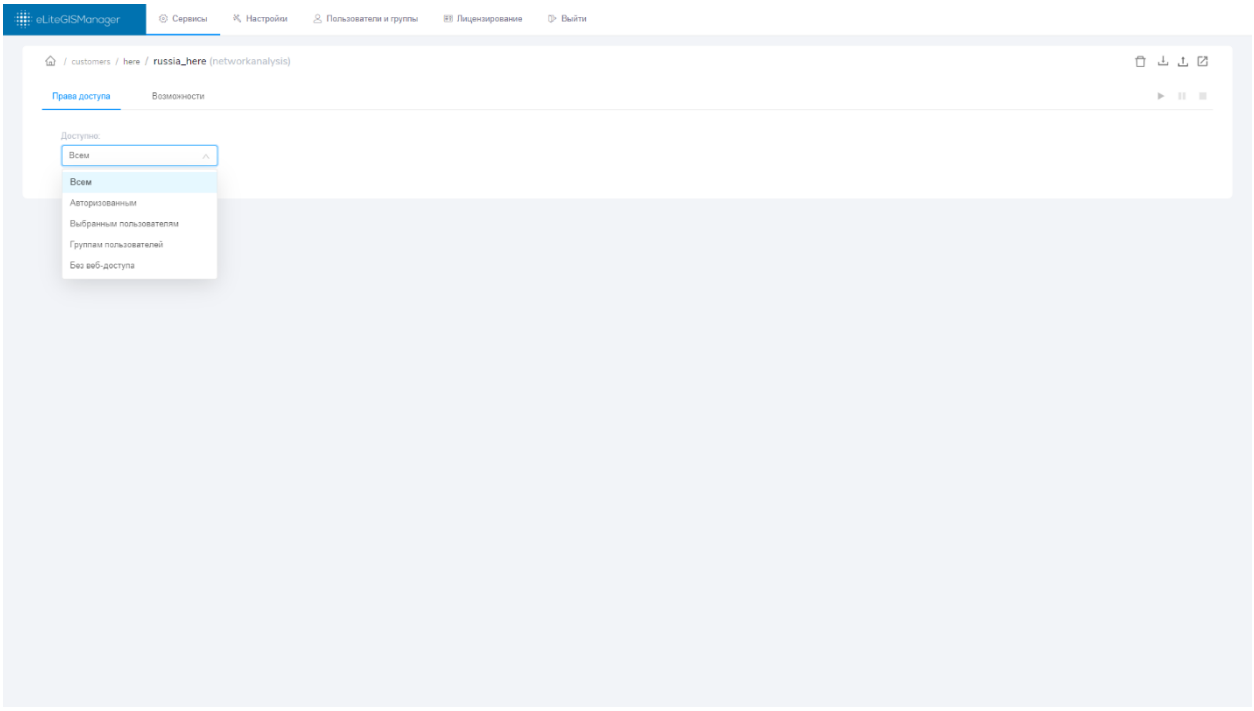



Figure 53 – Setting access rights for network analysis service

By default the access to published service will be allowed for all users, but you can change this setting selecting one of the provided options:

- For all;
- For authorized;

- For selected users;
- For selected user groups;
- No web access.

## 7.4.Setting permitted operations for network analysis service

To get to setting of the network analysis service options, select its name in the services list. In the appeared window go to the *Permitted operations* tab, see Figure 54.

