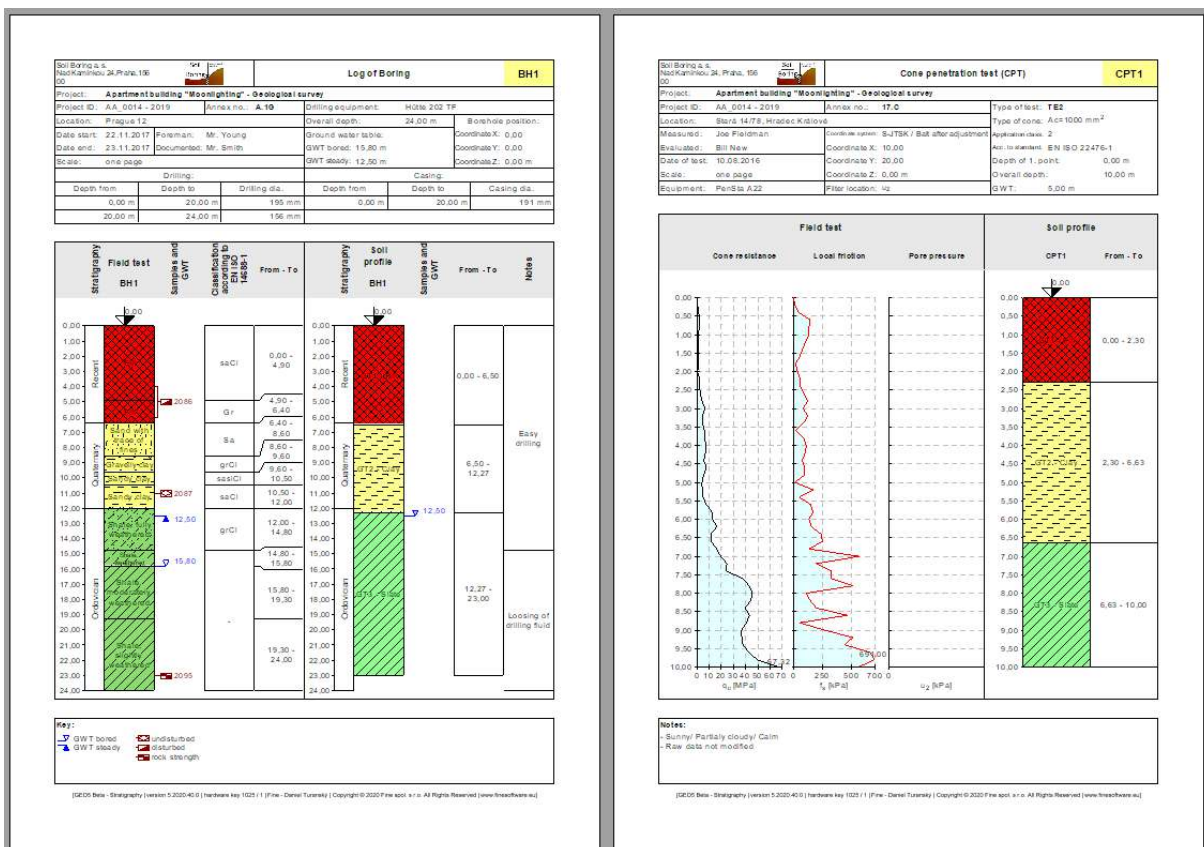


## Interpretation of Field Tests into the Soil Profiles

Program: Stratigraphy  
 File: Demo\_manual\_43\_1.gsg  
 Demo\_manual\_43\_2.gsg

Boreholes and some other field tests have to be simplified or interpreted for geotechnical design or the creation of a 3D subsoil model. It is necessary to create geotechnical types of soils, define the thicknesses of soil layers for each test.

**Assignment:** Interpret the field tests from Engineering Manual No. 42 into the soil profile.



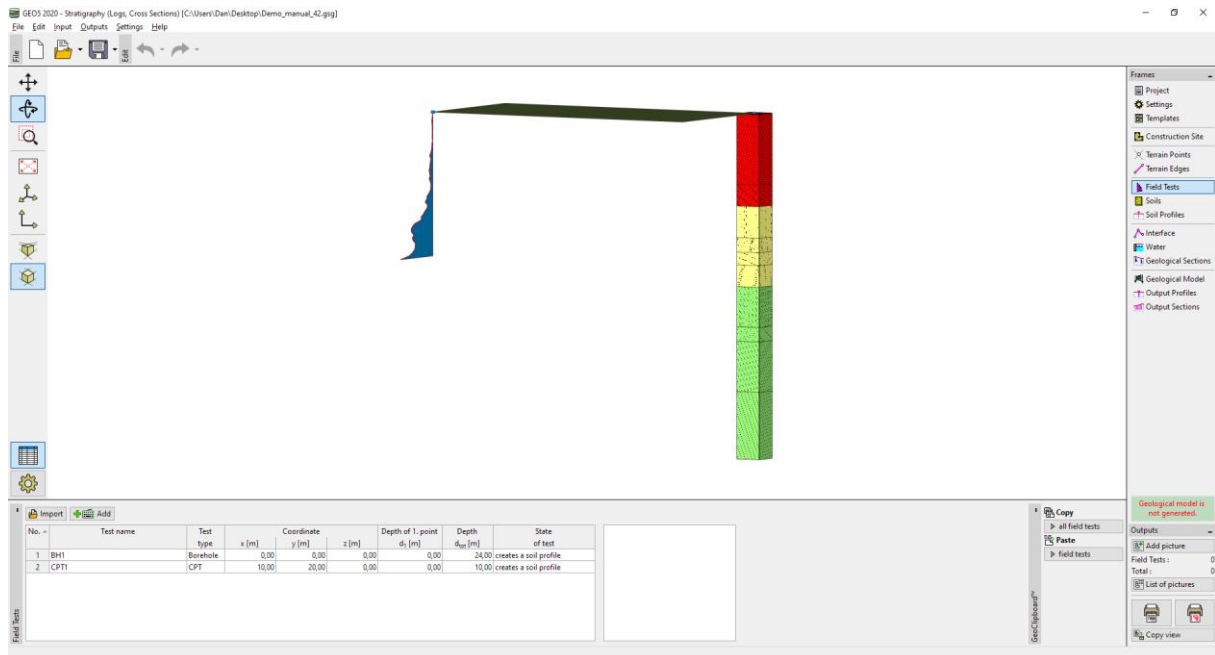
### Solution:

There are two ways we can proceed:

- Interpret the field tests separately in the "Soil Profile" frame
- Interpret the field tests when creating geological sections
- Combination of both ways

## Approach 1 – Interpretation of field tests in “Soil Profile” frame

We will open the Demo\_manual\_42.gsg file and look at the entered tests – borehole “BH1” and CPT “CPT1”.



First, we will look at the borehole protocol and think about which geotechnical soil types we want to create.

