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THE CHARACTERIZATION OF TILLS IN THE EDMONTON AREA USING STANDARD PENETRATION TEST RESULTS

by

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ABSTRACT

This study of the characteristics of the Edmonton till delineates various "soft" zones in the till. The basis of the study is the distribution, both areally and with depth, of the results of the Standard Penetration Test.

The report indicates that the Edmonton tills are more likely of a flow or melt-out origin rather than a lodgement origin. Further, a bilinear relationship between moisture contents and blow counts is suggested.

The majority of the soft zones in the Edmonton tills are found away from preglacial or postglacial valleys which suggests that these tills have undergone little consolidation due to drainage. These soft zones in the till preclude the assumption that the local till is an adequate bearing stratum.

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1. INTRODUCTION

1.1 GEOLOGY OF THE EDMONTON AREA

The City of Edmonton is located in the east central portion of Alberta at approximately 53.5°N Latitude and 113.5°W Longitude (Figure 1 After Kathol and McPherson 1975). This physiographic region is known as the Eastern Alberta Plain (Alberta 1969).

During Cretaceous times, the Edmonton area was inundated by a large inland sea extending from the Gulf of Mexico to the Arctic. Erosion of the highlands area to the west produced sediments which formed the bedrock in the Edmonton area. These deposits, termed the Edmonton Group (Irish 1970), consist primarily of interbedded and intertonguing sandstones, siltstones and mudstones. The interbedding and intertonguing of the deposit is primarily due to the fluctuating nature of the shallow inland sea.

Numerous coal seams may be found throughout the local bedrock sequence which reflects the presence of vast swamp areas during the Upper Cretaceous Period. Bentonite is also present in the bedrock, both as a constituent mineral in the clastic rocks and as individual beds (May and Thomson 1978).

During the Eocene, the Laramide Orogeny caused the Cretaceous deposits to be uplifted which brought about subaerial erosion that lasted for a large part of the Tertiary Period. This long period of erosion led to the development of the mature drainage system shown in Fig.2.

The valleys of these preglacial channels were very broad with gently sloping valley walls (Carlson 1967).

Towards the end of the Tertiary, a period of continental glaciation began with the ice sheet advancing up the regional slope of the land. As a result, the rivers aggraded and deposited a sequence of sands and gravels termed the Saskatchewan Sands and Gravels. These deposits, consisting of a clean quartzitic sand with minor chert pebbles, are usually restricted to the preglacial valleys.

The only recorded continental ice to invade the Edmonton area was the Wisconsin. Westgate (1969) postulated that local advances and retreats of this ice deposited two tills which he termed the upper and lower tills. These tills were laid down on the Saskatchewan Sands and Gravels in the preglacial channels or in contact with the bedrock in the upland areas.

As the continental ice sheet retreated, numerous ice marginal glacial lakes formed. The montmorillonite rich sediments of these glacial lakes settled out to form the lacustrine deposits overlying the till. St.Onge (1972) traced the history of a series of glacial lakes along the foothills of the Rocky Mountains as the continental ice sheet retreated. The last of the series of these lakes was glacial Lake Edmonton.

This lake first drained to the southeast through the Gwynne outlet in the approximate area of present day Millwoods and finally along the North Saskatchewan River.

1.2 LOCAL CONTRIBUTIONS TO THE QUATERNARY GEOLOGY OF THE EDMONTON AREA

May and Thomson (1978) provide a history of local contributions to the Quaternary geology of the Edmonton area. They indicate that numerous investigators, many of which were associated with the University of Alberta, studied various aspects of the stratigraphy for the area. Other later investigators presented some analytical data on glacial deposits which referred to a stratigraphy consisting of three tills with intercalated, interglacial beds.

In their study of a portion of central Edmonton, Bayrock and Berg (1969) acknowledge the presence of only one till. Westgate (1969) and Westgate et al. (1976) provide a summary of the Quaternary geology of the Edmonton area in which the presence of two tills was proposed. The present interpretation is that there is a single till sheet comprised of different types of tills (personal communication S. Thomson). These till types are discussed subsequently. Fig.3 summarizes the presently accepted stratigraphic framework. It should be noted that the sands and sandy gravels depicted between the two till layers in Fig.3 is not always present in the Edmonton area.

2. THE GENESIS OF TILLS

2.1 GLACIATION AND THE DEPOSITION OF TILLS

The movement of a glacier over a rock surface produces erosion by a combination of plucking and abrasion. Plucking is the removal and transportation of discrete blocks of rock by the glacier and abrasion is a process whereby glacial transport of these blocks over an intact rock surface produces fine particles. The grain sizes produced by the abrasion process depend primarily upon the mineralogy and structure of the source rock and the distance the source rock was transported by the glacier.

The products of glacial erosion are transported in the basal part of the glacier. Within the basal zone of transport, Boulton (1975) distinguished two subzones. First, a subzone of suspension in which the particles are relatively dispersed (concentrations less than 10% by volume) and travel at the same velocity as the moving ice, and second, a lower subzone of traction in which particles embedded in the lowest part of the glacier have a lower velocity than the ice because of frictional drag against the bed. This is the zone where much of the particle comminution during transport occurs.

Glaciers may also transport debris as medial or lateral moraines built up from debris falling onto the ice from nunataks or flanking valley sides, however these processes were not important on continental ice sheets since the majority of the glaciation occurred away from the mountainous regions.

There are three principle modes of deposition which depend upon the position of transport of the glacial debris (Boulton and Paul 1976). First, debris transported near the glacial bed is likely to be deposited subglacially as lodgement till. Second, where the thickness of basal debris is considerable, ablation at the snout causes debris to be released and deposited on the glacier surface where it is often fluid and highly mobile thus forming flow tills. This process tends to inhibit the ablation of underlying ice. Outwash deposits on an irregular surface of stagnating ice leads to the development of an undulating kame landscape. Third, the slow melting of ice beneath flow till or outwash capping releases more debris as till, which is often quite stable. This process preserves some elements of an englacial debris fabric and has been termed melt-out till. Table 1 shows a classification of till-associated landforms and sediments (Boulton and Paul 1976).

2.1.1 THE DEPOSITION OF LODGEMENT TILLS

The deposition of subglacial lodgement till occurs when the force exerted by the moving ice on particles in traction over the glacial bed is insufficient to overcome frictional resistance offered by the bed. Once subglacial lodgement is initiated, particles already lodged provide obstructions which impede other particles and create lodgement.

The principal landforms found on lodgement till include ellipsoidal drumlins elongated in the direction of ice movement, fluted moraine ridges parallel to the glacier flow direction and push moraines parallel to the glacier margin.

2.1.2 THE DEPOSITION OF FLOW TILLS

The deposition of flow till is initiated by the accumulation of debris on the glacier surface. The effect of this supraglacial accumulation is to preserve large masses of buried stagnant ice in areas from which the active glacier has retreated. Because of the low bulk concentration of debris in glacier ice, melt-out produces large quantities of water. Therefore, the resultant supraglacial till has a very high water content, is extremely unstable and flows readily down the smallest slope; thus the term flow till (Boulton and Paul 1976).

Flow tills are particularly prone to flow in relatively rapid lobate flows. The middle parts of these flows are often of slurry-like consistency and because of their greater mobility they may selectively remove much of the fine fraction from the till and deposit it elsewhere leaving behind a horizon depleted of fines. As a result, surface layers of flow tills often consist of a complex sequence of flow till layers, some rich and some poor in silt and clay.

This phenomenon leads to the classification of flow tills into two groups (Boulton and Paul 1976). First an upper or allochthonous till (far travelled from its source) subaerially derived which has undergone frequent flow and remoulding. On its surface, water released from active flows has preferentially transported away fines leaving a till depleted of fines. Streams on the surface may deposit stratified sand or gravel lenses which are subsequently covered by further till flows to produce a layered sequence of till alternating with fluvial sediments.

Second, a lower or parautochthonous till (little displaced from its source) which has accumulated basally, has not been subjected to surface processes and which retains a massive character.

2.1.3 THE DEPOSITION OF MELT-OUT TILLS

Melt-out tills generally accumulate as a result of the slow melting of debris-rich stagnant ice which is buried beneath a thick overburden. Therefore, some elements of englacial orientation fabrics are often preserved. These tills drain very slowly and are often under-consolidated.

2.2 THE EFFECT OF GEOLOGIC PROCESSES ON GEOTECHNICAL PROPERTIES OF TILLS

The geotechnical properties of sediments should be related to the sediment source, mode of transport and mode of deposition. It follows that the mineralogy and grain size distribution of glacial debris is a function of the source rock and the distance of transport.

The mode of deposition of glacial debris as till and post depositional processes also influence the geotechnical properties of a till. Depositional processes determine the bulk density of the till and its state of consolidation. They may also produce sorting in the till which can cause changes in the grain size distribution and its Atterberg limits. In turn, these changes affect the shear strength and permeability of the till.

2.2.1 LODGEMENT TILLS

Lodgement tills have generally been deposited under considerable ice thicknesses, however they often exhibit small preconsolidation pressures (Boulton and Paul 1976) as, when effective pressures beneath a glacier fall below a critical value, the assumed constant shear stress at the glacier sole coupled with subglacial deformation causes remoulding of the till.

The effect of subglacial deformation on an otherwise dense lodgement till was demonstrated by Boulton, Dent and Morris (1974). They made observations beneath and immediately beyond the retreating margin of the Breidamerkurjökull glacier in Iceland. These observations showed a lodgement till with a two layer structure; a dense lower layer with an average void ratio of 0.38 and a surface layer with and average void ratio of 0.68.

These authors suggest that the upper layer of the till had deformed as a result of shear stresses imposed by the glacier and that under the small marginal effective pressures, shear failure and subsequent dilation had opened up the structure to one of higher void ratio. Coarse grained tills are particularly susceptible to dilation under shear as the abundant large particles collide.

Thus, deformation by glaciers can produce remoulding of sediments and destroy structures related to previous stresses. As a consequence, if a material is remoulded, it will not consolidate to such a high density as was present in the former more efficiently packed particle distribution.

Jointing, which is often observed in lodgement till, also appears to be related to unloading and to shearing. Boulton (1970) has shown the existence of subhorizontal joints produced by unloading during glacier retreat which led to the release of stored strain energy and dilation jointing. He also found that till often contained sub-horizontal joint surfaces which carried distinct striae in the direction of ice movement. Freezing and thawing with the resultant formation of segregated ice lenses as well as drying out of till may also produce jointing in lodgement till.

2.2.2 FLOW TILLS

The laminated nature of flow tills is very important in that geotechnical properties may differ strongly from those of the massive till around them. Their presence can produce a rapid and complex spatial variation in such properties.

Within a sheet of flow till, there is a density contrast between that material which has melted with little movement (parautochthonous) and that material that has been transported a considerable distance (allochthonous). Parautochthonous tills generally have higher densities than allochthonous tills. Additional density contrasts are also observed in allochthonous tills that have been transported as an unremoulded mass and those that have undergone shear during flow.

Drastic changes in grain size distribution in flow tills can occur as the result of the removal of fines by percolating water and fluctuations of natural moisture content due to changing groundwater levels. Partial saturation due to the lowering of groundwater levels leads to the development of suction pressures. These suction pressures decrease the void ratio of the till and result in overconsolidation and jointing.

2.2.3 MELT-OUT TILLS

When first released from glacial ice, melt-out tills possess a high void ratio, however this high void ratio can rapidly decrease under high overburden pressures (Boulton and Paul 1976). Melt-out till that is formed at depth beneath a till cover will adopt a void ratio that is controlled by the effective stress on the surface of melting. Pore water pressure at this surface is controlled by the balance between the rate of meltwater production during thaw and the rate of meltwater expulsion as the soil consolidates under its own weight.

Morgenstern and Nixon (1971) have shown that the significant factor in this process is the thaw consolidation ratio "R", where $R=\alpha/2Cv$, α=rate of advance of thaw front,and Cv= coefficient of consolidation. The excess pore pressure so generated is given by: $u= d/(1+1/2R)$ where d= effective stress on a horizontal surface after dissipation of excess pore pressure.

The generation of such pore pressures may lead to the generation of slides within the flow till. Additional evidence reported by Boulton (1975) suggests that melt-out tills are most often normally consolidated and generally unjointed.

3. DESCRIPTION OF EDMONTON TILLS

3.1 GENESIS OF EDMONTON TILLS

As described previously in Section 1.1, "Geology of the Edmonton Area", Westgate (1969) postulated the presence of two till sheets which he termed the upper and lower tills. The present interpretation is that there is a single till sheet comprised of different types of tills (personal communication S. Thomson).

In general, the till in the Edmonton area consists of diamicton containing erratics derived from the Canadian Shield to the northeast (Shaw 1982). Many of the clasts are faceted and striated with the regional preferred orientation of the long axis of the clasts lying parallel to the ice flow directions. The large clasts of Upper Cretaceous bedrock and other preglacial sediments within the diamicton are evidence of glacial erosion and their preservation precludes deposition by running water or by sedimentation through a body of standing water (Shaw 1982). These large clasts of Upper Cretaceous bedrock and other preglacial sediments are rare throughout the Edmonton tills and are generally found near the lower zones of the deposit. This suggests that lodgement till is rare or is thin in the Edmonton area and that where present, it is the oldest or first deposited till.

Shaw (1982) indicated that angular clasts of subtill sediment are ubiquitous in the Edmonton tills and that the presence of perfectly preserved internal sedimentary structures such as cross-lamination and plane bedding precluded the deposition of much of the Edmonton tills by lodgement. He further argued that a melt-out origin better accounts for the presence of these structures.

The upper tills overriding the lower tills have reworked the upper meter or so of the lower tills as evidenced by pebble reorientation. This is a zone of intense fracturing that represents inherent weakness and a greater fracture permeability in the till. Shaw (1982) provided further evidence of faults occurring in the upper part of the lower till, the sand lenses found in the tills and the lower part of the upper till. He suggested that a possible mechanism for this faulting is subsidence as underlying stagnant ice melted out. Melting of this ice and the fine grained nature of the resultant till together with the sand overburden were probably associated with local underconsolidation and low effective pressures caused by thaw-consolidation.

The upper zone of the till often contains pockets of sand that vary from one to several meters in diameter and from several centimeters to a meter thick. These pockets may be water bearing and the water may be under pressure. Tunnels excavated through the Edmonton tills often encounter these sand lenses. Their observation clearly shows the presence of current bedding (May and Thomson 1978).

Shaw (1982) attributed the sand pockets and lenses in the till to meltwater of superglacial, englacial or basal origin and stated that sharp upper contacts of the sand or gravel pockets implied deposition in an ice tunnel, but the extensive faulting with relatively small displacements implies some settling of the sand as the ice beneath melted out. Consequently, the tunnels were englacial. Any melting along the roof of the tunnel simply caused debris to be released and sorted in the flow that caused the melting. The melt-out till beneath the sand would cause local underconsolidation for which the faults and diapiric injects of till into sand are evidence. Thus it would appear that in the case of the irregular faulted lenses and inclusions, some form of meltwater origin is quite acceptable.

3.2 GEOTECHNICAL DATA FOR EDMONTON TILLS

In order to obtain the information required to prepare this paper, a review of the available geotechnical data on Edmonton tills was conducted. Local geotechnical consultants as well as the Materials Testing Section of the City of Edmonton Engineering Department provided the data for this report.

The types of data collected include the location and designation of the bore hole, the ground surface elevation, the elevations of the top and bottom of the till where available, the sample elevation, insitu moisture contents, unconfined compressive strengths where available, the blow count values and the Atterberg limits where available. A complete listing of all the data obtained for this report is included as Appendix A. Discussions of this data may be found in subsequent sections of this report.

3.3 GEOTECHNICAL PROPERTIES OF EDMONTON TILLS

As stated earlier, the present interpretation is a single till sheet in the Edmonton area comprised of different types of tills. These till deposits are heterogeneous and usually contain a high percentage of local bedrock material. The upper part of the till deposit has a dominant system of columnar joints in contrast to the lower part of the deposit where the joint system is rectangular.

Boulton and Paul (1976) suggested that Atterberg limits serve as good quantitative indicators of the fundamental geotechnical properties of the debris which is deposited as till. They cited Casagrande (1948) and Skempton (1970) as producing plots of plasticity index versus liquid limit for sedimentary clays of low carbonate and organic content and normally consolidated marine clays.

The resulting plots of the Casagrande "A" line and the Skempton marine clay line are shown on Fig. 4. Also shown on this plot is the "T" line proposed by Boulton and Paul (1976) for samples of till obtained from beneath and at the margins of modern glaciers in Iceland, Spitsbergen and the Alps. They suggested that the "T" line owes its position relative to Skempton's trend line to the difference in grading between till and sedimentary clay. When depositional and post-depositional processes produce a grading which is substantially different from that of the parent englacial debris, tills move away from the "T" line.

The points shown on Fig. 4 are from the data obtained from the Edmonton tills. As this figure shows, relatively few of the data points lie close to the "T" line indicating that depositional and/or post-depositional processes have affected the gradation of the till. This tends to support the contention that the majority of the Edmonton tills are of a flow or melt-out origin rather than a lodgement origin.

Numerous authors have discussed the general geotechnical properties of Edmonton tills. Thomson and El-Nahhas (1980) produced a table of values quoted by various authors. A summary of this work is shown in Table 2.

The data of Table 2 show ranges in moisture content from 11 to 22% and ranges in blow counts (Standard Penetration Test) of 40 to 150 blows. The majority of these data points have been obtained from projects in the "downtown" core of Edmonton.

The data collected for this report comes from areas throughout Edmonton and exhibit a much wider range of values. Moisture content values range from 10 to 43% and blow counts range from 5 to 93 blows. Much higher moisture contents and much lower blow count values were obtained when samples from the greater Edmonton area were considered. This point will be discussed in subsequent sections.

4. DEPENDENCY OF BLOW COUNTS ON MOISTURE CONTENT AND DEPTH

In order to determine whether the blow count values obtained from the Edmonton tills are dependent on moisture content or on depth below ground surface, various plots that examined these parameters were prepared from the data collected for this report.

The first two plots, Fig. 5 and Fig. 6, show moisture content versus blow count and blow count versus depth for all of the till data collected throughout Edmonton. Both of these plots show a very large amount of scatter, however the plot of moisture content versus blow count in Fig. 5 shows a definite trend of increasing blow counts for decreasing moisture contents. Further, if we assume the Standard Penetration Test is an indicator of till type, Fig. 6 suggests that several till types do exist because of the large range of blow count values observed at any given depth.

In order to reduce the scatter present in Fig. 5 and 6, the data points throughout the city were separated into seven areas:

Area 1 - Millwoods

Area 2 - West End

Area 3 - North

Area 4 - Northeast

Area 5 - Downtown North

Area 6 - Strathcona

Area 7 - South Central

These seven areas are delineated on Fig. 37.

The plots of moisture content versus blow count for each of these seven areas are presented on Fig. 7 to 13. The plots of blow count versus depth for each of the seven areas are presented on Fig. 14 to 20.

The plots of moisture content versus blow count (Fig. 7 to 13) again show a relatively large amount of scatter, however, the overall trend of increasing blow counts for decreasing moisture contents is very evident. In addition, there is an indication that, in most cases, for moisture content values above 17 to 18%, the blow count values were relatively independent of moisture content. For moisture contents below 17 to 18%, the blow counts were sensitive to moisture content change with large increases in blow count values for small decreases in moisture content being evident. This suggests that there is evidence for a bilinear relationship between moisture content and blow counts for the Edmonton tills.

The plots of blow count versus depth (Fig. 14 to 20) still show a very large amount of scatter and do not show any discernible relationship between depth and blow counts.

A further attempt to reduce the amount of scatter in both sets of plots was undertaken by plotting only data points from boreholes with more than one blow count value. The plots of moisture content versus blow count for the multisample bore holes from each of the various areas are on Fig. 21 to 27. The plots of blow count versus depth from each of the various areas are on Fig. 28 to 34.

When Fig. 21 to 27 are compared to Fig. 7 to 13, the degree of scatter has been reduced, but some scatter is still present. However, the bilinear relationship between moisture content and blow count is evident, as shown on Fig. 27.

A comparison of Fig. 28 to 34 with Fig. 14 to 20 shows a significant reduction in the amount of scatter. A closer examination of Fig. 28 to 34 reveals a slight trend for lower blow counts to occur near the upper and lower zones of the deposit with higher blow counts present in the central area. This trend is illustrated on Fig. 30 by dashed lines. To investigate this relationship further, plots of the general stratigraphy and blow counts were produced for a line in the downtown and Millwoods areas. The locations of these lines are shown on Fig. 37. The plot for the downtown area, shown on Fig. 35, generally supports the trend of lower blow counts occurring near the top and bottom of the till with higher blow counts being found in the middle area. The plot for the Millwoods area, shown on Fig. 36, also supports this observation.

It should be noted that when viewing the plots of moisture content and depth versus blow count, the Standard Penetration Test is an empirical test and is dependent on operator and equipment performance to achieve consistent results. These points are more fully discussed by Lanigan (1982).

Since the data of this report were obtained from various sources, it is likely that many different operators and drilling rigs were involved in deriving this data. Therefore, some scatter is inevitable purely from an operational standpoint; regardless of differences in the geology of the till deposits. In spite of this obvious drawback, no attempt has been made to correct the data for operator and equipment error. The data have been shown exactly as presented in the original reports.

5. SOFT ZONES IN THE EDMONTON TILLS

5.1 LOCATIONS OF SOFT ZONES

As discussed in Section 3.3, "Geotechnical Properties of Edmonton Tills", most of the published geotechnical data on Edmonton tills comes from projects in the "downtown" core. These data have generally described the till as having relatively high strengths and low moisture contents and as an excellent foundation material.

However, a close scrutiny of the till data obtained from projects throughout the City of Edmonton (listed in Appendix A) reveals that, in numerous locations, the till strengths are relatively low. In addition, some locations exhibit insitu moisture contents much higher than normally encountered in the Edmonton tills. All of the locations of the boreholes from which blow count values were recorded are plotted on a map of the City of Edmonton, Fig. 37.

The thalwegs of the preglacial valleys in the Edmonton area are also shown on this figure. The blow count values have been divided into 3 groups, viz; $N<20$, $20 \le N \le 30$ and $N> 30$.

This map shows that although low and high blow count locations are distributed throughout the city, the downtown north (Area 4) and the south central (Area 7) areas have the highest concentrations of high blow count locations. The Millwoods (Area 1) and north (Area 3) areas have the highest concentrations of low blow count locations.

5.2 MECHANISMS FOR SOFT ZONE FORMATION

As suggested in Section 3.1, "Genesis of Edmonton Tills", numerous sand lenses and inclusions in the Edmonton tills are of a meltwater origin. This would imply that at least the upper portion of the till is of "flow" or "meltwater" origin.

Boulton (1975) discusses a model for flow tills in which he postulates a mass of stagnant ice immediately in front of an active retreating glacier. As the stagnant ice melts, debris incorporated within the ice accumulates on the surface along with large quantities of meltwater. Outwash streams from the retreating active ice mass flow across the stagnant, flow till covered ice and in doing so create channels or small lake depressions in which water washed sands can accumulate (Thomson, Martin and Eisenstein 1980).

These water-washed sands are then often covered by lobes of flow till which when combined with the retreat of the ice, bring about the abandonment of the channel. The constant shifting of these channels and the accumulation of flow till generates the sand lenses in a random manner.

It follows that the processes operating during ablation can produce the majority of the Edmonton tills and the lens shaped sand inclusions found throughout them. Further, an ablation origin for the Edmonton till also accounts for many of the relatively low blow count values observed in the data collected for this report, since the large amounts of meltwater present at the time of the till deposition would result in weak slurry like tills at the outset.

However, the presence of many high blow count values indicates that some of the till data is at variance with the ablation origin postulated above unless following deposition, some events occurred to bring about consolidation. Various alternatives are available for the consolidation of select zones of the till including dessication, the altithermal effect, local drainage through preglacial or postglacial channels, regional changes in groundwater levels and increased overburden load by the addition of sediments from glacial Lake Edmonton. Also, some of the till may not be of flow or melt-out origin, but of lodgement origin. It is most likely that combinations of these processes contributed to the consolidation of the select till zones which now exhibit high blow counts.

6. DISCUSSION

Even though the majority of the available data in the Edmonton area have been collected, the map on Fig. 37 shows some areas that have relatively little data available. Although this situation is unfortunate, a brief study of the map (Fig. 37) shows that the majority of these areas are older residential areas or undeveloped areas which by their very nature tend to have a very limited amount of geotechnical data available.

In section 3.3, "Geotechnical Properties of Edmonton Tills", the conformity of the Edmonton tills to the proposed Boulton and Paul (1976) "T" line was discussed. Fig. 4 shows a plot of the Boulton "T" line and the data points from the Edmonton tills. This plot reveals that relatively few of the Edmonton till data points lie close to the "T" line. This suggests that depositional and/or post-depositional processes have affected the gradation of the till which , in turn, indicates that the majority of the Edmonton tills are of a flow or melt-out origin rather than a lodgement origin.

An investigation of the dependency of blow counts on moisture content and depth was made in Section 4.0, "Dependency of Blow Counts on Moisture Content and Depth". This showed a bilinear dependency of blow counts on moisture content. As Fig. 7 to 13 and 21 to 27 show, for moisture content values above 17 to 18%, as the moisture content values decreased, the blow count values increased. For moisture contents below 17 to 18%, the blow count values could not be easily predicted from the moisture content values.

Since the Edmonton tills consist generally of a matrix of sand, silt and clay sizes, those tills with moisture contents above 17 to 18% may have a higher percent clay fraction than other tills. This postulated increase in clay fraction may be explained by the Boulton (1975) till formation model discussed in Section 5.2, "Mechanisms for Soft Zone Formation". The numerous outwash streams flowing across the stagnant flow till covered ice would tend to remove some of the clay sizes from the areas they flowed through and deposit them elsewhere. In addition, an increase in clay fraction may reduce the permeability of the till locally and thus increase the time required for consolidation to occur with respect to those areas where the percent clay fraction is lower.

The plots of blow counts versus depth tend to show a general trend of lower blow counts in the upper and lower zones of the till, with higher blow counts being evident in the middle area. This observation suggests that perhaps depositional and/or postdepositional processes have affected the degree of consolidation of the upper and lower till zones.

As presented in section 4.3, "Mechanisms for Soft Zone Formation", a meltwater origin for the majority of the Edmonton tills would account for many of the relatively low blow counts observed in the data collected for this report.

After a study of the map (Fig. 37) of the location of the blow count values in the Edmonton tills, it may be noted that the majority of the low blow count data points are located away from the preglacial or postglacial channels in the Edmonton area, eg., Millwoods (Area 1). Conversely, most of the high blow count data points are located near the preglacial or postglacial channels, eg., downtown north (Area 5) or south central (Area 7).

The mechanism of till consolidation by local drainage through preglacial or postglacial channels, postulated in section 5.2, "Mechanisms for Soft Zone Formation", is supported by blow count data of the Edmonton tills. The presence of the few isolated high blow count data points away from the preglacial or postglacial channels may reflect the operation of other possible till consolidation mechanisms such as desication, the altithermal effect, regional changes in groundwater levels and increased overburden load by the addition of sediments from glacial Lake Edmonton.

The trend of lower blow counts in the upper and lower zones of the deposit with higher blow counts in the middle area may be explained by the consideration of depositional and postdepositional processes. The low blow count values in the upper zones of the deposit may be the result of the influence of glacial Lake Edmonton. The low blow count values in the lower till zones may be due to the dilation hypothesis proposed by Boulton, Dent and Morris (1974). They suggest that shear failure and subsequent dilation beneath an active glacier can open up the till structure to one of a higher void ratio which would in turn result in lower blow count values.

The presence of some obviously softer zones in the Edmonton till has some definite implications. As outlined by Thomson, Martin and Eisenstein (1980), the presence of a soft zone in the till at the site of a proposed 14 story building complex in downtown Edmonton resulted in the changing of the foundation system from bearing in till to bearing in the Saskatchewan Sands and Gravels to eliminate the danger of differential settlement.

The map on Fig. 37 indicates that there are numerous areas throughout Edmonton where the blow counts in the till are lower than the values generally found in the downtown core. Fortunately, the majority of the large multistory buildings in Edmonton are situated in the downtown area, however, as the city grows, the need for large multistory buildings in other areas where soft zones in the till may be present will develop.

Thus it becomes increasingly important that geotechnical engineers understand that till deposits are more complex than generally considered, both with respect to geotechnical properties and geologic origin. This reinforces the need to undertake detailed and thorough investigations at proposed construction sites in order to understand the geologic history of the deposits and to determine how this history has affected their geotechnical properties.

7. CONCLUSIONS

On the basis of the information presented in this report, the following conclusions are offered:

1) The departure of the Atterberg limits of Edmonton tills from the "T" line proposed by Boulton and Paul (1976) suggests the majority of the Edmonton tills have a melt-out or flow origin rather than a lodgement origin.

2) The relationship between moisture content and blow counts for the Edmonton tills appears to be bilinear in nature with blow counts being independent of moisture contents for moisture content values higher than 17 to 18% and dependent on moisture content for values lower than 17 to 18%.

There also appears to be some data which suggests a trend of low blow counts in the upper and lower parts of the till with higher blow counts present in the middle area. This may be due to the effect of glacial Lake Edmomton on the upper parts and the dilation effect proposed by Boulton, Dent and Morris (1974) on the lower parts.

3) A flow till or meltwater origin for the majority of the Edmonton tills and the general processes operating during ablation appear to account for the many relatively low blow count values observed in the data collected for this report.

4) The zones in the Edmonton tills with high blow counts are often found adjacent to preglacial or postglacial valleys indicating that significant consolidation of these tills may have ocurred through drainage into the adjacent valleys. Other consolidation mechanisms such as desication, the

altithermal effect, regional changes in groundwater levels and increased overburden load by the addition of sediments from glacial Lake Edmonton may account for the presence of the high blow count till zones away from the preglacial or postglacial valleys.

5) Due to the complex nature of till deposits, it is important that geotechnical engineers understand how the geologic origin of the till can affect its geotechnical properties. The presence of numerous soft zones in the Edmonton till mapped in this report make it imperative that geotechnical engineers take care in their foundation investigations in the Edmonton area to ensure that changes in the strength properties of the till which may occur within their jobsite are recognized.

8. RECOMMENDATIONS FOR FUTURE RESEARCH

1) Conclusions 1 and 2 of this report imply that the grain size distribution is a very significant factor in both the geologic origin and geotechnical properties of the Edmonton till. Further research could be carried out on the grain size analysis of Edmonton tills to determine if the postulated melt-out or flow till origin and the bilinear relationship between moisture content and blow counts are supported by additional data. In order to proceed with this work, objective criteria for melt-out till, flow till and lodgement till must first be developed.

2) This report has initiated a data bank on geotechnical information on the Edmonton tills. It would be of benefit to the geotechnical community if this data bank were continually updated.

3) A project similar to this one undertaken on the Edmonton tills could be undertaken for all the Pleistocene deposits in the Edmonton area to build up a data bank on their extent and geotechnical properties.

