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Northern Ontario
Engineering Geology Terrain Study 101

NORTH BAY AREA

(NTS 31L/SW)

Districts of Nipissing and Parry Sound

by

John F. Gartner

1980

Ontario

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MAP
(accompanying report)

Map 5041 (coloured) – Northern Ontario Engineering Geology Terrain Study, Data Base Map, North Bay (NTS 31L/SW). Scale 1:100 000.

Map 5044 (coloured) – Northern Ontario Engineering Geology Terrain Study, Septic Systems Capability Map, North Bay (NTS 31L/SW). Scale 1:100 000.

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John F. Gartner[1]

1.0 INTRODUCTION:

This report contains an inventory of regional engineering terrain conditions in the North Bay area, Districts of Nipissing and Parry Sound. The area, which covers NTS block 31L/SW, lies between Latitudes 46°00'N and 46°30'N and Longitudes 79°00'W and 80°00'W. It forms part of a series of publications which provide similar terrain data for some 370 000 km^2 of northern Ontario.

The purpose of the mapping is to provide a guide for engineering and resource planning functions at a level of detail consistent with a scale of 1:100 000. The terrain information is contained on the Data Base Map (OGS Map 5041, accompanying this report). The Septic Systems Capability Map (OGS Map 5044, accompanying this report) is a derived map which classifies the terrain of the North Bay area in terms of its suitability for installation of septic systems.

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Interpretation of existing black and white aerial photographs, at a scale of approximately 1:38 000, was the primary method of obtaining this terrain information. The interpretation was checked with published and unpublished literature which documented previous field visits and observations. During the fall of 1977, roads in the area were traversed and observed terrain conditions recorded as further verification of the office studies. Thus, the map represents a reconnaissance overview of the engineering conditions of the terrain.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. Further information on the mapping techniques, legend format, and possible uses of this terrain data is available in the "Ontario Engineering Geology Terrain Study Users' Manual" (Gartner, Mollard, and Roed 1980), a companion publication to this series of maps and reports.

2.0 GEOLOGICAL SETTING:

2.1 BEDROCK:

Precambrian rocks of the Grenville Structural Province underlie the North Bay map-area. These rocks have a long and complex geological history covering at least 2 500 million years (Lumbers 1971). They have been strongly metamorphosed, folded, and then intruded by igneous rocks.

The oldest and most abundant rocks of the metamorphic complex are metasediments derived largely from siliceous sandstones and siltstones. These metasediments consist of a variety of gneisses and can be found throughout most of the map-area.

Stocks, sheets, and batholiths of felsic igneous rocks were emplaced within the metasediments and were themselves metamorphosed to gneiss and migmatite. Four major batholiths have been delineated by Lumbers (1971): 1) the Sturgeon Falls Batholith, north of Lake Nipissing; 2) the Mulock Batholith, in the north-central part of the map-area; 3) the Bonfield Batholith, east of North Bay; and 4) the Powassan Batholith, southeast of Lake Nipissing.

Carbonatite complexes at Callandar Bay and on the islands in the central part of Lake Nipissing have high potential for such commodities as copper-nickel, uranium, columbium, and silver. Mineral potential throughout the remainder of the map-area is rated by Springer (1978) as "least".

2.2 QUATERNARY:

Glacial ice advanced toward the southwest (Boissonneau 1968), depositing a thin, discontinuous veneer of ground moraine till over the bedrock. The till is characterized by a red to grey colour, a general lack of carbonates, and a very low percentage of material of silt size or finer (Harrison 1972).

During deglaciation, crustal depression due to glacial loading permitted waters from the Upper Great Lakes to pond and spill eastward through the area and into the Ottawa Valley drainage system. Thus, glaciolacustrine deposits are common within this map-area. Lobation of the ice margin during retreat uncovered a sequence of drainage routes to the east, collectively known as the North Bay Outlet (Chapman 1975). Two major morainal features were formed during this recession: the Genesee Moraine, located about 15 km east of Powassan in the southeastern part of the map-area, and the Rutherglen Moraine, south of Rutherglen on the east-central margin of the area (Harrison 1972). These landforms have been termed kame moraines by Chapman (1975) and are shown on the Data Base Map (OGS Map 5041, accompanying this report) as complex, glaciofluvial ice marginal deposits.

The Quaternary deposits found in the North Bay map-area are quite complex, having resulted from a variety of geological processes associated with glacial, glaciofluvial, and glaciolacustrine conditions. The user is advised to refer to Harrison (1972) and Chapman (1975) for further discussions on the glacial history.

3.0 ENGINEERING TERRAIN UNITS:

3.1 BEDROCK LANDFORMS:

3.1.1 Description:

Rock knob (RN) terrain is common throughout the North Bay map-area.

There is very little soil cover immediately south of Lake Nipissing, but organic deposits are numerous and the terrain is low and undulating. Surface drainage is often poor, and the water table is at surface in the organic deposits. A typical terrain unit letter code is:

$$\frac{\text{RN(pOT)}}{\text{Lu-M(W)}}$$

North of Lake Nipissing, the topography of the rock knob terrain becomes more pronounced, and ground moraine and glaciolacustrine deposits are common subordinate landforms, forming a veneer over the bedrock. The soil is generally less than 1 m thick on the crests of the rock outcrops, but can thicken to several metres on the flanks and in depressions between the bedrock highs. Typical letter codes are:

$$\frac{\text{RN(tMG, pOT/R)}}{\text{Mu-D(M)}} \qquad \frac{\text{RN(sLP, tMG/R) (pOT)}}{\text{Lu-M(W)}}$$

East of Lake Nipissing and near the southern margin of the map-area, the bedrock terrain becomes more rugged, and slopes are often steep and complex. Ground moraine and organic deposits are common subordinate landforms. Typical letter codes are:

$$\frac{\text{RN(tMG, pOT/R)}}{\text{Mj-D(M)}} \qquad \frac{\text{RN(tMG, pOT/R)}}{\text{Hj-D(M)}}$$

South of Trout Lake in the east-central part of the area, there is very little soil cover. The bedrock terrain consists of knobby, bare outcrops surrounded by organic terrain. A typical letter code is:

$$\frac{\text{RN(pOT)}}{\text{Mn-D(W)}}$$

3.1.2 Significance:

RESOURCES: Portions of the bedrock can be used for crushed stone purposes. Springer (1978) has indicated areas of high potential northeast of North Bay and in Boulter, North Himsworth, and Mulock Townships. Detailed evaluations of the suitability of specific rock units for aggregate use would be required.

Ground water resources within the bedrock will be limited to fractures, faults, and fissures. The occurrence of aquifers is unpredictable and the terrain has poor potential for ground water supplies.

GENERAL CONSTRUCTION: The major constraints in terms of construction are the bedrock outcrops, the occurrence of large boulders on surface, and the organic terrain that is often associated with the bedrock, especially south of Lake Nipissing. This means that, in most instances, excavations will required blasting. Site-grading will be expensive and rock fills will be necessary in grading works. Foundation conditions should be excellent on the bedrock, but route alignments will require rock cut-and-fill operations.

Because of the shallow drift cover and the variety of outcrop shapes and forms, development activities will be difficult and expensive. In areas of low bedrock relief (e.g. immediately south of Lake Nipissing) the engineer must contend not only with bedrock, but with poor surface drainage and organic deposits. South of Trout Lake, the higher relief and the steep, complex bedrock slopes will increase development costs.

Management of the land for any development will be complex. The variable rock slopes, combined with the shallow overburden, will make the terrain susceptible to surface erosion, especially when cleared of vegetation.

WASTE DISPOSAL: The bedrock terrain is not amenable, in its natural state, to the disposal of waste, whether it be garbage, septic tank effluent, or industrial liquids. Development of lagoons or tile fields will require extensive grading of rock materials and importation of soil fill. Fractures in the bedrock could act as conduits for migration of effluents, and the pollution impact on surface drainage courses could be significant.

3.2 MORAINAL LANDFORMS:

3.2.1 Description:

Ground moraine (MG) occurs as a subordinate landform in rock knob terrain throughout most of the map-area. It also occurs as the dominant landform in terrain units located 1) northeast of North Bay in the northern part of the area and 2) northeast and west of Powassan in the southern part.

Northeast of North Bay, the ground moraine covers knobby bedrock terrain and the unit is designated as:

$$\frac{\text{tMG/RN}}{\text{Mj-M}}$$

The till is stony and sandy in texture (Harrison 1972) and is characterized by a red to grey colour, a lack of carbonates, and a very low percentage of material of silt size or smaller. Typically, material of sand size or larger is dominant and clay-sized particles amount to less than 3 percent by weight of the till. Boulders up to 1 m in diameter are common, with occasional blocks reaching 4.5 m. Relief is moderate, the topography is rugged, and the surface drainage is mixed wet and dry. Rock knobs outcrop throughout the unit.

