LEGEND AND NOTES TO ACCOMPANY SURFICIAL GEOLOGY AND GEOMORPHOLOGY MAPS 96 E, F, 106P

MAP[1] UNIT	NAME	SURFICIAL DEPOSIT		LANDFORM			GROUND ICE	LAND[2] ZONE	SOILS[3]					VEGETATION[4]			COMMENTS
		Material	Estimated Thickness	Topography	Drainage Pattern	% Water			Texture U.S.D.A.	Unified Classification	Micro-relief cm	Depth of thaw cm	Drainage (deciles)	Stable	After Fire	occurrence**	
fOv	Organic veneer (mapped mainly) as a secondary unit with tMp, tMv)	Peat - typically woody sedge peat	20-60 cm	Shallow channels, runs and depressions; Slope 0-3° Relief to 1 m	Surface seepage in channels, depressions	0-5	Organic veneer lies mainly within the active layer; (for ice in mineral soil below, see associated map unit).	0									Similar to fO; areas with mappable fOv component (+10%) should be avoided in construction of roads, pipelines etc.
								1	woody sedge peat over L-C mineral	Pt/CL-ML	Sedge tussocks 10-50	50-100	Poor to wet 10	Cx-Bi-tL	Cx-Wi	1	
								2	woody sedge peat over L-C mineral	Pt/CL-ML	Sedge tussocks 10-50	50-150	Poor to wet 10	Cx-Bi-tL	Cx-Bi-tL	1	
								3	woody sedge peat over L-C mineral	Pt/CL-ML	Sedge tussocks 10-30	100-200	Poor to wet 10	Cx-Bi-tL	Cx-Bi-tL	1	
								6N	woody sedge peat over L-C mineral	Pt/CL-ML	0	200+	Poor to wet 10	Cx-Al-tL	Cx-Al	1	
fO	Organic (fenland)	Peat - typically woody sedge peat	2-3 m	Flat to very gently to gently sloping, in part with reticulate network of low ridges. Slope 0-2° Relief to 1 m	No organised drainage; water at surface throughout summer months	5-20	Commonly unfrozen to 2+ m (see "Depth of Thaw" for respective zones) little data available on segregated ice content at greater depths.	0									Poor drainage, plus high compressibility and low strength of the material make it unsuitable for any type of construction.
								1	Mesic sedge peat	Pt	0 to tussocky	150 to unfrozen	Wet 10	Cx-Cott. or Cx-Bi-tL	Cx-Cott.	1	
								2	Mesic sedge peat	Pt	None Some sedge tussocks	200 to unfrozen	Wet 10	Cx-Cott. or Cx-Bi-tL	-	1	
								3	Mesic sedge peat	Pt	0	unfrozen	Wet 10	Cx-Cott. or Cx-Bi-tL	-	2	
								6N	Mesic sedge peat	Pt	0	unfrozen	Wet 10	Cx-Bi-tL	-	3	
pO	Organic (peatland)	Peat - typically sedge and woody sedge peat overlain by sphagnum peat	2-4 m	Flat to very gently sloping, typically with numerous shallow steep-sided (2-3 m) depressions occupied by lakes ponds and bogs.	Depressions interconnected by seepage channels	5-20	Commonly up to 20%, locally up to 60% segregated ice within peat; typically 30-100 cm, locally up to 3 m total thickness segregated ice in mineral soil immediately below peat. Peat in wet depressions commonly thawed to 1+ m (Zones 1,2) or unfrozen (Zones 2,3,6N).	0									Subsidence of up to 1 m common, and subsidence up to 3 m possible when vegetation is removed; alternation of permanently frozen peat plateaus and thawed depressions and water bodies presents serious problems in construction of roads, pipelines, etc.; material highly compressible when thawed.
								1	Fibric to mesic peat	Pt	Some polygon trenches to 100cm	20-30	Imp. 10	Lichen-bS	Sphagnum-Er	1	
								2	Fibric to mesic peat	Pt	Some sphagnum hummocks	25-30	Imp. 10	Lichen-bS	Sphagnum-Er	1	
								3	Fibric to mesic peat	Pt	Some sphagnum hummocks	25-30	Imp. 10	Lichen-bS	Sphagnum-Er	3	
								6N	Fibric to mesic peat	Pt	Some sphagnum hummocks	40-50	Imp. 7 Poor 3	bS-moss-Er Sphagnum-bS	Er-bS Sphagnum-Bi	2	
gAp s,gAp si/g Ap	Alluvial floodplain of high energy streams	Sand, gravel in part with silt veneer	1-5+ m sand and/or gravel 0 - 2 m silt	Flood plain and low bordering terraces scarred by braided channels Slope 0-3° Relief to 2 m	Intermittent drainage through braided channels	0	Permafrost lacking in unvegetated parts of floodplain; elsewhere cement ice only or locally unfrozen (Zones 3,6N), except in silt veneer which commonly has 10-25% segregated ice as thin (1 mm - 2 cm) seams.							Occasionally flooded	Frequently* flooded		Subject to periodic flooding; constitutes potential reserve of gravel but extraction presents serious possibility of deleterious changes in stream course and downstream changes in stream regimen.
								0									
								1	S+G	SM-GM	0	50-200	Imp. to well	Wi-Al	bare	1	
								2	S+G	SM-GM	0	50-200	Imp. to well	Wi-Al	bare	1	
								3	S+G	SM-GM	0	50-200+	Imp. to well	bPo-Al-Wi	bare	1	
								6N	S+G	SM-GM	0	200 to unfrozen	Well 4 Imp. 3 Poor 3	wS-bPo bPo-wS bPo-Al-Wi	bare bare bare	1	
s,siAp siAp	Alluvial floodplain of low energy streams	Fine-grained sand, silt	3-5+ m	Flood plain and low bordering terraces, commonly with meander scars Slope 0-3° Relief to 1 m	No integrated drainage system; impeded by meander scroll ridges where present	0-20	Permafrost lacking in unvegetated part of floodplain; elsewhere 10 to 25% segregated ice by volume as thin (1 mm - 2 cm) seams. Cement ice only in sandier units and locally unfrozen (Zone 6N). Ice wedges in polygonal pattern (diameter of polygons 6-25 m) common in Zone 2.	0									Subject to periodic flooding; possible occurrence of ice wedges which upon removal of vegetation will melt and produce a polygonal network of depressions.
									FSL to SiL	SM to CL-ML	0	50 to unfrozen	Imp. 4 Poor 6	wS Cx-tL	Wi-Al Cx-Wi	1	
