SOIL FEATURES
Richland County, North Dakota

The following table gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

A restrictive layer is a nearly continuous layer that has one or more physical, chemical, or thermal properties that significantly impede the movement of water and air through the soil or that restrict roots or otherwise provide an unfavorable root environment. Examples are bedrock, cemented layers, dense layers, and frozen layers. The table indicates the hardness and thickness of the restrictive layer, both of which significantly affect the ease of excavation. Depth to top is the vertical distance from the soil surface to the upper boundary of the restrictive layer.

Potential for frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as low, moderate, or high, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as low, moderate, or high. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

SOIL FEATURES--Continued
Richland County, North Dakota

Map symbol and soil name	Restrictive layer				Potential for Frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated Steel	Concrete
		In	In				
Af:							
Aastad----------	---	---	---	---	Moderate	High	Low
Forman----------	---	---	---	---	Moderate	High	Low
Ag:							
Aberdeen--------	---	---	---	---	Moderate	High	Moderate
Ah:							
Aberdeen--------	---	---	---	---	Moderate	High	Moderate
Ak:							
Aberdeen--------	---	---	---	---	Moderate	High	Moderate
Galchutt--------	---	---	---	---	High	High	Low
Ao:							
Aberdeen--------	---	---	---	---	Moderate	High	Moderate
Ryan----------	---	---	---	---	Moderate	High	Moderate
Ar:							
Antler----------	---	---	---	---	High	High	Low
As:							
Antler----------	---	---	---	---	High	High	Low
Tonka----------	---	---	---	---	High	High	Low
At:							
Arveson---------	---	---	---	---	High	High	Low
Fossum----------	---	---	---	---	Moderate	High	Low
Au:							
Arveson---------	---	---	---	---	High	High	Low
Fossum----------	---	---	---	---	Moderate	High	Low
Av:							
Arveson, VERY WET----------	---	---	---	---	High	High	Low
Fossum, VERY WET	---	---	---	---	Moderate	High	Low
Aw:							
Arvilla---------	---	---	---	---	Low	Moderate	Low
BbD:							
Barnes----------	---	---	---	---	Moderate	Moderate	Low
Buse----------	---	---	---	---	Moderate	Moderate	Low
BbD2:							
Barnes, ERODED--	---	---	---	---	Moderate	Moderate	Low
Buse, ERODED----	---	---	---	---	Moderate	Moderate	Low
BcD:							
Barnes----------	---	---	---	---	Moderate	Moderate	Low
Buse----------	---	---	---	---	Moderate	Moderate	Low
Langhei---------	---	---	---	---	Moderate	Low	Low
BdB:							
Barnes----------	---	---	---	---	Moderate	Moderate	Low
Svea----------	---	---	---	---	Moderate	High	Low
Bf:							
Bearden---------	---	---	---	---	High	High	Low
Bg:							
Bearden, MODERATELY DEEP OVER CLAY------	---	---	---	---	High	High	Low
Glyndon, MODERATELY DEEP OVER CLAY------	---	---	---	---	High	High	Low
Bo:							
Borup----------	---	---	---	---	High	High	Low
Br:							
Borup, VERY WET-	---	---	---	---	High	High	Low
Ca:							
Cashel----------	---	---	---	---	Moderate	High	Low
Co:							
Colvin----------	---	---	---	---	High	High	Low
DkB:							
Dickey----------	---	---	---	---	Low	High	Low
Towner----------	---	---	---	---	Moderate	High	Low
Do:							
Doran----------	---	---	---	---	High	High	Low
Dp:							
Doran----------	---	---	---	---	High	High	Low
Perella---------	---	---	---	---	High	High	Low