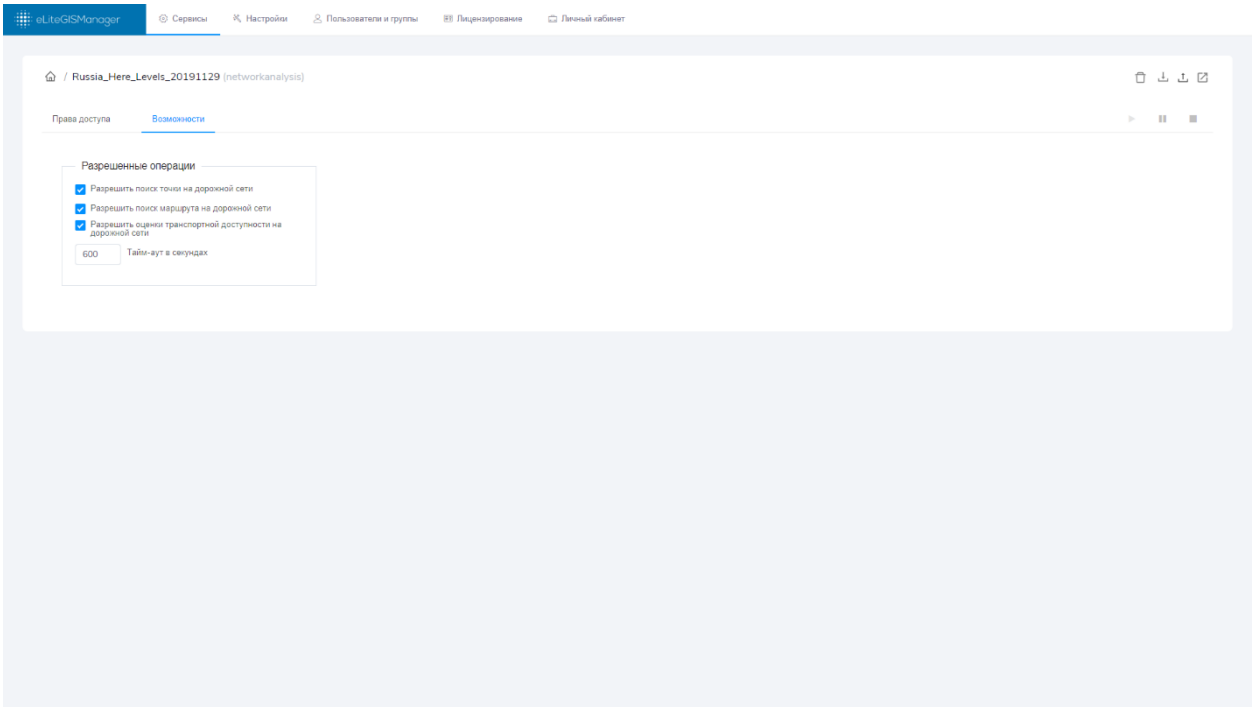
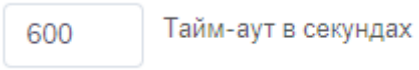



Figure 54 – Setting permitted operations for selected network analysis service

eLiteGIS supports the following operations for network analysis services:

- *Allow route search on road network*
  This operation is provided to search route by two and more points of the road network.
- *Allow estimates of transport accessibility on road network*
  This operation is provided to calculate service areas by road network.

Here you can also specify the query timeout 

. The default timeout is 10 minutes.

At that, when performing the above operations the service algorithm supports the following options:

- Use road hierarchy;
- Use restrictions (no left turn, etc..);
- Specify point/polyline/polygon barriers;
- Calculate route cost using multiple rules, for example, the optimal route by time and by distance.

The above mentioned parameters are set in CoGIS Designer by adding service to the map application. See more details in ‘Creating map applications in CoGIS’ manual.

# Appendix A – Ready-to-use geoprocessing tools available in eLiteGIS

| № | Tool name | Input parameters | Output parameters |
|---|---|---|---|
| **Work with database** | | | |
| 1. | Get local geodatabase | none | • Local geodatabase |
| 2. | Get tables from geodatabase | • Input geodatabase<br>• Tables names | • Tables |
| 3. | Create table in geodatabase | • Target geodatabase<br>• Table name | • Created table |
| 4. | Delete feature classes from geodatabase | • Names of feature classes to be deleted<br>• Target geodatabase | • Geodatabase after deletion of feature classes |
| 5. | Create feature class | • Target geodatabase<br>• Name of feature class<br>• Type of geometry: point, polyline, polygon, multipoint, not specified<br>• Coordinate system | • Created feature class |
| 6. | Clone feature class | • Input feature class<br>• Geodatabase of output feature class<br>• Name of feature class in geodatabase<br>• Mode of data cloning: clone scheme and data, clone scheme only | • Cloned feature class |
| 7. | Delete tables from geodatabase | • Geodatabase<br>• List of tables | • Geodatabase |
| 8. | Get names of fields in layer | • Input layer | • Name of ObjectID field<br>• Name of Shape field<br>• Names of fields with data |

| № | Tool name | Input parameters | Output parameters |
|---|---|---|---|
| 9. | Add field to feature class | • Field length<br>• Whether field is mandatory or not mandatory<br>• Field value<br>• Field type: undefined, small integer, integer, big integer, single, double, string, date, OID, geometry, BLOD, GUID, Annotation, Raster, Boolean<br>• Field name<br>• Input feature class | • Output feature class |
| 10. | Delete fields in feature class | • Target feature class<br>• Names of fields to be deleted | • Changed feature class |
| 11. | Execute SQL task | • Target geodatabase to execute task<br>• SQL task | • Geodatabase after SQL task execution<br>• Result of SQL task execution |
| Work with data | | | |
| 12. | Get number of objects in layer | • Input layer | • Number of objects in layer |
| 13. | Check for occurrence of objects in layer | • Input layer | • Result of checking for occurrence of objects in layer |
| 14. | Add object to feature class | • Input feature class<br>• Names of fields of new object<br>• Values of specified fields | • Updated object class<br>• ObjectID of added object |
| 15. | Delete objects in layers | • Input layers | • Cleared layers |
| 16. | Update objects in layer | • Input layer<br>• Names of object fields to be updated<br>• Values of specified fields | • Updated layer |
| 17. | Synchronize objects in layer | • Input layer | • Output target layer |

