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ONAKAWANA DEVELOPMENT LIMITED

ONAKAWANA LIGNITE PROJECT

Report on the Geology of the Onakawana Lignite Deposit, 1980

Prepared by
Techman Ltd. - Manalta Coal Ltd.

ONAKAWANA LIGNITE DEPOSIT

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ONAKAWANA CROSS-SECTIONS

DRAWING N^O	Cross-Section	Latitude	Vertical Scale	Horizontal Scale
BR-370-15-01-00	AA'	5,608,095 N	1: 500	1:5,000
BR-370-15-02-00	BB'	5,607,500 N		
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BR-370-15-08-00	HH'	5,605,765 N		
BR-370-15-09-00	II'	5,605,470 N		
BR-370-15-10-00	JJ'	5,605,190 N		
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BR-370-15-12-00	LL'	5,604,565 N		
BR-370-15-13-00	MM'	5,604,185 N		
BR-370-15-14-00	NN'	5,603,880 N		
BR-370-15-15-00	OO'	5,603,565 N		
BR-370-15-16-00	PP'	5,603,240 N		
BR-370-15-17-00	QQ'	5,603,015 N		
BR-370-15-18-00	RR'	5,602,730 N		
BR-370-15-19-00	SS'	5,602,300 N		
BR-370-15-20-00	TT'	5,602,000 N		
BR-370-15-21-00	UU'	5,601,700 N		
BR-370-15-22-00	XX'	NORTH-SOUTH	1: 500	1:5,000

1.0 INTRODUCTION

1.1 General

Onakawana Development Limited of Toronto, Ontario, contracted Techman Ltd. and Manalta Coal Limited of Calgary, Alberta, to complete a detail study of the geology and to calcualte lignite reserve estimates for the Onakawana Lignite deposit in Northern Ontario. Work was undertaken during the period May to August 1980.

1.2 Location and Access

The Onakawana lignite deposit is located 200 kilometres north of Cochrane, Ontario and 96 kilometres south of Moosonee (see Figures 1.0.1 and 1.0.2). The area is crossed by latitude 50° 37'N and longitude 81° 25'W.

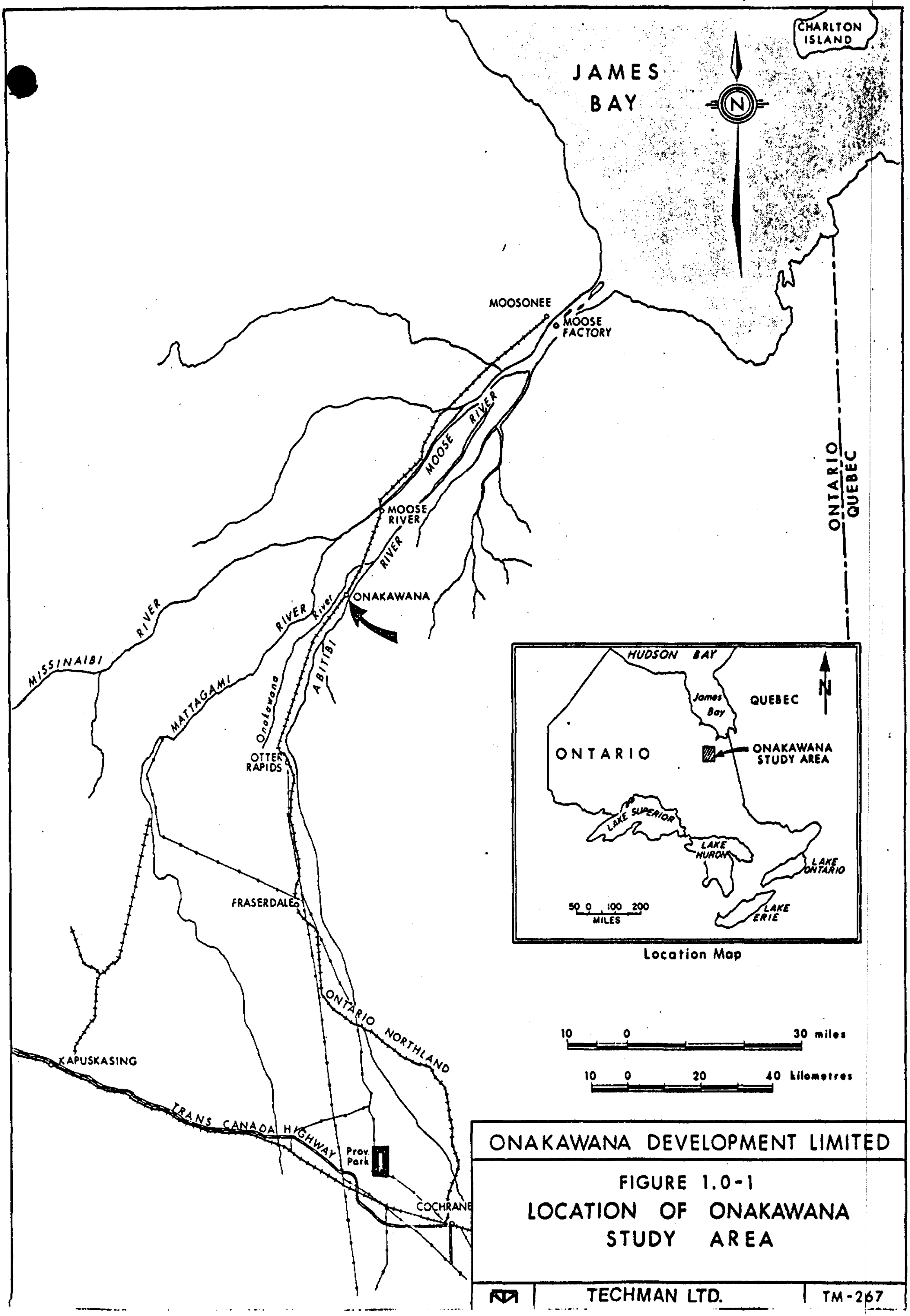
Access can be gained by helicopter from Timmins or via a branch of the Ontario Northland Railway from Cochrane to Moosonee which crosses the eastern part of the lignite field.

1.3 History

The lignite deposit was first reported in 1672 by English settlers at Moosonee and was used as fuel in blacksmith operations.

The first geological investigation was by Isbister in 1855. Later field work was conducted by R. Bell (1877), W. A. Parks (1889), E. B. Borrow (1880 & 1891), J. M. Bell (1904). Baker (1911) and Keele (1920). References to their reports are listed in the ODM reports of Dyer (1930), Dyer and Crozier (1933) and Dyer and Gerrie (1952).

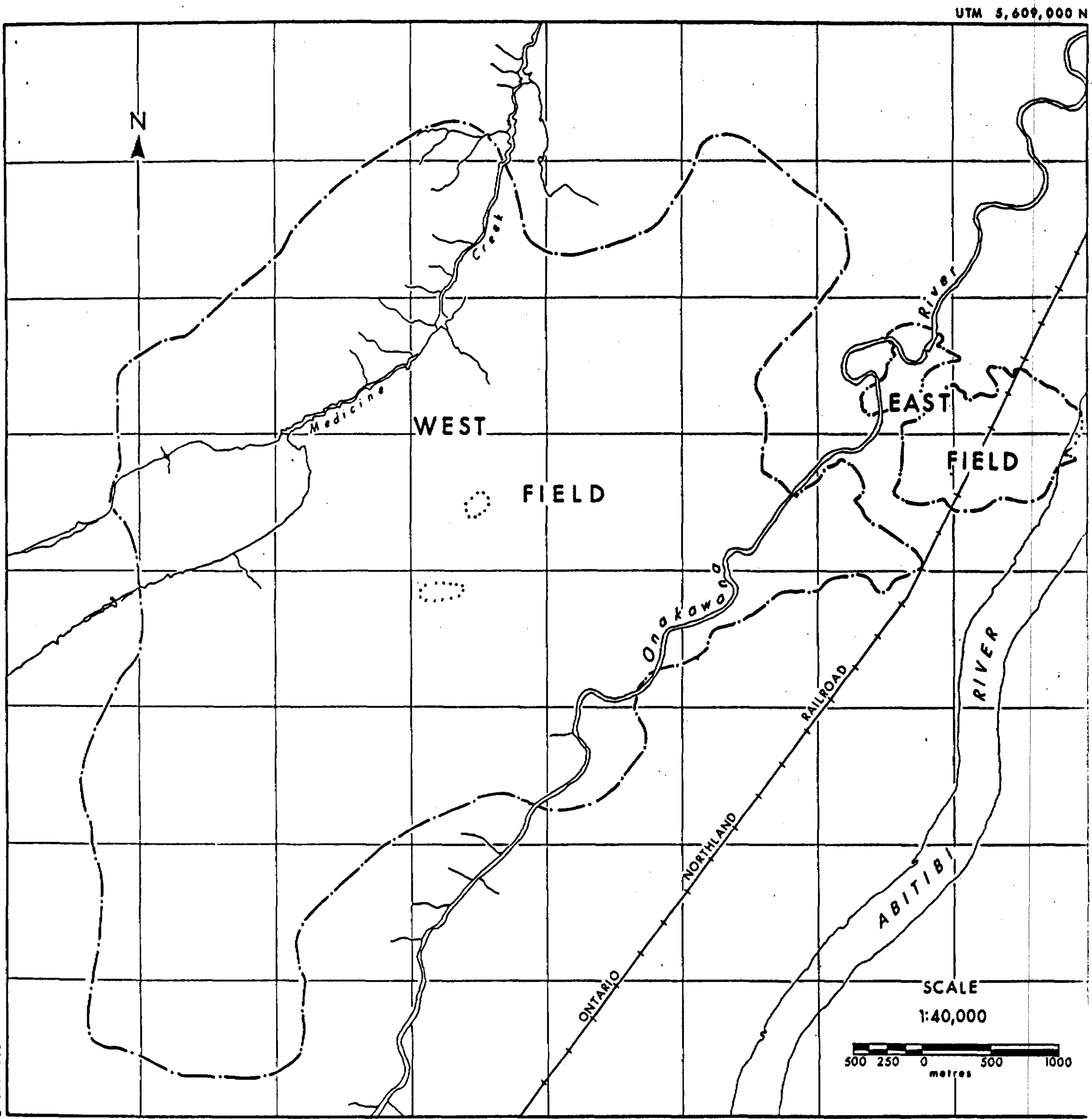
The area underlain by the deposit was withdrawn from staking by the Ontario Government in 1926 and a detailed study by the Ontario Department of Mines was initiated to evaluate the economic potential of the lignite and fire clays. During the years 1929 to 1933, 116 drillholes



ONAKAWANA DEVELOPMENT LIMITED

FIGURE 1.0-1
LOCATION OF ONAKAWANA STUDY AREA

TECHMAN LTD. | TM-267



ONAKAWANA STUDY AREA

FIGURE 1.0-2

and two shafts were completed. A report was published in 1933 summarizing the geology, coal quality, mining and utilization studies. A report completed by the Ontario Research Foundation also published in 1933, recommended that no immediate commercial development be undertaken at that time.

The property lay dormant until 1939 when the Timiskaming and Northern Ontario Railway undertook a drilling program adjacent to the railroad. This area was extensively drilled and a bulk sample was extracted to evaluate the quantity and quality of the lignite reserves as potential fuel for locomotive power generation.

The Alberta Coal Company (now Manalta Coal Ltd) conducted a short drilling program during 1968 to further delineate the lignite field. Additional drilling, was done by Manalta Coal Ltd. in 1972 and 1980, under a contract for Onakawana Development Ltd. (a subsidiary of Manalta Coal Ltd).

In 1977, Golder Associates drilled a series of holes as part of a geotechnical investigation of the Onakawana lease area.(ref.) Excepting for holes which were deep enough to penetrate lignite, this series of holes provides little useful geological information of the lignite deposit.

TABLE 1

SUMMARY OF DRILLING

Drilling Program	Drillhole Prefex	# of Holes	# of Holes with Surveyed Coor.	Geophysical Logs	Total Metres
1929-33	DH,C	116	?	--	5781
1939-43	B	182	?	--	5720
1967-68	68	55	7	--	2223
1972	P,ON,EA,H,HC	78	9	--	3616
1977	G	27	0	27	832
1980	ODL	29	29	29	1309
TOTAL		487	45	56	18881

Of the 487 Onakawana drillholes, 451 fall within the 64 km^2 area covered by the 1:10,000 scale topographic base map prepared by T.E. Rody Company Ltd. Approximately 60% of these holes are clustered in an area of the map representing 7 1/2 km^2 and are too closely spaced to be adequately analysed on a scale of 1:10,000. The 36 drillholes which do not appear on the 1:10,000 scale map are listed below with an explanation for their omission.

TABLE 2

DRILLHOLE DELETIONS

OFF LEASE AREA

EA1-72	P29-72	DH-3
P1 -72	P30-72	DH-14
P3 -72	P31-72	DH-15
P4 -72	DH-94	
P5 -72	DH-95	
P6 -72		

Sub-total 14

WITHIN LEASE AREA BUT OUTSIDE 1:10,000 MAP COVERAGE

P7 -72	P17-72
P8 -72	P25-72
P9 -72	P27-72
P10-72	P28-72
P11-72	H15-72
P12-72	H16-72
P13-72	
P14-72	
P16-72	

Sub-total 15

HOLE ABANDONED

G202
G307
G411

Sub-total 3

LOCATION UNKNOWN

DH78
DH79
DH80
DH81

Sub-total 4

GRAND TOTAL 36

2.0 DETAILED TECHNICAL DATA AND INTERPRETATION

2.1 Purpose

Although a number of reports assessing the geology of the Onakawana lignite deposit have been prepared since 1930, concern has been expressed regarding the reliability of the data from some of the drilling programs and there has been some disagreement on seam correlations between reports.

The scope of this report entails:

1) The establishment of confidence limits for drillhole information and the elimination of unreliable data.

2) A review of the lignite seam correlation.

3) The preparation of a complete set of geological contour maps (at a scale of 1:10,000) for seam isopach and structure, bedrock surface, overburden, interburden, and parting isopach maps.

4) The preparation of a series of east-west cross-sections through the property at 300 metre intervals drawn at a vertical scale of 1:500 and a horizontal scale of 1:5000 (10:1 vertical exaggeration).

5) The preparation of a "mini report" to summarize the methodology, and geologic assessment as well as a brief interpretation of the possible environments of deposition during the period of peat accumulation.

2.1.1 Methodology

The project, initiated in the later part of May, involved a complete review of previous geologic data and reports including a search for drillhole survey coordinates and the assessment of the reliability of the hole descriptions.

Basemaps were prepared at 1:5,000 and 1:10,000 scales on topographic maps supplied by Onakawana Development Ltd. Drillholes were plotted according to a code, based on apparent reliability of location information. Holes lacking coordinates were omitted (see Table 2).

A preliminary set of east-west cross-sections were drawn at 300 metre intervals to establish a consistent seam correlation. Holes not falling on the lines were projected to the nearest line. Three additional cross-sections following SW-NE trends were also drawn using only geophysical logs from the 1980 drill program. A revised seam correlation was based extensively on the geophysical log profiles.

Contour maps were prepared at a 1:10,000 scale based on the revised lignite seam correlations from the preliminary cross-sections. Contour maps for the Eastern area were originally drawn at 1:5,000 scale because of the high density of drillhole in this area, and were then reduced to a 1:10,000 scale.

A revised set of east-west cross-sections at 300 metre intervals were then drawn using the information from the contour maps. The sections were drawn in an east-west direction to aid in mine planning since mining operations are planned to be directed from east to west with the highwall running at right angles to the sections. The revised sections show only the drillholes that lie along the line or were close enough to the line that the information would conform with the geometry of that line. One north-south trending cross-section (XX') was constructed to verify the seam correlations expressed in the east-west sections. Because of intrinsic errors in map contours caused by interpolating values between data points, a priority list was established for confidence of map contours. From the correlation established from geophysical logs (1980 drilling) it was found that the best marker horizon in the Cretaceous stratigraphy was the base of the lower seam. This marker was also the most common value throughout the deposit because of local erosion of stratigraphically higher marker zones. Therefore, it was decided that this contour had the highest confidence limit. The thickness isopach of the lower seam had the next highest confidence limit followed by the top structure of the lower seam, bottom structure of the upper seam, net thickness of upper seam, thickness isopach of interburden between the upper and lower seams, and finally the top structure of the upper seam. The cross-sections were thus constructed by plotting contour information with the highest confidence limits working down in sequence until the lowest confidence limits. If during this procedure an error was found, the contour map with the least confidence limit was adjusted to conform with information from maps of higher confidence limits. By using this procedure it was possible to construct cross-sections and contour maps that best represent the actual geometry of the lignite deposit.

2.1.2 Data Confidence Limits

Confidence limits for drillholes were formed on the basis of reliability of hole coordinates (highest confidence for surveyed locations), the use of geophysical logging, and the presence of a geologist's or drillers logs of the hole. Since the confidence limits are based on qualitative rather than quantitative analyses, no numerical values are expressed.

The 1980 series of drilling was assessed the highest level of confidence because the holes had surveyed coordinates and geophysical logs.

Some of the 1968 and 1972 holes were surveyed but were rated below the 1980 drilling because geophysical logs were not run in the holes. The holes completed during 1929-33 and 1939-43 are rated with a high degree of confidence. Although it could not be determined if the collar locations were surveyed and no geophysical logs were run, the detail reports would indicate that extensive work was carried out during these programs. A lower confidence limit was placed on the remaining unsurveyed 1968, 1972, holes since hole coordinates seem to vary from one map to another and no geophysical logs were run.

The following chart summarizes the level of confidence placed on the available drill data (the lower the "position" the higher the confidence level):

Position #	Criteria
1	1980 drillholes with surveyed coordinates and geophysical logs.

2	1968 and 1972 drillholes with surveyed coordinates; no geophysical logs
3	1929-33 and 1939-43 collar coordinates may or many not be surveyed; no geophysical logs.
4	1968, 1972, 1977 drillholes with no surveyed coordinates; no geophysical logs for 1968 and 1972 holes; logs for 1977 holes were run in till
5	Holes with uncertain collar locations and hence not shown on accompanying maps.

2.2 Geology

2.2.1 General Geology

The Onakawana lignite deposit lies within the Moose River Basin and is underlain by Precambrian gneisses and Devonian sedimentary rocks. The lignite occurs in Cretaceous strata which is overlain by Pleistocene sediments (see Table 3). Surface exposures of Cretaceous strata are rare and, most of the geological information has been gained through drilling.

The Precambrian syenitic and granitic gneisses are unconformably overlain Devonian strata comprising of clastic sediments of the Sextant Formation, limestones, dolomites, and gypsums of the Williams Island Formation and clays and shales of the Long Rapids Formation.

Jurassic sands and clays, found locally overlying the Devonian strata, have not been identified within the Onakawana lease area.

The Cretaceous Mattigami Formation unconformably overlies the Devonian and Jurassic strata and is comprised of poorly indurated clay and sand layers along with the seams of lignite.

TABLE 3

TABLE OF FORMATIONS

Era	Period	FORMATION	LITHOLOGY
CENOZOIC	Quaternary		Post glacial: peat, calcareous lacustrine and marine clay and shell-bearing sand
			Glacial and interglacial: calcareous till, peat, largely calcareous Lacustrine and marine clay and shell-bearing sand
MESOZOIC	Cretaceous	MATTIGAMI FORMATION	Clay, in part carbonaceous and laminated, in part variegated "fire clay"; sandstone, non-indurated, quartzose, coarse "silica sand", lignite
	Jurassic	Jurassic beds	Sand, non-indurated, quartzose, fine, well-rounded; grey-green, calcareous in part
PALEOZOIC	Upper Devonian	LONG RAPIDS FORMATION	Clay, poorly indurated, non-calcareous; inter-bedded pale green, soft, and harder, dark grey shale
	Middle Devonian	WILLIAMS ISLAND and older FORMATIONS	Limestone, partly fossiliferous, and dolomite with with some gypsum and red beds
	[illegible]	SEXTANT FORMATION	Coarse clastic rocks, red beds, arkose, plant

Recent peat deposits with an average thickness of 1 metre cover marine clay and glacial till except in areas adjacent to major rivers where drainage conditons improve and trees are present.

2.2.2 Detailed Geology

The lignite deposit, covering an area of approximately 2430 hectares, is divided into an upper and lower seam. Localized rider seams are also associated with the major divisions. The seams dip gently (less than 1 degree) to the west although local high and low areas within the deposit cause the seam to undulate.

The lower seam, comprised of two units, is generally continuous throughout the area. The lower unit is more continuous than the upper unit and tends to shale out in the western areas. The two units are locally separated by clay partings which attain a maximum recorded thickness of 5.7 metres.

The lower seam appears to be unaffected by glacial erosion except in the subcrop area, along a north south trending section bounded by UTM coordinates E466,500 and E467,000 (see map E12) and in a north-south trending zone between UTM coordinates E467,000E and E470,000 [the area, about 200 metres wide, divides in the north to two depressions leaving a small island of coal (see map E12)]. Glacial erosion and/or pre-glacial channelling may have resulted in the removal of the lignite in these areas. Holes 80-16 and 80-17 failed to intersect coal and a geological interpretation has defined the extent of this feature.

Lignite thickness of the lower seam varies throughout the field and reaches a maximum recorded thickness of 19.5 metres in the south central part of the field. The variations may be attributed to topographic highs and lows during peat accumulation and to the effect of glacial erosion.

Strata separating the lower and upper seams includes clay and and silica sand. The presence of sand is quite variable and apparently has no relationship to the thickening or thinning of the two seams. The lateral extent of the sand is unknown due to the extensive glacial erosion and low density drilling in areas where it occurs.

The upper seam, which has been subject to more intense glacial erosion, covers a smaller area than the lower seam. The largest area of upper seam lies within UTM coordinates E463,700 and E466,000 and 5,601,500 and N5,607,000. A remmant of upper seam, also occurs between N5,605,200 and N5,604,300 and E466,700 and E467,800 and is a structural depression.

The upper seam exhibits variable thickness, ~~(up to 12.4 meters)~~ attaining a maximum thickness of 12.4 metres, and commonly contains a number of clay partings.

The overburden consists of Cretaceous clay and sand along with Quaternary boulder clay, gravel, sand, clay, and peat. The variability of lithologies make correlation between drillholes difficult and impracticable. The total overburden varies over the deposit and attains it's greatest thickness in the western areas where over 50 metres has been encountered.

Correlations of lithologic units are, in some cases, difficult due to typing errors and faulty drilling practices which may, in some instances, result in gravels and boulder clays being shown between and/or below the lignite deposits.

2.2.3 Tectonic Considerations

Previous data and reports have indicated that the lignite has been affected by pressures caused by the movement of thick ice sheets during the Pleistocene. Evidence for this conclusion are:

1) During the construction of the "W" shaft, thin to thick (up to 8 cm) bands of clay and gravel were found in the lignite and run generally perpendicular or oblique to the layering in the lignite. Dyer & Crozier (1933) speculated that the weight of the glacier(s) forced the overlying material into the natural fracture pattern of the lignite.

