Soil Survey
Of
Lepreau Provincial Park

K. K. Langmaid & G. Losier

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Lepreau Park

The Lepreau Provincial Park occupies parts of the Oromocto, Musquash and Lepreau watersheds in Western Charlotte and Eastern King and Queen Counties. The area is generally underlain by granites and other igneous rocks and the soils reflect this in their parent material. The climate of the region is influenced by its proximity to the Fundy coast and gives an abundance of moisture to the soil due to both low evaporation rates and the rainfall and fog during the growing season.

The topography is rolling with higher elevations to 800 feet. The area has been glaciated with varying depths of till and outwash material left. Except for the northern part of the Park which has material carried in from outside the area, the material appears to be derived predominantly from granitic material except for the southern part of the area where other igneous rocks predominate. The soils are generally shallow to bedrock and rock outcrop is common. The soils are generally very stony and bouldery and this will be one of the major limitations of the area.

The soils will be described in detail in Appendix A. They are generally Humo-Ferric, Ferro-Humic Podzols, Gleyed Podzols and Gleysols. Both ablational and basal tills are present and indurated layers, fragipan and orstein occur. Probably due to the relatively high humidity, ortstein layers are common in the soils, especially in the southern part of the Park. Large areas are imperfectly drained and even on the ridges the soils were moist or they contained free water where the bedrock came within a foot or so from the surface. The soil remained frozen in parts of the Park until mid-June and remained above the liquid limit along many of the roads and trails until well into July.

Peat bogs were common but were usually shallow and had large boulders in them that came to the surface or were underlain at a foot or so by a thin mineral soil 5-10 inches thick overlying bedrock. Boulder fields were common and these usually had moss or Lichen with scattered trees and shrubs growing on them and were difficult to distinguish from peat bogs on aerial photographs.

Ratings of the Soils.

The tables showing the results of Laboratory analysis and rating of the soils for a variety of uses are attached to this report. The ratings were made on the results of the laboratory studies, the morphological characteristics in the soil descriptions and other observations made on similar soils in other areas. The ratings were done by procedures laid down by the Soil Conservation Service of the U.S.D.A. The amount of stone boulders and rock outcrop have a considerable influence on the final rating of the soils for a particular use. In Table 1 - Engineering Interpretations of the Soil, these were not taken into consideration. But with the amounts of stone etc., that are present the ratings generally drop to the lowest level.

APPENDIX A

Juniper Catena

The soils of the Juniper catena are associated with Tuadook, Gagetown and Island Lake catenas. The other catenary members are the imperfect to poorly-drained Jummet Brook and the very poorly drained McKiel series. The origin of the parent material appears to be ablational. The material is derived from gray granites, basalts, felsites. The soils are often shallow and rocky and slopes may be precipitous.

The topography is rolling to hilly.

Juniper Series

The Juniper soils are the well-drained members of the catena. They occur on the tops of hills and plateaus and the well-drained upper slopes. The profiles are usually stony and rocky and have been classified as Orthic Humo-Ferric Podzols. The vegetation consists of balsam fir, red spruce, black spruce, yellow and white birch, bunchberry, broom moss, haircap moss, sphagnum mosses and squarrose moss. A description of a well-drained virgin profile is as follows:

Horizon	Depth (inches)	Description
L	$2\frac{1}{2}$ - 2	Freshly fallen litter, needles, twigs, moss; pH 4.0
F	2 - 1	Semidecomposed organic material; fibrous; pH 3.8
H	1 - 0	Black well-decomposed organic matter; fine, granular; pH 3.8

Horizon	Depth (inches)	Description
Ae	0 - 4	Light gray (10YR 7/1) loam; moderate, fine granular; friable, loose, nonplastic; abrupt, wavy boundary; pH 3.8.
Bfh	4 - 7	Yellowish red (5YR 5/6) loam to silt loam; strong, fine granular; loose, slightly plastic, nonsticky; abrupt, wavy boundary; pH 4.2.
Bf	7 - 12	Brownish yellow (10YR 6/6) gravelly loam; moderate, fine granular; friable, soft, slightly plastic, nonsticky; clear, smooth boundary; pH 4.6.
Bf2	12 - 18	Reddish yellow (7.5YR 6/6) gravelly gritty loam; medium, fine granular; friable, soft, slightly plastic, nonsticky; pH 5.4.
BC	18 - 33	Yellowish brown (10YR 5/4) gravelly gritty silt loam; strong, fine granular; friable, soft to slightly hard, slightly plastic, slightly sticky; gradual, smooth boundary; pH 5.0.
C	33+	Dark brown (10YR 4/3) gravelly loam; weak granular; loose, slightly plastic, slightly sticky; pH 5.0.

Variations. The Ae horizon may vary from 2-6 inches and from a sandy loam to loam. Bhf and Bfhc horizons may be present. In small areas, the Bhf and Bhfc are sufficiently developed to classify the profiles as Ferro-Humic Podzols and the ortstein characteristic may be dominant. These are designated with a superscript. The depth of the solum varies from about 20 to 33 inches. The texture ranges from a gravelly loam to a loamy gravel.

The soils are generally very stony, but occasionally areas containing a small volume of stones may be found. The parent material in some places contains small hard lumps resembling the parent material of the Tuadook soils.

Use: These soils are best suited for forestry.

Jummet Brook Series

The Jummet Brook soils are the imperfectly and poorly drained members of the Juniper catena. They are closely associated with the Juniper and McKiel soils and have a similar mode of deposition and geological origin as the Juniper soils. They occur on lower seepage slopes and depressional areas. The vegetation consists of balsam fir, spruce, white birch, red maple, bunchberry, aster, woodfern, and moss. These soils are classified as Gleyed Orthic Humo-Ferric Podzols. A description of a typical virgin profile is as follows:

Horizon	Depth (inches)	Description
L	3 - 2¾	Needles, twigs, leaves, moss; pH 4.0.
F	2¾ - 1¾	Brown, semidecomposed organic material, felted; pH 3.8.
H	1¾ - 0	Black, well-decomposed organic material; medium granular; pH 3.8.
Aeg	0 - 4	Gray (10YR 6/1) silt loam; common, medium, distinct, mottles; weak, fine platy; firm, moderately plastic, moderately sticky; abrupt, wavy boundary; pH 4.2.
Bfgj	4 - 8	Brown (7.5YR 5/4) gravelly loam; common, fine, faint mottles; moderate, medium granular; friable, moderately plastic, slightly sticky; clear boundary; pH 4.4.

Horizon	Depth (inches)	Description
Bfgj2	8 - 17	Brown (10YR 5/3) gravelly loam; common, medium distinct mottles; weak, medium granular; firm, moderately plastic, slightly sticky; clear boundary; pH 4.6.
Cgj	17 - 36+	Dark brown (10YR 4/5) gravelly loam; common, medium, distinct mottles; amorphous breaking to medium granular; firm, moderately plastic, slightly sticky; pH 4.8.

Variations. The textural variations range from sandy loams to loams in the parent material and from loams to silt loams in the solum. The distinctness of the Bfgj horizon fades as the drainage becomes poorer and the mottling becomes more apparent. The depth of organic material varies from about 2 to 4 inches. The stoniness ranges from 3 to 5 and the amount of gravel is sufficient to place all these soils in the gravelly phase.

Use. Because of its excessive stoniness and rockiness, it is considered unsuitable for any agricultural purpose but permanent pasture. It should grow a good forest cover of commercial species and in most places has good regeneration. Drainage would be a problem if the land were cleared. It is generally not suited for intensive use.

McKiel Series

The McKiel soils are the very poorly drained soils of the Juniper catena. They occur in depressional areas. The soils are classified as Orthic Humic Gleysol and grade into the peaty phase, and into peat where they occur adjacent to peat bogs. The vegetation consists of red maple, alders, black

spruce, larch, sphagnum mosses, and bunchberry. A description of a virgin profile is as follows:

Horizon	Depth (inches)	Description
L	$4\frac{1}{2}$ - $3\frac{1}{2}$	Needles, twigs, leaves, moss; pH 4.2.
F	$3\frac{1}{2}$ - 2	Dark brown, semidecomposed organic material; felted; pH 3.8.
H	2 - 0	Black, well-decomposed organic material; medium granular; pH 3.8.
Ah	0 - 3	Very dark brown (10YR 2/2) silty clay loam; weak, medium granular; loose, soft, slightly plastic, slightly sticky; smooth boundary; pH 4.2.
Aheg	3 - 7	Very dark grayish brown (10YR 3/2) silt loam; common, fine, faint mottles; weak, medium granular; slightly plastic, slightly sticky; clear boundary; pH 4.4.
Aeg	7 - 10	Dark gray (10YR 4/1) silt loam; common, large, distinct mottles; weak platy to medium granular; slightly plastic; clear, smooth boundary; pH 4.4.
Bgj	10 - 18	Dark yellowish brown (10YR 3/4) gravelly sandy loam; many, large, distinct mottles; weak, medium granular; slightly hard, loose, slightly plastic, slightly sticky; gradual boundary; pH 4.6.
Cgj	18 - 36+	Dark brown (10YR 4/3) gravelly gritty loam to sandy loam; common, medium, distinct mottles; weak, medium granular to structureless; pH 4.8.

Variations. The organic horizon varies from 3 to 24 inches in depth. Where the organic horizons are deeper than this, the soil is classified as a Peat or Muck. Usually where the organic material is over 6 inches in depth, the surface material is sphagnum peat. The degree of mottling varies somewhat and the Bg horizon gives the appearance of a concentration of mottles. The texture varies from a sandy loam to a loam and is always gravelly. The soil is generally stony and has large numbers of granite boulders scattered over and through it.

