Emlid Flow 360

USER DOCUMENTATION

Firmware version **31.8**
Emlid Flow app version **10.6** or newer

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1 Introduction

Emlid Flow and Emlid Flow 360 allow working with survey projects in an easy and convenient way. Create and configure projects in the cloud-based web app Emlid Flow 360, and work with them later in the field—collect or stake out data using the mobile app Emlid Flow.

To sync data between your devices, create an Emlid account. Once you're logged in, every change in your projects will be immediately backed up to the cloud and available on every device you use.

2 Getting started

This guide describes how to start working with the Emlid Flow 360.

2.1 Accessing the app

Create an Emlid account to access Emlid Flow 360.

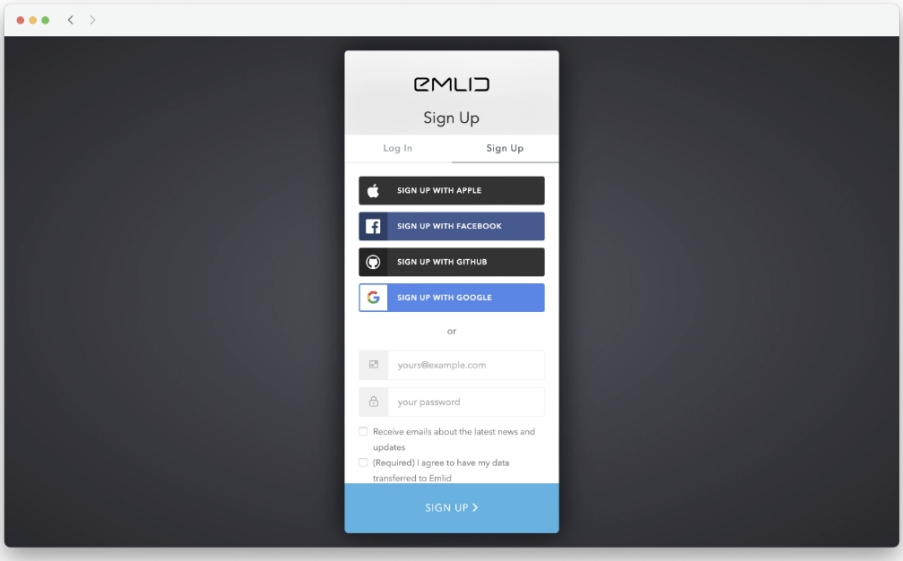
2.2 Creating Emlid account

Emlid account allows you to sync your projects between Emlid Flow and Emlid Flow 360 as well as between different devices, and instantly save the progress of your survey. You can have access to all your project data, custom coordinate systems, code libraries, and NTRIP profiles across your devices.

Tip: Using an Emlid account, you can access our Community forum and Emlid Caster.

To create an Emlid account, follow the steps below:

1. Go to flow360.emlid.com.
2. Click the *Sign Up* tab.



3. Type in your email and password in the corresponding fields.
4. Click the *SIGN UP* button.
5. Verify your email address by following the on-screen instructions.

After you create an Emlid account, log in to Emlid Flow or Emlid Flow 360 to enable data sync between all your devices.

3 Preparing Projects

3.1 Create or import project

Tip: *We recommend creating projects before the survey since some coordinate systems require additional downloads in Emlid Flow.*

This guide describes how to create or import a project in Emlid Flow to survey.

3.1.1 Overview

Projects are a way to group and operate your survey data. Using projects, you can collect and stake out data in the preferred coordinate system. Projects can be linked with a code library to help you manage survey data later in the post-processing.

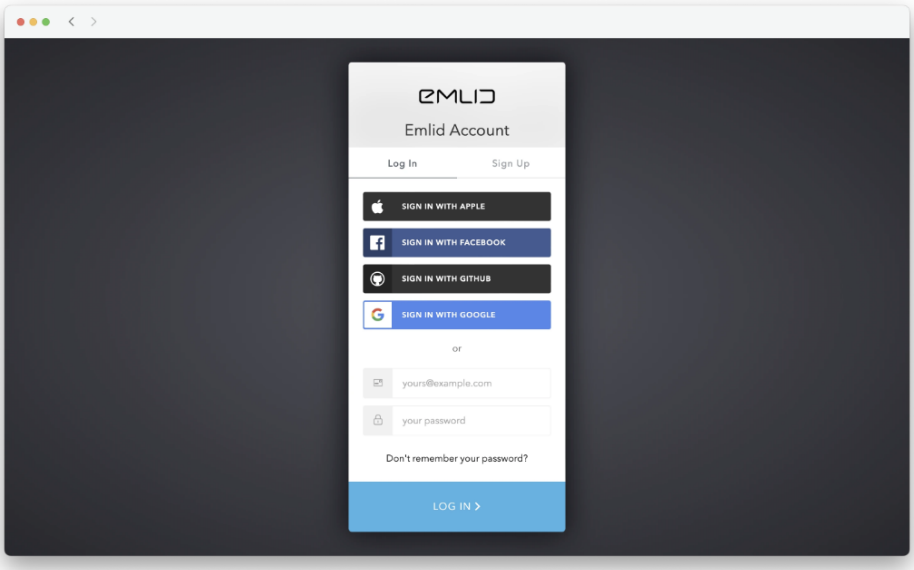
3.1.2 Workflow

Every survey starts with a project.

Creating project

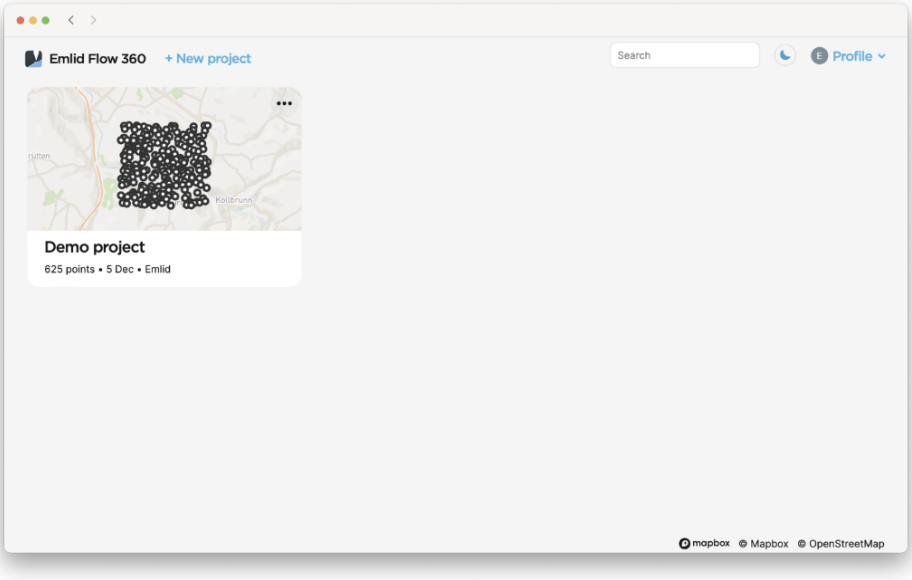
To create a project in Emlid Flow 360, follow the steps below:

1. Go to flow360.emlid.com and sign up or sign in using your Emlid account.

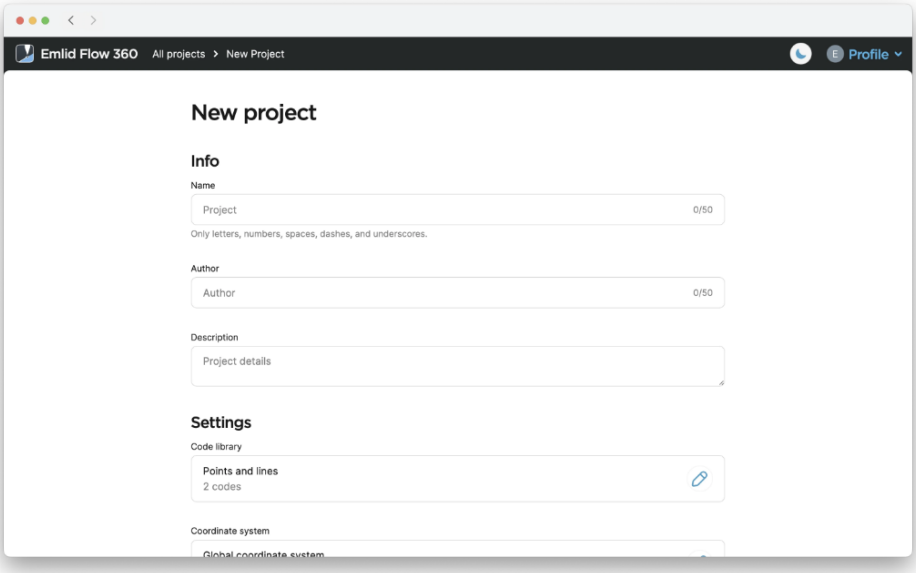


Tip: *To learn how to create an Emlid account, check the Getting started guide.*

2. Click + *New project* in the top left corner.



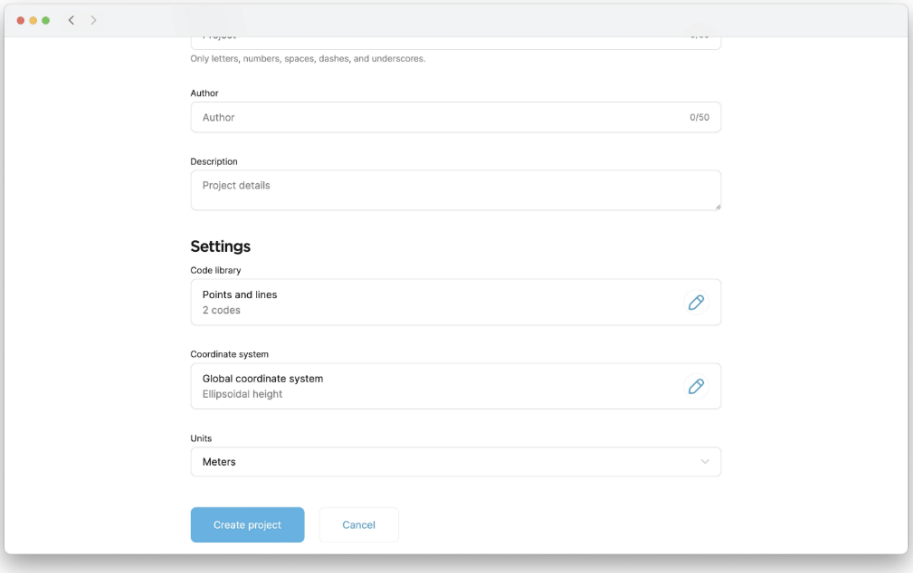
3. Fill in your project info.



4. With the subscription plan, you can link a code library to your project to work with lines and codes.

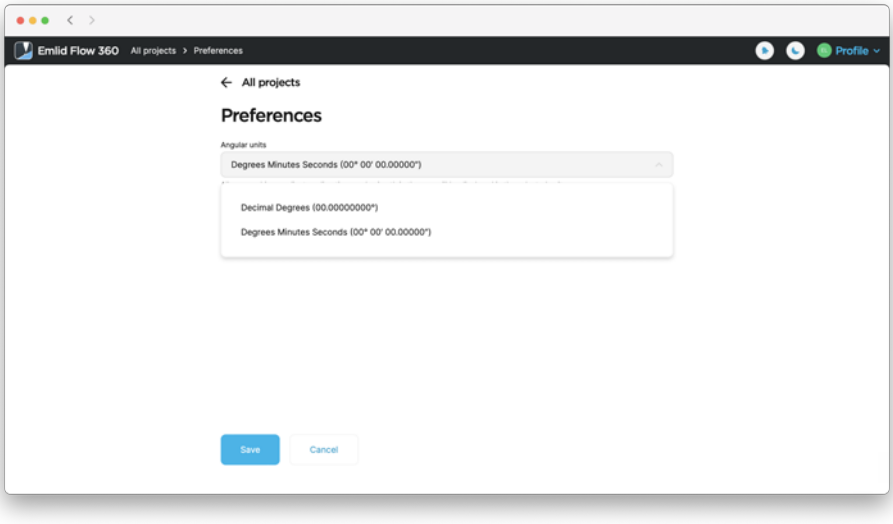
   Note: *You can specify the linked code library only when creating a project.*

5. To specify the coordinate system you want to work in, click the *Edit button* in the *Coordinate system* cell.

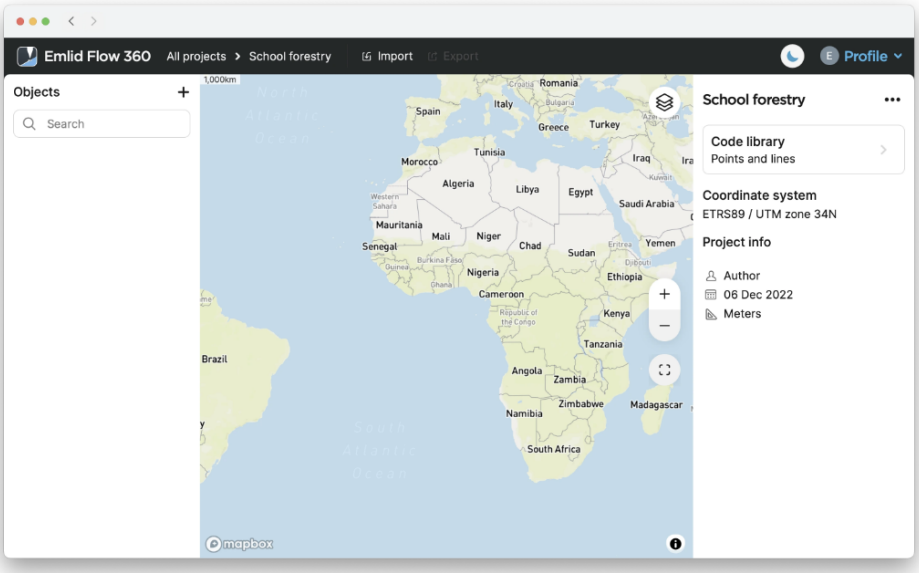


Tip: Check the Introduction to coordinate systems to learn more.

6. Select the measurement units for your project from the *Linear Units* drop-down menu.



7. Click the *Create project* button. Emlid Flow 360 will open the project.



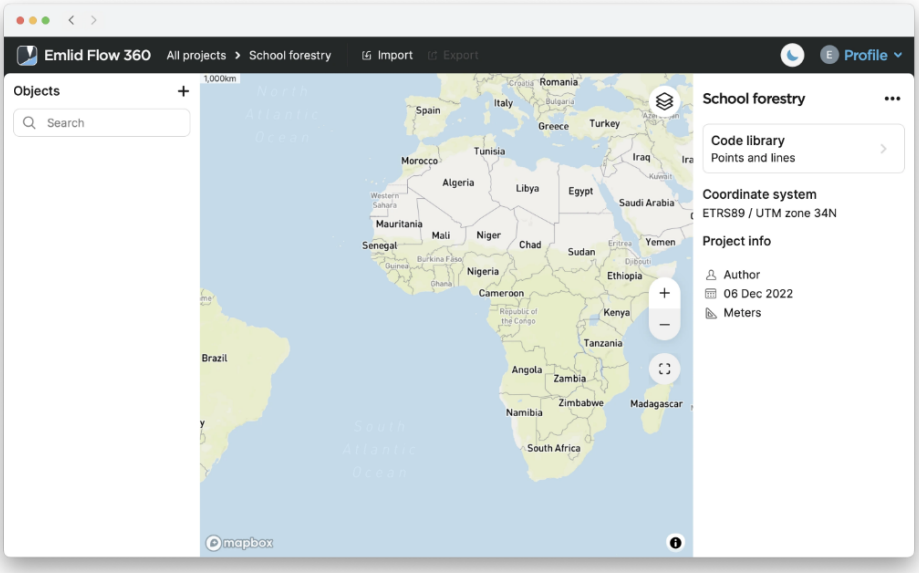
8. Open your project in Emlid Flow and ensure the coordinate system files are downloaded to your mobile device.

Once the project is created, you can start surveying with Emlid Flow.

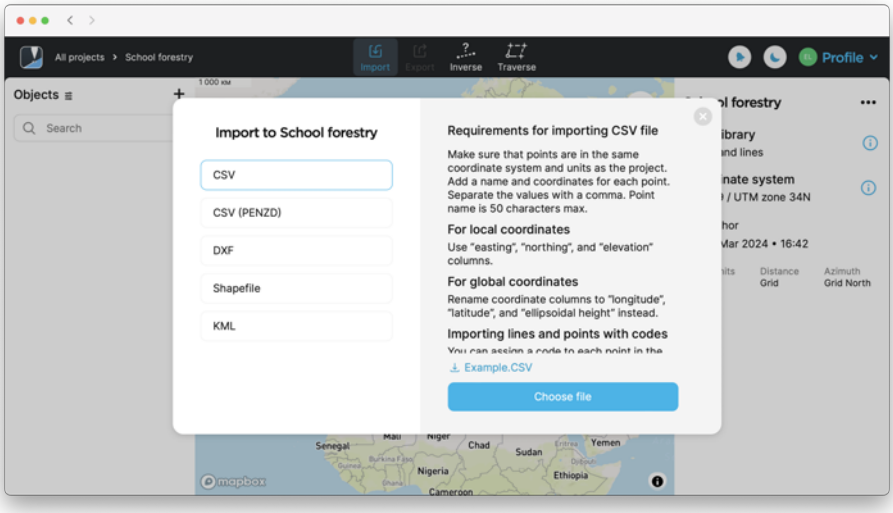
Importing project data

To import the project, follow the steps below:

1. Click on the *Import* button on the top panel.



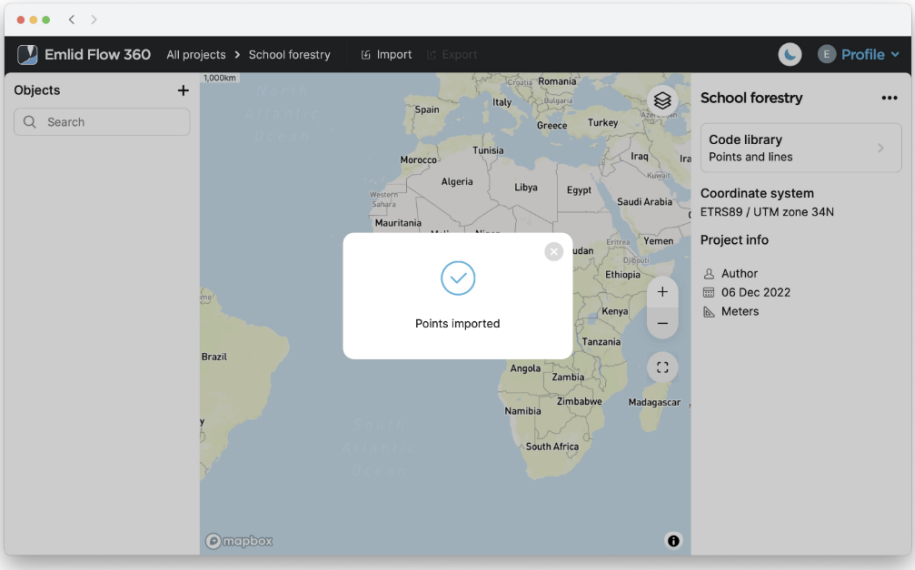
2. Choose the import format. Tap the import format you want to use. The format requirements will appear.



3. Choose the project file.

   Note: *Emlid Flow 360 supports projects only with points and lines. Lines support is included only in the subscription plan.*

4. Wait until Emlid Flow 360 finishes importing the project. Once the project is imported, you will see the confirmation sign.



Now all the objects are imported to your project.

Adding NTRIP profile

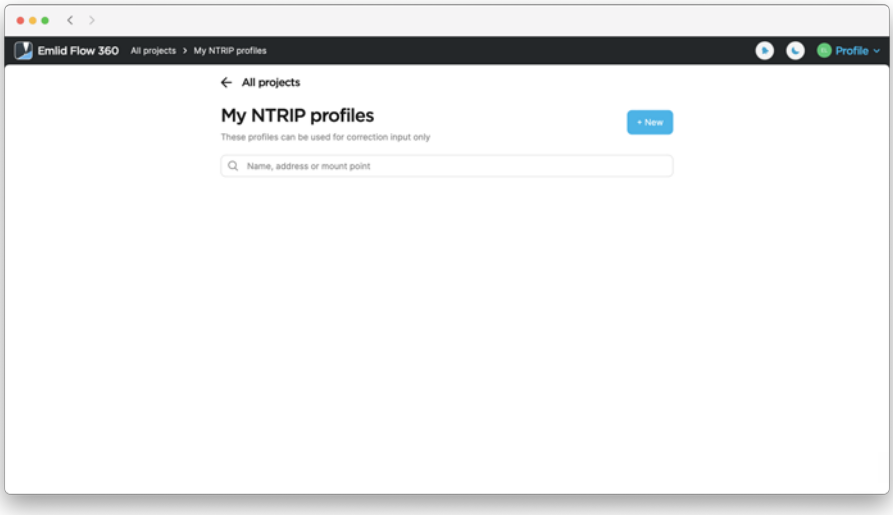
When setting up a project, you can also add an NTRIP profile at this stage to receive NTRIP corrections

during your surveys. You can create and manage NTRIP profiles in both Emlid Flow and Emlid Flow 360, and your profiles will be synchronized between the applications.

To add a new NTRIP profile, follow these steps:

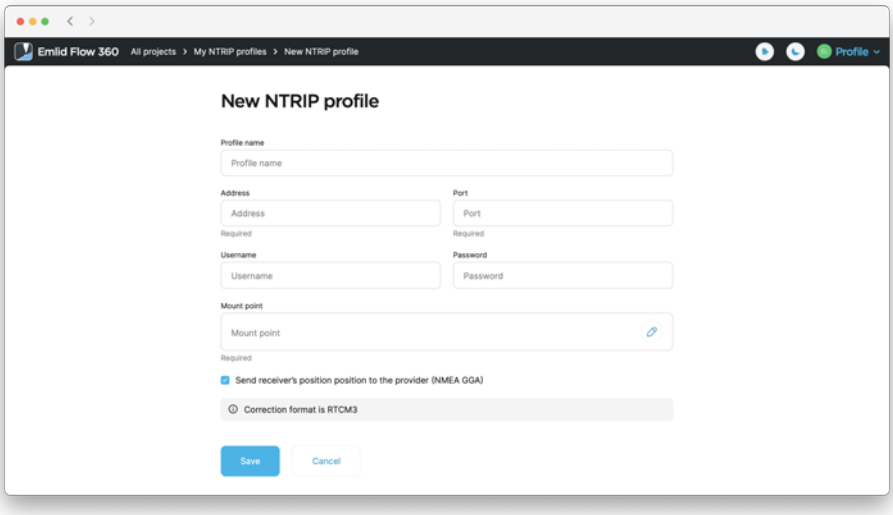
1. Open the Emlid Flow 360 app and tap Profile in the upper-right corner.

2. Tap *My NTRIP profiles*.
3. Tap the *+New* button.



4. Fill in the information from your NTRIP provider.

   Tip: *To find out which mount point suits you better, check the website of your NTRIP provider. The closer the mount point, the more precise your solution will be.*



5. Tap *Save*.

Now your new NTRIP profile is saved in your NTRIP profiles list.

3.2 Intoduction to coordinate systems

3.2.1 Overview

To define the precise location of surveyed objects in the world, you need to set up a coordinate system (CS) when creating a project.

When choosing a coordinate system, you should make the decision based on the area you want to work in: for each region, there is a coordinate system optimized for this specific area. Once you've determined in which CS you need the rover's coordinates and which base datum is required, check if you can obtain coordinates of a known point in the same datum.

Note: *You cannot change the CS settings once the project is created.*

Caution: *A mismatch in the CS setup between your rover and your base or the NTRIP service can result in poor accuracy of survey results.*

3.2.2 Setup

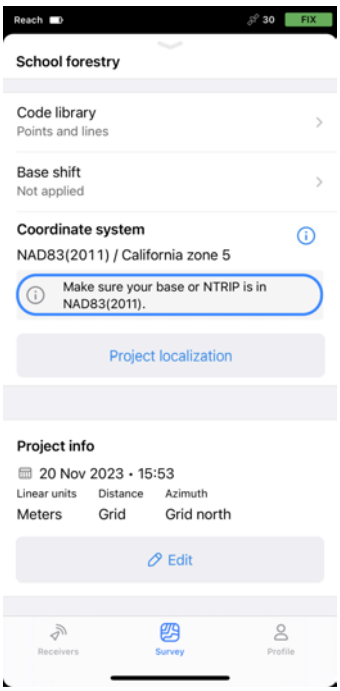
You can set up the CS for your project in several ways.

Choose from the library

Emlid Flow and Emlid Flow 360 contain the verified registry of local CSs for specific countries. Every coordinate system is based on a specific local datum. The datum is projected onto the flat surface using projection. All you need is to find your country in the registry and apply it to your project. The information provided for each country explains which datum should be used for both your rover and your base or NTRIP.

In this case, the apps apply Grid distance and Grid North azimuth. Grid distance is the distance measured on the projection flat plane. Grid North azimuth is the angle measured clockwise between a line parallel to the central meridian, and the direction to a point of interest (a straight line between two points on the projection flat plane).

Below is an example of a local coordinate system you can use in Emlid Flow and Emlid Flow 360: NAD83(2011) / California zone 56 where NAD83(2011) is a datum, California zone 5—a projection. When setting up a project on your rover , pay attention to the note in the Emlid Flow app. It will show you in which datum your base or NTRIP should be.

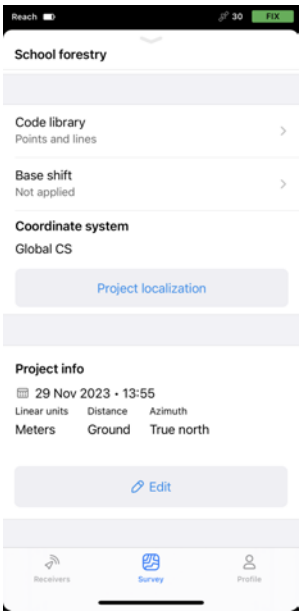


Apply global CS

This option is used to get started with the Emlid Flow app and quick tests in the field. As a result, you get geographic coordinates—latitude, longitude, ellipsoid height—in the datum of your base.

