Extended Legend

SURFICIAL GEOLOGY AND LANDFORMS

Malloch Hill (97 F), Mackenzie Delta (107 C), Stanton (107 D), Cape Dalhousie (107 E)

To accompany open file maps

by V.N. Rampton

UNIT NOTATION	MAP-UNIT	MATERIALS	ESTIMATED THICKNESSES	GEOMORPHOLOGY[1] (includes comments re dynamic processes and natural hazards)	GEOLOGIC COMMENTS	PERMAFROST AND ICE CONTENT[2] (deposits permanently frozen unless otherwise indicated)	SURFACE WATER AND DRAINAGE	ORGANIC DEPOSITS WITHIN UNIT	SUSCEPTIBILITY TO GULLEYING (increases with slope)	SUSCEPTIBILITY TO MASS MOVEMENT (increases with slope)	SUSCEPTIBILITY TO THERMOKARST SUBSIDENCE (decreases with slope)	"HAZARD[3] INDEX"
C	COLLUVIUM											
$_sC$	Sandy colluvium	Sand?	No data	Gently sloping plain to moderately steep escarpment: undisturbed slopes appear stable.	Overlies poorly consolidated sandstone and conglomerate.	No data	Good on steep slopes: fair on gentler slopes.	Swales contain peat, probably 5-15 ft.	Major on escarpments; minor on gentler slopes.	Slumps on steeper slopes.	Moderate on gentle slopes (≤10 ft).	4
$\frac{_cC_v}{_{sh}R}$	Clayey colluvium overlying shale.	Clay and silty clay (weathered, generally non-bentonitic shale) with cobbles and boulders scattered on surface.	3 ft±	Upland with gentle to moderate slopes and integrated drainage network; solifluction and slump features rare; undisturbed slopes relatively stable.		Little excess ice.	Fair: small pools along ice-wedge network; beaded drainage common.	Organic-rich deposits to 15 ft in valleys.	Minor to major.	Minor to major slumps and mudflows.	Negligible	7
$\frac{_cC_v}{_sF^G}$	Clayey colluvium overlying fluvial sand.	Clayey diamicton over medium-grained sand and local gravel.	Diamicton, 2-5 ft; thinnest on hill crests: underlying sands 100 ft±	Gently rolling plain: local relief to 40 ft±	Diamicton was originally till.	Diamicton generally saturated with excess ice, locally 20% excess ice: underlying sands generally contain 5-10% excess ice, rarely massive ice.	Fair: pools in depressions.	Peat to 8 ft ± in depressions.	Negligible	Minor mudflows on slopes.	Minor (≤6 ft) except where thaw extends down to massive ice.	6
E	EOLIAN DEPOSITS											
E	Eolian sand.	Sand; layers of terrestrial peat, commonly woody.	10-60 ft	Flat except for small ridges and hills: active blow-outs common.	Overlies $_sF^G_t$	No excess ice.	Good	Nil	Major (?) where sand is thick.	Minor slumps on slopes.	Nil	2
$_sE_v$	Thin eolian(?) sand.	Silty fine sand.	0-15 ft	Linear hills 15-30 ft high: undisturbed surface appears stable.	Overlies $\frac{_{\not s}\mathcal{M}}{_c\mathcal{M}}$	Probably little excess ice.	Good	Nil	Minor	Negligible	Negligible	4
$\frac{E_{v,(r)}}{_sF^G_p}$	Dune sand overlying sandy outwash.	Fine to medium sand; layers of terrestrial peat.	0-12 ft	Dunes, 20 ft maximum height, generally 5-10 ft: active blow-outs common adjacent to streams and lakes: r indicates linear and cresentic dunes.		No excess ice.	Drainage impeded and small thaw-pools common on large flat areas.	Generally negligible.	Minor	Negligible	Negligible	3
F	FLUVIAL DEPOSITS											
$_{\not s}F^A_p$	Active floodplain.	Silt, fine sand or clayey silt; commonly organic.	20 ft+	Flat floodplain: surface inundated at least once annually.	Includes $_{\not s}F^A_p$, Mackenzie Delta.	Distribution of permafrost and unfrozen ground may be irregular: ice lenses probably common in upper permafrost.	Poor, surface often saturated: marshy areas.	Negligible	Negligible	Nil	Minor	10
$_{\not s}F_p$, F_p	Floodplain (partly abandoned)	Same as above.	20 ft+	Flat floodplain or very low terrace: surface inundated during highest floods: near sea level, occasionally inundated by marine water.		Taliks may be common under a continuous surface layer of permafrost: ice lenses probably common.	Small thaw-pools, lakes and marshy areas common.	Peat locally thick up to 8 ft.	Negligible	Negligible	Minor	9
