Ministry of
Northern Development
and Mines
Ontario

ONTARIO GEOLOGICAL SURVEY

Open File Report 5801

Buried Sand and Gravel Features and Blending Sands in Eastern Ontario

By

G.A. Gorrell

1991

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ABSTRACT

This report details the position of specific sand and gravel features which are buried in Eastern Ontario and delineates the portions which may pass the requirements for specific products. This information will be of use in managing aggregate resources in the future.

The study concentrates on a series of north-south oriented features which are distributed across Eastern Ontario. The study focused on these features because earlier work indicated that in portions of the features extensive sand and gravel reserves are present below the water table. Previously, the actual three dimensional extent of these features had never been completely mapped because they had been altered and buried subsequent to their formation.

The observations from the features indicated that a variety of processes were responsible for their formation. To simplify the observations, areas of similar characteristics have been assembled into groups called lithofacies.

These lithofacies have been used to predict the three dimensional extent of the systems. These predictions were then confirmed or disproved with geophysical studies and subsurface drilling. This work indicated that many of the features are interconnected and that large volumes of material lie below the water table in what was identified as the glaciofluvial portions of the features.

The study has also shown that there are distinct and consistent transitions from one lithofacies to another. Since these transitions were found in all features, they have been used to determine the possible aggregate uses of different portions of the features. For example, in the area which was deemed to be near what was once an ice-margin the lithofacies consisting of large scour fills were found to consistently pass the gradational requirements for concrete sand. This lithofacies could be traced into others which will pass the requirements for blending sand and granular C-fine.

The work has indicated that large volumes of material are still available within the features. However, most of these reserves are found below the water table. In the future, if material is to be secured close to the markets (urban areas), it will have to be excavated from below the water table. Remaining reserves, which pass the

requirements for higher quality products, such as asphalt and concrete sand, have been delineated on the bases of their lithofacies.

Different transitions were identified in portions of the features which had been modified by shoreline processes. These transitions were noted and it was found that, similar to the unaltered portion of the features, they pass specific gradational requirements. It is in these altered areas where blending sand is most apt to be found.

The importance of water associated with these features has also been demonstrated in this study. It was shown that over forty small communities in Eastern Ontario could potentially obtain a potable water supply from specific portions of the features. Four communities; Embrum, Chesterville, Crysler and Vars are, or will in the near future, obtain all their potable water from the systems. It was also noted that many of the wetlands in the study area, for example the Groveton and Winchester Bogs, are found adjacent to these systems.

It is hoped that the information in this report will be used to aid planners, land owners, consultants, and other interested agencies in managing and using effectively the identified resource. This will ensure that no damage in the future is caused by poor management, that non-renewable resources are preserved and that adjacent future land uses will be compatible.

BURIED SAND AND GRAVEL FEATURES AND BLENDING SANDS IN EASTERN ONTARIO

by

George A. Gorrell
Gorrell Resource Investigations

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1.0 INTRODUCTION

The increase in residential development within rural Eastern Ontario and its associated requirement for municipal services have created a greater demand for high quality sand and gravel and groundwater. Growth of the many smaller communities surrounding the large urban centres results in an increased demand for sand and gravel to maintain or improve roads, build homes and construct sewage systems. This has led to the apparent depletion of many of the known sand and gravel deposits.

In addition, the development has put increased demand on the aquifers which have historically been exploited. Many of the aquifers have been contaminated or are being used to their capacity. In some of the developing areas, bedrock aquifers have insufficient yields to provide a communal water source or have naturally poor quality (sulphur, salt, iron) to which the newer relocated residents are unaccustomed. These problems can be alleviated if high yielding aquifers in buried sand and gravel deposits can be located within a cost-effective distance of these areas.

A series of buried and/or confined glacial features are distributed across Eastern Ontario. These features, which formed during the last ice age, consist generally of fan-shaped sedimentary bodies composed of fine sediment surrounding a central ridge composed of sand, gravel and boulders. These central ridges overlie small bedrock channels. Subsequent to their formation the Champlain Sea inundated Eastern Ontario and many of these features were buried by clay or modified by shoreline processes.

The purpose of this report is to provide a detailed analysis of the buried sand and gravel features found across Eastern Ontario. The investigation commenced with the identification of the features, followed by the detailed logging of the sedimentary structures and sequences. Areas which were not logged but were predicted by the developed lithofacies mode; were proven to exist with seismic studies and drilling. This work will: 1) delineate the three dimensional extent of the systems; 2) assess the quantity and quality of the sand and gravel; 3) define the depositional environments in which the associated sediment passes specific gradation requirements; 4) suggest the direction the ground water travels; and 5) estimate, if applicable, the water yield of the features.

These points will indicate areas where substantial reserves of sand and gravel are available and assist communities and consultants to locate aquifers capable of producing large volumes of water.

2.0 METHOD

2.1 Preliminary Work

The preliminary work involved a review of the geological work which had previously been completed in the area. Studies by Carson (1982a,b) Chapman and Putnam (1985), Cheel and Rust (1982, 1986), Gadd (1963a,b, 1980), Gorrell (1986b), Gorrell and Fletcher (1983a,b), Gwyn and Lohse (1973), Gwyn and Thibault (1973), Gwyn and Girard (1975), Henderson (1973), MacClintock (1958), Rust (1977), Rust and Romanelli (1975), Richard (1982a,b,c, 1984a,b), Sharpe (1979), Terasmae (1980), Williams and Telford (1986), Williams et al. (1985a,b,c,d) and Young et al. (1983) were examined and pertinent data were transferred to the 1:50 000 scale topographic maps. This was followed by the examination of aerial photographs with approximate scales of 1:50 000 and 1:16 000 (taken from flights flown in 1948, 1969, 1971 and 1976). The interpreted extent of the sedimentary bodies was drawn on the aerial photographs.

2.2 Detailed Work

The field work was conducted between the months of June and December, 1986; May to June, 1987 and November 1987 to February 1988. The work included: a) logging and sampling of a large number of pit faces; b) assessment of clast fabric; c) examination of the underlying bedrock if exposed; d) completion of seismic studies; e) drilling; and f) monitoring piezometers.

Logging and Sampling of the Pit Faces

The pit faces were logged according to the headings shown in Figure 1. Where possible, the face was logged from the bottom to the top, however portions which had sloughed extensively were not logged. Samples of many individual units were taken. When the face was logged its location was marked on the topographic maps. Representative or interesting units or sedimentary structures were photographed. As portions of the pit(s) were logged

a small scale sketch map was drawn. All the logged sections, bedrock outcrops, points of reference and face heights were marked on the sketch.

Many of the headings shown in Figure 1 are self-explanatory. For readers not familiar with the headings they are referred to Appendix A.

The disturbance column in Figure 1 denotes features which have been formed by inorganic agencies at the time of, or very shortly after the sediment had been deposited. These features formed before the sediment had consolidated, and are generally localized. Ball and pillow structures, dish structures and dewatering structures are examples of such disturbances.

The description of the grain size of the unit concerns the sorting and size distribution and whether the unit is or is not graded. The sorting and size distribution defines whether the sediment is bimodal, polymodal, and whether it is clast or matrix supported. The sediment was classified by its predominant grain sizes. For example, a medium sand was described as being the sand where more than 50% of the volume would be retained on a 50 mesh and 100 mesh Tyler sieve (150 to 300 μm).

Throughout the report terms are used which describe the type of sedimentary structures that were observed. A general description of these terms is given in Appendix A.

Unit	Thickness	Basal Contact	Sedimentary Structure	Height of set	Angle of climb	lateral continuity	Paleocurrent	Disturbance	Grain size (est)

Figure 1. Headings for the observations which were recorded when a section was logged (modified from Shaw 1975).

Clast Fabric

In areas where the pit faces consisted of gravel and boulders it was difficult to log them under the headings shown in Figure 1. Instead, the clast fabric was determined.

The fabric refers to the orientation and inclination of clasts which are not spherical (Harms et al. 1982). The orientation of the clasts was described in terms of the direction of orientation of the long axis. The inclination refers to the dip of the major plane.

Examination of the Underlying Bedrock

In some areas the pits have been excavated to bedrock. Where the bedrock was close to the surface it was cleared using a shovel, pick and broom. Any marks or features on the bedrock were examined. Using a Brunton compass, the orientation of these features was determined. These features were then sketched and photographed. Where possible, their lateral extent were noted.

Seismic Studies

Seismic studies were carried out under the direction of L. Thompson, Ministry of Northern Development and Mines. These were carried out in areas where the sand and gravel features were thought to be buried by extensive volumes of clay. The seismic equipment consisted of a ES 1225 12 channel seismograph, geophones and an energy source. The energy source consisted of shotgun shells, which were detonated approximately 1 m below the ground surface. Both reflected and refracted waves were recorded. The interpretation of these waves indicates the types of sediment which are below the ground surface, the depth to bedrock and the location of the water table. Some of the seismic lines are shown in Appendix D.

Drilling

The drilling, which was carried out under contract, was supervised by a geologist from the Ministry of Northern Development and Mines. The mandate of the drilling program was to: 1) sample and determine the stratigraphy of the material in the features which lie below the water table; 2) determine whether the exposed features

are interconnected and joined by clay buried segments; 3) delineate what portion(s) of the identified features are actually part of the feature and not a subsequent modification; and 4) install piezometers.

Hollow stem augers, which permitted samples to be taken at regular depths, were used in the subsurface investigation. The drill holes were logged according to the headings shown in Figure 2. The samples which were taken were bagged and labelled according to drill hole number and sample depth. Drilling was continued to such a depth that: 1) there was a refusal; 2) bedrock was encountered; or 3) when the necessary information had been obtained.

The piezometers were constructed by Ministry staff. They are composed of either 12 mm or 25 mm diameter schedule 40 PCV pipe and 230 mesh geo-textile cloth. Screens were constructed on one end of some of the 3 m long pipe sections by plugging the bottom with schedule 40 caps and cutting six 25 mm by 10 mm slots near the end of the pipes. These slots were wrapped with the geo-textile cloth which was attached to the pipes with fibre tape. If the piezometers where installed at depths greater than 3 m the pipe sections were connected with schedule 40 joints secured to the pipe sections with PVC glue.

DRILL LOG

Date: Hole Number: Hole Type: Recorder:
Location:

Depth	Description (colour texture)	Water-table	Material profile	Hollow Stem Data		
				Sample #	Blows	Depth

Figure 2: Headings for drill logs.

Piezometer Monitoring

The locations of the piezometers is listed in Appendix C. A water-level gauge was used to monitor the piezometers on a regular basis to observe any change in the static level of the groundwater.

Evaluation of Collected Data

The evaluation of the collected data consisted of a) analysis of particle size of representative samples; b) graphical representation of the sections which had been logged; c) graphical representation of the drill holes; d) calculation of the piezometric head; and e) calculation , using a computer program, to determine if particular bedforms and depositional environments pass specific gradational requirements.

Particle Size Analysis

Over 600 samples were taken over the course of the field work. These samples were bagged and labelled according to their section and unit number or drill hole number and sample depth. Those drilling samples which appeared to contain greater than 15% silt size fraction were not sieved because they were deemed not to be usable other than fill. However, those samples were noted as containing very fine material.

It was observed in all the features within specific depositional environments, identical lateral and vertical sequences and cycles were present. Care was taken to sample the individual sequences and cycles. These samples were sieved and the results were used to determine if any significant variance within similar sequences and cycles exists.

A total of between 80 and 110 g was split from the selected samples. This material was oven dried and placed upon a nest of sieves of decreasing size downward. The sieves were then placed on an automatic shaking device which was allowed to operate for 15 to 20 minutes. The proportion of the total sample retained on each sieve was weighed.

The percent passing for each sample was calculated and plotted. Using these graphs a data base was established which allowed assessment of the possible uses of the sediments.

Graphical Representation

The information found on the completed field logs was not in a form which could be easily interpreted. To facilitate the interpretation of the sedimentary bodies the information was grouped by lithofacies. The method used to develop these lithofacies is based on the manner used by Shaw (1987). The lithofacies are defined in Section 6.0 and symbols are shown in Figure 3.

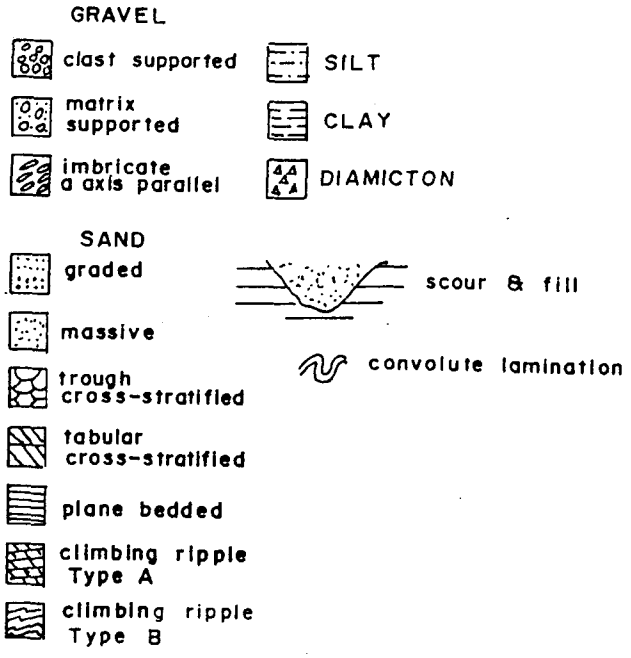


Figure 3: Symbols for sedimentary structures.

3.0 SYSTEMS

3.1 Introduction

The studies completed on the area indicate that seven north-south oriented glaciofluvial landforms are spaced, across Eastern Ontario, between Hawkesbury and Carp (Figure 4). Although these landforms do not appear to be connected on the surface, Ministry of the Environment well records (1986), drilling and seismic studies suggest that many of them are connected below the surface sediment by small ridges consisting of sand and gravel. Since the features are connected, they have been classified as systems. The seven systems, shown in Figure 4, are:

3.2 Hawkesbury System -I

This system was observed on the surface only east of Hawkesbury, Prescott County, on the East Hawkesbury/West Hawkesbury boundary. Gorrell and Fletcher (1983a) indicated that this system extends to a minimum of 12 m. below the ground surface. This is supported by Ministry of the Environments well records (1986), which indicate that the system is found up to 35 m below the surface (see Map 1).

3.3 Dunvegan-Maxville-Warina System -II

Gorrell and Fletcher (1983b) indicated that this feature consists predominantly of shoreline features such as foreshore ridges, spits and bars. However, the sorted sediment extends to a minimum depth of 10 m below the ground surface. The origin of the sediment below the ground surface was not determined. The system is above the ground surface near Dunvegan and Maxville, Glengarry County, and can be traced to Warina, Stormont County.

3.4 Casselman-Crysler-Finch System -III

This system can be observed above the ground surface near the Village of Casselman, Russell County, and the Villages of Crysler and Finch, Stormont County. This system is possibly connected to the thick gravel bodies reported near Newington by Owen (1951) and Gorrell and Fletcher (1983b).

3.5 Vars-Morewood-Maple Ridge System -IV

This system can be observed above the ground surface in the Village of Sarsfield, east of the Villages of Leonard and Vars, northeast, west and southwest of the Village of Morewood, Dundas County and in Maple Ridge

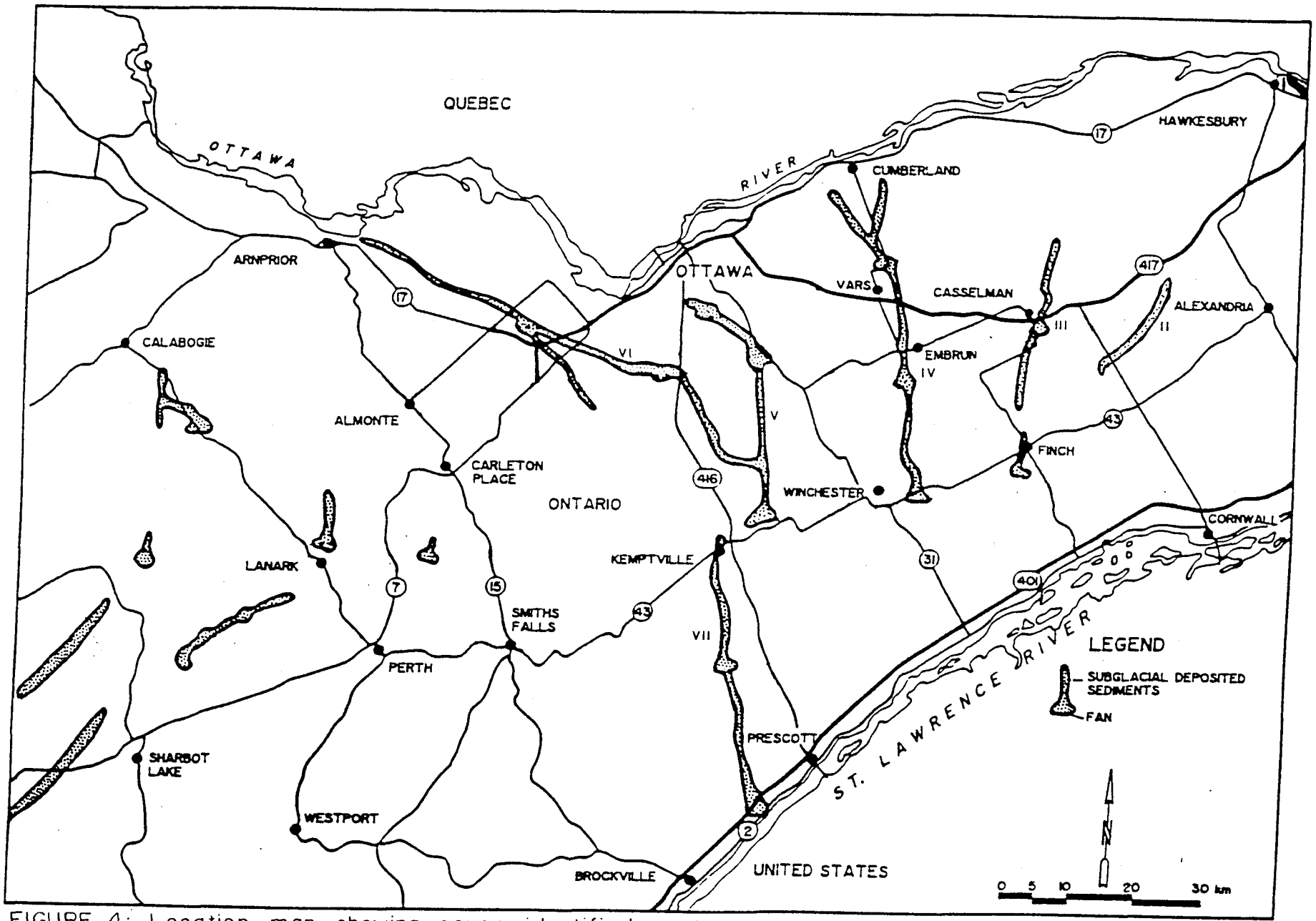


FIGURE 4: Location map showing seven identified systems.

between the Villages of Winchester and Chesterville (Figure 4). It is probable that the glaciofluvial feature northeast of the Village of Navan and Petrie Island on the Ottawa River are part of this system (See Maps 5 and 6).

3.6 **Ottawa Airport-Loughlin Ridge - V**

This is one of the largest system which can be observed above the topography (Figure 4). It appears to extend from the Ottawa Airport, Gloucester Township, through Osgoode Township, to the Loughlin Ridge, Mountain Township. Many smaller minor ridges radiate away from, and merge into this system. These ridges are oriented approximately parallel to the main system before the main system bends. This suggests that this system may be connected below the ground surface to the sixth and seventh system.

3.7 **Arnprior-Galetta-Stittsville-Trail Road-Kars System - VI**

This system is observed above the topography near the Village of Carp, Arnprior and Bells Corners (Figure 4). Similar to System V, many small minor ridges radiate away from and merge into the system. Again, this suggests that the feature is much more extensive than is obvious.

3.8 **Kemptville-Roebuck-Blue Church System-VII**

This system is observed above the local topography east of the Town of Kemptville, south of the Village of Oxford Mills, in Limerick Forest, south of the Village of Roebuck and near the Blue Church Road, between Brockville and Prescott, Grenville County (Figure 4). It is possible that this system is an extension of Systems V and VI.

4.0 **POST-DEPOSITION MODIFICATION**

It is difficult to distinguish the actual longitudinal and lateral extent of many portions of the systems because post-depositional modification has been extensive. This modification can assigned to one of four causes: 1) burial; 2) limnological; 3) removal; and 4) deformation.

4.1 **Burial**

The studies which have previously been completed on the area (Gadd 1963b; Barnett 1985; Richard 1982a,b,c, 1984a,b) have indicated that because it was isostatically depressed after the retreat of the Laurentide Ice Sheet, Eastern Ontario, was inundated by a brackish body of water called the Champlain Sea. These studies indicate that the meltwater entering the Ottawa Valley carried large volumes of sediment which were: 1) deposited subaerially as a delta extending from Renfrew County near the Town of Pembroke into the Province of Quebec; and 2) as flocculated mud commonly called Leda clay. These sediments have buried large portions of the glaciofluvial systems.

4.2 **Limnological**

Where the area was inundated by the Champlain Sea, features which were at elevations at or above wave base were susceptible to modification and erosion by waves and by ephemeral currents. Since the shorelines in the Champlain Sea represent shorelines which prograde chiefly by the addition of sediment from erosion, only units typical of this kind of deposition will be discussed. These units are shown in Figure 5. Because the Champlain Sea was both transgressive and regressive, these units may be inter-stratified.

Shoreline Units

a) The backshore is the part of the beach which lies above the average high-water level. It is subjected to modification by waves only when water levels are extremely high. Storms can produce beach ridges at the highest water level.

b) The foreshore is the part of the shoreline that is periodically flooded and exposed. This unit is usually distinguished by tidal cycles but because there is little evidence of tidal cycles with the Champlain Sea, this portion of the shoreline is difficult to distinguish. For the purpose of this report the foreshore has been classified as the portion of the shoreline that was frequently, but not always, covered by water due to waves breaking on shore. This is a subjective break-down which is based on the depth of water which is controlled by the fetch, seiche and other factors which will change the wave base. The predominant bedding type within this unit is swash cross-stratification. It consists of evenly spaced laminations separated by low angle discordances. Features which are common also are rill marks, adhesion ripples and flat topped wave ripples.

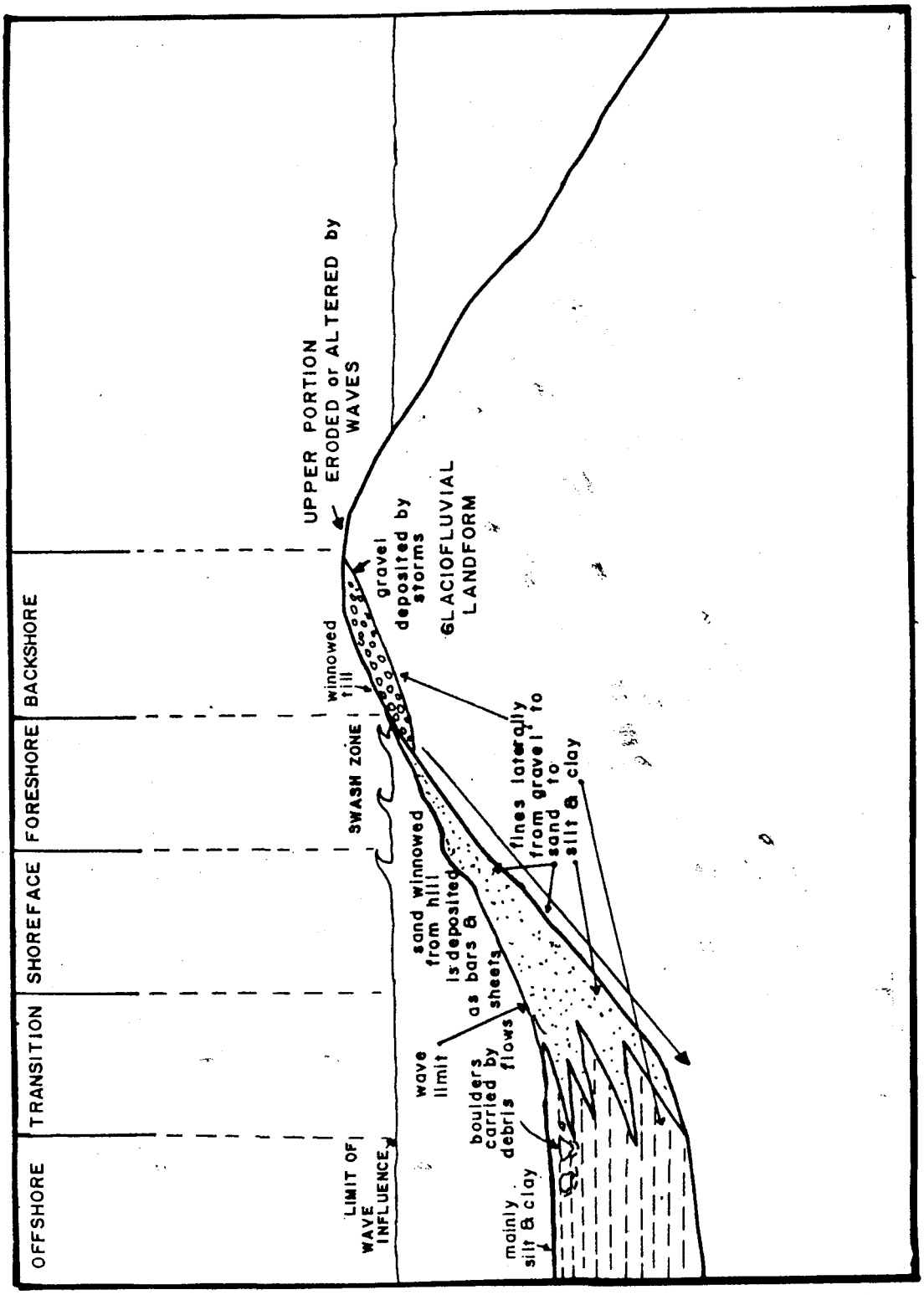


Figure 5: Shoreline units typical of a prograding shore.

b') The shoreface is the part of the shoreline which always lies below water and extends from the lowest water line to the depth where sand is not typically found. In this area sediment derived from the land and the sea are collected. The lower limit of this zone corresponds to the average maximum wave base. Trough cross-stratification is generally found within the upper shoreface while hummocky cross stratification is found within the lower shoreface. Longshore bars are also commonly formed in this portion of the shoreline.

c) The area of transition is found where there is a gradational change from the sand-size sediment of the shoreface to the mud of the offshore unit. With respect to the foreshore and the shoreface, this portion of the shoreline may be very bioturbated.

d) In the offshore, sediments consist principally of silt and clay. Because the Champlain Sea was transgressive and regressive, this zone can possibly be classified as relic since it relates to an earlier water-levels.

It is beyond the scope of this report to describe the type of features and sedimentary structures which may develop along a shoreline. The final shoreline profile depends on such factors such as wave intensity, duration of shoreline forming events, sediment supply and other limnological factors. The author refers interested parties to discussions by Reineck and Singh (1980) and Elliott (1983).

In general, the backshore, foreshore and the upper shoreface units undergo the greatest modification because of the interaction between the swash, surf and breaker zones and storms (Figure 5). As sediment is added to the shoreline, the foreshore and shoreface migrate seaward to be deposited ultimately on the offshore sediments. Since modification can dramatically change an existing feature, the correct identification of this modification is imperative if the actual extent of the system is to be distinguished.

For example, the central ridges which pass through the systems rise above the surrounding sediment if they have not been subjected to shore modification. However, in many areas the central ridge has been subjected to wave erosion, and has been planed to the level of the surrounding sediment. Much of the gravel which overlies the fan portions of the systems probably originated from the erosion of the central ridge.

4.3 **Removal**

Gadd (1963b, 1980) indicated that the ancestral Ottawa River carved channels through the sediment that was deposited before and during the Champlain Sea Phase. It is probable that portions of the glaciofluvial systems were removed during the establishment of the modern Ottawa River.

4.4 **Deformation**

It is difficult to determine the deformation mechanism of a sedimentary sequence and structure. Deformation may be caused by: 1) rapid sedimentation; 2) melting of ice blocks which had supported the sediment; 3) cyclical loading by waves or earthquakes; or 4) static loading by debris flows, slumps and iceberg impacts.

5.0 GLACIOFLUVIAL SYSTEMS

Some of the largest reserves of sand and gravel and the highest water yields in Eastern Ontario are found within the glaciofluvial portion of the systems. The potential of the systems can only be realized if the processes which were responsible for the formation of these systems are understood the actual lateral and longitudinal extent of these systems may be predicted.

Studies that have been completed on the glaciofluvial systems within Eastern Ontario suggest that they developed under both stagnant and active ice conditions (Gorrell 1986a; Gorrell and Shaw in preparation). It was hypothesized that upward incised conduits or R-channels are unstable under active ice conditions and that water tends to move subglacially as sheet flow (Weertman 1972). Meltwater, because it was under large pressure gradients, would flow at high velocities and have a high erosional potential. It may have possibly been capable of eroding a channel into the bedrock. When the glacier was active the bedrock channel was not as prone to closure as would be a tunnel (R-channel) cut into the ice. Therefore, when the ice was active, the only stable means by which meltwater could flow would be within a bedrock channel or as sheet flow.

Channels, identified from seismic work (Appendix D), drilling and from the examination of Ministry of the Environment's well records (1986), were found to underlie all of the glaciofluvial systems within Eastern Ontario. Exposures of the bedrock channels show that they are superimposed with grooves, ridges and sichelwannen. This

suggests that the meltwater was divergent and sinuous at relatively small scales, and involved flow separation and the production of intense vortices (Shaw 1983).

Once the ice became stagnant, deformation and shear stress within the glacier would approach zero, and the sliding and internal motion would decrease (Rothlisberger 1972; Weertman 1972). In comparison to the pressure in the glacier, the overburden pressure would decrease towards the channel margins and the bedrock channels (N-channel) would act as collectors of meltwater (Nye 1973). The conduit would expand upwards into the ice as flowing water melted the ice of the channel wall. As this conduit filled with sediment, an esker would develop.

5.1 **System Development**

Subglacial

Boulders would be deposited initially as the flow waned. As discharge decreased further, fine sand would be deposited and this could filter into the voids between the boulders. Since the deformation and shear stress within the stagnant ice would be virtually zero, the tunnel would expand as the bed aggraded. Clasts which rolled along the bed would be deposited with a preferred fabric of *a* axes transverse and *b* axes dipping upstream. As the tunnel captured more meltwater from smaller englacial and subglacial tunnels, the rate of deposition would increase. Aggradation would then be faster than the expansion of the tunnel and the bed would start to slide. This sliding would continue until the flow waned.

As sediment was deposited within the conduits, their capacity would decrease and an excess of water would then be funnelled into them. Some of the frictional heat produced as the water flowed through the conduit would be used to enlarge the conduit. However, because the conduits cannot adjust instantaneously to increased discharge (Rothlisberger 1972; Shreve 1972) most of this excess meltwater would produce high static pressures.

Where the conduit bends, these high static water pressures could lift the glacier from the bed and allow the formation of secondary conduits. These secondary conduits would continue to operate until they filled with sediment. However, because the static pressures would continue to be generated, other secondary conduits would develop at

bends farther back in the central conduit. All these conduits, because they were diverting meltwater, represented avulsions in the sub-glacial drainage system.

Sherve (1972) and Rothlisberger (1972) suggested that, in time, large passages tend to become arbsoresent with tributaries joining into larger truck passages. The author believes that the large systems within Eastern Ontario represent an arbsoresent sub-glacial meltwater system. Each system was draining a portion of the subglacial environment, much the same way as rivers drain the surrounding terrain. In the course of the field work it was noted that a few of the systems thinned to virtually nothing near bedrock escarpments. Weertman (1972) and Shreve (1972) suggested that this is due to the low pressure gradient on the lee side of large obstructions (escarpments) which tends to induce the meltwater to flow as a sheet. The extent of each system will be discussed in Section 6.0).

Ice-marginal

I Beads

Beads are conical shaped mounds which are typically steep sided. They are located where the central bedrock channel or esker is bent. They are 15 to 25 m high and 120 to 150 m wide.

The sedimentary structures and the grain size of the sediments within the beads show a rapid downstream change. Massive, crudely stratified and graded pebbles and cobbles are found in the proximal portion of the beads. This material passes downstream into massive units of medium to coarse sand and fine gravel, graded units of coarse to medium sand, crudely stratified units of medium sand and units of cross-laminated medium to fine sand. Although the sediment is faulted throughout the beads, there are fewer disruptions in the distal portion. Banerjee and McDonald (1975) suggested that beads are deposited annually and that they represent avulsions of meltwater in a cavity near the ice margin from the esker tunnel.

II Fans

As the ice margin retreated a series of fans would be deposited. If a water body existed at the ice margin, sedimentation would be by turbidity currents which flowed for long durations and which would deposit laterally extensive beds (Gorrell and Shaw in preparation). At the mouth of the conduit the emerging meltwater would scour

the previously deposited sediments (Gorrell and Shaw accepted). These scours would be filled immediately with diffusely bedded sand.

Fans which developed in front of secondary conduits differ from those which developed in front of the partially filled central conduit. Initially, sedimentation would have been by surge-type turbidity currents which entered the conduits only when the central channel was filled with meltwater. Sedimentary units deposited by these currents thin rapidly, are thinner than those deposited by turbidity currents which flowed for longer durations and show lateral transitions, although they are not always well developed (Gorrell and Shaw accepted).

As the minor conduits captured progressively more meltwater from the central conduit, it is probable that the central conduit would have been abandoned. Sedimentation in front of the new main conduit would then be by turbidity currents which flowed for long durations. These currents are classified as quasi-continuous turbidity currents. Sedimentary units deposited by these currents should, with respect to units deposited by surge-type currents: 1) be thicker; 2) thin gradually; 3) show large scale cross-bedding with some preservation of stoss laminae; 4) have constant angles of climb; 5) show obvious lateral transitions; and 6) show well developed sedimentary structures. The sedimentary succession deposited by these currents suggests that the sediment was deposited in broad sheets as the current expanded upon emergence from beneath the glacier.

The switching of meltwater from one conduit to another may have caused sudden increases in discharge in the receiving conduit. Sediments deposited directly in front of this conduit might then be eroded. The presence of the large and small scale scours in many of the fan sediments suggests such sudden increases in flow. A few of the smaller scours could be traced down flow where they pass into the graded massive and cross beds. The morphology and inter-relationships of all the features are shown in Figures 6 and 7.

It should be stated that there are many processes which have led to the formation of the systems. Classifying each system by sedimentary structure would be unproductive, for there is too much information. However, the relationships which were discussed above may be divided into lithofacies, or assemblages of structures which are common. These lithofacies are discussed in the following section.

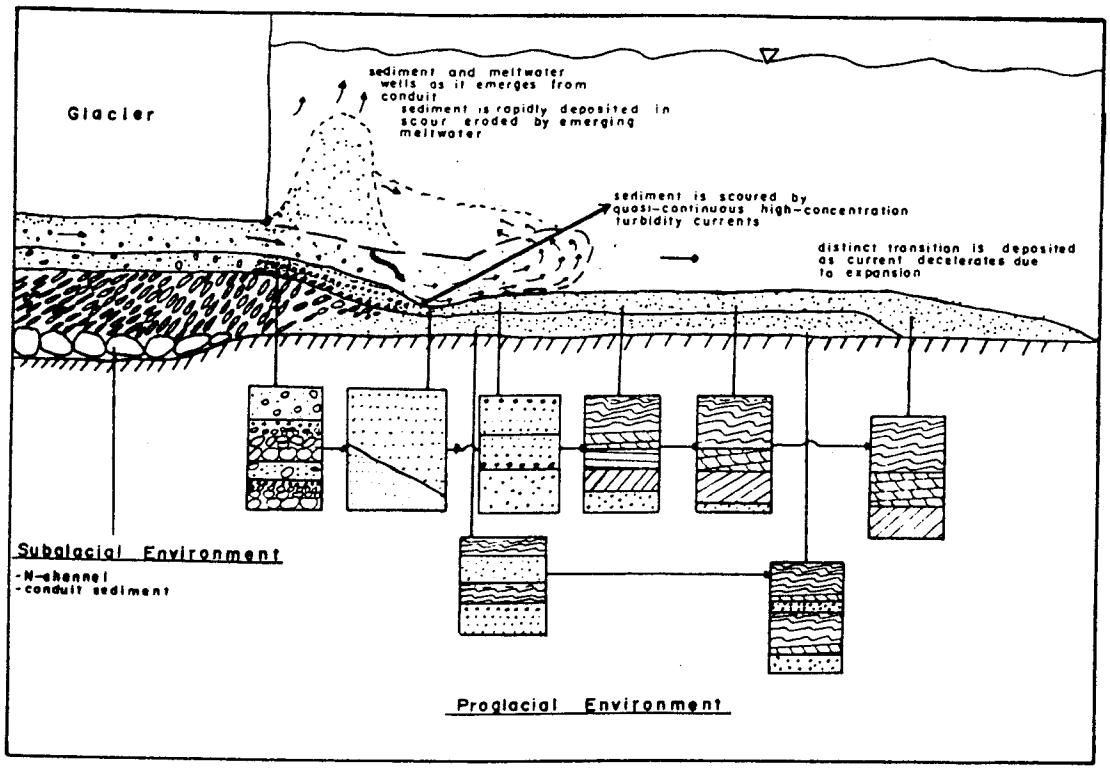


Figure 6: Depositional processes responsible for the formation of the systems. See Figure 3 for symbols legend.

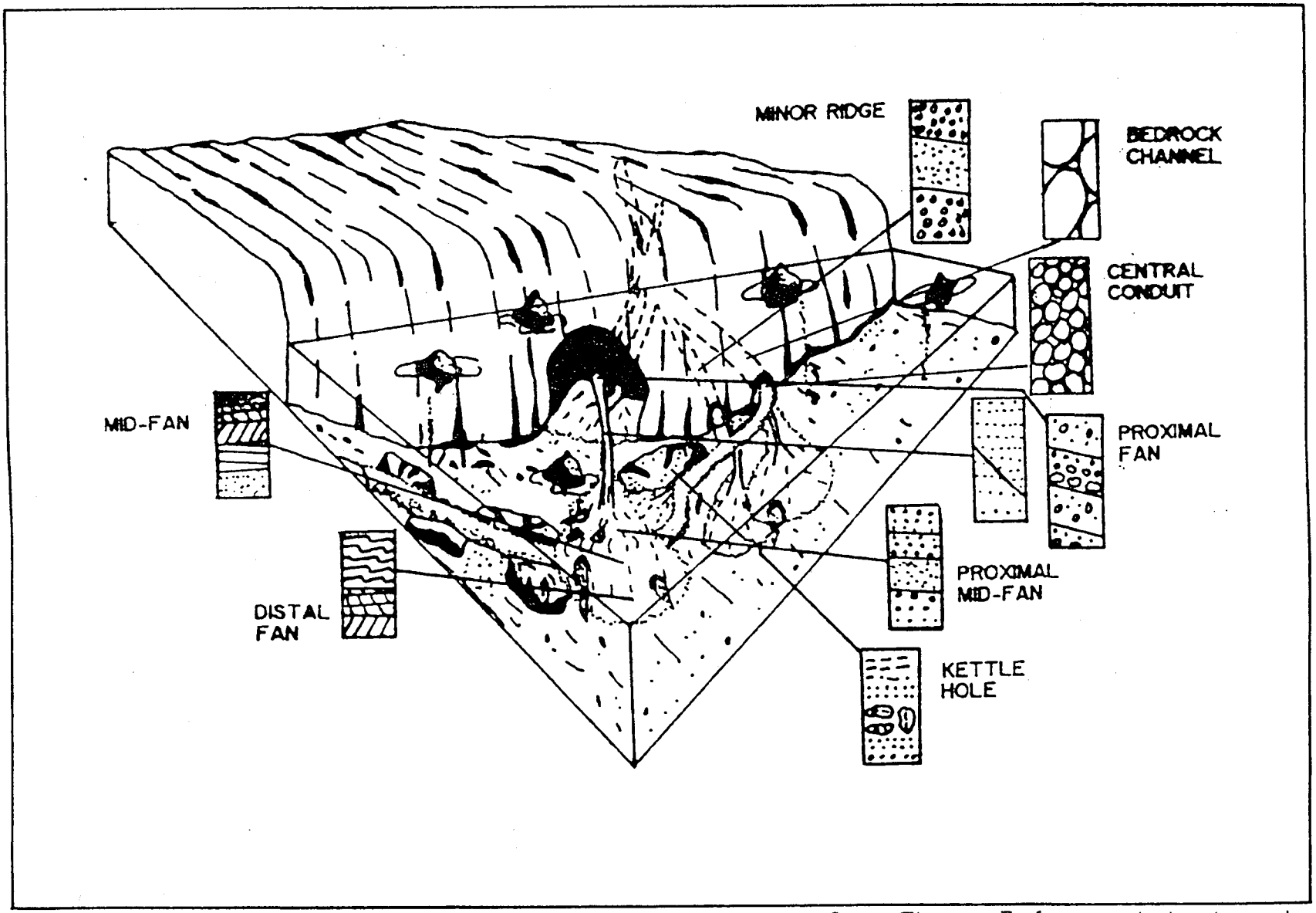


FIGURE 7: Representation of the environment of deposition. See Figure 3 for symbols legend.

6.0 LITHOFACIES

The observations of the seven identified systems indicates that a variety of depositional processes were responsible for their formation. Many of these processes were discussed in Sections 4.0 and 5.0. To simplify the acquired information, facies have been conceived which have assembled the observed sedimentary structures and sequences into groups. These facies were developed only after all the exposures were logged.

6.1 Facies 1: clast-supported boulders

As described previously, the bedrock channel which underlies the gravel ridge is filled with boulders. The average diameter of these boulders is greater than 0.60 m. In a few areas the diameter of the boulders were observed to be up to 5.0 m. The material of this facies is so large that when the operators encounter it they generally cease excavating.

6.2 Facies 2: imbricated clasts

In the steep-sided ridge the clasts were observed to be imbricated. Near the base of the ridge the fabric of the clasts tends to be *a* axis transverse and *b* axis dipping upstream. This suggests that the clasts had mainly been carried in traction and had rolled along the bed.

Near the top of the ridge the fabric is random to slightly *a* axis parallel with *a* axis dipping upstream. This suggests that the velocity of the current was greater than the current which deposited the gravel at the base of the conduit. The diameter of the clasts of this facies are generally less than 0.60 m. The operators crush this material to produce crushed stone.

6.3 Facies 3: cycles of open work, graded cobbles and matrix supported clasts

This facies is found in close proximity to the facies 2.Its thickness ranges from 0.40 to 1.2 m and consists of cycles of graded open-work cobbles and pebbles overlain (or underlain) by matrix supported (fine sand) cobbles. The diameter of the clasts in the matrix-supported portion are always less than the diameter of the clasts at the base of the open work portion. The operators produce crushed stone from this facies.

6.4 Facies 4: fining upward cycles, from graded beds to cross-lamination

This facies consists of cycles which have erosional bases which pass upwards through graded and massive fine gravel to coarse sand, through trough cross-beds, planar cross-stratification, and planar laminated medium to coarse sand which in turn are capped, where not eroded, by very thin cross-laminated fine sand. These cycles meet the gradational requirements of concrete sand.

6.5 Facies 5: scours filled with diffusely bedded coarse to medium sand

This is the thickest of all the facies within the systems. It consists of a single or series of nested scours which are up to 12.0 m thick. In cross section, where the scours are nested, they become progressively smaller upwards. All the scours are filled with diffusely bedded coarse to medium sand. The sand is classified as diffusely bedded because laminae can be seen only on close observation. Perpendicular to the centre of the scour, the bases are wavy. These scours can be traced directly to facies 3. These scours were observed to truncate facies 6, 7 and 8. This facies meets the gradational requirements of concrete and asphalt sand.

6.6 Facies 6: cycles of graded and massive sand, planar lamination and cross-lamination

This facies is often found in close proximity to facies 5. It consists of cycles which fine upward from graded and/or massive medium to coarse sand through planar laminated medium sand to thin units of cross-laminated fine sand. The angle of climb of the cross-laminated units increases upwards. The units within this facies are often found to dip greater than 10°. This facies generally meets the gradational requirements for concrete sand.

6.7 Facies 7: cycles of graded sand, trough cross beds, planar cross-stratification and thin cross-laminated caps

This facies is found in close proximity to facies 5. These cycles are very thick (>0.80 m) and pass upwards from normally and inversely graded fine gravel and coarse sand through trough cross bedded and planar cross-stratified and planar laminated medium sand to thin caps of cross-laminated fine sand. In many instances the stoss laminae of the planar cross-stratified units are partially preserved. In addition many of the individual bedforms came be traced up and downcurrent to other types of beds. This facies will generally meet only the gradational requirements for blending and asphalt (4 & 8) sand.

6.8 Facies 8: cycles of graded and massive beds, planar cross-stratification, planar lamination and cross lamination

The main difference between this facies and facies 7 is the thickest of the units. In facies 7, the cross-bedded and cross-stratified units represent more than half of the cycle. Whereas in facies 8, these units are thin, representing less than 30% of the cycle width. The cross-laminated units being by far the most predominant. In addition, the angle of climb for these units does not change.

The relationships of the facies are shown in Figure 8. Once the facies(s) have been identified the possible use(s) of the material can be determined. This will be discussed further in the next section.

7.0 APPLICATIONS

7.1 Introduction

The effective use of a resource depends greatly on the available information about that resource. Sedimentology, when applied to glacial deposits, is one approach which allows a different perspective to be applied to the features.

Glaciofluvial sedimentary bodies, consisting of sorted sediment, form a series of systems (Figure 4) across Eastern Ontario. These systems have been extensively modified by shoreline processes and, as a result, are buried or confined by thick sequences of clay. In many areas these sedimentary bodies are not only potential sources of high quality sand and gravel, but they may also be potential sources of large quantities of potable water. To effectively use the systems requires site specific information that may be used to predict the actual lateral and longitudinal extent of the sedimentary systems.

Three types of glaciofluvial features identified within Eastern Ontario are shown in Figure 9. The first consists of a steep sided thin sinuous ridge. Internally the sediment ranges in size from boulders to thin beds of silt. The second type of glaciofluvial feature consists of a series of conical hills abutting a central ridge. The range in sediment grain size within this feature is similar to the first. The third type consists of large and expansive sedimentary bodies. Although there is a central ridge consisting of gravel and boulders the feature is predominantly sand.

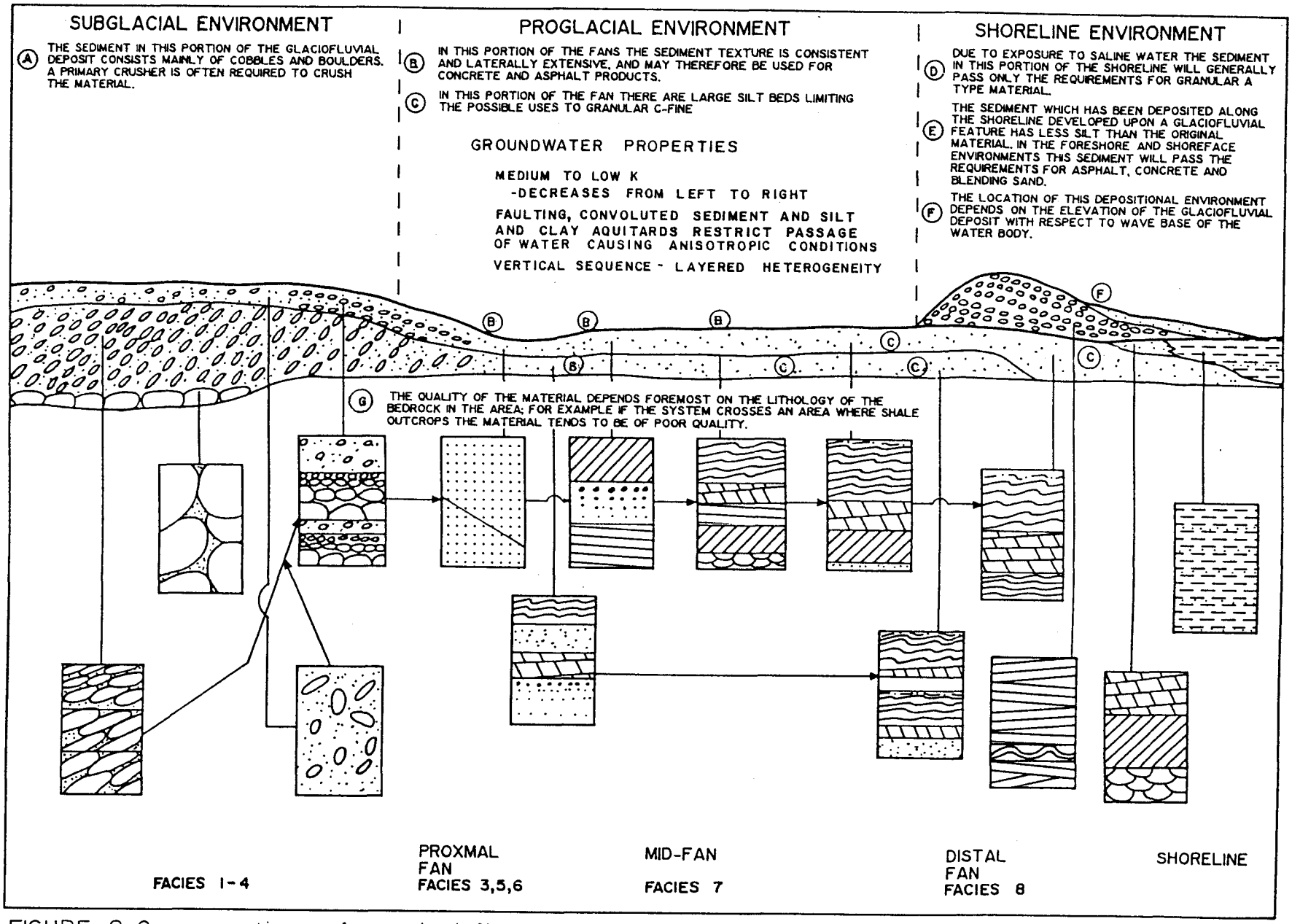


FIGURE 8: Cross-section of a glaciofluvial system and location of each lithofacies. See Figure 3 for symbols legend.

These features have, in the past, been broadly grouped as one sedimentary body; a kame/esker complex or other similar description. However, the information which may be acquired from this type of classification is limited. This is because the range in grain size within the features is considerable, both horizontally and vertically. If the features are to be used effectively, they should be sub-divided.

Since their deposition, the features have been extensively altered by limnological processes. Additionally, because they are partially buried, the actual lateral and longitudinal extent is not obvious. The collection and assimilation of useful information requires a thorough and detailed understanding of the processes responsible for the deposition of the sedimentary bodies.

Examination of the features show that within the systems there is considerable consistency from one system to another in similar lithofacies with respect to the grain size and lateral continuity of the sediment. This consistency is a product of the depositional processes and simplifies the division of the systems into smaller components. Since the systems can be readily divided into smaller components based on the sediment characteristics, it is possible to access the potential uses of the sediment in each segment, including whether portions of the systems can potentially be used as a water resource.

7.2 **Buried Sand and Gravel Resources**

In areas where these glaciofluvial systems rise above the local ground surface there is often a sand and gravel extraction operation. However, depending on which portions of the system the material is being removed, the operator may be obtaining material which was deposited by a considerable range of processes. The position of the pit on the deposit will determine the available volume of economic material at that site.

Distinguishing whether the material was deposited along a shoreline or by glaciofluvial processes is important because it gives the operators an indication of what to expect within different portions of their pits. The large range of grain size within the features may hinder the effective use of the sediment and feature. For example, if clay is encountered at depth in a particular pit the operator might assume that this level is the limit for economical extraction for the whole feature. However, this may not necessarily be the case, for as discussed in Section 4.2 the

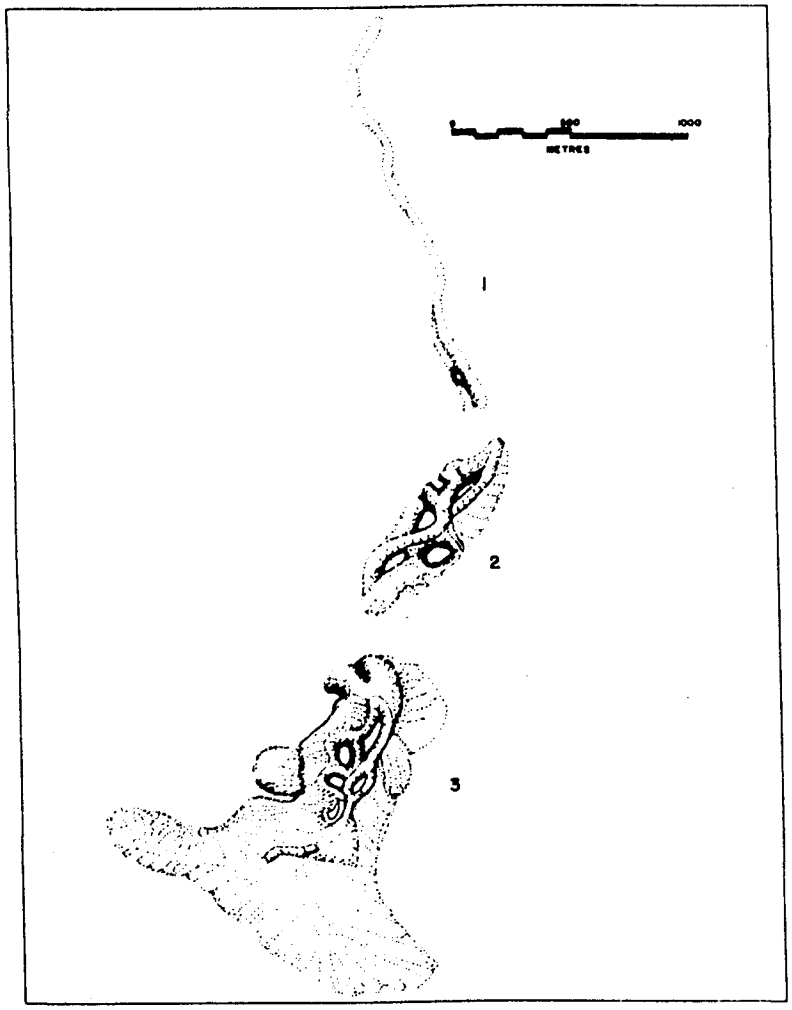


Figure 9: The three types of glaciofluvial systems identified in the study area. 1. Ridge; 2. Series of conical hills abutting ridge; 3. large expansive sedimentary bodies.

clay which is considered to be the economical limit of excavation, may in fact overlie material which may potentially be extracted. Examples of this situation are cited below.

The separation of the glaciofluvial and the shoreline portions of the systems are shown, where possible, on Maps 1 to 11. The sediment within the glaciofluvial portion of the systems is deeper, laterally more extensive and has a wider textural range than that which was deposited along a shoreline. These trends are consistent over all of the systems.

Figure 8 gives a conceptual portrayal of the vertical and horizontal transitions between lithofacies found within the systems. In the subglacial portion of the system the sediment consists primarily of gravel which has a preferred fabric in the lower portion of the sequence and a random fabric near the top (facies 2). This gravel can be traced down-current into the proximal environment to cycles of normally graded clast pebbles and cobbles and matrix supported cobbles (facies 3). These cycles are believed to be deposited near the ice margin (Figure 8).

In this portion of the deposit, the quality of the material depends, to a large extent, on the lithology of the bedrock in the area. Therefore, the quality of the material cannot be classified on a regional basis. For example, System 4, as shown on Map 5, crosses an area near Village of Vars where the upper bedrock unit is shale (Wilson 1946; Williams et al. 1985c). A large proportion of the material in the system in this area consists of shale. As a result the quality of the material in the glaciofluvial portion is very poor. Testing by the Ministry of Transportation of the material indicates that it will pass only the requirements for granular C.

The grain size of the sediment fines down-current of the gravel units because, during deposition, the current expanded laterally and mixed with the ambient water at the ice margin (Figures 6 and 7). The gravel can be traced down-current to scours filled with diffusely bedded medium sand and graded and massive bedded medium to coarse sand (facies 5). These scours represent erosion by a high concentration turbidity currents where the diffusely bedded fills consisting of medium to coarse sand were dumped en mass (Figure 6). The graded and massive beds indicate that the sediment was deposited rapidly. Traced down-current these beds and large scours grade into cycles (facies 7) of graded and massive beds, trough cross-beds, planar cross-beds and planar laminations and then down-current

into cycles (facies 8) of cross-beds and cross-laminations and finally into cross-laminations and silt drapes (Figure 6). The grain-size distribution and sorting characteristics are shown in Figure 10. The depositional environment and associated facies are summarized in Table 1.

Numerous samples were obtained of many of the sedimentary structures from the systems. These samples were sieved and the results were averaged for each structure to obtain a particle size breakdown representative for each. Figures 11 to 14 display the textural analysis of the sand within the lateral progression observed within the proglacial portion of the fans. The gradational envelope established by the Ministry of Transportation for concrete and asphalt sand are also on the graphs. These graphs indicate that only the material deposited near the ice margin will pass the gradational requirements for asphalt and concrete sand. The grain size analysis of many of these samples are shown in Table 2 and Appendix B.

It is possible to delineate the sedimentary structures and facies which correspond to each depositional environment (Figure 8). In the upper fan, proximal environment, facies 5 is the predominant structure(s), although cross-beds and cross-laminations were observed occasionally (facies 6). In the mid-fan area the material is not as homogeneous and the structures consist of a series of fining upward cycles as described in facies 7 (Figure 8, Table 1). These cycles can be traced into the distal environment where facies 8 is found.

The transition, in the upper fan, outlined above is in contrast to the transition in the lower fan (Figure 8). In the lower fan portion of the systems, the structures are not as large and extensive. As discussed earlier, this suggests that this lower portion of the systems were deposited by pulse-type currents which rapidly decelerated and deposited a thin bed. This lower portion of the systems is characterized by small cycles consisting of many sedimentary structures.

In the proximal portion of the fans, these structures consist of graded and massive units, small scours and cross-laminations. These units rapidly grade into small graded and massive units and large units of cross-lamination. Only in the proximal portion of the fan will the sediment pass the gradational requirements for concrete and asphalt. However, this portion of the fan has often a limited horizontal extent. Where possible, the areas within the systems which consist predominately of this type of sequence are shown on the Maps 1 to 11.

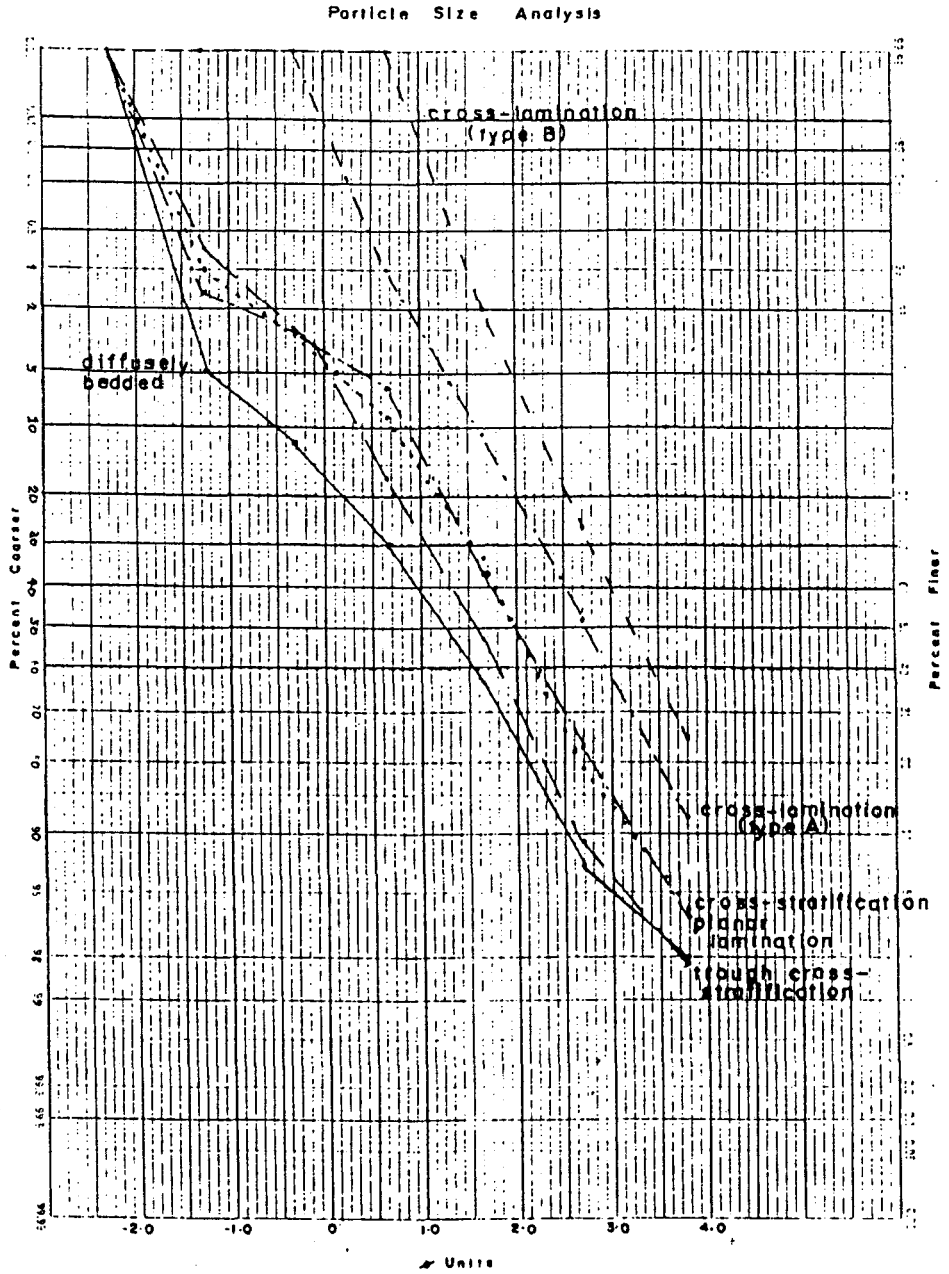
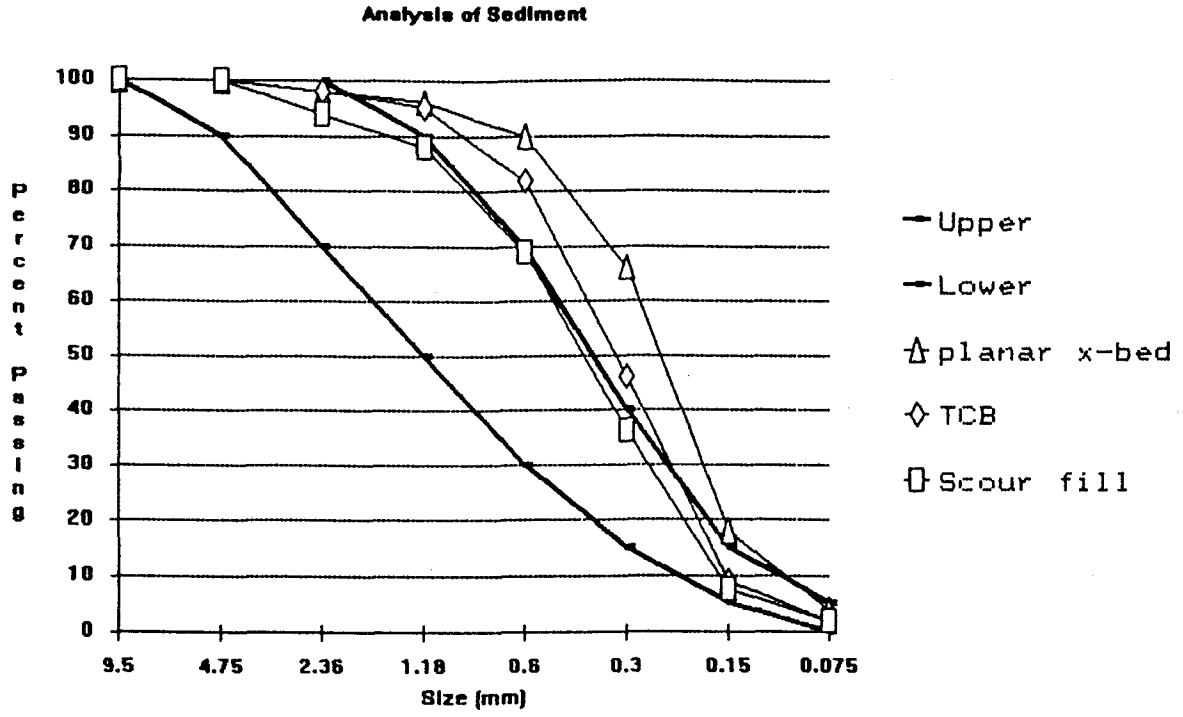


Figure 10: Particle size breakdown of particular sedimentary structures.