In this case, the apps apply Ground distance and True North azimuth. Ground distance is the distance measured on the actual surface of the Earth, taking the mean elevation of the measured points into account. True North azimuth is the angle ranging from 0 to 360 degrees measured clockwise between True North and the direction to a point of interest.

Below is an example of using the Global CS option in Emlid Flow and Emlid Flow 360. If you enter the base coordinates in NAD83(2011) in the Base settings, you'll get the NAD83(2011) coordinates with the rover by default.



Use custom CS

If you know the projection parameters and the required local coordinate system is not

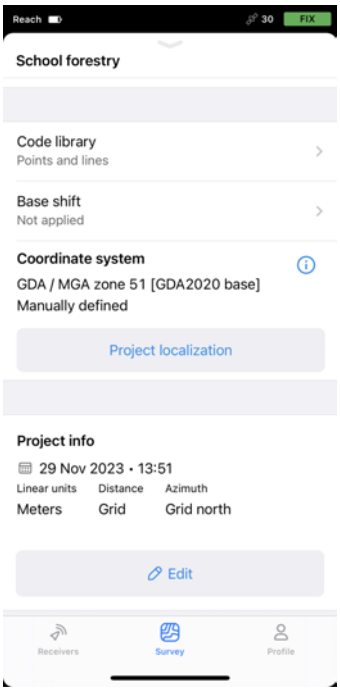
supported in Emlid Flow and Emlid Flow 360, you can add your own CS by entering the following parameters:

Note: *Since not every group of parameters is required for a coordinate system configuration, you may omit some of them and only use the parameters that you have for your projection.*

- Ellipsoid your datum is based on
- Projection type and its parameters
- Transformation type and its parameters
- Geoid model

In this case, the apps apply Grid distance and Grid North azimuth. Grid distance is the distance measured on the projection flat plane. Grid North azimuth is the angle measured clockwise between a line parallel to the central meridian, and the direction to a point of interest (a straight line between two points on the projection flat plane).

Below is the example of a custom CS set up in Emlid Flow.



3.3 Set up coordinate system from library

Tip: *We recommend setting up the projects indoors before the survey as some coordinate systems require additional downloads in Emlid Flow.*

This guide shows how to set up a coordinate system for your project in Emlid Flow.

3.3.1 Overview

Caution: *You can only configure the coordinate system while creating a new project.*

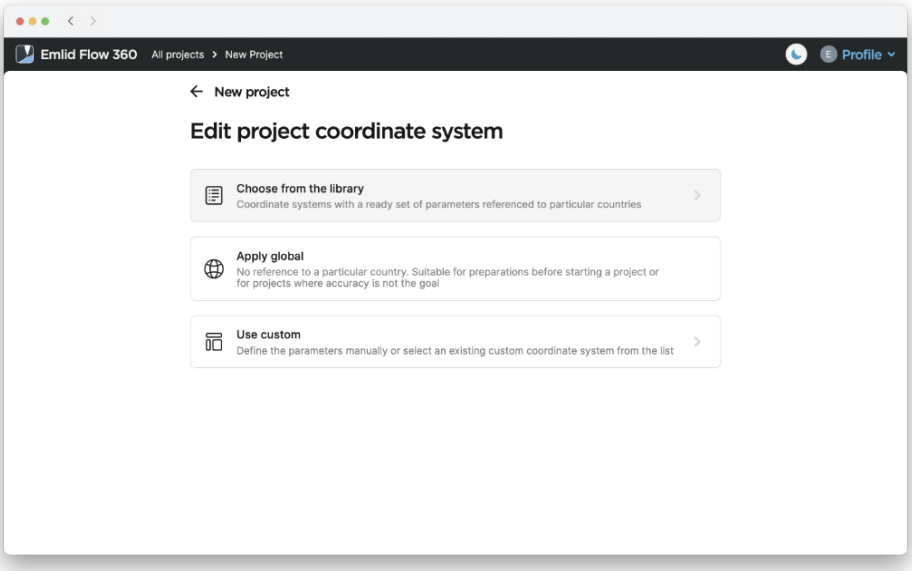
Emlid Flow contains a library of ready-to-use local coordinate systems and vertical datums for specific countries. If you need additional information on the coordinate system in your country.

To show you all the steps, we will walk you through the example of configuring a coordinate system for Switzerland.

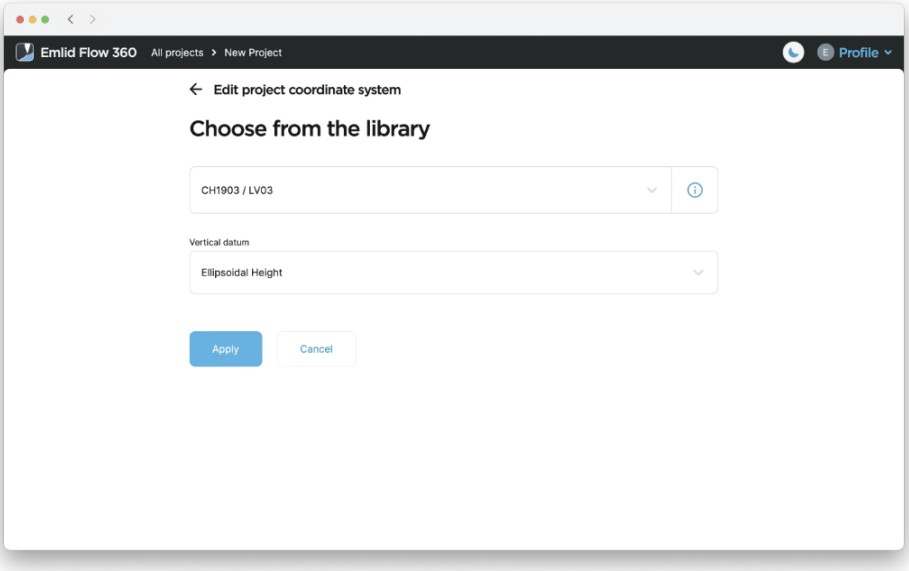
3.3.2 Setting up coordinate system

While creating a project, follow the steps below:

1. On the *New project* screen, click the *Coordinate system* cell.
2. Click *Choose from the library*.



3. Search the required coordinate system by its name, country, or code.
   We enter Switzerland and pick CH1903 / LV03.



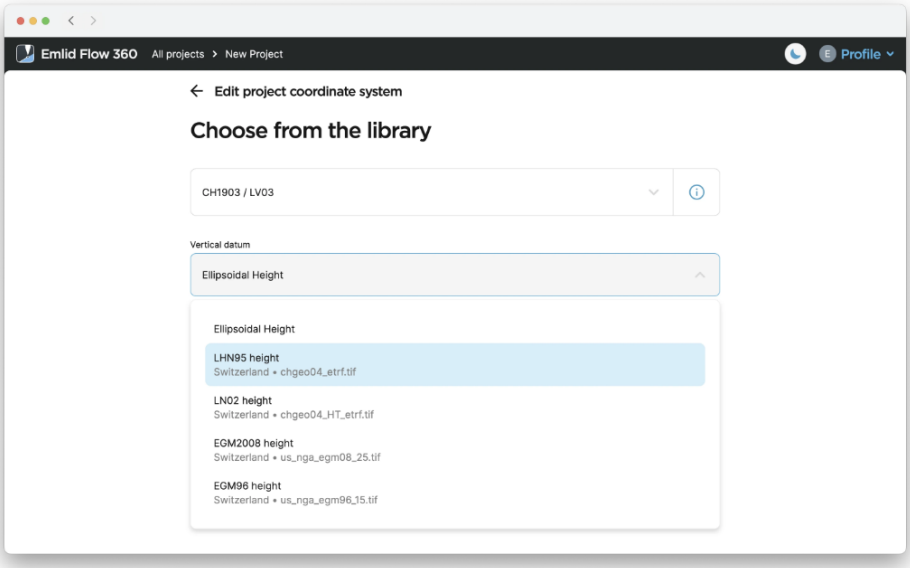
Tip: *To learn more about the suggested coordinate system, tap the info icon next to the system. Depending on the chosen coordinate system, the screen can contain the following information:*

- *Datum and its reference ellipsoid with parameters*
- *Global datum and its reference ellipsoid with parameters*

- *Projection type and its parameters*
- *Transformation type and its parameters*

4. Click the *Vertical datum* cell. The app will show you available vertical datums. Choose the one you need and click *Apply*.

   We select LHN95 height.



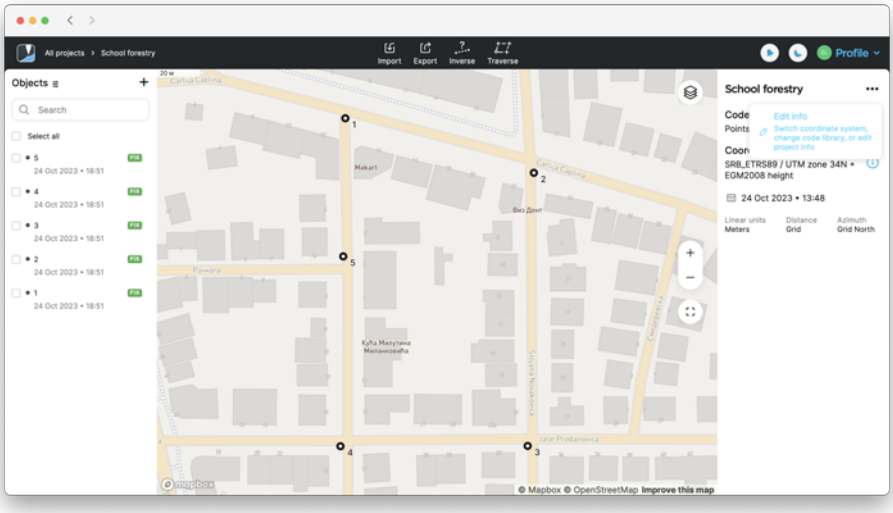
Tip: *Make sure that the coordinate system of your project and the base or NTRIP you use are in the required datum. You can find the required datum for your country in the countries list. You can also find this information in your project in Emlid Flow.*

You can continue creating the project for survey.

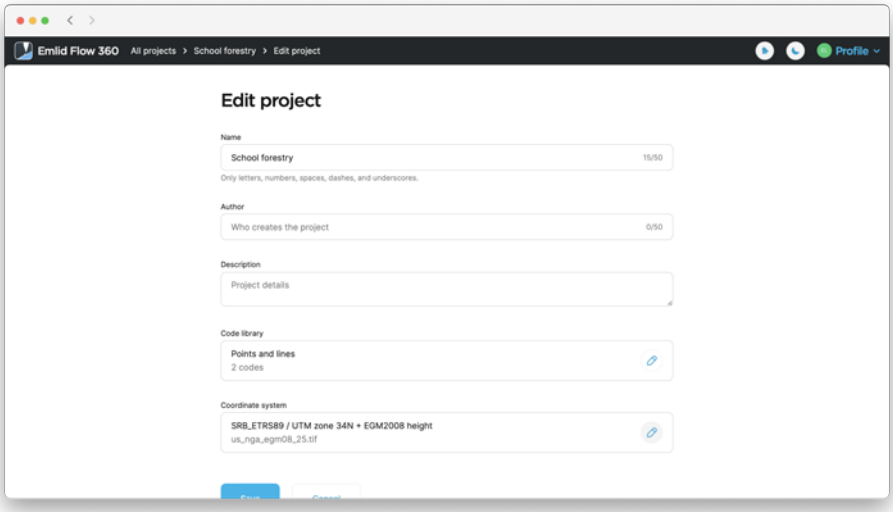
3.3.3 Editing coordinate system

In Emlid Flow 360, you can change a coordinate system for your project. Follow the steps below:

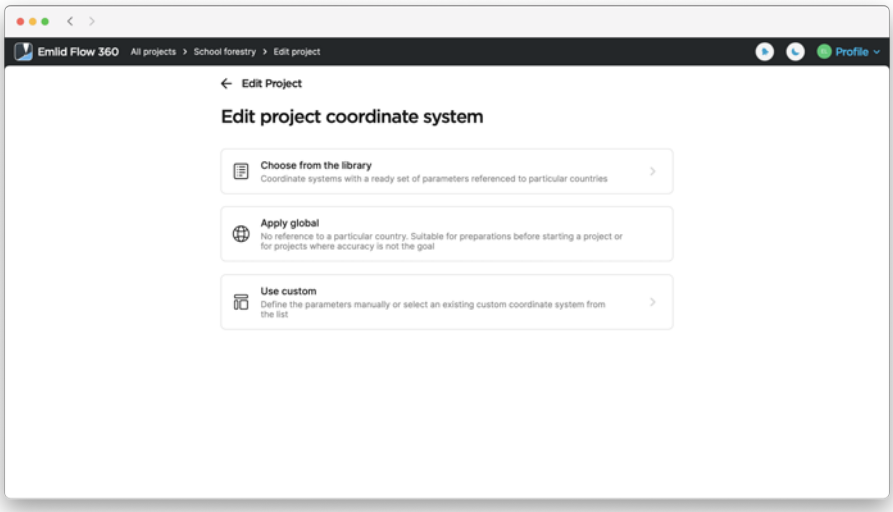
1. Open the project in Emlid Flow 360.
2. Tap the three-dot button in the upper-right corner, then tap *Edit* info.



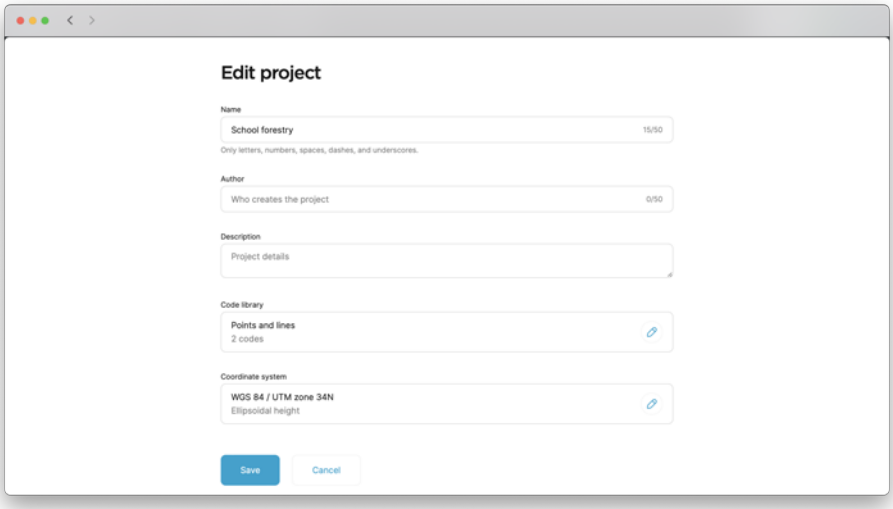
3. Tap the *Edit* button in the *Coordinate system* section.



4. Select a suitable option to set a new CS.



5. After you've selected the new CS, tap *Save* to apply the changes.



3.4 Set up custom coordinate system

Tip: *We recommend setting up the projects indoors before the survey as some coordinate systems require additional downloads in Emlid Flow.*

This guide describes how to set up a custom coordinate system in Emlid Flow if you cannot find the required one and know its parameters.

3.4.1 Overview

Note: *You can only configure the coordinate system while creating a new project.*

To configure the custom coordinate system, you can use 4 different properties:

- Ellipsoid your datum is based on
- Projection type and its parameters
- Transformation type and its parameters
- Geoid model

Note: *Since not every group of parameters is required for a coordinate system configuration, you may omit some of them and only use the parameters that you have for your projection.*

- *If the projection is based on the same datum as the base, skip the transformation step.*
- *If you decide to work with ellipsoidal height, don't select the geoid model.*

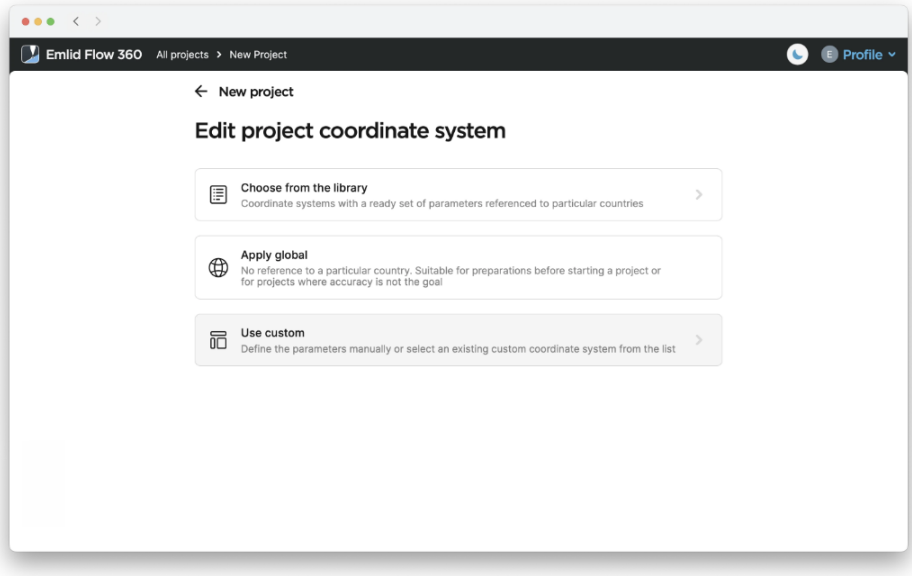
Tip: *On some Android devices, default keyboards do not provide a minus sign. To get access to it, we recommend downloading Gboard, a virtual keyboard app, from the Google Play Store.*

To show you all the steps, we will walk you through the example of transformation from the GDA2020 datum to GDA94, performing MGA zone 51 projection, and applying the AUSgeoid2020 geoid model to the GDA2020 datum.

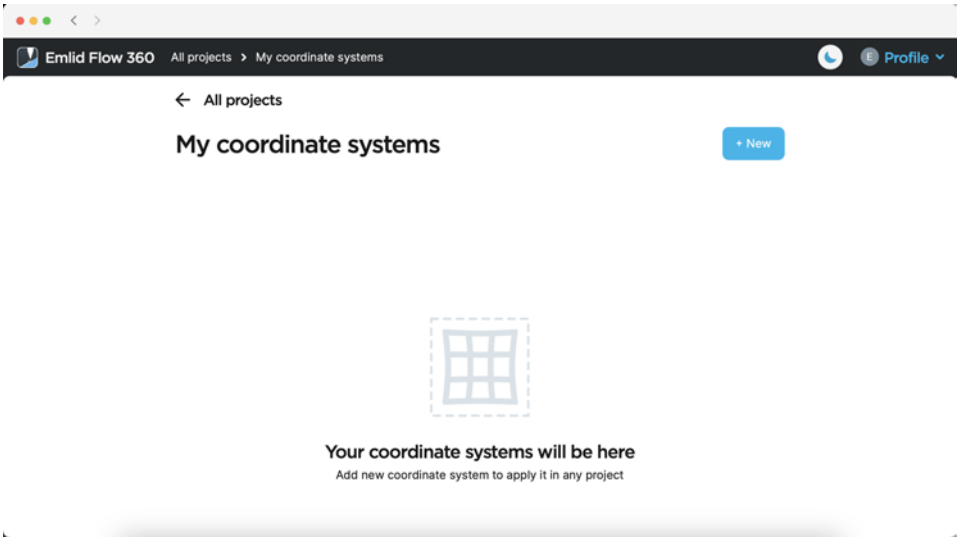
3.4.2 Creating custom CS

When picking a coordinate system for your project, follow the steps below:

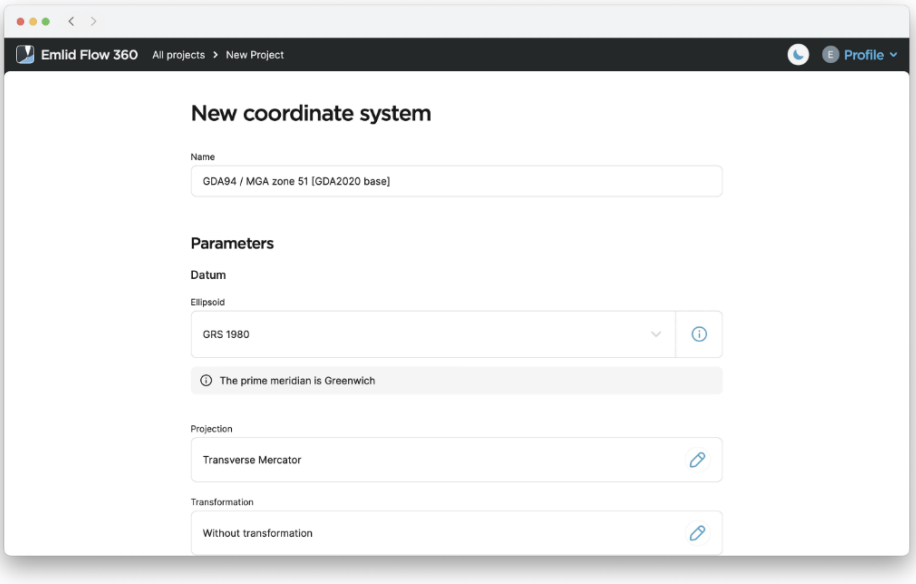
1. On the *Edit project coordinate system* screen, click *Use custom*.



2. To create a custom coordinate system, click the + *New* button.



3. Enter the name of your custom coordinate system. Using this name, you will be able to find it in the list of coordinate systems later on.



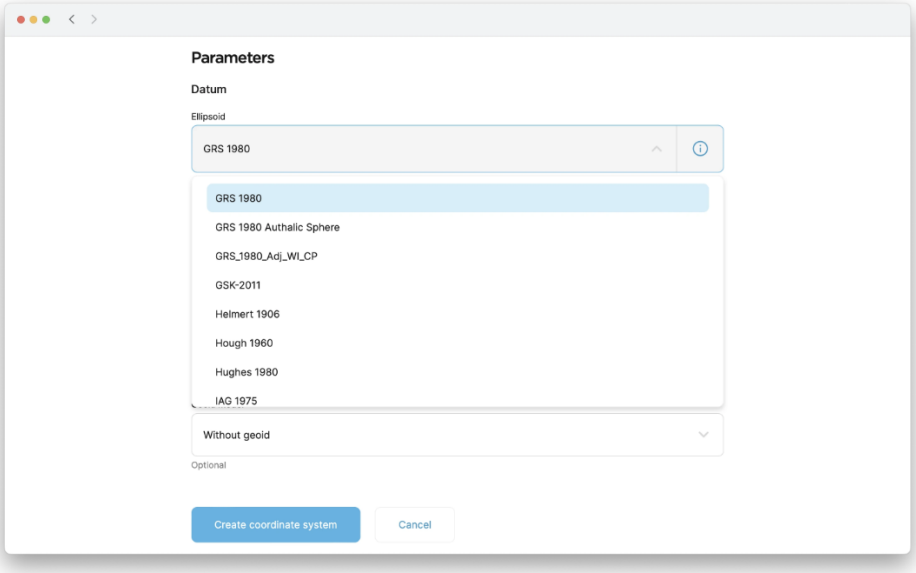
We name the coordinate system **GDA94 / MGA zone 51 [GDA2020 base]**.

3.4.3 Specifying ellipsoid for datum

Note: *This step is mandatory.*

In this section, we set up the ellipsoid the datum based on. By default, the GRS 1980 ellipsoid is selected. To change it, perform the following steps:

Note: *It updates the Semi-major axis and 1/f parameters accordingly. You can access these parameters by clicking the information icon on the right side of the Ellipsoid cell.*



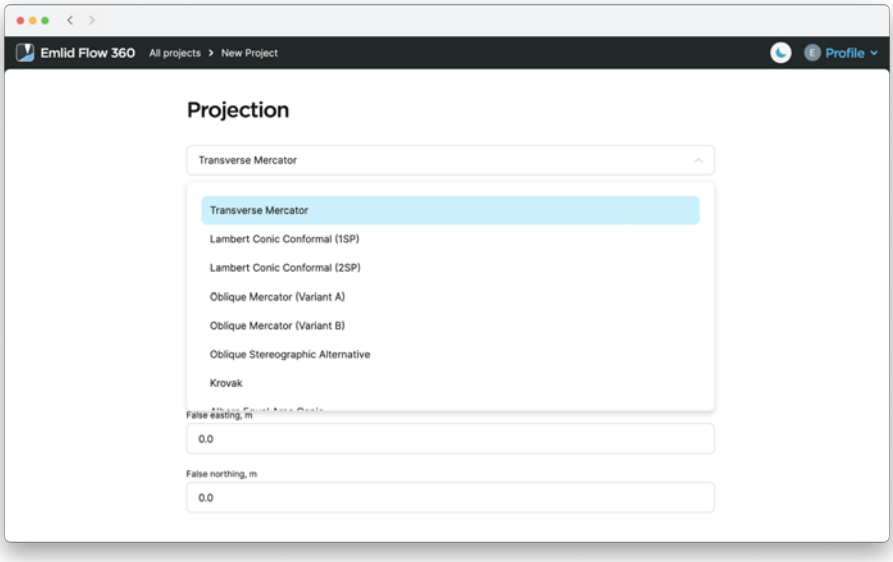
The GDA94 datum uses the GRS 1980 ellipsoid, so we leave it as is.

Note: If the required datum is missing, contact us at support@emlid.com.

3.4.4 Applying projection

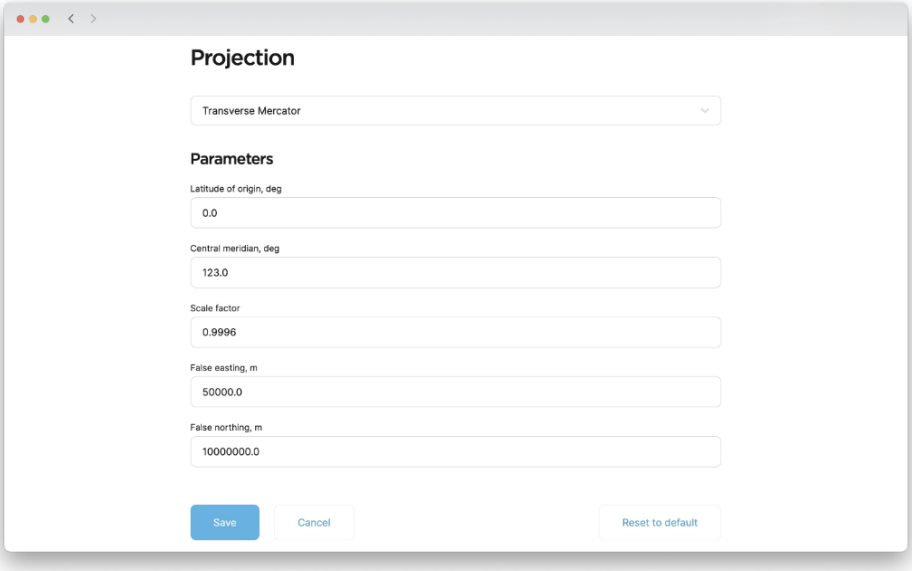
1. To configure projection, click the *Projection* cell.