| № | Tool name | Input parameters | Output parameters |
|---|---|---|---|
| | | • Names of key fields to be compared<br>• Target layer<br>• Names of fields to be updated<br>• Update mode of input layer objects: update, do not update<br>• Deletion mode of not existing objects in input layer: delete, do not delete<br>• Add mode of missing objects in target layer: add, do not add<br>• Update mode of geometry in layer: update, do not update<br>• Date of last change of input layer<br>• Field for recording date of last change of input layer | |
| 18. | Get field values of objects in layer | • Input layer<br>• Field name<br>• Sorting by field<br>• Maximum number of objects | • Field values |
| Work with geometry | | | |
| 19. | Cut feature layer by geometry | • Feature layer to be cut<br>• Input geometry by which the layer will be cut<br>• Cutting mode: keep layer inside geometry, keep layer outside geometry<br>• Field for recording objects IDs of input layer<br>• Fields copying mode: copy all, do not copy | • Target (cut) layer |

| № | Tool name | Input parameters | Output parameters |
|---|---|---|---|
| 20. | Create buffered feature layer | • Input layer of spatial objects<br>• Buffer size<br>• Coordinate system for buffer size<br>• Field for recording ID of input layer object<br>• Fields copying mode: copy all, do not copy | • Buffered layer with spatial objects |
| 21. | Convert geometry to set of vertices | • Input geometry<br>• Type of points for geometry conversion: all points, centroids, origin point, end point, origin and end points<br>• Field for recording ID of input layer object<br>• Fields copying mode: copy all, do not copy | • Feature layer with geometries converted to points |
| 22. | Filter feature layer relative to another layer | • Input layer of spatial objects<br>• Target feature layer (by which the filtration is done)<br>• Type of spatial relationship between layer objects: the input layer object intersects the target layer object, the input layer object contains the target layer object, the input layer object locates outside the boundaries of the target layer object<br>• Fields copying mode: copy all, do not copy<br>• Field for recording ID of input layer object | • Filtered feature layer |
| 23. | Merge layer geometries | • Input layer of spatial objects | • Merged geometry |
| 24. | Project feature class to other coordinate system | • Input layer of spatial objects<br>• Target coordinate system | • Reprojected feature class |

| № | Tool name | Input parameters | Output parameters |
|---|---|---|---|
| 25. | Cut feature layer to rectangles | • Input layer of spatial objects<br>• Cutting scale<br>• Rectangles overlap (%)<br>• Coordinate system for cutting (metric)<br>• Cutting mode using grid: cutting all geometries by one grid, cutting each geometry by specific grid<br>• Rectangular width (mm)<br>• Field for recording X index of rectangular by grid<br>• Template for recording X index of rectangular by grid: 1,2,…,9,10,11,…; A,B,…,Y,Z,AA,…<br>• Rectangular height (mm)<br>• Field for recording Y index of rectangular by grid<br>• Template for recording Y index of rectangular by grid: 1,2,…,9,10,11,…; A,B,…,Y,Z,AA,… | • Cut feature layer |
| Work with layers and map | | | |
| 26. | Get SQL definition query of layer | • Input layer | • SQL definition query of layer |
| 27. | Specify SQL definition query for layer | • Target layer<br>• SQL definition query for layer<br>• SQL editing mode for layer: rewrite, add with 'and', add with 'or' | • Layer with new SQL definition query |
| 28. | Get descriptions of print templates | • Input file with print templates | • Descriptions of print templates |
| 29. | Print web map in PNG/PDF format | • Print template | • Output file |

| № | Tool name | Input parameters | Output parameters |
|---|---|---|---|
| | | • Output file format: PNG32, PDF<br>• Input web map in JSON format | |
| 30. | Multipage printing by specified rectangular areas | • Maps to be printed<br>• Tile services for printing<br>• Files naming template<br>• Extent for printing thumbnail map<br>• Coordinate system for printing thumbnail map<br>• DPI: DPI96, DPI120, DPI180, DPI240, DPI300<br>• ZIP file name<br>• Output file format: PNG32, PDF<br>• X index by grid<br>• Y index by grid<br>• Start index of page numbering<br>• Overlap of rectangular printing areas (%)<br>• Input rectangular areas (extents) for printing<br>• Print template | • Files for printing<br>• Path to folder with files for printing |
| 31. | Change data source for map layers | • Input map<br>• Parameters for input data connection<br>• Target geodatabase connection string<br>• Input geodatabase type: GeoPackage, UGD, CMF2, Shapefile, MSSQL, PostgreSQL, unknown<br>• Target geodatabase type: GeoPackage, UGD, CMF2, | • Map with changed data source |

