Soil vulnerability to ferric clogging of subsurface drains

Ferric clogging of agricultural drains depends on a number of intrinsic soil properties, including soil nature, soil texture and the presence of iron-rich podzolized or gleyed horizons in the profile. It is caused mainly by ferric iron (Fe^{3+}) precipitation after the oxidation of ferrous iron (Fe^{2+}) under favourable physical and chemical conditions. Iron-oxidizing bacteria take free iron in solution in groundwater and transform it into gelatinous deposits that clog the openings in the drain pipe. This type of clogging is of common occurrence in sulphate and iron-rich acidic soils. The most important determining factors appear to be soil and groundwater acidity and the presence of acidic organic matter in the surface horizons (N'Dayegamiye and Nolin 1990).

The interpretation model is based on two intrinsic soil factors: taxonomic order and substratum texture (Table 1). For subsurface drainage planning purposes, other descriptors might be taken into account, such as subsoil and substratum pH and subsoil iron and aluminum content. In addition, in view of the influence of relief in the movement of water through soil, it is important to study the toposequence of the soils in which subsurface drainage pipes are to be laid, because the iron that clogs the pipes may well originate elsewhere and be brought in by water flow (N'Dayegamiye and Nolin 1990).

Table 1. Assessment model for soil vulnerability to ferric clogging of subsurface drains in acidic- to neutral-reaction mineral soils

Texture class of the C horizon*	Taxonomic order				
	Podzol	Brunisol	Luvisol	Gleysol	Regosol
1 - 2 - 3	High	Moderate	Moderate	Nil to low	Nil to low
4 - 5	Moderate	Nil to low	Nil to low	Nil to low	Nil to low

*See Table 5 for definition of texture classes
Adapted from Martin and Nolin 1991

The most vulnerable soils are podzols, sandy-textured materials in the vicinity of the pipes, and poorly and very poorly drained soils that may be characterized by anaerobic conditions in the vicinity of the pipes during much of the growing season. These highly vulnerable soils (e.g. Achigan series) account for 4.4% of the study area. They occur mainly in Richelieu and Saint-Hyacinthe Counties and around the sandy terrace in Saint-Amable. Moderately vulnerable soils also occur, accounting for 7.7% of the total (e.g. Massueville series). Soils with nil to low vulnerability account for 84.9% of the study area, while 3% of the study area consists of uninterpreted soils (i.e. soils with satisfactory drainage).