2) The driller's and geologist's descriptions have reported the presence of gravel and boulder layers within and below the lignite, thus indicating possible movement and dislocation of lignite from the main body of the deposit.

3) The relative softness of the Cretaceous "bedrock" material would not display much resistance to an oblique force (the force would be generally from the north as the ice sheets passed over the deposit).

The above phenomena can be attributed to the glacial affects. However, some features are caused by at least two unrelated factors.

1) Errors were found in the transcribing of the original hole descriptions. For example, Hole 68-25 shows a typed description as "grey clay and boulders" lying below the lignite seam. This would indicate that till occurs below the lignite and suggests that the lignite is disturbed and separated from the main lignite body. The original driller's log, however, does not describe any boulders in the clay material below the seam.

2) Other instances occur where boulders or gravel have been described in or below the lignite seams. This can be caused in some cases by post Cretaceous rocks being dislodged up hole and falling down below the bit where it is redrilled as "in place" gravel or rock material. Similarily during coring operations, where the rocks and core barrel are removed from the hole each time the core tube is filled, material may fall down the hole. In soft and fractured coal, low water pressures are required during coring. These low pressures are insufficient to wash out dislodged up hole rocks. Consequently, these rocks may end up at the bottom of the hole. Furthermore, the soft coal can and does slip out of the core tube and remains in the hole with the dislodged rock material. The next run would then core through the previously cored coal, and gravel and into uncored material. The resulting core description would show a gravel within the seam. Complete geophysical logs of each hole would provide a check against the driller's or geologist's descriptions.

The previous discussion would indicate that some phenomena can be attributed to either glacial disturbance or observation errors. Bands within the lignite as described in the W shaft cannot be explained as observation errors. A certain degree of glacial "bulldozing" and related features must have occured but are difficult to assess through drilling. Careful high density (closely spaced holes) drilling may aid in predicting areas where some disturbance has occured.

2.2.4 Environment of Deposition

The lignite deposit occurs in a structural basin underlain by, Devonian strata and Precambrian gneisses.

The drainage direction, as determined in an area to the south west of the property indicates a paleocurrent direction trending to the north (L.L. Price, 1978).

The depositional environment as suggested from a study of plant fossils by Bell in 1928, and supported by Hopkins and Sweet (1976) suggest a conifer swamp environment characterized by periodic flooding. Transportation of peat material was minimal. The lithologies indicate the existence of meandering streams, ephemeral lakes, swamps and bogs, possibly in an upper deltaic environment. The lignite of the upper and lower seams is comprised distinct layers of woody (tree trunks and roots), earthly (crumbles in hand), and peaty (small stems of woody lignite) material in varying proportions. The relative abundance of megaspores varies within the different seams and may represent one criteria for seam correlation within the field. The silica sands may represent infilling by meandering streams crossing the depositional area.

2.3 Lignite Reserve Estimates

TABLE 4 contains a summary of the estimated in situ reserves contained in the lignite field.

The thickness isopach maps for each seam were planimetered and volumes and tonnes for each contour interval calculated. Reserve calculations were based on previous work by Golder and Associates (1977) which showed the lignite to have a weight of 75 lb/ft.^{3}. To convert cubic metres to metric tonnes, the volume (m^3) was multiplied by 1.199. The in situ reserve estimates are a summation of the calculated data.

TABLE 4

Area	Seam Division	Estimated Reserves (metric tonnes)
East Field	Upper Seam	Not present
	Lower Seam	6,222,164
West Field	Upper Seam	30,498,212
	Lower Seam	145,541,986
TOTAL		182,262,362

CONCLUSIONS AND RECOMMENDATIONS

The lignite deposit at Onakawana has been subdivided into an upper seam which is present in the western part of the property and a lower seam which is generally continuous throughout.

Glaciation has effectively removed the lateral extensions of the lignite deposits in all directions causing the Onakawana field to be completely surrounded by thick deposits of Quaternary material. The upper seam has been removed over larger areas than the lower seam.

Future drilling should be conducted in the central and western areas to better define the subcrops, coal thicknesses, effects of glacial erosion and to confirm the proposed seam correlation. A complete set of geophysical logs should be run for all drillholes in future drill programs. In addition to drilling, palynostratigraphic (pollen and spore) analyses may also help to confirm the present seam correlations.

The additional drilling should be completed three-five years prior to the commencing of the mining operation in each area. A drill program should be undertaken in the following locations:

1) the northwest area of the East Field where there is some question as to the continuity of the seam;
2) adjacent to holes 80-16 and 80-17 to confirm the geological interpretation and
3) in areas where the lignite appears abnormally thick to prove or disprove past drill data.

The drillhole spacing should be related to 1) quality of previous drilling, 2) previous drillhole spacing, 3) the correlation between future drill-hole data and the cross-sections that accompany this report (if data agrees with sections, no additional drilling is required).

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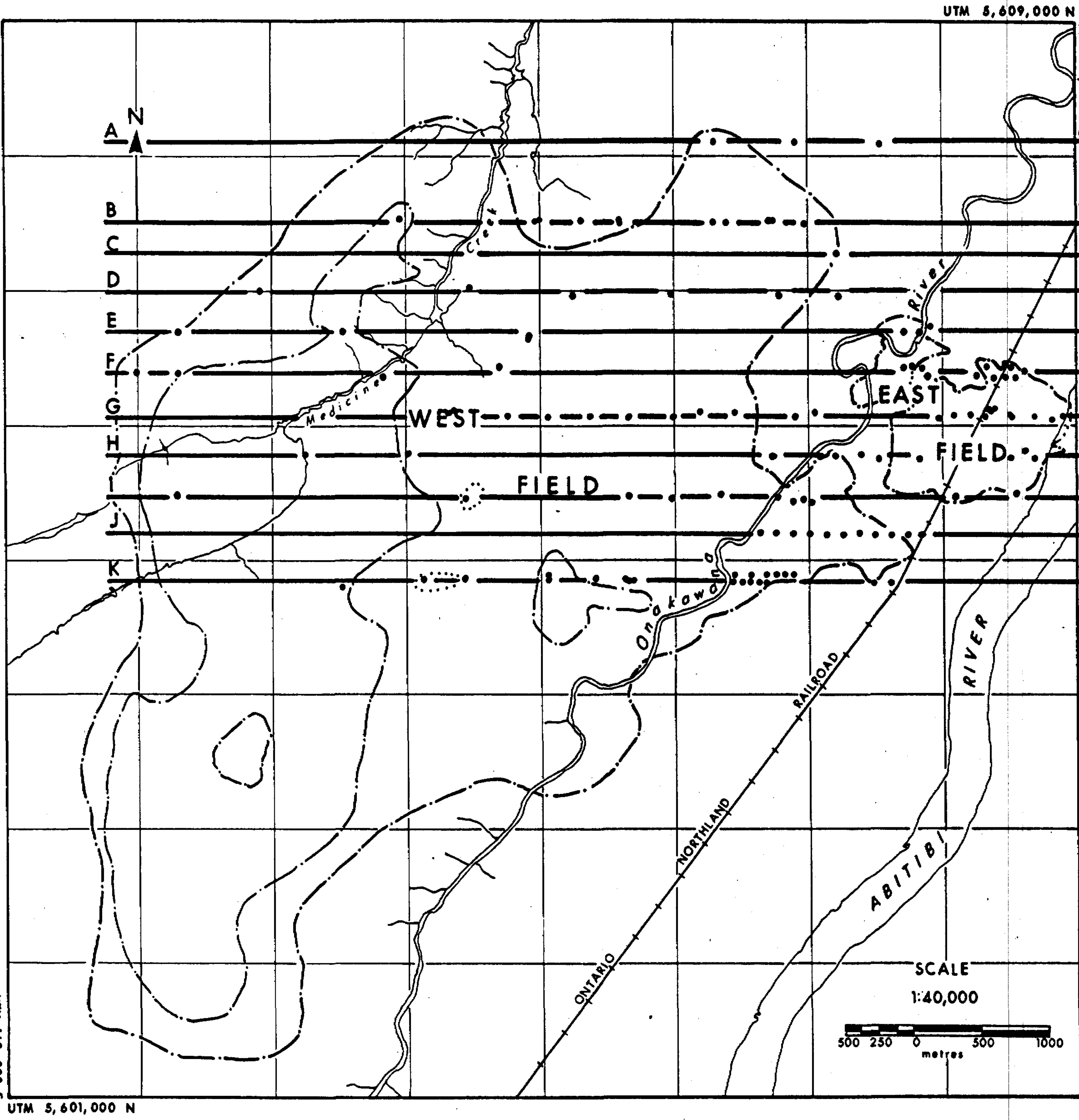

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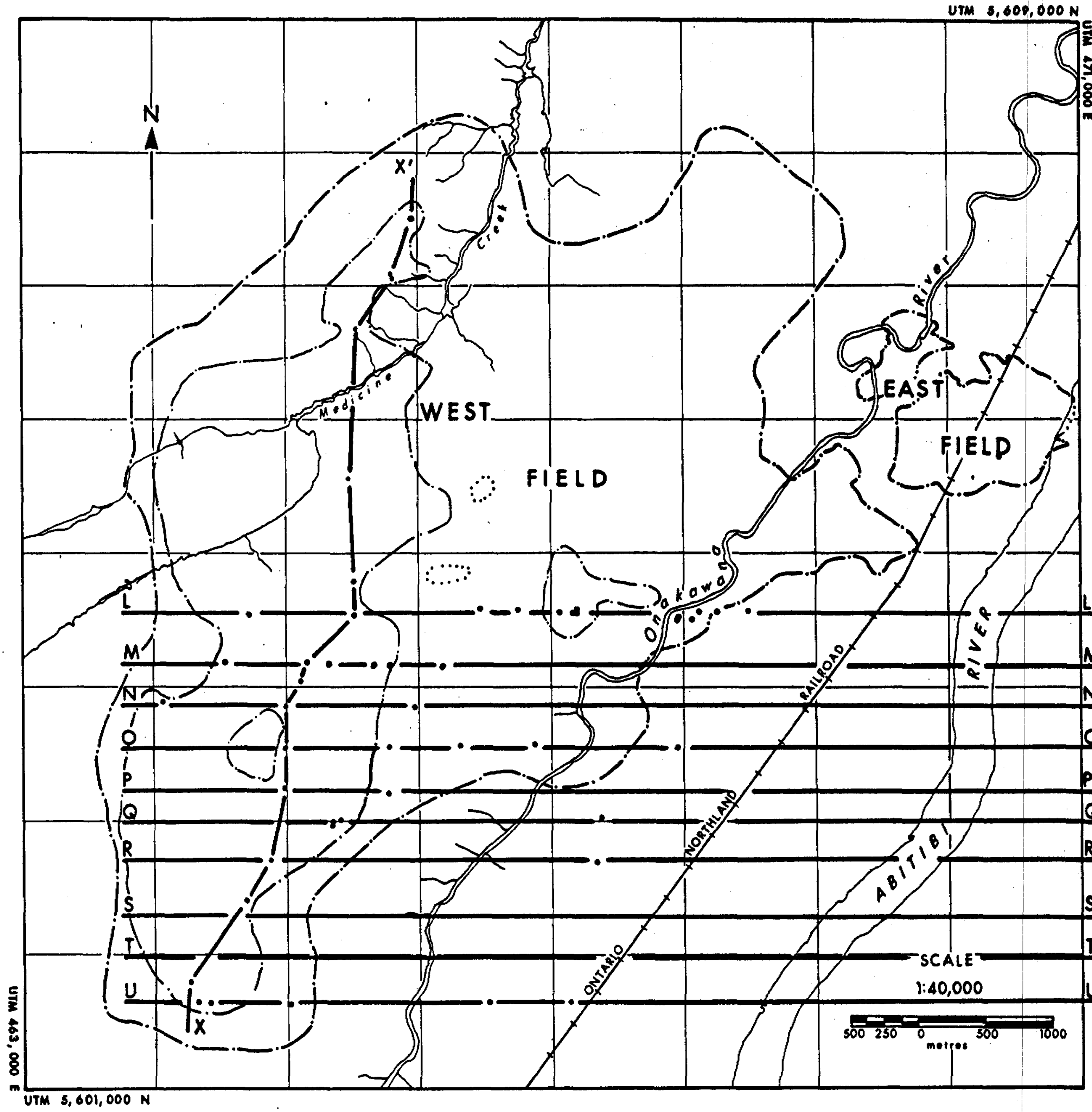

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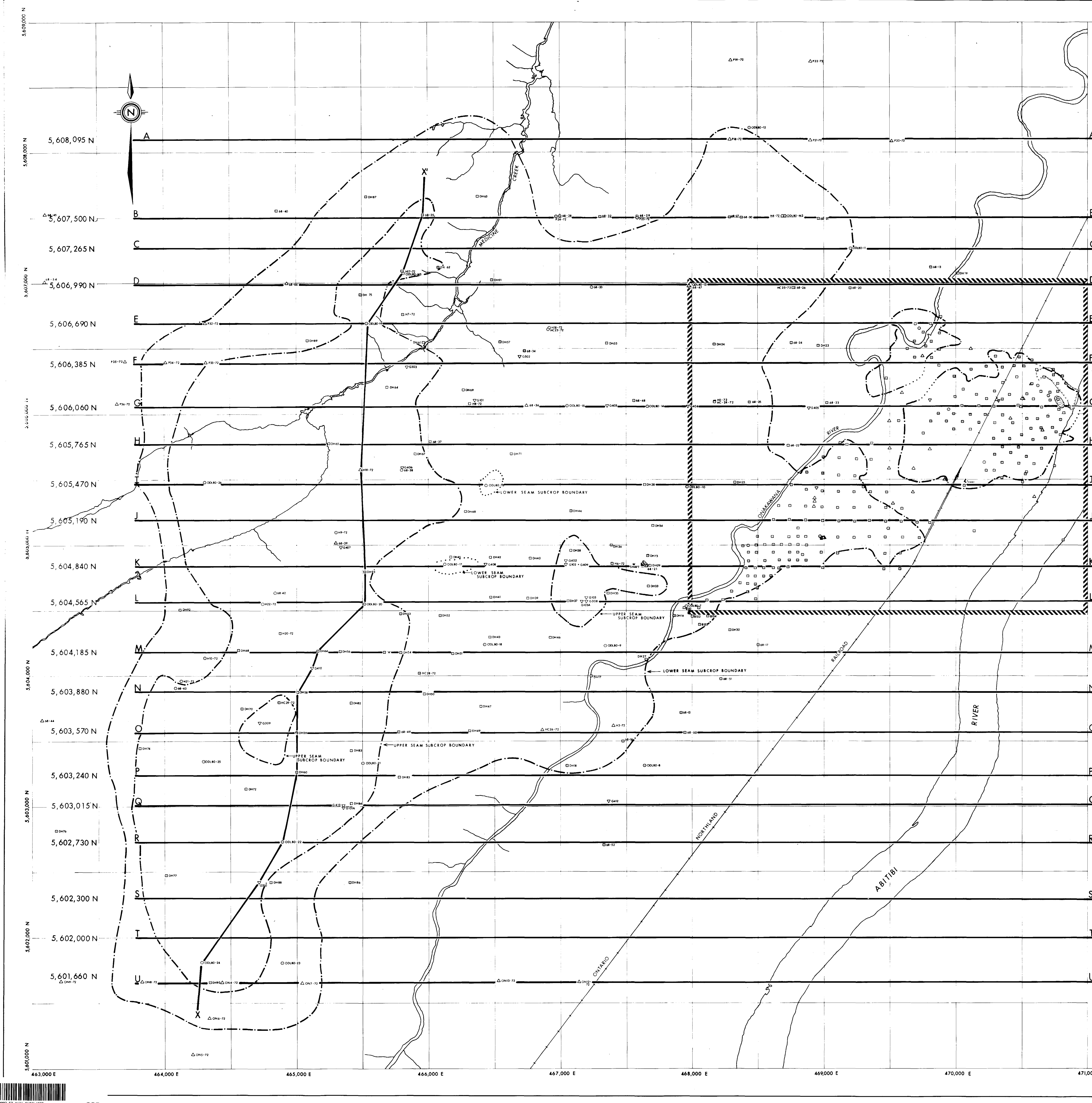
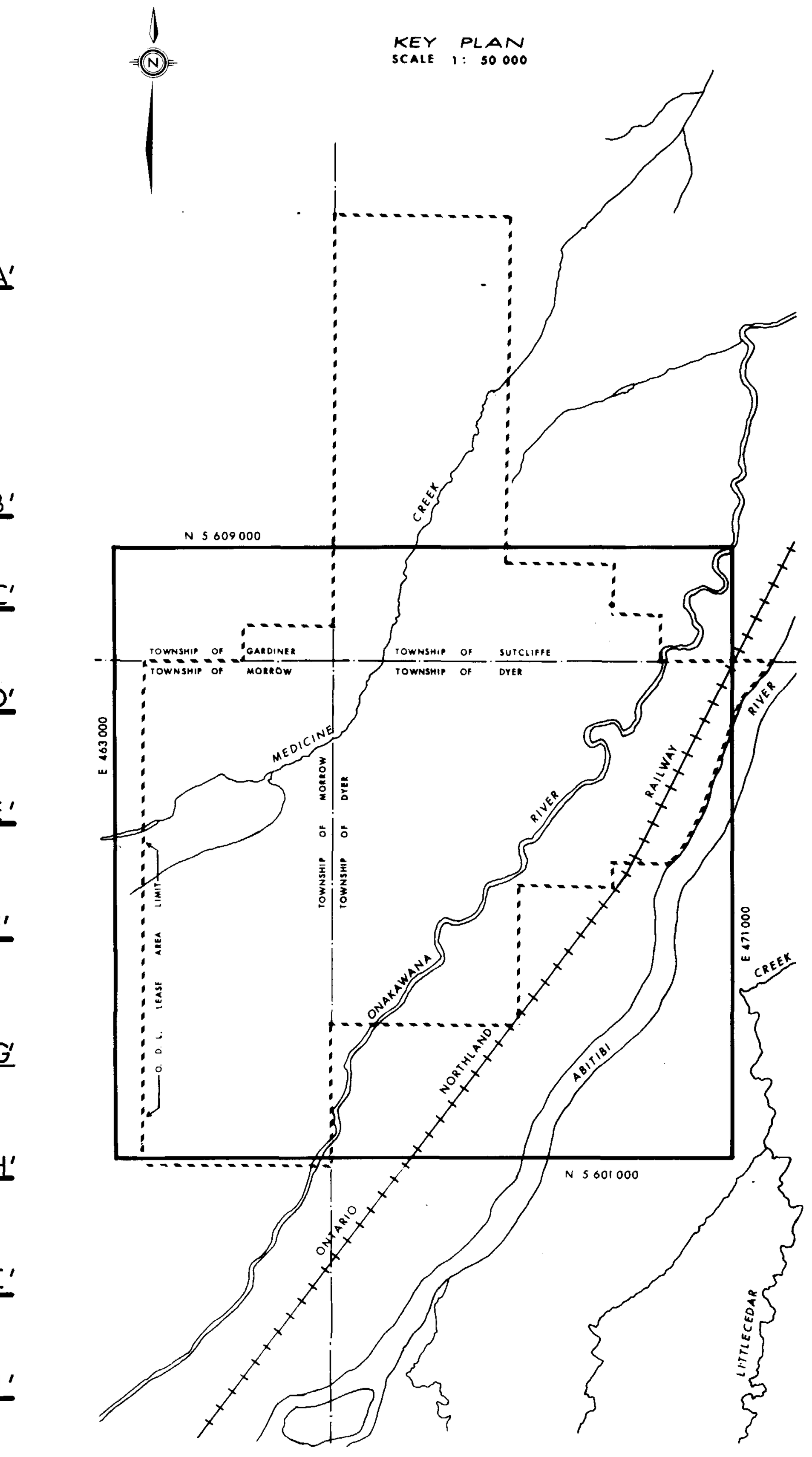




LEGEND

Test pit

Tailings pile

Abandoned shaft

Limit of area covered on detail sheet

Drillhole symbols

⊙ Drillhole location known to have been surveyed or presurveyed

□ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation

△ Drillhole co-ordinates appear to be approximate (± 15m)

▽ Drillhole co-ordinates known to be approximate (±15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available Information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole, partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA,P,ON,& H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80 -	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Lignitic coal subcrop boundary (inferred, assumed)