Northeast of Powassan, the ground moraine landform is identified by the letter code:

$$\frac{\text{tMG/R}}{\text{Lun-D}}$$

Relief is low and the topography is undulating, with a few knobby features reflecting irregularities in the underlying bedrock surface. Drainage conditions are dry.

West of Powassan, the ground moraine and associated sandy outwash overlie bedrock knobs, and organic terrain is an occasional subordinate landform. Typical letter codes are:

$$\frac{\text{tMG, sGO/RN}}{\text{Mu-D}} \qquad \frac{\text{tMG/RN(pOT)}}{\text{Mu-D(W)}}$$

This complex terrain unit is composed predominately of glacial till, with some interstratified sand, gravel, and boulders.

3.2.2 Significance:

RESOURCES: Ground moraine is not an ideal landform in which to find deposits of sand and gravel. At best, only small pockets of suitable material can be expected. However, locally significant occurrences of sand and gravel may occur where the ground moraine has been modified by meltwaters or glaciolacustrine action.

Ground water resources are expected to be significant only where the ground moraine has a substantial thickness and overlies permeable sand and gravel at depth. Such a situation can be identified only through more detailed studies.

GENERAL CONSTRUCTION: Because ground moraine till is bouldery and often forms only a thin blanket over the bedrock, there will be a number of construction problems associated with rock excavation and grading. Excavations, except for shallow ones, will likely intersect bedrock and zones of very bouldery soils. On the other hand, the proximity of bedrock means that bearing capacities for foundations will generally be excellent.

WASTE DISPOSAL: The bouldery nature of the till and the existence of near-surface bedrock place constraints on the siting of waste disposal facilities. Septic systems are probably feasible, but site-specific investigations will be required to ascertain bedrock levels, slope conditions, and the proportion of boulders in the till. Determination of the thickness and hydrogeologic characteristics of the morainal till and the surrounding environment is important when assessing these terrain units for solid or liquid waste disposal schemes.

3.3 GLACIOFLUVIAL LANDFORMS:

3.3.1 Description:

Outwash (GO) deposits are widespread throughout the map-area. Immediately north of North Bay, a large area of outwash blankets the bedrock. In some localities the sediments reach thicknesses of more than 30 m, but usually they form a 3 to 5 m thick blanket over ground moraine and bedrock.

Typical terrain unit letter codes are:

$$\frac{\text{sgGO}}{\text{Lu-D}} \qquad \frac{\text{gsGO}}{\text{Lu-D}} \qquad \frac{\text{sGO, pOT/R(RN)}}{\text{Lu-M}} \qquad \frac{\text{sGO, tMG/RN(RN)}}{\text{Mu-M(D)}}$$

These indicate that the outwash consists of sandy gravel, gravelly sand, or sand. In some localities, peaty organic terrain or ground moraine till over bedrock are also dominant. Rock knobs are a common subordinate landform. Relief is usually low, the topography is undulating, and drainage is dry or mixed.

In the northeastern quadrant of the area, there are a number of gravelly sand outwash deposits which have good aggregate resource potential. Harding (1946) mentioned the existence of well-bedded sand and gravel units which are widespread in the valley of Antoine Creek and can occur more than 30 m above the level of the present stream. Field observations for the present engineering geology terrain study recorded up to 20 m of cobbly sand and gravel in a pit face north of Twenty Minute Lake in French Township. Typical letter codes are:

$$\frac{\text{sgGO}}{\text{Lu-D}} \qquad \frac{\text{gsGO}}{\text{Ltk-D}} \qquad \frac{\text{sgGO(RN)}}{\text{Lku-M}}$$

Outwash also forms a mantle over ground moraine and bedrock in two places along the southern margin of the area, near Restoule and south of Powassan. Kames can occur either as dominant or subordinate landforms. Typical letter codes are:

$$\frac{\text{sGO/tMG/R(tsGK)}}{\text{Mu-M}} \qquad \frac{\text{sGO, tbGK(pOT)}}{\text{Lun-M(W)}}$$

Eskers (GE, >>>>>) and *kames* (GK) are dominant landforms in the southeastern quadrant of the map-area. Terrain units containing these landforms extend from Lake Talon on the east-central margin of the area south-southwest for a distance of approximately 35 km to the southern margin. These complex terrain units, consisting of kames, eskers, and outwash deposits, correlate with the Rutherglen and Genesse Moraines described by Harrison (1972) and the eskers and kame moraines described by Chapman (1975).

Examples of terrain unit letter codes describing these features are:

$$\frac{\text{sgGE}}{\text{Lru-D}} \qquad \frac{\text{sgGK, tME}}{\text{Mu-D}} \qquad \frac{\text{sgtGK, sgGE(sgGO)}}{\text{Mdnk-D}}$$

$$\frac{\text{gsGE, gsGO}}{\text{Lrk-D}} \qquad \frac{\text{sgGE, sgGK}}{\text{Lru-D}}$$

These indicate that the landforms consist of gravelly sand to sandy gravel. The kames can contain appreciable inclusions of glacial till, although this is not always shown in the codes. Relief is low to moderate, there are many ice-contact features such as knobs, kettles, and ridges, and the terrain is sometimes dissected. The outwash is usually undulating and surface drainage conditions are dry.

Harrison (1972, p. 15) described the Genesee Moraine as ". . . more than 5 miles long and, in places, up to 2 miles wide. Rolling hills formed by the dissection of a great thickness of sand with some gravel, compose the south side of the moraine, while the higher, northern side consists of sand and gravel cut by streams flowing in gullies as much as 100 feet deep. Several large kettle holes more than 100 feet deep are developed in these deposits, while two complex esker systems can be traced into the northern fringe". This indicates that it is a very complex landform.

Other, more isolated kame landforms were identified throughout the southern part of the map-area, especially in the vicinity of Powassan. Eskers are commonly associated with these ice contact features. Chapman (1975) described the Boulter Esker, located in Boulter Township in the southeastern part of the area, as standing over 30 m high in places and consisting of two or three strands. The esker located in Bonfield Township in the east-central part of the area consists of a single ridge which, in most places, is less than 15 m in height.

3.3.2 Significance:

RESOURCES: The glaciofluvial landforms in the North Bay map-area have excellent potential for the development of sand and gravel resources. Outwash (GO), eskers (GE), and kames (GK) consisting of sandy gravel (gs) or gravelly sand (sg) are particularly good prospects. Examples include:

1) portions of the large outwash deposit situated north of North Bay,
2) a number of outwash deposits located in French, Phelps, and Olrig Townships in the northwestern part of the area,
3) the esker-kame-outwash complex which extends from Lake Talon in the eastern part of the area south-southwest for a distance of 35 km to the southern margin,
4) the kame deposits around Powassan in the south-central part of the area, and
5) the outwash deposit located approximately 8 km west of Powassan.

The larger glaciofluvial landforms have good potential for ground water supplies, especially where the deposits are thick.

GENERAL CONSTRUCTION: The materials which comprise these glaciofluvial landforms are generally granular in nature and exhibit good engineering characteristics. However, the following local conditions can cause construction difficulties:

1) areas of potentially high water tables,
2) near-surface bedrock,
3) steep and complex slopes in the kame units, and
4) the existence of surface and buried boulders.

The terrain unit letter codes should be studied to determine whether such local conditions might exist in the area of interest.

WASTE DISPOSAL: Because of the permeable nature of the materials and the possibility of connections between ground water and surface water, the disposal of liquid and solid wastes within glaciofluvial landforms must be approached with considerable caution. Detailed hydrogeological investigations are required to determine potential contaminant flow characteristics.

3.4 GLACIOLACUSTRINE LANDFORMS:

3.4.1 Description:

Glaciolacustrine plains (LP) occur in a number of localities throughout the North Bay map-area, but are concentrated in the southeastern quadrant and along the north shore of Lake Nipissing.

