



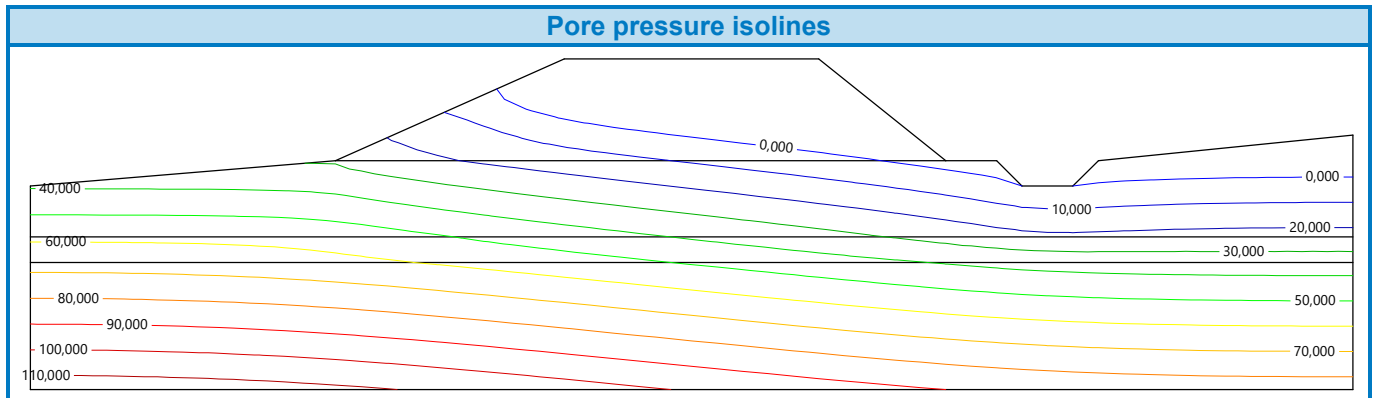
## Input data (Stage of construction 3)

### Assigning and surfaces

| No. | Surface position | Coordinates of surface points [m] |        |        |        | Assigned soil    |
|-----|------------------|-----------------------------------|--------|--------|--------|------------------|
|     |                  | x                                 | z      | x      | z      |                  |
| 1   |                  | 10,00                             | -4,00  | 5,00   | 0,00   | Silty Gravel<br> |
|     |                  | -5,00                             | 0,00   | -14,00 | -4,00  |                  |
| 2   |                  | 26,00                             | -7,00  | 26,00  | -3,00  | Silty Sand<br>   |
|     |                  | 16,00                             | -4,00  | 15,00  | -5,00  |                  |
|     |                  | 13,00                             | -5,00  | 12,00  | -4,00  |                  |
|     |                  | 10,00                             | -4,00  | -14,00 | -4,00  |                  |
|     |                  | -26,00                            | -5,00  | -26,00 | -7,00  |                  |
| 3   |                  | 26,00                             | -8,00  | 26,00  | -7,00  | Sandy Clay<br>   |
|     |                  | -26,00                            | -7,00  | -26,00 | -8,00  |                  |
| 4   |                  | -26,00                            | -8,00  | -26,00 | -13,00 | Silty Sand<br>   |
|     |                  | 26,00                             | -13,00 | 26,00  | -8,00  |                  |

### Water

Water type : Waterflow analysis





## Water flow (Analysis using finite element method)

### Topology

#### Global settings

Analysis type : Steady state water flow

#### Interface

| No. | Interface location | Coordinates of interface points [m] |       |        |       |       |       |
|-----|--------------------|-------------------------------------|-------|--------|-------|-------|-------|
|     |                    | x                                   | z     | x      | z     | x     | z     |
| 1   |                    | -26,00                              | -5,00 | -14,00 | -4,00 | -5,00 | 0,00  |
|     |                    | 5,00                                | 0,00  | 10,00  | -4,00 | 12,00 | -4,00 |
|     |                    | 13,00                               | -5,00 | 15,00  | -5,00 | 16,00 | -4,00 |
|     |                    | 26,00                               | -3,00 |        |       |       |       |
| 2   |                    | -14,00                              | -4,00 | 10,00  | -4,00 |       |       |
|     |                    |                                     |       |        |       |       |       |
| 3   |                    | -26,00                              | -7,00 | 26,00  | -7,00 |       |       |
|     |                    |                                     |       |        |       |       |       |
| 4   |                    | -26,00                              | -8,00 | 26,00  | -8,00 |       |       |
|     |                    |                                     |       |        |       |       |       |