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CLASSIFICATION of TILL - ASSOCIATED LANDFORMS and SEDIMENTS

<table>
<tr><th>Land system</th><th></th><th>Sediment association</th><th>Principle till types</th></tr>
<tr><td>(i) GLACIATED VALLEY LAND SYSTEM May be superimposed on (ii) or (iii)</td><td>medial & lateral moraines kame terraces</td><td rowspan="2">(a) SUPRAGLACIAL SEDIMENT ASSOCIATED (may be superimposed on b.)</td><td rowspan="2">SUPRAGLACIAL MORAINIC TILL -- (derived from supraglacial debris source)
FLOW TILL — Allochthonous / Parautochthonous
MELT OUT TILL</td></tr>
<tr><td>(ii) SUPRAGLACIAL LAND SYSTEM</td><td>kame moraines</td></tr>
<tr><td>(iii) SUBGLACIAL/ PREGLACIAL LAND SYSTEM</td><td>Drumlins, fluted moraines, pushed-moraines, outwash plains & terraces</td><td>(b) SUBGLACIAL/ PROGLACIAL SEDIMENT ASSOCIATION</td><td>MELT OUT TILL
LODGEMENT TILL
LEE-SIDE TILL</td></tr>
</table>

(After Boulton and Paul 1976, modified)

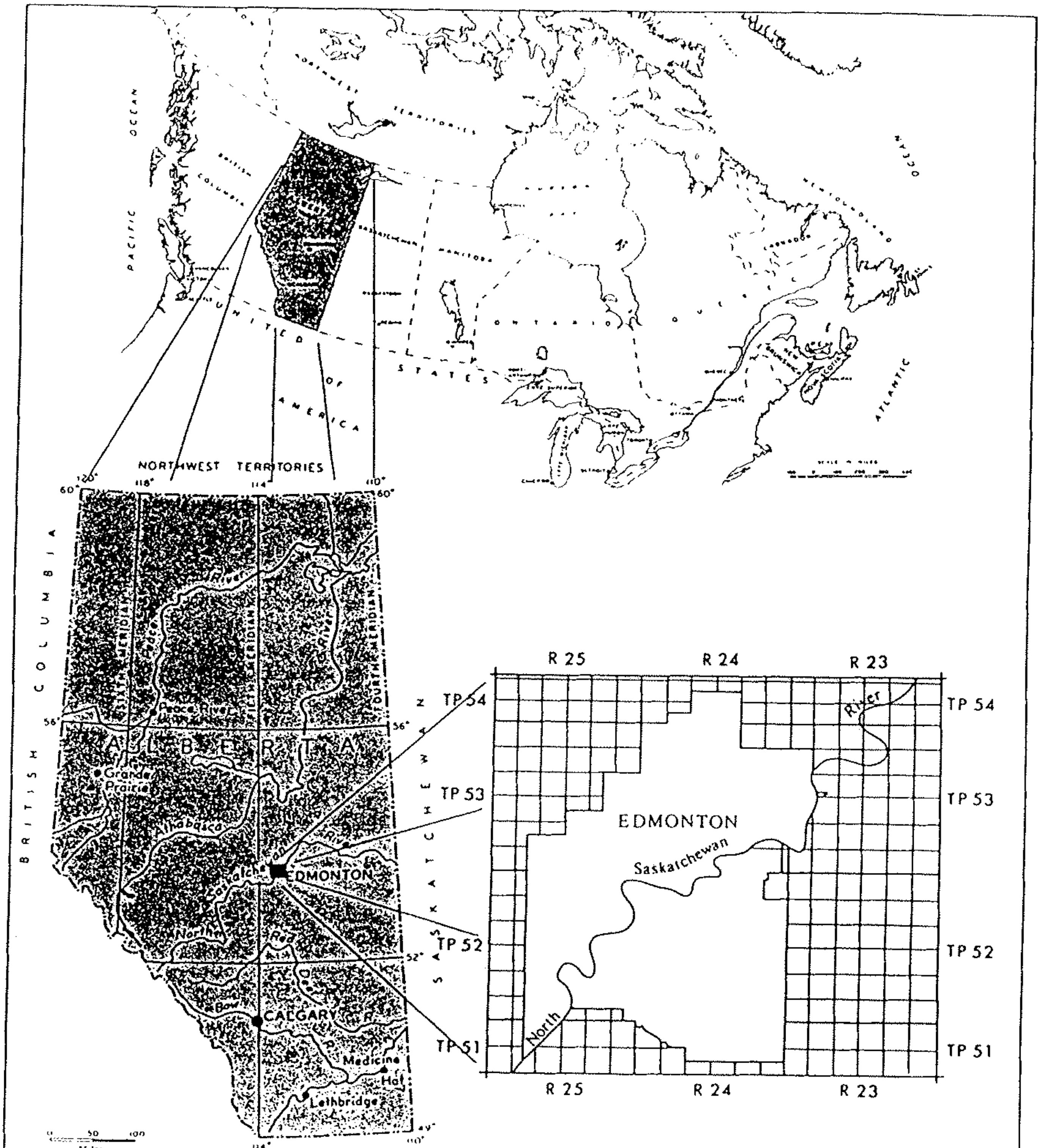
TABLE 1

TABLE 2

GEOTECHNICAL PROPERTIES of TILL

Reference	Morgenstern and Thomson (1971)	DeJong and Harris (1971)	Thomson and Yacyshyn (1977)	El-Nahhas (1977)	Eisenstein and Thomson (1978)
Density (kN/m^3)	---	19-22	---	22	20.6--21.2
Natural moisture content (%)	12-22	11-19	15	12	12-20
Liquid limit (%)	28-48	22-42	40	31	20-40
Plastic limit (%)	12-22	9-20	20	15	12-20
% clay	20-30	20	20-30	42	20-30
% silt	---	38	25-35	31	25-35
% sand	---	42	40-50	27	40-50
Void ratio	---	0.35-0.4	---	0.36	--
Degree of saturation (%)	---	75-95	---	89	--
Unconfined strength (kPa)	345-828	140-240	140-245	--	140-245
Peak angle of shearing resistance (deg)	---	---	27	--	---
Peak cohesion (kPa)	---	---	28	--	---
Standard penetration (blows/0.3m)	---	60-150	--	--	40-60 (Some > 100)

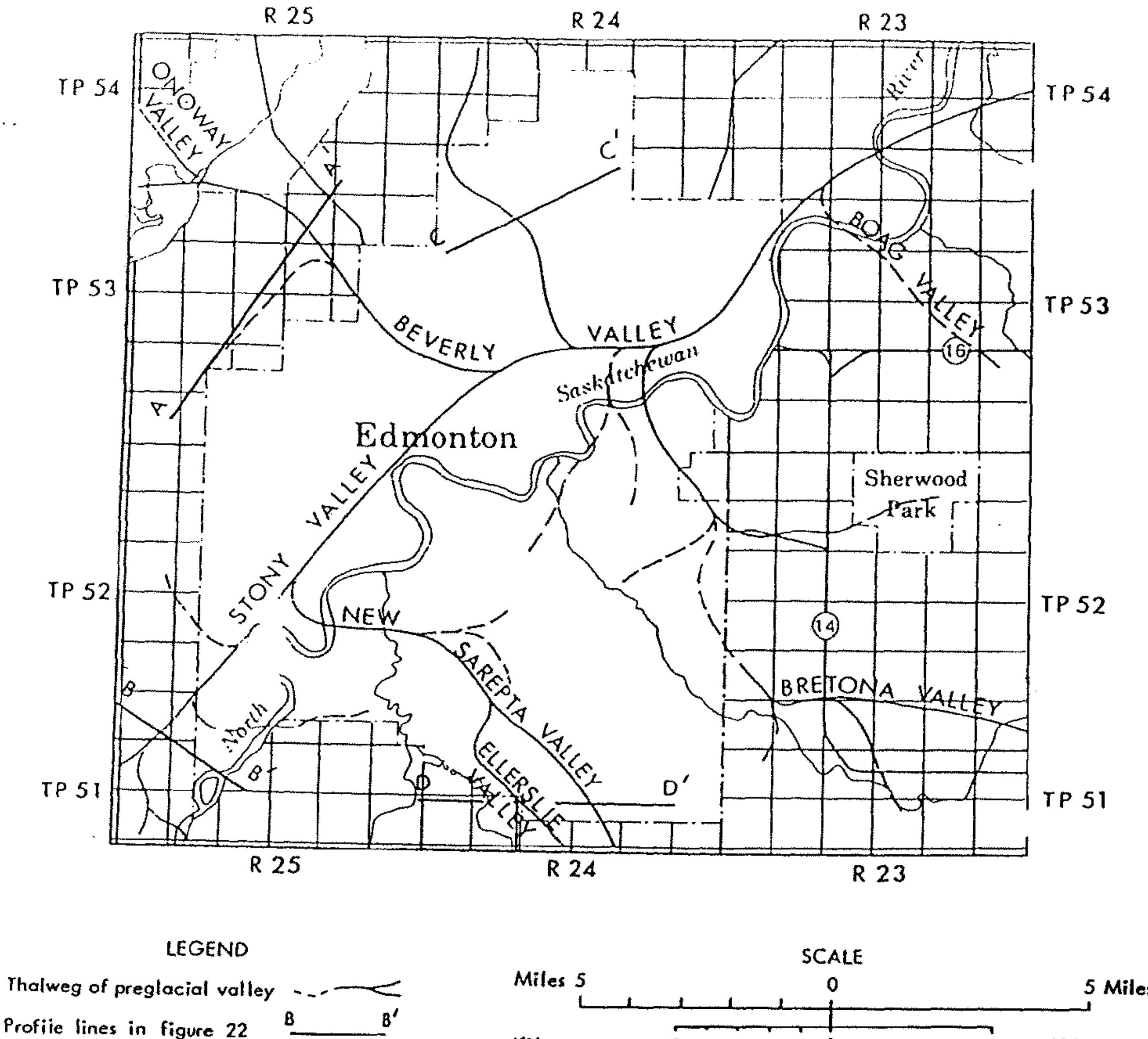
(After Thomson and El-Nahhas 1980, Modified)



Location map of the study area.

(After Kathol and Mcpherson 1975, Modified)

FIGURE 1



Thalwegs of preglacial valleys in the Edmonton area.

(After Kathol and Mcpherson 1975, Modified)

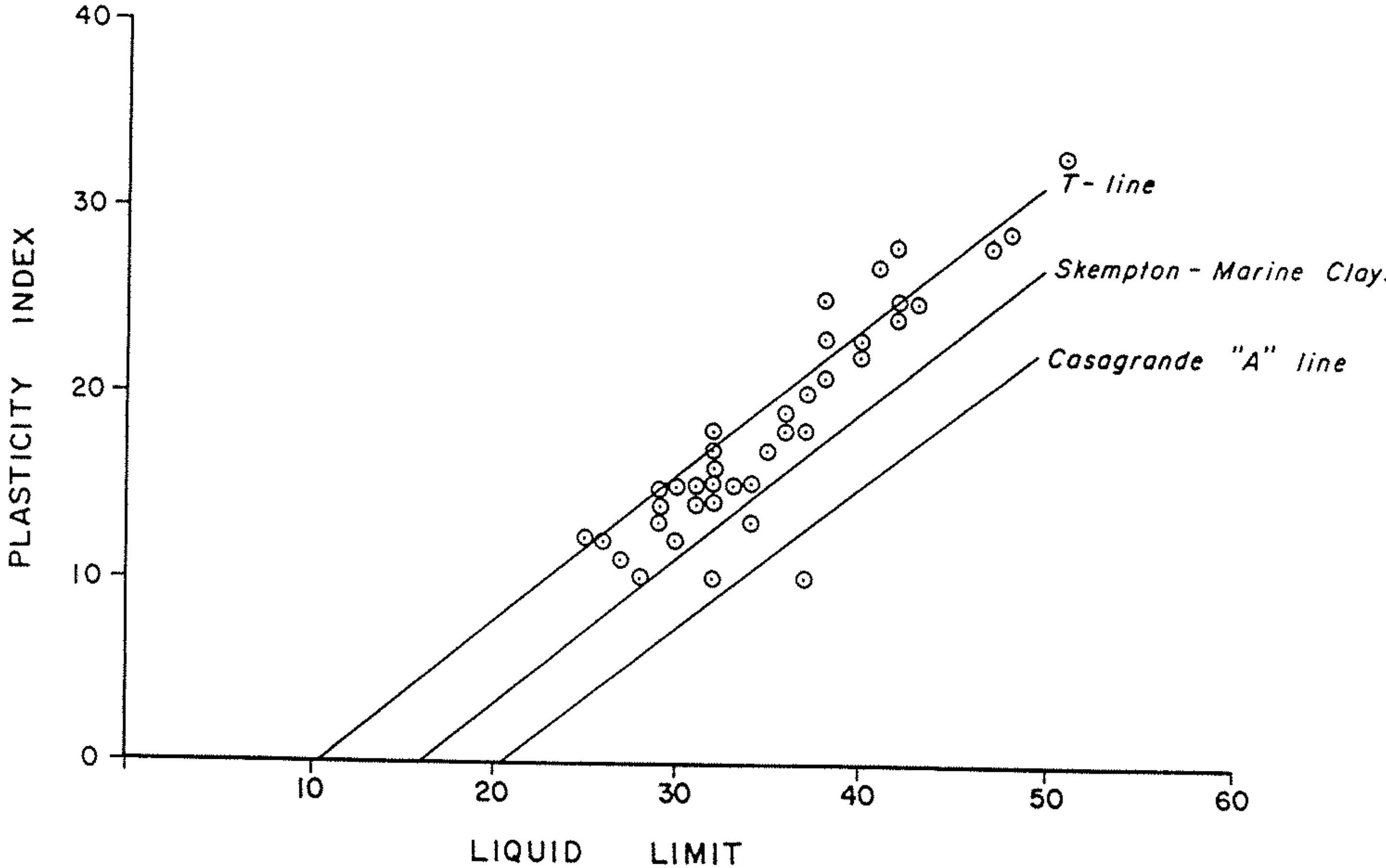
FIGURE 2

Cenozoic	Quaternary	Holocene	Alluvium, organic deposits, recent lake deposits
		Pleistocene	Lacustrine sand, silt and clay, organic deposits, aeolian sand and silt, river alluvium
			Till
			Sand and sandy gravels, some silt and clay (may or may not be present)
			Till
	Tertiary (undivided)		Saskatchewan gravels and sands.

Generalized Quaternary stratigraphy of the Edmonton area

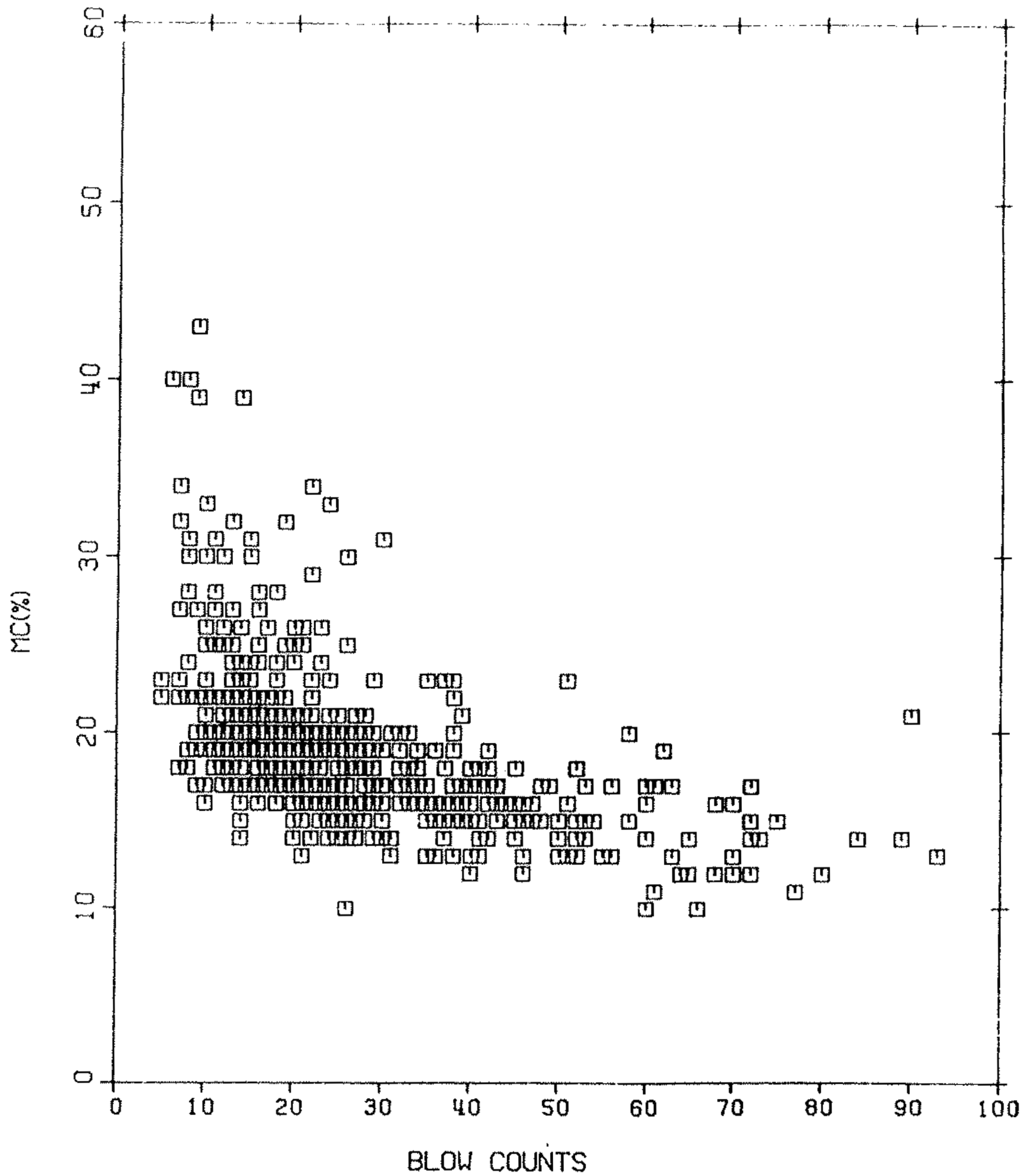
(After Westgate, 1969 Modified)

FIGURE 3



LIQUID LIMIT/ PLASTICITY INDEX PLOT for EDMONTON TILLS

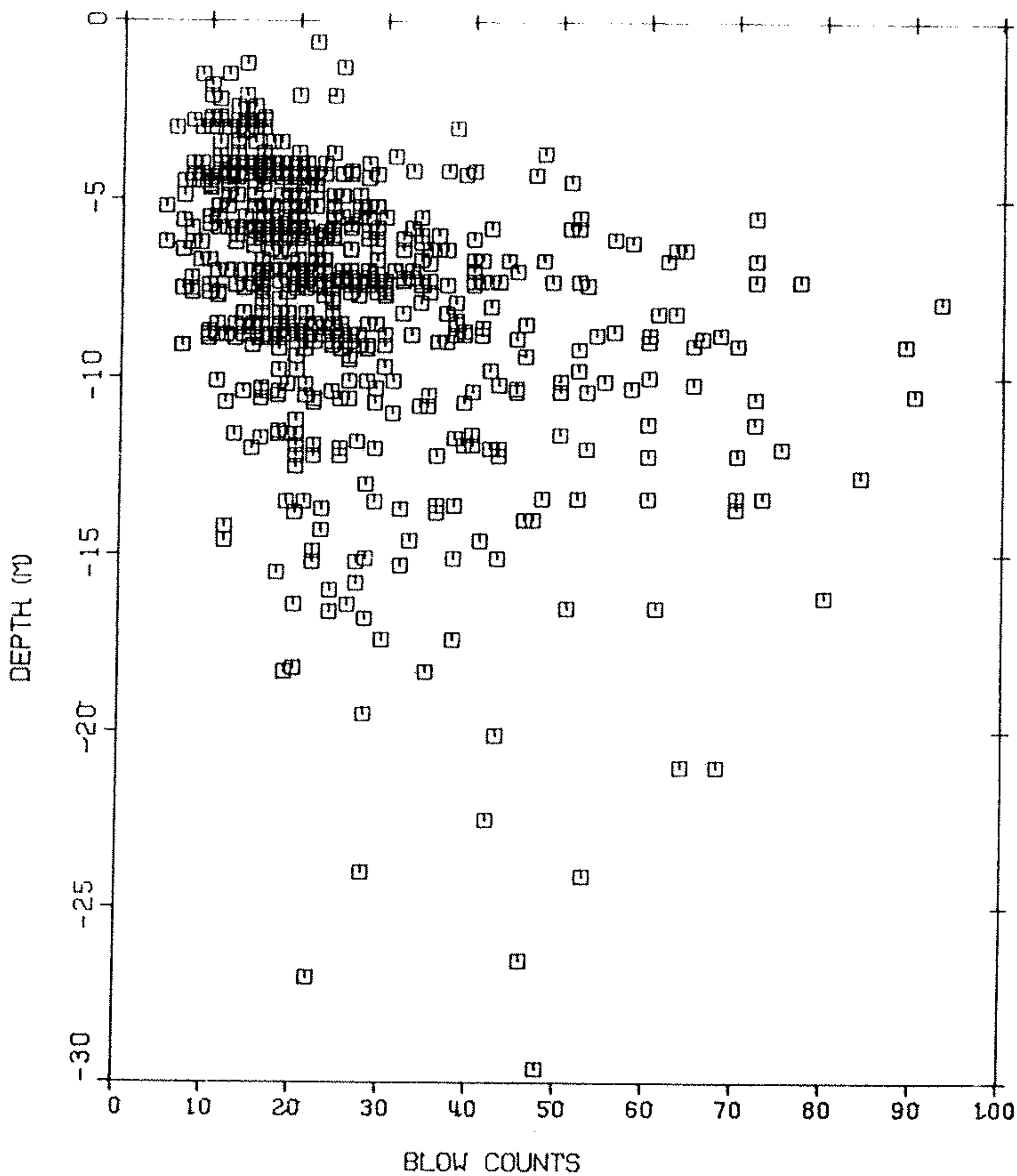
FIGURE 4



PLOT OF MOISTURE CONTENT VERSUS BLOW COUNTS(SPT)

(ALL DATA)

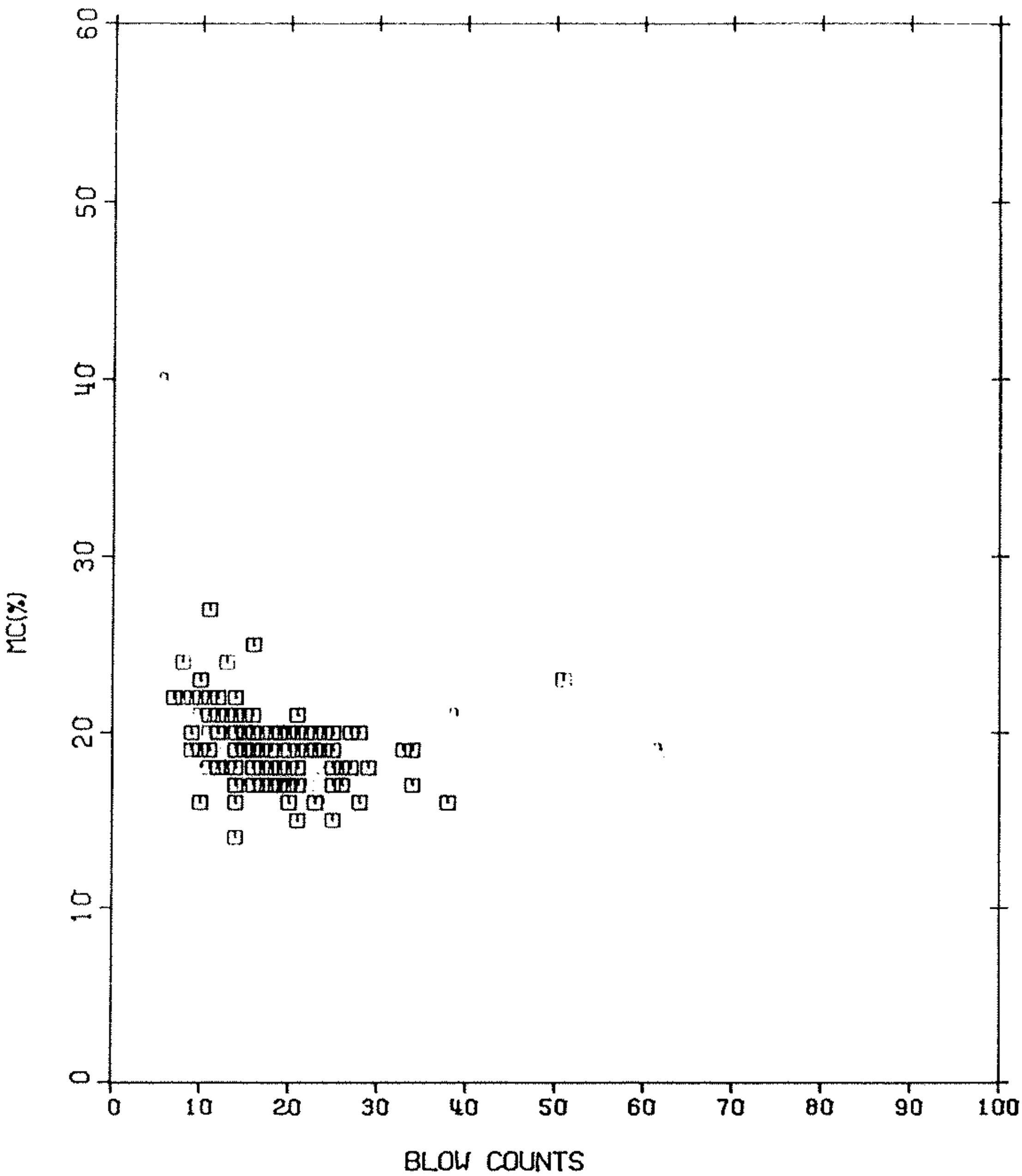
FIGURE 5



PLOT OF BLOW COUNTS (SPT) VERSUS DEPTH

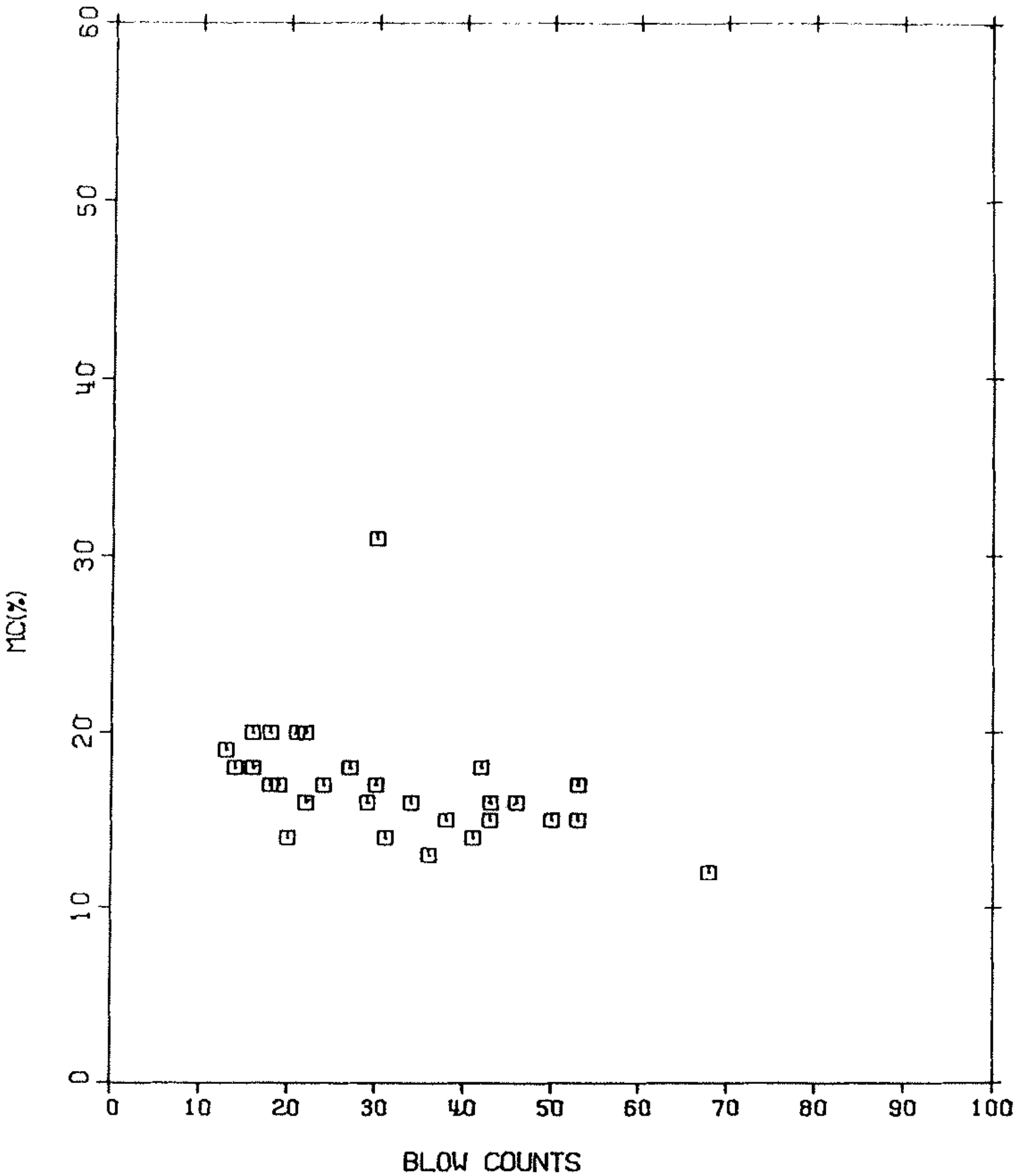
(ALL DATA)

FIGURE 6



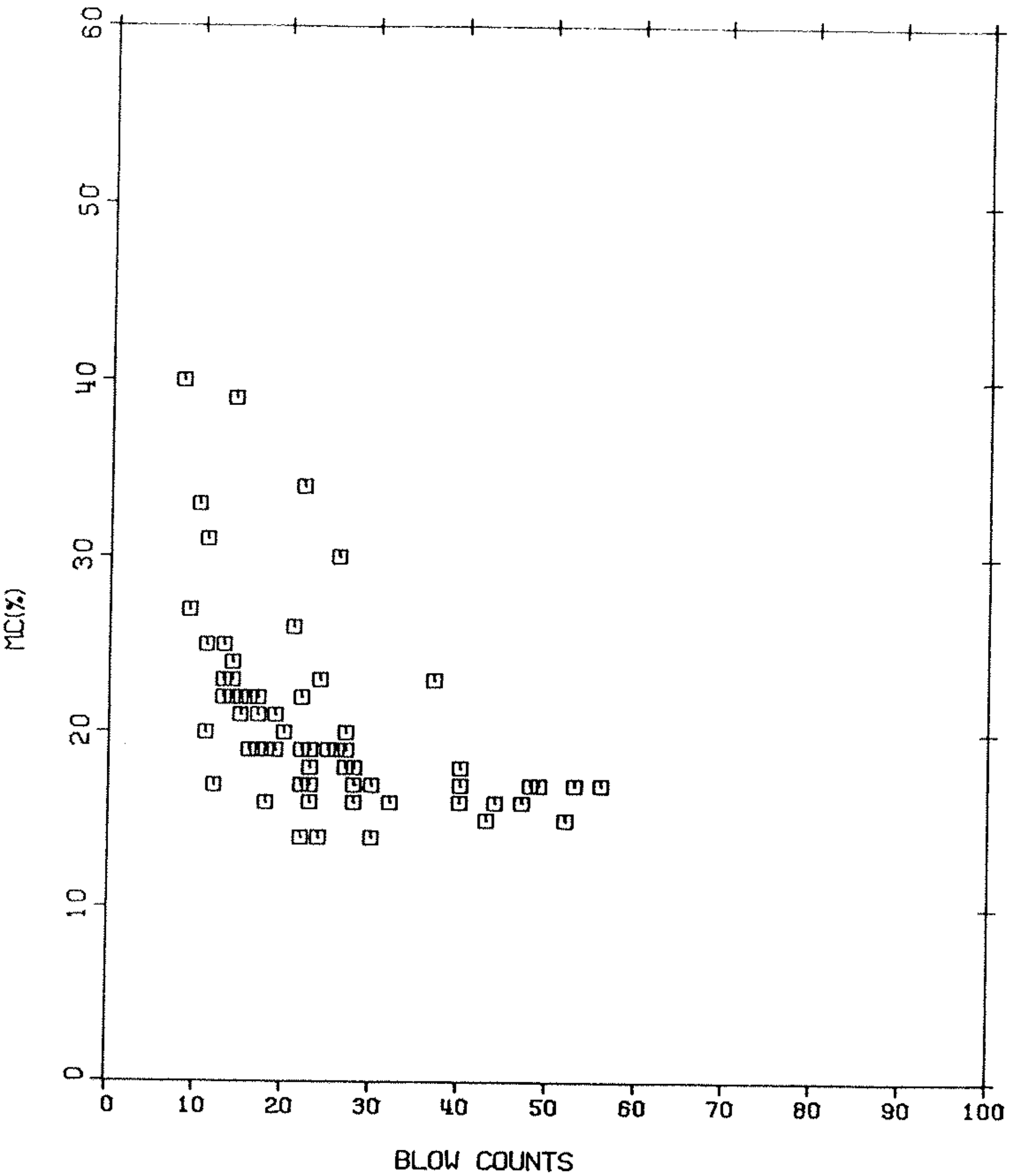
MOIST CONT VS BLOW COUNTS (SPT) AREA 1,MILLWOODS