1:10,000

METRES

500 400 300 200 100 0 250 500

63.4121

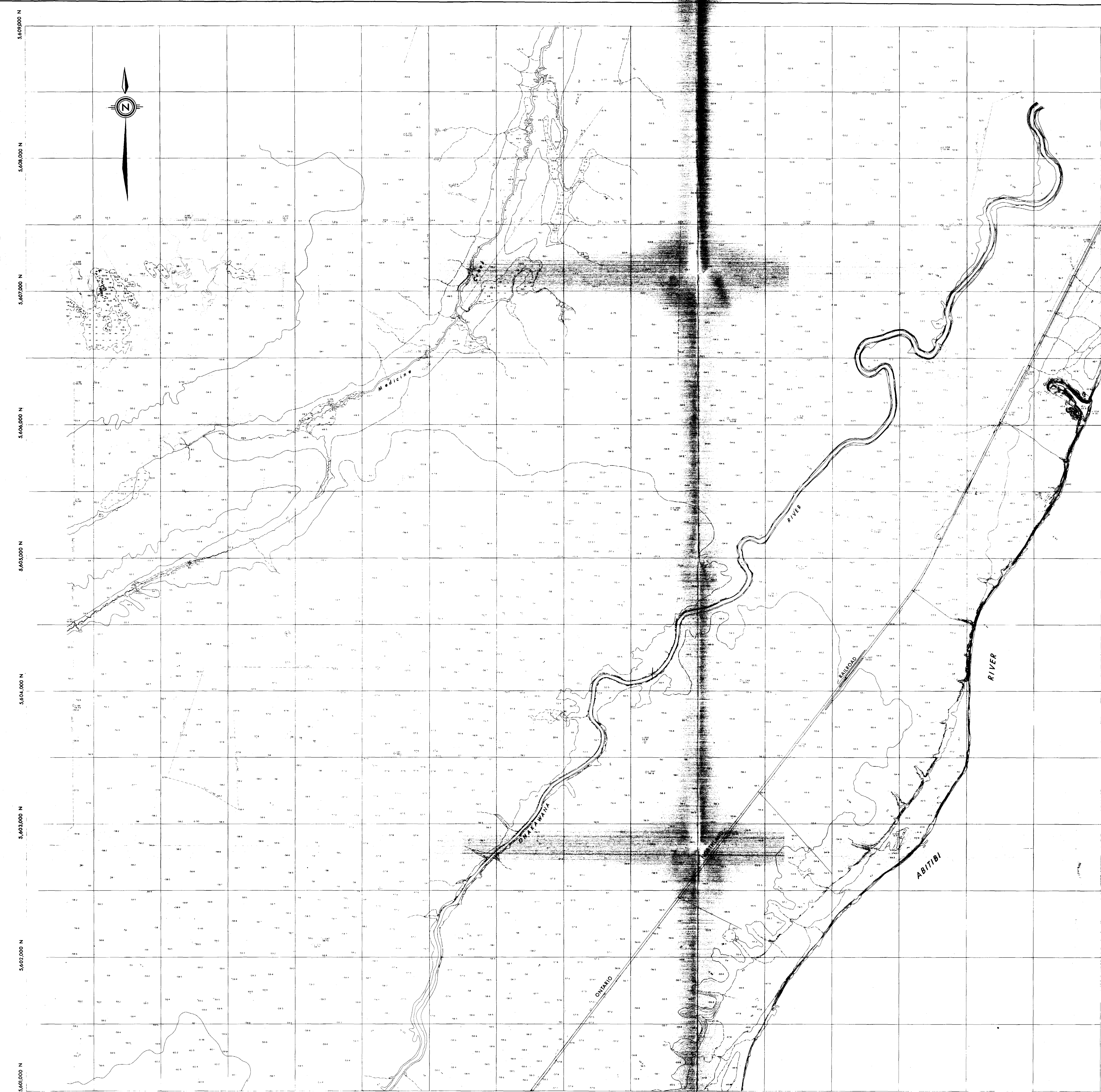
CLIENT: onakawana development limited

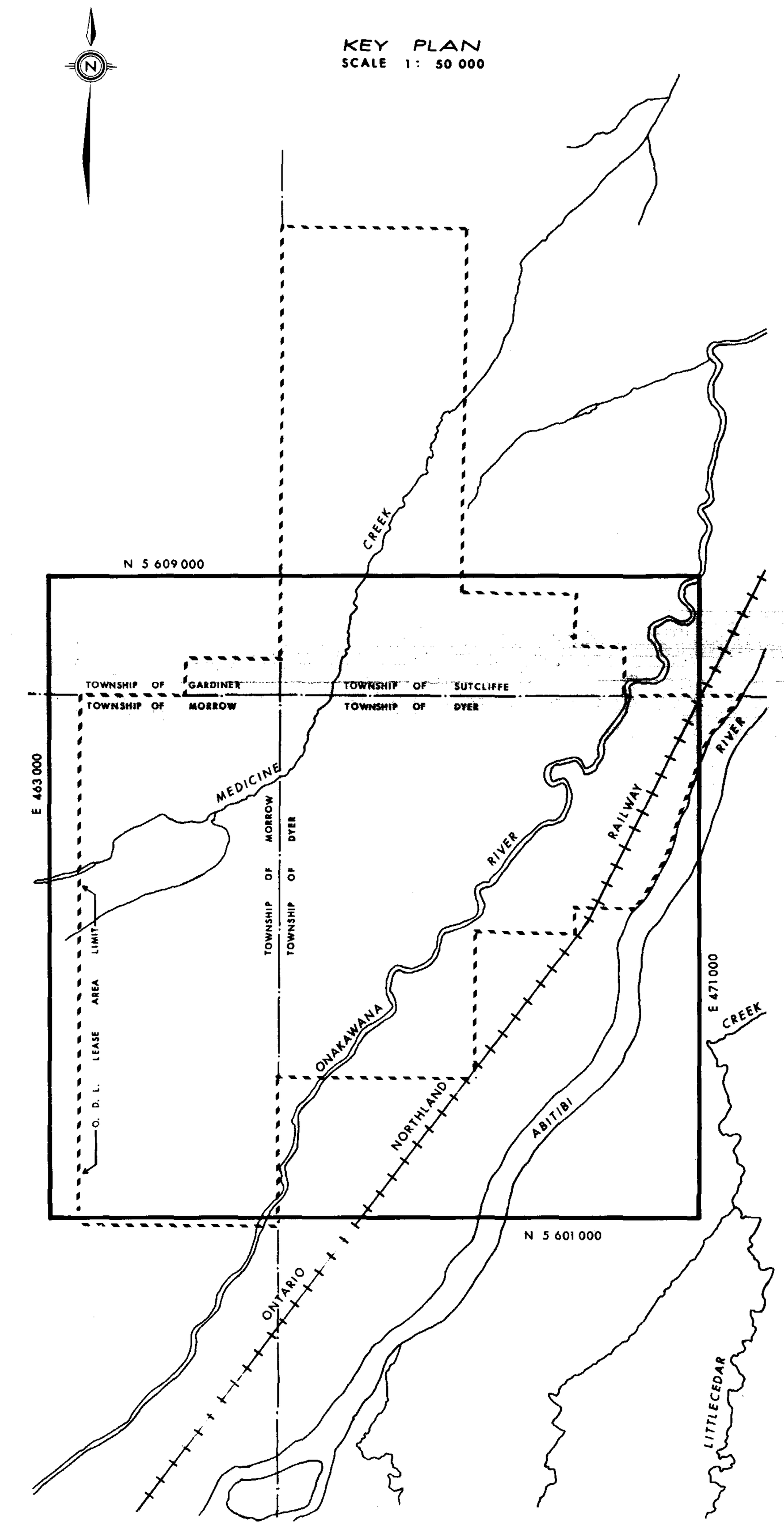
TITLE: ONAKAWANA LIGNITE DEPOSIT

INDEX TO CROSS-SECTIONS

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No.:
JULY 1980	MLR, KEC	KEC, MLR	TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY:	DRWG. No.: E-370-15-03-00

200





NOTES:

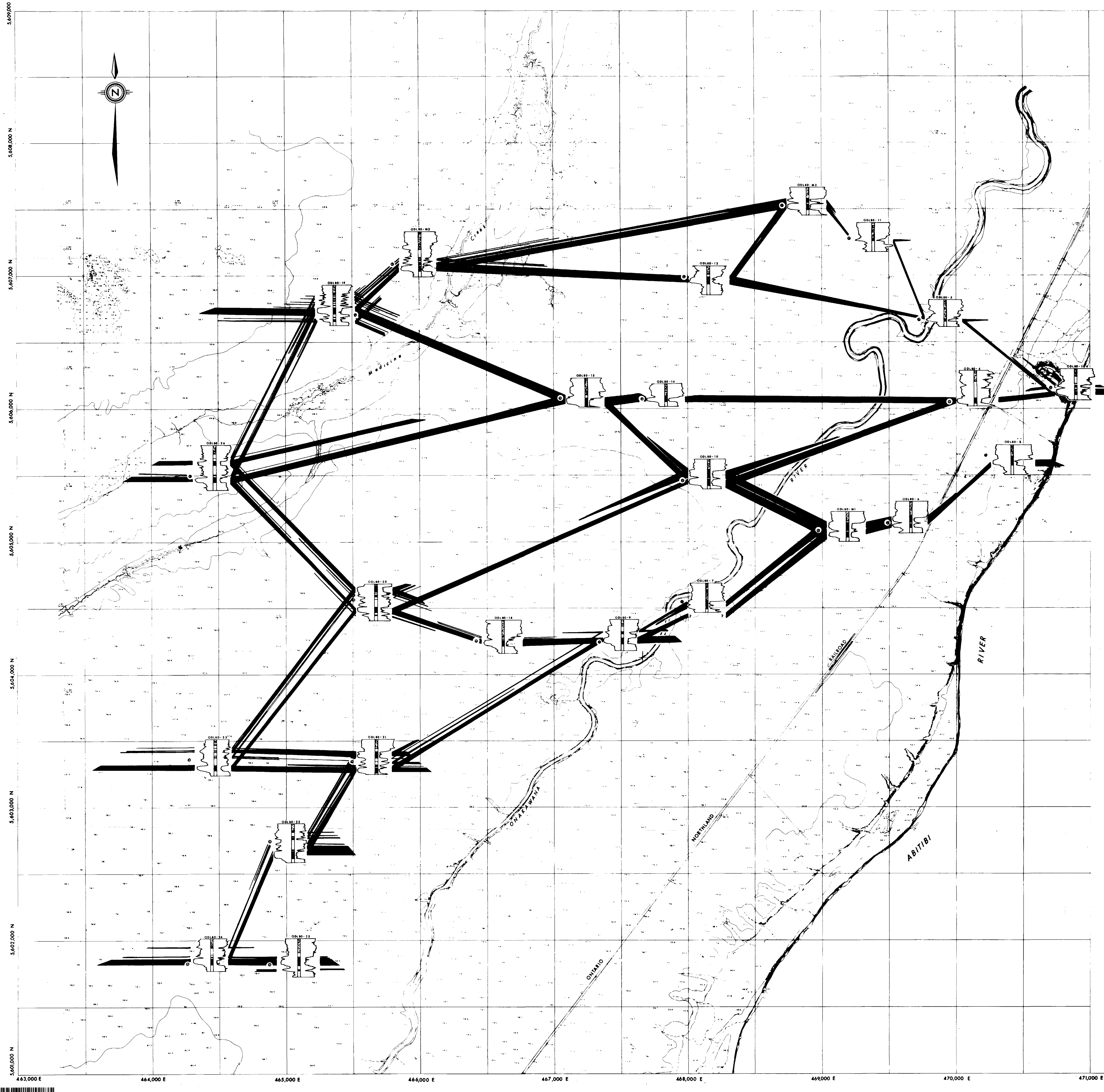
UNIVERSAL TRANSVERSE MERCATOR GRID, ZONE 17, CENTRAL MERIDIAN 81° 00' W.
ELEVATIONS ARE BASED ON CANADIAN GEODETIC DATA.
AERIAL PHOTOGRAPHY BY KENTING EARTH SCIENCES LIMITED, NOVEMBER, 1978.
CONTROL SURVEYS BY T.E. RODY LIMITED.
PHOTOGRAMMETRIC COMPILATION BY McELHANNEY SURVEYING & ENGINEERING LTD.

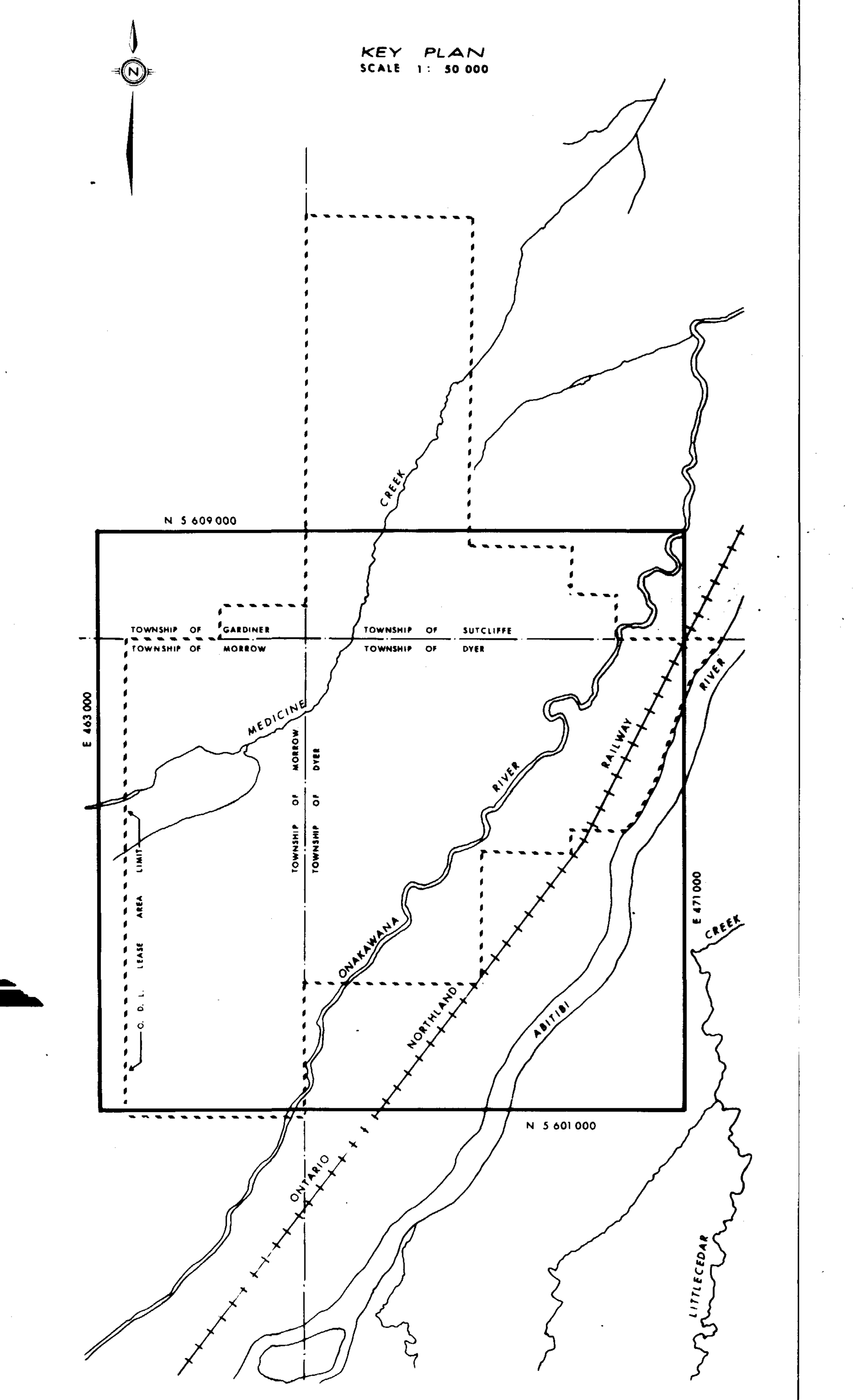
1:10,000
METRES
500 400 300 200 100 0 250 500

63-4121

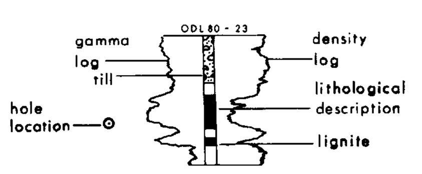
CLIENT: onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT TOPOGRAPHIC BASE MAP			
DATE:	COMPILED BY:	DRAWN BY:	PROJECT No.: TM 370
Teckman Ltd. • manalta coal ltd.		CHECKED BY:	DRWG. No.: E-370-15-01-00

210





THREE DIMENSIONAL REPRESENTATION OF LIGNITIC COAL SEAM CORRELATION USING ONLY GEOPHYSICAL LOGS FROM 1980 HOLES.

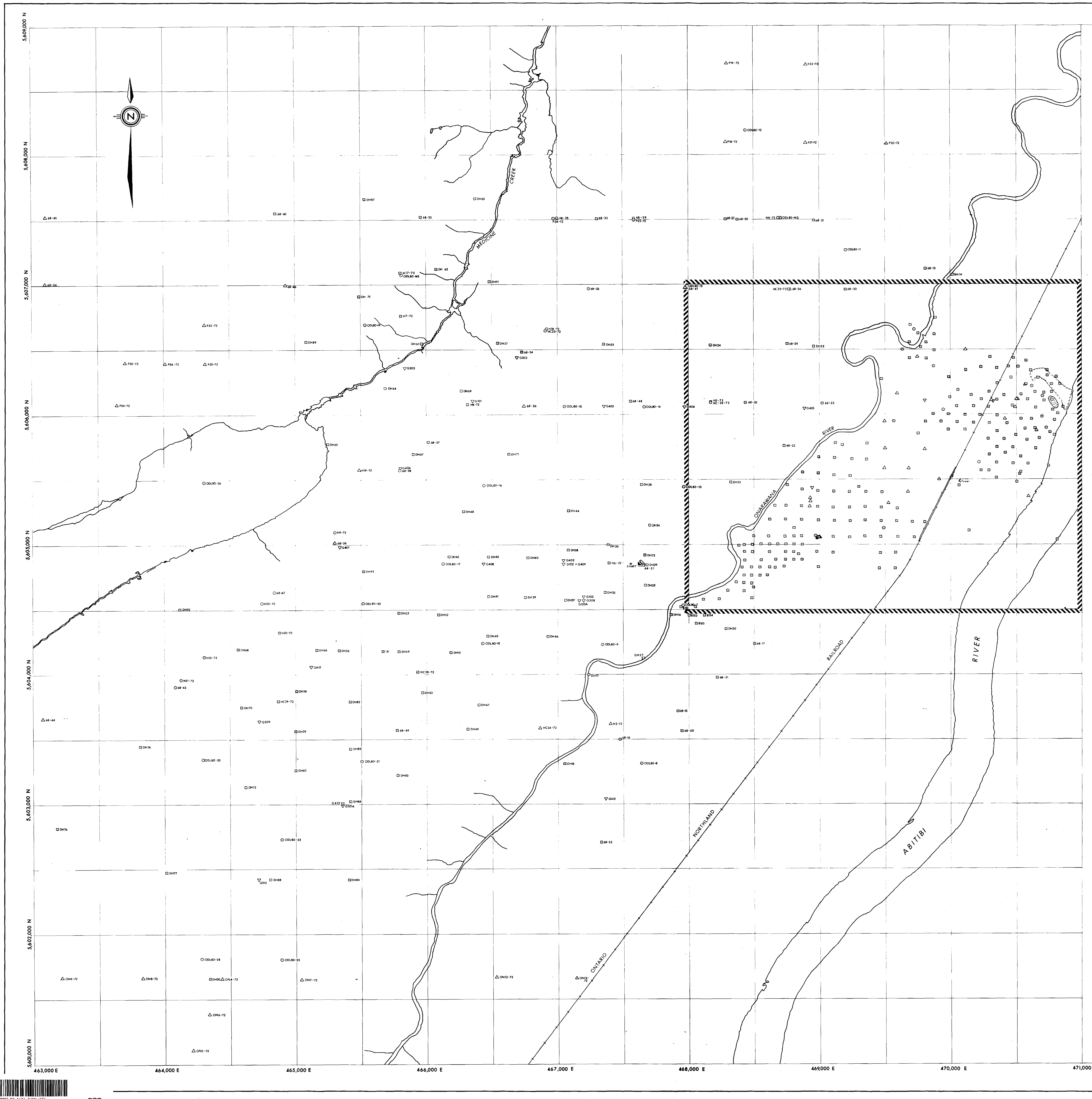


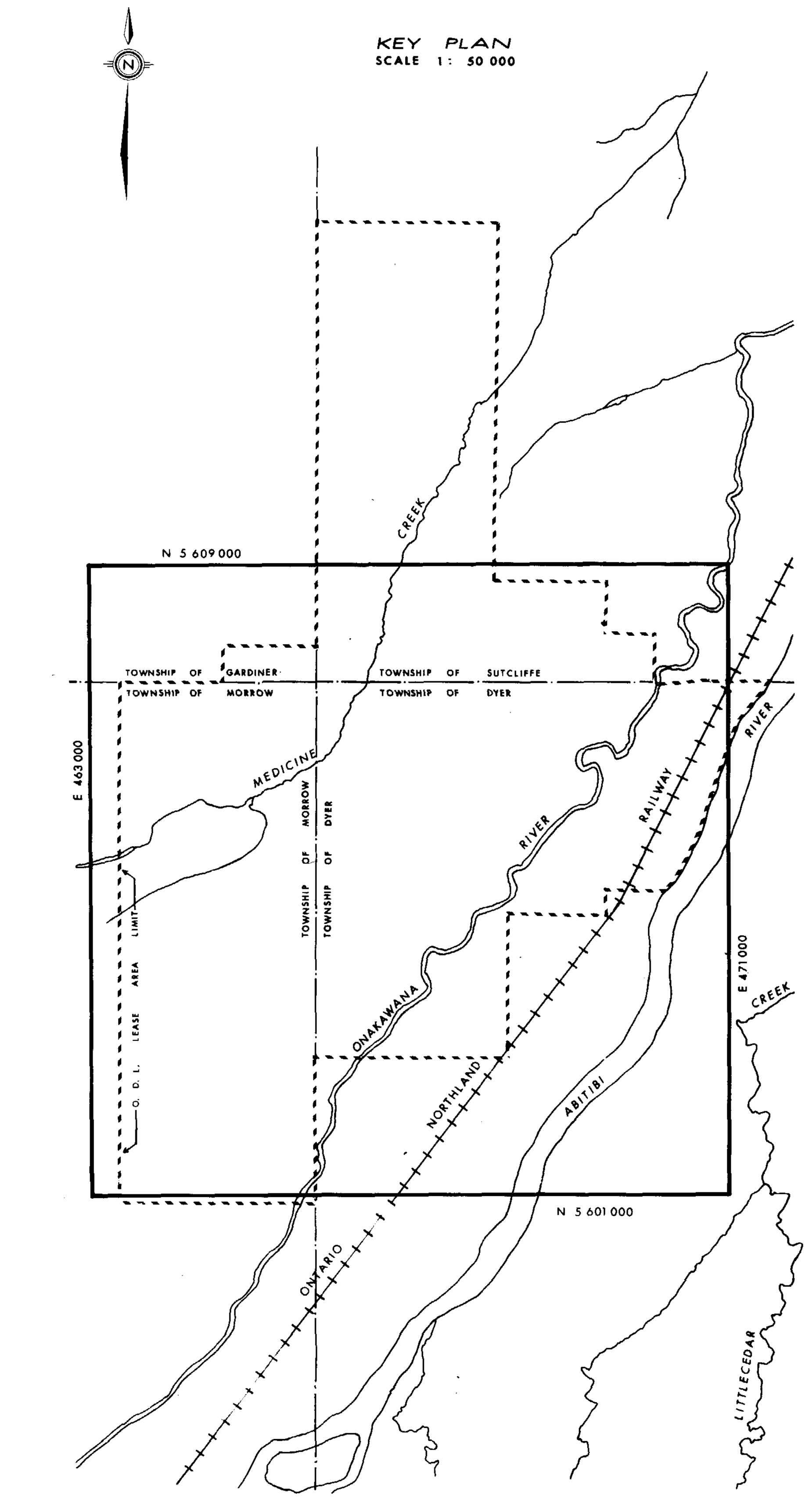
1:10,000
METRES

63-4121

CLIENT: onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT			
FENCE DIAGRAM			
DATE: JULY 1980	COMPILED BY: PSWG	DRAWN BY: PSWG	PROJECT No.: TM 370
Techman Ltd. + monenco coal ltd.		CHECKED BY:	DRAWG. No.: E-370-15-02-00

220





LEGEND

	Test pit
	Tailings pile
	Abandoned shaft
	Limit of area covered on detail sheet

Drillhole symbols

- ⊙ Drillhole location known to have been surveyed or presurveyed
- ⊡ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation
- △ Drillhole co-ordinates appear to be approximate (± 15m)
- ▽ Drillhole co-ordinates known to be approximate (± 15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available Information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole; partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA, P, ON, & H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80-	1980	Driller's, geologist's and geophysical log (Hole partially cored)