SOIL FEATURES--Continued
Richland County, North Dakota

Map symbol and soil name	Restrictive layer				Potential for Frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated Steel	Concrete
		In	In				
Dt:							
Doran----------	---	---	---	---	High	High	Low
Tonka----------	---	---	---	---	High	High	Low
Dv:							
Dovray----------	---	---	---	---	Moderate	High	Low
EeC:							
Eckman----------	---	---	---	---	High	Moderate	Low
Zell----------	---	---	---	---	High	Low	Low
EmB:							
Egeland---------	---	---	---	---	Moderate	Low	Low
Maddock---------	---	---	---	---	Low	Moderate	Low
En:							
Embden----------	---	---	---	---	Moderate	Moderate	Low
Tiffany---------	---	---	---	---	High	High	Low
Et:							
Embden----------	---	---	---	---	Moderate	Moderate	Low
Tiffany---------	---	---	---	---	High	High	Low
Ey:							
Exline----------	---	---	---	---	Moderate	High	High
Ryan----------	---	---	---	---	Moderate	High	Moderate
Fa:							
Fairdale--------	---	---	---	---	Moderate	Moderate	Low
Fb:							
Fairdale--------	---	---	---	---	Moderate	Moderate	Low
Fairdale, CHANNELED------	---	---	---	---	Moderate	Moderate	Low
Fd:							
Fairdale--------	---	---	---	---	Moderate	Moderate	Low
Fe:							
Fargo----------	---	---	---	---	High	High	Low
Ff:							
Fargo----------	---	---	---	---	High	High	Low
Fg:							
Fargo, DEPRESSIONAL---	---	---	---	---	High	High	Low
FhB:							
Fargo----------	---	---	---	---	High	High	Low
Fk:							
Fargo, TILL SUBSTRATUM-----	---	---	---	---	High	High	Low
Fm:							
Fargo----------	---	---	---	---	High	High	Low
Enloe----------	---	---	---	---	High	High	Low
Fn:							
Fargo, TILL SUBSTRATUM-----	---	---	---	---	High	High	Low
Enloe, TILL SUBSTRATUM-----	---	---	---	---	High	High	Low
Fo:							
Fargo----------	---	---	---	---	High	High	Low
Hegne----------	---	---	---	---	High	High	Low
Fp:							
Fargo, TILL SUBSTRATUM-----	---	---	---	---	High	High	Low
Hegne, TILL SUBSTRATUM-----	---	---	---	---	High	High	Low
Fr:							
Fargo----------	---	---	---	---	High	High	Low
Ryan----------	---	---	---	---	Moderate	High	Moderate
Fs:							
Fargo----------	---	---	---	---	High	High	Low
Ryan----------	---	---	---	---	Moderate	High	Moderate
Ft:							
Fordville-------	---	---	---	---	Low	Moderate	Low
Renshaw---------	---	---	---	---	Low	Moderate	Low
FuB:							
Forman----------	---	---	---	---	Moderate	High	Low
Aastad----------	---	---	---	---	Moderate	High	Low

SOIL FEATURES--Continued
Richland County, North Dakota

Map symbol and soil name	Restrictive layer				Potential for Frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated Steel	Concrete
		In	In				
FuB2:							
Forman, ERODED--	---	---	---	---	Moderate	High	Low
Aastad, ERODED--	---	---	---	---	Moderate	High	Low
FvC:							
Forman, ERODED--	---	---	---	---	Moderate	High	Low
Buse, ERODED----	---	---	---	---	Moderate	Moderate	Low
FvC2:							
Forman----------	---	---	---	---	Moderate	High	Low
Buse----------	---	---	---	---	Moderate	Moderate	Low
FwB:							
Forman----------	---	---	---	---	Moderate	High	Low
Peever----------	---	---	---	---	Moderate	High	Moderate
Fx:							
Fossum----------	---	---	---	---	Moderate	High	Low
Ga:							
Galchutt--------	---	---	---	---	High	High	Low
Gc:							
Galchutt--------	---	---	---	---	High	High	Low
Enloe----------	---	---	---	---	High	High	Low
Fargo----------	---	---	---	---	High	High	Low
Gd:							
Galchutt--------	---	---	---	---	High	High	Low
Overly----------	---	---	---	---	High	High	Low
Ge:							
Gardena---------	---	---	---	---	High	Moderate	Low
GfB:							
Gardena---------	---	---	---	---	High	Moderate	Low
Eckman----------	---	---	---	---	High	Moderate	Low
Gh:							
Embden----------	---	---	---	---	Moderate	Moderate	Low
Gardena---------	---	---	---	---	High	Moderate	Low
Gk:							
Gilby----------	---	---	---	---	High	High	Low
Gm:							
Gilby, MODERATELY SALINE---------	---	---	---	---	High	High	Moderate
Gn:							
Gilby----------	---	---	---	---	High	High	Low
Hamerly---------	---	---	---	---	High	High	Low
Go:							
Glyndon---------	---	---	---	---	High	High	Low
Gr:							
Glyndon---------	---	---	---	---	High	High	Low
Tiffany---------	---	---	---	---	High	High	Low
Gt:							
Glyndon---------	---	---	---	---	High	High	Low
Tiffany---------	---	---	---	---	High	High	Low
Gu:							
Glyndon---------	---	---	---	---	High	High	Low
Wyndmere--------	---	---	---	---	High	Moderate	Low
Gw:							
Grano----------	---	---	---	---	High	High	Low
Ha:							
Hamar----------	---	---	---	---	Moderate	High	Low
Hb:							
Hamar, MODERATELY DEEP OVER CLAY------	---	---	---	---	Moderate	High	Low
Hc:							
Hamar----------	---	---	---	---	---	---	---
He:							
Hamar, MODERATELY DEEP OVER CLAY------	---	---	---	---	Moderate	High	Low
Hf:							
Hamar----------	---	---	---	---	Moderate	High	Low
Ulen----------	---	---	---	---	Moderate	Low	Low