FIGURE 7



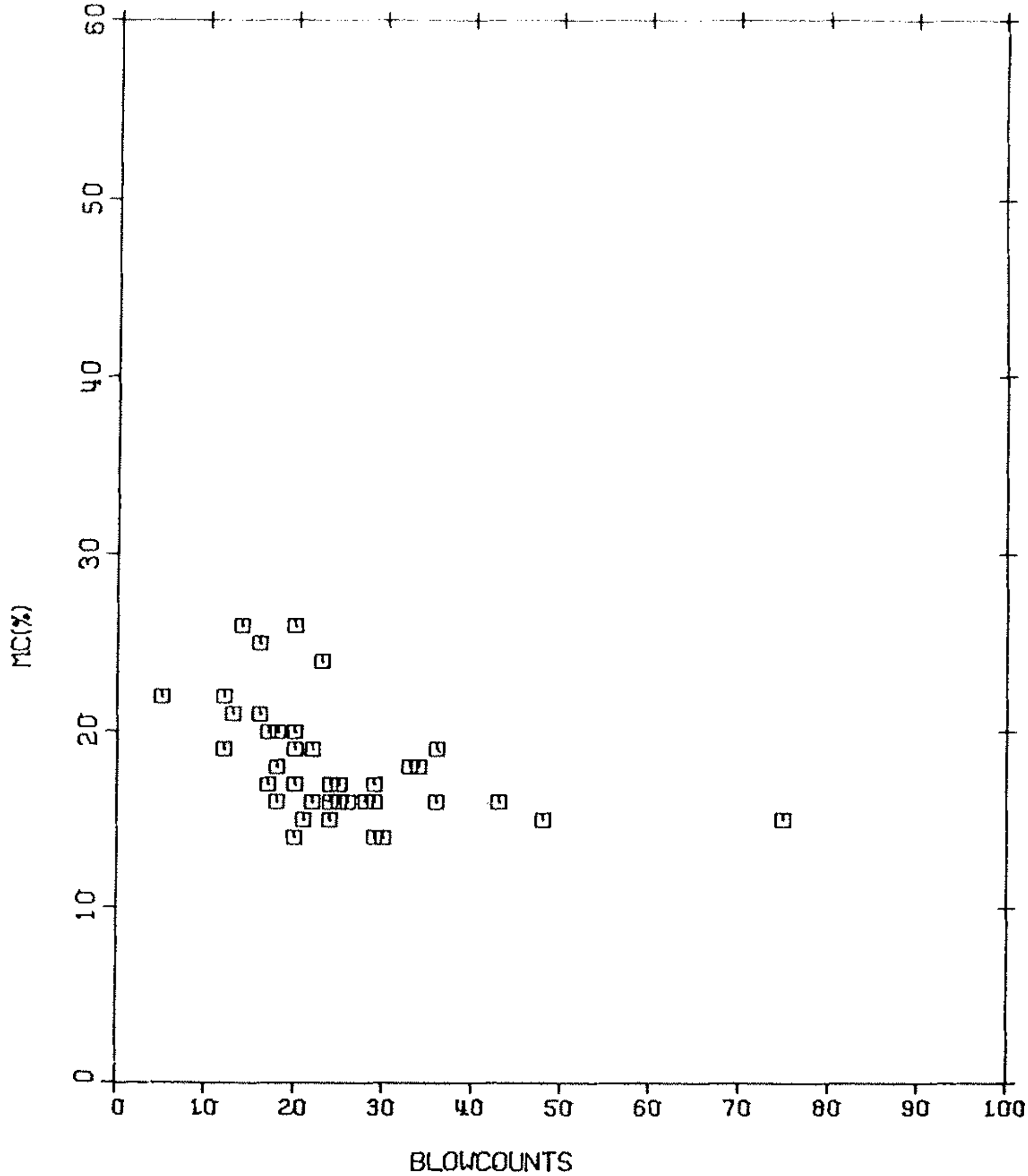
MOIST CONT VS BLOW COUNTS (SPT) AREA 2,WEST END

FIGURE 8



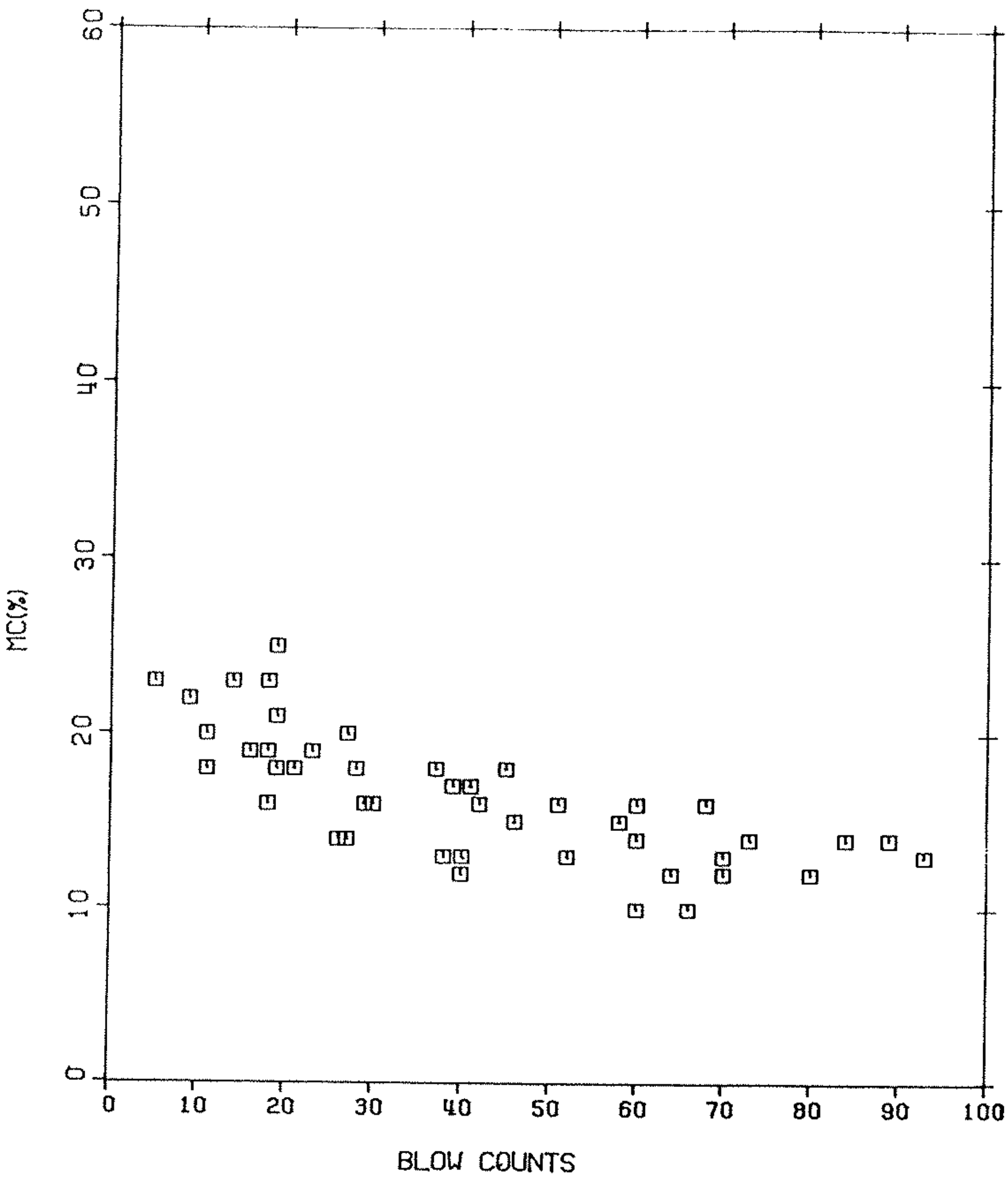
MOIST CONT VS BLOW COUNTS (SPT) AREA 3, NORTH

FIGURE 9



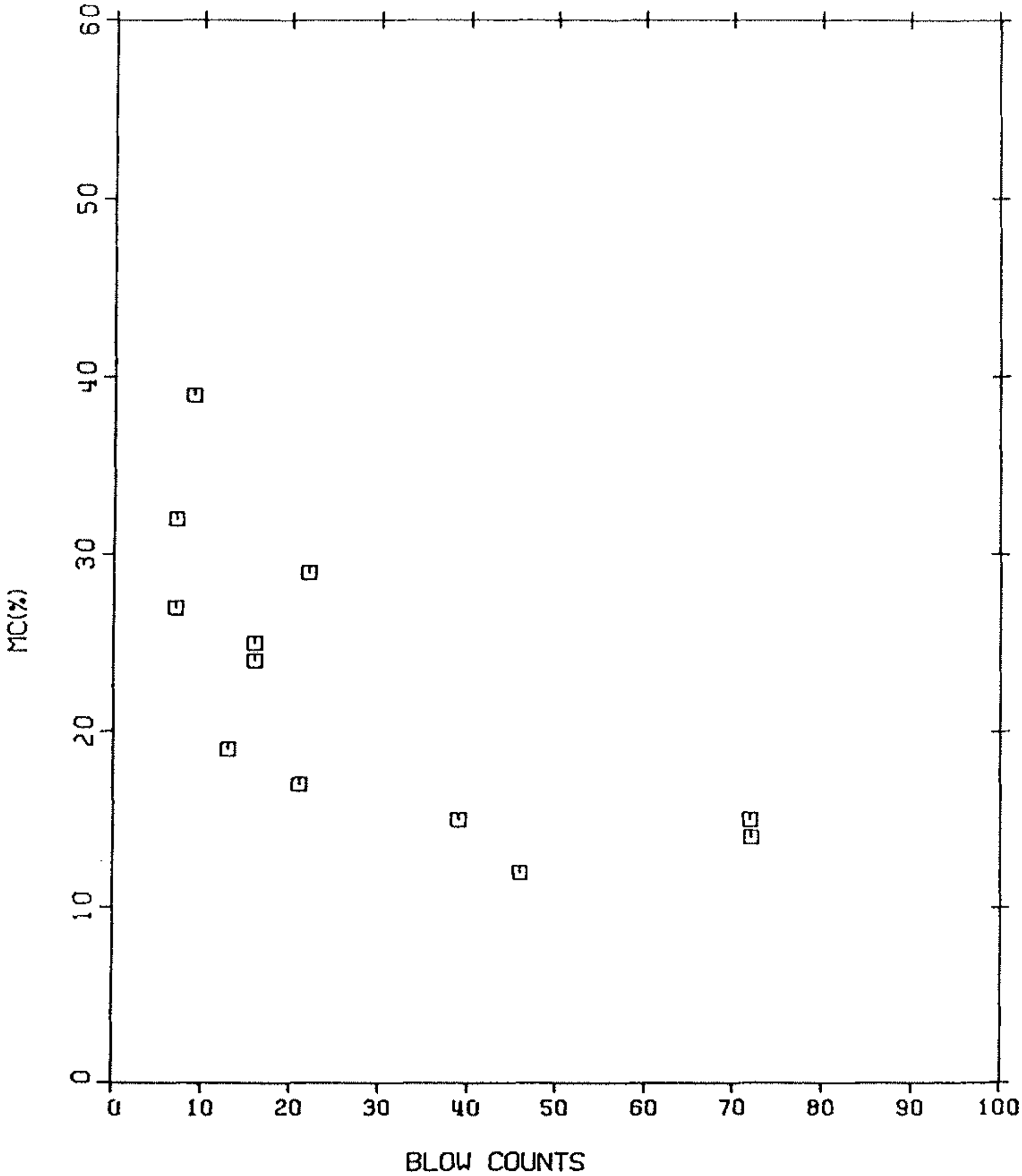
MOIST CONT VS BLOW COUNTS (SPT) AREA 4, NORTHEAST

FIGURE 10



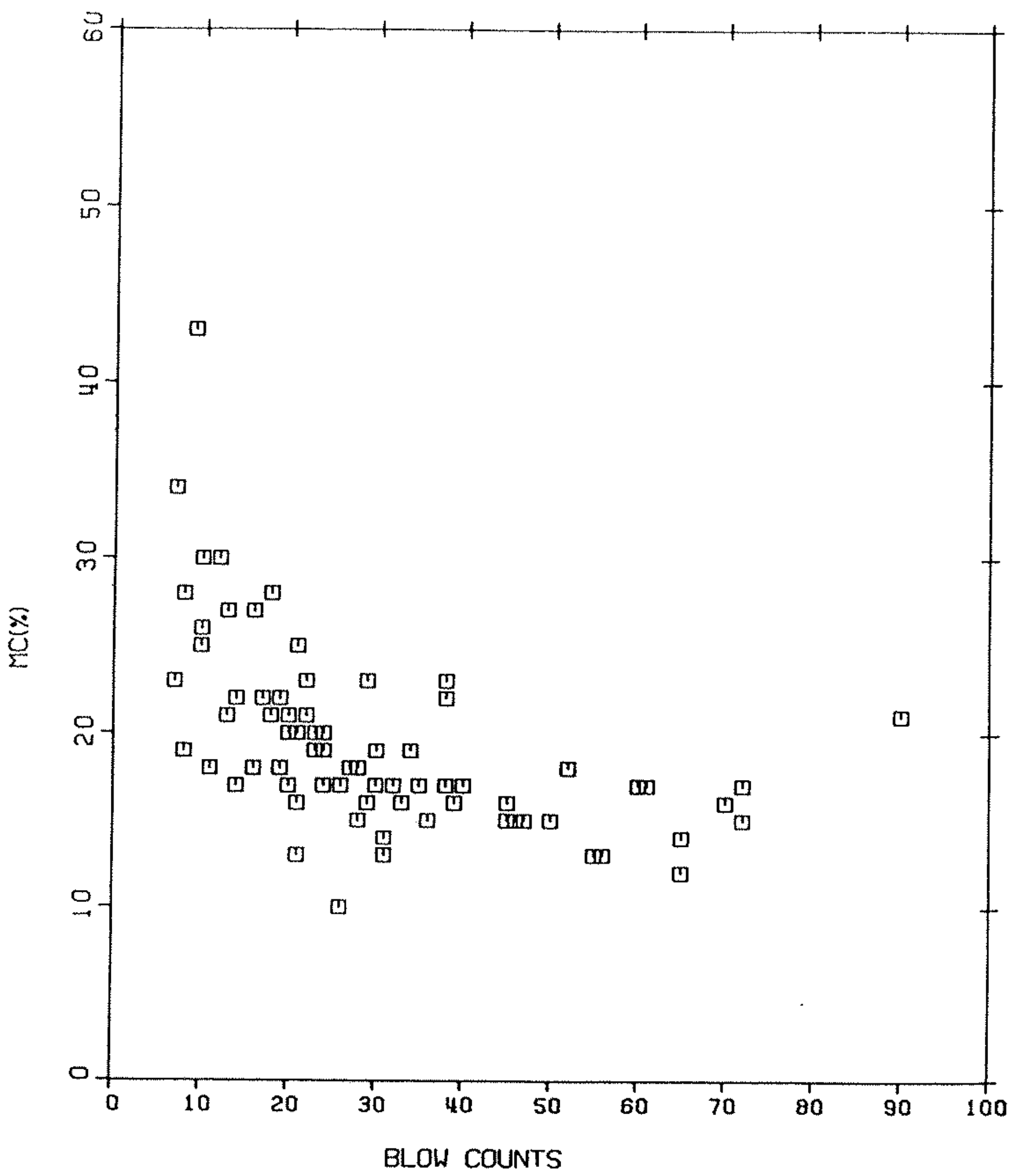
MOIST CONT VS BLOW COUNTS (SPT) AREA 5, DT NORTH

FIGURE II



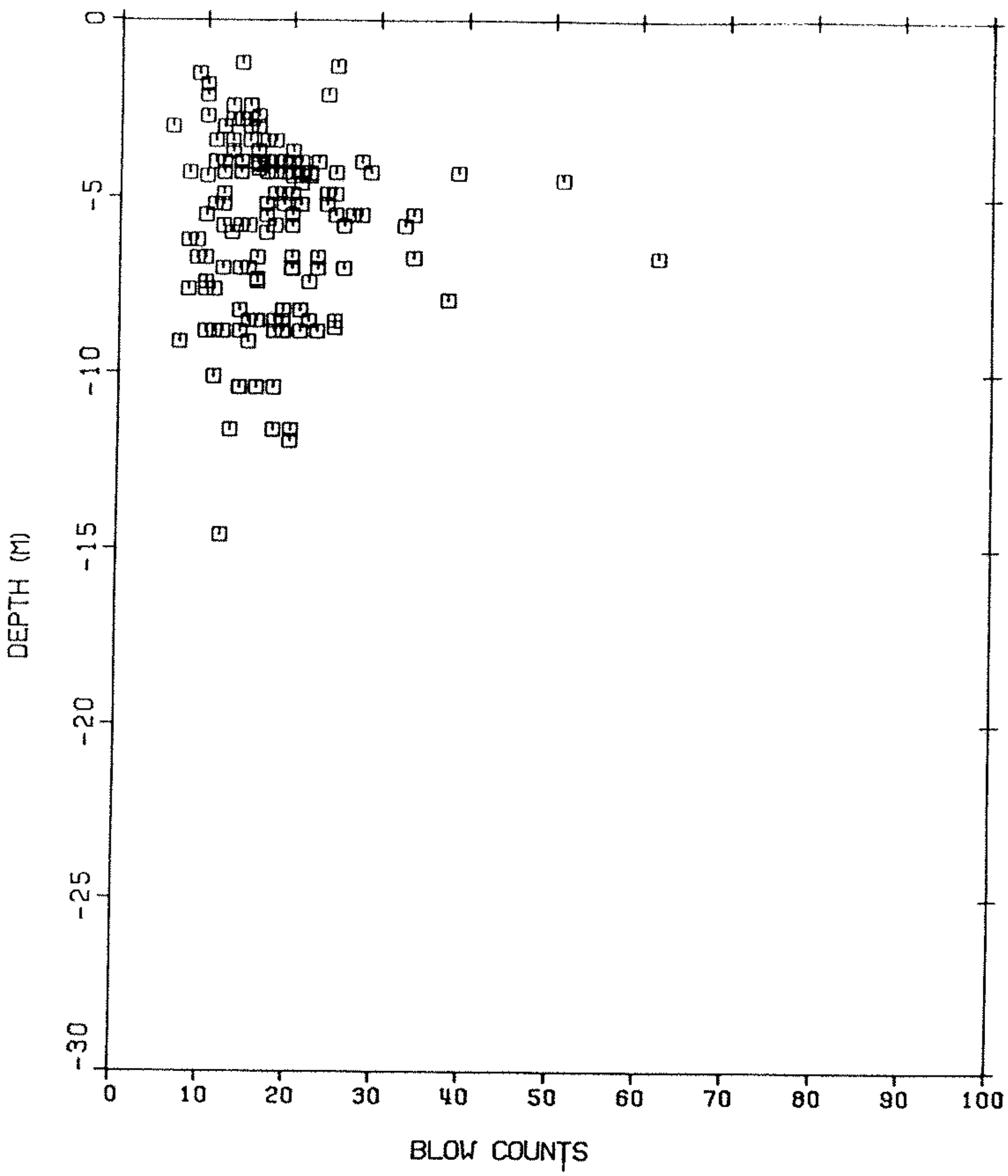
MOIST CONT VS BLOW COUNTS(SPT) AREA 6, STRATHCONA

FIGURE 12



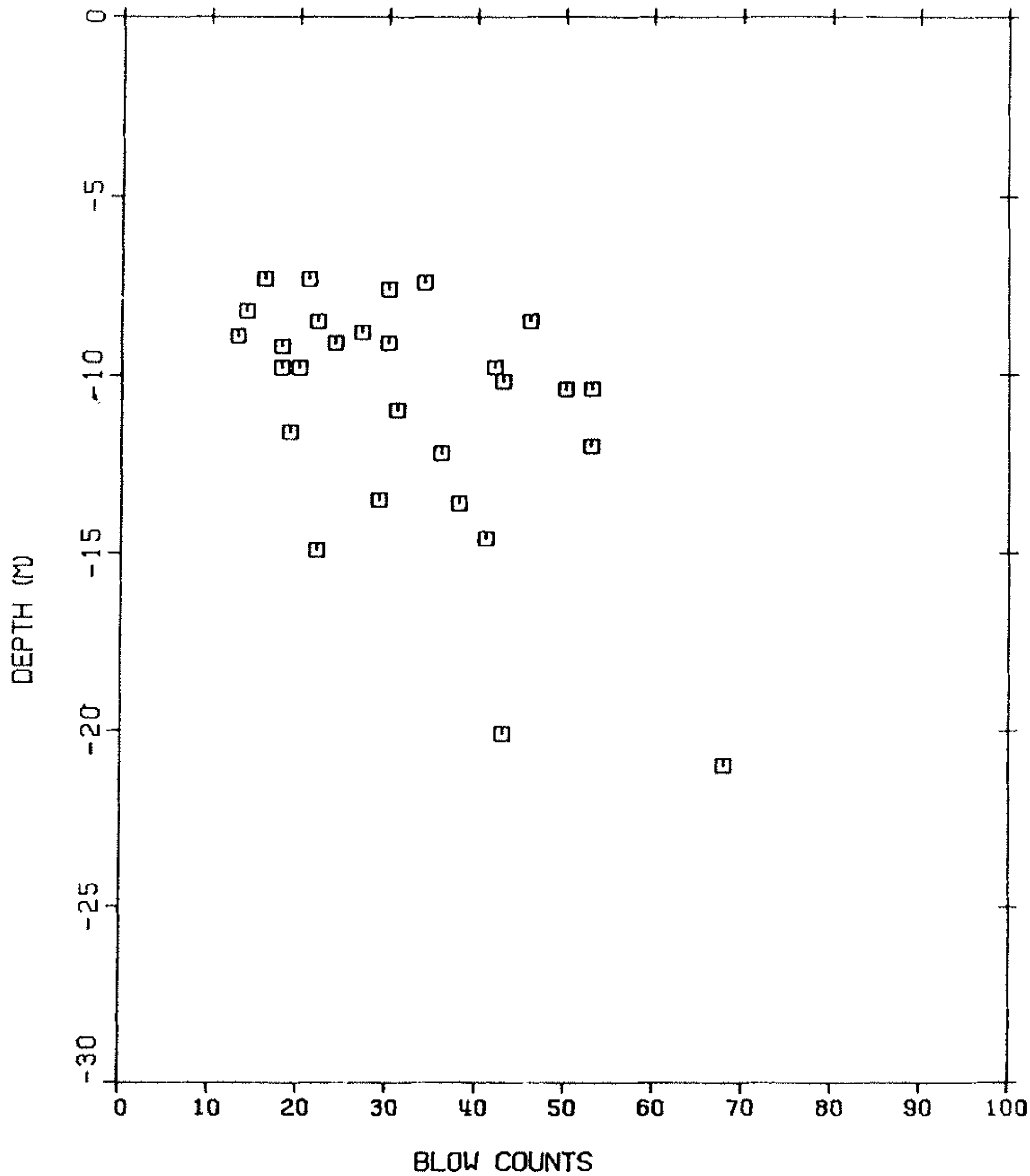
MOIST CONT VS BLOW COUNTS(SPT) AREA 7, SOUTH CENT

FIGURE 13



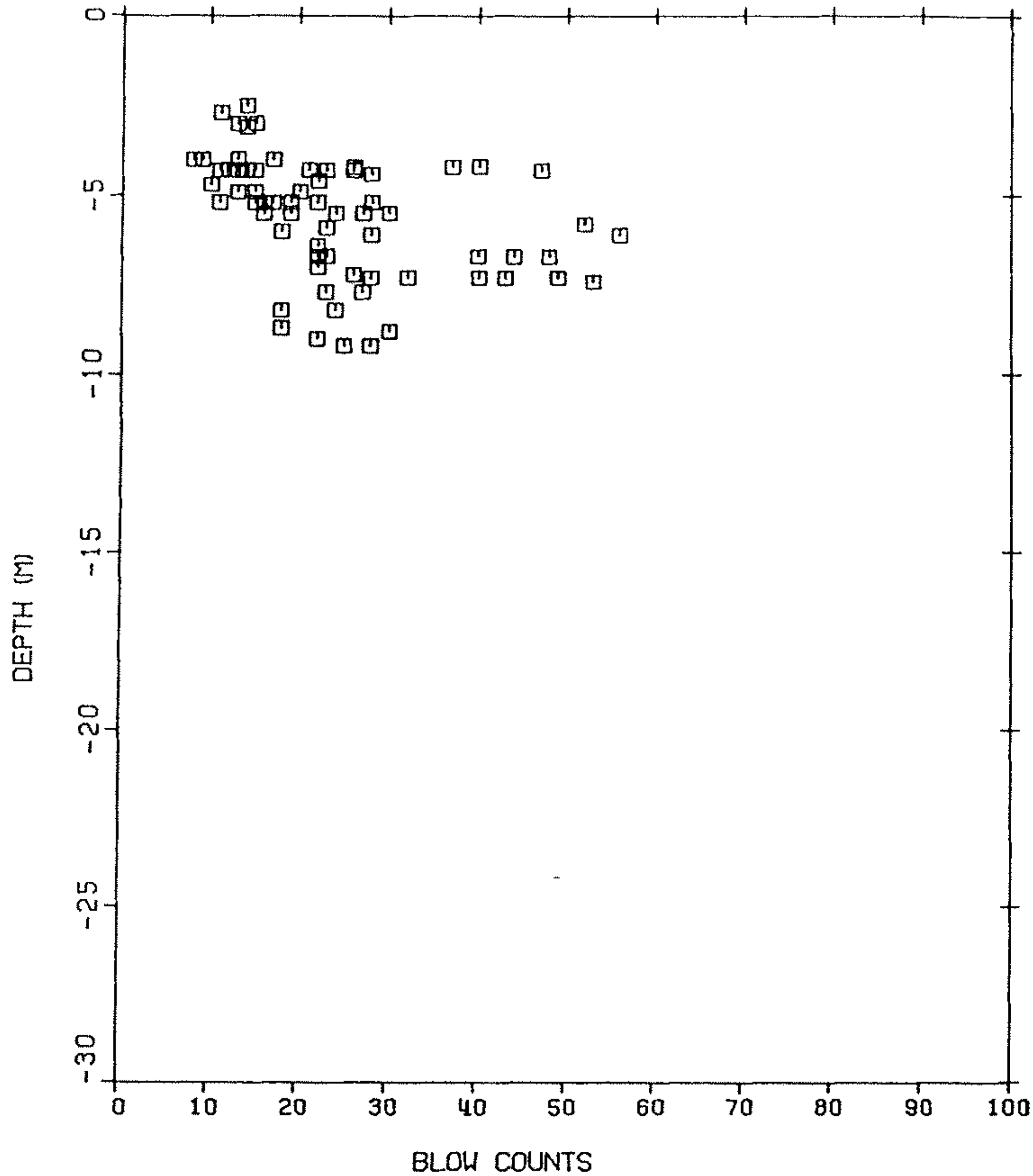
BLOW COUNTS (SPT) VS DEPTH AREA 1, MILLWOODS

FIGURE 14



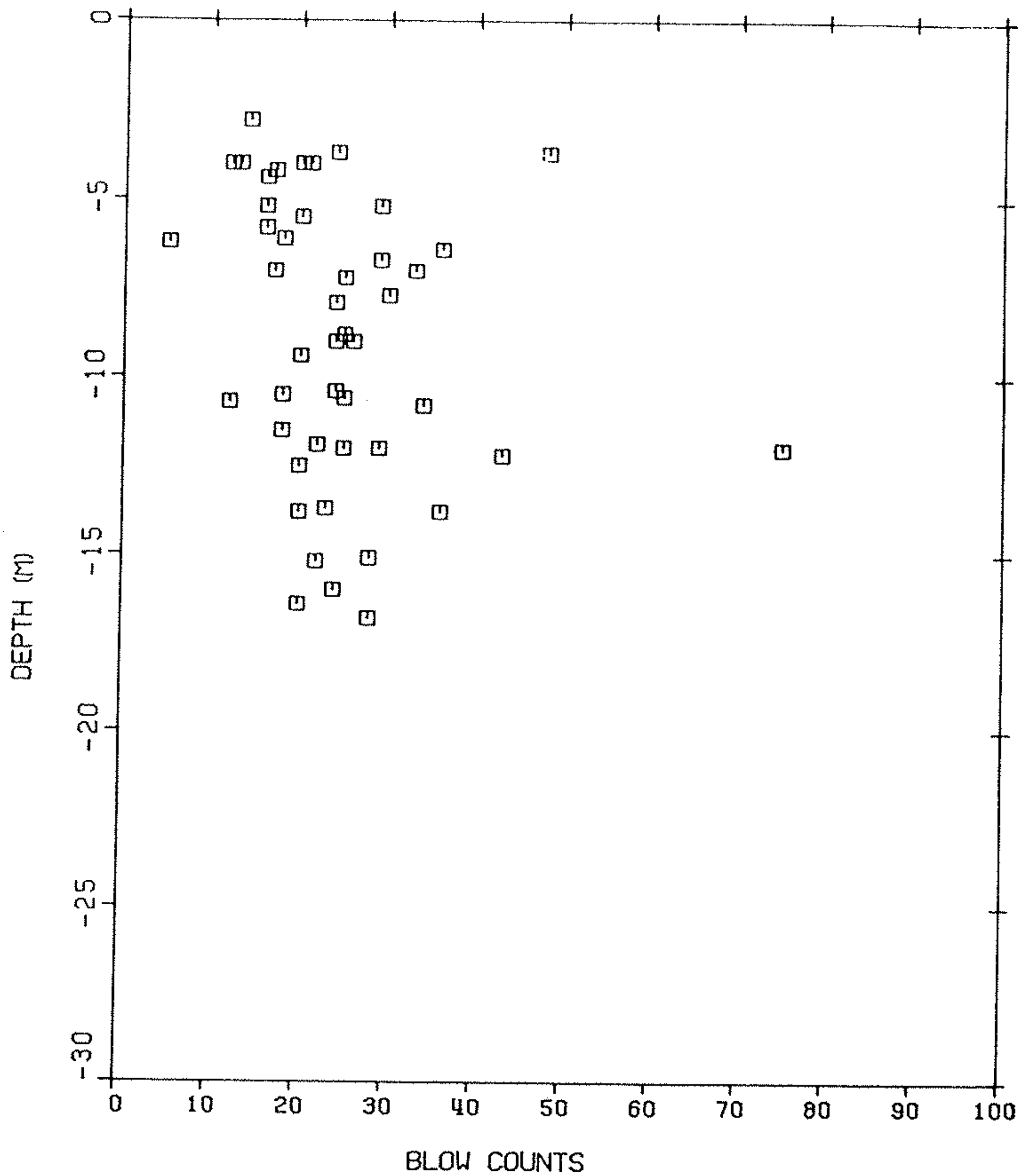
BLOW COUNTS (SPT) VS DEPTH AREA 2, WEST END