								2	FSL to SiL	SM to CL-ML	0	100 to unfrozen	Imp. 4 Poor 6	wS-bS Cx-tL	Wi-Al Cx-Wi	1	
								3	FSL to SiL	SM to CL-ML	0	100 to unfrozen	Imp. 4 Poor 6	wB-bPo-wS Cx-tL	Wi-Al Cx-Wi	1	
								6N	FSL to SiL	SM to CL-ML	0	200 to unfrozen	Imp. 5 Poor 5	bPo-wS Cx-tL	bare bare	2	
s,siApk siApk	Thermokarst alluvial floodplain (associated with low energy streams only)	Fine-grained sand, silt	3-5+ m	Level floodplain, in part with meander scars, and with numerous channels and thermokarst ponds. Slopes 0-3°, short steep slopes to 45° Relief to 5 m	Seepage to ponds and lakes to adjacent streams by connecting channels	20-50	20 to 50% segregated ice by volume in upper 2-3 m (and probably to greater depth). No data for Zone 6N.	0									Thermokarst processes active around pond margins; possible occurrence of ice wedges which upon removal of vegetation will melt and produce a polygonal network of depressions.
								1	FSL to SiL	SM to CL-ML	Hummocks and trenches 0-40	40-200+	Mod. well 1 Imp. 4 Poor 5	wS wS-bS-lichen Cx-Wi	- - -	1	
								2	FSL to SiL	SM to CL-ML	Hummocks 0-50	50-200+	Mod. well 2 Imp. 4 Poor 4	wS wS-bS-lichen Cx-Wi	- - -	1	
								3	FSL to SiL	SM to CL-ML	Hummocks 0-20	100 to unfrozen	Mod. well 2 Imp. 4 Poor 4	wS wS-bS Cx-tL	wB-bPo-wS bPo-Al Cx-Wi	1	
								6N	FSL to SiL	SM to CL-ML	0	200 to unfrozen	Mod. well 2 Imp. 4 Poor 4	wS-moss wS-bS Cx-tL	bPo-wS-bS bPo-Al Cx-Wi	1	
gAt s,gAt si/g At	Alluvial terrace of high energy streams	Sand, gravel in part with silt veneer	1-5+ m sand and/or gravel 0-2 m silt	Level to gently sloping terrace, in part with shallow channels and steep scarps. Slope 0-3°, locally to Relief to 5 m greater at scarps.	Surface drainage without integrated drainage system	0-5	Cement ice only or locally unfrozen (Zones 3,6N), except in silt veneer which commonly has 10 to 25% segregated ice as thin (1 mm - 2 cm) seams.	0									Offer good construction sites where silt veneer is thin; potential aggregate source.
								1	S -SiL (often over gravel)	SM to CL-ML	Hummocks 0-20	75-150	Mod. well 3 Imp. 5 Poor 2	wS wS-bS-lichen Cx-Wi	wB-wS Al-Wi Wi-Cx	1	
								2	SL-SiL (often over gravel	SM to CL-ML	Hummocks 0-20	75-150	Mod. well 3 Imp. 5 Poor 2	wS-lichen bS-lichen Cx-Wi	wS-bPo bPo Wi-Al	1	
								3	SL-SiL (often over gravel)	SM to CL-ML	Hummocks 0-20	100 to unfrozen	Mod. well 3 Imp. 5 Poor 2	wS wS-bS Cx-Wi	wB wB-bS Cx-tL	1	
								6N	SL-SiL (often over gravel)	SM to CL-ML	0	200 to unfrozen	Mod. well 4 Imp. 4 Poor 2	wS-tA wS-bPo bS-sphagnum	jP tA-bS Wi-sphagnum	1	
s,siAt	Alluvial terrace of low energy streams	Fine-grained sand, silt; locally with veneer of eolian silt or sand	1-10 m sand and silt	Level to gently sloping terrace, in part with shallow channels and steep scarps. Slope 0-3°, locally to 30° Relief to 5 m greater at scarps.	Surface drainage without integrated drainage system	0-20	No data for Zone 2; segregated ice as thin (1 mm - 2 cm) seams in Zone 3; probab cement ice only in sand units in Zone 6N; absence of naturally occurring thermokarst on terraces suggests that massive ground ice bodies are not present.	0									
								1									
								2	FSL to SiL	SM to ML	0	100 to unfrozen	Imp. 4 Poor 6	wS-bS Cx-tL	Wi-Al Cx-Wi	1	
								3	FSL to SiL	SM to ML	0	100 to unfrozen	Imp. 4 Poor 6	wB-bPo-wS Cx-tL	Wi-Al Cx-Wi	1	
								6N	FSL to SiL	SM to ML	0	200 to unfrozen	Imp. 5 Poor 5	bPo-wS Cx-tL	Al Cx-Wi	1	
Af si,sAf si,s,gAf siAf	Alluvial fans and fan aprons	Highly variable-silt, sand, gravel, peat	2-15 m	Gently to moderately sloping fans and aprons. Slopes 1-12°	One or more shifting streams usually present; downslope seepage in poorly defined runs	0	Highly variable; low in gravel, mod. to very high in silt (the more common case). Thin seams in upper 2-3 m, thick layers to 30+ cm depth. Ice content generally lower in coarser sediments at head of fan than in finer sediments at outer margin.	0									Fans subject to sudden and damaging shifts of streams; fans with high silt content are unsuitable for construction.
								1	Variable; generally SL-SiL	Variable	Hummocks 0-50	50-100+	Mod. well 2 Imp. 6 Poor 2	wS wS-bS-lichen Cx-Wi	Wi-Al Wi-Al Cx-Wi	1	
								2	Variable; generally SL-SiL	Variable	Hummocks 0-50	50-100+	M. w.-well 3 Imp. 6 Poor 1	wS-wB bS-lichen Cx-tCx-Wi	Wi-Al-tCx Wi-Al-tCx Cx-tCx	1	
								3	Variable; generally SL-SiL	Variable	0	100 to unfrozen	Mod. well 3 Imp. 6 Poor 1	wS-wB bS-moss Cx-tL	Wi-bPo Wi-Al Cx-Wi	1	
								6N	Variable; generally SL-SiL	Variable	0	100 to unfrozen	Mod. well 3 Imp. 6 Poor 1	tA-wS bS-moss bS-sphagnum	tA tA-wS Cx-Wi	1	
gAf	Alluvial fans	Gravel, sand	2-50+ m	Gently to moderately and steeply sloping fans Slopes 3-12°	One or more shifting streams usually present; considerable subsurface seepage	0	No data; active (bare) fans probably unfrozen and cement ice only in inactive (vegetated) fans.							Seldom flooded	Frequently* flooded		Fans composed of gravel offer well-drained building sites but sudden and damaging shifts of streams on the fans are common; gravel fans are good sources of aggregate; subsurface drainage may cause difficulties in utilization of borrow pits.
								0									
