

# Pathfinder ArcGIS Pro Addin

version 1.2

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# Contents

<b>Pathfinder addin for ArcGIS Pro</b>	<b>1</b>
Introduction to Pathfinder	1
The Pathfinder methodology	1
Using Pathfinder's Web Application	3
Combining Pathfinder Web and ArcGIS Addin	4
Workflow 1: from Addin to Web	4
Workflow 2: from Web to Addin	5
Installing the Pathfinder Addin	5
Using the Pathfinder Addin	6
Login with a Pathfinder account	7
Project Section	8
Create project	9
Edit project	11
Adding and removing layers in ArcGIS	13
Edit project points	13
Delete project	13
Access the project on the web	14
Copy project data from the cloud	15
Select the source project and scenario	16
Copying project and layers	16
Copying scenarios	19
Downloading results	20
Add layers to an existing project in the cloud	22
Scenario Section	24
Results Section	28
Calculate Resistance Map	28
Calculate Corridor Map	29
Calculate Path(s)	30
Calculate All	31
Status log	31
Results folder	31
Support and FAQ	32
Large datasets	32
Long processes	32
Changes in Pathfinder Web	32
Deleting the Pathfinder project	33
Debugging errors	33





# Pathfinder addin for ArcGIS Pro

**Pathfinder** is a cloud application and HTTP REST API developed by **Gilytics**, used for the planning and routing of linear infrastructures like powerlines, underground cables, pipelines, roads, railways, as well as optimal placement of solar plants and other location-dependent facilities.

This user manual focuses on the Pathfinder addin for ArcGIS Pro, which allows users to access Pathfinder services directly from ArcGIS.

Download a [PDF version](#) of this manual.

## Note

This manual refers to **version 1.2** of the ArcGIS Pro addin, which can be downloaded from our [plugins page](#).

- Introduction to Pathfinder
- Installing the Pathfinder Addin
- Using the Pathfinder Addin
- Project Section/Panel
- Scenario Section/panel
- Result Section/panel
- Support and FAQ

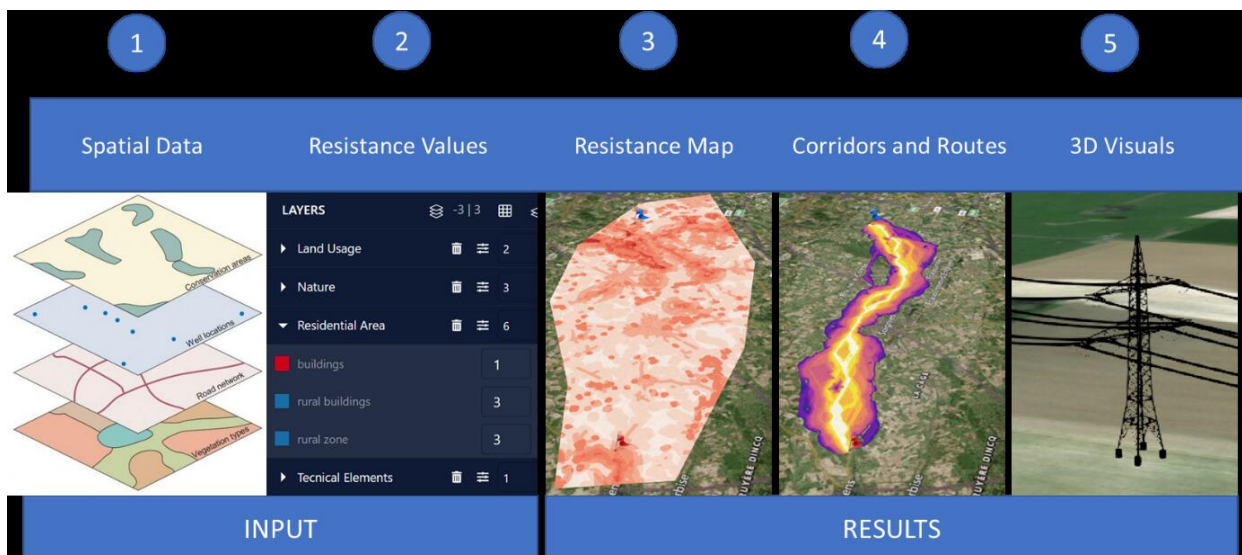
The left navigation area provides quick links to all the content.

## Introduction to Pathfinder

Pathfinder is a decision support system which implements a proven methodology to optimize the location and routing of infrastructure elements, taking into account spatial and cost constraints.

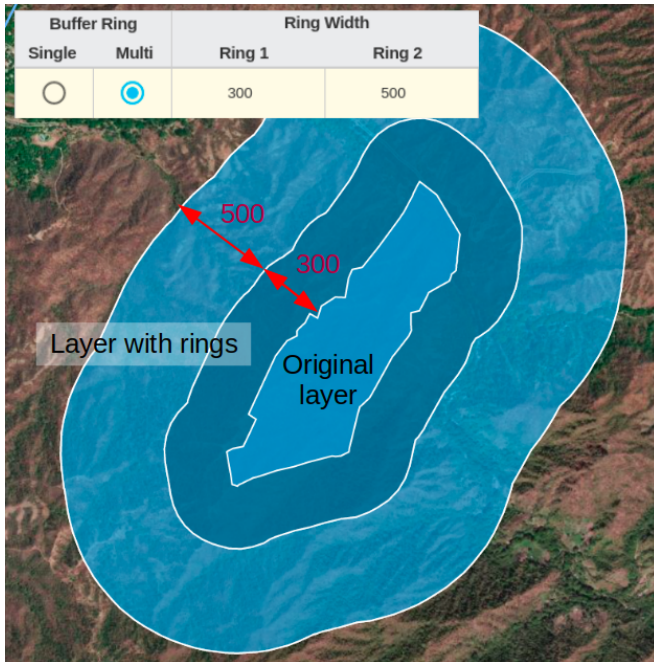
## The Pathfinder methodology

The following diagram describes the typical steps followed with Pathfinder.



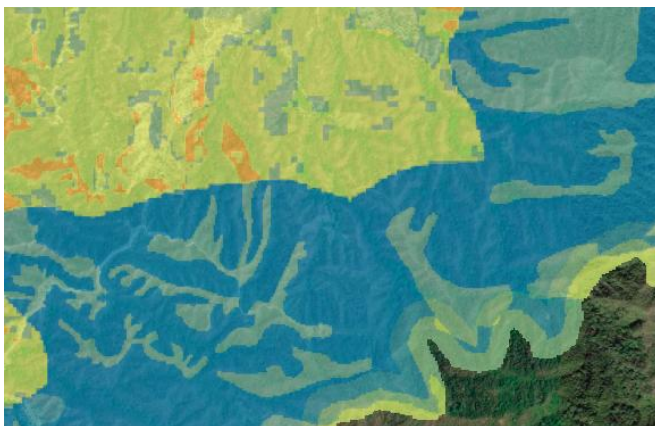
1. In a first step, relevant *spatial data*, representing constraints for the routing, are identified and imported into the application. A **project** is created for a specific *study area* and it typically contains *start* and *end* points for the routing.
2. Next, spatial data **layers** are assigned *parameters* representing their suitability for the infrastructure (e.g. power lines). These parameters are *ring distances and resistance values* and should take into account regulations, costs and other planning constraints.

The *ring distances* define areas of influence around the original data layers, and are used to assign different resistance values depending on the distance.

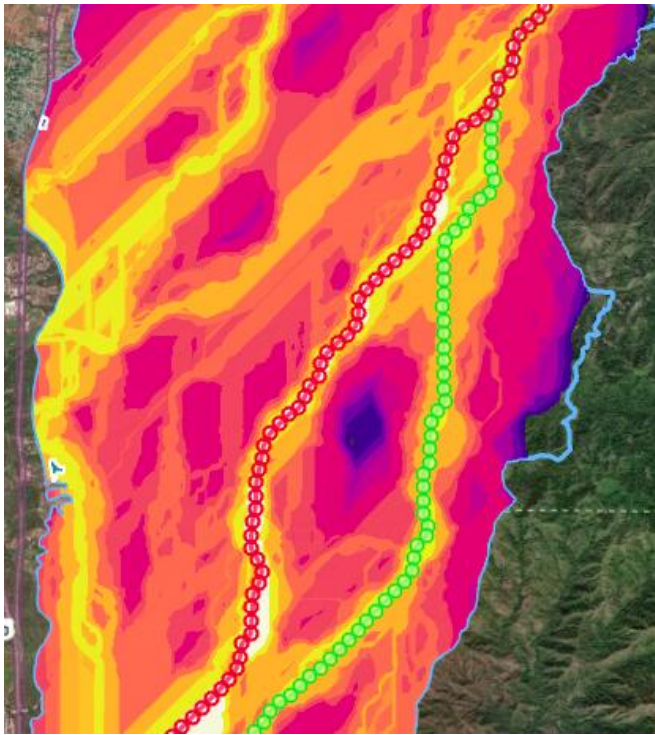


The *resistance values* define how suitable a layer area is for the location of the infrastructure (e.g. being crossed by powerlines and placing their pylons) and they usually have different values for each layer ring.

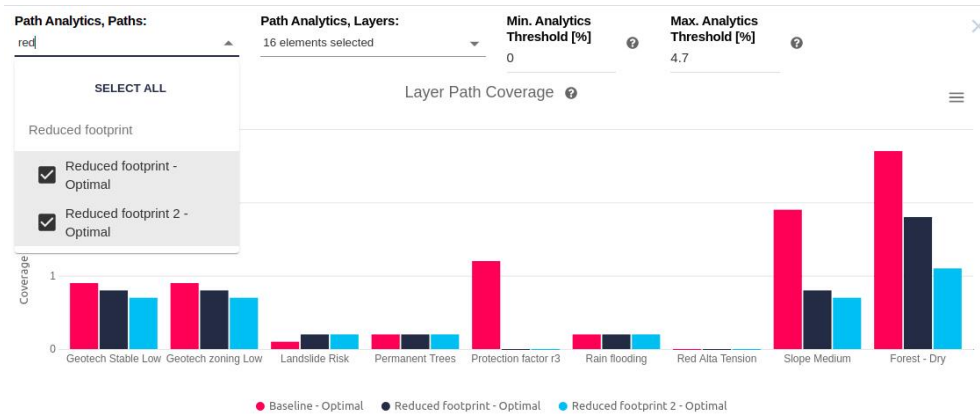
3. Based on these scenarios, Pathfinder runs a multi-criteria decision analysis (**MCDA**) to calculate the **resistance map** for the entire planning area.



4. The resistance map is the basis for Pathfinder to identify a **corridor map** and **optimal paths** within the planning area.



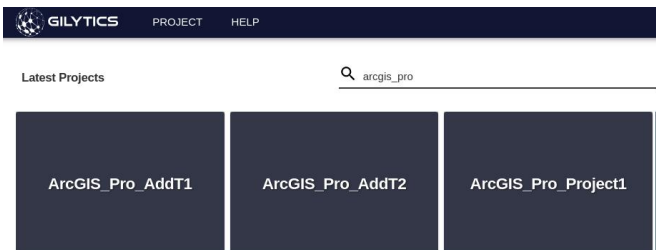
5. The results can be **evaluated** quantitatively and visually on the map or 3D view, and **exported** to georeferenced files.



## Using Pathfinder’s Web Application

The same Pathfinder account credentials used to access the ArcGIS addin can also be used to login into the [Pathfinder web application](#). In fact, all the projects created from the ArcGIS addin can be accessed in this web application.

If you ArcGIS document is named “Area1”, then you can find the corresponding project in Pathfinder as “ArcGIS\_Area1”:

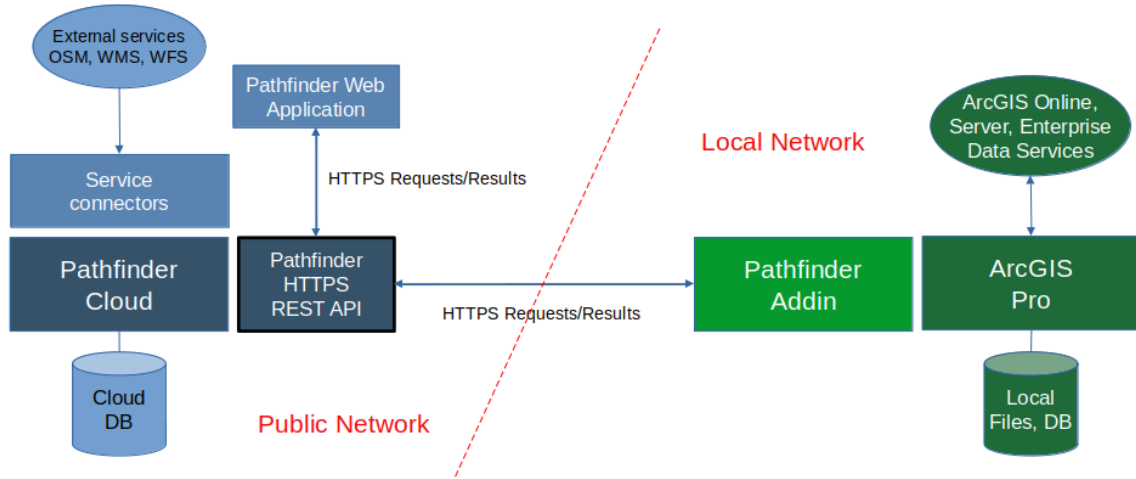


Read the [Pathfinder’s user manual](#) if you want to use the web version of Pathfinder and take advantage of its advanced features.

## Combining Pathfinder Web and ArcGIS Addin

Since Pathfinder projects can be created and modified from both the Addin and from the Pathfinder Web application, it is important to keep in mind and apply rules that avoid inconsistencies and conflicts between both platforms.