FIGURE 15



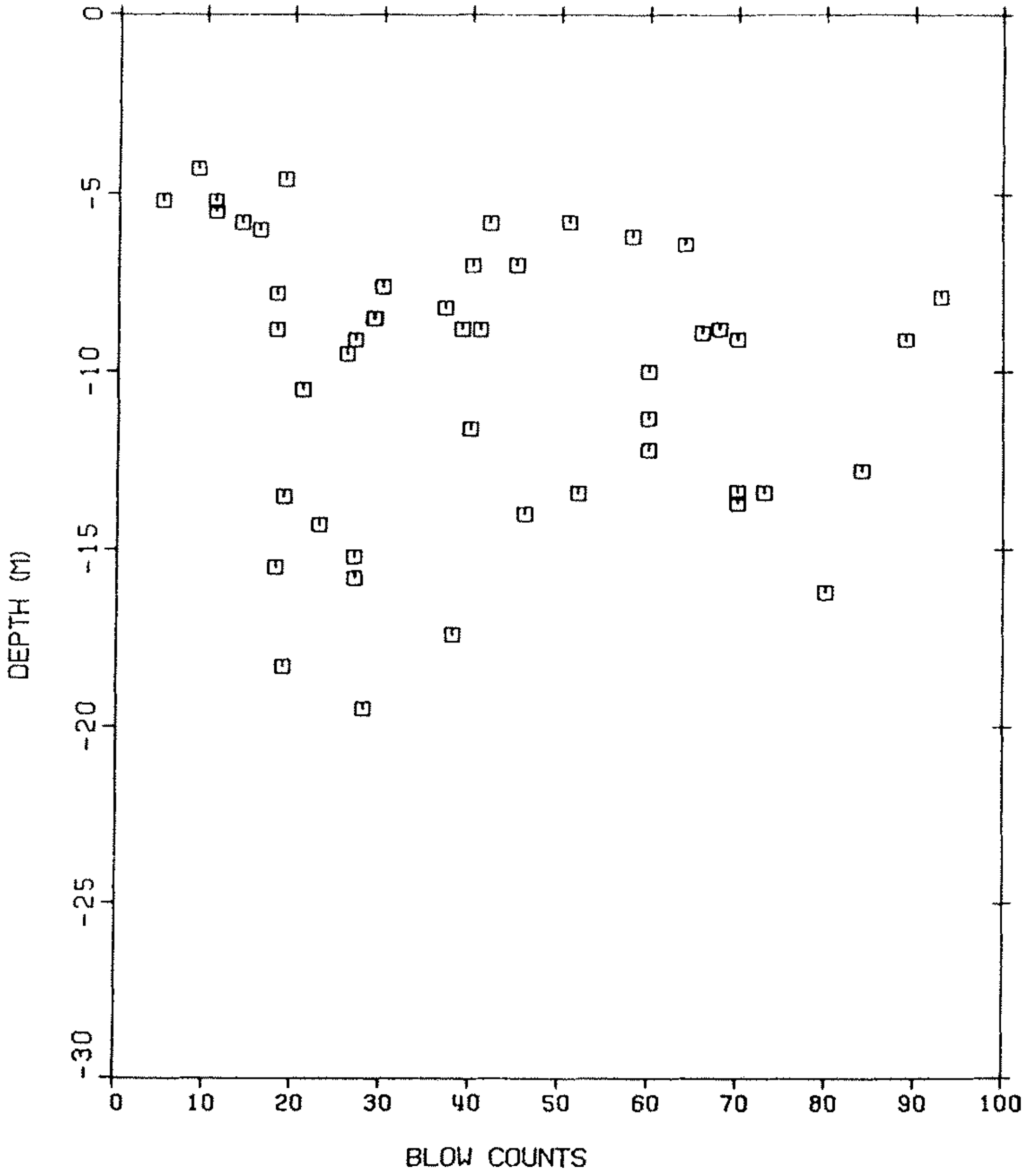
BLOW COUNTS (SPT) VS DEPTH AREA 3, NORTH

FIGURE 16



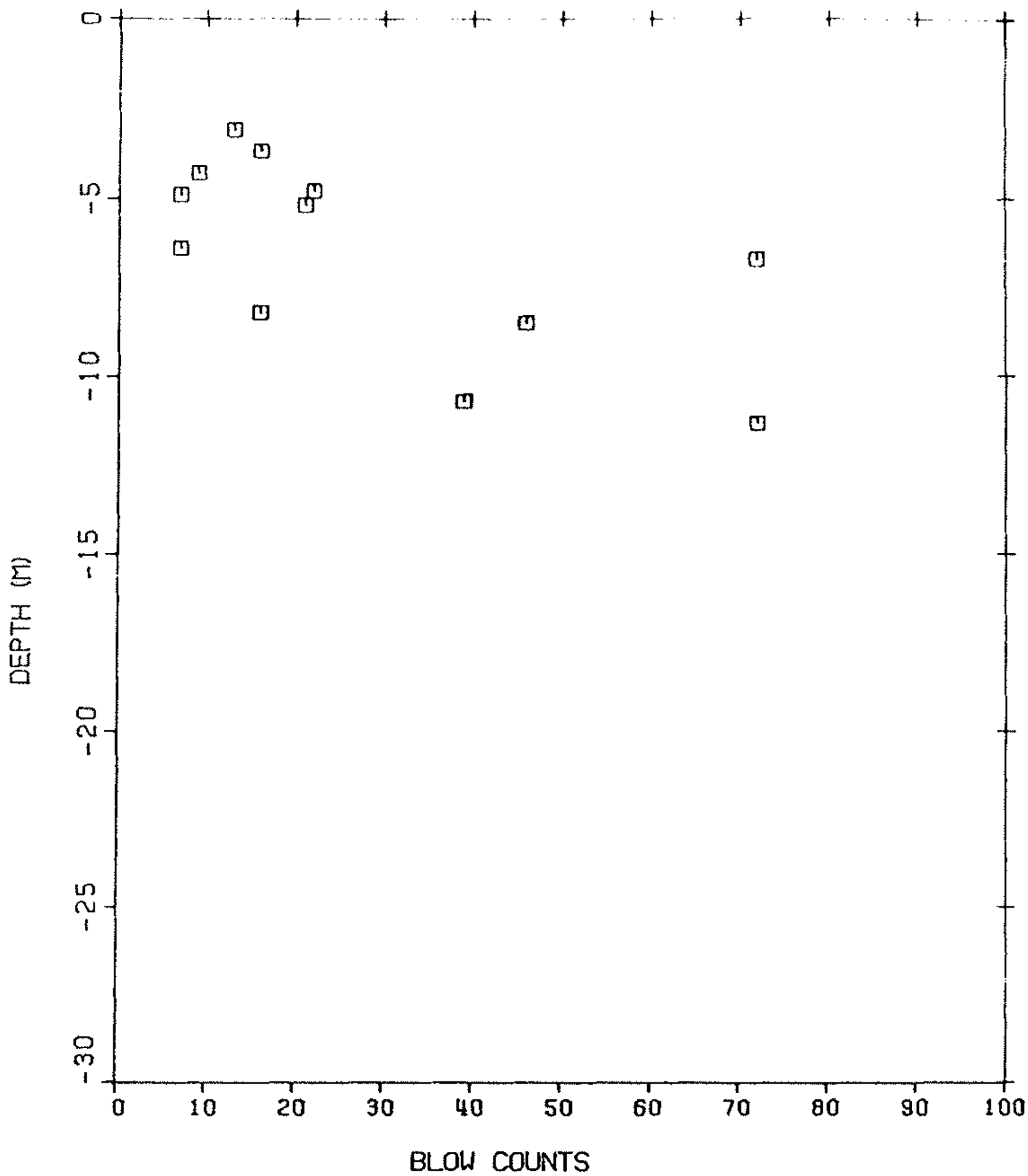
BLOW COUNTS (SPT) VS DEPTH AREA 4, NORTHEAST

FIGURE 17



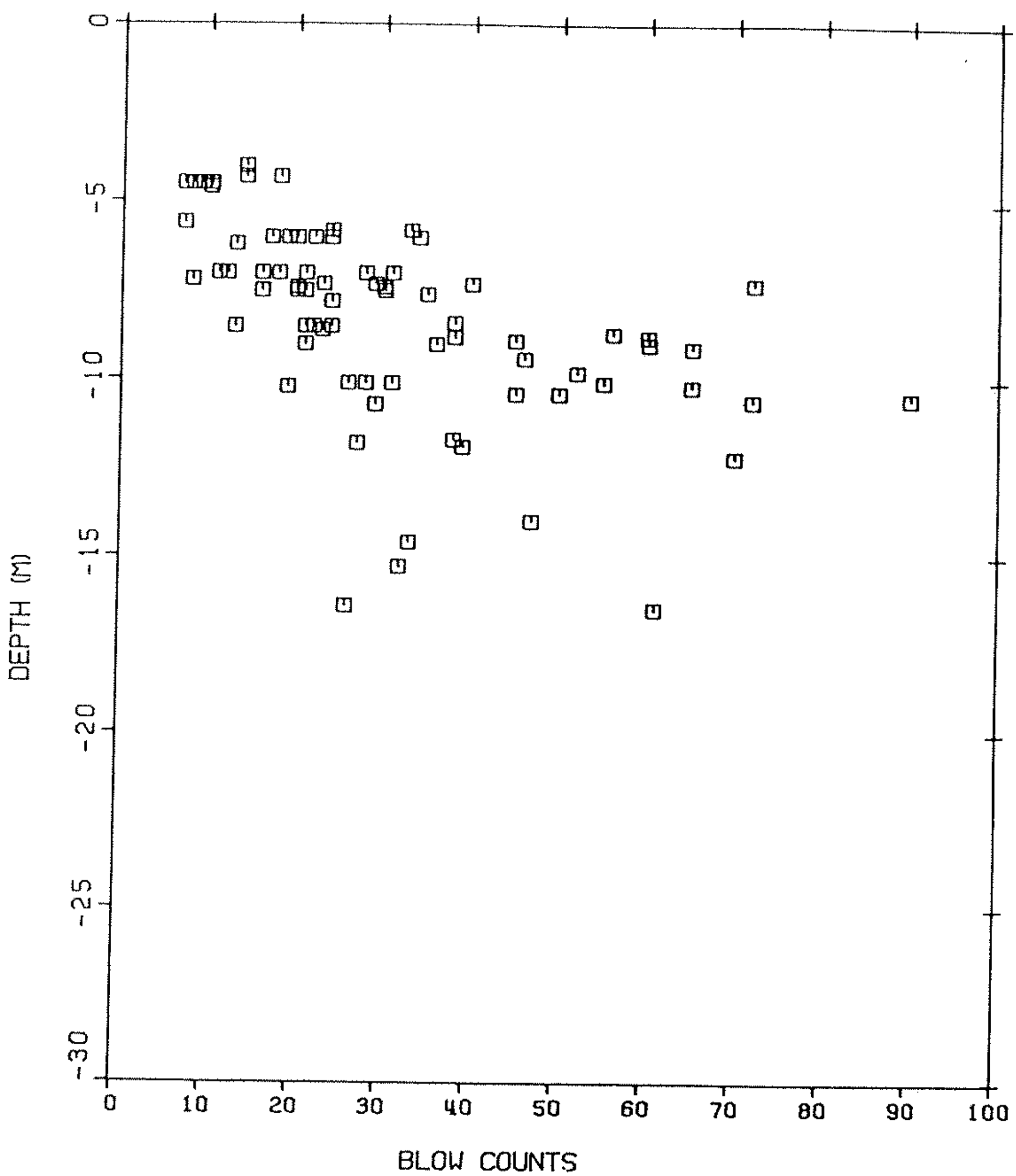
BLOW COUNTS (SPT) VS DEPTH AREA 5, DT NORTH

FIGURE 18



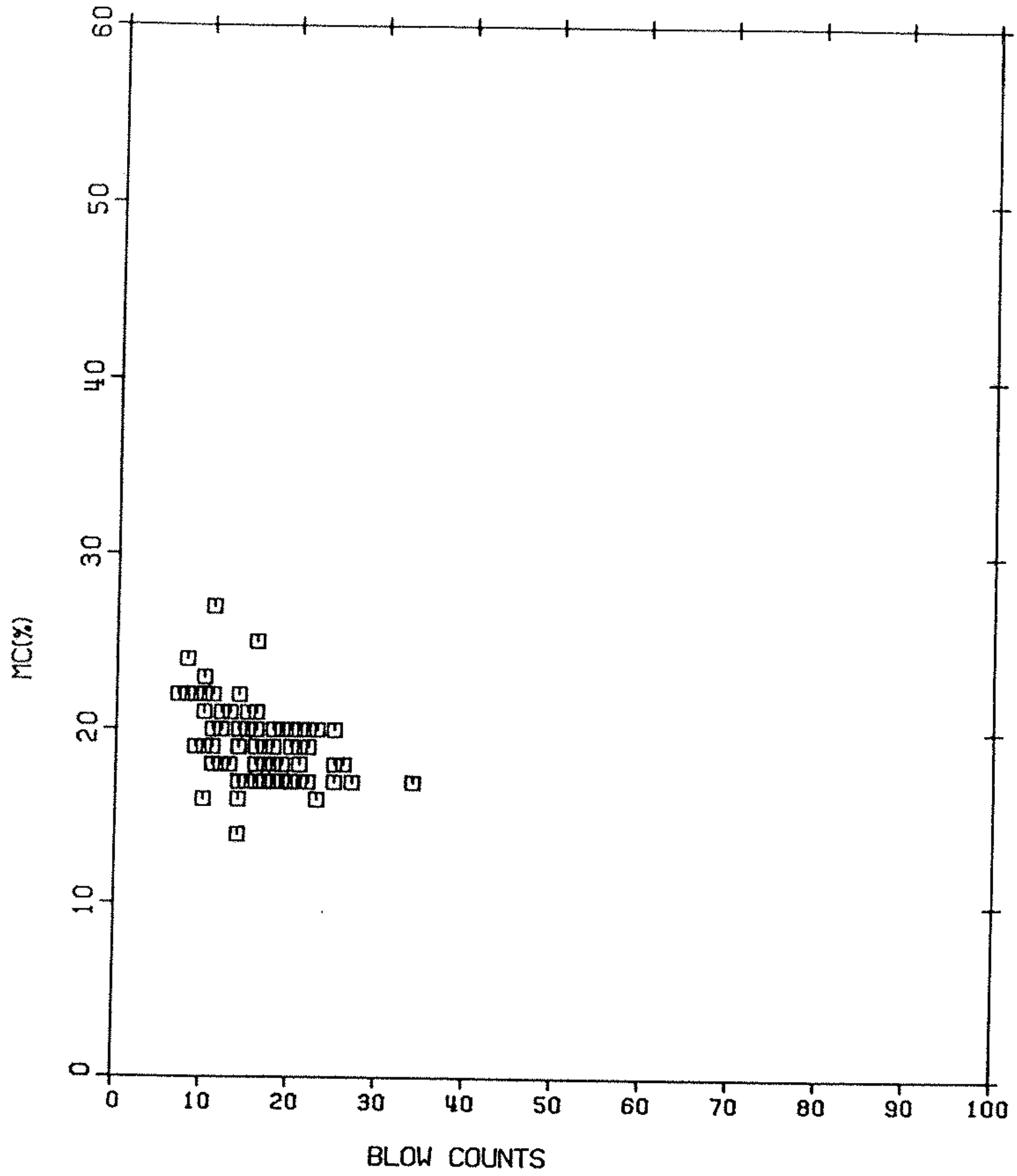
BLOW COUNTS (SPT) VS DEPTH AREA 6, STRATHCONA

FIGURE 19



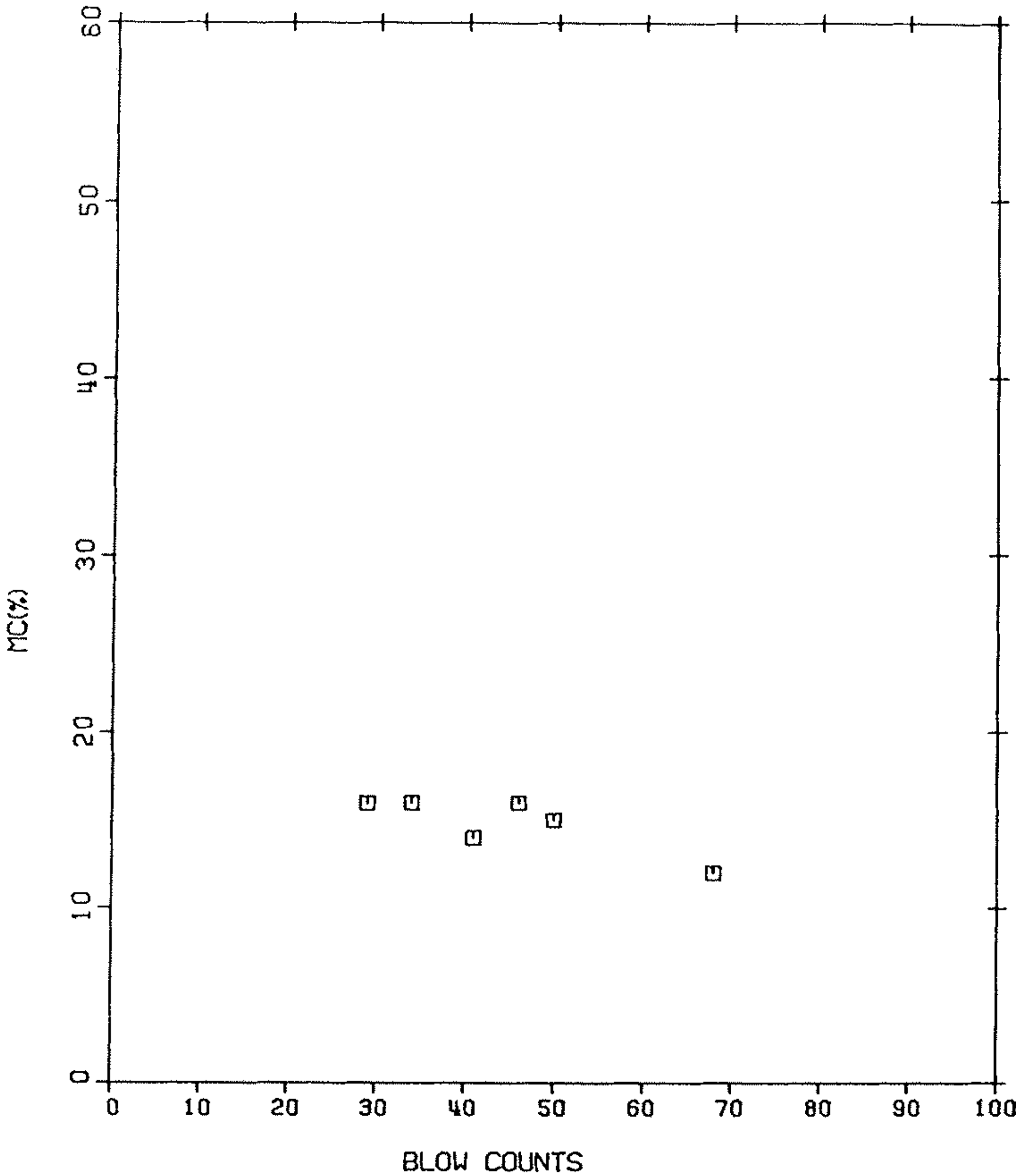
BLOW COUNTS (SPT) VS DEPTH AREA 7, SOUTH CENT

FIGURE 20



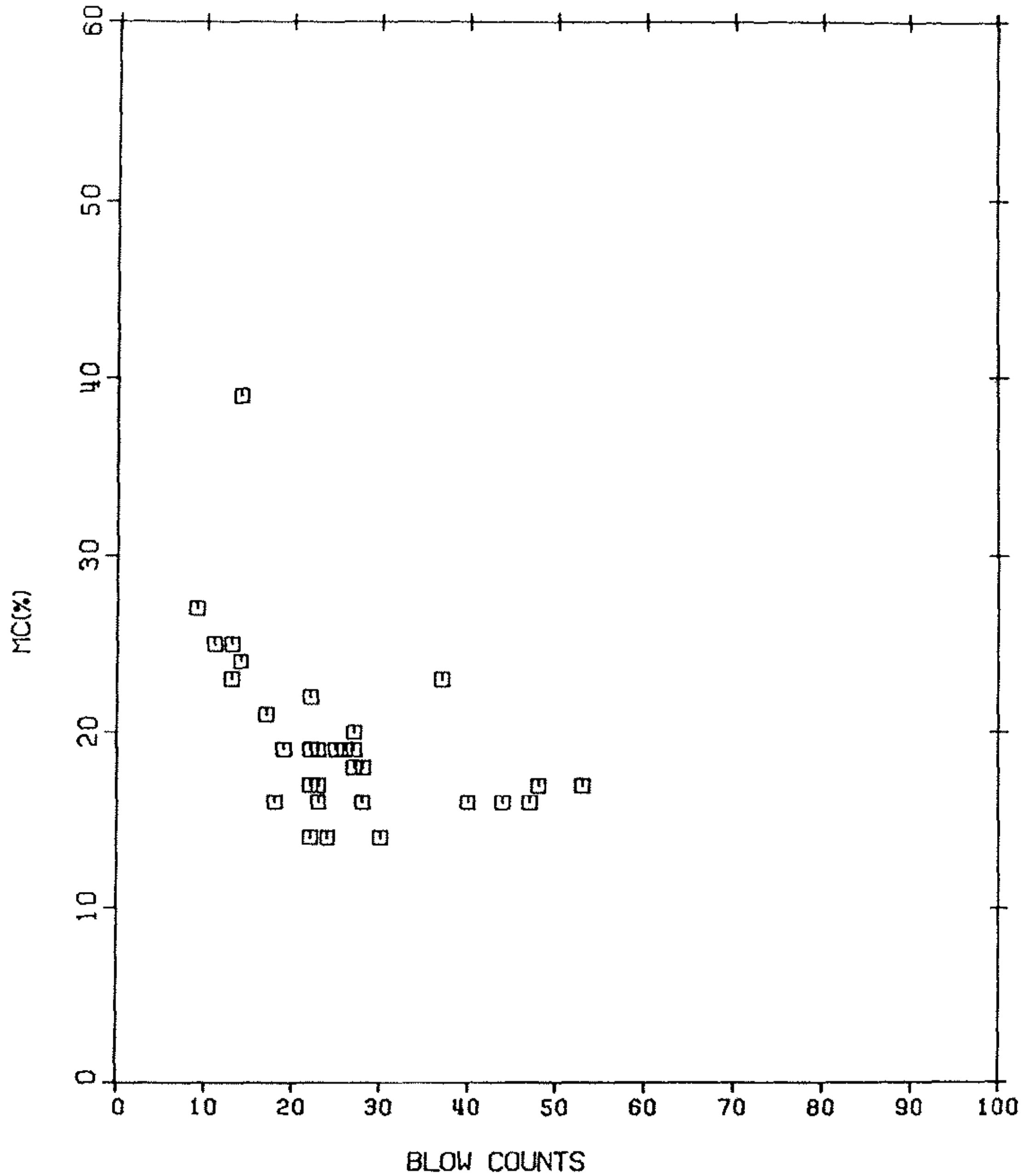
MC VS N(SPT) AREA 1 MILLWOODS MULTISAMPLE BH

FIGURE 21



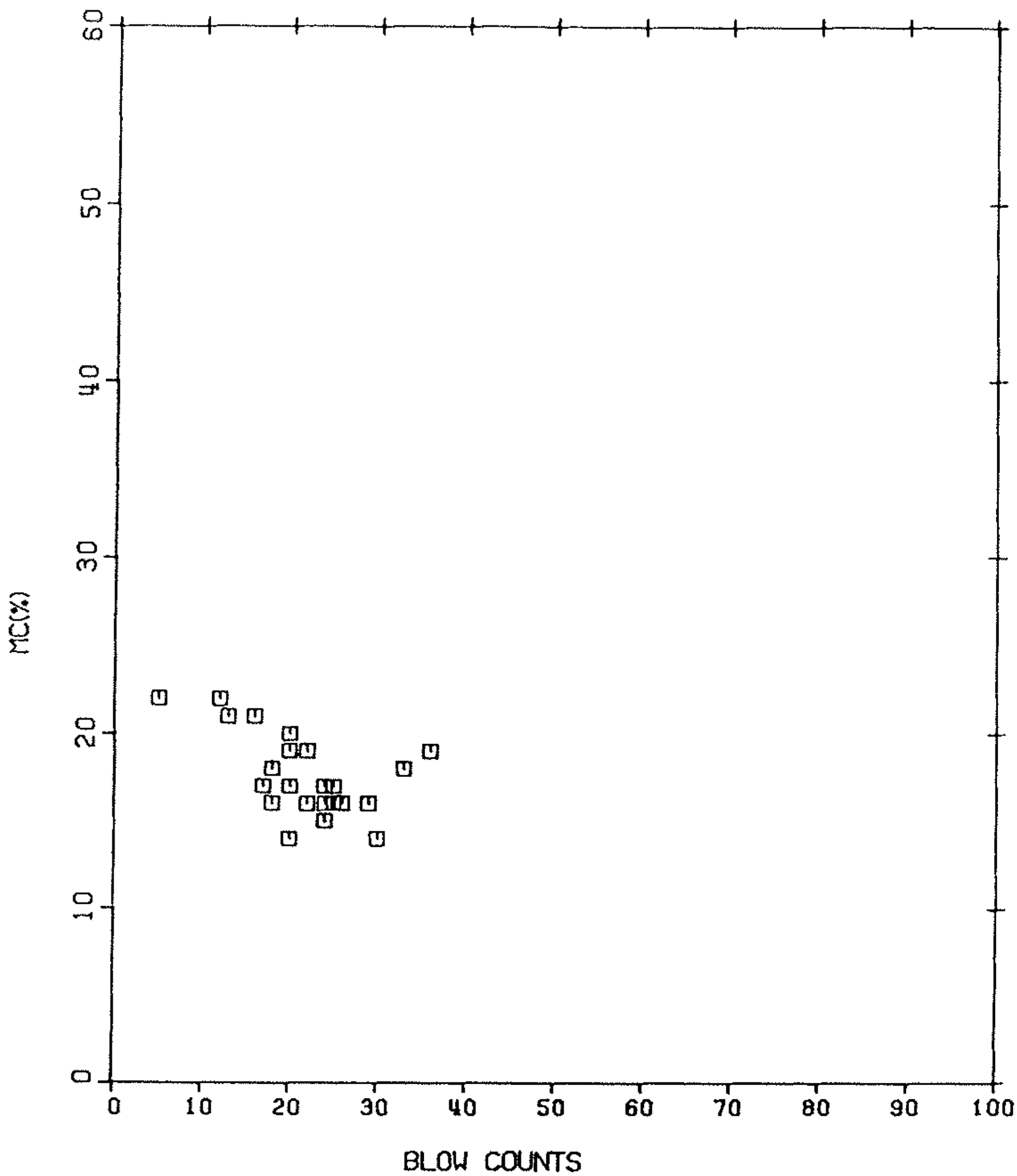
MC VS N(SPT) AREA 2 WEST END MULTISAMPLE BH

FIGURE 22



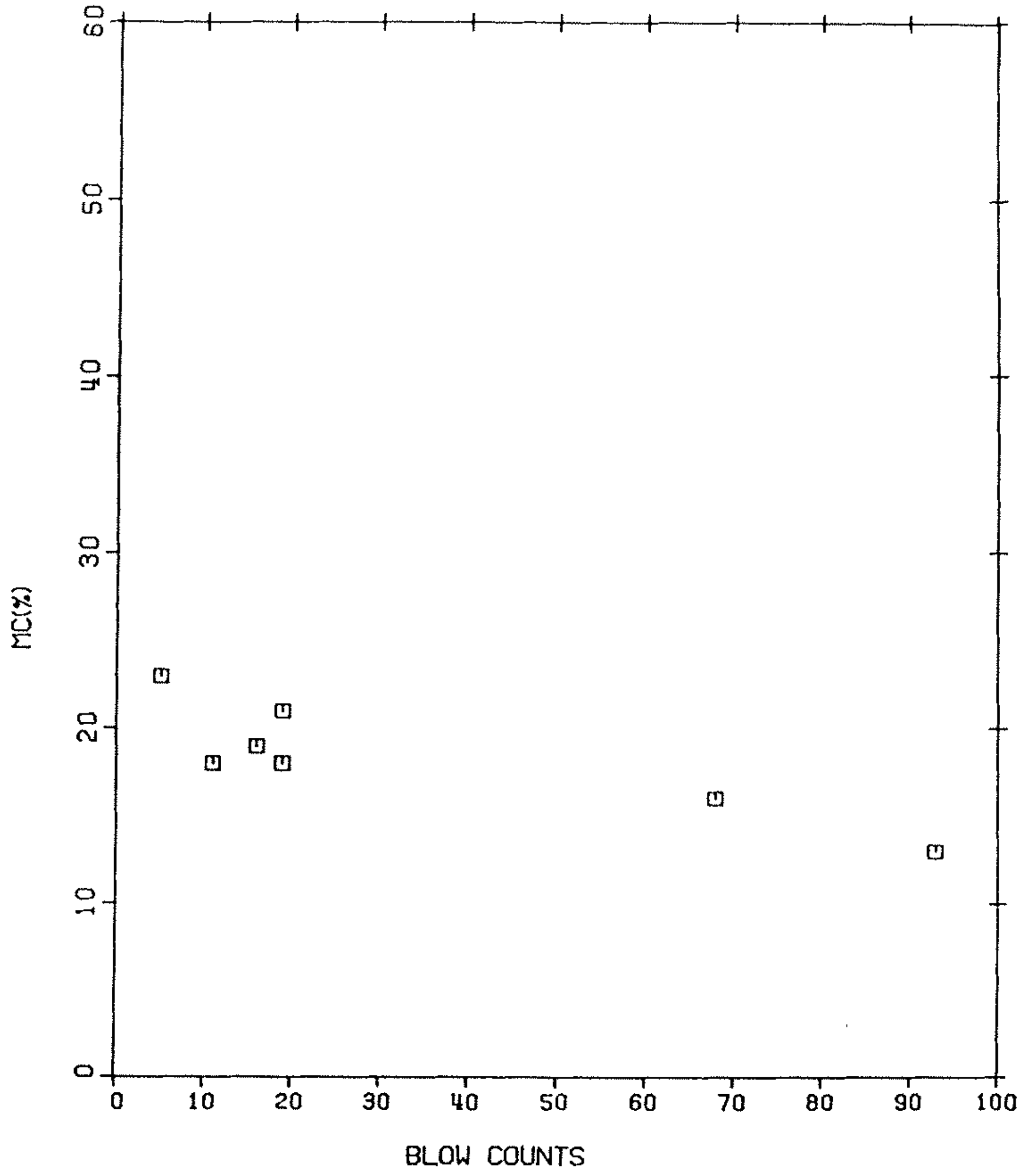
MC VS N(SPT) AREA 3 NORTH MULTISAMPLE BH

FIGURE 23



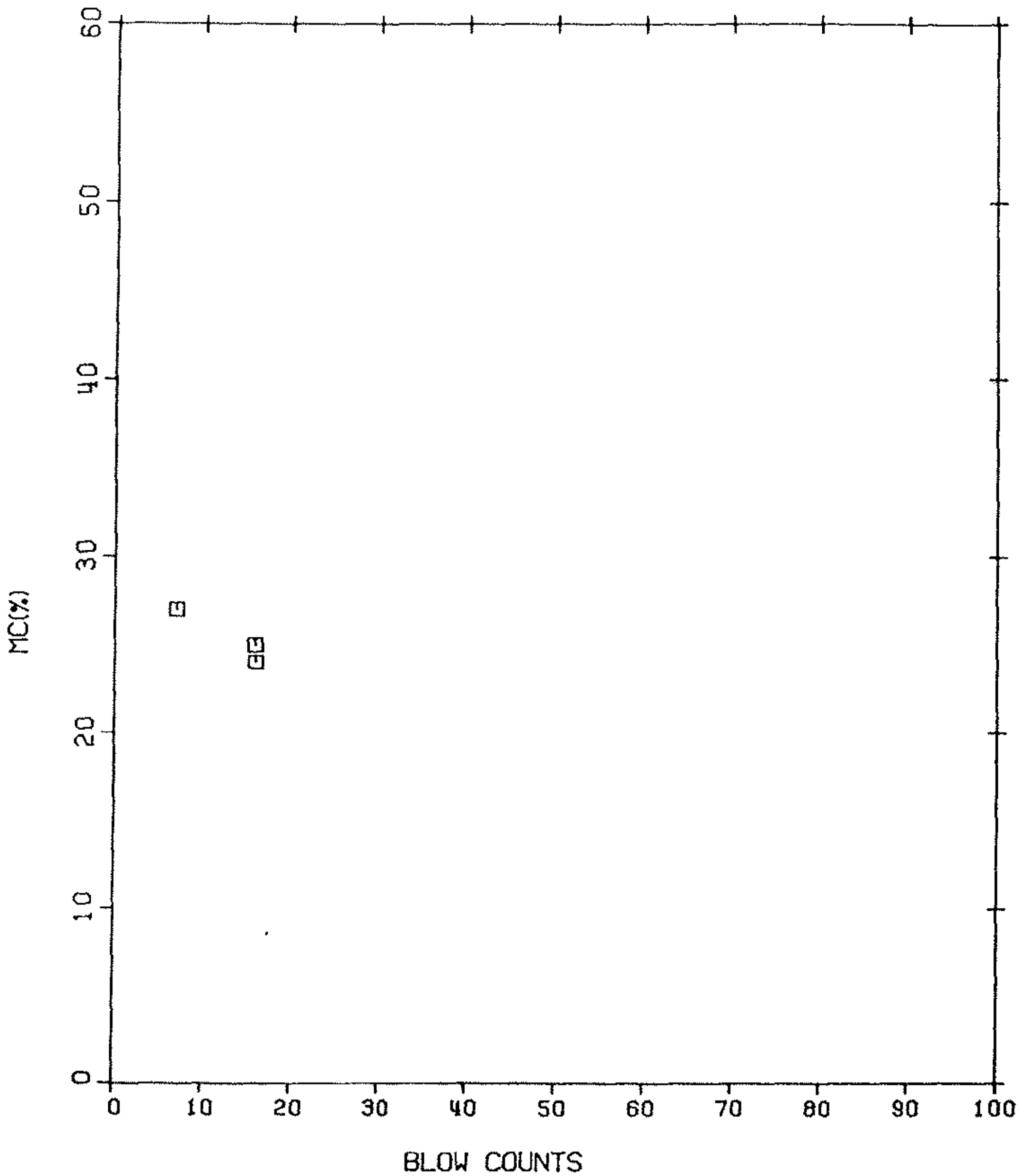
MC VS N(SPT) AREA 4 NORTHEAST MULTISAMPLE BH