Use. These soils are suitable for forestry. The best drained sites produce a fair forest growth, but where the drainage is poor the vegetation is slow growing (black spruce and sphagnum).

Pinder Catena

The soils of the Pinder Catena are derived mainly from light colored granitic rocks. The soils appear to be glacial till but in some places have been modified slightly by water. The topography is hummocky and of undulating and gently rolling character. The hummocks are about 50 feet above the surrounding area and in a roughly East-West orientation. The poorly drained areas lie between the mounds. These soils are very stony and bouldery. The boulders are generally rounded and are often in excess of 100 cubic feet in volume. The Pinder Catena is associated with the Juniper, Island Lake and Gagetown Catenas.

The vegetation is varied but where the following description was taken it was red spruce, white pine, larch, wild raisin, sour top blueberry, sheep laurel, *Cladonia alpestris*.

Horizon	Depth (inches)	Description
L	3 - 2	Reindeer moss (lichen), pine needles and debris from other vegetation.
F	2 - 1½	Very dusky red (10R 2/2) semidecomposed fibrous organic matter; slightly greasy; pH <3.8.
H	1½ - 0	Reddish black (10R 2/1) well-decomposed organic matter; weak granular structure; moderately greasy; pH <3.8.
Aeh	0 - 1½	Dark gray (10YR 4/1) sandy loam, moderate amount of fine gravel; fine, weak platy breaking to fine granular; soft, friable, nonsticky, nonplastic; horizon boundary, clear, smooth to wavy; pH 3.9.
Ae	1½ - 4 pockets to 9"	Pinkish gray (5YR 6/2) sandy loam; there are pockets of coarser material where the granite has weathered. The rocks in this are leached white. Soft, very friable; very slightly sticky, very slightly plastic; horizon boundary wavy, abrupt; pH 4.2.
Ae & Bhf	Pockets to 5 or 6"	Pinkish gray (5YR 6/2) and dark reddish brown (5YR 2/2). This gives it a streaked appearance, fine sandy loam; fine platy; weakly cemented, has a greasy feel; horizon boundary broken; pH 5.0.
Bfhc	4 - 12	Dark reddish brown (5YR 3/3) exterior yellowish red (5YR 5/6) interior of peds. This becomes reddish yellow (7.5YR 6/6) with depth, sandy loam; very coarse platy to coarse subangular blocky; very strongly cemented; horizon boundary clear, wavy; pH 5.5.

Horizon	Depth (inches)	Description
BCc	12 - 17	Reddish yellow (7.5YR 6/6) with about 7% pale brown (10YR 6/3) sandy loam; coarse, subangular blocky; hard, very strongly cemented; horizon boundary slightly wavy; pH 5.5. Brown material gives positive NaF test for Bf.
CBc	17 - 26	Pale brown (10YR 6/3) with 7% reddish yellow (7.5YR 6/6) sand; subangular blocky to coarse, weak platy; cemented; becomes less hard in the lower part of horizon; horizon boundary clear, wavy; pH 5.6
C	26 - 60+	Pale brown (10YR 6/3) sandy loam; weak, pseudo-platy structure; firm in situ breaks readily on removal. There appears to be slight leaching or bleaching around the stones. The stones frequently have silt caps on them. The stones are predominantly rounded and subangular granites, pH 5.4

Variations. These soils vary somewhat in the parent material; in some places they seem to be somewhat water reworked and there are areas with fragipan and these are indicated where observed by a superscript "x". It was not thought feasible to separate these as a new soil series at this time. The orstein layers vary considerably in hardness and degree of development.

Use. These soils are poorly suited for agriculture. They appear to have only moderate growth rates and regeneration for forestry and their stoniness and large boulders make them somewhat difficult for road building and logging.

Coronary Sandy Loam

This is the imperfectly to poorly drained member of the Pinder Catena. It would have the same textural characteristics as the Pinder but be more poorly drained. At this time it has not been sampled or fully described.

Hurd Sandy Loam

This is the very poorly drained member of the Pinder Catena. It occurs in the lowlying areas associated with the Pinder and Coronary soils. These soils would fall into the Gleysolic order of the Canadian classification system. They are relatively poor soils for forestry and unsuitable for agriculture. They are of little use for recreation except as interpretation areas.

Lomond Catena

This was originally mapped in this area and included all those soils formed on the igneous rocks. In this study it has been restricted to the soils derived from igneous sources other than granite. It has only two catenary members mapped, the well-drained Lomond loam and the poorly drained Deed loam. The soils are stony and often shallow to bedrock with rock outcrops common.

Lomond Stony Loam

The Lomond series is a well-drained podzol relatively shallow in depth and has many stones and boulders both on the surface and through the material. The vegetation on the site sampled in the park is spruce, balsam fir, white birch, stunted white pine, red maple, wild raisin, bunchberry, blueberry, feather moss, trillium, sheep sorrel.

Mode of origin. Ablational till derived mainly from gray metamorphosed and igneous rocks of Precambrian to Devonian age.

Horizon	Depth (inches)	Description
L	3 - 2¾	Brown dead needles and twigs.
F	2¾ - 2	Brown semidecomposed organic material; pH<3.8.
H	2 - 0	Black (5YR 2/1) amorphous, greasy, well decomposed organic material; horizon boundary wavy; pH <3.8.
Ae	0 - 3 pockets to 7"	Light gray (5YR 7/1) sandy loam; medium platy structure; soft, very friable, slightly sticky, slightly plastic; horizon boundary irregular, abrupt; pH 3.7.
Bhf	3 - 4	Dark reddish brown loam; strong fine granular structure; soft, friable to loose, slightly sticky, slightly plastic; horizon boundary irregular, clear; pH 4.2-5.1, varies with the distance from the rocks.
Bfh	4 - 12	Yellowish red (5YR 4/6) loam; strong, fine granular structure; soft, very friable, slightly sticky, slightly plastic; horizon boundary irregular, clear, follows down deeper in cracks between the rocks; pH 5.0.
Bfh2	12 - 17	Reddish brown (5YR 5/4) silt loam; strong, fine granular; soft, very friable, slightly sticky, slightly plastic to plastic; horizon boundary wavy, clear; pH 5.3.

Horizon	Depth (inches)	Description
C	17 - 26	Yellowish brown (10YR 5/4) gravelly loam; soft, friable, slightly plastic and slightly sticky; some silt caps on the rocks and on the bedrock; pH 5.3.

The bedrock in this pit is at 26". About 50-70% of this soil is made up of stones greater than 6-7". Some of these are several feet in diameter and weigh 500 to 1000 pounds. The surface of the soil does not look that stony.

Variations. The parent material of this soil will vary somewhat in color from yellowish brown to brown and somewhat in texture. It sometimes has a cemented B horizon.

Uses. It has been cleared in various places in the past and used for agriculture, these have been at best subsistence farms and have largely been abandoned or allowed to grow back into forest. They are now being used for blueberry production. Its use for intensive recreation would be limited by its stoniness and outcrops of bedrock. The same would apply to road building.

Deed Loam

This is the poorly to very poorly drained member of the Catena. It is formed on the same parent material as the Lomond but is saturated with water for most of the year. The description that follows was taken outside the park area some years ago.

Horizon	Depth (inches)	Description
L-H	4 - 0	Dark brown to black organic matter becoming more decomposed with depth; pH <4.0.
Ah	0 - 3	Dark gray to black sandy loam to loam; moderate to fine granular structure; greasy high organic content; pH 5.0.
Aeg	3 - 9	Grayish white gravelly stony sandy loam; common dark and light brown mottles; weak, platy structure; slightly hard, firm; pH 5.6.
Bg	9 - 18	Bluish gray to pale brown, many large prominent mottles, loam to sandy loam; amorphous; pH 5.8.
Cg	22+	Light brown to dark gray, gravelly, stony loam to sandy loam; common, distinct mottles; amorphous; pH 6.0.

Variations. This will vary in degree of wetness and in the definition of the profile caused by this. The depth to bedrock will vary from being several inches to a few feet from the surface. The depth of organic matter will vary from two or three inches to a foot or more when it would be classed as a terric peat.

Uses. The use of this soil is severely restricted due to its wetness and stoniness. It is saturated for much of the year.

Lepreau Series

This was encountered at only one area in the park just north of Victoria Lake. No description was taken, just notes. At the time of observation it was frozen but it could be lumped with the Juniper for use predictions.

Soils formed on Basal Till overlain by loose ablational material

The mode of origin of this group of soils has been debated by various pedologists, some claiming that the looser material has been created by the action of vegetative roots.

Harcourt Catena

The soils of this catena occur along the northern border of the park and several small spots further south at West Long Lake and just northeast of Tomoowa Lake. They are formed on brown loose material underlain by reddish brown compact till at about 14-18 inches. There are three members of the Catena, the well drained to moderately well drained Harcourt series, the imperfectly to poorly drained Coal Branch Series and the very poorly drained Grangeville Series. They occur on gently rolling topography in the park, the Coal Branch and Grangeville soils on the lower slopes and in the valleys.

Harcourt Series

The Harcourt series is the well drained to moderately well drained member of the Catena. They generally have 14-18 inches of loose granular material above the compact material.

The description of a typical Harcourt soil is as follows:

Vegetation. Red maple, balsam fir, white birch, bunchberry , sarsaparilla, creeping snowberry, interrupted fern, running club moss, ground pine, wood sorrel, bristly club moss, star flower, yellow clintonia, prince's pine.