**Edit field test properties (borehole)**

— Test parameters

Test name:

Coordinate : x =  [m]    y =  [m]

Height :     z =  [m]

Depth of 1. point :     $d_1$  =  [m]

Overall depth :     $d_{tot}$  =  [m]

Field test generates soil profile

No.	Thickness t [m]	Hloubka d [m]	Soil name	Soil pattern	Layer description
1	4,90	0,00 .. 4,90	Fill		fine grained SAND with some silt, dense, mixed with cobbles of concrete and pieces of bricks partly the size is larger than the borehole diameter, black colour of the soil
2	1,50	4,90 .. 6,40	Fill		coarse GRAVEL with some silt (clayey shale) and fresh angular cobbles up to 15 cm, dark grey colour
3	2,20	6,40 .. 8,60	Sand with trace of fines		medium grained with some fine soil, dense, rust-brown
4	1,00	8,60 .. 9,60	Gravelly clay		hard, gravel particles up to 10 mm (weathered shale), brown
5	0,90	9,60 .. 10,50	Sandy clay		hard, with some pieces of gravel (quartz) up to 50 mm dia., brown

**Soil profile**

Depth [m]

0,0  
1,5  
3,0  
4,5  
6,0  
7,5  
9,0  
10,5  
12,0  
13,5  
15,0  
16,5  
18,0  
19,5  
21,0  
22,5  
24,0

Soil profile layers (from top to bottom):

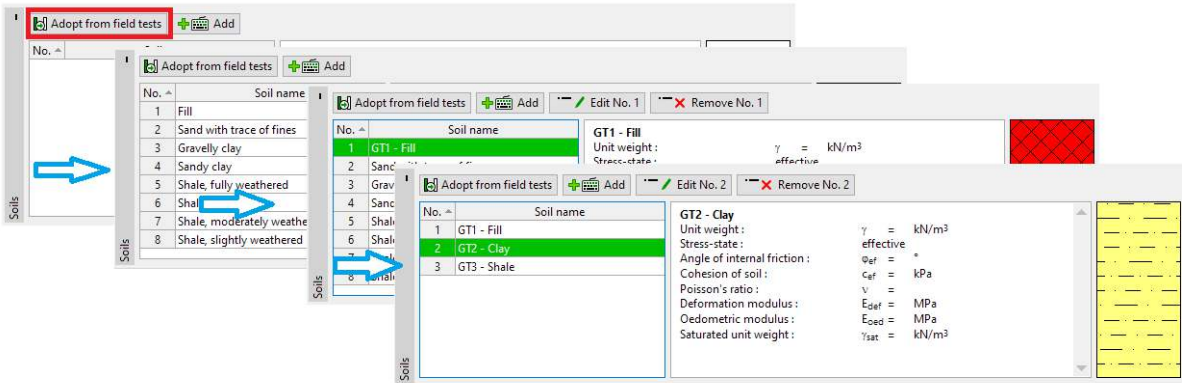
- 0,0 - 4,90 m: Fill (Red cross-hatch pattern)
- 4,90 - 6,40 m: Fill (Red cross-hatch pattern)
- 6,40 - 8,60 m: Sand with trace of fines (Yellow dotted pattern)
- 8,60 - 9,60 m: Gravelly clay (Yellow horizontal line pattern)
- 9,60 - 10,50 m: Sandy clay (Yellow horizontal line pattern)
- 10,50 - 12,0 m: Shale, fully weathered (Green diagonal line pattern)
- 12,0 - 13,5 m: Shale (Green diagonal line pattern)
- 13,5 - 15,0 m: Shale, moderately weathered (Green diagonal line pattern)
- 15,0 - 16,5 m: Shale, slightly weathered (Green diagonal line pattern)
- 16,5 - 18,0 m: Shale, slightly weathered (Green diagonal line pattern)
- 18,0 - 19,5 m: Shale, slightly weathered (Green diagonal line pattern)
- 19,5 - 21,0 m: Shale, slightly weathered (Green diagonal line pattern)
- 21,0 - 22,5 m: Shale, slightly weathered (Green diagonal line pattern)
- 22,5 - 24,0 m: Shale, slightly weathered (Green diagonal line pattern)

Buttons:

The solution is never exactly clear; there are always different ways of simplification – for example:

- GT1 Landfill, GT2 Sand, GT3 Clay, GT4 Weathered Slate, GT5 Slate
- GT1 Landfill, GT2 Fine-grained soils, GT3 Slate

In our example, we will choose a significant degree of simplification, and we will continue to work with three geotechnical types only. We will switch to the “Soils” frame. So that we do not have to input the names, samples, and colours of the soil again, we will take them from the tests. We will change the individual names of the soils and delete the other soils.

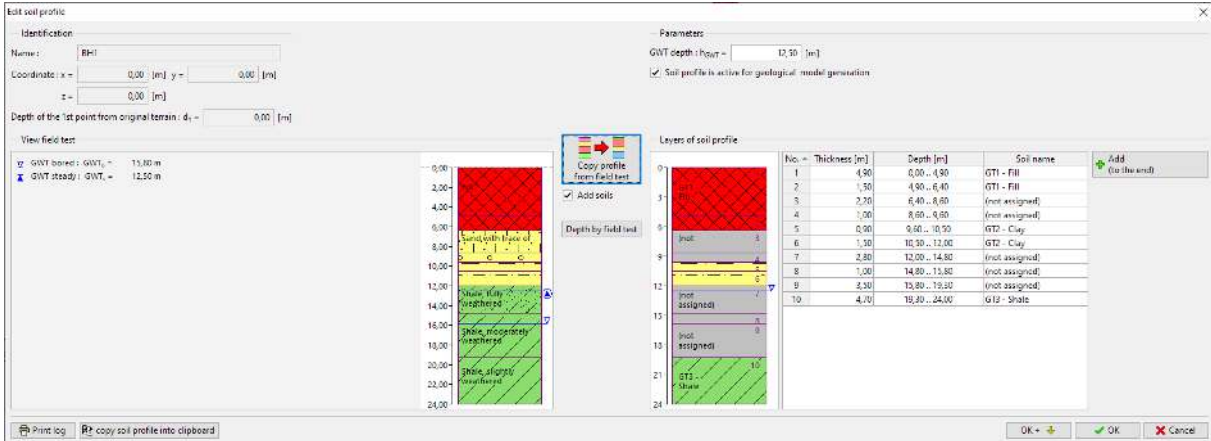


*Note: New soils can also be added when creating a Soil profile or Geological section; it is not necessary to return to this frame.*