								1	S+G	SM-GM	0	75-150	Mod. well 6 Imp. 3 Poor 1	wS-lichen wS-bS-lichen Cx-tL	bare	1	
								2	S+G	SM-GM	0	100 to unfrozen	Mod. well 6 Imp. 3 Poor 1	wS-lichen bS-lichen Cx-tL	bare	1	
								3	S+G	SM-GM	0	100 to unfrozen	Mod. well 8 Imp. 1 Poor 1	wS wS-bS Cx-tL	bare	1	
								6N									
Cx	Colluvial complex	Colluvium derived from entire range of surficial deposits plus bedrock detritus	1-5+ m	Steeply sloping valley walls and scarps. Slope 12 to 45° Relief to 300 m		0								South aspect	North aspect*		Active stream erosion, slumping, retrogressive-thaw flow slides, active-layer detachment slides common; irregularity of topography and slope instability present major problems for any kind of construction; see comments re map unit on which colluvium is developed.
								0	Variable	-	Stripes 0-20	30-200	Excess 4 Well 4 Imp. 2	bare Bi-Wi tCx	Cx-lichen tCx-Wi-sphagnum tCx-Cott.	1	
								1	Variable	-	0	30-250	Excess 4 Well 4 Imp. 2	bare Grass-wB bS-lichen	Cx bS-lichen bS-lichen	1	
								2	Variable	-	0	30-300	Excess 4 Well 4 Imp. 2	bare tA-wS-wB bS-lichen	Cx bS-lichen bS-lichen	1	
								3	Variable	-	0	50-300+	Excess 4 Well 4 Imp. 2	Grass tA-wB-wS bS-wS	Wi-Al bS-wS bS-lichen	1	
								6N	Variable	-	0	100 to unfrozen	Excess 5 Well 3 Imp. 2	wB-tA wB-wS bS-Er	bare Wi-wB Bi-sphagnum	1	
Cv	Colluvial veneer	Rock detritus, minor glacially transported material	0-2 m	Veneer conforms to bedrock topography Hilly to mountainous Slopes to 35°	Generally freely drained	0		0	Variable	-	Solifluction lobes and terraces 0-75	20-200	Well 8 Imp. 1 Poor 1	Cx Cott.-tCx tCx-sphagnum		3	Sorted polygons, stone stripes, in part active, suggest cryoturbation; solifluction lobes on high slopes (elev. 1200+ m) of Mackenzie and Franklin Mountains indicate active creep of colluvial veneer. On steep, undissected slopes in surficial units in lowland areas, where thin drift commonly masks bedrock, colluviation may affect both the drift and underlying bedrock.
								1	Variable	-	0	50-200	Well 8 Imp. 1 Poor 1	wS-wB bS-lichen tL-bS-Cx	Bi-Al Al-Wi Wi-Cx	1	
								2	Variable	-	0	200+	Well 8 Imp. 1 Poor 1	wB-wS wS-bS Wi-tL	wB wB-bS Cx-Wi	1	
								3	Variable	-	0	200 to unfrozen	Well 8 Imp. 1 Poor 1	wS-wB wS-bS Cx-tL	tA-wB wB-bS Wi-Cx	1	
								6N									
sE sEv	Eolian deposits	Sand, mainly fine to medium grained	1-20 m	Thin veneer or dune ridges within or adjacent to areas of Gp or Lp Slope to 20° Relief to 10 m	Mainly subsurface seepage; no organised drainage	0	No data; probably cement ice only below active layer and locally unfrozen; segregated ice highly probably in subjacent glaciolacustrine silts where eolian deposits occur within areas of Lp.	0									Offers restricted well-drained sites within large areas of poorly drained sandier units of Lp,Lpk; subject to wind erosion when vegetation mat is removed. Gulleying commonly occurs upon removal of the vegetation mat in areas where eolian sand forms a thin veneer over ice-rich till or lacustrine sediments.
								1									
								2									
								3	LS-S	SP	0	50 to unfrozen	Well 7 Imp. 2 Poor 1	tA-wS wS-wB bS-tL-Cx	tA wB tL-Wi	1	
								6N	LS-S	SP	0	70 to unfrozen	Well 5 Imp. 2 Poor 3	tA-wS wS-bPo bS-sphagnum	jP tA-bS Wi-sphagnum	2	
si,cLp cLp siLp si,c,sLp	Glaciolacustrine plain	Glaciolacustrine silt and clay, minor sand; discontinuous organic cover	1-20+ m silt and clay, minor sand	Flat to gently sloping Slope 0-2° Relief to 3 m	Surface seepage through fen-filled depressions	0-20	Commonly 10 to 25% (5-15% in Zones 3,6N) segregated ice as thin (1 mm - 2 cm) seams in upper 1-3 m; segregated ice as reticulate network to 40% (to 25% in Zone 6N) by volume, or thick tabular bodies of nearly pure ice at greater depth (no data for Zone 6N).	0									Active-layer detachment slides, followed by development of retrogressive-thaw flow slides, common on this unit (and on lesser areas of steep slope not mapped as Cx), especially following fire or other disturbance of vegetation. Gulleying commonly results even on gentle slopes upon removal of vegetation due to combined hydraulic and thermal erosion and disruption of the drainage network.
								1	SiL-SiC	CL-ML to ML	Hummocks 20-60	50-90	Imp. 4 Poor 6	wS-bS-lichen Cx-tL	wB-wS-Wi Wi-Al	1	
								2	SiL-SiC	CL-ML to ML	Hummocks 20-75	50-100	Imp. 5 Poor 5	bS-lichen-tCx bS-tL-Cx	wB-Wi Wi-tL	1	
								3	SiL-SiC	CL-ML to ML	Hummocks 10-50	50-200	Imp. 5 Poor 5	bS-lichen tL-bS-Cx	bS-lichen tL-Wi-Cx	1	
								6N	SiL-SiC	CL-ML to ML	Hummocks 0-30	50-200	Imp. 5 Poor 5	wB-moss bS-moss	bS-wB bS-Wi	1	
si,cLpk si,c,sLpk	Glaciolacustrine thermokarst plain	Glaciolacustrine silt and clay, minor sand; discontinuous organic cover	1-20+ m silt and clay, minor sand	Flat to gently sloping, numerous shallow thermokarst lakes and ponds Slope 0-5° Relief to 6 m	Seepage centripetal to ponds and lakes, intermittent seepage through fen-filled depressions between ponds and lakes	25	As si,cLp	0									Thermokarst processes active around pond margins; active-layer detachment slides, followed by development of retrogressive-thaw flow slides, common on colluvial slopes (Cx) developed on this unit (and on lesser areas of steep slope not mapped as Cx), especially following fire or other disturbance of vegetation. Gulleying is common even on gentle slopes upon removal of vegetation.
