Deltares

FAQ

Has the high water altered the bed of the Meuse?

Update: 31-8-2021

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Riverbeds change as a result of erosion and sedimentation. Erosion occurs where the flow concentrates and accelerates; sedimentation where the flow fans out and slows down. During high water, the flow follows a completely different pattern than it would in normal circumstances. The acceleration and slowing down of the flow are stronger and they are seen in different locations. The result is a mosaic of erosion and sedimentation along the river. In the summer bed, the old bed position gradually recovers later when the normal discharge regime returns.

Sand deposits near the Berg aan de Maas ferry (km 38.9), still visible in the grass after being moved to the side when sand was removed from the ferry threshold.

However, the bed does not recover naturally if the erosion occurs after a limit to the strength of a bed or bank has been exceeded. This is the case, for example, if a bank defence fails or if a thin layer of gravel starts to move and covers layers with finer sand. Deep scour holes can then form suddenly. In the steep and fast-flowing Grensmaas, this is a threat between kilometres 17 and 45, where fine-grained Tertiary sands are located close below the surface. As a result, various scour holes formed during the high water of July 2021. At Berg aan de Maas (km 38.9) the bed eroded to a level below

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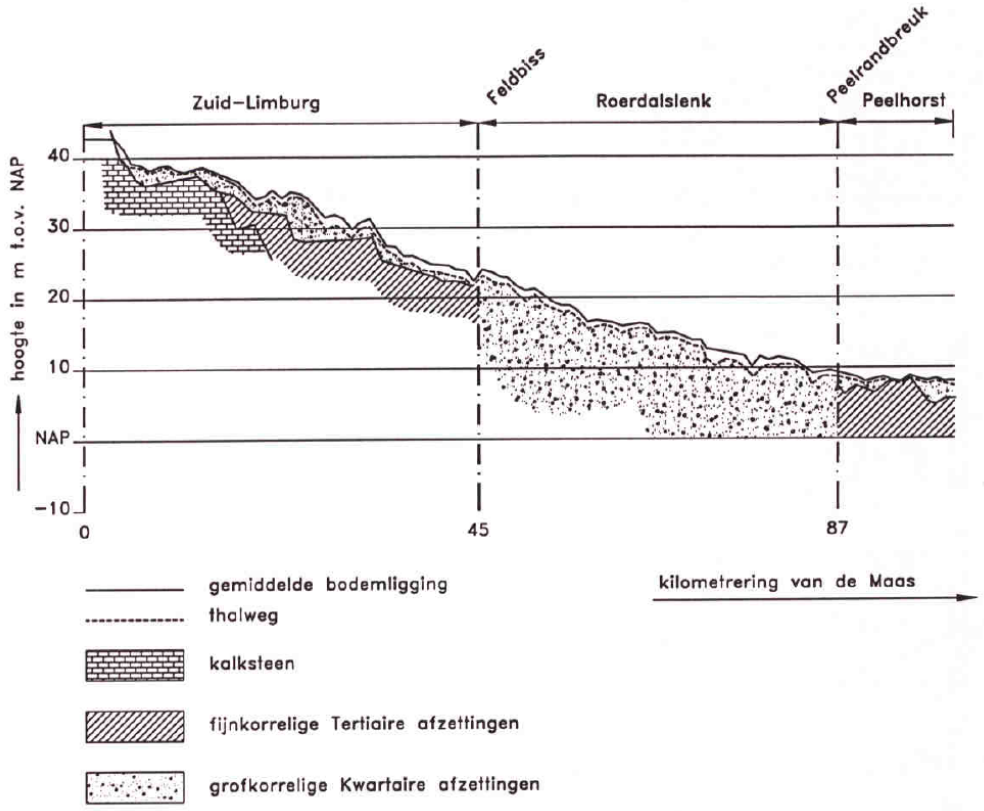
10 m NAP, resulting in a pit extending below the surrounding river bed to a depth equivalent to a four-storey flat.



Simplified geological longitudinal profile of the Meuse (Mosselman & Wang, 1994). Fine-grained Tertiary deposits are just under the surface of the river bed between kilometres 17 and km 45.