2. Choose the required projection type:
    - Albers Equal Area Conic
    - Krovak
    - Lambert Conic Conformal (1SP)
    - Lambert Conic Conformal (2SP)
    - Mercator (Variant B)
    - Oblique Mercator (Variant A)
    - Oblique Mercator (Variant B)
    - Oblique Stereographic Alternative
    - Transverse Mercator



We perform the *Transverse Mercator* projection.

3. Enter the projection parameters.



4. Save changes.

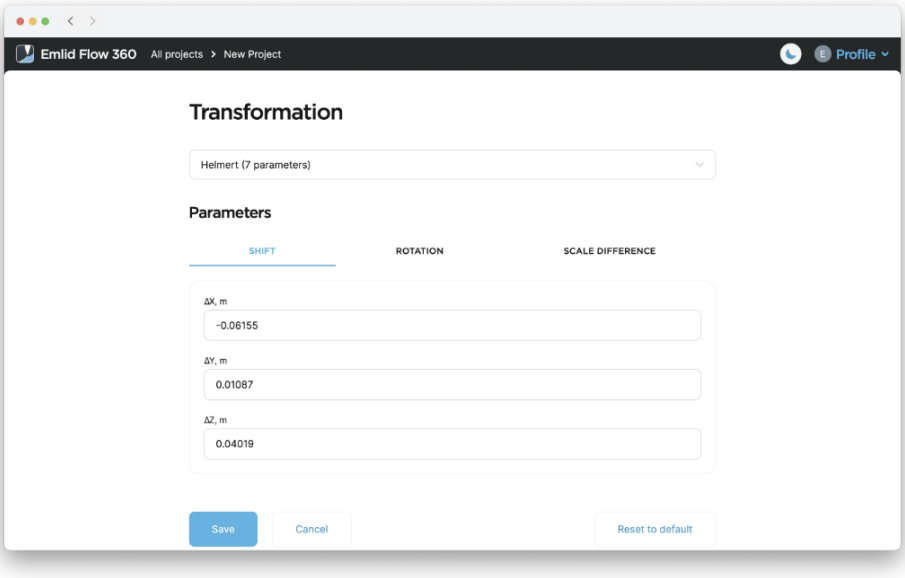
3.4.5 Specifying transformation parameters

Note: *You need to configure this option only if your coordinate system uses a datum that differs from the base's one.*

1. Click the *Transformation* cell.
2. Choose the required transformation type: Helmert or Molodensky-Badekas.

   We need the Helmert transformation to go from GDA2020 to GDA94 datum.
3. Fill in the transformation parameters: there are 7 of them for the Helmert transformation and 10 for Molodensky-Badekas.

   Tip: *The app can also perform transformations with only 3, 4, and 6 parameters. You can type in the parameters you have and leave the others empty.*



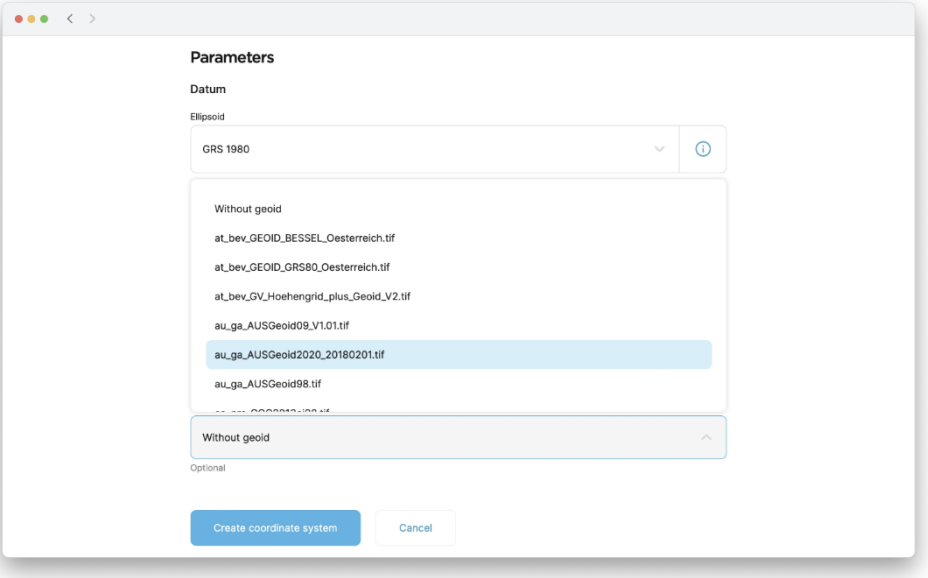
4. Save changes.

3.4.6 Choosing geoid model

Note: *Apply the geoid model to your custom coordinate system only if you require orthometric height for your project. Emlid Flow applies geoid correction to the datum the base works with, so make sure to choose the appropriate one.*

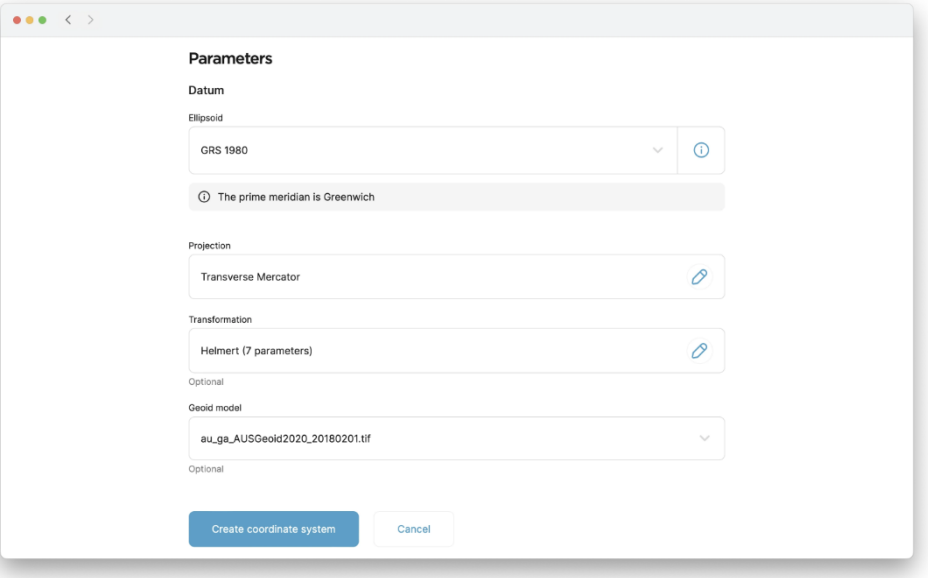
Click the *Geoid model* cell and select the appropriate geoid file from the list.

We select the AUSgeoid2020 that is meant to be used for coordinates in GDA2020.

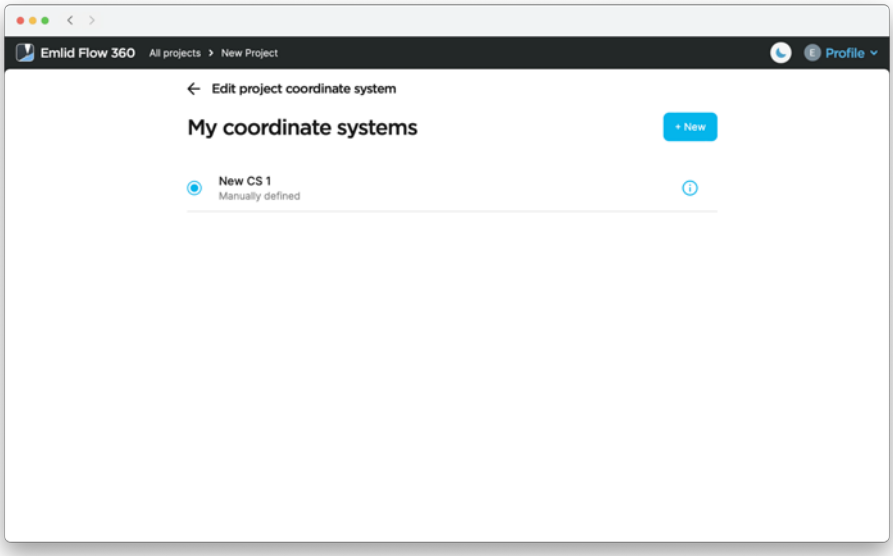


3.4.7 Saving custom CS

Once everything is configured, click *Create coordinate system* on the*New coordinate system* screen to save the coordinate system. From now on, your custom coordinate system is saved to your Emlid account and synced among all your devices.



You can find your custom coordinate systems on the *Custom coordinate system* screen.



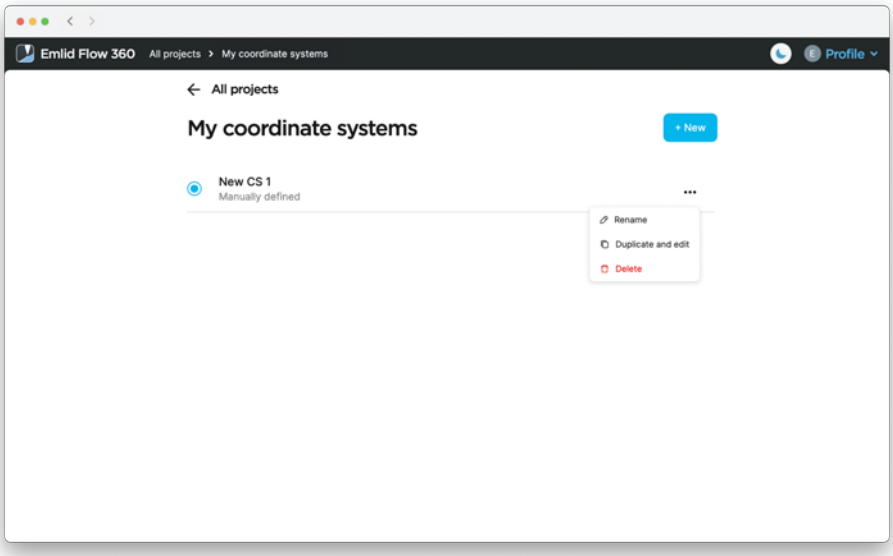
You can continue creating the project for survey.

3.4.8 Editing custom CS

You can edit parameters of your custom CS in the Emlid Flow 360 app. To do so, follow these steps:

Note: *The editing option is not available for calibrated systems.*

1. Tap *Profile* in the upper-left corner and select *My coordinate systems* from the drop-down menu. The list of your custom CSs will open.
2. Tap the three dots button to rename, duplicate, edit or delete your custom CS.



Tip: *Duplicating your CS allows you to quickly edit parameters without having to enter them twice.*

3. Edit the parameters and tap *Create coordinate system*.

3.5 Apply localization

This guide describes how to apply localization in Emlid Flow to calculate local coordinate system parameters or adjust the existing one.

3.5.1 Overview

The Localization feature in the Emlid Flow app allows you to calculate local coordinate system parameters or to adjust the existing one to fit control points in the survey area.

When applying localization, Emlid Flow compares pairs of control and measured point coordinates and applies translation, rotation, and scaling to calculate the local coordinate system parameters. The app automatically selects the best algorithm based on the number of points and the specified projection and allows horizontal and vertical adjustments to be used together or separately.

To apply localization, you'll need to perform the following:

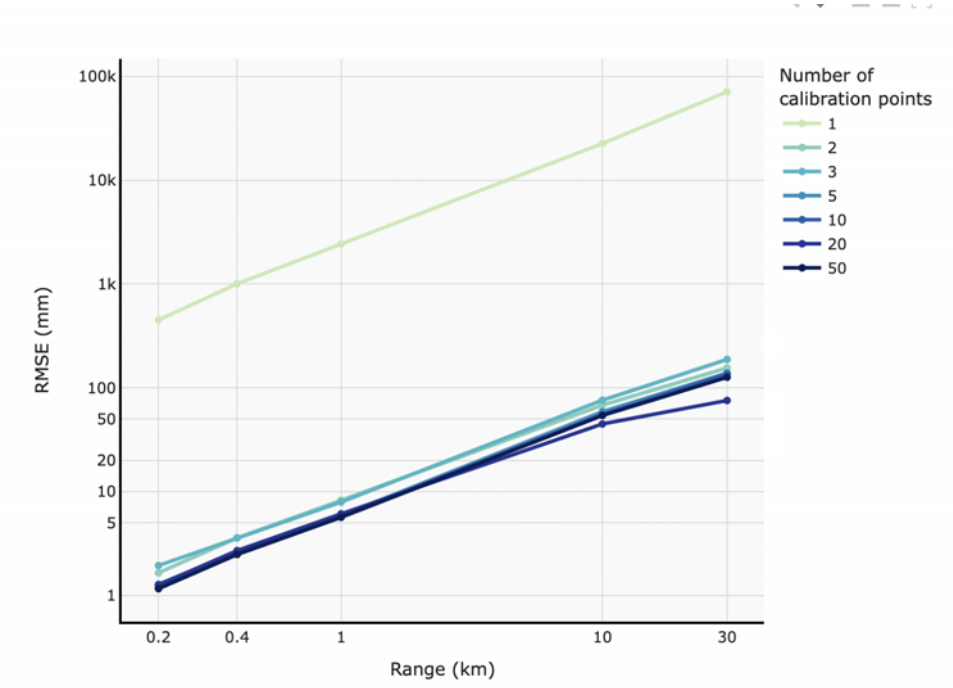
1. Add control points.
2. Measure the same control points with the rover in RTK .
3. Pair the coordinates of the control points with the measured ones.

3.5.2 Preparation

To ensure high localization accuracy, we recommend making sure your input data is sufficient.

Number of points

The number of control points has a direct impact on the resulting accuracy of the performed localization. In general, we recommend using from 5 to 10 control points.



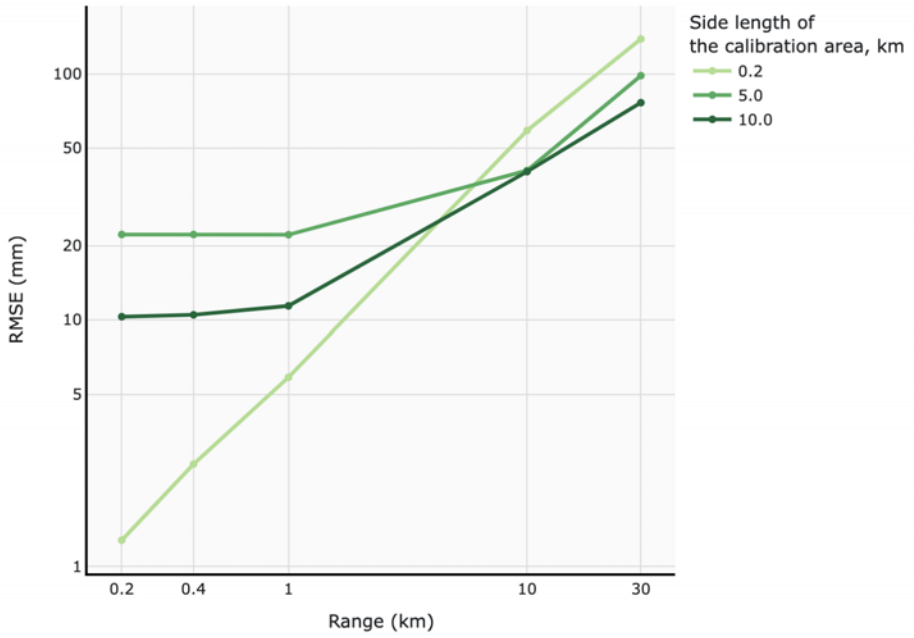
RMSE within the range from the center of a 200x200 m localization area, depending on the number of control points. Both X and Y axes are in the log scale.

Based on the chart, we can see the following:

- Using 1 point for localization should be avoided.
- Using at least 3 points makes the accuracy much better.
- Using more than 10 points doesn't make much difference.

Distribution of points

The distribution of control points also affects accuracy. In general, we recommend spreading the control points evenly across the entire area of interest.



RMSE at distances from the center of the localization area, depending on the spread of 5 control points. Both X and Y axes are in the log scale.

Based on the chart, to achieve the best accuracy, we recommend performing localization for smaller work sites and collecting measurements only within the area where the control points were located.

Use of projection

Providing information about the projection can have both positive and negative effects on localization accuracy. We recommend that you try both options to see which works best for you.

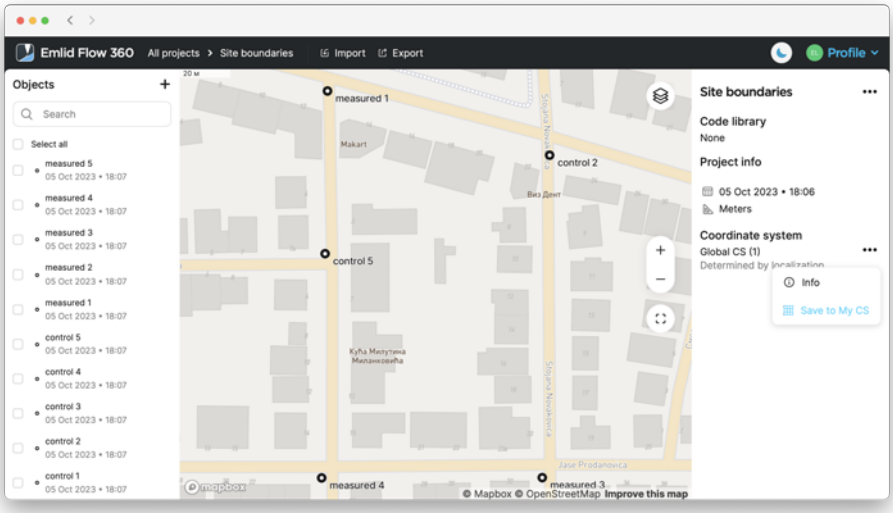
3.5.3 Saving coordinate system

You can save your coordinate systems determined by localization and use them in new projects.

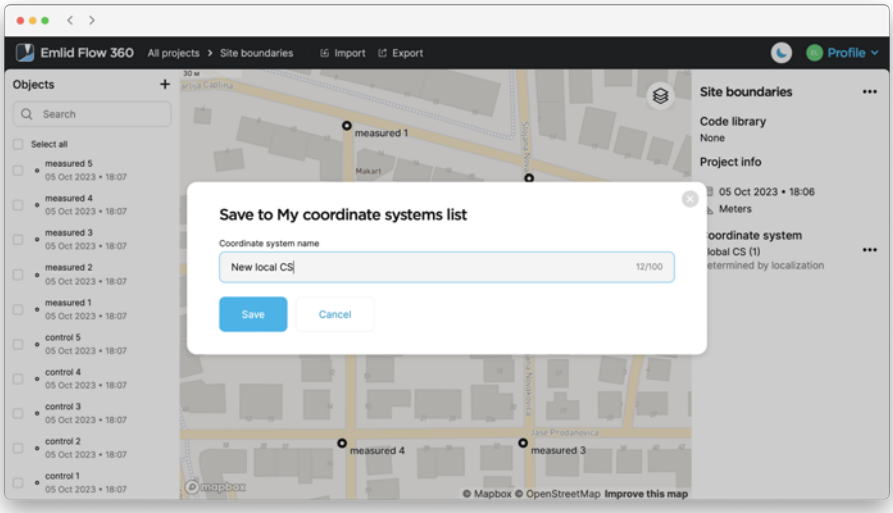
To save your coordinate system determined by localization in Emlid Flow 360, follow these steps:

1. Open the project with the coordinate system determined by localization you want to save.

2. Go to the *Coordinate system* section.
3. Tap the three dots button, and select *Save to my CS* from the drop-down menu.



4. Enter the name and tap *Save*.



Now the coordinate system is saved to the *My coordinate systems list*.

3.6 Manage code libraries

Note: *You can manage your code libraries only in Emlid Flow 360.*

This guide explains how to add new code libraries or update existing ones using Emlid Flow 360.

3.6.1 What is survey code?

A survey code is a set of letters and numbers used to define collected data on a map, for example, a tree or a fence. Codes can include additional information about the collected object—such as geometry type and a brief description.

3.6.2 What is code library?

A code library is a list of survey codes that can be linked to a project. Code libraries are a way to have all frequently used codes in one place to have consistency throughout all your projects. Using Emlid Flow 360, you can add your own code libraries and update them with new codes later. New codes will be automatically added to a particular code library on every device you use.

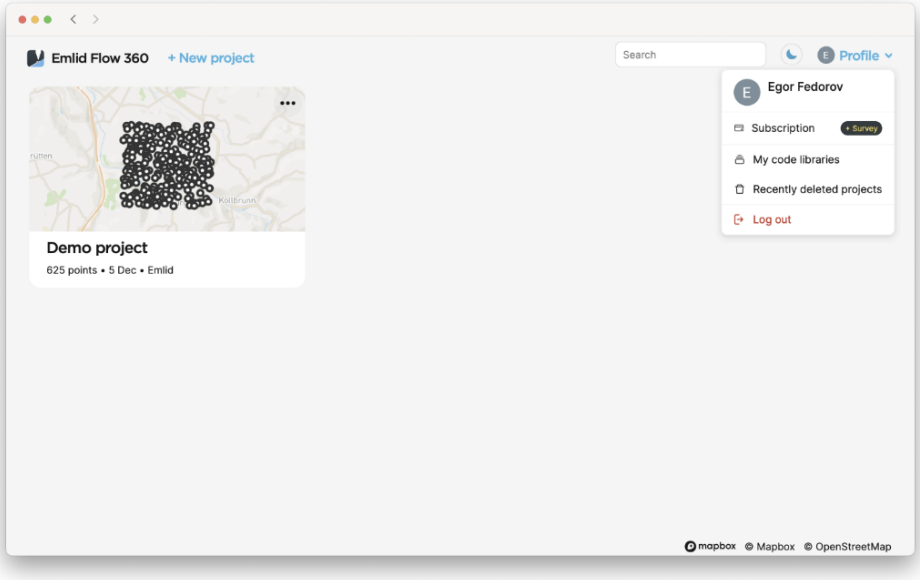
Tip: *If you forgot to add some codes that you need in the field, you can easily create codes on the go in Emlid Flow.*

3.6.3 Adding code library

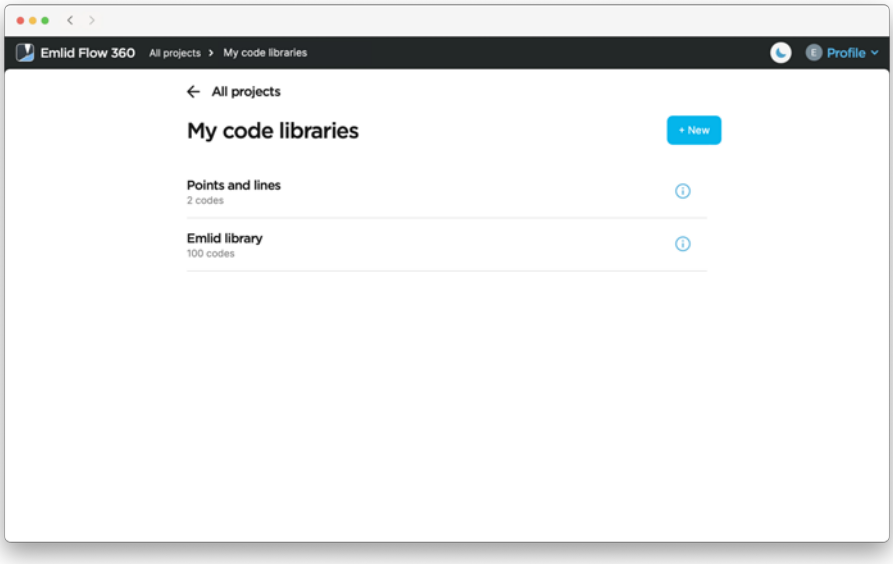
Your Emlid account has 2 default libraries: 'Points and lines' containing 2 simplest codes, and 'Emlid library' containing the most commonly used survey codes. Using Emlid Flow 360, you can add your own code libraries.

To add a code library, follow the steps below:

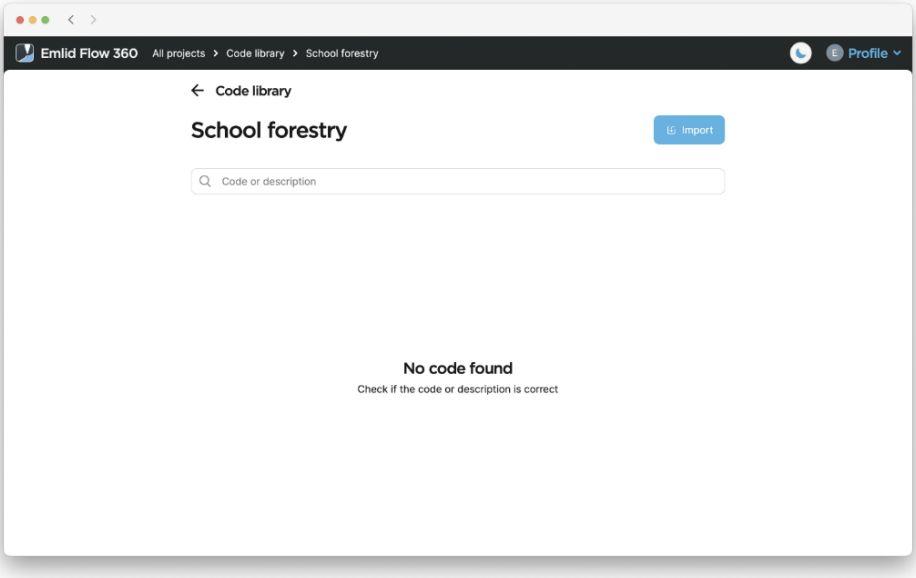
1. In the *Profile* menu, click *My code libraries*.