								1									
								2	SiL-SiC	CL-ML to ML	Hummocks 20-75	50-150+	Mod. well 2 Imp. 5 Poor 3	wS-wB-bS bS-lichen-tCx tL-bS-Cx	wS-bS-Wi wS-wB-Wi tCx-Wi-tL	1	
								3	SiL-SiC	CL-ML to ML	Hummocks 0-50	60-200	Mod. well 2 Imp. 5 Poor 3	wS-bS-moss bS-lichen bS-sphagnum	wB-wS wB-bS-Al tL-Wi	3	
								6N	SiL-SiC	CL-ML to ML	Hummocks 0-20	80-200	Mod. well 2 Imp. 5 Poor 3	wS-moss bS-moss bS-moss-Er	tA-wB bS-wB-Er Wi-Bi	2	
s,siLp si,sLp sLp s,si/si,c Lp s/si,c Lp	Glaciolacustrine plain	Glaciolacustrine sand and silt commonly overlying glaciolacustrine silt and clay; discontinuous organic cover	2-30+ m sand and silt 3-15+ m silt and clay	Flat to gently sloping Slope 0-2° Relief to 3 m	Surface seepage through fen-filled depressions and subsurface seepage in sandier areas	0-20	Commonly 10-25% segregated ice as thin (1 mm - 2 cm) seams, but segregated ice rare in sand; locally in Zone 6N cement ice only or unfrozen to depth of 2-5 m.	0									Active-layer detachment slides, followed by development of retrogressive-thaw flow slides, common on colluvial slopes (Cx) developed on this unit (and on lesser areas of steep slope not mapped as Cx), especially following fire or other disturbance of vegetation. Rotational slope failures (S) common along banks of larger streams where sand and silt is thicker than 10m. Gulleying is common even on gentle slopes upon removal of vegetation.
								1									
								2									
								3	FSL to SiL	SM to ML	Hummocks 0-30	50-200	Mod. well 2 Imp. 4 Poor 4	tA-wS-wB bS-lichen bS-tL-Cx	wS-wB bS-wB tL-Wi-Cx	3	
								6N	FSL to SiL	SM to ML	Hummocks 0-20	80-200+	Mod. well 2 Imp. 4 Poor 4	tA-wS-wB bS-moss bS-moss-Er	wS-wB bS-wB-Er Wi-Bi	3	
s,siLpk si,sLpk s,si/si,c Lpk	Glaciolacustrine thermokarst plain	Glaciolacustrine sand and silt commonly overlying glaciolacustrine silt and clay; discontinuous organic cover	2-30+ m sand and silt 3-15+ m silt and clay	Flat to gently sloping, numerous shallow thermokarst lakes and ponds Slope 0-5° Relief to 6 m	Seepage centripetal to ponds and lakes, intermittent seepage along fen-filled depressions between ponds and lakes	25	As s,siLp	0									Thermokarst processes active around pond margins; active-layer detachment slides, followed by development of retrogressive-thaw flow slides, common on colluvial slopes (Cx) developed on this unit (and on lesser areas of steep slope not mapped as Cx), especially following fire or other disturbance of vegetation. Rotational slope failures (S) common along banks of larger streams where sand and silt is thicker than 10m. Gulleying is common even on gentle slopes upon removal of vegetation.
								1									
								2									
								3	FSL to SiL	SM to ML	Hummocks 10-40	50-200+	Mod. well 2 Imp. 6 Poor 2	wS-wB bS-lichen tL-bS-Cx	wS-wB-Al bS-wB tL-Wi-Cx	3	
								6N	FSL to SiL	SM to ML	Hummocks 0-20	80-200+	Mod. well 2 Imp. 5 Poor 3	wS-tA-wB bS-moss bS-moss-Er	wS-wB bS-wB-Er Wi-Bi	3	
sLb sLbx	Glaciolacustrine beach	Sand, minor gravel	1-3 m exceptionally to 15 m (see comments)	Ridges and terraces Slope to 15° Relief to 5 m	Drainage mainly subsurface	0	No data; probably cement ice only and locally unfrozen in Zone 6N.	0									Offers restricted well-drained sites at margins of large areas of poorly drained units of Lp,Lpk; locally in the Norman Wells area thin beach deposits have probably been derived from reworking of underlying glaciofluvial sands and gravels (probably kame terraces).
								1									
								2									
								3	S to FS	SM to SW	0	70 to unfrozen	Well 6 Imp. 3 Poor 1	tA-wS wS-bPo bS-sphagnum	jP tA-bS Wi-sphagnum	1	
								6N	S to FS	SM to SW	0	70 to unfrozen	Well 6 Imp. 3 Poor 1	tA-wS wS-tA bS-tL-Cx	tA wB-bS tL-Wi	1	
gLb	Glaciolacustrine beach	Gravel, minor sand	1-3 m exceptionally to 15 m (see comments)	Ridges and terraces Slope to 15° Relief to 5 m	Drainage mainly subsurface	0	No data; probably cement ice only.	0									Offers good but restricted construction sites; in the Norman Wells area thin beach gravels have probably been derived from reworking of underlying glaciofluvial gravels (probably kame terraces). Beach gravels (and the underlying glaciofluvial gravels) are a good source of aggregate.
								1									
								2									
								3	S-G	SW-GW	0	Unfrozen	Well 7 Imp. 3	tA-wS wS-wB	tA wB	1	
								6N									
gGp s,gGp sGp gGt s,gGt sGt	Glaciofluvial plain Glaciofluvial terrace	Sand, gravel, locally with veneer of eolian silt or sand; locally silt, peat in channels	2-30+ m	Flat to gently sloping Slope 0-2° Relief to 5 m Interrupted by shallow channels and low scarps Relief to 10 m, exceptionally to 30 m	Drainage mainly subsurface; locally with seepage along channels	0-5	Typically cement ice only; absence of permafrost common in Zone 6N; segregated ice may be present within silt and below peat in channels.	0	G+S	GW-SW	-	50-150	Well 5 Imp. 4 Poor 1	Bi Bi-Wi tCx-sphagnum	Cx Wi tCx	1	Offers good construction sites; major source of aggregate where material is gravel rather than sand or in channels which may contain peat and ice-rich silt. Where unit grades into units Lp,Lpk, the surface deposit is typically sand rather than gravel and may be underlain by ice-rich silt.