Table 1: Summary of the systems and identification of the lithofacies.

Depositional Environment	Facies	Possible Uses	Transmissivity
Subglacial			
bedrock channel	boulders (1) clasts>0.60 m	crushed stone	very high
esker ridge	imbricated clasts(2)	crushed stone	very high
bead	cycles of graded cobbles and matrix supported clasts (3)	crushed stone	very high
minor ridges	clast supported cobbles (3)	crushed stone	high
	fining upward cycles of massive and graded sand, t.c.b., planar lminat. and x-lamin. (4)	concrete sand	medium
Proglacial			
proximal fan	cycles of graded clast supported cobbles and matrix supported clasts (3)	crushed stone	high
	sours filled with diffusely bedded sand (5)	concrete sand	medium
	cycles of graded and massive coarse sand and planar lamination (6)	concrete sand	medium to low
mid-fan	thick cycles of graded sand, t.c.b, planar x-beds, planar lamin. and x-lamin. (7)	blending and asphalt sand	medium to low
distal fan	thin beds of planar x-strat. and planar lamin. ripples with consistent A.O.C.(8)	granular-C fill	low

t.c.b trough cross beds
A.O.C. angle of climb
(#) lithofacies number



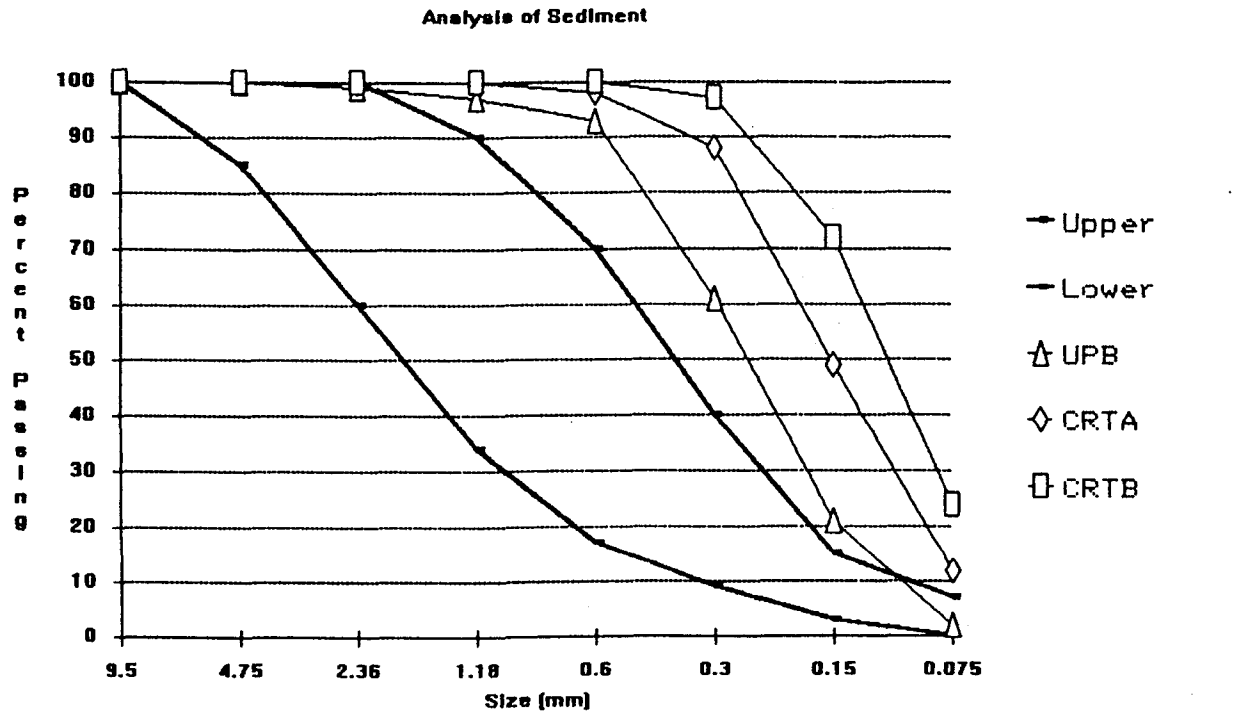


Figure 11: Particle size analysis of sedimentary structures identified in the glaciofluvial environment and the gradational limits for asphalt.

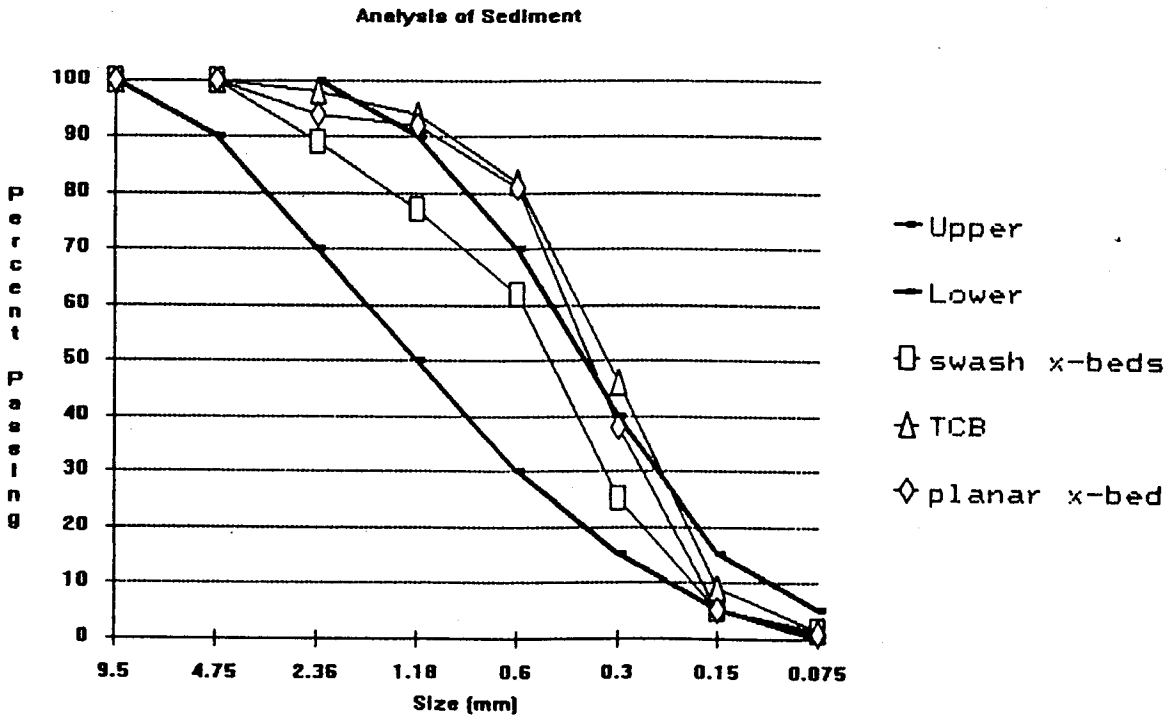
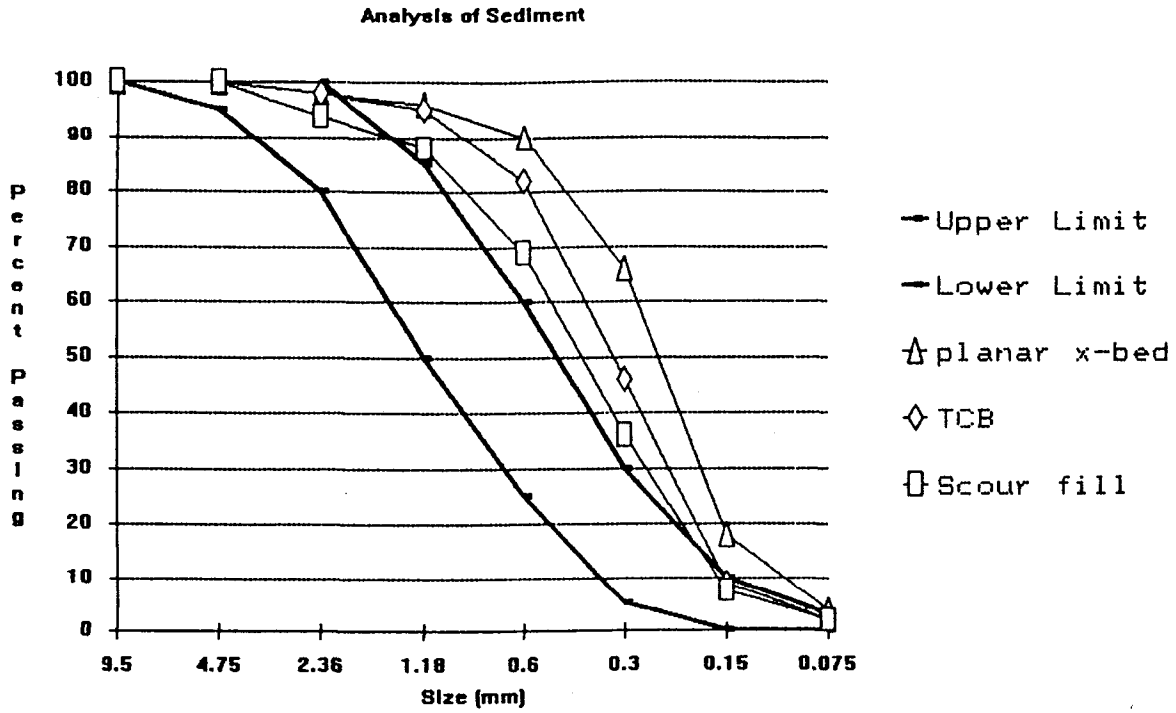


Figure 12: Particle size analysis of sedimentary structures identified in the shoreline environment and the gradational limits for asphalt.



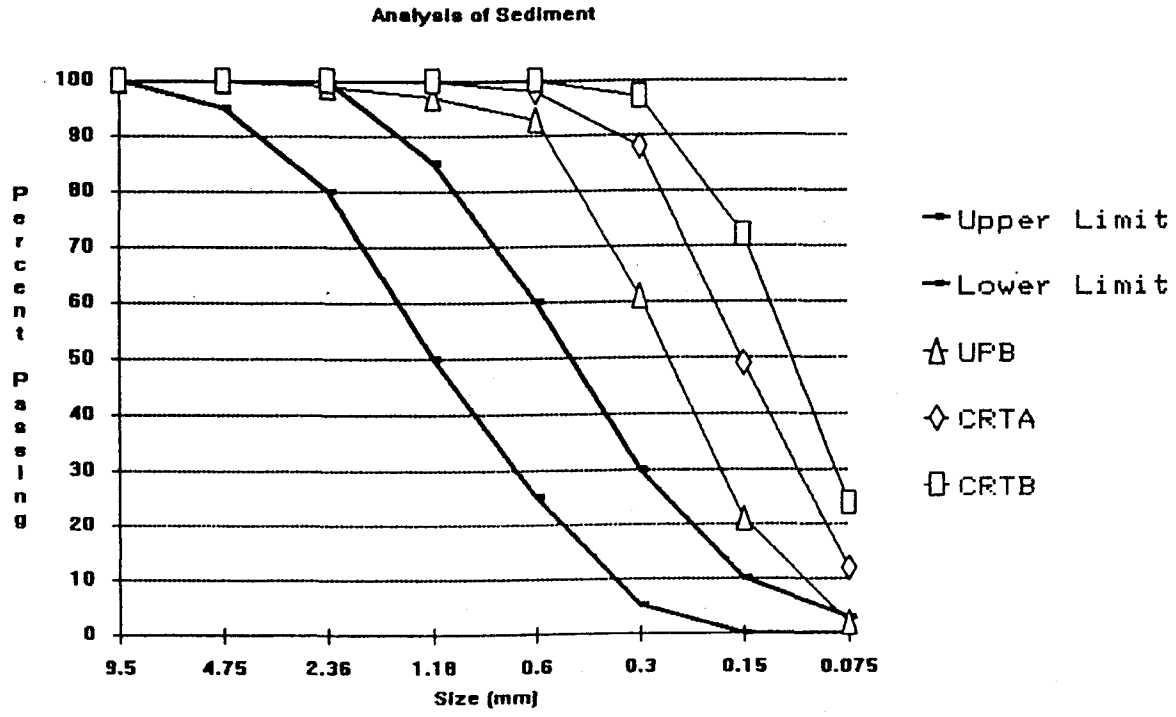


Figure 13: Particle size analysis of sedimentary structures identified in the glaciofluvial environment and the gradational limits for concrete.

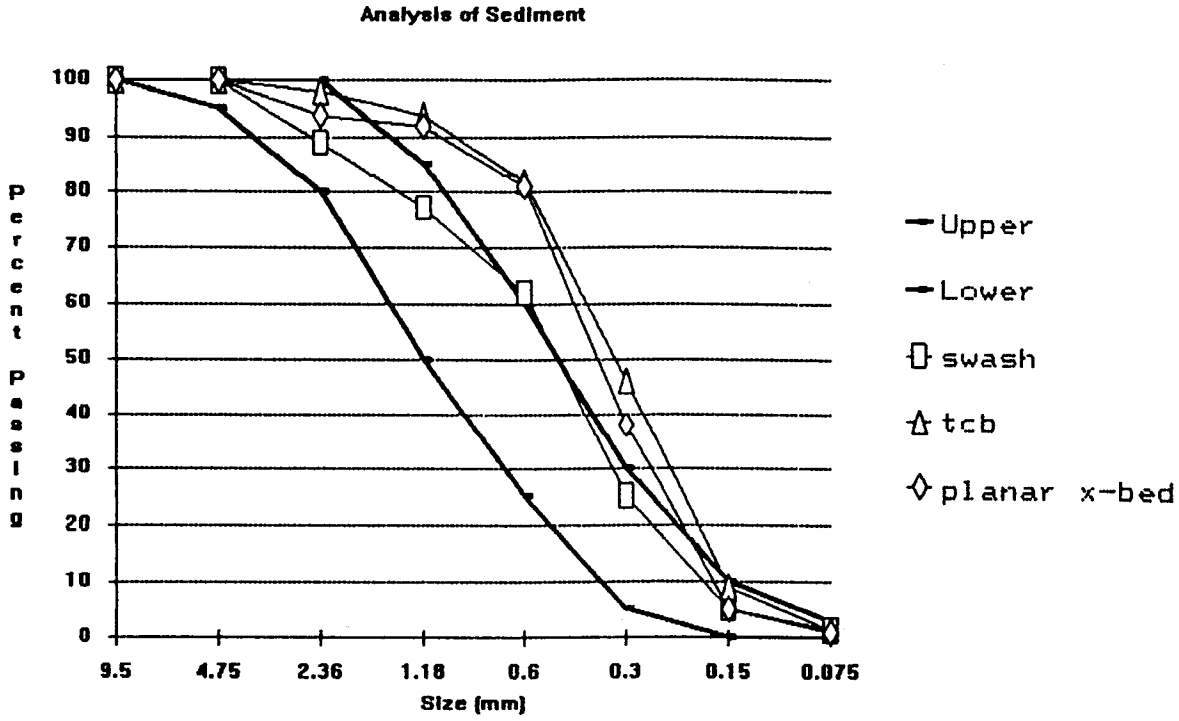


Figure 14: Particle size analysis of sedimentary structures identified in the shoreline environment and the gradational limits for concrete.

Table 2: Analysis of the sedimentary structures.

Size of sediment analysis											
Sedimentary structure	phi 5	phi 16	phi 25	phi 50	phi 75	phi 84	phi 95	Mean	Sorting	Skewness	Kurtosis
Scour	-1.30	0.10	0.50	1.40	2.05	2.40	3.00	1.30	1.23	-2.71	2.73
gl. x-bed	0.20	1.20	1.50	2.10	2.60	2.90	3.65	2.07	0.95	-0.69	1.56
T.C.B.; glac	0.05	0.60	0.90	1.60	2.15	2.40	3.10	1.53	0.91	-0.26	1.56
UFR	0.50	1.20	1.45	2.05	2.65	3.00	3.60	2.00	0.92	0.09	1.52
CRTA	1.35	1.95	2.25	2.80	3.35	3.60	4.10	2.78	0.83	-0.25	1.24
CRTB	2.10	2.50	2.70	3.20	3.70	3.90	4.30	3.20	0.68	-0.00	0.90
Swash	-1.40	-0.80	0.00	1.10	1.80	2.10	2.65	0.80	1.34	-3.23	2.99
Sh. x-bed	-1.25	0.60	0.90	1.50	2.05	2.25	2.75	1.45	1.02	-0.12	1.89
t.c.b.; shore	-0.10	0.70	1.00	1.70	2.25	2.50	3.20	1.63	0.95	-0.67	1.69

In the proximal environment facies 5 are large enough that the inclusion of the finer beds will not have a significant effect on the texture of the sediment and therefore meet the gradation requirements for concrete and asphalt. In the mid- to distal-fan the cycles of facies 7 may significantly affect the overall gradation. However, even with the presence of coarser beds, the inclusion of all the sediment in a pit face would still prevent this portion of the fan from meeting concrete specifications. The environment of deposition, the type of material which may possibly be available, and the possible constraints within each portion of the fan are shown in Figure 15.

Superimposed upon all of the systems are features deposited by limnological process (Figure 8). Within these features the grain size of the sediment ranges in size from cobble and boulders within storm beaches and lags, through fine to coarse sand in the foreshore and shoreface environments to rhythmically bedded silt and clay in the offshore environment. The gravel within the backshore and upper foreshore portion of the shoreline will usually pass only the requirements for granular A type material. A possible explanation is that the material was exposed and weakened due to exposure to saline water and seasonal frost variations and is therefore no longer as sound as it was originally.

In the shoreface and lower foreshore environments the sediment ranges in size from fine gravel to medium sand. Similar to the glaciofluvial deposits, samples were obtained from many of the individual sedimentary structures from the different environments. Figures 13 and 16 display the average textural breakdown of the sand within these environments. Even though the bedforms are the same, they appear to contain less silt than the same bedforms formed in the glaciofluvial environment. There is less silt because the sediment was derived mainly from the glacio fluvial system and it has been sorted further by wave transportation. As indicated in Figures 13 and 16 only the material deposited in the foreshore as swash cross-beds will pass the requirements for asphalt and concrete sand. However, the sediment deposited in the shoreface as trough cross-beds and planar cross-stratification may pass the gradational requirements for blending sand. This will be discussed further in the next section.

It is often difficult to distinguish the glaciofluvial portion of the systems from the portions which were deposited due to progradation of a shoreline. As mentioned previously, it is important that the two be distinguished because within each environment the uses of the material differ, the possible constraints vary and the vertical and

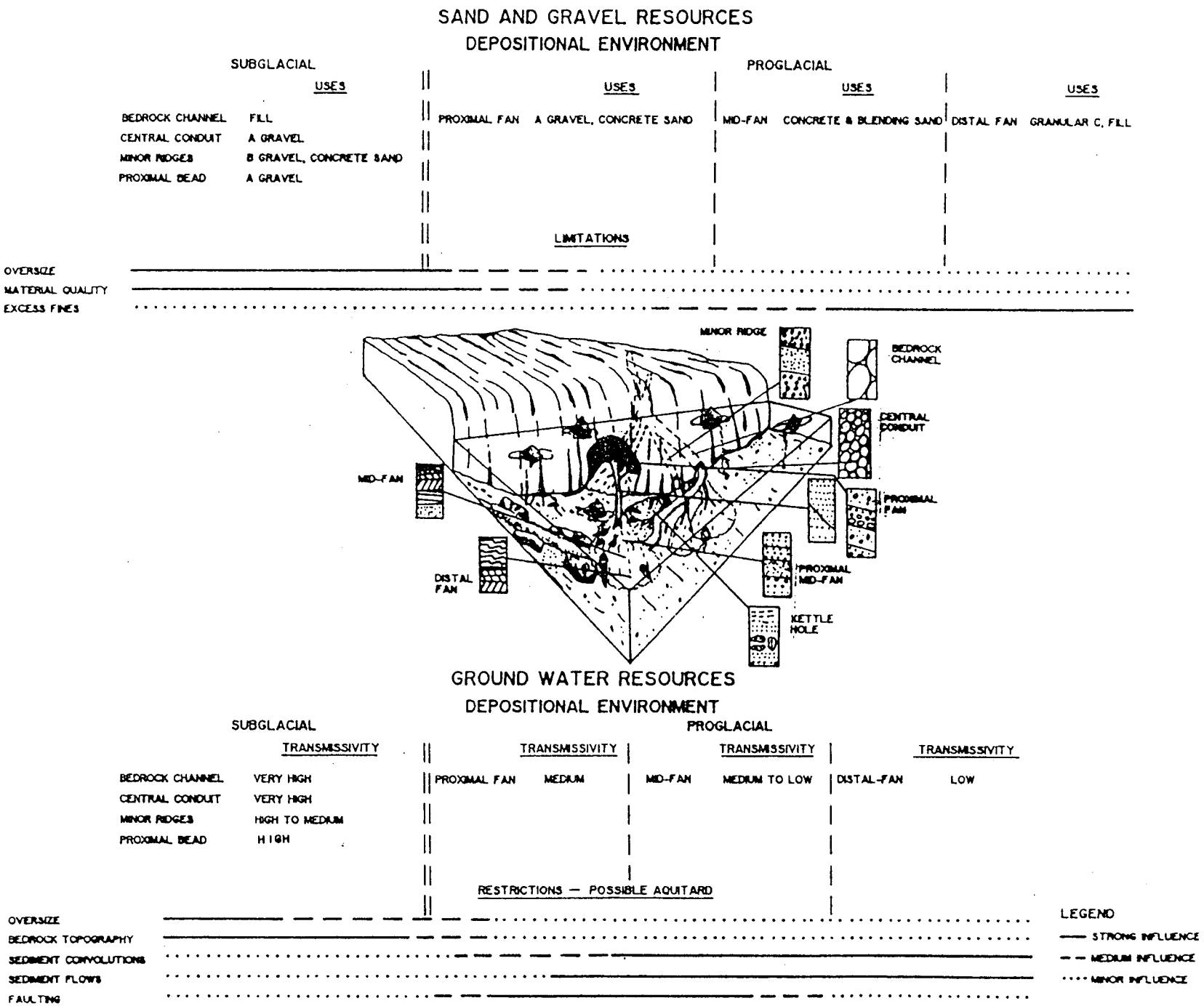


Figure 15: Representation of the uses and constraints within each depositional environments.

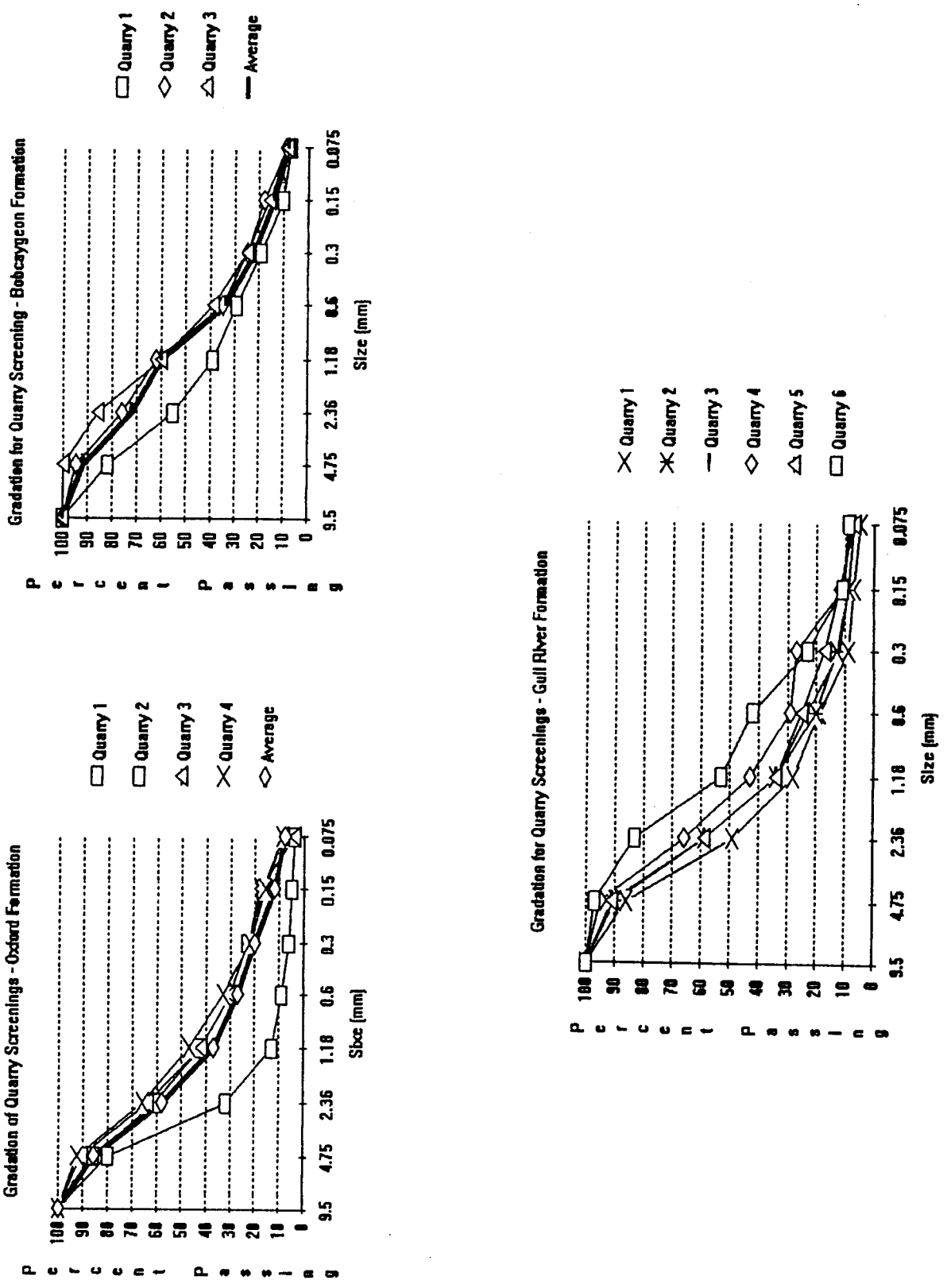


Figure 16: Gradation of the quarry screenings.

lateral extent differ significantly.

One fairly conclusive way of distinguishing the two environments is the transition between bedforms. As shown in Figure 8 and discussed above, there are definite lateral transitions between facies within the glaciofluvial portion of the systems. However, in the shoreline environment a different transition is evident. In the backshore and upper foreshore portions of the shoreline the sediment consists predominantly of fining upward cycles of boulders, cobbles and pebbles. These cycles can be traced seaward to swash cross-beds, trough cross-beds, planar cross-stratification and cross-laminations and rhythmically bedded silt and clay. The principal bed which distinguishes the shoreline environment are the swash cross-beds. In addition, since the shoreline along the glaciofluvial features tended to prograde, the rhythmically bedded silts and clays generally underlie the sand units described above.

An easier way to distinguish the two environments is the presence of shells and shell fragments along bedding planes. If the shells are present the sediment has been deposited or affected by, limnological processes. However, the absence of shells does not necessarily indicate that the sediment is glaciofluvial in origin.

The final way of distinguishing the two environments is on the basis of texture. The cross-bedded units deposited due to shoreline progradation tend to contain less silt than similar units deposited within the glaciofluvial system. Therefore, if the texture of the two similar structures are compared, the sediment deposited along a shoreline may contain less silt. This approach should be used only if the first two methods are explored, and additional evidence is required to substantiate observations. Once the environments have been distinguished, the possible constraints to the extraction of the feature may be determined.

The foremost constraint within the shoreline environment with respect to the extraction of the material, is the seaward and downward fining of the sediment. For example, if the operators are extracting material which was deposited within the foreshore and the upper shoreface they should recognize that this sediment will fine downwards and seaward to cross-laminations of fine sand and then to rhythmites of silt and clay (Figures 5 and 8). To obtain a consistent material gradation, the sediment should be excavated in a zone parallel to that which was once the shore and at a constant pit depth. Extending the excavation beyond these lithofacies will probably result in a different

material gradation. If these lithofacies are mapped initially, the pit managers will have the opportunity to optimize their operation. Many of the segments of the systems which are shoreline deposits are shown on Maps 1 to 11. Where identified, the lithofacies which is below the shoreline sediment is also shown.

It is also useful to know what the shoreline has prograded upon. With respect to the systems outlined within this report, the shore prograded over either a portion of the glaciofluvial feature or over sediment which surrounded the system prior to the deposition of the shoreline material. For example, a portion of System 6 near the Ottawa landfill site (Map 8) between Cedarview Road and Moodie Drive, has been subdivided into glaciofluvial and shoreline environments. Investigation has found that at specific locations, the shoreline has prograded over both the glaciofluvial sediment and the till which surrounds the feature. These units are shown on the Map 8.

In the area where the shoreline has prograded over the glaciofluvial sediment the operator has to remove only 1 to 3 m of rhythmically bedded silt and clay to extract the underlying glaciofluvial sediment (DH's 115-118, 121 and 122; Appendix C). However, in the area where the shoreline has prograded over the till the maximum depth of extraction will be the top clay, for there is no usable material below it (DH's 106, 110 and 111; Appendix C).

The southern portion of System 5 is another example of how the correct identification of the feature and sedimentary structure may result in a well managed excavation. In the central portion of the feature it was found that there was greater than 35 m of sediment; 15 m of which is below the water table (DH's 69 to 73; Appendix C). This portion of the feature is glaciofluvial in origin. Approximately one kilometre north of these drill holes (DH 67, 74 and 75; Appendix C) there is less than one third the amount of sorted material. This segment of the system is the shoreline portion.

This orientation of the system changes from north-south to east-west in the southern portion of System 5. The change in orientation is accompanied by a lithofacies change; the gradation of the material and the type of sedimentary structures suggests that there is a partial transition from proximal fan to mid fan environments (DH's 76 and 77; Appendix C). If the potential of the feature is to be realized this transition must be recognized.

Large quantities of material, particularly around the City of Ottawa, have been removed from the systems. As a result, many of the systems have been excavated to, or slightly below, the water table. However, the work has indicated that significant volumes of material remain below the water table within the glaciofluvial portion of the systems. The depth of usable material below the water table has been shown for a few areas on Maps 1 to 11. This material could be excavated with a drag-line or by using some other method which permits excavation below the water table. If this type of excavation is possible, the useable volume of sand and gravel reserves will increase significantly.

7.3 **Blending Sand**

The preceding discussion on the glaciofluvial systems indicated that material from specific depositional environments and lithofacies will consistently pass the gradational requirements for certain products. However, the delineation of areas containing material which will pass blending sand requirements is not as apparent. This is because a blending sand is a sand which, when blended in small quantities with quarry screenings, produces a product which meets the gradational specifications for asphalt or concrete. There are problems classifying this material in the field because its use depends to a large part on the gradation of the quarry screenings which will be mixed with the sand. In addition, different blends of sand and quarry screenings are required for different types of asphalt. In the context of this study, a blending sand is classified as that grade of sand which, when mixed at varying ratios with varying ratios of quarry screenings, will produce an asphalt mix which can be used as hot laid (H.L.) 1 and 3.

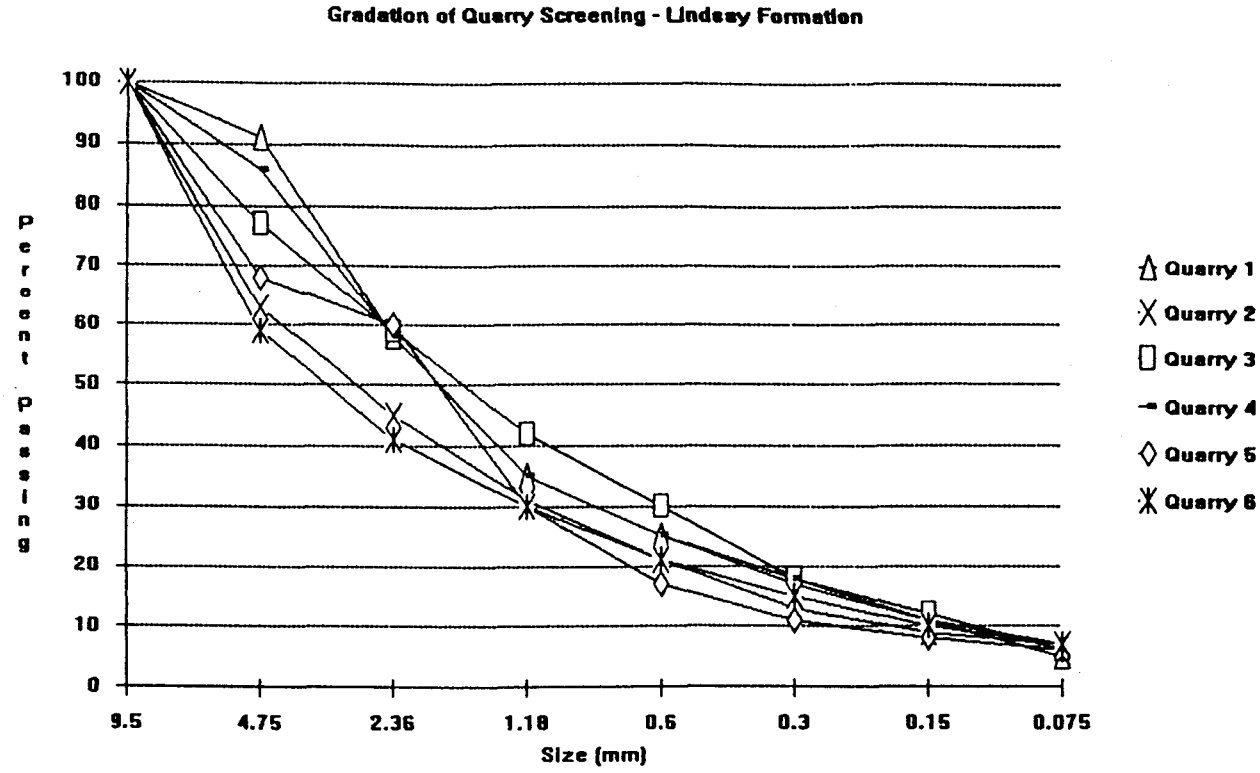
It is difficult to classify what exactly a blending sand is without initially determining the gradation of the quarry screenings which will be mixed with the sand. The mix depends on the source of screenings which are to used. However, if it were possible to determine a consistent regional gradation for quarry screenings, the screening gradation could be considered as a fixed variable for most asphalt mixes. Once the gradation for the screening is fixed, it becomes a matter of determining which depositional environment and facies would be consistently fit within the gradational envelope for H.L. 1 and 3.

Samples of quarry screenings were taken from many of the quarries in Eastern Ontario. The quarries which produce asphalt are using sand in their mixes from, with the exception a few in the northeast portion of the study area, pits within the study area. The rock which is quarried is from the: 1) Oxford Formation, a light to dark grey, sublithographic dolomite; 2) Rockcliff Formation, an interbedded fine-grained light greenish grey quartz sandstone, shaly limestone and shale; 3) Gull River Formation, an interbedded silty dolomite, lithographic to fine crystalline limestone, shale and fine-grained calcareous quartz sandstone; 4) Bobcaygeon Formation, a sublithographic to fine crystalline limestone with some shale beds; 5) Verulam Formation, an interbedded bioclastic limestone, sub-lithographic to fine crystalline limestone and shale beds; and 6) Lindsay Formation, an interbedded sublithographic to fine crystalline limestone, calcareous shale and calcarenite (Wilson 1946; Williams et al. 1985a,b,c,d). The location and the lithology of the quarries which were sampled are shown on Maps 1 to 11.

The screening samples were grouped according to formation. The samples from each group were then sieved in accordance to the procedures established by the ASTM standards. The results from each sample group are shown in Figures 16 and 17.

The average variation within each group and each particle size was low, with the exception of the samples from the Oxford Formation and the Lindsay Formation. Investigation subsequent to the sampling found that where there was a substantial variation for one sample it was due to the manner in which the screenings were processed. Alternatively, the variation may be due to sampling errors. However, overall the group variation is low (Figures 16 and 17) suggesting that when the same bedrock unit are crushed by the same means, the screenings will be generally similar.

The gradational curves for the groups of quarry screenings were combined and averaged to produce a single curve representing the regional gradation curves for the different bedrock lithologies. The curves obtained for each sampled group of bedrock units are shown in Figure 18. These curves are the fixed variable described above and may be used to determine the ratio of sand and screening required to fit the asphalt gradational envelope. However, it is necessary to specify the upper and lower limits for the ratio of blending sand to quarry screenings which can be used before this envelope is calculated.



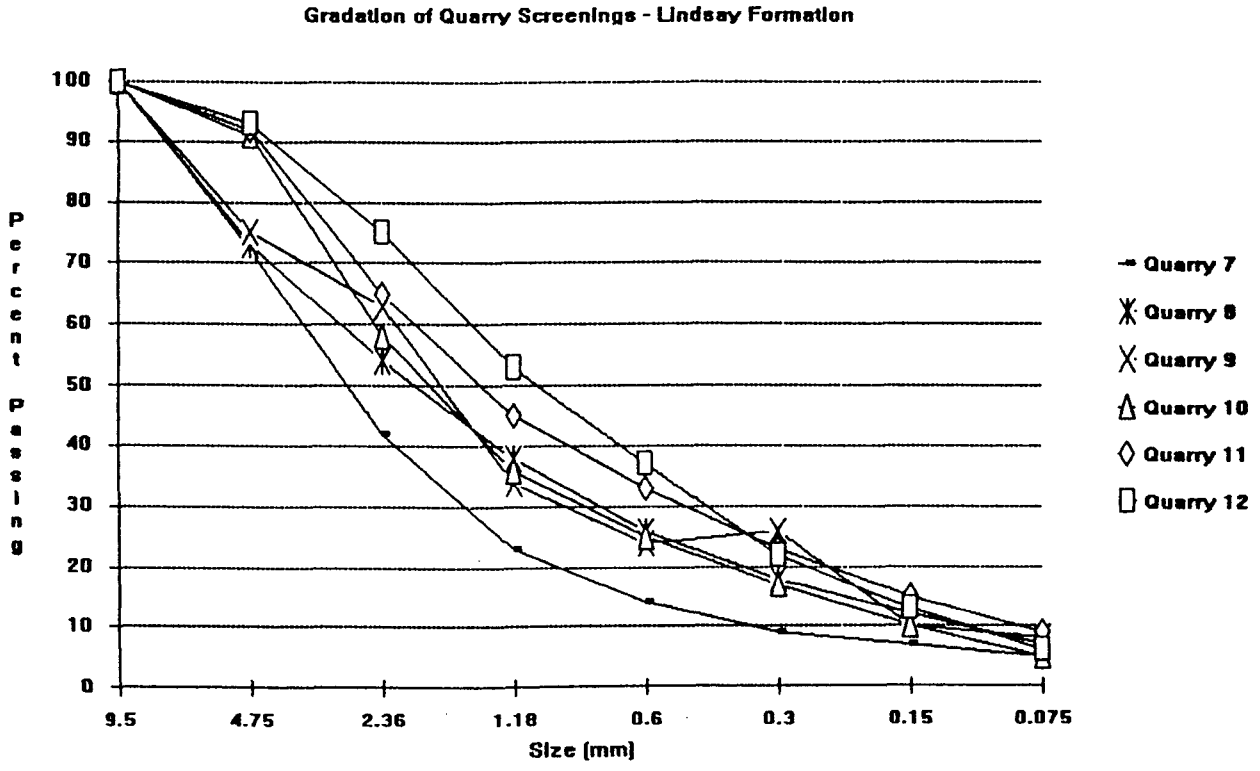


Figure 17: Gradation of the quarry screenings.

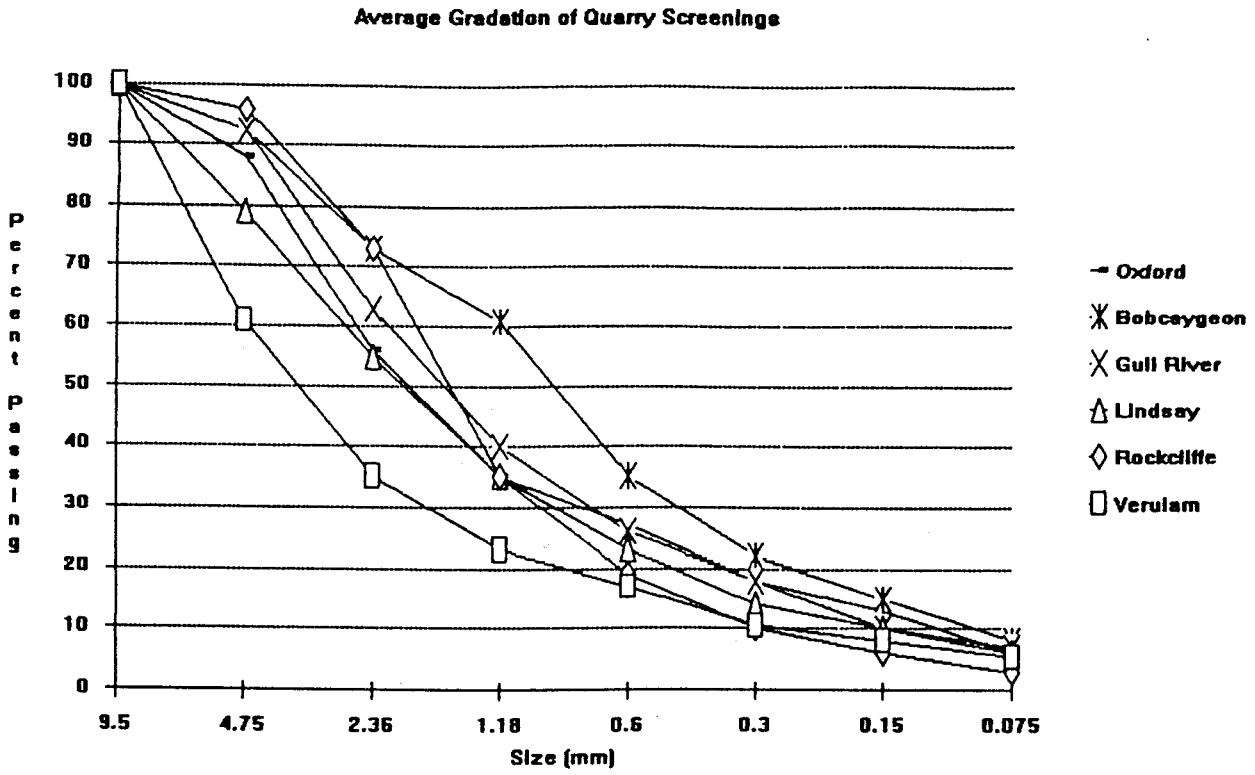
Guidelines obtained from the Ministry of Transportation suggest that the ratio for blending sand to quarry screenings mixes should not exceed 4:1. If too much sand is added to the mix and this ratio rises the blend will be too rounded and not contain enough silt. A mix obtained from this kind of blend will not have sufficient void space. Brien (1978) found that if the sand particles are too rounded and too polished they adhere poorly to the bitumen. If the mix contains more quarry screenings than blending sand there will be an overabundance of voids and silt. This will result in a blend that has excessive angularity. Asphalt which has an angular mix is difficult to compact when laid. Therefore, the upper and lower boundaries for the blending sand to quarry screening ratios have been selected to be 1:1 to 4:1. The blending sand gradational envelope for these limits are shown in Figure 19.

There are further conditions which should be specified before blending sands are defined because a sand and quarry screening mix which fits within the envelope may still not be acceptable. First, the gradation curve for a blending sand should be relatively smooth with no obvious steps. Steps indicate that there is a deficiency in a specific grain size, which will affect the void space percentage and will prevent optimum compaction of the mix.

A second condition that must be met relates to the sands fine faction. The specifications of Ministry of Transport indicate that approximately 70% of the blending sand must pass through the 600 μm sieve and be retained by a 150 μm sieve. A silt content of 0 to 2% is considered ideal. If the silt content (percent passing a 0.075 μm sieve) is greater than 5% the sand is not suitable.

When samples of the quarry screenings were obtained, a sample of the blending sands which was being used was also collected. The source of this sand was also determined by interviewing the quarry manager. These samples were sieved and the results are shown in Figure 20.

An average size distribution was calculated for all the blending sands which are being currently used by the quarries in Eastern Ontario (Figure 19). This curve falls within the calculated blending sand gradational envelope shown in Figure 19. The average gradational curve of the blending sand currently being used by the quarries was placed on the graphs for the different facies identified within portions of the systems (Figures 21 and 22). The graphs indicate that the sediment which was deposited in the mid-fan of the glaciofluvial environment and within the



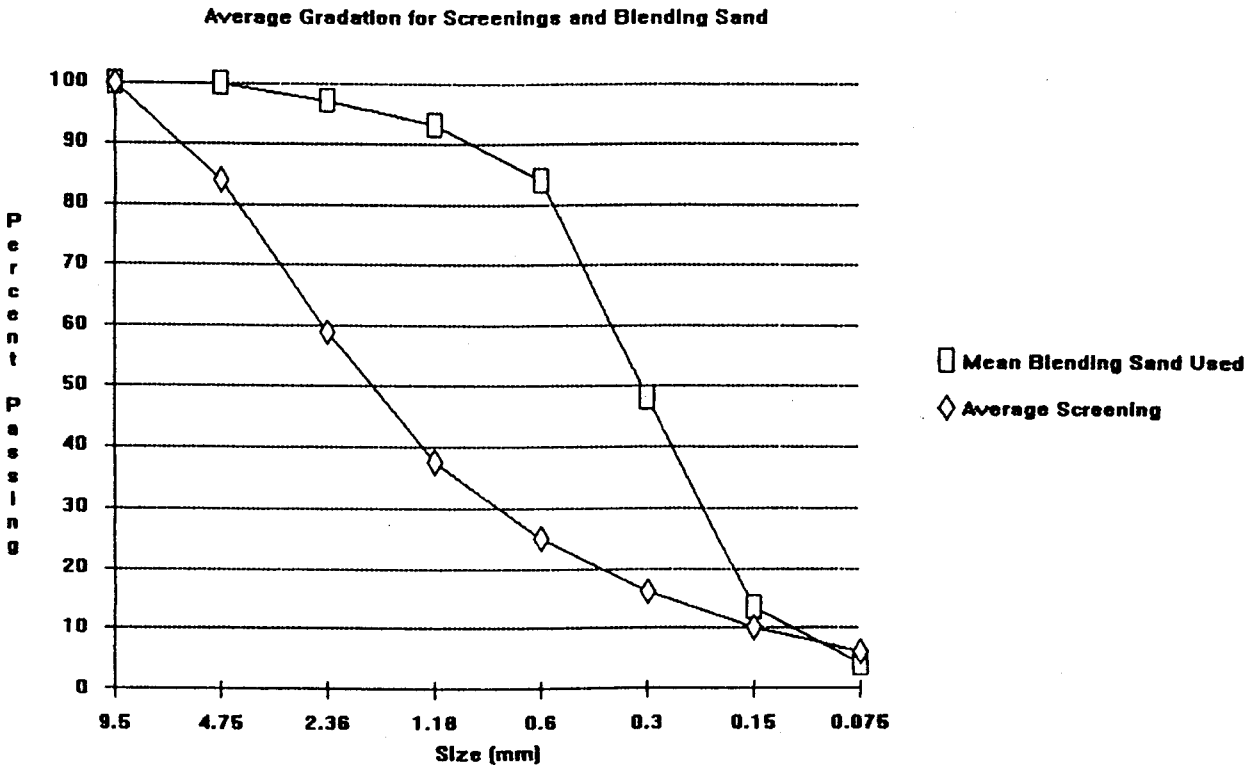


Figure 18: Average screening gradation for each bedrock Formation and average blending sand gradation.

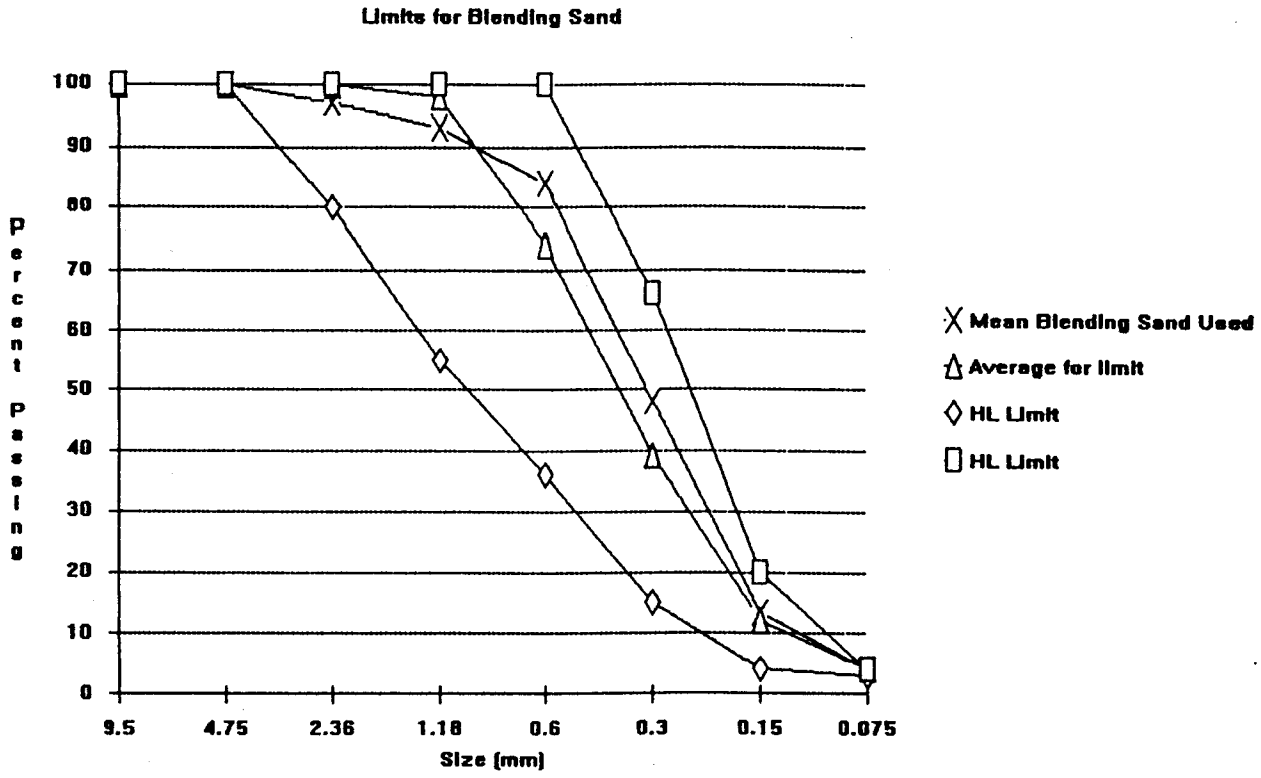


Figure 19: Average gradation for blending sands used in study area and 1:1 and 1:4 screening and sand gradational limits.

shoreface zone of the shoreline will pass the requirements for blending sand. The environment of deposition, the type of material which may possibly be available, and the possible constraints within each portion of the system are shown in Figure 15.

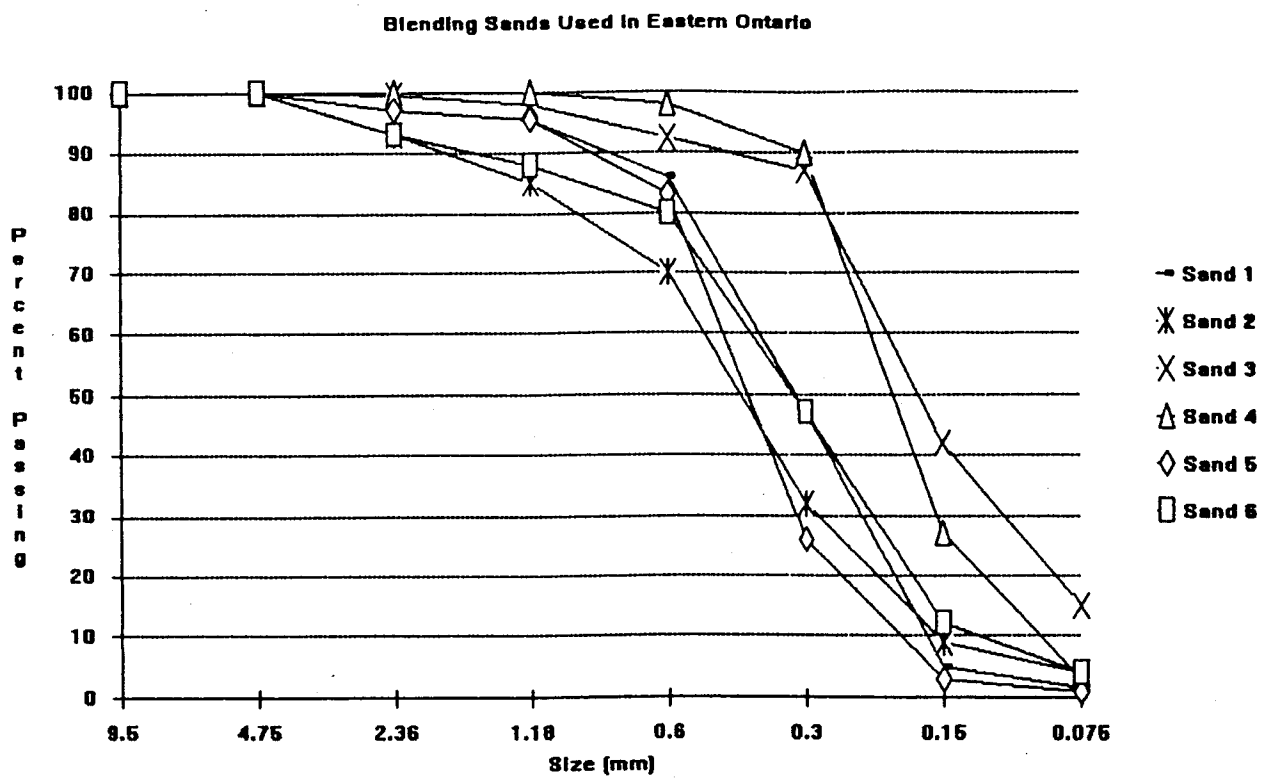
The graphs shown in Figures 21 and 22 indicate that the area within the systems where blending sand is most apt to be found are within the mid-fan (facies 7) and shoreface environments. However, there will be localized areas in other portions of the systems which will also pass the gradational requirements for blending sand but the volume of material which could be extracted from these areas is limited. It would be limited because the other portions of the systems are very dynamic and there will be substantial thicknesses of coarser and finer beds which may considerably change the average gradation. For example, it was observed that within a few of the systems facies 5 has truncated facies 8, the gradation at these locations may be coarse enough meet blending gradational requirements. The mid-fan and shoreface portions of the systems where blending sand is most apt to be found are shown on Maps 1 to 11.

A summary of which depositional environment and facies pass the gradational requirements for blending sand is shown in Table 1. As discussed above, the area of the systems which is apt to consistently pass the requirements for blending sand is within the shoreface and mid-fan portions.

7.4 **Ground Water Resources**

As discussed previously, there is a broad range in grain size of sediment within the systems. This large variation has a corresponding broad range in permeability or hydraulic conductivity (K). Since these K values are dependant on the position within the feature, the systems are classified as being heterogeneous (Freeze and Cherry, 1979). Table 3 gives values of hydraulic conductivity (K) for an idealized lateral sedimentary sequence. The largest K values in this idealized sequence and facies are found within the portions of the systems which were deposited subglacially (Table 3).

The values given in Table 3 are for lateral sequences found commonly within the systems. This illustrates that the hydraulic conductivity correlates to the depositional processes which formed the features. As shown in Figure 8, the K values decrease distally from the source. This change in permeability, because it relates to a lateral



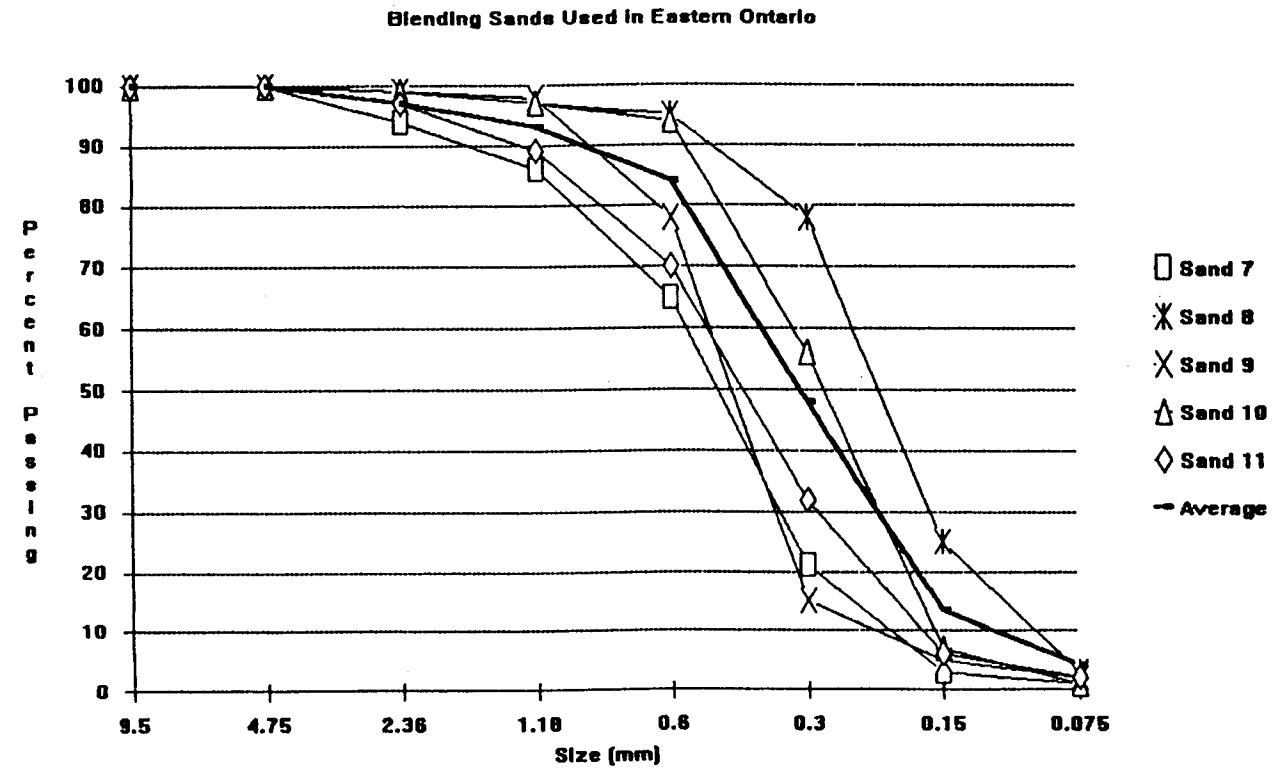


Figure 20: Particle size analysis of the blending sands used in the study area.

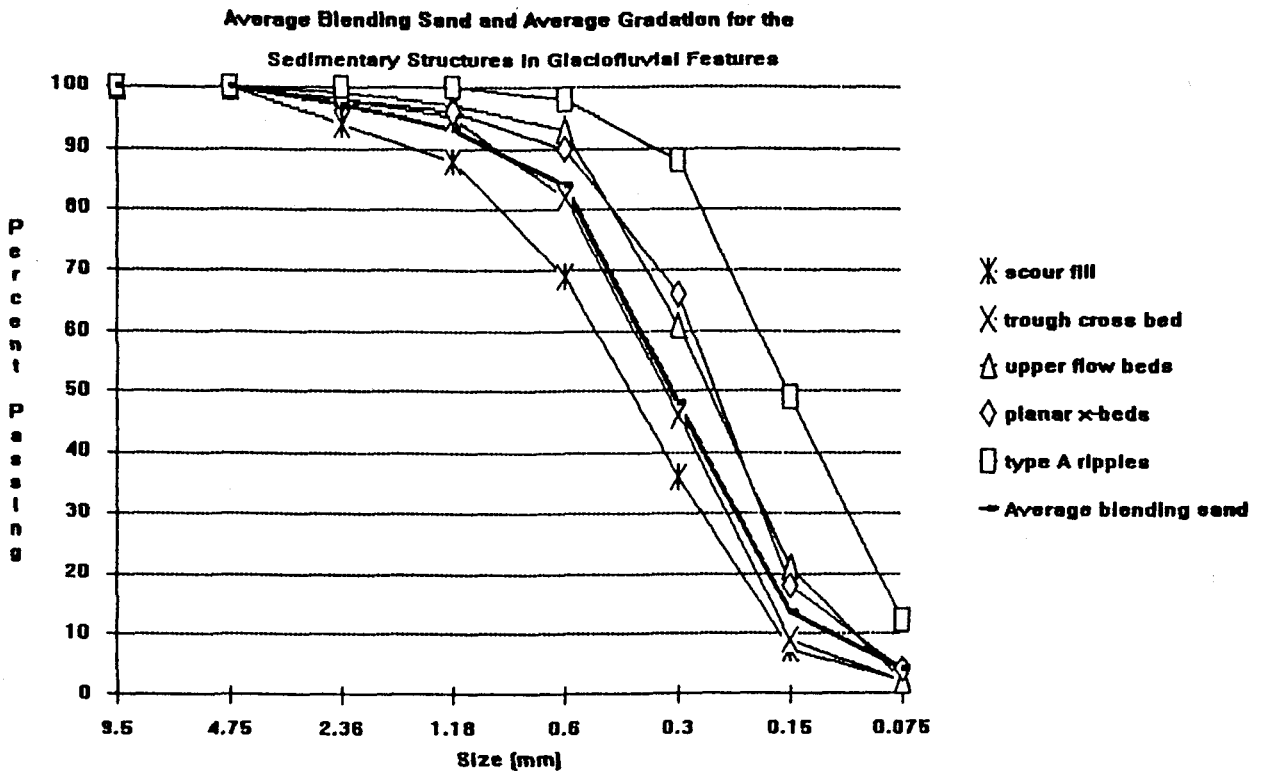


Figure 21: Average gradation of the sedimentary structures in the glaciofluvial environment and the average blending sand gradation.