### General architecture



### Note

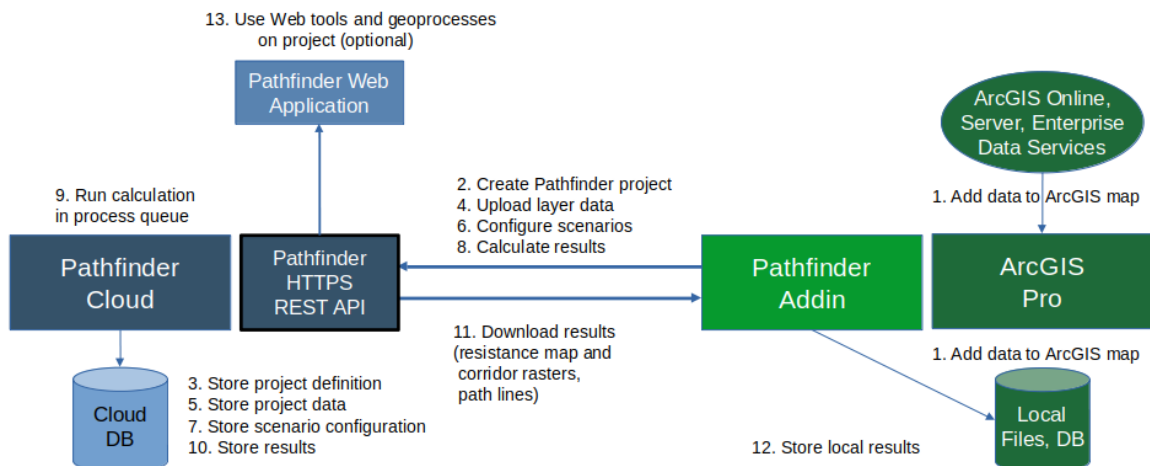
Changes done to a Pathfinder project in the Addin or in the Web are not automatically propagated or synchronized to the other platform. This propagation/synchronization must be done manually.

### Workflow 1: from Addin to Web

If you are primarily an ArcGIS user and the data you need for your Pathfinder analysis is already in an ArcGIS document, the most natural process for you is to create the Pathfinder project, setup the scenario and run the calculations from the Addin. Most of this user manual details the processes to work with this workflow.

The following image shows the typical steps and internal data flow when a project is created and modified from the Addin:

### Workflow 1: Create Pathfinder project from Addin



Note that, as mentioned, you can access the project from the Web application to use advanced analysis or reporting tools. You can also modify the project layers or scenarios, but this is not recommended. If you do so, you will be responsible to propagate these changes back to the Addin version, either manually or using the From Cloud tool.



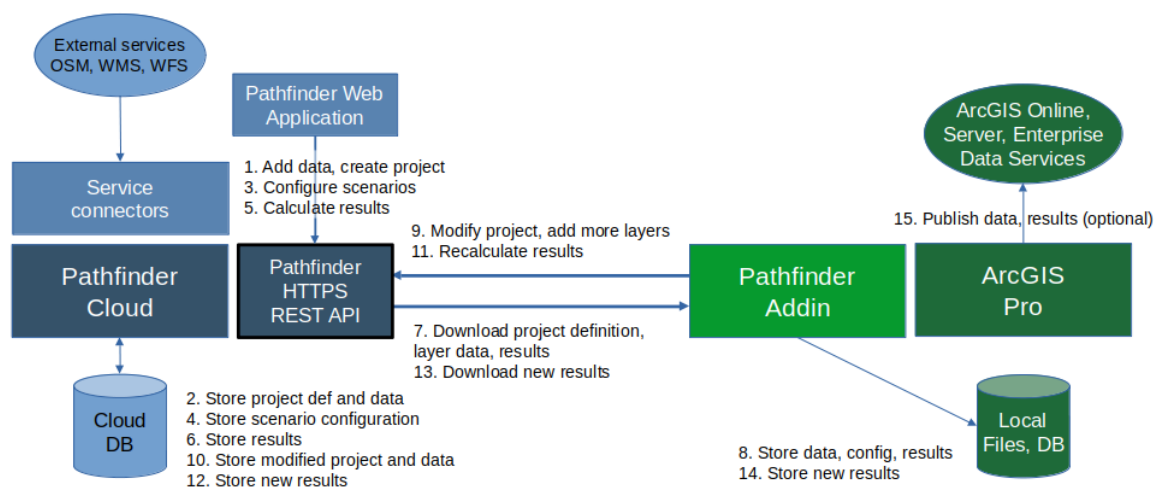
## Workflow 2: from Web to Addin

Starting with the 1.1 version of the Addin, it is also possible to copy to ArcGIS the project, data, scenarios and/or results created on the Web application. This may be useful when:

- You have lost your ArcGIS document with the original Pathfinder project. In this case, the Pathfinder cloud works as a backup that you can use to recover your project in ArcGIS.
- Someone made changes to the Pathfinder project in the Web application (added new layers or modified their buffers) and you need to apply those changes to your ArcGIS version.
- To share with others a project you created. If other ArcGIS users in your company have a Pathfinder account with access to your project, they can use this functionality to create their own local copy. Then, they will be able to create their own scenarios and results.

The following image shows the typical steps which may be followed when you create a project on the Web and then copy it to the addin and perform some changes in it.

## Workflow 2: Access and modify Pathfinder project



As mentioned, note that you are responsible to keep the consistency between changes done in the Addin and the Web, by you and by other users with access to the project.

### Note

Starting with version 1.2 of the addin, you can also add ArcGIS layers to a Pathfinder project in the cloud, without the need to download first the Pathfinder project to ArcGIS Pro.

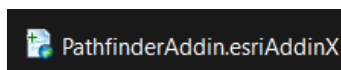
*Disclaimer:* the scenarios depicted in this manual do not represent actual customer projects or infrastructure proposals, and are presented for demonstration purposes only.

For more help, please [contact Gilytics](#).

## Installing the Pathfinder Addin

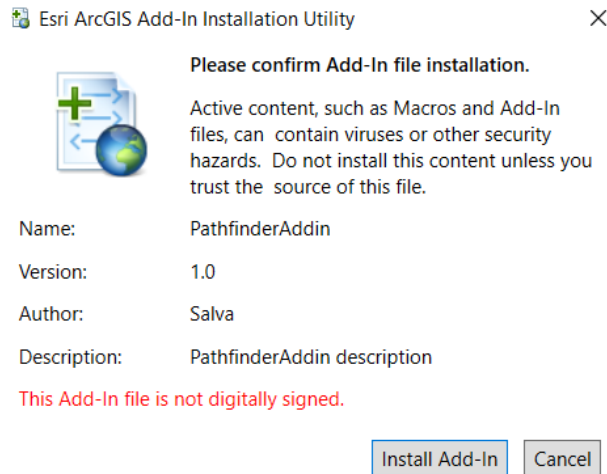
Download the addin file.

To install the add-in, double-click on the downloaded `.esriaddin` file.

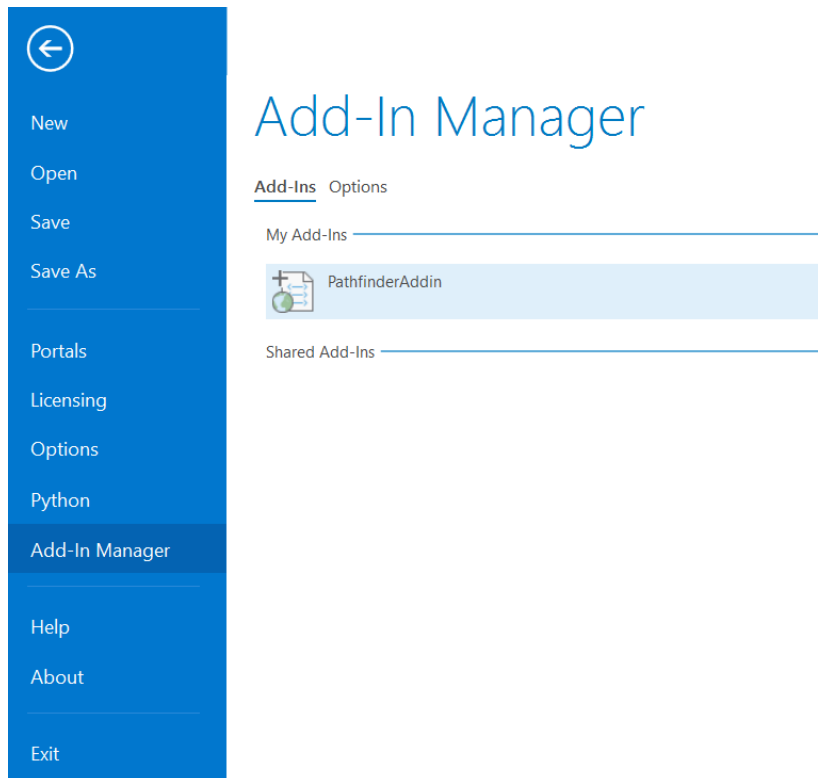


## Using the Pathfinder Addin

A pop-up window will open.



After clicking on *Install Add-In*, the installation will be done. See available add-ins in the Add-in Manager of ArcGIS Pro.



The Pathfinder tab will be available the next time you open the ArcGIS Pro application. If you had it open during the addin installation, close it and open it again.

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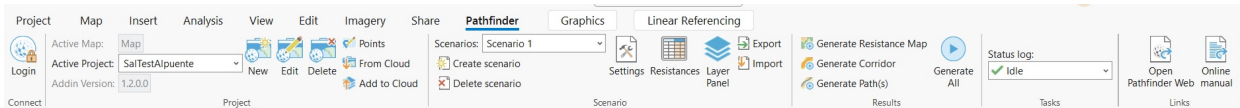
For more help, please [contact Gilytics](#).

## Using the Pathfinder Addin

The Pathfinder Add-in allows ArcGIS Pro users to create Pathfinder projects from an ArcGIS Map or 3D Map, and run siting and routing calculations directly from ArcGIS.

## Using the Pathfinder Addin

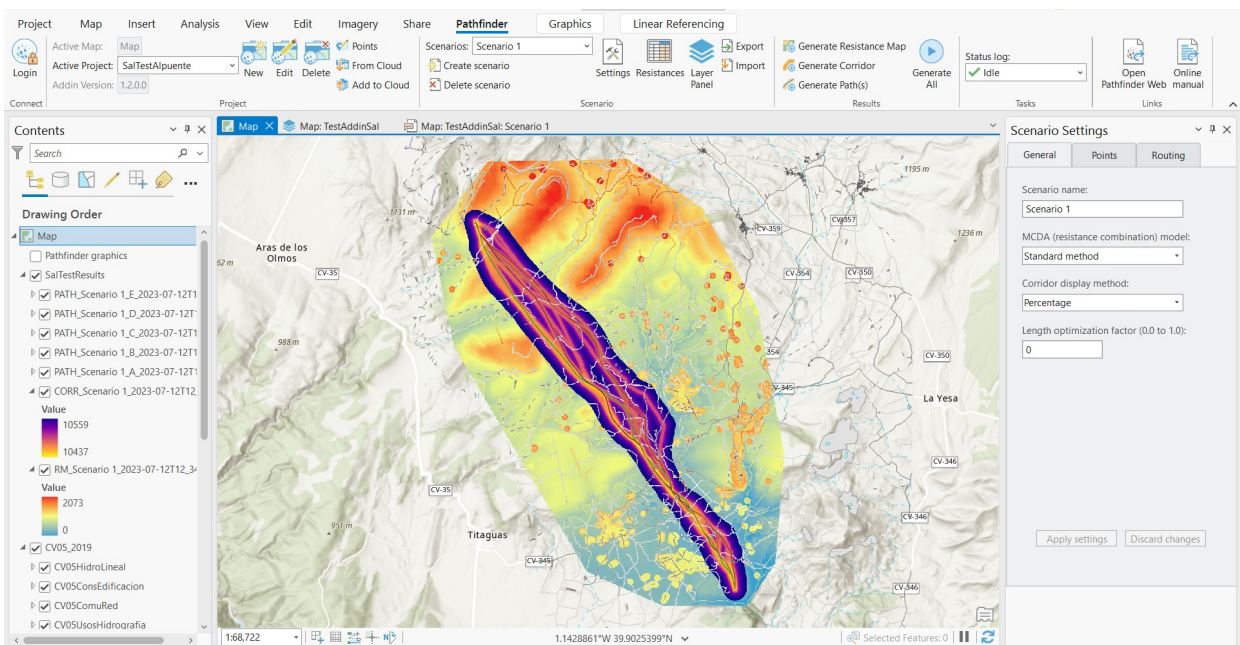
A Pathfinder ribbon tab with control sections will be visible when the add-in is installed.



A typical add-in workflow will follow these steps:

1. Add the relevant data as layers in your ArcGIS document.
2. Create a Pathfinder project.
3. Edit the project content by adding selected layers and specifying their rings.
4. Setup scenarios by defining the constraints and options.
5. Calculate the Pathfinder results: the Resistance Map, the Corridor Map and the Path(s), which will get stored as local files and added to your ArcGIS document. The results are also kept in Pathfinder Web.
6. Use the results to print a map or perform further analysis in ArcGIS.
7. Access the project in the [Pathfinder web](#) application if you wish to use additional Pathfinder features like geoprocesses, analytics and reporting.

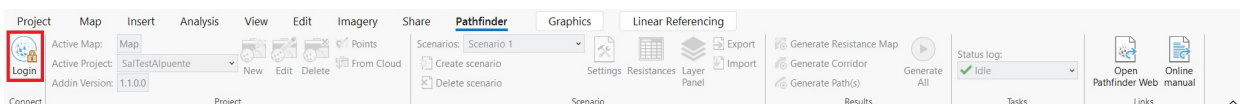
This image shows an example of routing results in ArcGIS once the workflow is complete.



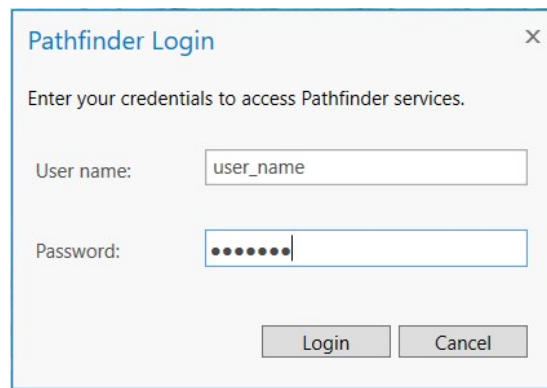
## Login with a Pathfinder account

In order to use Pathfinder services, you will first need to authenticate with your Pathfinder credentials.