$_{\not s}F_t$	Fluvial terrace.	Silt, clayey silt, and clay.	20 ft+	Flat terrace: shallow entrenched meander scars.	Locally includes $_{\not s}F^A_p$ and $_{\not s}F_p$	Ice lenses probably common.	Small thaw-pools, lakes and marshy areas.	Peat locally thick, up to 8 ft in swales.	Minor	Mudflow and ground ice slumps may develop on slopes.	Moderate	5
$_{\not s}F_t$	Fluvial terrace.	Sand; rare silty and clayey beds.	15 ft+	Low flat terrace; local relief up to 15 ft due to former channels, bars, etc.: rare active blow-outs.	Glaciofluvial(?)	Ice lenses in finer facies.	Small thaw-pools common in former channel traces.	Peat 5-10 ft thick common in former channel traces.	Minor	Minor slumps on slopes.	Minor if excess ice is present; otherwise negligible.	4
F_f	ALLUVIAL-FANS											
$_cF_f$, $_{\not s}F_f$	Alluvial-fan	Clay or silt as indicated; locally pebbly.	0-30 ft	Alluvial fans and aprons: fans along abandoned channel of Horton River periodically receive sediment.	Adjacent to escarpments cut in shale or capped by clayey diamicton.	Ice lenses probably present	Good except on gentle and flat slopes where active layer is saturated during melt season.	2 ft ± on more gentle slopes.	Minor	Mudflow may occur on slopes.	Minor to moderate on gentle slopes.	9
$_{g,s}F_f$	Alluvial-fan	Gravel or sand.	0-30 ft	Alluvial fans: undisturbed surface stable.	Adjacent to $_gF^G$	Little or no excess ice.	Good	Negligible	Minor	Minor slumps.	Nil	2
F^G	GLACIOFLUVIAL DEPOSITS											
$_sF^G_t$, $_gF^G_t$, $_{s,g}F^G_t$	Outwash terrace.	Sand, gravel, or interbedded sand and gravel as indicated; local pebbly beds and gravelly channel-fills.	30 ft+, but may be as thin as 10 ft	Flat terrace: some relief due to channel traces and bars.	Underlain by $_{sh}R$	Little or no excess ice.	Drainage good, except on larger flat areas and in channel traces: thaw-pools common in latter areas.	Negligible except on larger flat areas and in channel traces.	g-Negligible s-Minor	Negligible Minor slumps on slopes.	Nil Minor	1 3
$_sF^G_p$, $_gF^G_p$, $_{s,g}F^G_p$	Outwash plain. (excluding areas in Eskimo Lakes basin)	Same as above: materials become finer grained toward their northern edges: locally covered by veneer of silt (0-3 ft).	Generally 20 ft+, but may be as thin as 10 ft in Malloch Hill area: gravel may thin to 10 ft.	Flat outwash plain; local relief (< 20 ft) due to rare terraces, channel traces, and small thermokarst basins; dunes and active blow-outs common around lakes and abandoned lakes.	Underlain by $_{sh}R$ in Malloch Hill area.	Gravel generally free of excess ice; sand contains little excess ice (< 10%); shot hole logs and thermokarst lakes suggest icy sediments or massive ice at depths of 20-200 ft: excess ice common in silty veneer.	Same as above.	Same as above.	g-negligible	Ice slumps may occur where icy sediments are present above base of slope.	Negligible generally; but moderate to major if thaw extends down to icy sediments or massive ice.	1-2
$_sF^G_{pk}$, $_gF^G_{pK}$, $_{s,g}F^G_{pK}$	Outwash plain; modified by thermokarst. (excluding areas in Eskimo Lakes basin)	Sand, gravel, or interbedded sand and gravel as indicated: a few pebbly beds and gravelly channel-fills in sand.	Generally 50 ft+; gravel may be as thin as 10 ft.	Hummocky; summits of positive features accordant; local relief to 150 ft.		Excess ice generally negligible: shot hole logs and deep thermokarst depressions indicate massive ice and icy sediments at depths of 20-200 ft.	Very good.	Negligible, except in some depressions.	s-Minor	Minor slumps on slopes: ice slumps may occur if icy sediments are above base of slope; ice slumps will form in areas of M and M_v.	Negligible to major depending on ice content of sediment and depth of thermal disturbance: minor to moderate in areas of M and M_v.	2-3 (6)
$_sF^G_K$, $_gF^G_K$, $_{s,g}F^G_K$, $_{g,s}F^G_K$, F^G_K	Hummocky outwash; morphology due to thermokarst?	Same as above.	Same as above.	Hummocky to gently rolling; local relief to 150 ft.	Shot hole logs suggest that areas of M and Mv are present within this unit.	Same as above.	Very Good.	Same as above.				