1:10,000
METRES
500 400 300 200 100 0 250 500

63.4121

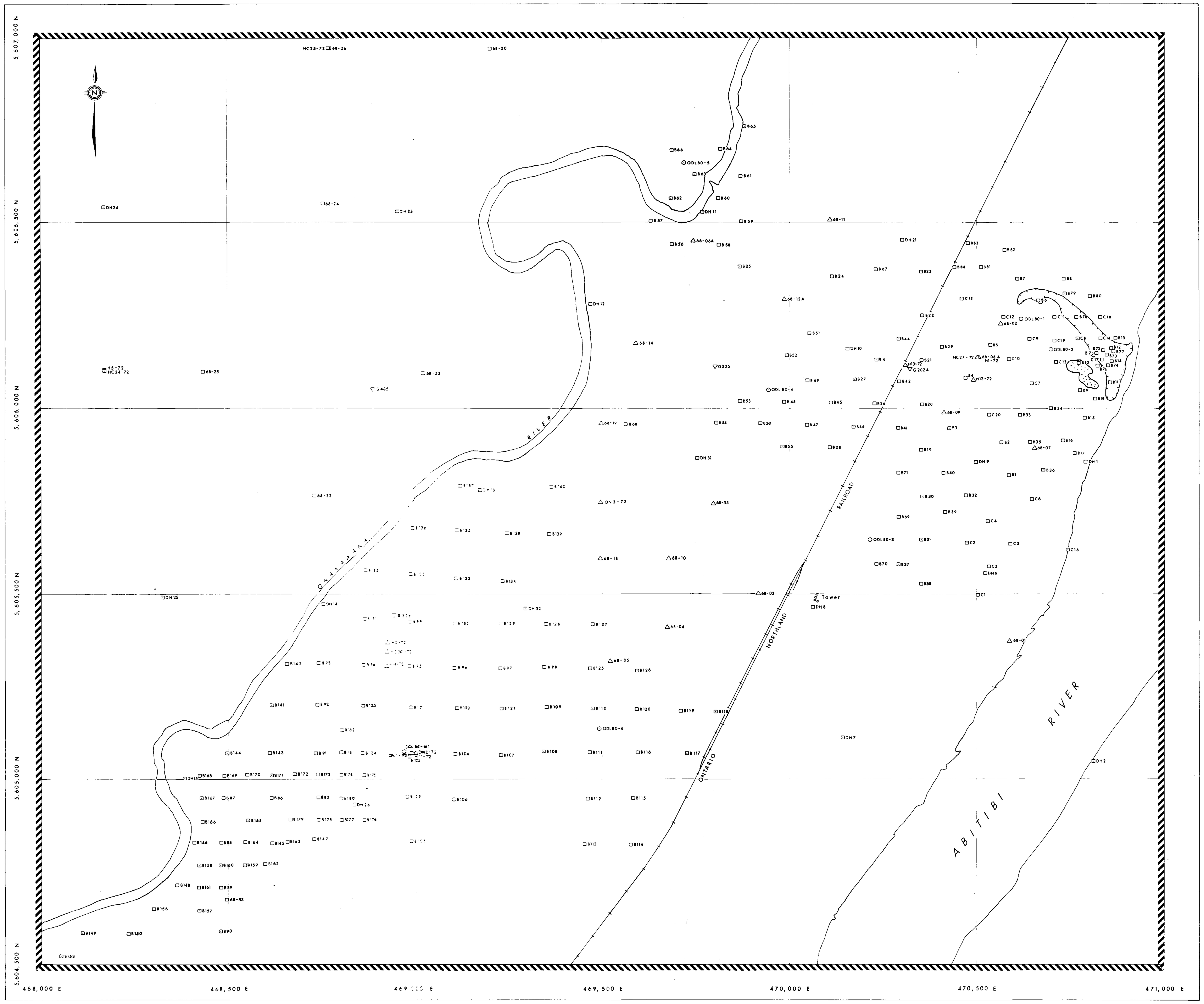
CLIENT: onakawana development limited

TITLE:
ONAKAWANA LIGNITE DEPOSIT
ONAKAWANA DRILLHOLE LOCATIONS

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No:
JULY 1980	MLR	PLS, RGP, MLR	TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY:	DRWG. No.: E-370-15-04-00

DETAIL SHEET

SHOWING AREA OF DENSE DRILLING
EAST OF THE ONAKAWANA RIVER



LEGEND

Test pit

Tailings pile

Drillhole symbols

○ Drillhole location known to have been surveyed or presurveyed

□ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation

△ Drillhole co-ordinates appear to be approximate (± 15 m)

▽ Drillhole co-ordinates known to be approximate (± 15m). Hole drilled by Golder Associates for geotechnical study

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W Shaft	1929 - 1933	Geologist's log
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EA, P, ON, & H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80 -	1980	Driller's, geologist's and geophysical log (Hole partially cored)

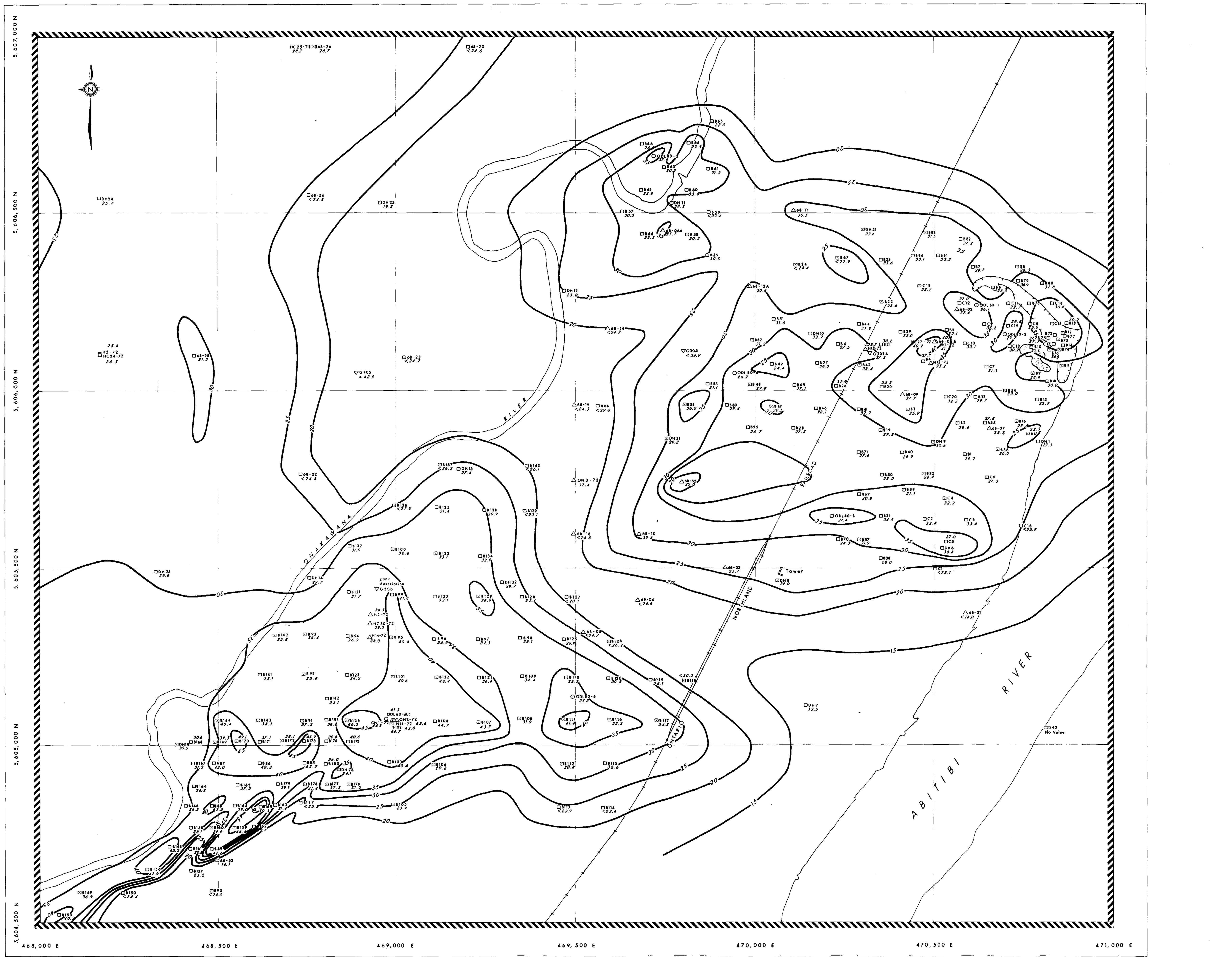
1:5,000
METRES

300 250 200 150 100 50 0 100 200 300

63-421

CLIENT: **onakawana development limited**			
TITLE: ONAKAWANA LIGNITE DEPOSIT — ONAKAWANA DRILLHOLE LOCATIONS			
DATE: JULY 1980	COMPILED BY: MLR	DRAWN BY: MLR	PROJECT No.: TM 370
Techman Ltd. • monalta coal inc.		CHECKED BY: [signature]	DRWG. No.: E-370-15-05-00

240



DETAIL SHEET

SHOWING AREA OF DENSE DRILLING
EAST OF THE ONAKAWANA RIVER

LEGEND

Test pit

Tailings pile

Drillhole symbols

- ○ Drillhole location known to have been surveyed or presurveyed
- □ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation
- △ Drillhole co-ordinates appear to be approximate (± 15 m)
- ▽ Drillhole co-ordinates known to be approximate (± 15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available information
DH	1929 - 1933	Driller's or field geologist's log
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W Shaft	1929 - 1933	Geologist's log
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EA, P, ON, & H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80-	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

NDE Hole not deep enough to show coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Structural contour (metres)

1:5,000
METRES

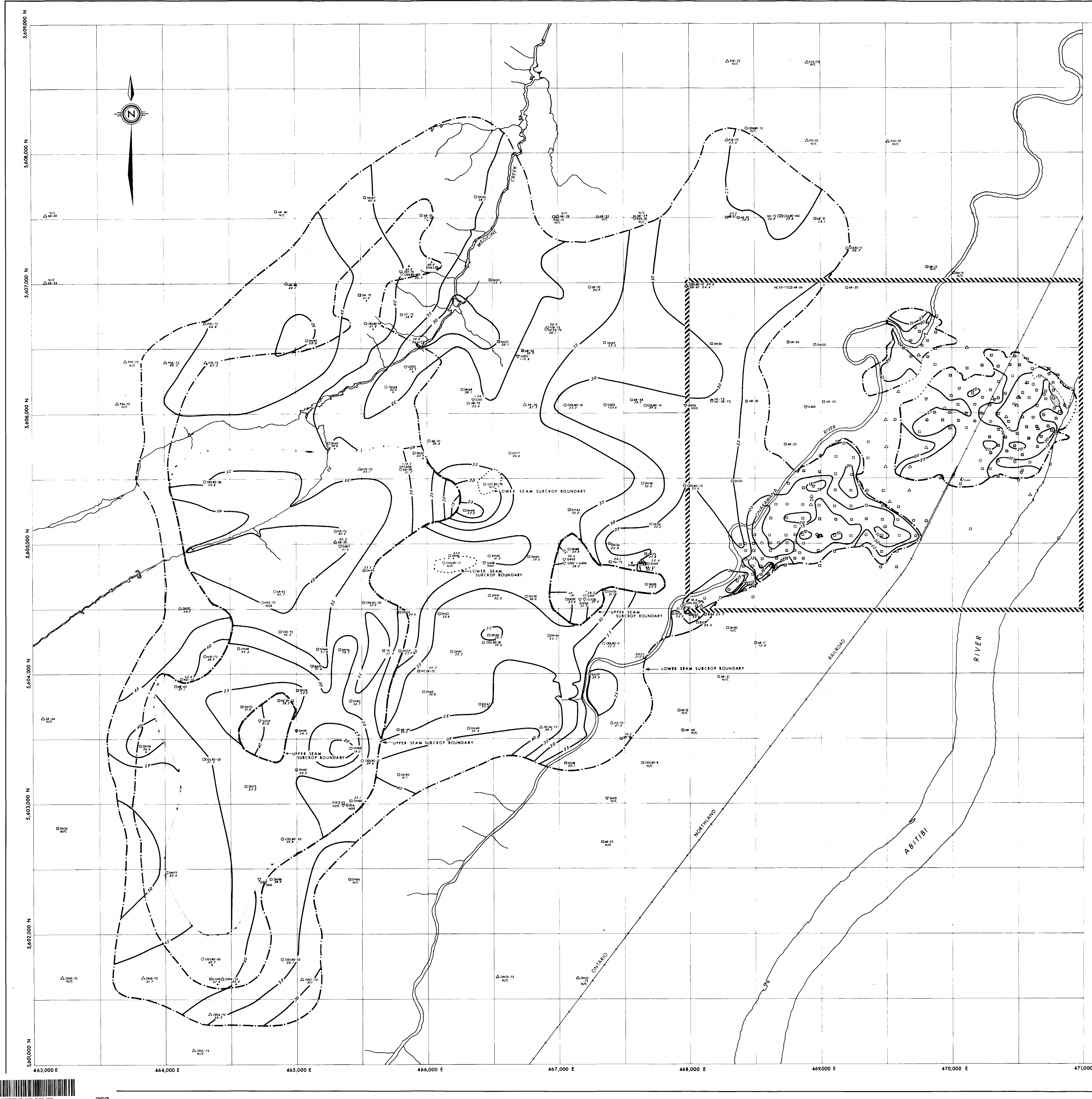
300 250 200 150 100 50 0 100 200 300

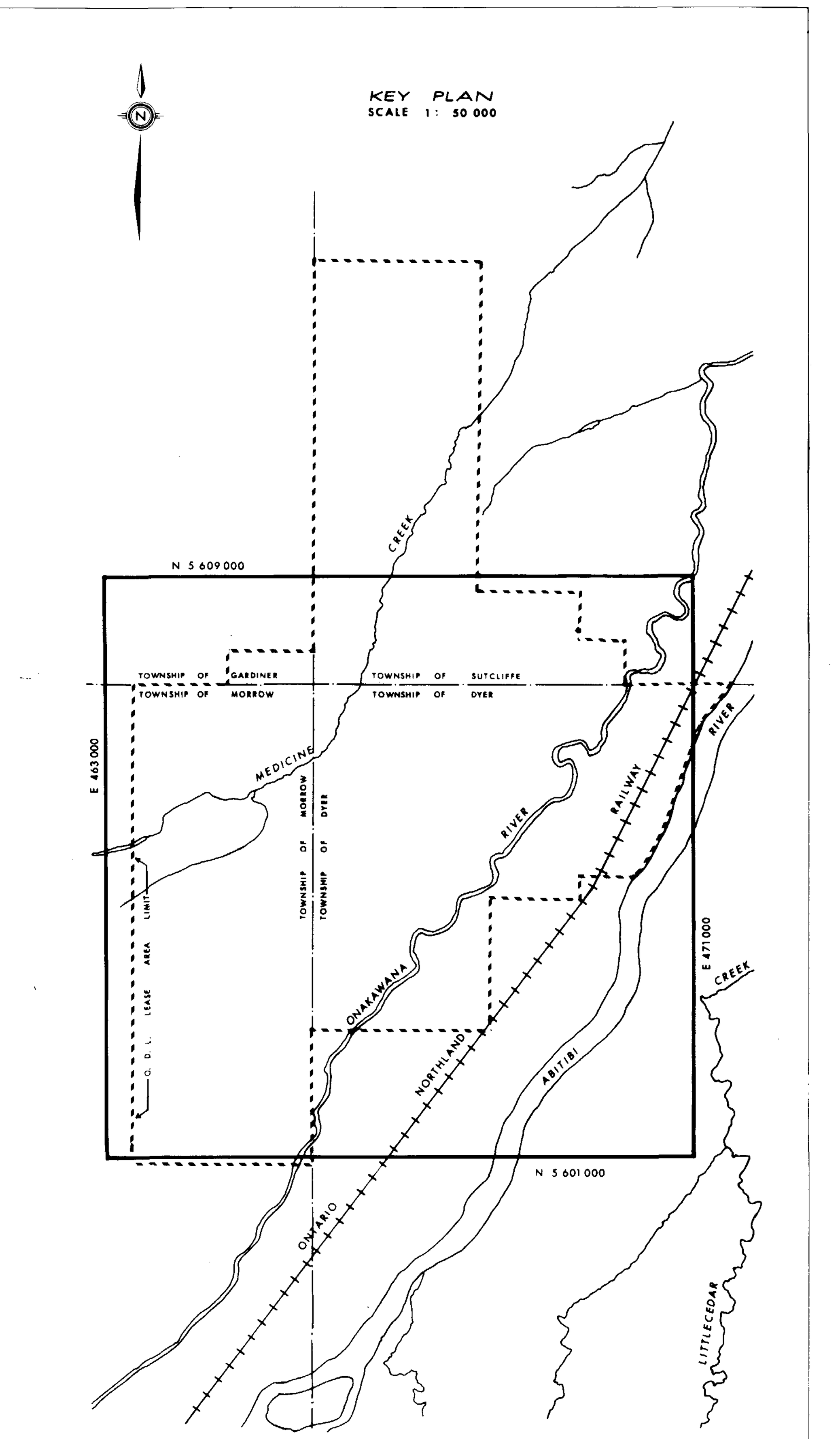
CONTOUR INTERVAL 5m

63-4121

CLIENT: onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT — STRUCTURAL CONTOUR MAP of PRE-PLEISTOCENE ('BEDROCK') SURFACE			
DATE: JULY 1980	COMPILED BY: MLR	DRAWN BY: PLS, MLR	PROJECT No: TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY: MLR	DRWG. No: E-370-15-07-00

250





LEGEND

- Test pit
- Tailings pile
- Abandoned shaft
- Limit of area covered on detail sheet

Drillhole symbols

- ○ Drillhole location known to have been surveyed or presurveyed
- □ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation
- △ Drillhole co-ordinates appear to be approximate (±15m)
- ▽ Drillhole co-ordinates known to be approximate (±15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available Information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole, partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA,P,ON,& H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80-	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

- N/C No lignitic coal recorded
- • Upper seam considered unmineable
- NDE Hole not deep enough to record coal if present
- Lignitic coal subcrop boundary (inferred, assumed)
- Limit of mineable upper seam
- —25— Overburden isopach (metres)

1:10,000
METRES
500 400 300 200 100 0 200 500

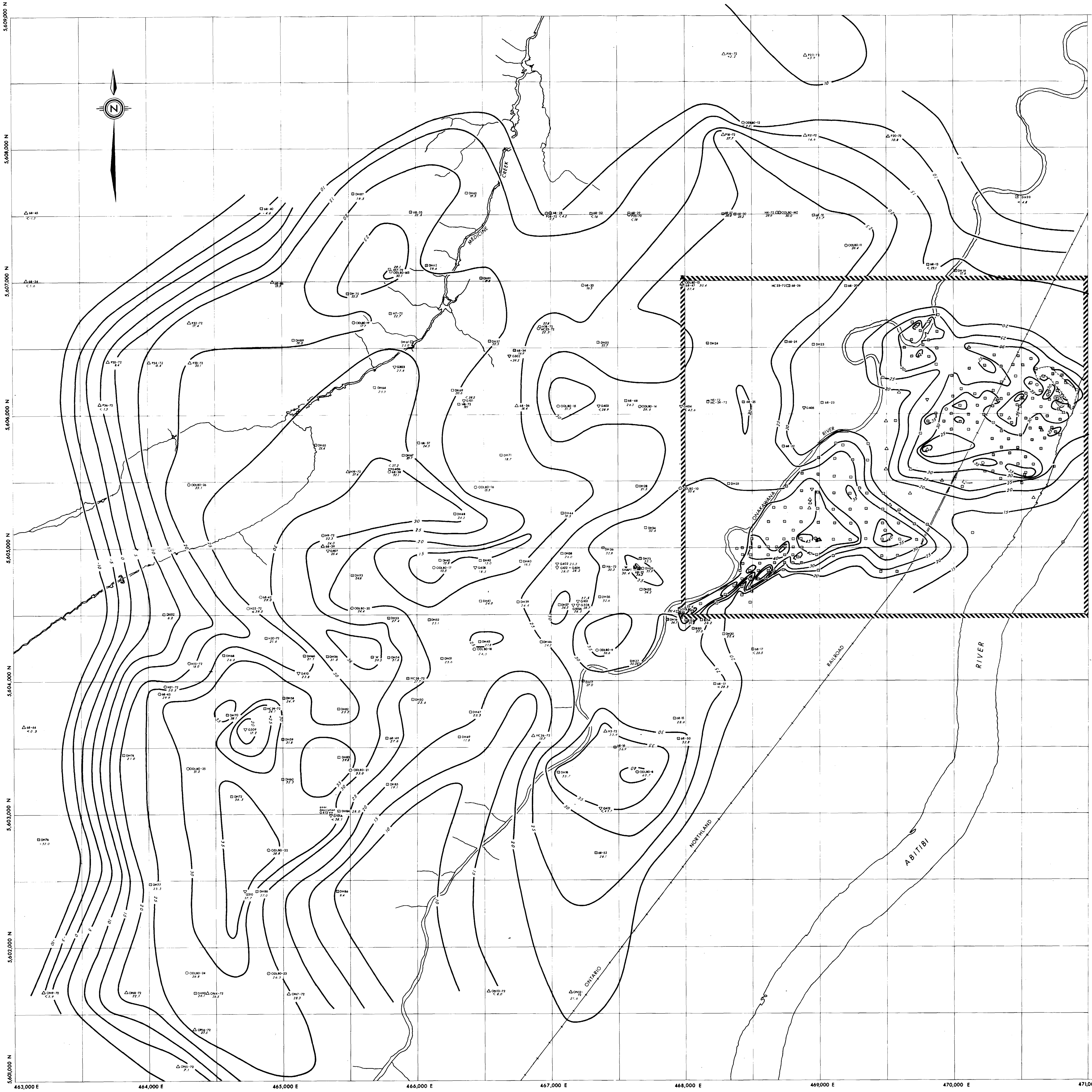
CONTOUR INTERVAL 5m

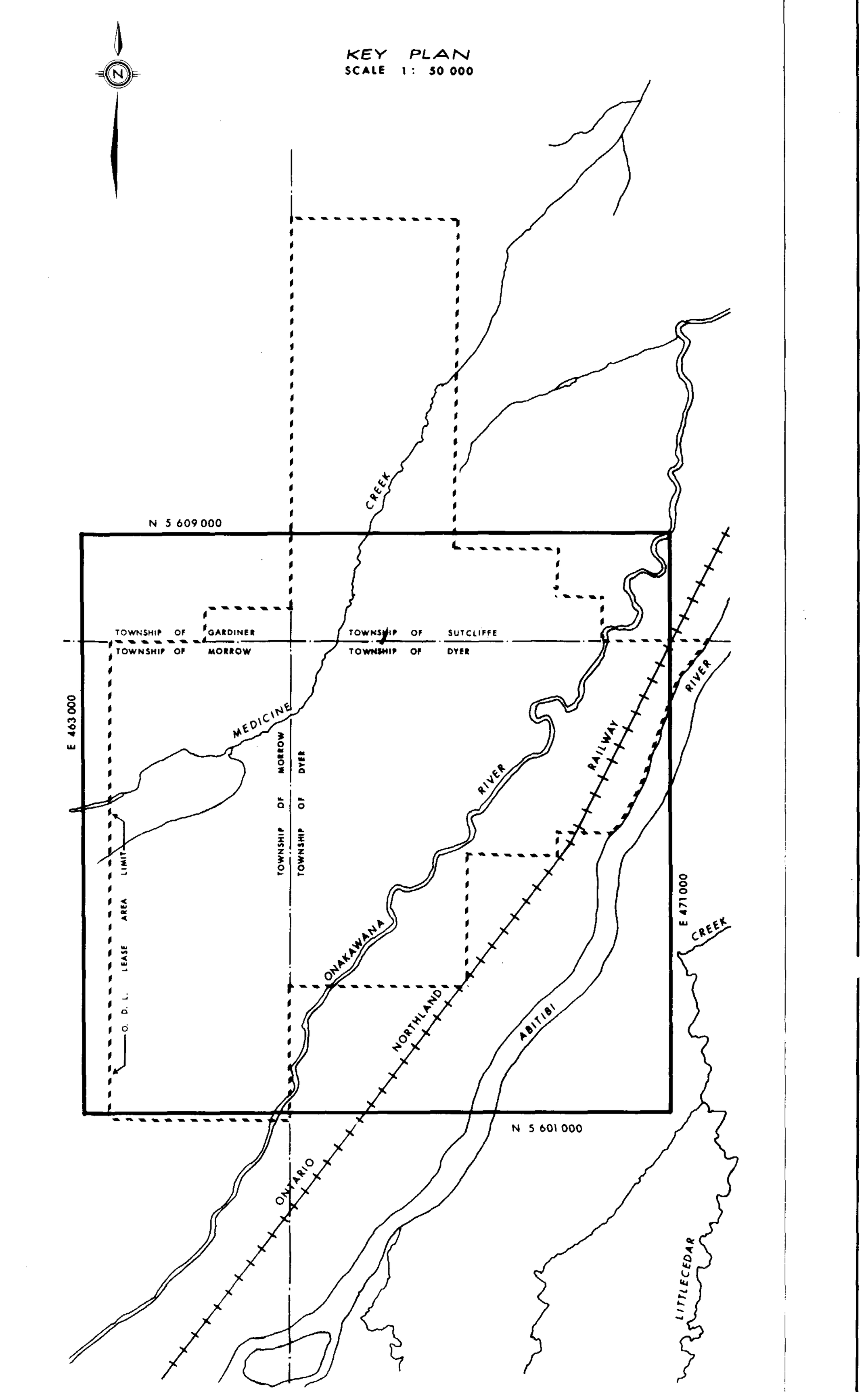
63.4121

CLIENT:	onakawana development limited
TITLE:	ONAKAWANA LIGNITE DEPOSIT ISOPACH MAP of OVERBURDEN THICKNESS
DATE: JULY 1980	COMPILED BY: PSWG, MLR, JHR
DRAWN BY: PLS	PROJECT No.: TM 370
CHECKED BY: [signature]	DRWG. No.: E-370-15-08-00

Teckmen Ltd. • manalta coal ltd.