SOIL FEATURES--Continued
Richland County, North Dakota

Map symbol and soil name	Restrictive layer				Potential for Frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated Steel	Concrete
		In	In				
Hg:							
Hamar	---	---	---	---	Moderate	High	Low
Ulen	---	---	---	---	Moderate	Low	Low
Hh:							
Hamerly	---	---	---	---	High	High	Low
Hk:							
Hecla, LOAMY SUBSTRATUM	---	---	---	---	Moderate	High	Low
Hm:							
Hecla	---	---	---	---	Moderate	Low	Low
Hamar	---	---	---	---	Moderate	High	Low
Hm3:							
Hecla, SEVERLY ERODED	---	---	---	---	Moderate	Low	Low
Hamar, SEVERLY ERODED	---	---	---	---	Moderate	High	Low
Hn:							
Hecla	---	---	---	---	Moderate	Moderate	Low
Hamar	---	---	---	---	---	---	---
Ho:							
Hecla	---	---	---	---	Moderate	Moderate	Low
Arveson	---	---	---	---	---	---	---
Hamar	---	---	---	---	Moderate	High	Low
Hr:							
Hecla	---	---	---	---	Moderate	Low	Low
Maddock	---	---	---	---	Low	Low	Low
Kr:							
Kratka	---	---	---	---	Moderate	High	Low
La:							
Ladelle	---	---	---	---	High	High	Low
Lb:							
Ladelle, CHANNELED	---	---	---	---	High	High	Low
Wahpeton, CHANNELED	---	---	---	---	High	High	Low
Ladelle	---	---	---	---	High	High	Low
Wahpeton	---	---	---	---	High	High	Low
Lm:							
Lamoure	---	---	---	---	High	High	Moderate
Lp:							
La Prairie	---	---	---	---	Moderate	Moderate	Low
MdC:							
Maddock	---	---	---	---	Low	Low	Low
MhB:							
Maddock	---	---	---	---	Low	Low	Low
Hecla	---	---	---	---	Moderate	Low	Low
MlB:							
Maddock	---	---	---	---	Low	Low	Low
Hecla	---	---	---	---	Moderate	Low	Low
Hamar	---	---	---	---	Moderate	High	Low
Mr:							
Marsh	---	---	---	---	High	High	Low
NuC:							
Nutley	---	---	---	---	Moderate	High	Low
Oc:							
Overly	---	---	---	---	High	High	Low
Od:							
Overly, MODERATELY SALINE	---	---	---	---	High	High	Moderate
Bearden, MODERATELY SALINE	---	---	---	---	High	High	Moderate
Oe:							
Overly, MODERATELY SALINE	---	---	---	---	High	High	Moderate
Bearden, MODERATELY SALINE	---	---	---	---	High	High	Moderate