Horizon		Depth (inches)	Description
L		$2\frac{1}{4}$ - 2	Brown; leaves, needles, twigs, last year's starting to dry out; very little decomposition as yet; pH 4.0
F		2 - 1	Reddish black (10R 2/1); moist, well decomposed organic material; felted; fibrous; pH 4.2
	H	1 - 0	Black (10R 2/0) well decomposed organic material; fine crumb structure; greasy, root hairs and root fibers through it; pH 4.4
	Ae	0 - 2	Grayish brown (10YR 5/2) sandy loam; weak, platy structure breaking to fine granular; friable, very slightly sticky to non-sticky, slightly plastic; horizon boundary wavy, abrupt; pH 4.2
	Bfh	4 - $8\frac{1}{2}$	Strong brown (7.5YR 5/6) loam to silt loam; strong medium granular structure; firm in situ; slightly sticky, moderately plastic, friable; horizon boundary wavy; concentration of roots; pH 4.5
	Bfh2	$8\frac{1}{2}$ - 11	Dark yellowish brown (10YR 4/4) loam to silt loam; weak or moderately subangular blocky and medium granular; slightly firm in situ; friable, moderately plastic, slightly sticky; horizon boundary slightly wavy, clear; pH 4.4
	Bc	11 - 13	Brown (10YR 5/3) heavy loam; moderate subangular blocky structure breaking to medium and fine granular; firm in situ when moist; friable, slightly sticky, slightly plastic; horizon boundary tends to be diffuse; clay skins in the lower horizon; pH 4.4.

Horizon	Depth (inches)	Description
C1	13½ - 16	Brown (7.5YR 5/4) sandy clay loam; moderate, medium subangular blocky structure; firm, moderately sticky, moderately plastic; horizon boundary wavy, abrupt; pH 4.5.
IIC	16 - 20	Reddish brown (5YR 4/3)mottles (7.5YR 4/4) dark brown, distinct, medium to fine 25%; clay loam, gravelly; subangular blocky to pseudo platy; some clay skins; hard, firm, moderately sticky, plastic; moderately impermeable to impermeable; clay skins calm; pH 4.6.
IIC2	20 - 28	Reddish brown (5YR 4/3); mottles (5YR 5/8), distinct, medium, common; gravelly clay loam; coarse subangular blocky; very firm peds, hard, very firm, moderately sticky, moderately plastic; somewhat compact, impermeable to moderately impermeable; horizon boundary clear; pH 5.0.
IIC3	29 - 60+	Reddish brown (5YR 4/3) gravelly, gritty clay loam; very firm, coarse, subangular blocky structure; some indication of pseudo platiness; hard, very firm; slightly sticky, plastic; clay flows common to bottom; pH 5.2.

Variations. These soils vary in the depth to the IIC horizons from 12 to at times 24 or 26 inches, but the deep ones are unusual. The texture varies from sandy loam to silt loam. There is a tendency for these soils to be wet in the spring due to the impermeable nature of the subsoil.

Use. These soils may be used for agriculture or other uses when plants are grown except where they are on stronger slopes. Except for a week or so in spring when the frost is coming out they can be used for most recreation uses. They are poor for septic tank disposal beds.

Coal Branch

This is the imperfectly drained to poorly drained member of the Harcourt Catena. It occupies the lower slopes and seepage areas and the fringes around the very poorly drained areas.

Vegetaion. Spruce (90%), birch (10%) with understory mostly of tree species seedlings. Ground, 80% is covered by moss.

A description of a typical profile is as follows:

Horizon	Depth (inches)	Description
L	4 - 1	Yellowish green; undecomposed or slightly decomposed moss.
F - H	1 - 0	Dark brown; semi-decomposed and well decomposed organic matter.
Ae	0 - 1	Light gray (2.5Y 7/2) moist, sandy loam; weak, fine granular structure; friable; 5% stone; abrupt, smooth boundary; pH 4.3
Bfh	1 - 4	Brown (7.5YR 4/4) moist with 5% fine dark brown (7.5YR 3/3) mottling; sandy loam; strong, medium granular structure; friable; 5 - 10% stone; clear, smooth boundary; pH 4.8

Horizon	Depth (inches)	Description
Bfg	4 - 10	Brown (7.5YR 4/4) moist, 5% coarse mottles of dark brown (7.5YR 3/3), 5% fine streaks of strong brown (7.5YR 5/6) and pale green (5G 6/2) matrix; sandy loam; moderate strong, medium granular structure; friable; 10% stone; clear, wavy boundary; pH 5.0.
Cg	10 - 17	Brown (7.5YR 5/4) moist, large mottles of strong brown (7.5YR 5/6) and dark brown (7.5YR 3/3), with 5% streaks of pale green (5G 6/2); sandy loam; weak large granular structure; friable; 10-15% stone; abrupt, clear boundary; pH 4.8.
IICg	17-	Reddish brown (5YR 4/4) moist, 10% large mottles of dark reddish brown (5YR 3/3) and bluish gray (5B 5/1) matrix; clay loam; weak, medium subangular structure; firm, slightly sticky, slightly plastic; 20% stone; pH 5.0.

Variations. The intensity of mottling will increase in the upper part of the solum and be in the Ae horizon and the colors of the B horizon will be duller with decreasing drainage. The textures may vary to a loam and sometimes into the lower part of the silt loam categories.

Use. These soils would require drainage before they could be put to any intensive use. They are wet for 40-50% of the growing season.

Grangeville

This is the very poorly drained member of the Catena. It occurs in the valleys and depressional areas or on large flat areas where water movement is restricted by lack of grade.

Vegetation. Spruce, tamarack, cedar, balsam fir, red maple, gray birch, haircap moss.

A description of a typical profile is as follows:

Horizon	Depth (inches)	Description
L	3 - 2½	Brown; slightly decomposed to undecomposed needles, branches and moss; gradual, smooth boundary; pH 4.1.
F	2½ - 1	Dark brown; semidecomposed organic material; gradual smooth boundary; pH 3.9.
H	1 - 0	Black; well decomposed organic material; abrupt, smooth boundary; pH 4.0.
Aeg	0 - 9	White (10YR 8/1) when dry, light gray (5Y 7/1) when moist; sandy loam; weak, fine platy structure in situ and broken to weak, fine subangular blocky structure; friable when moist, slightly hard when dry, non-sticky and non-plastic when wet; less than 1% stone; abrupt, smooth boundary; pH 4.1.
Bg (IIBg?)	9 - 19	Mixed with 50% dark brown (7.5YR 3/2) and 45% reddish yellow (7.5YR 6/6) plus a few light greenish gray (5GY 7/1) mottles when dry, and about 50% dark reddish brown (5YR 2/2) mixed with 45% yellowish red

Horizon	Depth (inches)	Description
		(5YR 5/6), plus a few greenish gray (5GY 6/1) mottles when moist; loam to clay loam; moderate, strong subangular blocky structure; firm when moist, hard when dry, sticky and plastic when wet; 5% stone; clear, smooth boundary; pH 4.4.
IIC1g	19 - 25	Reddish brown (5YR 5/3) about 80%, with 10% yellowish red (5YR 5/6), plus a few pinkish gray (5YR 7/2) and light greenish gray (5G 7/1) when dry, and 80% reddish brown (5YR 4/3) with 10% yellowish red (5YR 4/5), plus a few pinkish gray (5YR 6/2) and greenish gray (5G 6/1) when moist; clay loam; strong, coarse, subangular blocky structure; firm when moist, very hard when dry, very sticky and very plastic when wet; more than 10% stone; diffuse, smooth boundary; pH 4.6
IIC2g	25 - 31	Same color as IIC1g, except it has 10% light greenish gray (5G 7/1) dry, and greenish gray (5G 6/1) moist mottles; clay loam; strong, coarse subangular blocky structure; very firm, very hard, very sticky and very plastic; 20% stone; diffuse, smooth boundary; pH 4.9
IIC3g	31 - 37	Reddish brown (5YR 5/3) with 10% (5G 7/1), 5% very dark gray (10YR 3/1), 5% light gray (5Y 7/2) and a few brown (10YR 5/3) coarse mottling when dry, and reddish brown (5YR 4/3) mottled by 10% greenish gray (5G 6/1), 5% black (10YR 2/1), 5% light olive gray (5Y 6/2) and a few brown (10YR 4/3)

Horizon	Depth (inches)	Description
		mottles when moist; clay loam; moderate strong, medium subangular blocky structure; very firm, very hard, very sticky and very plastic; 20% stone; diffuse, smooth boundary; pH 4.7
IIC4g	37 - 43	Same color as IIC3g but with 15% (5G 7/1) when dry and shift to (5G 6/1) when moist; same in texture, consistency, structure, stoniness as IIC3g; diffuse, smooth boundary; pH 4.8
IIC5g	45 - 49	Same color as IIC3g; clay loam; weak, medium subangular structure; very firm, extremely hard, very sticky and very plastic; 30% stone; clear, smooth boundary; pH 4.9
IIC6g	49 - 60	Same as IIC5g in color, texture, structure, consistency, but with 50% stone; pH 4.9

Variations. The depth of loose material varies and the B may be formed in this loose material.

Use. The use of these soils is severely restricted by its poor drainage. It is saturated with water in all but the very dryest part of the season and in some areas water will stand on the surface for varying periods of time.