260





LEGEND

Test pit

Tailings pile

Abandoned shaft

Limit of area covered on detail detail sheet

Drillhole symbols

- ⊙ Drillhole location known to have been surveyed or presurveyed
- ⊡ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation
- △ Drillhole co-ordinates appear to be approximate (± 15m)
- ▽ Drillhole co-ordinates known to be approximate (±15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available Information
DH	1929 - 1933	Driller's or field geologist's log
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W Shaft	1929 - 1933	Geologist's log
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68-	1968	Driller's log
EA,P,ON,&H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL-80	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

NDE Hole not deep enough to record coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Structural contour (metres)

1:10,000

METRES

500 400 300 200 100 0 250 500

CONTOUR INTERVAL 5m

63-4121

CLIENT: onakawana development limited

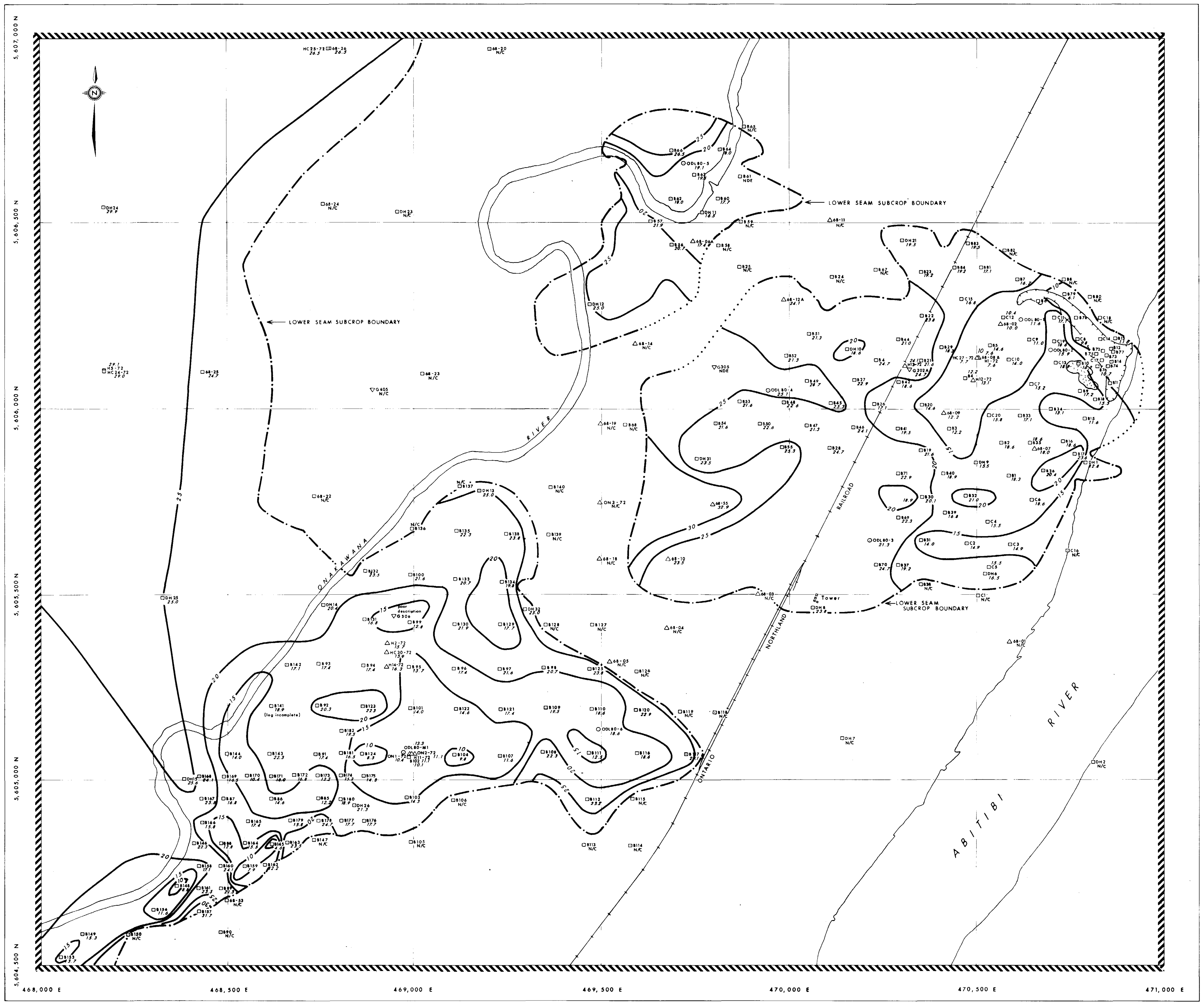
TITLE:

ONAKAWANA LIGNITE DEPOSIT

STRUCTURAL CONTOUR MAP of PRE-PLEISTOCENE ('BEDROCK') SURFACE

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No:
JULY 1980	PSWG, JHR, MLR	JHR, PSWG, MLR	TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY: [signature]	DRWG. No.: E-370-15-06-00

270



DETAIL SHEET

SHOWING AREA OF DENSE DRILLING
EAST OF THE ONAKAWANA RIVER

LEGEND

Test pit

Tailings pile

Drillhole symbols

○ Drillhole location known to have been surveyed or presurveyed

□ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation

△ Drillhole co-ordinates appear to be approximate (± 15 m)

▽ Drillhole co-ordinates known to be approximate (± 15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available information
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'A'	1929 - 1933	Geologist's log (Deep oil exploration hole; partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA, P, ON, & H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80-	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

NDE Hole not deep enough to show coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Overburden isopach (metres)

1:5,000
METRES

300 250 200 150 100 50 0 100 200 300

CONTOUR INTERVAL 5m

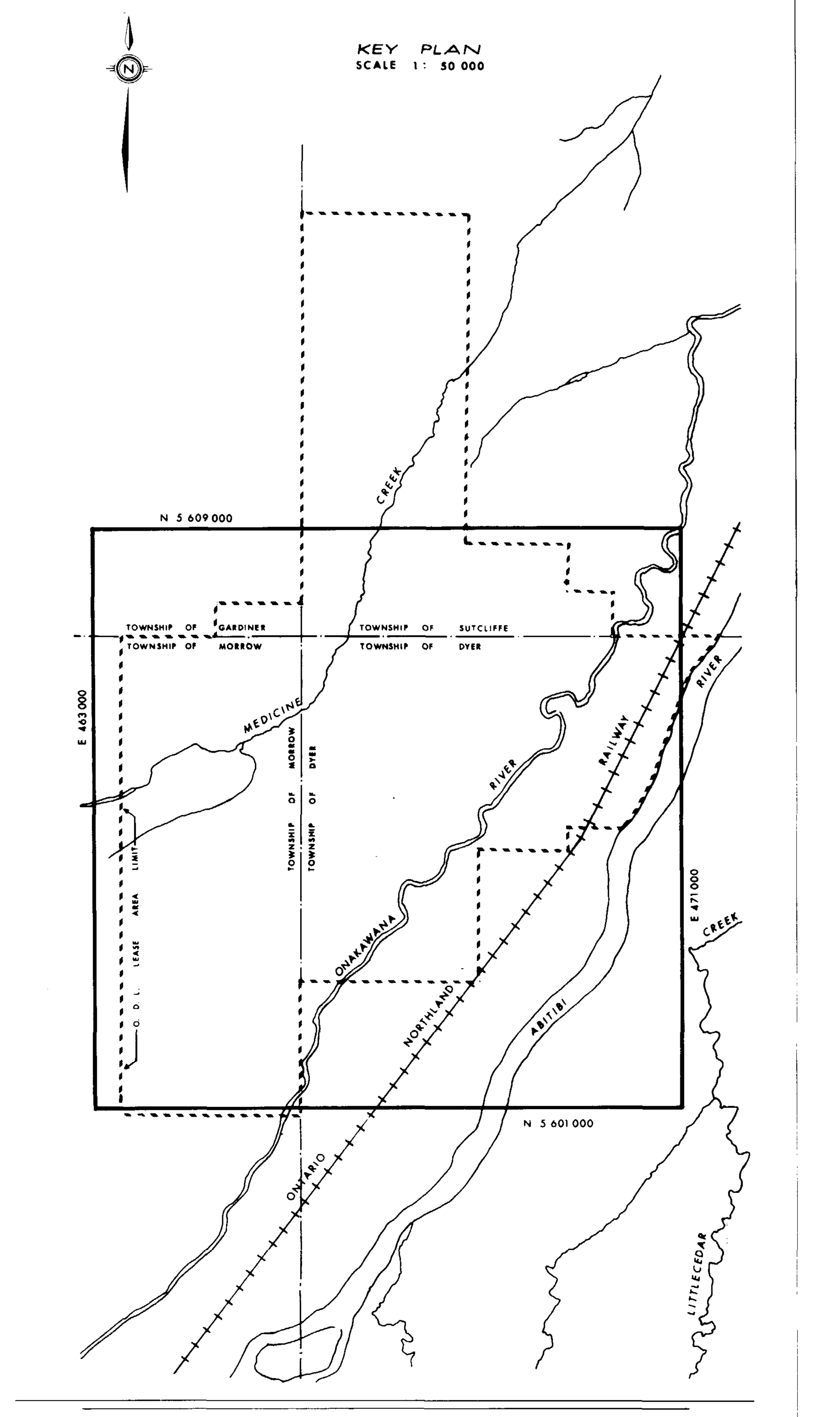
63-4121

CLIENT: onakawana development limited

TITLE: ONAKAWANA LIGNITE DEPOSIT
ISOPACH MAP of OVERBURDEN THICKNESS

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No:
JULY 1980	MLR	MLR, JHR	TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY:	DRWG. No: E-370-15-09-00

280



LEGEND

- Test pit
- Tailings pile
- Abandoned shaft
- Limit of area covered on detail sheet

Drillhole symbols

- ○ Drillhole location known to have been surveyed or presurveyed
- □ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation
- △ Drillhole co-ordinates appear to be approximate (±15m)
- ▽ Drillhole co-ordinates known to be approximate (±15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available Information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole, partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
E.A.,P.,ON.,&H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80 -	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

- N/C No lignitic coal recorded
- NDE Hole not deep enough to record coal if present
- Lignitic coal subcrop boundary (inferred, assumed)
- Structural contour (metres)

1:10,000
METRES

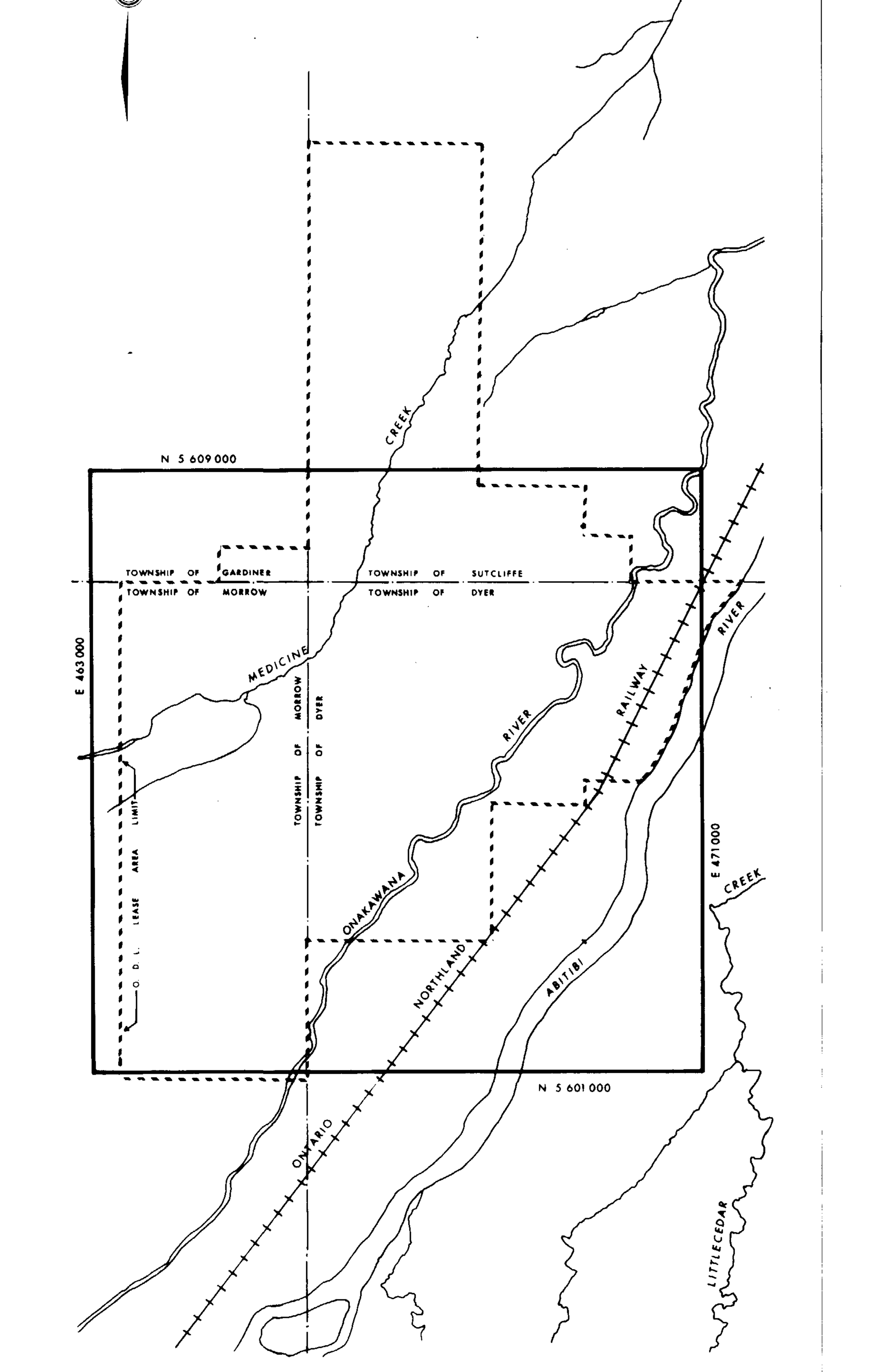
CONTOUR INTERVAL 2m

63.4121

CLIENT: **onakawana development limited**			
TITLE: ONAKAWANA LIGNITE DEPOSIT STRUCTURAL CONTOUR MAP of TOP OF UPPER SEAM			
DATE: JULY 1980	COMPILED BY: PSWG, JHR	DRAWN BY: JHR, PLS	PROJECT No.: TM 370
Tecfuma Ltd. • monenco		CHECKED BY: [signature]	DRWG. No.: E-370-15-10-00

290

KEY PLAN
SCALE 1: 50 000



LEGEND

Test pit

Tailings pile

Abandoned shaft

Limit of area covered on detail sheet

Drillhole symbols

○ Drillhole location known to have been surveyed or presurveyed

□ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation

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▽ Drillhole co-ordinates known to be approximate (±15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

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ODL 80-	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

NDE Hole not deep enough to record coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Lignitic coal isopach (metres)

1:10,000
METRES
500 400 300 200 100 0 250 500

CONTOUR INTERVAL 2m

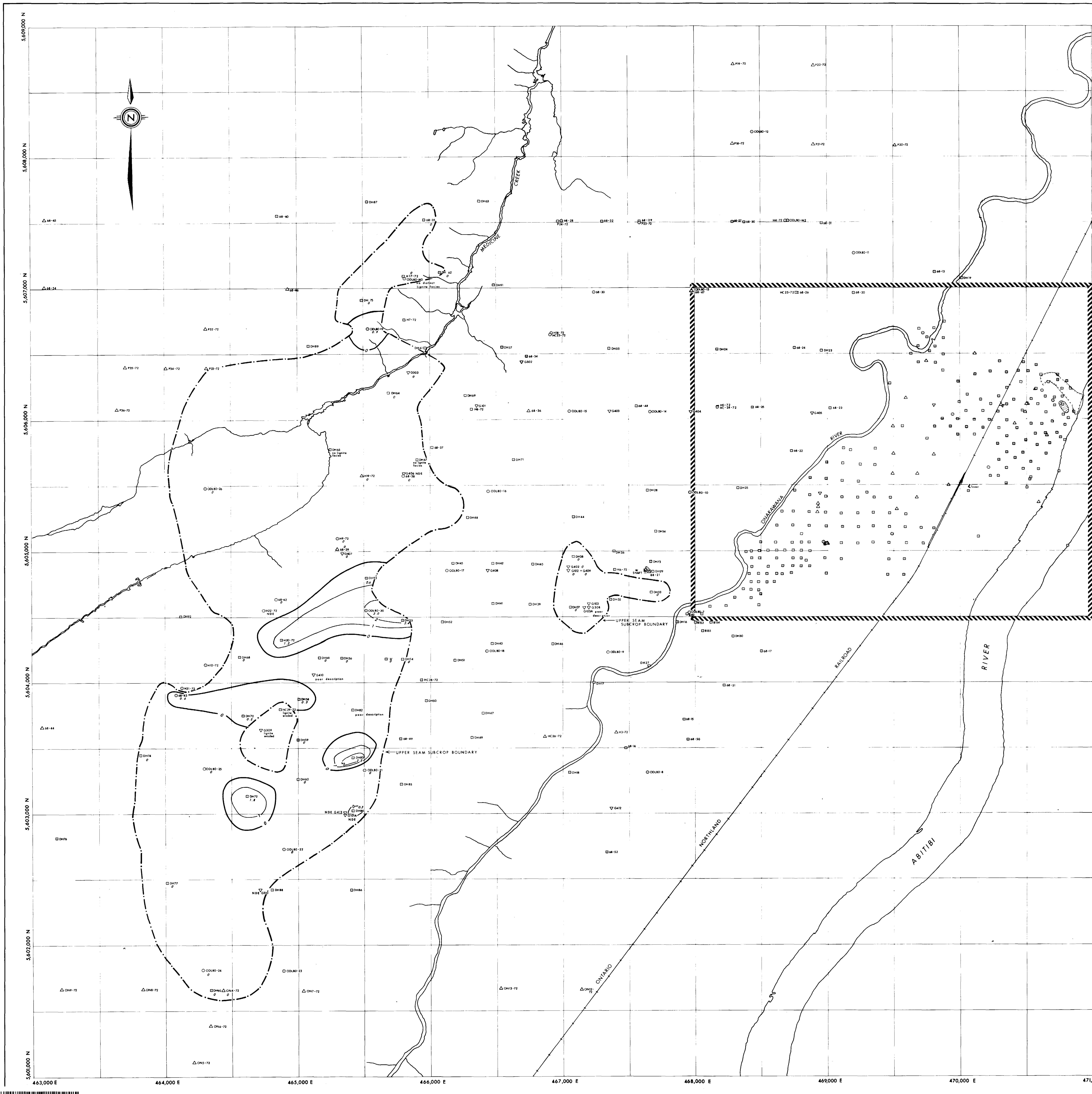
63-4121

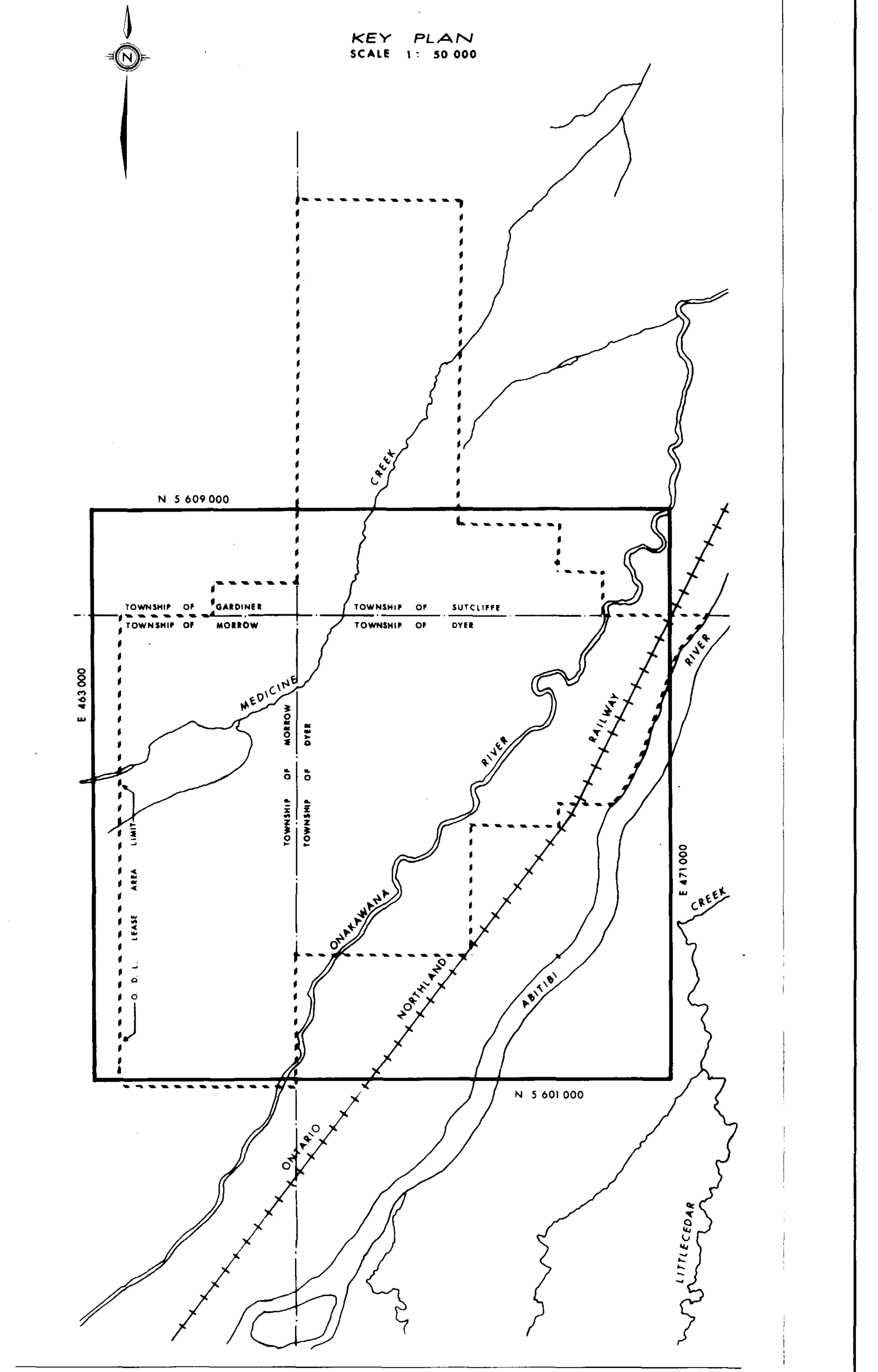
CLIENT: onakawana development limited

TITLE: ONAKAWANA LIGNITE DEPOSIT
ISOPACH MAP of NET THICKNESS OF UPPER SEAM

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No.:
JULY 1980	PSWG	KEC, PLS	TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY:	DRWG. No.: E-370-15-11-00