To log in, click on the Login icon in the Pathfinder panel:



Enter your username and password in the Pathfinder Login tool.

A screenshot of a 'Pathfinder Login' dialog box. The dialog has a title bar with 'Pathfinder Login' and a close button (X). Below the title bar, it says 'Enter your credentials to access Pathfinder services.' There are two input fields: 'User name:' with the text 'user\_name' and 'Password:' with seven dots. At the bottom, there are two buttons: 'Login' and 'Cancel'.

Once the login process is completed, you can create your Pathfinder project.

### Note

If [two factor authentication](#) (TFA) has been enabled in Pathfinder Web for your user, the login will fail. Please disable it temporarily, login in the Addin, and then restore the TFA on the Web application.

### Note

The add-in will remember your login credentials, so you won't need to enter again the credentials in the next sessions. However, if the session becomes invalid (for instance, you use it from a different location), you may need to log in again.

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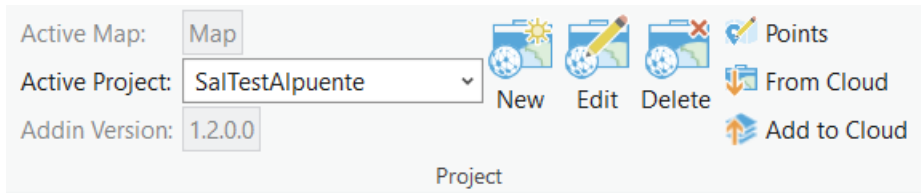
*Disclaimer:* the scenarios depicted in this manual do not represent actual customer projects or infrastructure proposals, and are presented for demonstration purposes only.

For more help, please [contact Gilytics](#).

## Project Section

This section allows you to:

1. See the list of existing Pathfinder projects in your ArcGIS document.
2. Create a new Pathfinder project based on the current ArcGIS document.
3. Edit and upload the project content:
  - Add or remove layers added to a Pathfinder project.
  - Update the layer data in Pathfinder, if it has been changed in ArcGIS.
  - Change the number and width of the layer rings (influence areas).
4. Delete a Pathfinder project.
5. Edit the Start and End points of the project, for routing calculations.
6. Download a Pathfinder project from the cloud, its data, scenarios and results.

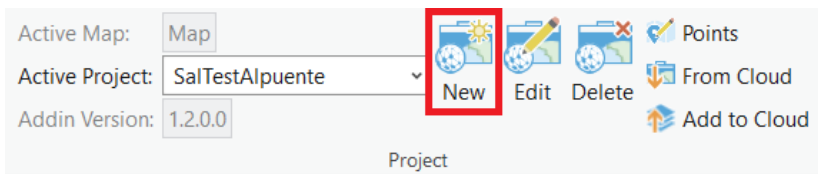


## Note

Multiple Pathfinder projects can be created in the same ArcGIS Map or Map 3D, for different areas. If you need to study different constraints or Start/End points options in the same area, create a single project with different scenarios.

## Create project

To create a project, use the New Project button in the *Project* section.



A dialog opens to set some options.

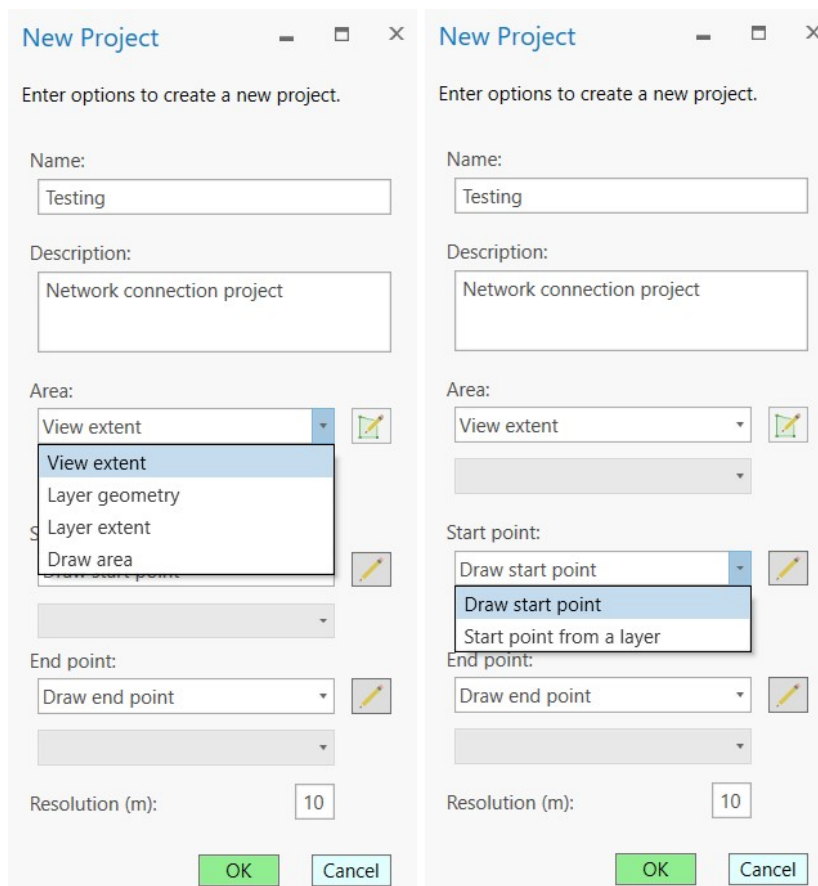
A screenshot of the 'New Project' dialog box. The title bar reads 'New Project'. Below the title bar, it says 'Enter options to create a new project.' The dialog contains several input fields and dropdown menus. The 'Name' field contains the text 'Testing'. The 'Description' field contains the text 'Network connection project'. The 'Area' dropdown menu is set to 'View extent'. Below it is a smaller dropdown menu. The 'Start point' dropdown menu is set to 'Draw start point'. Below it is a smaller dropdown menu. The 'End point' dropdown menu is set to 'Draw end point'. Below it is a smaller dropdown menu. The 'Resolution (m)' field contains the number '10'. At the bottom of the dialog, there are two buttons: 'OK' and 'Cancel'.

**The options to generate a Pathfinder project are:**

- Name: user-given name. Since multiple projects can be created in the same ArcGIS Map, this name may be different from the Map name.
- Description: text to identify or describe the Pathfinder project.
- Area: the region where the simulations will be performed.
- Start and End points: the points used to calculate routes. They can also be added or modified in the Scenarios.
- Resolution: the spatial accuracy of the calculations. Its default value is 10 meters. It may be necessary to increase this value for very large areas. An error message will appear if the resolution must be increased.

The name, area, and resolution fields are mandatory.

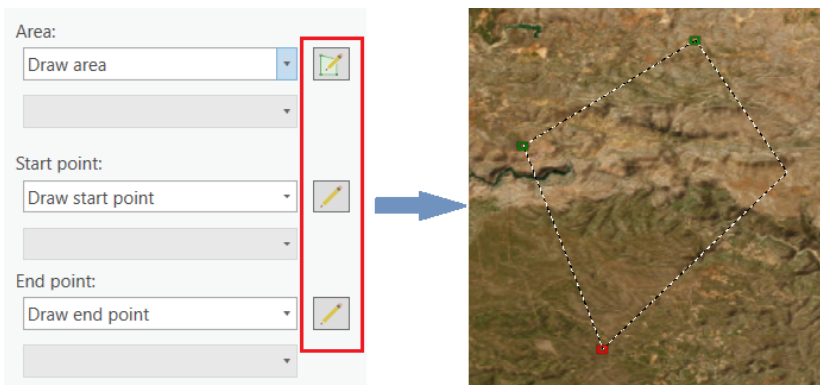
The project area, start and end points can be defined from ArcGIS layers, data files or drawn manually when the user creates the project.



**Note**

The project area and the project resolution cannot be changed once the project is created. Just delete the project and create it again. The start and end points can be changed with the Edit Project Points button or defined in the Scenario Settings.

To draw start/end points or the project area, select the Draw option and click on the right Draw button. Then click on the map and edit the project area or selected point.



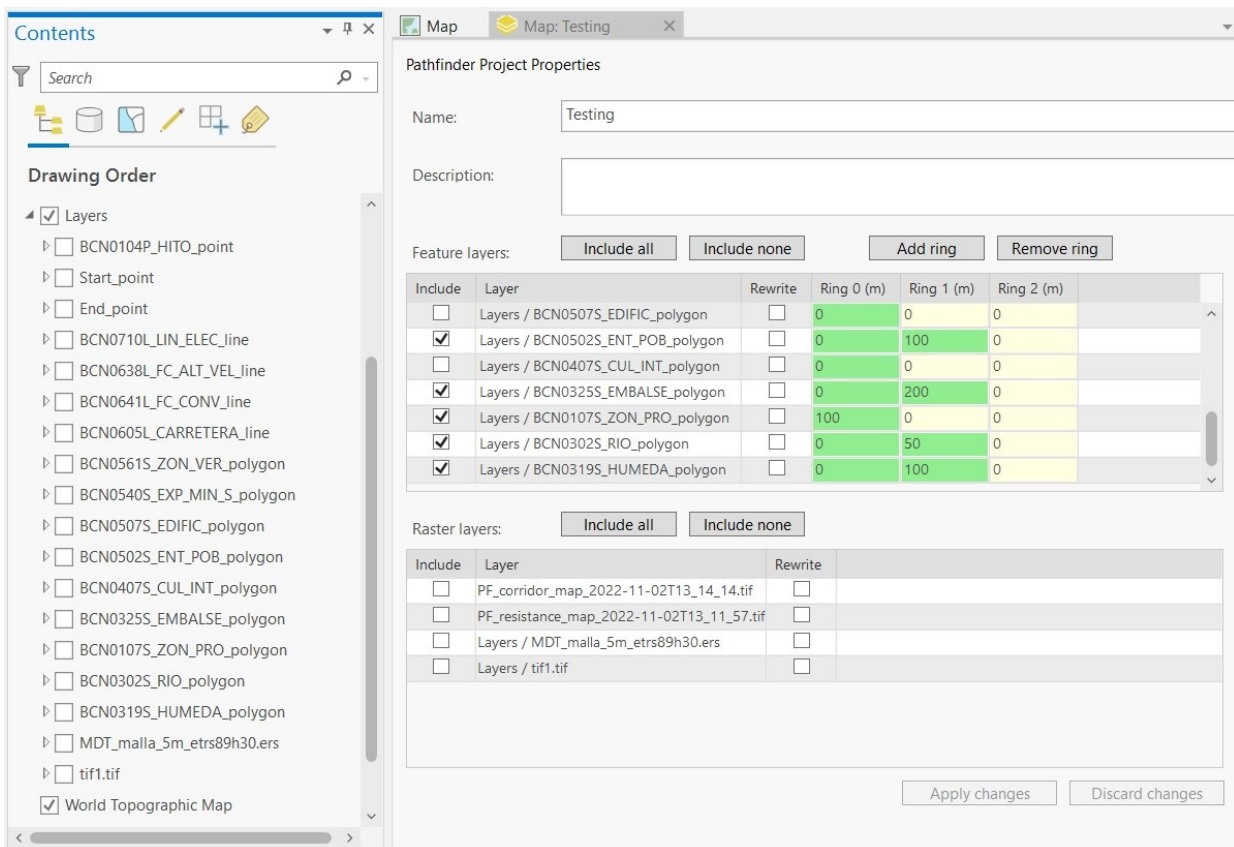
## Note

Each Pathfinder project created in the ArcGIS Pro addin is stored in Pathfinder cloud and can be accessed from Pathfinder Web, as well as downloaded by users of your organization with access to it.

## Edit project

To edit a Pathfinder project, first the user must select the it in the *Active Project* list, in the Pathfinder tab. Then, click the *Edit Project* button to open the Project Content pane.

In this pane, the user can add, delete or rewrite layers in the Pathfinder project. The layers present in the ArcGIS document will be displayed, as shown in the image below, in two separate tables for vector and raster data.



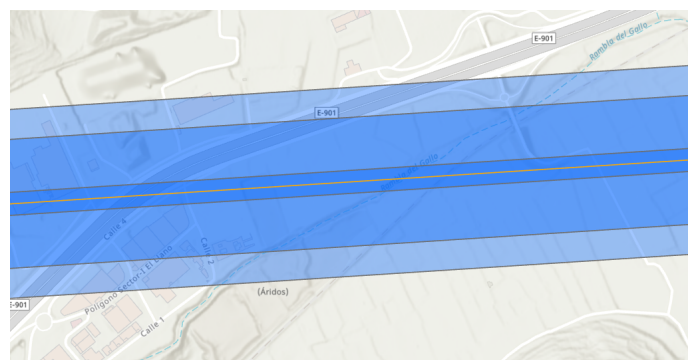
Possible operations in this pane are:

- **Add layers.** To include them in the Pathfinder project, the *Include* option must be checked. It is possible to include all the layers in the list by clicking *Include all* button.

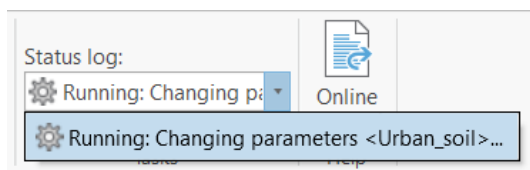
- **Remove layers** that are already in the Pathfinder project, by unchecking the *Include* option.
- **Rewrite layers.** If the user has changed an ArcGIS layer included in the Pathfinder project (the geometry has been edited, or features have been added or deleted), we can update it by checking the *Rewrite* option.
- Define the **rings or buffers** of each vector layer. Users can create multiple influence areas or rings around the original feature, so different resistance values can be assigned to each ring. By default, vector layers have only one ring. To generate more, click the *Add ring* button and change their default ring width value of 0 to a larger one.

For instance, this image shows how to create three rings for the *Power lines* layer. The first ring has a width of 10m, the second ring has a width of 100m and the third ring is 50m wide.