Tuadook Catena

The Tuadook catena is located in the central and southern part of the Park. It is associated with the Juniper catena. The various soils of this catena have developed on a ground moraine derived primarily from granites, basalts, felsites, volcanics and gneiss. The topography is rolling. The soils in this catena are generally very stony. The catena consists of the well-drained Tuadook, the imperfectly and poorly drained Redstone and the very poorly drained Lewis series. The latter was not mapped in this area.

Tuadook Series

The Tuadook soils are the well-drained members of the catena. They are classified as Orthic Humic Podzols. The vegetation consists of yellow birch, white birch, sugar maple, red maple, striped maple, balsam fir, white spruce, red spruce, hobblebush, bracken fern, wood fern, haircap moss, wild raisin, sarsaparilla, cucumber root, serviceberry, hypnum moss, sheep laurel, wood sorrel and bunchberry. A description of a typical virgin profile is as follows:

Horizon	Depth (inches)	Description
L	trace	Dead litter.
F-H	4 - 0	Dark brown to black fibrous mat. The woody material is still visable. The material between this is well-decomposed, humic, greasy; pH 3.8.
Ae	0 - 4 thickness $1\frac{1}{2}$ - 9	Pinkish gray (5YR 6/2) sandy loam; weak platy breaking to weak medium granular structure; soft, friable, non-sticky, non-plastic; horizon boundary abrupt, wavy; pH 3.7.

Horizon	Depth (inches)	Description
Bfh	4 - 10 thickness 4 - 9	Yellowish red (5YR 5/6) loam; moderate fine to medium granular structure; about 20% of the horizon is strongly cemented. Around the stones there is a thin Bhf layer where the water has been concentrated. Roots appear to concentrate on top of rocks; horizon boundary abrupt, wavy; pH 4.8.
Bf	10 - 13 thickness 3 - 8	Strong brown (7.5YR 5/6) sandy loam; moderate to medium granular; some patchy weak cementation occurring immediately below the cementation in the horizon above; soft, very friable, slightly sticky and plastic; horizon boundary wavy, abrupt; pH 5.1.
C_1	13 - 32	Brown (10YR 5/3) gravelly sandy loam; platy structure; hard, extremely firm, non-plastic and non-sticky, brittle. There are no streaks or signs of polygons. The brittleness is not consistent in horizontal or vertical displacement; pH 5.1.
C_2	32 - 40	Brown (10YR 5/3) gravelly sandy loam; brittle and hard; pH 5.0.

Thirty to forty per cent of the volume of this soil is occupied by boulders and stones.

Variations. The texture may vary from sandy loam to a silt loam. There are only slight variations in the depths of the organic horizons. The Ae horizon varies from 1 to 3 inches in thickness whereas the greatest variation is in the Bhf horizon which varies in thickness from 2 to 6 inches.

A Bh horizon occasionally occurs along with the Bhf and Bhfc horizons. These may have a combined depth of up to 14 inches and a Bfhc may occur below this. Because of the light colors in the B horizons, this was thought to be an Orthic Humo-Ferric Podzol and only the very dark ones were mapped as Orthic Ferro-Humic Podzols in the field. The depth of the solum varies greatly. In some places it is up to 40 inches thick. This may be due to downhill creep or the solum may have been formed on ablational material and here a thicker solum can develop.

The texture varies from a gravelly sandy loam to a gravelly silt loam, but the actual percent variation of the primary particles is not more than 5% to 10%. There is only a slight variation in pH. Stoniness varies from 3 to 5 with occasional small areas of 2. The till is thin and rock outcrops occur frequently. In some places the compact layer has the characteristics of a fragipan but due to its very stony nature the bottom of this could not be found and the slaking characteristic disappeared with depth.

Use. The use of this soil is severely restricted by the large amount of stones and boulders in and on it.

Redstone Series

The Redstone soils are the imperfectly to poorly drained members of the Tuadook catena. They occur on the seepage slopes and depressional areas associated with the Tuadook catena. The vegetation consists of balsam fir, white and yellow birch, white spruce, aster, dwarf raspberry, wood fern, beaked moss, bunchberry and sedge. They are classified as Gleyed Orthic Humo-Ferric Podzols. A description of a typical virgin profile is as follows:

Horizon	Depth (inches)	Description
L	3 - 2½	Brown, leaves, twigs and moss; pH 4.4.
F	2½ - 2	Very dusky red (2.5YR 2/2) semidecomposed litter; fibrous; pH 4.6.
H	2 - 0	Black (2.5YR 2/0) well-decomposed, slightly greasy, organic material; moderate, medium granular; stony; pH 4.2.
Ahegj	0 - 6	Grayish brown (10YR 5/2) gravelly and stony silt loam; many, medium, faint dark brown (7.5YR 4/2) mottles; weak, platy breaking to moderate medium granular; friable, plastic, slightly sticky; clear, wavy boundary; pH 4.6.
Bfgj	6 - 13	Yellowish brown (10YR 5/6) gravelly and stony loam; common, medium, distinct, dark yellowish brown (10YR 4/4) mottles; moderate, medium granular; friable, slightly plastic, non-sticky; pH 4.6.
Bfgj2	13 - 23	Brown (10YR 5/3) loam; many, medium, distinct dark brown (7.5YR 4/4) mottles; strong, fine, pseudo platy; slightly plastic, non-sticky; pH 4.6.
Cgj	23+	Dark yellowish brown (10YR 4/4) gravelly loam; common, fine, faint yellowish brown (10YR 5/6) mottles; weak, pseudo platy; compact, hard, non-plastic, non-sticky; pH 4.6.

Variations. The depth of the organic horizons vary from 2 to 4 inches. An Aeg horizon of from 2 to 4 inches is often present and the Aheg horizon

may occasionally be absent or be only 1 or 2 inches in thickness. A thin Ah horizon is sometimes present. Where the drainage is better a Bfhg horizon takes the place of the upper Bfgj horizon. A Gleyed Ferro-Humic Podzol profile does occur. This may have a Bhfg horizon between 4 and 7 inches thick. It is usually followed by a weakly cemented Bfhcg horizon, which is often 10 inches thick. This usually occurs half way down the north facing slopes.

Use. In the north central part of the province this soil grows good stands of merchantable timber. Its main limitations are stoniness and wetness.

Soils Formed on Outwash Sands, Gravels and Silts

Clarendon Catena

These soils are found in the northern part of the Park in the lowland area north of South Oromocto Lake and again just south of the Lake. They appear to be deposited by local ponding and have rounded stones and boulders on the surface.

A three member catena was mapped consisting of the well-drained Clarendon, the imperfect to poorly drained Tomoowa and the very poorly drained Poqueawis. They are associated with the Gulquac and Gagetown soils.

Clarendon Series

The Clarendon series is found on the better drained areas. The topography is gently undulating and these soils occur on the low ridges and knolls with the Tomoowa and Poqueawis occupying the lower land and depressions between the ridges.

Vegetation. Beech, sugar maple, yellow birch, hobblebush, running club moss, scattered small red spruce and balsam fir, striped maple and rose twisted stalk.

A description is as follows:

Horizon	Depth (inches)	Description
L	$1\frac{1}{4}$ - 1	Last year's leaves; loose, fluffy.
F	1 - $\frac{1}{2}$	Very dusky red (10R 2/2) partially decomposed organic material; slightly felted, slightly greasy; pH $\bar{<}$3.8.
H	$\frac{1}{2}$ - 0	Reddish black (10R 2/1) well decomposed organic material; granular; slightly greasy; pH $\bar{<}$3.8.
Ae	0 - 1 Pockets to 3	Pinkish gray (5YR 6/2) silt loam; weak medium platy structure; soft, friable, non-sticky, slightly plastic; horizon boundary wavy, abrupt; pH 3.9.
Bfh	1 - $9\frac{1}{2}$ Pockety	Yellowish red (5YR 4/6) silt loam; strong, fine, granular structure; soft, friable, slightly sticky, slightly plastic; roots penetrate readily; smooth horizon boundary; pH 5.1.
Bf	$9\frac{1}{2}$ - 15	Reddish brown (5YR 4/4) silt loam; weak platy breaking to weak fine granular structure; slightly hard, friable, slightly sticky, slightly plastic; horizon boundary smooth; pH 4.9.
BC	15 - 17	Reddish brown (5YR 4/4) silt loam; platy or laminated structure; slightly hard, firm, sticky, plastic; roots moving horizontally at bottom of this profile; pH 4.8.

Horizon	Depth (inches)	Description
C_1	17 - 35	Weak red (2.5YR 5/2 to 4/2) silt loam; weak, coarse, blocky to coarse platy, laminated; hard, firm, slightly sticky, slightly plastic; there are some clay skins along the ped surfaces and through some of the vesicles. There are some small rounded pebbles and stones scattered through this, unoriented; pH 4.9
C_2	35 - 42+	Weak red (2.5YR 4/2) silt loam; fine, faint, few mottles; amorphous to slightly platy; hard, firm, slightly sticky, plastic; pH 4.9

At 65 inches hit either bedrock or big boulders.

Variations. Some slight variation in texture can be expected in these soils. The stoniness appears to be mostly on the surface. At some other sites there appears to be a red stony till at about four feet.

Use. This would probably be very susceptible to frost heaving but is about the only area intensive activities could be carried on. If the vegetation is removed it would tend to be dusty or slippery and muddy. It would provide poor traction.

Tomoowa

The imperfectly drained Tomoowa was not described but has been mapped. It would have similar characteristics to the Clarendon but would have a higher water table and be saturated for probably 50% of the year. This would limit many of its uses.