300





LEGEND

Test pit

Tailings pile

Abandoned shaft

Limit of area covered on detail sheet

Drillhole symbols

○ Drillhole location known to have been surveyed or presurveyed

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Source of drillhole and shaft information

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EA,P,ON,&H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80-	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

② Number of partings within seam

NDE Hole not deep enough to record coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Parting isopach (metres)

1:10,000
METRES
500 400 300 200 100 0 250 500

CONTOUR INTERVAL 1m

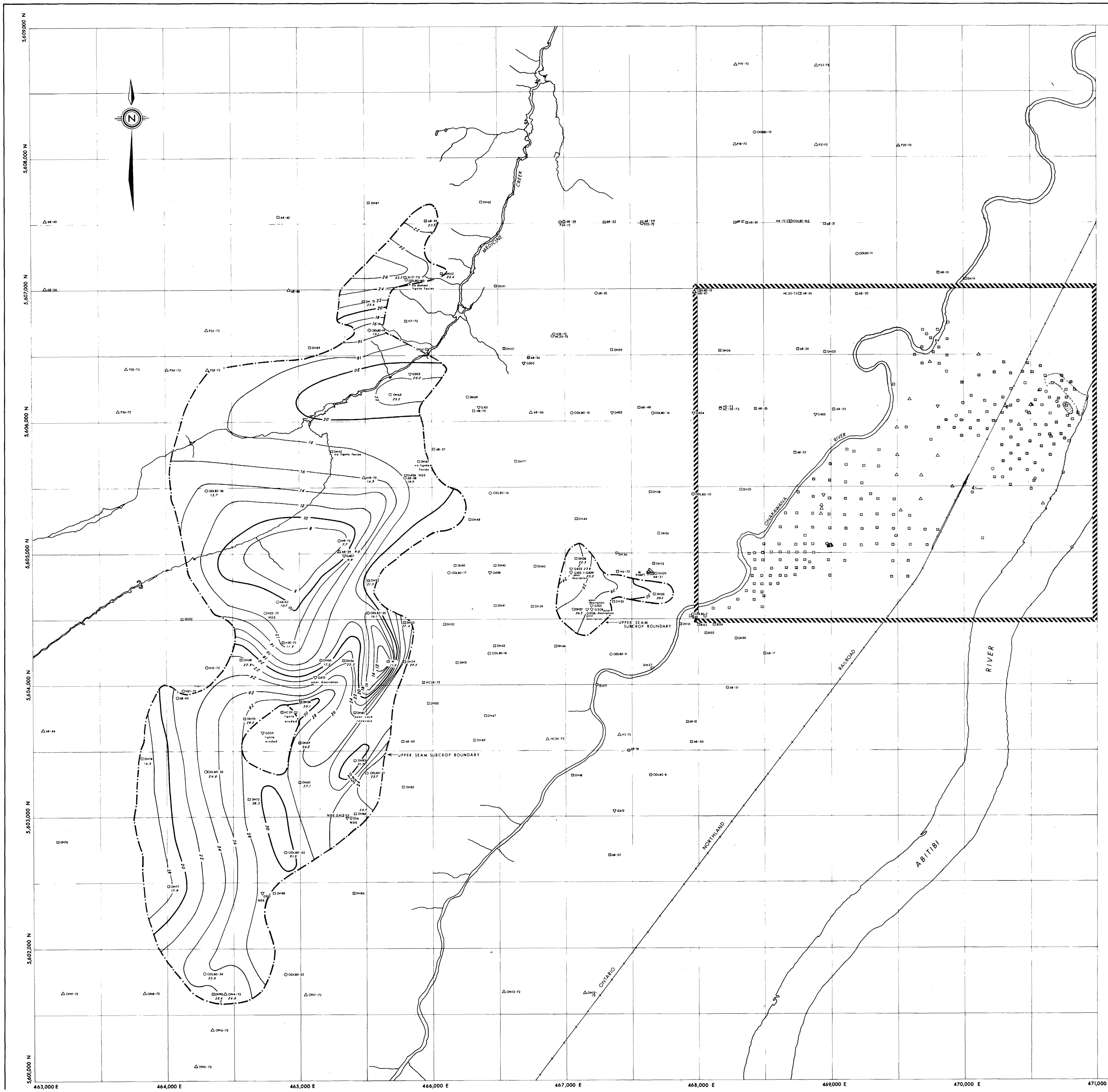
63.4121

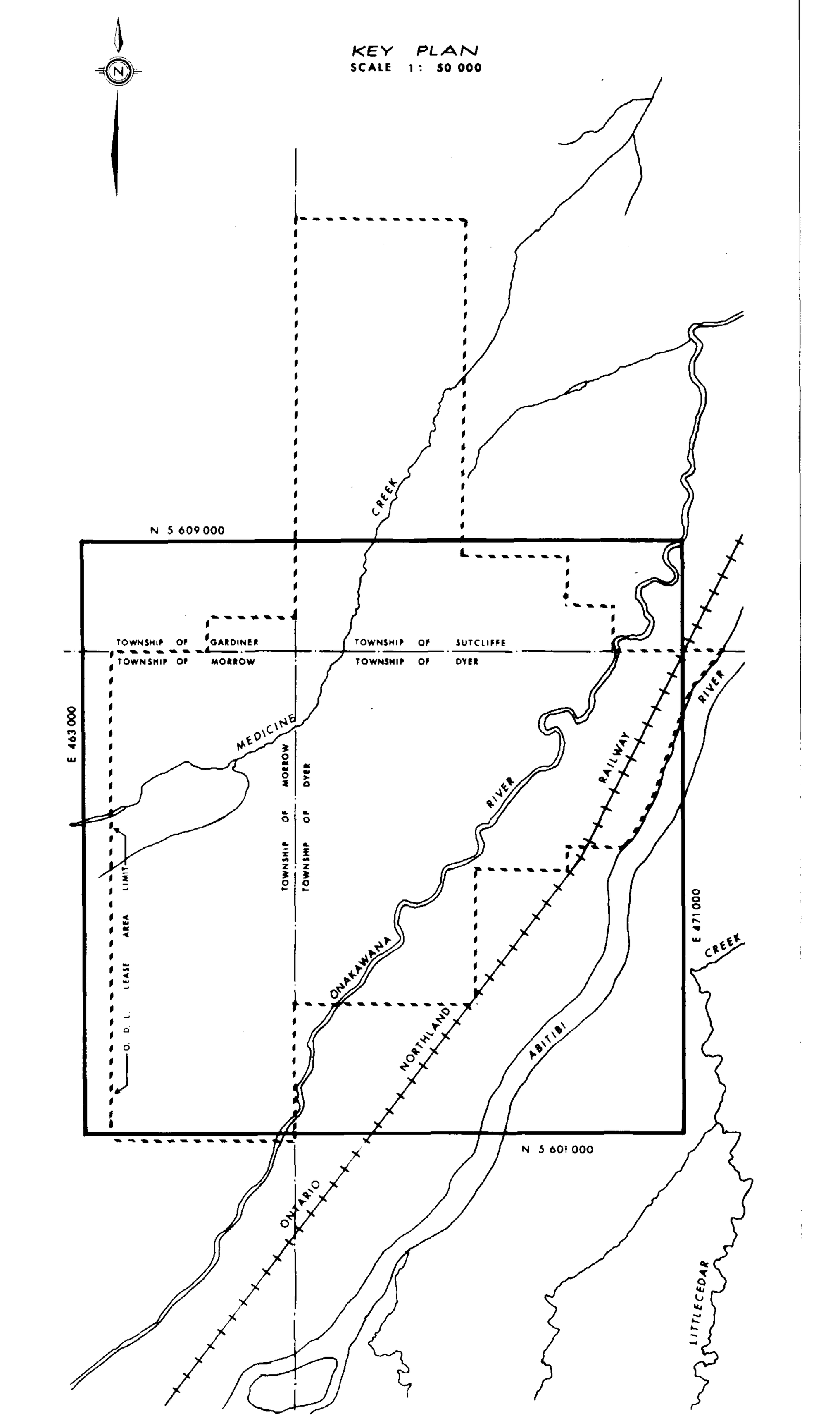
CLIENT: **onakawana development limited**

TITLE:
ONAKAWANA LIGNITE DEPOSIT
ISOPACH MAP
of
PARTING THICKNESS WITHIN UPPER SEAM

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No.:
JULY 1980	PSWG	PLS	TM 370
Techman Ltd. • monolta coal ltd.		CHECKED BY: [signature]	DRWG. No.: E-370-15-12-00

310





LEGEND

Test pit

Tailings pile

Abandoned shaft

Limit of area covered on detail sheet

Drillhole symbols

○ Drillhole location known to have been surveyed or presurveyed

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Source of drillhole and shaft information

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DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole, partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA,P,ON,&H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80-	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

NDE Hole not deep enough to record coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Structural contour (metres)

1:10,000

METRES

500 400 300 200 100 0 250 500

CONTOUR INTERVAL 2 m

63.4121

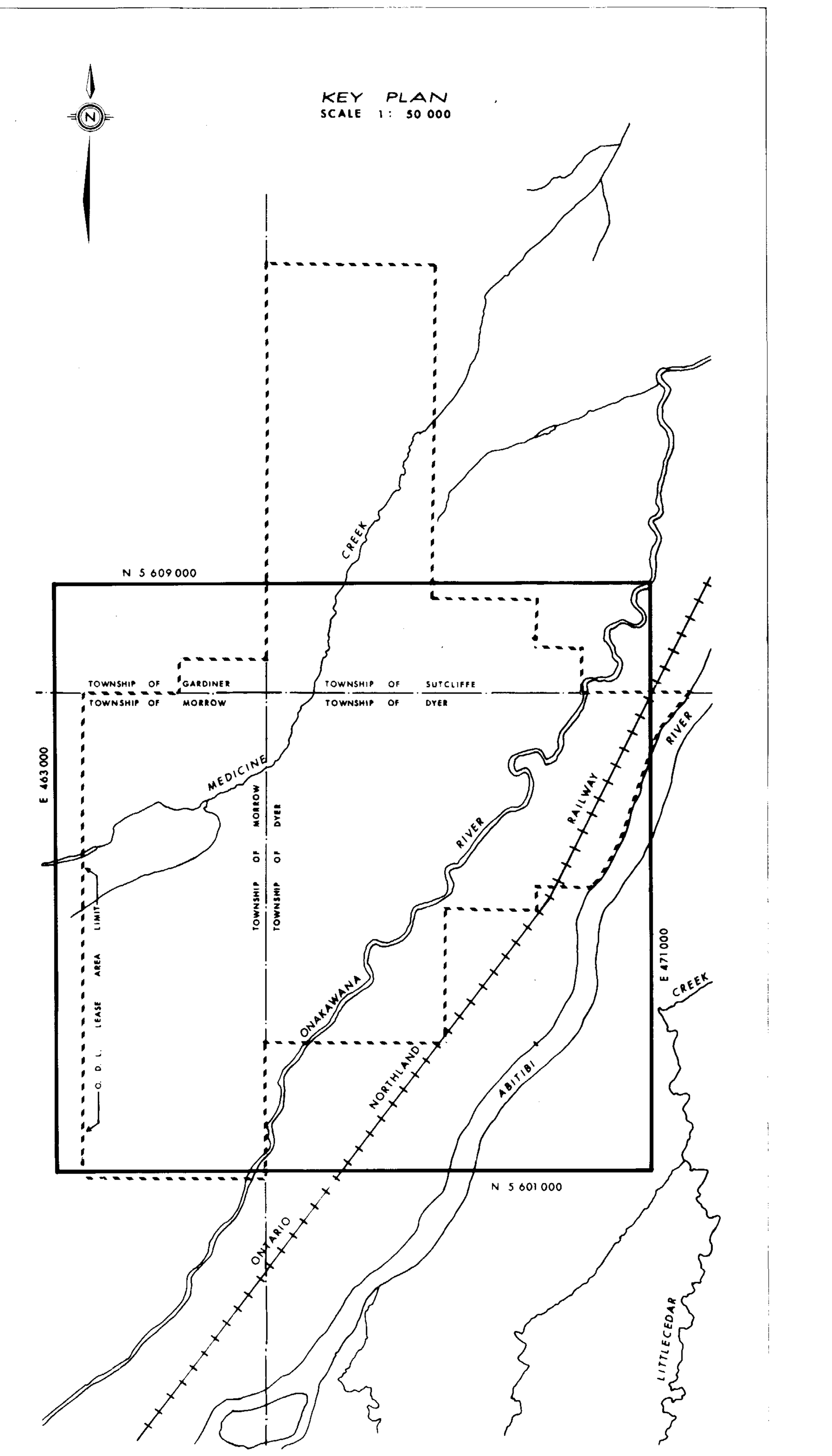
CLIENT: onakawana development limited

TITLE: ONAKAWANA LIGNITE DEPOSIT

STRUCTURAL CONTOUR MAP of BASE OF UPPER SEAM

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No:
JULY 1980	PSWG, JHR	JHR, PLS	TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY: [signature]	DRWG. No.: E-370-15-13-00

320



LEGEND

Test pit

Tailings pile

Abandoned shaft

Limit of area covered on detail sheet

Drillhole symbols

○ Drillhole location known to have been surveyed or presurveyed

□ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation

△ Drillhole co-ordinates appear to be approximate (± 15m)

▽ Drillhole co-ordinates known to be approximate (±15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available Information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole; partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA, P, ON, & H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80 -	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

• Upper seam considered unmineable

NDE Hole not deep enough to record coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Limit of interburden

Interburden isopach (metres)

1:10,000

METRES

500 400 300 200 100 0 250 500

CONTOUR INTERVAL 1m

63-4121

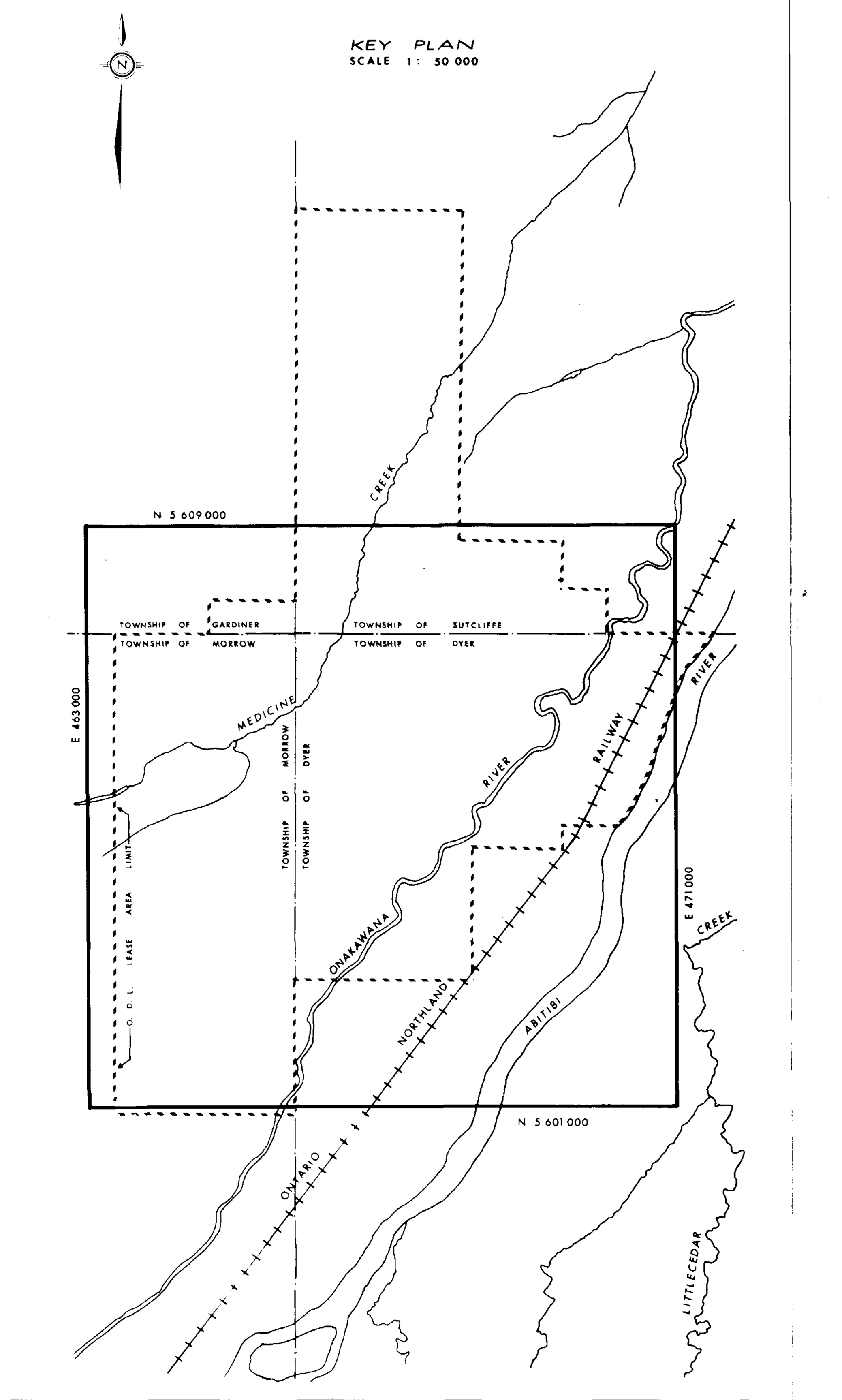
CLIENT: **onakawana development limited**

TITLE: ONAKAWANA LIGNITE DEPOSIT

ISOPACH MAP of THICKNESS OF INTERBURDEN BETWEEN UPPER AND LOWER SEAMS

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No:
JULY 1980	PSWG, MLR	PLS, DBM	TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY: MLR	DRWG. No.: E-370-15-14-00

33Ø



LEGEND

Test pit

Tailings pile

Abandoned shaft

Limit of area covered on detail sheet

Drillhole symbols

○ Drillhole location known to have been surveyed or presurveyed

□ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation

△ Drillhole co-ordinates appear to be approximate (± 15m)

▽ Drillhole co-ordinates known to be approximate (± 15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available Information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole; partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA,P,ON,&H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80-	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

NDE Hole not deep enough to record coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Structural contour (metres)

1:10,000

METRES

500 400 300 200 100 0 250 500

CONTOUR INTERVAL 2m

63.4121

CLIENT: **onakawana development limited**

TITLE: ONAKAWANA LIGNITE DEPOSIT

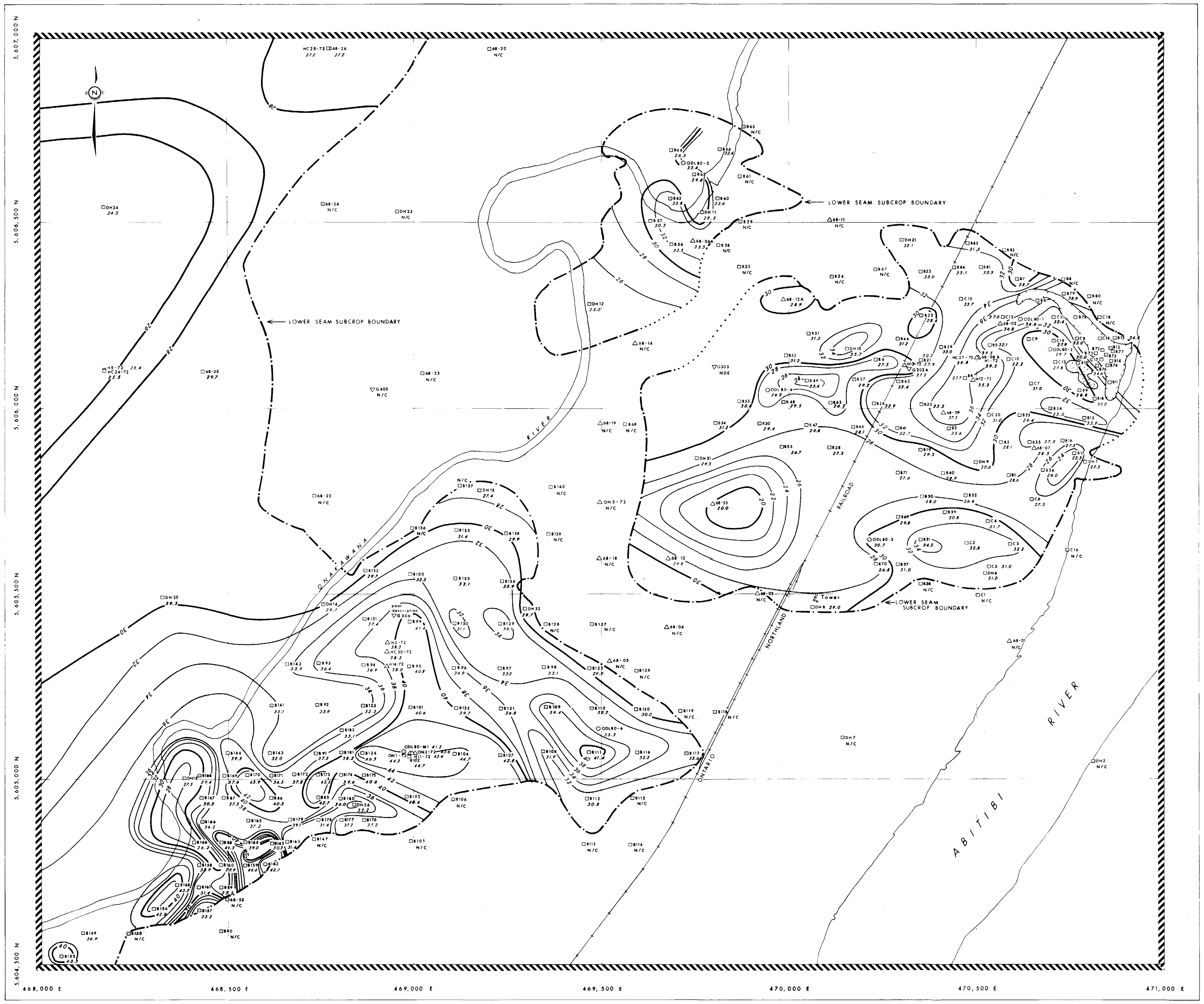
STRUCTURAL CONTOUR MAP of TOP OF LOWER SEAM