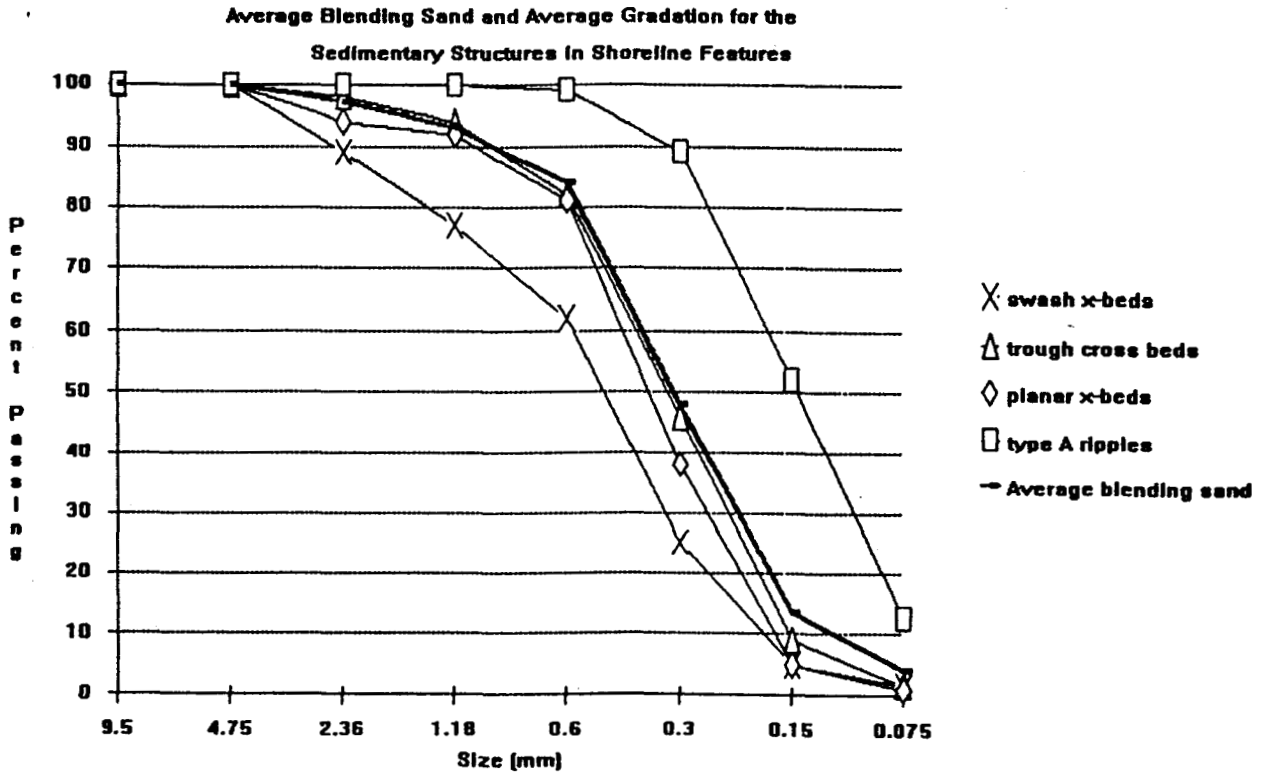


Figure 22: Average gradation of the sedimentary structures in the shoreline environment and the average blending sand gradation.

Table 3: Hydraulic conductivity values for depositional environments.

Environment	Facies	Sedimentary Structure	d_{10}	d_{10}^2 (mm^2)	K $d_{10}^2 \cdot 10^{-2}$
Subglacial	n-channel	boulders	600	360,000	3,600
	esker	gravel	80	6,400	64
	esker margin	gravel & sand	10	100	1
	minor ridges	f. gravel & m. sand	0.60	0.360	0.004
	esker bead	sand & gravel cycles	0.70	0.490	0.005
Proglacial	proximal fan	diffusely bedded	0.18	0.031	0.0003
	mid-fan	TCB	0.15	0.23	0.0002
	mid-fan	planar lamination	0.10	0.010	0.0001
	mid-fan	x-beds	0.11	0.012	0.00012
	distal fan	CRTA	0.07	0.005	0.00005
	distal fan	CRTB	0.05	0.003	0.00003
Shoreline	foreshore	swash	0.21	0.044	0.0004
	shoreface	x-beds	0.18	0.03	0.0003

d_{10} - grainsize where 10% of the particles are finer
K - hydraulic conductivity

transition, illustrates that the features have trending heterogeneity (Freeze and Cherry, 1979).

It should be stressed that the values given in Table 3 are for an idealized lateral facies sequence. However, the vertical distribution of the sequence is not consistent. This inconsistency is very pronounced within the portions of features which were deposited distally and formed facies 8 in the fans. Within these portions of the features (Figure 8), silt and clayey-silt units cap many of the sand units. Therefore, the deposits not only have trending heterogeneity but have also layered heterogeneity.

There are hydraulic factors other than hydraulic heterogeneity which are dependant on the sediment gradation. If K is autonomous, relative to the position for which it is calculated within the feature, the sedimentary feature may be classified as hydraulically isotropic. However, if the calculated value for K is dependant on position within the feature, the sedimentary body is hydraulically anisotropic. As discussed within Section 5.0 and shown in Figure 8, the proglacial features formed in response to variable types of flow (pulsed and quasi-continuous for the underflows, and random for debris flows and slumps). The principal characteristics of these flows are that they thin away from the source due to lateral expansion and waning, and significant amounts of sediment are deposited from suspension. The horizontal and vertical sequences deposited by these flows are dependent on the source of these flows. The values for K will change because of the variable depositional environments. Therefore, the systems are anisotropic and may be classified as having trending layered heterogeneity.

Transmissivity (T), or the ease of groundwater flow through a sedimentary formation, may be defined as the hydraulic conductivity multiplied by the thickness of the unit (Freeze and Cherry 1979). Freeze and Cherry (1979) also indicated that T values of 0.015 $m^2.s^{-1}$ are required if the sedimentary body is to be considered suitable for water well exploitation.

An aquifer, with respect to the glaciofluvial systems, is defined as saturated permeable geologic sediment which may transmit sufficient quantities of water under ordinary hydraulic gradients to be used for water well exploitation (modified from Freeze and Cherry 1979). Aquitards are facies which can transmit significant quantities

of water on a regional scale but are not permeable enough to be used for water well exploitation (Freeze and Cherry, 1979).

Using Table 3 and assuming that a T value of 0.015 $m^2.s^{-1}$ is the minimum requirement for the facies to be considered an aquifer, the portions of the systems which may be exploited for water can be calculated by determining the thickness of the unit (b). As shown in Table 4 and Figure 8 the lowest values of b are for those facies deposited in the subglacial environment. The values obtained for b in the proglacial environment, and in the shoreline environment, which developed upon the glaciofluvial systems, are more that a magnitude larger. Thicknesses on the scale of these calculated depths do not exist within any of the systems. Therefore, the sediment deposited within the proglacial environment within the systems should not be considered as aquifers because the depths calculated are non-existent. However, because the facies deposited within these environments can transmit significant quantities of water on a regional scale they are classified as aquitards.

The distinction between the aquifer and aquitard is significant and does have important implications. Although the permeability of an aquitard is low, the storage capacity is very high (Freeze and Cherry, 1979). If aquifers are used as a water source the obtained water is derived initially from the aquifers. However, as pumping continues there is flow from the aquitard to the aquifer and it is actually the aquitard that provides much of the water; the aquifer only transmits it (Freeze and Cherry 1979).

The above discussion suggests that the ideal source of water from the glaciofluvial systems occurs where the subglacial portion of the systems have fans connected to them. At these locations the coarse grained subglacially deposited sediments (aquifers) could obtain water from the less permeable but larger fans (aquitards) which are connected to them. In areas where the glaciofluvial systems have been used as an aquifer this opinion has been corroborated. The highest yields and largest transmissivities have been found in the proximal fan for the Embrum, Crysler, Chesterville and Vars water studies (GeoAnalysis 1979; Water and Earth Science Associates 1986, 1987a,b). These relationships occur where an ice margin once existed. A fan develops at the ice margin because of the lateral expansion of the subglacial meltwater flow into a proglacial subaquatic environment (Section 5.0).

Table 4: Thickness of the units versus transmissivities.

Environment	Facies	Sedimentary Structure	d10 (mm)	$d10^2$ (mm)	K $d10^2.10^{-2}$	T ($m^2.s^{-1}$)	T ($m^2.day^{-1}$)	b(m)
Subglacial	N-channel	boulders	600	360000	3600	0.015	648	0.002
	esker conduit	gravel	80	6400	64	0.015	648	8.109
	esker margin	gravel and sand cycles	80	6400	64	0.015	648	7
	minor ridge	medium sand to fine gravel	0.6	0.36	0.0036	0.015	648	4.17
	esker bead	sand and gravel cycles	0.7	0.49	0.0049	0.015	648	3.06
Proglacial	proximal fan	diffusely bedded	0.18	0.031	0.0031	0.015	648	47.88
	mid-fan	TCB	0.153	0.023	0.00023	0.015	648	47.88
	mid-fan	planar lamination	0.102	0.01	0.0001	0.015	648	64.00
	mid-fan	tabular x-beds	0.108	0.012	0.00012	0.015	648	128.6
	distal fan	CRTA	0.073	0.005	0.00005	0.015	648	281.48
	distal fan	CRTB	0.054	0.003	0.00003	0.015	648	514.4
Shoreline	foreshore	swash	0.21	0.044	0.00044	0.015	648	34.01
	shoreface	tabular x-beds	0.18	0.031	0.00031	0.015	648	47.88
			d10 (mm)	$d10^2$(mm)	K $d10^2.10^{-2}$	T ($m^2.s^{-2}$)	T ($m^2.day^{-1}$)	b (m)

These are generalized conclusions and other factors such as regional hydraulic gradient and bedrock topography also may have an effect on local flow. However, if the discussion regarding the depositional setting as outlined in Section 5 of the landform is understood, they are secondary factors. For example, the presence of bedrock will have a local effect on flow. But, as discussed Section 5 the coarser facies develop in areas where the bedrock has been eroded. In addition, regional flow will have an affect, but similar to the reason why the bedrock is a secondary factor the systems tend to develop in lower areas, which are focal points for recharge.

Three to five marginal positions can be identified across Eastern Ontario, suggesting that the ice margin retreated as a curtain across the region. This is supported by the location of the fans; without exception a fan has developed at approximately the same latitude within each system. These systems are shown in Figure 23 and the Maps 1 to 11.

The portion of the systems where fans have developed represent the ideal locations for groundwater exploitation. However, these are not the only portions which could be used. As shown in Figure 23 and Maps 1 to 11, the systems may be traced north to south across Eastern Ontario. They are not always evident on the surface because they are either buried by thick clay, or modified extensively by shoreline processes. Recent work has shown that the systems are interconnected in a few locations. This fits the depositional model (Section 5.0) developed for the sedimentary bodies. The model indicated that the systems operated simultaneously and that the largest system should capture the meltwater from the smaller adjacent systems because the largest one would have a smaller pressure head (Shreve 1972; Weertman 1972 and Gorrell and Shaw accepted).

Therefore, the subglacially deposited facies of the systems may be used as groundwater resources since high yields of water may be derived from these interconnected features. Table 5 indicates the Towns and Villages near potential water yielding sand and gravel deposits.

Other factors affecting the hydraulic conductivity of the sedimentary bodies are shown in Figure 15. These factors relate to the way the sedimentary body developed. Two factors which are significant with respect to use of the subglacially deposited sediment for water exploitation do not necessarily affect transmissivity but rather they

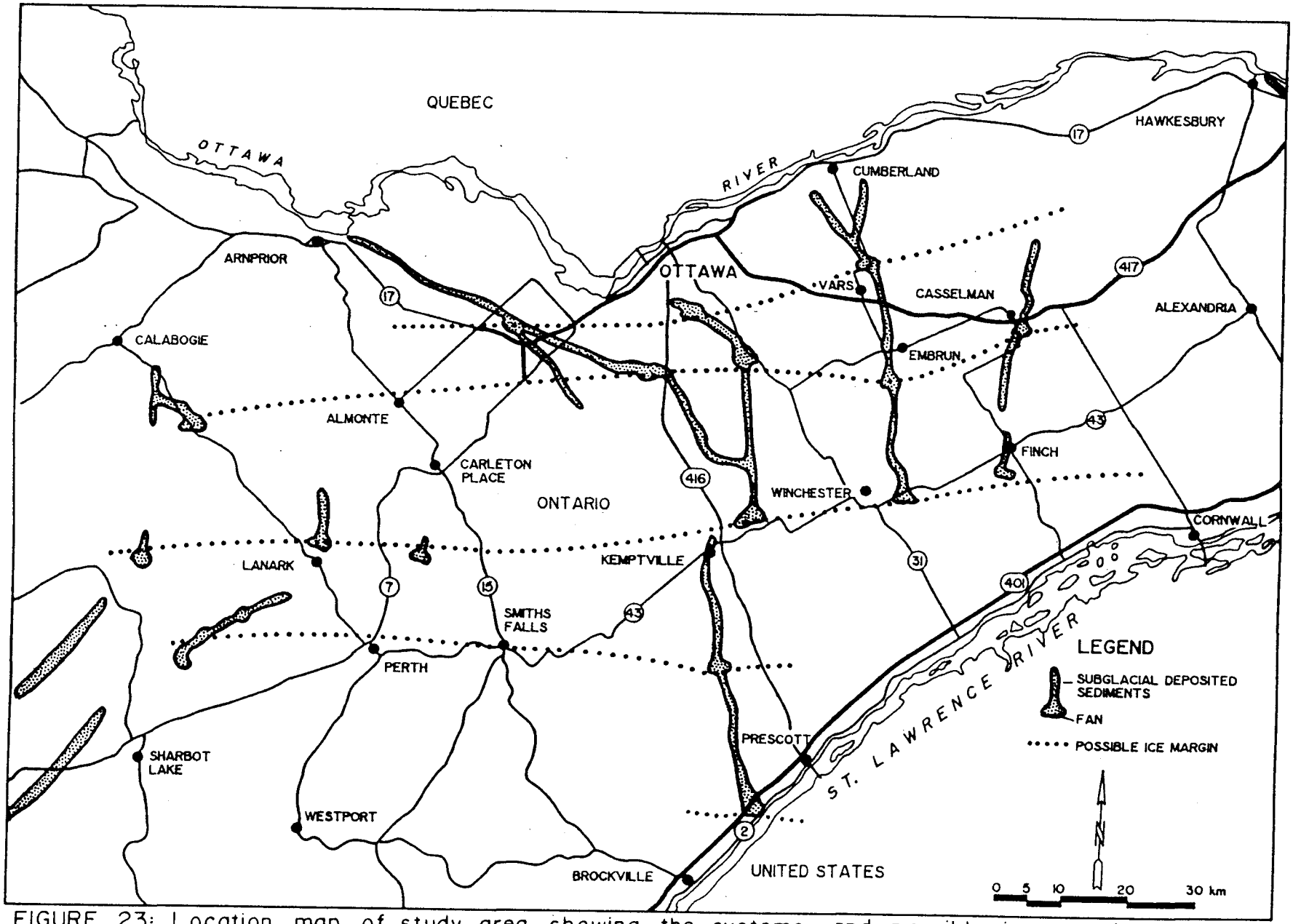


FIGURE 23: Location map of study area showing the systems and possible ice margins.

restrict water well development and hinder the accurate mapping of the sedimentary body.

The first factor is the presence of boulders (facies 1) in the bedrock channel beneath the esker ridge and within the esker ridge itself. This type of material makes water well development difficult. The boulders are difficult to drill through and they tend to crush any water well intake placed within the facies.

The second factor, bedrock topography, makes it difficult to outline and map the water bearing units. Since the channel is not necessarily straight, the actual flow patterns are often difficult to outline. The bedrock, below the upper weathered portion, acts as an impermeable boundary forcing the groundwater to flow parallel to the weathered horizon. If the underlying bedrock is fractured as it often is beneath the systems, the upper 3 to 5 m of the rock is generally hydrologically connected to the overburden.

Other restrictions are the presence of aquitards and their relationship to the sediments. These units, because they change the lateral continuity of the sediment the sedimentary and stratigraphic sequence, restrict the flow of groundwater through the sedimentary bodies. Large differences in fluid pressure may be present in adjacent units (Freeze and Cherry 1979). The presence of aquitards make the accurate hydrologic mapping of the sedimentary body difficult. Many of these features are not readily observed on the surface and their influence is often overlooked. Therefore, the flow nets which are constructed of a glaciofluvial generally do not show the actual pattern of groundwater flow, but rather an average of which is below the surface because all the factors which affect flow are not always identified.

These aquitards may partially control the direction and speed at which that groundwater will flow. It is therefore important, that when dealing with possible groundwater contamination, that they be outlined. For example, if the aquitards are near the ground surface they may protect the underlying sedimentary units from surface contamination. However, if these units are buried, the actual flow path of the contaminants may be very difficult determine. For example, a sedimentary unit encountered at one location may not be hydraulically connected to a unit of similar texture in the immediate area because it is separated by one or more of these aquitards. If the sedimentary sequence is identified, an accurate portrayal of the sedimentary body may be obtained. This will assist with the deter

Table 5: Towns and Villages near water yielding buried sand and gravel deposits.

System I	Distance
Hawkesbury	2.5
System II	
Maxville	3.0
Dunvegan	0
Moose Creek	7.0
Warnia	0
Monkland	5.0
Avonmore	7.0
System III	
Lemieux	4.0
Ste. Rose de. Pres.	5.0
Casselman	3.0
St. Albert	3.5
Crysler	5.0
Berwick	4.0
Finch	0
Newington	5.0
System IV	
Orleans	3.0
Navan	5.5
French Hill	3.0
Sarsfield	0
Leonard	0.5
Bearbrooke	0
Vars	2.5
Limoges	5.0
Embrum	3.0
Russell	3.0
Morewood	1.5
Marionville	5.0
Winchester	3.0
Winchester Springs	6.0
Chesterville	4.0

System V	Distance
Ottawa	-
Nepean	-
Gloucester	-
Greely	0
S. Gloucester	0
West Osgoode	0
Hallville	2.0
Mountain	5.0
Kemptville	5.0
System VI	
Amprior	3.0
Galetta	0
Kinburn	0
Marathon	1.0
Carp	0.5
Stittsville	0
Richmond	4.0
	6.0
Manotick	2.5
Kars	0
North Gower	5.5
System VII	
Oxford Mills	1.0
Roebuck	0
Domville	2.0
Maynard	0.5
Prescott	3.0
Maitland	7.0

mination of how the contaminants move through the sedimentary body.

Another notable factor dealing with the hydraulic properties of the sedimentary bodies are the buried portions of the systems. As shown on the Maps 1 to 11 the features are not always on the surface. In many areas the sedimentary bodies are buried by thick sequences of clay up to 30 metres thick. If the buried sections are drilled, the groundwater tends rises above the water bearing sedimentary body. This indicates that the sedimentary body is under artesian conditions.

It appears that the portion of the sedimentary bodies which are above the ground surface are recharge areas and can be classified as unconfined aquifers. The buried portions, because they assist with the water removal from the exposed components of the bodies, have artesian conditions and are classified as confined aquifers. These buried portions are potentially good sources of potable water because they are protected from surface contaminants. An exception would be if the source of the contamination is in the recharge area.

In summary, the series of glaciofluvial sedimentary systems in Eastern Ontario are important potential sources of potable water. Because these systems are regularly spaced across the region (Figure 23) many communities may conceivably use these sedimentary bodies as a potable water source in the future. To facilitate future work, the best potential segments, subglacial deposited sediments, are shown on the Maps 1 to 11. The communities which could use these systems are listed in Table 5.

8.0 SYSTEMS

8.1 Discussion

System I

Very little of this System I is observable above the ground surface which is approximately 60 m ASL. Field work completed on the system indicates that it is composed of a central and minor ridges consisting of sand and gravel and fans consisting of coarse to fine sand. The system is flanked by, and in places covered with, rhythmically bedded silts and clays. The system has been excavated to as deep as 15 m.

The sedimentary structures which were identified indicate that the current which deposited the majority of the systems came from the northwest. Many of the sedimentary sequences and structures are faulted, suggesting that at the time of deposition the system was bounded by ice. As the ice melted the sediment faulted due to the removal of lateral support. Drilling and Ministry of the Environment's well records (1986) indicate the system is narrow, yet deep.

The system decreases in height eastward until, east of the existing excavation (Map 1), 3 to 5 m of clay overlies the sorted sediment. The eastern surface limit of the aggregate is not the system boundary because the sediments, which were deposited in a proximal glacial environment, extend eastward beneath the silt and clay rhythmites (Gorrell and Fletcher 1983a). Ministry of the Environment well records (1986) indicate that substantial quantities of medium sand are found beneath 20 m of rhythmites southeast of where the system is above the surface.

Uses

Much of the material that is above the water table is buried by significant thicknesses of silt and clay. The amount of material which has to be stripped limits extraction potential. Also, extraction below the water table may cause slumping of the faces which will contaminate better quality sand and gravel present below the water table.

It is probable that high water yields could be obtained from this system. A waste disposal site located on the system may sterilize part of the system for water extraction. The quality of water and hydrological data should be assessed if the system is to be used to supply large quantities of water.

System II

Investigation of System II indicates that the small ridge observed above the ground surface is a beach ridge formed on the backshore by storms. Many shell fragments are found along the bedding planes.

This ridge can be traced westward towards Warina, Stormont County (Maps 2 and 3). Near Warina the single ridge, consisting of sand and gravel, splits into many smaller segments oriented south and southwestward. These segments are composed of planar cross stratified medium grained sand overlain by wave ripples (Appendix

A). This sedimentary sequence suggests that the smaller segments are spits formed on the upper shoreface and foreshore.

Uses

This collection of features are not glaciofluvial ridges as are the other systems. The assemblage of features were included in this study because they have a large areal extent and more importantly, the gradation of the material consistently passes blending sand requirements. Many of the operators who excavate sand from this system are supplying the quarries in the area with blending sand.

Gorrell and Fletcher (1983b) indicated that in System II there is a minimum of 10 m medium to fine sand below the water table. This sand passes the requirements for granular C fine and blending sand.

Since this material is confined on all sides by clay and/or till this feature may supply high water yields. However, the sediment below the water table consists of medium to fine sand which may not have transmissivity values large enough to produce high water yields (see Table 4). Site specific testing will determine the potential of the formation to provide water.

System III

The northern portion of this system is first observed above the ground surface 3 km east of the Village of Casselman, Russell County (Map 5), where it consists of an esker and fan. North of Casselman the system is buried by a delta which prograded into the Champlain Sea. Gorrell (1986b) indicated that the delta consisted of rhythmically bedded fine sand, silt and clay, truncated by scours filled with medium to fine sand. Gorrell (1986b) indicated that this sequence is typical of a subaerial portion of the delta, where the rhythmites represent interchannel areas and the scours are distributary channels. Although Ministry of the Environment's well records (1986) and seismic work suggest that sorted sediment and a bedrock channel underlie the delta, no surficial expression of these features are evident.

Southwest of the Casselman area, the system is not observed above the ground surface for approximately 7 km. Well records and seismic studies suggest that in this area the feature is buried beneath the clay. These records and studies also suggest that the feature may thin to virtually nothing just north of the Stormont/Russell County boundary. This discontinuity may be due to a rise in the underlying bedrock topography.

A sand deposit is found adjacent to a surface exposure of bedrock (see Map 5). This sand deposit thickens westward for approximately 200 m where it grades into rhythmically bedded silt and clay. The sand deposit consists of trough cross-bedded medium sand. This bedding is oriented southeastward suggesting that the upper 2 to 3 m of the feature consists of bars deposited on the shoreface. This sand body can be traced southward to a glaciofluvial system identified by Gorrell and Fletcher (1983b).

Investigation of the glaciofluvial feature located 4 km east of Crysler indicates that only a portion of the feature above the ground surface is glaciofluvial. The sedimentary structures indicate that much of the western portion of the feature consist of sediment deposited in the foreshore/shoreface environment. This is confirmed by the drilling done by Gorrell and Fletcher (1983b), Water and Earth Science Associates Ltd. (1986) and by the author. These studies indicate that to 15 m of sorted sediment is found below the water table in the eastern portion of the feature and only 1 to 2 m on the western side. This suggests that the glaciofluvial system was, at one time, situated above wave base and that spits and bars developed on the western side due to shoreline progradation. Rhythmites of silt and clay were found beneath the sorted sediment confirming that the shore had prograded over offshore sediment. It is probable that much of this material was derived from the glaciofluvial feature, and that the system was originally much higher.

System III disappears south of Crysler and is not observed above the surface until southwest of the Village of Finch near Sandtown (see Map 6). Studies by Williams et al. (1985d), well records, seismic studies and drilling indicate that the underlying bedrock surface is irregular. These irregularities may have disrupted the subglacial drainage system producing a disjointed system. It is also possible that the system is buried by clay and was undetected. The latter is probably correct, for just south of the Village of Finch (see Map 6), the system consists of

a narrow, thin sand and gravel ridge located within a bedrock channel. A system of this size would be difficult to detect if it was covered by a significant thickness of fine-grained sediment.

The Sandtown system, similar to the Crysler ridge, was modified by shoreline processes. The upper 3 to 5 m of the western and southern portions of the feature consist mainly of trough cross bedded and planar cross stratified coarse to medium sand and ripple cross-laminated fine sand. Shell fragments were found along bedding planes. Drilling indicates that the sediment fines downward where shells fragments are more abundant. This observation suggests that the sediment was deposited along a prograding shoreline. The glaciofluvial and shoreline facies are distinguished on Map 6.

In the northern portion of the Sandtown System, the glaciofluvial and shoreline portions have been excavated to bedrock. Beneath the glaciofluvial portion is a 60 m wide bedrock channel up to 1.8 m deep superimposed with grooves, p-forms and sichelwannen. However, under the shoreline portion, the bedrock is marred only by glacial abrasion marks. This suggests that meltwater erosion was limited to the vicinity of the channel and that erosion by ice occurred away from the margins of the subglacial conduit.

Well records, seismic studies and drilling by the author indicate that the bedrock dips southward. Sedimentological evidence suggests that although the central and eastern portions consist of material were deposited by meltwater, the western and southern portions which were deposited by wave wash and longshore drift.

Uses

Seismic studies, drilling and the Ministry of the Environment's well records (1986) indicate that, in the glaciofluvial portions, up to 15 m of material remains below the water table. These glaciofluvial portions can be subdivided into esker ridges consisting of sand, gravel and boulders, and fans which consist of fine gravel to fine sand. The samples which were analyzed indicate that the gradation of the sand is inconsistent, and that only the cross stratified and cross bedded sediment in the proximal portion of the fan(s) will pass high quality aggregate specifications (Table 1, Figures 8 and 15). The mid-fan portion of the fan may pass the requirements for blending sand. The esker segments will only pass the requirements for modified granular A and granular B and C.

East of Crysler the feature has been extensively modified by limnological processes. Grain size analysis of the sediment indicates that, in this area, the sediment deposited in the shoreface environment will pass blending sand gradational requirements.

It was also found that small minor ridges of sand and gravel are located where the esker ridge bends. These ridges are oriented approximately parallel to the main system north of where the main system bends. These ridges are buried by too much clay to be economically extracted although they may potentially be used as a source of water.

The gradation of the shoreline features is more consistent than the glaciofluvial segments. Grain size analysis of these sediments indicates that when processed they will pass the requirements for asphalt, concrete and blending sand (Figures 12, 14 and 22; Appendix B).

Work done by Water and Earth Science Associates Ltd. (1986) indicate that the glaciofluvial segment of the Crysler portion of the system will produce water yields up to 400 IGPM. Well log data (see Map 6) and the results from the piezometers suggest that all the glaciofluvial portions will produce similar yields. This would have to be confirmed before they are developed as a water source. The quality of the water should be tested before any water supply projects are started, since a waste disposal site once operated in the Sandtown area. Analysis of which portion may be suitable for a water source was discussed in a previous section.

System IV

System IV is complex, consisting of many depositional environments. The northern portion of the system is found near the Villages of Sarsfield, Leonard and Vars (see Map 6). Here the system consists of a central ridge composed of sand, gravel and boulders, beads consisting of sand and gravel and fans consisting of coarse to fine sand. In this area the system, which is approximately 70 to 80 m ASL, has been modified extensively by shoreline processes and buried by clay. Well log data, seismic studies and drilling indicate that the thickness of the unconsolidated material decreases southward from the Village of Sarsfield, where there is greater than 20 m of sediment, to less than 10 m near the Village of Bearbrook.

A feature consisting of sand and gravel was identified northeast of the Village of Navan and on Petrie Island on the Ottawa River. The sedimentary structures and sequences indicate that these features are of glaciofluvial origin (see Map 6). Information obtained from Ministry of the Environment's well records (1986) and seismic studies suggest that these features are connected sub-surfically to the Sarsfield-Vars system, joining the system east of the Village of Leonard.

South of the Village of Vars the system is no longer visible above the ground surface. Well log records, seismic studies and drilling indicate that a narrow sand and gravel body, buried by rhythmites of silt and clay, is located 1.5 km north of the Village of Embrum. This narrow sand and gravel body can be traced from the Vars ridge to the glaciofluvial system northeast of the Village of Morewood.

Well log records, previous studies (GeoAnalysis 1979; Gorrell and Fletcher 1983b) and drilling (Appendix C, DH's 51-55) indicate that the Morewood portion of the system is up to 30 m deep. The system consists of a central ridge composed of sand, gravel and boulders and fans composed of coarse to fine sand (see Map 6). The system has been modified extensively on its western side by shoreline processes. It is probable that the central ridge may have risen considerably higher and has been bevelled. The glaciofluvial and shoreline facies are shown on Map 6.

The system disappears from above the ground surface for two kilometres east of the Town of Winchester. However, seismic studies, Ministry of the Environments well records (1986) and drilling for this project indicate that the system is present in a bedrock trough. The system rises to 80 to 90 m ASL at Maple Ridge where it is composed of: 1) a shoreline modified central esker ridge which consists of clast supported sand, gravel and boulders with a preferred fabric; 2) a fan consisting of coarse, medium and fine sand; and 3) shoreline features consisting of gravel and coarse to fine sand. Well records and drilling indicate that the ridge is up to 24 m deep. The different facies and sedimentary structures are shown on Map 6.

Uses

There are large reserves of sand and gravel beneath the water table within System IV. Analysis of the sediment though, indicates a high percentage of shale in the northern portion of the system, limiting its possible use to modified granular A and granular B and C. Random pebble counts throughout the system indicates that the amount of shale decreases southward in the glaciofluvial portion and, toward what was seaward in the shoreline sediments. In these areas the sediment may pass higher quality specifications.

The Town of Embrum currently obtains all its potable water from the system north of the Village of Morewood (see maps 1 to 11). Drilling and the analysis of water well data throughout the remainder of the system suggest that other portions of it may be used a communal water supply. Water and Earth Science Associates Ltd. have completed water supply studies for the Towns of Vars and Chesterville (Water and Earth Science Associates Ltd., 1987a,b). Their work indicated that water yields may be obtained from the system in the Vars and Chesterville areas. Grain size analysis of portions of the systems are found in Appendix B.

System V

The areal extent System V above the ground surface is the largest of all the systems which were identified. The northern portion of this system, which is 100 to 110 m ASL, extends from Bells Corners to the Ottawa Airport. It is composed of a central esker ridge which consists of clast supported gravel and boulders, fans consisting of fine gravel to fine sand and shoreline features consisting of coarse to medium sand. It is believed that the central ridge has been modified extensively by shoreline processes, and that it was once considerably higher.

South of the airport, the system widens. The identified lithofacies suggest that approximately two-thirds of the system consists of sediment deposited directly by meltwater. The remainder of the feature was deposited by shoreline progradation. The glaciofluvial and shoreline features are shown on Map 7.

Near the Village of Greely, the system, here as high as 110 m ASL, narrows to a central esker ridge, consisting of clast supported gravel and boulders, and fans consisting of fine gravel to fine sand. In close proximity

to this ridge is a large area composed predominantly of facies 5 material. Little shoreline modification of the sediment is evident. This portion of the system is currently being developed.

South of Greely, through Osgoode Township, the system, which lies at approximately 100 m ASL, meanders around knobs of till. Examination of the sedimentary structures suggests that most of the western side and the upper portion of the eastern side of the system is a product of shoreline modification. Drilling and well log data however, indicate that significant depths of glaciofluvial sediment are beneath the shoreline sediment on the eastern side of the system.

Small ridges composed of sand and gravel radiate in a sub-parallel direction from the central system. Examination of the sedimentary structures within these ridges suggests that many of them are products of shoreline modification (spits), although a few of them suggest deposition by meltwater. These meltwater ridges are oriented approximately sub-parallel to the main system(s) before the main system(s) bends. It was found that the small ridge which is oriented northwesterly, southeast of the Village of Osgoode, represents a subglacial connection between Systems V and VI.

South of Osgoode Township the system rises in elevation to a maximum of 110 m ASL at the Loughlin Ridge. Richard (1982b) indicated that the central portion of this ridge is of glaciofluvial origin. Examination of the sedimentary structures within and around the ridge indicates that the glaciofluvial system is composed of: 1) a central ridge consisting of imbricated gravel and boulders; 2) beads consisting of, in the proximal portion, cyclical arrangements of clast supported gravel and in the distal portion matrix supported gravel to medium sand; and 3) fans consisting of fine gravel to fine sand. The different depositional environments are shown on the Maps 7 and 8. Drilling and seismic studies indicate that up to 24 m of sorted sediment lies below the water table.

Examination of the sedimentary structures indicates that the Loughlin Ridge has been modified considerably by shoreline processes and that the central ridge has been bevelled. Storm beaches, offshore bars, swash cross beds and spits are found along all the margins of the system, (see Map 8). Seismic studies and drilling indicate that clay underlies these sediments and a clay rich till separates them from the glaciofluvial portion.

South of the Loughlin Ridge the system decreases in elevation to below 110 m ASL. In this area much of the system is a product of shoreline modification (see Map 8). Seismic studies and drilling indicate that the underlying bedrock rises in elevation and that only 10 m of sorted sediment occurs below the water table. The southern most vestige of the system was observed approximately 3.5 km east of the Town of Kemptville.

Uses

There are significant reserves of sand and gravel within the glaciofluvial portions of the system. Analysis of the sediment indicates that the quality of the material in the proximal to middle portion of the fans may pass the requirements for concrete and asphalt products (see Figures 11 and 13). Although the reserves are not as extensive in the shoreline portion of the system, much of the material that was deposited on the foreshore/shoreface has a gradation that will meet concrete, asphalt and blending sand requirements. A summary of the grain size of the collected samples are given in Appendix B.

Many homes and small communities obtain their potable water from the system. Well log records data and the results obtained from the monitoring of the installed piezometers suggest that all the glaciofluvial portions will produce high water yields. However, because waste disposal sites are located upon the system the quality of the water should be tested before any large water recovery schemes are initiated.

System VI

System VI has the largest longitudinal extent, stretching from the Town of Arnprior to the Village of Kars (Figure 4). The northern portion, which is southeast of Arnprior parallel to the CNR train track, projects above the ground surface to approximately 2 km southeast of the Village of Galetta. It is composed of a central esker ridge consisting of clast supported gravel and boulders and fans consisting of fine gravel to fine sand (see Map 9). Portions of the system are buried by clay and it is probable that the central ridge has been considerably modified by shoreline processes.

South of Galetta the system disappears below the ground surface. Seismic studies, consultant reports (Water and Earth Science Associates Ltd. 1985) and well records suggest that the feature may underlie the Carp River at

depths up to 60 m. The system may also be discontinuous because the Precambrian rock knobs which are south of Galetta may have disrupted the subglacial drainage net.

The portion of the System VI that next emerges above the ground surface south of Galetta is located between the Village of Carp and the Town of Stittsville. Drilling and well log data indicate that the glaciofluvial portion of this system is up to 35 m deep (Maps 7 and 9). In the Carp area, portions of the system are buried by as much as 20 m of clay.

In the Carp area system VI is composed of: 1) a central esker ridge and small minor ridges consisting of sand, gravel and boulders; 2) fans consisting of fine gravel to fine sand: and 3) shoreline features consisting of coarse to fine sand. The modification of the glaciofluvial feature by shoreline processes had been extensive north of Stittsville where the feature is approximately 100 m ASL. Many of the sedimentary structures and sequences have been deformed by slumping. Shell fragments are found throughout the sediment suggesting that the deformation was probably due to loading by waves. The different depositional environments are shown on the Maps 7 and 9.

Well log records and seismic studies suggest that the system may underlie the Carp River east of Stittsville. The feature rises to the surface, to a maximum elevation of 120 m ASL, near the junction of Trail Road and Moodie Drive in the Township of Nepean. Investigation of this portion of the complex indicates that it is composed of: 1) a central esker ridge and minor ridges consisting of sand, gravel and boulders: 2) fans consisting of fine gravel to fine sand; 3) shoreline features consisting of gravel to fine sand; and 4) a large unsorted sediment body. The extent of each depositional environment is shown on Map 7 and 9.

Much of the feature has been extensively modified by shoreline processes. It is probable that the gravel which overlies the fan portion was derived from the bevelled central ridge. The sedimentary structures which were observed suggest that a large proportion of the western margin, and a part of the central portion of the feature represents shoreline progradation. The extent of each depositional environment is shown on Map 7 and 9.

System VI can be traced south of the Trail Road complex to the Village of Kars. At this location it is composed of: 1) a central esker ridge consisting of sand, gravel and boulders; 2) fans consisting of fine gravel to fine sand; and 3) shoreline features consisting of coarse to very fine sand. The probable facies and depositional environments are shown on Map 7 to 9.

South of Kars, the system upper portion of the system is truncated by the Rideau River. Well log records, drilling and the examination of the sediments on the eastern side of the river indicate that the system continues on the eastern side of the River and connects with the System V, southeast of the Village of Osgoode.

Uses

There are significant reserves of sand and gravel beneath the water table in the glaciofluvial portions of System VI. Analysis of the sediment indicates that the quality of the material in the proximal to middle portion of the fans, where there are large scours and fills and where there are thick cross-beds, may pass the requirements for concrete and asphalt products. These locations are shown on maps 7 to 9.

The aggregate reserves within the shoreline features which developed upon and beside the glaciofluvial systems are not as extensive as those in the glaciofluvial portion. The testing of these features suggests that although the shoreline features are separated from one another by tens of kilometres, the grain size distribution of each particular facies is similar. It was found that within the foreshore/shoreface portions much of the material has a gradation that will meet blending sand requirements (Figure 22). A summary of the grain sizes is given in Appendix B.

The water yields recorded by Ministry of the Environment's (1986) which may be obtained from portions of the glaciofluvial portion of the system are high. However, because two large waste disposal sites are located upon the system (see maps 7 and 8), the quality of the water should be tested before any large water recovery schemes are initiated in their vicinity.

System VII

It is not known whether this system is an extension of Systems V and VI which had developed earlier, or if it is a separate system. The system is present on the ground surface from Kemptville south to the St. Lawrence River (see maps 8, 10 and 11). It is composed of: 1) a central esker ridge consisting of sand, gravel and boulders; 2) fans consisting of fine gravel to fine sand; and 3) minor, shoreline features. These segments are shown on Maps 8, 10 and 11. Young et al. (1983) indicated that in portions of the system as much as 10 m of sorted sediment are found beneath the water table.

Uses

There are significant reserves of sand and gravel beneath the water table in the glaciofluvial portions of the System VII. The analysis of the sediment indicates that the quality of the material in the proximal to middle portion of the fans, where large scours and fills and thick cross-beds are present, may pass the requirements for concrete and asphalt products. These locations are shown on Map 8, 10 and 11. A summary of the grain size of the sediment and the corresponding facies and depositional environments are listed in Table 1.

Many homes and small communities obtain their potable water from the system. However, because waste disposal sites are located upon the system (see Map 8, 9 and 11), the quality of the water should be tested in the area of the disposal sites before any large schemes are initiated.

9.0 SUMMARY

The effective use of a resource depends greatly on the available information about that resource. The information obtained from sedimentology provides site specific information which can be used to predict the three dimensional extent and the type of material in other portions of the sedimentary features. This information aids planners, land owners, consultants, and other interested agencies managing and effectively using the features.

This study demonstrates a technique which can be used to delineate glacial sedimentary bodies in a manner which provides site specific details in a simplified way. Observations from the seven identified systems indicates that a variety of depositional processes were responsible at different times for their formation. To simplify the acquired

information, lithofacies have been constructed which have assembled the observed sedimentary structures and sequences into groups.

The lithofacies were developed only after all the exposures were logged. Therefore, they represent divisions which can be observed in the field. This approach aids in the management of the resource, for instead of classifying the feature by a general morphologic title and listing a general stratigraphy, the lithofacies may be used to ascertain the probable three dimensional relationships existing within the feature.

This approach can be classified as a 'bottom to top' technique, for it relies more on the understanding of the processes responsible, than on the morphological expression of the feature. This is a dynamic approach, for as more information is acquired about specific depositional environments, the relationships which are evident between them can be determined more readily. Once the relationships are understood, and the facies mapped, the use of specific segments of the feature, as done for this study, may be determined.

The purpose of this study was to illustrate that valuable information about specific glacial sedimentary bodies may be obtained by working at a detailed scale. The advantages of such an analysis are numerous.

The most obvious advantage is the capability to classify the material by depositional environment and facies. This information indicates which grain size gradations are likely to be obtained in specific portions of the features. With this information the potential uses of the sediment may be determined.

The rural areas surrounding the urban centres are being increasing developed. For this development to proceed, large volumes of aggregate for road construction and maintenance, back-fill for the homes and material for the septic system beds is required.

In the study area, much of the material which lies above the water table within the large glaciofluvial systems has been removed or built upon. However, this study indicates that extremely large quantities of sand and gravel lie below the water table in the glaciofluvial portions of the systems. The assurance that adequate reserves

of material are available for future demands may require the recognition that material must be excavated below the water table.

The evaluation of the resource uses range beyond just the classification of the material for construction purposes. As communities develop into the outlying areas, the presence of sand and gravel operations are not always regarded as a compatible land use with residential developments. Although site plans are required for the aggregate operations to precede in a manner which decreases the impact of the operation, these plans do not generally recognize that specific gradation transitions often exist within the features. If material, such as clay and hardpan (till, diamicton) are encountered, the operator is left with the choice of either not excavating it and thereby not following the site plan, or excavating it and losing money. If the gradational transitions have been previously mapped workable site plans can be developed and followed.

There are less tangible benefits to be obtained from the geological portion of the study. Many processes led to the development of the systems as they appear today. By documenting at a detailed scale the structures and sequences it was possible to classify the sediments by depositional environment and lithofacies. These classifications may be of considerable benefit when compared to other areas where similar structures and sequences are found and where the depositional environment is poorly understood.

Another less obvious benefit from the study deals with the processes which formed the systems. The features were deposited by meltwater which flowed under and away from a glacier. It was noted that karstic features are often found in close proximity to large glaciofluvial systems. For example; the sink holes and solution pits near Corkery, west of Carp, and the large solution fractures near Finch. It is possible that meltwater flowing as a sheet under the ice may have caused the solution of the limestone and dolomite. Gorrell (1988), suggested that some of the karstic features in Prince Edward County, Ontario, may have been formed be caused by subglacial flowing meltwater.

The importance of water associated with glaciofluvial deposits was demonstrated in this study. It was shown that many small communities in Eastern Ontario could potentially obtain their potable water from these systems. Four

communities; Embrum, Chesterville, Crysler and Vars are, or will in the near future, obtain their municipal water from the systems. To ensure that these sources remain potable requires that adjacent land uses are compatible.

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APPENDIX A: Explanation of Terms

SEDIMENTARY STRUCTURES

Primary sedimentary structures are the most important features in terms of sediment interpretation. These features allow the interpreter to estimate the velocity and direction of the depositing current, classify the sedimentary environment(s) and determine temporal relationships. Many of these structures are formed by currents and represent the migration of bed forms. Although it is not intended to review all sedimentary structures, the most common ones found in the sedimentary bodies will be described briefly.

RIPPLE CROSS-LAMINATION:

The terminology of Jopling and Walker (1968) was used to describe ripple cross-lamination. The types of ripple cross-lamination are described below.

TYPE A: This type consists of climbing sets of lee-side laminae. There is no preservation of stoss laminae. This type is similar to the type 1 of Walker (1963). Jopling and Walker (1968) indicated that mica and clay minerals can be found near the base of the lee-side laminae. The absence of stoss laminae implies that the fallout from suspension was not rapid enough to bury the sediment moving on the bed. Bed load was the dominant means of deposition.

TYPE B: This type consists of climbing sets of lee-side laminae with preservation of thick stoss-side laminae. The laminae can be traced from one ripple to another. Jopling and Walker (1968) indicated that silt and sand are found on both sides of the ripples, and that mica and clay are concentrated in the troughs. Because stoss-side laminae are preserved deposition from suspension must have kept pace with deposition by bed load.

TYPE C: This type is similar to type B. The difference is that silt and fine sand are restricted to the crest and stoss side and grade into mud in the troughs. The distinguishing feature between this type and type B is the grading within co-sets. Jopling and Walker (1968) indicated that there is a grading from fine sand at the base to mud at the top. The amplitude of the ripple decreases upward and may pass into planar lamination. The grading indicates that the current decelerated during deposition. This occurs in turbidites (Jopling and Walker 1968).

The angle of climb of ripples depends on the net rate of sediment deposition on the bed and the velocity of the ripples tangentially over the bed (Allen 1971). The velocity is determined by the rate of bed-load transport that would occur if there was not any net deposition and the different depositional rate between the upstream and downstream portions of the ripple (Allen 1971). It can be measured in the field by measuring the angle at which successive crests in a set climb. Generally the steeper the angle of climb, the greater the amount of sediment deposited from suspension. In most cases this implies that the flow is waning.

WAVE RIPPLES: This type of cross-lamination is produced when flow is oscillates in different directions. These types of conditions are produced by waves breaking on shore. These ripples are generally asymmetrical with straight crests (Harms et al. 1982; Reineck and Singh 1980).

PLANAR LAMINATION: This consists of distinctly laminated sets of sediment that were deposited approximately parallel to the depositional surface. It can be formed by relatively strong currents (upper flow regime plane bed) or by relatively weak currents (lower flow regime plane bed). The grain size and the structure association are used to distinguish the type of current that deposited the lamination. For example, if the bed consists of coarse sand and it can be traced down-current to planar cross-stratification and further down-current to ripple cross-lamination it can be described as having been deposited in the upper flow regime.

PLANAR CROSS-STRATIFICATION: This describes cross-laminae sets that when viewed on vertical faces perpendicular to flow the laminae do not conform with the lower set boundary (Harms et al., 1982). Viewed on the horizontal surface the laminae are straight to slightly sinuous (Harms et al. 1982).

Reineck and Singh (1980) and Harms et al. (1982) indicated that planar cross-stratification is deposited by migrating two dimensional large ripples. These bed conditions indicate lower flow conditions than trough cross-stratification. Some of the sets have tangential upper and lower boundaries. The author believes that these are produced by the deposition of much of the material from suspension.

TROUGH CROSS-STRATIFICATION: Harms et al. (1982) stated that trough cross-stratification is deposited by large migrating three dimensional ripples. Formation of this ripple type occurs in higher flow conditions than those producing planar cross-stratification. Viewed transverse to flow, the sets are arranged in a nested pattern with each having a lower concave-upward erosional surface. In this transverse section the laminae in the troughs are generally symmetrical and parallel to the lower erosional surface.Each of these scours or troughs is parallel with the flow.

Each set represents deposition on the upstream surface of the scour on a foreset or toeset bed. Scour pits are maintained because of the strong reattaching flow within the ripple trough. The scours remain elongate and unchanged for significant distances upstream.

CLAST FABRIC: The fabric or imbrication of the clasts can be regarded as a sedimentary structure (Shaw 1972; Johannson 1976). It refers to the orientation and inclination of clasts which are not spherical (Harms et al. 1982). The orientation of the clasts is described in terms of the direction of orientation of the long axis. Imbrication refers to the dip of the major plane. The fabric types that can be obtained are outlined below. Studies by Rust (1972) and Harms et al. (1982) indicated that when the clasts are oriented *a* axes transverse to flow with b axes dipping upstream the clasts had rolled across the bed. Where the fabric shows *a* axes parallel to flow with a axes dipping upstream the clasts were not rolled across the bed. The clasts are still reacting to the fluid stress, but instead of rolling across the bed they are in dispersion above the bed.

GRADING: The term grading implies a progressive change in grain size within the unit, and it consists of two types: 1) distribution grading where all percentiles of the size distribution change or 2) coarse tail grading where the size of only the coarsest few percentiles change (Harms et al. 1982). A unit may also be inversely or normally graded. Inverse grading indicates that the unit coarsens upward, while normal grading means that the unit fines upward.

CONTROLS AND PROCESSES: It is fundamental that the behaviour of the water and sediment entering a water body are outlined, since the deposition of the sediment is controlled by how water and sediment react when entering a water body. Kenney (1975) outlined three common characteristics in proglacial water bodies. He found that the

water bodies have a low organic content, that inflowing water derived from melted snow and ice is approximately at the same temperature as the water body and that, because the water body receives runoff from both precipitation and ablation of snow and ice, through-flow is high. The interactions between these three conditions partially control sedimentation within water bodies.

Sediment is deposited according to the behaviour of a stream which forms a jet as it enters the water body. The inflowing jet decreases in velocity when it enters the water body. This occurs because the inflowing jet expands laterally, losing velocity by the expansion of its flow and momentum by mixing with the ambient water. The density differences between the inflowing and lake waters are the prime reasons for the response of the jet. The jet expands laterally if the ambient water and the inflowing water have similar densities. The jet loses momentum as the inflowing waters expand laterally (by shear which creates turbulent mixing) pushing the waters in front of it. If, because of suspended sediment, the jet is denser than the ambient water it forms an underflowing turbidity current.

The density of the water is controlled by a number of factors. The most obvious factor is temperature. Water is most dense at 4°C where the density is 1,000 $kg.m^{-3}$. As temperature changes the density of the water decreases. If there is no suspended and/or dissolved sediment within the jet and the temperature of the water body and jet are approximately the same the jet will overflow.

The fluid density is controlled also by the concentration of sediment in the water. The greatest density change occurs when the suspended sediment load is increased. When the discharge of water is high, as when a large amount of meltwater is produced, the density of a jet commonly exceeds the density of the water body into which it flows. The jet may form an interflow if the sediment concentration is reduced. Where suspended sediment causes the inflowing jet to be much denser that the ambient water an underflowing turbidity current is generated.

Middleton and Hampton (1976) found that the velocity of a turbidity current is dependent on the relative density of the fluids, current thickness and bottom slope. They expressed the average velocity of the whole turbidity current as:

$$\bar{U} = (8g/f_o + f_i.(\ /\ )dS)^{0.5}$$

and the velocity of the turbidity current head as:

$$V = 0.7((\ /\ )gd_2)^{0.5}$$

Where $\bar{U}$ is the average velocity, V is the velocity of the head, g is acceleration due to gravity, d is the thickness of the current, d_2 is the thickness of the head, S is the inclination of the surface on which the flow is occurring, f_o is the frictional resistance at the bottom, f_i is the frictional resistance at the upper surface,is the density of the inflowing water andis the difference between the density of the inflowing water and the ambient water.

A turbidity current involves a turbulent sediment/water mixture (Middleton and Hampton, 1976). These flows develop head and tail regions with the head usually 1.5 to 2 times thicker than the tail. The particles in a turbidity current are kept in suspension by turbulence in the flow. Continuous forward motion occurs as long as there is a transfer of dense fluid (sediment and water) into the head. These currents can be further subdivided into high and low concentration currents, and continuous and surge-type currents.

Continuous turbidity currents (Sanders 1965; Middleton and Hampton 1976; Leeder 1983), are currents in which the loss of turbulence by mixing is compensated by the continuous supply of a dense fluid. These currents form when a sediment laden stream enters a water body (Leeder 1983; Middleton and Hampton 1976). As long as the discharge is maintained the current will not lose turbulence and will lose power only if it expands laterally (Lowe 1976).

In contrast, surge-type or pulsed turbidity currents are currents in which the loss of turbulence by mixing is not compensated by a continuous supply of a dense fluid. These currents must decelerate because the supply of the denser fluid is finite. Therefore, the head shrinks and the sediment deposited decreases until the current is completely dissipated (Leeder 1983).

The classification of turbidity currents into low-density and high-density types is based respectively on the non-suspension and suspension of material. Middleton (1967) indicated that sediment deposition begins only a short distance behind the head in a low-density turbidity current. These currents do not have any erosive power, but they are capable of transporting large amounts of fine sediment. Slow deposition from suspension is followed by extended bedload movement and then by the rapid deposition of sediment from suspension followed by the slow deposition of the finest particles from suspension (Leeder 1983).

High concentration turbidity currents have tremendous erosive potential. The erosion precedes sediment deposition and is characterized by mass shearing and formation of a liquefied sediment deposit (Leeder, 1983).

The units in this sequence consist of normally and inversely graded beds. Middleton (1967) produced graded beds from turbidity currents and found that they can be produced by a) layer-by-layer deposition from dilute turbidity currents where the grain size progressively fines upward, and b) high concentration flows where only the coarse grains show a decrease in size. He also found that inverse grading is characteristic of high concentration flows.

Other Terms

DIAMICTON: Unsorted rock debris which has a similar texture as till. This material was either not deposited directly by a glacier or its genesis cannot be determined. The range in grain size of diamicton is between clay and large boulders.

GLACIOFLUVIAL FEATURES: These are sediments which were deposited by running water beneath or within a glacier or beyond the glacier margin. Eskers, esker-fans, and outwash are examples of glaciofluvial features.

GRADATION: The proportion of material of each particle size, or the frequency distribution of various sizes which constitute a sediment. The size limits for different particles are as follows:

Boulders	more than 200 mm
Cobbles	75-200 mm
Coarse gravel	26.5-75 mm

Fine gravel	4.75-26.5 mm
Coarse sand	2.0-4.75 mm
medium sand	0.425-2.0 mm
fine sand	0.075-0.425 mm
silt and clay	< 0.075 mm

HOT-LAID (OR ASPHALTIC) AGGREGATE: Bituminous, cemented aggregates used in the construction of pavements either as surface or bearing course (H.L. 1, 3 and 4), or as binder course (H.L. 2 and 8) used to bind the surface course to the underlying granular base course.

LITHOLOGY: The description of rocks on the basis of such characteristics as colour, structure, mineralogic composition and grain size. It is generally the description of the physical character of the rock.

NYE CHANNELS: Drainage channels beneath the glacier which have been cut into the substrata.

PALEOZOIC: One of the major divisions of the geologic time scale thought to have covered the time between 600 and 230 million years ago. The paleozoic Era is subdivided into six geologic periods. Four of these, Cambrian, Ordivician, Silurian and Devonian, are found in Southern Ontario.

PLEISTOCENE: An epoch of the recent geological past including the time from approximately 2 million years ago to 7,000 years ago. Much of the Pleistocene was characterized by glacial activity.

POSSIBLE RESOURCE: Reserve estimates based largely on a broad knowledge of the geological character of a feature and for which there are few, if any, samples or measurements. The estimates are based on assumed continuity or repetition for which there are reasonable geological indications.

PROBABLE RESOURCE: Reserve estimates of material based on some specific knowledge of a geologic character of the feature and for which there are samples and measurements. The estimates are based on assumed continuity between test locations.

PRECAMBRIAN: All geologic time, and its corresponding rocks, before the beginning of the Paleozoic; it is equivalent to approximately 90% of geologic time.

SHALE: A fine-grained, sedimentary rock formed by the consolidation of clay and silt and characterized by well developed bedding planes, along which the rock breaks readily into thin layers. The term shale is also commonly used for fissile claystone, siltstone and mudstone.

TILL: Unsorted rock debris which was deposited directly by a glacier. The range in grain size of till is between clay and large boulders.

WISCONSINAN: Pertaining to the last glacial period of the Pleistocene Epoch in North America. The Wisconsin began approximately 100,000 years ago and ended approximately 7,000 years ago. The glacial deposits and landforms of southern Ontario are predominantly the result of glacial activity during the Wisconsinan Stage.