Poqueawis

This is the very poorly drained member of the catena. It is severely gleyed and has considerable gray colors. It is saturated for a large part of the year and may be flooded for short periods during wet weather.

Island Lake Catena

This is developed on outwash sands derived mainly from light colored granites. It occurs mainly in the southern part of the Park along the Lepreau and Musquash Rivers. It is associated with the Gagetown, Juniper and Lomond catenas. Only two catenary members have been mapped, the well to excessively drained Island Lake series and the poorly drained Pennfield series. It occurs along the river valleys and is associated with rock-out crops and peat deposits.

Island Lake Series

The Island Lake series is the well drained member of the catena. It is formed on water deposited sands and is apparently of no great depth as rock-out crops occur frequently. The topography is gently undulating and peat bogs occur frequently in the same area.

Vegetation. Where the sample was taken it has been cut over or burned at some time. Surrounding the area are spruce, larch, rhodora, kalmia, blueberries and small rock cranberries.

A description of a typical profile is as follows:

Horizon	Depth (inches)	Description
L	trace	Leaves, needles, etc.
H	3 - 0	Dark grayish brown (5YR 2/2) well decomposed organic material; pH $\bar{<}$3.8.
Ae	0 - 2½ thickness 2 - 7	Gray (5YR 6/1) loamy sand; weak, medium platy to amorphous; very friable; horizon boundary abrupt, wavy to irregular; pH 4.1.
Bhf	2½ - 4½ thickness 2 - 8	Very dusky red (10R 2/2) with dark reddish brown streaks (10R 3/4) sandy loam; weak, granular; weakly cemented, slightly hard; horizon boundary wavy, abrupt; pH 4.4.
Bf	4½ - 12	Yellowish red (5YR 5/6) gravelly, loamy sand, single grain structure; weakly cemented in places, friable; horizon boundary wavy; pH 5.3.
Bhfc	12 - 15 thickness ½ - 4	Very dusky red (10R 2/2) single grain sand; more strongly cemented than above horizon; horizon boundary abrupt, wavy; pH 4.9.
Bfc	15 - 22	Strong brown (7.5YR 5/6) coarse sand, single grain; strongly cemented; pH 5.3.
BC	22 - 28	Yellowish brown (10YR 5/6) and pale brown (10YR 6/3) fine loamy sand; cemented intermittently; pH 5.3.
C	28 - 100+	Pale brown (10YR 5/3) fine, sandy loam to very fine sandy loam; banded; pH 5.1.

These soils are derived mainly from granitic material. There is some variation in texture and the sequence of horizons. The Bhfc horizon may not always be present and in places there appears to be a fragipan developed below the BC.

Use. This soil tends to be droughty but where it is found in the Park there is usually adequate humidity and rainfall to supply any vegetation that may be grown on it. If large areas were exposed to the winds, drifting could occur.

Pennfield Sandy Loam

The Pennfield series is the poorly drained member associated with the Island Lake Catena. It occurs in the lower areas and depressions and very often has peat associated with it. No detailed description has been taken.

Use. The use is limited by the wetness and stoniness of this soil. It might have an interpretive use.

Gagetown Catena

The Gagetown catena is developed on coarse outwash gravels, kames and eskers. The material greater than 2 mm being primarily granitic. There are three catenary members, the well-drained Grand Falls, the imperfectly drained Geary and the very poorly drained Penobsquis. The topography is gently undulating or has the long, sinuous, horse-back topography of the eskers.

Gagetown Series

The Gagetown series is the excessive to well drained member of the catena. It is very stony and bouldery in the Park, especially on the long esker south of South Oromocto Lake and west of Victoria Lake.

Vegetaion. Fir, spruce, white birch, haircap and fern moss, blueberry and bunchberry.

A description of a typical profile is as follows:

Horizon	Depth (inches)	Description
L	$2\frac{1}{2}$ - 2	Freshly fallen litter, leaves, twigs; pH 5.4.
F	2 - 1	Semi-decomposed organic material; fibrous; pH 5.0.
H	1 - 0	Black, well decomposed organic material; strong crumb structure; pH 4.2.
Ae	0 - 4	Light gray (10YR 7/1) gravelly silt loam; moderate to fine crumb structure; soft, slightly plastic, slightly sticky; lower boundary abrupt, wavy; pH 4.2.
Bhf	4 - 10	Dark reddish brown (5YR 3/4) gravelly loam; weak, fine crumb structure; slightly plastic, slightly sticky, loose; pH 5.4.
Bf_1	10 - 15	Reddish-brown (5YR 4/4) gravelly sandy loam; weak, fine crumb; slightly firm, soft; slightly plastic, slightly sticky; pH 5.6.
Bf_2	15 - 17	Reddish-yellow (5YR 7/6) fine gravel to gravelly loamy sand; single grain; friable; pH 5.6.
BC	17 - 30	Dark yellowish-brown (10YR 4/3) gravelly loamy sand to fine gravel; single grain; firm; weakly cemented layers; pH 6.0.
C	30 - 84	Light yellowish-brown (2.5Y 5/4) stratified gravel; coarse and fine; some layers of sand; pH 5.6.

Variations. The principal variations are in the color of the parent material and the cementing that occurs in the Bf and BC horizons. The amount of boulders is variable in the Park, especially in the eskers the soil is very bouldery.

Use. This may be used for road metal and most other uses. It is generally rapidly drained but the top foot has considerable silt and clay and tends to pack with traffic and use. This lowers the infiltration rate and water may accumulate on the surface.

Geary

This is the imperfectly drained member of the catena. It occupies the low land and the edges of the depressions.

Vegetation. Second growth spruce, fir, gray birch, pin cherry, moss.

A description of a typical profile is as follows:

Horizon	Depth (inches)	Description
L-H	2 - 0	Dark reddish-brown (5YR 2/2) organic matter; strong crumb structure; pH $\bar{<}$ 3.8.
Aeg	0 - 4	White (2.5Y 8/2) sandy loam; mottles distinct, fine, common; single grain; loose; pH $\bar{<}$ 3.8.
Bfhg	4 - 9	Reddish-brown (5YR 4/4) sandy loam to loamy gravel; mottles faint, fine, common; strong, fine granular; loose; friable; pH 4.6.
Bfg	9 - 14	Brown (7.5R 5/4) gravelly sandy loam; distinct, medium, common mottles; fine granular structure; friable; pH 4.6.
Bfcg	14 - 24	Dark brown (7.5YR 4/4) gravelly loamy sand; strongly cemented; pH 4.8.
Cg	24+	Dark brown (7.5YR 4/4) gravelly loamy sand; distinct, medium, common mottles; single grain; loose; pH 4.8.

Variations. This soil may vary considerably in the amount of development, especially of the B horizon and the amount of Orrtein (cementing) present. As the soil becomes more poorly drained the colors become duller. If the cemented layer becomes continuous this prevents surface water from moving down through the soil and there is a hanging watertable.

Use. This soil may be used for road metal. Water filling the pit may be a problem. The wetness of the soil will impose rather severe limitations as to its use.

Penobsquis Gravelly Loam

The Penobsquis soils are the very poorly drained members of the catena and occur in depressional areas where the watertable is high for a large part of the year.

Vegetation. Black spruce, cedar, fir, bunchberry, wood fern, twin flowers, creeping snowberry, one flowered pyrola, gold thread, schreber's moss, bristly club moss.

A description of a soil of this series is as follows:

Horizon	Depth (inches)	Description
L	3 - 2¾	Brown leaves, needles; pH 4.4
F	2¾ - 2	Reddish black (10R 2/1) semidecomposed organic material; matted; horizon boundary abrupt; pH 5.4
H	2 - 0	Black (5YR 2/1) well decomposed organic material; strong, fine crumb structure; greasy; horizon boundary abrupt; pH 5.4

Horizon	Depth (inches)	Description
Bg	0 - 10	Pale olive (5Y 6/3) gravelly loam; fine, moderate, granular structure; slightly plastic, slightly sticky; mottling faint, fine, few; horizon boundary gradual; pH 5.4
Cgl	10 - 21	Gray (5Y 6/1) loamy gravel; single grain structure; loose; mottles faint, coarse, few; horizon boundary gradual; pH 5.4
C2	21 - 32	Dark gray (N4) gravel; single grain structure; loose; mottling indistinct; pH 5.4

Variations. A distinct Ae is frequently present. The pH may be somewhat lower than this.

Use. The use of this soil is severely limited by very poor drainage. The watertable is within 30 inches of the surface for considerable periods of time. It could be used for low intensity activities or for road metal if the free water could be drained from the pit.

Gulquac

The Gulquac is a red outwash gravel found associated with the Clarendon silt loam. It occurs on the north side of the South Oromocto Lake. The sample described below is taken from another area of it within the province but they have similar appearance, characteristics and uses.

Vegetaion. White spruce, fir, fir seedlings, caragana moss, *Cormus canadensis*; peaked hazel, strawberry, wild raisin, toad flax.

Horizon	Depth (inches)	Description
L)		Newly fallen litter; pH 5.0.
)		
F)	1	Brown matted semidecomposed organic matter; pH 4.6.
)		
H)		Dark brown to black well decomposed organic matter; fine, granular structure; pH 4.6. Depth of these three horizons is 1 inch.
Ae	0 - 5	Very pale brown (10YR 7/2) gravelly loam; granular structure; soft, friable; horizon boundary wavy; pH 4.6.
Bfh	5 - 10	Reddish-brown (5YR 4/4) gravelly sandy loam; fines form medium weak granular structure; friable to loose; horizon boundary gradual; pH 4.6.
Bf	10 - 18	Reddish-brown (5YR 4/3) gravelly sandy loam; weak, granular structure; loose; horizon boundary gradual; pH 4.8.
C	18 -	Dark brown (7.5YR 4/4) gravel; loose, open; gravel stones well rounded; pH 4.6.