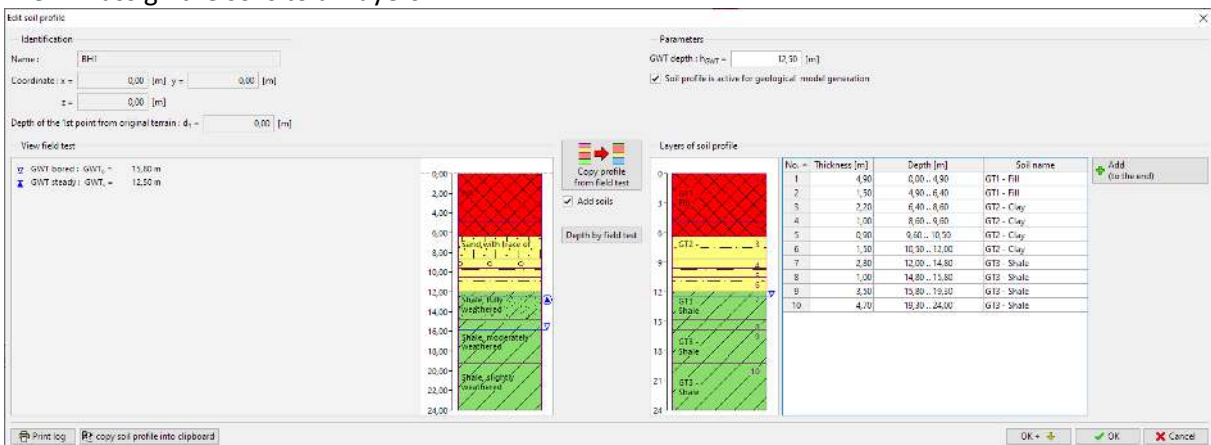
We will select the borehole BH1 – we see, that the interface of layers and partly even the soils were copied from the specified borehole.



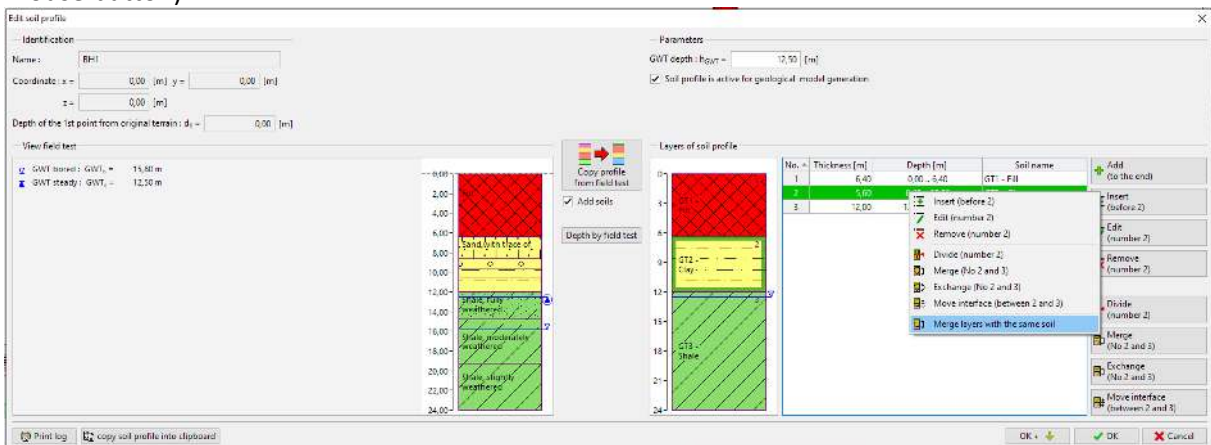
We will open the soil profile and edit it.



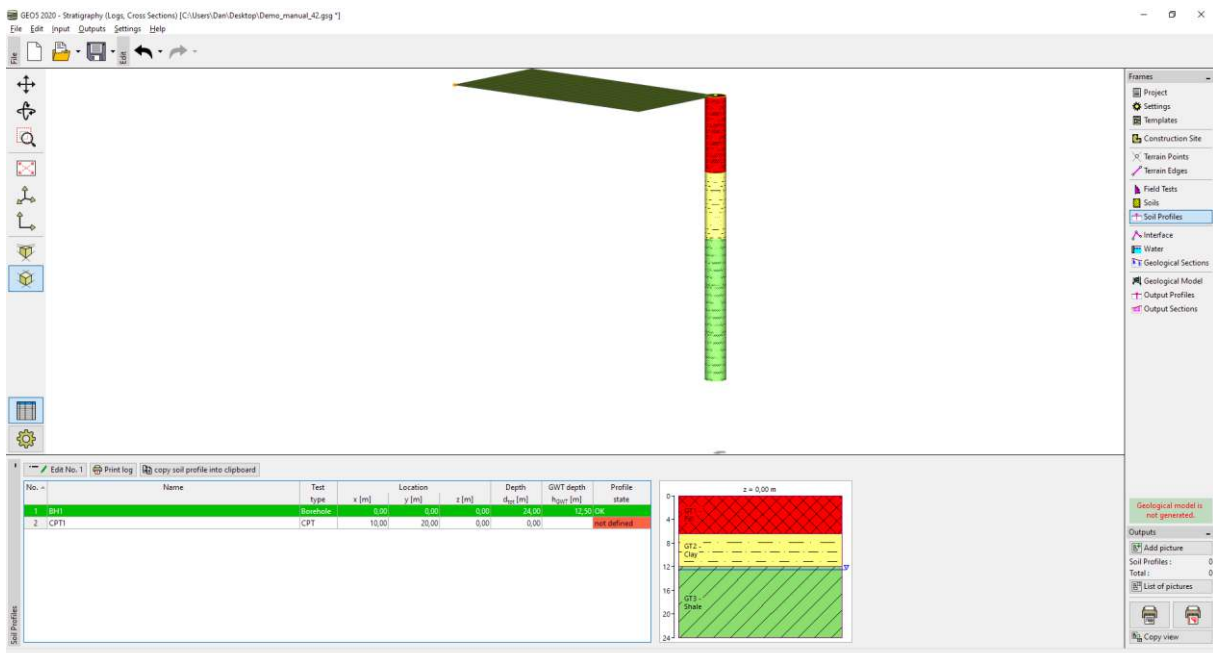
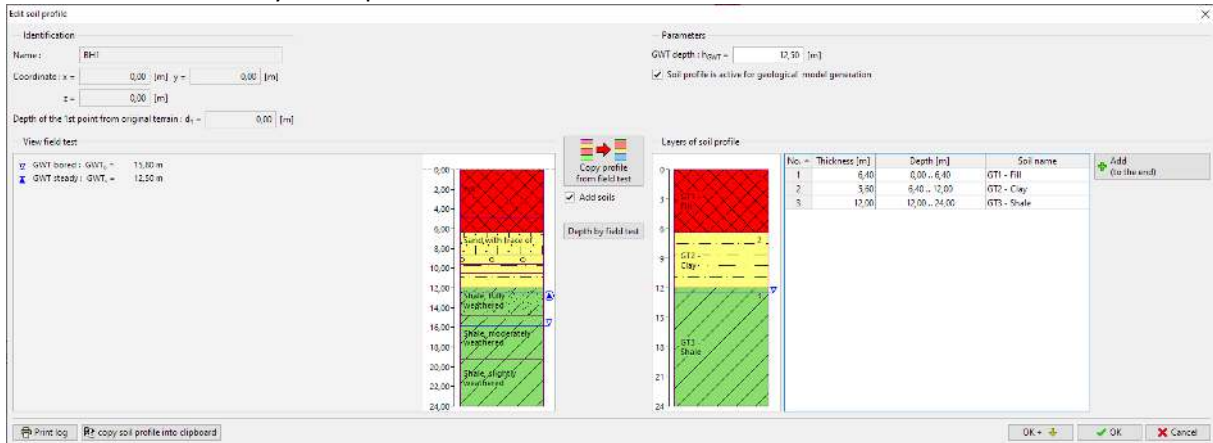
We will assign the soils to all layers.