#### Soil parameters

##### Silty Gravel

Permeability coeff. in X-direction :  $k_{x,sat} = 2,000E-03$  m/day  
 Permeability coeff. in Z-direction :  $k_{z,sat} = 2,000E-03$  m/day  
 Initial void ratio :  $e_0 = 0,70$   
 Transition zone model : van Genuchten  
 Model parameter :  $\alpha = 0,200$  1/m  
 Model parameter :  $n = 5,000$

##### Silty Sand

Permeability coeff. in X-direction :  $k_{x,sat} = 1,000E+00$  m/day  
 Permeability coeff. in Z-direction :  $k_{z,sat} = 1,000E+00$  m/day  
 Initial void ratio :  $e_0 = 0,70$   
 Transition zone model : van Genuchten  
 Model parameter :  $\alpha = 0,200$  1/m  
 Model parameter :  $n = 5,000$

##### Sandy Clay

Permeability coeff. in X-direction :  $k_{x,sat} = 1,000E-01$  m/day  
 Permeability coeff. in Z-direction :  $k_{z,sat} = 1,000E-01$  m/day  
 Initial void ratio :  $e_0 = 0,70$   
 Transition zone model : van Genuchten



Model parameter :  $\alpha$  = 0,200 1/m  
Model parameter :  $n$  = 5,000

### Assigning and surfaces

| No. | Surface position | Coordinates of surface points [m] |        |        |        | Assigned soil    |
|-----|------------------|-----------------------------------|--------|--------|--------|------------------|
|     |                  | x                                 | z      | x      | z      |                  |
| 1   |                  | 10,00                             | -4,00  | 5,00   | 0,00   | Silty Gravel<br> |
|     |                  | -5,00                             | 0,00   | -14,00 | -4,00  |                  |
| 2   |                  | 26,00                             | -7,00  | 26,00  | -3,00  | Silty Sand<br>   |
|     |                  | 16,00                             | -4,00  | 15,00  | -5,00  |                  |
|     |                  | 13,00                             | -5,00  | 12,00  | -4,00  |                  |
|     |                  | 10,00                             | -4,00  | -14,00 | -4,00  |                  |
|     |                  | -26,00                            | -5,00  | -26,00 | -7,00  |                  |
| 3   |                  | 26,00                             | -8,00  | 26,00  | -7,00  | Sandy Clay<br>   |
|     |                  | -26,00                            | -7,00  | -26,00 | -8,00  |                  |
| 4   |                  | -26,00                            | -8,00  | -26,00 | -13,00 | Silty Sand<br>   |
|     |                  | 26,00                             | -13,00 | 26,00  | -8,00  |                  |

### Mesh generation

#### Mesh generation parameters

Element edge length : 1,00 [m]  
Mesh smoothing : yes  
Generate multinode elements : no

#### Mesh generation result

**Finite element mesh was successfully generated.**

Number of nodes 1153

Number of elements 2104 (region 1096, beam 252, interface 756)



## Water flow - Input data (Stage of construction 1)

### Assignment and activation

| No. | Region | Assigned soil    |
|-----|--------|------------------|
| 1   |        | Silty Gravel<br> |
| 2   |        | Silty Sand<br>   |
| 3   |        | Sandy Clay<br>   |
| 4   |        | Silty Sand<br>   |

### Line - flow

| No. | Line flow |          | Location         | Boundary type | Parameters                  |
|-----|-----------|----------|------------------|---------------|-----------------------------|
|     | new       | modified |                  |               |                             |
| 1   | Yes       |          | Mesh line No. 1  | impermeable   |                             |
| 2   | Yes       |          | Mesh line No. 2  | impermeable   |                             |
| 3   | Yes       |          | Mesh line No. 3  | pore pressure | $Z_{GWT} = -1,10 \text{ m}$ |
| 4   | Yes       |          | Mesh line No. 5  | impermeable   |                             |
| 5   | Yes       |          | Mesh line No. 6  | impermeable   |                             |
| 6   | Yes       |          | Mesh line No. 7  | seepage       |                             |
| 7   | Yes       |          | Mesh line No. 8  | seepage       |                             |
| 8   | Yes       |          | Mesh line No. 9  | seepage       |                             |
| 9   | Yes       |          | Mesh line No. 10 | impermeable   |                             |
| 10  | Yes       |          | Mesh line No. 11 | pore pressure | $Z_{GWT} = -1,10 \text{ m}$ |
| 11  | Yes       |          | Mesh line No. 12 | impermeable   |                             |
| 12  | Yes       |          | Mesh line No. 14 | impermeable   |                             |
| 13  | Yes       |          | Mesh line No. 15 | impermeable   |                             |
| 14  | Yes       |          | Mesh line No. 17 | impermeable   |                             |
| 15  | Yes       |          | Mesh line No. 18 | impermeable   |                             |
| 16  | Yes       |          | Mesh line No. 19 | impermeable   |                             |