Variations. The principal variation is in the depths of the various horizons. The parent material is stratified and thus textures vary considerably over short distances.

Use. May be used as road metal and should be good for camp sites. Where the surface has more silt and clay in it, it may pack under traffic and cause local ponding.

Lorneville

This is a weak red marine clay. It occurs in only one small area at the south entrance to the park at Lepreau. The top of the soil there is more silty than where the following description was taken a mile or so west of the park. The drainage is moderately well drained to imperfect.

Vegetation. Alders and other scrubby growth (cut over).

Horizon	Depth (inches)	Description
L - H	3 - 0	Dark reddish brown (5YR 2/2) slightly to well decomposed organic matter; pH 3.7
Ae	0 - 3	White clay loam (5YR 8/1); medium platy; hard, very firm, moderately sticky, plastic; pH 3.7
Bt1	3 - 7	Reddish brown (5YR 5/4) clay; coarse laminated to blocky structure; hard, very firm; sticky, plastic; ph 3.9
Bt2	7 - 11	Weak red (10R 4/4) clay; coarse laminated to blocky structure; hard, very firm; sticky, plastic; pH 4.1
C	11+	Weak red (10R 4/4) clay; coarse laminated to weak, coarse blocky; hard, very firm, sticky, plastic; pH 6.0

Variations. In the Park area there was a thin layer of sand over the surface and a few laminae of sand lower down in the deposit.

Use. This is small enough to be ignored except possibly for the road going through it. It would be susceptible to frost heaving.

Organic Soils

There are numerous areas of organic soils in the area. They are generally not very deep and often occur over bedrock or on shallow soils resting on bedrock. They are frequently very bouldery and the largest areas occur along water courses. They are generally Fibrosols and a large part of their composition is sphagnum. They are suitable only for nature study.

Land Types

These are mapping units of heterogeneous materials.

Bottomland

The Bottomland is a complex of alluvial and colluvial material often found along brooks. It varies greatly in texture, drainage, stoniness and pH. It is chiefly used for pasture. It usually has 6 to 12 inches of silt loam high in organic material underlain by coarse sand and gravel. They would be classified as Orthic and Cumulic Regosols and the poorly drained members would be in the gleyed subgroups.

Lithic Podzols

These are areas of soils and outcrops where the soil is less than 20 inches deep to bedrock. There is considerable variation in the profile over the bedrock. In some cases it is only 4 or 5 inches of soil with an Ae, Bhf horizons while in others it approaches 20 inches and has more or less unweathered parent material over bedrocks. It has pockets of deeper material scattered through the area and these are stony. There are patches of bare rock and some shallow peat growing on them.

Gleyed Lithic Podzols

The Gleyed Lithic Podzols are similar except they are predominantly imperfectly drained and poorly drained and are Gleyed Podzols and they have some well drained Lithosols occuring with them.

KEY TO THE SOILS

Parent Material				Drainage					Classification
Mode of Deposition	Geological Source	Color	Texture	Excessive to Well	Well	Moderately Well	Imperfect to Poor	Very Poor	
Shallow soils developed on ablational material	Granites and other igneous rocks	dark brown	stony, gravelly loam		Juniper		Jummet Brook	McKiel	Orthic Humo-Ferric Podzol Gleyed Humo-Ferric Podzol Orthic Gleysol
		pale brown	stony sandy loam to sand	Pinder			Coronary	Hurd	Orthic Humo-Ferric Podzol Gleyed Humo-Ferric Podzol Orthic Gleysol
	rhyolites, etc.	yellowish-brown	loam		Lomond			Deed	Orthic Humo-Ferric Podzol Orthic Gleysol
		brown	loam			Lepreau			Orthic Humo-Ferric Podzol
Ablational till underlying basal till	gray sand, stones & red shales	brown over red	clay loam		Harcourt		Coal Branch	Grangeville	Orthic Humo-Ferric Podzol Gleyed Humo-Ferric Podzol Orthic Gleysol
	granites, rhyolites, etc.	brown	sandy loam		Tuodook		Redstone		Orthic Ferro-Humic Podzol Gleyed Ferro-Humic Podzol
Outwash sands & gravels or beach remnants	red shales & sand stones	red	silt & sand bouldery		Clarendon		Tomoowa	Poqueawis	Orthic Humo-Ferric Podzol Gleyed Humo-Ferric Podzol Orthic Gleysol
	granites	pale brown	sand	Island Lake			Pennfield		Orthic Humo-Ferric Podzol Gleyed Humo-Ferric Podzol
		yellowish-brown to brown	cobbly, sand & granite	Gagetown			Geary	Penobsquis	Orthic Humo-Ferric Podzol Gleyed Humo-Ferric Podzol Orthic Gleysol
	red sandstone & conglomerates some granite	reddish-brown	cobbly, sand & gravel	Gulquac					Orthic Humo-Ferric Podzol
Marine deposits	unknown	reddish-brown	silt & clay			Lorneville			Orthic luvisol

KEY TO THE SOILS (Cont'd)

Parent Material				Drainage					Classification
Mode of Deposition	Geological Source	Color	Texture	Excessive to Well	Well	Moderately Well	Imperfect to Poor	Very Poor	
Recent alluvium	various	brown	silt & sandy loam over gravel and sand			Bottomland			Regosol
rganic	sphagnum & sedges	brown	organic						Fibrosols
Land classes	granites & other igneous rocks	brown	sandy loam to loam	Excessive to moderately well Lithic Podzols then ablational material over bedrock and deeper pockets of same. Easily saturated with water and pockets of very poorly drained material.					
				Gleyed Lithic Podzols similar to above but dominantly poorly to very poorly drained.					

Table 1 - Engineering Interpretations of the Soil

Soil Name	Adaptability to Winter Grading	Susceptibility to Frost Action	Suitability of Soil Material for		Suitability as Source of		Suitability for Ponds		Soil Features Affecting Engineer Practices	
			Road Subgrade	Road Fill	Topsoil	Sand and Gravel	Reservoir	Embankment	Vertical Alignment in Highways	Agricultural Drainage
Bottomland	Poor	Moderate	Fair	Fair	Fair	May be good at depth	Poor, moderate	Poor to moderate	Subject to overflow	May or may not be needed, stony
Clarendon	Poor	High	Fair	Poor to fair	Fair	Not suitable	Fair, inspect for sand lenses at each site	Fair to poor compaction	Subject to erosion and sloughing	Bouldery
Coal Branch	Poor	High	Moderate	Moderate	Fair	Not suitable	Good	Fair to good	Moderately high water-table, hanging water-table	High watertable, impermeable parent material
Coronary	Poor	High due to drainage	Fair	Fair	Poor	Fair	Poor	Fair	Bouldery, cemented upper layers	Bouldery
Deed	Poor	Moderate to high, drainage	Fair to poor stoniness	Fair to poor stoniness	Poor	Fair	Poor	Fair	Bouldery, high water-table, shallow to bedrock	Bouldery, shallow to bedrock
Gagetown	Good	Low	Good	Good	Fair	Good	Poor, excessive seepage	Poor, rapidly permeable	No unfavorable features	Not needed
Geary	Poor	Moderate	Poor due to drainage, good otherwise	Poor due to drainage	Fair	Good, limited by water-table	Poor, permeable	Poor, permeable	Seepage, bouldery	Bouldery, high watertable, cut slopes subject to seepage and sloughing

May be lowered to poor due to rocks and outcrops and shallowness to bedrocks.

Table 1 - Engineering Interpretations of the Soil

Soil Name	Adaptability to Winter Grading	Susceptibility to Frost Action	Suitability of Soil Material for		Suitability as Source of		Suitability for Ponds		Soil Features Affecting Engineer Practices	
			Road Subgrade	Road Fill	Topsoil	Sand and Gravel	Reservoir	Embankment	Vertical Alignment in Highways	Agricultural Drainage
Grangeville	Poor	High	Poor	Poor	Fair	Not suitable	Good, high watertable	Good	High watertable	High watertable, impermeable, parent material
Tolquac	Good	Low	Good	Good	Fair	Good	Poor, excessive seepage	Poor, rapidly permeable	No unfavorable features	Not needed
Harcourt	Fair	High	Fair	Fair	Poor	Not suitable	Good	Good for small dams	Seepage on cut slopes, bouldery	Compact, subsoil fine texture
Hurd	Poor	High due to drainage	Fair to poor	Fair to poor	Poor	Fair	Poor, high watertable	Poor, stony, bouldery, high watertable	Bouldery, high watertable	Bouldery, high watertable
Island Lake	Good	Medium to high	Good	Good	Poor	Fair	Poor, excessive seepage	Fair to poor	Bouldery, blows	Not needed
Jummet Brook	Poor	Moderate to high	Fair	Fair	Poor	Poor	Poor unless treated	Fair to poor, must be compacted, bouldery	Bouldery, shallow to bedrock, high watertable	Bouldery, shallow to bedrock
Juniper	Fair	Moderate	Fair	Fair to good	Poor	Poor	Poor unless treated	Fair to poor, must be compacted, piping	Bouldery, shallow to bedrock	Not needed
Ireau	Fair	Moderate	Fair	Fair to good	Poor	Poor	Poor unless treated	Fair to poor, must be compacted, piping	Bouldery, shallow to bedrock	Not needed

