Deltares

Enabling Delta Life

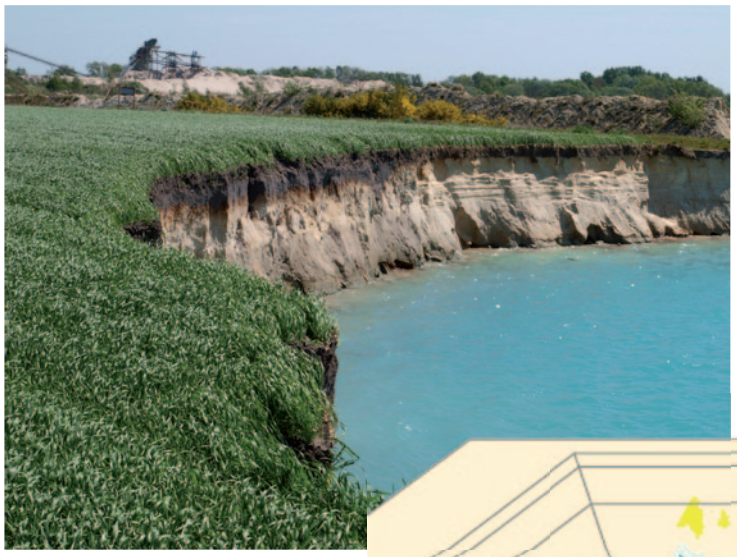
Stability of sandy and silty under water slopes

The assessment of the stability of under water slopes in unprotected sandy or silty material is often an important issue for dredging in harbours and fairways, trenching and sand mining. It is also important for natural river- and estuary or lake banks near eroding flows, often related with dike safety.

A generally applied approach to define slope stability in geotechnics is a shear failure analysis according to Bishop/Spencer. Deltares has developed the program MSTAB to assess the stability for this failure mechanism.

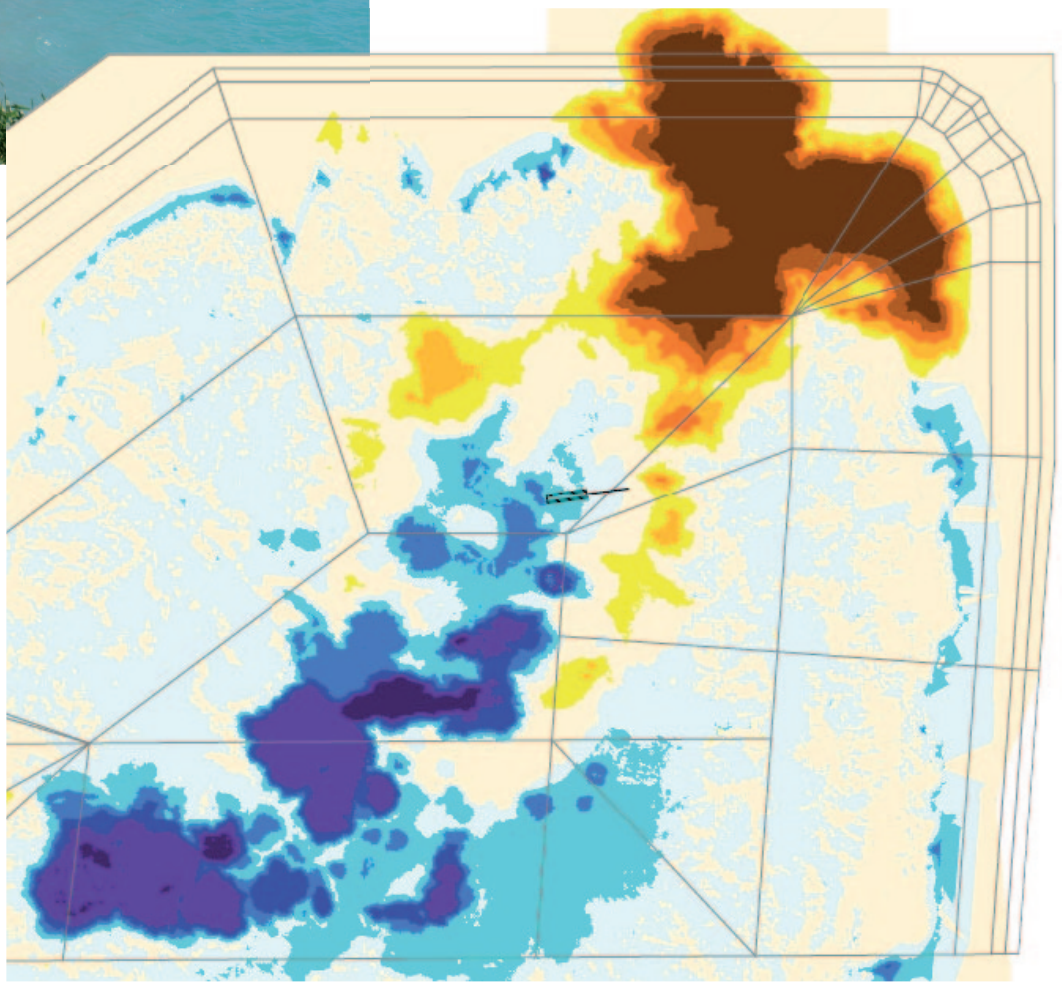
Another type of under water slope failure that is known to occur at much gentler slopes is a flow slide. The soil material is eroded and suspended at the surface and flows down the slope as a turbidity current, initiated by a gradually retrograding breach, eventually resulting in a total degradation of the under water slope. In the case loosely packed sand layers are present, the process will be enhanced or initiated by local liquefaction.

Recently, Deltares has evaluated field surveys of a large number of observed slope instabilities resulting in bank collapse in sandy and silty material in the Netherlands. In most of the observed field cases, a flow slide was responsible for the instability. Only the very top of the slope above water usually collapses by shear failure at the end of the flow slide process.



Bank collapse after flow slide in a sand mining pit

Deltares has carried out experimental and theoretical research for over 20 years now in the field of liquefaction and breaching flow slides and developed the computer models SLIQ2D and HMBREACH to analyze the process and compute safe slope designs as recommended in CUR 113, based on CPT, borings and laboratory soil investigations. These tools have been improved during the analysis of a large number of observed flow slides and have been applied in numerous practical situations.



Measured soil transport after slope failure by a flow slide in a sand mining pit

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Deltares is a leading, independent, Dutch-based research institute and specialist consultancy for matters relating to water, soil and the subsurface. We apply our advanced expertise worldwide, to help people live safely and sustainably in delta areas, coastal zones and river basins.