Along the north shore of Lake Nipissing near Sturgeon Falls, the deposits consist mainly of sandy silt and have low relief, planar surfaces. They sometimes form only a thin veneer over the bedrock. Surface drainage is generally imperfect and water often ponds on the surface. Typical terrain unit letter codes are:

$$\frac{\text{msLP}}{\text{Lp-Dh}} \qquad \frac{\text{sLP/RN(pOT)}}{\text{Lu-M(W)}}$$

A review of water well logs and foundation borings indicates that the City of North Bay is underlain by glaciolacustrine sediments which consist of a surficial deposit of silty sand overlying varved clay and silt. This situation is indicated by the letter code:

$$\frac{\text{smLP/mcLP}}{\text{Lu-M}}$$

East of Bonfield in the east-central part of the area, the glaciolacustrine deposits range in texture from silty sand to silt and clay, and usually overlie bedrock or ground moraine. Typical terrain unit letter codes are:

$$\frac{\text{mscLP/R(RN)}}{\text{Lu-M}} \qquad \frac{\text{msLP/tMG(RN)}}{\text{Lu-M}}$$

Along Highway 63 northeast of North Bay, varved clay and silt are buried by outwash sand and gravel in some localities. A terrain unit located near Balsam Creek in Phelps Township has the letter code:

$$\frac{\text{sGO/mLP/RN}}{\text{Mu-M}}$$

Near Powassan in the southern part of the area, the glaciolacustrine deposits consist of sand and silt with some clay. Rock knobs occur as a subordinate landform. The letter code is:

$$\frac{\text{smLP(RN)}}{\text{Lu-M}}$$

The deposits in the southwestern part of the map-area consist predominantly of fine sand and are associated with organic terrain overlying bedrock. The letter code in this case is:

$$\frac{\text{sLP, pOT/R}}{\text{Lu-M}}$$

A *glaciolacustrine delta* (LD) dominates the landscape east of Sturgeon Falls on the north shore of Lake Nipissing. The delta has a low relief, planar surface, is composed of sandy silt and very fine sand, and has wet surface drainage conditions. Organic terrain is intermingled with the deltaic deposits, as indicated by the terrain unit letter code:

$$\frac{\text{msLD(pOT)}}{\text{Lp-W}}$$

Raised or abandoned beach ridges (LB) occur along the north and south-eastern edges of the above delta, and are shown as:

$$\frac{\text{smLB/msLD}}{\text{Lu-W}}$$

Further to the east along the north shore of Lake Nipissing, sandy beach ridges have formed over ground moraine. These are depicted by the letter code:

$$\frac{\text{sLB/tbMG}}{\text{Lp-M}}$$

Glacial lake waters have washed the ground surface and modified the existing morainal and glaciofluvial landforms throughout the area. Such features are not identifiable on the airphotos at the scale of interpretation used for this study.

3.4.2 Significance:

RESOURCES: There are recorded instances of clay from glaciolacustrine deposits near Powasson, North Bay, and Sturgeon Falls being used for the manufacture of brick and tile (Guillet 1967, 1977). Thus, certain of these deposits do have resource potential. It may be possible to obtain sand and gravel from small, local beach deposits, but these cannot be considered a significant resource in view of the small quantities and often poor quality of material. Ground water sources may exist at depth beneath the thick lake plain deposits.

GENERAL CONSTRUCTION: Construction conditions within the glaciolacustrine landforms are rated as only poor to fair. The low relief and planar topography produce poor surface drainage in many places. The fine-grained texture of the soils (i.e. silt, clay, and very fine sand) causes problems related to earth handling, compaction, and frost susceptibility. Bearing capacity for foundations is a problem due to the poor geotechnical characteristics of the clay and silt and the substantial thicknesses of these deposits in certain areas.

WASTE DISPOSAL: Glaciolacustrine landforms are not always suitable for waste disposal schemes. The impermeable nature of the silt and clay impedes the proper functioning of tile beds. Sanitary landfill facilities must be specially designed to avoid contamination of the surface water, and cover materials are often difficult to handle.

3.5 ORGANIC AND ALLUVIAL LANDFORMS:

3.5.1 Description:

Organic terrain (OT) is found throughout the map-area, as a common subordinate landform within the rock knob terrain. However, only the large deposits have been shown as separate terrain units on the Data Base Map (OGS Map 5041, accompanying this report).

The organic materials can cover outwash, glaciolacustrine deposits, or bedrock terrain, as indicated by the letter codes:

$$\frac{\text{pOT/sGO}}{\text{Lp-W}} \qquad \frac{\text{pOT/sLP}}{\text{Lp-W}} \qquad \frac{\text{pOT/RN}}{\text{Lu-W(D)}}$$

More commonly though, the organic terrain occurs as a deeper deposit, shown as:

$$\frac{\text{pOT}}{\text{Lp-W}}$$

Alluvial plains (AP) are associated with most drainage courses, but only the larger ones have been shown on the Data Base Map. An example is the alluvial plain of the Sturgeon River, represented by the letter code:

$$\frac{\text{sAP}}{\text{Lp-M}}$$

3.5.2 Significance:

Both the organic terrain and the alluvial plains have very poor engineering properties and should be avoided by human activities. They are prone to flooding, can contain soft and compressible soils, and are generally unsuitable for any type of development.

Graham (1976) described a peat deposit, situated north of Sturgeon Falls, where horticultural grade peat moss appears to be present.

4.0 SUMMARY OF ENGINEERING SIGNIFICANCE:

The preceding section described the characteristics of the major landform types and their engineering and resource significance. Table 1 is a summary of the general engineering significance of the more common terrain units found in the area. This table is intended only as a guide to help the reader in assessing the overall significance of the map-units. Site-specific work is necessary to better define actual ground conditions, such as drainage and slope, which are not considered in the table, but which may affect the engineering significance of the various terrain units.

5.0 EXAMPLE OF A DERIVED MAP: SEPTIC SYSTEMS CAPABILITY

5.1 GENERAL COMMENTS:

The Data Base Map (OGS Map 5041, accompanying this report) is complex, due to the inclusion of all of the terrain factors contained in the legend. For the information to have direct user benefit, the engineering terrain units must be analysed further to provide derived maps for specific requirements. A Septic Systems Capability Map (OGS Map 5044)

TABLE 1: SUMMARY OF ENGINEERYING SIGNIFICANCE

		BEDROCK	MORAINAL	GLACIOFLUVIAL			GLACIOLACUSTRINE		ORGANIC
		RN(tMG, pOT/R) / Mu-D(M)	tMG/R / Mj-M	GO	GE	GK	LP	LD	OT
RESOURCE POTENTIAL	SAND & GRAVEL	Poor	Poor	Excellent	Excellent	Good	Poor	Poor	N/A
	GROUND WATER	Poor	Poor	Good	Fair	Fair	Poor	Poor	Poor
LIGHT CONSTRUCTION CONDITIONS	EXCAVATIONS	Blasting	Fair to Poor	Excellent	Good	Fair	Good	Poor	Poor
	FOUNDATIONS	Excellent	Good	Good	Good	Good	Fair to Poor	Very Poor	Very Poor
	GRADING	Difficult	Fair	Good	Good	Fair	Good	Poor	Very Poor
	MATERIAL RE-USE	Rockfill	Fair to Good	Excellent	Excellent	Good	Fair to Poor	Poor	Very Poor
WASTE DISPOSAL SUITABILITY	SEPTIC SYSTEMS	Very Poor	Fair	Good	Fair	Fair	Fair to Poor	Poor	Very Poor
	LANDFILL	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Very Poor
	LAGOONS	Very Poor	Fair to Good	Fair	Fair	Fair	Good	Poor	Very Poor

has been included in this report as an example of the sorts of information that can be obtained from the Data Base Map.

5.2 CRITERIA:

The complex array of engineering terrain units in the North Bay map-area can be interpreted to produce a map showing engineering conditions as they apply to the siting and design of septic systems for waste disposal. The suitability of the land for septic systems is dependent upon a number of factors. These include soil texture and type, soil permeability, proximity of bedrock and ground water to the surface, and slope of the ground surface. All of these criteria can be interpreted from the basic engineering terrain unit letter codes found on the maps. However, the reader should be advised that the information upon which this derived map is based is only at a level of detail consistent with a scale of 1:100 000. The map is intended as a guide to regional planning, and should not be used for design purposes.

5.3 LAND CAPABILITY UNITS:

Based on the foregoing criteria, the North Bay map-area can be divided into five units of varying suitability for septic system disposal of wastes.

Green areas are underlain by dry, coarse-grained soils with level to undulating topography. The soils are generally very permeable, but due to a high silica content their absorption qualities are less than ideal. These units provide suitable locations for the design and construction of septic tank systems. The soils are permeable enough to allow the effluent to seep away from the tile bed; ground water is deep enough so that it will not be affected; and the topography is level enough to provide adequate grades without extensive earthworks. Most of the land which falls in this category lies north and northeast of North Bay within glaciofluvial outwash deposits.

Orange areas are underlain by coarse-grained soils exhibiting hummocky relief with complex slopes. The major constraints to the siting of septic systems in this terrain are the steep slopes and, to a lesser extent, the high percentage of boulders in some of the soils. However, site-grading and special design of the tile fields should alleviate these problems, thus giving the orange areas fair to good suitability for septic systems.

Pink areas contain a variety of conditions. Soils are mainly coarse-grained but often underlain by bedrock and/or ground water at depths of less than 3 m. Surface drainage is sometimes imperfect, but the topography is usually undulating and not too severe. Within these units, the main problem with the siting of tile fields is the possibility of ground water and bedrock levels being close to the tiles. Site-specific investigations are necessary to determine the exact positions of bedrock and ground water. In some cases, tile fields may have to be raised.