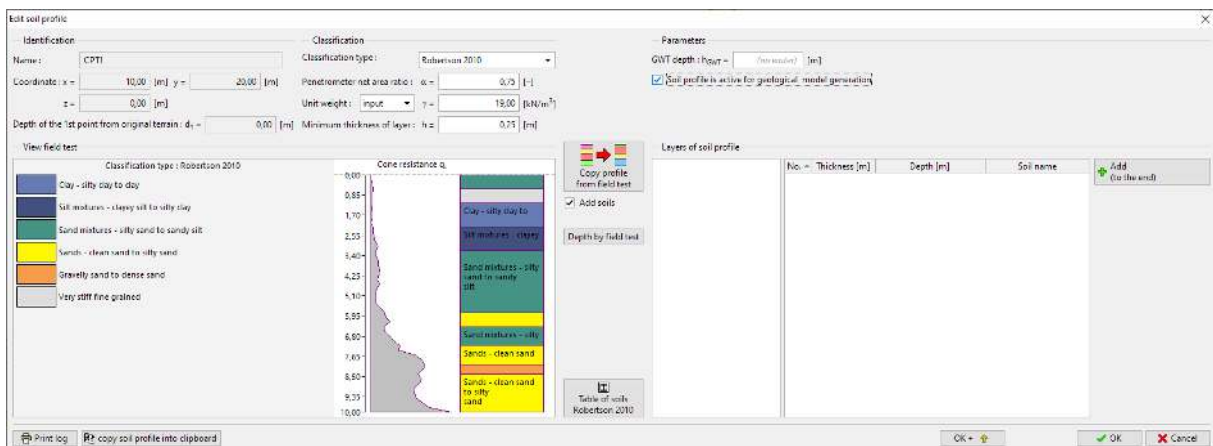
Finally, we will remove the redundant interfaces – the easiest way is to merge the same layers into one by using the “Merge layers with the same soil” option in context menu (available using right mouse button).



The result is a three-layer soil profile.






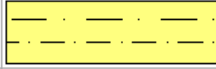
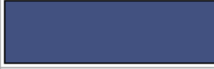







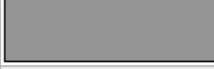





Next, we will interpret the CPT. When the dialog box opens, the program evaluates the CPT test by the Robertson method and will design the soil layers.

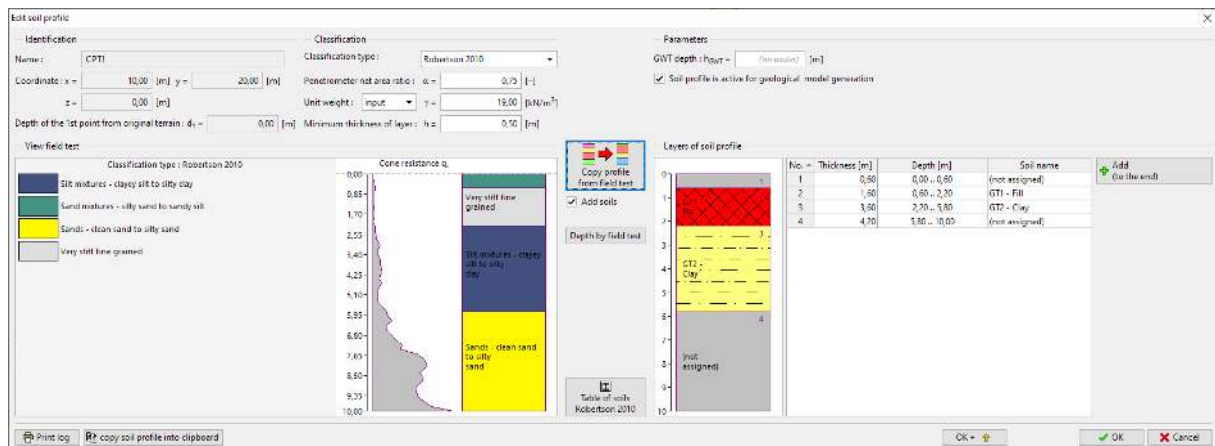


We can assign soil types, according to Robertson, to our geotechnical types. Press the “Table of soils Robertson 2010” button and try to assign the soils.

Table of soils (Robertson 2010) ✕

Soil description		Assigned soil	
Sensitive fine grained		(not assigned)	 Add soil
Organic soils - clay		GT2 - Clay ▼	 Add soil
Clay - silty clay to clay		GT2 - Clay ▼	 Add soil
Silt mixtures - clayey silt to silty clay		GT2 - Clay ▼	 Add soil
Sand mixtures - silty sand to sandy silt		(not assigned)	 Add soil
Sands - clean sand to silty sand		(not assigned)	 Add soil
Gravelly sand to dense sand		(not assigned)	 Add soil
Very stiff sand to clayey sand		GT1 - Fill ▼	 Add soil
Very stiff fine grained		GT1 - Fill ▼	 Add soil

We will change the size of the minimal layer to 0.5 m to reduce the number of layers and assign the created layers to the profile.



We will then modify the profile by assigning a layer of Slate and merging a layer of landfill.

**Identification**  
 Name: CPT1  
 Classification type: Robertson 2010  
 Coordinate: x = 10,00 [m], y = -20,00 [m]  
 z = 0,00 [m]  
 Depth of the 1st point from original terrain: d<sub>1</sub> = 0,00 [m]

**Classification**  
 Classification type: Robertson 2010  
 Penetrometer not area ratio: a = 0,70 [-]  
 Unit weight: input  
 Minimum thickness of layer: h = 0,10 [m]

**Parameters**  
 GWT depth (h<sub>GWT</sub>) = [m]  
 Soil profile is active for geological model generation

**View field test**  
 Classification type: Robertson 2010  
 Legend:  
 - Blue: Silt mixtures - clayey silt to silty clay  
 - Green: Sand mixtures - silty sand to sandy silt  
 - Yellow: Sands - clean sand to silty sand  
 - Grey: Very stiff fine grained

**Cone resistance**  
 Graph showing cone resistance (kPa) vs depth (m). The curve shows a sharp increase at 0m, followed by a relatively constant value until about 2.2m, then a slight increase, and finally a sharp increase starting at 5.8m.

**Layers of soil profile**

No.	Thickness [m]	Depth [m]	Soil name
1	2,20	0,00 - 2,20	GT1 - Fill
2	3,50	2,20 - 5,80	GT2 - Clay
3	4,70	5,80 - 10,00	GT3 - Slate

Now the profile is created.