Feature layers:						
		Include all	Include none	Add ring	Remove ring	
Include	Layer	Rewrite	Ring 0 (m)	Ring 1 (m)	Ring 2 (m)	
<input type="checkbox"/>	PF_path_A_2022-12-20T14_03_30	<input type="checkbox"/>	10	0	0	
<input type="checkbox"/>	Layers / BCN0104P_HITO_point	<input type="checkbox"/>	10	0	0	
<input type="checkbox"/>	Layers / Start_point	<input type="checkbox"/>	10	0	0	
<input type="checkbox"/>	Layers / End_point	<input type="checkbox"/>	10	0	0	
<input checked="" type="checkbox"/>	Layers / BCN0710L_LIN_ELEC_line	<input type="checkbox"/>	10	100	50	
<input type="checkbox"/>	Layers / BCN0638L_FC_ALT_VEL_line	<input type="checkbox"/>	10	0	0	
<input type="checkbox"/>	Layers / BCN0641L_FC_CONV_line	<input type="checkbox"/>	10	0	0	



After all the options are set, click on *Apply changes* to apply them to the Pathfinder project. The **Status log** list will show when the process is done.



Multiple steps are performed during this apply process, including exporting layers' data (within the project area), uploading them to Pathfinder, and calculating the ring geometries.

## Note

The time required to complete this process can be long. Please be patient.

The maximum size for raster data is 200MB. If a raster's size in the project area is larger, it will be resampled to reduce it.

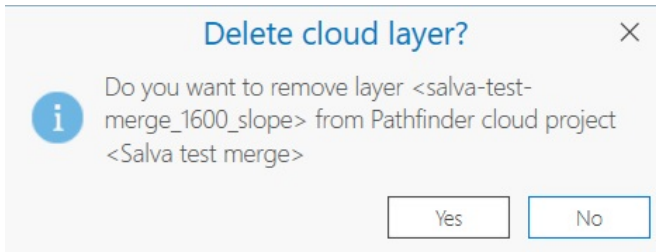
Complex vector layers may need a long time to be processed, and they may fail to be loaded into Pathfinder. Consider splitting them by area or by attribute.



## Adding and removing layers in ArcGIS

When layers are added or removed to the ArcGIS map, the list of layers in the Pathfinder panels is automatically refreshed. New layers in the map are not automatically added to the Pathfinder project, you need to select them in the Edit panel.

When a layer is removed from the ArcGIS map and it was used in the Pathfinder project, you will be prompted to choose whether to *delete it from Pathfinder cloud* or not. If you created the Pathfinder project from ArcGIS, this may make sense. However, if this layer was downloaded from Pathfinder cloud, it is safer to keep it in the server.

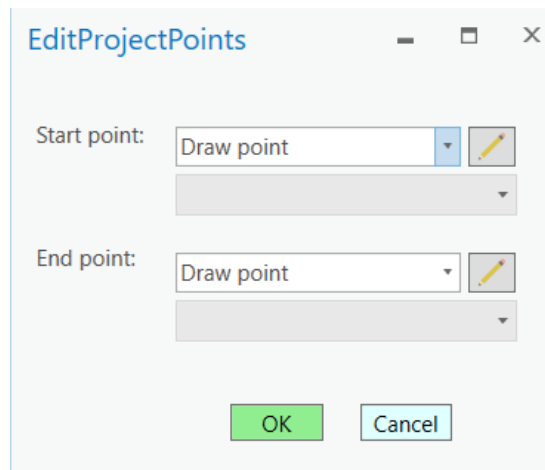


## Edit project points

After the project creation, it is possible to change the start and end points in the Pathfinder project. In the Project section, click on the *Edit Project Points* button.

The options to specify the points are 1) to draw the new location point or 2) to select a new layer containing a point feature.

The procedure to draw the points is the same as when creating the project: select the draw option and then click on the right button with the pencil icon, then draw the point on the map.

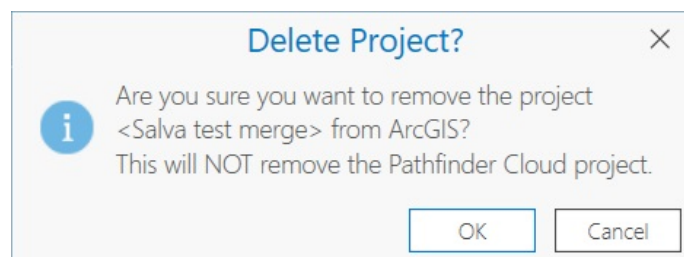


## Delete project

If the Pathfinder project is not needed any more, it can be eliminated by using the *Delete* project button.

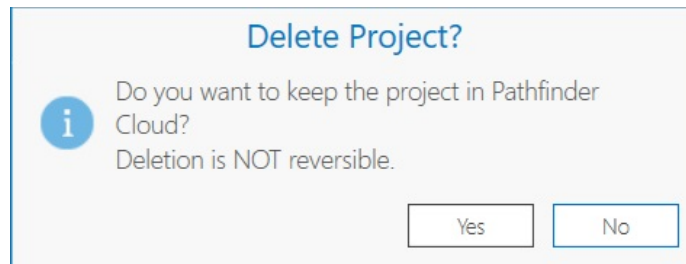
Note that there are two independent elements that can be deleted in this operation. First, there is the local project configuration in your ArcGIS. Removing this configuration just disconnects your ArcGIS from the Pathfinder cloud project, but it doesn't remove any data in the cloud, and it neither removes any data in your ArcGIS document.

You must confirm this local configuration removal with the following message box:



The second component is the Pathfinder project itself in the cloud. If you remove this, you will release space in our Pathfinder account to create other projects, but all layer, scenario and results data will be removed from the cloud storage, so it is highly recommended that you save local copies of all this information.

The following message will appear for you to confirm the removal of the cloud project. If you are unsure, it recommended to select "Yes" to keep the project.



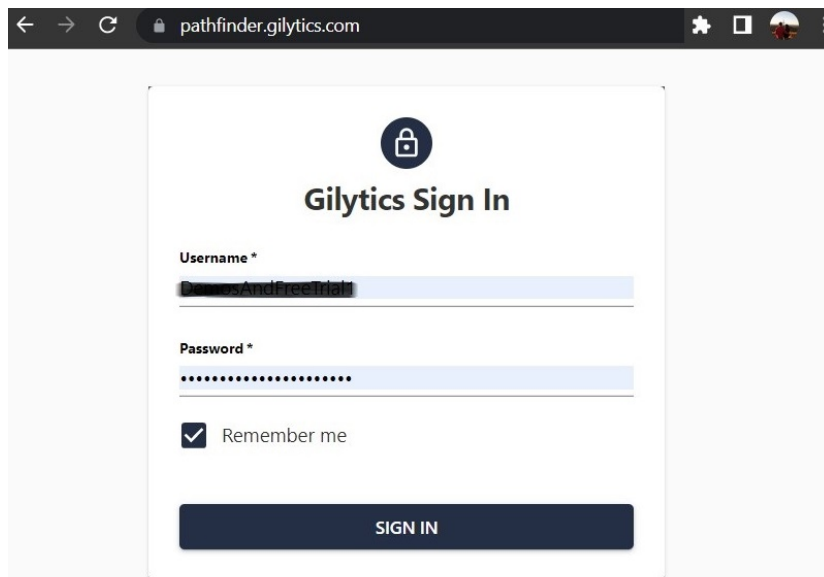
### Note

Deleting a Pathfinder project does not affect the content of the ArcGIS Pro document. No layers will be removed.

## Access the project on the web

Users can open the project in the Pathfinder web site to access functionalities only available online, like the Printed Report or the 3D visualization.

To access the project online, go to [Pathfinder](#) and enter your username and password in the login page.



Once logged in, you will see all the projects created in your Pathfinder account. The projects created from the ArcGIS add-in will have an *ArcGIS\_Pro\_* prefix followed by the user-given project name.



To open a project, just click on the tile with its name.

## Note

The changes done to a project on the Web are not automatically synchronized with the addin. In general, it is not recommended to change the content of the project (add/remove layers or modify parameters) in the Pathfinder web application.

If you change project data, scenarios or results on the Web application, and want to update the addin, use the “Copy from cloud” tool below.

## Copy project data from the cloud

There are a few reasons why you may need to copy Pathfinder projects from the cloud into your ArcGIS Pro document:

- You have lost your ArcGIS document with the Pathfinder project. In this case, the Pathfinder cloud works as a backup that you can use to recover your project in ArcGIS. Note, though, that only the latest results are kept in the cloud. You will not be able to recover results that were recalculated again unless you have copied them elsewhere.
- Someone made changes to the Pathfinder project in the Web application and you need to apply those changes to your ArcGIS version. If anyone used the Web application to add new layers or modified the buffer settings of the project, or you changed the resistance and other parameters of one of your scenarios (scenarios are always owned by their creators), you can apply those changes to your ArcGIS project.
- As a collaborative tool, to share with others ArcGIS users a Pathfinder project you created. If other ArcGIS users in your company have a Pathfinder account with access to your project, they can use this functionality to create their own local copy of the project data. Then, they will be able to create their own scenarios and results.

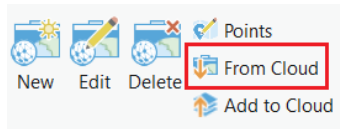
## Note

This functionality must be used carefully. It is your responsibility to maintain consistency between the ArcGIS and cloud versions of the project, and avoid multiple users with admin permissions to change the same project, unless you are all careful. It is recommended that the project layers and configuration are managed by a single person. Scenarios are not a problem in this regard, because they are always managed by the user who created them, and each user manages different scenarios in the same project.

## Note

Pathfinder permissions apply to which projects you will be able to see and copy their data. Scenarios and results are private to each user, so you will only be able to copy those you created with the same user you are logged in the Addin. In the future, we will support accessing shared scenarios as well.

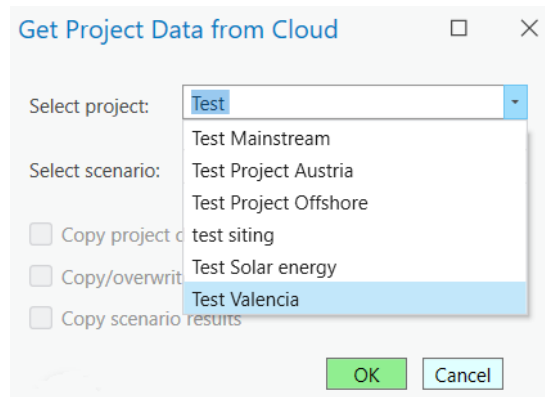
If you want to copy project data from a cloud project to ArcGIS, use the “From cloud” tool in the Project section:



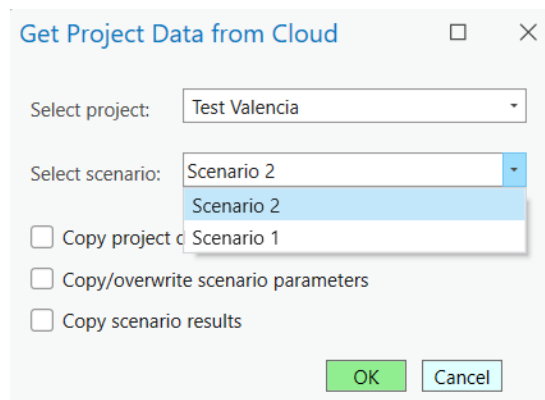
A dialog will open to select the source project and which of its components will be copied.

### Select the source project and scenario

The Copy From Project dialog will access the list of all projects available to the logged in user. You can type some text to filter the list:



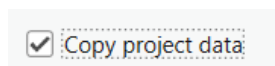
After selecting the project, the scenarios defined in it by your user will be listed. As in Pathfinder web, you can only access scenarios created by your user. Shared scenarios are not yet supported in the addin.



Scenario selection does not affect the layer data download, but it will be used if you select to download a scenario configuration, or its results.

### Copying project and layers

The first option in the dialog is to copy the project data.



Like the others in the dialog, this option is not mandatory. You should use it when you want to:

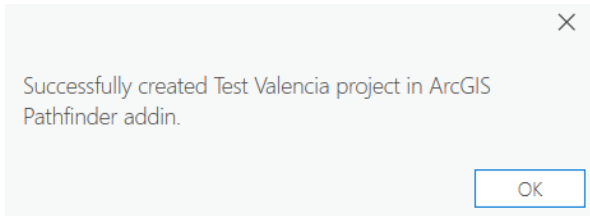
- Get a local copy of the project layers' geodata.
- Get the layer configuration (list of layers in the project and their rings) so you can change it from ArcGIS.
- Get scenario information, if you didn't already have a local copy of the project.

When this option is selected and the OK button is clicked, the following actions happen:

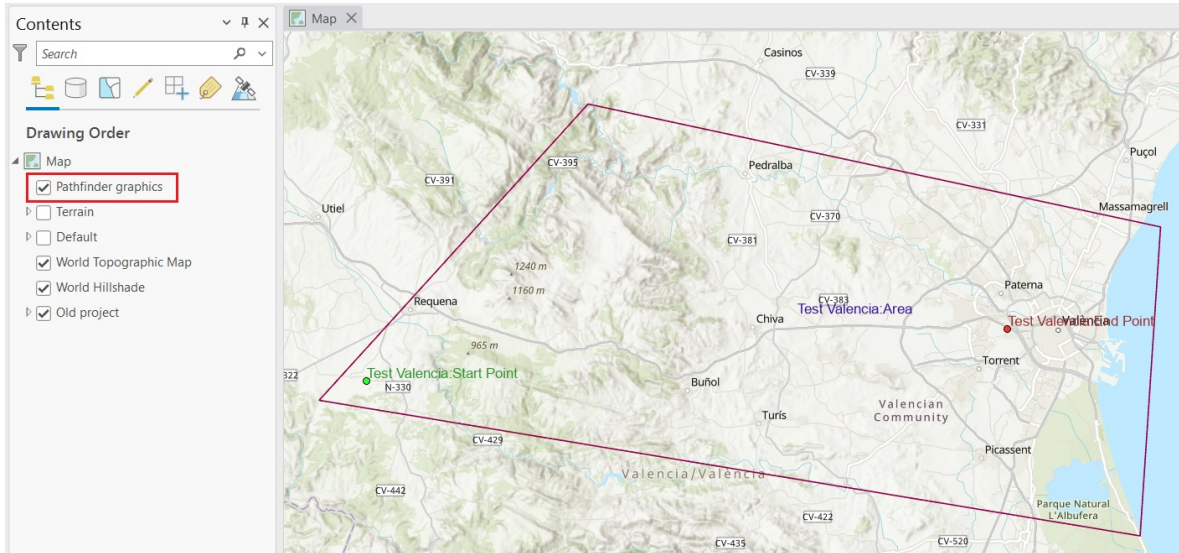
- The basic **project properties** (extent, start and end points, name and description) are copied to your ArcGIS.