$_{s,g}F^G_m$	Hummocky outwash.	Sand and/or gravel.	No data.	Hummocky; local relief to 100 ft.		No data; excess ice probably minimal.	Fair	Peat in depressions.	Minor	Minor slumps on slopes.	Probably negligible or minor.	1-2
$_gF^G_r$	Esker	Gravel	30 ft±	Linear features 200-2000 ft wide; locally multiple ridges or hummocky.		Probably nil; massive ice may be present in underlying sediments.	Very good.	Nil	Negligible	Negligible	Nil except if thaw line intercepts icy sediments or massive ice.	1
$_{s\not s}F^G_p$	Outwash plain. (Eskimo Lakes basin)	Sand; organic detritus: upper 8 ft may be silt or clayey silt.	20 ft±	Flat outwash plain: active ice slumps on recently steepened slopes.	Unit probably grades to $_cL^G_k$	Silty beds are icy: massive ice near base of unit.	Fair	Generally ≤1 ft.	Minor	Ice slumps on slopes.	Minor (≤6 ft) except if thaw line intersects massive ice.	6
$_sF^G_p$	Outwash plain. (Eskimo Lakes basin)	Sand; organic detritus; a few silty beds near top of unit.	10-30 ft	Same as above.		Silty beds may be icy: massive ice common near base of unit.	Fair	Same as above.	Minor	Ice slumps if base of slope lies below level of massive ice.	Same as above.	4
$_sF^G_{pk}$	Outwash plain: modified by thermokarst. (Eskimo Lakes basin)	Same as above.	10-30 ft	Outwash plain, many depressions 10-100 ft deep: active ice slumps on recently steepened slopes.		Same as above.	Fair	Peat may be 10-30 ft thick in depressions.				
L	LACUSTRINE DEPOSITS: THERMOKARST ORIGIN											
L	Thermokarst lake basins.	Texture of deposits related to adjacent map-units.	5-20 ft +	Flat to gently sloping areas; frequently "stepped": heaving active in some localities: blow-outs in sandier basins.		Ice lenses common in fine-textured deposits (excess ice content to 60%) massive ice under pingos and domes.	Commonly marshy.	5-10 ft of peat common.	Negligible	Negligible	Moderate if ice content high.	5
L^G	GLACIOLACUSTRINE DEPOSITS											
$_cL^G_K$	Glaciolacustrine deposits: modified by thermokarst.	Clay, silty clay.	10 ft +	Rolling: local relief 50-100 feet.		Commonly icy: 50% excess ice common.	Fair to poor.	Negligible except in depression.	Negligible to minor.	Negligible	Minor to moderate probable.	9
L^G, $_{\not s}L^G$, $_{s,g}L^G$	Glacio(?)lacustrine deposits.	Thinly bedded silt, clay and sand; sand and gravel where indicated: material commonly relates to adjacent map-unit.	10-20 ft	Flat to gently sloping plain: "terraced" in some localities.		Ice lenses in finer textured deposits: massive ice in pingos.	Thaw-pools common on surface: drainage generally poor.	Peat generally 2-10 ft thick.	Negligible to minor.	Negligible	Minor to moderate.	4-5
M	MORAINAL DEPOSITS											
M	Moraine	Stony clayey diamicton: one sample 43% >2mm; remainder 19% s, 29% si, 52% cl.	40 ft ±	Low rolling hills: ice slumps present on recently steepened slopes.		Commonly 20% excess ice.	Fair: small pools common along ice-wedge networks.	Negligible	Negligible	Ice slumps on slopes.	Moderate to major.	6
M_K	Moraine: modified by thermokarst.	Clayey diamicton: samples run 10% ± >2mm; 10-20% s, 20-40% si, 50-65% cl: pockets of sorted silty and clayey deposits.	15-50 ft	Hummocky to rolling: local relief to 150 ft +: hills are "involuted" in the Tuk area with characteristic pattern of ridges and swales with 2-10 ft relief: active ice slumps.		Till often icy, reticulate ice lenses - excess ice to 20%: mud-flow debris free of excess ice: pond deposits icy"; massive ice common at base of till in "involuted hills".	Fair: poor in swales on "involuted hills".	Generally negligible: irregular patches of peat up to 10 ft, especially in "involuted hills".	Negligible	Minor ice slumps if disturbance shallow; major ice slumps if massive ice exposed.	Minor to moderate.	7