Appendix B: Gradation of Samples

Sample Number	Location	#4	#8	#16	#30	#50	#100	#200	Pan
		Percent Passing							
		4.8	2.4	1.2	0.6	0.3	0.15	0.075	
		size in mm							
1	02-20	100.0	100.0	99.8	98.8	91.1	52.3	17.0	0.0
2	Bertr L'O	90.0	61.3	38.5	25.7	15.8	9.9	6.4	0.0
3	Bertrand	100.0	93.8	86.0	65.2	21.5	3.9	0.8	0.0
4	Whis gu S	72.9	43.1	22.8	13.4	8.9	6.2	4.3	0.0
5	CC quar S	76.4	59.5	42.6	29.3	17.9	11.3	7.2	0.0
6	Smith Dun	86.4	58.3	36.6	24.8	16.4	10.5	6.3	0.0
7	Smiths, D	100.0	92.8	88.9	80.1	48.0	12.3	3.2	0.0
8	Bertrand	67.0	49.2	29.9	17.1	10.5	7.3	4.9	0.0
9	CGC Cornw	97.3	83.1	54.2	41.6	23.5	11.7	5.6	0.0
10	CGC Corn	90.3	60.1	38.5	24.2	13.6	8.0	4.6	0.0
11	CGC BS Su	100.0	94.9	82.5	53.5	17.0	4.8	2.4	0.0
12	Dib from	95.1	67.7	44.3	28.8	25.8	12.4	8.9	0.0
13	GrvlHill	100.0	99.4	98.5	94.1	56.6	7.0	1.1	0.0
14	Perm Corn	92.3	59.7	34.4	20.2	12.9	9.1	6.7	0.0
15	PermCornw	100.0	96.3	88.5	70.2	31.4	7.0	2.1	0.0
16	Blair GrH	72.6	54.5	38.5	27.0	17.6	11.2	7.2	0.0
17	Warnia-To	100.0	99.9	99.8	98.9	91.1	28.6	3.1	0.0
18	Blair MCk	92.3	65.6	45.8	32.7	22.0	14.0	8.2	0.0
19	Blair MoC	58.2	41.1	29.1	20.7	14.3	8.7	4.9	0.0
20	Blair Moo	100.0	99.0	97.8	95.4	78.4	25.6	2.6	0.0
21	Blair Moo	74.5	52.9	34.9	23.7	15.0	9.5	6.0	0.0
22	CorGrav C	100.0	97.5	95.0	83.2	25.5	4.3	2.1	0.0
23	CorGv Cas	100.0	99.3	98.1	77.4	16.1	4.7	2.6	0.0
24	CorGv Cas	94.2	74.0	52.9	37.0	22.0	12.8	7.6	0.0
25	CorGv Cas	63.4	46.0	31.4	21.2	12.8	7.7	4.8	0.0
26	07-10	100.0	100.0	100.0	99.3	91.3	30.4	6.3	0.0
27	07-15	100.0	100.0	99.6	94.6	43.8	10.2	2.2	0.0
28	07-20	100.0	100.0	99.1	87.2	36.5	6.5	1.4	0.0
29	09-15	100.0	99.9	99.6	89.3	35.9	16.5	9.1	0.0
30	Vinette E	100.0	100.0	100.0	96.7	64.8	15.2	3.9	0.0
31	Vinette W	100.0	100.0	99.7	80.7	11.5	2.3	0.8	0.0
32	Provo pit	100.0	96.2	91.7	84.2	40.7	5.7	2.4	0.0
33	Provo ver	100.0	96.8	89.7	46.5	16.8	6.3	3.1	0.0
34	Provost P	100.0	100.0	100.0	98.8	52.4	10.8	1.8	0.0
35	Provost W	100.0	100.0	99.6	59.5	8.5	2.7	1.6	0.0
36	Richer Cr	100.0	99.9	98.5	43.1	5.7	2.0	1.1	0.0
37	Richer P	100.0	100.0	100.0	99.9	99.4	71.8	17.8	0.0
38	Richer pi	100.0	86.4	74.0	44.1	4.7	1.6	0.8	0.0
39	Richer Pi	100.0	96.7	95.9	85.7	17.8	5.3	1.2	0.0
40	Richer Pi	100.0	100.0	100.0	100.0	99.7	78.4	28.3	0.0
41	Richer pl	100.0	98.5	96.7	90.6	58.0	7.4	1.5	0.0
42	Richer pl	100.0	98.2	97.7	85.0	8.3	1.5	0.6	0.0
43	Richer S	100.0	100.0	100.0	99.9	99.2	32.8	3.8	0.0
44	Richer So	100.0	99.7	94.4	78.4	31.3	4.6	1.2	0.0
45	Richer Vp	100.0	100.0	100.0	99.9	71.5	6.5	1.1	0.0
46	Richer-N.	100.0	94.4	85.0	58.4	30.3	2.7	0.8	0.0
47	14-20	100.0	100.0	99.8	99.7	99.6	55.1	14.0	0.0
48	14-20	100.0	100.0	99.9	99.4	94.7	30.7	6.3	0.0
49	14-40	100.0	99.3	99.2	96.2	34.8	10.1	3.2	0.0
50	16-35	100.0	82.6	64.5	37.0	17.3	7.5	4.3	0.0

Percent Passing

Sample Number	Location	#4	#8	#16	#30	#50	#100	#200	Pan
		4.8	2.4	1.2	0.6	0.3	0.15	0.075	
		size in mm							
51	17-15	100.0	100.0	100.0	99.8	78.3	13.2	2.1	0.0
52	17-25	100.0	99.9	99.4	93.7	33.6	9.4	4.1	0.0
53	B of Finc	60.6	35.1	22.4	15.8	11.0	7.4	4.8	0.0
54	Finch Pit	100.0	100.0	100.0	99.8	96.5	51.5	16.2	0.0
55	FinchTp W	100.0	56.9	37.7	27.0	18.9	13.2	8.5	0.0
56	Sandtown-	100.0	84.6	66.8	47.7	11.5	2.4	1.0	0.0
57	Sndtwn Bl	100.0	99.5	95.4	81.7	47.0	14.1	3.7	0.0
58	Sndtwn Su	100.0	100.0	100.0	99.2	85.7	18.4	2.7	0.0
59	Sndtwn Su	100.0	99.4	99.1	97.2	82.6	13.3	1.8	0.0
60	Blar Sndt	100.0	100.0	100.0	99.9	98.9	88.0	38.0	0.0
61	ABlair St	95.1	76.3	52.6	36.6	24.4	16.5	11.0	0.0
62	22-10	100.0	90.4	82.6	76.8	58.4	20.2	7.1	0.0
63	23-15	100.0	99.8	99.8	99.8	98.9	72.3	21.9	0.0
64	24-15	100.0	85.2	62.1	31.5	10.4	4.9	2.9	0.0
65	26-30	100.0	95.4	91.6	84.2	56.7	27.4	12.2	0.0
66	28-15	100.0	100.0	99.6	97.8	51.7	9.3	3.6	0.0
67	28-15	100.0	98.9	95.4	87.8	50.7	20.4	10.6	0.0
68	Osg Pit E	100.0	96.5	81.2	50.7	13.4	2.6	0.8	0.0
69	Osg bhind	100.0	97.1	91.3	36.9	14.2	1.7	0.8	0.0
70	MapRid Os	100.0	43.7	18.5	9.3	5.5	3.1	1.8	0.0
71	Osgoode V	100.0	65.8	33.7	11.7	4.2	2.4	1.8	0.0
72	MapRid Os	100.0	85.7	78.8	63.7	36.1	8.9	1.1	0.0
73	33-20	100.0	99.1	98.4	96.8	90.7	55.0	15.6	0.0
74	34-30	100.0	97.9	96.4	86.0	43.7	15.3	6.5	0.0
75	34-35	100.0	97.9	95.0	87.7	57.2	14.4	4.7	0.0
76	34-50	100.0	80.2	67.8	56.4	41.4	26.5	16.0	0.0
77	35-15	100.0	88.1	75.2	44.9	12.8	7.3	4.6	0.0
78	35-25	100.0	98.2	94.4	82.3	42.5	9.5	2.6	0.0
79	MapRid Mo	100.0	55.1	29.0	14.0	7.9	5.2	3.6	0.0
80	MonastMap	100.0	99.7	99.4	97.5	67.1	13.8	3.3	0.0
81	36-15	100.0	97.2	95.9	92.1	72.7	29.7	7.9	0.0
82	36-25	100.0	93.1	86.0	76.1	55.0	25.7	10.5	0.0
83	36-45	100.0	89.3	83.7	75.6	51.7	21.3	9.0	0.0
84	MapRid Hu	100.0	99.9	94.7	90.3	63.5	15.6	2.4	0.0
85	MapRid Hu	100.0	100.0	100.0	99.8	95.9	58.1	18.3	0.0
86	38-30	100.0	99.8	98.8	98.4	94.5	56.0	14.6	0.0
87	40-15	100.0	98.7	97.2	88.2	58.5	25.7	8.1	0.0
88	40-25	100.0	99.8	98.3	89.0	79.9	27.2	9.3	0.0
89	41-15	100.0	99.4	98.9	96.1	77.3	28.9	6.4	0.0
90	41-25	100.0	99.1	97.8	96.1	87.6	46.2	10.7	0.0
91	44-15	100.0	100.0	99.2	98.8	94.6	72.6	32.2	0.0
92	44-35	100.0	100.0	99.2	98.7	89.7	51.3	16.6	0.0
93	SulBros P	100.0	100.0	100.0	99.0	84.8	29.0	4.9	0.0
94	Hwy31Q N.	96.7	72.9	35.4	18.4	10.2	5.8	3.6	0.0
95	Provo cha	100.0	99.1	80.0	24.7	5.4	2.1	1.2	0.0
96	Provo pit	100.0	100.0	98.8	84.2	39.9	8.2	2.5	0.0
97	Provostpi	100.0	99.1	98.5	92.8	61.5	8.6	2.3	0.0
98	51Grab	100.0	98.3	94.8	86.2	62.0	15.1	4.4	0.0
99	51-25	100.0	85.6	75.5	47.1	19.5	10.2	5.6	0.0
100	51-35	100.0	97.1	94.7	92.3	74.4	19.9	6.8	0.0

Percent Passing

Sample Number	Location	#4 4.8	#8 2.4	#16 1.2	#30 0.6	#50 0.3	#100 0.15	#200 0.075	Pan
		size in mm							
101	54Grab	100.0	97.2	94.0	84.2	53.2	17.0	6.2	0.0
102	56-20	100.0	84.2	74.3	66.7	40.6	13.0	7.2	0.0
103	Felton Qu	90.9	66.6	47.0	33.9	21.4	13.7	8.5	0.0
104	Coburn Pl	100.0	100.0	99.0	89.8	25.9	2.0	0.5	0.0
105	Cotrans p	100.0	99.9	99.8	99.1	78.5	21.3	2.6	0.0
106	Cotrans r	100.0	100.0	100.0	99.9	96.6	40.0	5.8	0.0
107	Cotrans W	100.0	94.3	64.8	27.9	8.6	2.2	1.1	0.0
108	RedDrag A	100.0	100.0	99.8	99.0	84.1	35.8	6.0	0.0
109	RedDrag p	100.0	100.0	99.7	89.1	22.8	3.1	1.1	0.0
110	61-15	100.0	100.0	99.8	99.8	93.0	32.5	7.1	0.0
111	62-10	100.0	90.4	84.2	68.2	30.3	12.4	6.9	0.0
112	62-blw20	100.0	85.0	72.8	54.6	32.6	14.8	5.8	0.0
113	64-15	100.0	99.7	99.1	95.9	73.0	27.4	8.1	0.0
114	PermaNava	94.5	58.9	37.3	25.1	16.5	10.2	5.6	0.0
115	PermaneNa	91.8	56.8	36.1	25.0	17.1	10.1	6.1	0.0
116	PermNav N	100.0	91.8	74.7	39.5	10.9	4.3	2.5	0.0
117	Redm S.of	100.0	100.0	99.7	86.7	25.4	3.4	0.9	0.0
118	Redmond V	100.0	91.2	71.1	35.5	8.5	2.1	0.8	0.0
119	Redmond V	100.0	93.4	79.8	52.9	21.5	6.6	1.7	0.0
120	Redpit mi	100.0	100.0	100.0	99.1	64.1	13.0	2.2	0.0
121	Redpit Sc	100.0	99.8	82.1	55.6	21.9	4.7	1.0	0.0
122	Redpit SW	100.0	100.0	100.0	99.8	91.9	33.4	5.8	0.0
123	67-15	100.0	86.2	77.3	68.2	45.8	20.4	12.4	0.0
124	67-30	100.0	97.6	94.2	84.6	47.4	13.5	6.6	0.0
125	68-10	100.0	86.0	83.0	78.1	56.0	15.2	7.1	0.0
126	68-30	100.0	98.5	95.4	87.3	47.3	11.6	5.4	0.0
127	68-40	100.0	99.0	97.1	90.9	49.8	9.8	4.1	0.0
128	69-b20	100.0	90.8	77.2	52.0	22.6	10.7	5.9	0.0
129	69-m20	100.0	88.4	70.9	55.6	31.1	13.3	6.6	0.0
130	69-t20	100.0	96.3	73.6	61.4	28.0	7.0	2.9	0.0
131	70-10	100.0	80.2	55.8	30.7	12.8	7.2	4.1	0.0
132	70-20	100.0	96.3	81.8	55.3	23.6	11.1	6.9	0.0
133	70-25	100.0	97.7	89.0	67.4	33.6	14.4	7.6	0.0
134	70-30	100.0	99.8	97.2	85.8	61.6	35.7	16.1	0.0
135	71-10	100.0	98.2	88.1	63.9	22.2	5.5	2.4	0.0
136	71-15	100.0	98.0	87.1	65.4	29.7	13.2	7.2	0.0
137	71-25	100.0	98.2	89.6	68.2	27.8	11.0	7.0	0.0
138	71-b20	100.0	98.3	86.2	57.4	23.2	10.1	5.6	0.0
139	72-10	100.0	99.9	99.7	97.4	47.3	7.2	2.6	0.0
140	72-15	100.0	100.0	100.0	98.2	49.4	7.8	2.5	0.0
141	72-20	100.0	100.0	99.9	98.0	58.2	12.9	3.7	0.0
142	Map Gr Gl	100.0	83.4	66.1	44.4	18.4	3.8	1.1	0.0
143	Map Gr N	100.0	100.0	100.0	98.5	82.7	19.6	0.9	0.0
144	Map Gr N.	100.0	99.9	98.3	87.9	67.8	39.6	17.2	0.0
145	Map Gr pT	100.0	100.0	97.6	81.2	31.3	6.0	1.8	0.0
146	MapGr A r	100.0	100.0	100.0	99.4	87.3	37.7	5.6	0.0
147	MapGr beh	100.0	100.0	99.0	92.7	49.6	7.4	1.3	0.0
148	MapGr bhl	100.0	99.9	99.7	95.4	50.7	13.4	8.1	0.0
149	MapGr mor	100.0	99.8	98.9	90.4	38.8	5.6	1.1	0.0
150	MapGr N.	100.0	98.7	93.7	86.3	58.8	5.2	0.6	0.0

Percent Passing

Sample Number	Location	#4 4.8	#8 2.4	#16 1.2	#30 0.6	#50 0.3	#100 0.15	#200 0.075	Pan
					size in mm				
151	MapGr N.o	100.0	100.0	100.0	99.8	78.4	5.1	1.2	0.0
152	MapGr VFR	100.0	91.9	86.2	77.0	45.1	7.1	1.2	0.0
153	74-10	100.0	100.0	97.3	82.6	38.2	5.8	3.4	0.0
154	74-20	100.0	100.0	99.4	90.0	50.7	15.8	7.8	0.0
155	74-40	100.0	94.9	87.3	78.8	57.1	14.9	4.8	0.0
156	75-20G	100.0	100.0	99.9	99.6	96.1	53.0	12.2	0.0
157	75-5G	100.0	100.0	99.9	99.4	96.7	71.0	26.5	0.0
158	76-10	100.0	99.5	98.1	95.9	60.8	14.4	5.3	0.0
159	76-15	100.0	100.0	99.9	97.9	53.4	14.4	6.6	0.0
160	76-30	100.0	76.6	58.6	43.9	27.6	13.9	7.0	0.0
161	77-10	100.0	96.1	80.1	53.3	22.5	6.1	3.0	0.0
162	77-20	100.0	94.3	80.9	60.4	26.7	12.8	7.7	0.0
163	77-50	100.0	92.0	73.9	57.2	36.6	16.4	8.8	0.0
164	78-10	100.0	93.2	89.4	87.5	84.3	48.4	7.0	0.0
165	78-20	100.0	93.2	87.2	83.5	75.7	39.2	18.4	0.0
166	Moore S.G	100.0	96.6	85.7	62.7	30.1	10.5	8.5	0.0
167	MooreSGor	100.0	99.8	99.4	93.2	41.9	4.6	0.7	0.0
168	FBM shore	100.0	99.9	99.8	98.3	25.4	94.2	1.8	0.0
169	FBM swash	100.0	98.1	96.8	89.5	41.4	4.4	0.5	0.0
170	FBM Wpit	100.0	100.0	99.6	92.8	21.4	1.6	0.4	0.0
171	FBM W.pit	100.0	97.9	97.2	90.1	23.3	0.4	0.0	0.0
172	80-10	100.0	89.9	79.0	59.9	28.9	15.4	9.6	0.0
173	80-30	100.0	99.8	99.1	96.2	69.7	23.4	1.3	0.0
174	80-40	100.0	100.0	99.9	99.6	91.7	49.5	11.8	0.0
175	81-10	100.0	97.0	93.2	83.1	44.1	18.3	7.1	0.0
176	81-20	100.0	99.0	96.9	85.0	52.1	23.3	16.9	0.0
177	81-30	100.0	100.0	99.9	98.9	89.2	31.2	6.6	0.0
178	82-10	100.0	99.5	99.0	97.4	78.9	23.2	9.9	0.0
179	82-10	100.0	98.5	90.0	62.5	24.9	9.9	3.7	0.0
180	82-15	100.0	99.9	98.4	87.6	36.6	11.6	6.0	0.0
181	82-20	100.0	100.0	98.9	87.4	37.3	11.7	6.2	0.0
182	82-20	100.0	99.1	97.0	93.8	89.8	70.4	23.8	0.0
183	Osgoode P	100.0	100.0	98.1	78.6	21.6	2.7	0.8	0.0
184	Osgoodwsi	100.0	100.0	100.0	99.9	99.3	91.4	35.8	0.0
185	89-10	100.0	97.1	91.2	78.4	34.1	12.7	6.6	0.0
186	89-20	100.0	94.0	88.7	84.5	64.5	22.6	5.8	0.0
187	Osg SbyDH	100.0	100.0	99.7	94.0	42.7	7.0	1.0	0.0
188	Warran Bo	100.0	100.0	100.0	99.8	88.3	23.1	3.1	0.0
189	93grab	100.0	99.9	96.8	74.4	35.7	13.8	4.9	0.0
190	94-10	100.0	99.0	95.2	72.3	30.4	10.8	5.9	0.0
191	94-20	100.0	98.8	91.5	61.6	21.4	9.5	5.6	0.0
192	94-40	100.0	98.9	96.5	85.5	43.7	17.3	9.4	0.0
193	Osg MainP	100.0	100.0	100.0	99.9	98.5	63.7	16.0	0.0
194	Osgood Ma	100.0	99.8	95.3	67.8	26.5	8.3	1.4	0.0
195	Osgoode M	100.0	100.0	100.0	100.0	98.6	45.2	5.1	0.0
196	96-10	100.0	76.5	45.4	25.7	16.7	12.5	9.2	0.0
197	96-15	100.0	69.5	43.3	28.3	19.1	13.3	9.5	0.0
198	97-10	100.0	84.1	54.8	34.5	17.0	9.0	5.8	0.0
199	97-20	100.0	96.0	90.1	80.6	29.4	13.2	7.3	0.0
200	Greely Bs	100.0	75.6	45.7	27.3	9.5	3.4	1.9	0.0

Percent Passing

Sample Number	Location	#4 4.8	#8 2.4	#16 1.2	#30 0.6	#50 0.3	#100 0.15	#200 0.075	Pan
					size in mm				
201	Greely E.	100.0	82.5	57.6	34.4	12.1	3.2	1.6	0.0
202	Greely He	100.0	100.0	100.0	100.0	99.9	79.4	21.5	0.0
203	Greely W	100.0	100.0	100.0	100.0	99.8	71.4	10.4	0.0
204	Greely W	100.0	100.0	99.9	88.5	43.9	13.6	3.0	0.0
205	Greely W.	100.0	100.0	100.0	100.0	100.0	75.9	8.6	0.0
206	98-10	100.0	96.3	89.4	67.7	24.8	5.7	2.4	0.0
207	98-15	100.0	96.9	91.3	77.2	36.3	12.3	6.3	0.0
208	98-20	100.0	86.3	72.8	58.8	25.5	14.8	10.6	0.0
209	Moff pit	100.0	100.0	99.2	90.5	24.8	2.5	0.6	0.0
210	Moffat Gr	100.0	100.0	100.0	100.0	90.3	26.9	5.0	0.0
211	Moffat Gr	100.0	97.7	75.5	34.7	4.0	0.9	0.7	0.0
212	Moffat S.	100.0	92.5	68.5	42.7	19.8	3.5	0.8	0.0
213	Greely	100.0	100.0	100.0	95.2	58.4	8.8	1.3	0.0
214	Pyper Pit	100.0	100.0	100.0	100.0	99.7	97.8	56.9	0.0
215	Pyper Sou	100.0	100.0	100.0	100.0	99.2	49.3	5.0	0.0
216	Pyper S.#	100.0	100.0	100.0	100.0	99.1	72.3	21.8	0.0
217	99-10	100.0	99.7	99.6	99.5	97.9	78.1	25.0	0.0
218	99-30	100.0	100.0	99.9	99.8	96.7	64.6	20.9	0.0
219	99-40G	100.0	97.0	95.9	94.8	90.5	64.6	31.9	0.0
220	100-10	100.0	100.0	100.0	99.5	85.3	38.2	13.9	0.0
221	100-30	100.0	100.0	100.0	98.8	83.3	42.6	15.7	0.0
222	Osg pitS#	100.0	100.0	100.0	100.0	99.4	85.4	26.6	0.0
223	Osg #8 W#	100.0	94.3	89.5	65.8	16.6	3.5	0.9	0.0
224	Osg#31&#8	100.0	100.0	100.0	99.7	42.7	4.5	0.8	0.0
225	Mof N.#8	100.0	99.7	91.9	59.5	21.2	3.2	0.8	0.0
226	Moff N#8	100.0	100.0	100.0	100.0	94.8	45.7	10.3	0.0
227	Moff N#8	100.0	100.0	100.0	100.0	99.5	81.3	23.9	0.0
228	Moffat N	100.0	98.1	85.0	53.9	13.2	2.3	0.9	0.0
229	101-20	100.0	100.0	99.7	95.8	72.1	43.7	21.2	0.0
230	102-10	100.0	99.9	98.2	80.4	46.6	19.0	8.4	0.0
231	102-15	100.0	100.0	99.4	89.4	40.2	11.0	4.7	0.0
232	102-15	100.0	97.5	96.6	94.3	73.1	33.2	13.3	0.0
233	Dib/W Joh	100.0	100.0	100.0	100.0	99.7	89.9	33.7	0.0
234	Dib/War J	100.0	99.6	89.8	60.8	28.0	6.7	1.5	0.0
235	D/W JCors	100.0	100.0	100.0	100.0	96.9	58.4	10.4	0.0
236	D/W JCors	100.0	100.0	99.6	95.7	57.9	14.2	2.5	0.0
237	D/W plana	100.0	100.0	99.8	98.3	84.3	37.5	5.4	0.0
238	103-15	100.0	98.5	85.4	57.3	32.4	13.2	6.4	0.0
239	103-20	100.0	99.5	90.4	64.5	26.9	6.8	3.2	0.0
240	104-15	100.0	86.5	65.8	48.1	28.4	8.9	5.1	0.0
241	104-20	100.0	79.3	58.9	43.0	28.6	17.0	11.5	0.0
242	BVRdust	80.0	33.4	13.5	8.6	6.4	5.1	3.8	0.0
243	DIBbsnd	100.0	99.9	98.7	93.5	78.0	43.8	14.6	0.0
244	DIBdust	86.5	61.0	42.4	30.8	22.4	15.1	8.8	0.0
245	ARMdust	92.6	64.7	42.9	30.5	22.7	17.0	2.5	0.0
246	FCMbsnd	100.0	93.7	85.5	71.0	33.4	9.3	4.0	0.0
247	FCMdust	100.0	87.7	61.0	40.0	24.7	14.8	8.7	0.0
248	105-10	100.0	100.0	99.9	99.8	98.7	66.9	15.0	0.0
249	105-15	100.0	97.9	91.1	67.8	36.8	15.1	8.9	0.0
250	105-30	100.0	99.7	99.4	94.7	39.9	8.0	3.6	0.0

Percent Passing

Sample Number	Location	#4	#8	#16	#30	#50	#100	#200	Pan
		4.8	2.4	1.2	0.6	0.3	0.15	0.075	
		size in mm							
251	Drum prop	100.0	75.7	65.4	54.4	19.1	1.4	0.4	0.0
252	Drumm Ced	100.0	74.2	32.9	10.5	3.3	1.3	0.7	0.0
253	Drumm Ced	100.0	84.4	67.3	47.9	22.9	6.0	1.9	0.0
254	Drummond	100.0	76.2	59.4	37.2	12.1	2.6	0.9	0.0
255	Drummond	100.0	97.8	95.4	94.6	61.0	12.4	2.3	0.0
256	Drummond	100.0	97.3	93.4	84.6	59.6	2.8	0.9	0.0
257	106-15	100.0	96.0	77.5	58.2	34.5	11.8	7.1	0.0
258	106-20	100.0	97.0	69.7	44.9	25.3	9.1	4.7	0.0
259	106-40	100.0	99.8	98.5	92.1	60.5	22.3	10.8	0.0
260	107-10	100.0	95.1	85.9	69.9	43.2	18.1	7.8	0.0
261	107-20	100.0	89.5	79.5	66.3	37.0	11.5	5.2	0.0
262	Braz Pit	100.0	99.3	97.5	93.4	41.7	3.4	0.5	0.0
263	Brazeau,	100.0	66.7	30.9	12.7	6.4	3.5	2.6	0.0
264	Burn unde	100.0	99.7	99.2	94.5	56.9	5.7	0.3	0.0
265	Burns bac	100.0	100.0	100.0	99.5	80.0	15.3	2.5	0.0
266	Burns Mpi	100.0	100.0	100.0	99.8	99.1	75.1	22.7	0.0
267	Burns Mpi	100.0	100.0	100.0	99.9	99.5	76.0	23.7	0.0
268	Burns Mpi	100.0	100.0	100.0	94.9	45.0	6.5	1.2	0.0
269	Burns Spi	100.0	99.9	99.4	97.9	41.0	3.0	0.5	0.0
270	Burns S.p	100.0	95.0	91.3	80.8	28.4	4.2	2.4	0.0
271	Burnside	100.0	98.7	96.7	88.2	34.0	4.1	1.2	0.0
272	Burnside	100.0	86.5	81.0	72.6	29.5	1.7	0.7	0.0
273	115-15	100.0	87.4	59.0	31.0	9.9	2.9	1.3	0.0
274	120-20	100.0	97.8	93.2	81.4	53.8	21.1	6.1	0.0
275	120-30	100.0	99.8	98.6	95.5	82.2	48.4	18.2	0.0
276	120-50	100.0	99.2	97.8	94.4	73.4	33.6	12.1	0.0
277	MCPbsnd	100.0	98.0	95.0	86.6	48.3	5.7	1.5	0.0
278	MCPdust	86.0	48.9	28.7	17.5	9.6	5.6	3.5	0.0
279	SPRdust	82.1	55.8	39.3	28.9	18.5	11.4	7.3	0.0
280	124-10	100.0	98.9	94.8	79.7	36.5	8.7	4.7	0.0
281	WilsonP M	100.0	97.7	92.9	69.3	9.6	1.9	0.8	0.0
282	127-10	100.0	97.2	88.3	72.6	27.6	11.4	5.2	0.0
283	128-10	100.0	100.0	99.9	92.1	12.2	4.0	1.6	0.0
284	133-10	100.0	100.0	99.9	99.2	62.9	15.6	10.3	0.0
285	133-20	100.0	100.0	99.8	99.5	60.8	13.0	8.0	0.0
286	134-20	100.0	98.5	96.7	95.1	77.4	48.5	16.5	0.0
287	134-30	100.0	98.6	96.0	94.6	66.5	36.7	13.7	0.0
288	136-10	100.0	99.8	99.5	98.7	74.6	32.4	11.6	0.0
289	136-30	100.0	99.5	99.1	97.2	86.9	42.1	13.0	0.0
290	136-40	100.0	97.7	96.9	94.4	82.1	35.9	9.9	0.0
291	137-10	100.0	97.7	92.6	79.8	46.9	26.3	9.0	0.0
292	137-15	100.0	99.4	96.9	91.0	77.0	53.4	17.8	0.0
293	137-20-30	100.0	99.2	97.7	95.3	89.4	64.2	21.8	0.0

DRILL LOG

DATE Oct/28/86 DRILL HOLE # 1 DRILL TYPE H.S. RECORDER G.G.

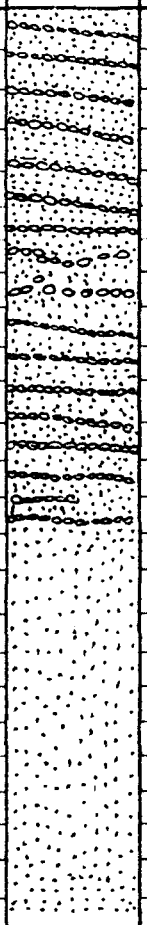
STATION -East of Hawkesbury, UTM 5334 50492; In pit, northeast of dump

DEPTH (m)	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	-layered sand and gravel, stns. 5-15cm					
	-sand f-m; 200-16;wt. at 0.8m					
1-2	very similar to above, except that it					
	is sandier, pebs. less than 2 cm					
2-3	ditto, abit sandier; fmsand 200-30					
	with some # 16					
3-4	mainly sand; fmsand 200-30; highly					
	saturated					
4-4.6	pulled out because augers were filling					
	up, and hole was caving in					

DRILL LOG

DATE Nov/11/86 DRILL HOLE # 33 DRILL TYPE H.S. RECORDER G.G.

STATION Maple Ridge area. Osgoode Pit, east side where foresets are found. UTM 4778 49933 7.0 m face

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	small layers of snd and grvl, clasts					
	3-5 cm. snd 200-16					
1-2	ditto					
2-3	ditto					
3-4	+25% stn, clasts 2-10cm					
	watertable at 4.0 m					
4-5	fgrvl and fmsnd layers, snd 200-30					
	grvl < 5cm					
5-6	ditto					
6-7	layered mfsnd and fgrvl, < 5%stn,					
	snd 200-50 some 30 clasts <5cm					
7-8	very dense fsnd, 200-100 some 50					
8-9	ditto					
9-10	vfsnd, 200-100					
10-11	ditto					
11-12	ditto, slightly coarser snd. 200-50					
	pulled augers at 12.2m					

DRILL LOG

DATE Oct/28/86 DRILL HOLE # 2 DRILL TYPE H.S. RECORDER G.G.

STATION East of Hawkesbury; UTM 5334 50492; on top of plain, 30 m south of dump and pits

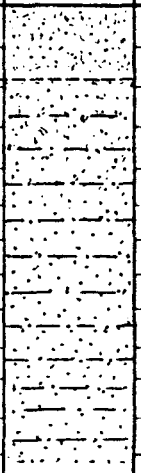
DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	very fsand, silty clay;					
1-2	clay; very soft to 1.5 m then					
	saturated silty sand with clay layers					
2-3	ditto, clay layers 1-3 cm; sand-mvf					
	200-100 3-7 cm					
3-4	ditto; water table at 3.4 m					
4-5	silty sand to 4.9 m then + 20% gravel					
	stns 2-25 cm, cmsnd, 100-16					
5-6	ditto to 5.5 m, then mvfsnd 200-100;					
	a few small, 1-2 cm clay layers					
6-7	ditto					
7-8	ditto to 7.6 m, rods stuck, pulled out					

DRILL LOG

DATE Oct/28/86 DRILL HOLE # 3 DRILL TYPE H.S. RECORDER G.G.

STATION East of Hawkesbury, Just north of Highway # 17

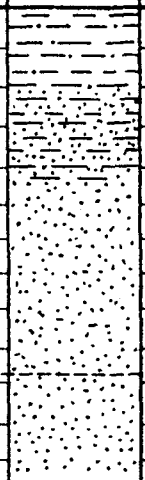
UTM 5329 504825

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fsnd, 200-100, water table at 0.9m					
1-2	fine silty sand					
2-3	ditto					
3-4	ditto					
4-5	ditto					
5-6	ditto to 6.1 m and then pulled out					

DRILL LOG

DATE Oct/29/86 DRILL HOLE # 4 DRILL TYPE H.S. RECORDER G.G.

STATION East of Casselman (3 km) 49585 50179; Just north west of pit; 30m from edge

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	tpsl, oxidized silty clay					
1-2	ditto to 1.5 m, then layered mfsnd. & silty clay; layers 2-5 cm, snd 200-50					
2-3	ditto to 2.3 m then mfsnd, 200-50 with some 30					
3-4	ditto					
4-5	ditto, water table at 4.8 m					
5-6	ditto to 6.1 m					

DRILL LOG

DATE Oct/29/86 DRILL HOLE # 5 DRILL TYPE H.S. RECORDER G.G.

STATION East of Casselman (3km) 49585 50179; north-mid portion of pit

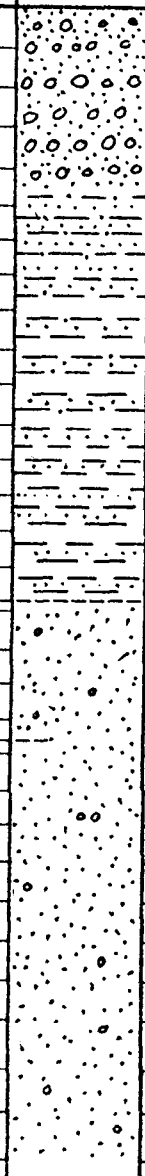
DEPTH	DESCRIPTION(Colour, Texture. Moisture. etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered silty clay and sand, layers					
	1-5 cm. fsnd. 200-100, stns at 0.9 m					
1-2	layered silty clay and sand; sand f to					
	vf, 200-100					
2-3	layered silty clay and sand to 2.7 m;					
	then fm sand 200-30, few silt layers	--				
3-4	ditto					
4-5	ditto					
5-6	ditto					
6-7	ditto					
7-8	ditto					
		P				
8-9	ditto					
9-10	ditto					
10-11	ditto					
11-12	ditto					
12-13	ditto					
13-14	ditto					
14-15	ditto					
15-16	ditto					
16-17	ditto to 16.8 m then till to 17.4 m					
	piezometer installed at 7.6m					

DRILL LOG

DATE Oct/30/86 DRILL HOLE # 6 DRILL TYPE H.S. RECORDER G.G.

STATION East of Casselman (3km); south end of pits, on small ridge

UTM 4958 50175

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	open work and matrix supported sand					
	and gravel layers, clasts 2-25cm. fmsd.					
1-2	ditto, matrix mfsnd 200-50,					
	sand is oxidized					
2-3	ditto to 2.3 m, then layered silty					
	clay and mfsnd. 200-100					
3-4	ditto, less sand; layers of sand 2-5cm					
	clay layers 5-15 cm.					
4-5	ditto, smaller sand layers					
	clay has been oxidized					
5-6	ditto					
6-7	mainly clay, sand layers are less than					
	5mm					
7-8	ditto to 7.9 m then mfsnd 200-50 some					
	30					
8-9	mfsand, occasional clast which is less					
	than 2.5 cm in diameter					
9-10	ditto					
		P				
10-11	ditto					
11-12	ditto					
12-13	ditto					
13-14	ditto					
14-15	ditto					
	~~piezometer installed at 9.7m~~					

DRILL LOG

DATE Nov/3/86 DRILL HOLE # 7 DRILL TYPE H.S. RECORDER G.G.

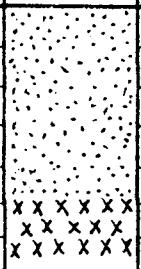
STATION Just north of the Stormont/Russell boundary, Cambridge Tp.
UTM 4929 50113, Vinette Pit, northwest corner, north of drainage ditch

DEPTH	DESCRIPTION(Colour, Texture. Moisture. etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	mfsnd 200-50					
1-2	ditto, occasional clast which is less					
	than 5 cm					
2-3	ditto to 2.7m; them cm snd 100-16 and					
	clasts less than 2.5 cm; wt at 2.7m	---		1	7-9-11	3.0
3-4	ditto					
4-5	ditto					
				2	5-1-2	4.6
5-6	ditto					
6-7	ditto to 6.7 m then gravel layers; +			3	15-17-	6.1
	20% gravel layers	p			10	
7-8	ditto to 7.3 m and then bedrock					
				4	sunk	7.6
	piezometer installed at 6.9 m					

DRILL LOG

DATE Nov/3/86 DRILL HOLE # 8 DRILL TYPE H.S. RECORDER G.G.

STATION Just north of the Stormont/Russell boundary, Cambridge Tp.
UTM 4929 50113, Vinette Pit; south east corner

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fmsnd. 200-30 very little 16					
1-2	ditto					
2-3	ditto to 2.4 m and then bedrock					

DRILL LOG

DATE Nov/3/86 DRILL HOLE # 9 DRILL TYPE H.S. RECORDER G.G.

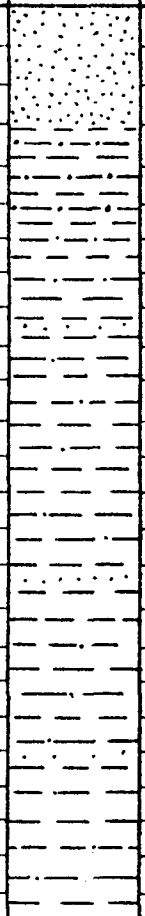
STATION Just north of the Russell/Stormont boundary, Vinette Pit
UTM 4929 50113, north east corner, just south of pond, 120n of DH 8

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fmsnd. 200-30 some 16					
	small silt layers 0.8m to 1.0 m					
1-2	fmsnd. 200-30, getting finer downwards					
	water table at 1.8 m					
2-3	mfsnd. 200-50, small clasts which are					
	less than 5 mm					
3-4	ditto					
4-5	ditto					
				1	6-5-2	4.6
5-6	ditto to 5.5 m then small gravel					
	layers; bedrock at 6.2 m	p		2	12-17-rf	6.1
	piezometer installed at 5.8m					

DRILL LOG

DATE Nov/3/86 DRILL HOLE # 10 DRILL TYPE H.S. RECORDER G.G.

STATION On the Stormont/Russell Border; UTM 4923 50102
South side of forced road

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	oxidized fmsnd. 200-30					
1-2	ditto to 1.5 m then small silt and					
	clay layers, layers 2-5 cm.					
2-3	ditto to 2.8 m then mainly clay with					
	very small silty sand partings					
3-4	mainly clay, small silty sand partings					
4-5	ditto					
				1	1-1-1	4.6
5-6	ditto					
6-7	ditto					
7-8	ditto					
8-9	ditto					
9-10	ditto					
10-11	ditto					
11-12	ditto, pulled augers at 12.2 m					

DRILL LOG

DATE Nov/4/86 DRILL HOLE # 11 DRILL TYPE H.S. RECORDER G.G.

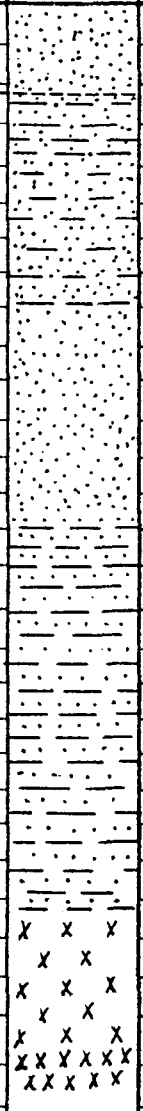
STATION On the Stormont/Russell County Border; UTM 4923 50102
94 m west of the road junction

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	Oxidized fsnd. 200-100 some #50					
1-2	Ditto to 1.4 m then layered silty clay					
	and fine sand					
2-3	ditto to 2.8 m then clay					
	water table at 2.9m					
3-4	clay with vsmall sand partings					
4-5	ditto					
5-6	ditto to 5.3 m, then a 0.8 m thick					
	fsnd layer, 200-100					
6-7	layered fsnd and silty clay, layers					
	are 2-5 cm thick, snd 200-100					
7-8	ditto					
8-9	ditto					
9-10	ditto					
10-11	ditto to 10.7 and then mainly clay					
	with sand layers less than 5mm thick					
11-12	mainly clay					
12-13	ditto	P				
13-14	ditto to 13.4 m and then broken					
	bedrock					
	piezometer installed at 12.2 m					

DRILL LOG

DATE Nov/4/86 DRILL HOLE # 12 DRILL TYPE H.S. RECORDER G.G.

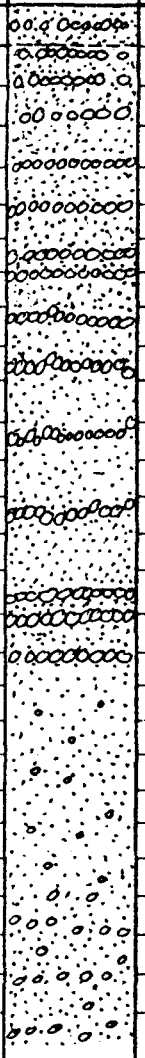
STATION On the Stormont/Russell County borders, UTM 4924 50102
24 m west of the road junction

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	Oxidized mfsnd, 200-30, mainly 200-50					
1-2	ditto to 1.2 m then saturated silty					
	sand clay to 1.8m					
2-3	mainly silty sand although there are					
	small silty clay partings					
3-4	ditto to 4.0m , them mainlymfsnd, 200-					
	30					
4-5	ditto					
5-6	ditto					
6-7	ditto to 7.0m, then layered mfsnd and					
	clay, layers 2-6 cm.					
7-8	ditto					
8-9	ditto					
9-10	ditto					
10-11	ditto					
11-12	ditto					
12-13	ditto to 12.2 m, then weathered bedrock					
13-14	weathered bedrock to 13.7 and thensolid					
	bedrock					

DRILL LOG

DATE Nov/4/86 DRILL HOLE # 13 DRILL TYPE H.S. RECORDER G.G.

STATION Richer Pit, North pit; Stormont County, Finch Tp.;
UTM 4925 50086; bottom of north pit, 4-5.5 m removed

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	+20% grvl. clasts 2.5-12 cm. materail					
	is in layers, cmsnd 200-16					
1-2	ditto, layers 4-15 cm. thick					
2-3	ditto					
3-4	+25% grvl. material is in layers;					
	clasts 2.5 20 cm, cmsnd. 100-16					
4-5	ditto					
5-6	ditto					
6-7	ditto but the clasts range 4-30cm					
	still cmsnd					
7-8	ditto					
8-9	ditto to 8.7m then mainly layers of					
	fmsnd and mcsnd					
9-10	ditto; fmsnd 200-30 cmsnd 100-16 with					
	clasts less than 1.5 cm					
10-11	ditto					
11-12	ditto to 11.9 m and then layers of					
	cmsnd 100-16 and + 20% gravel 2.5-20cm					
12-13	ditto					
13-14	ditto to 13.7 m and then pulled augers					

DRILL LOG

DATE Nov/4/86 DRILL HOLE # 14 DRILL TYPE H.S. RECORDER G.G.

STATION Richer Pit; Stormont County, Finch Tp. unopened portion (west) of property, UTM 4924 50084

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fmsnd 200-50 with a few small silty					
	clay layers, layers 0.5-1.5 cm					
1-2	ditto, but fewer and smaller clay					
	layers					
2-3	ditto, fewer clayers, snd 200-30 and					
	it is oxidized			1	6-10-	3.0
3-4	mainly mfsnd although there are a few				10-15	
	small clay layers, less than o.5 cm					
4-5	ditto, snd is slightly finer, mainly					
	200-50			2	6-9-17	4.6
5-6	layered mfsnd, 200-50 some 30					
	water table at 5.5 m					
6-7	saturated mfsn 200-50			3	8-17-17	6.1
7-8	ditto					
				4	7-17-21	7.6
8-9	ditto, snd is slightly finer 200-100					
9-10	ditto			5	7-17-12	9.1
10-11	ditto, sand is slightly coarser at					
	10.7m 200-50 some 30			6	5-10-13	10.7
11-12	slightly coarser sand, 200-30 some 16					
	sand is in layers					
12-13	ditto					
13-14	ditto					
				7	1-2-8	13.7
14-15	ditto					
15-16	ditto					
16-17	ditto, sand is msnd, 200-30					
	pulled augers at 16.8 m					

DRILL LOG

DATE Nov/5/86 DRILL HOLE # 15 DRILL TYPE H.S. RECORDER G.G.

STATION Richer Pit, front portion of the north pit, 4-6 m has been removed, UTM 4927 50080

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	+20 % grvl, clasts less than 2.5 cm,					
	cmsnd 100-16, material in layers					
1-2	ditto, layers 30-45 cm thick, clasts					
	are slightly larger					
2-3	ditto, clasts 5-15cm, layers 30-45cm					
	mcsnd 100-16 with pebs less than 1 cm					
3-4	layers of cmsnd and fgrvl, layers 10-					
	15 cm. grvl less than 0.5 cm (open)					
4-5	ditto to 4.7 m then layered cmsnd and					
	vfgrvl, clasts less than 1.0 cm					
5-6	ditto					
6-7	layered snd. and grvl. clasts 2-15 cm.					
	layers 10-20 cm. cmsnd 100-16					
7-8	layered mcsnd and grvl, layers 5-20cm					
	clasts 5-25 cm.					
8-9	layered cmsnd and grvl, layers 5-15 cm					
	snd 200-16					
9-10	ditto					
10-11	layered msnd and grvl, layers 4-6 cm	P				
	rfsl at 10.7 m bedrock or boulders					
	piezometer installed at 10.7 m					

DRILL LOG

DATE Nov/5/86 DRILL HOLE # 16 DRILL TYPE H.S. RECORDER G.G.

STATION Richer Pit, south pit south west corner, 2-3.5 m removed
UTM 4927 50076

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	+25% gravel in layers, clasts 2.5-12cm					
	msnd 200-30 some 16		wt			
1-2	ditto to 1.5m and then mainly sand in					
	layers, clasts 2.5-10cm, msnd 200-30					
2-3	mainly msnd, 200-30 some 16, smaller					
	fsnd layers 200-100					
3-4	mainly sand, clasts 2.5-6 cm. layers					
	5-15 cm. msnd, 200-30 some 16					
4-5	ditto, less than 10 % stn., fmsnd					
	200-30					
5-6	ditto					
6-7	ditto					
7-8	ditto					
8-9	ditto					
9-10	ditto, occasional clast less than 3cm					
10-11	ditto to 10.7 then layered cmsnd and					
	fgrvl, clasts 1.5-3cm, snd 50-16			1	7-26-27	10.7
11-12	+25 grvl, very large grvl layer at					
	11.3 m, then layers of grvl and csnd					
	pulled augers at 12.2 m	p				
	piezometer installed at 12.2 m					

DRILL LOG

DATE Nov/6/86 DRILL HOLE # 17 DRILL TYPE H.S. RECORDER G.G.

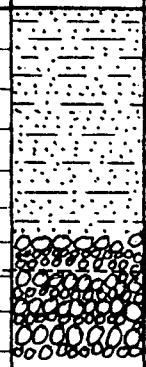
STATION East of Berwick, 1 km south of DH 16, UTM 4928 500585
on east side of gravel road

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	oxidized fsnd. 200-50					
1-2	ditto to 1.5 m then vfsnd 200-100					
2-3	ditto					
3-4	fsnd, msnd layers with occasional stn.					
	fsnd 200-100, msnd 200-30 stn 1-3 cm.					
4-5	ditto water table at 4.7m					
				1	8-15-21	4.6
5-6	mfsnd 200-50 some 30 and occasional					
	stn. 1-3.5 cm.					
6-7	msnd 200-30, some 16 very dense					
7-8	ditto to 7.6 m then fmsnd 200-30					
				2	10-18-26	7.6
8-9	ditto					
9-10	vcsnd and grvl layers, pebs less than					
	5 cm. layers 10-25 cm.					
10-11	ditto					
				3	9-15-17	10.7
11-12	ditto to 11.7 and then till					
	piezometer installed at 10.7m					

DRILL LOG

DATE Nov/6/86 DRILL HOLE # 18 DRILL TYPE H.S. RECORDER G.G.

STATION East of Berwick, 194 m south of DH 17, on east side of road, UTM 4928 500585

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	oxidized fsndand silt layers, snd 200-					
	100					
1-2	ditto fewer silt layers					
2-3	ditto to 2.9 m then boulders					
3-4	grvl and boulder layers, water table					
	3.4 m;					
4-5	ditto; rfsl at 4.6 m					

DRILL LOG

DATE Nov/6/86 DRILL HOLE # 19 DRILL TYPE H.S. RECORDER G.G.

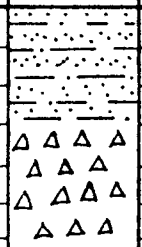
STATION On east-west road, north east of Berwick, just south of Duff McMonagle UTM 4931 50048 South side of road

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	road fill					
1-2	ditto to 1.5m then rhythmites of silt,					
	clay and sand					
2-3	ditto					
3-4	few snd layers, mainly rhythmites of					
	clay and silt, red oxidized silt layers					
4-5	ditto					
5-6	ditto to 5.3 m then stny layers,					
	clasts 1-5cm.					
6-7	mainly rhythmites of silt and clay					
7-8	ditto to 7.6 m then till					
8-9	ditto, pulled augers at 9.1m					

DRILL LOG

DATE Nov/6/86 DRILL HOLE # 20 DRILL TYPE H.S. RECORDER G.G.

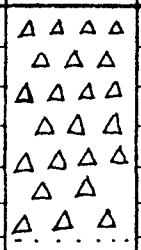
STATION On east-west road, con. 6 lot 16, Finch Tp.; 210 m west of DH 19 UTM 4930 50048; south side of road

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	rhythmites of sand and silty clay					
	fsnd 200-100					
1-2	ditto to 1.5 m, then till					
2-3	till, pulled augers at 3m					

DRILL LOG

DATE Nov/6/86 DRILL HOLE # 21 DRILL TYPE H.S. RECORDER G.G.

STATION 1 km west of DH 20 UTM 4922 50042

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	till					
1-2	till					
2-3	till					
3-4	rhythmites of fsand, silt and clay					
4-5	rhythmites of silt and clay					
5-6	ditto, pulled augers at 6.1m					

DRILL LOG

DATE Nov/7/86 DRILL HOLE # 22 DRILL TYPE H.S. RECORDER G.G.

STATION Sandtown, Onsabruck; Sullivan/Art Blair Pit; in south portion of pit, UTM 4937 49325

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	small cmsnd and fgrvl layers; snd 200					
	-16, grvl less than 5 cm.					
1-2	ditto to 1.5m then layered c and fsnd					
	shells found in fsnd, 200-100					
2-3	ditto, layers 5-15cm					
				1	9-14-12	3.0
3-4	mainly vfsnd, close to silt, many					
	shells found,					
4-5	ditto to 4.6 m then rhythmites of					
	fsnd, silt and clay			2	13-34-	4.6
5-6	ditto, layers 2-7 cm, clay layers				37	
	5mm, snd 200-100					
6-7	ditto, many shells					
7-8	ditto					
				3	0-5-9	7.6
8-9	ditto					
9-10	ditto to 9.5 m, then stn layers					
	bedrock at 9.7m					

DRILL LOG

DATE Nov/7/86 DRILL HOLE # 23 DRILL TYPE H.S. RECORDER G.G.

STATION A. Blairs/Sullivans property, con. 8 south of the paved road
In portion east of barn and north of drain UTM 4933 49936

5.0 metres removed

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered fgrvl and fsnd, snd 200-100					
	grvl is less than 5 cm.					
1-2	ditto to 1.4 m, thenwatertable and					
	mfsnd with shells					
2-3	small clay layers at 2.0 m, layers 1-		S			
	2 cm., shells present, fsnd at 2.7m			1	17-35-45	3.0
3-4	mfsnd, 200-100, some 50, no shells					
	present					
4-5	ditto to 4.6m, then vsmall clay layers					
	clay layers less than 3mm			2	3-14-15	4.6
5-6	ditto to 5.1 m then mfsnd 200-50 no					
	shells					
6-7	ditto			3	9-29	6.1
7-8	ditto					
8-9	ditto					
9-10	ditto			4	17-30	9.1
10-11	ditto, no shells					
11-12	ditto to 11.6m then +25% grvl, clasts					
	2-20cm.					
12-13	ditto	P				
13-14	ditto to 13.7m. then pullled augers					
	piezometer installed at 12.2m					

DRILL LOG

DATE Nov/7/86 DRILL HOLE # 24 DRILL TYPE H.S. RECORDER G.G.

STATION Art Blairs property, southern portion east of DH 23
UTM 4935 49936 4-5m removed

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered mfsnd and fgrvl, pebs less					
	than 5 cm. snd 200-50 some 30, wt 0.5					
1-2	ditto,					
2-3	ditto					
3-4	layered silty-clay, fsnd and fgrvl					
	layers, clasts less than 5cm.					
4-5	ditto to 4.6m then vfsnd and silt					
	rhythmites, snd 200-100			1	3-4-34	4.6
5-6	ditto					
6-7	ditto to 6.7 m then 0.2 m of dense					
	clayey-silt, then vfsnd 200-100					
7-8	layered silt and vfsnd, very dense					
	snd 200-100, dense clayey silt at 7.3			2	20-28-41	7.6
8-9	layered silty clay and vfsnd					
9-10	ditto to 9.8 m then grvl					
10-11	layered grvl, clasts 5-25 cm.					
	bedrock at 11.1m.			3	15-12-33	10.7

DRILL LOG

DATE Nov/10/86 DRILL HOLE # 25 DRILL TYPE H.S. RECORDER G.G.

STATION Sandtown, middle portion of Art Blairs property, north part of con. 8, Osnabruck Tp. 4m face, 100m east of 'A' stockpile

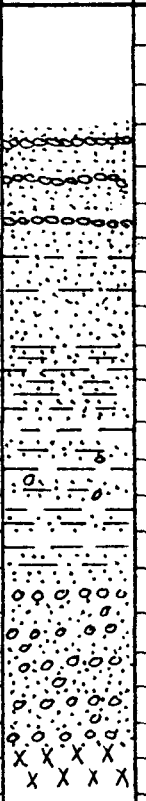
UTM 4934 49947

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	+15 layered cmsnd and fgrvl, snd 100-16, clasts < 5cm. wt at 0.5m					
1-2	ditto					
2-3	ditto					
3-4	ditto, clasts < 3cm					
4-5	ditto to 4.6 m then layered fsnd and silt layers, layers 1-5cm					
5-6	ditto					
6-7	ditto, except that the silt layers are <5mm			1	8-14-22	6.1
7-8	mainly fsnd 200-100, some 50, very few silt layers, layers 2-10 cm					
8-9	ditto					
9-10	vcsndand fgrvl layers, snd 100-16, +25% grvl layers, clasts < 7 cm.			2	20-42-24	9.1
10-11	ditto					
11-12	ditto to 11.9 m then bedrock					
		p	x x x x x x x x	3	------	12.2
	piezometer installed at 11.9 m					

DRILL LOG

DATE Nov/10/86 DRILL HOLE # 26 DRILL TYPE H.S. RECORDER G.G.

STATION Art Blairs Property, 100 m west of DH 25, 2m in relief above DH 25, UTM 4934 49947

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fill, crushed grvl.					
1-2	ditto to 1.5m then layered mfsnd and fgrvl, clasts 2-8 cm, layers 5-15cm					
2-3	ditto					
3-4	layered fsnd,msnd layers; a few small silty-clay layers,					
4-5	ditto to 4.6m, then layered silty-sand and very small clay layers					
5-6	ditto, fsnd 200-100 some 50 clay layers < 1.5cm.					
6-7	ditto, very dense sand, occasional stn. clast <4 cm, mfsnd 200-50			1	10-16-28	6.1
7-8	ditto to 7.6 m then +20% stn with the clasts < 4cm					
8-9	ditto, fmsnd 200-30, very little 16 layers 5-20 cm.					
9-10	ditto, rfsl at 9.8 m; probably bedrock					

DRILL LOG

DATE Nov/11/86 DRILL HOLE # 27 DRILL TYPE H.S. RECORDER G.G.

STATION Sandtown area. Art Blairs property, east of dump in Southern portion. UTM 4926 49947, 4-5m removed

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	mfsnd, shell present, snd 200-50					
	watertable at 0.5 m					
1-2	ditto to 1.5, then finer snd, 200-		S			
	100, shells present					
2-3	ditto					
3-4	mcsnd, 100- 16, with layers of fgrvl					
	clasts < 5mm, grvl at 3.7m					
4-5	+20% grvl, clasts <5 cm, snd 100-16					
				1	1-8-47	4.6
5-6	ditto					
6-7	+ 10_ grvl, msnd 200-16, pebs W 5mm					
	small silt layers, <3mm					
7-8	ditto to 7.6m then vcsnd and +15%					
	grvl, clasts < 5mm, snd 50-16			2	11-20-	7.6
8-9	ditto, clasts 2-10 cm.	P			21	
9-10	vcsnd, 50-16, +15_ grvl. clasts 2-					
	15 cm.					
10-11	ditto					
11-12	ditto, bedrock at 11.4 m.		X X X X X X X			
	piezometer installed at 8.5 m.					

DRILL LOG

DATE Nov/11/86 DRILL HOLE # 28 DRILL TYPE H.S. RECORDER G.G.

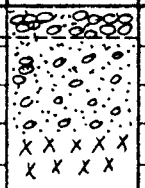
STATION Sandtown area. Art Blair's property, 15 m south of pond
4.5 m removed, UTM 4935 50948

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered msnd and stns, <10% stn,					
	clasts < 5mm, snd 200-16					
1-2	ditto					
2-3	ditto					
3-4	mcsnd 100-30 some 15, pebs < 5mm					
4-5	ditto					
	at 4.6m 40-75-118-107-137 per 15cm.			1	1-17-26	4.6
5-6	ditto					
6-7	ditto, very dense sand					
7-8	ditto					
8-9	ditto, pulled augers at 9.1m					

DRILL LOG

DATE Nov/11/86 DRILL HOLE # 29 DRILL TYPE H.S. RECORDER G.G.

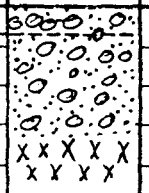
STATION On Finch Tp. side of the Sandtown property, 15m from where rock is showing on the surface, UTM 4936 49958

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	+25 grvl, clasts 5-30 cm	---				
	water table at o.4m					
1-2	ditto to 1.8m and then bedrock					

DRILL LOG

DATE Nov/11/86 DRILL HOLE # 30 DRILL TYPE H.S. RECORDER G.G.

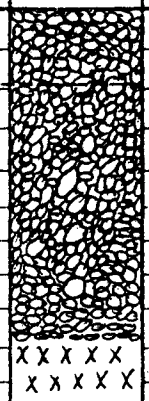
STATION 30m north of DH 29, bedrock on surface within 6m
UTM 4936 49958

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	grvl-boulders, clasts 10-40cm.					
	snd 100-16, watertable at 0.3m					
1-2	ditto to 1.8 m then bedrock					

DRILL LOG

DATE Nov/11/86 DRILL HOLE # 31 DRILL TYPE H.S. RECORDER G.G.

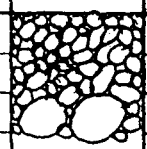
STATION Far north corner of pit where DH 29and 30 were done,
No ridge is obvious and the ground is flat, UTM 4936 49963

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	grvl-boulders, clasts 10-40 cm.					
	watertable at 0.9 m.	---				
1-2	ditto					
2-3	ditto					
3-4	ditto, clast up to 50 cm					
4-5	ditto to 4.4m and then bedrock					

DRILL LOG

DATE Nov/11/86 DRILL HOLE # 32 DRILL TYPE H.S. RECORDER G.G.

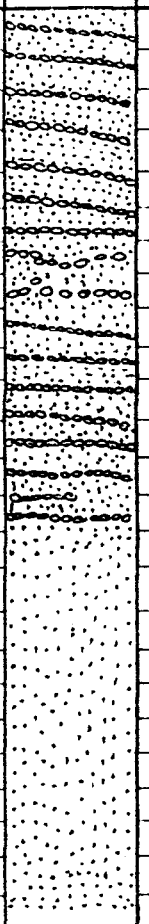
STATION Centre of ridge that runs through the property indicated in DH29 to 31 UTM 4935 49966

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	grvl boulders					
	clasts up to 65 cm					
1-2	ditto to 1.5 m. and rfsl too coarse					

DRILL LOG

DATE Nov/11/86 DRILL HOLE # 33 DRILL TYPE H.S. RECORDER G.G.

STATION Maple Ridge area. Osgoode Pit, east side where foresets are found. UTM 4778 49933 7.0 m face

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	small layers of snd and grvl, clasts					
	3-5 cm. snd 200-16					
1-2	ditto					
2-3	ditto					
3-4	+25% stn, clasts 2-10cm					
	watertable at 4.0 m					
4-5	fgrvl and fmsnd layers, snd 200-30					
	grvl < 5cm					
5-6	ditto					
6-7	layered mfsnd and fgrvl, < 5%stn,					
	snd 200-50 some 30 clasts <5cm					
7-8	very dense fsnd, 200-100 some 50					
8-9	ditto					
9-10	vfsnd, 200-100					
10-11	ditto					
11-12	ditto, slightly coarser snd. 200-50					
	pulled augers at 12.2m					

DRILL LOG

DATE Nov/11/86 DRILL HOLE # 34 DRILL TYPE H.S. RECORDER G.G.

STATION Maple Ridge Body, Osgoode pit, west side, by stockpile, 4 metres has been removed. UTM 4776 49933

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	rhythmites of fsnd and silty-clay					
	watertable at 0.9m					
1-2	ditto					
2-3	ditto, snd 200-100, layers 2-6cm.					
3-4	ditto					
4-5	ditto					
5-6	ditto to 5.2m then layered cmsnd and					
	fgrvl, snd 100-16, clasts < 5cm					
6-7	ditto, layers 5-25cm.			1	8-38-29	6.1
7-8	layered msnd and fgrvl, <15% stn, snd					
	100-30, clasts <5cm.					
8-9	ditto to 8.2m, then layered msnd and					
	fsnd, 100-30 and 200-100					
9-10	ditto			2	5-11-11	9.1
10-11	ditto to 10.7 and then saturated fsnd					
	200-50, some 30					
11-12	coarser snd, 100-16, small layers of					
	fgrvl, clasts <5mm					
12-13	ditto, layers 5-15cm.			3	5-11-14	12.2
13-14	ditto					
14-15	ditto to 14.3, then till					
15-16	till			4	7-2-19	15.2
16-17	till					
17-18	ditto to 17.7m, then rfsl, probably			5	------	17.2
	bedrock					

DRILL LOG

DATE Nov/12/86 DRILL HOLE # 35 DRILL TYPE H.S. RECORDER G.G.

STATION Maple Ridge Body. Osgoode Pit, bottom of front east portion, east of scales, 6.5m face UTM 4778 49932

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	silty-sand					
1-2	ditto to 1.5m then +20% grvl and csnd,					
	in layers, snd 100-16, clasts to 10cm					
2-3	ditto, but clasts are larger, up to					
	25cm.					
3-4	vcsnd and fgrvl in layers, snd 100-16					
	clasts 5-15cm, layers 5-30cm					
4-5	ditto, +20% grvl, layers 5-30cm.					
				1	5-40-4	4.6
5-6	ditto					
6-7	ditto to 6.1m then <10% stn and msnd					
	layers, snd 200-30	P				
7-8	ditto					
				2	11-24-40	7.6
8-9	ditto, pulled augers at 9.1m					
	piezometer installed at 6.7m					

DRILL LOG

DATE Nov/12/86 DRILL HOLE # 36 DRILL TYPE H.S. RECORDER G.G.

STATION Maple Ridge Body. Monast Pit, north of tracks, just west of trees, on pit floor(south side of pit), 1.5m face UTM 4778 499385

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	+35%stn, and vcsnd in layers, snd 100-					
	16, clasts 2-5cm, snd coarsens downw.					
1-2	ditto, but clasts are larger 2-20cm.					
	layers 5-30cm					
2-3	ditto, water table at 2.4m.					
3-4	ditto					
4-5	ditto to 4.3m. then msnd, 200-30, some					
	16 grvl layers at 5.0m			1	3-5-22	4.6
5-6	Layered +25% grvl and csnd, layers 5-					
	25cm, clasts 2-8cm, snd 100-16					
6-7	layered csnd and fgrvl, clasts <5mm					
	and snd 100-16					
7-8	ditto to 7.6m , then layered msnd and					
	fgrvl, <10% stn, clast<1cm, 200-16 snd			2	8-9-13	7.6
8-9	ditto, layers 5-20 cm.					
9-10	<5 stn, fmsnd 200-30 some 16, clasts					
	<5mm					
10-11	ditto					
				3	2-2-7	10.7
11-12	ditto to 11.1 then grvl layers					
12-13	ditto					
13-14	ditto to 13.7 and then pulled augers					

DRILL LOG

DATE Nov/13/86 DRILL HOLE # 37 DRILL TYPE H.S. RECORDER G.G.

STATION Maple Ridge Body. Monast property, north of pit in unopened area, just south of the fence line. UTM 4777 49939

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	rhythmites of clayey-silt to 0.9m.,					
	then layered +25% grvl, clasts 2-8cm					
1-2	ditto, layered snd and grvl, clasts 2-					
	8cm cmsnd 100-16, layers 5-25cm.					
2-3	ditto					
3-4	ditto					
4-5	ditto					
5-6	ditto, pulled augers at 6.1m.					
		p				
	piezometer installed at 6.1m.					

DRILL LOG

DATE Nov/13/86 DRILL HOLE # 38 DRILL TYPE H.S. RECORDER G.G.

STATION Maple Ridge Body. Property east of Monast's property, north of tracks, within trees. On pit floor UTM 47795 49939

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered msnd and +25% grvl, snd 200-30					
	clasts 2-5cm., layers 5-25cm.					
1-2	ditto					
2-3	ditto, water table at 2.4m.					
3-4	ditto except the grvl is +20%					
4-5	ditto to 4.1m. then msnd, 200-30					
5-6	ditto to 5.2m then layered +20% grvl					
	and msnd layers to 5.5m, then sm. till					
6-7	fsnd layers to 6.7m., 200-100; then	p		1	17-41-39	6.1
	csnd and fgrvl layers, 100-16 and <5cm					
7-8	vcsnd and fgrvl layers, snd 100-16 and					
	clasts <2.5cm, layers 2-10cm.					
8-9	ditto					
9-10	mainly msnd and vcsnd layers, 200-30			2	11-45-53	9.1
	and 100-16, layers 5-25cm (c. thicker)					
10-11	ditto to 10.7m. then layered +20%					
	fgrl and csnd layers, 100-16, stns<2.5cm					
11-12	ditto					
12-13	ditto, pulled augers at 12.2m.					
	piezometer installed at 6.1m					

DRILL LOG

DATE Nov/13/86 DRILL HOLE # 39 DRILL TYPE H.S. RECORDER G.G.

STATION Monast Property, Maple Ridge. North of tracks, west portion of property. 50 m north of CPR tracks. UTM 4774 49937

DEPTH	DESCRIPTION (Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	clayey-silt					
1-2	ditto, few stns, < 5cm					
2-3	ditto					
3-4	ditto,					
4-5	ditto to 4.7m, then vfsnd 200-100 with occasional stn., clasts < 5cm.					
5-6	ditto					
6-7	ditto			1	18-25-32	6.1
7-8	ditto					
8-9	ditto to 8.5m. then till					
9-10	till					
10-11	clayey-silt till to 10.7 and then pulled augers			2	39-72-rfsl	10.7

DRILL LOG

DATE Nov/13/86 DRILL HOLE # 40 DRILL TYPE H.S. RECORDER G.G.

STATION Monast Property, Maple Ridge. Front pit, east side, 3-4 m. removed. East of pit access road. UTM 4779 49936

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	silty-clay, occasional stn, clasts					
	<5cm					
1-2	ditto, few stn. layers which are					
	<2.5cm.					
2-3	ditto, water table at 2.9m.					
3-4	layered fsnd and mcsnd; fsnd 200-100					
	csnd 100-16, layers 5-15cm.					
4-5	ditto					
				1	15-24-30	4.6
5-6	ditto					
6-7	ditto					
7-8	layered fsnd and csnd, fsnd 200-100					
	csnd 100-16,			2	4-3-2	7.6
8-9	ditto to 8.2m. then fsnd, 200-100 some					
	50					
9-10	ditto					
10-11	ditto to 10.7, then fmsnd 200-30					
				3	5-6-12	10.7
11-12	ditto					
12-13	ditto to 12.2 and then pulled augers			4	3-8-12	12.2

DRILL LOG

DATE Nov/13/86 DRILL HOLE # 41 DRILL TYPE H.S. RECORDER G.G.