SOIL FEATURES--Continued
Richland County, North Dakota

Map symbol and soil name	Restrictive layer				Potential for Frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated Steel	Concrete
		In	In				
OlB:							
Overly----------	---	---	---	---	High	High	Low
Beotia----------	---	---	---	---	High	High	Low
Pc:							
Parnell---------	---	---	---	---	High	High	Low
Pd:							
Parnell---------	---	---	---	---	High	High	Low
Tonka----------	---	---	---	---	High	High	Low
Pf:							
Peever----------	---	---	---	---	Moderate	High	Moderate
Forman----------	---	---	---	---	Moderate	High	Low
Pr:							
Perella, MODERATELY DEEP OVER CLAY------	---	---	---	---	High	High	Low
Ps:							
Perella, MODERATELY DEEP OVER CLAY------	---	---	---	---	High	High	Low
Ro:							
Roliss----------	---	---	---	---	High	High	Low
Ry:							
Fargo----------	---	---	---	---	High	High	Low
Ryan----------	---	---	---	---	Moderate	High	Moderate
Sd:							
Serden----------	---	---	---	---	Low	Moderate	Low
Se:							
Serden----------	---	---	---	---	Low	Moderate	Low
Stabilized Dune Land----------	---	---	---	---	Low	Moderate	Low
ShB:							
Sioux----------	---	---	---	---	Low	Low	Low
Renshaw---------	---	---	---	---	Low	Moderate	Low
ShE:							
Sioux----------	---	---	---	---	Low	Low	Low
Renshaw---------	---	---	---	---	Low	Moderate	Low
Sr:							
Stirum, LOAM----	---	---	---	---	Moderate	High	Moderate
Arveson---------	---	---	---	---	---	---	---
St:							
Strongly Saline Land----------	---	---	---	---	High	High	Moderate
Su:							
Svea----------	---	---	---	---	Moderate	High	Low
SvB:							
Svea----------	---	---	---	---	Moderate	High	Low
Buse----------	---	---	---	---	Moderate	Moderate	Low
SvC:							
Svea----------	---	---	---	---	Moderate	High	Low
Buse----------	---	---	---	---	Moderate	Moderate	Low
Sw:							
Svea----------	---	---	---	---	Moderate	High	Low
Gardena---------	---	---	---	---	High	Moderate	Low
Sy:							
Swenoda---------	---	---	---	---	Moderate	High	Low
Wyndmere--------	---	---	---	---	High	Moderate	Low
Td:							
Tiffany---------	---	---	---	---	High	High	Low
Tf:							
Tiffany---------	---	---	---	---	High	High	Low
Th:							
Tiffany, MODERATELY DEEP OVER CLAY------	---	---	---	---	High	High	Low
Tk:							
Tonka----------	---	---	---	---	High	High	Low
To:							
Towner----------	---	---	---	---	Moderate	High	Low

SOIL FEATURES--Continued
Richland County, North Dakota

Map symbol and soil name	Restrictive layer				Potential for Frost action	Risk of corrosion	
	Kind	Depth to top	Thickness	Hardness		Uncoated Steel	Concrete
		In	In				
Tw:							
Swenoda	---	---	---	---	Moderate	High	Low
Towner	---	---	---	---	Moderate	High	Low
Un:							
Ulen	---	---	---	---	Moderate	Low	Low
Va:							
Vallers	---	---	---	---	High	High	Low
Ve:							
Venlo	---	---	---	---	Moderate	High	Low
W:							
Water	---	---	---	---	---	---	---
Wa:							
Wahpeton	---	---	---	---	High	High	Low
Wahpeton, CHANNELED	---	---	---	---	High	High	Low
We:							
Wet Alluvial Land	---	---	---	---	High	High	High
Wy:							
Wyndmere	---	---	---	---	High	Moderate	Low
ZeD:							
Zell	---	---	---	---	High	Low	Low
Eckman	---	---	---	---	High	Moderate	Low
ZeE:							
Zell	---	---	---	---	High	Low	Low
Eckman	---	---	---	---	High	Moderate	Low