Table 1 - Engineering Interpretations of the Soil

Soil Name	Adaptability to Winter Grading	Susceptibility to Frost Action	Suitability of Soil Material		Suitability as Source of		Suitability for Ponds		Soil Features Affecting Engineer Practices	
			Road Subgrade	Road Fill	Topsoil	Sand and Gravel	Reservoir	Embankment	Vertical Alignment in Highways	Agricultural Drainage
Lomond	Fair	Moderate	Fair	Fair to good	Poor	Poor	Poor unless treated	Fair to good, must be compacted	Bouldery, shallow to bedrock	Not needed
Torneville	Poor	Moderate	Poor	Poor	Poor	Not suitable	Good, check for sand pockets	Fair to poor	Seepage on cut slopes, sloughing	Fine material, may fill tile, slow percolation
McKiel	Poor	High drainage	Fair to poor	Fair to poor	Poor	Poor	High water-table	Fair to poor, stony, bouldery piping	Bouldery, high water-table	Bouldery, stony
Pennfield	Poor	High drainage	Fair drainage	Fair drainage	Poor	Fair, limited by high water-table	Poor, high watertable	Poor, permeable	High water-table, sloughs	High watertable, sloughs
Penobsquis	Poor	High drainage	Good, poorly drained	Good, poorly drained	Poor	Good, high watertable	Poor, permeable, high watertable	Poor, permeable	High water-table	High watertable, lack of outlets
Pinder	Fair	Moderate	Good	Good	Poor	Poor	Poor unless treated	Fair, must be compacted, medium-low permeability	Bouldery, shallow to bedrock	Not needed
Poqueawis	Poor	High	Poor drainage	Poor drainage	Fair	Not suitable	Fair, inspect for sand pockets, high watertable	Fair, compacted, needs protection piping	High water-table, sloughing	High watertable, sloughing
Redstone	Fair	High drainage	Fair drainage	Fair drainage	Fair	Not suitable	Good	Fair, stable when compacted, piping	Bouldery, seepage on cut slopes	Compact subsoil bouldery

Table 1 - Engineering Interpretations of the Soil

Soil Name	Adaptability to Winter Grading	Susceptibility to Frost Action	Suitability of Soil Material for		Suitability as Source of		Suitability for Ponds		Soil Features Affecting Engineer Practices	
			Road Subgrade	Road Fill	Topsoil	Sand and Gravel	Reservoir	Embankment	Vertical Alignment in Highways	Agricultural Drainage
Grangeville	Poor	High	Poor	Poor	Fair	Not suitable	Good, high watertable	Good	High watertable	High watertable, impermeable, parent material
Gulquac	Good	Low	Good	Good	Fair	Good	Poor, excessive seepage	Poor, rapidly permeable	No unfavorable features	Not needed
Harcourt	Fair	High	Fair	Fair	Poor	Not suitable	Good	Good for small dams	Seepage on cut slopes, bouldery	Compact, subsoil fine texture
Hurd	Poor	High due to drainage	Fair to poor	Fair to poor	Poor	Fair	Poor, high watertable	Poor, stony, bouldery, high watertable	Bouldery, high watertable	Bouldery, high watertable
Island Lake	Good	Medium to high	Good	Good	Poor	Fair	Poor, excessive seepage	Fair to poor	Bouldery, blows	Not needed
Jummet Brook	Poor	Moderate to high	Fair	Fair	Poor	Poor	Poor unless treated	Fair to poor, must be compacted, bouldery	Bouldery, shallow to bedrock, high watertable	Bouldery, shallow to bedrock
Juniper	Fair	Moderate	Fair	Fair to good	Poor	Poor	Poor unless treated	Fair to poor, must be compacted, piping	Bouldery, shallow to bedrock	Not needed
Lepreau	Fair	Moderate	Fair	Fair to good	Poor	Poor	Poor unless treated	Fair to poor, must be compacted, piping	Bouldery, shallow to bedrock	Not needed

Table 1 - Engineering Interpretations of the Soil

Soil Name	Adaptability to Winter Grading	Susceptibility to Frost Action	Suitability of Soil Material		Suitability as Source		Suitability for Ponds		Soil Features Affecting Enginner Practices	
			Road Subgrade	Road Fill	Topsoil	Sand and Gravel	Reservoir	Embankment	Vertical Alignment in Highways	Agricultural Drainage
Reece	Fair	High	Fair	Fair	Fair, some problem with stone	Not suitable	Fair	Fair, stable when compacted, most susceptible to piping	Seepage on cut slopes	Not needed
Toomoowa	Poor	High	Poor Drainage	Poor Drainage	Fair	Not suitable	Fair, inspect for sandy pockets	poor when compacted piping	High watertable part of year, bouldery	Bouldery, sloughing
Tuadook	Fair	High	Good	Good	Fair, problems with stones	Not suitable	Good, check to see if compact layer slakes	Good to fair, stable when compacted, stony piping	Seepage on cut slopes, bouldery	Not needed
Peat	Poor	Organic	Not suitable	Not suitable	Good for conditioning	Not suitable	Not suitable	Not suitable	Low bearing strength	Special equipment outlets
Lithic Podzols	Shallow to	bedrock and	outcrop of	bedrock						
Gleyed Lithic Podzols	Shallow to	bedrock and	outcrop of	bedrock						

Table 2

Soil Suitability for Recreation Development

Mapping Unit	Slope	Stoniness & Ledgeness	Undeveloped Tent Sites	Developed Tent & Picnic Sites	Trailer Park Sites	Camp or Cottage Sites	Playing Fields	Golf Courses	Small Pond Building	Roads or Trails
Bottomland	a-c	2-3	C	C	C	C	C	C	C	C
Clarendon	b-c	4	B	B	B	B	B	B	C	B
Coal Branch	b-c	3-4	C	C	C	C	C	C	B	C
Coronary	b-c	4 I-IV	C	C	C	C	C	C	C	C
Deed	all	all	C	C	C	C	C	C	C	C
Gagetown	b-c	2	A	A	A	B	B	B	C	A
	d-e	2	B	B	C	B	C	B	C	B
	b-c	3-4	C	B	B	B	C	C	C	B
	d-e	3-4	C	C	C	B	C	C	C	C
Geary	b-c	2	B	B	B	C	C	C	C	B-C
		3-4	C	C	C	C	C	C	C	C
Grangeville	b-c	3-4	C	C	C	C	C	C	B	C
Gulquac	b-c	2	A	A	A	B	B	B	C	A
	b-c	3-4	C	B	B	B	C	C	C	B
	d	2	B	B	B	B	C	B	C	B
Harcourt	b-c	3-4	C	C	C	C	C	C	B	B
	e-f	3-4	C	C	C	C	C	C	C	C
Hurd	all	all	C	C	C	C	C	C	C	C
Island Lake	c-d	5	C	C	C	B	C	C	C	B
		5 II	C	C	C	C	C	C	C	B
Jummet Bk.	c-d	4-5	C	C	C	C	C	C	B	C
Juniper	c-d	4-5	C	C	C	C	C	C	C	C
		4-5 I-IV	C	C	C	C	C	C	C	C
Lepreau	d	5	C	C	C	C	C	C	C	C
Lomond	b-c	4	C	C	C	C	C	C	C	C
		4-5 I-V	C	C	C	C	C	C	C	C
Lorneville	b-c	1	B	B	B	B	B	B	A-B	B

Table 2

Soil Suitability for Recreation Development (Cont'd)

Mapping Unit	Slope	Stoniness & Ledgeness	Undeveloped Tent Sites	Developed Tent & Picnic Sites	Trailer Park Sites	Camp or Cottage Sites	Playing Fields	Golf Courses	Small Pond Building	Roads or Trails
McKiel	all	all	C	C	C	C	C	C	B	C
	b								B	
Pennfield	b-c	4-5	C	C	C	C	C	C	C	C
Penobsquis	b-c	4-5	C	C	C	C	C	C	C	C
Pinder	b-c	4-5	C	C	C	C	C	C	C	C
	c-d	4-5	C	C	C	C	C	C	C	C
Poqueawis	b-c	4-5	C	C	C	C	C	C	C	C
Redstone	b-c	4-5	C	C	C	C	C	C	C	C
Reece	c	4	B	B	B	B	C	B	C	B
Toomoowa	c	4	C	C	C	C	C	C	B	C
Tuodook	c	4	B	B	B	B	C	B	C	B
	c	5	C	C	C	C	C	C	C	C
Peat		all	C	C	C	C	C	C	C	C
Lithic Podzols			C	C	C	C	C	C	C	C
Gleyed Lithic Podzols			C	C	C	C	C	C	C	C

