10 FLOW AROUND A SHEET PILE WALL

In this tutorial the flow around a sheetpile wall will be analysed. The geometry model of Chapter 3 will be used. The *Well* feature is introduced in this example.

Objectives:

- Using wells

10.1 INPUT

To create the geometry:

- Open the project defined in Chapter 3.
- Save the project under a different name (e.g. 'Flow around a sheet pile wall'). The material parameters remain unchanged. The used groundwater parameters are shown in Table 10.1.

Table 10.1 Flow parameters

Parameter	Name	Silt	Sand	Loam	Unit
Groundwater					
Data set	-	USDA	USDA	USDA	-
Model	-	Van Genuchten	Van Genuchten	Van Genuchten	-
Soil type	-	Silt	Sand	Loam	-
$> 2\mu m$	-	6.0	4.0	20.0	%
$2\mu m - 50\mu m$	-	87.0	4.0	40.0	%
$50\mu m - 2mm$	-	7.0	92.0	40.0	%
Use defaults	-	From data set	From data set	From data set	-
Permeability in horizontal direction	k_x	0.5996	7.128	0.2497	m/day
Permeability in vertical direction	k_y	0.5996	7.128	0.2497	m/day

In the *Structures* mode click the *Create hydraulic conditions* button in the side toolbar.

Select the *Create well* option in the appearing menu.

- Draw the first well by clicking on (42.0 23.0) and (42.0 20.0).
- Draw the second well by clicking on (58.0 23.0) and (58.0 20.0).

10.2 MESH GENERATION

- Proceed to the *Mesh* mode.
- Select the cluster as shown in Figure 10.1 and in *Selection Explorer* specify a *Coarseness factor* of 0.25.

Create the mesh. Use the default option for the *Element distribution* parameter (*Medium*).

View the mesh. The resulting mesh is displayed in Figure 10.2.

- Click on the *Close* tab to close the Output program.

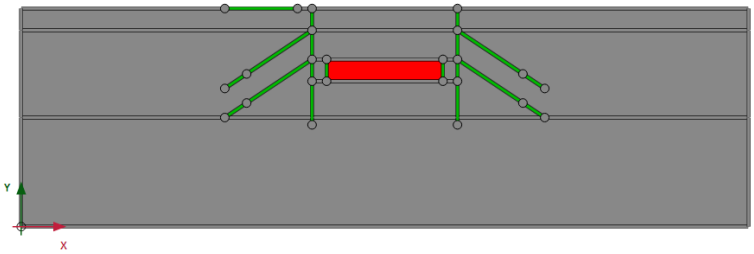


Figure 10.1 Indication of the local refinement of the mesh in the model

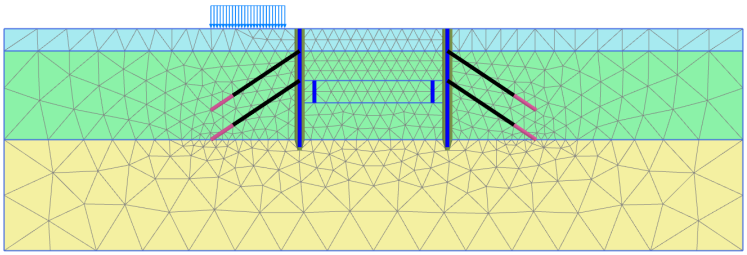


Figure 10.2 The generated mesh

10.3 CALCULATIONS

- Proceed to the *Staged construction* mode. In this project only groundwater flow analysis will be performed.

In the *Phases explorer* remove the existing phases (Phases 1 to 6).

Initial phase

In this phase the initial steady-state pore pressure distribution is considered. To define the initial phase:

- In the *General* subtree of the *Phases* window select the *Flow only* option in the *Calculation type* drop-down menu.
- The standard settings for the remaining parameters are valid for this phase.
- The default groundwater flow boundary conditions are valid. Only the bottom boundary of the model (*BoundaryYMin*) is *Closed* whereas the rest of the boundaries are *Open*.
- The water level created according to the head specified in the borehole is assigned as *GlobalWaterLevel*.

