LEGEND

MAP UNIT		MATERIAL	LANDSCAPE OR LANDFORM		ASSUMED THICKNESS (feet)	ORGANIC DEPOSITS AND PERMAFROST	GENERAL COMMENTS
Regional Genetic Units	Basic Genetic-Morphologic Units		Origin or Feature	Topography			
ALLUVIAL (A)*	Ap	gravel, sand, silt	alluvial floodplain	nearly flat or gently irregular surfaces on the bottoms, sides, or mouths of river valleys; abandoned channels occur in places; local relief is commonly less than 5 feet	5 to 40	fen and some bog occur in places; local patches of permafrost occur in bogs	good to poor source of aggregate; textures are variable and commonly reflect the texture of unconsolidated deposits along the valley sides; sand and gravel are common in valleys cut in till and clay, and silt is common in valleys cut in glacial lake basins
	At		alluvial terrace		20 to 100	organic deposits are generally absent over gravel and sand but occur on poorly drained parts of silty deposits; where bog is more than 2 feet thick, permafrost commonly occurs at a depth of 1 to 4 feet	along Hayes and lower Nelson rivers the sediments are mainly silt and silty sand estuarine deposits and a succession of small deltas that formed as sea level fell following the time of formation of the highest marine strandlines (about 400 feet a.s.l.) in this region
	Aa		delta and estuarine valley fill				
MARINE (W)*	Wp	clay, silt	marine nearshore	nearly flat surfaces; widespread organic terrain cover has local relief of 2 to 8 feet and is greatest along the bog-fen margins; includes abandoned beach complexes, beach ridges, spits, and bars with local relief commonly less than 5 feet	4 to 20	bog and fen form an unbroken cover over the plains and between abandoned shoreline features; bog is 6 to 12 feet thick, and permafrost occurs at a depth of 1 to 4 feet; ice content is high and commonly makes up the bulk of samples above the contact with underlying inorganic sediments	these deposits are mainly a silt and clay veneer overlying extensively wave-reworked till plains; gravel and sand designated "g" and "s" are common to abandoned beaches; bouldery surfaces may occur where the veneer is thin or absent; along Nelson River varved clay separates the veneer from the underlying till; beach complexes and ridges are good sources of sand and fine gravel; these deposits are restricted to the Hudson Bay Lowlands, mostly below 400 feet a.s.l.
	Wt	silt, sand, gravel					
	Wr						
GLACIOFLUVIAL (F)*	Fn	gravel, sand, silt	proglacial outwash	surfaces marked by knolls or pits with local relief from 10 to 50 feet; shallow channel scars are common on nonpitted terrace surfaces	10 to 50	bog, fen, and permafrost generally are absent	good source of sand and gravel, limited amounts where present as a veneer
	Fr						
	Ft						
LACUSTRINE (L)*	Lp	clay, silt, sand	glacial lake basin and nearshore	nearly flat or gently irregular surfaces with 5 to 25 feet local relief; knolls and ridges of bedrock are common in places		bog and fen form a nearly continuous cover over the plains, in places broken by bedrock outcrops; in the vicinity of hilly bedrock terrain, patches of bog and fen are confined to the low areas between hills and clay-blanketed knolls; bog is generally 2 to 9 feet thick, and permafrost occurs at a depth of 1 to 4 feet; ice content is high and commonly makes up the bulk of samples above the contact with underlying inorganic sediments	varved clays and silts are the most common surficial sediments in this region; generally they are veneered over gently irregular plains of bedrock and till; thicknesses are highly variable; maximum thicknesses may occur in local bedrock hollows and be minimal to zero on the crests of knolls and ridges; within blanketed areas clay and silt commonly overlie bedrock on stoss slopes, and sand or bouldery till are present on lee slopes of bedrock hills and knolls
	Lb			strongly irregular or hilly clay-mantled terrain within or adjacent to areas of bedrock hills			
	Lr	sand, gravel	glacial lake nearshore	ridge or series of ridges with 4 to 10 feet local relief	4 to 10	bog and fen may occur in areas between beach ridges; cover is generally thin and discontinuous	ridges designated "g" or "s" are good sources of sand and gravel
ICE CONTACT(I)*	Ih	sand, gravel	kame moraines and kame-eskerine complexes; in part gradational into deltas	hills, knolls, and ridges that occur as complexes along linear trends continuous for tens of miles; the highest parts are 50 to 300 feet above adjacent terrain; surfaces commonly are pitted with depressions up to 100 feet deep	50 to 300	bog, fen, and permafrost generally are absent	good source of mainly sand and some gravel; bouldery surfaces indicative of gravel occur in places and gravel probably occurs at depth within parts of the sandy landforms, particularly in the vicinity of partly buried channels
	In		kames	knolls that occur in clusters or as isolated features generally less than 50 feet above adjacent terrain	10 to 50		
	Ir		eskers	sinuous ridges generally less than 50 feet above adjacent terrain			
MORAINIC (M)*	Mp	sandy till derived mostly from Precambrian granitic bedrock and silty till derived mostly from Paleozoic carbonate bedrock	ground moraine	gently irregular or broadly rolling till plains with 5 to 25 feet local relief; bedrock commonly is exposed, particularly on knolls and ridges	0 to 100	bog and fen form a nearly continuous cover over the regional plains, in places broken by bedrock outcrops, knolls, drumlins, and drumloids; patches of bog and fen are confined to the low areas between outcrops, knolls, and drumlins; bog is generally 2 to 9 feet thick, and permafrost occurs at a depth of 1 to 4 feet; ice content is high and commonly makes up the bulk of samples above the contact with underlying inorganic sediments	sandy till generally overlies Precambrian bedrock and is fairly stony and loose at the surface, particularly on the higher parts of knolls and drumlins that have been reworked by lake water; at depth and where older tills are preserved (i.e. lee slopes of knolls), it is very hard, compact, and resistant to ripping; silty till generally overlies carbonate bedrock and is typically dense and compact but less resistant to ripping than the hard sandy till; most ground moraine was inundated by glacial lakes of variable duration; deposition and erosion resulted in extensive veneers or patches of clay and silt or coarse lag veneers on ridges and knolls
	Mn		hummocky moraine; strongly irregular ground moraine	broadly hummocky, commonly with 15 to 50 feet relief between knolls and depressions; areas of scattered knolls and hills with 25 to 100 feet relief	15 to 100	bog and fen occur in local flats and depressions; bog is 2 to 9 feet thick, and permafrost occurs at a depth of 1 to 4 feet; ice content is high and commonly makes up the bulk of samples above the contact with underlying sediments	
	Md		drumlins or drumloids	knolls or ridges with distinctive, streamlined aspect imparted by glacier flow; common to ground moraine	10 to 25	bog and fen are absent, although generally present over adjacent flats; local patches of permafrost may occur on wooded, north-facing slopes	
	Mt		water erosion	escarpments or valley walls with fairly steep slopes and about 50 to 100 feet local relief	50 to 100		
BEDROCK (R)*	cR	Paleozoic carbonate bedrock	not applicable	mainly flat to gently irregular plains; scarps and knolls with 10 to 30 feet relief occur in places	not applicable	bogs are generally absent; grassy fens occur in places	loose rock rubble 1 to 3 feet thick veneers much of the bedrock; in places it provides limited amounts of gravelly aggregate
	R	Precambrian bedrock		mostly gently irregular to broadly rolling plains and/or areas of knolls and ridges with 15 to 50 feet relief; in the western part of the region hilly bedrock terrain with up to 300 feet relief is interspersed with clay-blanketed terrain of lower relief		bog and fen cover low areas between bedrock outcrops; bog is 2 to 9 feet thick, and permafrost occurs at a depth of 1 to 4 feet beyond the bog margins; ice content is high and makes up the bulk of samples above the contact with underlying inorganic sediments	extensive outcrop surfaces or numerous small exposures between bog and fen covered low areas occur on the plains; a veneer of drift underlies much of the bog and fen on the plains and may be considerably thicker in the low areas between bedrock hills and knolls; prominent bedrock hills and intervening lower relief terrain are a preglacial landscape somewhat modified by glaciation