**Soil Profiles Table**

No.	Name	Test type	x [m]	Location y [m]	z [m]	Depth h <sub>soil</sub> [m]	GWT depth h <sub>GWT</sub> [m]	Profile state
1	BH1	Borehole	0,00	0,00	0,00	24,00	12,50	OK
2	CPT1	CPT	10,00	-20,00	0,00	10,00		OK

**Soil Profiles**  
 z = 0,00 m  
 Legend:  
 - Red: GT1 - Fill  
 - Yellow: GT2 - Clay  
 - Green: GT3 - Slate

## Approach 2 – creation of soil profiles using Geological Sections

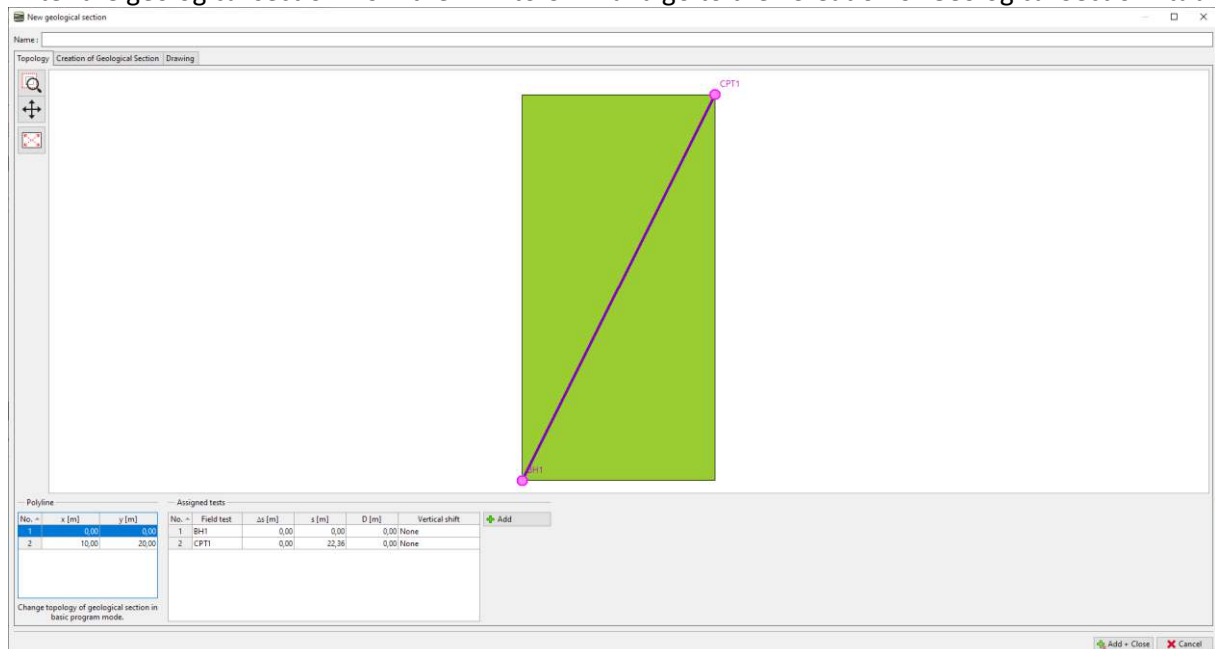
This method has the advantage that we can create our idea for multiple profiles at the same time. We can also leave the decision of which geotechnical types to create until the creation of the section.

Again, we open *Demo\_manual\_42.gsg* file.

We will go to the “Geological Sections” frame.

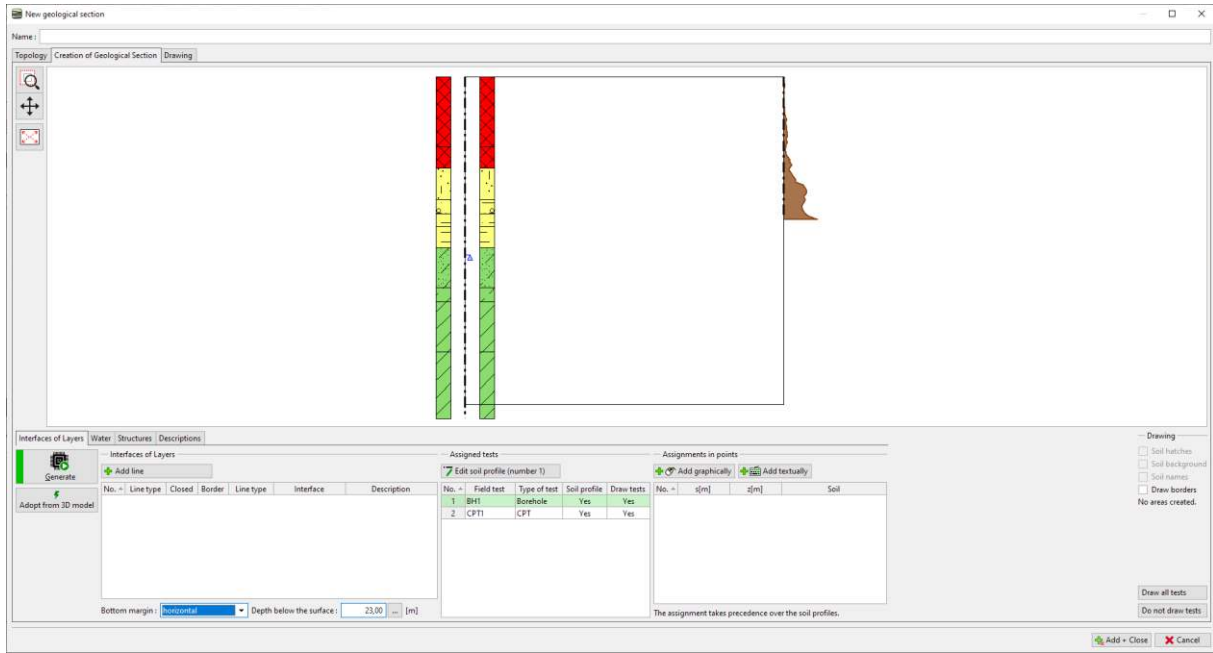


Enter the geological section from the BH1 to CPT1 and go to the “Creation of Geological Section” tab.