$\frac{M_v}{_sF}K$	Morainal deposits overlying (?) fluvial sands.	Clayey diamicton.	No data, but diamicton believed to be >15 ft.	Hummocky to rolling: local relief to 150 ft ±: ice slumps active.		Excess ice to 20%±.	Fair	Up to 15 ft ± of peat in depressions and in irregular patches on hills.	Negligible	Ice slumps on slopes.	Moderate	6
$\frac{M_v}{_sF}K$, $\frac{M_v}{_sF,\mathcal{M}}K$	Thin morainal deposits overlying fluvial and/or marine sand: modified by thermokarst.	Clayey diamicton: fluvial sands generally medium to coarse with rare gravel lenses: marine sands fine to medium.	Diamicton thickness 0-15 ft, rarely to 30 ft+: underlying sands 30 ft+.	Hummocky to rolling: local relief to 150 ft +: ice slumps where thick icy till caps recently steepened slopes.	Shot hole logs indicate greater thickness of diamicton than seen in most exposures and indicated in this table.	Same as above: some massive ice in underlying deposits at depths of 20-200 ft.	Fair	Same as above.	Minor where sand, specially marine sand, is near surface.	Minor ice slumps in diamicton veneer; slumps and flows in sand: major ice slumps if massive ice exposed.	Minor: major if thaw line intersects massive ice.	6
$\frac{M_v}{_s\mathcal{M}}K$	Thin morainal deposits overlying marine deposits: modified by thermokarst.	Clayey diamicton: marine clay and fine to medium sand.	Diamicton thickness, 0-20 ft: underlying sandy units 20 ft ±, clayey units 15 ft ±.	Rolling: local relief exceeds 100 ft, but generally less than 40 ft: ice slumps on recently steepened slopes.	Same as above.	Diamicton probably icy: thick ice lenses occur in deformed marine sediments.	Poor to fair: low areas often marshy.	Same as above.	Minor	Ice slumps on slopes.	Minor to major, dependent upon presence of excess ice and depth of thaw line.	8
$\frac{M_v}{_{sh}R}K$	Thin morainal deposits over shale: modified by thermokarst.	Clayey diamicton: underlying material is Cretaceous shale.	Diamicton thickness generally 0-15 ft, locally thicker.	Rolling: local relief exceeds 100 ft in some places.		Diamicton commonly icy: ice lenses rare in weathered shale.	Fair	Same as above.	Negligible	Ice slumps on slopes.	Minor to moderate.	7
$\frac{M_v}{_{sh}R}$	Thin morainal deposits over shale.	Same as above.	Diamicton thickness 0-15 ft.	Sloping plain: some local relief due to stream incission.		Same as above.	Fair to poor.	Same as above.	Minor	Minor ice slumps and superficial mud-flows.	Same as above.	8
$\frac{M_v}{_{\not s}\mathcal{M}}e$	Thin morainal deposits over marine(?) silts.	Clayey diamicton: underlying material is interbedded silt, clayey silt and fine sand.	Diamicton thickness 0-15 ft, rarely to 30 ft: underlying silts 20 ft.	Broad channels give unit local relief to 100+: ice slumps common on recently steeped slopes.		Diamicton generally icy: ice lenses and massive ice common in underlying silts.	Fair to poor.	Peat to 15 ft in channels.	Minor	Ice slumps on slopes.	Same as above.	7
$\mathcal{M},F_G$	GLACIALLY MODIFIED DEPOSITS											