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No:
JULY 1980	JHR, PSWG	KEC, PSWG	TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY:	DRWG. No.: E-370-15-15-00

340

DETAIL SHEET

SHOWING AREA OF DENSE DRILLING
EAST OF THE ONAKAWANA RIVER



LEGEND

Test pit

Tailings pile

Drillhole symbols

○ Drillhole location known to have been surveyed or presurveyed

□ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation

△ Drillhole co-ordinates appear to be approximate (± 15 m)

▽ Drillhole co-ordinates known to be approximate (± 15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole; partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA, P, ON, & H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80 -	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

NDE Hole not deep enough to show coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Structural contour (metres)

1:5,000
METRES

300 250 200 150 100 50 0 100 200 300

CONTOUR INTERVAL 2m

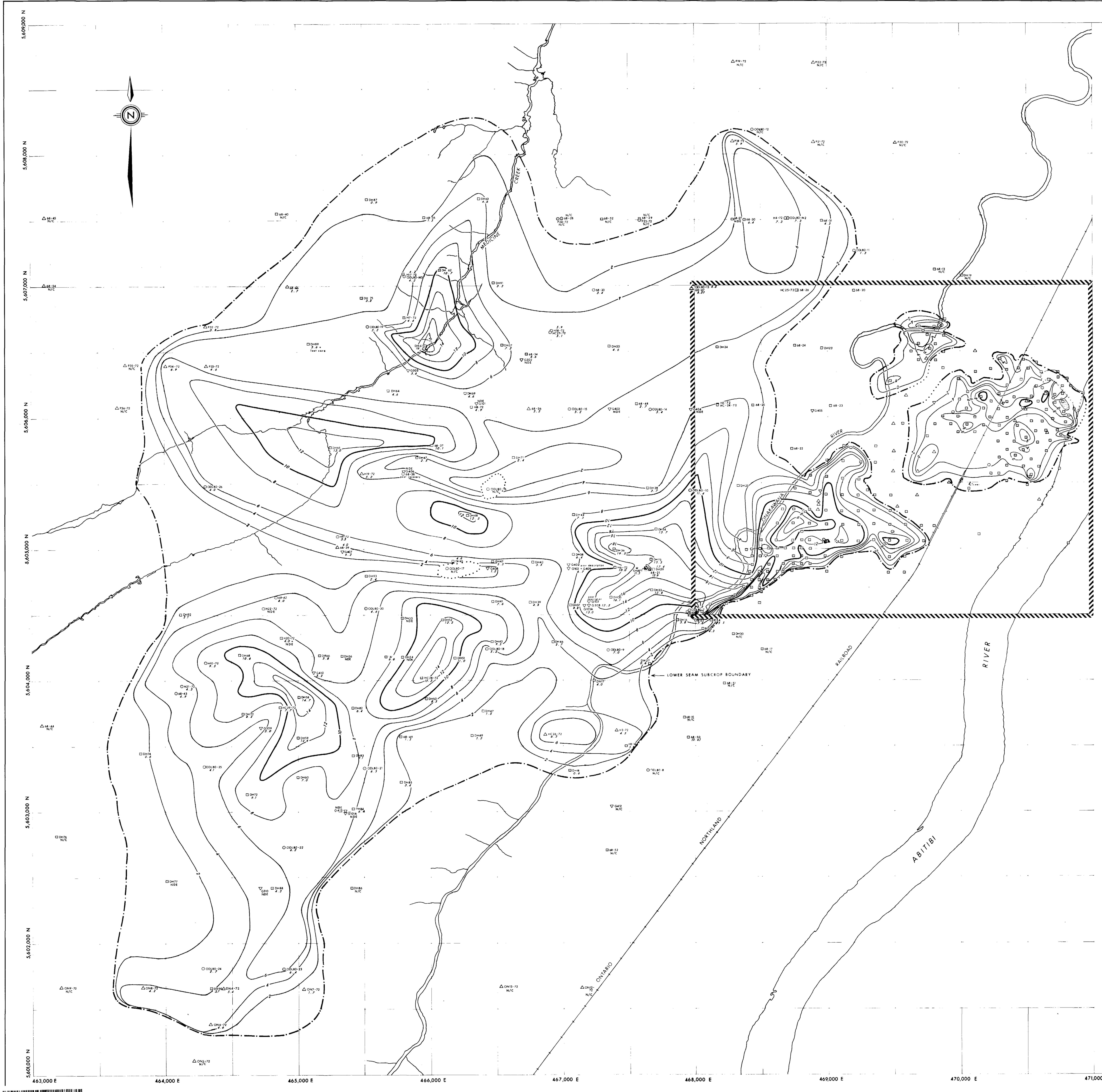
63.4121

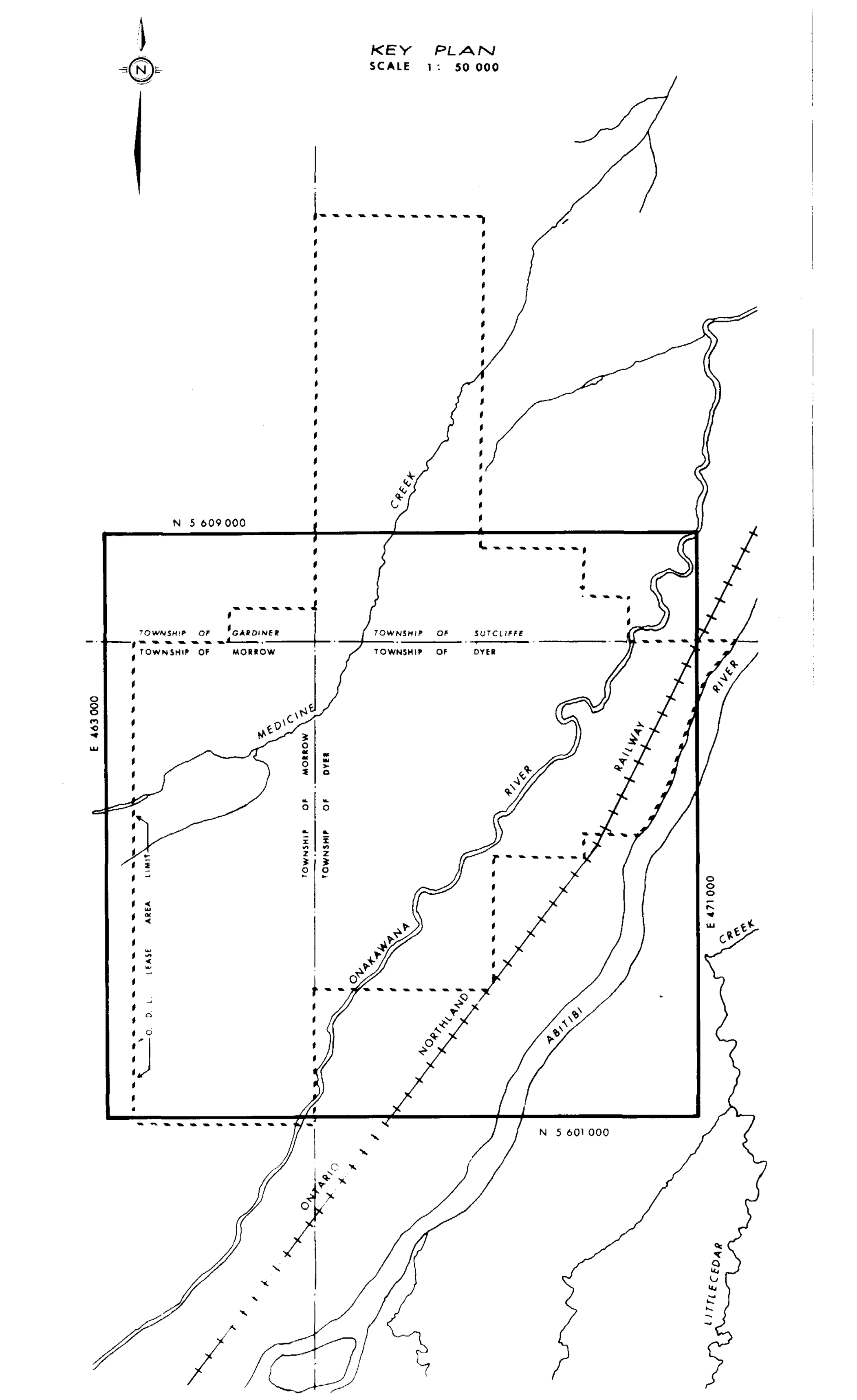
onakawana development limited

ONAKAWANA LIGNITE DEPOSIT
STRUCTURAL CONTOUR MAP
of
TOP OF LOWER SEAM

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No.:
JULY 1980	PSWG	JHR, PSWG	TM 370
Techman Ltd. • monenco		CHECKED BY:	DWG. No.: E-370-15-16-00

350





LEGEND

	Test pit
	Tailings pile
	Abandoned shaft
	Limit of area covered on detail sheet

Drillhole symbols

- ○ Drillhole location known to have been surveyed or presurveyed
- □ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation
- △ Drillhole co-ordinates appear to be approximate (± 15m)
- ▽ Drillhole co-ordinates known to be approximate (±15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available Information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole; partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA, P, ON, & H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80-	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

NDE Hole not deep enough to record coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Lignitic coal isopach (metres)

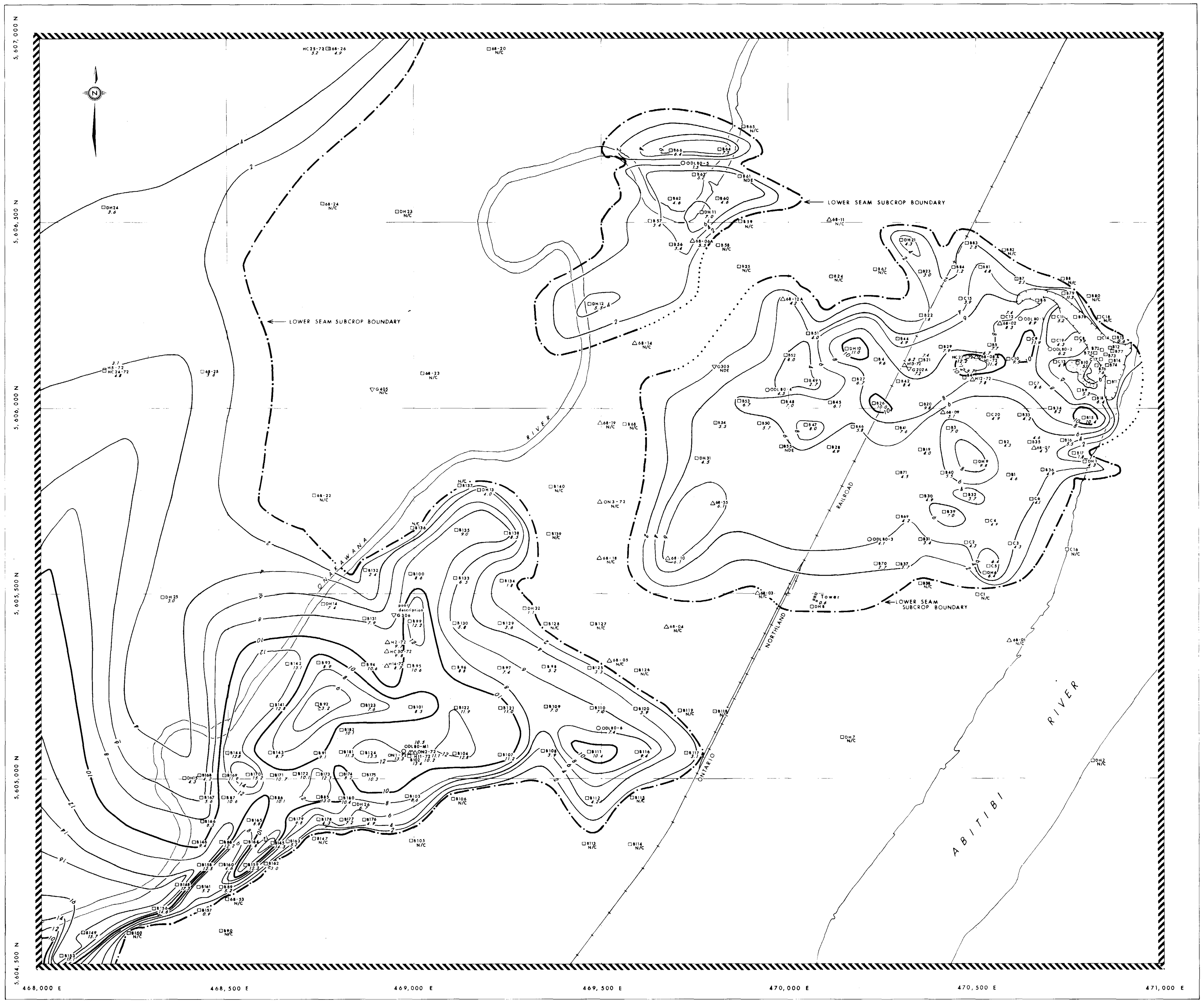
1:10,000
METRES
500 400 300 200 100 0 250 500

CONTOUR INTERVAL 2m

63.4121

CLIENT: onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT ISOPACH MAP of NET THICKNESS OF LOWER SEAM			
DATE: JULY 1980	COMPILED BY: PSWG, MLR	DRAWN BY: PLS, DBM	PROJECT No: TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY: PSWG [signature]	DRWG. No.: E-370-15-17-00

360



DETAIL SHEET

SHOWING AREA OF DENSE DRILLING
EAST OF THE ONAKAWANA RIVER

LEGEND

Test pit

Tailings pile

Drillhole symbols

- ○ Drillhole location known to have been surveyed or presurveyed
- □ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation
- △ Drillhole co-ordinates appear to be approximate (± 15 m)
- ▽ Drillhole co-ordinates known to be approximate (± 15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole, partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1961	Field geologist's log
68-	1968	Driller's log
EA, P, ON, & H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80 -	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

NDE Hole not deep enough to show coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Lignitic coal isopach (metres)

1:5,000
METRES

300 250 200 150 100 50 0 100 200 300

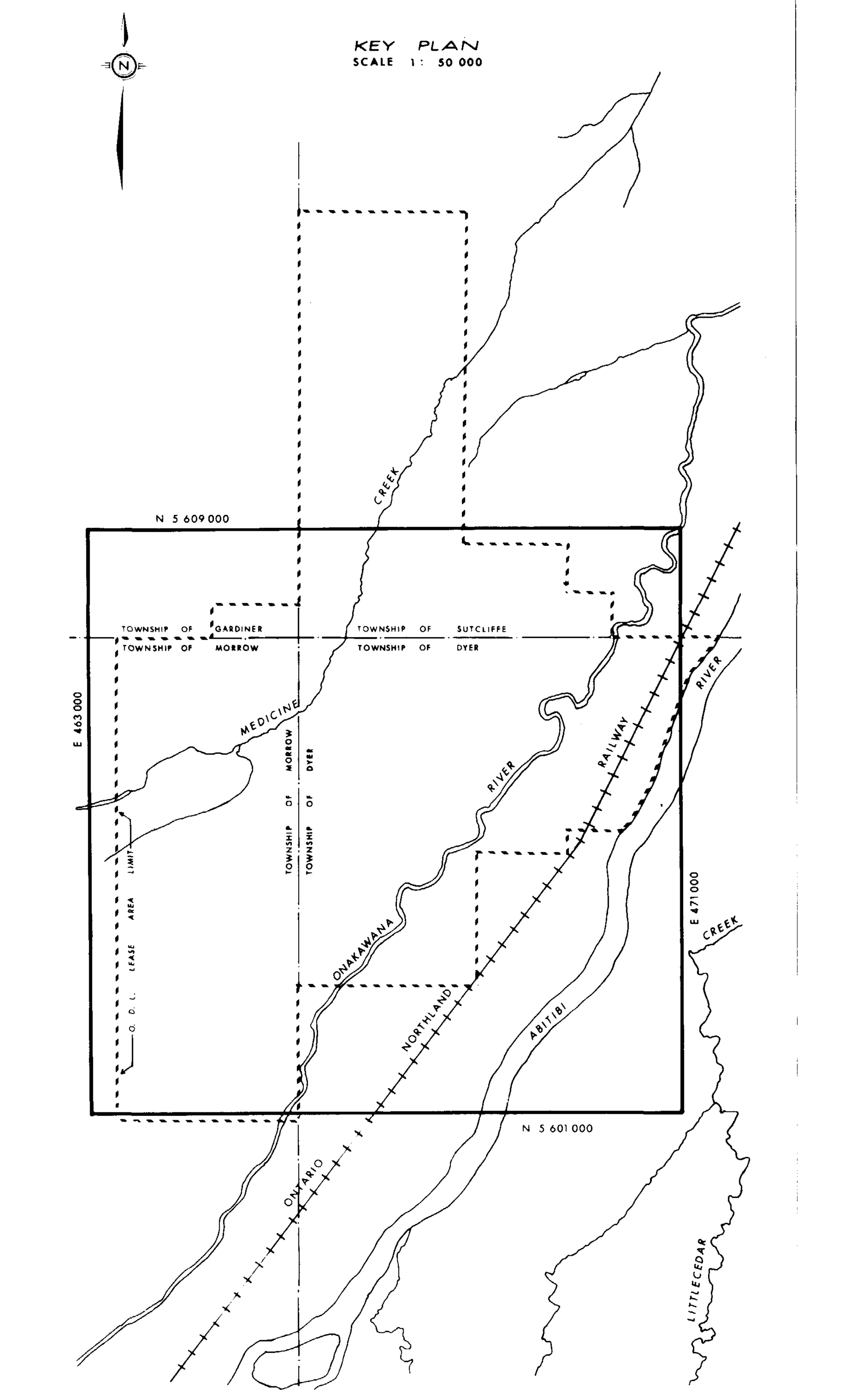
CONTOUR INTERVAL 2m

63.4121

CLIENT:	onakawana development limited
TITLE:	ONAKAWANA LIGNITE DEPOSIT ISOPACH MAP of NET THICKNESS OF LOWER SEAM

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No.:
JULY 1980	MLR	MLR, DBM	TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY:	DRWG. No.: E-370-15-18-00

370



LEGEND

Test pit

Tailings pile

Abandoned shaft

Limit of area covered on detail sheet

Drillhole symbols

○ Drillhole location known to have been surveyed or presurveyed

□ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation

△ Drillhole co-ordinates appear to be approximate (±15m)

▽ Drillhole co-ordinates known to be approximate (±15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available Information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole; partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA, P, ON, & H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80-	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

② Number of partings within seam

NDE Hole not deep enough to record coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Parting isopach (metres)

1:10,000
METRES
500 400 300 200 100 0 250 500

CONTOUR INTERVAL 1m

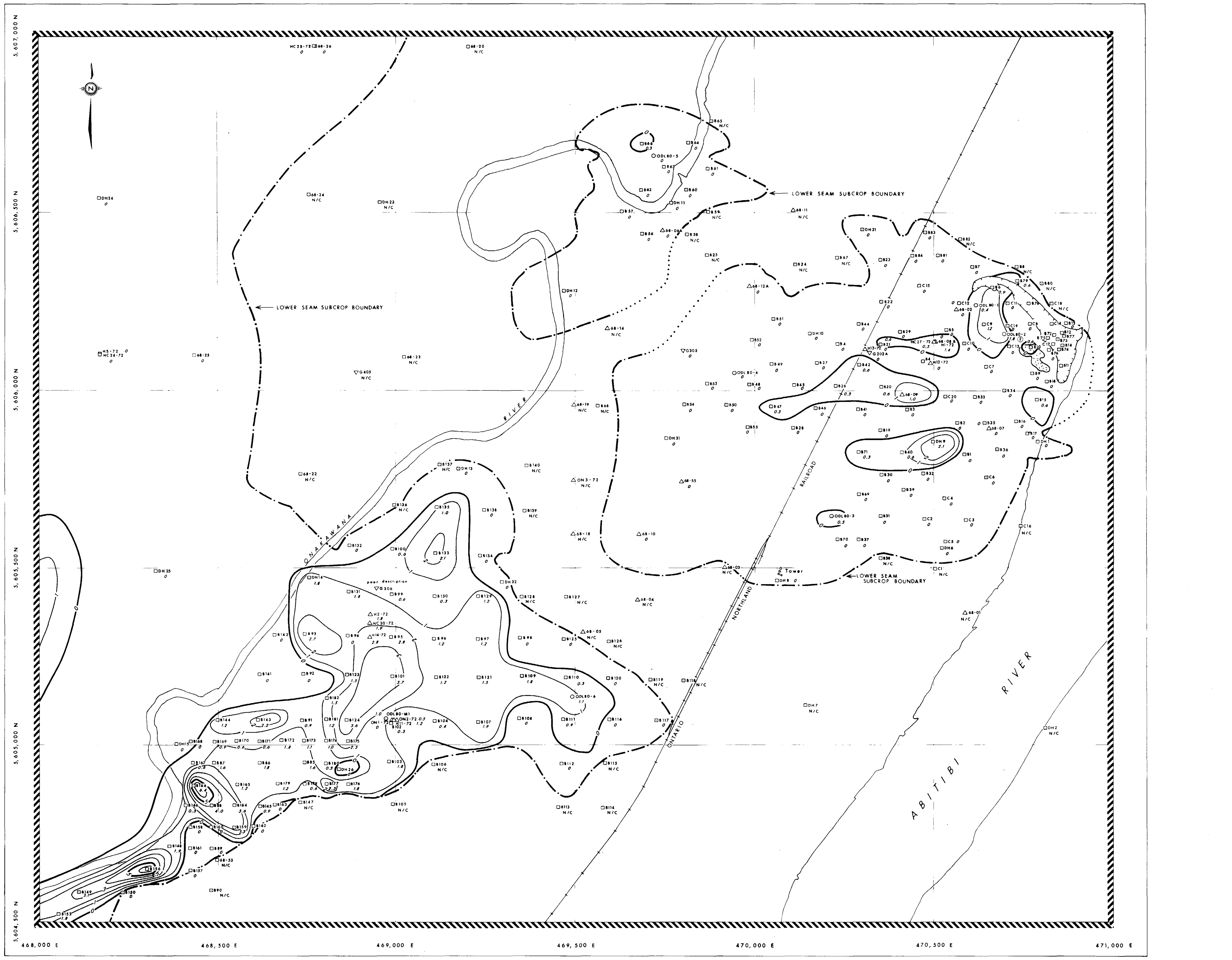
63.4121

CLIENT: onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT ISOPACH MAP of PARTING THICKNESS WITHIN LOWER SEAM			
DATE: JULY 1980	COMPILED BY: PSWG, MLR	DRAWN BY: RGP, DBM	PROJECT No: TM 370
Teckman Ltd. • manalta coal ltd.		CHECKED BY: [signature]	DRWG. No.: E-370-15-19-00