A confirmation dialog appears:

## Project Section



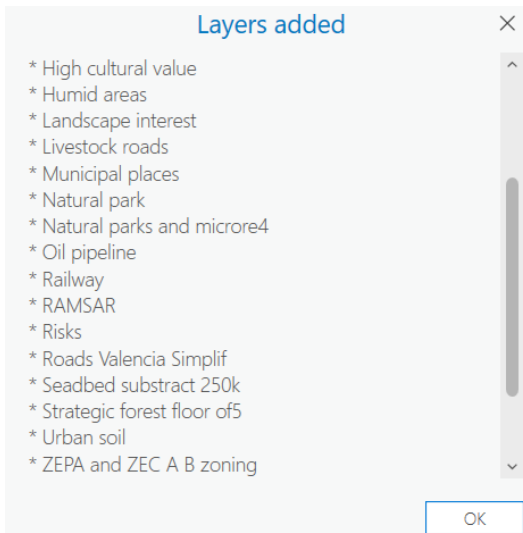
The map view zooms to the project extent, and its area and start/end points are displayed as graphics. A new "Pathfinder graphics" layer is created containing these graphic elements.



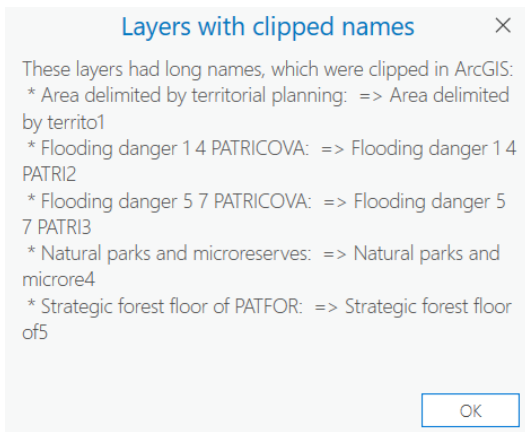
- The **project layers** are copied.

The vector or raster data of the layers in the Pathfinder project will be downloaded and added to your ArcGIS document. This may take some time, depending on the data complexity.

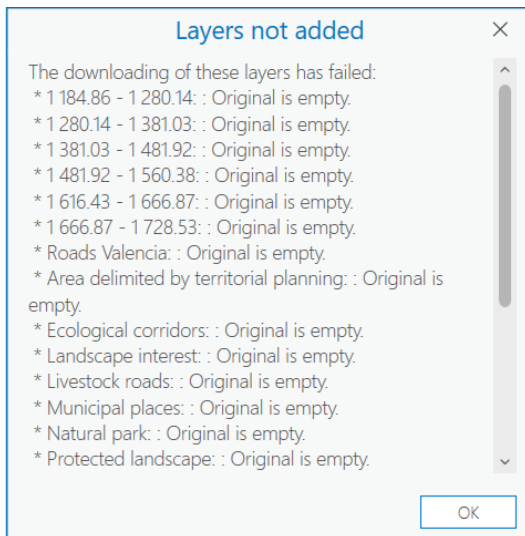
A dialog will show the list of layers that were successfully copied:



In some cases, long layers names will need to be clipped to comply with ArcGIS geoprocessing limits. A dialog will show how the original names have been shortened:

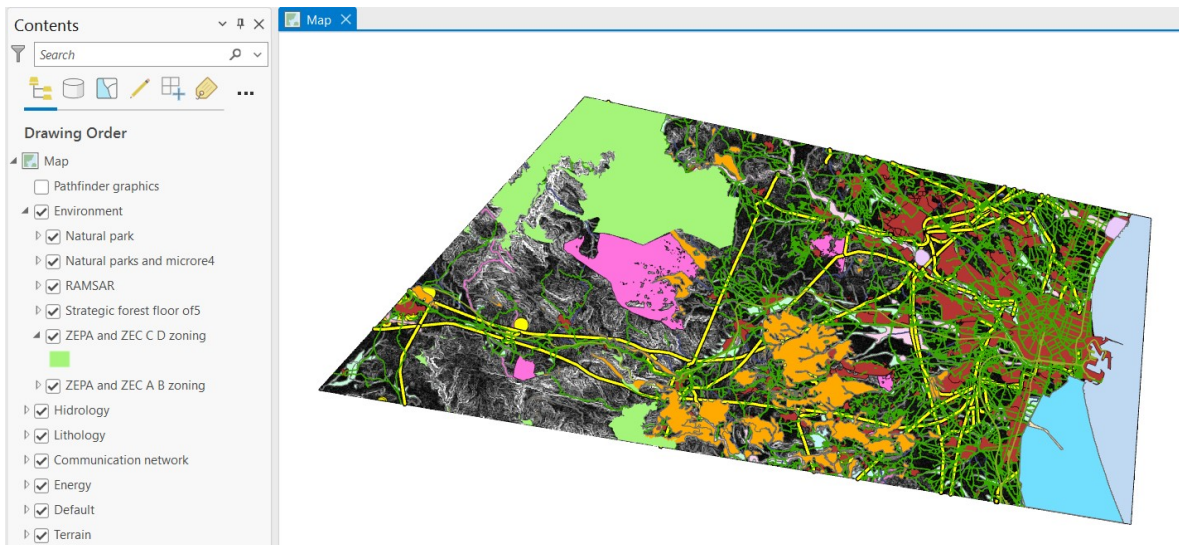


If the data download fails for some layers, a dialog will open to list them:



In the list of failed layers, you will see the error messages explaining what happened. In most case, the reason will be that *the layer is empty in Pathfinder* (it doesn't contain any data in the project area).

- **Group layers** are created for each category in the Pathfinder project. So, the downloaded layers will be added to groups reflecting the category classification in the original Pathfinder project.



Where are the downloaded *data stored*?

- The raster data, and vector data in some cases, are stored as GeoTIFF and shape files in the project folder, inside a "Pathfinder Results / layers" subfolder.
- Most of the vector data will be stored directly in the project's default geodatabase.

## Note

The added layers will be displayed with ArcGIS' default symbology. In the current version, the original Pathfinder symbology is not applied.

## Note

If your Pathfinder project was already defined in the ArcGIS document, the existing layers will not be overwritten. Only new layers will be downloaded and created in ArcGIS. If you want to refresh the data of some layer from the cloud's original ones, first remove them from the ArcGIS project **without removing them from Pathfinder cloud**.

## Copying scenarios

As mentioned, a scenario can be selected from the dropdown in the dialog. Only one scenario can be copied at a time, but you can use the tool multiple times to copy more scenarios as needed.

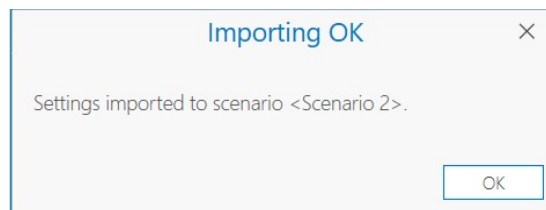
If you want to copy one scenario, select this checkbox.

To apply the resistances defined in the scenario, you should have the corresponding layers already in your ArcGIS document. If you don't, select also the checkbox to copy the project data.

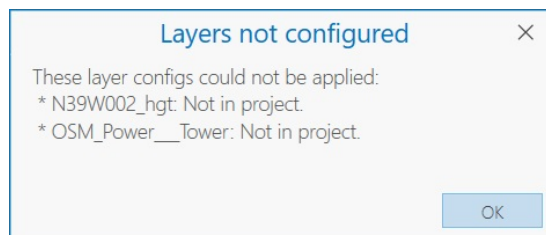
Copy/overwrite scenario parameters

If the scenario is already defined in ArcGIS, you will be prompted to confirm your wish to overwrite it.

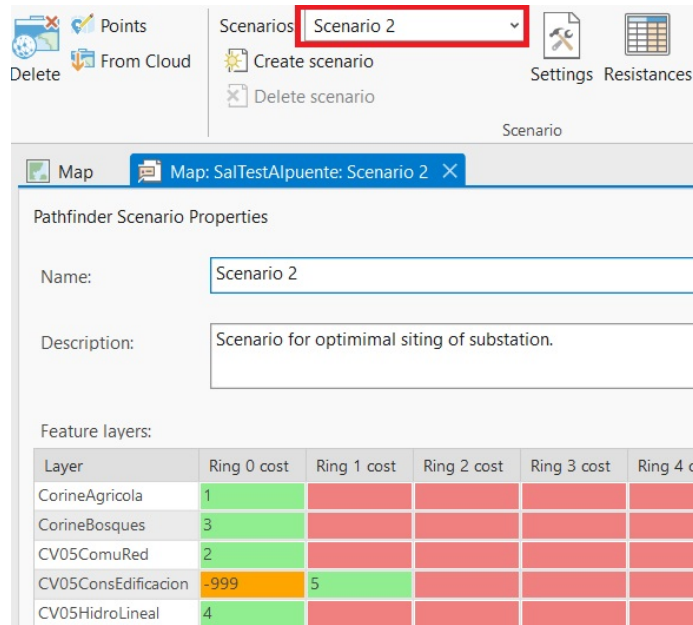
Once the scenario is copied, you will see a confirmation as well:



If some of the scenario layers are not present in your project (they were not downloaded correctly, or have been removed), a dialog will show that some layer configurations from the scenario could not be copied:



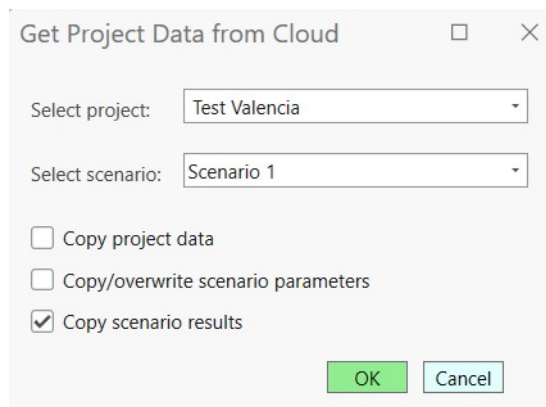
After the scenario is copied, the Resistances pane for the scenario will open, and it will be shown in the Scenario section of the Pathfinder tab.



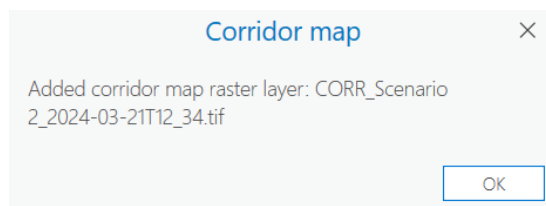
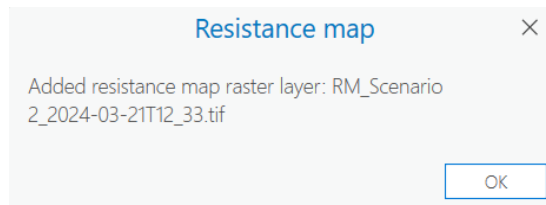
From this moment, you can apply changes to your Pathfinder project scenario from ArcGIS.

## Downloading results

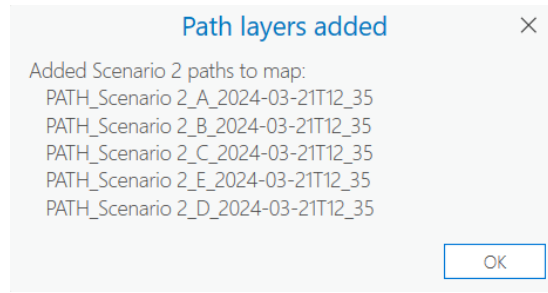
You can also download the results (Resistance Map, Corridor raster and Paths) from a selected cloud project scenario.



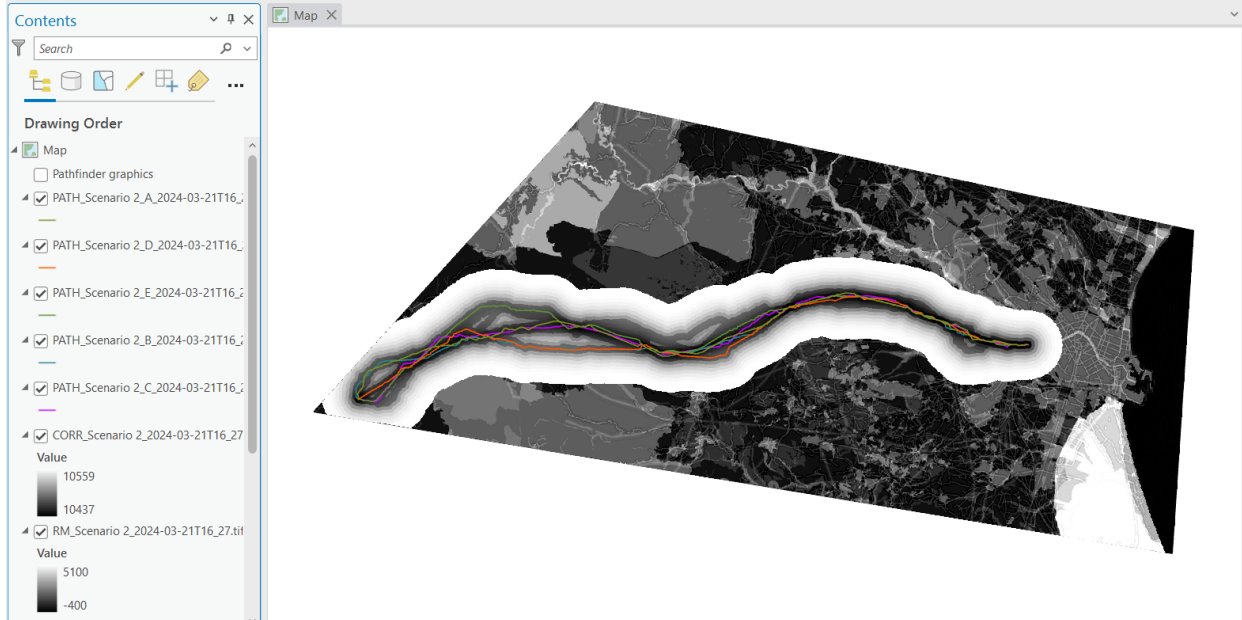
If the results haven't been calculated yet, you will see a notification message. Otherwise, the resistance map, corridor map and path(s) already computed in Pathfinder cloud for the selected scenario will be downloaded to ArcGIS and added as layers to the map.