Blue areas are underlain by fine-grained glaciolacustrine soils. The terrain is level to undulating; surface drainage is imperfect; the soils have low permeabilities; and ground water levels are often close to the surface. These conditions create a potentially poor environment for the siting of septic systems. Careful site-specific investigations are needed to determine the optimum design for the system. Special engineering, in the form of raised tile fields, is often required.

Uncoloured areas consist of bedrock terrain, organic deposits, and wet surface soils. Conditions are generally unsuitable for septic systems within this unit unless expensive engineering designs are considered. In the bedrock terrain, problems would include grades, proximity of bedrock, availability of fill material, and general construction difficulties. Within the organic terrain and wet soils, poor drainage conditions and the presence of water table at or above ground surface present the major problems.

6.0 REFERENCES:

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Ontario Geological Survey

Northern Ontario
Engineering Geology Terrain Study 101

NORTH BAY AREA

(NTS 31L/SW)

Districts of Nipissing and Parry Sound

by

John F. Gartner

1980

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Map 5044 (coloured) – Northern Ontario Engineering Geology Terrain Study, Septic Systems Capability Map, North Bay (NTS 31L/SW). Scale 1:100 000.

Northern Ontario
Engineering Geology Terrain Study 101

NORTH BAY AREA

(NTS 31L/SW)

Districts of Nipissing and Parry Sound

by

John F. Gartner[1]

1.0 INTRODUCTION:

This report contains an inventory of regional engineering terrain conditions in the North Bay area, Districts of Nipissing and Parry Sound. The area, which covers NTS block 31L/SW, lies between Latitudes 46°00'N and 46°30'N and Longitudes 79°00'W and 80°00'W. It forms part of a series of publications which provide similar terrain data for some 370 000 km^2 of northern Ontario.

The purpose of the mapping is to provide a guide for engineering and resource planning functions at a level of detail consistent with a scale of 1:100 000. The terrain information is contained on the Data Base Map (OGS Map 5041, accompanying this report). The Septic Systems Capability Map (OGS Map 5044, accompanying this report) is a derived map which classifies the terrain of the North Bay area in terms of its suitability for installation of septic systems.

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Interpretation of existing black and white aerial photographs, at a scale of approximately 1:38 000, was the primary method of obtaining this terrain information. The interpretation was checked with published and unpublished literature which documented previous field visits and observations. During the fall of 1977, roads in the area were traversed and observed terrain conditions recorded as further verification of the office studies. Thus, the map represents a reconnaissance overview of the engineering conditions of the terrain.

An engineering terrain legend was developed to facilitate the mapping and to provide a common information base for the entire map series. This legend is shown on the accompanying Data Base Map. Further information on the mapping techniques, legend format, and possible uses of this terrain data is available in the "Ontario Engineering Geology Terrain Study Users' Manual" (Gartner, Mollard, and Roed 1980), a companion publication to this series of maps and reports.

2.0 GEOLOGICAL SETTING:

2.1 BEDROCK:

Precambrian rocks of the Grenville Structural Province underlie the North Bay map-area. These rocks have a long and complex geological history covering at least 2 500 million years (Lumbers 1971). They have been strongly metamorphosed, folded, and then intruded by igneous rocks.

The oldest and most abundant rocks of the metamorphic complex are metasediments derived largely from siliceous sandstones and siltstones. These metasediments consist of a variety of gneisses and can be found throughout most of the map-area.

Stocks, sheets, and batholiths of felsic igneous rocks were emplaced within the metasediments and were themselves metamorphosed to gneiss and migmatite. Four major batholiths have been delineated by Lumbers (1971): 1) the Sturgeon Falls Batholith, north of Lake Nipissing; 2) the Mulock Batholith, in the north-central part of the map-area; 3) the Bonfield Batholith, east of North Bay; and 4) the Powassan Batholith, southeast of Lake Nipissing.

Carbonatite complexes at Callandar Bay and on the islands in the central part of Lake Nipissing have high potential for such commodities as copper-nickel, uranium, columbium, and silver. Mineral potential throughout the remainder of the map-area is rated by Springer (1978) as "least".

2.2 QUATERNARY:

Glacial ice advanced toward the southwest (Boissonneau 1968), depositing a thin, discontinuous veneer of ground moraine till over the bedrock. The till is characterized by a red to grey colour, a general lack of carbonates, and a very low percentage of material of silt size or finer (Harrison 1972).

During deglaciation, crustal depression due to glacial loading permitted waters from the Upper Great Lakes to pond and spill eastward through the area and into the Ottawa Valley drainage system. Thus, glaciolacustrine deposits are common within this map-area. Lobation of the ice margin during retreat uncovered a sequence of drainage routes to the east, collectively known as the North Bay Outlet (Chapman 1975). Two major morainal features were formed during this recession: the Genesee Moraine, located about 15 km east of Powassan in the southeastern part of the map-area, and the Rutherglen Moraine, south of Rutherglen on the east-central margin of the area (Harrison 1972). These landforms have been termed kame moraines by Chapman (1975) and are shown on the Data Base Map (OGS Map 5041, accompanying this report) as complex, glaciofluvial ice marginal deposits.

The Quaternary deposits found in the North Bay map-area are quite complex, having resulted from a variety of geological processes associated with glacial, glaciofluvial, and glaciolacustrine conditions. The user is advised to refer to Harrison (1972) and Chapman (1975) for further discussions on the glacial history.

3.0 ENGINEERING TERRAIN UNITS:

3.1 BEDROCK LANDFORMS:

3.1.1 Description:

Rock knob (RN) terrain is common throughout the North Bay map-area.

There is very little soil cover immediately south of Lake Nipissing, but organic deposits are numerous and the terrain is low and undulating. Surface drainage is often poor, and the water table is at surface in the organic deposits. A typical terrain unit letter code is:

$$\frac{\text{RN(pOT)}}{\text{Lu-M(W)}}$$

North of Lake Nipissing, the topography of the rock knob terrain becomes more pronounced, and ground moraine and glaciolacustrine deposits are common subordinate landforms, forming a veneer over the bedrock. The soil is generally less than 1 m thick on the crests of the rock outcrops, but can thicken to several metres on the flanks and in depressions between the bedrock highs. Typical letter codes are:

$$\frac{\text{RN(tMG, pOT/R)}}{\text{Mu-D(M)}} \qquad \frac{\text{RN(sLP, tMG/R) (pOT)}}{\text{Lu-M(W)}}$$

East of Lake Nipissing and near the southern margin of the map-area, the bedrock terrain becomes more rugged, and slopes are often steep and complex. Ground moraine and organic deposits are common subordinate landforms. Typical letter codes are:

$$\frac{\text{RN(tMG, pOT/R)}}{\text{Mj-D(M)}} \qquad \frac{\text{RN(tMG, pOT/R)}}{\text{Hj-D(M)}}$$

South of Trout Lake in the east-central part of the area, there is very little soil cover. The bedrock terrain consists of knobby, bare outcrops surrounded by organic terrain. A typical letter code is:

$$\frac{\text{RN(pOT)}}{\text{Mn-D(W)}}$$

3.1.2 Significance:

RESOURCES: Portions of the bedrock can be used for crushed stone purposes. Springer (1978) has indicated areas of high potential northeast of North Bay and in Boulter, North Himsworth, and Mulock Townships. Detailed evaluations of the suitability of specific rock units for aggregate use would be required.

Ground water resources within the bedrock will be limited to fractures, faults, and fissures. The occurrence of aquifers is unpredictable and the terrain has poor potential for ground water supplies.

GENERAL CONSTRUCTION: The major constraints in terms of construction are the bedrock outcrops, the occurrence of large boulders on surface, and the organic terrain that is often associated with the bedrock, especially south of Lake Nipissing. This means that, in most instances, excavations will required blasting. Site-grading will be expensive and rock fills will be necessary in grading works. Foundation conditions should be excellent on the bedrock, but route alignments will require rock cut-and-fill operations.

Because of the shallow drift cover and the variety of outcrop shapes and forms, development activities will be difficult and expensive. In areas of low bedrock relief (e.g. immediately south of Lake Nipissing) the engineer must contend not only with bedrock, but with poor surface drainage and organic deposits. South of Trout Lake, the higher relief and the steep, complex bedrock slopes will increase development costs.

Management of the land for any development will be complex. The variable rock slopes, combined with the shallow overburden, will make the terrain susceptible to surface erosion, especially when cleared of vegetation.

WASTE DISPOSAL: The bedrock terrain is not amenable, in its natural state, to the disposal of waste, whether it be garbage, septic tank effluent, or industrial liquids. Development of lagoons or tile fields will require extensive grading of rock materials and importation of soil fill. Fractures in the bedrock could act as conduits for migration of effluents, and the pollution impact on surface drainage courses could be significant.

3.2 MORAINAL LANDFORMS:

3.2.1 Description:

Ground moraine (MG) occurs as a subordinate landform in rock knob terrain throughout most of the map-area. It also occurs as the dominant landform in terrain units located 1) northeast of North Bay in the northern part of the area and 2) northeast and west of Powassan in the southern part.