								1	G+S	GW-SW	Hummocks 0-10	75-150	Well 5 Imp. 4 Poor 1	wS-lichen bS-lichen tL-Bi-Cx	wB-Wi-wS bS-wS-Wi Cx-Bi	1	
								2	G+S	GW-SW	Hummocks 0-10	75-150+	Well 6 Imp. 3 Poor 1	wS wS-bS-lichen tL-bS-Cx	wS-wB-grass wS-bS-wB Cx-tL	1	
								3	G+S	GW-SW	0	150 to unfrozen	Well 7 Imp. 2 Poor 1	wS bS-wS tL-bS-Cx	wS-wB wS-bS-wB Cx-tL	1	
								6N	G+S	GW-SW	0	150 to unfrozen	Well 7 Imp. 2 Poor 1	tA-wS tA-bS-Wi bS-moss-Er	jP wB-jP-Wi bS-moss	2	
gGh s,gGh gGr s,gGr	Hummocky, ridged glaciofluvial deposits (includes eskers and esker complexes)	Gravel, sand		Hummocks and ridges, relief to 40 m Slope 5-15°	Drainage mainly subsurface	0	Typically no segregated ice in well drained sites (absence of permafrost locally in Zone 6N), but segregated ice may be present in association with silt layers beneath depressions.	0									Offers good construction sites; major source of aggregate where material is gravel rather than sand.
								1	G+S	GW-SW	0	50-150+	Well 8 Imp. 2	wS-wB bS-wS	wB-wS-grass wB-wS-bS	1	
								2	G+S	GW-SW	0	150+	Well 8 Imp. 2	wS-wB bS-wS-lichen	wS-wB-grass wS-wB-bS	1	
								3	G+S	GW-SW	0	150 to unfrozen	Well 7 Imp. 2 Poor 1	tA-wS wS-bS bS-tL-Cx	wS-wB wB-wS-bS Cx-tL	1	
								6N	G+S	GW-SW	0	200 to unfrozen	Well 7 Imp. 2 Poor 1	tA-wS tA-bS-Wi bS-moss-Er	jP wB-jP-Wi bS-moss	1	
tMp tMv tMpv	Moraine plain	Glacial till - typically clay, silt, minor sand and gravel. Locally up to 90% > 2 mm	tMp: 2-20 m tMv: 0-3 m tMpv: 1-20 m	Flat to gently sloping (0-3°) except as indicated by the slope superscript Relief to 5 m	Downslope seepage in shallow subparallel runnels	0-5	Commonly 10-25% segregated ice as thin (1 mm - 2 cm) irregular discontinuous seams in upper 2-3 m. Thicker (10 cm to 3+ m) ice lenses at depth locally in Zones 1,2, rare in Zone 3. Unfrozen ground common in Zone 6N where permafrost is controlled by exposure, elevation, drainage, and/or organic cover.	0									Potential subsidence on removal of vegetation typically less than 1 m (but note that unit may have up to 10% unmapped fO or pO, and that locally ice content at depth may be high); because of drainage by numerous subparallel runnels, roads or berms normal to slope direction require numerous culverts to avoid impoundment of surface water.
								1	CL-L	CL to ML	Hummocks 20-60	50-80	Mod. well 2 Imp. 4 Poor 4	wS-lichen bS-wS-lichen tL-bS-Cx	wB-wS wB-wS-Wi Cx-Al-Wi	3	
								2	CL-L	CL to ML	Hummocks 10-40	50-150	Mod. well 2 Imp. 5 Poor 3	bS-wS-wB bS-lichen tL-bS-Cx-Al	wS-wB-bS wS-wB-Wi Cx-Al	3	
								3	CL-L	CL to ML	Hummocks 0-30	50-200	Mod. well 2 Imp. 5 Poor 3	wS-bS-bPo bS-lichen tL-bS-Cx	wB-wS-Al bS tL-Wi-Cx	3	
								6N	CL-L	CL to ML	Hummocks 0-20	80 to unfrozen	Mod. well 3 Imp. 4 Poor 3	wS-tA-wB wS-tA bS-moss-Er	tA-jP-wB bS-tA-Wi bS-Er	3	
tMp^1 tMv^1 $tMpv^1$ tMp^2 tMv^2	Moraine plain	Glacial till	tMp^1: 2-20 m tMv^1: 0-3 m $tMpv^1$: 1-20 m tMp^2: 2-20 m tMv^2: 0-3 m	$Slope^1$ 3-8° $Slope^2$ 8-12°	Downslope seepage in shallow subparallel runnels	0-5	As tMp	0									Potential subsidence on removal of vegetation typically less than 1 m; potential for creep of active layer, especially in slope $category^2$. Because of drainage by numerous subparallel runnels, roads or berms normal to slope direction require numerous culverts to avoid impoundment of surface water.
								1	CL-C	ML-CL	Hummocks 20-75	50-150	Mod. well 3 Imp. 6 Poor 1	wS-lichen bS-wS-lichen tL-bS-Cx	wB-wS wB-wS-Wi Cx-Al-Wi	1	
								2	CL-SiC (locally some L)	ML-CL	Hummocks 20-60	50-150	Mod. well 5 Imp. 4 Poor 1	bS-wS-wB bS-lichen bS-tL-Cx	wS-wB-bS bS-wS-Wi Cx-tL	1	
								3	CL	CL	Hummocks 0-30	50-200	Well 4 Imp. 4 Poor 2	wS-bS-wB bS-lichen tL-bS-Cx	wB-wS-Al bS tL-Wi-Cx	1	
								6N	CL	CL	Hummocks 0-20	80 to unfrozen	Well 4 Imp. 4 Poor 2	wS-tA-wB wS-tA bS-moss-Er	tA-jP-wB bS-tA-Wi bS-Er	2	
tMd	Drumlin moraine plain	Glacial till	2-30+ m	Moraine plain with individual drumlins, to fluted moraine plain Slope 2-15° Relief to 60 m	Parallel seepage or streams in fluted moraine, to trellis pattern or deranged drainage in moraine plain with drumlins	0-15	No data; segregated ice may be present in clay or silt tills but only cement ice in gravelly tills in crests of drumlins in Zone 6N; intervening depressions probably contain segregated ice in association with silt layers.	0									Similar to tMp; crests of drumlins and drumlinoid ridges typically well-drained, intervening depressions poorly drained; construction of roads, etc. easier parallel to than normal to orientation of drumlins. Locally on Fort Norman map sheet (96C) drumlinoid ridges are probably composed of ice-moulded Tertiary bedrock with a thin veneer of till.
								1									
								2	GL-CL	GC-CL	Hummocks 0-30	50-150	Well 3 Imp. 4 Poor 3	bS-wS-wB bS-lichen bS-tL-Cx	wS-wB-bS wS-wB-Wi Cx-tL	1	
								3	GL-CL	GC-CL	Hummocks 0-30	50-200	Well 3 Imp. 4 Poor 3	wS-wB-bPo bS-lichen tL-bS-Cx	wB-wS-Al bS tL-Wi-Cx	1	
								6N	GL-CL	GC-CL	Hummocks 0-20	80 to unfrozen	Well 4 Imp. 2 Poor 2	wS-tA-wB wS-tA bS-moss-Er	tA-jP-wB bS-tA-Wi bS-Er	1	