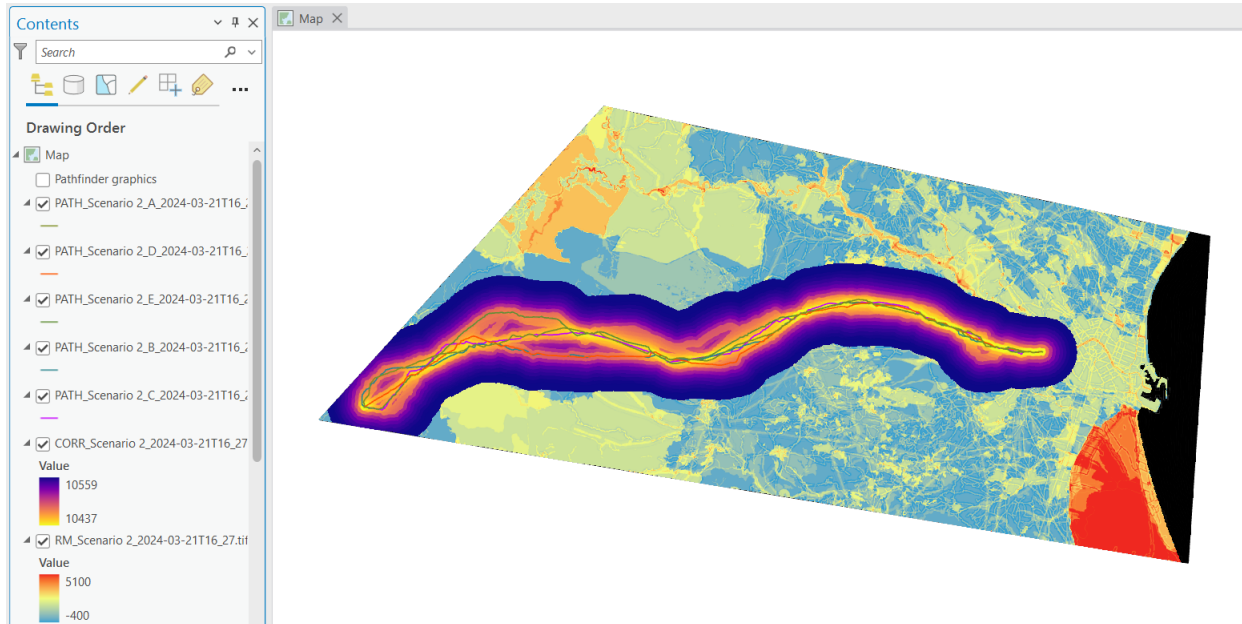




As mentioned, data downloaded from Pathfinder, including these results, will be displayed with default symbols:



You can then use ArcGIS symbology options to change the visualization the results as you prefer:



Same as if you generate the results locally, the corresponding files will be stored in a subfolder within your ArcGIS project folder: "Results/MyScenarioName":

> ArcGIS > Projects > TestCopy2 > Pathfinder Results > Scenario 1

Name

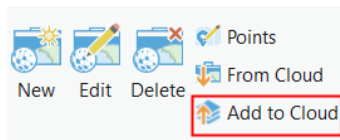
- PATH\_Scenario 1\_A\_2023-10-02T09\_24.cpg
- PATH\_Scenario 1\_A\_2023-10-02T09\_24.dbf
- PATH\_Scenario 1\_A\_2023-10-02T09\_24.prj
- PATH\_Scenario 1\_A\_2023-10-02T09\_24.sbn
- PATH\_Scenario 1\_A\_2023-10-02T09\_24.sbx
- PATH\_Scenario 1\_A\_2023-10-02T09\_24.shp
- PATH\_Scenario 1\_A\_2023-10-02T09\_24.shp.xml
- PATH\_Scenario 1\_A\_2023-10-02T09\_24.shx
- CORR\_Scenario 1\_2023-10-02T09\_23.tif
- RM\_Scenario 1\_2023-10-02T09\_22.tif

## Add layers to an existing project in the cloud

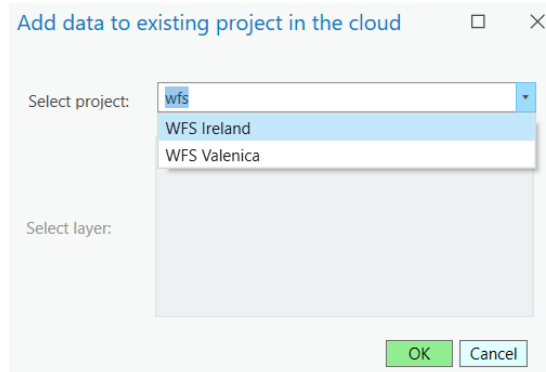
We use this tool when we want to upload ArcGIS layers to an existing Pathfinder project in the cloud without first downloading that project to ArcGIS. The requirements to use it are:

- Authorization: to upload layers to an existing cloud project, the user must belong to the company owning the project and have administrator-level permissions.
- Data: the layers must be already present in the Contents of the ArcGIS Pro map.

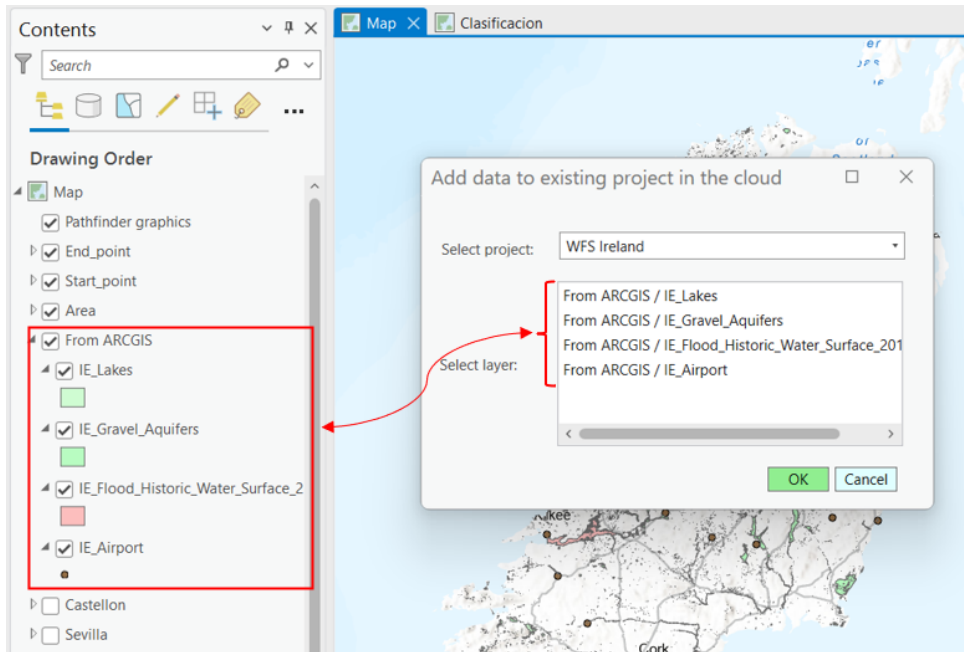
You can find this tool in the Project section:



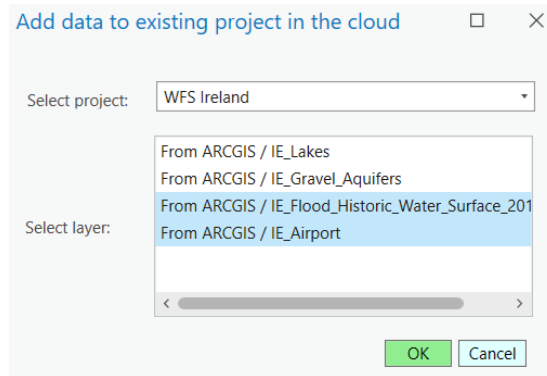
A dialog box will open to select one of the projects from your company. To filter the list of projects, type some text.



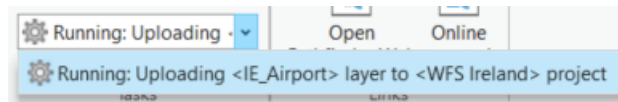
Once the project is selected, all the layers in the ArcGIS map intersecting its area will be listed.



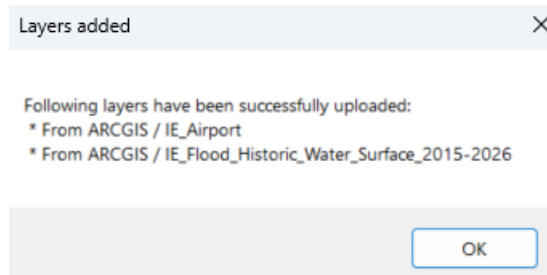
Now, choose all the layers to be uploaded to the Pathfinder cloud project by clicking on their names.



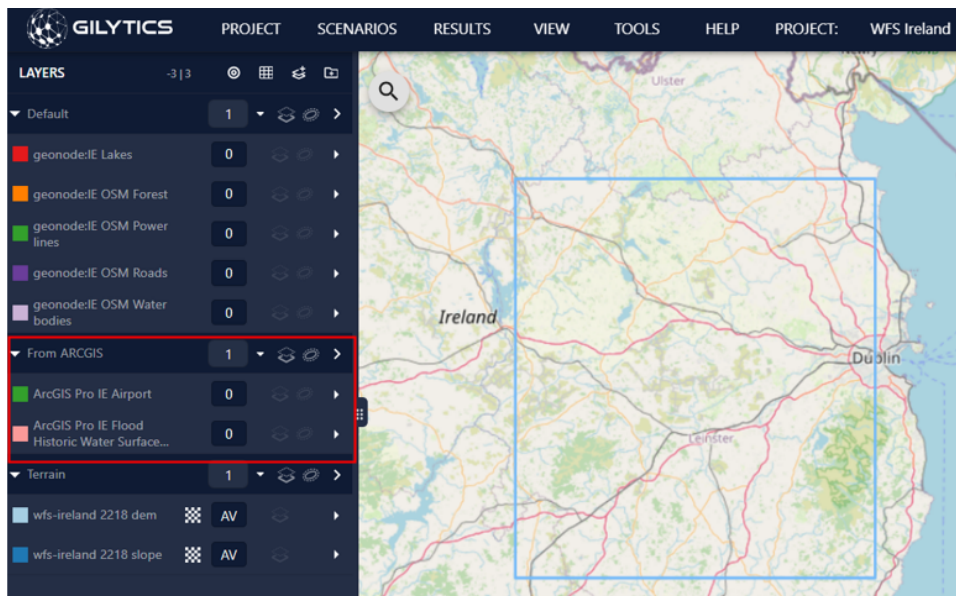
When the layers are selected, click the OK button. The uploading will start and the *status log list* will show the running process.



As soon as the process is complete, a confirmation dialog will appear:



Afterwards, the new layers will appear in Pathfinder Web as part of the project and all authorized users will be able to use them in their scenarios.



## Note

The time required to complete the uploading process depends on the layers size. Please be patient.

Complex vector layers may need a long time to be processed. Sometimes this process fails. Try again or consider splitting them in multiple layers by area (clipping) or by attribute values (e.g. different types of buildings).

Large raster data (small cell size in a large area) may be downsampled to fit with Pathfinder's data upload limit (currently 200MB).

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For more help, please [contact Gilytics](#).

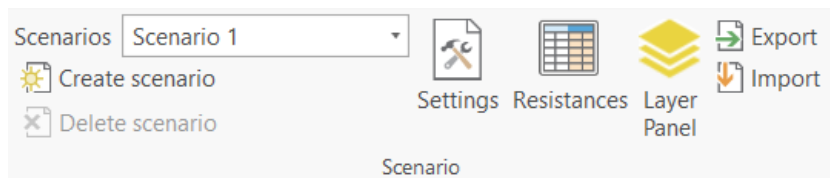
## Scenario Section

Once the project is created and data layers are added, the next step is to define the constraints affecting the location of our infrastructure. These restrictions are specified in the Scenarios.

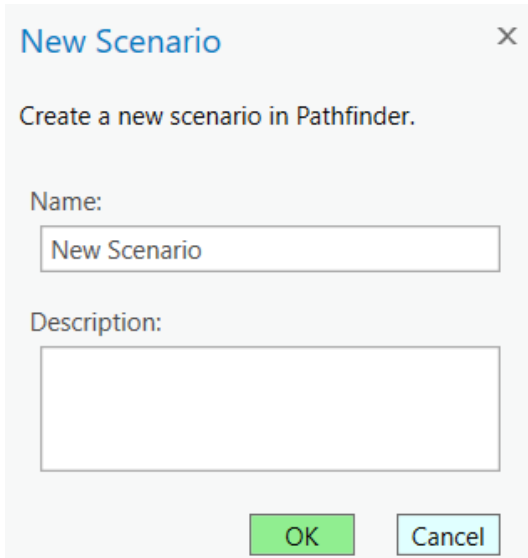
The constraints are defined by:

- **Resistance values** assigned to each data layer ring (or raster value). Resistance values reflect the relative importance or cost of each spatial element in preventing the infrastructure to be located or crossing the area.
- **Key points**. In every scenario, the start and end points can be different. It is also possible to add intermediate points, to force the routes to pass through them. When the scenario points are set, they will be used instead of the project points.
- Routing options. Different **algorithms** can be used to calculate the optimal routes. The available algorithms may depend on the company license. Check the documentation to see which one is best for your needs.