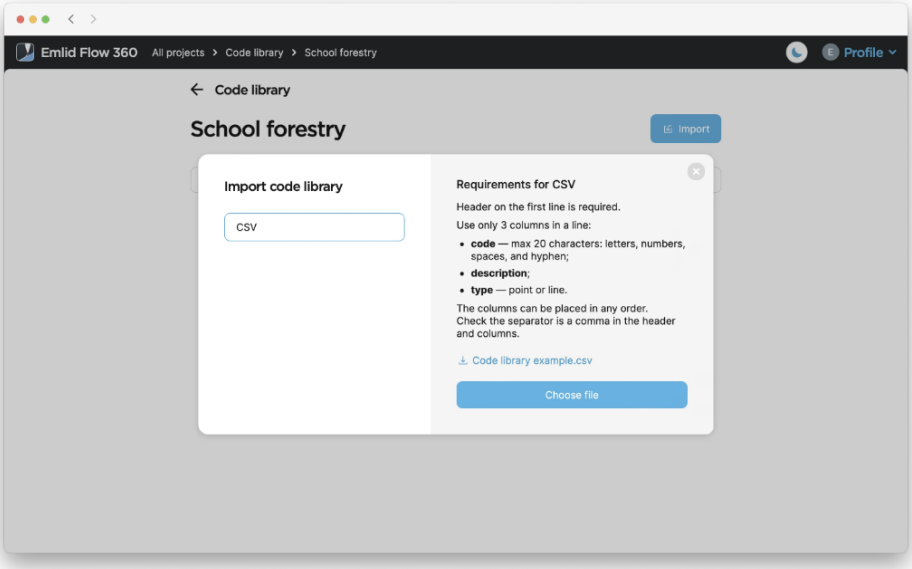
2. Click + *New* library.



3. Name your library and click *Create*.
4. To add survey codes to your library, click the *Import* button.



5. Import the file with survey codes by clicking *Choose file*. When the library is imported, you will see the confirmation sign.



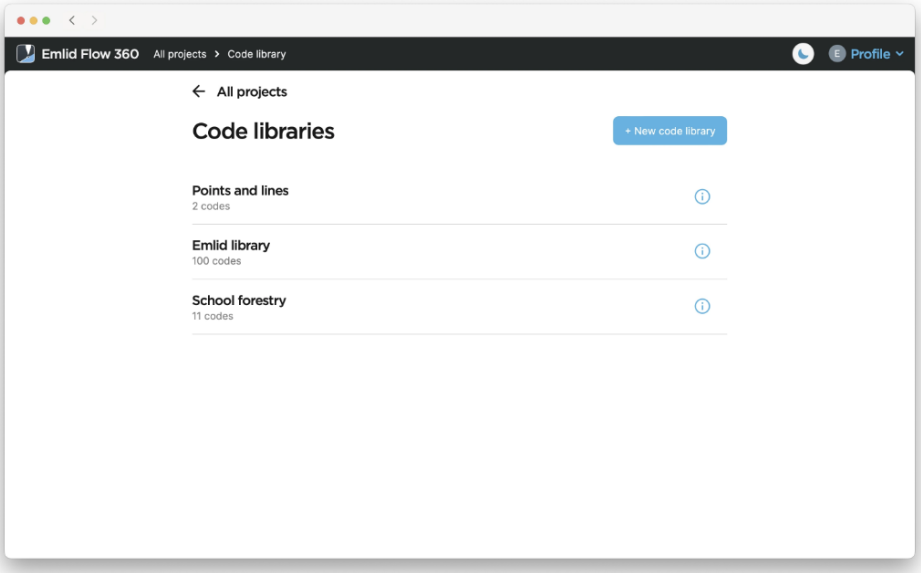
Once you added a new code library, it will be synced across all your devices. You can link this library to any of your projects.

3.6.4 Adding codes to existing code libraries

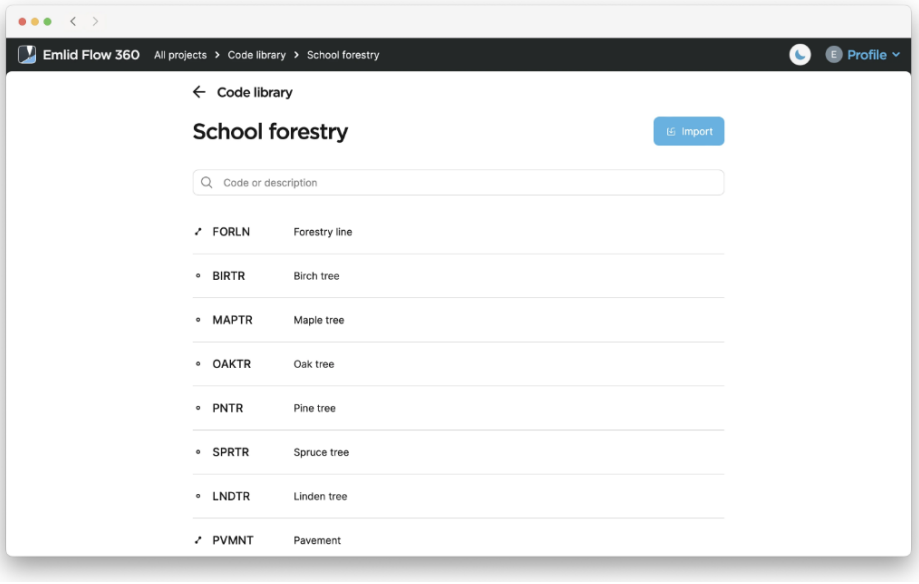
Note: *You can add new codes only to the libraries created by you.*

To add new codes to your existing code libraries, do the following:

1. Navigate to the *My code libraries* screen.

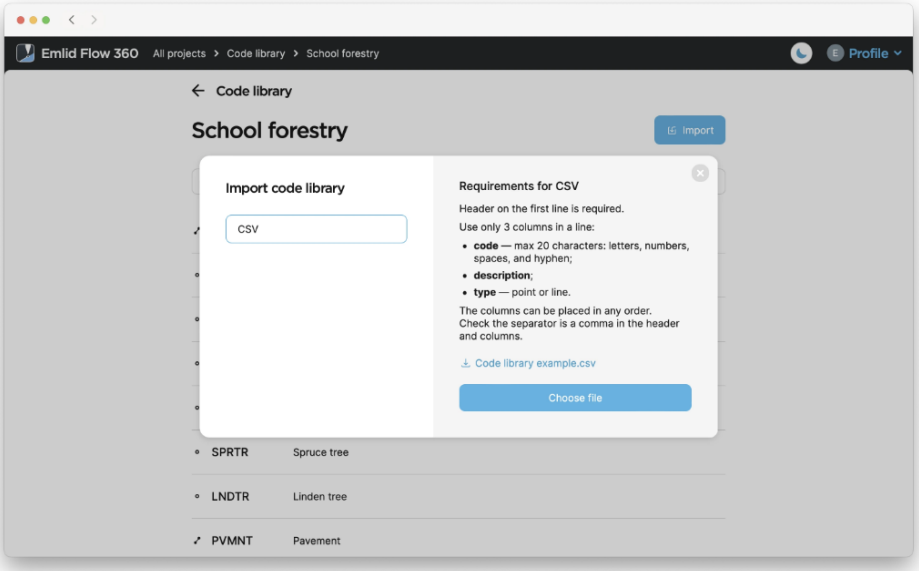


2. Select the library where you want to add new codes.
3. To add new codes, click *Import*.



4. Import the file with new survey codes by clicking *Choose file*. When the codes are imported, you will see the confirmation sign.

Tip: *A single code library can't contain two survey codes with the same code name. Before adding new codes to your library, make sure the file you're uploading doesn't duplicate the already existing codes.*



Once you added new codes to your code library, the code library will be updated with new codes among all your devices.

3.7 Create WMS layers library

This guide explains how to create a WMS layers library in Emlid Flow 360 to add layers to your projects.

3.7.1 Overview

In Emlid Flow 360, you can load WMS layers from web map services, create your own WMS layers library linked to your Emlid Account, and add WMS layers from it to the projects. The use of WMS layers in projects allows you to get visual control and context of your survey area.

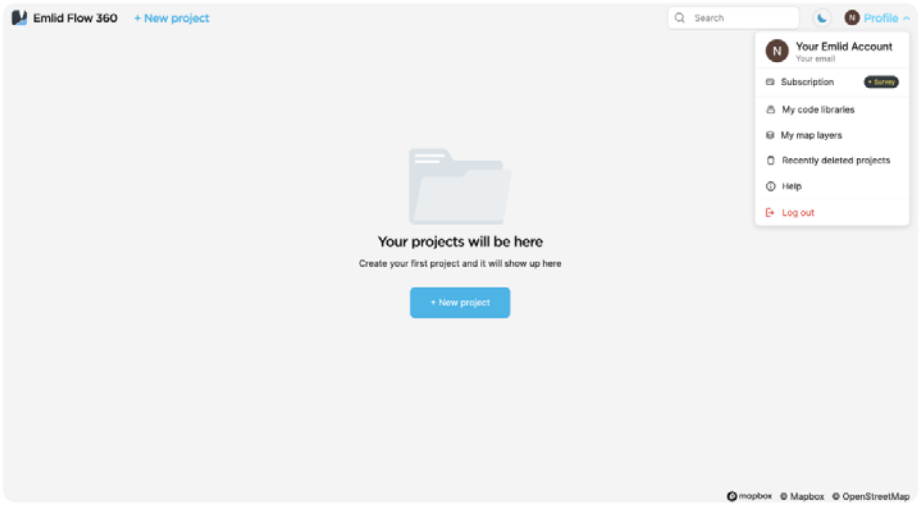
To add a WMS layer to the library, you need only a URL from the web map service—type or paste a link, and Emlid Flow 360 will load the list of available layers. After that, you can add the loaded layers to any of your projects in Emlid Flow 360.

Note: *You can add layers to your library and projects only in Emlid Flow 360.*

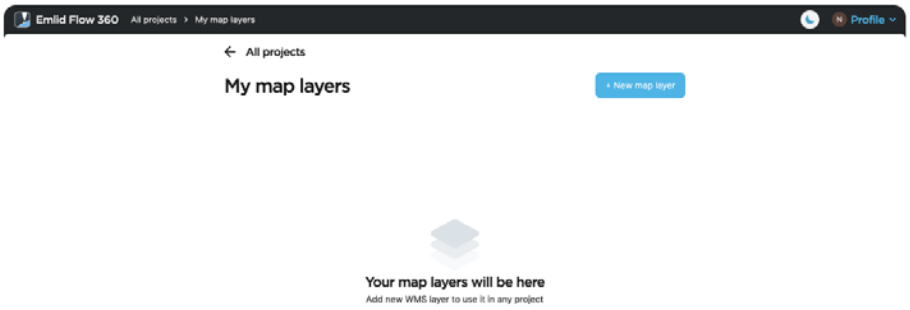
3.7.2 Adding WMS layers to library

To add WMS layers from web map services and create your own library, follow the steps below:

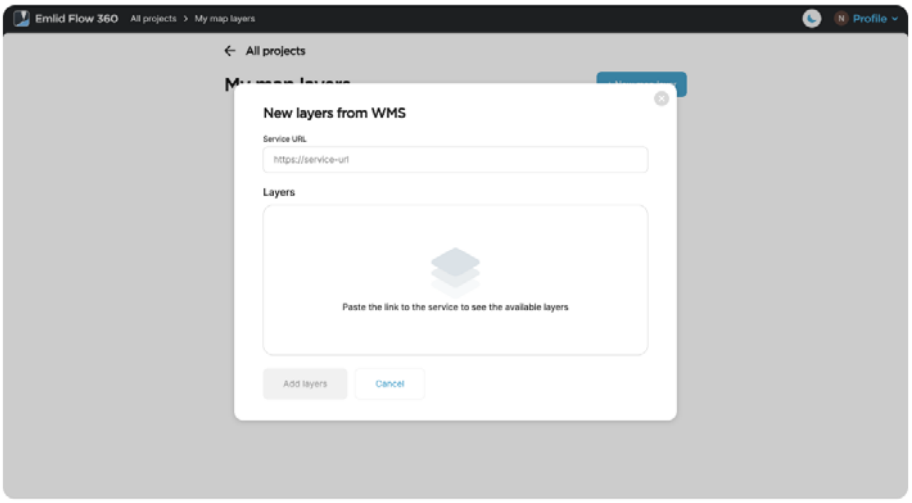
1. Go to flow360.emlid.com and sign up or sign in using your Emlid account.
2. Go to the *Profile* menu and click *My map layers*.



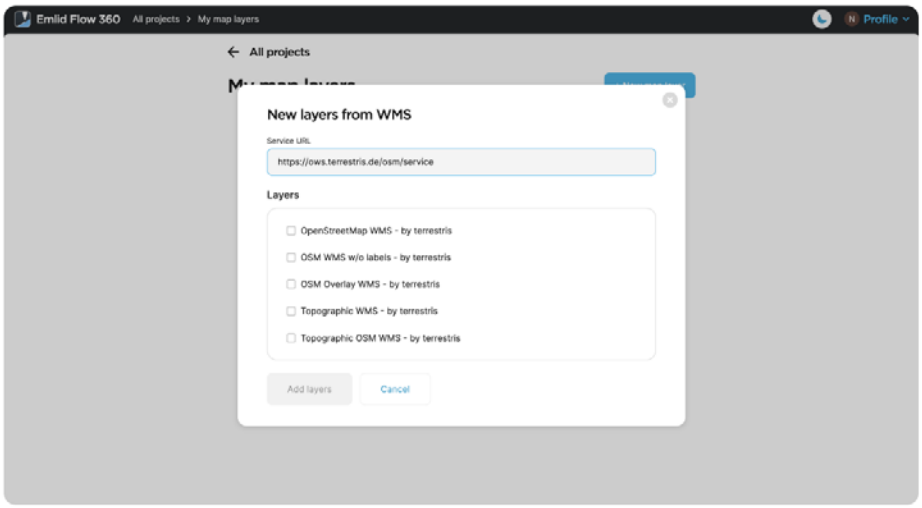
3. Click + *New map layer* to add a new layer.



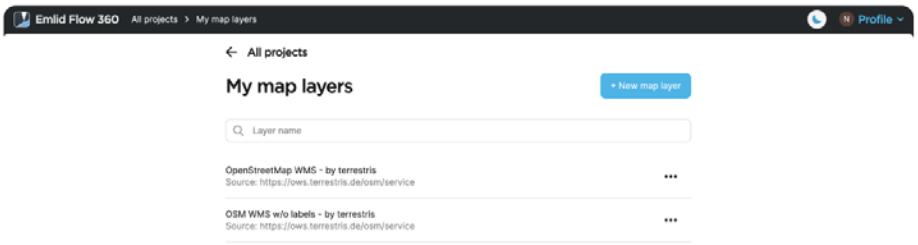
4. Type in or paste the address of the WMS service you use. Emlid Flow 360 will load the list of available layers.



5. Select the layers you want to add and click *Add layers*.



Wait until the layers are loaded.



Once WMS layers are loaded to the library, you will be able to add them to any project in Emlid Flow 360.

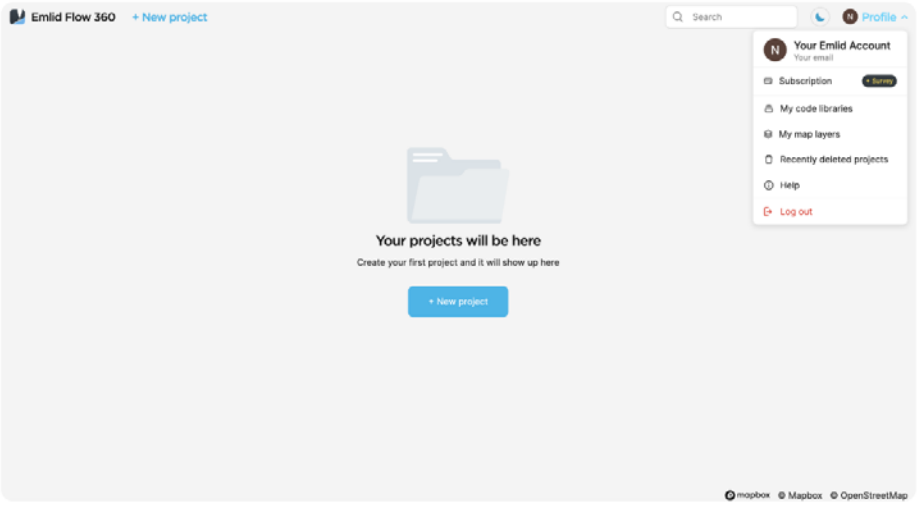
Tip: *Learn more about adding WMS layers to your project from WMS layers library in Emlid Flow 360 in the Add WMS layers to project guide.*

3.7.3 Deleting WMS layers from library

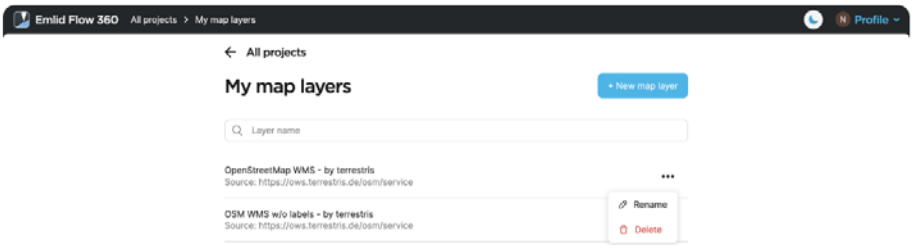
Caution: *This action permanently removes layers from your WMS layers library and cannot be undone.*

To delete a WMS layer from your WMS layers library, follow the steps below:

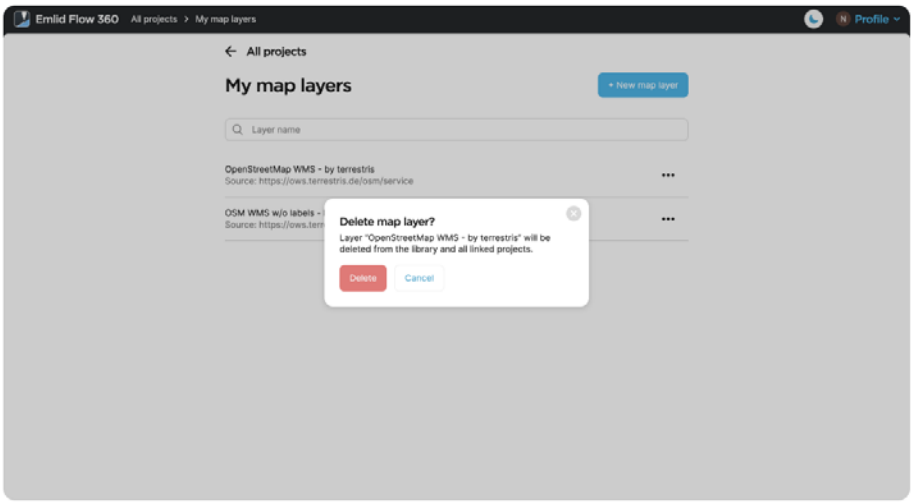
1. Go to flow360.emlid.com and sign up or sign in using your Emlid account.
2. Go to the *Profile* menu and click *My map layers*.



3. Click the *My map layers* button, choose the layer you want to delete and click the menu button near it.



4. Click *Delete* and confirm the deletion.



3.8 Add WMS layers to project

This guide explains how to add WMS layers from the WMS layers library to your project in Emlid Flow 360.

3.8.1 Overview

With the WMS layers library in Emlid Flow 360, you can select and add layers to your projects in Emlid Flow 360. After that, you can get access to these projects in Emlid Flow.

The use of WMS layers in projects allows you to get visual control and context of your survey area.

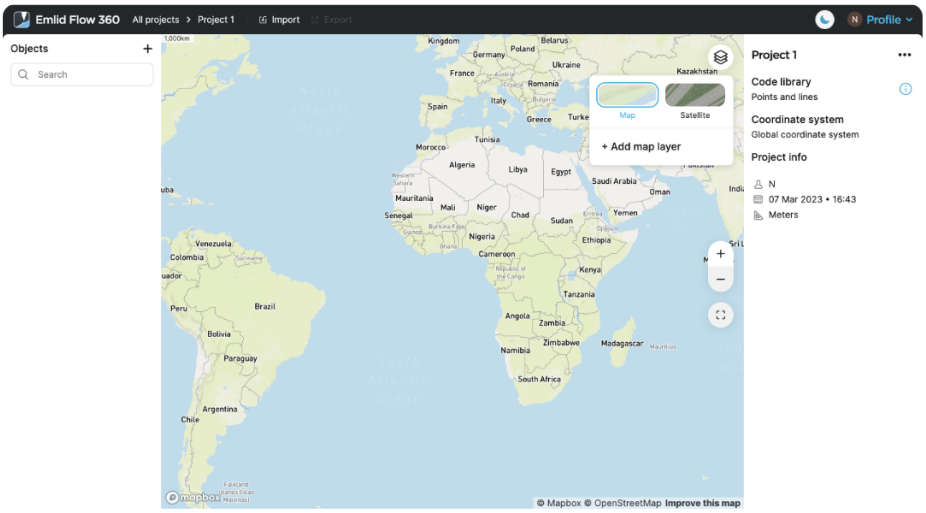
Tip: *Learn more about creating a WMS layers library in Emlid Flow 360 in the Create WMS layers library guide.*

Note: *To get access to projects with added layers from the WMS layers library in Emlid Flow, you should log into the same Emlid account you use in Emlid Flow 360. Learn more in Working with map layers.*

3.8.2 Add layers from library to project

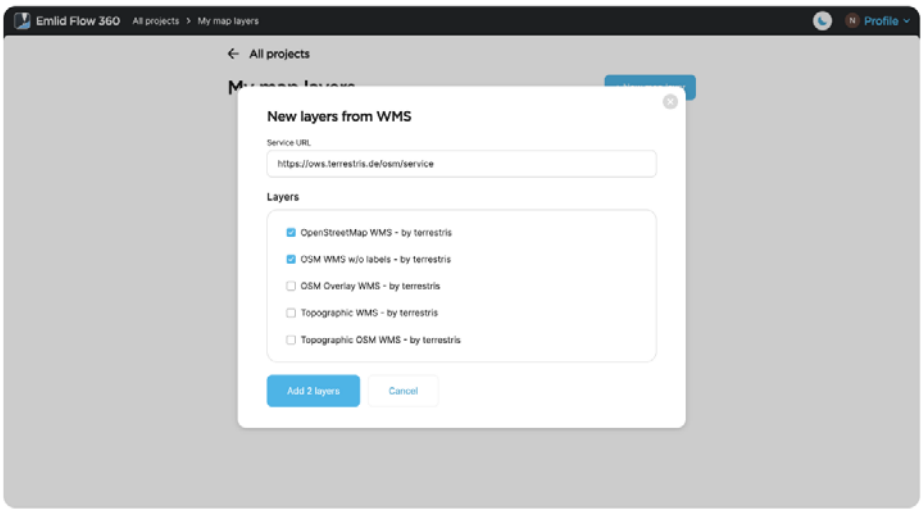
To add layers to your project from the WMS layers library in Emlid Flow 360, follow the steps below:

1. Go to flow360.emlid.com and sign up or sign in using your Emlid account.
2. Open your project and click the *Map layers* button.

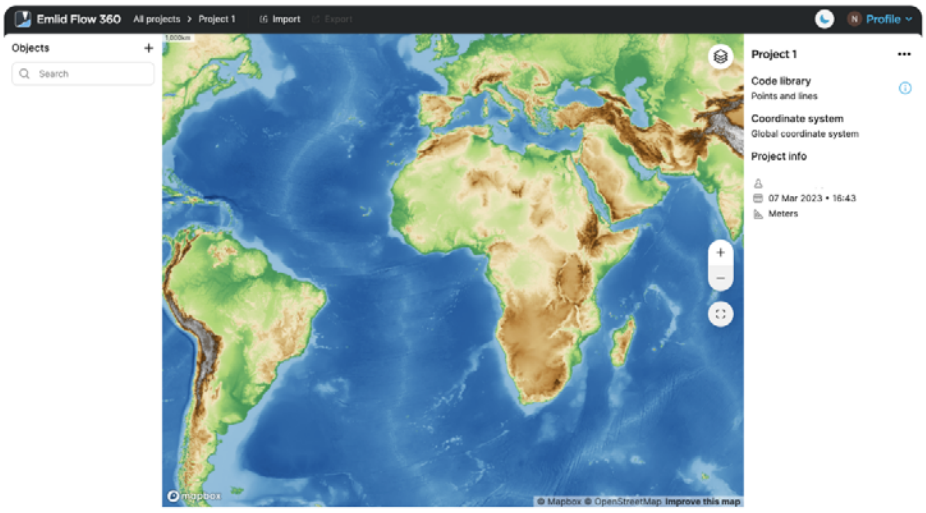


3. Click *Add map layer* and select required layers.

   Note: *You can also add new layers right in the project. Tap New map layer.*



4. Click *Add to project.*



Once the layers are added to your project, you can start working with them both in Emlid Flow 360 and Emlid Flow.

Tip: *Click the Map layers button to switch between vector and satellite map types, reoder layers using the drag-and-drop feature, and change their visibility and opacity on the map by clicking the eye icon near the layer and name of the layer correspondingly.*

3.8.3 Delete layers from project

Note: *The layer will be removed only from the project. You can add it again by clicking the Map layers button and Add map layer.*

You can delete WMS layers from your project as follows:

1. Go to flow360.emlid.com and sign up or sign in using your Emlid account.
2. In Emlid Flow 360, open your project and click the *Map layers* button.
3. Click on the layer you want to delete.



4. Click *Remove from project* and then click *Delete*.

3.9 Create lines from existing points

This guide explains how to create a line from existing points in your project in the Emlid Flow 360 app.

