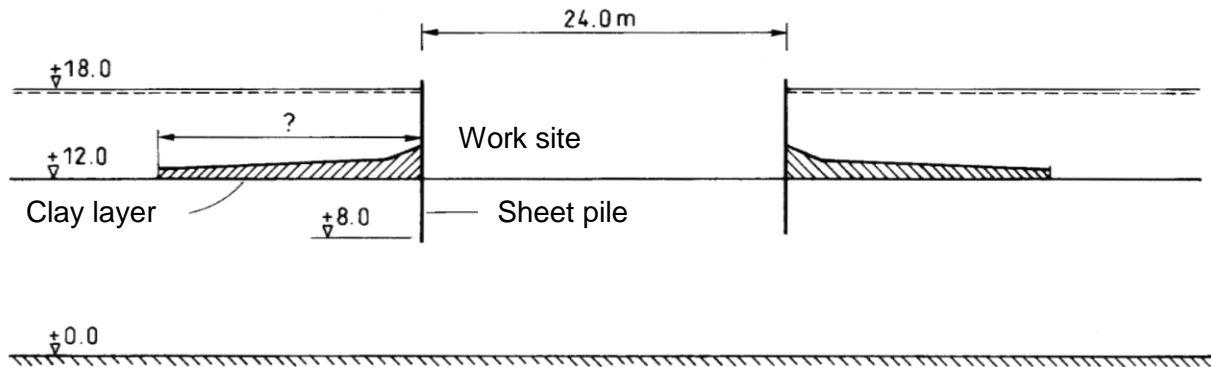


Assignment 2 – Groundwater Flow



A horizontal layer of sand of 12 m's depth rests on impermeable ground. To create a water-free working-site, a sheet pile is driven to the depth of 4 m. The water depth is 6 m and the permeability of the sand is 10^{-4} m/s. When the working site is pumped free from water and the water level is on the ground of the working site, the leakage through the ground is so high that the cost for electrical installations and pumps becomes unreasonably high. Further, one is concerned about the risk for internal scour. With half the leakage simpler pumps could be used and the costs could thereby be considerably reduced. Further, the risk for internal scour would decrease.

Your consultant engineers firm is hired to solve the problem. A colleague gives you a hint that the water flow will decrease if an impermeable clay layer is placed on the ground outside the sheet pile.

First, do a one-dimensional approximate calculation that gives a length of the clay layer needed to reduce the leakage to a half of the flow without clay. This is made to check if it is a good idea to go further with this idea. Then do a two-dimensional more accurate FE-analysis of the inflow. Compare the results of the length of the clay layer obtained from the two models. From the two-dimensional calculation you should also check the risk for internal scour and where this might appear.

The assignment will be judged according to the criteria given in the course program and the note on report writing. The report should contain the following parts:

- Background
- Description of the approximate 1-d calculation
- Description of the two-dimensional accurate FE-analysis.
- Results from both analysis
- Discussion

The report without appendices must not contain more than 5 pages and should serve as a background for a decision for the engineers at the work-site. It must contain the assumptions with comments (geometry model, physical model, material model, boundary conditions, load model and numerical model), calculations (m-files may be placed in an appendix) and commented results (presented in diagrams/figures) – the results section must be written in a way that is easily understood by the engineer in charge at the work-site.