tMm t,gMm	Subdued hummocky moraine	Glacial till, minor gravel	5-30 m	Broad hummocks 10 to 30 m high 100 to 500 m across Slopes to 10°	Deranged; centripetal to local depressions	5-30	Commonly up to 10%, locally up to 40% (probably less in Zone 3) segregated ice as thin (1 mm - 2 cm) irregular discontinuous seams in upper 2-3 m. Thicker (10 cm to 3+ m) ice lenses common in Zones 0, 1, locally in Zone 2, rare in Zone 3.	0	CL-L (locally some G)	CL to ML (some GC)	Hummocks 30-60	50-75	Imp. 8 Poor 2	Cott.-tCx tCx-sphagnum			Summits of broad hummocks typically well drained, similar to tMp; lower slopes and intervening depressions may have high ice content, with potential for subsidence of serveral metres on removal of vegetation.
								1	CL-L (locally some G)	CL to ML (some GC)	Hummocks 20-75	50-150	Mod. well 3 Imp. 5 Poor 2	wS-lichen bS-wS-lichen tL-bS-Cx	wB-wS wB-wS-Wi Cx-Al-Wi	1	
								2	CL-L (locally some G)	CL to ML (some GC)	Hummocks 20-60	50-150	Mod. well 5 Imp. 3 Poor 2	wS-lichen bS-lichen bS-tL-Cx	wS-wB-bS wS-wB-Wi Cx-tL	1	
								3	CL-L (locally some G)	CL to ML (some GC)	Hummocks 0-30	50-200	Mod. well 4 Imp. 2 Poor 4	wS-bS-bPo bS-lichen bS-tL-Cx	wB-wS-Al bS tL-Wi-Cx	1	
								6N									
tMh t,gMh tMr t,gMr	Hummocky moraine Ridged moraine	Glacial till, minor gravel Glacial till, minor gravel	15-50+ m 15-50+ m	Individual to coalescent hummocks 15 to 50+ m high; Slopes to 20°, exceptionally 30° Individual and compound straight to sinuous ridges 15 to 50+ m high; Slopes to 20°, exceptionally 30°	Deranged, centripetal to local depressions	0-15	Highly variable depending upon topographic postion; crests of prominent hummocks and ridges well-drained and ice-free to depths of 2-5 m; lower slopes as for tMm.	0	GL-CL (local gravel deposits)	GC-GM to CL	Hummocks 15-50	80-90	Mod. well 2 Imp. 6 Poor 2	Bi-Cx Cott.-tCx tCx-sphagnum			Crests of prominent ridges and hummocks offer restricted good construction sites. Ice content and potential for subsidence may be high in depression.
								1	GL-CL (local gravel deposits)	GC-GM to CL	Hummocks 0-60	50-150	M.well-well 5 Imp. 4 Poor 1	wS-lichen bS-wS-lichen tL-bS-Cx	wB-wS wB-wS-Wi-Al Cx-Al-Wi	1	
								2	GL-CL (local gravel deposits)	GC-GM to CL	Hummocks 0-50	50-120	M.well-well 6 Imp. 3 Poor 1	wS-wB-bS bS-lichen bS-tL-Cx	wS-wB wS-wB-Wi Cx-tL	1	
								3	GL-CL (local gravel deposits)	GC-GM to CL	Hummocks 0-30	50-200	Mod. well 6 Imp. 3 Poor 1	wS-wB-bPo bS-lichen tL-bS-Cx	wB-wS-Al bS-Er tL-Wi-Cx	1	
								6N									
g,tMh g,tMr	Hummocky moraine (includes hummocky ablation moraine) Ridged moraine (includes crevasse fillings)	Bouldery glacial till, gravel, minor clay or silty till Bouldery glacial till, gravel, minor clay or silty till	15-50+ m 15-50+ m	Individual to coalescent hummocks 15 to 50+ m high; Slopes to 20°, exceptionally 30° Individual and compound straight to sinuous ridges 15 to 50+ m high; Slopes to 20°, exceptionally 30°	Mainly subsurface	0	Segregated ice only present where material is clay or silt till; probably cement ice only in gravels; crests of prominent hummocks and ridges well-drained and ice-free to depths of 2-5 m; segregated ice in silt and clay filled depressions.	0	LG-L	GM to SM	0-30	50-90	Well 6 Imp. 3 Poor 1	Bi-Cx Cott.-tCx tCx-sphagnum	- - -	1	Crests of promenent ridges and hummocks commonly well drained and offer restricted good construction sites; major source of aggregate where material is gravel rather than bouldery till, clay or silty till.
								1	LG-L	GM to SM	0-30	50-150	Well 6 Imp. 3 Poor 1	wS-lichen bS-wS-lichen tL-bS-Cx	wS-wB wB-wS-Wi-Al Cx-tL	1	
								2	LG-L	GM to SM	0	50-150	Well 7 Imp. 2 Poor 1	wS-wB-bS bS-lichen bS-tL-Cx	wS-wB wS-wB-Wi Cx-tL	1	
								3	LG-L	GM to SM	0	50 to unfrozen	Well 7 Imp. 2 Poor 1	wS-bS-tA wS-wB bS-moss-Er	jP-wB bS-tA-Wi bS-Er	1	
								6N									
R	Bedrock	Tertiary conglomerates, sandstones, shales. Cretaceous sandstones, shales. Paleozoic sandstones, carbonates, shales evaporites, quartzites.		Mainly prominent ridges, scarps and hills developed on resistant sandstones, quartzites and carbonates	Generally freely drained but with some poorly drained depressions	0	No records of segregated ice, but possibility of ice in joints and fracture zones; segregated ice may be present in silt filled depressions. Ice-filled fractures observed locally in sandstone in Zone 1, probable also in Zones 0,2,3; thin ice lenses possible in shales near surface in Zones 0 to 3; thin seams of ice observed in weakly consolidated Tertiary siltstone in Zone 6N.	0	Variable	-	0	-	Excess 7 Imp. to Poor 3	bare tCx-sphagnum	bare -	3	Carbonate rocks of Paleozoic age provide suitable material for rip-rap and crushed aggregate; sandstones and shales of Imperial Formation readily rippable to provide fill; shales, especially bentonitic shales of Cretaceous age, subject to massive slides; weakly-cemented conglomerates of Tertiary age are a major source of aggregate.
								1	Variable	-	0	-	Excess 8 Imp. to Poor 2	Bare to scattered wB-Al-bS bS-tL-Cx	bare Cx-Wi-tL	2	
								2	Variable	-	0	-	Excess 8 Imp. to Poor 2	Bare to scattered wB-Al-bS bS-tL-Cx	Scattered wB-bS Cx-Wi-tL	1	
								3	Variable	-	0	-	Excess 8 Imp. to Poor 2	Scattered wB-wS bS-moss-Er	Bare to scattered wB bS-Wi	1	
								6N									