3.9.1 Overview

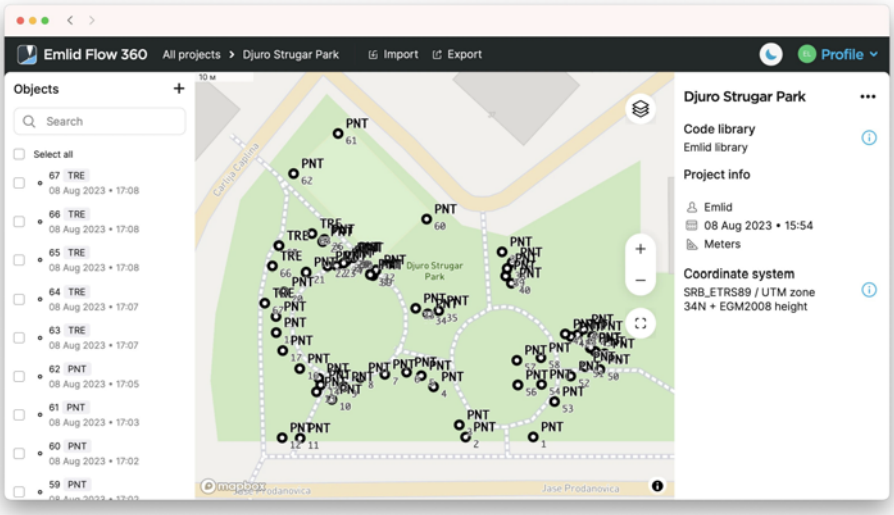
Emlid Flow 360 allows you to create lines from existing points. With this feature, you can create and stake out linear objects like fences, roads, and buildings with as many points as you need for further use in GIS or CAD software.

Note: *In Emlid Flow 360, you can see the 3D length of your line.*

3.9.2 Workflow

To create a new line from existing points, follow the steps below:

1. Open the project you want to work with.
2. Go to the list of Objects, tap the + button at the top, and select *"Add line"* from the drop-down menu.



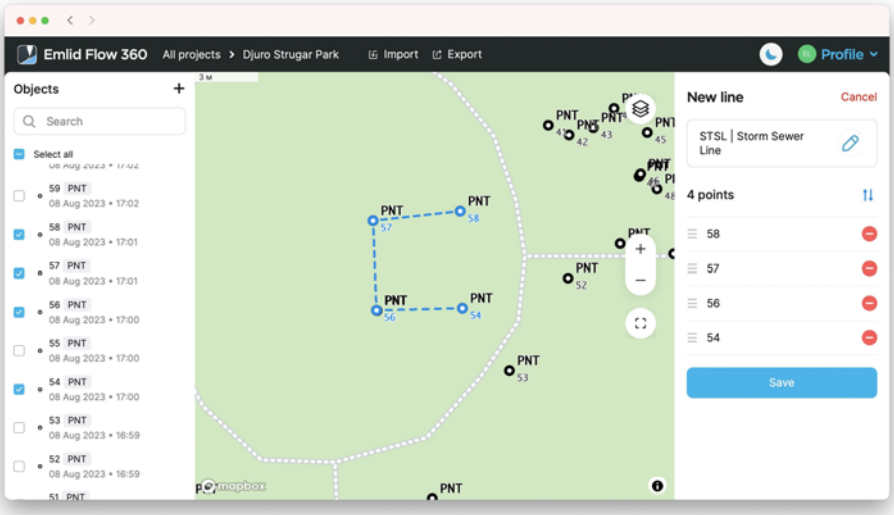
Tip: *In Emlid Flow 360, you can turn point labels on and off on the map. To do this, follow these steps:*

- *Open your project in Emlid Flow 360.*
- *Click the Layers button.*
- *Click Labels on the map, turn on or turn off the following: point name and code.*

Tip: *Tap the parameters icon next to Objects to customize the information you want to display for each object. You can customize the display of the following data:*

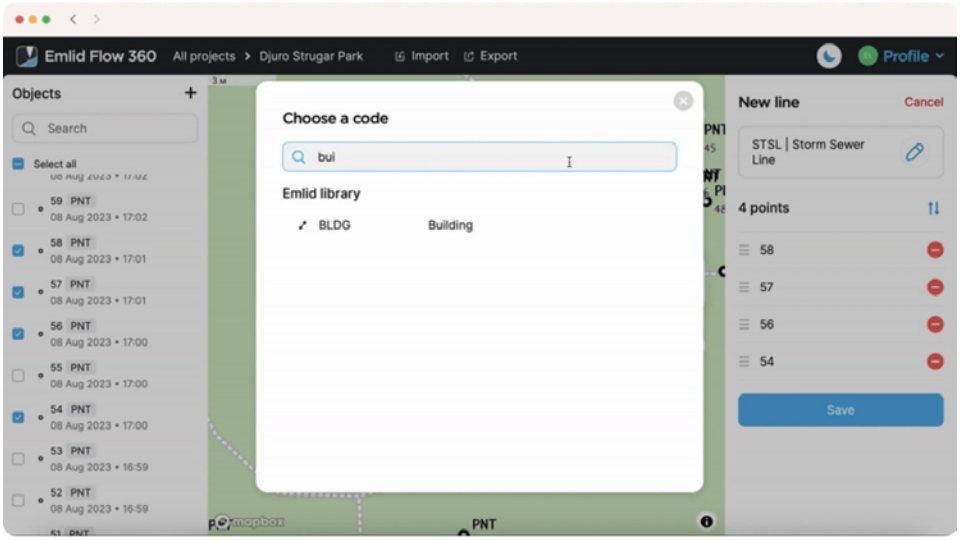
- *Point Name*
- *Code*
- *Date and Time*
- *Solution*

3. Select points on the map or from the list to add them to the line.

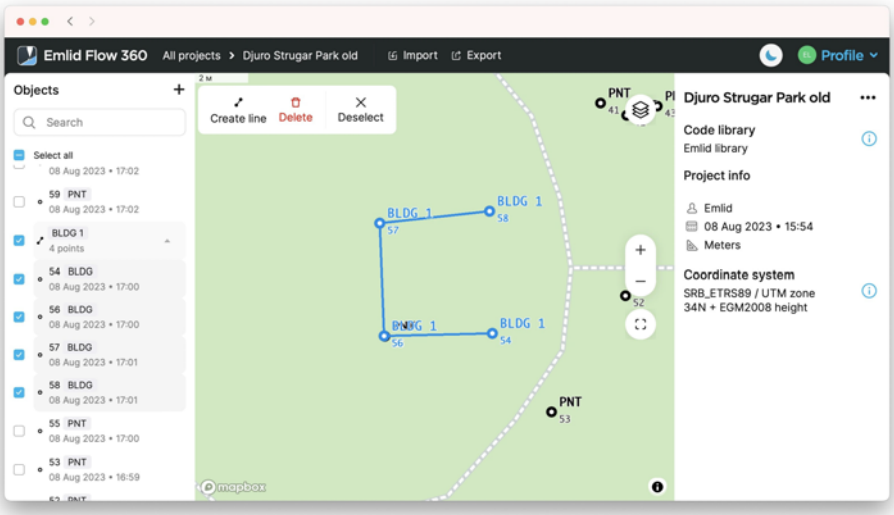


Tip: *You can change the order of the points by dragging them.*

4. Select a code for your line from your Code library list. Tap *Save* to create a line.



After you create a new line, it appears in the list of objects.



Now you can add new lines or keep working with the line you've just created.

3.10 Edit lines

This guide explains how to edit lines in your project in the Emlid Flow 360 app to correct the collected data.

3.10.1 Overview

Emlid Flow 360 allows you to edit lines in your survey projects in the office to correct the data collected in the field. With the Edit line feature, you can adjust the vertices of a line or change its code. The feature is available for both created and imported projects and includes the following editing options:

- Change point order.
- Delete points from a line.
- Add points to a line.
- Change the code of a line.

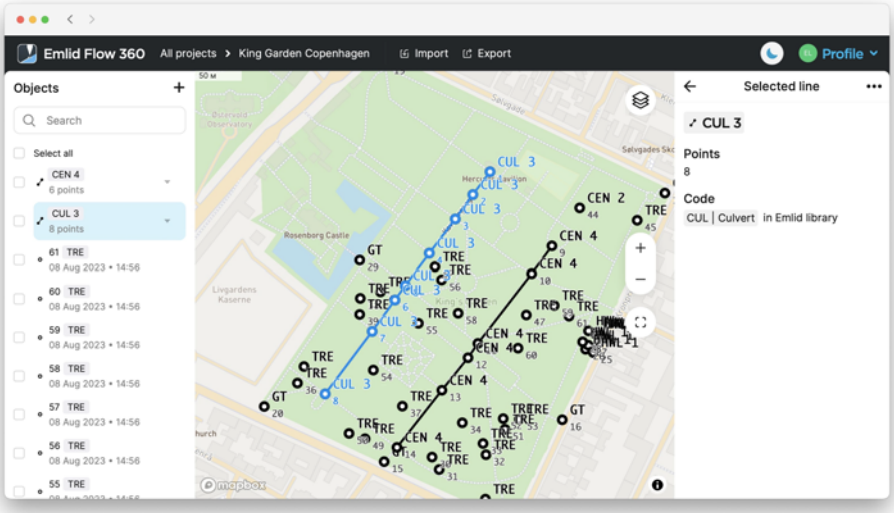
The Emlid Flow 360 app also allows you to delete a line while keeping or deleting its points.

Note: *When importing a project into Emlid Flow, make sure you follow the requirements for each format. See the Create or Import Project guide to learn more about importing a project into Emlid Flow 360.*

3.10.2 Editing lines

To edit a line in Emlid Flow 360, follow these steps:

1. Open the Emlid Flow 360 app on your device.
2. Select the project you want to edit.
3. Open the list of objects, and select the line you want to edit.



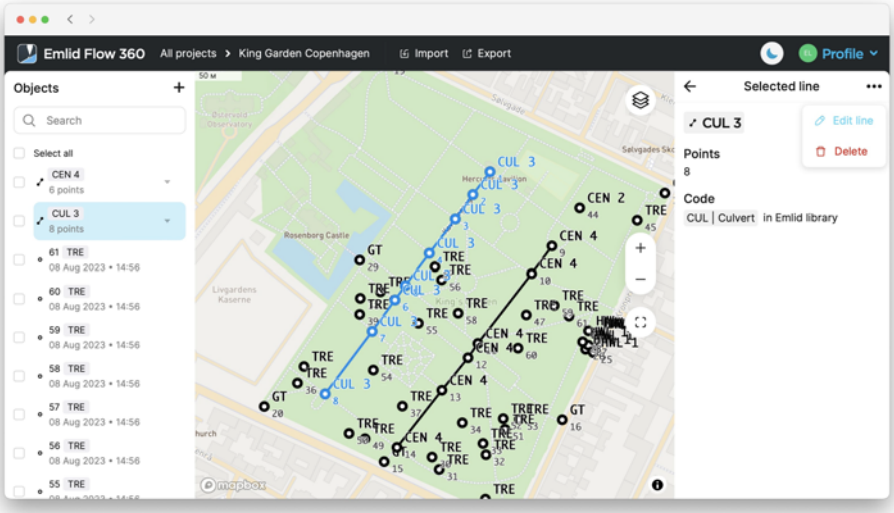
Tip: *In Emlid Flow 360, you can turn point labels on and off on the map. To do this, follow these steps:*

- *Open your project in Emlid Flow 360.*
- *Click the Layers button.*
- *Click Labels on the map, turn on or turn off the following: point name and code.*

Tip: *Tap the parameters icon next to Objects to customize the information you want to display for each object. You can customize the display of the following data:*

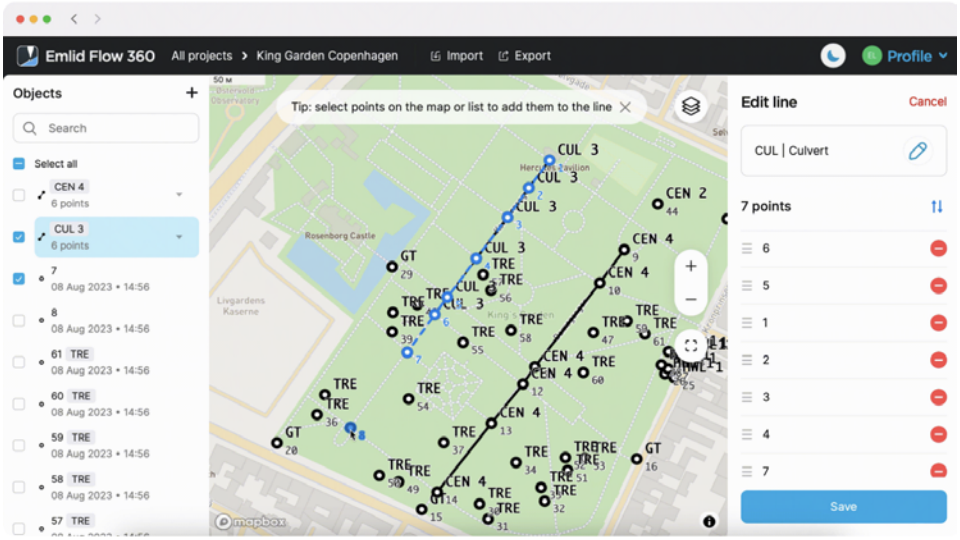
- *Point Name*
- *Code*
- *Date and Time*
- *Solution*

4. In the line editor, tap the three dots, then choose *Edit line* from the drop-down menu.

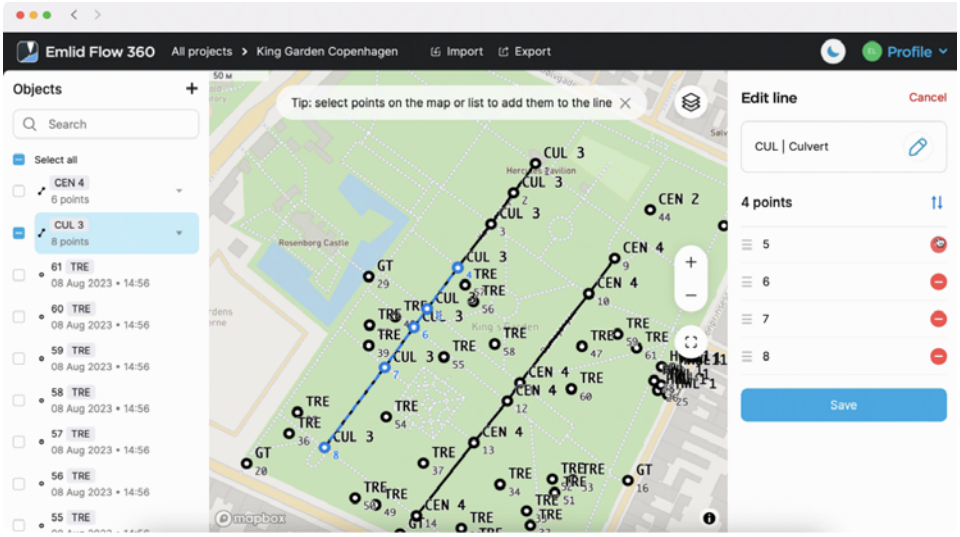


Now, you can:

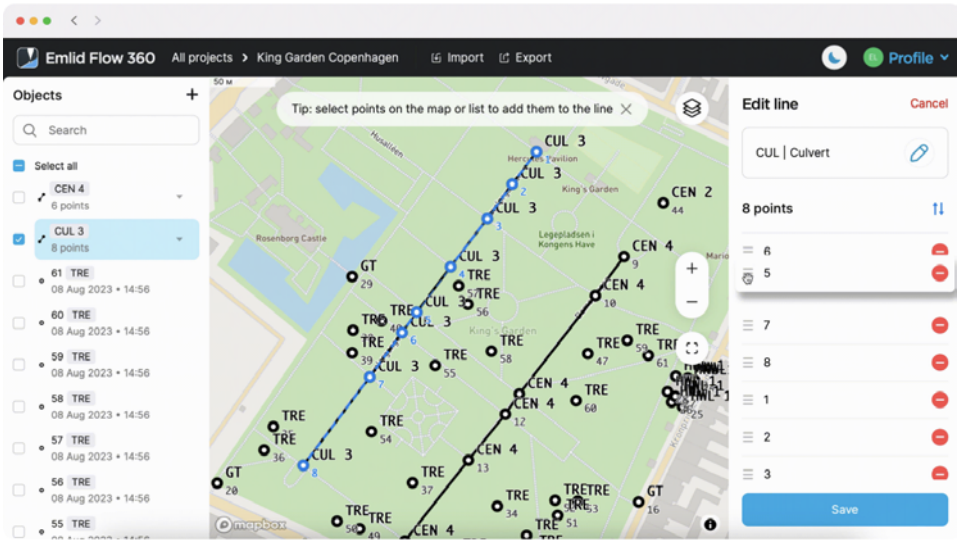
- Add points/lines by selecting them directly on the map or from the list.



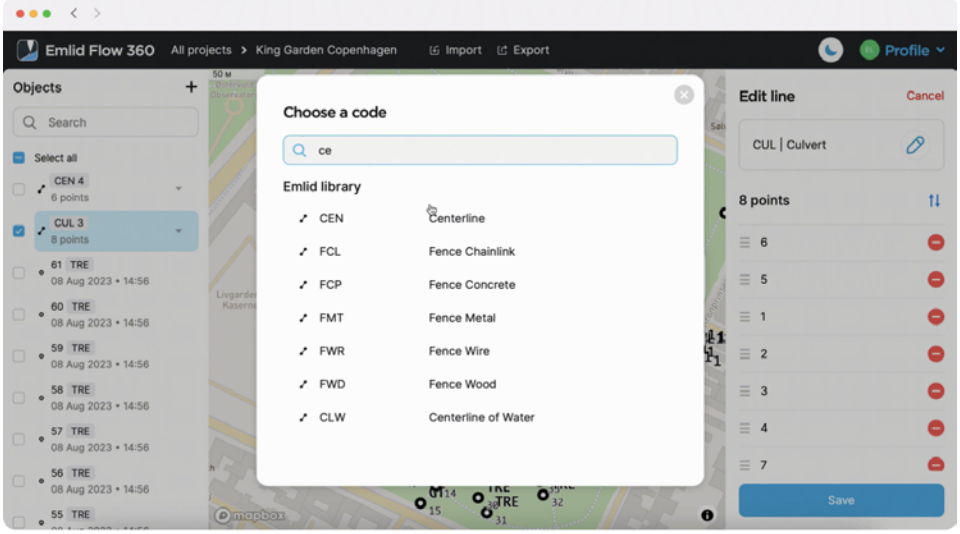
- Delete points by tapping the red minus button or tapping the point on the map.



- Rearrange points by dragging them to change the line geometry.



- Change the code by tapping the blue pencil button.

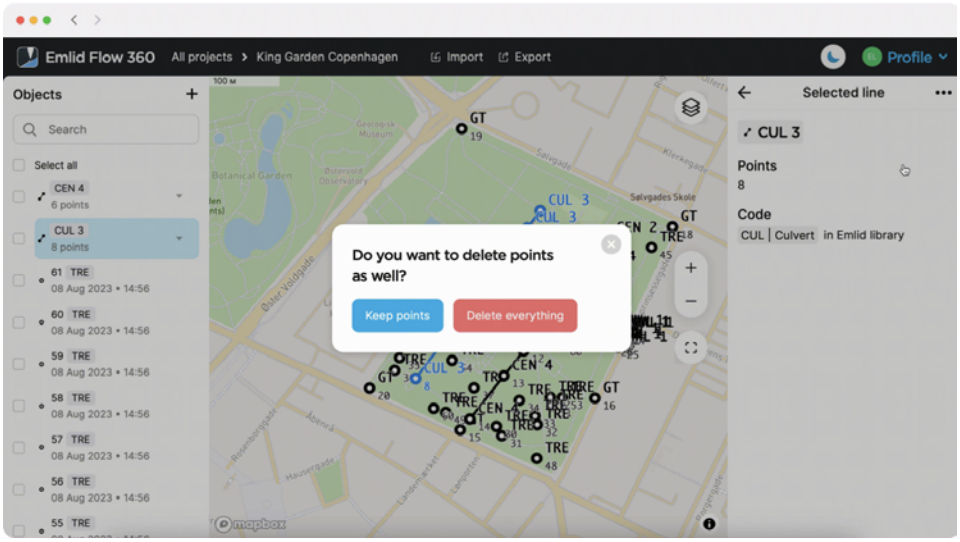


Tap *Save* to apply the edits.

3.10.3 Deleting lines

If you want to delete a line, you can choose to keep or delete the associated points. Do the following:

1. Select the line you want to delete from the list of objects in your project.
2. In the line editor, tap the three dots, then select *Delete* from the drop-down menu.
3. Select the appropriate option.



Now you can edit other lines or keep working with the line you've just edited.

3.11 Calculate inverse

This guide explains how to use the Inverse tool in Emlid Flow and Emlid Flow 360 to calculate coordinate geometry data such as area, distance, azimuth, and more for known points.

3.11.1 Overview

The Inverse tool in Emlid Flow and Emlid Flow 360 allows you to calculate geometry data for existing points. The tool can assist you in such projects as planning civil or utility engineering works and monitoring construction progress.

The software calculates the following values based on the number of input points:

When you select two and more points:

- Direction (True North azimuth, Grid North azimuth)
- Slope distance (Slope Ground distance, Slope Grid distance)
- 2D distance (2D Ground distance, 2D Grid distance)
- Height difference
- Grade

- Delta East (for points in a local CS only)
- Delta North (for points in a local CS only)

When you select three and more points:

- Slope distance (Slope Ground distance, Slope Grid distance)
- 2D distance (2D Ground distance, 2D Grid distance)
- Area
- Slope perimeter
- 2D perimeter

Depending on the coordinate system (CS) used in your project, different distance and azimuth types are used in the calculations:

CS type	Distance type	Azimuth type
Global CS	Ground distance	True North azimuth
Local CS	Grid distance	Grid North azimuth

Note: *See our Introduction to coordinate systems guide to learn more about distance and azimuth types in different CSs.*

Note: *When calculating area in a local coordinate system, the software applies a variation of the Shoelace formula, which approximates the area using trapezoids:*

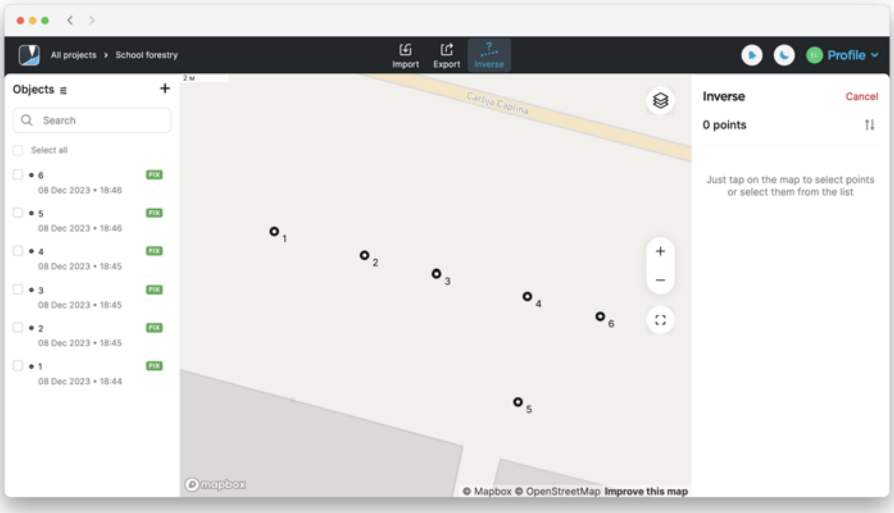
$$A = \frac{1}{2}\sum_{i=1}^{n}(y_i + y_{i+1})(x_i - x_{i+1})$$
$$= \frac{1}{2}\Big((y_1 + y_2)(x_1 - x_2) + \cdots + (y_n + y_1)(x_n - x_1)\Big)$$

Area in a global coordinate system can be calculated for ellipsoid (on the ellipsoid surface) or ground (at the mean ground elevation). We use the method described in section 6 of Algorithms for geodesics by C. F. F. Karney (2013).

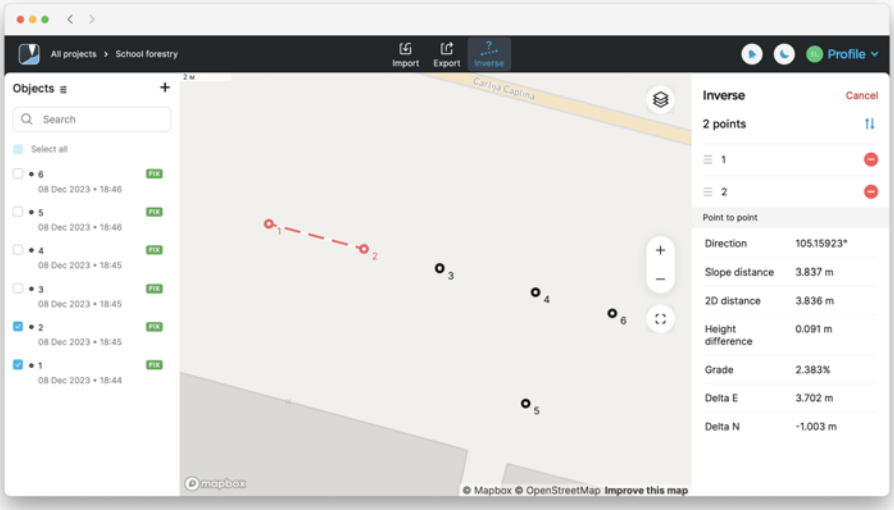
3.11.2 Workflow

To apply the Inverse tool in the Emlid Flow 360 app, follow these steps:

1. Open the project in Emlid Flow 360.
2. Tap *Inverse* at the top of the screen to calculate the results.



3. Select the points you want to calculate the inverse for from the map or Objects list.

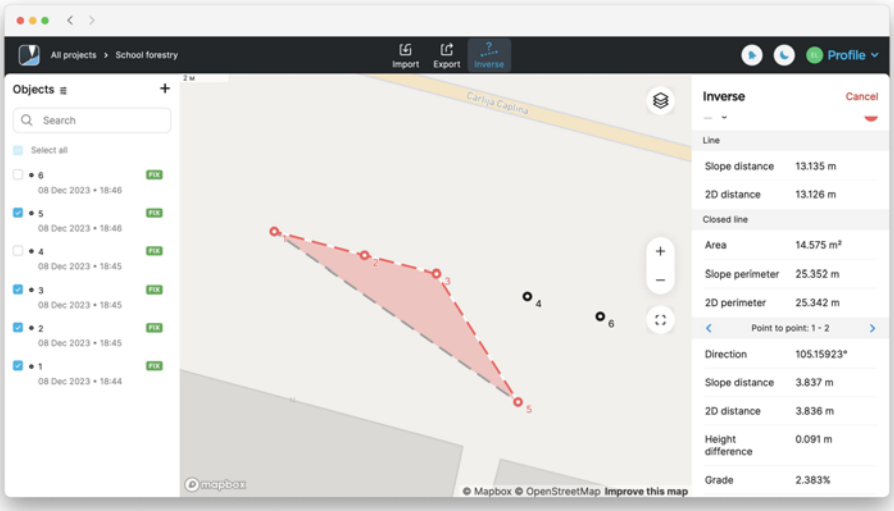


Tip: *In Emlid Flow and Emlid Flow 360 you can also find the point-to-point, line, and closed line information for each line. To see this information, just tap on the line.*

4. Find the calculated results on the right side of the screen. To calculate results for more than two points, use the arrow buttons to switch to a different set of two points.