STATION Monast Property, Maple Ridge. Southwest corner, just north of barn; 3.5-4m. face. UTM 4778 499325

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	silty-sand; 200-100					
1-2	ditto to 1.5m., thenbasically the same except for small silt layers					
2-3	ditto, silt layers < 1cm.					
3-4	ditto, water table at 3.2m.					
4-5	ditto to 4.6m., then fsnd 200-100 some 50,30			1	13-23-22	4.6
5-6	ditto, occasional stn. <5 cm.					
6-7	ditto					
7-8	ditto					
				2	1-1-10	7.6
8-9	ditto to 9.1m and then pulled augers			3	7-9-3	9.1
		P				
	piezometer installed at 9.1m.					

DRILL LOG

DATE 87/12/11 DRILL HOLE # 42 DRILL TYPE H.S. RECORDER G.G.

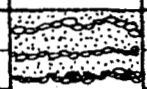
STATION Maple Ridge property; Osgoode sand and gravel pit; north of high school; UTM 4775 499325 bottom of pit, 6 m face

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fine sand and m to csand layers, layers 10 to 20 cm.					
1-2	ditto, sand 200 -16, clasts < 3 cm					
2-3	ditto			1	18-19-22	3.0
3-4	ditto					
4-5	ditto, large stn. layer at 4.8 m clasts 5-10 cm					
5-6	ditto except that fine sand layers are much larger, sand 200-100			2	4-14-22	6.1
6-7	msand and fine sand layers, layers 10-25 cm thick					
7-8	ditto					
8-9	ditto to 9.5 m then very dirty sediment, tillish			3	4-4-13-18	9.1
9-10	till 9.9 m thenrfsl.		△△△△△			

DRILL LOG

DATE 87/12/1 DRILL HOLE # 43 DRILL TYPE H.S. RECORDER G.G.

STATION Maple Ridge property, Osgoode sand and gravel pit behind high school, northwest corner, 4-5 m face, UTM 47735 49933

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layer fgrvl and medium to fine sand to 0.9 m then till					
1-2	till					
2-3	till					

DRILL LOG

DATE Nov/14/86 DRILL HOLE # 44 DRILL TYPE H.S. RECORDER G.G.

STATION Maple Ridge Body, pit south of Highway # 43. Middle, west portion of Pit, 3m. face. UTM 447775 49930

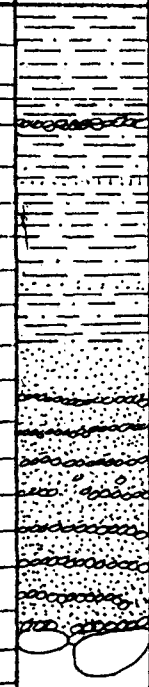
DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fsnd, 200-100; type B ripples, few small silt layers (drapes) <1.5cm.					
1-2	ditto, except that there are a few small csnd layers, <1cm 100-16					
2-3	ditto					
3-4	ditto, water table at 3.8m.					
4-5	ditto					
5-6	ditto			1	4-8-11	4.6
6-7	ditto					
7-8	ditto					
8-9	ditto			2	5-16-29	7.6
9-10	ditto					
10-11	ditto					
11-12	ditto			3	6-1-3	10.7
12-13	ditto to 12.5m. then till					
13-14	ditto to 13.7 and then pulled augers					
	piezometer installed to 6.1m			4	69-110	13.7

DRILL LOG

DATE 87/12/10 DRILL HOLE # 45 DRILL TYPE H.S. RECORDER G.G.

STATION South of the Boyne, 15m west of the north/south line rd.

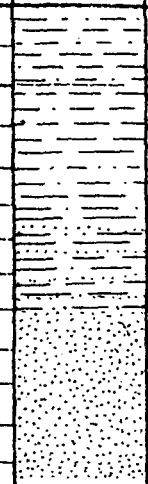
UTM 4777 49946

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	rhythmically bedded silt and clay					
1-2	ditto to 1.5m then small stn. layer, clasts 1-3 cm, then rhythmites					
2-3	rhythmites, smallfine sand layer at 2.2 m					
3-4	rhythmites, small sand layer at 3.7m					
4-5	ditto to 4.5 m then fmsand					
5-6	medium sand and small fine stn. layers clasts 2-10 cm					
6-7	mcsand and medium to fine gravel, layers 10 -30 cm			1	3-10-10	6.1
7-8	ditto					
8-9	ditto to 8.2 m then pulled out because it was too coarse					
	piezometer installed to 6.1m					

DRILL LOG

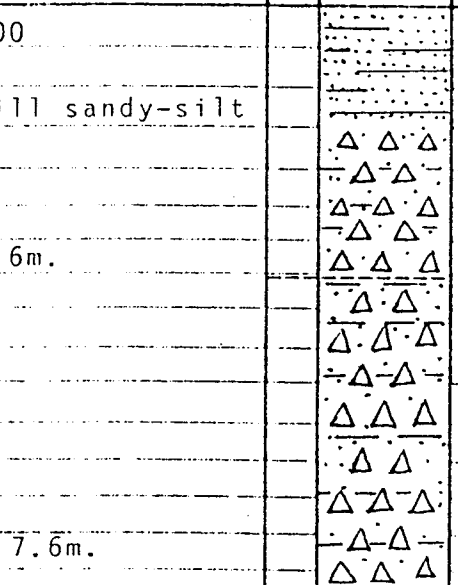
DATE 87/12/10 DRILL HOLE # 46 DRILL TYPE H.S. RECORDER G.G.

STATION 18 m west of DH 45

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	rhythmites of silt and clay					
1-2	ditto					
2-3	ditto, sand layers present at 2.8 m					
3-4	sand layers become more frequent, still mainly silt and clay					
4-5	mainly medium to very fine sand					
5-6	ditto to 6.2 m and then pulled augers					

DATE Nov/14/86 DRILL HOLE # 47 DRILL TYPE H.S. RECORDER G.G.

STATION North of the Maple Ridge Body. On farmers access road, south of Boyd, just south of the farm to the west. UTM 4777 499485

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	tpsl, silty sand, 200-100					
1-2	ditto to 1.4 m., then till sandy-silt till					
2-3	ditto					
3-4	ditto, water table at 3.6m.					
4-5	ditto					
5-6	ditto,					
6-7	ditto					
7-8	ditto, pulled augers at 7.6m.					

DRILL LOG

DATE Nov/14/86 DRILL HOLE # 48 DRILL TYPE H.S. RECORDER G.G.

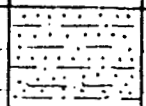
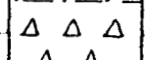
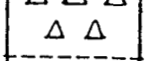
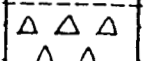
STATION North of the Maple Ridge Body. On the farmers access road, south of Boyd, west of the farm to the west. UTM 4777 499485, 200n of DH 42

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	silty sand to 0.8 then sandy silt till					
1-2	till					
2-3	ditto					
3-4	ditto					
4-5	ditto to 4.6m. and then pulled augers					

DRILL LOG

DATE Nov/17/86 DRILL HOLE # 49 DRILL TYPE H.S. RECORDER G.G.

STATION Farm east of the Winchester dump, west of Boyd.
UTM 4771 49948

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	rhythmites of fsnd and silt, snd 200-100, layers 1-3cm.					
1-2	ditto to 1.2m. then a sandy-silt till					
2-3	till					
3-4	ditto, watertable at 3.2m.					
4-5	ditto to 4.6 m. and then pulled augers			1	50-69	4.6

DRILL LOG

DATE Nov/14/86 DRILL HOLE # 50 DRILL TYPE H.S. RECORDER G.G.

STATION Provost Pit, south of Morewood. UTM 4766 49999.6m removed

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	+30% layered mfgrvl and csnd, snd 100-16, clasts 2-8cm.;wt at 0.4m.					
1-2	ditto, layers 5-30 cm.					
2-3	ditto					
3-4	ditto					
4-5	ditto					
5-6	ditto					
6-7	ditto	p				
7-8	ditto to 7.6m. and then pulled augers					
	piezometer installed at 6.1m.					

DRILL LOG

DATE Nov/17/86 DRILL HOLE # 51 DRILL TYPE H.S. RECORDER G.G.

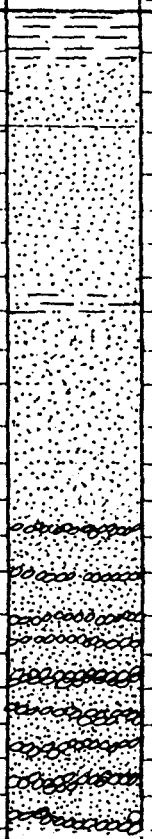
STATION On the second hill west of Morewood. On the top of the hill 300m. north of the barn. UTM 4757 500155

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	Tpsl, layered mfgrvl and cmsnd, Layers 5-20cm and clasts 2-6cm, snd 200-16					
1-2	ditto					
2-3	ditto					
3-4	ditto, many of the clasts are shale					
4-5	ditto					
5-6	ditto, the sand is very dense,			1	12-29-23	4.6
6-7	the sand is not as coarse, 200-30, some 16					
7-8	ditto, layers 5-10cm. water table at 7.8m.					
8-9	ditto			2	17-23-21	7.6
9-10	layered fsnd and cmsnd, 200-100 and 100-16, layers 2-8cm.					
10-11	ditto					
11-12	layered +20% mgrvl and cmsnd, layers 10-20cm. , snd 100-16			3	11-15-54	10.7
12-13	ditto					
13-14	ditto to 13.4m. then very dense layers of msnd and diamicton			4	26-29-73	13.6
14-15	layered fsnd and till, layers 5-10cm.					
15-16	ditto, the fsnd layers are <1cm and the till layers are 5-15cm.					
16-17	ditti to 16.6m. and then mainly a sandy-silt till			5	rfsl	16.8
17-18	till					
18-19	ditto to 18.3 and then pushing 3000 psi and then pulled augers					

DRILL LOG

DATE 87/12/16 DRILL HOLE # 52 DRILL TYPE H.S. RECORDER G.G.

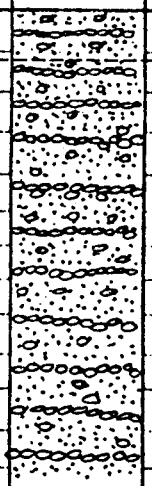
STATION West of DH 51, at base of hill on pit floor

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	rhythmically bedded clay to 0.6m then fine sand layers					
1-2	layered fine and medium sand, layers 10-15 cm					
2-3	ditto					
3-4	ditto to 3.7 m then 0.30 m silt layer then medium to fine sand layers					
4-5	ditto, fine and medium sand layers					
5-6	ditto					
6-7	ditto to 6.8 m, then m-c sand and f gravel, layers 10 25 cm.					
7-8	ditto					
8-9	ditto					
9-10	ditto					
11-12	ditto to 12 m then rfsl					

DRILL LOG

DATE Nov/18/86 DRILL HOLE # 53 DRILL TYPE H.S. RECORDER G.G.

STATION Dagenais Property, north of Morewood. Southwest corner of property, just east of pond. 4-5m. removed; UTM 4762 50039

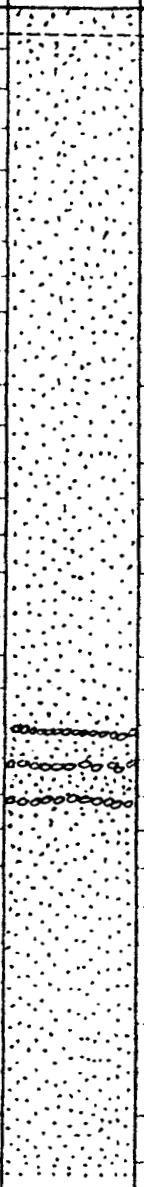
DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered cmsnd and fmgrvl. snd 200-16, clasts < 5cm. abundance of shale					
1-2	ditto, the layers are 5-15cm					
2-3	ditto					
3-4	mcsnd and small fgrvl layers, clasts < 6cm. snd 100-16			1	10-15-17	4.6
4-5	ditto					
5-6	ditto, pulled augers at 6.1m.					

DRILL LOG

DATE Nov/18/86 DRILL HOLE # 54 DRILL TYPE H.S. RECORDER G.G.

STATION Dagenais property, north of Morewood. East side of excavated area, just north of large pond, yet south of smaller pond.

UTM 4763 50039

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fsnd, 200-50					
1-2	ditto, slightly coarser sand, 200-30					
2-3	ditto					
3-4	mfsnd 200-30 mainly 200-50					
4-5	ditto to 4.6 and then msnd 200-30					
5-6	ditto					
6-7	ditto					
7-8	ditto					
8-9	ditto					
9-10	ditto to 9.4m., then layered cmsnd and fgrvl, clasts <5cm, snd 211-16					
10-11	ditto to 10.7m., then msnd 200-30					
11-12	msnd, 200-30					
12-13	ditto					
13-14	ditto to 13.7 and then fsnd, 200-100 some 50.					
14-15	ditto					
15-16	ditto to 15.2 and then pulled augers					

DRILL LOG

DATE Nov/19/86 DRILL HOLE # 55 DRILL TYPE H.S. RECORDER G.G

STATION Dagenais property, north of Morewood. Southeast corner, in open field, adjacent to main ridge. UTM 4763 500385

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	sndy-silt rhythmites to 0.8m., then fsnd. snd 200-100, wt at 0.8m.					
1-2	ditto to 1.5m. then vfsnd and					
	and occasional stn, snd 200-50, <3%st					
2-3	ditto, the sand is slightly finer, 200-100 with some 50					
3-4	ditto					
4-5	ditto					
5-6	ditto					
6-7	ditto					
7-8	ditto					
8-9	ditto					
9-10	ditto					
10-11	ditto					
11-12	ditto					
12-13	ditto to 12.3m. then layered fgrvl, fsnd					
13-14	ditto to 13.2m. then sandy-silt till					
14-15	till					
15-16	ditto to 15.2 and then pulled augers					

DRILL LOG

DATE Nov/19/86 DRILL HOLE # 56 DRILL TYPE H.S. RECORDER G.G.

STATION Dagenais property, north of Morewood. By pond on the mid-west side. Southwest of the scales. UTM 47625 50040

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered csnd and mfgrvl. clasts <5cm and snd 100-16, layers 10-25cm.					
1-2	ditto					
2-3	ditto					
3-4	ditto					
4-5	ditto, pulled augers at 4.6m	p				
	piezometer installed at 3.8m.					

DRILL LOG

DATE Nov/20/86 DRILL HOLE # 57 DRILL TYPE H.S. RECORDER G.G.

STATION North of the Embrun water supply. By blue barn, on east side of the road. UTM47565 50092

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	brown oxidized clay, stiff and dry					
1-2	ditto to 1.8m. thensaturated layered brown and grey clay, wt at 1.7m.					
2-3	ditto. layers 2-5cm					
3-4	ditto, layers 2-6cm.					
4-5	ditto to 4.6m. and then the clay is predominantly grey, small <1cm brwn					
5-6	grey clay, small <1cm. brown layers					
6-7	ditto					
7-8	ditto					
8-9	ditto, the brown layers are rare and <0.5cm.					
9-10	ditto					
10-11	ditto					
11-12	ditto to 11.4m. then layered mfgrvl and csnd, TOO-16, clasts 2-10cm.					
12-13	ditto	p-				
13-14	ditto					
14-15	ditto					
15-16	ditto, pulled augers at 15.2m.					
	piezometer installed at 12.2m.					

DRILL LOG

DATE 87/12/15 DRILL HOLE # 58 DRILL TYPE H.S. RECORDER J.B.

STATION northwest of Embrun, east of Brisson, on north side of Tp. Rd.

UTM 4747 50164

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layer brown clay and silt					
1-2	ditto					
2-3	ditto to 2.4, then grey clay with small red layers					
3-4	ditto					
4-5	ditto					
5-6	ditto					
6-7	ditto, grey clay layers very large grey clay layers					
7-8	mainly grey clay and small silt layers					
8-9	ditto					
9-10	ditto					
10-11	ditto					
11-12	ditto					
12-13	ditto					
13-14	ditto					
14-15	ditto					
15-16	ditto					
16-17	ditto					
17-18	ditto					
18-19	ditto					
19-20	ditto to 19.4 m then msnd and fgrvl layers 15-20 cm					
20-21	ditto to 21.3, piez. installed					

DRILL LOG

DATE Nov/20/86 DRILL HOLE # 59 DRILL TYPE H.S. RECORDER G.G.

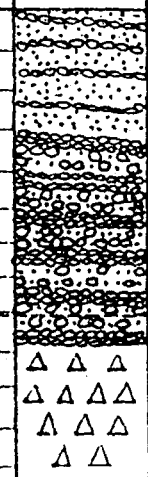
STATION Just north of Bearbrook, Cumberland Tp. 35m. east of main N/S road, on north side. UTM 4738 50263

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	Layered fgrvl and mcsnd. snd100-16, clasts <1.5cm					
1-2	ditto to 1.5m., then rhythmites of fsnd and clayey-silt					
2-3	ditto, layers <2.5cm.					
3-4	ditto					
4-5	ditto, water table at 4.9m.					
5-6	ditto to 5.3m. the vcsnd and fgrvl layers, snd 100-16, clasts <2cm					
6-7	ditto, layers 5-25cm.					
7-8	ditto to 7.9, then very large boulders or bedrock	P=	X X X X			
	piezometer installed at 6.9m.					

DRILL LOG

DATE Nov/20/86 DRILL HOLE # 60 DRILL TYPE 53 RECORDER G.G.

STATION North of Bearbrook, on gravel side road. 50 m east of DH 59.
UTM 4742 50264

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	cmsnd and mgrvl layers, clasts 4-10cm					
	snd 200-16, layers 5-30cm.					
1-2	ditto to 1.5m., then layered matrix					
	supported mgrvl and pea grvl layers.					
2-3	ditto, grvl <1cm and clasts within					
	matrix supported units 2-15cm.,					
3-4	ditto, sand in matrix-supported 200-					
	100					
4-5	ditto to 4.4 and then sandy-silt till					
	water table at 4.0m.					
5-6	till					
6-7	ditto to 6.1m. and then pulled augers					

DRILL LOG

DATE Nov/20/86 DRILL HOLE # 61 DRILL TYPE H.S. RECORDER G.G.

STATION East of Leornard, on road-side of leased Red Dragon Pit, UTM 4732 50300

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered fsnd and msnd, fsnd 200-100 msnd 200-30 some 16, layers 5-20cm.					
1-2	ditto to 1.5m., then mainly msnd with occasional stn., snd is oxidized					
2-3	ditto, snd 100-30, some 16					
3-4	fmsnd (planar x-beds) 100-30, little 16					
4-5	ditto			1	6-27-24	4.6
5-6	ditto					
6-7	ditto to 6.6m. thenlayered mfgrvl and cmsnd, clasts 2-8cm, snd 100-16					
7-8	ditto, layered, layers 3-7cm., small clasts (<5mm) within mcsnd.			2	9-18-19	7.6
8-9	ditto to 8.8m. then larger and coarser layers, clasts 5-10cm, snd 100-16					
9-10	ditto, pebs in snd layers <5mm					
10-11	larger and coarser layers, clasts 5-16, snd 50-16, layers 5-25cm., wt 10.1	p		3	17-8-12	10.7
11-12	ditto to 11.3, then boulders, clasts >10cm.					
12-13	ditto to 12.2 thenrfsl; either boulders or bedrock					
	piezometer installed at 11.0m.					

DRILL LOG

DATE Nov/21/86 DRILL HOLE # 62 DRILL TYPE H.S. RECORDER G.G.

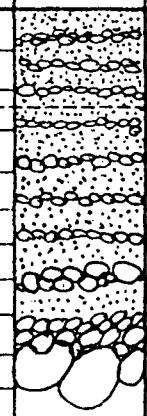
STATION Red Dragon Pit, south portion of property, in fan. By Water and Earth Science's DH 44, 5-6m. face UTM 4736 50276

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered cgrvl to 0.6m., then saturated msnd, 200-30, water table 0.9m.					
1-2	ditto to 1.5m. then layered oxidized csnd and fgrvl, 100-16, clasts <5mm					
2-3	ditto, layers 5-20cm.					
3-4	mcsnd and msnd layers, occasional stn. snd 100-16, 200-30, clasts.<1.5cm			1	8-12-18	3.0
4-5	ditto to 4.6m. then a 20 cm. mgrvl layer, then cand msnd layers					
5-6	csnd and msnd layers, layers 5-20cm.					
6-7	layered fmgrvl and csnd, clasts 3-10cm and snd 100-30 some 16, layers 15-30cm					
7-8	ditto, clasts larger, 5-15cm., snd 200-16					
8-9	ditto, clasts 5-20cm.					
9-10	ditto to 9.8m. then sandy-silt till					
10-11	till to 10.3m. then black shale (Billings Shale) cored 15cm.					

DRILL LOG

DATE Nov/24/86 DRILL HOLE # 63 DRILL TYPE H.S. RECORDER G.G.

STATION Red Dragon Pit, Cumberland Tp., North portion where esker portion has been excavated. UTM 4735 502815 7.5m. removed, Near W&E 42

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered mgrvl and csnd; clasts 5-15cm					
	snd 100-16; layers 5-20cm.					
1-2	ditto, +30% grvl. water table at 1.2m	---				
2-3	ditto					
3-4	ditto, but clasts are much larger;					
	clasts 5-40cm. (at least)					
4-5	ditto to 4.3m. then boulder rfsl.					

DRILL LOG

DATE Nov/24/86 DRILL HOLE # 64 DRILL TYPE H.S. RECORDER G.G.

STATION Red Dragon Pit, Cumberland Tp.. North portion where the esker ridge was (7.5m. removed) 20m. east of DH 63 UTM 4735 502815

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered cmsnd and mgrvl; clasts 3-20cm snd 100-16, layers 5-25cm.			-		
1-2	ditto, water table at 1.2m.					
2-3	ditto					
3-4	ditto					
4-5	ditto to 4.6m. then mainly cmsnd 200-16, occasional stn. clast 2-6cm.					
5-6	ditto, <5% stn.					
6-7	ditto to 6.7m. thenboulder rfsl.					

DRILL LOG

DATE Nov/24/86 DRILL HOLE # 65 DRILL TYPE H.S. RECORDER G.G.

STATION Red Dragon pit, Cumberland Tp. 2m. east of garage.
UTM4734 50280

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fill, was dumped in		f			
			f			
1-2	ditto to 1.5m, then fsnd 200-100,		f			
	small sandy-silt caps, wt at 1.4m.					
2-3	ditto					
3-4	ditto					
4-5	diamicton (till?)		Δ Δ Δ Δ Δ			
5-6	layered mfsnd and fgrvl, clasts < 6cm.					
	snd 200-30, some 16					
6-7	ditto, pulled augers 6.7m.					
		p				
	piezometer installed at 6.7m					

DRILL LOG

DATE Nov/24/86 DRILL HOLE # 66 DRILL TYPE H.S. RECORDER G.G.

STATION Loughlin Ridge, Redmond Pit. Sw corner by settling pond.
UTM 4570 49902

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fsnd 200-50, small sandy-silt caps					
	water table at 0.8m.					
1-2	ditto					
2-3	ditto					
3-4	ditto					
4-5	ditto					
				1	sunk	4.6
5-6	ditto					
6-7	ditto					
7-8	ditto	p				
8-9	ditto to 8.5m. then clay diamicton					
			△ △ △			
	piezometer installed to 7.0m		△ △			

DRILL LOG

DATE Nov/25/86 DRILL HOLE # 67 DRILL TYPE H.S. RECORDER G.G.

STATION Loughlin Ridge, Redmond Pit, NW corner. 60m. north of face.
UTM 45685 499055

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered mgrvl and cmsnd, a few shell					
	fragments, clasts 2-6cm. layers 6-15cm.					
1-2	ditto to 1.5m. snd 100-16, then ditto					
	except that layers are 5-10cm.					
2-3	ditto					
3-4	msnd and fmgrvl layers, snd 100-30,					
	layers10-15cm. clasts 5-15cm.					
4-5	ditto to 4.6m. then layered cmsnd and					
	fgrvl, snd 100-16, clasts < 1.5cm.			1	18-46-71	4.6
5-6	ditto, layers 5-20cm.					
6-7	layered msnd with small fgrvl layers,			2	15-21-27	6.1
	snd 100-30, some 16, clasts < 5mm.					
7-8	ditto, snd layers 5-20 cm, grvl layers					
	< 2cm.					
8-9	ditto					
9-10	ditto			3	13-16-18	9.1
10-11	ditto					
11-12	ditto to 11.6 then clay till, the till					
	has pebs <1.5cm.					
12-13	ditto			4	12-12-17	12.2
13-14	ditto to 14.0m					
14-15	mfsnd to 14.5m. snd 200-30, some 16,					
	pebs. <5mm then till					
15-16	clay-till with fsnd layers, <5cm.;			5	8-9-12-17	15.2
	snd 200-100 some 50					
16-17	ditto, sandy-clay-till					
17-18	ditto					
18-19	ditto, pulled augers at 18.3m.			6	19-17-20	18.3

DRILL LOG

DATE Nov/25/86 DRILL HOLE # 68 DRILL TYPE H.S. RECORDER G.G.

STATION Loughlin Ridge, Redmond Pit. New Section that was bought in the pine trees. On ski trail, 70m. north of rise. UTM 45785 49908

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	tpsl. red oxidized fsnd, 200-100,					
	small, <2cm silt layers					
1-2	ditto to 1.5m. then fmsnd 200-50, some					
	30					
2-3	ditto to 2.4m. then fsnd with silty					
	layers					
3-4	mfsnd, 200-50 some 30			1	6-7-9	3.0
4-5	ditto, few small stn layers with					
	clasts <1.5cm, layers 5-20cm.					
5-6	ditto, occasional small silt layer					
6-7	fmsnd, 200-50, some 30 and 16			2	9-18-18	6.1
7-8	ditto, small stn layers, clasts <5mm.					
	stn. layers <1.5cm					
8-9	ditto					
9-10	ditto, mainly sand, a few small stn.			3	12-16-31	9.1
	layers					
10-11	ditto					
11-12	ditto					
12-13	ditto			4	26-43	12.2
13-14	ditto, water table at 14.0m.					
14-15	ditto					
15-16	ditto			5	45-70	15.2
16-17	ditto					
17-18	ditto					
18-19	ditto, pulled augers at 18.3m					

DRILL LOG

DATE Nov/25/86 DRILL HOLE # 69 DRILL TYPE H.S. RECORDER G.G.

STATION Loughlin Ridge, Redmond property. Northeast corner, on top.
UTM 4572 499065

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered +30%fmgrvl and matrix-supported					
	mgrvl and fsnd, clasts 2-8cm,					
1-2	ditto, snd in m.s. 200-100, clasts2-					
	12cm., layers 5-30cm.					
3-4	mainly mfsnd, 200-30, <20stn, although					
	it is in layers, clasts 1-6cm.					
4-5	ditto to 4.9m. then +30% stn in layers					
	clasts 2-10cm.snd 200-100 (ms)					
5-6	ditto to 5.2m. then fmsnd 200-30					
6-7	ditto to 6.4m. then clay-till					
7-8	clay-till to 7.9 then mfsnd 200-50,					
	some 30			1	pushed	7.6
8-9	ditto, occasional stn., in small layers					
	clasts <5cm.;					
9-10	ditto					
10-11	ditto					
11-12	ditto					
12-13	ditto					
13-14	ditto					
14-15	ditto					
15-16	ditto					
16-17	ditto to 16.6m. then 30cm mgrvl layer,					
	clasts 2-8cm., snd 200-50, some 30					
17-18	mainly mfsnd 200-50 some 30, in layers					
	5-15cm.					
18-19	ditto					
19-20.	ditto, pulled augers at 19.8m.					

DRILL LOG

DATE Nov/26/86 DRILL HOLE # 70 DRILL TYPE H.S. RECORDER G.G.

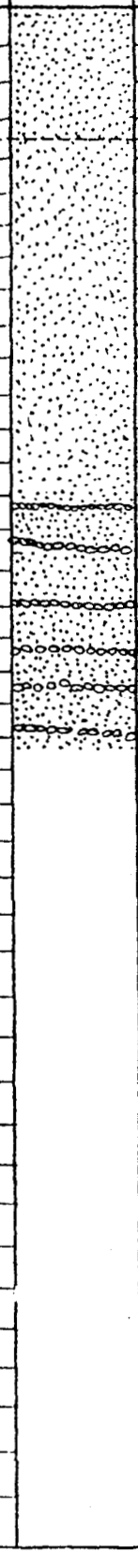
STATION Loughlin Ridge, Redmond Pit. Middle of pit, north of coarse section, just north of the core; 21.9m. face. UTM 4569 49905

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered msnd and fgrvl, snd 200-16, clasts < 5mm., layers 10-35cm.					
1-2	ditto to 1.5, then mainly csnd, 100-16 small, <5cm grvl layers, clasts <5mm.					
2-3	ditto					
3-4	ditto			1	4-19-10	3.0
4-5	layered mfgrvl and msnd, snd 200-50, clasts <5cm.			2	22-21-19	4.6
5-6	small layers of fmsnd, 200-30, small sandy-silt caps					
6-7	ditto to 6.7m. the 25cm layer of mfgrvl clasts 2-8cm.			3	13-15-15	6.1
7-8	layered cmsnd and fgrvl, snd 200-30, some 16, clasts <3mm.; layers 2 (g)-10			4	8-12-19	7.6
8-9	ditto, the stn. layers are slightly larger, 2-6cm					
9-10	ditto to 9.1 then pulled augers			5	8-21-34	9.1

DRILL LOG

DATE Nov/27/86 DRILL HOLE # 71 DRILL TYPE H.S. RECORDER G.G.

STATION Loughlin Ridge, Redmond Pit. Northeast corner, north of where coarse gravel was once. 24m. face; UTM 4567 499045

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fmsnd, no layering, 200-50, some 30,16			-		
1-2	ditto, water table at 1.7m.; sand is slightly finer; 200-50					
2-3	ditto, 200-50, little 30					
3-4	ditto			1	14-15-23	3.0
4-5	ditto			2	5-7-8	4.6
5-6	ditto					
6-7	ditto			3	4-4-3	6.1
7-8	ditto, small stn layers 2-4cm, clasts < 1.5cm.			4	pushed	7.6
8-9	ditto					
9-10	ditto					
10-11	ditto to 10.7 and then pulled augers			5	pushed	10.7

DRILL LOG

DATE Nov/27/86 DRILL HOLE # 72 DRILL TYPE H.S. RECORDER G.G.

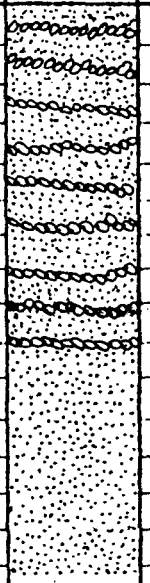
STATION Loughlin Ridge. Redmond property. Portion south of the core yet north of DH 66 Right at the edge of what was once the ridge. 7.0m. removed. UTM 4570 499025

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	+20mfgrvl, clasts 2-10cm. layered with					
	cmsnd 200-16, layers 5-30cm.(fill?)					
1-2	ditto to 1.2m., then mfsnd 200-50					
	some 30, water table 1.2m.					
2-3	ditto, slightly finer					
3-4	ditto, slightly finer 200-50, very			1	4-20-25	3.0
	little 30					
4-5	ditto					
				2	pushed	4.6
5-6	ditto					
6-7	ditto					
7-8	ditto, pulled auger 7.6m					
				3	pushed	7.6

DRILL LOG

DATE 87/12/17 DRILL HOLE # 73 DRILL TYPE H.S. RECORDER G.G.

STATION Redmond sand and gravel, north east corner UTM 4571 499075

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered fine gravel and m to c sand layers 15-30 cm					
1-2	ditto					
2-3	ditto					
3-4	ditto					
4-5	ditto to 4.6 m thenmfsand					
5-6	ditto					
6-7	ditto, pulled augers 7.6 m			1	15-16-22	1

DRILL LOG

DATNov/27/86 DRILL HOLE # 74 DRILL TYPE H.S. RECORDER G.G.

STATION Loughlin Ridge, Maple Grove property. Portion that is just north of Redmonds property, beside pines, n. of DH 67

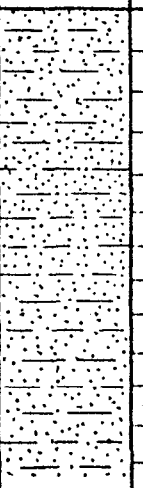
UTM 45665 499075

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered cmsnd and sandy-silt, layers					
	5-15cm., pebs. <3mm. watertable 0.5m.					
1-2	ditto, sand 200-30, some 16 and clasts					
	<1cm.					
2-3	ditto					
3-4	ditto			1	4-5-6	3.0
4-5	ditto					
5-6	ditto					
6-7	saturated sand, 200-30, some 16, a few		S	2	pushed	6.1
	shell fragments					
7-8	ditto to 7.9 then small 1.5-2cm. clay					
	layers, whole shells found		S			
8-9	saturated sand, 200-30, some 16 a few					
	shell fragments					
9-10	the sand is slightly finer, 200-50					
	30		S			
10-11	ditto to 10.7 then clay-silt inter-					
	bedded with <0.5cm. fsnd					
11-12	mainly silty-clay with vsmall fsnd					
	layers, 2-5cm. 200-100					
12-13	ditto, clay layers 10-15cm.					
13-14	ditto					
14-15	very dense layers, mainly silty-clay,					
	layers 10-20cm, fsnd layers 5-10					
15-16	ditto, the sand is mf, 200-50 some 30					

DRILL LOG

DATE Nov/27/86 DRILL HOLE # 75 DRILL TYPE H.S. RECORDER G.G.

STATION Loughlin Ridge, Maple Grove property. On flats north of the ridge. 1.9m. of fmgrvl removed. UTM 45645 49906

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	vfsilty-sand, -200-100					
1-2	ditto, small <1.0cm silt layers					
2-3	ditto					
3-4	ditto					
4-5	ditto					
5-6	ditto					
6-7	ditto to 6.1m. and then pulled augers					

DRILL LOG

DATE Nov/27/86 DRILL HOLE # 76 DRILL TYPE H.S. RECORDER G.G.

STATION Loughlin Ridge, Maple Grove property. On ridge, NE of scales and north of adjacent barn and home. UTM 45645 49901

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	mainly sand, 200-30					
1-2	ditto to 1.5m. thenthe sand is slightly coarser, some 16					
2-3	ditto					
3-4	ditto			1	8-14-37	3.0
4-5	ditto to 4.6 and then slightly coarser uptp pebs. 3mm.			2	11-34-40	4.6
5-6	ditto					
6-7	ditto to 6.7m. the layered fgrvl and cmsnd; snd 100-16, clasts <2.5cm.			3	17-33-50	6.1
7-8	ditto, layers 5-15cm.					
8-9	ditto					
9-10	ditto			4	18-59-60	9.1
10-11	ditto to 10.7 then layered mgrvl and csnd; clasts 5-10cm., snd 100-16					
11-12	ditto, layers 5-25cm.					
12-13	layered cmgrvl and vcsnd, clasts 10-20cm. snd 50-16, layers 10-40cm.					
14-15	ditto to 14.3m. then mainly cmsnd 100-30, some 16					
15-16	ditto to 15.2 then pulled augers			5	6-12-15	15.2

DRILL LOG

DATE Nov/28/86 DRILL HOLE # 77 DRILL TYPE H.S. RECORDER G.G.

STATION Loughlin Ridge, Maple Grove property. Bottom of pit just north or the scales and office, east side of pit. 14-15m. face UTM 4562 49900

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered csnd and fmsnd, c--100-16, pebs.<3mm.					
1-2	ditto, watertable at 2.1m.;					
2-3	ditto, cmsnd 200-16, mainly 100-16, clasts <5mm., layers 5-20cm.					
3-4	ditto			1	4-5-14	3.0
4-5	ditto			2	pushed	4.6
5-6	ditto					
6-7	ditto			3	pushed	6.1
7-8	ditto to 7.9m. then 25cm mfgrvl, clasts 2-10cm.					
8-9	ditto					
9-10	ditto			4	pushed	9.1
10-11	ditto					
11-12	ditto to 11.9m then sandy-silt-clay till interbedded with mcsnd,					
12-13	ditto, snd layers 5-10cm, till layers 6-15cm.					
13-14	ditto					
14-15	ditto to 14.9m. then bedrock					

DRILL LOG

DATE Nov/28/86 DRILL HOLE # 78 DRILL TYPE H.S. RECORDER G.G.

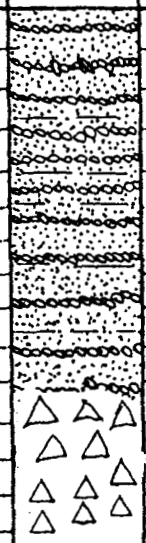
STATION Loughlin Ridge, south portion, north of dump, A. Murry property.
By road, just inside the fence, on old access road.
UTM 4540 498625

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered fsnd and m.s. mfgrvl, snd 200-50, clasts 2-8cm.					
1-2	ditto, snd is finer, 200-100					
2-3	ditto, shells found					
3-4	ditto, the clasts are <3cm water table at 3.3m.			1	4-8-23	3.0
4-5	ditto, shells found					
				2	4-4-3	4.6
5-6	ditto to 5.8m, then stn. fine, clasts <4mm. then vfsnd and small silt layers					
6-7	ditto to 6.7m. then very dense silty sand with cobbles, shells found, pebs <7cm.	p		3	9-17-29	6.1
7-8	ditto to 7.6m. then pulled augers;					
	piezometer installed at 6.7m.					

DRILL LOG

DATE 87/2/22 DRILL HOLE # 79 DRILL TYPE H.S. RECORDER G.G.

STATION South Gower Tp., property just west of Moores, on south side of road, on top of small hill

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	cmsnd and fgravel, layers 5 to 20 cm					
1-2	fining downwards, silt layers included					
2-3	ditto					
3-4	ditto					
4-5	ditto to 5.1m then till					
5-6	ditto					
6-7	ditto					

DRILL LOG

DATE Nov/28/86 DRILL HOLE # 80 DRILL TYPE H.S. RECORDER G.G.

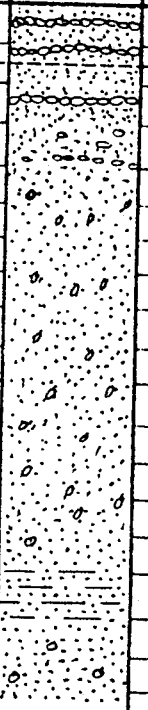
STATION Loughlin Ridge, B. Forbes Pit. Bottom of his east pit, northwest side. 7 m. face. UTM 4557 49896

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered mfgrvl and cmsnd, clasts 2-20cm., snd 100-16					
1-2	ditto to 1.2m. then layered mcsnd and fgrvl, snd 100-30, clasts < 5mm.					
2-3	ditto			1	17-38-60	3.0
3-4	layered mfsnd and msnd, 200-100 and 200-30 to 3.7m. then layered snd andg					
4-5	ditto to 4.3m, layers 20-40cm, then layered mfsnd 200-50, some 30			2	8-16-19	4.6
5-6	ditto					
6-7	ditto			3	9-14-15	6.1
7-8	layered fsnd, 200-100 with silt drapes					
8-9	ditto					
9-10	ditto, larger silt layers			4	8-13-14	9.1
10-11	ditto					
11-12	ditto					
12-13	ditto to 12.2 and then pulled augers			5	grab	12.2

DRILL LOG

DATE Dec/1/86 DRILL HOLE # 81 DRILL TYPE H.S. RECORDER G.G.

STATION Loughlin Ridge, F.B.M. property. Northeast of T junction, east side of pit. UTM 4555 49896 6m. face

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered sand and grvl, +20% stn.					
	clasts 2-8cm. snd 100-16					
1-2	ditto to 1.5m. layers 10-20cm, then					
	cmsnd with <5mm. stn. 100-16					
2-3	ditto, layers 10-25cm.					
3-4	ditto			1	17-18-70	3.0
4-5	ditto to 4.6m. then msnd 100-30, some 16, stns <5mm			2	20-14-15	4.6
5-6	ditto					
6-7	ditto			3	14-20-20	6.1
7-8	ditto to 7.4m then vfsnd, 200-100,					
	small 1-2cm silt layers					
8-9	ditto to 8.1m then mcsnd and occasional					
	clast, 100-16,					
9-10	ditto, pulled augers at 9.1m.					

DATE Dec/1/86 DRILL HOLE # 82 DRILL TYPE H.S. RECORDER J.B.

STATION Loughlin Ridge, F.B.M. property. Northeast of T, where backsets are. On west side of access road. 5.5m. face UTM 45525 49893

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered snd and grvl to 0.8m. snd 200-					
	30, clasts 2-8cm., then 200-30snd					
1-2	ditto, layers 5-15cm.					
2-3	ditto to 2.4m. then mcsnd 100-16,					
3-4	ditto, in layers 5-15cm.			1	8-16-13	3.0
	water table at 3.6m					
4-5	ditto					
5-6	ditto					
6-7	ditto to 6.7 then msnd and few stns,			2	pushed	6.1
	layers 5-20cm., grvl ly. thin					
7-8	coarser, more silt					
8-9	ditto to 8.2m. then sandy-silt till					
	to 8.8m. the rfsl; br or boulders					

DATE Dec/1/86 DRILL HOLE # 83 DRILL TYPE H.S. RECORDER G.G.

STATION Reids Mills, east side of County Road, right on Dundas/Ottawa Carleton border. UTM 4565 499435

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered fgrvl and fmsnd, snd 200-50					
	some 30, clasts < 5mm					
1-2	ditto to 1.5m. then mfsnd 200-50 some					
	30					
2-3	ditto					
3-4	ditto			1	8-26-29	3.0
4-5	ditto					
				2	13-30-43	4.6
5-6	ditto					
6-7	ditto			3	18-30-29	6.1
7-8	ditto					
8-9	ditto					
9-10	ditto, water table at 9.4m.			4	24-53-100	9.1
10-11	ditto to 10.7m then layered mfgrvl					
	and mfsnd, clasts 2-6cm snd 200-50					
11-12	ditto, snd 200-50 some 30 and 16					
12-13	ditto to 12.2m then pulled augers	P-		5	6-8-17	12.2
	piezometer installed at 12.2m.					

DRILL LOG

DATE 87/12/8 DRILL HOLE # 84 DRILL TYPE H.S. RECORDER G.G.

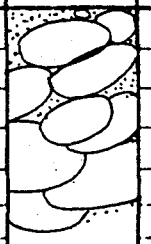
STATION C. Moore pit, Osgoode Tp. Bottom of pit; south side
UTM 4543 4968

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layers of csand and fine sand; layers 10-15 cm; clasts <2 cm					
1-2	ditto			1	18-14-9	1.5
2-3	ditto to 2.7 m then tillish layers and very fine sand					
3-4	ditto			2	30-15-10	3.0
4-5	ditto			3	none	4.5
5-6	ditto					
6-7	ditto to 6.4 m then pulled augers					

DRILL LOG

DATE 87/12/10 DRILL HOLE # 85 DRILL TYPE H.S. RECORDER G.G.

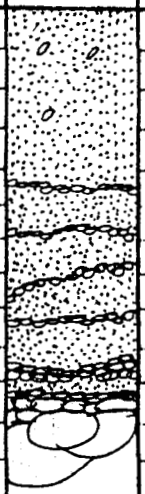
STATION E. Moores pit, Osgoode tp. centre of feature, 15 m NE of DH 84

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	medium gravel and mc sand; clasts up to 35 cm					
1-2	ditto					
2-3	ditto; too coarse so pulled augers					

DRILL LOG

DATE 87/12/1 DRILL HOLE # 86 DRILL TYPE H.S. RECORDER G.G.

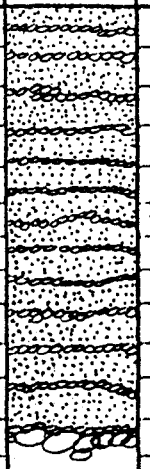
STATION E. Moores pit; Osgoode Tp. SE corner by disabled crane
2.0 m face

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	medium to fine sand and occasional stone;					
1-2	ditto					
2-3	ditto to 2.1 m then fmgravel and msand layers, clasts 2-10 cm					
3-4	ditto					
4-5	ditto					
5-6	same to 5.2 m then very stny, clasts up to 30 cm; pulled augers at 6.1 m					
	piezometer installed at 5.7 m					

DRILL LOG

DATE 87/12/18 DRILL HOLE # 87 DRILL TYPE solids RECORDER G.G.

STATION 5 m north of DH 86

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	mfsand and mfgravel layers; layers 10-20 cm					
1-2	ditto					
2-3	ditto to 2.4 m then fm gravel and nsand layers, clasts 2-10 cm					
3-4	ditto					
4-5	ditto					
5-6	same to 5.6 m the very stny and there-pulled augers					

DRILL LOG

DATE 87/12/18 DRILL HOLE # 88 DRILL TYPE solids RECORDER G.G.

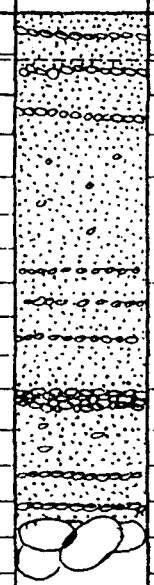
STATION East side of Rideau River, southeast of Kars

UTM 4501 49976

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered coarse gravel and mcsand; layers 10-25 cm; many shells present		5			
1-2	ditto		5			
2-3	ditto, many shells		6			
3-4	ditto, many shells		5			
4-5	ditto to 4.2 m then very coarse gravel layers, clasts > 4 cm					
5-6	ditto, small m sand layers, layers 5-15 cm; no shells observed					
6-7	ditto, no shells					
7-8	ditto, no shells					
8-9	ditto, no shells					
9-10	ditto, no shells					
10-11	ditto, too coarse, pulled augers 10.7m					

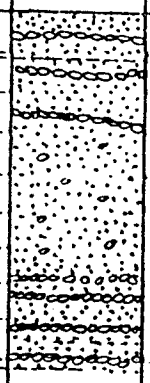
DATE Dec/2/86 DRILL HOLE # 89 DRILL TYPE H.S. RECORDER G.G.

STATION Osgoode property, on north extension of Loughlin Ridge.
UTM 4554 50019 East side of property, 5.5m face

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered snd and grvl, clasts 2-5cm,					
	snd 100-16					
1-2	ditto to 1.5m, then mainly cmsnd, with					
	a few pebs, clasts <1cm snd 100-16					
2-3	ditto					
3-4	mainly snd, 200-30, a few stn layers					
	clasts < 1cm layers 5-15cm					
4-5	ditto					
5-6	20cm stn layer at 5.0m. then snd 200-					
	16, clasts <4cm					
6-7	layered snd and mfgrvl, layers 5-25cm					
	clasts 2-20cm, br or bldrs at 6.7					

DATE Dec '86 DRILL HOLE # 90 DRILL TYPE H.S. RECORDER G.G.

STATION Osgoode property, on north extension of Loughlin Ridge.
UTM 4554 50019 East side of property, 5.5m face

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered snd and gravl, clasts 2-5cm, snd 100-16					
1-2	ditto to 1.5m, then mainly cmsnd, with a few pebs, clasts <1cm snd 100-16					
2-3	ditto					
3-4	mainly snd, 200-30, a few stn layers clasts < 1cm layers 5-15cm					
4-5	ditto					
		P				
	piezometer installed at 4.6 m.					

DRILL LOG

DATE Dec/2/86 DRILL HOLE # 91 DRILL TYPE H.S. RECORDER G.G.

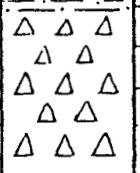
STATION Osgoode Pit, same location as DH 89 and 90, middle of property
UTM 4553 50018 west of middle pit

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Dingram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fsnd, 200-100, very silty					
1-2	ditto to 1.2m then sandy-silt till					
2-3	till					
3-4	till			1	15-60	3.0
4-5	till					
5-6	till					
6-7	till to 6.1m, then pulled augers					

DRILL LOG

DATE Dec/2/86 DRILL HOLE # 92 DRILL TYPE H.S. RECORDER G.G.

STATION Osgoode property, east of Osgoode. West side of property, bottom of Pit. 2.1m. face UTM 45495 50017

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fsnd to 0.8m. then 30cm of silt then till					
1-2	till					
2-3	till					

DRILL LOG

DATE Dec/2/86 DRILL HOLE # 93 DRILL TYPE H.S. RECORDER G.G.

STATION Osgoode Township, Dibble/Warran Pit. Bottom of east pit on west side. UTM 4553 500375 5m. face

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fmsnd and a few <5cm stn layers, snd					
	200-30 some 16					
1-2	ditto					
2-3	ditto					
3-4	ditto					
4-5	ditto to 4.6m. then pulled augers					
		p				
	piezometer installed at 4.6m					

DRILL LOG

DATE Dec/3/86 DRILL HOLE # 94 DRILL TYPE H.S. RECORDER J.B.

STATION Dibble/Warran property, Osgoode Township. In field northeast of Dn 93

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	tpsl, fsnd 200-100					
1-2	ditto to 1.5m. then mfsnd 200-50 some 30 and 16					
2-3	ditto					
3-4	ditto			1	7-14-22	3.0
4-5	ditto					
5-6	ditto			2	13-55-44	4.6
6-7	ditto			3	15-15-17	6.1
7-8	ditto to 7.9m. then stn layer and fsnd and fsnd and silt					
8-9	mfsnd 200-50 some 30					
9-10	ditto, water table at 9.1m			4	17-22-27	9.1
10-11	ditto					
11-12	ditto					
12-13	ditto			5	pushed	12.2
13-14	ditto to 13.7m. then mcsnd 100-16					
14-15	ditto, small clasts present					
15-16	ditto to 15.2m. then pulled augers			6	grab	12.2

DRILL LOG

DATE Dec/3/86 DRILL HOLE # 95 DRILL TYPE H.S. RECORDER J.B.

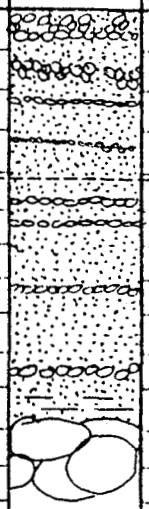
STATION Dibble/Warran property, Osgoode Tp., By gate
UTM 4554 50040

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	silty sand, few stns, clasts <2.5cm					
1-2	ditto to 1.2m, then silty clay till					
2-3	ditto to 2.2m then pulled augers					

DATE Dec/3/86 DRILL HOLE # 96 DRILL TYPE H.S. RECORDER J.B.

STATION Osgoode Sand and Gravel Pit, main property, at south face

UTM 4559 50078

DEPTH	DESCRIPTION(Colour, Texture. Moisture. etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered matrix supported and mcsnd layers20-40cm.					
1-2	ditto to 1.1 then layered mcsnd and fgrvl layers, snd 100-16, clasts < 5cm					
2-3	mcsnd, stn layers at 2.4m and 2.7m. snd 100-16, clasts <5cm wt 2.1m					
3-4	mcsnd and small stn layers			1	6-10-31	3.0
4-5	ditto			2	6-10-17	4.6
5-6	ditto to 5.3 then boulders and pulled augers. small silt layers					

DRILL LOG

DATE Dec/ 3/86 DRILL HOLE # 97 DRILL TYPE H.S. RECORDER J.B.

STATION Osgoode Sand and Gravel Pit, main property, at south face
UTM 4559 50078

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered matrix supported grvl and			-		
	mcsnd, layers 20-40cm,					
1-2	ditto, to 1.2m then mcsnd stn layer					
	1.8m.					
2-3	mcsnd and mfgrvl layers small vfsnd					
	10cm layers,					
3-4	ditto			1	4-12-26	3.0
4-5	ditto to 4.6m, then mcsilty sand					
	clasts 1-4 cm.	P		2	10-16-10	4.6
5-6	ditto					
6-7	ditto to 6.1m. then pulled augers			3	pushed	6.1
	piezometer installed at 4.6m.					

DATE Dec/4/86 DRILL HOLE # 98 DRILL TYPE H.S. RECORDER J.B.

STATION Osgoode Tp., Greely Pit, E of # 25
UTM 4560 50085

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	mcsnd and grvl, layers					
1-2	ditto					
2-3	ditto					
	water table at 2.3m.					
3-4	ditto			1	0-17-27	3.0
4-5	ditto, large stn layer at 4.9m.					
				2	-	4.6
5-6	grvl to 5.8m. then mcsnd					
6-7	mcsnd			3	-	6.1
		p				
7-8	ditto, larger grvl layers					
	pulled augers at 7.6m.			4	grab	7.6
	piezometer installed at 6.7m.					

DATE Dec/4/86 DRILL HOLE # 99 DRILL TYPE H.S. RECORDER J.B.

STATION Pyper pit, Osgoode Tp.: west face

UTM 4550 501325

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	mfsnd					
1-2	ditto to 1.5m. then fsilty snd					
2-3	ditto, water table at 2.1m.					
3-4	uniform fsnd 200-100			1	11-13-22	3.0
4-5	ditto to 4.9m. then vfsilty snd			2	7-11-18	4.6
5-6	ditto					
6-7	ditto			3	9-9-8	6.1
7-8	ditto to 7.6m. then fsnd 200-100					
8-9	ditto					
9-10	ditto			4	7-13-17	9.1
10-11	ditto					
11-12	ditto to 11.2m then layered fsnd and fgrvl					
12-13	ditto to 12.2m then pulled augers	P		5	5-3-6	12.2
	piezometer installed at 12.2m.					

DATE Dec/4/86 DRILL HOLE # 100 DRILL TYPE H.S. RECORDER G.B.

STATION Pyper Pit, Osgoode Tp. South face
UTM 45515 50132

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	mfsnd			-		
1-2	ditto					
2-3	ditto					
	water table at 2.7m.					
3-4	fsnd, small silt layers			1	8-12-20	3.0
4-5	ditto					
				2	6-8-14	4.6
5-6	ditto					
6-7	mfsnd			3	-	6.1
7-8	ditto to 7.6 then fsilty sand					
8-9	ditto					
9-10	ditto to 9.1m. and then pulled augers			4	-	9.1

DATE Dec/4/86 DRILL HOLE # 101 DRILL TYPE H.S. RECORDER G.B.

STATION Spratt/Moffat Pit, Gloucester Tp, west side
UTM 4543 50135

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	mfsnd to 0.6 then fsnd					
1-2	fsnd					
2-3	uniform fsnd					
	water table at 2.4m,					
3-4	mfsnd, small oxidized layers			1	10-18-21	3.0
4-5	ditto to 4.6m, then mfsnd and silt layers			2	5-12-15	4.6
5-6	ditto					
6-7	ditto			3	4-12-21	6.1
7-8	msnd grvl layers					
8-9	ditto to 8.8m, then boulder rfsl					
				4	-	8.8

DRILL LOG

DATE Dec/5/86 DRILL HOLE # 102 DRILL TYPE H.S. RECORDER G.G.

STATION Moffat Pit, Gloucester Pit. Under hydro-power lines west pit, east side, where channels are. UTM 4549 50139

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	msnd, few stns, clasts 1-3cm, snd 200-30					
1-2	ditto to 1.5m then layered fgrvl and mcsnd, 100-16, pebs < 5cm, layers 2-20					
2-3	ditto to 2.1m, then 20cm fgrvl layer, clasts <5cm, then layered as above					
3-4	fmsnd and small silt layers, snd 200-30, some 16, water table at 3.7m.			1	8-17-19	3.0
4-5	ditto to 4.6m then mfsnd 200-50 some 30			2	2-10-13	4.6
5-6	ditto to 5.9m then +20% mfgrvl layers					
6-7	+30% mfgrv; layers boulder rfsl at 7.0m			3	pushed	6.1
		p				
	piezometer installed at 7.0m.					

DATE Dec/5/86 DRILL HOLE # 103 DRILL TYPE H.S. RECORDER G.G.

STATION Dibble/Warran Pit, south of the race track, Gloucester Tp. South portion, near Moffat property. UTM 4535 50 145

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	grvl to 0.3m then layered cmsnd and			-		
	fsnd, 200-100 and 100-16, layers 5-20					
1-2	ditto to 1.5m then layered fgrvl and					
	csnd, clasts 2-5cm, snd 100-16					
2-3	ditto, water table at 2.1m.					
3-4	layered csnd and fmsnd, layers 5-10cm 100-16, 200-30, pebs < 5cm			1	12-18-15	3.0
4-5	ditto					
				2	pushed	4.6
5-6	ditto					
6-7	ditto to 6.1m. then snd and larger			3	pushed	6.1
	200-30 layers					
7-8	ditto to 7.6m. then occasional stn,					
	ditto sand					
8-9	ditto, 200-30 some 16					
9-10	ditto to 9.1m then fsnd			4	pushed	9.1
10-11	ditto to 10.4 then till					
11-12	till, rfsl at 11.0m.		Δ Δ Δ			

DRILL LOG

DATE Dec/5/86 DRILL HOLE # 104 DRILL TYPE H.S. RECORDER G.G.

STATION Dibble/Warran pit, Gloucester Tp, Johnston Corners, East side of pit, just w of Core. 5m face UTM 4535 50145

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	+20% layered msnd and fgrvl, snd 200-16, clasts <5cm			-		
1-2	ditto to 1.5m then msnd and silt layers-					
	silt layers 1-2.5cm snd 200-100, wt 1	2				
2-3	ditto to 2.7m then msnd and vcsnd layers					
3-4	ditto					
4-5	ditto to 4.6m then layered csnd and fgrvl			1	pushed	4.6
5-6	ditto,					
6-7	ditto to 6.1m then pulled augers			2	pushed	6.1
	piezometer installed at 6.1m.					

DATE Dec/8/86 DRILL HOLE # 105 DRILL TYPE H.S. RECORDER G.G.

STATION Trail Road area, on Cedarview road at corner of trail road, east side. UTM 44095 500865

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered grvl to 0.6m. then msnd					
	layers, 200-30					
1-2	ditto to 1.5m then alternating fsnd					
	laminae					
2-3	ditto					
3-4	layered msnd and mcsnd, layers 3-6cm			1	14-25-40	3.0
	m-100-30, mc- 100-16					
4-5	ditto to 4.6m then layered msnd and					
	mfsnd layers, layers 2-6cm,			2	13-25-41	4.6
5-6	ditto, mf-200-30 m-100-30					
6-7	ditto, water table at 6.6m.			3	8-14-22	6.1
7-8	ditto to 7.6m. then saturated 200-30					
	some 16 sand, few clasts < 5mm					
8-9	ditto					
9-10	ditto			4	4-6-8	9.1
10-11	ditto					
11-12	ditto					
12-13	ditto to 12.2m. and then pulled augers					

DATE Dec/8/86 DRILL HOLE # 106 DRILL TYPE H.S. RECORDER G.G.

STATION Trail Road property, Nepean Tp. Drummond property.
West portion, north east of scales. (Beach portion?) 3.5m. face.
UTM 44095 50094

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered msnd csnd layers, few pebs.					
	c-100-16, m-200-30, pebs. <5mm, shells	s	s			
1-2	ditto, water table at 1.2m., layers					
	5-25cm, shells		s			
2-3	ditto					
			s			
3-4	ditto, shells, slightly finer					
			s			
4-5	ditto, shells					
			s	1	pushed	4.6
5-6	ditto, shells					
			s			
6-7	slightly finer, becoming silt at 6.8m.			2	pushed	6.1
7-8	silt and clay layers, rhythmites					
	shells		s			
8-9	ditto					
			s			
9-10	ditto			3	pushed	9.1
			s			
10-11	ditto					
			s			
11-12	ditto, few stns.					
			s			
12-13	ditto to 12.2 and then pulled augers			4	pushed	12.2

DRILL LOG

DATE Dec/8/86 DRILL HOLE # 107 DRILL TYPE H.S. RECORDER G.G.

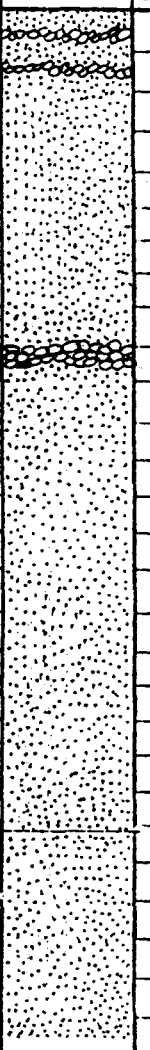
STATION Trail Road area, Drummond property, east of Cedarview. East side where fault blocks are. UTM 4412 50099

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fill, silty-clay					
1-2	ditto to 1.2 the layered cmsnd and csnd, cm-100-16, c-100-16, pebs <5mm					
2-3	ditto, layers 5-25cm, water table at 2.8m.					
3-4	ditto, clasts up to 2.5cm., layers 3-25cm			1	15-15-30	3.0
4-5	mainly vcsnd layers, 100-16, pebs<5mm layers 10-30cm			2	12-22-29	4.6
5-6	ditto					
6-7	vcsnd and larger clasts, clasts 15cm stn. layers 5-20cm			3	22-25-27	6.1
7-8	ditto					
8-9	ditto					
9-10	ditto, clasts 5-15, layers 10-25cm			4	grab	9.
10-11	ditto					
11-12	ditto					
12-13	vcsnd, 50-16 with pebs <1cm, clasts 5-15cm, pulled augers 12.2m			5	grab	12.2

DRILL LOG

DATE 87/12/18 DRILL HOLE # 108 DRILL TYPE H.S. RECORDER G.G.

STATION Drummond property, Trail Rd. area, southeast corner, UTM 4417 50098

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered mfgravel and cmsand to 0.8 m					
	layers 10-15 cm					
1-2	cm sand and m sand layers, very few					
	stns					
2-3	ditto					
3-4	ditto					
4-5	ditto to 4.5 m then a 25 cm stn. layer,					
	clasts 2-10 cm, then sand layers					
5-6	ditto, cm and m sand layers					
6-7	ditto					
7-8	ditto					
8-9	ditto					
9-10	ditto					
10-11	ditto, wt at 11.1 m					
11-12	ditto					
12-13	ditto					
13-14	ditto, sand filling augers; pulled					
	augers at 13.7 m					

DRILL LOG

DATE 87/12/21 DRILL HOLE # 109 DRILL TYPE H.S. RECORDER G.G.

STATION Drummond property, Trail Rd area, southeast corner,
UTM 4417 50098

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered angular clasts with diameters					
	up to 35 cm.					
1-2	ditto to 1.2 m then layered very fsand					
	and silt					
2-3	ditto to 2.7 m then layered layered					
	msand and c sand, layers 10-15 cm			1	10-25-20	3.0
3-4	ditto					
4-5	ditto					
5-6	ditto			2	12-25-30	6.1
6-7	ditto					
7-8	ditto					
8-9	ditto, m sand and c sand layers					
9-10	ditto, watertable at 9.8 m					
10-11	ditto					
11-12	ditto, augers filling with sand					
12-13	ditto, pulled augers at 12.2 m;					
	piezometer installed at 12.2 m					

DRILL LOG

DATE 87/12/22 DRILL HOLE # 110 DRILL TYPE H.S. RECORDER G.G.