1. MAP UNIT DESIGNATION

Texture	Genetic Category	Morphology
f-fen	O - organic	v - veneer (< 1.5 m thick)
p-peat	A - alluvial	p - plain
c-clay	C - colluvial	t - terrace
si-silt	E - eolian	d - drumlinoid
s-sand	G - glaciofluvial	s - striated (i.e. fluted)
g-gravel	M - morainal	m - rolling
t-till	S - slumped	h - hummocky
	R - bedrock	r - ridged
sh-shale		k - kettled (glaciofluvial) or thermokarst (glaciolacustrine or alluvial)
ss-sandstone		f - fan
		c - channelled
		x - complex
		b - beach

Superscripts: ^{1}slope (3-8°) ^{2}slope (8-12°)

The use of map unit designators is illustrated by the following examples:

tMp^1
- Genetic category designator "M" indicates that the unit is of morainal (glacial) origin
- textural modifier "t" indicates that the surficial material is till, a mixture of clay, silt, sand and gravel sizes
- morphologic modifier "p" indicates the surface is a plain
- superscript "1" indicates that the surface has a slope between 3 and 8°

$\frac{si,s}{g}At$
- Genetic category designator "A" indicates that the unit is of alluvial origin
- textural modifier "$\frac{si,s}{g}$" indicates that the surficial material consists of silt with significant sand content, overlying gravel
- morphologic modifier "t" indicates that the area is a terrace (i.e. above the floodplain level of the nearest stream)

Mixed Units

Where the areas of two or more map units are too small to be separately delineated at the map scale, mixed units are used. A common combination is tMp and pfO; the unit comprising over 50% of the total areas is shown first; where the secondary unit comprises 49-25%, the combination is shown as tMp-pfO; where the secondary unit comprises 24-5%, the combination is shown as tMp/pfO; percentages less than 5% are ignored.