FIGURE 24



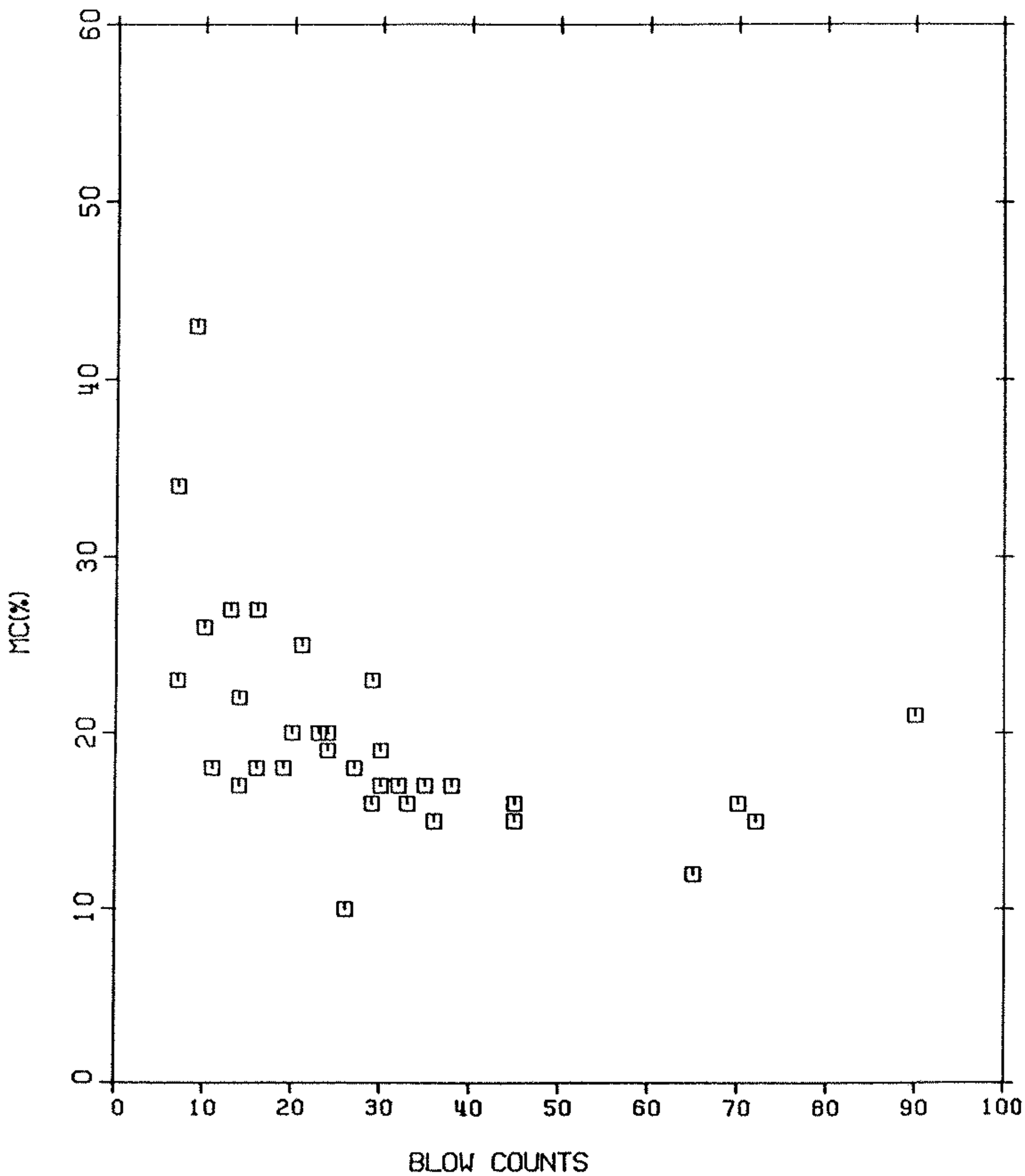
MC VS N(SPT) AREA 5 DT NORTH MULTISAMPLE BH

FIGURE 25



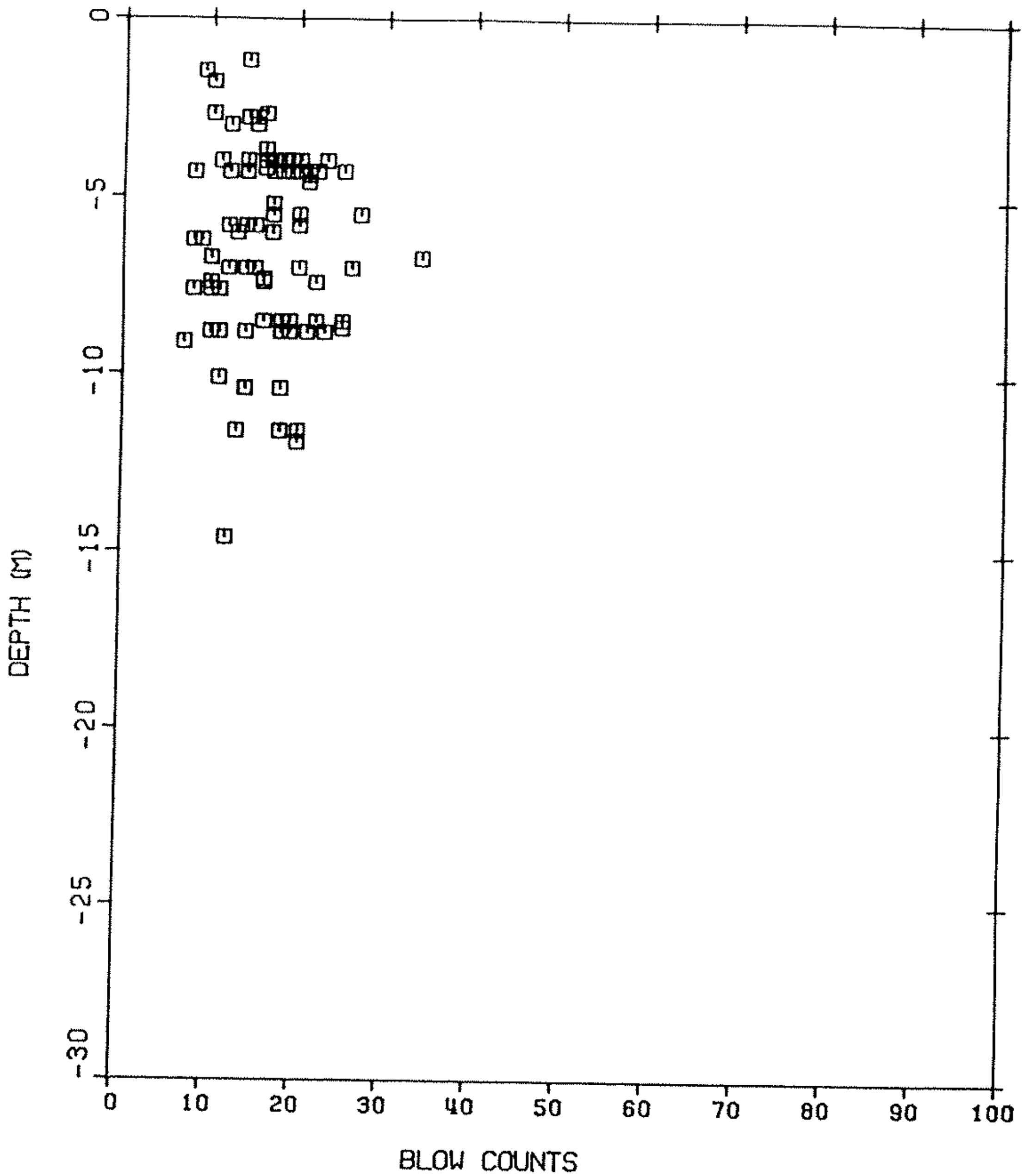
MC VS N(SPT) AREA 6 STRATHCONA MULTISAMPLE BH

FIGURE 26



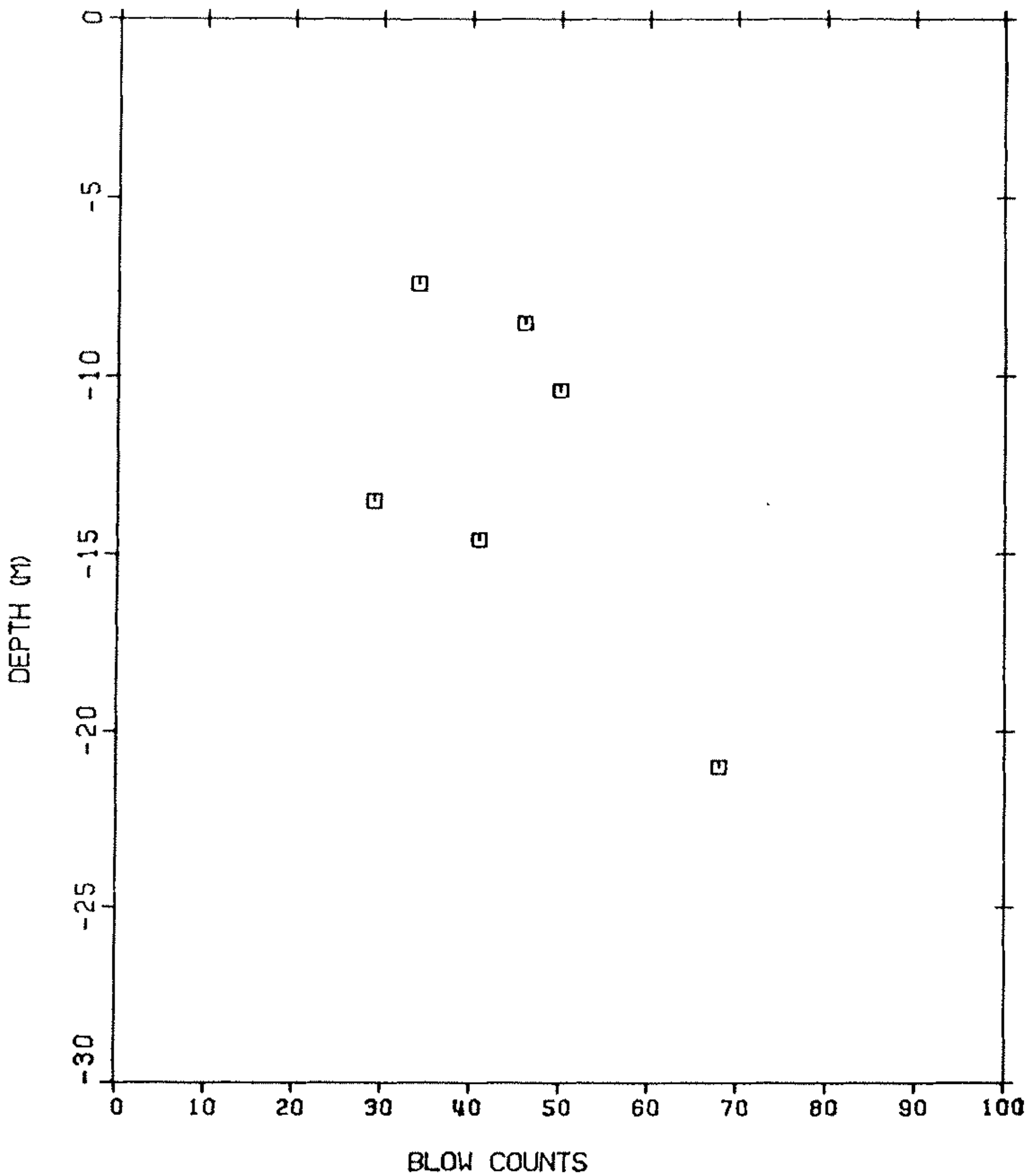
MC VS N(SPT) AREA 7 SOUTH CENT MULTISAMPLE BH

FIGURE 27



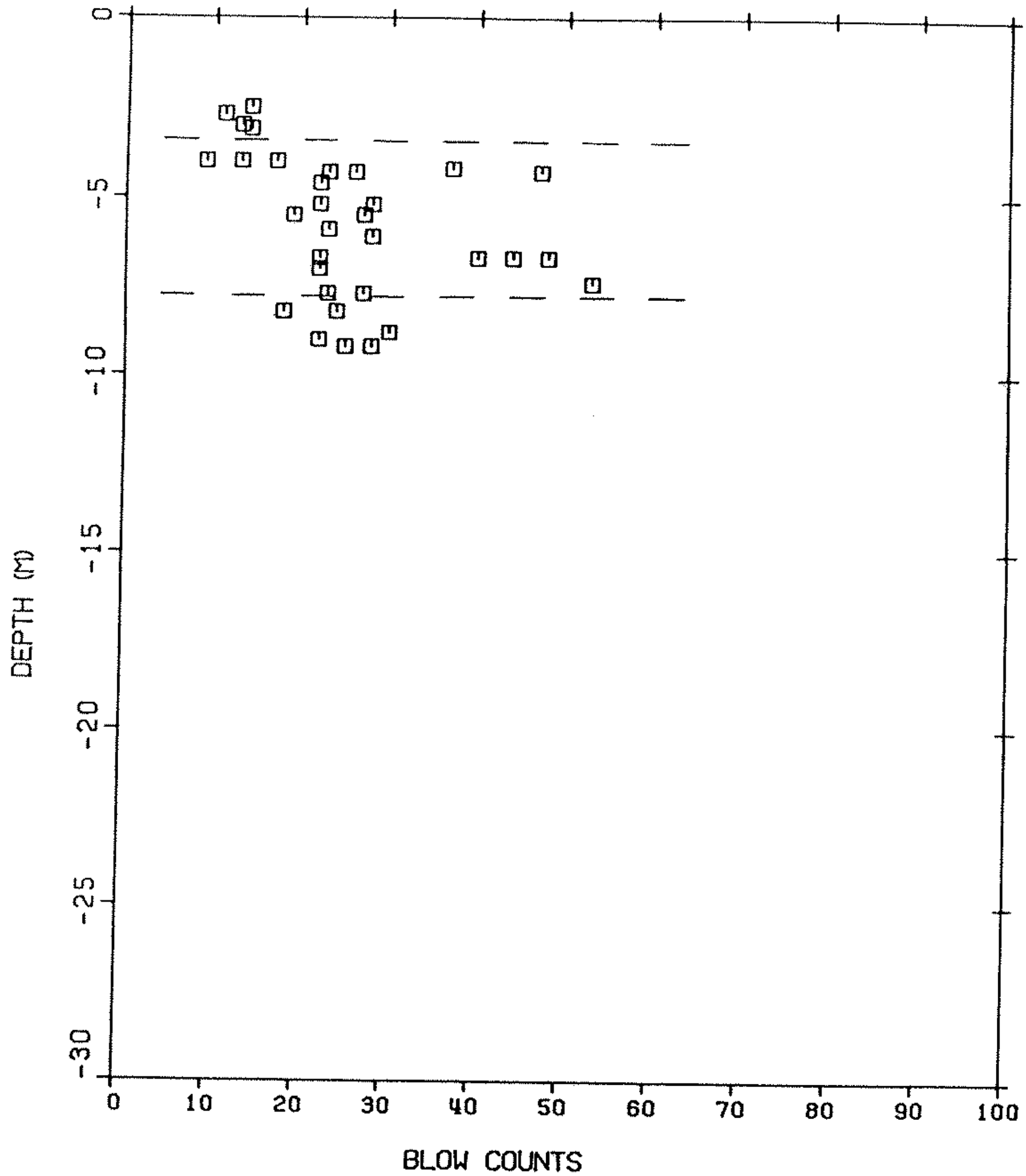
N(SPT) VS DEPTH AREA 1 MILLWOODS MULTISAMPLE BH

FIGURE 28



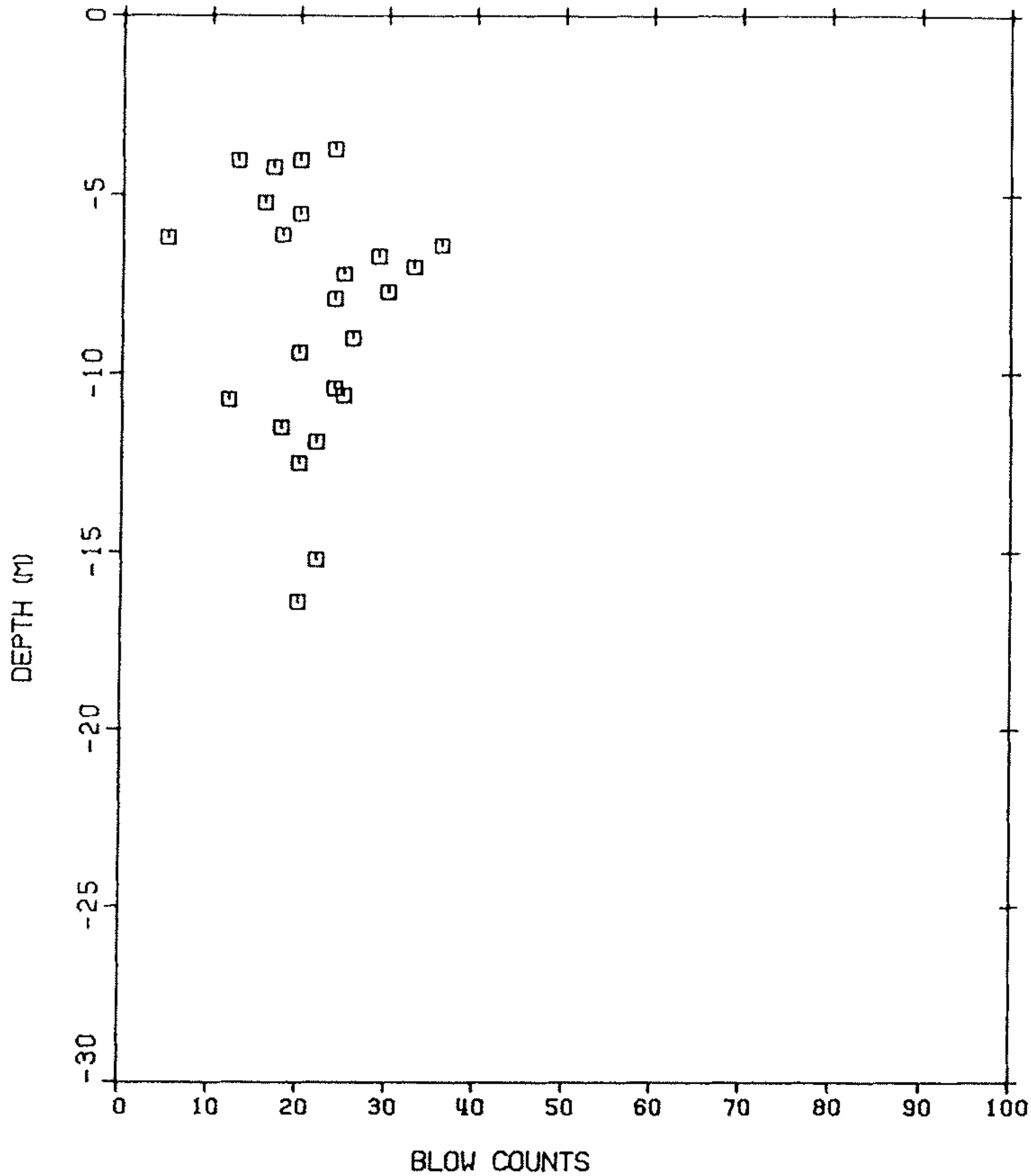
N(SPT) VS DEPTH AREA 2 WEST END MULTISAMPLE BH

FIGURE 29



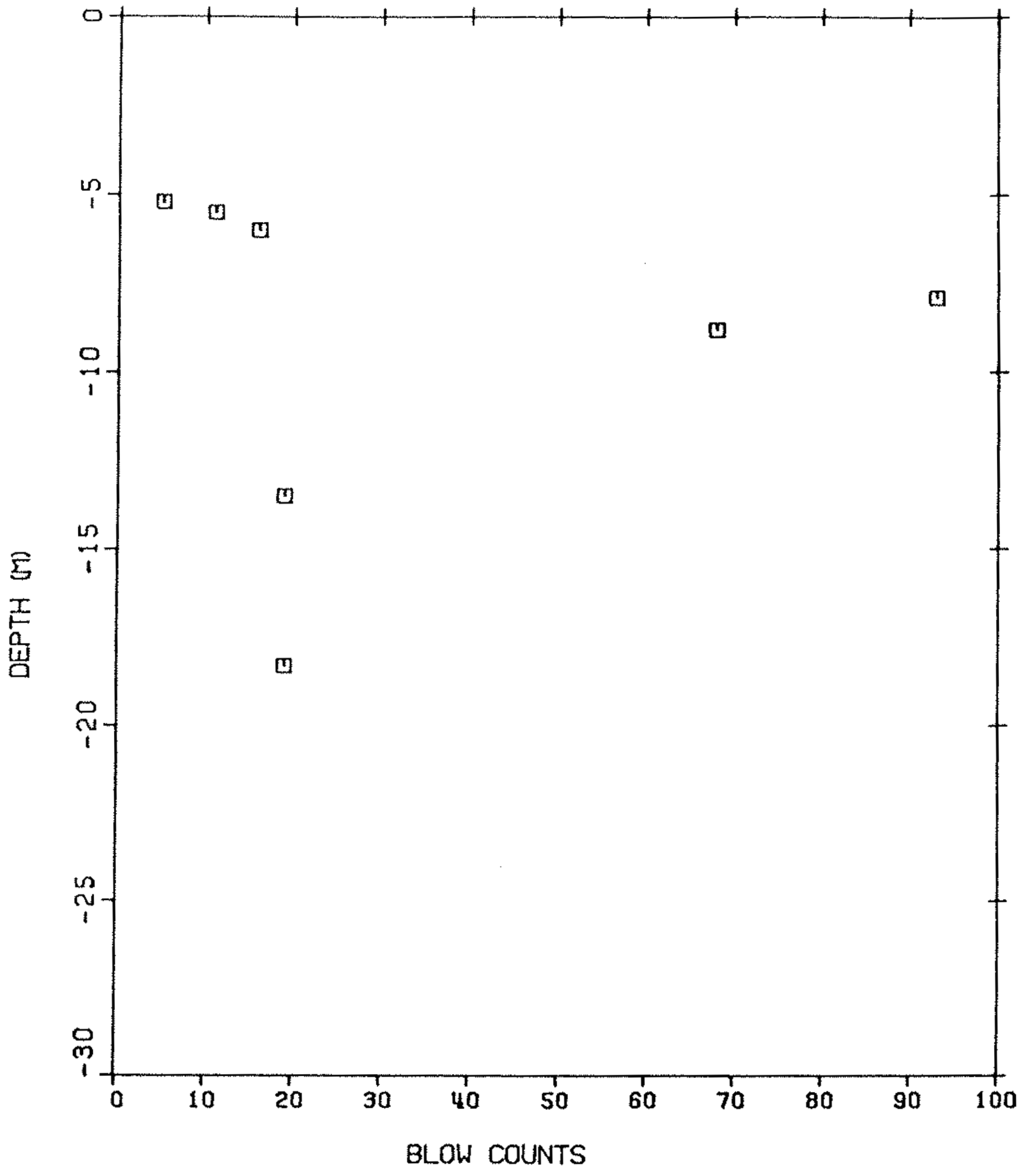
N(SPT) VS DEPTH AREA 3 NORTH MULTISAMPLE BH

FIGURE 30



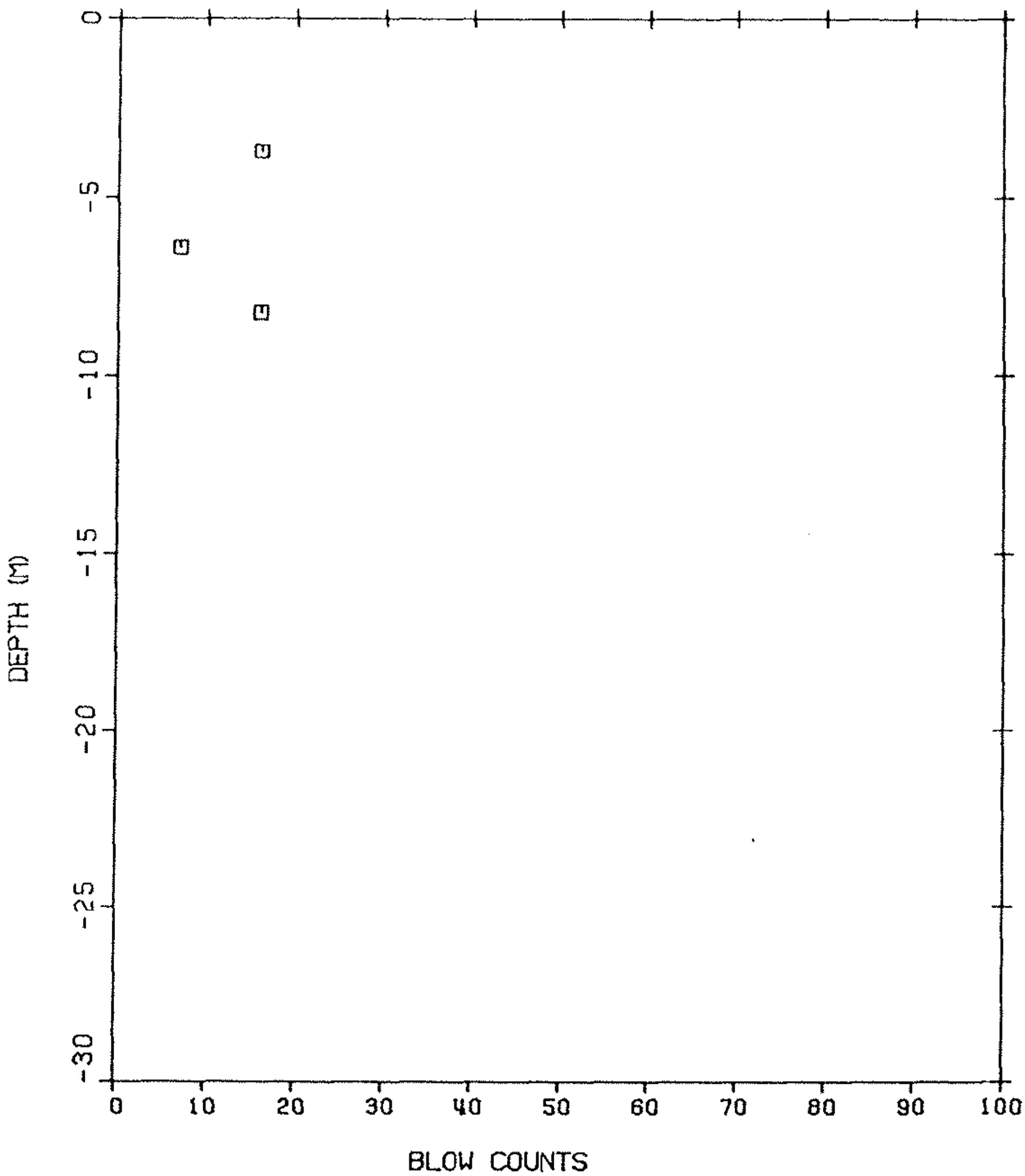
N(SPT) VS DEPTH AREA 4 NORTHEAST MULTISAMPLE BH

FIGURE 31



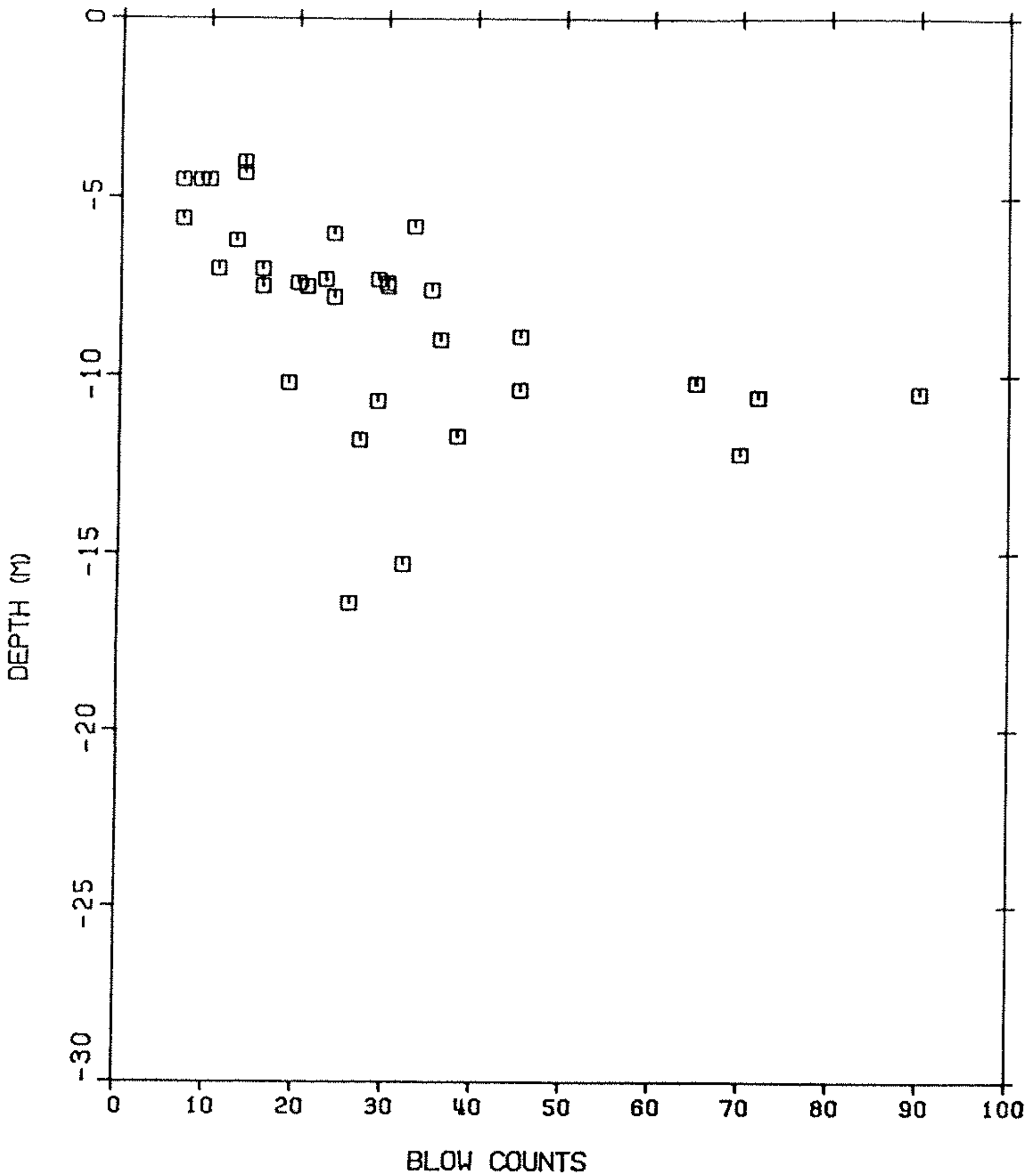
N(SPT) VS DEPTH AREA 5 DT NORTH MULTISAMPLE BH