Northeast of North Bay, the ground moraine covers knobby bedrock terrain and the unit is designated as:

$$\frac{\text{tMG/RN}}{\text{Mj-M}}$$

The till is stony and sandy in texture (Harrison 1972) and is characterized by a red to grey colour, a lack of carbonates, and a very low percentage of material of silt size or smaller. Typically, material of sand size or larger is dominant and clay-sized particles amount to less than 3 percent by weight of the till. Boulders up to 1 m in diameter are common, with occasional blocks reaching 4.5 m. Relief is moderate, the topography is rugged, and the surface drainage is mixed wet and dry. Rock knobs outcrop throughout the unit.

Northeast of Powassan, the ground moraine landform is identified by the letter code:

$$\frac{\text{tMG/R}}{\text{Lun-D}}$$

Relief is low and the topography is undulating, with a few knobby features reflecting irregularities in the underlying bedrock surface. Drainage conditions are dry.

West of Powassan, the ground moraine and associated sandy outwash overlie bedrock knobs, and organic terrain is an occasional subordinate landform. Typical letter codes are:

$$\frac{\text{tMG, sGO/RN}}{\text{Mu-D}} \qquad \frac{\text{tMG/RN(pOT)}}{\text{Mu-D(W)}}$$

This complex terrain unit is composed predominately of glacial till, with some interstratified sand, gravel, and boulders.

3.2.2 Significance:

RESOURCES: Ground moraine is not an ideal landform in which to find deposits of sand and gravel. At best, only small pockets of suitable material can be expected. However, locally significant occurrences of sand and gravel may occur where the ground moraine has been modified by meltwaters or glaciolacustrine action.

Ground water resources are expected to be significant only where the ground moraine has a substantial thickness and overlies permeable sand and gravel at depth. Such a situation can be identified only through more detailed studies.

GENERAL CONSTRUCTION: Because ground moraine till is bouldery and often forms only a thin blanket over the bedrock, there will be a number of construction problems associated with rock excavation and grading. Excavations, except for shallow ones, will likely intersect bedrock and zones of very bouldery soils. On the other hand, the proximity of bedrock means that bearing capacities for foundations will generally be excellent.

WASTE DISPOSAL: The bouldery nature of the till and the existence of near-surface bedrock place constraints on the siting of waste disposal facilities. Septic systems are probably feasible, but site-specific investigations will be required to ascertain bedrock levels, slope conditions, and the proportion of boulders in the till. Determination of the thickness and hydrogeologic characteristics of the morainal till and the surrounding environment is important when assessing these terrain units for solid or liquid waste disposal schemes.

3.3 GLACIOFLUVIAL LANDFORMS:

3.3.1 Description:

Outwash (GO) deposits are widespread throughout the map-area. Immediately north of North Bay, a large area of outwash blankets the bedrock. In some localities the sediments reach thicknesses of more than 30 m, but usually they form a 3 to 5 m thick blanket over ground moraine and bedrock.

Typical terrain unit letter codes are:

sgGO	gsGO	sGO, pOT/R(RN)	sGO, tMG/RN(RN)
Lu-D	Lu-D	Lu-M	Mu-M(D)

These indicate that the outwash consists of sandy gravel, gravelly sand, or sand. In some localities, peaty organic terrain or ground moraine till over bedrock are also dominant. Rock knobs are a common subordinate landform. Relief is usually low, the topography is undulating, and drainage is dry or mixed.

In the northeastern quadrant of the area, there are a number of gravelly sand outwash deposits which have good aggregate resource potential. Harding (1946) mentioned the existence of well-bedded sand and gravel units which are widespread in the valley of Antoine Creek and can occur more than 30 m above the level of the present stream. Field observations for the present engineering geology terrain study recorded up to 20 m of cobbly sand and gravel in a pit face north of Twenty Minute Lake in French Township. Typical letter codes are:

$$\frac{\text{sgGO}}{\text{Lu-D}} \qquad \frac{\text{gsGO}}{\text{Ltk-D}} \qquad \frac{\text{sgGO(RN)}}{\text{Lku-M}}$$

Outwash also forms a mantle over ground moraine and bedrock in two places along the southern margin of the area, near Restoule and south of Powassan. Kames can occur either as dominant or subordinate landforms. Typical letter codes are:

$$\frac{\text{sGO/tMG/R(tsGK)}}{\text{Mu-M}} \qquad \frac{\text{sGO, tbGK(pOT)}}{\text{Lun-M(W)}}$$

Eskers (GE, >>>>>) and *kames* (GK) are dominant landforms in the southeastern quadrant of the map-area. Terrain units containing these landforms extend from Lake Talon on the east-central margin of the area south-southwest for a distance of approximately 35 km to the southern margin. These complex terrain units, consisting of kames, eskers, and outwash deposits, correlate with the Rutherglen and Genesse Moraines described by Harrison (1972) and the eskers and kame moraines described by Chapman (1975).

Examples of terrain unit letter codes describing these features are:

$$\frac{\text{sgGE}}{\text{Lru-D}} \qquad \frac{\text{sgGK, tME}}{\text{Mu-D}} \qquad \frac{\text{sgtGK, sgGE(sgGO)}}{\text{Mdnk-D}}$$

$$\frac{\text{gsGE, gsGO}}{\text{Lrk-D}} \qquad \frac{\text{sgGE, sgGK}}{\text{Lru-D}}$$

These indicate that the landforms consist of gravelly sand to sandy gravel. The kames can contain appreciable inclusions of glacial till, although this is not always shown in the codes. Relief is low to moderate, there are many ice-contact features such as knobs, kettles, and ridges, and the terrain is sometimes dissected. The outwash is usually undulating and surface drainage conditions are dry.

Harrison (1972, p. 15) described the Genesee Moraine as ". . . more than 5 miles long and, in places, up to 2 miles wide. Rolling hills formed by the dissection of a great thickness of sand with some gravel, compose the south side of the moraine, while the higher, northern side consists of sand and gravel cut by streams flowing in gullies as much as 100 feet deep. Several large kettle holes more than 100 feet deep are developed in these deposits, while two complex esker systems can be traced into the northern fringe". This indicates that it is a very complex landform.

Other, more isolated kame landforms were identified throughout the southern part of the map-area, especially in the vicinity of Powassan. Eskers are commonly associated with these ice contact features. Chapman (1975) described the Boulter Esker, located in Boulter Township in the southeastern part of the area, as standing over 30 m high in places and consisting of two or three strands. The esker located in Bonfield Township in the east-central part of the area consists of a single ridge which, in most places, is less than 15 m in height.

3.3.2 Significance:

RESOURCES: The glaciofluvial landforms in the North Bay map-area have excellent potential for the development of sand and gravel resources. Outwash (GO), eskers (GE), and kames (GK) consisting of sandy gravel (gs) or gravelly sand (sg) are particularly good prospects. Examples include:

1) portions of the large outwash deposit situated north of North Bay,
2) a number of outwash deposits located in French, Phelps, and Olrig Townships in the northwestern part of the area,
3) the esker-kame-outwash complex which extends from Lake Talon in the eastern part of the area south-southwest for a distance of 35 km to the southern margin,
4) the kame deposits around Powassan in the south-central part of the area, and
5) the outwash deposit located approximately 8 km west of Powassan.

The larger glaciofluvial landforms have good potential for ground water supplies, especially where the deposits are thick.

GENERAL CONSTRUCTION: The materials which comprise these glaciofluvial landforms are generally granular in nature and exhibit good engineering characteristics. However, the following local conditions can cause construction difficulties:

1) areas of potentially high water tables,
2) near-surface bedrock,
3) steep and complex slopes in the kame units, and
4) the existence of surface and buried boulders.

The terrain unit letter codes should be studied to determine whether such local conditions might exist in the area of interest.

WASTE DISPOSAL: Because of the permeable nature of the materials and the possibility of connections between ground water and surface water, the disposal of liquid and solid wastes within glaciofluvial landforms must be approached with considerable caution. Detailed hydrogeological investigations are required to determine potential contaminant flow characteristics.

3.4 GLACIOLACUSTRINE LANDFORMS:

3.4.1 Description:

Glaciolacustrine plains (LP) occur in a number of localities throughout the North Bay map-area, but are concentrated in the southeastern quadrant and along the north shore of Lake Nipissing.