*Upper case letters used without morphologic descriptors in a complex unit indicate that the regional genetic unit occurs as a veneer (see complex units)

SURFICIAL GEOLOGY OF PROJECT AREA

DESCRIPTIVE NOTES

This map covers part of an area largely within the glaciated Canadian Shield of northeastern Manitoba (see index map) where surficial materials have been mapped by the Geological Survey of Canada. The region consists predominantly of low relief landscapes bordered along the northwestern margin by low hills of Precambrian bedrock. It is within the zone of discontinuous permafrost, and myriads of lakes separated by extensive peatlands and boreal forest cover render much of it formidable to access and habitation. Beneath the organic cover the surface almost everywhere reflects the effects of inundation by glacial lakes or marine waters. The lakes formed in front of the last continental glacier as it receded northward some 9000 to 7000 years ago followed by marine inundation of the eastern part of the region bordering Hudson Bay. Because of the interaction of these factors the area is characterized either by extensive blankets of thick varved clay and silt or by discontinuous patches of fine lacustrine or marine sediments between coarse lag deposits on hills or low ridges.

The map units were delimited on the basis of aerial photograph interpretation validated by aerial observations and selective ground control. The lithology and morphology of the bedrock and inorganic cover is reflected by five regional types of terrain: Canadian Shield bedrock, morainic, ice-contact, lacustrine, and marine terrains. Each regional type of map unit has within it variations of at least two or more of the other terrain types. Along with the regional categories are local units that consist of glaciofluvial and alluvial sediments, mostly associated with abandoned or modern valleys. In order to designate the considerable number of variations of regional units at the local level, a system developed for a similar reconnaissance type mapping project in Labrador (Fulton et al., 1975) was adopted and was modified somewhat to suit this region and the mapping scale.

The system permits the mapper to designate differences or variations of lithology and landform using letter symbols and by combining and arranging them in a systematic way to designate a particular map unit. This permits a flexibility that accommodates all the variations of the basic lithologies and landforms identified within each general map unit.