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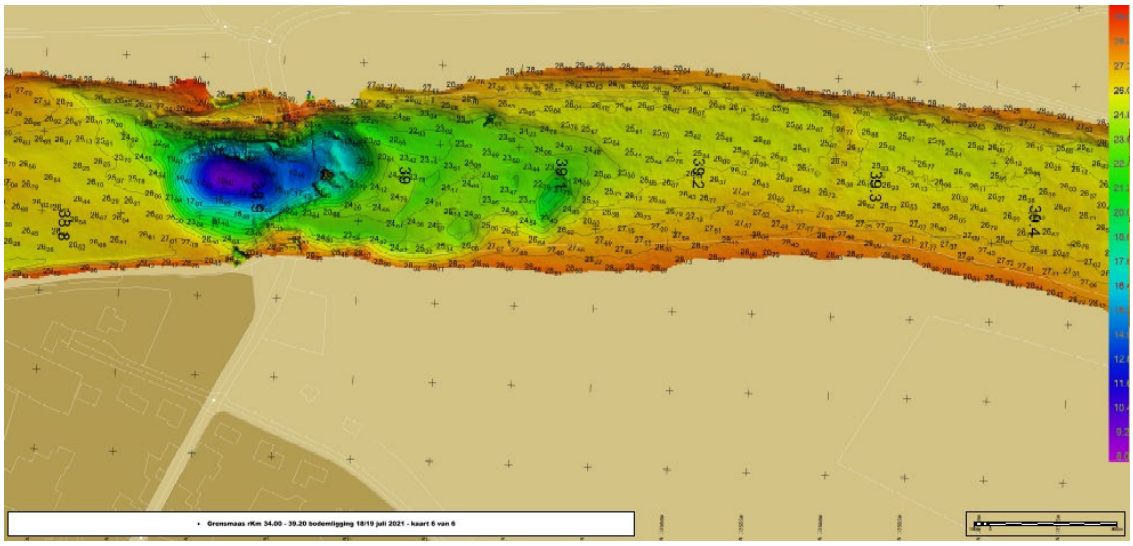

Scour hole extending to below 10 m NAP near Berg aan de Maas (km 38.9) (source: Rijkswaterstaat).

In addition to the bed, the banks of a river are also eroded by waves and the abrasive effect of fast-flowing water. Banks also slip if they become unstable due to water saturation or scouring at the toe. Erosion due to high flow rates is strongest when there are high discharges during a high-water period, but slippage primarily occurs after the high water passes when there is no longer any counter-pressure from the water in the river.

In normal circumstances, banks erode mainly on the outer bends where the bed is deeper and the water flows faster, and in places where ships manoeuvre or sail close to the bank. During periods of high water, bank erosion makes the flow cross-section wider, particularly where the flow narrows. Banks also erode during high water where the current flows out of the summer bed to take a path of less resistance across the winter bed, for example through ponds in the winter bed or a shortcut that cuts off a bend. Erosion on a new path of this kind may be the precursor to a change in the course of the river (Emriver river gravel mining demonstration. - YouTube). Indications that this was happening were seen after the high water in July 2021 along the Old Meuse, which forms the lower reaches of the Geleenbeek river.

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Bank erosion along the Old Meuse, or the lower reaches of the Geleenbeek river, in the winter bed of the Meuse.

Bank erosion is often the main problem seen in the river studies that Deltares conducts in countries such as Bangladesh, Myanmar and Vietnam. In the Netherlands, river banks are largely fixed in place with bank revetments or groynes. However, valuable habitats have been lost as a result. In order to restore river nature, many nature-friendly banks have been constructed in recent years. Deep below the surface, these are still fixed in place with rock but they can develop freely higher up due to the action of waves and currents. In 2020, Deltares developed tools for Rijkswaterstaat for the management of these dynamic banks<hyperlink 1>. These tools consist of forecasting methods for bank erosion, recommendations for the trade-off between protecting banks again or actually purchasing land for further erosion, and suggestions for alternative structures.

Hyperlink 1:
https://kennisbank.deltares.nl/Details/fullCatalogue/1000013043

Literature reference

Mosselman, E. & Z.B. Wang (1994), Onderzoek Watersnood Maas; Morfologische aspecten. Sub-report 6, Waterloopkundig Laboratorium, Report to the Minister of Transport, Public Works and Water Management (Boertien Committee 2), ISBN 90-802314-2-8.