Along the north shore of Lake Nipissing near Sturgeon Falls, the deposits consist mainly of sandy silt and have low relief, planar surfaces. They sometimes form only a thin veneer over the bedrock. Surface drainage is generally imperfect and water often ponds on the surface. Typical terrain unit letter codes are:

$$\frac{\text{msLP}}{\text{Lp-Dh}} \qquad \frac{\text{sLP/RN(pOT)}}{\text{Lu-M(W)}}$$

A review of water well logs and foundation borings indicates that the City of North Bay is underlain by glaciolacustrine sediments which consist of a surficial deposit of silty sand overlying varved clay and silt. This situation is indicated by the letter code:

$$\frac{\text{smLP/mcLP}}{\text{Lu-M}}$$

East of Bonfield in the east-central part of the area, the glaciolacustrine deposits range in texture from silty sand to silt and clay, and usually overlie bedrock or ground moraine. Typical terrain unit letter codes are:

$$\frac{\text{mscLP/R(RN)}}{\text{Lu-M}} \qquad \frac{\text{msLP/tMG(RN)}}{\text{Lu-M}}$$

Along Highway 63 northeast of North Bay, varved clay and silt are buried by outwash sand and gravel in some localities. A terrain unit located near Balsam Creek in Phelps Township has the letter code:

$$\frac{\text{sGO/mLP/RN}}{\text{Mu-M}}$$

Near Powassan in the southern part of the area, the glaciolacustrine deposits consist of sand and silt with some clay. Rock knobs occur as a subordinate landform. The letter code is:

$$\frac{\text{smLP(RN)}}{\text{Lu-M}}$$

The deposits in the southwestern part of the map-area consist predominantly of fine sand and are associated with organic terrain overlying bedrock. The letter code in this case is:

$$\frac{\text{sLP, pOT/R}}{\text{Lu-M}}$$

A *glaciolacustrine delta* (LD) dominates the landscape east of Sturgeon Falls on the north shore of Lake Nipissing. The delta has a low relief, planar surface, is composed of sandy silt and very fine sand, and has wet surface drainage conditions. Organic terrain is intermingled with the deltaic deposits, as indicated by the terrain unit letter code:

$$\frac{\text{msLD(pOT)}}{\text{Lp-W}}$$

Raised or abandoned beach ridges (LB) occur along the north and south-eastern edges of the above delta, and are shown as:

$$\frac{\text{smLB/msLD}}{\text{Lu-W}}$$

Further to the east along the north shore of Lake Nipissing, sandy beach ridges have formed over ground moraine. These are depicted by the letter code:

$$\frac{\text{sLB/tbMG}}{\text{Lp-M}}$$

Glacial lake waters have washed the ground surface and modified the existing morainal and glaciofluvial landforms throughout the area. Such features are not identifiable on the airphotos at the scale of interpretation used for this study.

3.4.2 Significance:

RESOURCES: There are recorded instances of clay from glaciolacustrine deposits near Powasson, North Bay, and Sturgeon Falls being used for the manufacture of brick and tile (Guillet 1967, 1977). Thus, certain of these deposits do have resource potential. It may be possible to obtain sand and gravel from small, local beach deposits, but these cannot be considered a significant resource in view of the small quantities and often poor quality of material. Ground water sources may exist at depth beneath the thick lake plain deposits.

GENERAL CONSTRUCTION: Construction conditions within the glaciolacustrine landforms are rated as only poor to fair. The low relief and planar topography produce poor surface drainage in many places. The fine-grained texture of the soils (i.e. silt, clay, and very fine sand) causes problems related to earth handling, compaction, and frost susceptibility. Bearing capacity for foundations is a problem due to the poor geotechnical characteristics of the clay and silt and the substantial thicknesses of these deposits in certain areas.

WASTE DISPOSAL: Glaciolacustrine landforms are not always suitable for waste disposal schemes. The impermeable nature of the silt and clay impedes the proper functioning of tile beds. Sanitary landfill facilities must be specially designed to avoid contamination of the surface water, and cover materials are often difficult to handle.

3.5 ORGANIC AND ALLUVIAL LANDFORMS:

3.5.1 Description:

Organic terrain (OT) is found throughout the map-area, as a common subordinate landform within the rock knob terrain. However, only the large deposits have been shown as separate terrain units on the Data Base Map (OGS Map 5041, accompanying this report).

The organic materials can cover outwash, glaciolacustrine deposits, or bedrock terrain, as indicated by the letter codes:

$$\frac{\text{pOT/sGO}}{\text{Lp-W}} \qquad \frac{\text{pOT/sLP}}{\text{Lp-W}} \qquad \frac{\text{pOT/RN}}{\text{Lu-W(D)}}$$

More commonly though, the organic terrain occurs as a deeper deposit, shown as:

$$\frac{\text{pOT}}{\text{Lp-W}}$$

Alluvial plains (AP) are associated with most drainage courses, but only the larger ones have been shown on the Data Base Map. An example is the alluvial plain of the Sturgeon River, represented by the letter code:

$$\frac{\text{sAP}}{\text{Lp-M}}$$

3.5.2 Significance:

Both the organic terrain and the alluvial plains have very poor engineering properties and should be avoided by human activities. They are prone to flooding, can contain soft and compressible soils, and are generally unsuitable for any type of development.

Graham (1976) described a peat deposit, situated north of Sturgeon Falls, where horticultural grade peat moss appears to be present.

4.0 SUMMARY OF ENGINEERING SIGNIFICANCE:

The preceding section described the characteristics of the major landform types and their engineering and resource significance. Table 1 is a summary of the general engineering significance of the more common terrain units found in the area. This table is intended only as a guide to help the reader in assessing the overall significance of the map-units. Site-specific work is necessary to better define actual ground conditions, such as drainage and slope, which are not considered in the table, but which may affect the engineering significance of the various terrain units.

5.0 EXAMPLE OF A DERIVED MAP: SEPTIC SYSTEMS CAPABILITY

5.1 GENERAL COMMENTS:

The Data Base Map (OGS Map 5041, accompanying this report) is complex, due to the inclusion of all of the terrain factors contained in the legend. For the information to have direct user benefit, the engineering terrain units must be analysed further to provide derived maps for specific requirements. A Septic Systems Capability Map (OGS Map 5044)

TABLE 1: SUMMARY OF ENGINEERYING SIGNIFICANCE

		BEDROCK	MORAINAL	GLACIOFLUVIAL			GLACIOLACUSTRINE		ORGANIC
		RN(tMG, pOT/R) / Mu-D(M)	tMG/R / Mj-M	GO	GE	GK	LP	LD	OT
RESOURCE POTENTIAL	SAND & GRAVEL	Poor	Poor	Excellent	Excellent	Good	Poor	Poor	N/A
	GROUND WATER	Poor	Poor	Good	Fair	Fair	Poor	Poor	Poor
LIGHT CONSTRUCTION CONDITIONS	EXCAVATIONS	Blasting	Fair to Poor	Excellent	Good	Fair	Good	Poor	Poor
	FOUNDATIONS	Excellent	Good	Good	Good	Good	Fair to Poor	Very Poor	Very Poor
	GRADING	Difficult	Fair	Good	Good	Fair	Good	Poor	Very Poor
	MATERIAL RE-USE	Rockfill	Fair to Good	Excellent	Excellent	Good	Fair to Poor	Poor	Very Poor
WASTE DISPOSAL SUITABILITY	SEPTIC SYSTEMS	Very Poor	Fair	Good	Fair	Fair	Fair to Poor	Poor	Very Poor
	LANDFILL	Poor	Fair	Poor	Poor	Poor	Fair	Poor	Very Poor
	LAGOONS	Very Poor	Fair to Good	Fair	Fair	Fair	Good	Poor	Very Poor

has been included in this report as an example of the sorts of information that can be obtained from the Data Base Map.

5.2 CRITERIA:

The complex array of engineering terrain units in the North Bay map-area can be interpreted to produce a map showing engineering conditions as they apply to the siting and design of septic systems for waste disposal. The suitability of the land for septic systems is dependent upon a number of factors. These include soil texture and type, soil permeability, proximity of bedrock and ground water to the surface, and slope of the ground surface. All of these criteria can be interpreted from the basic engineering terrain unit letter codes found on the maps. However, the reader should be advised that the information upon which this derived map is based is only at a level of detail consistent with a scale of 1:100 000. The map is intended as a guide to regional planning, and should not be used for design purposes.

5.3 LAND CAPABILITY UNITS:

Based on the foregoing criteria, the North Bay map-area can be divided into five units of varying suitability for septic system disposal of wastes.

Green areas are underlain by dry, coarse-grained soils with level to undulating topography. The soils are generally very permeable, but due to a high silica content their absorption qualities are less than ideal. These units provide suitable locations for the design and construction of septic tank systems. The soils are permeable enough to allow the effluent to seep away from the tile bed; ground water is deep enough so that it will not be affected; and the topography is level enough to provide adequate grades without extensive earthworks. Most of the land which falls in this category lies north and northeast of North Bay within glaciofluvial outwash deposits.

Orange areas are underlain by coarse-grained soils exhibiting hummocky relief with complex slopes. The major constraints to the siting of septic systems in this terrain are the steep slopes and, to a lesser extent, the high percentage of boulders in some of the soils. However, site-grading and special design of the tile fields should alleviate these problems, thus giving the orange areas fair to good suitability for septic systems.