   Note: *The displayed results will be different depending on the selected points. If you select 2 points, you'll see the point-to-point calculations. If you select 3 points, you'll also see the calculations on the area, slope perimeter, etc.*

   Note: *You can only use Closed line and Line for geometry measurements. It is not possible to import or export them as geometrical figures.*



Tip: *You can change the order of the points in the Inverse section by dragging and dropping them. To delete a point, tap the delete button.*

5. To exit the Inverse calculation mode, tap *Cancel* in the upper-right corner.

3.12 Calculate traverse

This guide explains how to use the Traverse tool in Emlid Flow and Emlid Flow 360 to create new geometry using the data from existing points.

3.12.1 Overview

The Traverse tool in Emlid Flow and Emlid Flow 360 allows you to create a new point using the known point data. All you need to create a new point is to specify its location relative to the known point by inputting distance, azimuth, and height difference values.

The tool can assist you in such projects as:

- **Transferring a survey plan to a real site**: transferring a survey plan, such as coordinate geometry descriptions, to accurately recreate the features on the site.
- **Fast design in the field**: some designs can be imperfect and simply do not contain all the necessary points. If you are building a rectangular object, such as a swimming pool, you only need one corner coordinate and the other three points can be built in Emlid Flow 360.
- **Calculating inaccessible points**: You can use Traverse to get the coordinates of a point that you can't actually measure. For example, if something is placed over the point or something blocks the view of the sky there.

Depending on the coordinate system (CS) used in your project, different distance and azimuth types are used in the calculations:

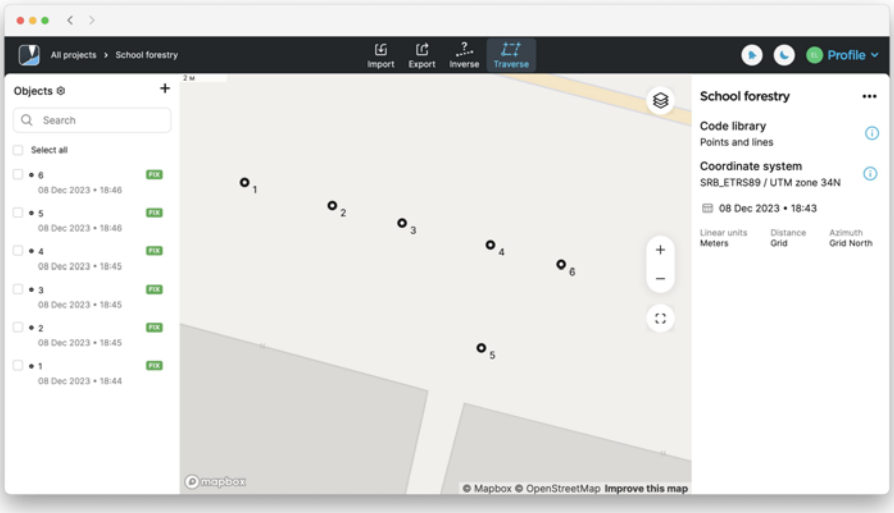
CS type	Distance type	Azimuth type
Global CS	Ground distance	True North azimuth
Local CS	Grid distance	Grid North azimuth

Note: *See our Introduction to coordinate systems guide to learn more about distance and azimuth types in different CSs.*

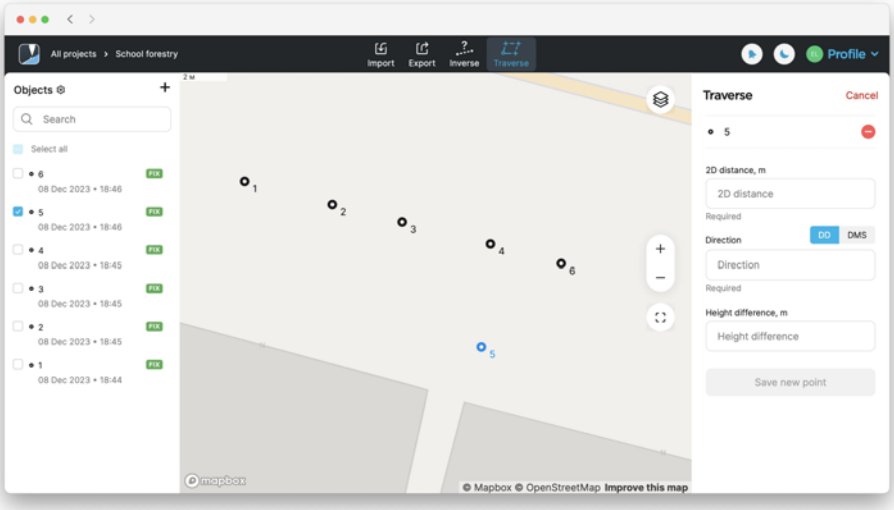
3.12.2 Workflow

To apply the Traverse tool in the Emlid Flow 360 app, follow these steps:

1. Open the project in Emlid Flow 360.
2. Tap *Traverse* at the top of the screen to calculate the results.

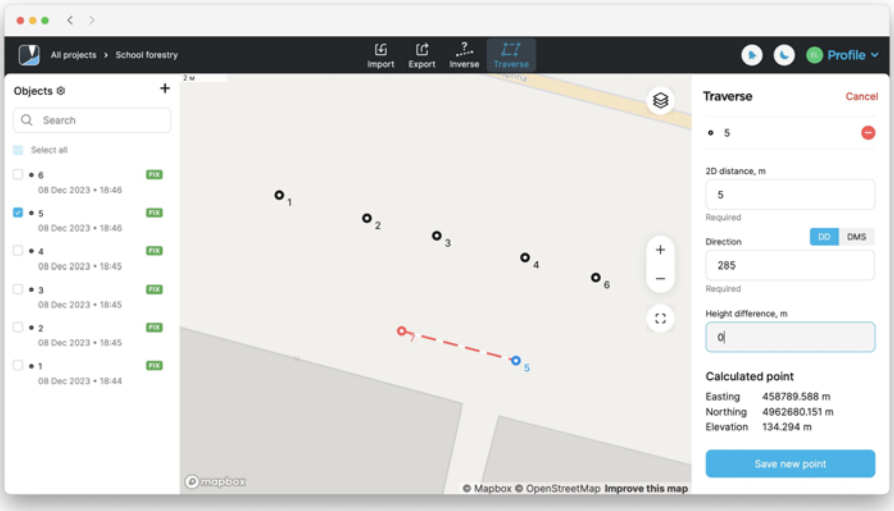


3. Select a starting point from the map or the list.



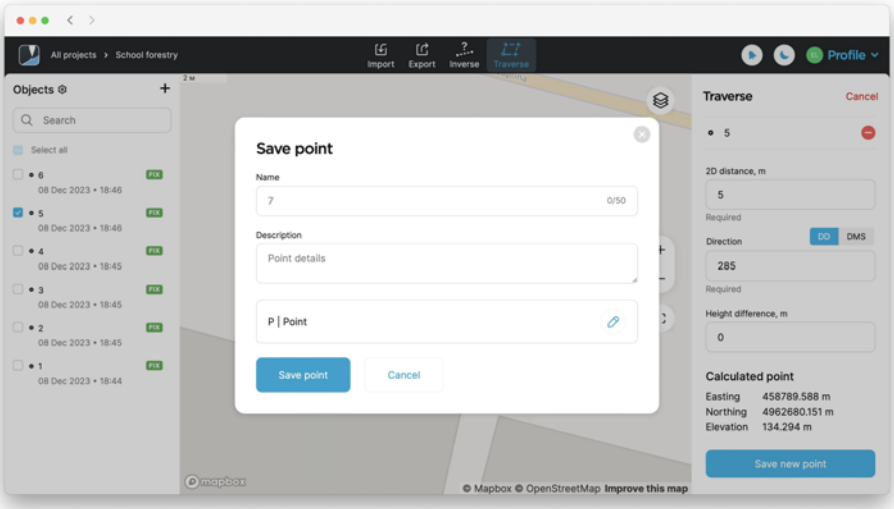
4. Enter the distance, direction (azimuth), and height difference from this point to create a new point. Tap *Save new point*.

   Note: *Distance must start from 0. Direction (azimuth) must be in the range 0-360 and can be in the DD or DMS format.*



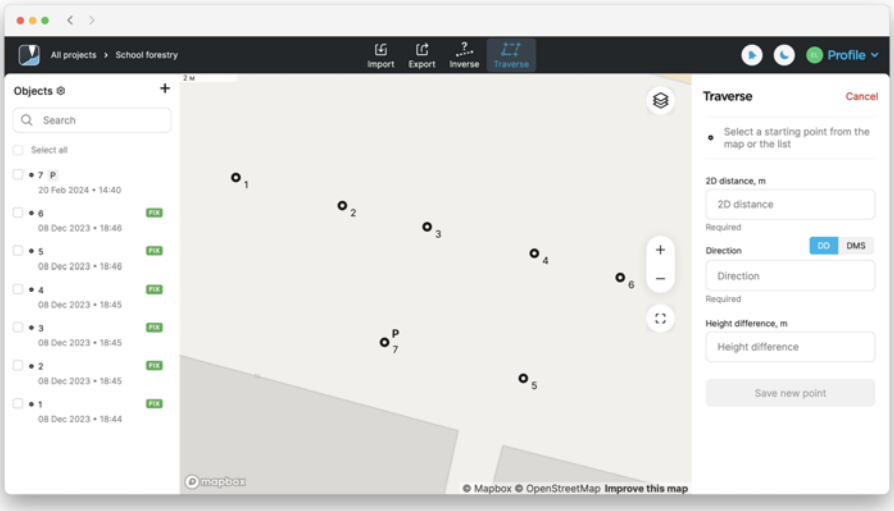
Tip: *To create a fast design when the initial direction is known, you can simply add the needed angle in the next calculations. For example, your first point is calculated with the azimuth of 34; if you need to build a square, add 90 every time, so it will be 124, 214, and so on.*

5. Enter the name, fill in the description, and assign a code for your new point.



Tip: *If you select a line as the survey code for your new points, you can then use the Create line feature to join them together into a line.*

6. Tap *Save point*. Now your new point has been saved into your project.



7. To exit the Traverse calculation mode, tap *Cancel* in the upper-right corner.

4 Getting ready projects

4.1 Export projects

This guide shows how to export project data from Emlid Flow or Emlid Flow 360 for further use in third-party GIS software.

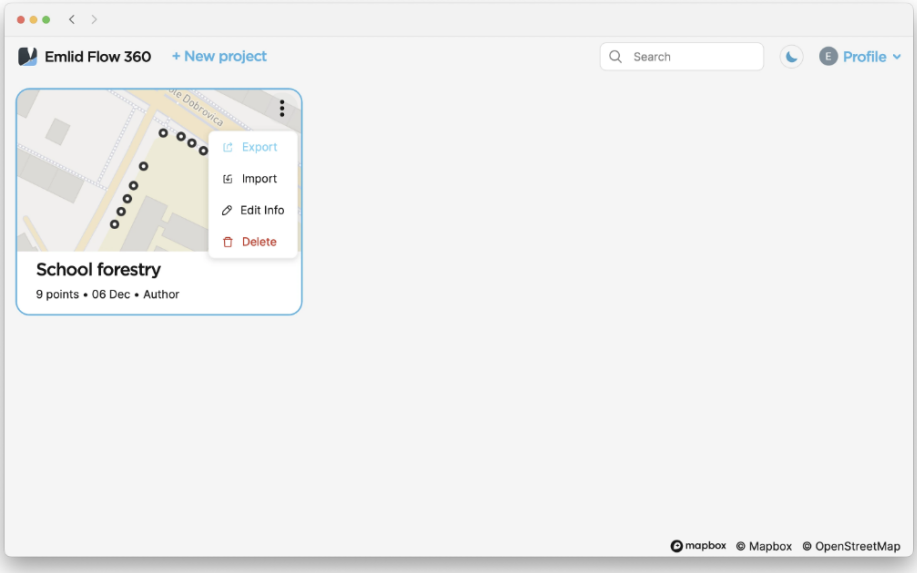
4.1.1 Overview

With Emlid Flow and Emlid Flow 360, you can export your projects as CSV, Custom CSV, DXF, KML, or Shapefile to work with them in third-party GIS software.

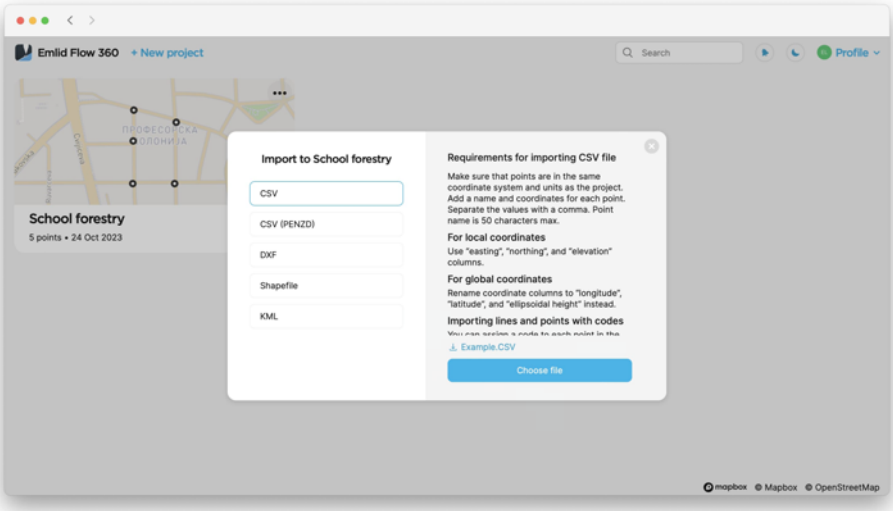
4.1.2 Exporting project

To export the project, follow the steps below:

1. Open Emlid Flow 360 and find the project you want to export.
2. Tap the 3 dots button in the top right corner of the project's plate. Click *Export*.



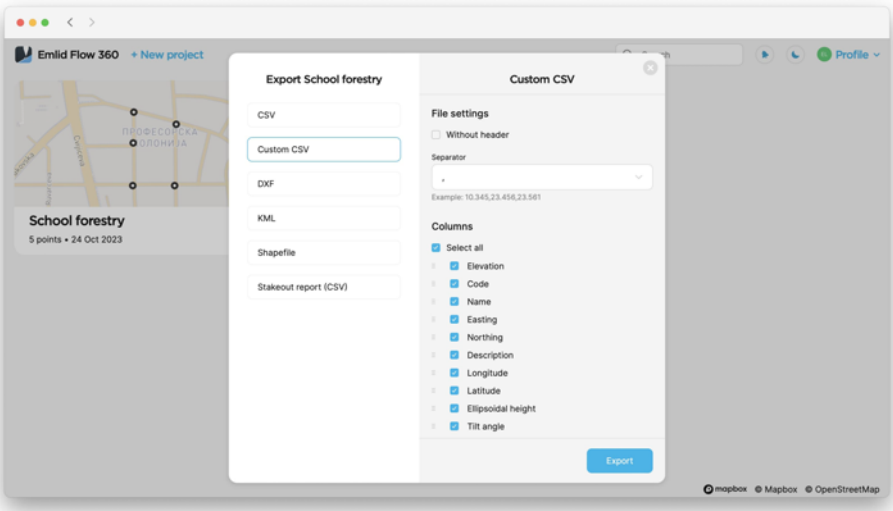
3. Choose the format in which you want to export your project.



4. **Note:** *This step is optional. The Custom CSV option for exporting projects is only available with the subscription.*

   With the Custom CSV option, you can customize the data you want to include in the CSV file you export from Emlid Flow 360 for further use in third-party software. Below are the options you can customize:

   - Include/exclude the header by checking Without header.
   - Select the separator type.
   - Select the columns you want to include in the CSV file.
   - Change the order of columns by dragging the fields.
   - Change column names by clicking on the field's name.



Once you set up all the necessary options, click *Save and export*. Emlid Flow 360 will save your current custom CSV configuration as a template for further use in Emlid Flow 360 and Emlid Flow.

Tip: *You can reset the confuguration and set up a new one by clicking Reset to default. To revert the name of the column, delete the text and press the Enter key.*

5. Wait until Emlid Flow 360 finishes to export your project. Save the file depending on the device you use.

Now your project's data is ready for further use in third-party GIS software.

5 Account and subscription managment

5.1 Account management

This guide describes how you can manage your Emlid account.

5.1.1 Overview

An Emlid Account is a free and simple way to synchronize your data from the Emlid Flow and Emlid Flow 360 apps across your mobile and desktop devices. Once you log in to your account, your data will be immediately backed up to the cloud and available on every device you use. Besides, with an Emlid Account, you can upgrade to the Survey subscription plan.

Tip: *Learn more about the Survey subscription plan on the Emlid Flow and Emlid Flow 360 landing page.*

5.1.2 Create account

All you need to create an account is to enter your email and set a password. This will automatically create a profile that will store your projects, NTRIP profiles, and custom coordinate systems. Follow the steps below:

1. Go to flow360.emlid.com.
2. Click the *Sign Up* tab.



3. Type in your email and password in the corresponding fields.
4. Click the *SIGN UP* button.
5. Verify your email address by following the on-screen instructions.

Once you create an Emlid account, log in to Emlid Flow or Emlid Flow 360 to enable data synchronization between all your devices.

Note: *You can delete your Emlid Account only in Emlid Flow.*

5.2 Subscription management

This guide describes how you can manage your Survey subscription.

Tip: *You can manage your subscription from both Emlid Flow and Emlid Flow 360.*

5.2.1 Overview

You can upgrade your Emlid Flow and Emlid Flow 360 apps to the Survey subscription. The upgrade requires an Emlid Account and offers two subscription plans based on monthly or yearly billing periods.

Note: *When subscribing for the first time, you will be offered a free 30-day trial.*

The subscription is multi-platform and features professional survey tools:

- coding,
- linework,
- a satellite map,
- WMS/WMTS layers,
- and localization

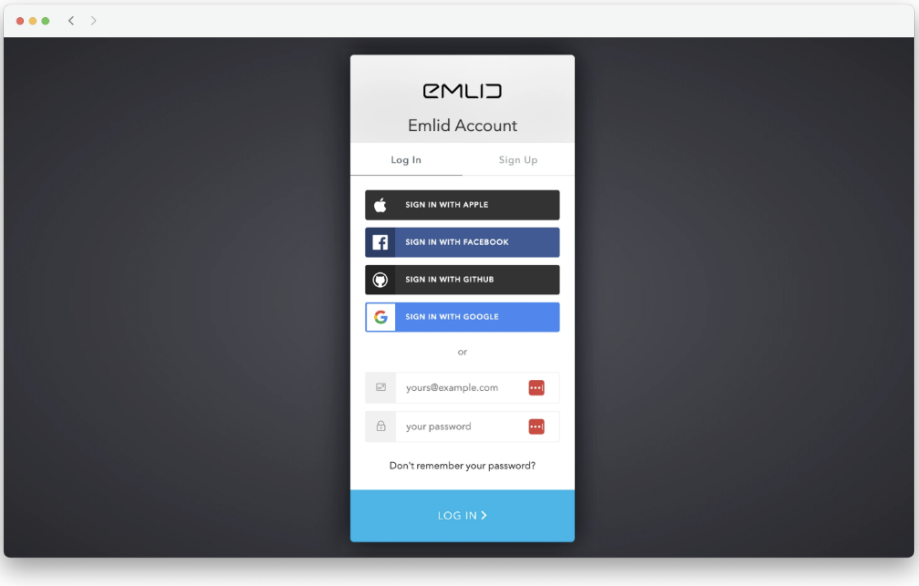
Tip: *Learn more about the Survey subscription plan on the Emlid Flow and Emlid Flow 360 landing page.*

5.2.2 Upgrade to Survey subscription

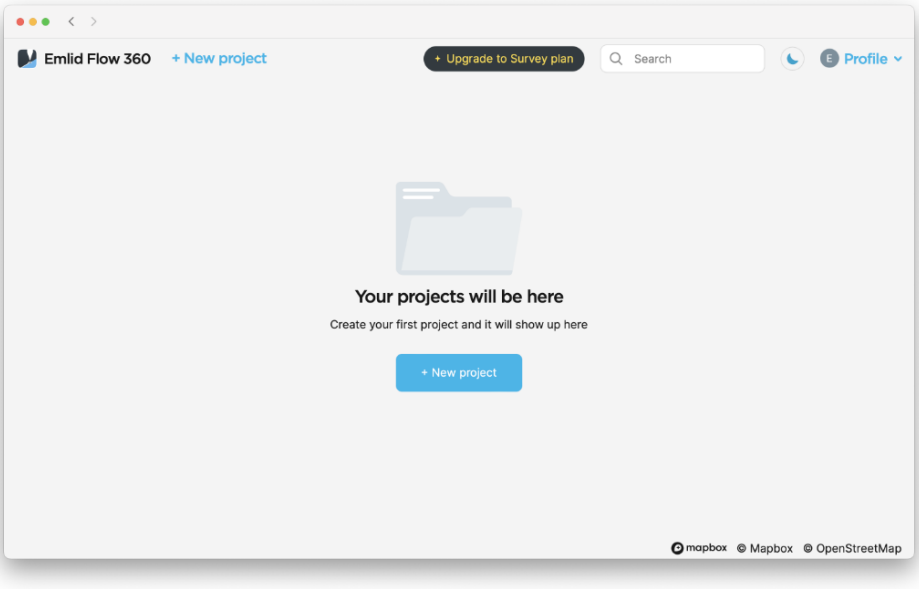
Tip: *If you haven't created an Emlid Account yet, check the Getting started guide.*

To upgrade to the Survey subscription, follow the steps below:

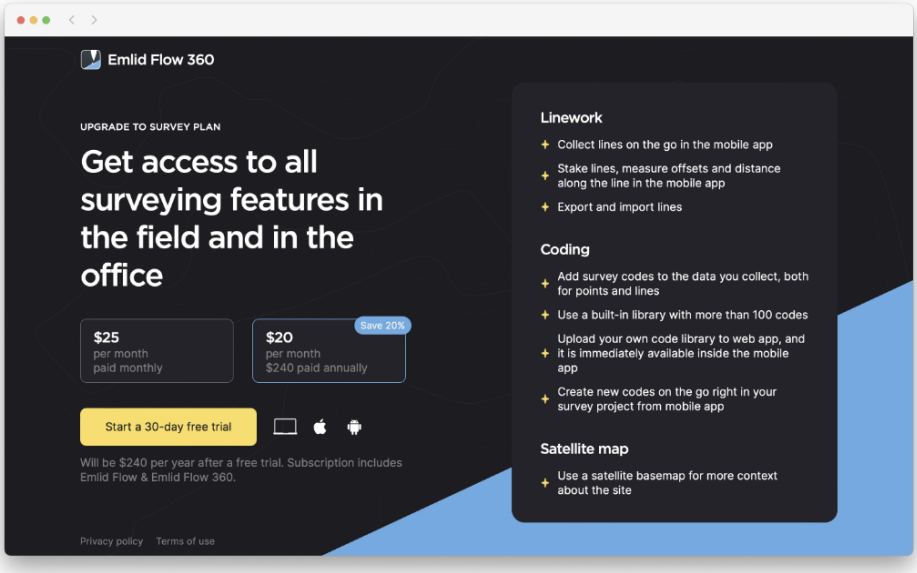
1. Go to flow360.emlid.com.
2. Log in to your Emlid Account.



3. Click the subscription plate.



4. Start a free trial and fill in your details. Tap *Continue*.



Note: *A free trial is 30 days. When the trial is over, the plan will be automatically renewed until cancelled. You can change the plan in the subscription management settings depending on your mobile device's platform.*

5. Fill in the payment details and click *Start Your Free Trial*. You'll be automatically redirected to the main screen.

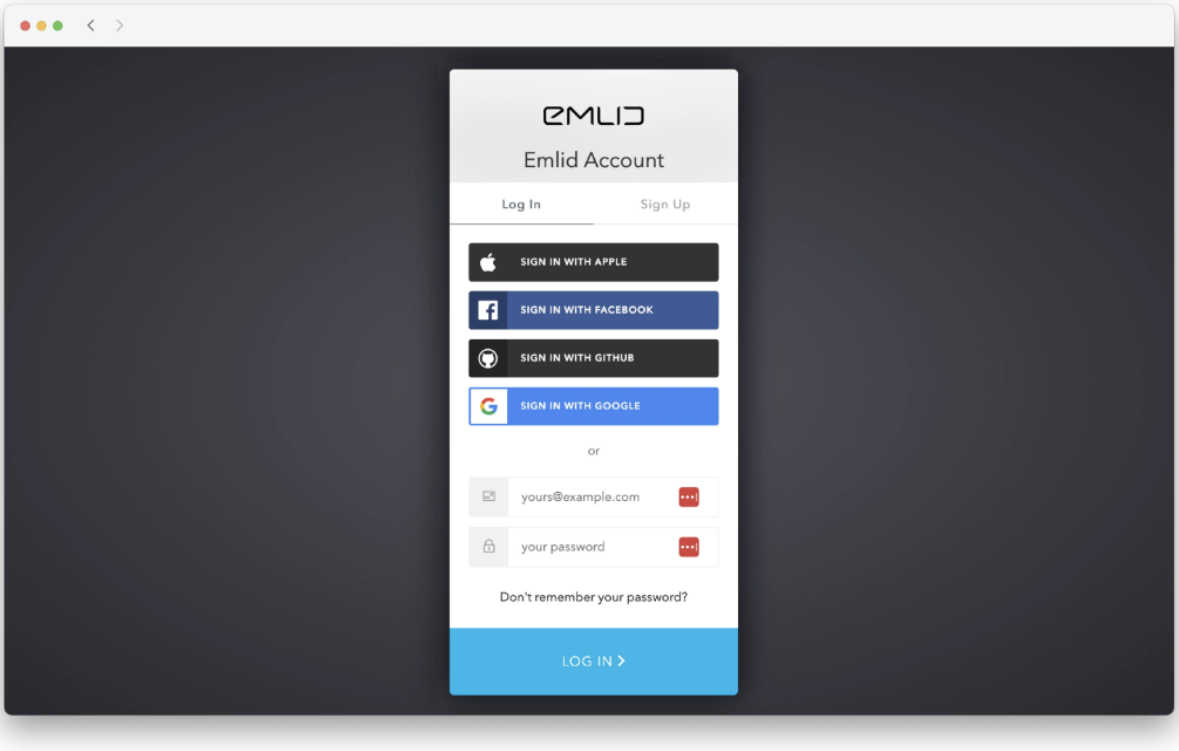
Once you upgrade to the Survey subscription, you can start using the featured professional survey tools both in Emlid Flow and Emlid Flow 360.