$_s\mathcal{M}_{G,K}$	Glaciated marine sands: modified by thermokarst.	Marine sand generally fine-grained: fine-grained dune sand through poorly sorted gravel to clayey diamicton cap marine sand: glacio-fluvial and lacustrine deposits along some depressions.	Marine sand generally 50 ft +: cliff-top dunes 5-15 ft: poorly sorted gravel 0-2 ft: clayey diamicton to 10 ft.	Hummocky: local relief to 200 ft± : active cliff-top dunes along coast: blow-outs on a few hill-crests.	Shot hole logs from north end of Richards Island indicate clayey material, 10-30 ft + commonly caps unit (?).	Marine sand appears to contain little excess ice, but thermokarst suggests thick massive ice at depths of 20-200 ft: clayey diamicton may contain excess ice.	Good	Negligible, except in some depressions	Minor	Minor slumps and flows: major ice slumps if massive ice exposed	Negligible to minor	4
$_{s,c}\mathcal{M}F_{G,K}$	Ice-thrust marine and fluvial sand and clay: modified by thermokarst.	Marine sand generally fine-grained: fluvial sand medium-grained: clay locally silty.	Sand 50 ft +: clay 30-40 ft.	Hummocky: local relief to 150 ft: a few ice slumps.		Sand appears to be free of excess ice, but massive ice (20 ft +) under clay common.	Variable	15 ft of peat in some depressions	Minor	Same as above	Minor to major	7
$_sF_{G,e}$, $_sF,\mathcal{M}_{G,e}$	Ice-thrust fluvial and/or marine sand.	Marine sand generally fine-grained: fluvial sand medium-grained, rare beds of woody detritus.	20 ft +	50-100 ft relief due to closely-spaced gullies: slopes appear stablized.	Underlain by interbedded sand and marine clay: clay may outcrop locally.	Sands free of excess ice.	Good	Negligible	Minor	Same as above	Negligible in general; moderate to major if icy sediments or massive ice are near surface.	3
$_c\mathcal{M}_{Ge}$	Ice-thrust marine clay.	Clay.	20 ft +	Same as above: active slumping on moderate and steep slopes.		Clay locally contains excess ice.	Fair	Negligible	Minor to major	Earth and ice slumps on slopes	Minor to moderate	8
$\mathcal{M}$	MARINE DEPOSITS											
$_{\not s}\mathcal{M}$	Marine deposits.	Silty fine sand overlying interbedded silt, clay, and sand.	Fine sand, 2-15 ft: underlying deposits ≤20 ft.	Gently sloping plain.	Unit is underlain by shale: beaches may be present at edge of unit.	Fine sand contains up to 50% excess ice: large ice wedges common.	Fair to poor: thaw-pool common along ice wedge networks	Negligible	Minor	Ice slumps on slopes	Moderate	8
$\frac{_{\not s}\mathcal{M}}{_c\mathcal{M}}$	Marine deposits.	Sand over clay.	Fine sand 2-15 ft: underlying clay 5-30 ft.	Same as above.		Same as above: reticulate network of ice lenses in clay.	Same as above	Negligible	Minor	Same as above	Moderate	8
$_{\not s}\mathcal{M}_K$	Marine deposits: modified by thermokarst.	Same as $_{\not s}\mathcal{M}$	Same as $_{\not s}\mathcal{M}$	Gently sloping plain interrupted by flat-bottomed thermokarst basin: local relief to 30 ft.	Same as $_{\not s}\mathcal{M}$	Same as $_{\not s}\mathcal{M}$	Same as $_{\not s}\mathcal{M}$ pools common in thermokarst depressions	Generally negligible: peat to 5 ft in some depressions	Minor	Same as above	Moderate	7
$\mathcal{M};\mathcal{M}F;F\mathcal{M}$	MARINE (AND ESTUARINE) DEPOSITS											
$_s\mathcal{M}^A_r$, $_g\mathcal{M}^A_r$, $\mathcal{M}^A_r$	Marine spits, bars, and beaches.	Sand, gravel.	2-8 ft	Actively-forming ridges 2-8 ft above mean sea level: higher ridges inundated only during highest storm tides.	Underlain by finer poorly sorted material.	Little excess ice.	Very good	Nil	Nil	Negligible	Nil	9-10
