

Supplementary material. S1 Descriptions of the geological sections of the Pudisoo River.

Section I: Lake Pikklaugas (source) – Kemba bridge (distance from the source approx. 9.5 km)

In this initial section, the river is artificially straightened, mainly flowing with a low gradient (<2 m/km) and meandering coefficient (<1.2) in a shallow (1 - 1.5 m) and narrow (3 - 5 m) channel valley cut into fine sand. Certain sections at 4 km and 6 km marks, however, deviate from this pattern. Here, the river erodes buried till ridges, leading to a channel bottom covered by gravelly deposits and sand, with boulders washed out of the till enhancing the complexity of the riverbed.

Section II: Kemba bridge – Liivapõllu (9.5 - 12 km)

The river in this section flows in a 1-3 m deep and up to 100 m wide floodplain valley. The floodplain consists of peaty soil, reaching up to 1 m in thickness. The channel bed is primarily covered by sand, with patches of gravelly sand. At the 10 and 11 km marks, the river cuts its way through the till, resulting in a bed covered by fine to medium gravel with few cobbles and boulders, enriching the sediment diversity in this section.

Section III: Liivapõllu – Loksa bridge (12 - 16.5 km)

This section of the river includes two shorter sections (at 14 and 15 km marks) with a noticeably higher gradient (7.4 m/km and 5.6 m/km, respectively). Here, the river courses through a narrow and deep (10 - 20 m) V-shaped valley, interspersed with narrow floodplain valley sections. In the high-gradient sections rapids are common; formed by boulders washed out of the till, with pebbly gravel nestled between them. Outside these high-gradient pockets, the river meanders more freely, the floodplain broadens, and the channel bed is dominated by sandy sediments. The whole valley section is characterized by slope springs, which sometimes form small streams.

Section IV: Loksa bridge – Raudsilla (16.5 - 25 km)

In this section, the river features a flood-plain valley with a variable depth (1 - 6 m) and width (ranging from a few meters to 150 m). The river primarily meanders along sandy coastal plains, with occasional gravelly material at the riverbed. The section includes four distinct subsections (Fig. 2):

Subsection a: Loksa bridge – Punsu stream (16.5 - 19 km)

The river, with a high meandering coefficient (1.6 - 1.9), flows in a gradually shallowing (8-1 m) and up to 100 m wide flood-plain valley on the former Punsu coastal lake plain.

Subsection b: Punsu stream – Leedikõrve (19 - 20 km)

This subsection is primarily distinguished by the channel bed sediments, made up of pebbly gravels containing cobbles. The river cuts through the 5 - 6 m high dune-capped Tagavälja coastal spit and thereafter, it heavily meanders in the flood-plain valley parallel to the spit.

Subsection c: Leedikõrve (20 - 22.5 km)

In this subsection, the river flows in an artificially straightened (meandering coefficient <1.2) simple channel valley dug into the fine-grained bottom sediments of the former coastal lake.

Subsection d: Leedikõrve – Raudsilla (22.5 - 25 km)

In this subsection, a meandering river (meandering coefficient 1.4 - 1.7) runs between sandy beach ridges in an up to 150 m wide and 2 - 3 m deep flood-plain valley. Fine to gravelly sand is covering the channel bed.

Section V: Raudsilla – River Mouth (25 – 32 km)

The final section of the Pudisoo River includes a shorter, very steep river section with a gradient of 11.8 m/km. This section is remarkable for its rapids, which result from large boulders washed out from till, and the gravelly sediments that cover the bed. Beyond these high-gradient areas, the depth of the valley reaches up to 16 m, with alternating V-shaped valley sections and sections with a narrow floodplain. The estuary features a simple meandering channel valley on the swampy coastal lowland, with characteristic oxbow formations.