STATION Drummond property, Trail Rd; on crest of hill
UTM 4413 500965

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered fgravel and fine sand					
1-2	ditto to 1.2 m then fsand and silt					
	silt layers and f gravel layers					
2-3	ditto, very silty sand layers and					
	fine gravel layers					
3-4	ditto					
4-5	ditto to 4.2 m then very dense till					
5-6	ditto, till					
6-6.1	till, pulled augers because material					
	was too dense					

DRILL LOG

DATE 87/12/22 DRILL HOLE # 111 DRILL TYPE H.S. RECORDER G.G.

STATION Drummond property, Trail Rd. In front portion just east of scales
UTM 4408 50095

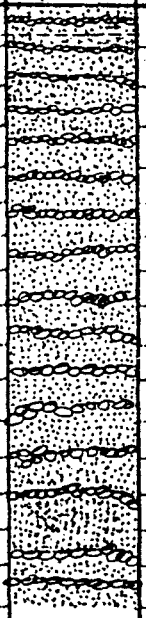
DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	msand and cm sand layers, few shells observed, layers 10-20 cm					
1-2	ditto, sand layers					
2-3	ditto, sand layers					
3-4	ditto, sand layers			1	15-20-18	3.0
4-5	ditto, sand layers and shell fragments			2	pushed	4.5
5-6	ditto					
6-7	ditto, sand layers					
7-8	ditto, sand layers					
8-9	ditto, small silt layers found at 8.8 m					
9-10	rhythmites of silt and clay, shells					
10-11	rhythmites					
11-12	rhythmites					
12-13	rhythmites to 12.2 m then mfsand and clayey-silt layers					
13-14	the same			3	12-4-4-15	13.7
14-15	the same					
15-16	the same					
16-17	the same					
17-18	the same to 17.3 then till					
	piezometer installed at 17.1 m					

DRILL LOG

DATE 87/12/23 DRILL HOLE # 112 DRILL TYPE H.S. RECORDER G.G.

STATION Brazeau pit, far southeast corner

UTM 4421 50095

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered fgravel and mcsand, layers					
	10-30 cm, clasts 2-5 cm.					
1-2	the same, the stns. appear larger					
2-3	the same					
3-4	the same			1	13-20-32	3.0
4-5	the same					
5-6	the same					
6-7	the same					
7-8	the same, auger filling in and binding;					
	pulled augers					
	piezometer installed at 5.5 m					

DRILL LOG

DATE 87/12/23 DRILL HOLE # 113 DRILL TYPE solids RECORDER G.G.

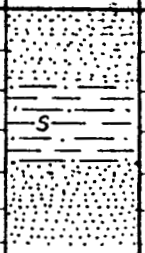
STATION 5 m west of DH 112, 12 m face

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered fgravel and mc sand					
1-2	the same					
2-3	the same					
3-4	the same					
4-5	the same					
5-6	the same					
6-7	the same					
7-8	the same					
8-9	the same					
9-10	the same to 9.1 m the very large boulders, clasts > 30 cm					
10-11	boulders, rfsl at 10.7					

DRILL LOG

DATE Dec/9/86 DRILL HOLE # 114 DRILL TYPE H.S. RECORDER G.G.

STATION Trail Road area, Burnside/Warran property. Northeast corner, close to hydrolines, 4.2m. face UTM 4393 500865

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fsnd, 200-100 to 0.8m then rhythmites					
	of silt and clay, shells					
1-2	ditto to 1.8m. thenvfsnd 200-100					
2-3	vfsnd, 200-100, pulled augers at 3.0m.					

DRILL LOG

DATE Dec/9/86 DRILL HOLE # 115 DRILL TYPE H.S. RECORDER G.G.

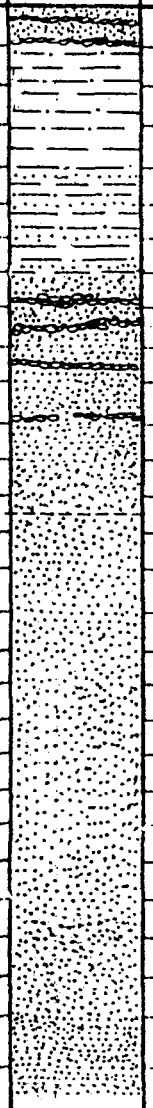
STATION Trail Road area, Burnside portion, south property. Southeast corner, where ponds are. 3-4m. removed. UTM 3945 50084

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered msnd and cmsnd, cm-200-16,					
	m-200-30, some 16, pebs < 5mm					
1-2	ditto, layers 5-20cm					
2-3	ditto, slightly finer					
	water table at 2.1m.					
3-4	ditto					
4-5	ditto, slightly finer					
5-6	smaller sand layers, 5-12cm, sand					
	200-30					
6-7	fining to silt to 6.4m then layered					
	silt and clay, mainly clay					
7-8	ditto					
8-9	mainly clay, small silt layers < 5mm					
9-10	ditto					
10-11	ditto					
11-12	ditto					
12-13	ditto to 12.2m. and then pulled augers					

DRILL LOG

DATE 88/2/15 DRILL HOLE # 116 DRILL TYPE H.S. RECORDER G.G.

STATION Burnside pit, south pit where wash plant is
southeast corner where excavation rises UTM 4395 50083

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered mcsand and fgrvl to 0,5 m					
	then rhythmites of silt and clay					
1-2	rhythmites of silt and clay					
2-3	rhythmites of fine sand, silt and clay					
3-4	ditto to 3.5 then mfsand and m sand					
	layers, few stns.					
4-5	layered mfsand and cmsand and fgravel					
	layers, layers 15-25 cm			1	17-18-24	4.5
5-6	the same, less gravel mainly sand					
	layers					
6-7	fsand and msand layers			2	18-17-22	6.1
7-8	the same			3	9-16-21	7.6
8-9	the same					
9-10	the same			4	10-17-21	9.1
10-11	the same					
				5	10-15-20	10.7
11-12	the same					
12-13	the same			6	3-4-8	12.2
13-14	the same					
				7	6-6-6	13.7
14-15	augers filling with sand and are					
	binding, pulled augers at 14.3 m					

DRILL LOG

DATE 88/2/16 DRILL HOLE # 117 DRILL TYPE H.S. RECORDER J.B.

STATION Burnside property, south pit, southeast corner, just north of pond
UTM 43945 50084

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fmsand	--				
1-2	fmsand					
2-3	fmsand, coarser than above					
3-4	coarser than above, msand fine gravel layers					
4-5	the same, stn layers more frequent					
5-6	the same					
6-7	the same					
7-8	the same					
8-9	the same					
9-10	the same to 9.8 m then layer silt and clay					
10-11	silt and clay to 10.8 m then coarse sand and fgravel			1	pushed	10.7
11-12	finer than above, mainly fine to medium sand					
12-13	fsand and layers of stns.			2	8-12-14	13.7
13-14	the same, the sand appears finer					
14-15	the same, appears a bit finer					
15-16	the same, augers binding at 15.2 m, pulled augers					
	piezometer installed to 10.2 m					

DRILL LOG

DATE 88/2/17 DRILL HOLE # 118 DRILL TYPE H.S. RECORDER J.B.

STATION Burnside pit, south pit where wash plant is located, south of pond, UTM 4393 50081

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered msand and fgravel					
1-2	the same mcsand and fgravel layers					
2-3	the same					
3-4	the same			1	11-9-12	3.0
4-5	the same			2	pushed	4.5
5-6	the same					
6-7	the same, finer, fewer stns.			3	pushed	6.1
7-8	the same, finer, fewer stns					
8-9	the same, silt layers becoming more frequent					
9-10	finer to 9.8 and then clay and silt layers					
10-11	silt and clay layers					
11-12	the same to 11.1 m then layered msand and fgravel					
12-13	the same					
13-14	the same					
14-15	the same					
15-16	the same, finer than above					
16-17	the same, finer than above					
	lost 7.6 m of augers					

DRILL LOG

DATE 88/2/18 DRILL HOLE # 119 DRILL TYPE solids RECORDER G.G.

STATION Burnside property, Middle pit along Moodie Dr.; east side of Moodie Dr. UTM 4387 50095

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layers of csand and fgravel, layers 10-15 cm, clasts <3.5 cm.	--				
1-2	the same					
2-3	the same,					
3-4	the same					
4-5	the same					
5-6	the same					
6-7	the same					
7-8	the same					
8-9	the same to 8.2 m thenboulders, clasts up to 30 cm, thenlayered fgravel					
9-10	layered fgravel and csand, layers 10-15 cm, clasts < 3.5 cm					
10-11	the same					
11-12	the same					
12-13	the same					
13-14	the same					
14-15	the same, denser, small till layers					
15-16	sand and till layers to 15.3, then mainly till					

DRILL LOG

DATE Dec/9/86 DRILL HOLE # 120 DRILL TYPE H.S. RECORDER G.G.

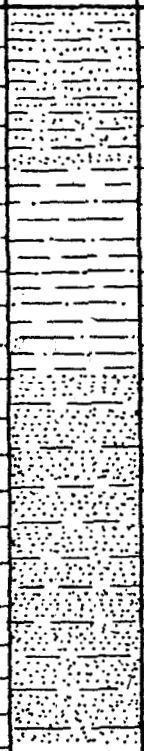
STATION Moodie Drive/Trail Road area. Main Burnside property, where office is located. Beside road, south end where pond is. UTM 4381 50097

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered vcsnd and pebs and cmsnd					
	>10% retained on 16, pebs up to 2.5cm					
1-2	ditto, layers 10-25cm for sand, stn					
	layers 2-5cm.					
2-3	ditto, water table at 2.0m.					
3-4	becoming finer, 100-16					
4-5	ditto, finer still, massive bedding,					
5-6	ditto					
6-7	mfsnd, massive 200-30, fining quickly					
7-8	mainly fsnd, 200-50					
8-9	ditto					
9-10	ditto					
10-11	ditto					
11-12	ditto, snd 200-50					
12-13	ditto					
13-14	ditto, pulled augers at 13.7m.					

DRILL LOG

DATE 88/1/4 DRILL HOLE # 121 DRILL TYPE H.S. RECORDER G.G.

STATION Burnside pit, main property, area which they lease
UTM 4376 50102

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered fsand and silt, fsand layers 5-10 cm, silt layers < 3cm					
1-2	the same					
2-3	the same to 2.1 m then rhythmites of silt and clay					
3-4	rhythmites			1	5-5-4	3.0
4-5	the same to 4.8 m then fsand layers					
5-6	layered fsand, msand and clay layers					
6-7	the same			2	3-12-7	6.1
7-8	the same					
8-9	the same					
9-10	the same, pulled out drill broken					

DRILL LOG

DATE 88/2/17 DRILL HOLE # 122 DRILL TYPE H.S. RECORDER G.G.

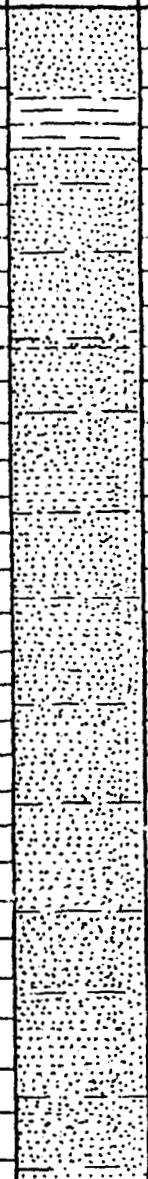
STATION Burnside pit, leased property behind their office, 10 m west of of DH 121 UTM 4376 50102

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	msand and silt layers (ripples and caps) to 0.9 m the silt and clay					
1-2	rhythmites of silt and clay					
2-3	rhythmites					
3-4	rhythmites					
4-5	rhythmites of silt and clay					
5-6	rhythmites of silt and clay to 5.5 m then layers of fsand and silt					
6-7	the same, the sand is slightly finer			1	4-4-4	6.1
7-8	the same, little silt, mainly layers of fsand and msand					
8-9	layers of msand, layers 10-25 cm					
9-10	the same			2	4-4-8	9.1
10-11	the same					
11-12	the same					
12-13	the same, sand filling the augers, pulled augers at 12.2 m			3	4-8-16	12.2
	piezometer installed to 10.7 m					

DRILL LOG

DATE 88/2/17 DRILL HOLE # 123 DRILL TYPE solids RECORDER G.G.

STATION Property leased by Burnside sand and gravel, behind main office, 32 m south of train tracks UTM 4375 50103

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layeres of m and f sand, layers 5-15 cm. thick					
1-2	the same to 1.2 m then 0.6 m of silt and clay rhythmites					
2-3	layers of msand, layers 10-15 cm very small silt caps					
3-4	the same					
4-5	the same					
5-6	the same					
6-7	the same					
7-8	the same					
8-9	the same					
9-10	the same					
10-11	the same					
11-12	the same					
12-13	the same					
13-14	the same					
14-15	the same					
15-16	the same, pulled augers at 15.2 m					

DRILL LOG

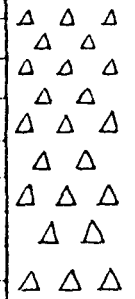
DATE Dec/10/86 DRILL HOLE # 124 DRILL TYPE H.S. RECORDER G.G.

STATION Rumps property, north of Stittsville, unopened
UTM 4213 501765; across from Wilson pit

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered fgrvl and cmsnd, clasts <1.5cm					
	snd 100-16					
1-2	less than 5% stn., less stn. layers					
	5-15cm					
2-3	ditto, snd 100-16					
3-4	slightly finer, snd 200-16, small			1	10-13-18	3.0
	<4cm stn. layers wt 3.8m					
4-5	finer sand layers, 200-30, some 16					
5-6	clay rhythmites, very dense; to 5.8m.					
	then silty-clay till					
6-7	till to 6.1m. and then pulled augers			2	4-8-34	6.1

DATE Dec/10/86 DRILL HOLE # 125 DRILL TYPE H.S. RECORDER G.G.

STATION North of Stittsville, Rumps property, unopened on west side of the wood lot. UTM 42085 50175

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	tpsl, sandy-silt-clay till					
1-2	till					
2-3	till					
3-4	till					
4-5	till to 4.2m and then rfsl					

DRILL LOG

DATE Dec/10/86 DRILL HOLE # 126 DRILL TYPE H.S. RECORDER G.G.

STATION Rumps property, north of Stittsville. Same property as DH 125 but 70m. south of wood lot, 120m north of DH 125. UTM 42085 501755

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	till		△ △ △ △ △ △ △ △			
1-2	till, pulled augers at 1.8m					

DRILL LOG

DATE Dec/10/86 DRILL HOLE # 127 DRILL TYPE H.S. RECORDER G.G.

STATION Wilson property, north of Stittsville, west side, 1.8m. face.
UTM 4202 501815

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered msnd, 100-30, some 16, very small silt caps (<1cm) wt 0.6m, shells		S			
1-2	ditto to 1.5m., layers 2-10cm. then layers of mfsnd 200-50, shells		S			
2-3	ditto, sand is grading finer, silt caps are larger, shells		S	1	10-15-10	3.0
3-4	vfsnd layers, 200-100, smaller layers shells		S			
4-5	sand layers are grading into rhythmites of silt and clay					
5-6	layered silt and clay					
6-7	mainly clay, small <1cm silt layers			2	2-4-4	6.1
7-6	mainly clay, pulled augers at 7.6m.			3	grab	7.6

DRILL LOG

DATE Dec/10/86 DRILL HOLE # 128 DRILL TYPE H.S. RECORDER G.G.

STATION Wilson property, north of Stittsville, north of Spratts property, south of airport. north side, middle of pit. UTM 4203 501825

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered msnd and fgrvl, clasts <5mm, snd 200-30, some 16					
1-2	ditto, layers 2-15cm, small silt layers noted					
2-3	ditto, water table at 2.7m.					
3-4	ditto			1	4-4-9	3.0
4-5	ditto	P				
5-6	slightly finer sand, 200-30. layers					
6-7	ditto to 6.1m. and then pulled augers			2	grab	6.1
	piezometer installed at 4.0m.					

DRILL LOG

DATE 88/2/19 DRILL HOLE # 129 DRILL TYPE solids RECORDER G.G.

STATION Smith Construction pit southeast of Arnprior; northwest corner of pit, UTM 39855 50309

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layers of gravel, clasts 5-25 cm					
1-2	the same, very coarse					
2-3	the same					
3-4	the same					
4-5	the same					
5-6	the same					
6-7	the same, rfsl at 6.4 m; too coarse					

DRILL LOG

DATE 88/2/19 DRILL HOLE # 130 DRILL TYPE solids RECORDER G.G.

STATION Smith Construction pit, southeast of Arnprior, 10 m east of DH 129 UTM 39855 50309

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layeredmcsand and fgravel, layers 10-					
	25 cm.					
1-2	the same to 2.4 m then layered coarse					
	gravel and c sand					
2-3	the same					
3-4	the same					
4-5	the same					
5-6	the samd, pulled augers at 5.8 m					

DRILL LOG

DATE 88/2/19 DRILL HOLE # 131 DRILL TYPE solids RECORDER G.G.

STATION Jackson pit, southeast of Galetta, south side of pit

UTM 4033 50302

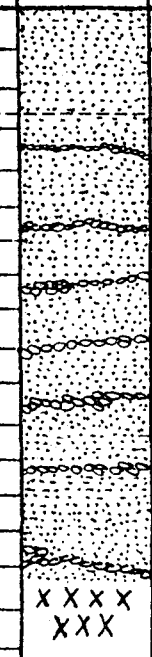
DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered cmsand and msand, layers 10-15 cm					
1-2	the same except that there are small gravel layers, clasts 2-4 cm					
2-3	the same					
3-4	the same					
4-5	the same					
5-6	the same					
6-7	the same					
7-8	the same, bedrock at 7.6 m					

DRILL LOG

DATE 88/2/19 DRILL HOLE # 132 DRILL TYPE solids RECORDER G.G.

STATION Dickson pit, southeast of Galetta far south side

UTM 4033 50302

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered cmsand and m sand, layers 10-30 cm					
1-2	the same except that there are small 2-5 cm gebble layers					
2-3	the same					
3-4	the same					
4-5	the same					
5-6	the same					
6-7	the same					
7-8	the same, bedrock at 7.6m					

DRILL LOG

DATE Dec/11/86 DRILL HOLE # 133 DRILL TYPE H.S. RECORDER G.G.

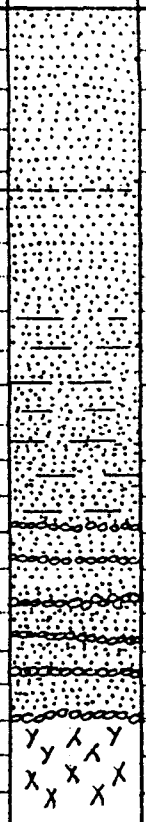
STATION Oxford on the Rideau Tp. just west of the dump, on east-west road, north side, adjacent to the Drewery property. UTM 4479 497695

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	tpsl, layered fsnd 200-50 and small silt drapes, <1% stn.					
1-2	layered fsnd and silt drapes					
2-3	layered fsnd, 200-50 and small silt drapes, water table at 2.4m.					
3-4	mfsnd layers, no stns, small silt drapes			1	7-11-14	3.0
4-5	ditto					
		p-		2	2-2-8	4.6
5-6	ditto					
6-7	ditto			3	grab	6.1
	piezometer installed at 4.7m.					

DRILL LOG

DATE Dec/11/86 DRILL HOLE # 134 DRILL TYPE H.S. RECORDER G.G.

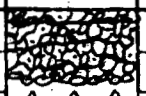
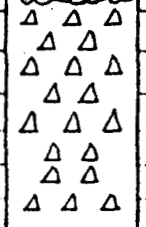
STATION Oxford on the Rideau Tp., just west of the dump, on the east-west road, north side adjacent to the Drewery property. 4m to east of DH 133
UTM 44795 497695

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	tpsl, layered fsnd, 200-50, very little 30					
1-2	ditto					
2-3	ditto, water table at 2.3m.					
3-4	ditto					
4-5	layered fsnd with small silt drapes, 200-50, some 30, layers 10-20cm.					
5-6	ditto					
6-7	ditto to 6.9m. the n small<5cm stn. layers. clasts <1.5cm, snd 200-30,					
7-8	ditto, snd 200-30, some 16, mainly 100-30					
8-9	layered fgrvl and cmsnd, snd 100-16, pebs < 2.5cm.					
9-10	ditto to 9.6m. then weathered bedrock to 10.1m, then bedrock					

DRILL LOG

DATE Dec/11/86 DRILL HOLE # 135 DRILL TYPE H.S. RECORDER G.G.

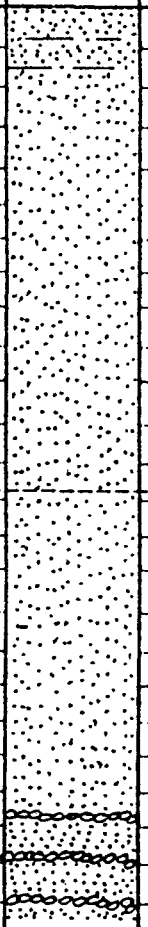
STATION Oxford on the Rideau Tp., Dr. Hicks Property. UTM 44825 49767

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered dirty grvl, clast are angular and are 4-15cm. to 0.9m.then till					
1-2	sandy-silt-till					
2-3	till					
3-4	till to 3.7m.					

DRILL LOG

DATE Dec/11/86 DRILL HOLE # 136 DRILL TYPE H.S. RECORDER G.G.

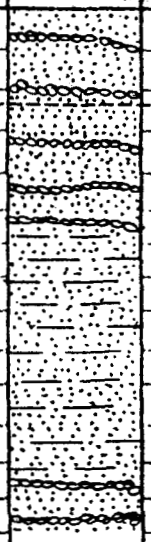
STATION Oxford on the Rideau Tp., north of the Finley property on the township road, UTM 4485 49753

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	tpsl layered mfsnd with small silt caps, 200-50					
1-2	layered mfsnd, 200-50 some 30					
2-3	ditto					
3-4	ditto, 200-30					
4-5	ditto, slightly coarser					
5-6	ditto					
6-7	layered msnd, coarsening downwards, water table at 6.4m.					
7-8	ditto, slightly coarser					
8-9	ditto					
9-10	ditto					
10-11	ditto to 10.7m. then layered fgrvl and msnd, clasts 1-2.5cm.					
11-12	ditto, snd 200-30, some 16					
12-13	ditto to 12.2m, and then pulled augers					

DRILL LOG

DATE Dec/11/86 DRILL HOLE # 137 DRILL TYPE H.S. RECORDER G.G.

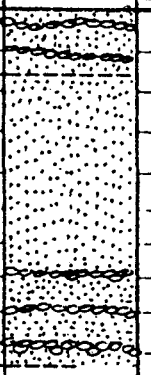
STATION Oxford on the Rideau Tp., on the Finley property, West side 5.6m. face. UTM 44885 497435

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered cmsnd and pebs, snd 100-16, clasts <5mm					
1-2	ditto, water table at 1.2m.					
2-3	ditto to 2.7m. then layered fsnd and small silt caps, 200-100					
3-4	ditto, layers 10-25cm.					
4-5	ditto					
5-6	ditto					
6-7	ditto to 6.2m. then layered mfgrvl and cmsnd. clasts 2-5cm, snd 100-16 rfsl at 7.0m.					

DRILL LOG

DATE Dec/11/86 DRILL HOLE # 138 DRILL TYPE H.S. RECORDER G.G.

STATION Oxford on the Rideau Tp., on the Finley property. Southeast corner of the south pit. UTM 44895 49743 3-4m. face

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered mfgrvl to 0.8m., then mcsnd					
	layers, pebs. < 1cm , wt at 0.8m.					
1-2	ditto					
2-3	ditto					
3-4	ditto to 3.4m. then layered mfgrvl and cmsnd snd 100-16					
4-5	ditto to 4.6 and then pulled augers					
		P				
	piezometer installed at 4.6m.					

DRILL LOG

DATE 88/2/22 DRILL HOLE # 139 DRILL TYPE H.S. RECORDER G.G.

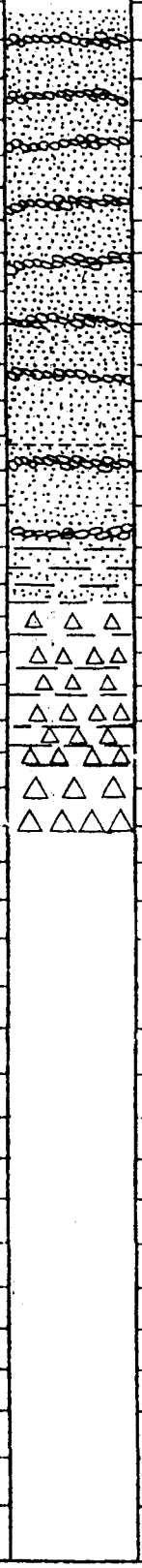
STATION O'Reilly pit, Oxford Tp. southwest side of property
UTM 4491 4728 ;8.5 m face

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fill to 0.9 m then layered msand and silt					
1-2	layered msand and fsand					
2-3	the same to 2.1 m then layered fsand and diamicton					
3-4	the same			1	10-22-19	3.0
4-5	the same			2	3-5-8	4.5
5-6	the same					
6-7	the same to 6.7 m then 30 cm gravel layer, clasts up to 25 cm			3	1-2-3-8	6.1
7-8	layered diamicton and mcsand			4	1-2-20-31	7.6
8-9	the same, rfsl at 9.1 m.			5	5-22-27	9.1
	piezometer installed at 7.6 m					

DRILL LOG

DATE 88/2/23 DRILL HOLE # 140 DRILL TYPE H.S. RECORDER G.G.

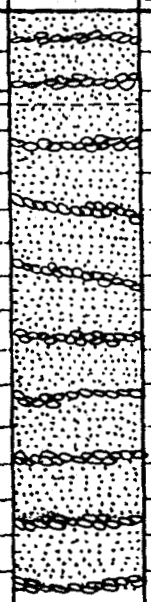
STATION O'Reilly pit, mid west side, north of pit access road
UTM 4491 49731

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	fill to 0.6 m then layered fgravel					
	and msand, layers 10-20 cm					
1-2	the same clasts 2 to 5 cm in diameter					
2-3	the same			1	11-13-15	3.0
3-4	the same					
4-5	the same			2	6-17-36	4.5
5-6	the same					
6-7	the same			3	11-34-26	6.1
7-8	the same to 7.9 m then layered clay					
	and fsand, clay layers thicken downwards			4	6-17-26	7.6
8-9	the same except for at 8.8 m then sand					
	is replaced by diamicton					
9-10	the same, clay and diamicton			5	4-6-7	9.1
10-11	the same					
				6	21-27-24	10.7
11-12	the same to 11.2 m then till, pulled					
	augers at 12.2 m			7	10-23-13	11.7

DRILL LOG

DATE 88/2/23 DRILL HOLE # I41 DRILL TYPE H.S. RECORDER G.G.

STATION McReynolds, at base of pit, in middle
UTM 4503 497015, 7.2 m face

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered csand and fgravel, layers 10-15 cm thick, clasts < 5 cm					
1-2	the same					
2-3	the same					
3-4	the same			1	2-12-19	3.0
4-5	the same			2	4-17-18	4.5
5-6	the same					
6-7	the same			3	7-37-36	6.1
7-8	the same, augers filling up at 7.6 m and were pulled piezometer installed at 7.7 m					

DRILL LOG

DATE 88/2/23 DRILL HOLE # 142 DRILL TYPE solids RECORDER G.G.

STATION McReynolds pit, 6 m north of DH 141

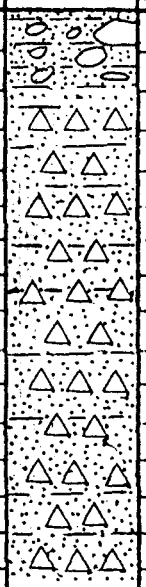
UTM 4503 497015

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered csand and fgravel, clasts < 5 cm, layers 5-15 cm					
1-2	the same					
2-3	the same					
3-4	the same					
4-5	the same					
5-6	the same					
6-7	the same					
7-8	the same					
8-9	the same					
9-10	the same					
10-11	the same to 10.5 m then bedrock					

DRILL LOG

DATE 88/2/24 DRILL HOLE # 143 DRILL TYPE solids RECORDER D.Y.

STATION O'Reilly property southeast of owners home, just south of the township right-of-way UTM 4504 49721

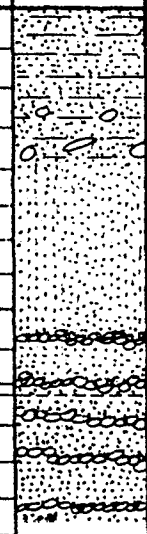
DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	siltly sand and stones					
1-2	silty sand till					
2-3	the same					
3-4	the same					
4-5	the same					
5-6	the same					
6-7	the same					
7-8	the same to 7.6 m and then pulled augers					

DRILL LOG

DATE 88/2/24 DRILL HOLE # 144 DRILL TYPE H.S. RECORDER D.Y.

STATION Drummond property, south of pit on north side of road allowance

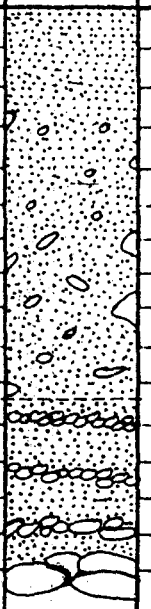
UTM 4518 49639

DEPTH	DESCRIPTION(Colour, Texture, Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	silty sand					
1-2	silt sand occasional stone < 4 cm					
2-3	layered very fine sand					
3-4	the same			1	10-14-18	3.0
4-5	the same to 4.3 m the stone layer,					
	clasts < 3 cm			2	stone	4.5
5-6	layered msand and stones, clasts					
	< 10 cm					
6-7	the same, pulled augers at 6.7 m					

DRILL LOG

DATE 88/2/24 DRILL HOLE # 145 DRILL TYPE H.S. RECORDER G.G.

STATION Drummond property, south of Limerick forest, 3 m west of DH 144
UTM 4518 49369

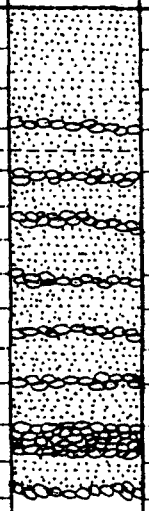
DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered oxidized sand					
1-2	layered mfsand, occasional stone,					
	layers 5-10 cm					
2-3	the same					
3-4	the same					
4-5	the same			1	6-12-16	4.5
5-6	the same to 5.3 m then layered gravel					
	and coarse sand, layers 20-40 cm					
6-7	the same			2	stones	6.1
7-8	the same to 7.6 m, then pulled augers					
	because it was too coarse					
	piezometer installed at 7.1 m					

DRILL LOG

DATE 88/2/25 DRILL HOLE # 146 DRILL TYPE H.S. RECORDER G.G.

STATION Property south of the South Nation River and northwest of Domville

UTM 4533 495765 5.2 m face

DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered silty sand					
1-2	the same to 1.4 m then layered fgravel					
	and cmsand, layers 15-30 cm.					
2-3	the same					
3-4	the same			1	6-14-10	3.0
4-5	the same			2	10-14-14	4.5
5-6	the same to 5.5 m then a 40 cm gravel layer					
6-7	layered mcgravel and c sand, pulled augers at 6.4 m because they were binding					

DRILL LOG

DATE 88/2/25 DRILL HOLE # 147 DRILL TYPE solids RECORDER G.G.

STATION Property south of the South Nation River and northwest of Domville
UTM 4533 495765 10 m n of DH 146

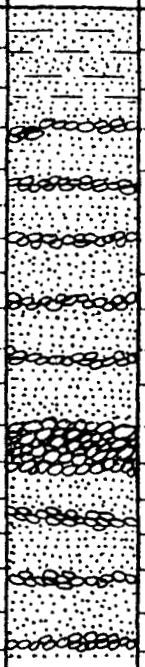
DEPTH	DESCRIPTION(Colour, Texture. Moisture, etc.)	WT	Material Diagram	Hollow Stem Data		
				Sample #	Blows	Depth
0-1	layered silty sand					
1-2	the same to 1.4 m then layered					
	fgravel and cmsand, layers 15-30 cm					
2-3	the same, clasts W 5 cm					
3-4	the same					
4-5	the same					
5-6	the same to 5.5 m then a 60 cm gravel					
	layer, clasts < 15 cm					
6-7	layered mc gravel and c sand, layers					
	20-60 cm					
7-8	the same					
8-9	the same, rfsl at 8.6 m					

TABLE 3: SUMMARY OF SEISMIC RESULTS IN RUSSELL AND DUNDAS COUNTIES AND IN OTTAWA-CARLETON REGIONAL MUNICIPALITY, ONTARIO. AUGUST - SEPTEMBER, 1986. (REFERENCE FIGURES 3 - 11)

LINE NO. & DIRECTION		LOCATION LOT	CONC.	TOWNSHIP	UTM CO-ORDINATES	LINE TYPE	VELOCITIES (m/s)	INTERPRETATION (MATERIAL)	BEDROCK DEPTH (m) FWD	RVS	AVG.	REF. LEVEL	BEDROCK
24	W-E	16	6	RUSSELL	5016700N 475200E	RX*	V2 = 1480	mottled clay - WT	30	31	31	road	Queenston Shale
	W-E	16	6	RUSSELL	5016800N 475400E	RX	V2 = 1480	clay - WT**	29	26	28	road	"
	W-E	15	7	RUSSELL	5016900N 475700E	RX	V2 = 1500	clay - WT	33	35	34	road	"
23	W-E	15	7	RUSSELL	5017150N 476200E	RX	V2 = 1530	clay - WT	36	37	37	road	"
17	W-E	11	7	RUSSELL	5014700N 477800E	RX	V2 = 1535	puddling sand - WT	49	51	50	road	Verulam Ls
20	W-E	11	6	RUSSELL	5013600N 476000E	RX	V2 = 1480	clay - WT	39	38	39	road	"
19	W-E	11	6	RUSSELL	5013850N 476400E	RX	V2 = 1525	sandy clay - WT	41	44	43	road	"
18	W-E	10	7	RUSSELL	5014250N 477200E	RX	V2 = 1545	sand - WT	44	45	45	road	"
14	W-E	6	6	RUSSELL	5010500N 476400E	RX	V2 = 1490	mottled clay - WT	32	30	31	road	Bobcaygeon Ls.
15	W-E	5	5	RUSSELL	5010100N 476100E	RX	V2 = 1575	clay - WT	22	26	24	road	"
						RR*	V1 = 930	clay					
							V2 = 1420	WT	22	21	22	road	
							V3 = 4180	limestone					
16	W-E	6	5	RUSSELL	5009950N 475500E	RX	V2 = 1445	mottled clay - WT	17	19	18	road	"
						RR	V1 = 700	gravel					
							V2 = 1440	clay - WT	20	21	21	road	"
							V3 = 5520	limestone					
29	W-E	28	5	CUMBERLAND	5020900N 475400E	RX	V2 = 1500	friable clay - WT	25	27	26	road	Carlsbad Shale
						RR	V1 = 420	sand					
							V2 = 1550	clay - WT	25	19	22	road	"
							V3 = 4310	shale					
28	W-E	28	4	CUMBERLAND	5021250N 476250E	RR	V1 = 965	gravel/clay					
							V2 = 1365	soft clay - WT	22	25	24	road	"
							V3 = 3940	shale					
21	E-W	13	6	RUSSELL	5015350N 475900E	RX	V2 = 1340	sand/clay	34	35	35	field	Queenston Shale
22	E-W	13	6	RUSSELL	5015050N 475150E	RX	V2 = 1500	clay - WT	36	37	37	field	"

* RX - Refraction, RR - Refraction ** WT - Water Table

LINE NO. & DIRECTION		LOCATION LOT	CONC.	TOWNSHIP	UTM CO-ORDINATES	LINE TYPE	VELOCITIES (m/s)	INTERPRETATION (MATERIAL)	BEDROCK DEPTH (m) FWD	RVS	AVG.	REF. LEVEL	BEDROCK
	W-E	1	4	RUSSELL	5006600N 476050E	RR	V1 = 465 V2 = 1510 V3 = 3810	sand/silt till - WT limestone	17	9	13	road	Bobcaygeon Ls.
13	W-E	A	5	RUSSELL	5006800N 476600E	RR	V1 = 430 V2 = 2305 V3 = 4800	sand/silt compacted till limestone	14	12	13	road	Gull R. Ls
	W-E	A	4	RUSSELL	5006700N 476400E	RR	V1 = 415 V2 = 1925 V3 = 4885	sand compacted till limestone	12	12	12	road	"
3	E-W	9	8	CAMBRIDGE	5014700N 495000E	RR	V1 = 235 V2 = 2035 V3 = 5590	topsoil compacted till limestone	16	14	15	road	Lindsay Ls.
	E-W	9	8	CAMBRIDGE	5014600N 494650E	RR	V1 = 240 V2 = 1790 V3 = 4880	topsoil compacted clay limestone	10	8	9	road	"
4	E-W	10	8	CAMBRIDGE	5014500N 494400E	RR	V1 = 465 V2 = 1535 V3 = 5420	silt mottled clay - WT limestone	13	14	13	road	"
5	E-W	10	8	CAMBRIDGE	5014350N 494100E	RR	V1 = 390 V2 = 1500 V3 = 5625	sand clay - WT limestone	13	12	13	road	"
27	W-E	17	7	RUSSELL	5017800N 475300E	RX RR	V2 = 1450 V1 = 485 V2 = 1250 V3 = 5840	clay - WT silt till/clay shale	29 29	28 24	28 27	field 	Queenston Shale "
26	W-E	17	7	RUSSELL	5018000N 475850E	RX RR	V2 = 1480 V1 = 540 V2 = 1340 V3 = 3635	clay - WT silt clay - WT shale	33 23	35 25	34 24	field field	" "
6	E-W	12	9	CAMBRIDGE	5012500N 493700E	RR	V1 = 645 V2 = 2640 V3 = 6070	clay weathered lmst. limestone	6	7	6	road	Lindsay Ls.
	E-W	12	9	CAMBRIDGE	5012450N 493450E	RR	V1 = 380 V2 = 1945 V3 = 5400	sand compacted till limestone	6	9	8	road	"

* R - Reflection, RR - Refraction ** WT - Water Table

LINE NO. & DIRECTION		LOCATION LOT	CONC.	TOWNSHIP	UTM CO-ORDINATES	LINE TYPE	VELOCITIES (m/s)	INTERPRETATION (MATERIAL)	BEDROCK DEPTH (m) FWD	RVS	AVG.	REF. LEVEL	BEDROCK
6	E-W	13	9	CAMBRIDGE	5012350N 493250E	RR	V1 = 655 V2 = 2355 V3 = 5610	clay compacted till limestone	5	8	6	road	Lindsay Ls.
11	W-E	11	7	WINCHESTER	4995200N 476150E	RR	V1 = 555 V2 = 1480 V3 = 4810	silt/clay WT limestone	5	8	6	field	Gull R. Ls
11	W-E	11	7	WINCHESTER	4995300N 476250E	RR	V1 = 445 V2 = 1100 V2 = 2350 V3 = 5225	sand/silt (FWD) clay (RVS) compacted clay limestone	9	8	8	field	"
10	W-E	12	6	WINCHESTER	4995400N 476550E	RR	V1 = 505 V2 = 1395 V3 = 5250	sand/silt clay - WT limestone	9	8	8	road	"
33	NE-SW	1	7	MOUNTAIN	4986900N 457100E	RR	V1 = 395 V2 = 1990 V3 = 3985	sand/gravel compacted till dolostone	24 (FWD only)			field	Oxford Ds
34	NW-SE	8/9	4	NEPEAN CITY	5009400N 440600E	RR	V1 = 320 V2 = 1770 V3 = 5970	sand compacted till dolostone	35	32	33	road	"
35	"	7	3	NEPEAN CITY	5008800N 440900E	RX	V2 = 1395	compacted till - WT	35	38	37	road	"
36	E-W			KANATA CITY	5013000N 432800E	RX	V2 = 1320	clay - WT	31	27	29	road	Gull R. Ls
37	E-W			KANATA CITY	5017950N 426250E	RX	V2 = 1350	clay - WT	25	29	27	road	Verulam Ls.
38	NE-SW	12	3	W. CARLETON (HUNTLEY)	5018450N 420600E	RX	V2 = 1820	compacted till	33	26	30	field	"
	NE-SW	12	3	W. CARLETON (HUNTLEY)	5018200N 420350E	RX	V2 = 1530	compacted till	24	28	26	field	"
39	NW-SE	8	8	W. CARLETON (FITZROY)	5026900N 408800E	RX	V2 = 1395	clay - WT	60	58	59	road	Bobcaygeon Ls.

NOTE 1: Lines consisting of 2 or more spreads are identified as #A, #B, etc. When analysing the results, care should be taken to apply depths according to line and spread locations (see Figs. 3 - 11) and the FWD and RVS directions of each spread or line. The overall accuracy of measured depths is about 10%.

NOTE 2: For depths less than approximately 22 m., refraction measurements are more reliable.
For depths greater than 22 m., reflection measurements are more reliable.

NOTE 3: Bedrock Formation information taken from OGS maps P.2493, P.2715, P.2717, P.2721, and P.2726; courtesy D.A. Williams

* RX - Reflection, RR - Refraction ** WT - Water Table

S9 - On Conc.6 road allowance, Lots 12 & 13, Winchester Twp., Dundas Co.; starting about 700m west of n-s bush road and ends 20m west of n-s bush road; line at road level.

12 - South side Conc. 9 road, Lots 15 & 16, Conc.8, Winchester Twp., Dundas Co.; starts at first north road west of "The Ninth" and runs east 784m; line in ditch 2m below road level.

16 - North side 5-6 sideroad straddling Conc.5 road, Lot 6, Conc.4 & 5, Russell Twp., Russel Co.; line on north jog in road starting about 150m east of west side jog; line at road level.

9 - South side Conc.7 road, Lots 14 & 15, Conc.6, Winchester Twp., Dundas Co.; line starts about 400m west of first south road west of Morewood-Chesterville road opposite sheet metal garage; line 1m below road level (road is not level).

25- North side 15-16 sideroad, Lot 16, Conc.6, Russell Twp., Russell Co.; east of Brisson starting at second utility pole just east of farm lane on south side of road; line 0.5m below road level.

29- North side of boundary road (Conc.1 road) with Russel Co., Lot 28, Cumberland Twp., Ottawa-Carleton Reg. Municipality; line starts just east of mail boxes at house and lane on south side; line 1m below road level.

30- South side 25-26 sideroad, Lot 26, Cumberland Twp., Ottawa-Carleton Reg. Municipality; line starts east of row of houses on south side and 20m east of creek; line 0.5m below road level.

31- South side 10-11 sideroad, Lot 11, Conc.4 & 5,Cumberland Co., Ottawa-Carleton Reg. Munic.; line starts about 500m west of Conc.5 road and east of creek where road levels out at second utility pole; line 1m below road level.

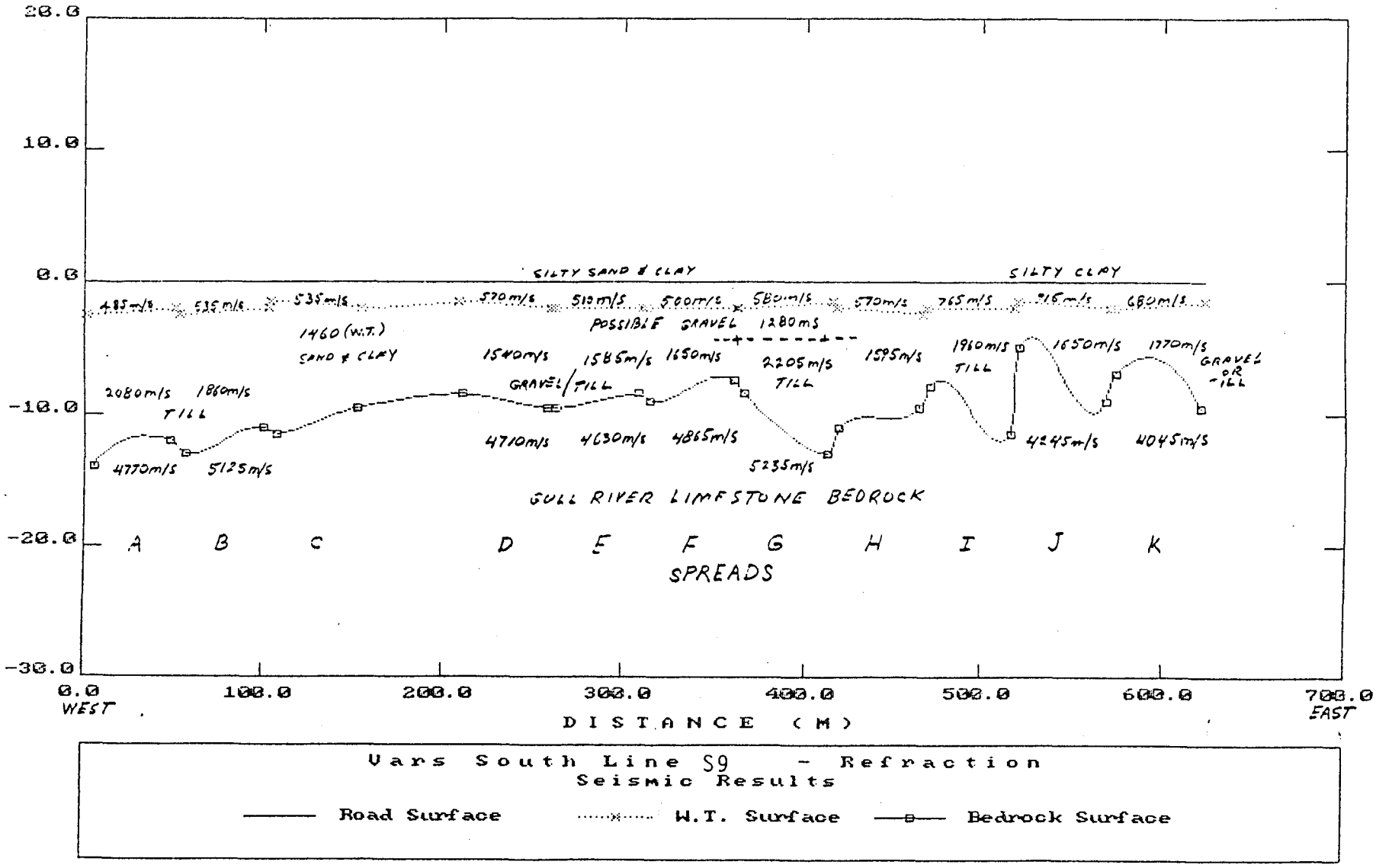
32- East side Conc.7 road, Lots 1,2, & 3, Conc.7, Cumberland Twp., Ottawa-Carleton Reg. Munic.; line starts at edge of cornfield just north of house on east side of road; line at road level.

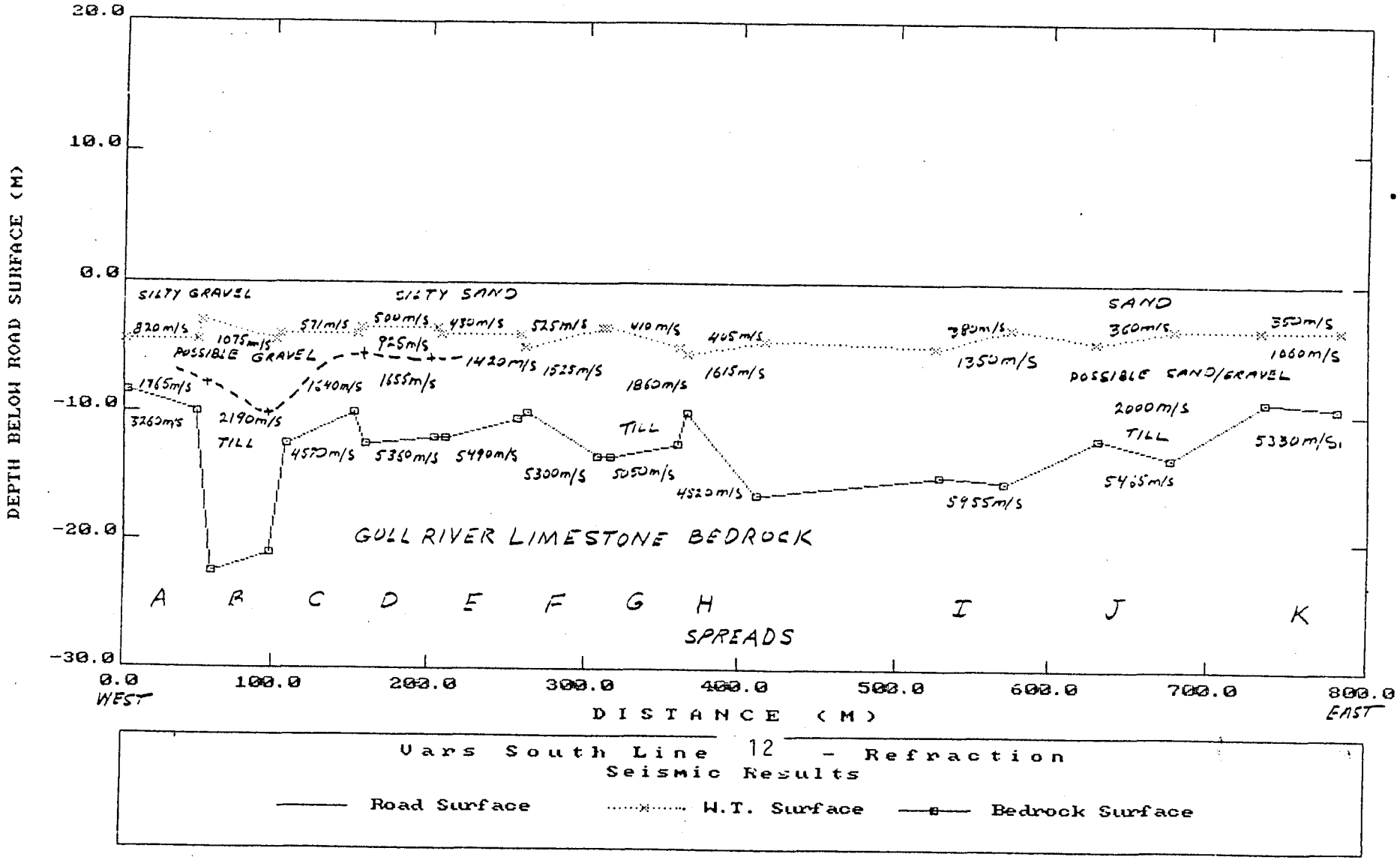
2- East side 9-10 sideroad, Lot 9, Conc.8, Cambridge Twp., Russell Co.; line starts north of Butternut Creek where curve in road straightens out; line 1m below road level.

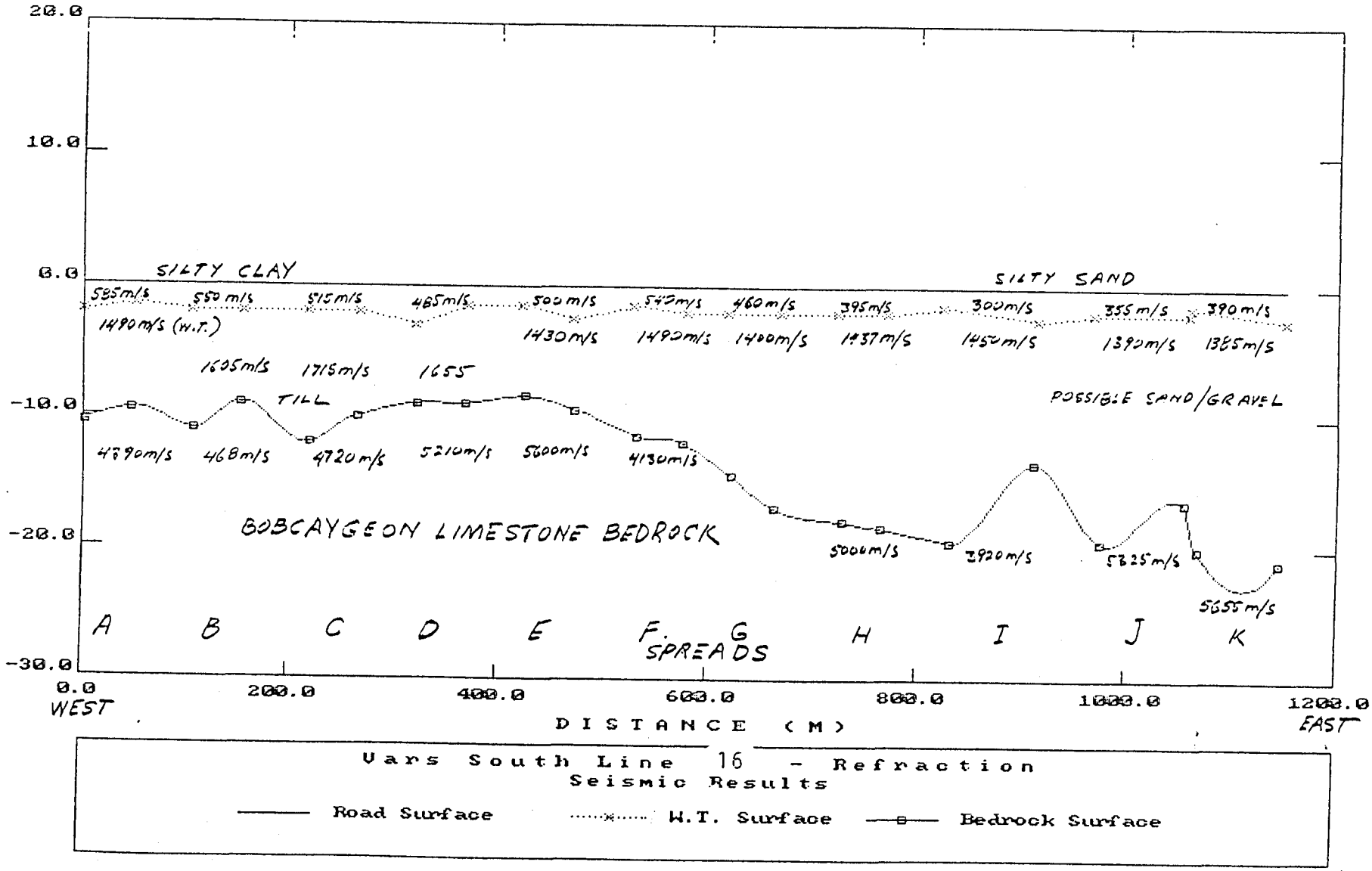
7- South side Conc.9 road east of Crysler, Lots 21,22 & 23, Conc.9, Finch Twp., Stormont Co.; starts about 500m west of road to north and just east of house on south side of road; line 1.5m below road level.

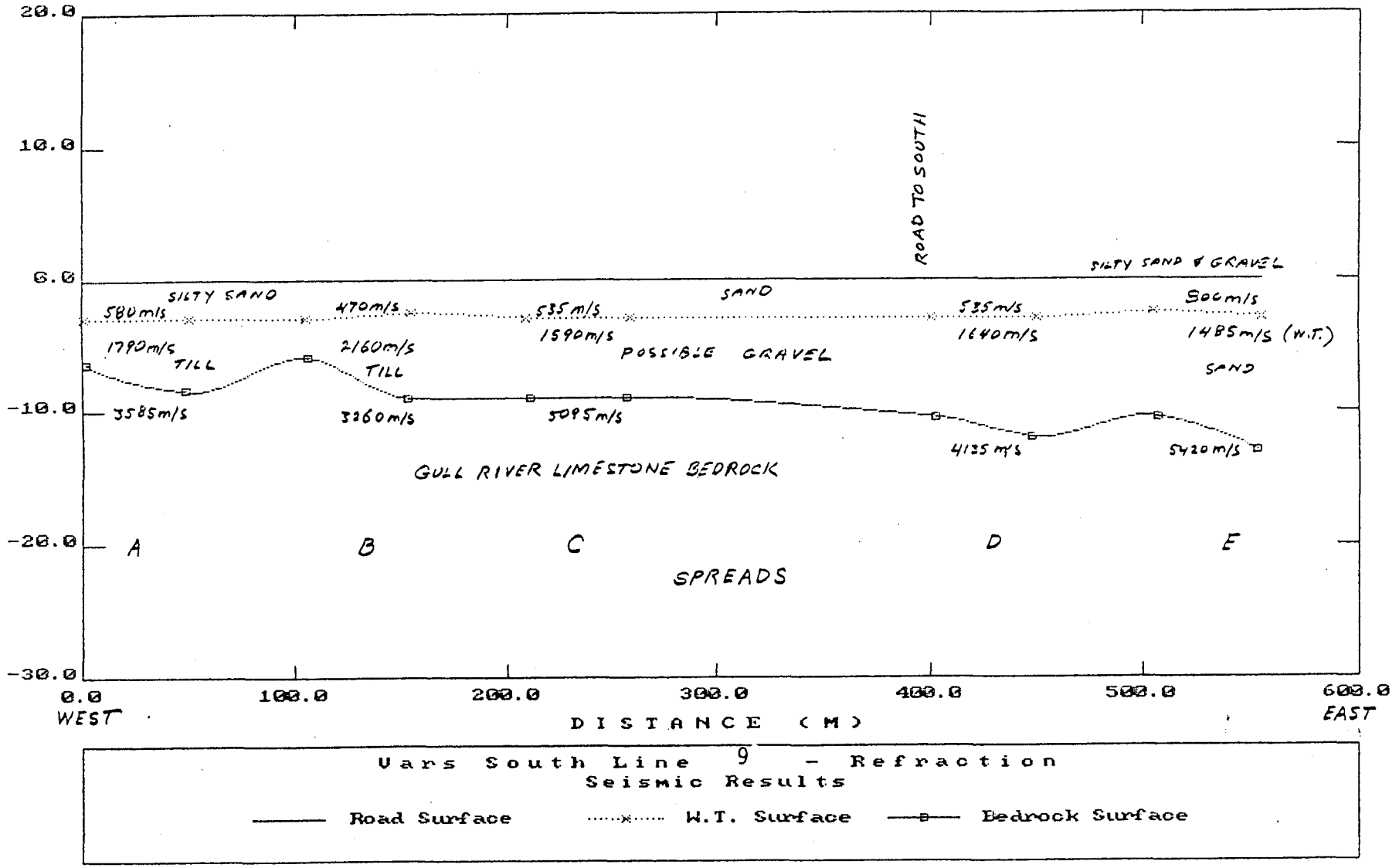
8- North side Conc.7 road; Lots 17 & 18, Conc.7, Finch Twp., Stormont Co.; line starts about 25m east of McIntyre-Lagrove Drain and ends about 40m west of Duff Creek; line at road level.

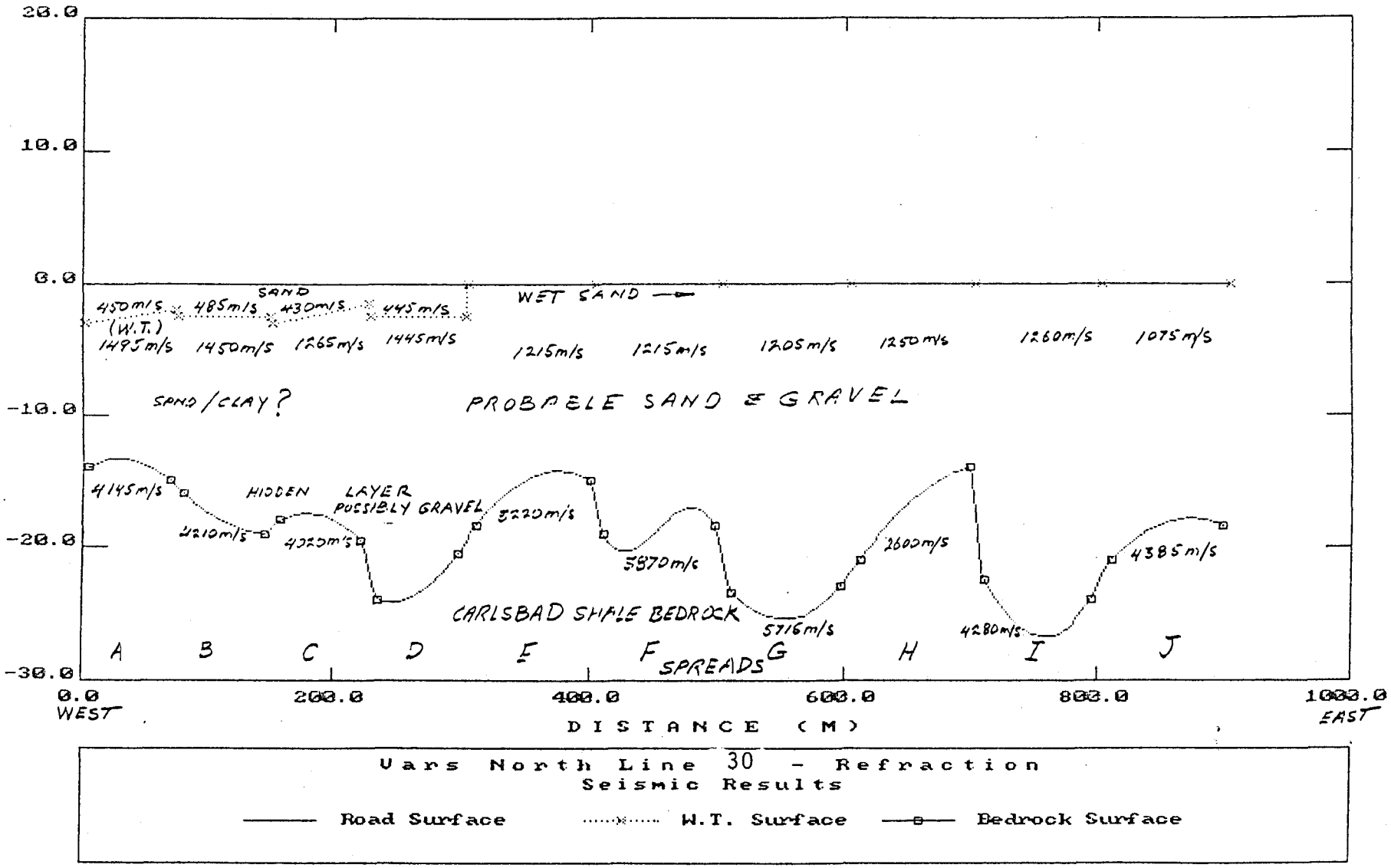
1- On Conc.14-15 road allowance, Lots 18,19 & 20, South Plantagenet Twp., Prescott Co.; line starts about 700m west of creek, skips 150m across creek and ends at 1450m; line at road level.