FIGURE 32



N(SPT) VS DEPTH AREA 6 STRATHCONA MULTISAMPLE BH

FIGURE 33



N(SPT) VS DEPTH AREA 7 SOUTH CENT MULTISAMPLE BH

FIGURE 34

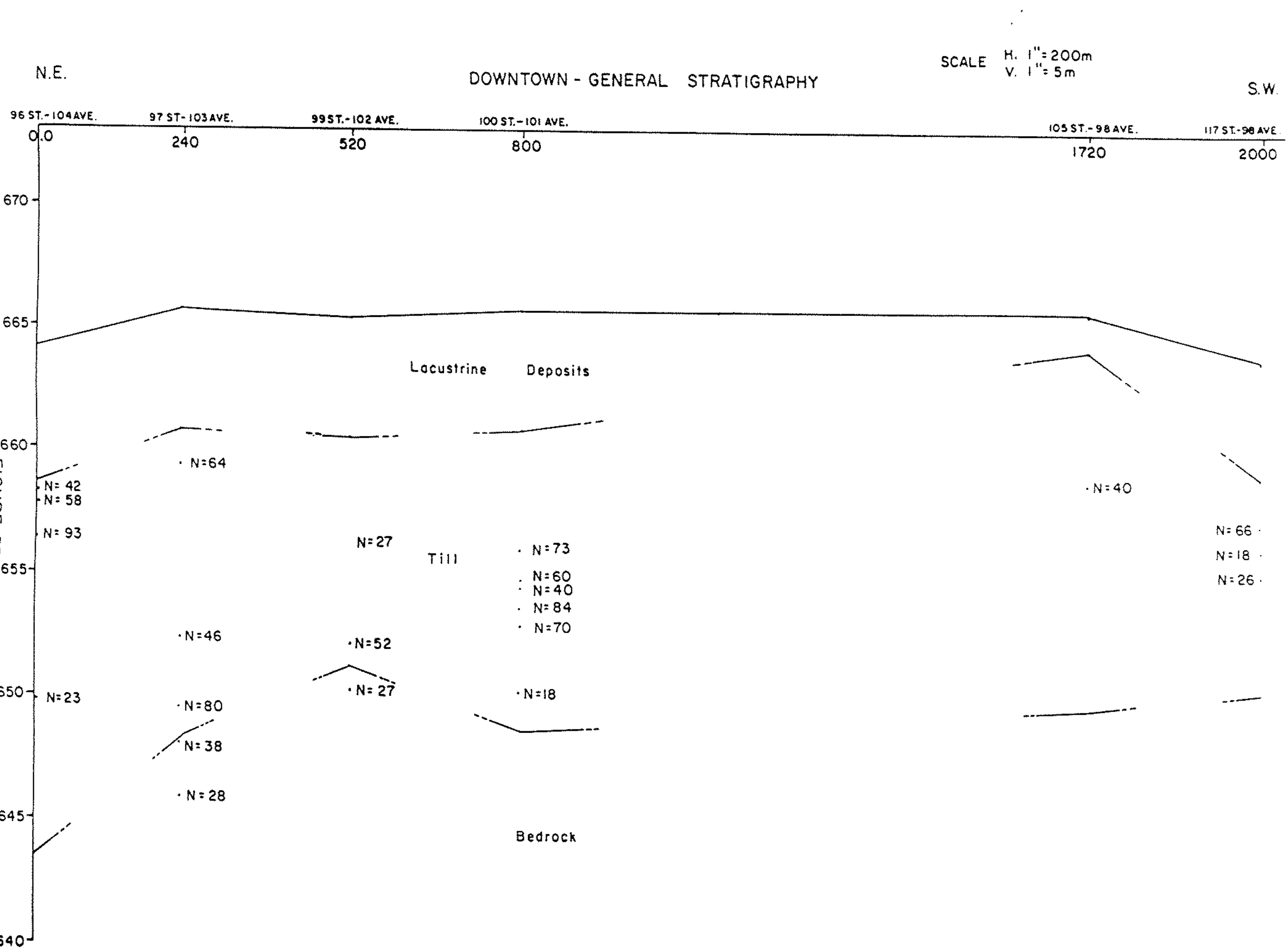

DOWNTOWN - GENERAL STRATIGRAPHY
N.E.
S.W.
SCALE H. 1" = 200m
V. 1" = 5m
96 ST. - 104 AVE.
97 ST. - 103 AVE.
99 ST. - 102 AVE.
100 ST. - 101 AVE.
105 ST. - 98 AVE.
117 ST. - 98 AVE.
0.0
240
520
800
1720
2000
670
665
660
655
650
645
640
Lacustrine Deposits
Till
Bedrock
N = 42
N = 58
N = 93
N = 23
N = 64
N = 46
N = 80
N = 38
N = 28
N = 27
N = 52
N = 27
N = 73
N = 60
N = 40
N = 84
N = 70
N = 18
N = 40
N = 66
N = 18
N = 26

FIGURE 35

MILLWOODS - GENERAL STRATIGRAPHY

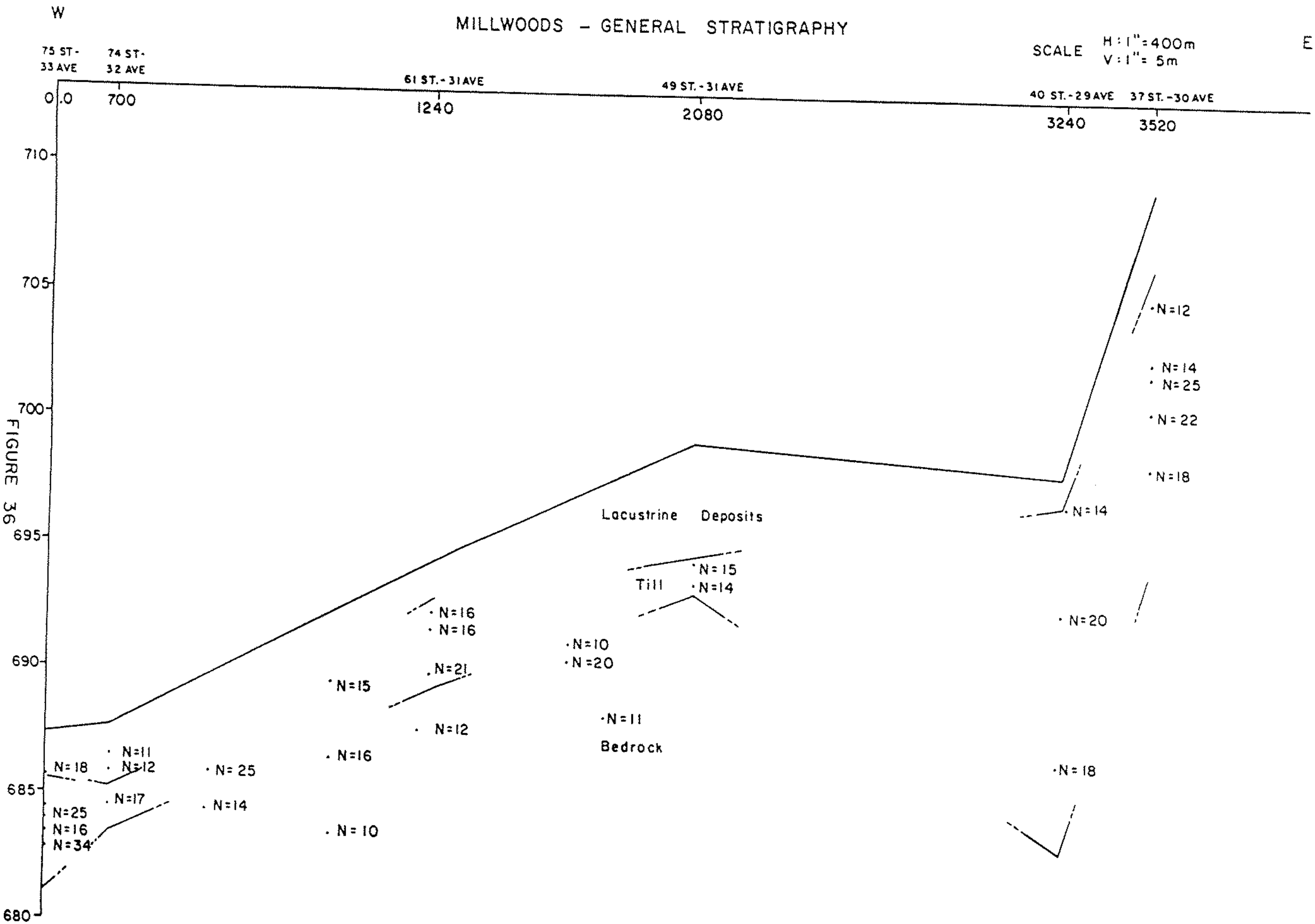


FIGURE 36

ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	QU KPA	N	LL (%)	PL (%)	COMMENTS
184 ST 40 AVE	1	679.6	666.4	0.0	663.1	13	343	51	0	0	TH TO 649.9
184 ST 40 AVE	1	679.6	666.4	0.0	658.6	12	430	64	0	0	TH TO 649.9
184 ST 42 AVE	1	656.0	650.8	0.0	647.2	13	0	35	0	0	TH TO 642.7
184 ST 45 AVE	4	684.4	670.0	0.0	669.3	20	0	38	0	0	TH TO 668.7
153 ST 45 AVE	1	683.4	683.1	0.0	653.8	17	392	48	40	17	TH TO 651.8
156 ST 43 AVE	3	678.5	677.0	647.4	675.4	17	67	9	0	0	
156 ST 43 AVE	3	678.5	677.0	647.4	652.0	13	344	46	0	0	
170 ST 40 AVE	1	669.5	664.3	650.1	660.4	17	64	28	0	0	
170 ST 40 AVE	1	669.5	664.3	650.1	657.3	15	120	25	0	0	
170 ST 40 AVE	1	669.5	664.3	650.1	652.8	16	113	24	0	0	
135 ST 32 AVE	8	668.1	661.7	649.8	653.5	16	0	33	41	14	
135 ST 31 AVE	9	669.3	662.6	655.0	659.0	16	0	60	29	14	
122 ST 45 AVE	44	666.6	656.8	655.0	666.5	13	363	55	0	0	TH TO 661.3
114 ST 43 AVE	1	671.8	665.4	0.0	662.9	22	0	38	0	0	TH TO 656.6
114 ST 43 AVE	5	671.8	665.1	0.0	659.9	16	325	39	48	19	TH TO 660.6
115 ST 41 AVE	7	668.1	662.0	0.0	660.8	17	287	72	0	0	TH TO 657.3
119 ST 40 AVE	1	667.8	661.1	0.0	658.7	14	0	65	0	0	
141 ST 32 AVE	1	666.1	651.3	649.4	649.6	17	0	61	0	0	
141 ST 32 AVE	4	670.5	665.5	651.0	663.5	18	0	11	0	0	
141 ST 32 AVE	4	670.5	665.5	651.0	654.1	10	0	26	0	0	
122 ST 45 AVE	2	669.2	660.9	0.0	660.2	16	125	21	0	0	TH TO 659.9
115 ST 45 AVE	3	671.5	664.7	0.0	662.8	13	0	56	0	0	TH TO 662.7
111 ST 45 AVE	4	672.1	665.7	0.0	661.7	16	0	45	0	0	TH TO 660.2
111 ST 45 AVE	4	672.1	665.7	0.0	660.3	18	0	27	0	0	TH TO 660.2
108 ST 45 AVE	6	674.2	669.7	0.0	668.4	16	221	33	0	0	TH TO 663.8
108 ST 45 AVE	6	674.2	669.7	0.0	664.0	12	0	65	0	0	TH TO 663.8
106 ST 45 AVE	7	672.7	666.5	0.0	662.0	16	0	29	0	0	TH TO 660.8
106 ST 45 AVE	7	672.7	666.5	0.0	661.0	17	0	38	0	0	TH TO 660.8
104 ST 42 AVE	8	672.2	665.4	664.0	664.7	17	0	20	0	0	
111 ST 43 AVE	10	672.4	665.4	0.0	658.4	15	306	47	0	0	TH TO 656.5
111 ST 43 AVE	11	672.1	666.0	0.0	662.6	15	430	46	0	0	TH TO 656.1
99 ST 43 AVE	1	673.2	667.8	663.2	664.8	23	0	38	0	0	
92 ST 43 AVE	3	674.9	674.9	672.9	674.4	30	0	15	0	0	
91 ST 43 AVE	4	679.1	677.0	673.8	674.6	23	0	61	0	0	
87 ST 43 AVE	6	683.6	680.5	678.4	679.3	20	0	0	38	17	
86 ST 43 AVE	7	689.2	686.2	684.2	684.8	18	331	20	0	0	COAL AND SANDSTONE
76 ST 44 AVE	10	692.5	691.5	684.7	689.5	21	0	12	0	0	
76 ST 44 AVE	10	692.5	691.5	684.7	686.5	18	230	17	0	0	
97 ST 35 AVE	2	683.1	680.9	677.3	679.1	25	181	11	0	0	
97 ST 35 AVE	2	683.1	680.9	677.3	677.6	18	210	28	0	0	
97 ST 35 AVE	5	681.5	679.4	676.7	677.6	22	220	13	0	0	
103 ST 34 AVE	1	675.5	670.3	0.0	669.5	22	46	17	0	0	TH TO 669.2
103 ST 33 AVE	2	674.4	670.4	0.0	668.4	19	137	34	0	0	TH TO 668.1
103 ST 31 AVE	3	676.3	674.2	0.0	670.3	21	131	22	0	0	TH TO 670.0
103 ST 31 AVE	4	676.4	674.3	0.0	671.9	43	36	9	0	0	TH TO 670.1
103 ST 31 AVE	4	676.4	674.3	0.0	670.4	20	56	24	0	0	TH TO 670.1
103 ST 29 AVE	5	675.7	672.0	0.0	669.7	22	114	19	0	0	TH TO 669.4
103 ST 27 AVE	7	675.4	671.5	0.0	670.6	19	190	24	0	0	TH TO 670.1
70 ST 48 AVE	3	689.5	686.5	686.0	686.7	24	57	13	0	0	
65 ST 48 AVE	7	685.0	679.5	0.0	677.6	22	71	10	0	0	TH TO 677.2

ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	QU KPA	N	LL (%)	PL (%)	COMMENTS
63 ST 48 AVE	9	684.5	680.5	0.0	678.3	22	0	9	0	0	TH TO 676.7
63 ST 48 AVE	9	684.5	680.5	0.0	676.9	18	0	11	0	0	TH TO 676.7
61 ST 48 AVE	11	683.6	680.5	0.0	677.4	22	0	8	0	0	TH TO 675.8
61 ST 48 AVE	11	683.6	680.5	0.0	676.0	24	0	6	0	0	TH TO 675.8
59 ST 48 AVE	13	682.9	680.7	0.0	678.6	19	146	14	0	0	TH TO 675.1
59 ST 48 AVE	13	682.9	680.7	0.0	675.3	20	0	11	0	0	TH TO 675.1
57 ST 48 AVE	15	682.3	678.6	0.0	676.3	18	66	13	0	0	TH TO 674.5
57 ST 48 AVE	15	682.3	678.6	0.0	674.9	21	68	16	0	0	TH TO 674.5
55 ST 48 AVE	17	681.3	681.3	0.0	678.5	17	118	15	0	0	TH TO 673.5
55 ST 48 AVE	17	681.3	681.3	0.0	677.0	22	95	8	0	0	TH TO 673.5
55 ST 48 AVE	17	681.3	681.3	0.0	673.7	22	0	10	0	0	TH TO 673.5
53 ST 48 AVE	19	680.5	680.5	0.0	677.7	20	105	14	0	0	TH TO 672.7
53 ST 48 AVE	19	680.5	680.5	0.0	673.1	22	60	10	0	0	TH TO 672.7
50 ST 48 AVE	21	679.7	679.7	0.0	676.9	17	131	14	0	0	TH TO 671.9
50 ST 48 AVE	21	679.7	679.7	0.0	672.3	17	186	22	0	0	TH TO 671.9
70 ST 44 AVE	1	691.0	690.1	687.3	689.2	21	95	10	0	0	
61 ST 41 AVE	2	687.6	684.6	0.0	682.4	18	0	17	0	0	TH TO 674.9
61 ST 41 AVE	2	687.6	684.6	0.0	680.6	20	124	12	0	0	TH TO 678.9
54 ST 40 AVE	17	699.6	696.8	694.9	695.9	21	95	13	0	0	
62 ST 39 AVE	25	690.4	688.2	665.8	686.1	21	210	39	0	0	
52 ST 39 AVE	38	702.9	700.7	697.1	698.9	18	268	21	0	0	
83 ST 42 AVE	2	682.4	679.1	0.0	677.6	17	0	18	0	0	TH TO 677.5
66 ST 41 AVE	1	683.8	681.5	0.0	680.8	40	53	6	0	0	TH TO 680.6
66 ST 41 AVE	6	684.0	681.4	0.0	679.6	23	94	10	43	18	TH TO 679.3
88 ST 44 AVE	1	687.1	685.9	681.2	682.7	20	287	22	0	0	
83 ST 42 AVE	13	680.9	676.7	0.0	674.2	18	0	62	0	0	TH TO 673.9
89 ST 39 AVE	22	683.1	674.8	677.0	677.9	19	0	18	0	0	
66 ST 43 AVE	5	691.0	689.2	686.7	687.0	20	268	16	0	0	
71 ST 42 AVE	16	687.3	686.4	683.4	684.9	18	210	13	0	0	
66 ST 40 AVE	30	684.9	682.1	679.1	680.8	18	134	16	0	0	
71 ST 36 AVE	2	695.6	694.0	691.6	692.2	20	172	13	0	0	
71 ST 36 AVE	3	696.2	694.6	691.9	692.6	19	228	15	0	0	
71 ST 37 AVE	3	694.0	692.5	688.6	690.7	19	181	18	0	0	
60 ST 37 AVE	9	703.5	701.0	0.0	698.3	18	268	21	0	0	TH TO 697.0
55 ST 37 AVE	20	700.1	698.3	697.4	698.0	16	708	24	0	0	
51 ST 36 AVE	23	701.3	701.0	697.7	699.2	18	316	10	0	0	
66 ST 35 AVE	32	697.1	696.2	690.4	691.9	20	105	18	0	0	
60 ST 34 AVE	35	692.8	691.0	0.0	687.6	18	134	12	0	0	TH TO 686.3
64 ST 35 AVE	36	693.4	690.4	0.0	688.2	21	162	11	0	0	TH TO 687.0
45 ST 38 AVE	7	703.8	701.5	697.4	699.5	19	277	14	0	0	
50 ST 40 AVE	14	700.4	698.6	691.6	695.5	16	143	17	0	0	
50 ST 40 AVE	14	700.4	698.6	691.6	694.9	17	277	27	0	0	
39 ST 36 AVE	16	708.1	705.0	699.2	702.3	17	258	18	0	0	
71 ST 33 AVE	6	691.0	689.8	0.0	686.4	21	191	0	0	0	TH TO 686.1
67 ST 32 AVE	10	689.6	687.9	0.0	684.9	20	239	0	0	0	TH TO 684.9
79 ST 36 AVE	1	685.7	683.0	676.8	678.5	17	407	0	0	0	
84 ST 36 AVE	2	685.2	682.1	0.0	681.5	18	0	20	0	0	TH TO 681.4
85 ST 37 AVE	1	684.3	680.9	0.0	679.4	20	0	19	0	0	TH TO 679.1
85 ST 37 AVE	3	684.3	680.9	0.0	679.4	19	0	20	0	0	TH TO 679.3
78 ST 38 AVE	1	684.3	681.2	0.0	679.4	18	316	24	0	0	TH TO 679.0

ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	QU KPA	N	LL (%)	PL (%)	COMMENTS
74 ST 38 AVE	3	685.4	682.8	0.0	680.9	19	335	25	0	0	TH TO 680.3
75 ST 30 AVE	4	691.9	680.7	689.2	688.6	20	124	16	0	0	
82 ST 31 AVE	11	687.3	684.0	0.0	682.1	19	239	17	0	0	TH TO 680.4
78 ST 30 AVE	21	687.0	684.9	0.0	683.1	20	86	14	0	0	TH TO 680.3
86 ST 29 AVE	24	685.5	681.8	0.0	679.7	19	0	33	0	0	TH TO 676.1

121	74 ST 29 AVE	1	689.8	687.9	0.0	686.4	21	105	11	0	0	TH TO 684.6
122	74 ST 29 AVE	3	690.7	689.2	0.0	685.8	20	0	12	0	0	TH TO 685.5
123	74 ST 32 AVE	2	687.6	685.2	683.4	684.3	20	153	17	0	0	
124	66 ST 28 AVE	2	691.0	689.8	688.8	688.2	22	105	0	32	16	
125	62 ST 29 AVE	5	694.3	693.7	690.1	691.3	19	181	15	0	0	
126	61 ST 31 AVE	18	694.3	692.8	689.2	691.6	20	143	16	0	0	
127	61 ST 31 AVE	18	694.3	692.8	689.2	689.8	19	239	21	0	0	
128	55 ST 31 AVE	21	693.7	692.5	689.2	691.0	23	105	10	0	0	
129	55 ST 31 AVE	21	693.7	692.5	689.2	689.5	20	124	20	0	0	
130	58 ST 32 AVE	26	695.2	695.2	691.6	692.2	19	172	16	0	0	
131	66 ST 28 AVE	1	691.5	690.4	686.9	688.5	21	116	12	0	0	
132	64 ST 28 AVE	2	691.8	691.8	687.2	690.3	19	83	9	0	0	
133	64 ST 28 AVE	2	691.8	691.8	687.2	686.8	20	130	15	0	0	
134	74 ST 31 AVE	1	692.4	691.8	684.8	691.1	15	237	25	0	0	SSC 686.3 TO 685.1
135	74 ST 31 AVE	2	692.6	690.6	0.0	686.2	20	202	21	34	19	TH TO 683.8
136	74 ST 31 AVE	2	692.6	690.8	0.0	683.9	18	0	25	0	0	TH TO 683.8
137	75 ST 33 AVE	1	687.3	685.5	681.2	683.4	20	258	16	0	0	
138	70 ST 32 AVE	4	690.1	687.6	0.0	685.8	20	0	25	0	0	TH TO 684.1
139	70 ST 32 AVE	4	690.1	687.6	0.0	684.3	20	0	14	0	0	TH TO 684.1
140	67 ST 33 AVE	6	690.1	687.9	0.0	686.4	21	124	16	0	0	TH TO 683.2
141	67 ST 33 AVE	6	690.1	687.9	0.0	683.4	19	0	10	0	0	TH TO 683.2
142	66 ST 29 AVE	7	691.9	690.7	689.2	689.5	20	124	15	0	0	
143	75 ST 29 AVE	10	689.5	688.8	0.0	685.5	18	239	18	0	0	TH TO 682.5
144	75 ST 29 AVE	10	689.5	688.8	0.0	682.8	17	0	34	0	0	TH TO 682.5
145	40 ST 34 AVE	10	704.4	702.9	695.9	700.1	20	143	18	0	0	
146	40 ST 34 AVE	10	704.4	702.9	695.9	697.4	14	0	14	0	0	
147	39 ST 32 AVE	21	706.8	703.8	697.1	702.6	19	0	14	0	0	
148	39 ST 32 AVE	21	706.8	703.8	697.1	698.3	17	0	18	0	0	
149	49 ST 31 AVE	24	699.2	694.6	693.1	693.4	20	210	14	0	0	
150	37 ST 30 AVE	38	709.3	706.2	694.0	705.0	20	0	12	0	0	
151	37 ST 30 AVE	38	709.3	706.2	694.0	700.7	20	0	22	0	0	
152	40 ST 29 AVE	42	698.0	696.8	683.1	692.5	17	220	20	0	0	
153	40 ST 29 AVE	42	698.0	696.8	683.1	686.4	17	0	18	0	0	
154	48 ST 28 AVE	46	701.6	699.5	693.4	697.7	17	229	14	0	0	SSG 693.3 TO 691.5
155	48 ST 28 AVE	46	701.6	699.5	693.4	694.6	21	0	15	0	0	
156	36 ST 27 AVE	62	710.8	709.3	700.1	706.8	17	286	16	0	0	
157	36 ST 27 AVE	62	710.8	709.3	700.1	702.3	17	0	25	0	0	
158	42 ST 26 AVE	66	703.8	700.7	691.6	689.8	19	134	20	0	0	
159	42 ST 26 AVE	66	703.8	700.7	691.6	692.2	17	0	20	0	0	
160	45 ST 23 AVE	70	702.3	701.0	685.5	698.3	20	238	23	0	0	
161	45 ST 23 AVE	70	702.3	701.0	685.5	690.7	21	0	13	0	0	
162	36 ST 24 AVE	84	712.0	711.4	695.8	708.1	20	124	19	0	0	
163	36 ST 24 AVE	84	712.0	711.4	695.9	703.5	17	181	19	0	0	
164	36 ST 24 AVE	84	712.0	711.4	695.9	697.4	20	0	12	0	0	
165	184 ST 62 AVE	1	684.3	671.5	0.0	670.8	16	0	0	0	0	TH TO 670.4
166	1											
167												
168	ADDRESS	BORE	GROUND	TOP TILL	BOT TILL	SAMPLE	MC	OU	N	LL	PL	COMMENTS
169		HOLE	ELEV	ELEV	ELEV	ELEV	(%)	KPA		(%)	(%)	
170												
171	184 ST 62 AVE	2	684.9	670.9	0.0	670.0	20	124	22	0	0	TH TO 668.1
172	170 ST 79 AVE	1	675.6	667.2	0.0	665.4	15	289	43	0	0	TH TO 659.1
173	170 ST 79 AVE	2	675.7	669.3	664.3	666.3	16	195	34	0	0	
174	170 ST 79 AVE	2	675.7	669.3	664.3	665.3	15	217	50	0	0	
175	178 ST 79 AVE	3	681.2	670.9	665.0	661.1	16	113	43	0	0	
176	167 ST 79 AVE	1	669.0	661.7	0.0	660.2	18	0	27	0	0	TH TO 660.0
177	168 ST 73 AVE	2	670.6	664.2	0.0	662.9	17	0	30	0	0	TH TO 662.6
178	166 ST 66 AVE	3	670.0	662.9	0.0	661.4	16	181	22	32	14	TH TO 660.7
179	167 ST 63 AVE	6	671.2	664.2	0.0	662.0	17	0	24	0	0	TH TO 661.7
180	164 ST 67 AVE	9	669.0	662.0	0.0	660.5	16	488	46	36	17	TH TO 650.7

181	164 ST 67 AVE	9	669.0	662.0	0.0	654.4	14	450	41	37	17	TH TO 650.7
182	160 ST 79 AVE	1	670.9	663.2	0.0	660.5	17	0	53	0	0	TH TO 660.8
183	153 ST 45 AVE	1	661.5	660.2	0.0	657.5	14	326	53	0	0	TH TO 657.0
184	153 ST 47 AVE	2	675.4	661.1	652.9	658.1	15	746	30	0	0	
185	153 ST 50 AVE	3	673.6	659.3	652.9	655.3	15	373	36	30	15	
186	175 ST 75 AVE	7	676.4	664.8	0.0	662.3	18	0	0	0	0	TH TO 662.2
187	175 ST 72 AVE	10	676.0	669.0	0.0	667.8	18	0	14	0	0	TH TO 667.6
188	180 ST 60 AVE	1	690.1	680.5	0.0	678.5	17	0	19	0	0	TH TO 678.4
189	178 ST 62 AVE	4	669.6	656.4	0.0	648.6	15	0	0	0	0	TH TO 647.1
190	170 ST 69 AVE	1	672.6	664.1	0.0	661.9	15	0	0	0	0	TH TO 661.8
191	170 ST 69 AVE	2	672.9	665.1	0.0	663.8	31	0	30	0	0	TH TO 662.5
192	170 ST 53 AVE	1	671.4	665.1	0.0	658.6	13	0	36	0	0	
193	142 ST 76 AVE	1	663.5	655.0	0.0	650.1	17	0	48	0	0	TH TO 638.2
194	115 ST 60 AVE	1	669.5	661.9	0.0	657.9	13	0	50	0	0	TH TO 656.5
195	113 ST 60 AVE	1	669.3	662.0	0.0	661.1	13	0	63	0	0	TH TO 659.3
196	113 ST 60 AVE	3	669.3	662.3	0.0	661.1	11	0	61	0	0	TH TO 659.5
197	145 ST 66 AVE	3	674.3	672.2	0.0	671.3	13	0	38	0	0	TH TO 670.0
198	112 ST 76 AVE	3	667.6	657.5	0.0	656.5	14	0	72	0	0	TH TO 655.1
199	88 ST 69 AVE	1	670.3	665.7	0.0	663.9	17	153	63	0	0	TH TO 663.9
200	88 ST 69 AVE	2	670.3	666.0	0.0	665.1	17	162	29	0	0	TH TO 663.5
201	88 ST 69 AVE	3	670.6	666.6	0.0	665.4	16	0	27	0	0	TH TO 663.9
202	103 ST 68 AVE	1	672.7	664.2	0.0	662.6	14	0	60	0	0	TH TO 661.6
203	103 ST 68 AVE	2	672.7	664.5	661.7	663.9	20	0	11	0	0	
204	103 ST 68 AVE	3	673.0	665.7	0.0	664.5	19	0	11	0	0	TH TO 661.7
205	87 ST 63 AVE	2	677.3	673.8	672.4	673.3	26	0	12	0	0	
206	87 ST 63 AVE	3	677.3	673.6	672.4	673.3	17	0	13	0	0	
207	87 ST 63 AVE	4	677.3	673.8	672.4	673.3	19	0	15	0	0	
208	87 ST 31 AVE	16	681.5	678.5	674.8	676.7	14	0	27	0	0	
209	86 ST 63 AVE	1	673.9	664.7	0.0	666.6	13	0	35	0	0	TH TO 666.3
210	86 ST 63 AVE	2	673.0	669.3	0.0	666.9	20	0	29	0	0	TH TO 663.8
211	92 ST 60 AVE	1	671.0	663.2	642.9	657.4	19	207	36	0	0	
212	92 ST 60 AVE	1	671.0	336.2	642.8	644.0	22	214	22	0	0	
213	92 ST 60 AVE	2	666.3	661.5	0.0	644.3	21	225	28	0	0	TH TO 643.8
214	92 ST 60 AVE	3	668.5	662.4	0.0	661.2	18	264	52	0	0	TH TO 644.0
215	82 ST 60 AVE	3	668.5	662.4	0.0	646.0	19	270	42	0	0	TH TO 644.0
216	108 ST 51 AVE	2	673.0	664.4	0.0	662.9	14	0	31	0	0	TH TO 661.5
217	104 ST 51 AVE	4	672.7	664.4	0.0	662.5	15	402	28	0	0	TH TO 662.4
218	97 ST 61 AVE	1	673.0	668.1	666.3	667.5	18	210	20	0	0	
219	97 ST 51 AVE	2	673.3	668.4	666.0	667.6	18	0	14	0	0	
220	97 ST 51 AVE	3	673.6	669.6	665.7	666.1	18	181	16	29	16	
221	1											
222												
223	ADDRESS	BORE	GROUND	TOP TILL	BOT TILL	SAMPLE	MC	OU	N	LL	PL	COMMENTS
224		HOLE	ELEV	ELEV	ELEV	ELEV	(%)	KPA		(%)	(%)	
225												
226	71 ST 73 AVE	1	672.4	666.5	0.0	665.0	20	84	19	0	0	TH TO 663.6
227	71 ST 73 AVE	2	672.0	667.2	0.0	666.2	18	260	17	0	0	TH TO 663.6
228	71 ST 73 AVE	4	671.2	666.8	0.0	665.3	17	218	15	0	0	TH TO 661.9
229	38 ST 82 AVE	10	668.4	665.4	0.0	664.5	20	0	0	0	0	TH TO 664.3
230	67 ST 68 AVE	1	676.7	675.5	0.0	674.4	0	86	0	0	0	TH TO 662.1
231	71 ST 68 AVE	1	674.9	670.3	655.4	0.0	0	0	0	0	0	
232	71 ST 61 AVE	4	677.4	674.8	648.2	0.0	0	0	0	0	0	
233	71 ST 63 AVE	7	677.0	675.7	0.0	674.8	20	172	14	0	0	TH TO 672.1
234	71 ST 63 AVE	8	677.6	676.4	0.0	675.4	18	201	20	0	0	TH TO 673.0
235	71 ST 63 AVE	8	677.6	676.4	0.0	674.5	20	106	10	0	0	TH TO 673.0
236	75 ST 63 AVE	4	675.0	672.6	0.0	670.8	22	47	13	0	0	TH TO 666.4
237	75 ST 63 AVE	4	675.0	672.6	0.0	662.0	16	147	28	0	0	SSG 659.6 TO 656.8
238	75 ST 63 AVE	5	675.4	673.0	656.1	671.0	21	152	12	0	0	SSG 664.8 TO 656.1
239	74 ST 63 AVE	2	675.9	671.1	0.0	667.0	20	87	10	40	18	TH TO 660.5
240	73 ST 63 AVE	3	676.6	671.7	0.0	664.6	19	108	15	0	0	TH TO 661.2