$\mathcal{M}^A_v$	Intertidal lagoons.	Silt or clay, organic: sandy deposits along north edge of Tuk Pen.	3-10 ft	Flat basins; receive moderate amounts of sediment at present: frequently inundated.	Lagoons are flooded lake basins and abandoned stream channels.	Permafrost generally present: no data re excess ice.	Poor; commonly marshy	Up to 2 ft	Negligible	Negligible	Minor to moderate	10
$_{\not s}\mathcal{M}^A_p$, $_{s\not s}\mathcal{M}^A_p$	Tidal flats.	Silt, clayey silt: sandy where indicated.	20 ft	Flat: frequently inundated.		Distribution of permafrost irregular: ice lenses in frozen material.	Poor; surface often saturated; local marshy areas	Negligible	Shallow gullys might develop if natural drainage interrupted.	Nil	Negligible	10
$_{\not s}\mathcal{M},F^A_p$	Estuarine flats.	Silt, clayey silt.	20 ft	Flat; frequently inundated.		Same as above.	Poor surface; often saturated; marshy areas common	Negligible	Same as above	Nil	Minor in areas of permafrost.	10
$_{\not s}F,\mathcal{M}^A_p$	Outer deltaic islands.	Silt, clayey silt.	20 ft +	Same as above		Permafrost thins toward outer edge of islands: ice lenses in frozen material.	Same as above	Negligible	Same as above	Nil	Same as above	10
O	ORGANIC DEPOSITS											
O	Organic deposits.	Peat: interbedded lacustrine silt common near base.	3-15 ft	High-centre peat polygons: some low-centre polygons.		Ice content high: moisture content many times dry weight common.	Water common along traces of ice wedges and in low-centre polygons		Nil	Nil	Minor to moderate; very minor if drainage maintained and upper layer of peat is not removed	8
R	BEDROCK											
$_{sh}R$	Bedrock escarpments.	Shale, generally non-bentonitic: thin colluvial cover.	100 ft+	Steep gullied escarpments, 100-200 ft high: streams actively down-cutting along gullies.	Major slumps along coast where combustion of coal has weakened shale.	Negligible	Good	Nil	Major	Slumps and superficial debris flows	Nil	9
U	UNDIFFERENTIATED DEPOSITS											
U	Undifferentiated (L?) deposits. (northeast of Tuk and near Denis High Hill)	Silt, clay, clayey diamicton?; high organic content.	20 ft +	Flat benches.		No data.	Fair	Negligible	Negligible	Minor ice slumps on slopes	Minor to moderate	6
U	Undifferentiated (L,F) deposits. (near Pete's Creek)	Probably sand or silt.	No data	Gently rolling plain: local relief to 20 ft +		No data.	Poor to fair	Large areas of peat, 10 ft ± thick	Minor	Minor slumps	Minor	5
$_{c\not s}U_p$	Undifferentiated (L,M) deposits.	Clay, silt or clayey diamicton.	20 ft +	Flat plain: ice slumps on recently steepened slopes.		Excess ice common.	Fair	Negligible	Negligible	Major ice slumps on slopes	Moderate	9
$_cU_k$	Undifferentiated (L,M) deposits: modified by thermokarst.	Clay or clayey diamicton.	15 ft ±	Rolling with many small swales: ice slumps common on recently steepened slopes.		Excess ice common.	Fair: water common along ice-wedge traces.	Peat common in depressions	Negligible	Major ice slumps on slopes	Moderate	9
U_h	Undifferentiated hummocky deposits.	No data, but probably clayey till and/or glacio-fluvial sand.	No data	Hummocky: local relief to 150 ft		No data.	No data	Peat appears to be thick in depressions	Minor on sandy slopes	Ice slumps possible on slopes	Probably only minor	6?

1. For distribution maps of pingos and ground ice slumps see Mackay, 1963.

2. Excess ice is frozen water in excess of the amount needed to saturate the soil. It is expressed as volume per cent of a sample of the material in a thawed state.

3. Potential for landscape damage following man-induced disturbances is proportional to numerical value assigned to map-unit.