### Analysis settings

#### Water flow

Method :

Newton - Raphson

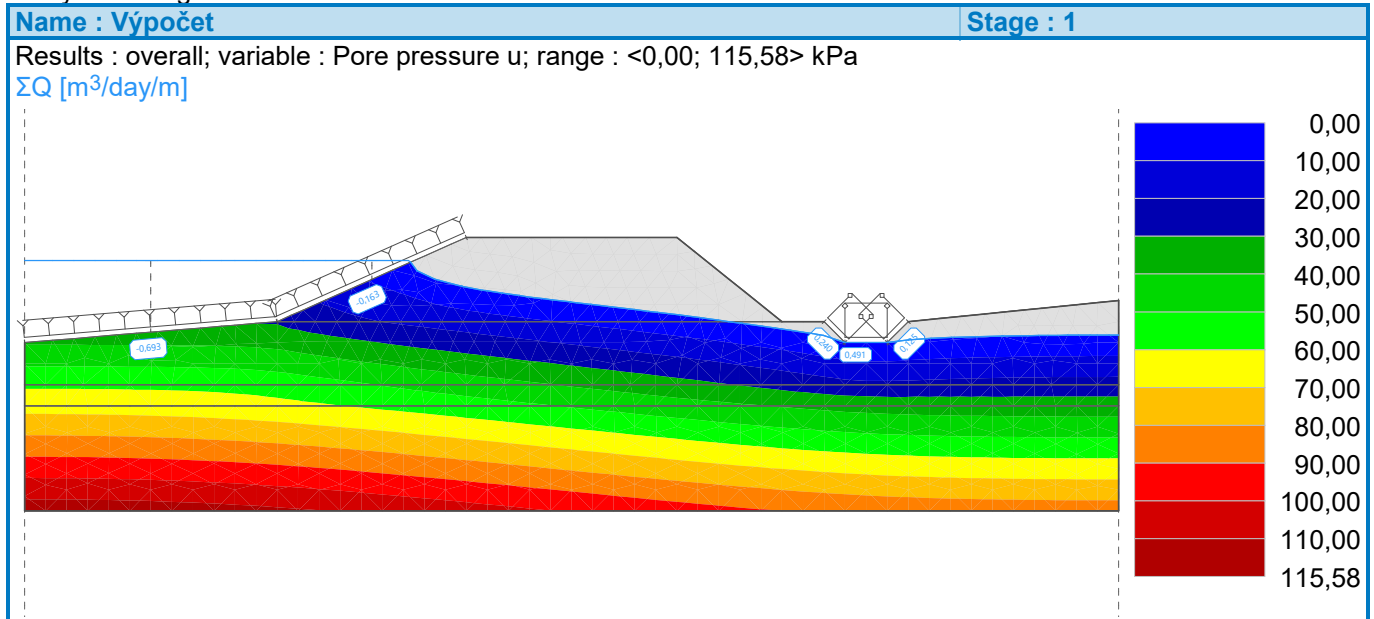


|  |                      |
|--|----------------------|
| Change of permeability matrix :                | after each iteration |
| Max. number of iterations for one calc. step : | 20                   |
| Pore pressure error :                          | 0,0100               |
| Equilibrium state error :                      | 0,0100               |
| Respect material interfaces :                  | no                   |

## Water flow - Results (Stage of construction 1)

Steady state water flow analysis successfully completed.

Analysis settings : **standard**



### Calculated total inflow / outflow

| Location         | Inflow<br>[m <sup>3</sup> /day/m] | Outflow<br>[m <sup>3</sup> /day/m] |
|------------------|-----------------------------------|------------------------------------|
| Line flow No. 3  |                                   | -0,163                             |
| Line flow No. 6  | 0,125                             |                                    |
| Line flow No. 7  | 0,491                             |                                    |
| Line flow No. 8  | 0,240                             |                                    |
| Line flow No. 10 |                                   | -0,693                             |
| Total            | 0,856                             | -0,856                             |