Phase 1

In this phase the lowering of the phreatic level in the excavation down to y = 20 m. This corresponds to the final excavation level in the project in Chapter 3.

Add a new phase.

- In the *Phases* window the calculation type is by default defined as *Flow only*.
- The default option (*Steady state groundwater flow*) will be used as *Pore pressure*

calculation type.

- In the *Staged construction* mode activate the interface elements along the wall.
- Multi-select the wells in the model and activate them.
- In the *Selection explorer* the behaviour of the wells is by default set to *Extraction*.
- Set the discharge value to 0.7 m^3/day/m.
- Set the h_{min} value to 20.0m. This means that water will be extracted as long as the groundwater head at the wall location is at least 20 m. Figure 10.3 shows the parameters assigned to the wells in the *Selection explorer*.

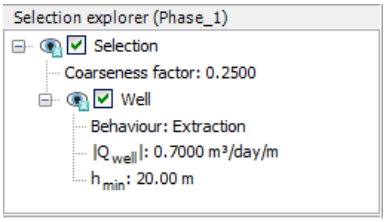


Figure 10.3 Well properties

Hint: Total discharge in Phase 1 is similar to the total outflow at the final excavation level as obtained from Chapter 3.

The definition of the calculation process is complete. Calculate the project.

Save the project after the calculation has finished.

10.4 RESULTS

To display the flow field:

- Select the Phase 1 in the drop down menu.
- From the *Stresses* menu select *Groundwater flow* → $|q|$. A scaled representation of the results (scale factor = 5.0) is shown in Figure 10.4.

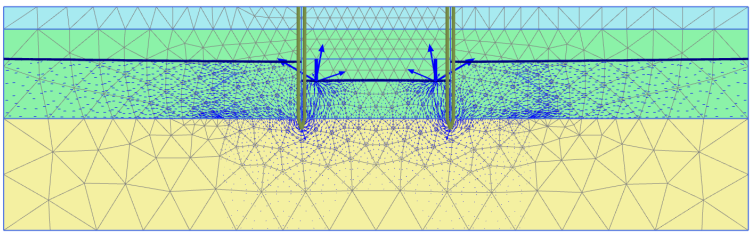
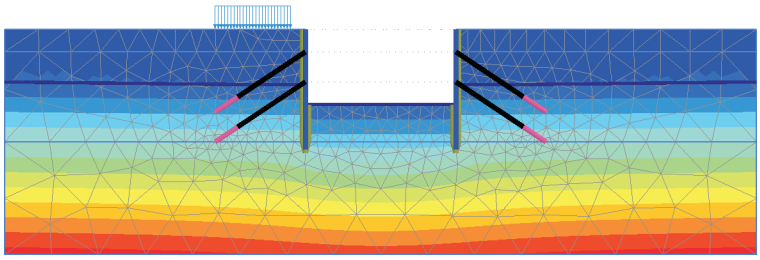


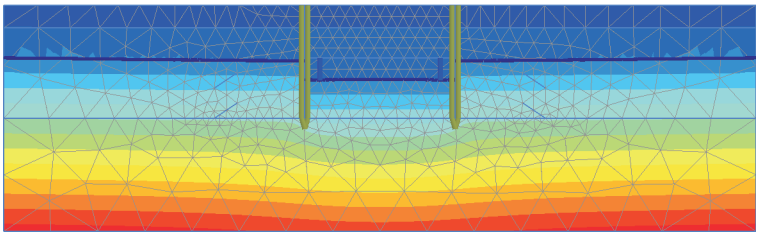
Figure 10.4 The resulting flow field at the end of Phase 1

From the *Stresses* menu select *Pore pressures* → p_{active}. Compare the results with the ones of the Phase 6 of the project defined in Chapter 3.

In Figure 10.5 the resulting active pore pressures when the water level in the excavation is at y = 20 m is displayed for both projects.



a. Active pore pressures (Phase 6 in Chapter 3)



b. Active pore pressures (Phase 1 in the current project)

Figure 10.5 Comparison of the resulting active pore pressures.