The Scenario section provides the following options:

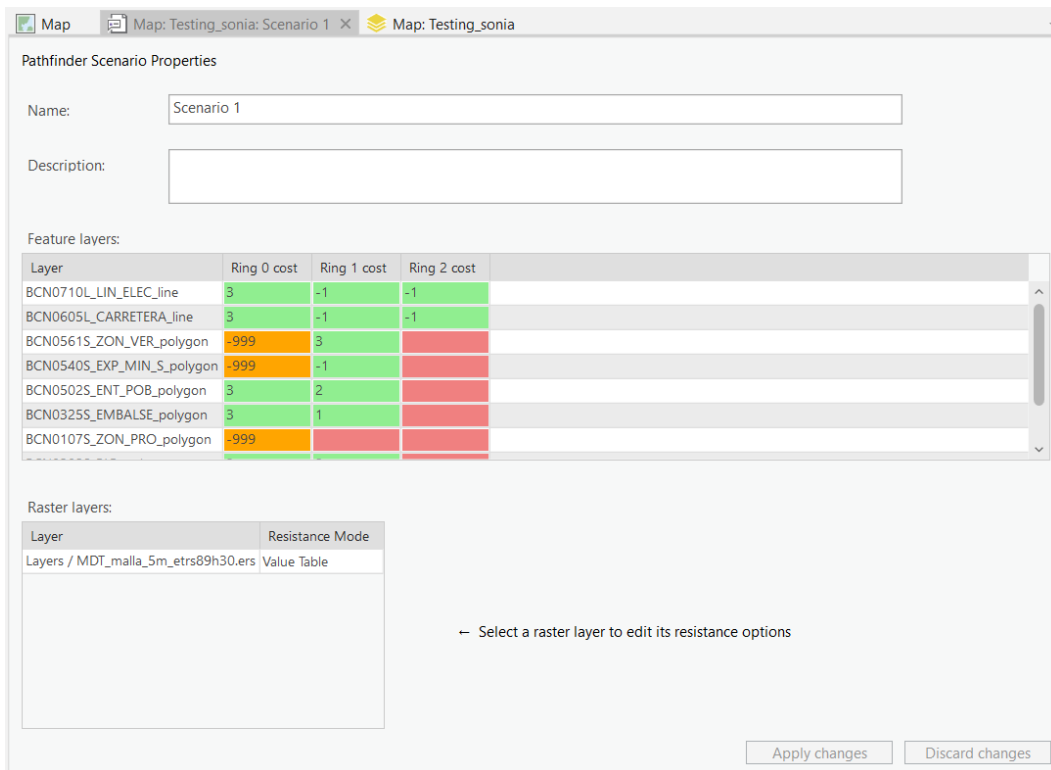


1. *Create/Delete* a scenario. The minimum number of scenarios is one, but it is possible to create more and delete the ones we don't need any more.



2. To set the data constraints, click on the *Resistance* button. A window pane will open with a table containing all the layers included in the Pathfinder project, split in vector layers and rasters.

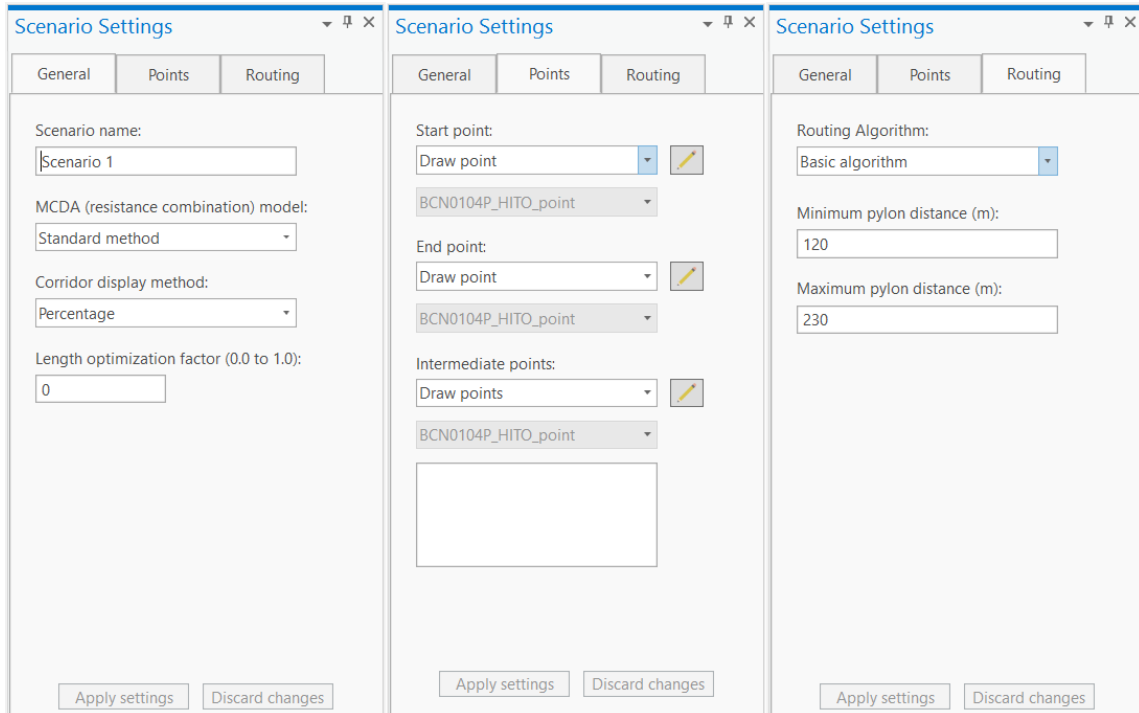
In the case of vector layers, we can set the resistance value for each ring. To specify a **forbidden area**, use the special value **-999**.



## Note

The scale of integer resistance values is arbitrary. They can range from 0 to 10, from -100 to 100, or any range you find useful. Use negative values in areas where you want to favor the location of the infrastructure.

3. *Settings*. A dockable pane will be shown, to define scenario settings in three different tabs: General, Points and Routing.



- a. *General* parameters, like the scenario name, the **MCDA model**, the method to calculate the **corridor** and the **length optimization factor**.
- b. *Scenario points*. The start and end points can be changed or added here. It is also possible to add intermediated points forcing the corridor and the paths to go through particular locations. Define these points by selecting an ArcGIS layer or drawing on the map.
- c. *Routing options*. In this tab, users can select the **routing algorithm** used to perform the routing calculation, as well as the minimum and maximum distances between the pylons (route nodes).

The available routing algorithms may depend on your company license. The most common options are:

**Basic algorithm.** The fastest to compute. It generates a single optimal path by finding the least resistance path across the resistance map, therefore, minimizing the total resistance.

**Pylon spotting.** It also optimizes the pylon/node location and the angles at those locations. Because of the additional resources required to run this algorithm, it may fail in large projects. We recommend reducing as much as possible the difference between the minimum and the maximum pylon distances. See the algorithms documentation for additional info on its parameters.

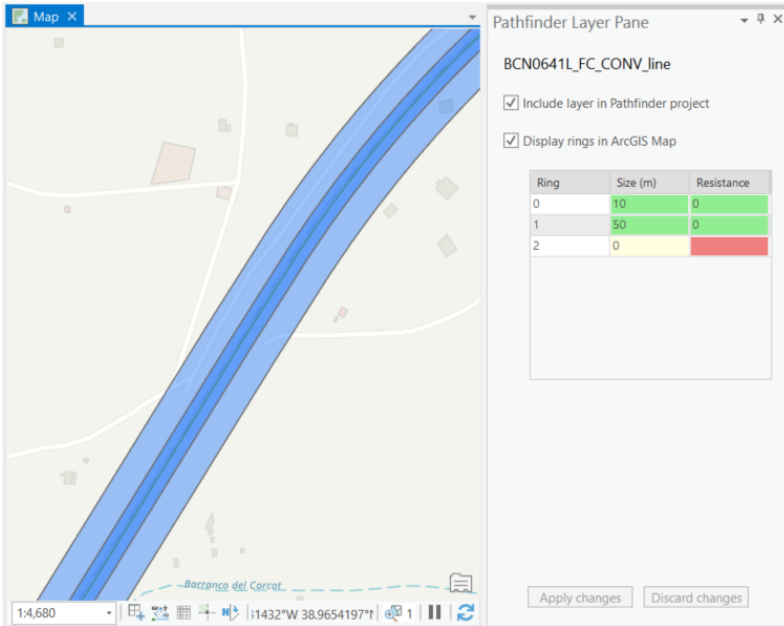
**Pathfinder explore.** It returns multiple path results, providing more alternative solutions with a fast and lean calculation. See the algorithms documentation for additional info on its parameters.

4. *Layer panel*. This button opens a dockable panel allowing control on the Pathfinder configuration of a selected ArcGIS layer.

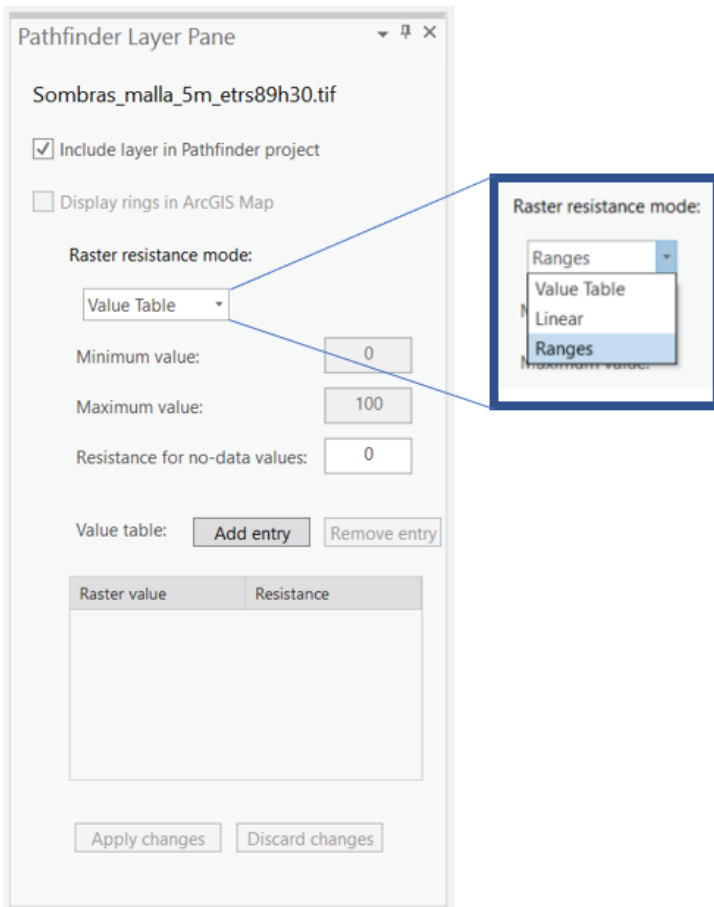
Two checkboxes can be used to:

- Add or remove the layer in the Pathfinder project.
- Display the rings set on the map

In the case of a vector layer included in the Pathfinder project, users can set the ring sizes and resistance values in this layer panel.



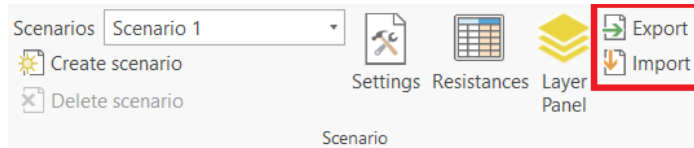
In the case of a raster layer, users can choose the raster resistance mode and set its parameters.



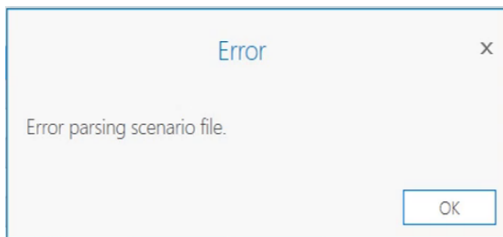
5. *Export or import* a scenario configuration to/from a JSON file. In order to backup or reuse the scenario resistances and settings, these values can be stored and recovered from JSON text files, which can be edited in any standard text editor.

Use the Export button to save a JSON file with all the scenario resistances and settings.

It is also possible to Import a previously saved or edited JSON to upload its resistance and scenario parameters. After the Import button is used, the new settings will be automatically applied to the Pathfinder project.



If there is a mismatch between the layers in the scenario file and the layers in the Pathfinder project, you may see this error message:



## Note

Remember to **apply changes** after any modification.

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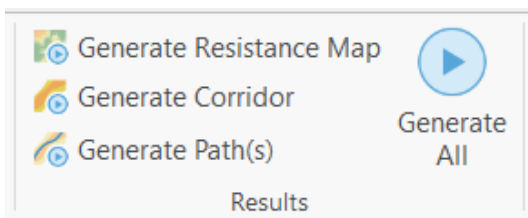
For more help, please [contact Gilytics](#).

## Results Section

Pathfinder can generate analysis deliverables based on the data and scenarios in the project, providing information about the optimal location and route of the infrastructure.

Typically, these results are generated in sequence, since each one is needed to calculate the next one.

To run the generation processes and access the available results, use the *Results section* in the Pathfinder tab.