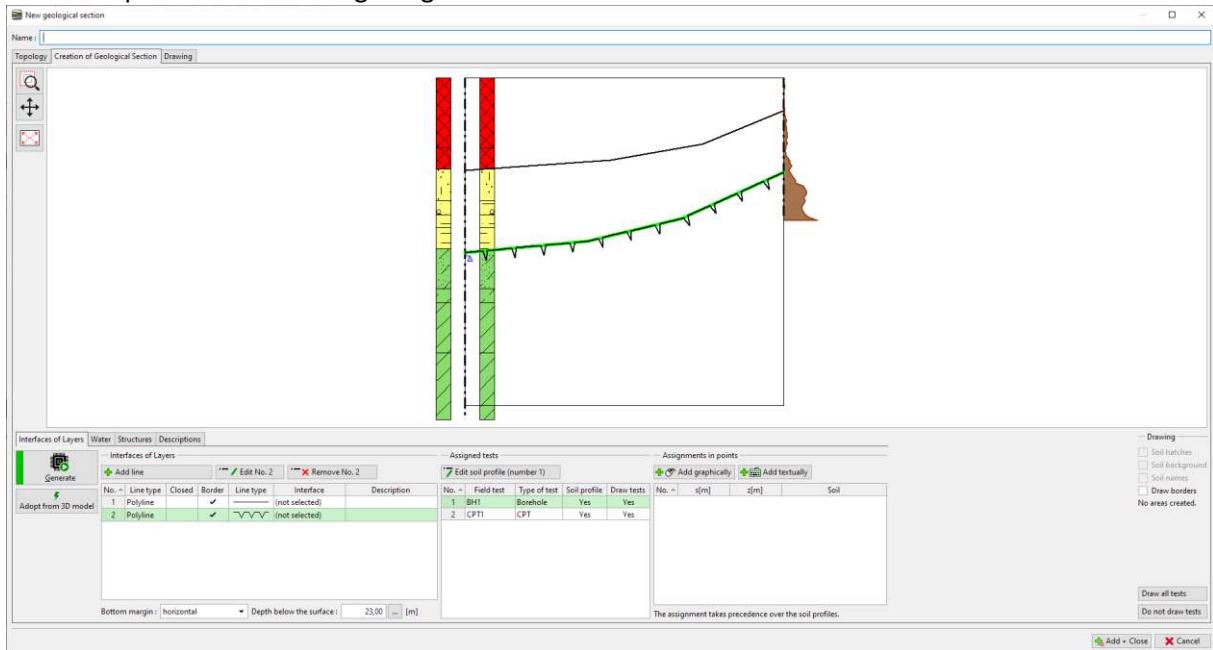


We see selected field tests. Soil profiles display on the axis of test, but they aren't created yet.

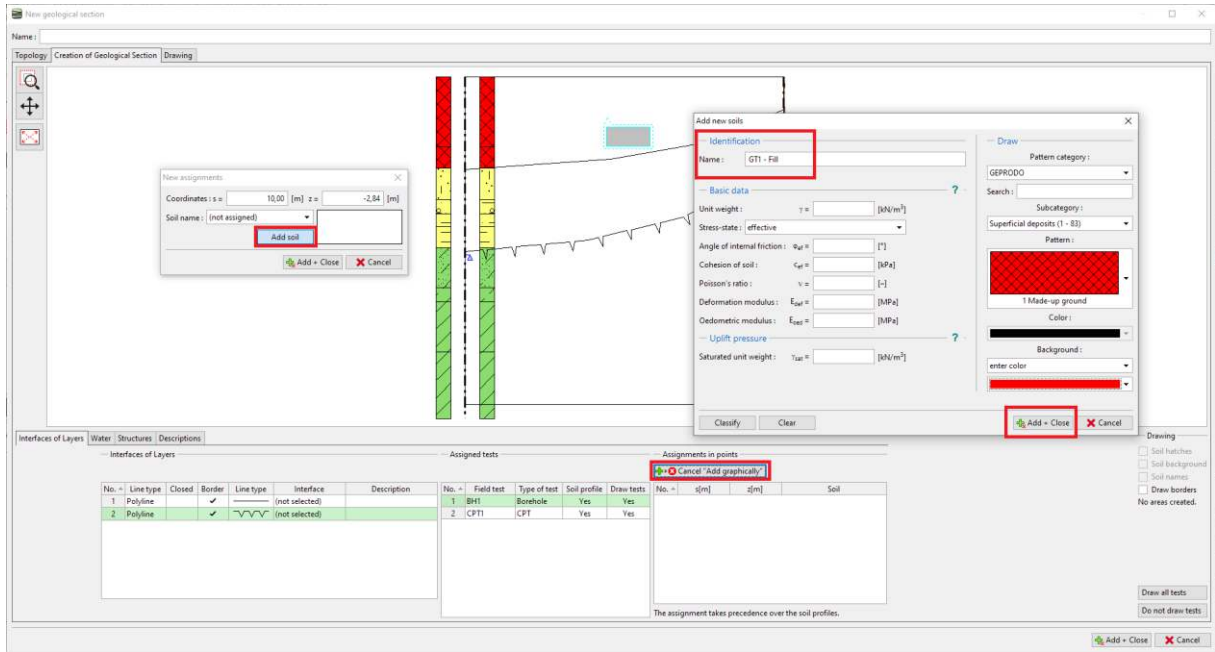




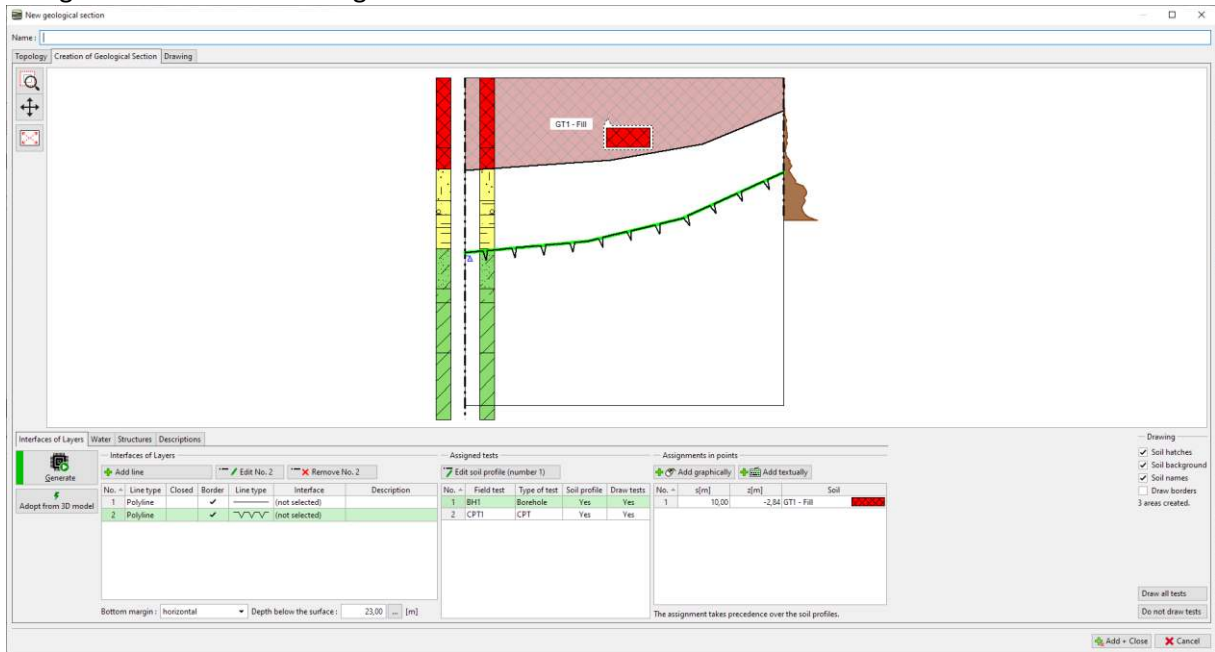
We will input our idea of the geological section.



