

Soil vulnerability to ditch and watercourse bank instability

Bank instability depends on the type of material and its resistance to detachment due to the flow of water in the ditch or stream, or due to hypodermic flow. The purpose of digging ditches and straightening watercourses is to eliminate surface water (rainfall and snowmelt) quickly. In some soils, these operations may cause erosion problems as a result of greater flow velocity and bank instability, with local soil losses and reduced cultivable acreage in some cases. In terms of the watershed as a whole, non-point-source pollution may become a problem because of eroded soil particles and sedimentation in watercourses. The hydraulic regime of watercourses may also be altered (Gosselin 1986).

The map can be useful to a variety of agricultural, municipal and environmental stakeholders and for road network purposes. Depending on the degree of vulnerability, particular attention should be devoted to the design and execution of excavation work, as regards, for example, ditch profiling standards, in which side slope length varies depending on the type of soil. Furthermore, various protective measures may be taken locally to enhance bank stability and reduce the risk of erosion, such as riprapping, construction of sills, profiling and/or sodding of side slopes (Gosselin 1986, Asselin et al. 1987). There are factors that may heighten the erosion vulnerability of banks, such as livestock access to the watercourse, unprotected drain outfalls and cultivation up to the top of the side slope. In terms of the watershed as a whole, retention ponds, terraces and other measures may be considered where flow velocity and watercourse sedimentation are becoming problematic.

Soil vulnerability to bank instability is arrived at from the particle size distribution in the profile (25-100 cm) and whether a contrasting layer is present between the subsoil (B) and the substratum (C) (e.g. a sandy layer over a clay layer). The assessment model (Table 1) shows organic and sandy soils as being highly vulnerable, while loamy soils and soils with a contrasting layer are identified as moderately vulnerable.

Table 1. Assessment model for soil vulnerability to ditch and watercourse bank instability

Subsoil (25-75 cm) particle size class	Substratum (≥ 75 cm) particle size class				
	Fragmentary and skeletal	Sandy	Coarse loamy and coarse silty	Fine loamy, fine silty or clayey	Organic
Fragmentary and skeletal	Nil to low	Moderate	Moderate	Nil to low	High
Sandy	High	High	High	High	High
Coarse loamy and coarse silty	Moderate	Moderate	Moderate	Moderate	High
Fine loamy, fine silty and clayey	Nil to low	Moderate	Moderate	Nil to low	High
Organic	High	High	High	High	High

Adapted from Martin and Nolin 1991

Soils with nil to low vulnerability (e.g. Providence series) account for 51.7% of the study area. These are mainly deep clay soils and well-drained soils. Moderately vulnerable soils (e.g. Saint-Aimé series) account for 14.9% of the total. Highly vulnerable soils (e.g. Aston series) account for 33.4% of the study area; these soils occur mainly in Richelieu and Saint-Hyacinthe Counties, along the Yamaska River and Salvail Creek,

and on the sandy terraces of the Bois de Verchères. They are poorly to very poorly drained sandy soils, soils with contrasting layers (e.g. loam over clay or sand over clay) or organic soils.