20.0
10.0
0.0
-10.0
-20.0
-30.0
DEPTH BELOW ROAD SURFACE (M)
SILTY SAND & CLAY
SILTY CLAY
485m/s
535m/s
535m/s
570m/s
510m/s
500m/s
580m/s
570m/s
765m/s
715m/s
680m/s
1460 (W.T.)
SAND & CLAY
POSSIBLE GRAVEL 1280mS
2080m/s
1860m/s
TILL
1540m/s
1585m/s
1650m/s
GRAVEL/TILL
2205m/s
TILL
1595m/s
1960m/s
TILL
1650m/s
1770m/s
GRAVEL OR TILL
4770m/s
5125m/s
4710m/s
4630m/s
4865m/s
5235m/s
4245m/s
4045m/s
GULL RIVER LIMESTONE BEDROCK
A
B
C
D
E
F
G
H
I
J
K
SPREADS
0.0
WEST
100.0
200.0
300.0
400.0
500.0
600.0
700.0
EAST
DISTANCE (M)
Vars South Line S9 - Refraction
Seismic Results
Road Surface
W.T. Surface
Bedrock Surface


DEPTH BELOW ROAD SURFACE (M)
20.0
10.0
0.0
-10.0
-20.0
-30.0
SILTY GRAVEL
SILTY SAND
SAND
820m/s
1075m/s
571m/s
500m/s
430m/s
525m/s
410m/s
405m/s
780m/s
360m/s
350m/s
1060m/s
POSSIBLE GRAVEL
925m/s
1420m/s
1525m/s
1615m/s
1350m/s
POSSIBLE SAND/GRAVEL
1765m/s
1640m/s
1655m/s
1860m/s
3260m/s
2190m/s
TILL
4570m/s
5350m/s
5490m/s
5300m/s
5050m/s
TILL
4520m/s
5955m/s
2000m/s
TILL
5465m/s
5330m/s
GULL RIVER LIMESTONE BEDROCK
A
B
C
D
E
F
G
H
I
J
K
SPREADS
0.0
WEST
100.0
200.0
300.0
400.0
500.0
600.0
700.0
800.0
EAST
DISTANCE (M)
Vars South Line 12 - Refraction Seismic Results
Road Surface
W.T. Surface
Bedrock Surface

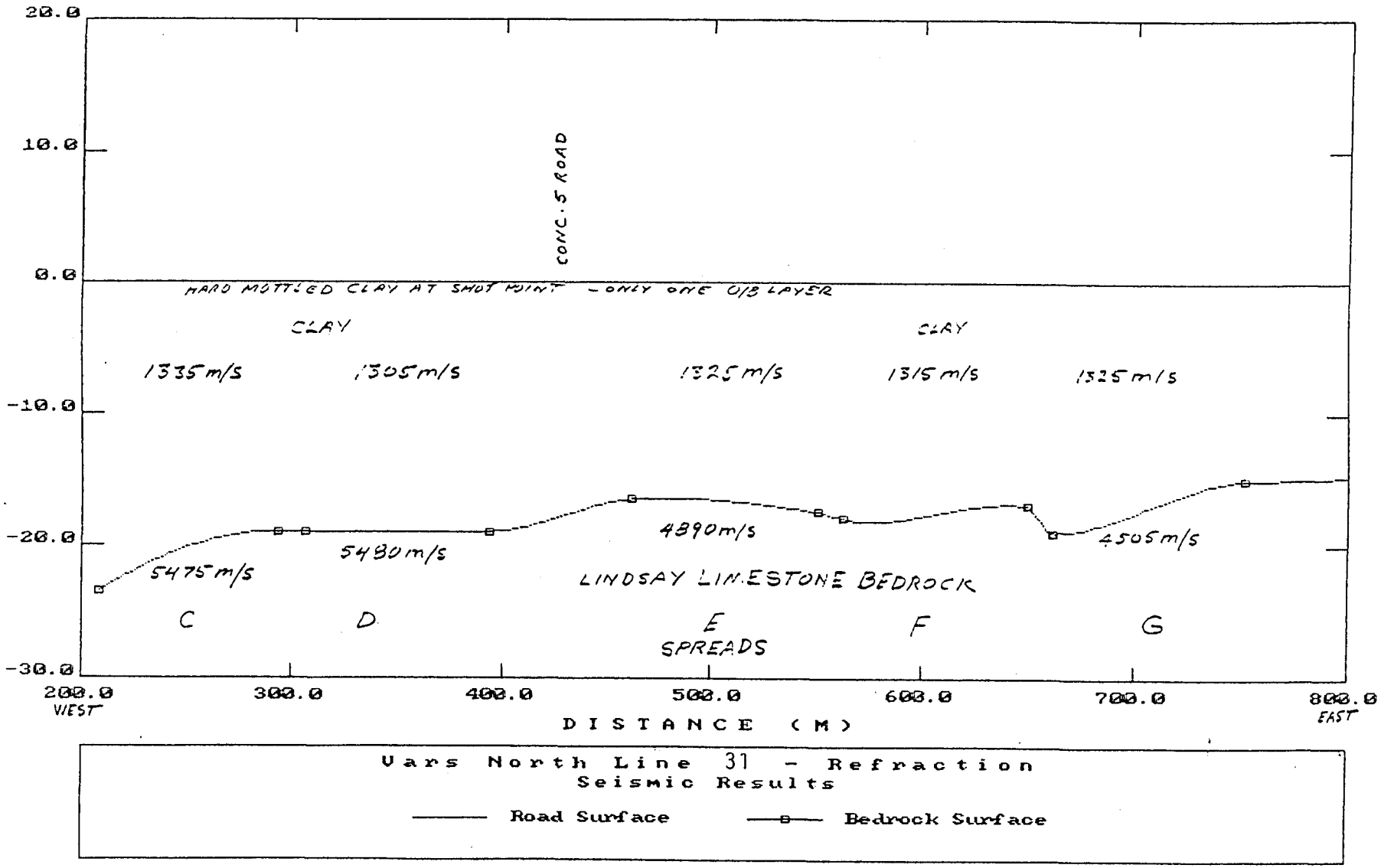

20.0
10.0
0.0
-10.0
-20.0
-30.0
DEPTH BELOW ROAD SURFACE (M)
SILTY CLAY
SILTY SAND
585m/s
550 m/s
515m/s
485m/s
500 m/s
540m/s
460m/s
395m/s
300m/s
355 m/s
390 m/s
1490m/s (W.T.)
1430m/s
1490m/s
1400m/s
1437m/s
1450m/s
1390m/s
1385m/s
1605m/s
1715m/s
1655
TILL
POSSIBLE SAND/GRAVEL
4890m/s
468m/s
4720m/s
5210m/s
5600m/s
4130m/s
5006m/s
5920m/s
5825m/s
5655m/s
BOBCAYGEON LIMESTONE BEDROCK
A
B
C
D
E
F
G
H
I
J
K
SPREADS
0.0
WEST
200.0
400.0
600.0
800.0
1000.0
1200.0
EAST
DISTANCE (M)
Vars South Line 16 - Refraction Seismic Results
Road Surface
W.T. Surface
Bedrock Surface

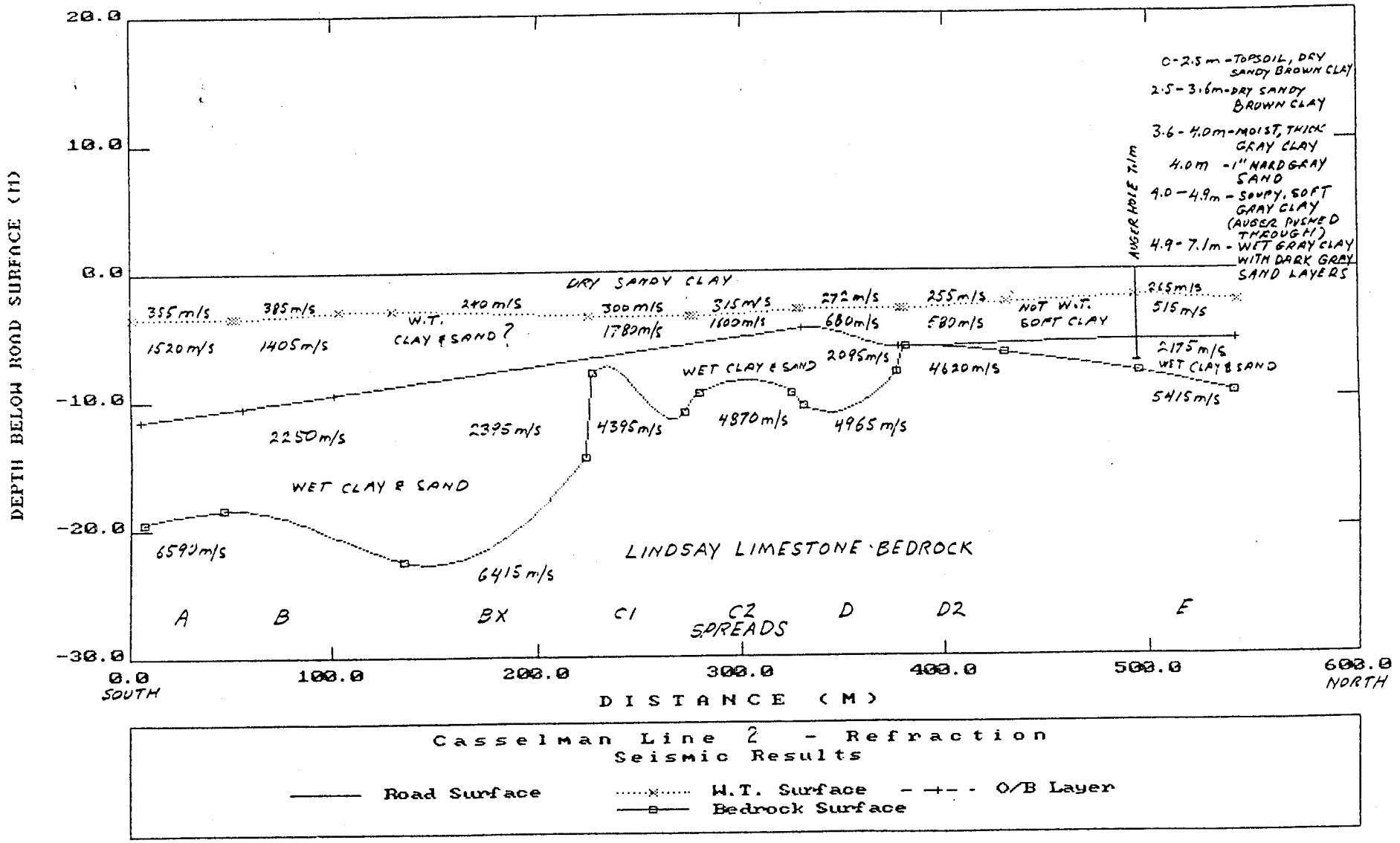

20.0
10.0
0.0
-10.0
-20.0
-30.0
DEPTH BELOW ROAD SURFACE (M)
ROAD TO SOUTH
SILTY SAND & GRAVEL
SILTY SAND
SAND
580 m/s
470 m/s
535 m/s
535 m/s
500 m/s
1790 m/s
TILL
2160 m/s
TILL
1590 m/s
POSSIBLE GRAVEL
1640 m/s
1485 m/s (W.T.)
SAND
3585 m/s
3260 m/s
5095 m/s
4135 m/s
5420 m/s
GULL RIVER LIMESTONE BEDROCK
A
B
C
D
E
SPREADS
0.0
WEST
100.0
200.0
300.0
400.0
500.0
600.0
EAST
DISTANCE (M)
Vars South Line 9 - Refraction Seismic Results
Road Surface
W.T. Surface
Bedrock Surface

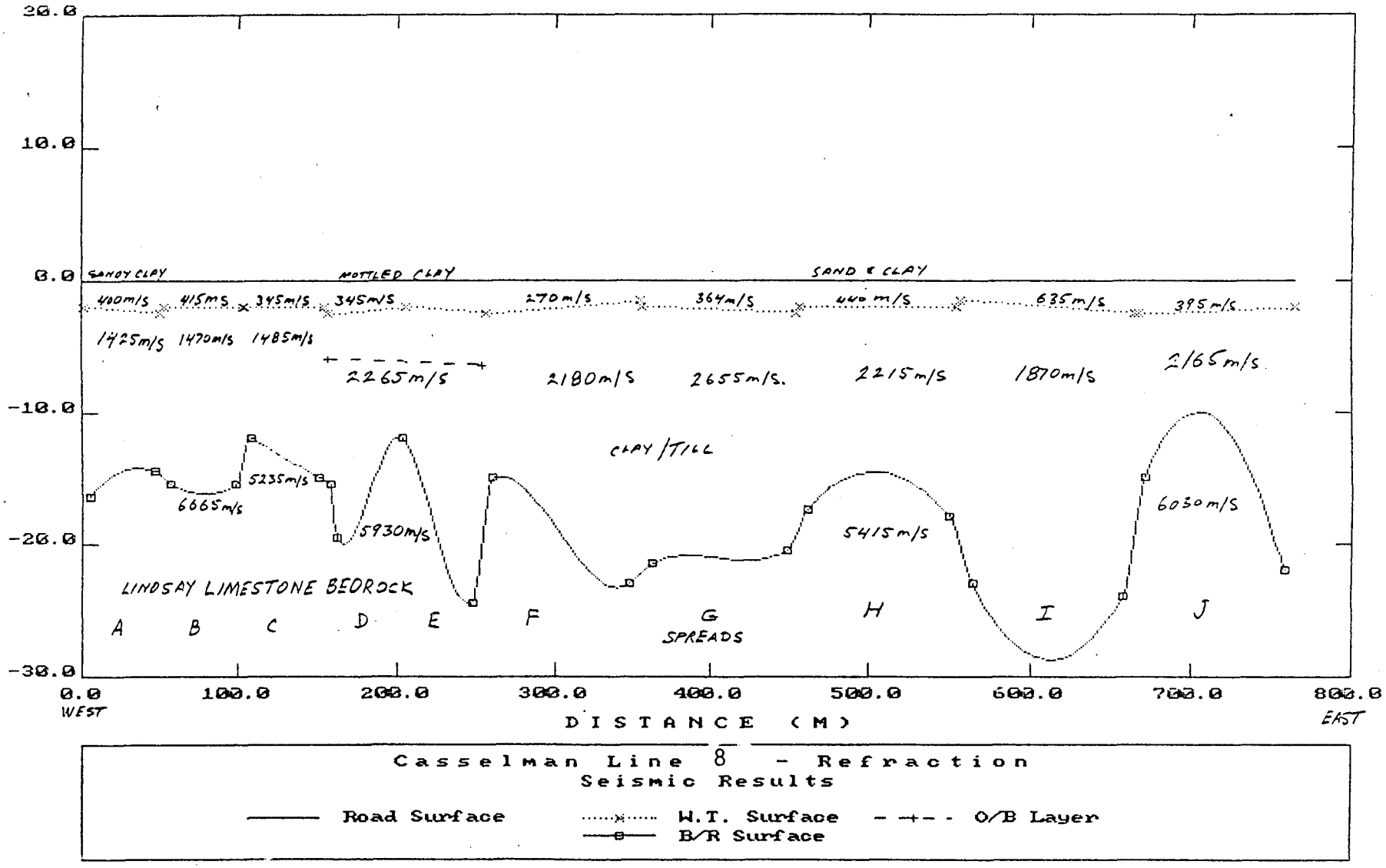


Vars North Line 30 - Refraction Seismic Results

——— Road Surface ·····×····· W.T. Surface —o— Bedrock Surface


20.0
10.0
0.0
-10.0
-20.0
-30.0
DEPTH BELOW ROAD SURFACE (M)
CONC. S ROAD
HARD MOTTLED CLAY AT SHOT POINT - ONLY ONE O/B LAYER
CLAY
CLAY
1335 m/s
1305 m/s
1325 m/s
1315 m/s
1525 m/s
5475 m/s
5480 m/s
4890 m/s
4505 m/s
LINDSAY LIMESTONE BEDROCK
C
D
E
F
G
SPREADS
200.0
WEST
300.0
400.0
500.0
600.0
700.0
800.0
EAST
DISTANCE (M)
Vars North Line 31 - Refraction
Seismic Results
Road Surface
Bedrock Surface


20.0
10.0
0.0
-10.0
-20.0
-30.0
DEPTH BELOW ROAD SURFACE (M)
0.0
SOUTH
100.0
200.0
300.0
400.0
500.0
600.0
NORTH
DISTANCE (M)
0-2.5m - TOPSOIL, DRY SANDY BROWN CLAY
2.5-3.6m - DRY SANDY BROWN CLAY
3.6-4.0m - MOIST, THICK GRAY CLAY
4.0m - 1" HARD GRAY SAND
4.0-4.9m - SOUPY, SOFT GRAY CLAY (AUGER PUSHED THROUGH)
4.9-7.1m - WET GRAY CLAY WITH DARK GRAY SAND LAYERS
AUGER HOLE 7.1m
DRY SANDY CLAY
355 m/s
385 m/s
240 m/s
300 m/s
315 m/s
272 m/s
255 m/s
265 m/s
515 m/s
W.T.
CLAY & SAND ?
NOT W.T.
SOFT CLAY
1520 m/s
1405 m/s
1780 m/s
1600 m/s
680 m/s
580 m/s
2095 m/s
4620 m/s
2175 m/s
WET CLAY & SAND
5415 m/s
WET CLAY & SAND
2250 m/s
2395 m/s
4395 m/s
4870 m/s
4965 m/s
WET CLAY & SAND
6590 m/s
6415 m/s
LINDSAY LIMESTONE BEDROCK
A
B
BX
C1
C2
SPREADS
D
D2
E
Casselman Line 2 - Refraction Seismic Results
Road Surface
W.T. Surface
O/B Layer
Bedrock Surface



Casselman Line 8 - Refraction Seismic Results

Road Surface — W.T. Surface — O/B Layer — B/R Surface

Observed Water levels and Installed Piezometers

DRILL HOLE NUMBER	GENERAL LOCATION	WATER LEVEL (m)	DEPTH PIEZ. INSTALLED (m)	COMMENTS
5	System 3, Casselman	2.7	7.6	
6	System 3, Casselman	7.9	9.7	
7	System 3, Vinette pit, west side	2.7	6.7	
9	System 3, Vinette pit, east side	1.8	5.5	
11	System 3, Rus/Stor border	2.9	12.2	
15	System 3, Richer N. pit	1.1	10.7	
16	System 3, Richer S. pit	1.2	12.2	
17	System 3, 1 km south of DH #16	4.7	10.7	destroyed, winter 87
23	System 3, Sandtown Sullivan pit	4.9	12.2	
25	System 3, Sandtown H A Blair pit	0.5	11.9	
27	System 3, Sandtown N. Blair pit	0.5	8.5	
35	System 4, Maple R. Osgoode pit	2.7	6.7	
37	System 4,Maple R Monast pit,back	0.9	6.1	plugged at 4.2m
38	System 4, Maple R Hutt pit,back	2.4	6.1	
41	System 4, Maple R Monast front	3.2	9.1	
44	System 4, Maple R, Hutt south	3.8	6.1	
45	System 4, N. Winchester Tp. line	1.2	6.1	
50	System 4, Provost pit, Morewood	0.4	6.1	
56	System 4, Dagenais pit, Morewood	0.8	3.8	
57	System 4, N. of Embrun supply	1.7	12.2	
58	System 4, E. of Brisson	1.8	21.3	
59	System 4, Bearbrooke side Rd.	4.9	6.9	
61	System 4, east of Leonard, N.	10.1	11.0	
65	System 4, Red Dragon garage	1.4	6.7	
66	System 5, Redmond pit, front	0.8	7.0	
78	System 5, A Murry, Loughlin R.	3.3	6.7	
83	System 5, Reids Mill, E of rd.	9.4	12.2	
86	System 5, E. Moores, SE corner	1.5	5.7	
90	System 5, Osgoode pit,small pit	0.6	4.6	
93	System 5,Dib/Warran pit, Osgoode	0.5	4.6	
97	System 5, Osgoode main pit	2.2	4.6	destroyed, ripped out
98	System 5, Greely S & G, E side	2.3	6.7	
99	System 5, Pyper pit, S. of #8	2.1	12.2	buried and destroyed
102	System 5,Moffat, N of #8, E.side	3.7	7.0	
104	System 5,Dib/Warran,Johnston C.	1.2	6.1	plugged at 4.6m
109	System 6, Drummonds SE corner	9.8	12.2	
111	System 6, Drummonds Front	0.7	17.1	
112	System 6, Brazeau pit, back	0.3	5.5	
117	System 6, Burnside S pit	0.4	10.2	
128	System 6, Wilson north of Stitt.	2.7	4.0	
133	System 7, East of Oxford dump	2.4	4.7	
138	System 7, Finley pit	0.8	4.6	
139	System 7, O'Reilly W side	0.7	7.6	
141	System 7, McReynolds, pit floor	1.2	7.7	
145	System 7, Drummonds S Limerick	5.3	7.1	

CONVERSION FACTORS FOR MEASUREMENTS IN ONTARIO GEOLOGICAL SURVEY PUBLICATIONS

Conversion from SI to Imperial			Conversion from Imperial to SI		
SI Unit	*Multiplied by*	*Gives*	*Imperial Unit*	*Multiplied by*	*Gives*
		LENGTH			
1 mm	0.039 37	inches	1 inch	**25.4**	mm
1 cm	0.393 70	inches	1 inch	**2.54**	cm
1 m	3.280 84	feet	1 foot	**0.304 8**	m
1 m	0.049 709 7	chains	1 chain	20.116 8	m
1 km	0.621 371	miles (statute)	1 mile (statute)	**1.609 344**	km
		AREA			
1 cm^2	0.155 0	square inches	1 square inch	**6.451 6**	cm^2
1 m^2	10.763 9	square feet	1 square foot	**0.092 903 04**	m^2
1 km^2	0.386 10	square miles	1 square mile	2.589 988	km^2
1 ha	2.471 054	acres	1 acre	0.404 685 6	ha
		VOLUME			
1 cm^3	0.061 02	cubic inches	1 cubic inch	**16.387 064**	cm^3
1 m^3	35.314 7	cubic feet	1 cubic foot	0.028 316 85	m^3
1 m^3	1.308 0	cubic yards	1 cubic yard	0.764 555	m^3
		CAPACITY			
1 L	1.759 755	pints	1 pint	0.568 261	L
1 L	0.879 877	quarts	1 quart	1.136 522	L
1 L	0.219 969	gallons	1 gallon	**4.546 090**	L
		MASS			
1 g	0.035 273 96	ounces (avdp)	1 ounce (avdp)	28.349 523	g
1 g	0.032 150 75	ounces (troy)	1 ounce (troy)	**31.103 476 8**	g
1 kg	2.204 62	pounds (avdp)	1 pound (avdp)	**0.453 592 37**	kg
1 kg	0.001 102 3	tons (short)	1 ton (short)	**907.184 74**	kg
1 t	1.102 311	tons (short)	1 ton (short)	**0.907 184 74**	t
1 kg	0.000 984 21	tons (long)	1 ton (long)	**1016.046 908 8**	kg
1 t	0.984 206 5	tons (long)	1 ton (long)	**1.016 046 908 8**	t
		CONCENTRATION			
1 g/t	0.029 166 6	ounce (troy)/ ton (short)	1 ounce (troy)/ ton (short)	34.285 714 2	g/t
1 g/t	0.583 333 33	pennyweights/ ton (short)	1 pennyweight/ ton (short)	1.714 285 7	g/t

OTHER USEFUL CONVERSION FACTORS

	Multiplied by	
1 ounce (troy) per ton (short)	20.0	pennyweights per ton (short)
1 pennyweight per ton (short)	0.05	ounces (troy) per ton (short)

Note: Conversion factors which are in bold type are exact. The conversion factors have been taken from or have been derived from factors given in the Metric Practice Guide for the Canadian Mining and Metallurgical Industries, published by the Mining Association of Canada in co-operation with the Coal Association of Canada.

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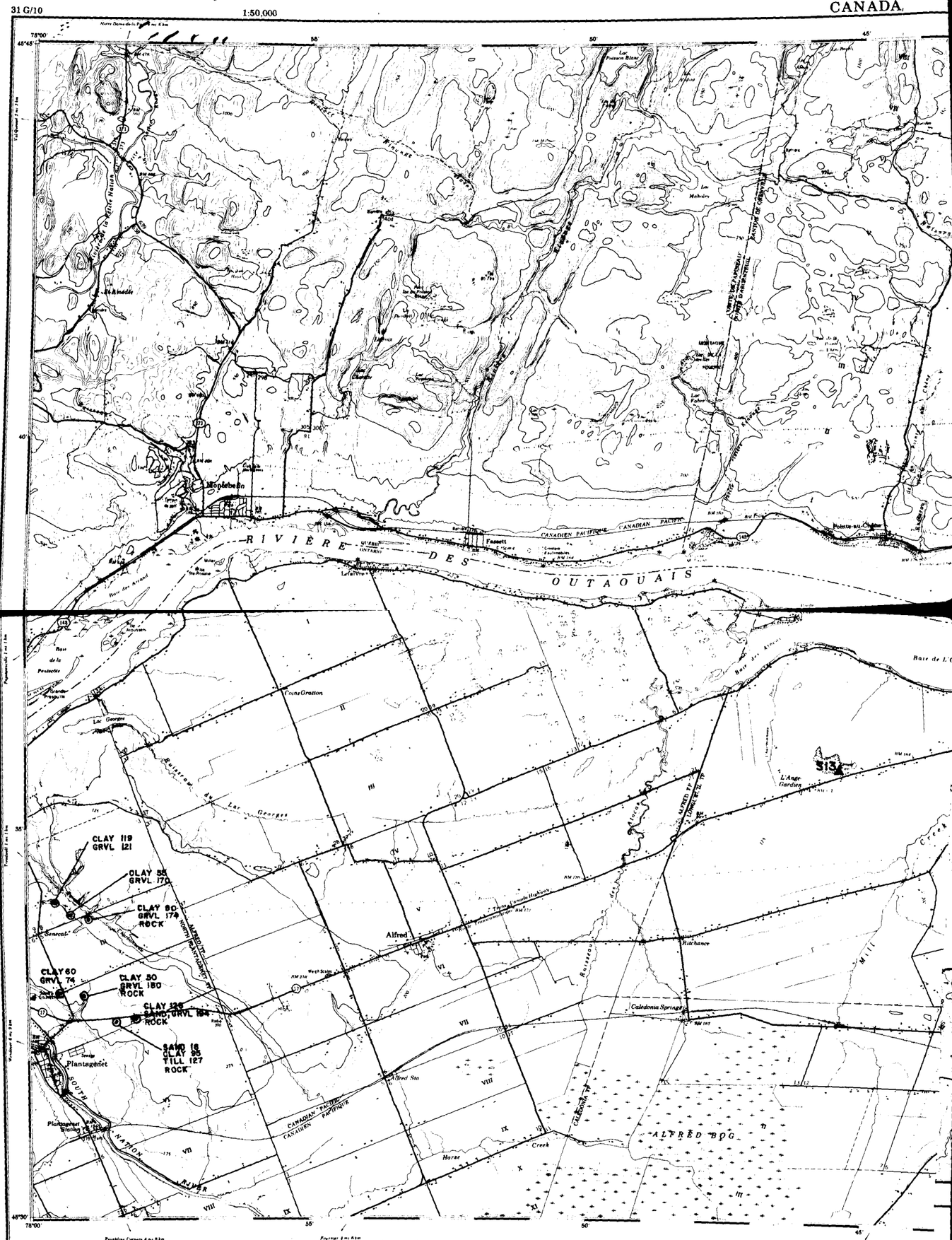
MAP I: System I

31 G/10 1:50,000 CANADA



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Roads	Routes
hard surface all weather	pavée toute saison
hard surface all weather	pavée toute saison
loose or stabilized surface all weather	gravier aggloméré toute saison
loose surface dry weather and unclassified streets	de gravier temps sec et rues hors classe
cart track	de terre
trail cut line or portage	sentier pierrée ou portage

FOR COMPLETE REFERENCE SEE REVERSE SIDE. POUR UNE LISTE COMPLÈTE DES SIGNES VOIR AU VERSO

HAWKESBURY
ONTARIO-QUÉBEC

Scale 1:50,000 Échelle

Miles 1 0 1 2
Metres 1000 0 1000 2000 3000
Yards 1000 0 1000 2000 3000

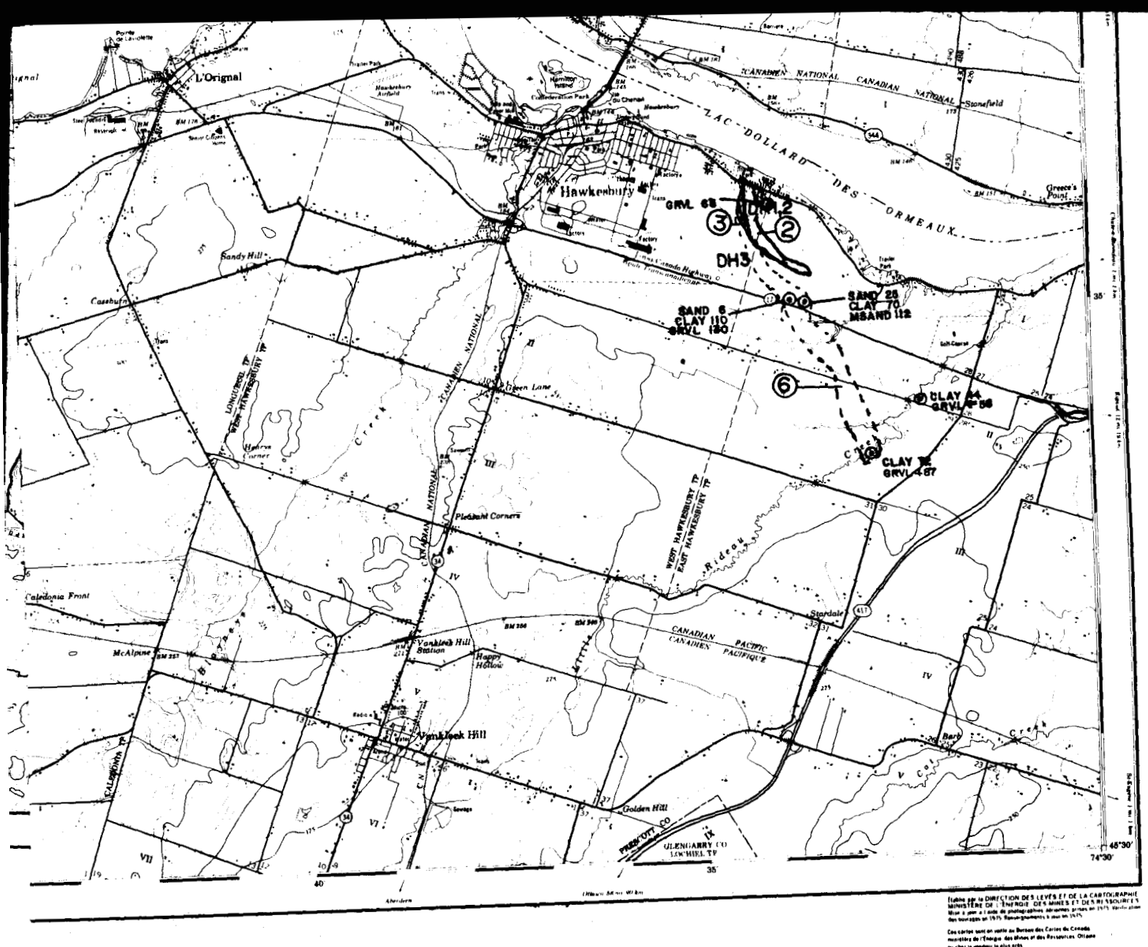
EDITION 4

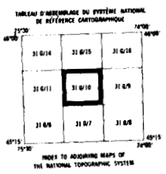
31 G/10

GLOSSARY GLOSSAIRE

ABBREVIATIONS ABRÉVIATIONS

HAWKESBURY
31 G/10
EDITION 4

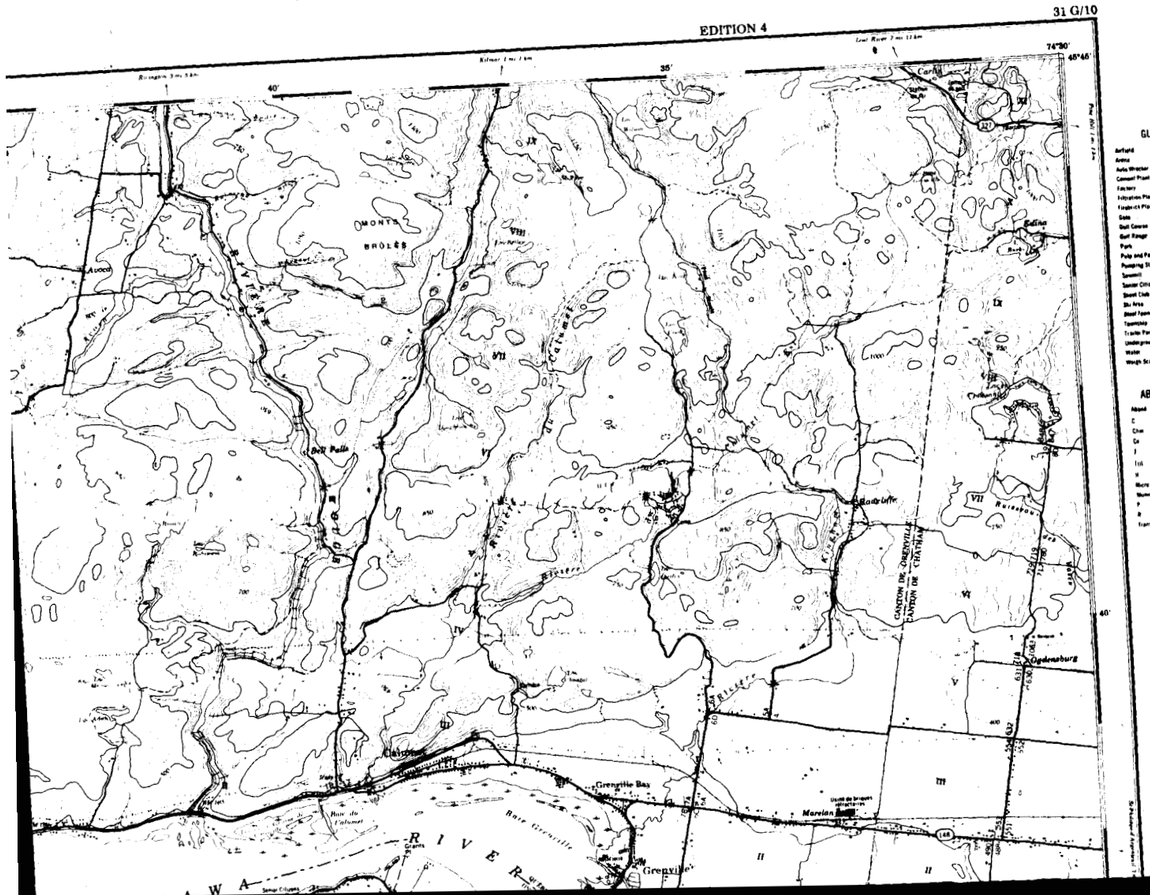




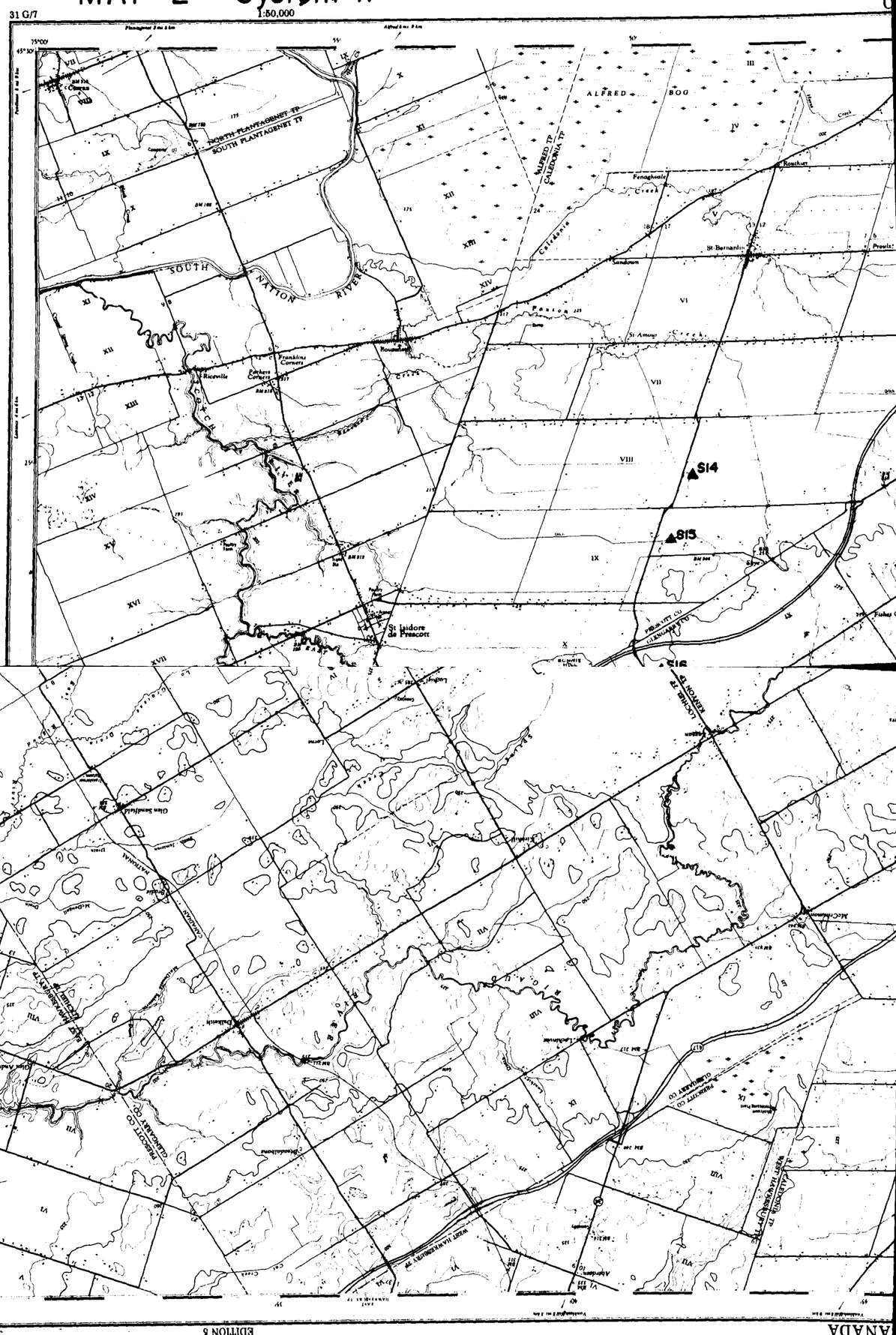
HAWKESBURY
31 G/10
EDITION 4

EDITION 4

31 G/10


MONTS BROLÉS
Bell Falls
Clarence Creek
Embrun
Russell
Casselman
Crysler
Maxville
Moose Creek
Lancaster
Dalkeith
Cardinal
Iroquois
Morrisburg
Ingleside
Long Sault
Dickinsons Landing
Williamsburg
Dundela
Dunbar
Winchester
Chesterville
Winchester Springs
Berwick
Finch
Avonmore
Monkland
Apple Hill
Glen Sandfield
Glen Walter
Maxville
Alexandria
Dalkeith
Glen Robertson
Cornwall
Summerstown
Martintown
Lancaster
Dunvegan
Glengarry
Glen Nevis
Glen Roy

MAP 2: System II



EXANDRIA
ONTARIO

Scale 1:50,000 Echelle

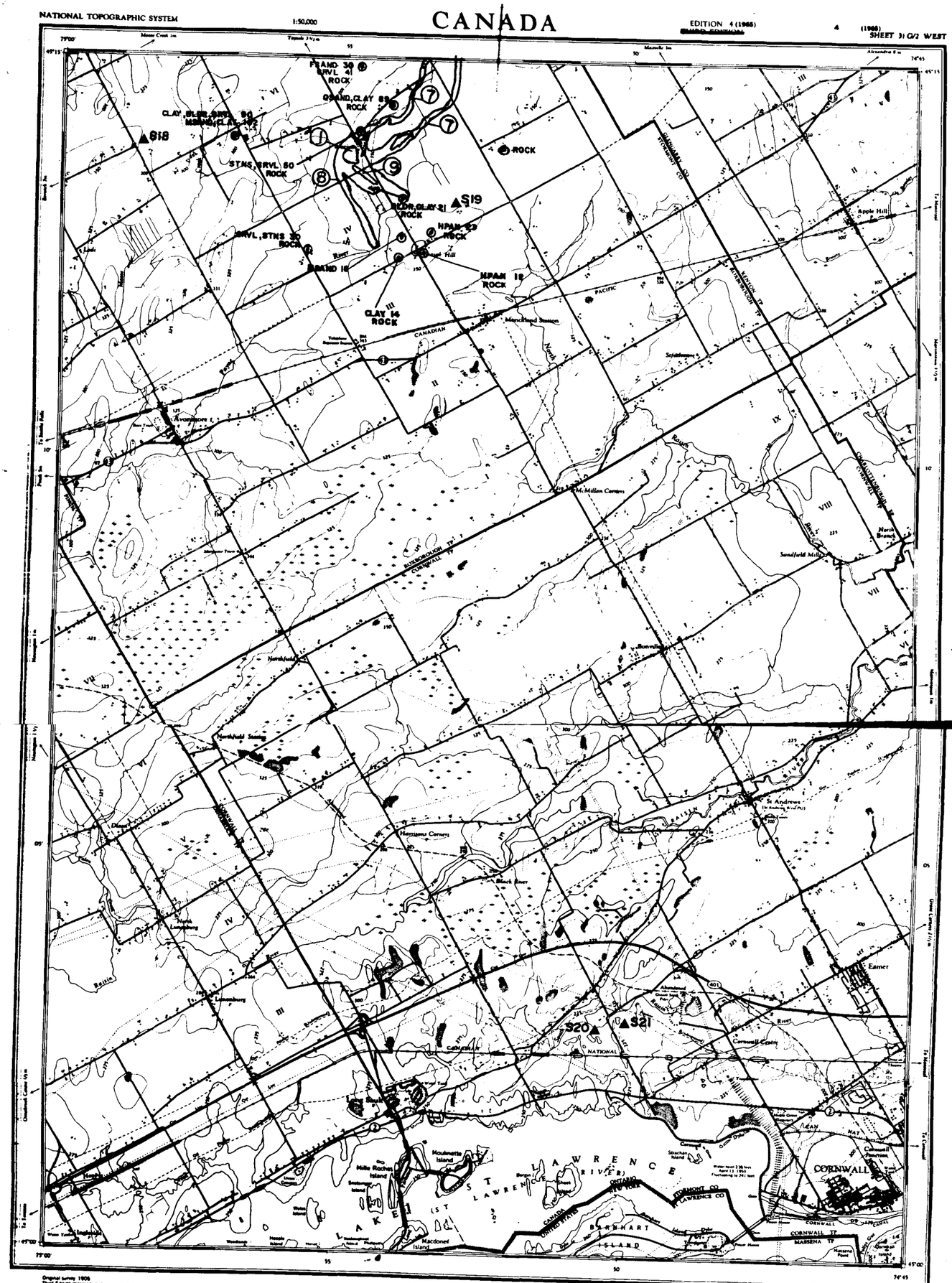
ALEXANDRIA
31 G/7

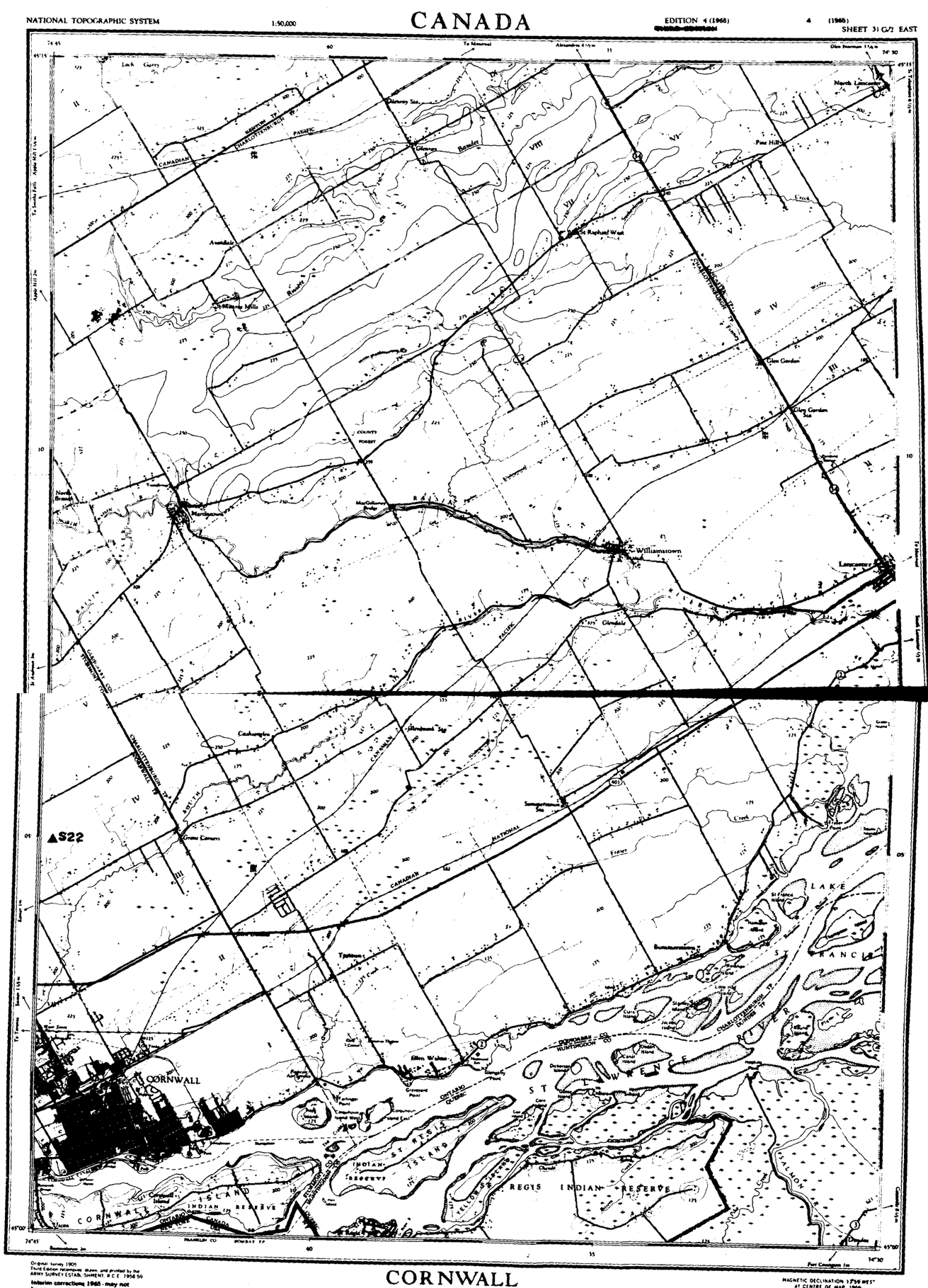
NATIONAL TOPOGRAPHIC SYSTEM 1:50,000

CANADA

EDITION 4 (1968) 4 (1968)

SHEET 31 G/2 WEST


FRAND 30
SRVL 4
ROCK
GRAND, CLAY 88
ROCK
CLAY, SLTS, SRVL 50
SAND, CLAY 40
618
STNS, SRVL 50
ROCK
ROCK
SDR, CLAY 21
ROCK
S19
HPAM 20
ROCK
SRVL, STNS 30
ROCK
SAND 18
HPAM 18
ROCK
CLAY 14
ROCK
Apple Hill
Maxville
Alexandria
Lancaster
Williamstown
Dunbar
Moulinette Island
Mille Roches Island
Macdonell Island
Nelson Island
Barnhart Island
Cornwall Island
Cornwall
Cornwall Centre
Cornwall Junction
Cornwall Industrial Park
Cornwall Island
Aultsville
Long Sault
Summerstown
Martintown
Glen Walter
Glen Sandfield
Moose Creek
Maxville
Finch
Crysler
Casselman
Embrun
Russell
Metcalfe
Vernon
Navan
Orleans
Ottawa
Rockland
Hawkesbury
Lachute
Montreal
Valleyfield
Huntingdon
Ormstown
Chateauguay
Beauharnois
Lancaster
Dundee
Huntingdon
Ormstown
Chateauguay
Beauharnois
Valleyfield
Montreal
Lachute
Hawkesbury
Rockland
Ottawa
Orleans
Navan
Metcalfe
Russell
Embrun
Casselman
Crysler
Finch
Maxville
Moose Creek
Glen Sandfield
Glen Walter
Martintown
Summerstown
Long Sault
Aultsville
Cornwall Island
Cornwall
Cornwall Centre
Cornwall Junction
Cornwall Industrial Park
Barnhart Island
Nelson Island
Macdonell Island
Mille Roches Island
Moulinette Island
Lancaster
Williamstown
Dunbar
Apple Hill
Maxville
Alexandria



CFR 580.1
MINES/LIBRARY

OFR 5801

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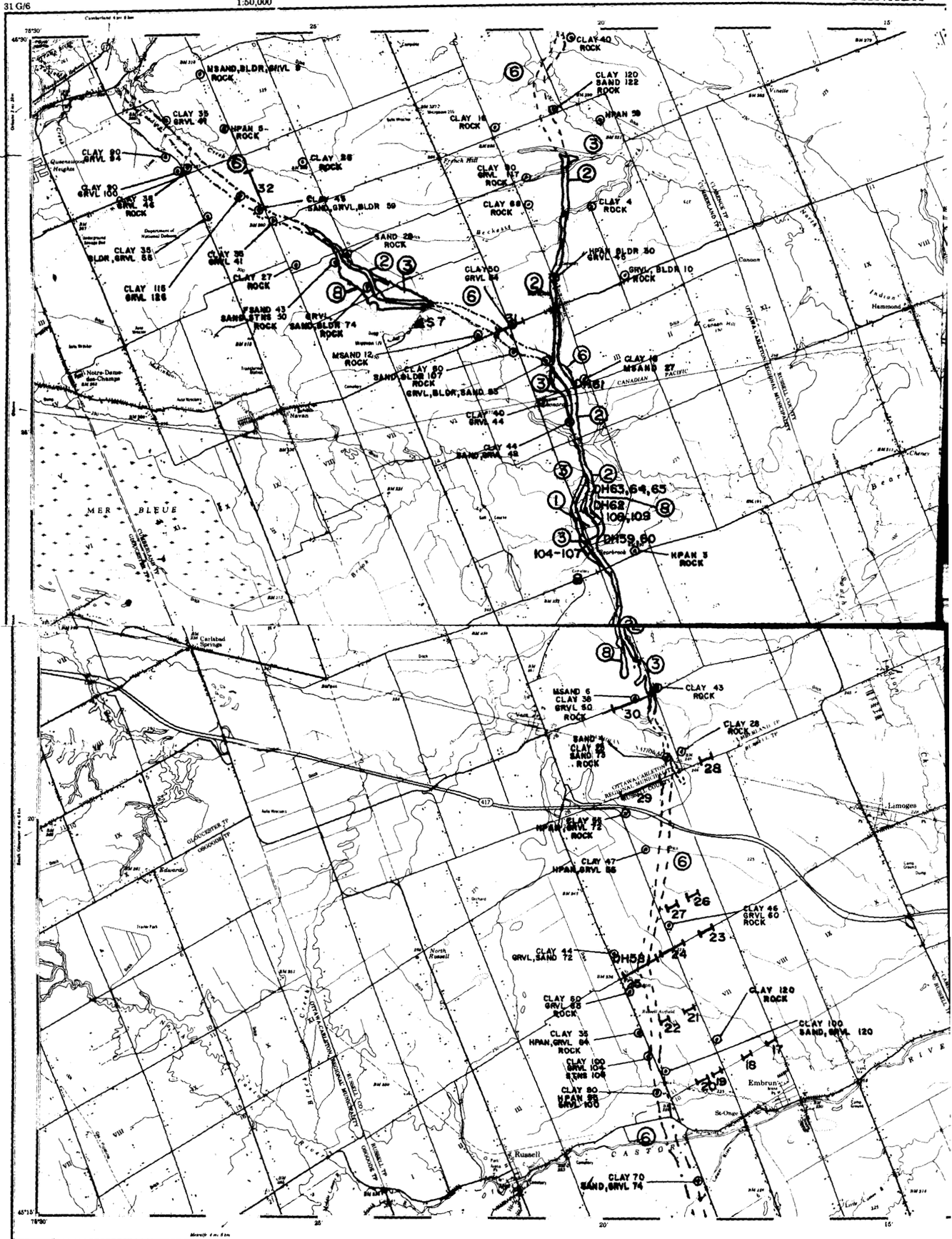
MAP 5: System III & IV



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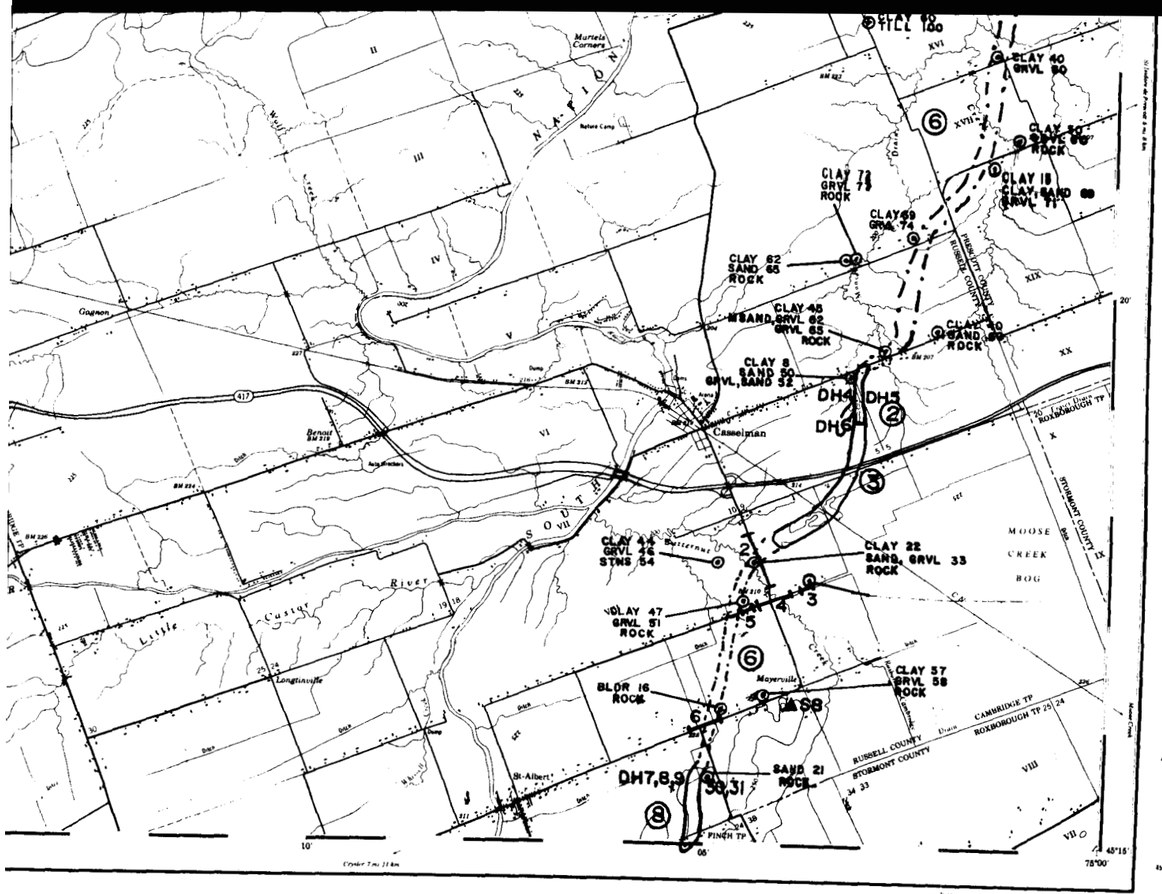
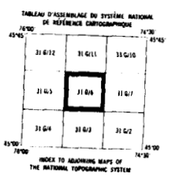
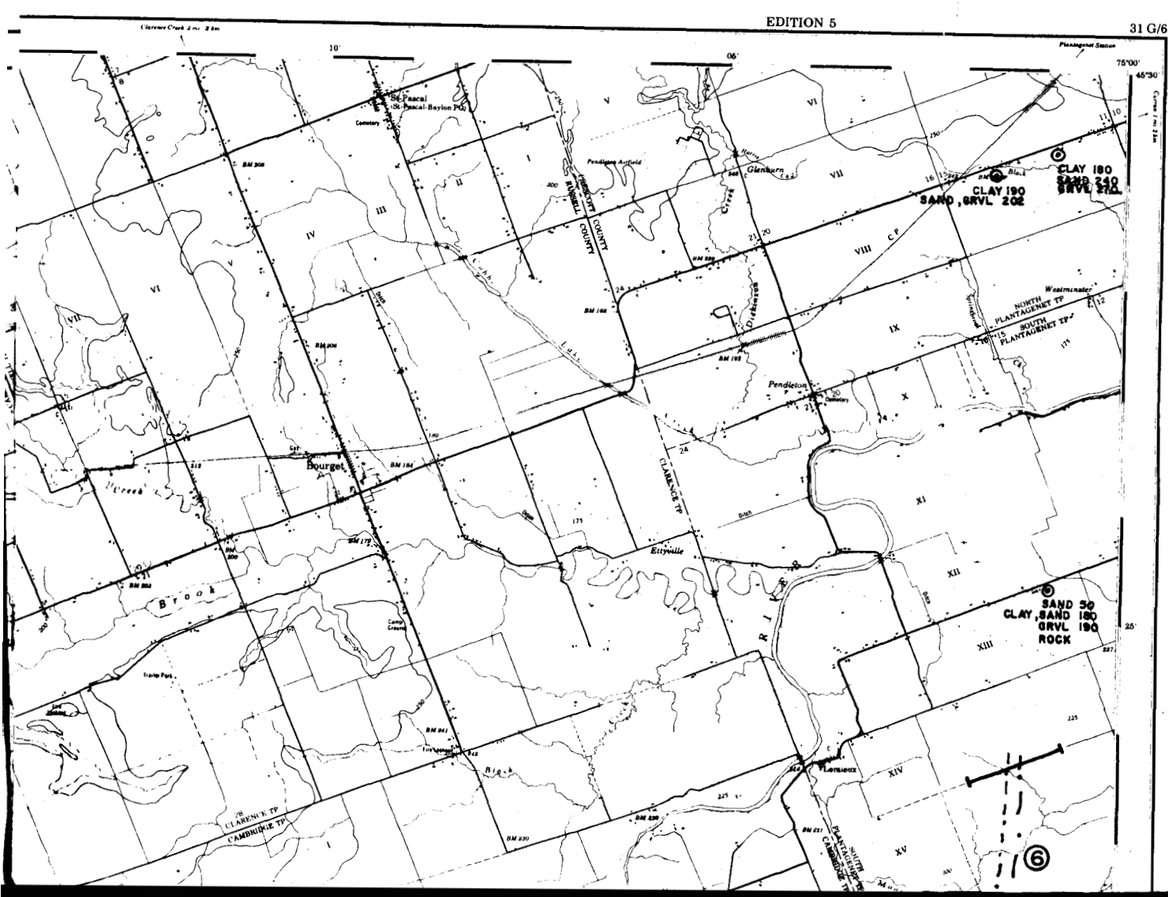