MAP SYMBOLS

Geological boundary, defined:

approximate:

assumed or transitional:

Escarpments, bedrock:

unconsolidated sediments (with or without underlying bedrock):

Glacial limit:

Shoreline:

Moraine ridge:

Backwall scarp (bedrock) of major slide:

Backwall scarp (retrogressive-thaw flow slide):

Esker:

Drumlin, drumlinoid ridge, ice movement inferred from form:

ice movement not inferred from form:

Prominent hummocks (commonly gravel):

Meltwater channel (major):

Meltwater channel (minor):

Patterned ground:

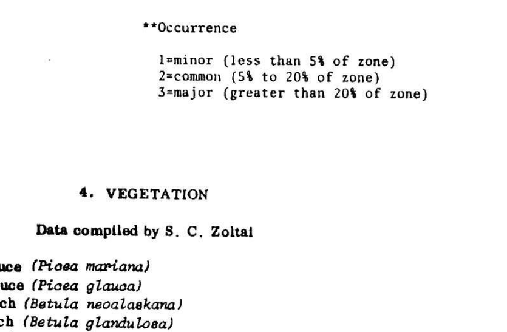
Karst sinkhole

S.H.

Karst depression or cluster of karst sinkholes

2. INDEX MAP OF LAND ZONES
(Similar vegetation and ground ice content)

Compiled by W. Pettapiece and S. C. Zoltai



**Occurrence

1=minor (less than 5% of zone)
2=common (5% to 20% of zone)
3=major (greater than 20% of zone)

4. VEGETATION

Data compiled by S. C. Zoltai

bS - black spruce *(Picea mariana)*
wS - white spruce *(Picea glauca)*
wB - white birch *(Betula neoalaskana)*
Bi - dwarf birch *(Betula glandulosa)*
tL - tamarack *(Larix laricina)*
Wi - willow *(Salix* sp.*)*
Al - alder *(Alnus* sp.*)*
tA - trembling aspen *(Populus tremuloides)*
bPO - balsam poplar *(Populus balsamifera)*
Cx - sedge *(Carex* sp.*)*
tCx - sedge tussock *(Carex* sp.*)*
Cott.- cotton grass *(Eriophorum* sp.*)*
Lichen - *Cladonia* sp., *Cetraria* sp.
Sphagnum - *Sphagnum* sp.
Er - Ericaceae *(Ledum* sp., *Chamaedaphne, Kalmia* etc.*)*

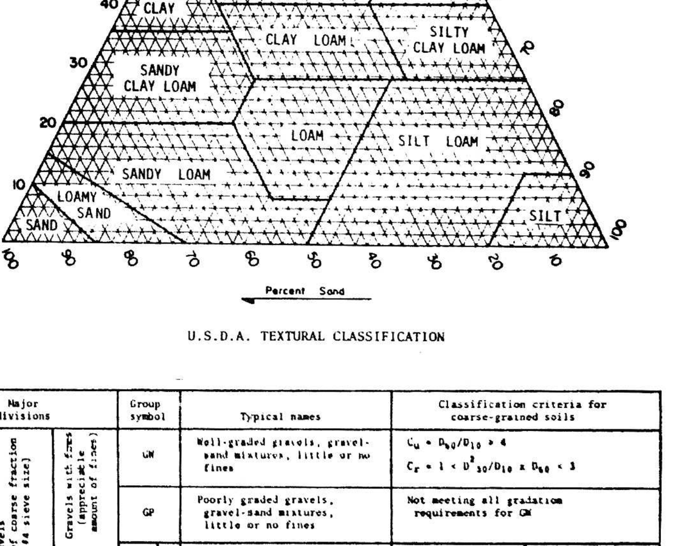
* Stable/After fire categories replaced by Occasionally flooded/Frequently flooded for alluvial units, and by South aspect/North aspect for colluvial units.

3. SOILS

Data compiled by W. Pettapiece

Microrelief is estimated on the mineral surfaces.

Drainage is estimated from a combination of topographical, vegetal and soil features.



U.S.D.A. TEXTURAL CLASSIFICATION

Major divisions			Group symbol	Typical names	Classification criteria for coarse-grained soils	
Coarse-grained soils (more than half of material is larger than #200)	Gravels (more than half of coarse fraction is larger than #4 sieve size)	Gravels with fines (appreciable amount of fines)	GW	Well-graded gravels, gravel-sand mixtures, little or no fines	$C_u = D_{60}/D_{10} > 4$ $C_c = 1 < D^2_{30}/D_{10} \times D_{60} < 3$	
			GP	Poorly graded gravels, gravel-sand mixtures, little or no fines	Not meeting all gradation requirements for GW	
		Clean gravels (little or no fines)	GM d/u	Silty gravels, gravel-sand-silt mixtures	Atterburg limits below A line or $I_p < 4$	Above A line with $4 < I_p < 7$ are borderline cases requiring use of dual symbols
			GC	Clayey gravels, gravel-sand-clay mixtures	Atterburg limits above A line with $I_p > 7$	
	Sands (more than half of coarse fraction is smaller than #4 sieve size)	Clean sands (little or no fines)	SW	Well-graded sands, gravelly sands, little or no fines	$C_u = D_{60}/D_{10} > 6$ $C_c = 1 < D^2_{30}/D_{10} \times D_{60} < 3$	
			SP	Poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW	
		Sands with fines (appreciable amount of fines)	SM d/u	Silty sands, sand-silt mixtures	Atterburg limits below A line or $I_p < 4$	Limits plotting in hatched zone with $4 \le I_p \le 7$ are borderline cases requiring use of dual symbols
			SC	Clayey sands, sand-clay mixtures	Atterburg limits above A line with $I_p > 7$	
Fine-grained soils (more than half of material is smaller than #200)	Silts and clays (liquid limit < 50)		ML	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands, or clayey silts with slight plasticity	1. Depending on percentages of fines (fraction smaller than 200 sieve size), coarse-grained soils are classified as follows: Less than 5% - GW, GP, SW, SP, More than 12% - GM, GC, SM, SC 5 to 12% - Borderline cases requiring dual symbols	
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays		
			OL	Organic silts and organic silty clays of low plasticity		
	Silts and clays (liquid limit > 50)		MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts		
			CH	Inorganic clays of high plasticity, fat clays		
			OH	Organic clays of medium to high plasticity, organic silts		

UNIFIED CLASSIFICATION