Organic deposits of variable thickness cover the surficial sediments and bedrock in most low lying, poorly drained parts of the region. These deposits are mapped where they exhibit features and surface textures readily identified on aerial photographs. This cover is broken in places by low rises or distinctive landforms. Numerous local organic deposits that lack distinctive features or that are masked by tree cover occur in low lying areas and are not mapped.

Map Unit Designators

The principal designators represent general lithologic-genetic types common to this region and comprise the following seven upper case letters: R (bedrock), M (morainic), L (lacustrine), I (ice contact), F (glaciofluvial), W (marine), and A (alluvial). In addition, to designate the landscape or landform characteristics of the lithologic-genetic units the following lower case letters are used: h (hill), n (knoll), r (ridge), p (plain), b (blanket), a (delta), d (drumlin), and t (terrace). These morphologic descriptors are placed after the lithologic-genetic ones, resulting in a designator with a lithologic, genetic, and morphologic connotation (e.g., Md, Mpd, Wt). The applicability of the use of this basic designator is extended greatly by combining from two up to four of these to form a particular map unit. The combinations are referred to as complex (e.g., $\frac{Lp}{Rn}$), composite (e.g., Lp; Rn), or complex-composite (e.g., $_{Lp}\frac{Lp}{Rn}$) units.

Complex Units: A horizontal line separating two basic inorganic units (e.g., $\frac{Lp}{Rn}$) indicates that the upper one is a veneer overlying a morphologically dominant one. Units designated as veneer may have considerable variations in local thickness; however, in order for the relief of the underlying material to be visible, the thickness of the veneering material generally will not exceed local relief. Furthermore, in these areas the underlying unit commonly is exposed locally. For example, within a complex of Precambrian bedrock knolls veneered with lacustrine clay ($\frac{Lp}{Rn}$), outcrops of bedrock no doubt will occur, and where sufficiently numerous or extensive to be regularly evident on aerial photographs, the designator is extended to a complex-composite one (e.g., $_{Rn}\frac{Lp}{Rn}$; Rn).

Composite Units: Composite units consist of two consecutively arranged basic designators separated by a single dot (Lp.Rn) or by two dots (Lp:Rn). Where one dot is used, the first letter couplet designates the nature of more than 50 per cent of the area represented by the map unit, and the second couplet designates the nature of roughly between 25 and 50 per cent. Where two dots are used, the first letter couplet designates the nature of more than 75 per cent of the area represented by the map unit, and the second couplet designates the general nature of the remainder.

Complex Composite Units: The same system of separation of designators by dots applies as to the composite units, except that one or both of the basic designators are replaced by complex designators (e.g., $_{Lp}\frac{Lp}{Rn}$ or $\frac{Lp}{Rn}$: $\frac{Lp}{Md}$).

Specific Lithology Symbols: Where a specific lithology of either gravel or sand is identified in marine or lacustrine deposits, the lower case letters g or s, respectively, are placed ahead of the general lithologic-genetic symbol (e.g., gLr; sLp).

Reference

Fulton, R.J., Hodgson, D.A., and Minning, G.V.
1975: Inventory of Quaternary geology southern Labrador: An example of Quaternary geology terrain studies in undeveloped areas; Geol. Surv. Can., Paper 74-46, 14p.

MAP SYMBOLS

Lithologic - Genetic Designator	Morphologic Descriptor
A - alluvial (gravel, sand, silt)	h - hill (>50 feet relief)
W - marine (clay, silt, gravel-g, sand-s)	n - knoll (<50 feet relief)
F - glaciofluvial (gravel, sand, silt)	r - ridge
L - lacustrine (clay and silt; gravel-g, sand-s)	d - drumlin or drumloid
I - ice contact (sand, gravel)	p - plain
M - morainal (till)	b - blanket
R - bedrock (Precambrian igneous and metamorphic; cR-Paleozoic carbonate)	a - delta t - terrace

Mapped Organic Deposits

Bog and bog containing fen: peaty material generally 5 to 9 feet thick and several feet or more above local water table; permafrost commonly occurs at a depth 1 to 4 feet depending on local factors (forest cover, slope aspect, drainage etc.)

Fen and fen containing bog: either a nearly continuous organic blanket over water or peaty material at or just below the level of the local water table; permafrost appears to be absent

Mixed bog and fen with bog most extensive

Mixed bog and fen with fen most extensive

Geological boundary

Moraine ridge

Drumlin or Drumloid (ice direction shown, not shown)

*Glacial striae (ice direction shown)

Esker (direction of flow assumed, uncertain)

Abandoned beach

Partly buried channel (large, small)

Abandoned or underfit channel (large, small)

Escarpment or steep bank

Minor intersecting lineaments or grooves

Limit of forebay flooding

Damsite or cofferdam (completed, proposed)

Gravel pit

*Information taken from published geological maps

Note: Symbols are printed in red on the face of the map and may form geological boundaries

Some map units and symbols shown in the legend may not appear on this map