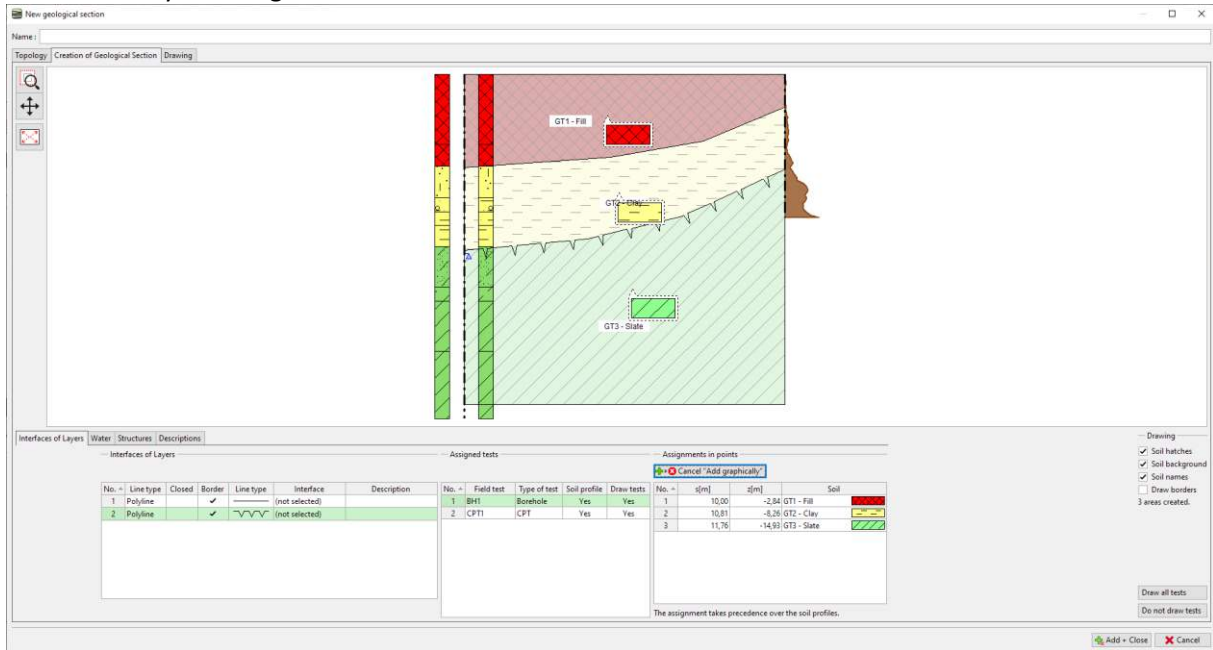
We input assignment points to the areas and assign soils, resp. geotechnical types. If the type is not created already, we can do it now.



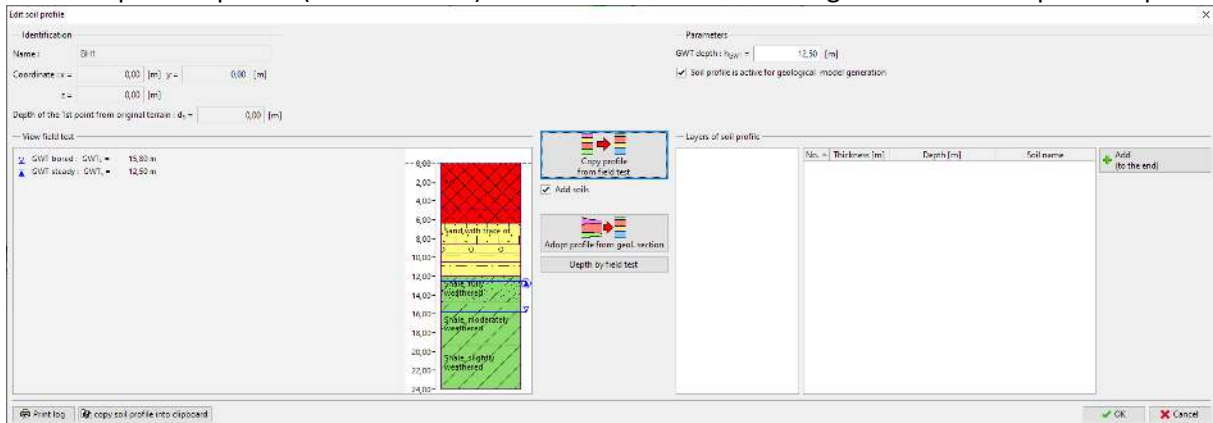
Using "Generate" button we generate area of fill.



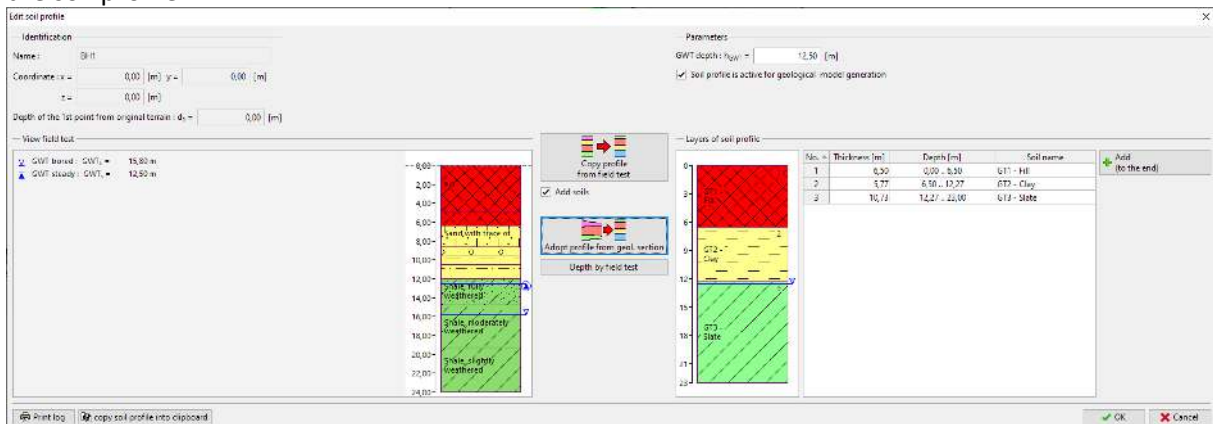
The same way we assign soils to other areas.