## Calculate Resistance Map

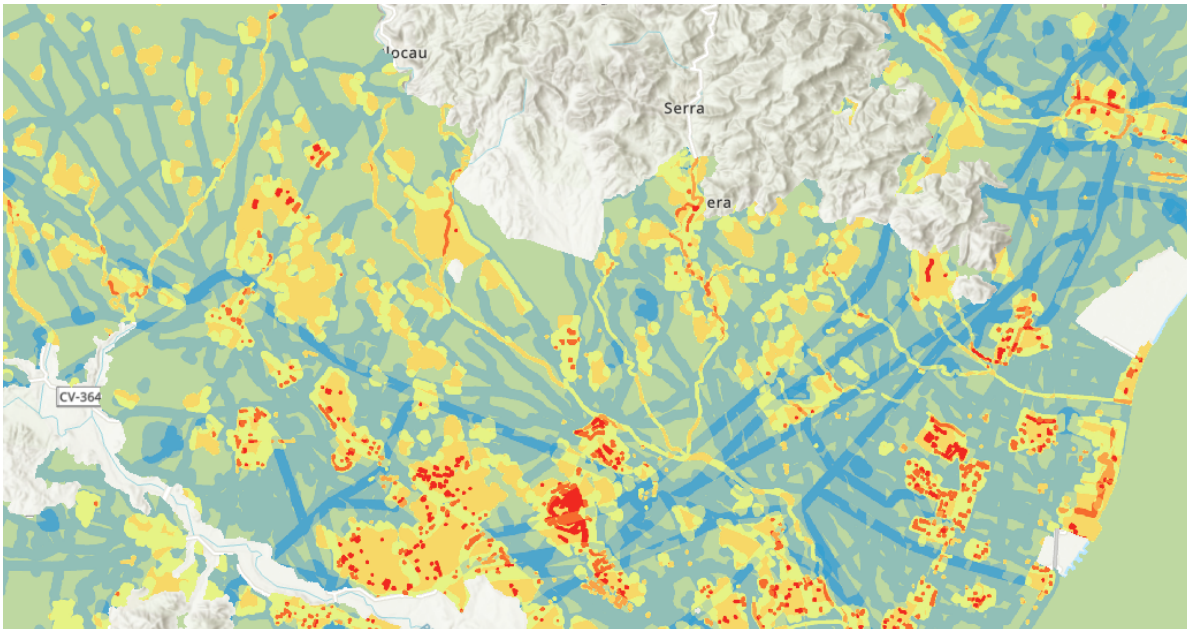
The first result to be calculated is the Resistance Map (RM), a combination of all the layer resistances in the project using the selected MCDA model.



The RM can be used for **optimal siting**, since lowest values will represent areas where the total resistance or cost is smallest.

To generate the RM, click on the *Generate Resistance Map* button. The result will be added as a raster layer in ArcGIS Map and displayed on the map view.

Areas with Forbidden values (-999) are represented by *No Data* values in the output raster and they will look transparent. As with any raster layer in ArcGIS, the resistance map visualization can be changed using the ArcGIS symbology options, for instance, to use a preferred color ramp or change the minimum and maximum values to be displayed.



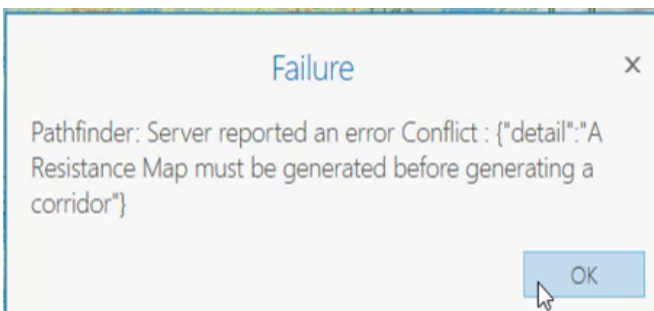
## Calculate Corridor Map

The Corridor Map provides a summary of all possible paths from the Start to the End point with an accumulated resistance near the optimum value, so in addition to hinting where the optimum path will be located, it shows possible alternative routes whose resistance is not much worse.

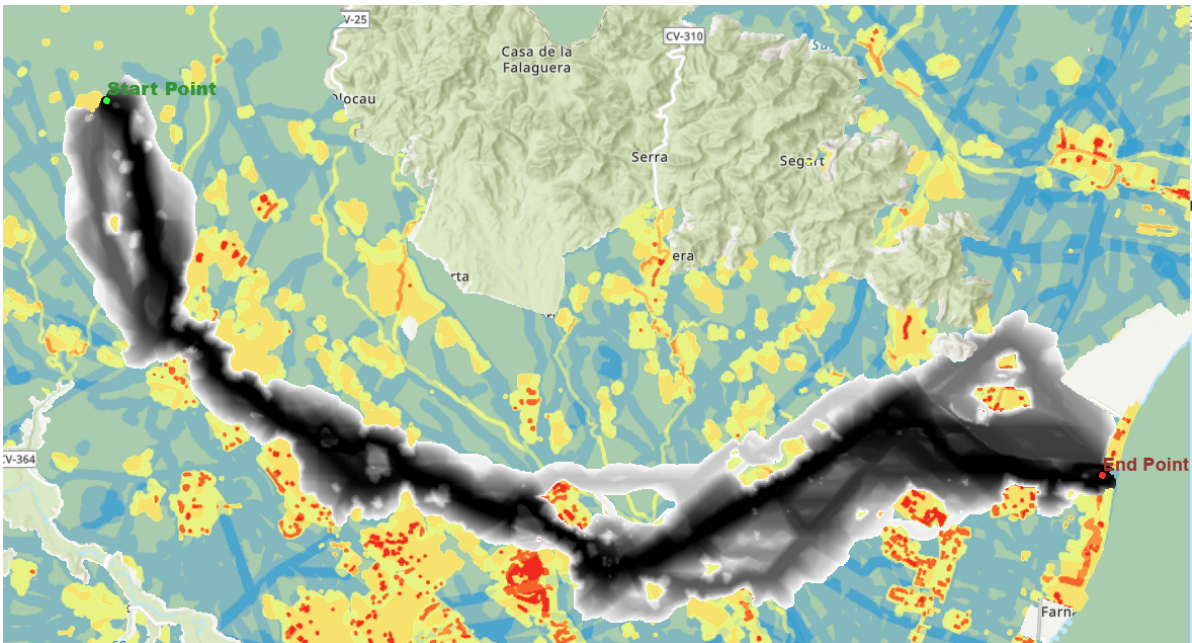
To calculate the Corridor Map, go to the *Results* section in the Pathfinder tab and click on the *Generate Corridor* button.

A corridor display method, percentage or percentile, can be specified in the *Scenario Settings* pane.

If the Resistance Map has not been calculated when executing the Corridor Map calculation, this error message will appear:



After the calculation process is complete, the corridor map will be displayed in the Map View.



By default, darker colors mean lower resistance. As with the RM, the user can change the color palette using the ArcGIS symbology options.

### Note

You might get a failure message if the Start or End points of the project are inside a **Forbidden** area. In that case, you need to change the project or scenario points.

## Calculate Path(s)

Once the Resistance Map and the Corridor Map are calculated, Pathfinder can find the optimal routes for a linear infrastructure going from the Start to the End points.

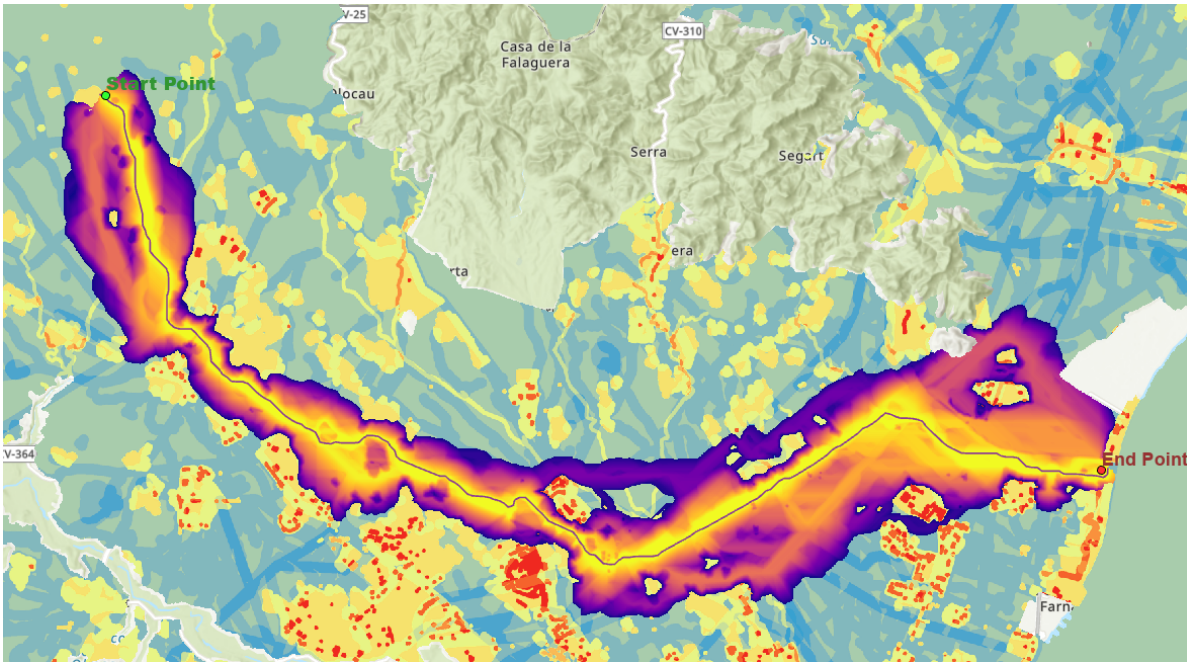
To run this calculation, click on the *Generate Path* button. The routing algorithm and other routing options can be modified in the *Scenario Settings – Routing* pane.



## Calculate All

Instead of generating the Resistance Map, Corridor and Path(s) one by one, it is possible to generate them all in sequence. This can be done with *Calculate All* option in the *Results* section.

The different results will be added to the map as they are generated.

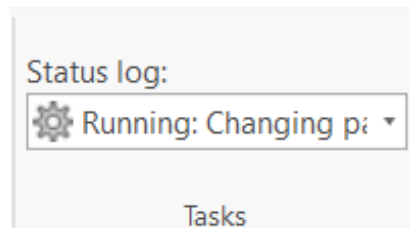


### Note

When project parameters (layers and their ring sizes) are changed, all the results should be recalculated to match these changes. If the Start or End points, layer resistances or scenario settings are changed, it is not necessary to recalculate the Resistance Map, only the Corridor Map and Paths.

## Status log

When a process execution is in progress, it is shown in the *Task* section. The current add-in version only allows for one process at a time.



## Results folder

The calculated results are saved to a local disk folder, in the same location where the ArcGIS project is stored.

### Note

All the result files include a timestamp in their names, showing when they were generated. In this way, multiple results do not overwrite each other.

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For more help, please [contact Gilytics](#).

## Support and FAQ

These are some troubleshooting tips you may find useful.

### Large datasets

#### If I try to export a large dataset, I get an error or the process takes forever

If your project area contains a lot of data (many features, or features with a complex geometry), there might be problems when exporting or updating the project.

To solve this issue:

- Simplify the features or
- Divide the data into smaller sets, creating multiple layers, and upload them separately

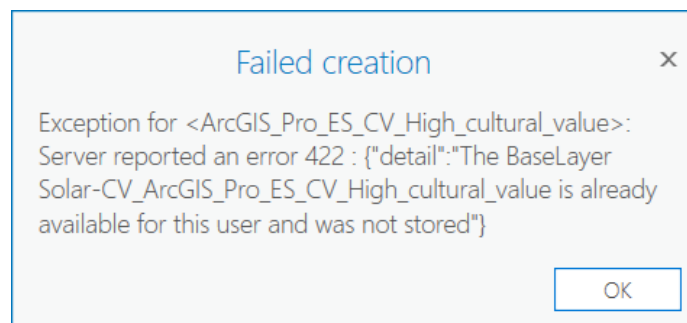
### Long processes

#### Calculations take a long time and I don't know how long the process will take

Processing requests to Pathfinder might take some time depending on the data size and options chosen. Our server infrastructure scales automatically to accommodate more requests, but there might be some waiting time. Currently, we don't have a mechanism to estimate the processing time.

#### ArcGIS closes while data was uploading to Pathfinder

If the ArcGIS program crashes or closes during a data upload process, the uploading will be interrupted. The data layer may have been correctly created in Pathfinder, but it will appear as *not included* in the add-in project panel. If you try again to include it in the project, the following message will appear.



To fix this, the layer must be manually removed from the [Pathfinder web project](#) and from your [Pathfinder web datasets](#).

### Changes in Pathfinder Web

#### Can I change my project in Pathfinder Web?

After you export your ArcGIS Pro data to Pathfinder, you can access the exported project in the Pathfinder Web application using the same user credentials.

In principle, you can perform any changes to the project in the web application. However, if you do so, the ArcGIS Pro and the Pathfinder Web settings will not be synchronized any more:

- Until you perform an Update from the ArcGIS Pro add-in, the Pathfinder Web settings will be applied to any calculation.

- When you perform an Update from ArcGIS Pro, the Pathfinder Web settings will be overwritten.

**Recommended uses** of Pathfinder Web for ArcGIS Pro addin users:

- Use analytics and reporting tools.
- Set parameters not available in the addin, like category groups and their weights. Be aware that some parameters may be overwritten if you apply again changes from the add-in.
- Use the 3D View for presentations. You can also use a 3D Map in ArcGIS.
- Continue working with a project if the original ArcGIS Pro document is lost.

**Non-recommended changes** in Pathfinder Web to keep the consistency with the ArcGIS Pro add-in.

- Add or remove layers.
- Change the layer rings or resistance parameters.

## Deleting the Pathfinder project

**If I use Project/Delete, will I lose my data and results?**

If you don't need to perform any more calculations, or want to start another project from scratch, you can just delete the current Pathfinder project.

This operation will not change you ArcGIS Pro document. The results you previously calculated will stay in your local disk results folder and the ArcGIS map.

## Debugging errors

**I'm having errors/issues. How can I explain to you what is happening?**

You can email your Gilytics account manager, contact Gilytics via our [web site](#) or use the online chat in Pathfinder Web.

This information will be useful for us to help you:

- Which version of the addin you are using.
- A screen capture or (even better) a video showing how the error happens.

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