5.2.3 Cancel Survey subscription

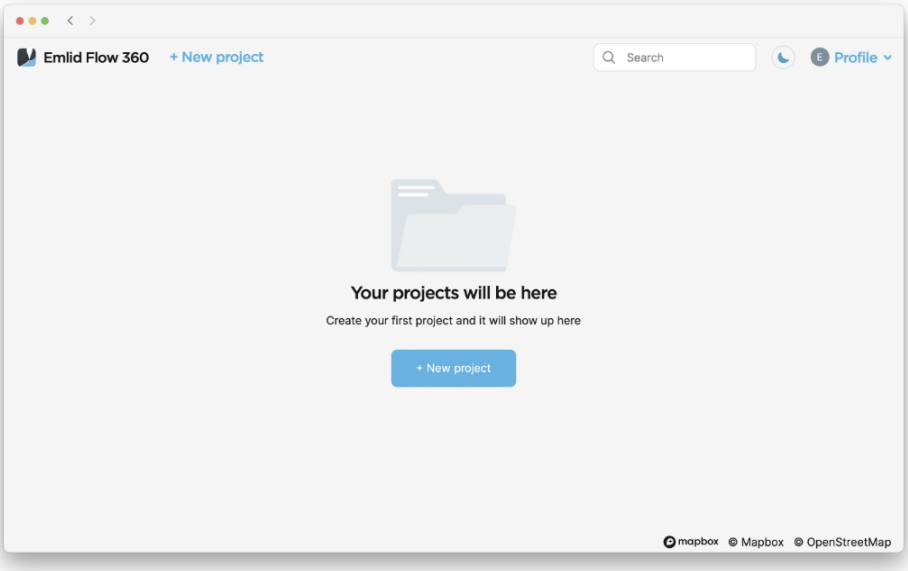
Note: *You can unsubscribe only on the platform you started the subscription.*

To cancel the Survey subscription, complete the following:

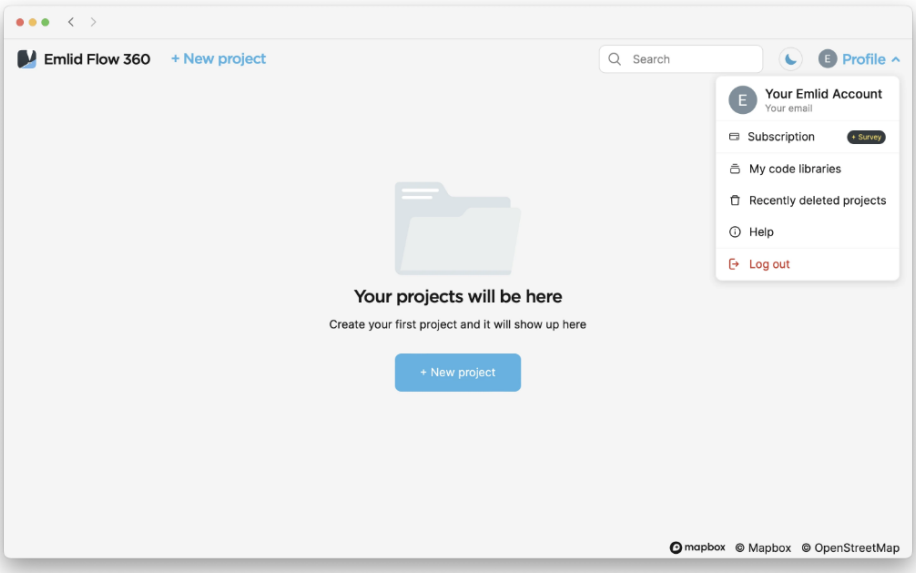
1. Go to flow360.emlid.com.
2. Log in to your account.



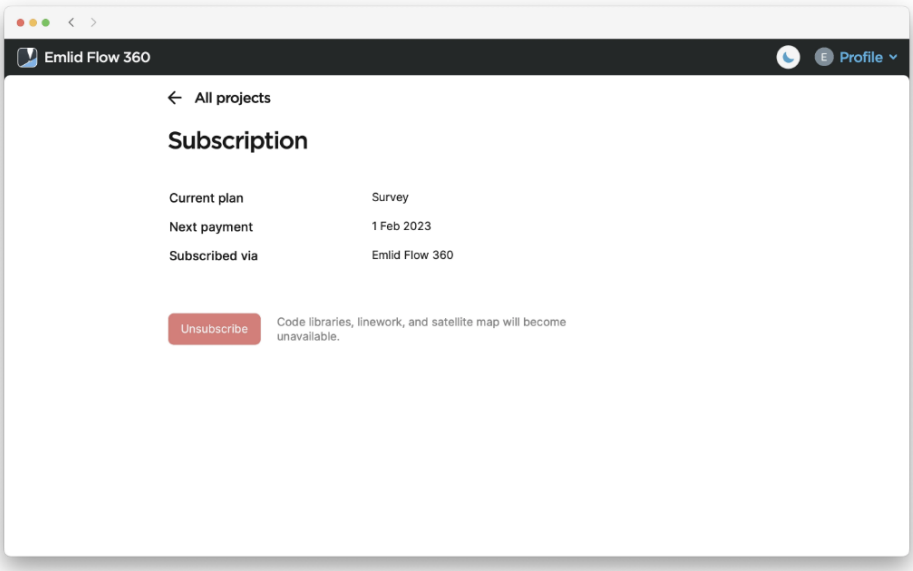
3. Click *Profile*.



4. Click *Subscription*.



5. Click *Unsubscribe* and confirm it.



Once you unsubscribe, code libraries, linework, and a satellite map will become unavailable for use. However, you still will be able to view created using the subscription projects with linework and codes and export them in any format.

If you need help, contact the Support team at support@emlid.com.

5.2.4 Restart Survey subscription

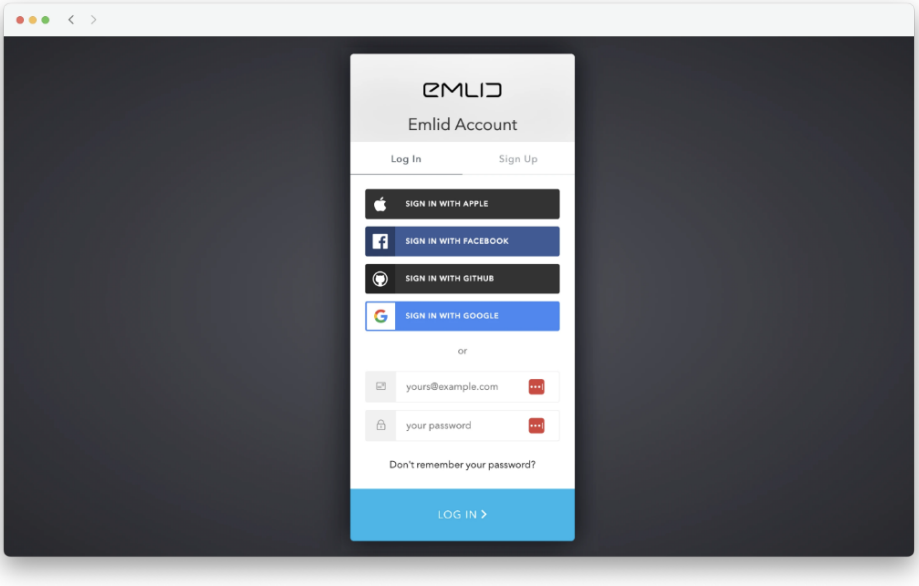
Note: If you want to restart the subscription with active days left, you should go to the platform where it was activated at first.

If you cancelled the subscription and want to restart it, you can easily do it both in Emlid Flow and Emlid Flow 360 anytime you want.

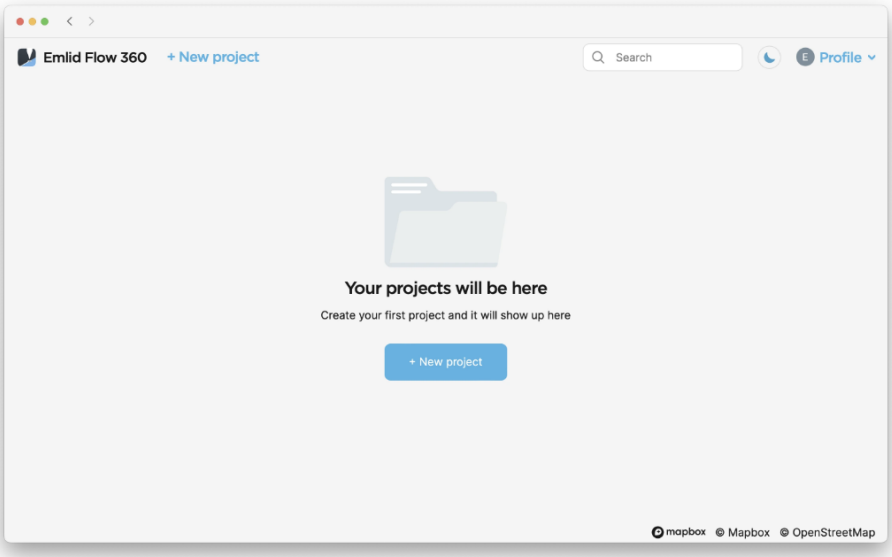
To restart the subscription, follow the recommendations below:

Note: *If you have days left on the active subscription, you can restart the subscription only when they are over.*

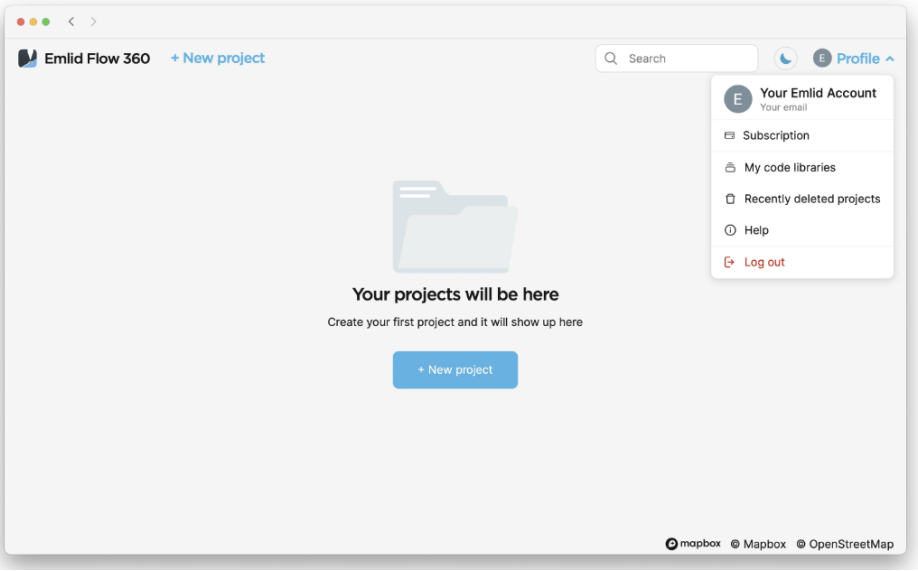
1. Go to flow360.emlid.com.
2. Log in to your Emlid Account.



3. Click *Profile*.



4. Click *Subscription*.



5. Fill in your details. Tap *Continue*.
6. Fill in the payment details and subscribe. You'll be automatically redirected to the main screen.

Once you restart your subscription, code libraries, linework, and a satellite map will be again available for use.

If you need help, contact the Support team at support@emlid.com.

5.3 How to apply codes in Emlid Flow 360

This guide shows how to apply codes in Emlid Flow 360 to get access to the Survey plan features both in Emlid Flow and Emlid Flow 360 and to extend the access period.

5.3.1 Overview

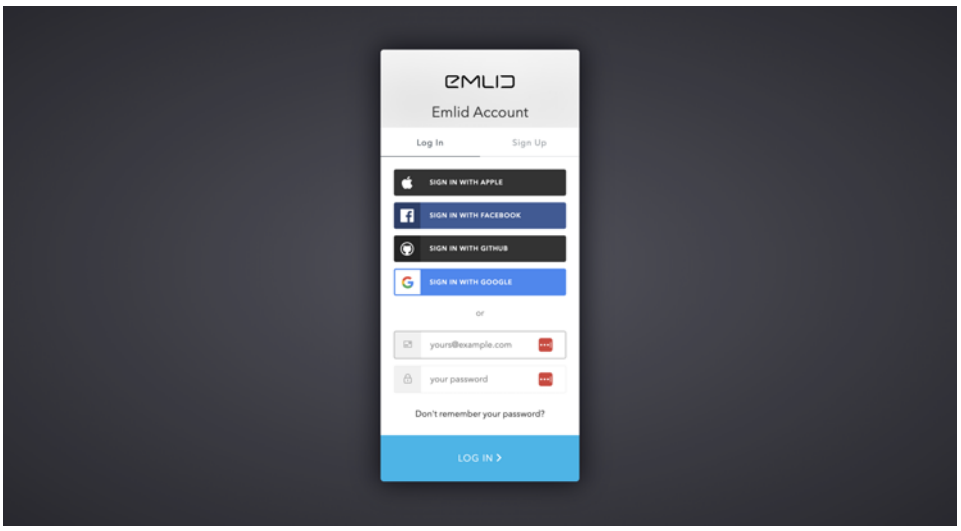
Codes are strings of numbers and letters that allow you to get access to the Survey plan features and then extend the access period. With a code, you can get access to the Survey plan features by simply entering it.

5.3.2 Applying code

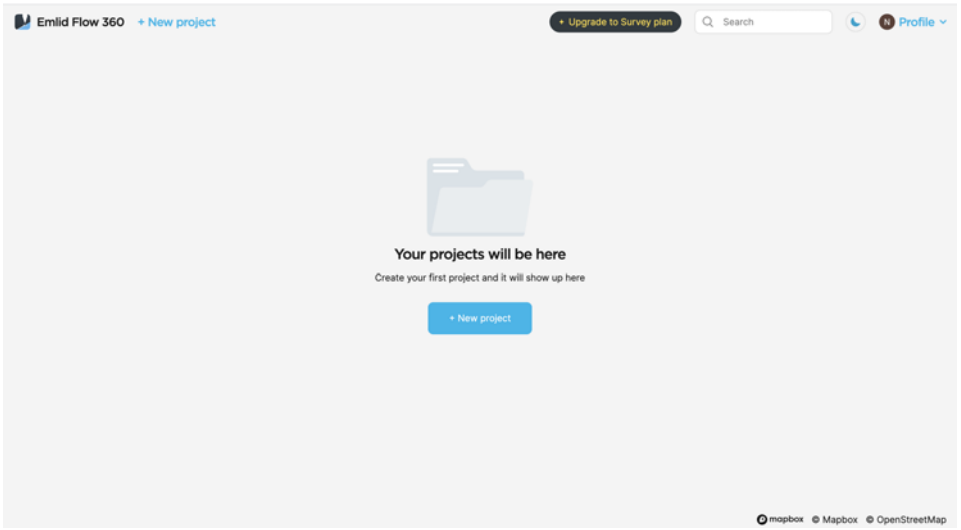
Note: *If you have an active subscription made through the mobile store, you need to cancel it first. Go to the mobile store and cancel the current subscription following the platform-specific rules and wait until the subscription ends.*

Get access to the Survey plan features with a code following the instructions below:

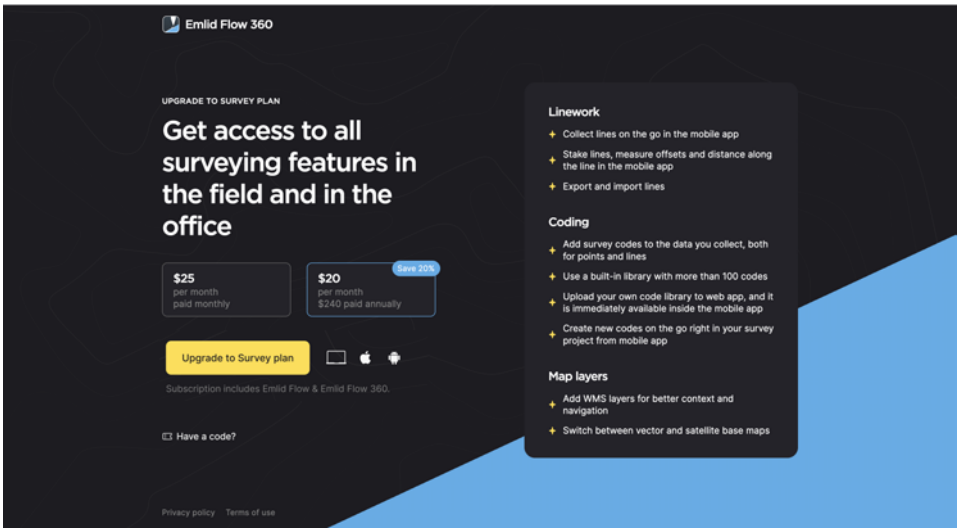
1. Go to flow360.emlid.com.
2. Log in to your Emlid Account.



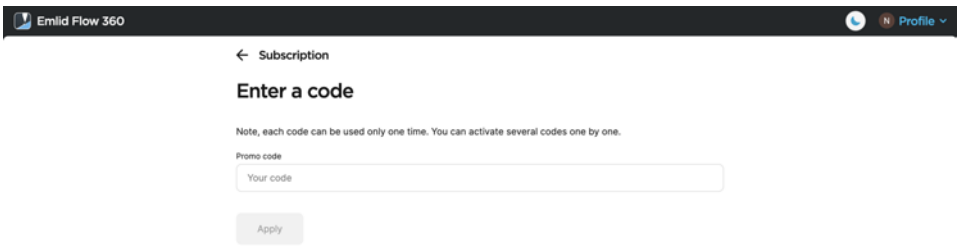
3. Go to *Upgrade to Survey plan*.



4. Click *Have a code?*.



5. Enter your code in the opened screen.



6. Click *Apply* and wait for the code to be verified and applied.

   Note: *You can use multiple codes in a row, but the total period they cover should not exceed 3 years. Close the window with the notification about the applied code and enter a new one.*

7. Click *Go to subscription* to go back to the main page.

   Now you've got access to the Survey plan features and can continue working with them in both Emlid Flow and Emlid Flow 360.

5.3.3 Extending access period

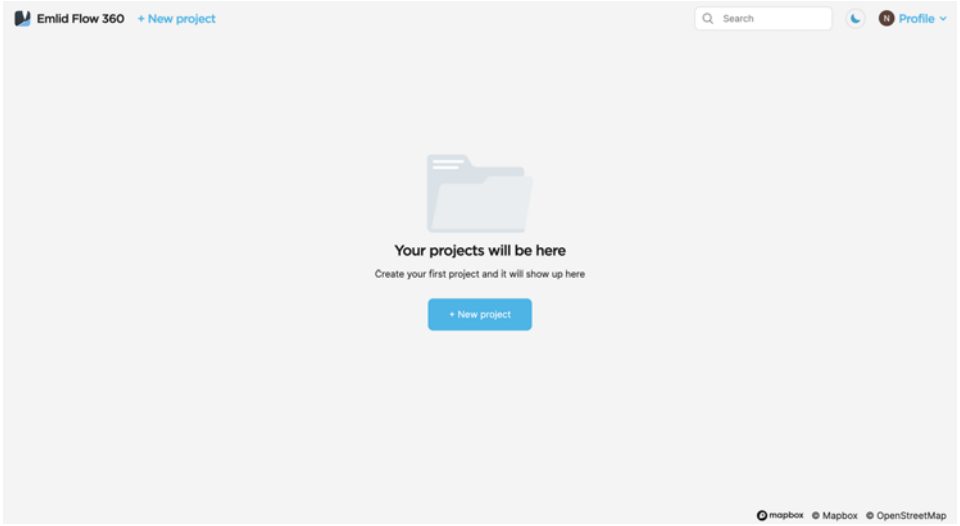
Note: *You can only extend the access period with a new code if it hasn't expired yet. To check the expiration date, click Profile and Subscription-you will see the field with the date.*

To extend the access period using a new code, follow the steps below:

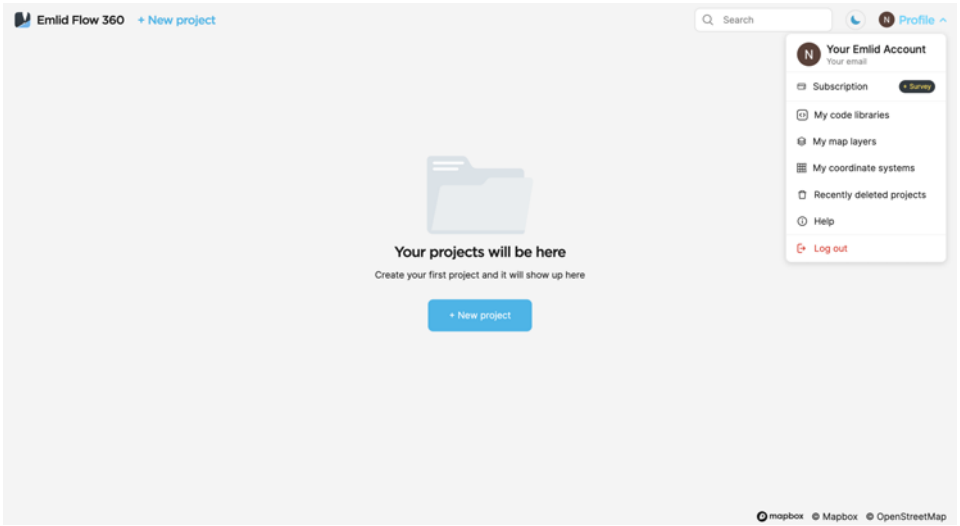
1.
2. Go to flow360.emlid.com.
3. Log in to your Emlid Account.



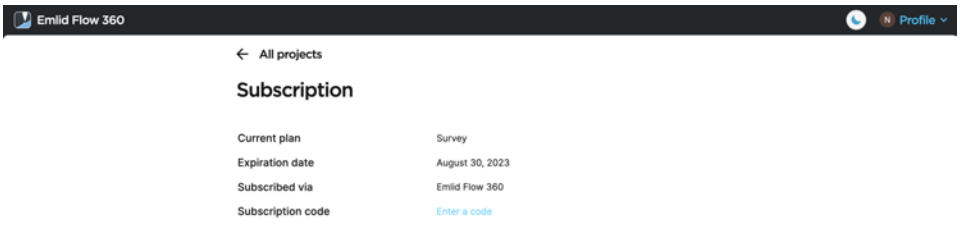
4. Go to *Profile*.



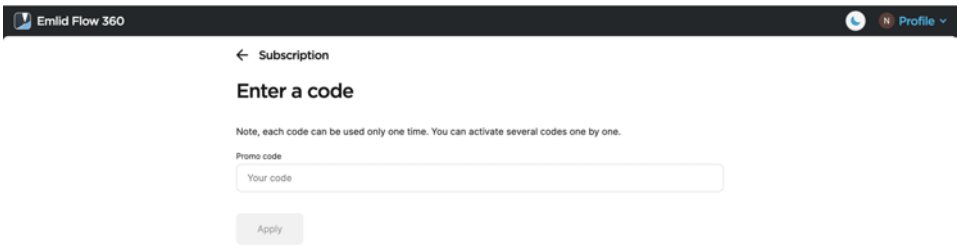
5. Click *Subscription*.



6. Click *Enter a code*.



*E*nter a code in the opened screen.



7. Click Apply and wait for the code to be verified and applied.

   Note: *You can use multiple codes in a row, but the total period they cover should not exceed 3 years. Close the window with the notification about the applied code and enter a new one.*

8. Click *Go to subscription* to go back to the main page.

Now you've extended the period of access to the Survey plan features and can continue working with them in both Emlid Flow and Emlid Flow 360.

6 Glossary

2D Grid distance

2D Grid distance between points A and B is the length of the straight line AB on a flat plane.

2D Ground distance

2D Ground distance between points A and B is the length of the shortest AB line on the surface of the ellipsoid.

2D perimeter

2D perimeter of an enclosed object is the sum of 2D distances of its sides without the height difference consideration.

Absolute positioning

Absolute positioning shows your actual global coordinates relative to the Earth's surface. Absolute positioning is a key to RTK surveys where you need absolute geographical accuracy (e.g, mapping, surveying the borders of the property, etc). In this case, your base absolute position is crucial for high accuracy results.

Accuracy

Accuracy is the closeness of the measurements to a specific value. In surveying, accuracy refers to whether the coordinates you collected are true relative to the global coordinates. Not to be confused with Precision.

Age of differential

Age of differential is the measure of how old are the corrections your receiver is getting. It is calculated by subtracting the time when the correction message has been generated from the current receiver time. The standard Age of Differential for RTK is normally 1-2 seconds.