Particle Size Distribution

Horizon	Depth inches	Gravel % Vol.	Sands 2-.05 V. coarse 2-1 mm	Coarse 1-0.5	Medium 0.5-0.25	Fine 0.25-0.10	Very fine 0.10-0.05	Total sand	Silt 0.05-0.002	Clay 0.002	Texture class	Bulk Density	Porosity Large	Porosity Fine
							Clarendon							
L-H	1 - 0											.17	63	31
Ae	0 - 1	4.4	1.4	2.3	2.3	7.9	11.7	25.6	61.6	12.8	sil	0.99	41	30
Bfh	1 - 9½	11.6	0.7	1.0	1.1	6.5	9.8	19.0	60.8	20.2	sil	0.77	26	45
Bf	9½ - 15	9.3	0.8	1.2	1.1	5.8	13.1	21.9	59.9	18.2	sil	1.07	25	31
BC	15 - 17	3.5	0.8	1.4	1.2	7.2	14.7	25.3	54.1	20.6	sil			
C_1	17 - 35	trace	0.6	0.9	0.9	5.9	13.4	21.7	60.6	17.8	sil	1.68	6	31
C_2	35 - 42		0.0	0.1	0.2	1.9	9.0	11.2	70.0	18.8	sil	1.67	4	34
							Coal Branch							
L	2 - 1½											0.19	64	30
FH	1½ - 0											0.19	64	30
Aeg	0 - 2½							64.0	24.8	11.2	sl	1.08	46	26
Bhf	2½ - 4½							50.8	16.0	33.2	scl	1.03	39	32
Bfh	4½ - 7							51.6	24.0	24.4	scl	.79	38	39
Bf	7 - 10½							54.0	28.0	18.0	sl	.96	38	33
BC	10½ - 13							44.4	29.6	26.0	l	1.42	16	30
$IICg_1$	13 - 19							50.4	21.6	28.0	scl	1.64	13	35
$IICg_2$	19 - 26							47.6	22.0	30.4	scl	1.72	14	25
$IICg_3$	26 - 39							51.2	20.8	28.0	scl	1.79	11	26
$IICg_4$	39 - 47							51.6	23.2	25.2	scl	1.86	10	23
$IICg_5$	47 - 53							51.6	23.2	25.2	scl	1.96	9	24

Partical Size Distribution

Table 3

Horizon	Depth (inches)	Gravel % Vol	Sands 2 - 0.05 Very coarse 2-1 mm	Coarse 1-0.5	Medium 0.5-0.25	Fine 0.25-0.10	Very fine 0.10-0.05	Total Sand	Silt	Clay	Texture	Bulk Density	Porosity Large	Porosity Fine
1477-1488					Grangeville									
L												(		
F												(0.15	50.6	37.4
H												(		
Ahg								49.2	33.2	17.6		1.39	15.7	32.1
II bg1								40.4	25.2	34.4		1.22	20.7	36.0
II Bg2								52.4	20.4	27.2		1.46	31.3	29.3
II Cg1								48.8	22.8	28.4		1.73	14.9	23.7
II Cg2								54.0	20.0	26.0		1.78	16.4	21.7
II Cg3								49.2	25.6	25.2		1.84	12.0	22.2
II Cg4								54.8	23.2	22.0		1.76	16.4	23.0
II Cg5								49.6	23.2	27.2				
II Cg6								50.8	24.8	24.4				
1423-34					Harcourt									
L	$2\frac{1}{4}$ - 2											(		
F	2 - 1											(0.27	60.7	31.9
H	1 - 0											(		
Ae	0 - 2		2.6	4.8	5.8	10.6	5.5	29.3				0.73	46.6	33.9
Bhf	2 - 4		3.7	6.1	7.5	12.1	6.4	35.8				0.89	38.5	36.5
Bfh	4 - $8\frac{1}{2}$		1.3	6.6	10.6	20.4	10.5	49.4				0.95	29.5	34.9
Bf	$8\frac{1}{2}$ - 11		2.7	7.0	8.6	14.1	7.7	40.0				0.99	17.5	47.4
	11 - 13		3.3	9.9	14.3	20.8	8.3	56.6				0.89	18.8	49.6
C	13 - 16		3.2	9.8	11.8	18.3	8.4	51.5						
II C1	16 - 20		2.7	5.7	8.3	16.0	8.1	40.9						

Partical Size Distribution

n	Depth (inches)	Gravel % Vol	Sands 2 - 0.05						Silt	Clay	Texture	Bulk	Porosity		Liquid Lim
			Very coarse 2-1 mm	Coarse 1-0.5	Medium 0.5-0.25	Fine 0.25-0.10	Very fine 0.10-0.05	Total Sand				Density	Large	Fine	
	20 - 28		2.8	7.3	9.4	16.4	7.7	43.5							
	28 - 60		3.1	4.9	6.5	13.2	8.2	35.8							
					Island Lake										
	3 - 0														
	0 - 2½		3.9	9.4	10.1	31.7	16.8	71.9	27.7	1.40	LS	1.34	48.1	1.5	
	2½ - 4½		4.4	8.0	9.3	30.0	11.6	63.4	23.6	13.0	SL	1.33	48.4	1.8	
	4½ - 12		14.3	23.9	17.3	22.6	5.9	83.9	12.1	4.0	LS				
	12 - 15		29.3	44.2	16.9	3.6	0.5	95.5	0.5	4.0	S				
	15 - 22		13.0	28.5	39.1	24.0	1.8	96.3	0.9	2.8	S	1.50	40.4	2.8	
	22 - 28		1.9	4.4	12.7	59.1	17.0	95.2	1.6	3.2	S	1.53	39.7	2.6	
	28 - 36		.1	0.5	6.4	29.7	22.4	58.0	40.7	1.40	SL	1.39	55.0	2.5	
					Juniper Sandy Loam										
		% u													
	0 - 2	6.66						58.0	34.0	8.0	SL				
	2 - 12	134						59.0	32.0	9.0	SL				
	12 - 20	1).1						66.0	26.0	8.0	gSL				
	20 t	).0						63.0	30.0	7.0	SL				
					Juniper Silt Loam										
t	2 - 0											.16	52.	31	
	0 - 2	18.4 9.2	1.4	3.2	4.2	5.8	14.6	29.2	55.9	14.9	gsi.l	1.22	28	24	31
	2 - 5	5.8 2.0	0.5	1.8	2.4	4.6	14.2	23.5	61.5	15.0	sil	0.81	13	56	60
	5 - 18	37.1 21.5	5.1	9.9	10.2	14.2	11.2	50.6	36.4	13.0	gl	1.33	38	10	31
	18 - 40	25.5 11.3	4.9	11.8	11.8	13.4	20.7	62.6	29.0	8.4	gsl.	1.58	51	5.7	26

Partical Size Distribution

Horizon	Depth (inches)	Gravel % Vol	Sands 2 - 0.05						Silt	Clay	Texture	Bulk	Porosity	
			Very coarse 2-1 mm	Coarse 1-0.5	Medium 0.5-0.25	Fine 0.25-0.10	Very fine 0.10-0.05	Total Sand				Density	Large	Fine
					Lomond									
L	3 - 2¾													
F	2¾ - 2													
H	2 - 0													
Ae	0 - 3		4.3	11.9	11.6	14.4	8.2	50.4	38.8	10.8	SL			
Bhf	3 - 4		3.8	23.9	5.5	14.7	9.8	39.7	46.1	14.2	L			
Bfh	4 - 12		5.3	8.8	6.9	11.2	19.6	39.7	49.1	16.2	L			
Bfh2	12 - 17		3.2	4.6	3.9	8.6	6.3	26.6	61.2	12.2	Sil			
C	17 - 26		4.9	8.5	7.3	13.1	12.7	43.8	47.0	9.2	L			
					Lorneville									
L - H	1 - 0													
Ae	0 - 3							23.0	48.0	29.0	CL			
Bt	3 - 7	7.0						23.0	31.0	46.0	C			
Bt	7 - 11	4.0						14.0	30.0	56.0	C			
C	11 - 0							18.0	35.0	47.0	C			
					Pinder									
L - H														
Aeh	0 - 1½	13.4 13.5x	8.4	14.4	11.9	18.0	10.6	63.3	30.5	6.2	SL	1.18	31.6	23.9
Ae	1½ - 4		7.8	12.9	11.2	19.7	13.2	64.7	31.5	3.8	SL			
AetBh			7.6	13.4	10.9	18.2	8.8	58.8	33.0	8.2	SL			
Bfh	4 - 12		14.7	18.5	12.5	20.7	11.5	77.9	19.3	2.8	LS			
Bc	12 - 17		9.8	13.5	10.7	21.4	16.3	71.5	26.7	1.8	SL	1.36		
Cb	17 - 26	27.5 30.0	10.5	11.9	10.2	25.5	29.8	87.9	10.3	1.8	S	1.67	25.6	13.4
C	26 - 48 t		10.9	14.6	10.8	19.1	13.6	69.1	27.1	3.8	SL	1.50		

Partical Size Distribution

Horizon	Depth (inches)	Gravel % Vol	Sands 2 - 0.05 Very coarse 2-1 mm	Coarse 1-0.5	Medium 0.5-0.25	Fine 0.25-0.10	Very fine 0.10-0.05	Total Sand	Silt	Clay	Texture	Bulk Density	Porosity Large	Porosity Fine
						Tuadook								
L	Trace											0.16	52.3	41.4
Fh	4 - 0													
Ae	0 - 4	13.6 11.4	6.4	10.4	10.5	16.3	9.7	53.4	39.8	6.8	SL	1.50	24.4	23.6
Ab	1 - 2 t		4.8	8.1	8.3	13.2	8.0	42.4	53.8	3.8	Sil			
Bfh	4 - 10	8.8 7.4	5.6	9.2	9.9	16.0	9.5	50.3	37.5	12.2	L	0.73	34.8	37.6
Bf	10 - 13	13.9 11.9	8.3	10.6	9.7	16.8	11.9	57.3	37.9	4.8	SL	1.10	25.4	33.2
C1	13 - 32	22.7 18.0	9.7	13.3	12.0	18.1	9.8	63.0	31.2	5.8	SL	1.57	17.2	23.5
C2	32 - 40	23.2 28.9	11.7	15.3	13.9	20.7	11.0	72.7	20.5	6.8	SL	1.75	17.0	16.8