Pink areas contain a variety of conditions. Soils are mainly coarse-grained but often underlain by bedrock and/or ground water at depths of less than 3 m. Surface drainage is sometimes imperfect, but the topography is usually undulating and not too severe. Within these units, the main problem with the siting of tile fields is the possibility of ground water and bedrock levels being close to the tiles. Site-specific investigations are necessary to determine the exact positions of bedrock and ground water. In some cases, tile fields may have to be raised.

Blue areas are underlain by fine-grained glaciolacustrine soils. The terrain is level to undulating; surface drainage is imperfect; the soils have low permeabilities; and ground water levels are often close to the surface. These conditions create a potentially poor environment for the siting of septic systems. Careful site-specific investigations are needed to determine the optimum design for the system. Special engineering, in the form of raised tile fields, is often required.

Uncoloured areas consist of bedrock terrain, organic deposits, and wet surface soils. Conditions are generally unsuitable for septic systems within this unit unless expensive engineering designs are considered. In the bedrock terrain, problems would include grades, proximity of bedrock, availability of fill material, and general construction difficulties. Within the organic terrain and wet soils, poor drainage conditions and the presence of water table at or above ground surface present the major problems.

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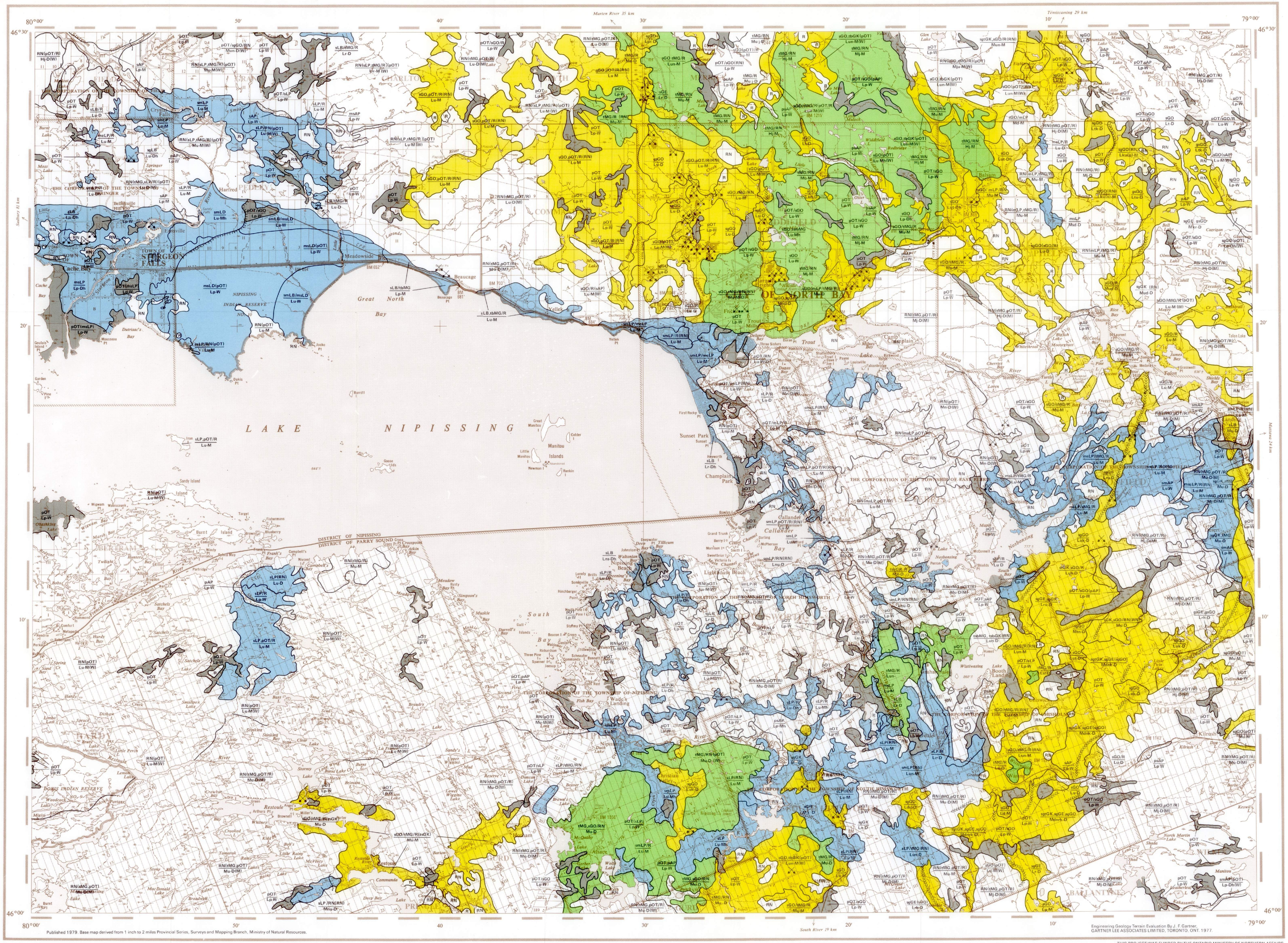


Published 1979. Base map derived from 1 inch to 2 miles Provincial Series, Surveys and Mapping Branch, Ministry of Natural Resources.

Engineering Geology Terrain Evaluation By J. F. Gartner,
GARTNER LEE ASSOCIATES LIMITED, TORONTO, ONT. 1977.

THIS PROJECT WAS FUNDED BY THE ONTARIO MINISTRY OF NORTHERN AFFAIRS.

Ontario

Ministry of Natural Resources

Hon. James A. C. Auld
Minister

Dr. J. K. Reynolds
Deputy Minister

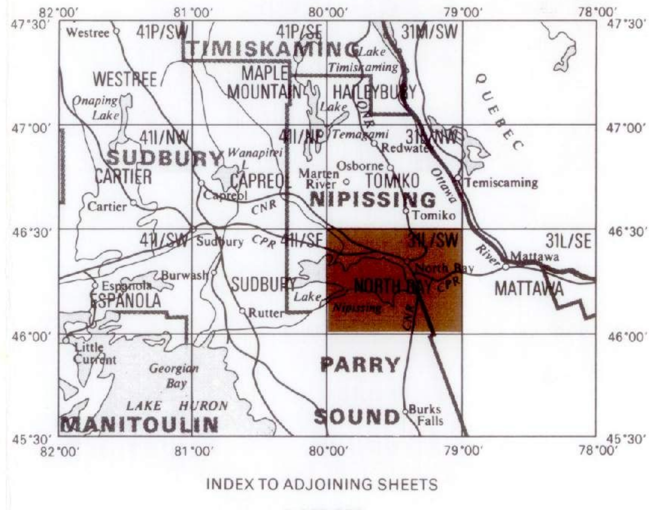
Ontario Geological Survey
Map 5041

Northern Ontario Engineering Geology Terrain Study

Data Base Map

NORTH BAY

NTS 31L/SW



INDEX TO ADJOINING SHEETS

1:100 000

One centimetre represents one kilometre

ENGINEERING TERRAIN LEGEND

The legend comprises four main components arranged as follows:

MATERIAL	LANDFORM
TOPOGRAPHY	DRAINAGE

Examples:

1. tMG(RN) / Mu(Hj)-D — dominant landform; material; subordinate landform; drainage; relief of subordinate landform; topographic variety of dominant landform; local relief

pOT/sGO / Lp-W — slash indicates a veneer of one landform overlying a second landform

LETTER SYMBOLS

MATERIAL

b boulders, bouldery
c clay, clayey
g gravel, gravelly
p peat, muck
r rubble
s sand, sandy
m silt, silty
t till

LANDFORMS

MORAINAL

ME End moraine
MG Ground moraine
MH Hummocky moraine

GLACIOFLUVIAL

GD Ice contact delta, esker delta, kame delta, delta moraine
GE Esker, esker complex, crevasse filling
GK Kame, kame field, kame terrace, kame moraine
GO Outwash plain, valley train

GLACIOLACUSTRINE

LB Raised (abandoned) beach ridge
LD Glaciolacustrine delta
LP Glaciolacustrine plain

ALLUVIAL

AP Alluvial plain

COLLUVIAL

CS Slope failure
CT Talus pile
CW Slopewash and debris creep sheet; minor talus

EOLIAN

ED Sand dunes

ORGANIC

OT Organic terrain

BEDROCK

RL Bedrock plateau
RN Bedrock knob
RP Bedrock plain
RR Bedrock ridge
/R Bedrock below a drift veneer

TOPOGRAPHY

LOCAL RELIEF

H Mainly high local relief
M Mainly moderate local relief
L Mainly low local relief

VARIETY

c channeled
d dissected, gullied
j jagged, rugged, cliffed
j* cliffy volcanic rock signature
k kettled, pitted
n knobby, hummocky
p plain
r ridged
s sloping
t terraced
u undulating to rolling
w washed, reworked