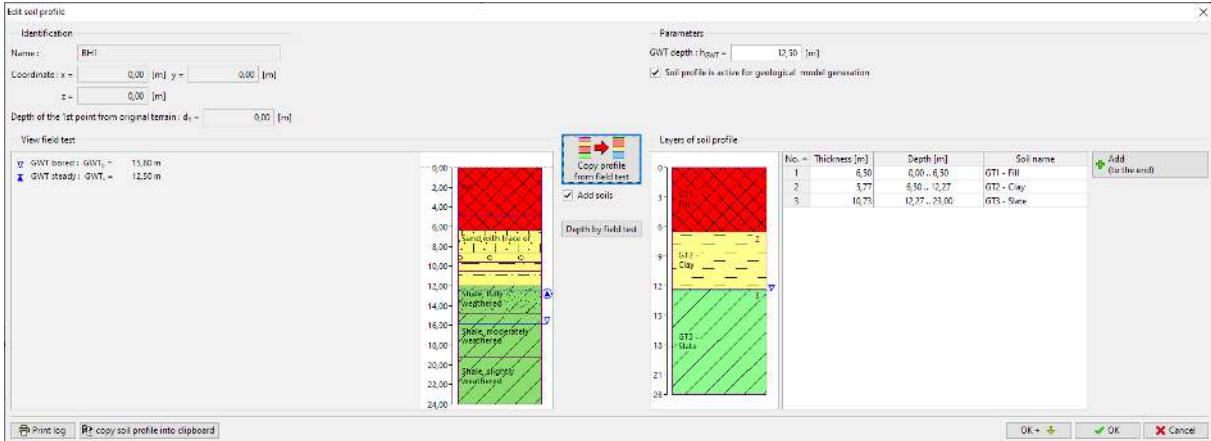
We will open soil profile (borehole BH1) and edit it. We can see dialog window for soil profile input.



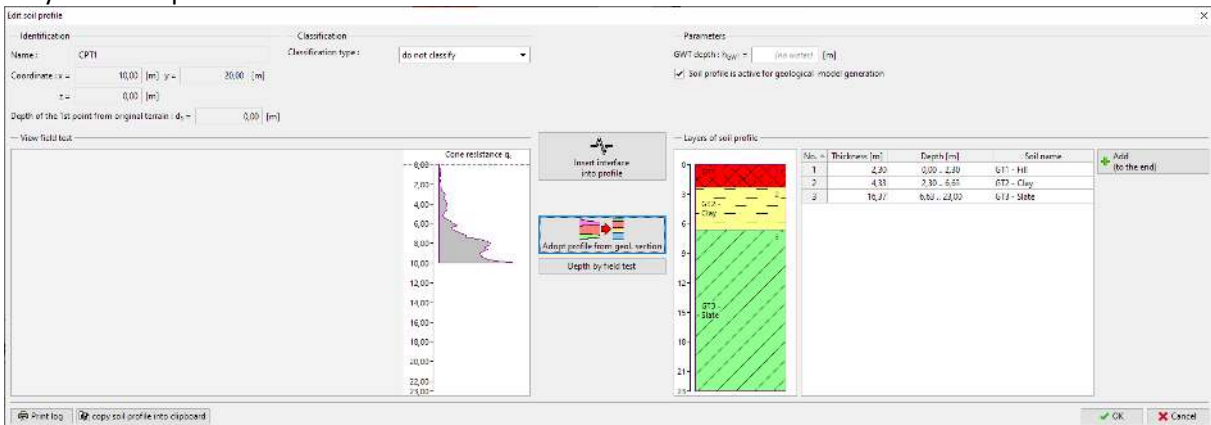
Using "Adopt profile from geol. section" button all data from geological section are transferred into the soil profile.



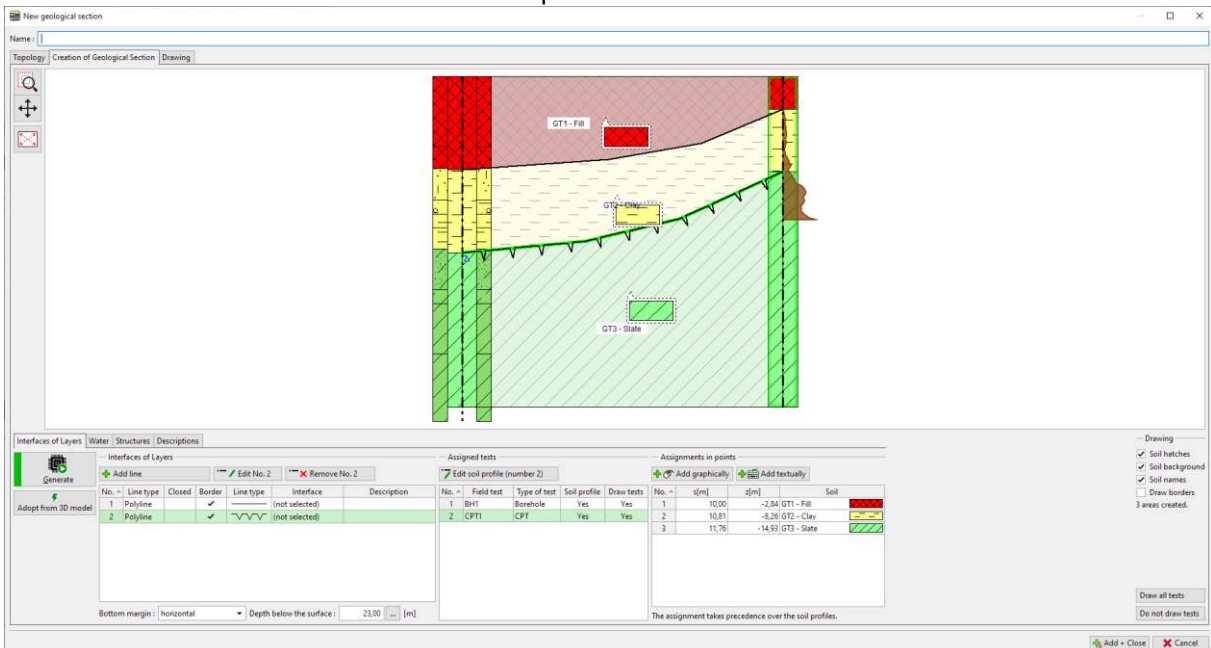
We will assign to the individual layers the corresponding geotechnical type – soil.



We will repeat the process for the CPT as well. It can be done to the depth of the model (below) or only to the depth of the field test.



After return into the section we see that soil profiles have been created.



## Working with Soil Profiles

The program, resp. the selected template contains protocols for printing the soil profiles – as a field test report and its interpretation.

**Log of Boring** (BH1)

Project: Apartment building "Moonlighting" - Geological survey

Location: Praha 12

Drilling equipment: Hoke 202 TP

Overall depth: 24.00 m

Soil profile: Recent (0.00-4.90), Quaternary (4.90-12.00), Older (12.00-24.00)

**Cone penetration test (CPT)** (CPT1)

Project: Apartment building "Moonlighting" - Geological survey

Location: Praha 12

Equipment: PenBis A22

Field test: Cone resistance, Local friction, Pore pressure

Soil profile: CPT1 (0.00-10.00)

Next, we can generate a 3D model of the subsoil from the created soil profiles.

**3D Geological Model**

No.	Name	Master	Active	Status
1	BH1		<input checked="" type="checkbox"/>	Original
2	CPT1		<input checked="" type="checkbox"/>	Original

Soil above interface	Assigned interface	Group order	Smoothing	Creates fault
1	Red (only from boreholes)	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>
2	Yellow (only from boreholes)	10	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>