INDEX TO ADJOINING MAPS OF THE NATIONAL TOPOGRAPHIC SYSTEM

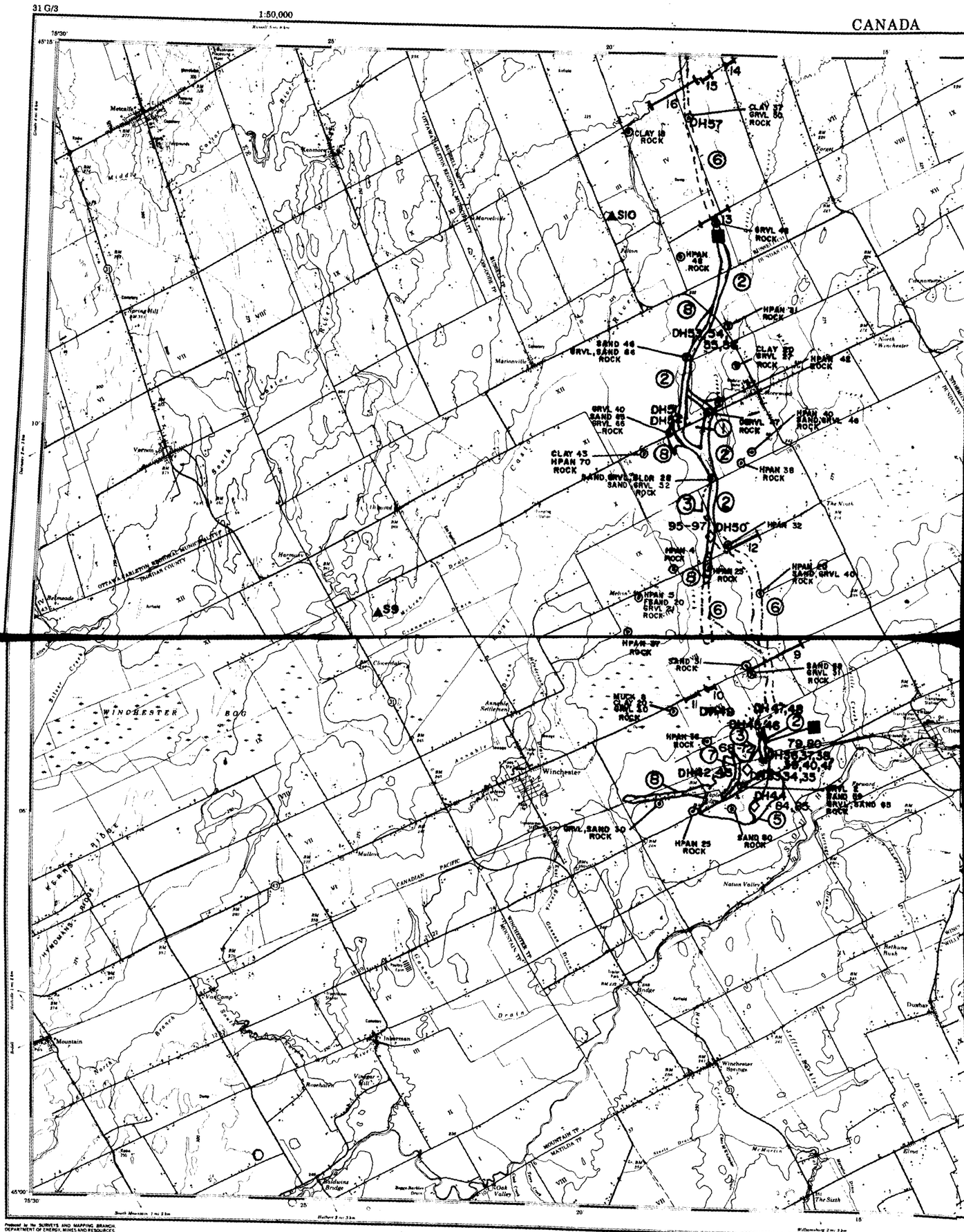
RUSSELL
31 G/6
EDITION 5

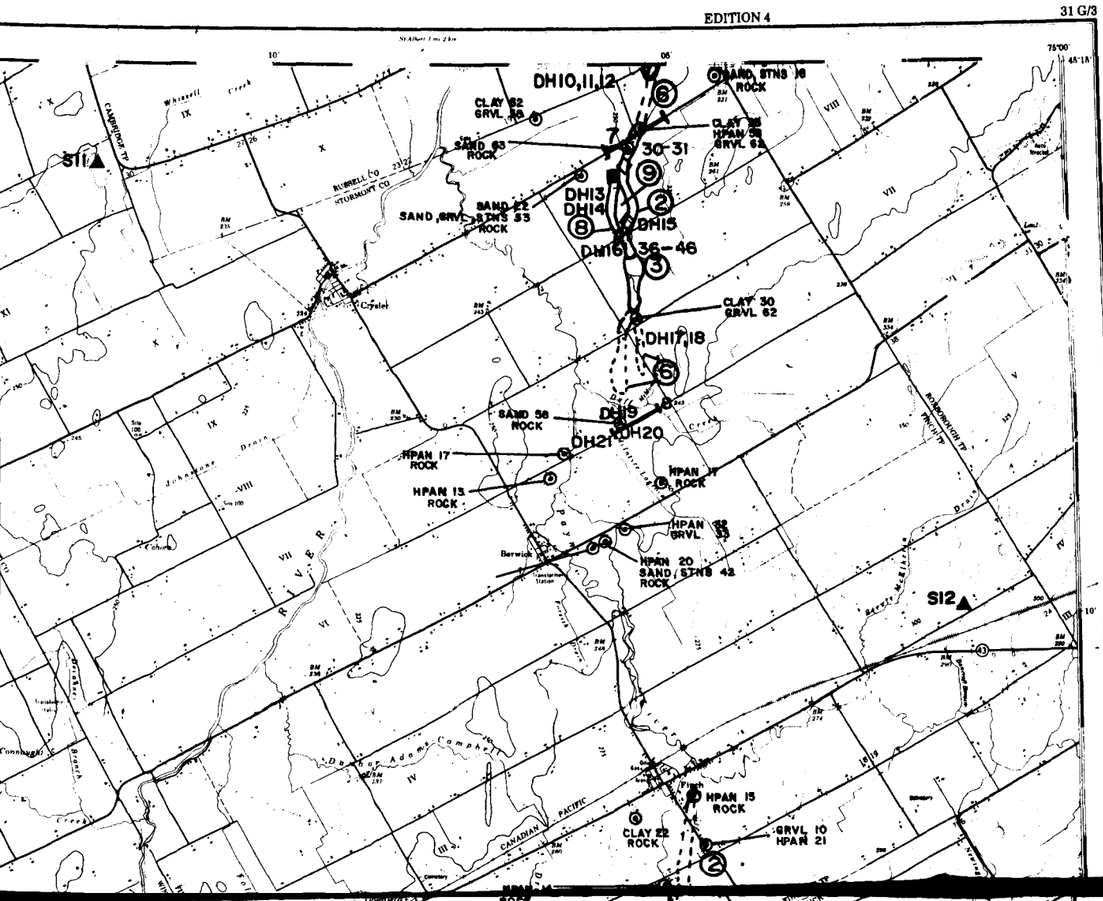


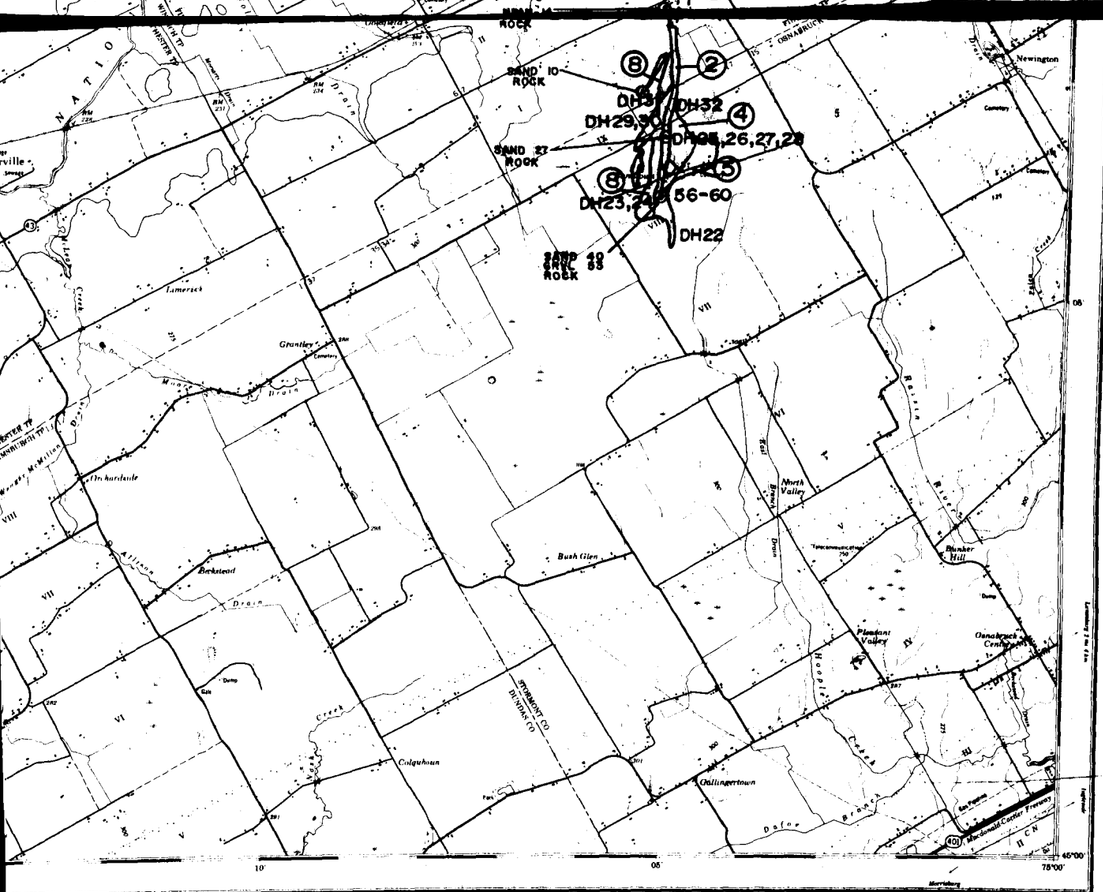
OFR 5801

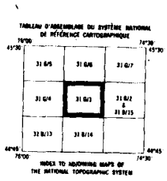
MINES/LIBRARY

MAP 6: System III & IV









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WINCHESTER
31 G/3
EDITION 4

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MAP 7: System V & VI

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Roads	Routes
hard surface, all weather	pavée, toute saison
hard surface, all weather	pavée, toute saison
loose or stabilized surface, all weather	gravier non-pavé, toute saison
loose surface, dry weather and unclassified streets	de gravier, temps sec et rues non classé
cart track	de ferme
trail, cut line or portage	sentier, percée ou portage

FOR COMPLETE REFERENCE SEE REVERSE SIDE — POUR UNE LISTE COMPLETE DES SIGNES VOIR AU VERSO

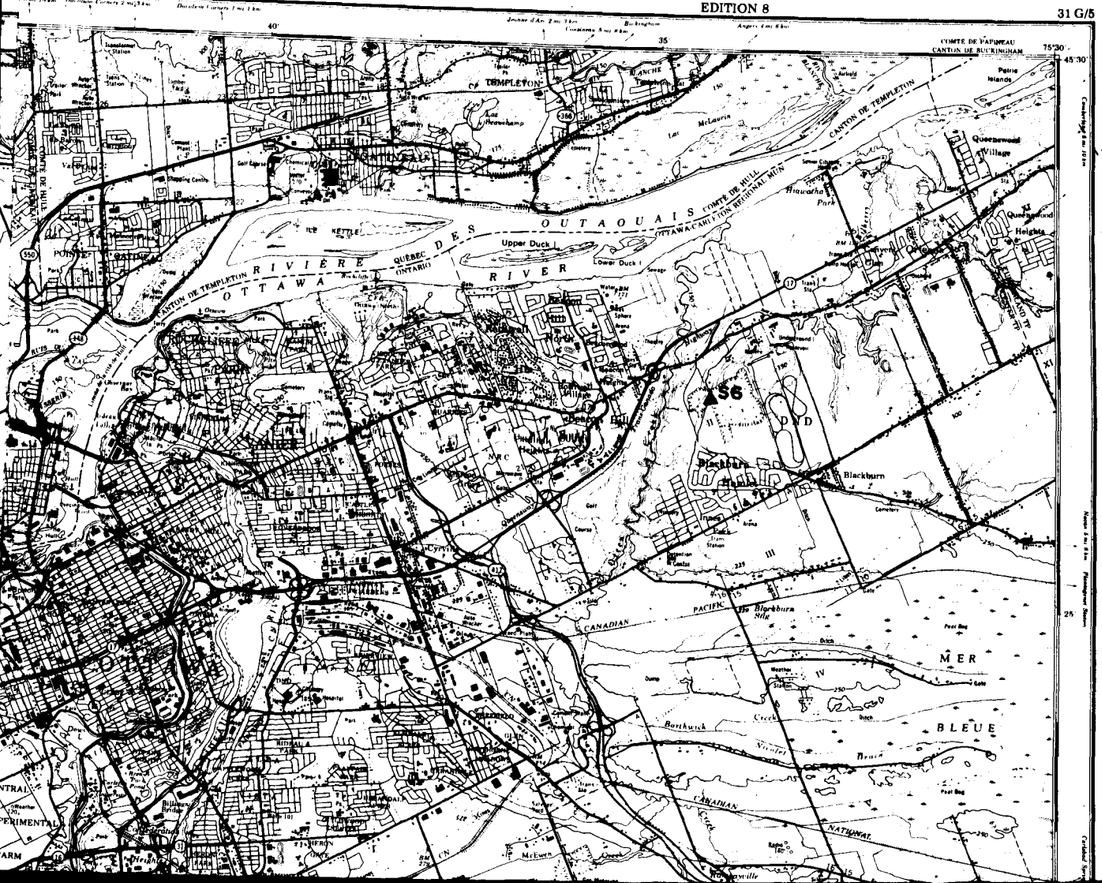
OTTAWA
ONTARIO-QUÉBEC

Scale 1:50,000 Échelle

Miles 1 0 1 2 3
Metres 1000 0 1000 2000 3000 4000
Feet 1000 0 1000 2000 3000 4000 Yards

EDITION 8

31 G/5



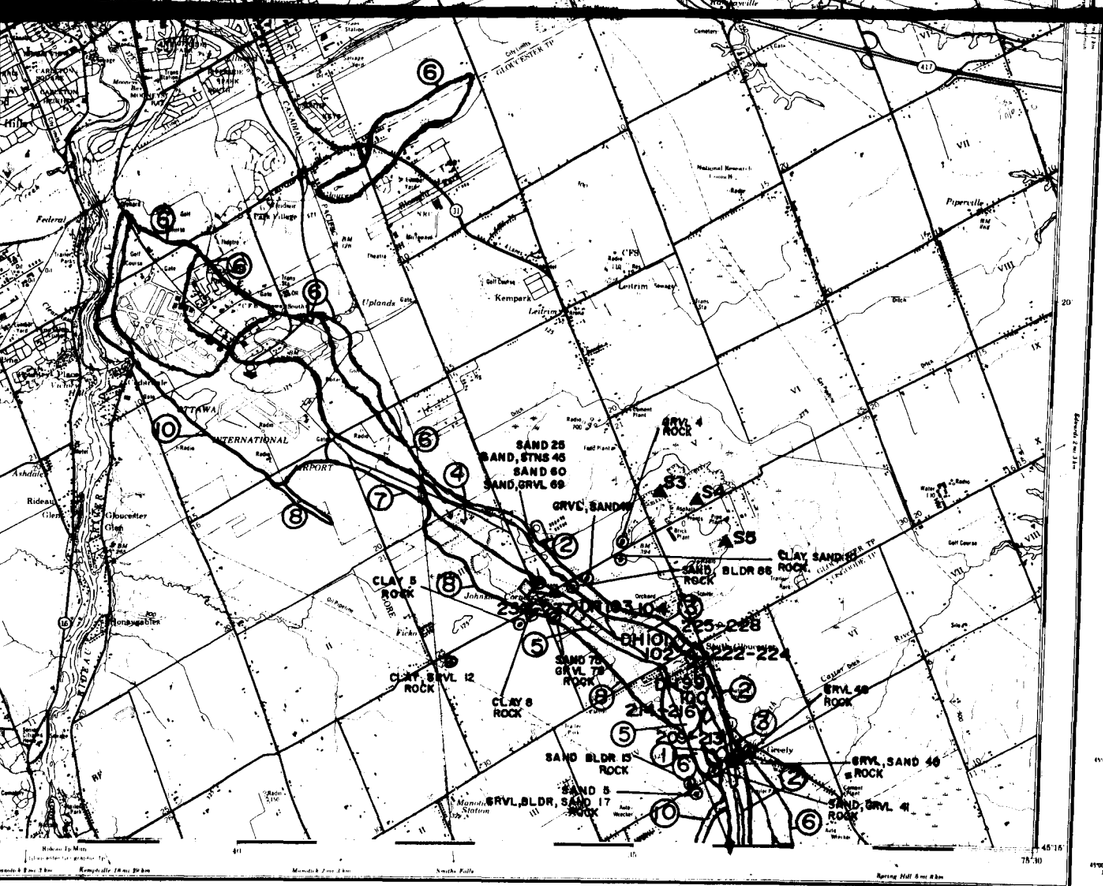


TABLEAU D'ASSEMBLAGE DU SYSTÈME NATIONAL DE RÉFÉRENCE CARTOGRAPHIQUE

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OTTAWA
31 G/5
EDITION 8

CONTOUR INTERVAL 25 FEET
Équidistance et l'eet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection

Communities within cities and towns are named in red

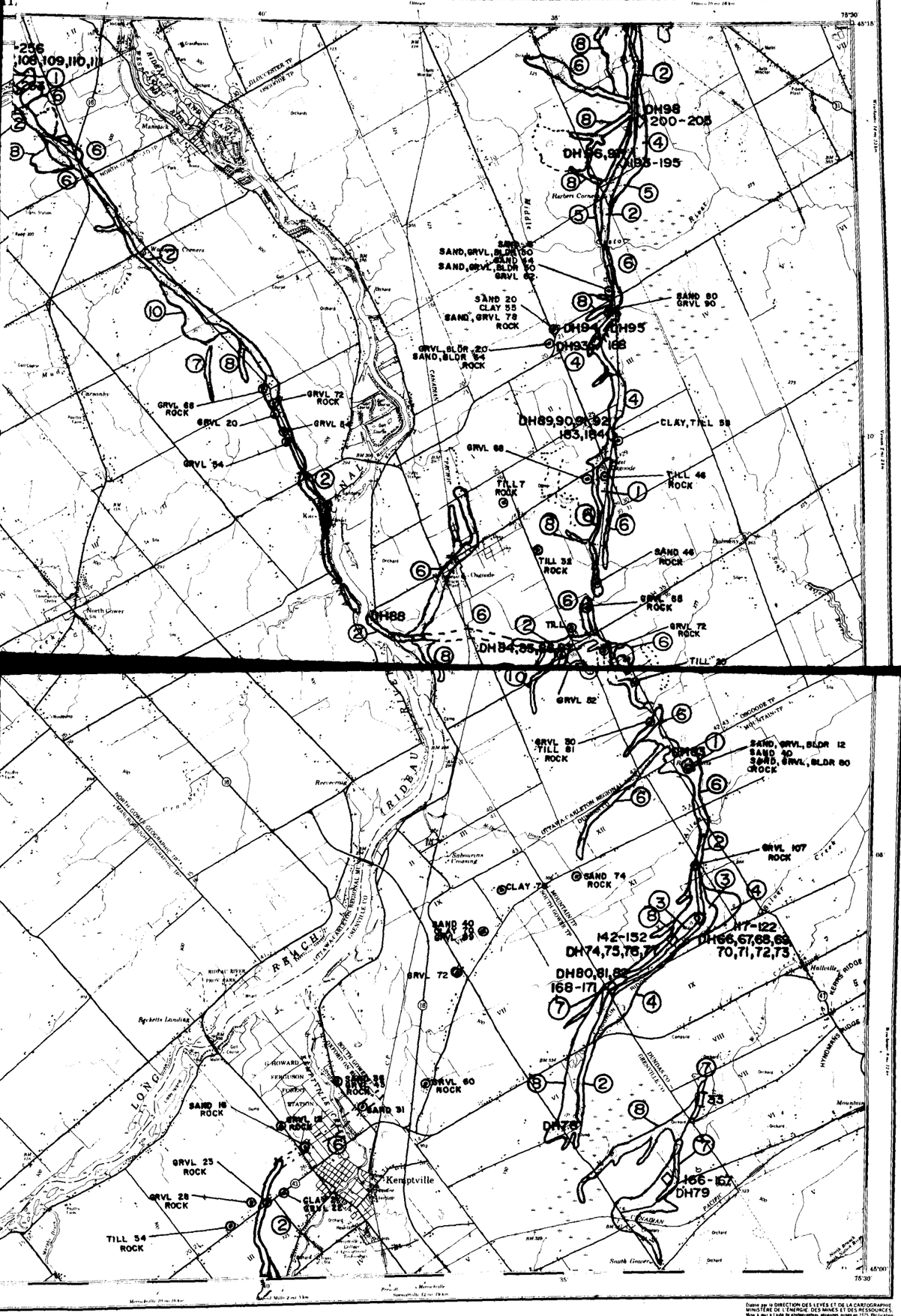
EQUIDISTANCE DES COURBES 25 PIEDS
Élévations en pieds au-dessus du niveau moyen de la mer
Système de référence géodésique nord américain 1927
Projection transverse de Mercator

Les communautés à l'intérieur des cités et villes sont désignées en rouge

OFR 5801 MINES/LIBRARY

MAP 8: System V to VIII

Stittsville
Richmond
Munster
Manotick
Kanata
Carleton Place
Almonte
Arnprior
Renfrew
Pembroke
Ottawa
Nepean
Gloucester
Cumberland
Osgoode
Rideau River
Jock River
Mississippi River
Ottawa River
Carp River
Constance Bay
Dwyer Hill
Thaver Hill Sch
Brassils
Pierces Corners
Malakoff
Mills Corners
Rivers Corners
Manotick Station
Prospect
Bridlewood
Ridgeview
Mansfield
Ridgedale
Shadow Ridge
Kanata Centre
Kanata Research Park
Kanata Lakes
Kanata Golf & Country Club
Glen Cairn
Glen Cairn Golf Course
Glen Cairn Park
Glen Cairn Estates
Glen Cairn Industrial Park
Glen Cairn Shopping Centre
Glen Cairn Community Centre
Glen Cairn Public School
Glen Cairn Separate School
Glen Cairn Fire Station
Glen Cairn Police Station
Glen Cairn Post Office
Glen Cairn Library
Glen Cairn Arena
Glen Cairn Swimming Pool
Glen Cairn Tennis Courts
Glen Cairn Baseball Diamond
Glen Cairn Soccer Field
Glen Cairn Football Field
Glen Cairn Track
Glen Cairn Golf Course
Glen Cairn Country Club
Glen Cairn Marina
Glen Cairn Boat Launch
Glen Cairn Beach
Glen Cairn Campground
Glen Cairn Picnic Area
Glen Cairn Trail
Glen Cairn Bridge
Glen Cairn Dam
Glen Cairn Power Station
Glen Cairn Water Treatment Plant
Glen Cairn Sewage Treatment Plant
Glen Cairn Landfill
Glen Cairn Quarry
Glen Cairn Gravel Pit
Glen Cairn Sand Pit
Glen Cairn Clay Pit
Glen Cairn Peat Bog
Glen Cairn Swamp
Glen Cairn Marsh
Glen Cairn Lake
Glen Cairn River
Glen Cairn Creek
Glen Cairn Stream
Glen Cairn Brook
Glen Cairn Pond
Glen Cairn Reservoir
Glen Cairn Aqueduct
Glen Cairn Pipeline
Glen Cairn Transmission Line
Glen Cairn Railway
Glen Cairn Road
Glen Cairn Highway
Glen Cairn Bridge
Glen Cairn Tunnel
Glen Cairn Overpass
Glen Cairn Underpass
Glen Cairn Interchange
Glen Cairn Toll Booth
Glen Cairn Weigh Station
Glen Cairn Rest Area
Glen Cairn Viewpoint
Glen Cairn Lookout
Glen Cairn Observation Tower
Glen Cairn Radio Tower
Glen Cairn Television Tower
Glen Cairn Microwave Tower
Glen Cairn Satellite Dish
Glen Cairn Antenna
Glen Cairn Transmitter
Glen Cairn Receiver
Glen Cairn Transceiver
Glen Cairn Repeater
Glen Cairn Amplifier
Glen Cairn Modulator
Glen Cairn Demodulator
Glen Cairn Encoder
Glen Cairn Decoder
Glen Cairn Multiplexer
Glen Cairn Demultiplexer
Glen Cairn Switch
Glen Cairn Router
Glen Cairn Gateway
Glen Cairn Server
Glen Cairn Client
Glen Cairn Workstation
Glen Cairn Terminal
Glen Cairn Printer
Glen Cairn Plotter
Glen Cairn Scanner
Glen Cairn Digitizer
Glen Cairn Camera
Glen Cairn Video Recorder
Glen Cairn Audio Recorder
Glen Cairn Tape Drive
Glen Cairn Disk Drive
Glen Cairn CD-ROM Drive
Glen Cairn DVD Drive
Glen Cairn Hard Drive
Glen Cairn Floppy Drive
Glen Cairn Memory
Glen Cairn Processor
Glen Cairn Motherboard
Glen Cairn Power Supply
Glen Cairn Battery
Glen Cairn Solar Panel
Glen Cairn Wind Turbine
Glen Cairn Generator
Glen Cairn Transformer
Glen Cairn Substation
Glen Cairn Switchyard
Glen Cairn Control Room
Glen Cairn Operator
Glen Cairn Technician
Glen Cairn Engineer
Glen Cairn Manager
Glen Cairn Supervisor
Glen Cairn Foreman
Glen Cairn Worker
Glen Cairn Crew
Glen Cairn Team
Glen Cairn Company
Glen Cairn Corporation
Glen Cairn Utility
Glen Cairn Municipality
Glen Cairn Township
Glen Cairn City
Glen Cairn Town
Glen Cairn Village
Glen Cairn Hamlet
Glen Cairn Community
Glen Cairn Population
Glen Cairn Census
Glen Cairn Survey
Glen Cairn Map
Glen Cairn Chart
Glen Cairn Graph
Glen Cairn Table
Glen Cairn Report
Glen Cairn Study
Glen Cairn Plan
Glen Cairn Design
Glen Cairn Construction
Glen Cairn Maintenance
Glen Cairn Repair
Glen Cairn Upgrade
Glen Cairn Expansion
Glen Cairn Development
Glen Cairn Project
Glen Cairn Budget
Glen Cairn Cost
Glen Cairn Price
Glen Cairn Revenue
Glen Cairn Profit
Glen Cairn Loss
Glen Cairn Tax
Glen Cairn Fee
Glen Cairn Charge
Glen Cairn Rate
Glen Cairn Schedule
Glen Cairn Timetable
Glen Cairn Route
Glen Cairn Direction
Glen Cairn Distance
Glen Cairn Time
Glen Cairn Speed
Glen Cairn Traffic
Glen Cairn Accident
Glen Cairn Emergency
Glen Cairn Safety
Glen Cairn Security
Glen Cairn Law
Glen Cairn Court
Glen Cairn Judge
Glen Cairn Lawyer
Glen Cairn Police
Glen Cairn Fire
Glen Cairn Ambulance
Glen Cairn Hospital
Glen Cairn Doctor
Glen Cairn Nurse
Glen Cairn Patient
Glen Cairn Medicine
Glen Cairn Health
Glen Cairn Disease
Glen Cairn Epidemic
Glen Cairn Pandemic
Glen Cairn Vaccine
Glen Cairn Immunization
Glen Cairn Quarantine
Glen Cairn Isolation
Glen Cairn Treatment
Glen Cairn Cure
Glen Cairn Prevention
Glen Cairn Education
Glen Cairn School
Glen Cairn College
Glen Cairn University
Glen Cairn Library
Glen Cairn Museum
Glen Cairn Art Gallery
Glen Cairn Theatre
Glen Cairn Cinema
Glen Cairn Concert Hall
Glen Cairn Opera House
Glen Cairn Stadium
Glen Cairn Arena
Glen Cairn Swimming Pool
Glen Cairn Golf Course
Glen Cairn Tennis Courts
Glen Cairn Baseball Diamond
Glen Cairn Soccer Field
Glen Cairn Football Field
Glen Cairn Track
Glen Cairn Park
Glen Cairn Garden
Glen Cairn Zoo
Glen Cairn Aquarium
Glen Cairn Botanical Garden
Glen Cairn Arboretum
Glen Cairn Forest
Glen Cairn Woodland
Glen Cairn Wilderness
Glen Cairn Nature Reserve
Glen Cairn Conservation Area
Glen Cairn Wildlife Refuge
Glen Cairn Bird Sanctuary
Glen Cairn Fish Hatchery
Glen Cairn Game Farm
Glen Cairn Ranch
Glen Cairn Farm
Glen Cairn Dairy
Glen Cairn Creamery
Glen Cairn Cheese Factory
Glen Cairn Winery
Glen Cairn Brewery
Glen Cairn Distillery
Glen Cairn Bakery
Glen Cairn Restaurant
Glen Cairn Cafe
Glen Cairn Bar
Glen Cairn Hotel
Glen Cairn Motel
Glen Cairn Inn
Glen Cairn Resort
Glen Cairn Spa
Glen Cairn Casino
Glen Cairn Racetrack
Glen Cairn Airport
Glen Cairn Heliport
Glen Cairn Seaplane Base
Glen Cairn Port
Glen Cairn Harbour
Glen Cairn Marina
Glen Cairn Boat Launch
Glen Cairn Ferry


DH98
200-205
DH96,97
185-195
SAND,GRVL,BLDR 80
SAND 14
SAND,GRVL,BLDR 80
GRVL 62
SAND 20
CLAY 53
SAND, GRVL 78
ROCK
DH94
DH95
DH93
168
SAND 80
GRVL 90
GRVL,BLDR 20
SAND,BLDR 54
ROCK
GRVL 68
ROCK
GRVL 72
ROCK
GRVL 20
GRVL 84
GRVL 54
DH89,90,91,92
183,184
CLAY,TILL 58
GRVL 68
TILL 46
ROCK
TILL
ROCK
TILL 38
ROCK
SAND 46
ROCK
GRVL 58
ROCK
GRVL 72
ROCK
TILL 20
DH88
DH84,85,86,87
GRVL 52
GRVL 30
TILL 61
ROCK
DH83
SAND, GRVL, BLDR 12
SAND 40
SAND, GRVL, BLDR 80
ROCK
GRVL 107
ROCK
CLAY 72
SAND 74
ROCK
SAND 40
GRVL 88
142-152
DH74,75,76,77
DH66,67,68,69
70,71,72,73
117-122
DH80,81,82
168-171
GRVL 72
GRVL 60
ROCK
SAND 18
ROCK
SAND 31
GRVL 18
ROCK
GRVL 23
ROCK
GRVL 28
ROCK
CLAY 30
GRVL 22
TILL 54
ROCK
DH78
DH79
166-167
Kemptville
Rideau River
Long Island
Rideau Canal
Jock River
Bytown and Rideau Canals
Bytown and Rideau Canals Historical Site
Kemptville Creek
Kemptville Ridge
Hydromark Ridge
Roberts Landing
Harbers Corners
North Gower
South Gower
Oxford Mills
Merrickville
Prescott and Russell Counties
Grenville County
Leeds County
Lanark County
Carleton County
Dundas County
Stormont County
Ottawa-Carleton Regional Municipality
Ottawa-Carleton Regional Road
Ottawa-Carleton Regional Forest
Mississippi-Rideau Provincial Park
Provincial Park
Provincial Forest
Provincial Wildlife Area
Provincial Nature Reserve
Provincial Highway
Provincial Highway Bypass
Provincial Highway Business
Provincial Highway Alternate
Provincial Highway Connecting Link
Provincial Highway Interchange
Provincial Highway Under Construction
Provincial Highway Proposed
Provincial Highway Abandoned
Provincial Highway Closed
Provincial Highway Ferry
Provincial Highway Toll
Provincial Highway Scenic
Provincial Highway Historic
Provincial Highway Recreational
Provincial Highway Tourist
Provincial Highway Trunk
Provincial Highway Secondary
Provincial Highway Tertiary
Provincial Highway Local
Provincial Highway Private
Provincial Highway Unimproved
Provincial Highway Seasonal
Provincial Highway Winter
Provincial Highway Summer
Provincial Highway Year-Round
Provincial Highway Limited Access
Provincial Highway Controlled Access
Provincial Highway Divided
Provincial Highway Undivided
Provincial Highway Four-Lane
Provincial Highway Two-Lane
Provincial Highway One-Lane
Provincial Highway Gravel
Provincial Highway Paved
Provincial Highway Concrete
Provincial Highway Asphalt
Provincial Highway Surface Treated
Provincial Highway Unpaved
Provincial Highway Dirt
Provincial Highway Sand
Provincial Highway Gravel
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Provincial Highway Clay
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Provincial Highway Boulder
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Provincial Highway Soil
Provincial Highway Vegetation
Provincial Highway Forest
Provincial Highway Woodland
Provincial Highway Brush
Provincial Highway Grass
Provincial Highway Crop
Provincial Highway Orchard
Provincial Highway Vineyard
Provincial Highway Pasture
Provincial Highway Meadow
Provincial Highway Field
Provincial Highway Garden
Provincial Highway Lawn
Provincial Highway Park
Provincial Highway Cemetery
Provincial Highway Golf Course
Provincial Highway Airport
Provincial Highway Heliport
Provincial Highway Seaplane Base
Provincial Highway Marina
Provincial Highway Boat Launch
Provincial Highway Campground
Provincial Highway Picnic Area
Provincial Highway Rest Area
Provincial Highway Scenic Lookout
Provincial Highway Historic Site
Provincial Highway Museum
Provincial Highway Visitor Centre
Provincial Highway Information Centre
Provincial Highway Tourist Information
Provincial Highway Emergency Services
Provincial Highway Police
Provincial Highway Fire
Provincial Highway Ambulance
Provincial Highway Hospital
Provincial Highway Clinic
Provincial Highway Pharmacy
Provincial Highway Doctor
Provincial Highway Dentist
Provincial Highway Veterinarian
Provincial Highway Optometrist
Provincial Highway Chiropractor
Provincial Highway Physiotherapist
Provincial Highway Psychologist
Provincial Highway Social Worker
Provincial Highway Nurse
Provincial Highway Midwife
Provincial Highway Paramedic
Provincial Highway Emergency Medical Technician
Provincial Highway Firefighter
Provincial Highway Police Officer
Provincial Highway Security Guard
Provincial Highway Lifeguard
Provincial Highway Coast Guard
Provincial Highway Search and Rescue
Provincial Highway Emergency Response
Provincial Highway Disaster Relief
Provincial Highway Humanitarian Aid
Provincial Highway Volunteer
Provincial Highway Donation
Provincial Highway Fundraising
Provincial Highway Charity
Provincial Highway Non-Profit
Provincial Highway Government
Provincial Highway Public
Provincial Highway Private
Provincial Highway Commercial
Provincial Highway Industrial
Provincial Highway Residential
Provincial Highway Agricultural
Provincial Highway Rural
Provincial Highway Urban
Provincial Highway Suburban
Provincial Highway Metropolitan
Provincial Highway Regional
Provincial Highway Local
Provincial Highway National
Provincial Highway International
Provincial Highway Global
Provincial Highway Universal
Provincial Highway Cosmic
Provincial Highway Infinite
Provincial Highway Eternal
Provincial Highway Timeless
Provincial Highway Boundless
Provincial Highway Endless
Provincial Highway Perpetual
Provincial Highway Forever
Provincial Highway Always
Provincial Highway Never
Provincial Highway Ever
Provincial Highway Sometimes
Provincial Highway Often
Provincial Highway Rarely
Provincial Highway Seldom
Provincial Highway Occasionally
Provincial Highway Frequently
Provincial Highway Usually
Provincial Highway Typically
Provincial Highway Normally
Provincial Highway Abnormally
Provincial Highway Unusually
Provincial Highway Strangely
Provincial Highway Oddly
Provincial Highway Peculiarly
Provincial Highway Curiously
Provincial Highway Interestingly
Provincial Highway Boringly
Provincial Highway Tediously
Provincial Highway Monotonously
Provincial Highway Repetitively
Provincial Highway Redundantly
Provincial Highway Superfluously
Provincial Highway Unnecessarily
Provincial Highway Needlessly
Provincial Highway Pointlessly
Provincial Highway Meaninglessly
Provincial Highway Senselessly
Provincial Highway Irrationally
Provincial Highway Illogically
Provincial Highway Absurdly
Provincial Highway Ridiculously
Provincial Highway Laughably
Provincial Highway Hilariously
Provincial Highway Comically
Provincial Highway Humorously
Provincial Highway Jokingly
Provincial Highway Seriously
Provincial Highway Solemnly
Provincial Highway Gravely
Provincial Highway Earnestly
Provincial Highway Sincerely
Provincial Highway Truthfully
Provincial Highway Honestly
Provincial Highway Frankly
Provincial Highway Openly
Provincial Highway Candidly
Provincial Highway Bluntly
Provincial Highway Directly
Provincial Highway Indirectly
Provincial Highway Obliquely
Provincial Highway Tangentially
Provincial Highway Peripherally
Provincial Highway Centrally
Provincial Highway Centrally
Provincial Highway Centr

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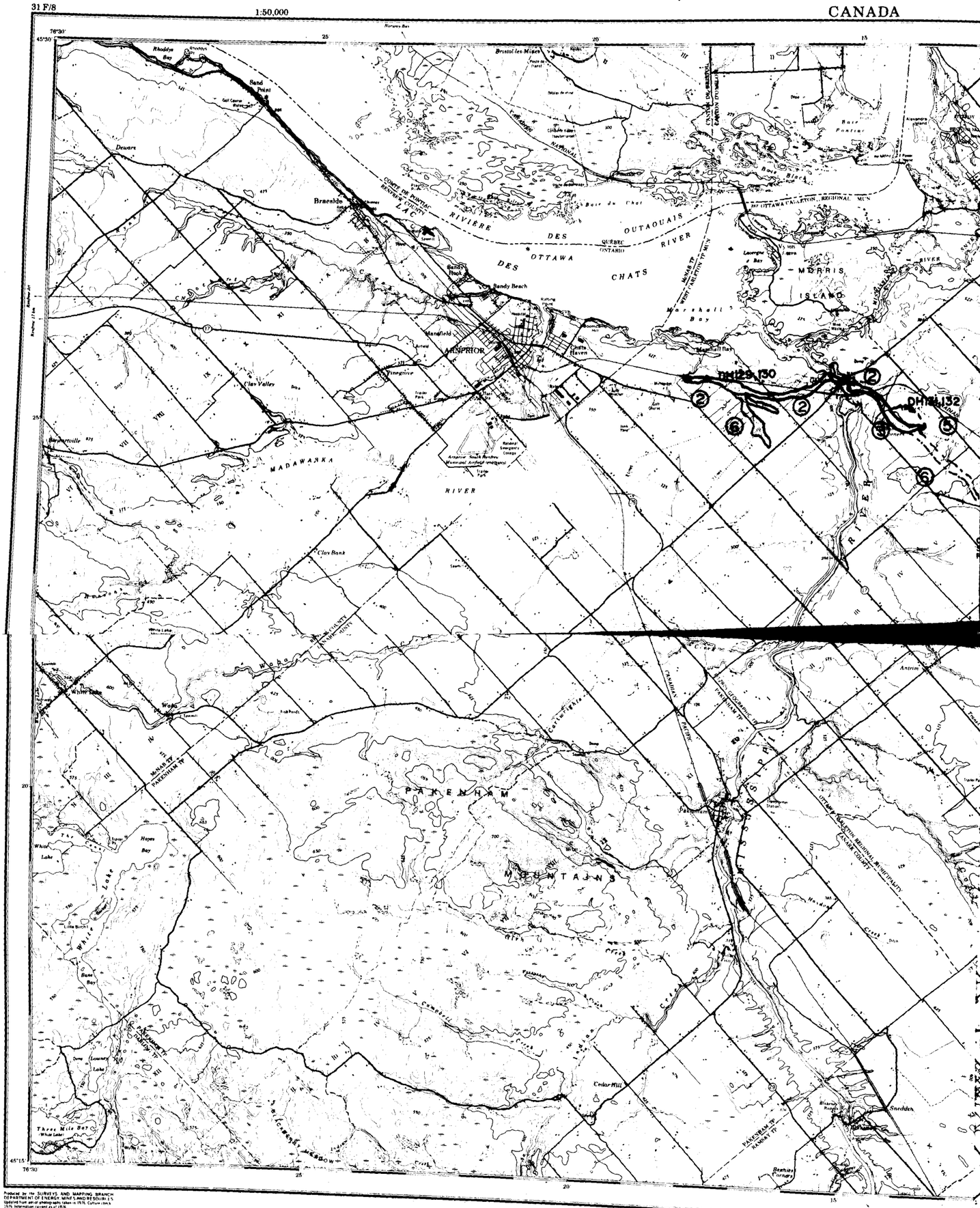
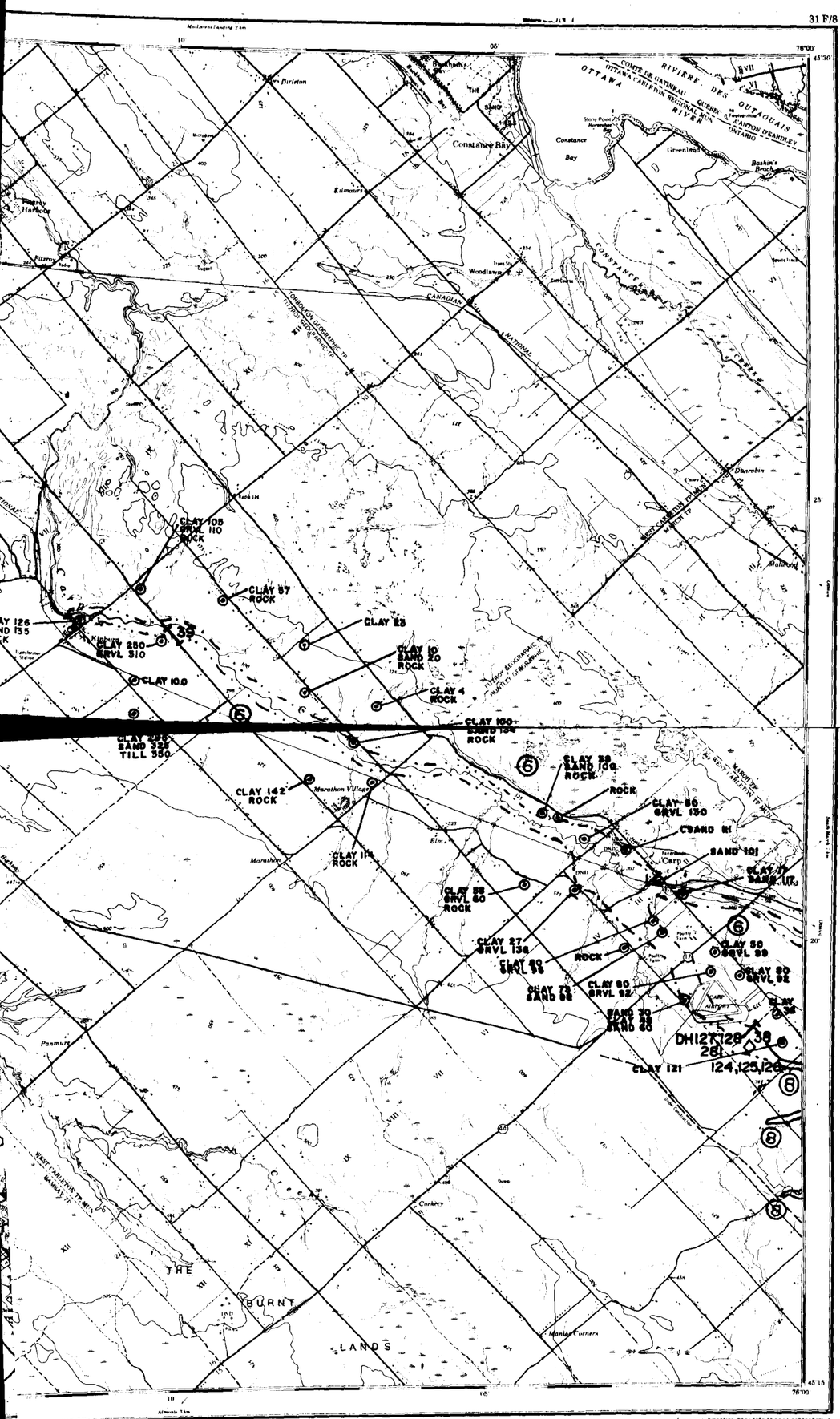
MINES/LIBRARY

MAP 9: System VI





GLOSSARY GLOSSAIRE

Airfield	Terrain d'aviation
Arena	Arena
City Limits	Limites de ville
Customs	Douane
Dock	Fossé
Dugout	Abrevoir
Dump	Dépotoir
Filtration Plant	Usine de filtration
Gas	Gaz
Golf Course	Terrain de golf
Hole Yard	Terrasse
Kiln	Four
Lookout	Belvédère
Mine Waste	Déblai de mine
Oil Works	Puits de pétrole
Park	Parc
Rink	Patinoire
Silver Columns Home	Tour de l'âge d'or
Ski Area	Station de ski
Skiing Bay	Tendance à tirements
Surveyed Line	Ligne arpentée
Tank	Réservoir
Water	Eau
Winter Road	Chemin d'hiver

For a complete glossary see reverse side
Pour un glossaire complet voir au verso

ABBREVIATIONS ABRÉVIATIONS

Aband	Abandoned	Abandonner ne
C	Cemetery	Cimetière
CO	County	Comté
E	Elevator	Elevateur
Fr	Farm	Tréservoir
IR	Indian Reserve	Réserve indienne
H	Hospital	Hôpital
L	Lot	Lot
Mn	Microwave	Mi-ro ondes
Mun	Municipality	Municipalité
P	Post Office	Bureau de poste
PH	Power House	Centrale électrique
RCMP	Royal Canadian Mounted Police	Gendarmerie Royale Canadienne
Res	Reservoir	Réservoir
Trans Sta	Transformer Station	Poste de transformateurs
Tri	True Farm Lineage	Licence de subsistance

TABLEAU D'ASSEMBLAGE DU SYSTÈME NATIONAL DE RÉFÉRENCE CARTOGRAPHIQUE

31 F/10	31 F/9	31 G/12
31 F/7	31 F/8	31 G/5
31 F/2	31 F/3	31 G/4

INDEX TO ADJOINING MAPS OF THE NATIONAL TOPOGRAPHIC SYSTEM

CONVERSION SCALE FOR ELEVATIONS ECHELLE DE CONVERSION DES ELEVATIONS

Metres 30 25 20 15 10 5 0 50 100 150 200 250 300 Metres

Feet 100 50 0 100 200 300 400 500 600 700 800 900 1000 Pieds

CONTOUR INTERVAL 25 FEET
Elevations in feet above Mean Sea Level
North American Datum 1927
Transverse Mercator Projection

EQUIDISTANCE DES COURBES 25 PIEDS
Elevations en pieds au dessus du niveau moyen de la mer
Système de référence géodésique nord-américain 1927
Projection transverse de Mercator

Etablie par la DIRECTION DES LEVÉS ET DE LA CARTOGRAPHIE, MINISTÈRE DE L'ÉNERGIE, DES MINES ET DES RESSOURCES. Mise à jour à l'aide de photographies aériennes prises en 1975, vérification des ouvrages en 1976. Renseignements à jour en 1976.

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ARNPRIOR
31 F/8
EDITION 7

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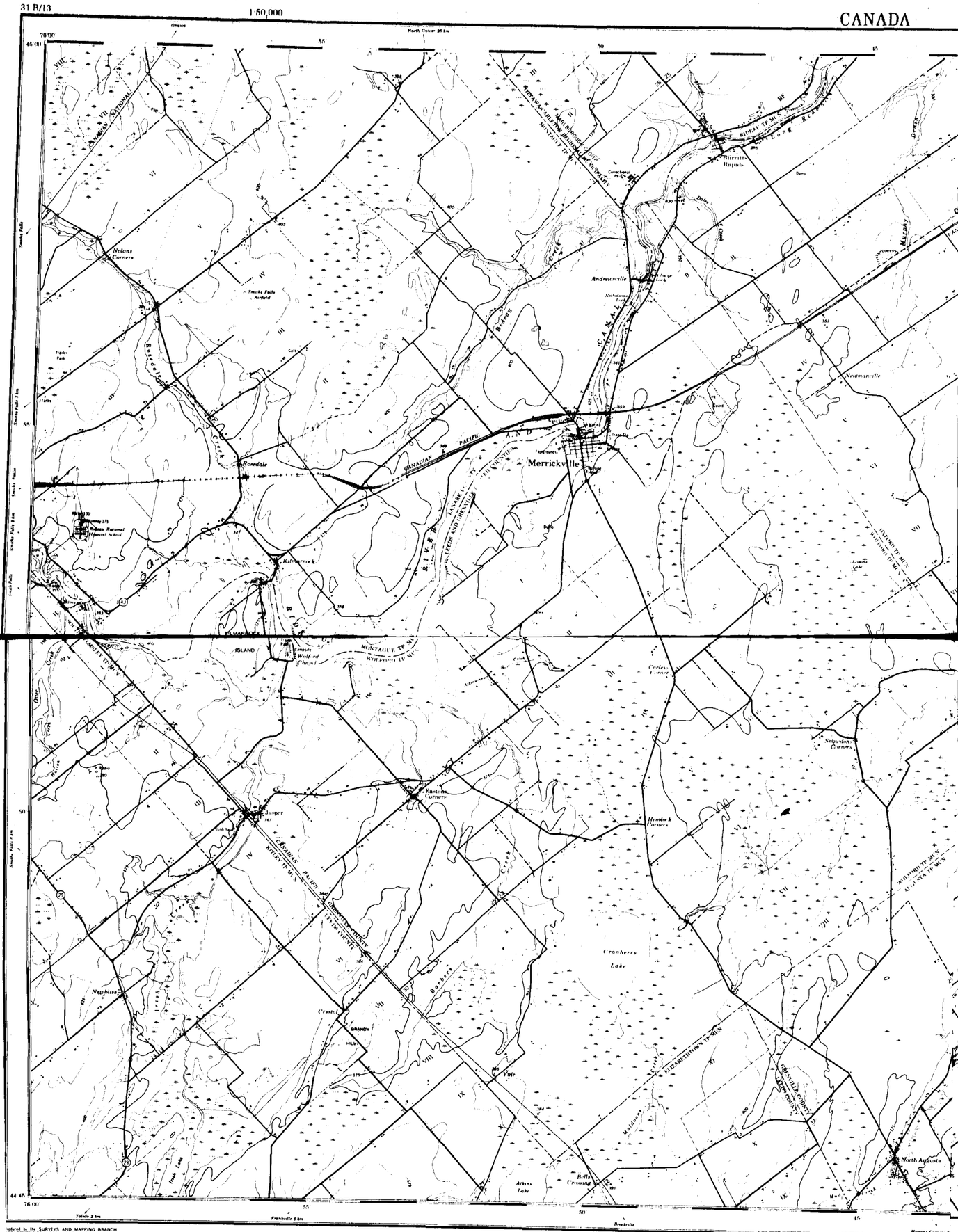
MAP 10: Sytsem VII



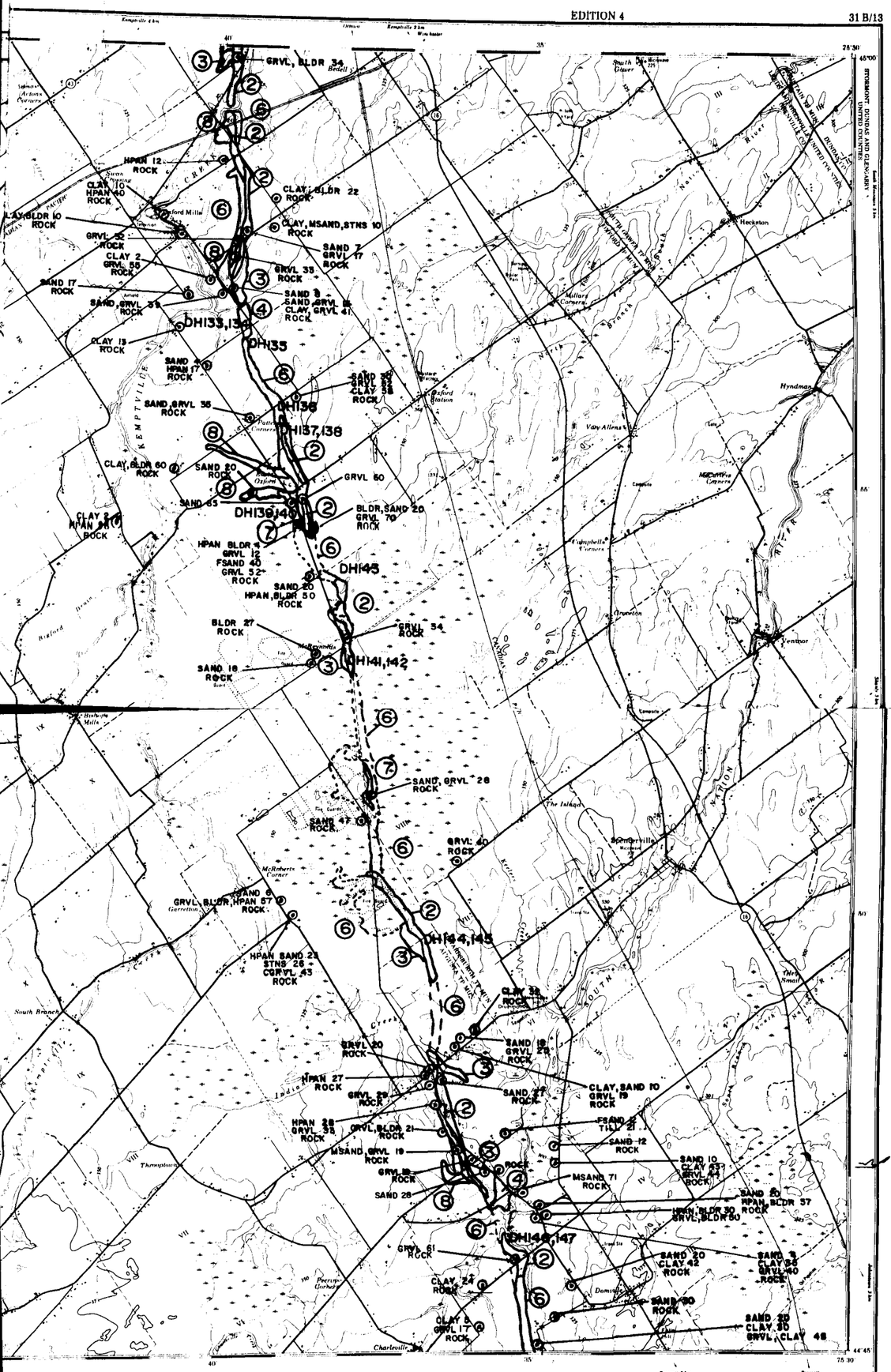
MERRICKVILLE
ONTARIO

Scale 1:50,000 Échelle

Miles 1 0
Metres 1000 0 1000 3000 3000
Yards 1000 0 1000 2000 3000 4000 Y

EDITION 4

31 B/13



GLOSSARY GLOSSAIRE

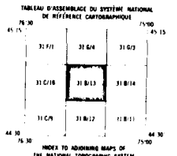
Airfield	Terrain d'aviation
Arena	Aréna
Cemetery	Limites de ville
Customs	Douane
Dock	Fosse
Dugout	Abreuvoir
Farm	Moulin
Fish Hatchery	Usine de transformation
Lake	Lac
Land Covered	Terrain de golf
Lookout	Forêt
Mine	Mine
Mine Waste	Bâtiments
Oil Wells	Déblai de mine
Park	Puits de pétrole
Pier	Parc
Ruin	Pylône
Senior Citizens Home	Tour de transmission
Ski Area	Station de ski
Skiing Slope	Tondeuse à filaments
Surveyed Line	Ligne arpentée
Tank	Réservoir
Water	Eau
Wireless Road	Chemin d'hiver

For a complete glossary see reverse side
Pour un glossaire complet voir au verso

ABBREVIATIONS ABRÉVIATIONS

Aband.	Abandoned		Abandonné ou
Cem.	Cemetery		Cimetière
C.O.	County		Comté
Ex.	Executive		Exécutif
Ferry	Ferry		Traversier
I.R.	Indian Reserve		Réserve indienne
Hosp.	Hospital		Hôpital
L.	Lot		Lot
Micro.	Microwave		Micro-ondes
Mun.	Municipality		Municipalité
P.O.	Post Office		Bureau de poste
Power	Power House		Centrale électrique
R.C.M.P.	Royal Canadian Mounted Police		Gendarmerie Royale Canadienne
Res.	Reservoir		Réservoir
Trans. Sta.	Transformer Station		Poste de transformateurs
Twp.	Township		Canton

TABLEAU D'ASSEMBLAGE DU SYSTÈME NATIONAL DE RÉFÉRENCE CARTOGRAPHIQUE



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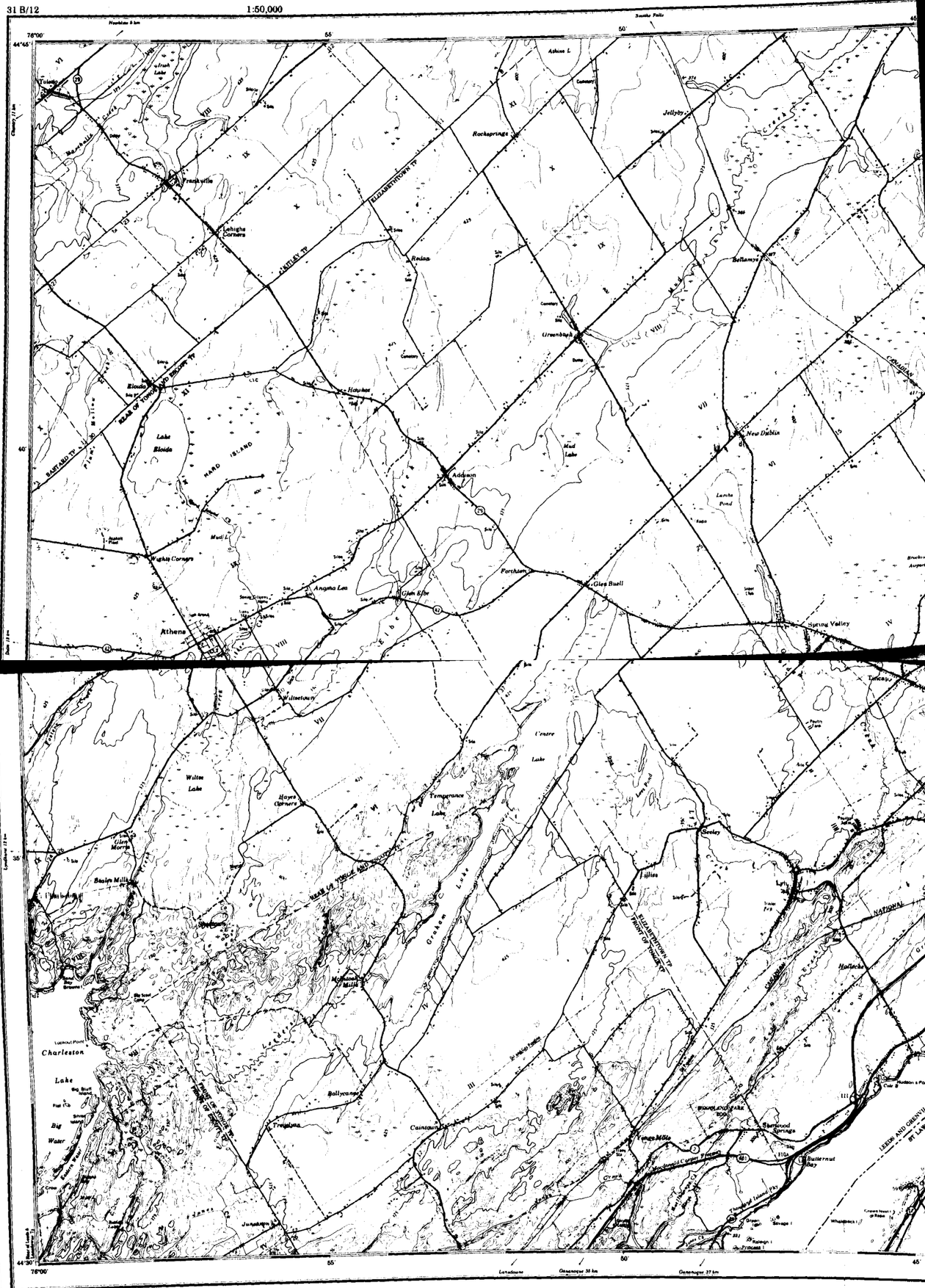
MERRICKVILLE
31 B/13
EDITION 4

OFR.5801

31 B/12, BROCKVILLE BLACK

MINES/LIBRARY

MAP II: System VII



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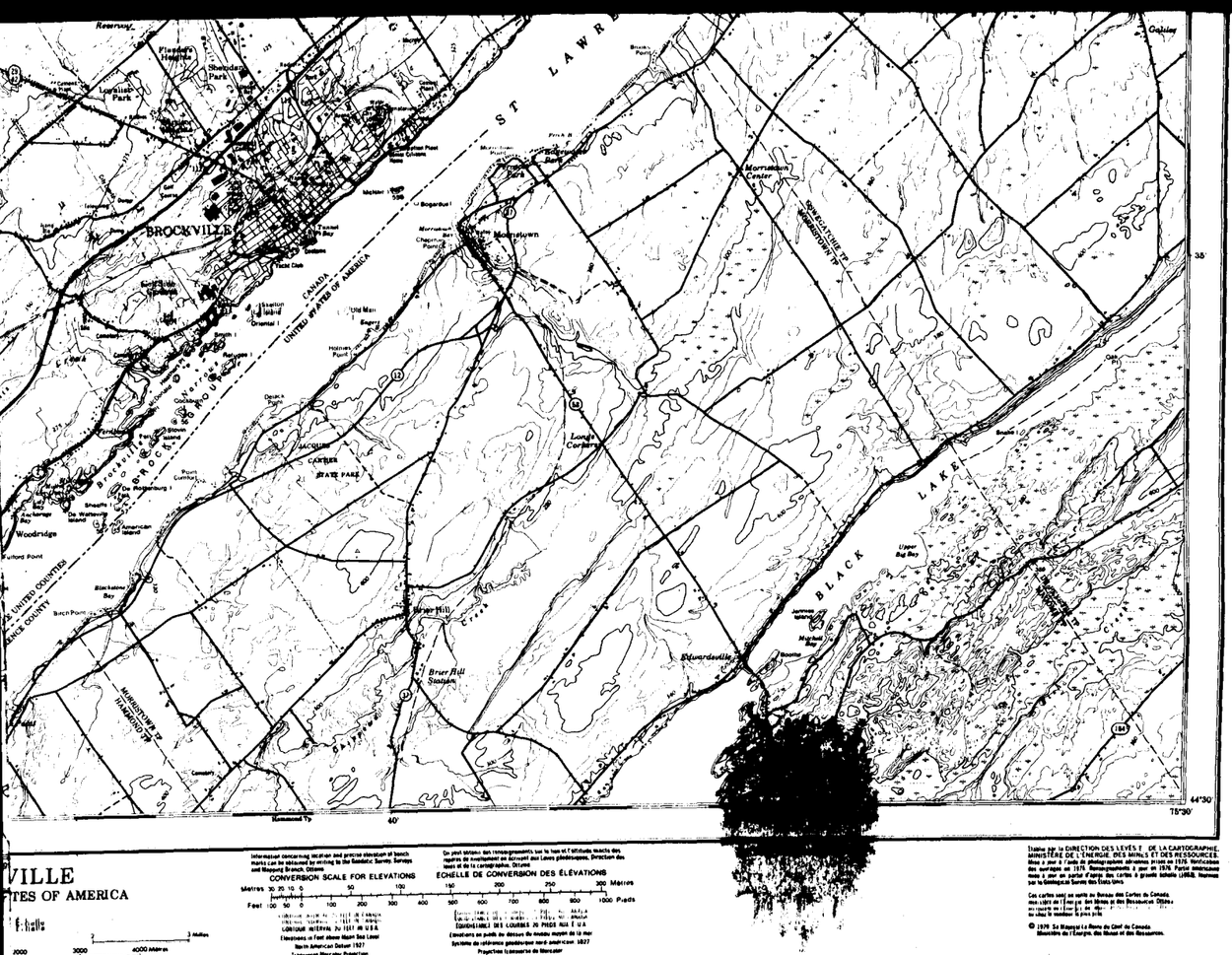
Department of Energy, Mines and Resources

Roads	Routes
hard surface, all weather	pavée, toute saison
hard surface, all weather	pavée, toute saison
loose or stabilized surface, all weather	gravier, aggloméré, toute saison
unclassified streets	rues hors classe
cart track	de terre
trail, cut line or portage	sentier, percée ou portage

FOR COMPLETE REFERENCE SEE REVERSE SIDE. POUR UNE LISTE COMPLETE DES SIGNES VOIR AU VERSO

BROCKV
CANADA-UNITED STA


ST LAWRENCE
BROCKVILLE
CANADA
UNITED STATES OF AMERICA
BLACK LAKE
Mountain View
Lansdowne
Elgin
Delta
Forfar
Toledo
Athens
Addison
Rockport
Lyndhurst
Gananoque
Brockville
Morristown
Ogdensburg
Prescott
Johnstown
Maitland
Algonquin
Fairfield East
Fairfield
Stone Corners
Bellamy
Bellamy Corners
Blue Church
Blue Church Bay
Rivers Point
Hollow Point
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OFR 5801

PUBLIC LIBRARY

LEGEND

(1) Unsorted Sediment - Diamicton

Glaciofluvial

(2) Subglacial Environment - - facies 1 to 4
(3) Proglacial Environment - proximal - facies 3, 5 and 6
(4) Proglacial Environment - mid-fan - facies 7
(5) Proglacial Environment - distal fan- facies 8
(6) Undifferentiated Glaciofluvial

Limnological

(7) Backshore -foreshore
(8) Shoreface
(9) Offshore
(10) Undifferentiated shoreline

Symbols

—— Feature is above the ground surface
--- Feature is buried
..... Inferred boundaries from well records and/or seismic lines
•-•- Feature is buried and has inferred boundaries

DH1 Drill holes, number
Well Log; Ministry of Environment
Seismic line, number
◇1 Sampled face, number
▲1 Sample location of quarry screenings, number
■ Location of communal water supply