DRAINAGE

SURFACE CONDITION

W Wet
D Dry
M Mixed wet and dry

h Suspected high water table

GRAPHIC SYMBOLS

Major end moraine (symbol located over ridge crest if present)
Well expressed drumlins and drumlinoid ridges
All other linear ice-flow features
Esker ridge (continuous, discontinuous; the symbol does not indicate direction of flow)
Abandoned shoreline (continuous, discontinuous)
Local dune area (type and location of individual dunes not indicated)
Abandoned river channel, spillway, or ice marginal channels
Escarpment
Small landslide scar
Sand or gravel pit
Quarry or mine workings evident from airphotos or field observation (crossed picks are shown in the area of open excavation)
Other man-made features (rock dumps, tailings, lagoons, landfills, etc.; type of feature mentioned where identifiable)
Steep-walled valleys, often bedrock-controlled features (continuous, discontinuous)
Talus (defined, inferred; base of talus triangle indicates downslope side of escarpment)
Line joining the same terrain units

NOTE 1:

This map is intended to be an inventory of regional engineering terrain conditions. Its purpose is to provide a guide for engineering and resource planning functions. The boundaries of the terrain units shown on the map are approximate only, consistent with a 1:100,000 scale. Site specific investigations are required in order to obtain detailed information for a particular area. The map user should refer to the accompanying report for a fuller description of terrain in the study area.

NOTE 2:

Colour is used to enhance what is considered to be the dominant engineering condition in simple, complex or layered terrain units.

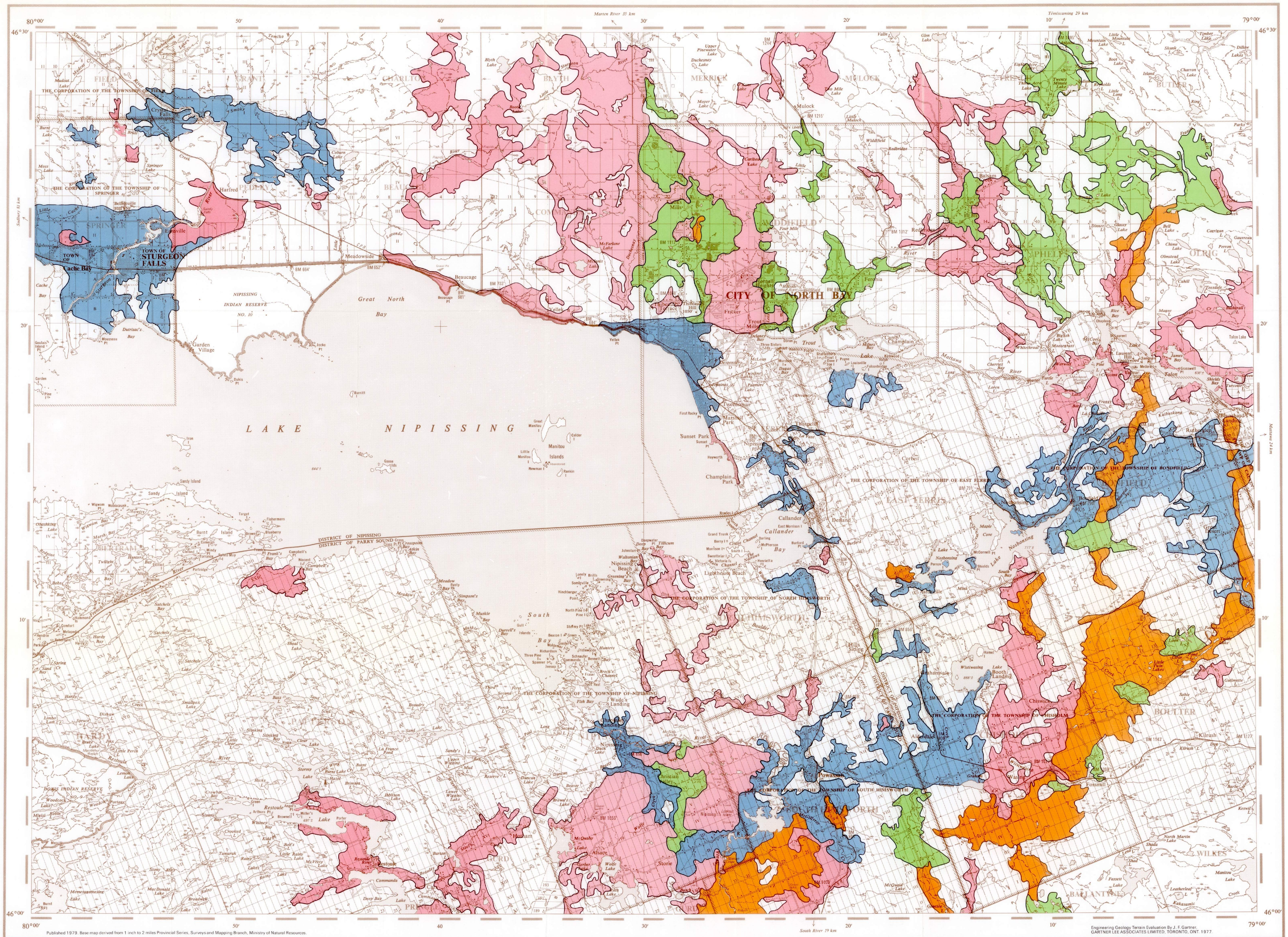
NOTE 3:

Not all letter and graphic symbols shown in the legend necessarily appear on this map sheet.

Information from this publication may be quoted if appropriate credit is given. Reference to this map is recommended as follows:

Gartner, J. F.

1979: Northern Ontario Engineering Geology Terrain Study, Data Base Map, North Bay. Ontario Geological Survey, Map 5041, Scale 1:100 000



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Ministry of Natural Resources
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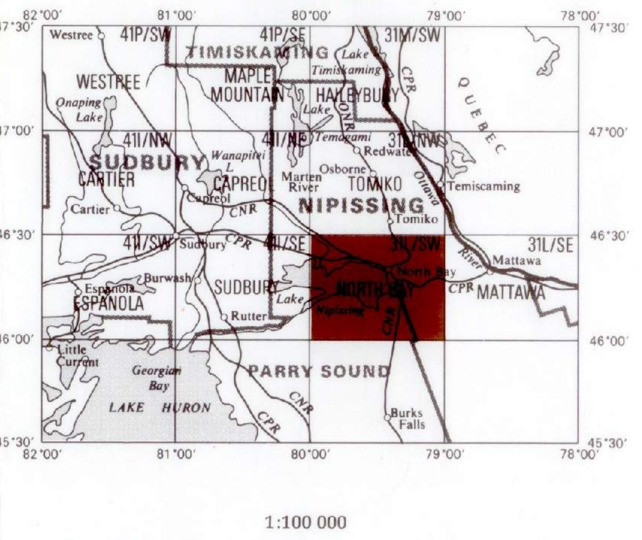
Ontario Geological Survey
Map 5044

Northern Ontario Engineering Geology Terrain Study

Septic Systems Capability Map

NORTH BAY

NTS 31L/SW



1:100 000

2 1 0 2 4 6

One centimetre represents one kilometre

SEPTIC SYSTEMS CAPABILITY MAP LEGEND

- (Green) Areas underlain by dry coarse grained permeable soils with level topography. Conditions usually excellent for construction and operation of septic tile fields. Existing well data and topographic maps should be studied to determine ground water flow and aquifer connection.
- (Orange) Areas underlain by dry coarse grained permeable soils with appreciable local boulder content. Slopes can be steep and complex, and tile field siting may require extensive regrading locally. Water table at depth, but ground water flow should be studied.
- (Pink) Areas underlain by coarse grained, permeable soils with suspected high ground water table and / or bedrock close to surface. Topography is usually undulating with low relief, but locally relief can be moderately rugged. Design of septic tile fields must consider depth to rock or water and these factors may require special engineering of beds.
- (Blue) Areas underlain by lake plain deposits of semi-permeable to impermeable sandy silts to clayey silts and silty clays. Topography is flat and surface drainage is imperfect to poor. Water tables can be high. Tile fields often require importation of fill and raising of tile beds by fill placements.
- (White) Areas underlain by bedrock and shallow drift, organic terrain, very wet subsoils. In the rock terrain tile fields require extensive engineering and are often impractical to install. Organic terrain requires extensive fill placement and this is not always feasible. Very poor terrain for siting of septic systems and often septic systems are not possible.

Information from this publication may be quoted if appropriate credit is given. Reference to this map is recommended as follows:

Gartner, J. F.

1979: Northern Ontario Engineering Geology Terrain Study, Septic Systems Capability Map, North Bay. Ontario Geological Survey, Map 5044, Scale 1:100 000