50 ST 51 AVE	1	688.0	684.0	0.0	680.5	19	239	0	0	0	TH TO 676.0
50 ST 51 AVE	3	687.2	685.5	0.0	679.3	16	0	36	0	0	TH TO 677.5
50 ST 60 AVE	1	690.3	686.3	681.5	684.5	21	134	19	0	0	
50 ST 60 AVE	1	690.3	686.3	681.5	682.7	19	0	28	0	0	
50 ST 60 AVE	2	689.7	687.8	680.6	683.9	24	137	18	30	18	
50 ST 60 AVE	3	688.6	685.9	0.0	682.6	19	302	36	0	0	TH TO 679.3
50 ST 60 AVE	3	688.6	685.9	0.0	679.6	19	196	26	0	0	TH TO 679.3
50 ST 58 AVE	4	692.5	689.9	687.8	688.3	21	108	0	55	21	COAL 687.8 TO 684.3
50 ST 58 AVE	5	692.3	691.4	687.7	690.8	19	121	12	0	0	COAL 687.7 TO 685.0
50 ST 55 AVE	1	686.7	686.7	0.0	682.3	24	165	13	0	0	TH TO 678.4
50 ST 55 AVE	1	686.7	686.7	0.0	679.3	18	135	40	0	0	TH TO 678.4
50 ST 55 AVE	1	686.7	686.7	0.0	677.8	22	136	17	0	0	TH TO 678.4
50 ST 59 AVE	1	687.9	683.6	0.0	680.5	15	319	27	0	0	TH TO 678.6
50 ST 56 AVE	2	691.8	688.6	685.9	687.4	20	304	20	0	0	
50 ST 56 AVE	3	690.0	687.6	686.3	687.2	22	30	10	0	0	
50 ST 55 AVE	4	688.4	687.9	0.0	685.4	22	0	13	0	0	TH TO 679.1
50 ST 55 AVE	4	688.4	684.9	0.0	684.1	20	100	18	0	0	TH TO 679.1
50 ST 56 AVE	4	688.4	684.9	0.0	684.1	20	237	25	0	0	TH TO 679.1
54 ST 53 AVE	5	683.9	681.1	0.0	679.5	18	220	18	0	0	TH TO 674.0
54 ST 56 AVE	6	688.4	686.9	683.7	684.6	20	340	31	0	0	
54 ST 53 AVE	6	683.9	681.1	0.0	678.0	21	209	15	0	0	TH TO 674.0
54 ST 58 AVE	7	688.6	688.0	0.0	686.8	20	98	14	0	0	TH TO 680.3
54 ST 58 AVE	7	689.6	688.0	0.0	685.3	25	101	12	0	0	TH TO 680.3
54 ST 58 AVE	7	689.6	688.0	0.0	683.7	24	180	15	0	0	TH TO 680.3
64 ST 58 AVE	7	689.6	688.0	0.0	680.7	20	243	16	0	0	TH TO 680.3
59 ST 59 AVE	8	690.3	689.0	0.0	687.5	20	0	11	0	0	TH TO 681.0
59 ST 59 AVE	8	690.3	689.0	0.0	682.9	15	413	37	0	0	TH TO 681.0
54 ST 57 AVE	9	682.8	679.0	0.0	677.0	20	0	11	0	0	TH TO 673.5
54 ST 57 AVE	9	682.8	679.0	0.0	675.4	20	154	13	0	0	TH TO 673.5
54 ST 57 AVE	9	682.8	679.0	0.0	673.9	18	0	18	0	0	TH TO 673.5
59 ST 57 AVE	10	683.3	680.3	0.0	679.0	22	105	12	0	0	TH TO 674.0
59 ST 57 AVE	10	683.3	680.3	0.0	677.5	20	162	17	0	0	TH TO 674.0
59 ST 57 AVE	10	683.3	680.3	0.0	675.9	21	160	13	0	0	TH TO 674.0
59 ST 58 AVE	11	687.2	685.7	0.0	682.9	18	248	16	0	0	TH TO 674.3
63 ST 58 AVE	12	685.3	683.6	0.0	681.5	18	159	11	0	0	TH TO 673.9

ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	QU KPA	N	LL (%)	PL (%)	COMMENTS
63 ST 58 AVE	12	685.3	683.6	0.0	680.9	17	163	20	0	0	TH TO 673.9
63 ST 53 AVE	13	682.8	680.8	0.0	680.0	20	161	16	0	0	TH TO 671.4
63 ST 53 AVE	13	682.8	680.8	0.0	678.4	20	234	16	0	0	TH TO 671.4
67 ST 58 AVE	14	683.2	682.0	0.0	680.4	30	110	8	0	0	TH TO 672.8
67 ST 58 AVE	14	683.2	682.0	0.0	674.5	17	0	10	0	0	TH TO 672.8
67 ST 58 AVE	14	683.2	682.0	0.0	673.0	16	0	21	0	0	TH TO 672.8
86 ST 58 AVE	1	672.4	668.1	0.0	671.8	19	0	22	0	0	TH TO 664.8
86 ST 58 AVE	3	672.4	668.1	0.0	663.5	17	0	26	0	0	TH TO 663.3
86 ST 58 AVE	5	672.4	668.1	0.0	665.1	20	0	24	0	0	TH TO 661.8
86 ST 58 AVE	5	672.4	668.1	0.0	662.0	17	0	40	0	0	TH TO 661.8
176 ST 95 AVE	9	676.5	669.6	0.0	668.0	16	316	0	0	0	TH TO 667.7
176 ST 100 AVE	1	677.2	668.5	0.0	666.7	17	192	0	0	0	TH TO 664.4
182 ST 96 AVE	1	680.0	672.7	0.0	671.8	17	389	32	0	0	TH TO 668.5
182 ST 96 AVE	1	680.0	672.7	0.0	668.8	15	203	20	0	0	TH TO 668.5
182 ST 96 AVE	2	680.1	673.7	0.0	670.4	17	249	30	32	16	TH TO 670.1
175 ST 89 AVE	1	676.0	668.5	0.0	666.8	20	0	18	0	0	TH TO 666.7
175 ST 90 AVE	5	676.3	666.7	0.0	667.4	19	0	13	0	0	TH TO 667.0
165 ST 92 AVE	1	675.1	668.1	0.0	666.6	17	268	0	0	0	TH TO 665.1
163 ST 92 AVE	2	675.4	670.3	0.0	670.0	30	0	0	0	0	TH TO 669.8
156 ST 90 AVE	1	671.6	663.5	0.0	661.7	17	181	18	0	0	TH TO 661.3
156 ST 90 AVE	2	671.6	663.2	0.0	662.0	14	181	20	0	0	TH TO 661.7
163 ST 87 AVE	1	672.4	663.6	0.0	658.8	16	274	38	33	18	TH TO 649.8
161 ST 87 AVE	4	671.7	663.2	0.0	666.2	16	178	29	0	0	TH TO 649.1
161 ST 87 AVE	4	671.7	663.2	0.0	650.7	12	176	68	0	0	TH TO 649.1
170 ST 83 AVE	1	675.4	666.0	0.0	664.5	14	258	31	0	0	TH TO 663.5
170 ST 83 AVE	9	674.8	666.0	662.0	665.1	18	220	42	0	0	
159 ST 79 AVE	1	670.6	660.8	0.0	658.6	15	570	53	0	0	TH TO 658.3
156 ST 84 AVE	1	671.5	665.1	0.0	664.2	18	239	16	0	0	TH TO 662.5
156 ST 84 AVE	2	671.5	665.1	0.0	664.2	20	95	21	0	0	TH TO 662.3
156 ST 84 AVE	7	671.8	665.4	0.0	664.5	18	172	16	0	0	TH TO 662.4
156 ST 84 AVE	11	671.8	665.1	0.0	664.5	20	220	15	0	0	TH TO 661.4
148 ST 100 AVE	1	671.2	665.1	0.0	664.2	17	392	22	0	0	TH TO 662.2
146 ST 100 AVE	2	670.9	666.1	0.0	663.9	18	335	18	0	0	TH TO 662.1
138 ST 95 AVE	1	653.6	647.1	0.0	645.6	24	134	0	0	0	TH TO 644.6
105 ST 98 AVE	1	668.1	665.1	0.0	663.6	16	229	0	0	0	TH TO 657.5
105 ST 98 AVE	3	665.7	664.2	649.5	658.7	13	0	40	0	0	SSG 648.5 TO 646.3
107 ST 98 AVE	2	665.9	660.7	648.8	657.0	10	0	66	0	0	SSG 651.5 TO 650.5
107 ST 98 AVE	3	664.6	662.8	653.1	656.0	14	0	26	0	0	SSG 653.1 TO 647.5
107 ST 98 AVE	5	663.6	659.0	650.2	656.0	16	0	18	0	0	SSG 650.2 TO 648.2
93 ST 95 AVE	5	662.3	654.8	0.0	653.1	18	0	62	0	0	TH TO 653.0
119 ST 100 AVE	1	659.6	652.0	0.0	651.1	16	383	29	0	0	TH TO 628.1
110 ST 88 AVE	1	673.9	669.8	0.0	669.1	29	103	22	0	0	TH TO 667.5
110 ST 84 AVE	2	673.6	671.8	0.0	670.5	19	81	13	0	0	TH TO 667.2
110 ST 88 AVE	3	673.1	339.4	0.0	668.5	25	157	18	0	0	TH TO 667.2
104 ST 92 AVE	7	641.9	641.0	633.4	636.7	26	0	20	42	18	
104 ST 88 AVE	10	644.0	641.0	634.0	640.4	25	0	18	0	0	
104 ST 88 AVE	10	644.0	641.0	634.0	637.6	27	0	7	0	0	
104 ST 88 AVE	10	644.0	641.0	634.0	636.8	24	0	15	40	16	
104 ST 86 AVE	13	669.0	666.6	662.9	664.8	39	0	8	86	27	
105 ST 85 AVE	1	669.6	665.4	663.5	664.8	32	0	7	0	0	

ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	QU KPA	N	LL (%)	PL (%)	COMMENTS
106 ST 87 AVE	1	668.4	664.5	662.6	664.2	18	124	0	0	0	
83 ST 84 AVE	1	662.3	655.3	649.2	654.4	16	0	16	0	0	
102 ST 80 AVE	1	684.9	680.9	43.0	679.7	18	105	0	0	0	TH TO 678.4
100 ST 86 AVE	12	684.9	681.9	0.0	681.1	26	153	0	0	0	TH TO 680.0
102 ST 86 AVE	15	682.6	679.9	0.0	678.4	30	95	0	0	0	TH TO 678.3
101 ST 84 AVE	16	682.7	679.6	0.0	678.7	20	46	0	0	0	TH TO 678.6
107 ST 83 AVE	1	684.0	679.2	0.0	677.6	18	220	0	0	0	TH TO 677.4
106 ST 82 AVE	2	684.7	682.0	0.0	679.5	36	96	0	0	0	TH TO 676.6
106 ST 84 AVE	7	684.4	683.1	0.0	680.6	17	144	0	0	0	TH TO 678.1
107 ST 84 AVE	9	683.9	680.2	0.0	680.0	37	66	0	0	0	TH TO 676.5
107 ST 85 AVE	16	681.7	678.3	0.0	677.9	21	77	0	0	0	TH TO 676.5
109 ST 87 AVE	2	669.6	663.2	660.5	661.1	12	0	46	0	0	
104 ST 84 AVE	3	672.1	668.4	0.0	666.9	17	0	21	0	0	TH TO 2222.8
109 ST 80 AVE	1	671.6	662.6	0.0	661.1	15	0	39	0	0	TH TO 660.9
104 ST 81 AVE	1	671.8	666.0	663.2	665.1	16	0	72	0	0	
95 ST 77 AVE	1	666.6	660.5	652.0	652.9	19	239	32	0	0	
97 ST 77 AVE	1	667.2	663.2	0.0	662.6	18	0	12	0	0	TH TO 658.4
97 ST 77 AVE	1	667.2	663.2	0.0	658.9	11	0	77	0	0	TH TO 654.4
50 ST 82 AVE	1	662.9	658.1	0.0	656.8	22	0	22	0	0	TH TO 656.7
55 ST 83 AVE	2	663.9	659.0	0.0	657.8	20	0	20	0	0	TH TO 657.3
58 ST 83 AVE	3	662.6	657.8	0.0	656.2	20	0	26	0	0	TH TO 656.8
63 ST 84 AVE	1	666.0	662.6	0.0	658.6	23	0	36	47	19	TH TO 659.3
63 ST 88 AVE	2	666.3	662.3	0.0	660.8	14	191	52	27	16	TH TO 659.3
64 ST 83 AVE	1	669.6	665.4	0.0	662.3	17	268	30	0	0	TH TO 660.3
64 ST 83 AVE	2	670.0	666.6	662.6	665.7	18	191	15	0	0	

64 ST 83 AVE	3	670.3	665.4	0.0	664.2	18	153	32	0	0	TH TO 660.9
64 ST 83 AVE	4	670.0	666.6	0.0	665.7	22	95	15	0	0	TH TO 660.7
64 ST 83 AVE	4	670.0	666.6	0.0	661.1	17	354	21	0	0	TH TO 660.7
67 ST 78 AVE	1	670.2	666.1	0.0	664.4	16	95	13	0	0	TH TO 663.9
67 ST 78 AVE	2	670.3	666.3	0.0	664.5	18	125	28	0	0	TH TO 664.0
184 ST 109 AVE	1	680.7	671.6	0.0	670.4	20	0	58	0	0	TH TO 666.8
184 ST 109 AVE	2	680.9	671.6	0.0	670.6	14	0	45	0	0	TH TO 667.5
184 ST 109 AVE	3	681.0	671.0	0.0	667.6	17	527	60	0	0	TH TO 653.3
184 ST 106 AVE	2	680.6	672.9	0.0	672.0	15	0	14	0	0	TH TO 670.1
154 ST 114 AVE	1	676.4	670.0	0.0	668.4	18	210	34	0	0	TH TO 666.8
154 ST 114 AVE	4	676.7	670.9	0.0	670.3	20	0	17	0	0	TH TO 667.4
181 ST 111 AVE	2	680.1	673.0	0.0	672.6	17	74	14	0	0	TH TO 672.3
182 ST 114 AVE	8	682.2	674.7	0.0	674.5	26	0	11	0	0	TH TO 674.4
170 ST 103 AVE	10	688.8	680.3	669.3	678.5	18	239	29	0	0	
170 ST 107 AVE	22	689.6	684.4	0.0	680.9	17	0	39	0	0	TH TO 676.2
170 ST 111 AVE	30	690.4	683.5	0.0	681.6	16	211	20	0	0	TH TO 677.0
178 ST 106 AVE	1	678.6	672.0	0.0	671.2	18	240	28	0	0	TH TO 670.8
178 ST 106 AVE	7	680.0	675.5	0.0	674.1	20	0	28	25	13	
178 ST 106 AVE	1	677.9	672.7	0.0	670.5	16	220	26	0	0	TH TO 668.6
156 ST 110 AVE	1	673.7	666.4	0.0	663.1	17	0	26	0	0	TH TO 661.7
156 ST 110 AVE	2	674.1	666.0	0.0	666.6	18	166	7	0	0	TH TO 661.6
156 ST 110 AVE	2	674.1	668.0	0.0	661.9	16	217	20	0	0	TH TO 661.6
156 ST 110 AVE	3	673.8	667.5	0.0	666.3	18	98	8	0	0	TH TO 661.3
156 ST 110 AVE	3	673.8	667.5	0.0	663.2	14	96	22	0	0	TH TO 661.3
170 ST 105 AVE	1	676.4	670.3	0.0	669.6	17	229	34	0	0	TH TO 667.9

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ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	OU KPA	N	LL (%)	PL (%)	COMMENTS
170 ST 105 AVE	4	676.4	669.6	0.0	669.0	15	258	41	0	0	TH TO 667.9
172 ST 105 AVE	1	675.7	669.6	0.0	668.4	16	114	18	0	0	TH TO 660.9
184 ST 102 AVE	1	681.4	674.6	0.0	672.5	28	32	16	0	0	
180 ST 102 AVE	5	681.1	677.1	0.0	675.0	18	119	23	0	0	TH TO 669.5
180 ST 102 AVE	5	681.1	677.1	0.0	676.5	22	65	16	0	0	TH TO 669.5
166 ST 103 AVE	2	676.0	670.9	0.0	670.3	17	210	20	0	0	TH TO 670.2
166 ST 103 AVE	3	676.0	669.3	0.0	669.0	19	210	17	0	0	TH TO 667.7
178 ST 102 AVE	1	678.5	671.9	0.0	671.1	17	125	24	0	0	TH TO 666.6
178 ST 102 AVE	3	678.6	673.7	0.0	672.5	20	104	15	0	0	TH TO 667.6
178 ST 102 AVE	4	678.3	673.4	0.0	672.2	17	105	20	0	0	TH TO 667.3
178 ST 102 AVE	4	678.3	673.4	0.0	670.8	16	100	23	0	0	TH TO 667.3
178 ST 102 AVE	5	678.7	673.8	0.0	672.6	18	132	17	0	0	TH TO 668.2
178 ST 102 AVE	5	678.7	673.8	0.0	671.1	17	185	16	0	0	TH TO 668.2
143 ST 115 AVE	1	673.3	667.2	0.0	666.0	18	181	26	31	17	TH TO 663.8
143 ST 115 AVE	2	673.0	667.2	0.0	665.7	19	287	25	0	0	TH TO 663.8
143 ST 115 AVE	3	673.0	666.6	0.0	673.3	14	134	25	0	0	TH TO 663.2
143 ST 115 AVE	3	673.0	666.6	0.0	663.5	15	248	26	0	0	TH TO 663.2
143 ST 115 AVE	4	673.3	666.6	0.0	665.7	21	162	19	0	0	TH TO 663.9
143 ST 115 AVE	5	673.3	667.2	0.0	664.5	16	220	20	0	0	TH TO 664.0
143 ST 115 AVE	6	673.3	667.5	0.0	666.9	32	162	18	0	0	TH TO 663.4
143 ST 114 AVE	1	673.5	664.0	0.0	662.8	16	0	22	0	0	TH TO 659.6
143 ST 114 AVE	1	673.5	664.0	0.0	660.0	16	274	21	0	0	TH TO 659.6
143 ST 114 AVE	2	673.2	664.1	0.0	661.0	17	252	22	0	0	TH TO 659.2
143 ST 114 AVE	4	673.2	667.1	0.0	666.0	18	0	16	0	0	TH TO 659.8
143 ST 114 AVE	6	673.5	664.4	0.0	661.8	16	0	16	0	0	TH TO 660.1
143 ST 115 AVE	1	673.3	667.2	0.0	666.3	19	95	19	0	0	TH TO 664.7
144 ST 114 AVE	2	685.5	680.3	0.0	679.2	18	373	28	0	0	TH TO 678.8
146 ST 114 AVE	5	685.7	677.8	0.0	677.1	19	0	15	0	0	TH TO 677.0
135 ST 111 AVE	2	673.0	667.8	0.0	666.6	14	0	37	0	0	TH TO 665.1
133 ST 115 AVE	1	670.6	665.7	0.0	665.1	21	0	10	0	0	TH TO 663.2

133 ST 115 AVE	2	670.6	665.1	0.0	662.0	21	114	18	0	0	TH TO 660.4
133 ST 115 AVE	3	670.3	664.6	0.0	663.2	17	0	12	0	0	TH TO 661.8
133 ST 115 AVE	2	670.8	665.9	0.0	664.8	22	13	13	0	0	TH TO 658.8
142 ST 111 AVE	9	672.8	666.5	0.0	663.6	20	175	21	38	16	TH TO 662.1
132 ST 107 AVE	5	667.8	659.6	0.0	659.0	16	584	0	0	0	TH TO 658.7
123 ST 101 AVE	1	667.2	661.6	0.0	659.5	16	0	30	0	0	TH TO 656.2
123 ST 101 AVE	3	667.4	661.9	0.0	661.4	21	132	24	0	0	TH TO 656.4
95 ST 114 AVE	1	663.2	657.8	0.0	657.5	31	105	8	0	0	TH TO 648.1
95 ST 114 AVE	1	663.2	657.8	0.0	651.4	17	0	40	0	0	TH TO 644.1
95 ST 114 AVE	4	662.8	657.5	0.0	656.8	20	124	20	0	0	
95 ST 114 AVE	6	662.9	657.5	0.0	654.1	15	0	54	0	0	
75 ST 110 AVE	1	663.9	660.8	0.0	657.8	15	641	40	0	0	TH TO 657.6
75 ST 110 AVE	5	661.1	657.1	0.0	655.6	12	0	72	0	0	TH TO 653.7
85 ST 110 AVE	6	675.0	673.2	0.0	670.9	31	105	15	0	0	TH TO 670.5
113 ST 111 AVE	1	664.2	657.8	0.0	657.1	17	354	22	0	0	TH TO 655.3
95 ST 106 AVE	1	664.2	659.3	0.0	659.0	20	181	11	0	0	TH TO 654.5
95 ST 106 AVE	2	663.9	659.3	0.0	658.4	18	0	11	0	0	TH TO 655.0
95 ST 106 AVE	2	663.8	659.3	0.0	655.0	16	0	68	0	0	TH TO 655.0
80 ST 103 AVE	3	641.3	634.6	632.5	633.4	18	181	0	37	27	
112 ST 130 AVE	9	685.5	681.6	0.0	679.7	16	565	52	0	0	TH TO 677.7

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ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	OU KPA	N	LL (%)	PL (%)	COMMENTS
112 ST 130 AVE	10	685.1	681.2	0.0	677.8	17	0	28	0	0	TH TO 676.1
95 ST 106 AVE	1	664.5	658.0	0.0	656.7	23	0	14	0	0	TH TO 658.7
86 ST 104 AVE	1	664.0	658.5	0.0	657.4	15	0	56	0	0	TH TO 655.2
86 ST 104 AVE	2	664.0	658.5	0.0	658.2	16	239	42	0	0	TH TO 655.2
86 ST 104 AVE	4	664.0	659.1	0.0	658.2	16	134	51	0	0	TH TO 655.2
95 ST 106 AVE	2	664.5	658.8	0.0	659.3	23	86	5	0	0	TH TO 656.3
95 ST 106 AVE	2	664.5	658.9	0.0	656.5	13	0	83	0	0	TH TO 656.3
104 ST 106 AVE	1	662.0	655.0	0.0	654.4	16	0	30	0	0	TH TO 652.2
110 ST 106 AVE	3	662.8	656.0	0.0	654.1	20	0	0	0	0	TH TO 653.0
117 ST 105 AVE	4	665.4	657.4	0.0	656.5	17	0	41	0	0	TH TO 655.3
104 ST 104 AVE	4	665.4	658.7	0.0	656.8	16	0	29	0	0	TH TO 656.4
104 ST 105 AVE	2	662.0	656.3	0.0	652.9	14	0	89	0	0	TH TO 651.6
105 ST 104 AVE	3	665.1	655.3	0.0	653.8	16	0	60	0	0	TH TO 652.3
105 ST 106 AVE	10	662.0	655.0	0.0	653.8	14	0	37	29	15	TH TO 650.3
105 ST 106 AVE	1	662.3	654.4	0.0	653.2	13	0	70	0	0	TH TO 651.6
108 ST 106 AVE	5	674.6	656.2	0.0	665.8	17	185	39	0	0	TH TO 669.0
116 ST 103 AVE	1	662.8	655.3	0.0	654.1	19	210	18	0	0	TH TO 652.1
107 ST 101 AVE	1	641.4	675.6	0.0	675.4	19	130	16	0	0	TH TO 662.9
107 ST 101 AVE	1	681.4	675.6	0.0	667.9	21	110	19	0	0	TH TO 662.8
107 ST 101 AVE	1	681.4	675.6	0.0	663.1	18	0	19	37	18	TH TO 662.9
106 ST 100 AVE	3	680.9	675.4	0.0	670.4	18	120	21	0		
106 ST 100 AVE	1	669.6	663.5	0.0	662.6	18	0	46	0		TH TO 653.9
97 ST 101 AVE	3	679.2	672.1	663.9	669.2	14	240	60	0	0	SSG 663.9 TO 661.0
100 ST 102 AVE	1	666.0	662.3	0.0	661.7	22	85	9	0	0	TH TO 656.0
100 ST 101 AVE	1	665.7	660.8	646.6	650.1	23	181	18	51	16	SSG 646.6 TO 645.2
100 ST 101 AVE	3	666.3	661.1	648.9	653.5	14	0	84	32	14	SSG 648.9 TO 646.0
100 ST 101 AVE	1	666.0	661.4	650.7	654.4	12	354	40	0	0	SSG 658.3 TO 656.9
88 ST 101 AVE	3	665.1	660.2	648.3	649.2	20	229	27	38	13	SSG 648.2 TO 644.8
88 ST 102 AVE	4	665.4	660.5	661.1	652.0	13	574	52	42	17	SSG 651.1 TO 643.9
87 ST 103 AVE	6	665.7	660.8	646.3	648.5	12	430	80	35	16	SSG 648.2 TO 641.1
87 ST 104 AVE	10	664.2	654.7	643.7	649.8	18	0	23	0	0	SSG 643.9 TO 637.5
87 ST 104 AVE	11	666.4	660.5	643.7	645.8	18	0	24	0	0	SSG 643.7 TO 637.3
95 ST 103 AVE	15	665.4	661.4	0.0	646.0	13	0	38	0	0	
87 ST 103 AVE	17	666.3	660.5	0.0	652.3	16	0	46	0	0	TH TO 645.0
100 ST 101 AVE	21	666.9	661.4	0.0	654.7	10	0	60	0	0	TH TO 651.7

101 ST 101 AVE	24	667.8	662.9	652.6	654.4	11	363	70	0	0	SSC 652.5 TO 644.5	####
107 ST 101 AVE	29	669.3	664.2	652.6	655.9	14	0	73	0	0	SSC 652.4 TO 645.3	####
100 ST 101 AVE	31	666.6	660.2	0.0	652.9	12	0	70	0	0		####
98 ST 102 AVE	33	665.7	661.4	648.0	659.3	12	0	64	0	0	SSC 648.0 TO 642.8	####
99 ST 101 AVE	34	665.4	659.9	646.5	650.1	14	0	27	0	0		####
89 ST 102 AVE	35	665.4	661.4	650.1	656.7	14	0	27	0	0	SSC 650.3 TO 642.2	####
73 ST 81 AVE	1	671.9	668.1	0.0	665.9	18	0	22	0	0	TH TO 663.1	####
72 ST 81 AVE	2	671.8	668.5	664.2	667.6	22	89	11	0	0		####
72 ST 81 AVE	2	671.8	668.5	664.2	653.6	24	44	20	0	0		####
71 ST 81 AVE	3	671.3	667.6	663.7	667.0	22	80	12	0	0		####
50 ST 101 AVE	1	666.6	659.9	659.6	659.9	16	258	0	0	0		####
62 ST 105 AVE	5	661.4	656.1	0.0	655.3	33	123	24	0	0	TH TO 652.6	####
63 ST 106 AVE	9	660.7	656.9	0.0	646.5	25	40	12	0	0	TH TO 651.9	####
74 ST 106 AVE	24	656.5	651.2	0.0	650.7	22	103	17	0	0	TH TO 647.7	####
170 ST 125 AVE	1	680.7	674.3	0.0	672.1	13	0	41	0	0	TH TO 672.2	####

ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	QU KPA	N	LL (%)	PL (%)	COMMENTS	
170 ST 125 AVE	2	679.5	674.7	0.0	672.5	18	85	28	32	15	TH TO 659.3	####
170 ST 128 AVE	9	679.7	673.3	0.0	672.5	21	85	21	0	0	TH TO 667.4	####
163 ST 125 AVE	1	680.5	675.9	0.0	674.0	22	0	18	0	0	TH TO 662.4	####
163 ST 125 AVE	2	680.3	675.6	0.0	674.0	23	0	15	0	0	TH TO 662.2	####
163 ST 126 AVE	3	679.6	674.3	0.0	671.6	14	0	42	0	0	TH TO 661.8	####
170 ST 118 AVE	51	681.3	674.6	0.0	674.1	13	0	32	0	0	TH TO 672.5	####
167 ST 120 AVE	1	679.1	672.7	0.0	671.8	16	248	28	33	18	TH TO 670.0	####
167 ST 120 AVE	2	678.4	672.1	0.0	670.6	16	344	26	0	0	TH TO 669.0	####
167 ST 120 AVE	3	679.1	672.7	0.0	671.6	17	277	30	0	0	TH TO 670.1	####
156 ST 118 AVE	1	688.7	680.7	0.0	679.9	20	15	17	0	0	TH TO 676.7	####
156 ST 118 AVE	2	688.7	680.4	0.0	679.7	20	10	20	0	0	TH TO 676.7	####
156 ST 118 AVE	5	688.8	681.8	0.0	680.0	17	13	16	36	18	TH TO 676.8	####
156 ST 116 AVE	6	689.4	682.2	0.0	680.7	17	17	18	0	0	TH TO 677.4	####
158 ST 118 AVE	4	688.3	680.4	0.0	679.0	17	20	16	0	0	TH TO 675.9	####
127 ST 127 AVE	1	688.0	683.6	0.0	682.6	23	0	24	0	0	TH TO 676.5	####
127 ST 127 AVE	3	684.0	681.1	676.7	679.8	17	0	40	0	0		####
137 ST 125 AVE	1	675.5	670.4	0.0	667.0	18	275	28	0	0	TH TO 661.8	####
128 ST 126 AVE	2	673.0	666.1	0.0	666.6	20	268	32	0	0	TH TO 665.0	####
128 ST 126 AVE	1	672.1	666.8	0.0	663.8	18	335	38	0	0	TH TO 663.0	####
128 ST 126 AVE	4	672.7	667.2	0.0	665.4	17	286	43	0	0	TH TO 663.5	####
128 ST 125 AVE	5	672.1	666.6	0.0	663.2	26	153	23	0	0	TH TO 662.8	####
118 ST 125 AVE	1	670.0	666.3	0.0	665.8	20	0	33	0	0	TH TO 665.7	####
121 ST 125 AVE	3	671.6	666.4	0.0	665.8	20	211	14	0	0	TH TO 662.8	####
122 ST 125 AVE	4	671.8	666.9	0.0	665.9	19	172	18	0	0	TH TO 664.3	####
163 ST 125 AVE	16	678.3	674.1	0.0	673.6	21	211	10	0	0	TH TO 672.0	####
163 ST 125 AVE	16	679.3	674.1	0.0	672.1	17	0	33	0	0	TH TO 672.0	####
170 ST 125 AVE	24	680.7	674.6	0.0	673.5	20	0	20	0	0	TH TO 671.8	####
117 ST 118 AVE	1	680.9	675.7	0.0	675.2	25	125	26	0	0	TH TO 672.1	####
117 ST 118 AVE	1	680.8	675.7	0.0	673.7	20	230	28	0	0	TH TO 672.1	####
117 ST 118 AVE	2	680.6	675.5	0.0	675.1	21	115	27	0	0	TH TO 671.8	####
117 ST 118 AVE	3	680.8	675.5	0.0	673.6	21	144	25	0	0	TH TO 670.4	####
117 ST 118 AVE	4	681.1	676.2	0.0	673.8	21	0	21	0	0	TH TO 672.1	####
117 ST 118 AVE	5	680.7	675.4	0.0	673.4	21	278	27	32	22	TH TO 671.9	####
142 ST 104 AVE	1	670.6	665.1	0.0	664.8	26	76	17	0	0	TH TO 660.5	####
142 ST 104 AVE	2	670.8	665.1	0.0	663.9	18	277	25	0	0	TH TO 660.2	####
142 ST 104 AVE	3	670.6	663.8	0.0	663.2	18	220	25	0	0	TH TO 658.9	####
112 ST 130 AVE	9	685.5	681.6	0.0	681.2	16	172	47	0	0	TH TO 677.7	####
112 ST 130 AVE	9	685.5	681.6	0.0	674.1	17	402	53	0	0	TH TO 677.7	####
112 ST 130 AVE	10	685.1	681.2	0.0	680.7	17	0	28	0	0	TH TO 676.1	####
97 ST 127 AVE	1	669.2	665.3	0.0	663.7	17	440	30	0	0	TH TO 662.2	####
97 ST 125 AVE	1	666.5	661.3	0.0	659.7	16	303	35	0	0	TH TO 648.1	####
97 ST 125 AVE	1	666.5	661.3	0.0	651.4	17	380	43	0	0	TH TO 648.1	####
97 ST 128 AVE	5	670.3	665.3	0.0	666.1	30	0	26	0	0	TH TO 666.0	####
112 ST 129 AVE	1	684.0	677.8	0.0	676.7	18	0	40	0	0	TH TO 675.0	####
112 ST 128 AVE	2	684.0	678.7	0.0	676.7	17	0	49	0	0	TH TO 675.0	####
107 ST 123 AVE	1	667.5	661.4	0.0	659.9	15	651	26	0	0	TH TO 658.3	####
107 ST 123 AVE	2	667.8	661.1	0.0	660.5	18	220	34	0	0	TH TO 658.7	####
104 ST 124 AVE	3	680.4	676.6	0.0	678.1	23	72	0	0	0	TH TO 675.6	####
97 ST 125 AVE	3	667.1	661.7	0.0	658.5	15	135	0	0	0	TH TO 658.4	####
97 ST 126 AVE	5	667.1	661.9	0.0	658.6	14	170	0	42	14	TH TO 652.3	####

ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	QU KPA	N	LL (%)	PL (%)	COMMENTS	
97 ST 120 AVE	5	663.9	659.5	0.0	658.2	27	107	0	0	0	TH TO 654.6	####
97 ST 123 AVE	11	666.5	662.8	0.0	662.5	34	92	0	0	0	TH TO 657.2	####
97 ST 123 AVE	11	666.5	662.6	0.0	660.3	18	0	34	0	0	TH TO 657.2	####
107 ST 120 AVE	1	680.1	674.6	0.0	673.0	16	0	29	0	0	TH TO 671.3	####
109 ST 120 AVE	1	666.9	662.0	0.0	660.2	18	0	41	0	0	TH TO 658.4	####
106 ST 118 AVE	1	666.0	661.1	0.0	660.2	22	220	19	0	0	TH TO 656.5	####
106 ST 118 AVE	2	666.0	661.1	0.0	659.8	23	114	15	0	0	TH TO 656.6	####
106 ST 118 AVE	2	666.0	661.1	0.0	657.1	17	536	33	0	0	TH TO 658.5	####
88 ST 117 AVE	1	662.6	657.5	0.0	655.3	17	0	42	0	0	TH TO 653.8	####
89 ST 117 AVE	2	662.9	657.8	0.0	655.8	15	0	30	0	0	TH TO 654.2	####
66 ST 131 AVE	2	663.2	660.5	0.0	658.3	16	220	21	0	0		####
42 ST 131 AVE	1	651.7	648.8	0.0	647.7	14	0	20	0	0		####
42 ST 131 AVE	1	651.7	648.9	0.0	644.7	18	306	0	0	0		####
42 ST 131 AVE	1	651.7	648.8	0.0	634.3	16	191	0	0	0		####
42 ST 131 AVE	1	651.7	648.8	0.0	632.2	16	287	0	0	0		####
42 ST 131 AVE	2	649.2	646.3	0.0	634.8	15	0	24	0	0		####
42 ST 131 AVE	2	649.2	646.3	0.0	635.8	15	268	0	0	0		####
50 ST 128 AVE	2	652.8	647.7	0.0	646.6	15	440	0	0	0		####
50 ST 130 AVE	1	652.6	646.5	645.3	645.8	20	0	17	0	0		####
52 ST 127 AVE	1	668.8	664.0	0.0	662.6	31	86	0	0	0		####
52 ST 126 AVE	2	667.9	664.2	0.0	662.0	35	77	0	0	0		####
53 ST 128 AVE	7	667.0	662.2	0.0	660.7	37	117	0	0	0		####
53 ST 128 AVE	8	667.4	662.2	0.0	661.1	34	124	0	0	0		####
53 ST 128 AVE	9	668.9	663.2	0.0	662.6	35	86	0	0	0		####
66 ST 123 AVE	1	658.6	654.1	0.0	653.6	25	181	16	0	0		####
66 ST 123 AVE	3	658.6	654.7	0.0	654.1	17	134	0	0	0		####
71 ST 116 AVE	1	660.3	651.0	0.0	648.3	15	0	43	0	0		####
72 ST 118 AVE	2	660.0	649.9	0.0	648.0	16	0	42	0	0		####
72 ST 120 AVE	3	659.8	651.7	0.0	649.1	16	330	35	0	0		####
72 ST 121 AVE	4	659.0	651.5	0.0	650.3	17	176	20	0	0		####
73 ST 124 AVE	5	659.5	656.1	0.0	655.1	32	73	13	0	0		####
73 ST 124 AVE	5	659.5	656.1	0.0	652.1	15	116	27	0	0	TH TO 641.1	####
68 ST 126 AVE	6	659.5	653.7	0.0	650.5	16	254	37	0	0		####
68 ST 126 AVE	6	659.5	653.7	0.0	645.9	17	199	38	0	0	TH TO 645.0	####
66 ST 127 AVE	7	658.1	653.2	0.0	644.3	26	0	20	0	0	TH TO 642.7	####
60 ST 129 AVE	8	654.9	643.6	0.0	641.1	16	0	36	0	0	TH TO 640.0	####
66 ST 125 AVE	10	657.7	652.2	0.0	648.9	16	0	25	0	0	TH TO 646.3	####
66 ST 123 AVE	11	658.0	646.7	0.0	645.6	16	0	43	0	0	TH TO 642.6	####
51 ST 118 AVE	1	655.3	646.8	0.0	646.8	20	0	20	0	0		####
35 ST 122 AVE	1	653.1	643.7	0.0	636.3	16	359	28	0	0		####
36 ST 122 AVE	2	653.0	641.1	0.0	639.3	24	0	23	0	0		####
22 ST 128 AVE	1	646.3	638.6	0.0	634.3	16	267	25	0	0	TH TO 623.7	####
22 ST 128 AVE	2	646.3	637.1	0.0	630.2	16	241	24	0	0		####
22 ST 130 AVE	3	644.4	636.4	623.3	628.4	17	363	24	0	0		####
21 ST 133 AVE	4	646.6	643.2	0.0	642.4	17	0	17	0	0	TH TO 624.2	####

21 ST 133 AVE	4	646.6	643.2	0.0	630.2	19	224	20	0	0	TH TO 624.2	
30 ST 126 AVE	1	648.6	645.0	0.0	643.4	17	287	29	0	0	TH TO 614.0	****
30 ST 128 AVE	2	647.7	645.6	0.0	644.0	17	246	24	0	0	TH TO 613.2	****
30 ST 128 AVE	2	647.7	645.6	0.0	635.6	19	0	22	0	0	TH TO 613.2	****
34 ST 125 AVE	1	642.5	637.5	0.0	636.3	22	0	5	0	0		****

ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	QU KPA	N	LL (%)	PL (%)	COMMENTS	
34 ST 125 AVE	1	642.5	637.5	0.0	634.6	14	0	30	0	0		
32 ST 120 AVE	4	653.6	651.9	0.0	650.4	26	262	14	0	0		
118 ST 150 AVE	1	677.9	673.3	0.0	672.7	22	114	16	0	0		****
119 ST 153 AVE	1	679.4	674.8	0.0	674.2	21	191	15	0	0		****
113 ST 152 AVE	1	676.7	673.3	0.0	671.5	20	172	11	0	0		****
113 ST 152 AVE	2	677.3	673.9	0.0	672.1	19	134	17	0	0		****
116 ST 152 AVE	1	678.5	673.9	0.0	673.2	19	181	16	0	0		****
116 ST 152 AVE	2	677.6	673.3	0.0	672.4	21	181	19	0	0		****
121 ST 145 AVE	1	677.9	674.6	0.0	673.6	31	105	11	0	0		****
121 ST 147 AVE	2	678.4	675.7	0.0	674.5	26	0	21	0	0		****
123 ST 147 AVE	3	679.1	675.1	0.0	674.8	17	0	12	0	0		****
123 ST 148 AVE	4	679.1	676.0	0.0	675.1	40	57	8	0	0		****
121 ST 151 AVE	5	679.1	676.0	0.0	674.8	22	0	13	0	0		****
122 ST 150 AVE	6	679.7	676.0	0.0	675.4	23	0	14	0	0		****
123 ST 151 AVE	7	680.6	677.0	0.0	676.4	21	95	15	0	0		****
121 ST 152 AVE	8	680.0	676.7	0.0	675.7	22	0	14	0	0		****
121 ST 143 AVE	1	677.3	672.7	0.0	671.3	19	262	18	0	0		****
121 ST 143 AVE	2	677.0	673.0	0.0	672.3	33	157	10	0	0		****
127 ST 137 AVE	1	677.8	672.1	668.4	670.6	0	0	26	0	0	SSC 668.4 TO 667.6	****
127 ST 153 AVE	14	680.9	676.7	0.0	672.2	0	0	18	0	0		****
118 ST 145 AVE	1	677.3	673.0	0.0	672.4	23	239	13	0	0		****
118 ST 145 AVE	2	677.3	672.7	0.0	672.4	20	229	20	0	0		****
142 ST 137 AVE	1	682.7	678.5	673.6	676.9	19	276	21	0	0		****
142 ST 137 AVE	1	682.7	678.5	673.6	675.3	19	282	34	0	0		****
142 ST 135 AVE	2	681.9	677.0	674.0	676.1	19	225	21	0	0		****
142 ST 134 AVE	3	681.3	676.6	672.7	675.5	23	255	14	0	0		****
142 ST 134 AVE	3	681.3	676.6	672.7	673.9	20	183	16	0	0		****
142 ST 133 AVE	4	681.2	676.3	672.5	676.3	20	201	20	0	0	SSC 672.5 TO 671.9	****
142 ST 133 AVE	4	681.2	676.3	672.5	673.8	19	277	22	0	0		****
149 ST 134 AVE	7	677.7	672.5	0.0	670.3	17	232	15	0	0		****
149 ST 137 AVE	10	678.9	670.4	666.8	668.3	18	0	16	0	0		****
117 ST 137 AVE	1	676.7	673.3	0.0	672.7	22	162	17	0	0		****
117 ST 137 AVE	2	676.7	673.3	0.0	670.3	34	0	22	0	0		****
117 ST 137 AVE	3	676.4	672.4	0.0	669.6	18	162	23	0	0		****
117 ST 137 AVE	4	676.7	672.4	0.0	671.8	22	86	15	0	0		****
117 ST 137 AVE	5	676.7	673.0	0.0	672.1	38	38	0	0	0		****
88 ST 150 AVE	2	678.2	677.0	0.0	676.0	21	143	0	0	0		****
88 ST 150 AVE	3	678.2	677.3	0.0	676.0	13	507	0	0	0		****
88 ST 150 AVE	4	677.3	676.7	0.0	675.1	27	153	0	0	0		****
88 ST 150 AVE	5	676.4	674.5	0.0	674.5	23	210	0	0	0		****
97 ST 153 AVE	2	677.0	674.8	0.0	673.0	27	0	9	0	0		****
97 ST 153 AVE	2	677.0	674.8	0.0	671.8	22	0	22	34	21		****
97 ST 153 AVE	5	676.4	673.6	0.0	670.9	0	0	16	0	0		****
97 ST 153 AVE	7	676.7	673.9	0.0	673.6	22	0	15	0	0		****
113 ST 155 AVE	1	678.5	674.2	0.0	673.0	20	239	27	0	0		****
113 ST 155 AVE	1	678.5	674.2	0.0	671.8	17	0	48	0	0		****
113 ST 155 AVE	2	677.9	673.6	0.0	672.7	18	296	28	0	0		****
113 ST 155 AVE	2	677.9	673.6	0.0	671.2	16	0	44	0	0		****
96 ST 135 AVE	1	672.4	668.4	0.0	665.1	15	0	43	0	0		****
96 ST 135 AVE	2	672.4	668.4	0.0	665.1	16	0	32	0	0		****

ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	QU KPA	N	LL (%)	PL (%)	COMMENTS	
96 ST 135 AVE	3	673.0	669.0	0.0	666.9	17	0	56	0	0		
64 ST 137 AVE	3	667.2	665.1	0.0	663.5	15	191	48	28	18		****
64 ST 137 AVE	5	667.5	663.9	0.0	663.5	19	0	12	0	0		****
74 ST 138 AVE	2	685.7	684.0	0.0	683.5	22	0	11	0	0		****
41 ST 131 AVE	13	642.1	636.6	0.0	634.9	16	332	25	0	0		****
41 ST 131 AVE	13	642.4	636.6	0.0	633.4	16	321	26	0	0		****
41 ST 131 AVE	13	642.4	636.6	0.0	630.9	18	132	18	0	0		****
42 ST 131 AVE	14	643.4	638.3	0.0	637.3	16	226	18	0	0		****
42 ST 131 AVE	14	643.4	638.3	0.0	632.8	17	327	25	0	0		****
44 ST 131 AVE	15	643.9	640.6	0.0	634.9	15	272	24	0	0		****
45 ST 131 AVE	16	648.7	645.6	0.0	636.7	14	335	29	0	0	TH TO 632.7	****
47 ST 132 AVE	17	660.5	646.8	0.0	646.1	21	107	16	0	0	TH TO 634.6	****
50 ST 133 AVE	18	650.7	645.5	0.0	645.1	19	150	0	0	0		****
50 ST 137 AVE	20	652.3	644.1	0.0	640.3	15	429	75	0	0		****
47 ST 137 AVE	21	652.6	642.7	0.0	642.1	20	115	18	0	0		****
53 ST 137 AVE	24	652.3	642.5	0.0	641.5	18	0	34	0	0		****
20 ST 144 AVE	6	647.7	641.9	0.0	641.0	16	0	29	31	16		****
20 ST 144 AVE	6	647.7	641.9	0.0	639.8	16	0	24	0	0		****
20 ST 144 AVE	6	647.7	641.9	0.0	638.3	17	0	20	0	0		****
20 ST 144 AVE	6	647.7	641.9	0.0	637.0	22	0	12	0	0		****
20 ST 144 AVE	6	647.7	641.9	0.0	635.2	14	0	20	0	0		****
20 ST 144 AVE	6	647.7	641.9	0.0	632.5	18	0	22	0	0		****
20 ST 144 AVE	7	648.0	643.1	606.9	-13.1	0	0	0	0	0		****
30 ST 138 AVE	1	649.8	646.5	0.0	646.9	21	201	13	0	0		****
30 ST 138 AVE	1	649.8	646.5	0.0	644.3	20	363	20	0	0		****
30 ST 138 AVE	1	649.8	646.5	0.0	642.8	18	239	33	0	0		****
30 ST 138 AVE	2	649.6	645.6	0.0	644.3	21	373	16	0	0		****
30 ST 138 AVE	2	649.6	645.6	0.0	643.1	19	277	36	0	0		****
112 ST 161 AVE	1	679.1	676.7	0.0	675.1	25	134	13	0	0		****
112 ST 161 AVE	1	679.1	676.7	0.0	673.6	19	0	27	0	0		****
112 ST 161 AVE	1	679.1	676.7	0.0	672.4	16	277	40	0	0		****
112 ST 161 AVE	2	679.1	674.5	0.0	673.6	19	220	19	0	0		****
112 ST 161 AVE	2	679.1	674.5	0.0	672.1	14	335	22	0	0		****
112 ST 161 AVE	2	679.1	674.5	0.0	670.9	14	0	24	0	0		****
112 ST 161 AVE	3	679.1	675.7	0.0	675.1	21	143	17	0	0		****
112 ST 161 AVE	3	679.1	675.7	0.0	672.4	17	0	22	0	0		****
112 ST 161 AVE	3	679.1	675.7	0.0	670.9	16	0	18	0	0		****
115 ST 164 AVE	3	680.3	676.7	0.0	676.0	21	287	0	0	0		****
115 ST 164 AVE	4	680.6	677.0	0.0	676.0	20	239	0	0	0		****
115 ST 164 AVE	7	681.5	677.9	0.0	673.3	19	316	0	0	0		****
115 ST 164 AVE	12	681.6	677.9	0.0	677.3	19	325	0	0	0		****
99 ST 169 AVE	1	679.9	678.1	0.0	677.2	25	131	11	0	0		****
99 ST 169 AVE	1	679.9	678.1	0.0	675.7	23	190	37	0	0		****
99 ST 169 AVE	1	679.9	678.1	0.0	670.7	19	0	25	0	0		****
99 ST 169 AVE	2	679.8	678.1	0.0	676.7	24	0	14	32	17		****
99 ST 169 AVE	2	679.8	678.1	0.0	675.2	19	0	22	34	19		****
99 ST 169 AVE	2	679.8	678.1	0.0	673.7	16	0	28	0	0		****
99 ST 169 AVE	2	679.8	678.1	0.0	672.1	18	0	27	0	0		****
99 ST 169 AVE	2	679.8	678.1	0.0	670.6	16	0	28	0	0		****
108 ST 172 AVE	1	680.2	678.1	0.0	677.7	30	97	14	0	0		****

ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	QU KPA	N	LL (%)	PL (%)	COMMENTS

ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	OU KPA	N	LL (%)	PL (%)	COMMENTS
108 ST 172 AVE	1	680.2	678.1	0.0	675.9	19	204	26	0	0	
108 ST 172 AVE	1	680.2	678.1	0.0	674.3	17	190	23	0	0	
108 ST 172 AVE	1	680.2	678.1	0.0	671.2	17	268	22	0	0	
108 ST 172 AVE	2	679.9	677.5	0.0	676.9	23	115	13	0	0	
108 ST 172 AVE	2	679.9	677.5	0.0	675.6	19	0	23	36	17	
108 ST 172 AVE	7	679.9	677.5	0.0	672.2	16	0	23	0	0	
108 ST 172 AVE	2	679.9	677.5	0.0	671.1	14	0	30	0	0	
75 ST 25 AVE	1	687.3	685.5	0.0	683.1	18	0	29	0	0	TH TO 683.0
75 ST 25 AVE	2	686.7	684.3	0.0	680.0	18	0	16	0	0	TH TO 677.2
66 ST 28 AVE	5	703.4	700.2	698.7	699.4	20	105	28	0	0	
66 ST 25 AVE	14	705.6	703.9	0.0	701.5	20	249	16	0	0	
66 ST 23 AVE	25	704.1	702.1	693.5	699.9	20	201	16	0	0	
66 ST 23 AVE	25	704.1	702.1	693.5	695.3	18	239	19	0	0	
38 ST 22 AVE	7	707.7	706.5	0.0	703.5	17	228	20	0	0	TH TO 697.4
38 ST 22 AVE	7	707.7	706.5	0.0	697.4	17	0	14	0	0	TH TO 697.4
42 ST 21 AVE	10	705.0	704.4	0.0	700.7	17	162	17	0	0	TH TO 695.3
42 ST 21 AVE	10	705.0	704.4	0.0	696.5	18	143	16	0	0	TH TO 695.3
39 ST 18 AVE	28	709.6	706.5	0.0	702.3	18	134	16	0	0	TH TO 696.1
39 ST 18 AVE	28	709.6	706.5	0.0	697.7	17	191	20	0	0	TH TO 696.1
37 ST 17 AVE	37	711.7	710.2	0.0	705.9	18	181	12	0	0	TH TO 701.3
37 ST 17 AVE	37	711.7	710.2	0.0	702.9	17	201	21	0	0	TH TO 701.3
36 ST 17 AVE	41	714.1	713.2	0.0	708.7	17	162	17	0	0	TH TO 703.8
36 ST 17 AVE	41	714.1	713.2	0.0	705.3	17	153	19	0	0	TH TO 703.8
46 ST 22 AVE	3	701.0	698.3	691.3	699.8	20	153	14	0	0	
46 ST 22 AVE	3	701.0	698.3	691.3	692.2	16	57	10	0	0	
49 ST 21 AVE	8	699.2	696.8	689.2	694.9	20	344	19	0	0	
49 ST 21 AVE	8	699.2	696.8	689.2	690.1	22	76	7	0	0	
45 ST 20 AVE	12	701.0	698.9	0.0	697.1	19	201	17	0	0	TH TO 691.5
45 ST 20 AVE	12	701.0	698.9	0.0	691.0	27	0	11	0	0	TH TO 691.5
48 ST 18 AVE	18	702.0	699.2	0.0	696.2	17	220	20	0	0	TH TO 691.6
48 ST 18 AVE	18	702.0	699.2	0.0	691.6	19	0	18	0	0	TH TO 691.6
46 ST 17 AVE	24	704.7	702.0	0.0	698.9	20	134	15	0	0	TH TO 695.2
46 ST 17 AVE	24	704.7	702.0	0.0	695.9	19	153	14	0	0	TH TO 695.2
42 ST 16 AVE	37	706.2	704.7	0.0	702.0	19	172	22	0	0	TH TO 696.1
42 ST 16 AVE	37	706.2	704.7	0.0	695.9	16	0	14	0	0	TH TO 696.1
59 ST 22 AVE	2	662.3	660.5	0.0	658.4	21	220	14	0	0	TH TO 655.4
54 ST 19 AVE	18	666.6	664.5	0.0	662.6	22	114	11	0	0	TH TO 658.0
54 ST 19 AVE	18	666.6	664.5	0.0	658.1	19	0	16	0	0	TH TO 658.0
61 ST 17 AVE	29	663.9	661.7	0.0	659.9	22	134	14	0	0	TH TO 656.8
61 ST 17 AVE	29	663.9	661.7	0.0	656.8	20	0	20	0	0	TH TO 656.8
53 ST 17 AVE	32	668.4	665.4	0.0	669.9	19	0	15	0	0	
66 ST 23 AVE	7	691.9	690.4	0.0	685.2	19	0	23	0	0	TH TO 684.9
70 ST 19 AVE	23	689.5	686.1	0.0	682.8	20	0	20	0	0	TH TO 682.4
75 ST 19 AVE	26	689.5	686.1	0.0	682.4	16	0	20	0	0	TH TO 682.3
66 ST 18 AVE	33	692.2	688.8	685.2	686.7	20	210	27	0	0	TH TO 685.2
75 ST 17 AVE	36	689.2	686.4	0.0	683.7	19	0	25	0	0	TH TO 682.1
76 ST 15 AVE	2	690.4	685.5	0.0	683.4	17	0	20	0	0	TH TO 681.8
73 ST 13 AVE	7	690.4	686.1	0.0	684.9	23	181	10	0	0	TH TO 682.0
76 ST 11 AVE	12	690.1	687.9	0.0	686.1	22	134	12	0	0	TH TO 683.0
66 ST 12 AVE	17	691.6	685.8	0.0	683.4	18	0	14	0	0	TH TO 683.1
71 ST 11 AVE	20	689.8	684.0	0.0	683.1	20	0	9	0	0	TH TO 682.9
75 ST 10 AVE	26	691.3	688.2	0.0	684.3	19	0	23	0	0	TH TO 684.2
66 ST 17 AVE	1	691.0	688.8	684.9	685.8	20	114	21	0	0	
53 ST 16 AVE	8	703.5	701.0	0.0	698.0	18	306	27	0	0	TH TO 697.0
62 ST 14 AVE	15	693.4	689.8	0.0	688.2	19	296	24	0	0	TH TO 686.6

ADDRESS	BORE HOLE	GROUND ELEV	TOP TILL ELEV	BOT TILL ELEV	SAMPLE ELEV	MC (%)	OU KPA	N	LL (%)	PL (%)	COMMENTS
52 ST 13 AVE	26	708.7	702.6	0.0	700.4	15	0	21	0	0	TH TO 700.2
56 ST 11 AVE	30	703.2	688.0	0.0	696.2	17	201	20	0	0	TH TO 695.8
63 ST 12 AVE	33	694.3	687.9	0.0	686.1	20	0	19	0	0	TH TO 686.0
38 ST 10 AVE	52	719.0	716.0	0.0	715.1	18	210	19	0	0	TH TO 709.1
38 ST 10 AVE	52	719.0	716.0	0.0	710.2	18	239	18	0	0	TH TO 709.1
48 ST 13 AVE	4	709.9	703.2	0.0	700.7	19	0	15	0	0	TH TO 699.6
37 ST 13 AVE	14	714.8	713.5	0.0	710.5	18	248	21	0	0	TH TO 704.3
37 ST 13 AVE	14	714.8	713.5	0.0	705.9	16	286	23	0	0	TH TO 704.3
49 ST 11 AVE	24	710.2	706.2	0.0	701.3	18	0	12	0	0	TH TO 699.7
42 ST 12 AVE	28	710.5	707.4	0.0	706.2	20	134	12	0	0	TH TO 700.1
42 ST 12 AVE	28	710.5	707.4	0.0	701.6	19	105	11	0	0	TH TO 700.1
49 ST 10 AVE	45	715.1	705.9	0.0	704.7	19	0	16	0	0	TH TO 704.6
109 ST 25 AVE	1	675.5	670.8	0.0	669.7	20	129	24	0	0	TH TO 669.2
109 ST 25 AVE	2	675.3	670.6	0.0	667.9	17	151	30	0	0	TH TO 664.9
109 ST 25 AVE	2	675.3	670.6	0.0	666.4	15	272	45	0	0	TH TO 664.9
107 ST 14 AVE	3	679.4	674.0	0.0	672.2	19	0	8	0	0	TH TO 671.9
108 ST 13 AVE	4	681.9	676.9	0.0	674.9	18	0	28	0	0	TH TO 674.1
107 ST 12 AVE	6	681.2	678.0	0.0	674.2	18	0	16	0	0	TH TO 673.8
107 ST 12 AVE	6	681.2	678.0	0.0	675.6	34	0	7	0	0	TH TO 673.8
105 ST 23 AVE	1	677.8	674.5	664.1	673.5	28	172	18	0	0	
105 ST 23 AVE	4	677.8	673.2	0.0	670.5	17	182	40	0	0	TH TO 670.2
104 ST 30 AVE	1	675.0	668.6	658.5	664.8	18	177	19	0	0	
104 ST 30 AVE	1	675.0	668.6	658.5	659.7	17	0	32	0	0	
104 ST 29 AVE	2	675.0	669.4	663.7	667.7	23	84	29	0	0	NSV 663.7 TO 648.3
104 ST 29 AVE	2	675.0	669.4	663.7	666.0	15	161	36	0	0	NSV 663.7 TO 648.3
104 ST 28 AVE	3	677.4	671.3	663.6	669.6	19	221	24	0	0	NSV 663.6 TO 647.0
104 ST 28 AVE	3	677.4	671.3	663.6	665.2	16	0	70	0	0	NSV 663.6 TO 647.0
104 ST 27 AVE	4	678.0	672.2	665.5	670.5	19	200	30	0	0	NSV 665.5 TO 645.8
104 ST 27 AVE	4	678.0	672.2	665.5	667.4	15	271	72	0	0	NSV 665.5 TO 645.8
104 ST 26 AVE	5	678.2	671.9	666.3	670.9	20	102	23	0	0	NSV 666.3 TO 646.3
104 ST 26 AVE	5	678.2	671.9	666.3	667.7	21	0	90	0	0	NSV 666.3 TO 646.3
104 ST 24 AVE	6	674.9	671.6	669.0	669.9	17	202	60	0	0	NSV 669.0 TO 651.0
104 ST 23 AVE	7	678.8	675.0	671.9	673.6	27	0	13	0	0	NSV 671.9 TO 669.1
104 ST 23 AVE	7	679.8	675.0	671.9	672.2	17	263	35	0	0	NSV 671.9 TO 669.1
104 ST 23 AVE	8	678.9	673.6	671.6	672.9	21	88	20	0	0	NSV 671.6 TO 669.8
102 ST 23 AVE	9	680.5	677.4	671.4	676.2	22	68	14	0	0	NSV 671.4 TO 647.1
102 ST 23 AVE	9	680.5	677.4	671.4	673.1	20	150	20	0	0	NSV 671.4 TO 647.1
85 ST 24 AVE	5	687.0	683.7	0.0	682.8	21	0	0	0	0	TH TO 682.7
105 ST 22 AVE	3	680.0	671.2	0.0	670.0	17	0	26	0	0	TH TO 669.5
104 ST 21 AVE	10	681.8	681.5	0.0	674.8	15	220	0	0	0	TH TO 674.3
104 ST 21 AVE	10	681.6	681.5	0.0	677.9	17	0	14	0	0	TH TO 674.3
105 ST 18 AVE	18	679.7	675.4	0.0	671.2	17	0	24	0	0	TH TO 670.8
111 ST 14 AVE	1	678.0	671.0	667.6	669.2	17	0	60	0	0	
89 ST 22 AVE	1	689.2	687.0	0.0	686.2	25	220	16	0	0	TH TO 682.0
89 ST 22 AVE	1	689.2	687.0	0.0	682.1	18	0	26	0	0	TH TO 682.0
78 ST 22 AVE	9	688.2	684.6	0.0	682.8	20	229	25	0	0	TH TO 682.4
86 ST 19 AVE	21	687.3	684.0	0.0	681.8	16	246	28	0	0	TH TO 681.5
75 ST 19 AVE	25	688.2	684.9	0.0	683.4	20	220	24	0	0	TH TO 681.8
82 ST 16 AVE	35	688.2	684.3	0.0	682.8	19	95	34	0	0	TH TO 681.2
88 ST 14 AVE	41	686.1	682.8	0.0	680.9	21	0	21	0	0	TH TO 680.7
82 ST 10 AVE	48	688.2	684.6	0.0	682.4	17	0	26	0	0	TH TO 682.2
107 ST 9 AVE	3	683.1	680.0	0.0	674.6	30	164	10	0	0	TH TO 674.2
108 ST 9 AVE	4	683.9	682.1	0.0	679.4	28	122	8	0	0	TH TO 679.0
109 ST 9 AVE	5	684.4	683.1	0.0	679.8	26	126	10	0	0	TH TO 679.5
120 ST 24 AVE	1	673.8	671.4	0.0	669.3	23	114	7	0	0	TH TO 665.9

841	120 ST	24 AVE	1	673.8	671.4	0.0	666.3	25	198	21	0	0	TH TO 665.9	####
842	120 ST	24 AVE	2	674.6	671.4	0.0	670.1	26	67	10	0	0	TH TO 666.7	####
843	120 ST	24 AVE	7	674.6	671.4	0.0	667.1	27	148	16	0	0	TH TO 666.7	####
844	120 ST	29 AVE	1	670.3	662.3	659.3	660.5	18	0	57	0	0		####
845	120 ST	25 AVE	3	673.6	666.9	665.7	666.6	30	0	12	0	0		####
846	118 ST	24 AVE	7	677.3	670.3	0.0	668.7	23	0	22	0	0	TH TO 668.6	####
847	117 ST	28 AVE	9	674.2	667.5	666.3	667.7	21	0	18	0	0		####
848	125 ST	28 AVE	11	669.6	662.9	0.0	661.1	21	0	13	0	0	TH TO 661.0	####
849	124 ST	23 AVE	1	674.9	666.6	665.1	666.3	19	0	23	26	14		####
850	114 ST	22 AVE	1	678.8	673.0	0.0	671.8	13	0	31	0	0	TH TO 666.9	####
851	112 ST	22 AVE	3	679.1	673.6	0.0	672.1	13	0	21	0	0	TH TO 671.8	####
852	114 ST	18 AVE	8	679.4	673.9	0.0	672.4	13	0	31	0	0	TH TO 672.2	####
853	119 ST	19 AVE	1	678.8	674.8	666.9	670.3	20	0	21	60	21		####

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