| № | Tool name | Input parameters | Output parameters |
|---|---|---|---|
| | | Shapefile, MSSQL, PostgreSQL, unknown<br>• Target tables naming template<br>• Data copying mode: copy all, do not copy | |
| 32. | Export map to QGS | • QGS file name<br>• Input map | • Output QGS file |
| 33. | Get map from CMF file | • JSON configuration file<br>• Input CMF file | • Output map |
| 34. | Export map to CMF file | • CMF file name<br>• Path to folder with object's card template<br>• Export mode of non-spatial objects: export, do not export<br>• Data export mode: copy fields and data, copy fields only<br>• Cut by geometry<br>• Input maps for extraction | • Output CMF file |
| 35. | Export map layer data to GeoPackage | • GPKG file name<br>• Export mode of non-spatial objects: export, do not export<br>• Data export mode: copy fields and data, copy fields only<br>• Input maps | • Output GPKG file |
| 36. | Generate CMF map from MXD file via CarryMap Builder | • CMF file name<br>• File with extraction rules<br>• Input toolbox file<br>• Input Python file<br>• Input EXE file<br>• Input MXD file<br>• Upload data mode: by default, keep links to data, upload data, keep links if possible | • Output CMF file |

| № | Tool name | Input parameters | Output parameters |
|---|---|---|---|
| Work with files | | | |
| 37. | Get path to service folder | none | • Path to service folder |
| 38. | Get files from folder | • Path to folder<br>• Search template<br>• Search mode in subfolders: search in all subfolders, search in specific directory only | • Files from folder |
| 39. | Get files from layer | • Input layer<br>• Field with file name<br>• Field with file content | • Obtained files |
| 40. | Get files from table via link | • Folder name prefix<br>• Field with file name<br>• Input table | • Obtained files |
| 41. | Archive files to ZIP | • ZIP archive name<br>• Input files | • Output ZIP archive |
| 42. | Archive folder to ZIP | • ZIP archive name<br>• Path to folder | • Output ZIP archive |
| 43. | Merge PDF files | • Output PDF file name<br>• Input PDF files | • Output PDF file |
| 44. | Import shape files to feature classes | • Shape files (including archives) | • Feature classes |
| 45. | Import ZIP archive with photos to layer | • Input ZIP archive with photos<br>• Target layer<br>• Export photos without geotags<br>• Field for recording date<br>• Size of buffer (tolerance) to group photos (m, 0 – no grouping)<br>• Time range to group photos (dd.hour:min:sec, 00:00:00 – no grouping) | • Layer with photos |

| № | Tool name | Input parameters | Output parameters |
|---|---|---|---|
| 46. | Import KML file to map | • KML file | • Output map |
| Simple utilities | | | |
| 47. | Merge objects arrays | • Array of input objects 1<br>• Array of input objects 2<br>• Type of arrays merge: join, intersect, delete duplicates, keep distinct objects | • Output objects array |
| 48. | Merge strings | • Input strings<br>• Delimiter | • Merged string |
| 49. | Replace substring in string | • Input string<br>• What should be found<br>• What is the replacement<br>• Replacement mode: by string, by regular expression | • Replaced string |
| 50. | Build SQL expression for field by bool value | • Field value<br>• Field name<br>• Field comparison type by value: =, <> | • Output SQL expression |
| 51. | Build SQL expression for field by numeric values | • Numeric values<br>• Field name<br>• Field comparison type by value: =, <>, >, <, >=, <=, in range, outside of range | • Output SQL expression |
| 52. | Build SQL expression for field by string values | • String values<br>• Field name<br>• Field comparison type by value: =, <> | • Output SQL expression |
| 53. | Linkup of SQL expressions | • Input SQL expressions<br>• Linkup using: and, or | • Output SQL expression after linkup |
| 54. | Execute mathematic operation | • First value<br>• Second value<br>• Operation type: +, -, *, / | • Operation result |

| № | Tool name | Input parameters | Output parameters |
|---|---|---|---|
| 55. | Compare numbers | • First value<br>• Second value<br>• Comparison type: >, <, <=, >=, = , <> | • Comparison result |
| 56. | Compare objects | • First object<br>• Second object<br>• Comparison type: =, <> | • Comparison result |
| 57. | Get substring by regular expression | • Input string<br>• Regular expression | • Found substring |
| 58. | Format string by template | • String template<br>• Value to substitute to template | • Formatted string |
| Managing model | | | |
| 59. | Organize tools execution | • First item<br>• Second item | • First item<br>• Second item |
| 60. | Break sequence execution by condition | • Break or do not break sequence execution<br>• Message in case of breach of sequence execution | • Whether sequence execution has been broken |
| 61. | Select object using ‘if’ condition | • Indicator of condition execution<br>• Object returned in case of condition execution<br>• Object returned in case of failure to execute condition | • Selected object |