Antenna Phase Center

Antenna Phase Center could be referred to as the antenna's source of radiation. All GNSS measurements referred to the phase center. The phase center does not correspond to the physical center of the antenna and its real position depends on the direction of the coming radio signal. In addition, every band has its own phase center respectively.

Antenna Reference Point

The antenna reference point is the center point on the bottom of the receiver. It is used for calculation of the antenna height.

Area

Area of an object is the total amount of space enclosed by its shape on flat surface.

AR ratio

This is a result of the ratio test performed on the potential "Fix" solution, it shows how many times is the best solution better than the next one. If this number is more than 3, Reach will consider RTK solution Fixed.

This parameter corresponds to single-band Reach devices only (Reach RS/RS+, Reach Module/M+).

Base

Base is one of the receivers that act as a reference station in RTK or PPK scenarios. It is a static unit with the determined coordinates that sends corrections to the moving unit or rover. If the base is set over the known point, it provides absolute accuracy.

Base Correction log

This log contains the corrections from the base station in RTCM3 format.

Baseline

Baseline is the distance between a rover and a base. If the baseline is bigger than recommended, the solution will be less accurate, the fix time will be longer or it won't be calculated at all.

BeiDou

BeiDou is a Chinese navigation system. Back in 2000, BeiDou-1 was only covering China. Then, in 2012, BeiDou-2 began covering the Asia-Pacific region. Since 2015, BeiDou offers global coverage. We recommend using this system if you are located in the Asia-Pacific region.

Client mode

The client mode means that Reach is connected to an external Wi-Fi network.

Continuous

Continuous is a strategy for solving the ambiguities in RTK and PPK. In this case, ambiguities are resolved epoch by epoch. Less stable than Fix-and-Hold, but no risk of holding a false fix.

Coordinate system

Coordinate system is a coordinate-based local, regional or global system used to locate geographical entities. A spatial reference system defines a specific map projection, as well as transformations between different spatial reference systems.

Correction input

This is the part of the rover's settings that is responsible for configuring the acceptance of the corrections. Using the correction input configuration in the Emlid Flow app, you can choose the way your rover receives the corrections: via Serial, TCP, NTRIP, Bluetooth, or LoRa. Reach receivers support the correction input in RTCM3 format.

Corrections

The corrections are the data that is used to eliminate ionospheric and tropospheric delays, and satellite clock errors. The static base transmits corrections to the moving rover in the RTK scenario.

CORS

Continuously Operating Reference Stations or CORS network is the network of the static stations that provide exact GNSS data (carrier phase, code range, etc) and corrections as well. Surveyors can access this information to increase the accuracy of their post-processed survey data or to work in RTK on site.

Delta E/N

Delta E/N between points A and B is the difference in their coordinates along the corresponding Easting and Northing axes.

Dilution of Precision or DOP

Dilution of Precision or DOP is the term used to evaluate the geometrical position of the satellites relative to the receiver. When the satellites are too close to each other in the field of view, it means the satellite geometry is weak (a high DOP value). If the distance between the satellites is sufficient and they are allocated evenly and cover more space, the geometry is considered strong, therefore, the DOP value is low. The lower the DOP, the more accurate your data is. A good DOP value is considered to be below 2.

Direction (azimuth)

Direction (azimuth) of a line AB, or from point A to B, is a horizontal angle in degrees, measured at point A clockwise between the direction to the north and the direction to point B.

Dynamic IP address

A dynamic IP address is an Internet Protocol (IP) address that is automatically assigned to your Reach device by a DHCP (Dynamic Host Configuration Protocol) server each time your Reach device connects to the network or reboots. These addresses are temporary and can change over time, which is in contrast to static IP addresses, which remain the same.

Elevation mask

Elevation mask can be configured in RTK settings in the Emlid Flow app. Satellites lower than set elevation will be excluded from the computation. The default setting is 15 degrees. Usually, satellites with a lower elevation provide too noisy measurements as the signal passes through the most atmosphere.

Emlid Flow

Emlid Flow is the mobile app created by Emlid. It is used to control and configure the Reach receivers, create projects, collect points, etc.

ENU

One of the formats for Position Streaming available for Reach devices. Simple text protocol for East, North and UP components of the baseline as well as solution status.

ERB

One of the formats for Position Streaming available for Reach devices. Used for communication to ArduPilot. ERB stands for Emlid Reach Binary protocol.

External bottom connector

External bottom connector is a 9-pin connector located at the bottom of Reach RS/RS+, RS2/RS2+, and RS3. It is used to supply constant power from an external battery, to establish RTK communication with third-party devices, and to stream Reach's position to other devices or third-party apps. It uses RS-232 serial communication protocol.

Fix-and-Hold

Fix-and-Hold is a strategy for solving the ambiguities in RTK and PPK. After the first ambiguity fix holds them constrained. Fix is more stable but in case first initialization was not correct it will take longer to recover and initialize correctly. You can think of it as if Fix had inertia.

Full System report

A full system report is a tool used to facilitate issues reports. It comes in ZIP archive, and contains system logs and technical details of your device as well as some sensitive information like your NTRIP credentials or network passwords. That is why we do not recommend sharing the report publicly. These are used to debug complicated cases in support.

Galileo

Galileo is a European satellite navigation system. It first started operating in 2011 and now has global coverage.

Global datum

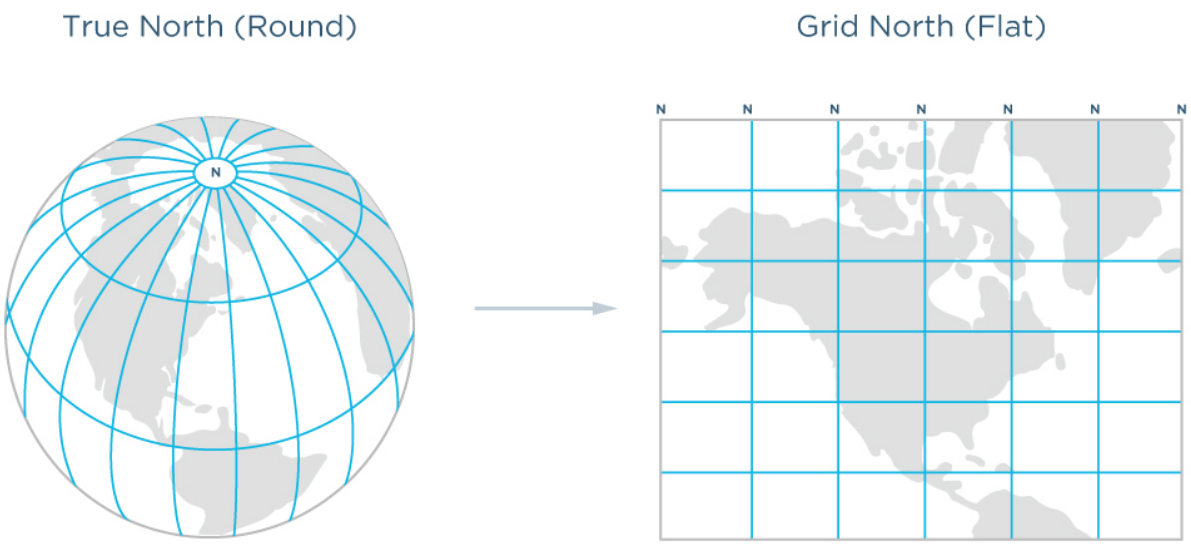
Global datum is an ellipsoidal coordinate reference system that is used by the receiver to measure coordinates before any transformations are applied.

Grade

Grade of a line is the measure of its steepness, with larger values standing for steeper slopes and 0 procent indicating a horizontal line.

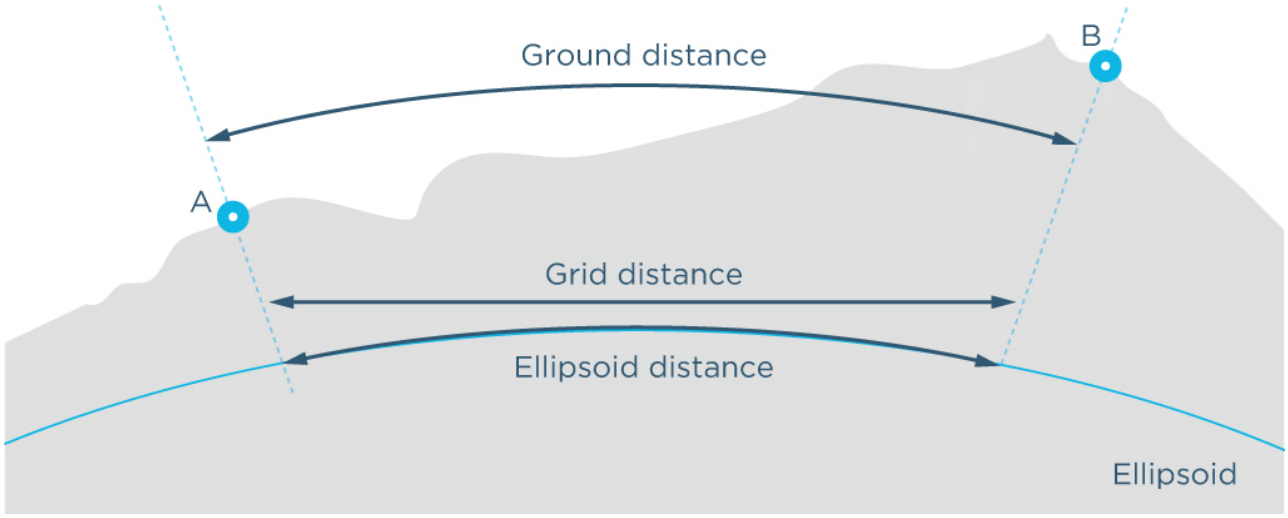
Grid North azimuth

Grid North azimuth is the angle measured clockwise between a line parallel to the central meridian, and the direction to a point of interest (a straight line between two points on the projection flat plane).



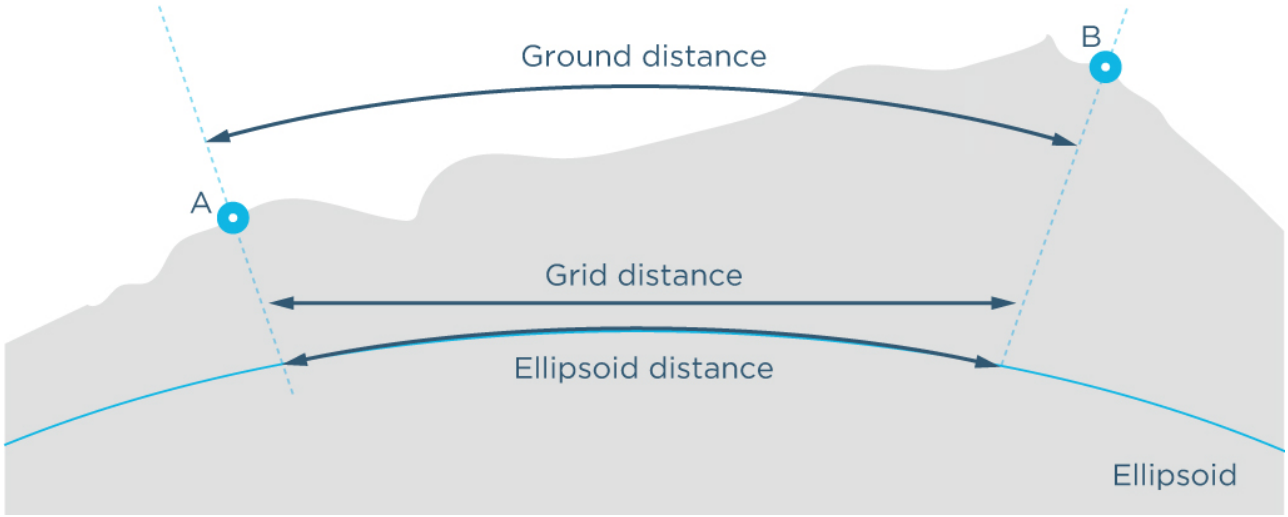
Grid distance

Grid distance is the distance measured on the projection flat plane.



Ground distance

Ground distance is the distance measured on the actual surface of the Earth, taking the mean elevation of the measured points into account.



Ground Control Point or GCP

Ground Control Point is a point on a surface with known coordinates. The GCPs are actively used in aerial mapping and photogrammetry. The surveyors set GCPs over the area, mark them so they can be visible from the drone. The GCPs are then surveyed to find their exact coordinates and used as reference points for future data processing.

GIS

Geographic Information System or GIS is a system for collecting, storing, analyzing, and graphically visualizing spatial data and related information about required objects.

GLONASS

GLONASS is a global satellite navigation system. It was created as an alternative to GPS in Soviet Union and first launched in 1982.

GLONASS AR mode

A processing parameter enabling to turn on and off the ambiguity resolution for the GLONASS signal separately. Contrary to GPS, all GLONASS satellites transmit on different frequencies, which results in Inter Channel Biases (ICB) that are unique for each receiver model.

Reach devices can correct GLONASS ICBs, allowing for GLONASS AR with non-Reach bases such as NTRIP casters. The general recommendation is to always have GLONASS AR set to on.

This parameter corresponds to single-band Reach devices only (Reach RS/RS+, Reach Module/M+).

GNSS

Global Navigation Satellite System or GNSS is a system designed to determine the location (geographical coordinates) of land, water, and air objects. Such systems consist of space equipment, a ground segment called control systems, and individual receivers. The operation of GNSS is based on measuring the distance from the antenna on the object (receiver) to satellites whose position is known with great accuracy.

GPS

Global Positioning System or GPS is a global satellite navigation system that measures distance, time, and location in the WGS 84 world coordinate system. The system was developed in 1978, and is operated by the United States.

Ground plane

A ground plane is a conductive plate providing insulation for the antenna. It may be a piece of metal, a roof of a car, a metal roof of a building, and etc. It is recommended to use at least a 70x70 mm ground plane.

Hot shoe adapter Hot shoe is a point on the top of a camera that is used to attach accessories or other equipment to the camera. Using hot shoe adapter, you can connect your camera to Reach M2/M+ for UAV mapping.

Hotspot mode

The hotspot mode means that the Reach is broadcasting its own Wi-Fi network.

Kinematic Positioning

Kinematic positioning is one of two positioning modes. It implies that the rover is moving during the positioning process.

LLH One of the formats for Position Streaming available for Reach devices. Simple text protocol for Latitude, Longitude, and Height as well as solution status.

Localization

Localization in GNSS surveying is a feature for calculating local coordinate system parameters or adjusting the existing one to fit control points in the survey area.

LoRa radio

Long Range or LoRa radio is used for Reach receivers to send or receive corrections without an internet connection. Reach RS3/RS+ is equipped with internal Lora radio. Reach M2/M+ has external LoRa radio available: you can connect it via S2 port. The radio works only one way: it either sends correction or receives them. Using LoRa modulation it is possible to hit up to 19 km (11.8 mi) in line of sight.

Mock location

Mock location feature of Android devices enables you to manually change the location of your device to any other place. In the case of Reach devices, it enables the GPS collector apps to get the GPS observations directly from the receiver instead of the internal GPS of the unit.

Mount Point

Mount point is a correction data source related to the specific physical or virtual reference station chosen or created based on your location respectively. When you get corrections from a VRS, you need to enable sending your receiver's position in the NMEA format.

Multi-band receiver

A multi-band receiver is a receiver that can accept signals from the satellite on more than one frequency band. It means the receiver takes less time to establish the first fix solution, has a longer baseline, and has more chances to maintain fix solution in the blocked sky view conditions.

Multipath

Multipath is an effect occurring when the GPS signal is deflected from the obstacles, so the GNSS receiver detects signals not only directly from the satellites but also from the local objects. Multipath effect results in an error in pseudo-range measurements and thus affects the positional accuracy.

Night mode

Night mode allows you to turn off the LEDs until the next reboot of the Reach device.

NMEA 0183

One of the formats for Position Streaming available for Reach devices. The most popular standard in the industry. Supported messages: GNRMC, GNGGA, GPGSA, GLGSA, GAGSA, GPGSV, GLGSV, GAGSV, GNGST, GNVTG, GNZDA.

NTRIP

The Networked Transport of RTCM via internet Protocol or NTRIP network is an alternative source of corrections. NTRIP allows your rover to accept corrections over the internet with no need for the second local receiver acting as a base. A reference station collects data, then sends it to NTRIP caster, where it is retransmitted through the internet port to the client rover connected via a particular port and authorized.

Point cloud

Point cloud is a set of vertexes in a three-dimensional coordinate system. Point clouds are created with 3D scanners and are used in photogrammetry and 3D-modeling.

Point Collection

Point collection is a feature in the Emlid Flow app that allows you to find the exact coordinates of the point. The receiver determines the coordinates (x, y, z) of a ground point and records it to your project for further processing .

Point Stakeout

Point stakeout is a feature in the Emlid Flow app that allows finding points with known coordinates on the site.

Pole Height

When preparing for point collection, configure the height of your survey pole in Emlid Flow. It will help the app to automatically calculate the antenna height.

Position log

This log contains positional information. Reach devices can log their position in LLH, XYZ, ENU, NMEA, and ERB formats.

Position Streaming

Reach devices can send the position data to third-party GIS apps and external devices including tractors, drones, robots, and more. The position could be out shared via Serial, TCP, and Bluetooth. Various applications require different formats of the positional data, that is why Reach outputs its position in LLH, XYZ, ENU, NMEA, and ERB.

PPK

Post-Processed Kinematic is one of the techniques used for highly accurate surveys. Same as in RTK, one needs two units: a base and a rover. The core difference is that in PPK scenario there is no need for a real-time connection between two units. Base and rover record logs separately, and these logs are processed together later using specific post-processing software, for example, RTKLib.

PPP

Precise Point Positioning or PPP is a technique used for determining the centimeter-level accurate coordinates of the point. The receiver put over a point is recording data for a certain period. Then this data is sent to the PPP services.

Precision

Precision is the closeness of two or more measurements to each other. Precision means that the coordinates you collected are true relatively to another object. In this case, you do not need exact georeferencing coordinates of the points, you only need to know that the collected points are, say, situated on the same distance from each other. Not to be confused with Accuracy.

QZSS

QZSS stands for Quasi-Zenith Satellite System—the Japanese satellite system. It primarily serves the Asia-Pacific region, with a particular focus on Japan's needs for precise and reliable positioning information. The first satellite was launched on September 11, 2010, and became operational in 2018.

Raw data log

A raw data log contains GNSS observations from the receiver without the calculation of accurate coordinates. It can be recorded in UBX or directly in industry-standard RINEX format.

Reach Panel

Reach Panel is a tool that allows you to access your Reach in a browser, monitor its status and get additional options such as downloading a large number of logs and configuring NMEA messages output on your Reach to integrate it with old agricultural machinery.

Relative positioning

Relative positioning shows your coordinates relatively to another reference object. The base sends information about its absolute position to the rover. Using this information, the rover determines its position relative to the base with centimeter accuracy.

RINEX

RINEX is a standard raw-data format that allows storing satellite observations and navigational data measurements made by the receiver. It also allows the post-processing of the received data by various applications from different manufacturers of receivers and programs.

RMS

The square root of the average of the squared error. The RMS calculations are used to evaluate the accuracy of the position measurement. A horizontal or vertical dilution of precision multiplied by three RMS could give the horizontal or vertical precision value respectively.

Rover

Rover is one of the two GNSS receivers that is used for collecting data in RTK or PPK scenarios. Rover is a moving unit: the surveyor uses rover to record the points, while rover receives the corrections from the static base.

RTCM3

RTCM3 is an industry standard format for correction output.

RTK

Real-Time Kinematic or RTK is one of the techniques used to improve the accuracy of the data collected from the satellites by the receiver. For RTK one needs two receivers: a base and a rover. The base sends corrections to the moving rover during data collection.

RTKCONV

RTKCONV is a tool in RTKLIB that converts UBX raw data or RTCM3 base correction data from a receiver to RINEX format.

RTKLIB

RTKLIB is an open-source program package for standard and precise positioning with GNSS. It is used for PPK data processing. Works with signals from GPS, GLONASS, Galileo, QZSS, BeiDou, and SBAS. Emlid produces the version of RTKLib tailored for Reach products.

RTKPLOT

RTKPLOT is a tool in RTKLIB that allows viewing and plotting the position solutions from RTKPOST as well as observation data from RTKCONV.

RTKPOST

RTKPOST is a tool for post-processing raw logs in RTKLIB. The result is stored in the position solution file in LLH WGS 84 – POS file. In this file, we will get centimeter-accurate track of the receiver.

Serial Port (UART, USB, RS-232)

A serial communication interface in which the information transfers in or out sequentially one bit at a time. That kind of communication could be realized via various devices like UART, USB, or RS-232. Reach receivers can use a serial port to exchange the position and correction data with 3rd party devices.

Signal-to-noise ratio

Signal-to-Noise Ratio or SNR is the primary indicator of how good the reception is. The value is equal to the ratio of the power of the useful signal to the noise power. You can find the SNR indicator on the main screen of the Emlid Flow app. When the SNR of a satellite is over 45, it will be marked green. Grey bars indicate SNR of the base station. The more satellites are in a green zone, the more precise your measurements are and the faster your ambiguity resolution is.

Simple System report

A Simple System report is a tool used to facilitate issues reports. It provides information about the Emlid Flow version, configurations, and network in a plain text format.

Single-band receiver

A Single-band receiver is a device that accepts signals from the satellite on one frequency band. It has the same level of accuracy as the multi-band one. Single-band receiver has shorter baseline in comparison to multi-band, and might not even find fix solution in blocked sky view conditions.

Slope distance

Slope distance from point A to point B is the length of the straight line AB, measured along the slope, taking the height difference between the points into account.

Slope perimeter

Slope perimeter of an enclosed object is the sum of slope distances of its sides with the height difference consideration.

SNR mask

Signal-to-Noise ratio mask or SNR mask is a tool that filters the satellites used for the fix solution. Satellites with low SNR will be excluded from the computation. The default setting in the Emlid Flow app is 35.

Solution status (FIX, FLOAT, SINGLE)

Solution status defines the precision that can be achieved at the moment. There are three solution statuses you can see when working with Reach devices.

SINGLE means that the rover has found a solution relying on its own receiver and base corrections are not applied. In this case, the receiver calculates its position with the precision of a few meters.

FLOAT means that the rover receives corrections from the base but cannot resolve all ambiguities and calculate its position with the centimeter accuracy.

FIX means that the rover using corrections from the base resolved the ambiguities in its positional calculation and achieved the solution with the centimeter-level precision.

Static Positioning

Static positioning is one of the positioning modes. It assumes that the Reach rover is static. Constraining the system helps to resolve ambiguities faster as well as produce measurements with higher precision.

TCP

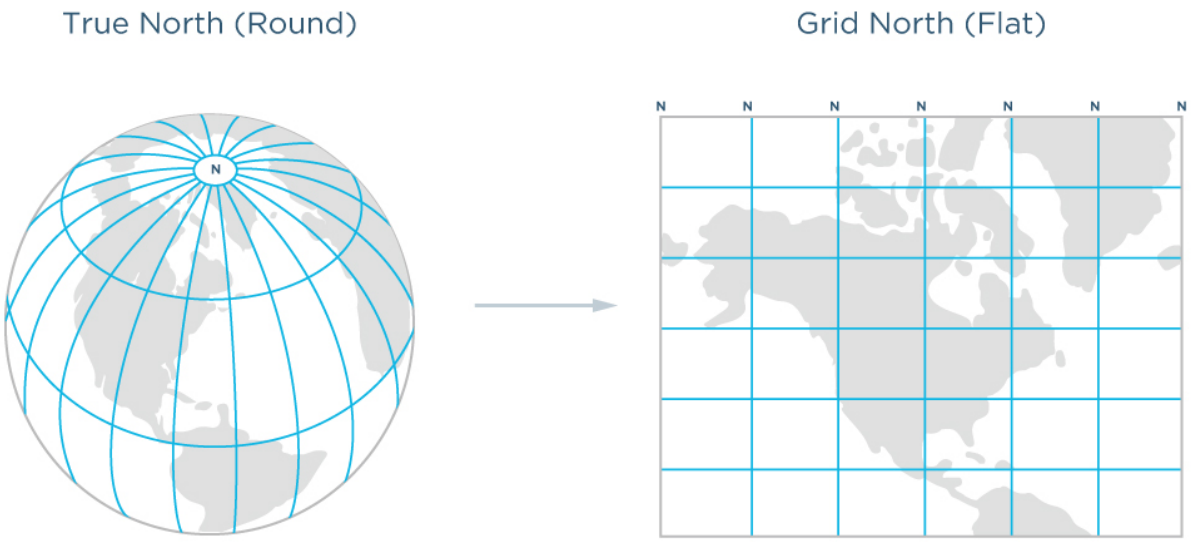
Transmission Control Protocol or TCP is one of the main internet data transfer protocols designed to control data transfer. Typical scenario for using TCP is sending correction data to an application on the same network or to a server with public IP.

Time mark

The time mark function verifies the exact moment when the camera takes a photo. After the flight, you can process the raw logs from the base and a rover to get an «*_events.pos» file. This file includes information about the time and coordinates of each photo. You can use geotagging software to write this information to the photos' EXIF data.

True North azimuth

True North azimuth is the angle ranging from 0 to 360 degrees measured clockwise between True North and the direction to a point of interest.



UBX

UBX is the GNSS raw data format. The UBX protocol is a u-blox proprietary binary protocol that outputs in hexadecimal format.

Update rate

The update rate is a value that shows how frequently the receiver calculates and reports its position. For Reach receivers, we recommend having 1 Hz update rate on the base and 5 Hz on the rover.

VRS

Virtual Reference Station or VRS is a useful tool for long baselines. It is an imaginary, unoccupied reference station generated nearby the RTK user. The rover sends data back to the NTRIP caster. NTRIP allows the uniting of the data from your rover and the data from dense NTRIP bases and models a virtual base next to you.

WGS 84

World Geodetic System 1984 or WGS 84 is the global system of geodetic parameters of the Earth, including the system of geocentric coordinates. It was accepted in 1984 and defines coordinates relative to the Earth's center of mass, with an error of less than 2 cm.

XYZ

One of the formats for Position Streaming available for Reach devices. Simple text protocol for X, Y, Z ECEF coordinates as well as solution status.