380

DETAIL SHEET

SHOWING AREA OF DENSE DRILLING
EAST OF THE ONAKAWANA RIVER



LEGEND

Test pit

Tailings pile

Drillhole symbols

- ○ Drillhole location known to have been surveyed or presurveyed
- □ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation
- △ Drillhole co-ordinates appear to be approximate (± 15 m)
- ▽ Drillhole co-ordinates known to be approximate (± 15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole; partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA, P, ON, & H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80 -	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

② Number of partings within seam

NDE Hole not deep enough to show coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Parting isopach (metres)

1:5,000
METRES

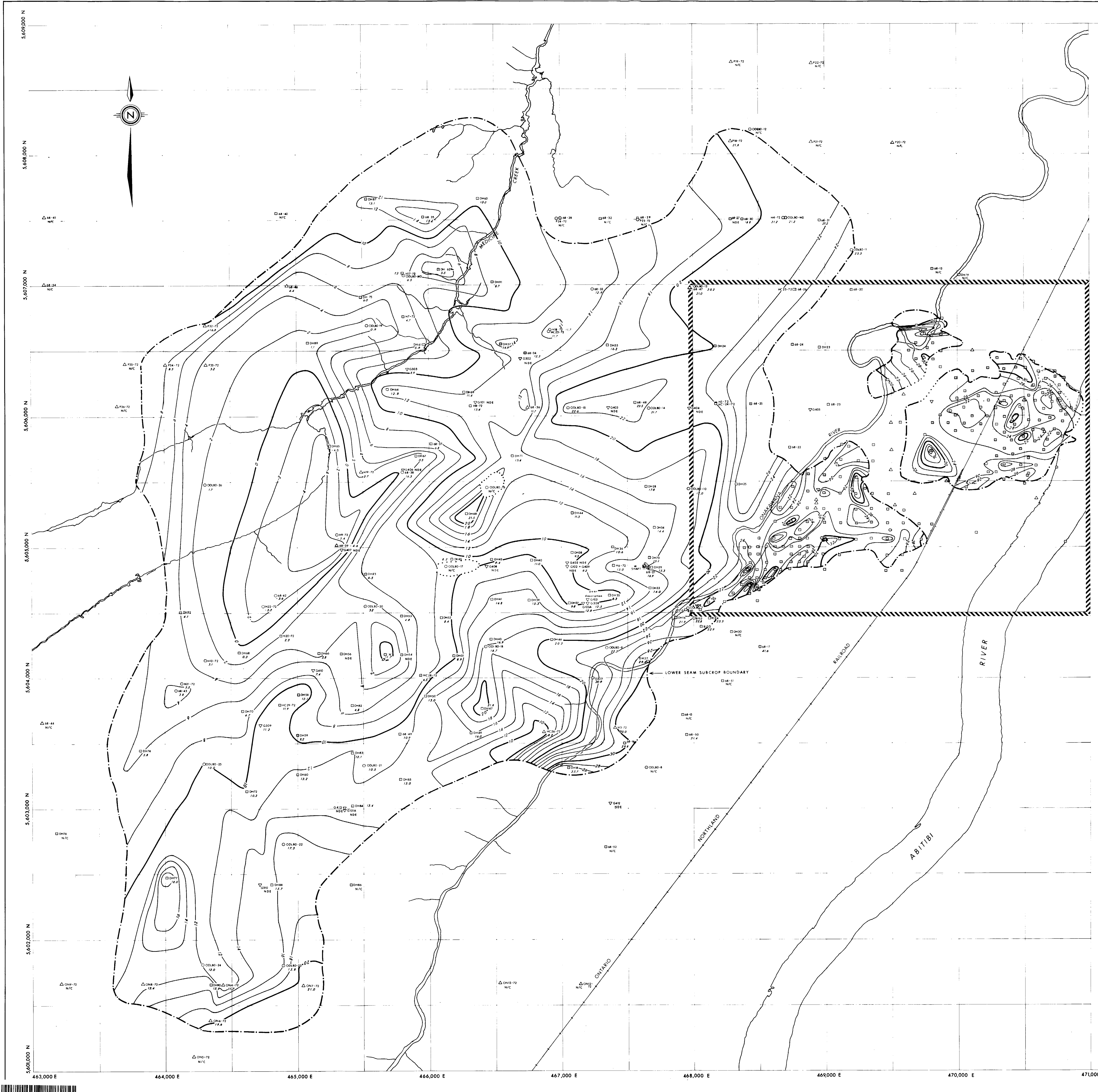
300 250 200 150 100 50 0 100 200 300

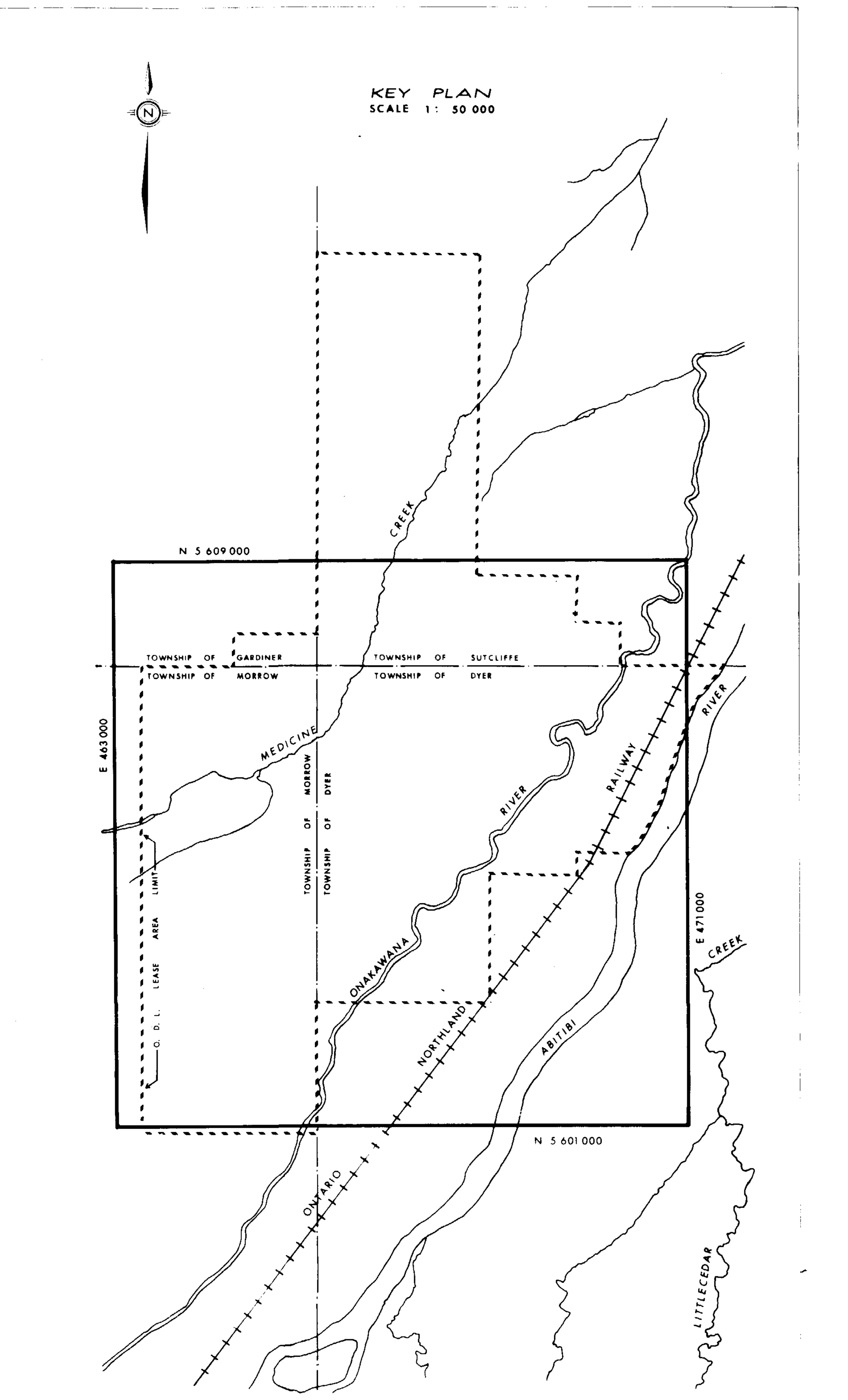
CONTOUR INTERVAL 1m

63-4121

CLIENT: onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT ISOPACH MAP of PARTING THICKNESS WITHIN LOWER SEAM			
DATE: JULY 1980	COMPILED BY: MLR	DRAWN BY: JHR, DBM	PROJECT No: TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY: [signature]	DRWG. No: E-370-15-20-00

390





LEGEND

Test pit

Tailings pile

Abandoned shaft

Limit of area covered on detail sheet

Drillhole symbols

○ Drillhole location known to have been surveyed or presurveyed

□ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation

△ Drillhole co-ordinates appear to be approximate (±15m)

▽ Drillhole co-ordinates known to be approximate (±15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available Information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole, partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA,P,ON,&H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80-	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

NDE Hole not deep enough to record coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Structural contour (metres)

1:10,000

METRES

500 400 300 200 100 0 250 500

CONTOUR INTERVAL 2m

63.4121

onakawana development limited

ONAKAWANA LIGNITE DEPOSIT

STRUCTURAL CONTOUR MAP of BASE OF LOWER SEAM

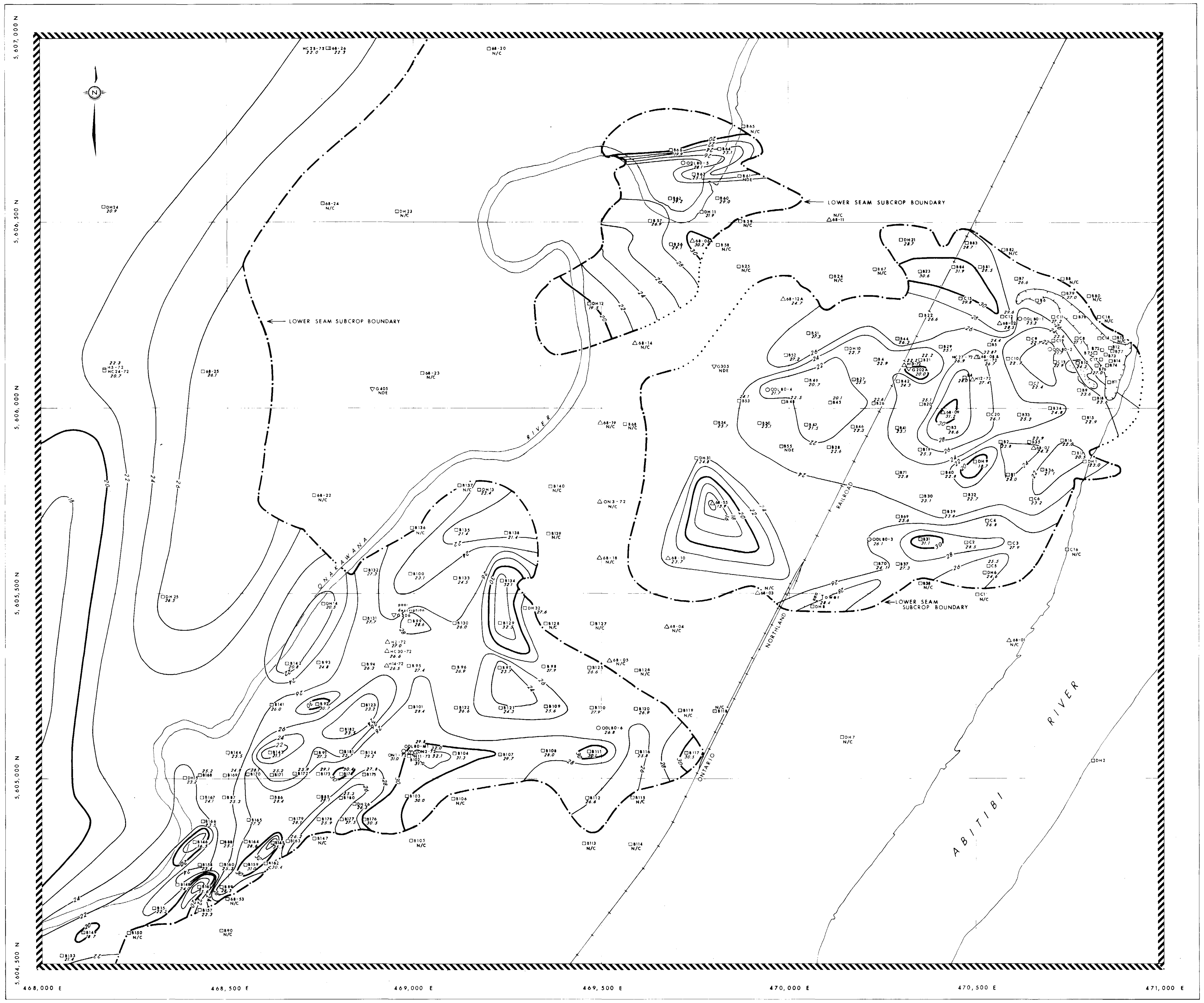
DATE	COMPILED BY	DRAWN BY	PROJECT No.
JULY 1980	EL, JHR, MLR	JHR, DBM, MLR	TM 370

Techman Ltd. • monenco coal ltd.

CHECKED BY: [signature]

DRWG. No. E-370-15-21-00

400



DETAIL SHEET

SHOWING AREA OF DENSE DRILLING
EAST OF THE ONAKAWANA RIVER

LEGEND

Test pit

Tailings pile

Drillhole symbols

○ Drillhole location known to have been surveyed or presurveyed

□ Drillhole co-ordinates appear to reflect survey data; original source of location information not known at time of map preparation

△ Drillhole co-ordinates appear to be approximate (± 15 m)

▽ Drillhole co-ordinates known to be approximate (± 15m). Hole drilled by Golder Associates for geotechnical study

Source of drillhole and shaft information

Prefix or name	Drilling program	Available information
DH	1929 - 1933	Driller's or field geologist's log
C	1929 - 1933	Field geologist's log (Hole partially cored)
'A'	1929 - 1933	Geologist's log (Deep oil exploration hole; partially cored)
W Shaft	1929 - 1933	Geologist's log
B	1939 - 1941	Field geologist's log
68-	1968	Driller's log
EA, P, ON, & H	1972	Driller's or field geologist's log
HC	1972	Field geologist's log (Hole partially cored)
G	1977	Graphic log (Hole cored and logged by geophysical methods for geotechnical study)
ODL 80-	1980	Driller's, geologist's and geophysical log (Hole partially cored)

Italicized number indicates datum (thickness or elevation above sea level) in metres

N/C No lignitic coal recorded

NDE Hole not deep enough to show coal if present

Lignitic coal subcrop boundary (inferred, assumed)

Structural contour (metres)

1:5,000
METRES
300 250 200 150 100 50 0 100 200 300

CONTOUR INTERVAL 2m

63.4121

CLIENT: onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT STRUCTURAL CONTOUR MAP of BASE OF LOWER SEAM			
DATE: JULY 1980	COMPILED BY: MLR	DRAWN BY: PLS., MLR	PROJECT No.: TM 370
Teckmaw Ltd. • manalta coal ltd.		CHECKED BY: [signature]	DRWG. No.: E-370-15-22-00

42I11NW0002 63.4121 BUTCLIFFE

410

LEGEND

- Muskeg
- Quaternary clay
- Boulder clay (till)
- Gravel
- Sand & gravel
- Sand
- Cretaceous clay
- Lignitic coal
- Pre-Pleistocene ('bedrock') surface
- Ⓤ Upper seam
- Ⓛ Lower seam — Top member / Bottom member

SCALE

300 200 100 0 m

0 5 10 m

Vertical exaggeration x10

AA'
CROSS-SECTION

5,608,095 N
LATITUDE (UTM)

63 4121

CLIENT	onakawana development limited
TITLE	ONAKAWANA LIGNITE DEPOSIT SCHEMATIC CROSS-SECTION

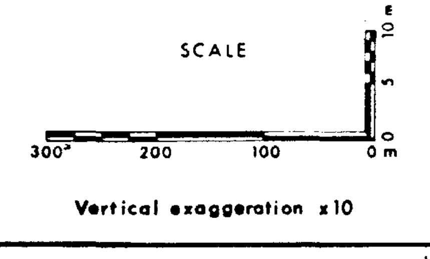
DATE:	COMPILED BY:	DRAWN BY	PROJECT No.
JULY 1980	JHR	KEC	TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY: [signature]	DRWG. No.: BR-370-15-01-00

420


464,000E
464,500E
465,000E
465,500E
466,000E
466,500E
467,000E
467,500E
468,000E
468,500E
469,000E
469,500E
470,000E
470,500E
471,000E
ELEV
DATUM
60 m
50 m
40 m
30 m
20 m
10 m
0 m
-10 m
68-40
68-35
Medicine Creek
P24-72
68-28
68-32
68-29
68-27
68-30
H4-72
OOL80-M2
68-31
Onakawana River
ONR
LEGEND
Muskeg
Quaternary clay
Boulder clay (till)
Gravel
Sand & gravel
Sand
Cretaceous clay
Lignitic coal
Pre-Pleistocene ("bedrock") surface
Upper seam
Lower seam
Top member
Bottom member
SCALE
300
200
100
0 m
0
5
10 m
Vertical exaggeration x10
B B'
CROSS-SECTION
5,607,500 N
LATITUDE (UTM)
CLIENT
onakawana development limited
TITLE
ONAKAWANA LIGNITE DEPOSIT
SCHEMATIC CROSS-SECTION
DATE: JULY 1980
COMPILED BY: JHR
DRAWN BY: KEC
PROJECT No.: TM 370
Techman Ltd. • manalta coal ltd.
CHECKED BY:
DRWG. No.: BR-370-15-02-00
430

LEGEND

- Muskeg
- Quaternary clay
- Boulder clay (till)
- Gravel
- Sand & gravel
- Sand
- Cretaceous clay
- Lignitic coal
- Pre-Pleistocene ("bedrock") surface
- Ⓤ Upper seam
- Ⓛ Lower seam: Top member / Bottom member



Vertical exaggeration x10

CC'
CROSS-SECTION

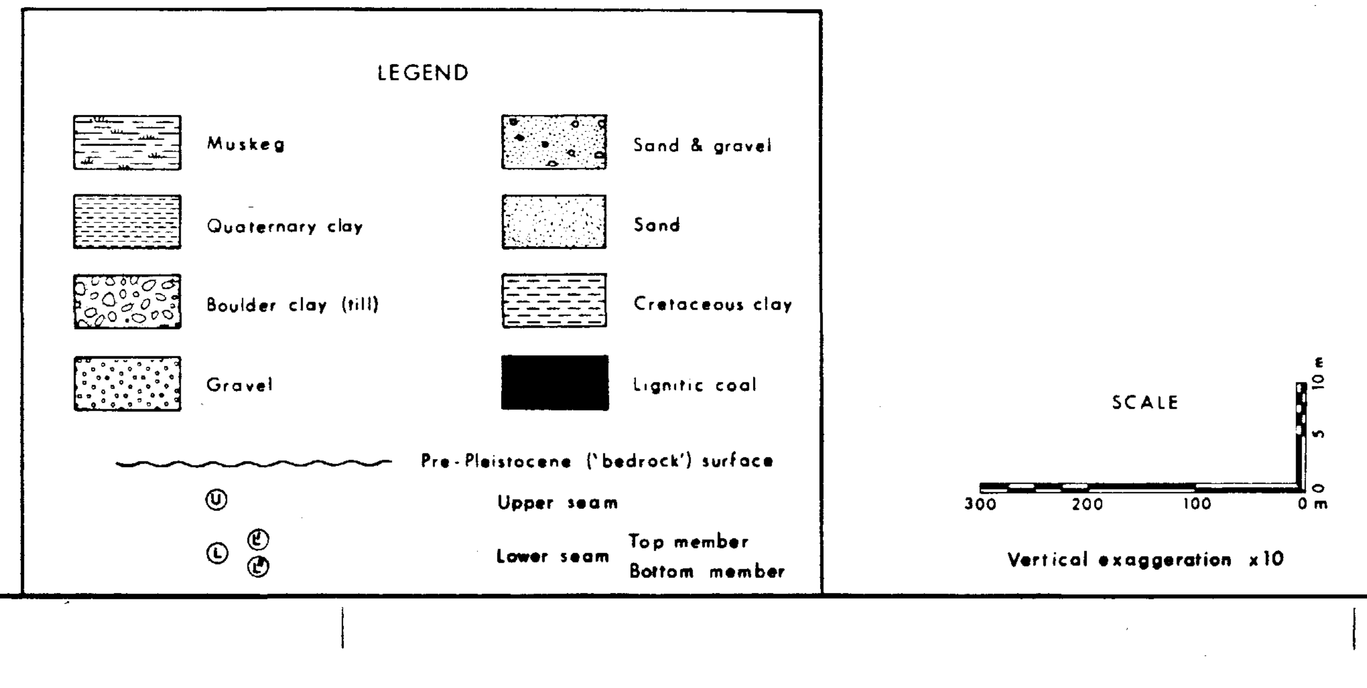
5,607,265 N
LATITUDE (UTM)

CLIENT: onakawana development limited

TITLE: ONAKAWANA LIGNITE DEPOSIT
SCHEMATIC CROSS-SECTION

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No.:
JULY 1980	JHR	PLS	TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY:	DRWG. No.: BR-370-15-03-00

44



DD'
CROSS-SECTION

5,606,990 N
LATITUDE (UTM)

CLIENT: **onakawana development limited**

TITLE: **ONAKAWANA LIGNITE DEPOSIT**
SCHEMATIC CROSS-SECTION

DATE:	COMPILED BY:	DRAWN BY:	PROJECT No.:
JULY 1980	PSWG	PLS	TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY: [signature]	DRWG. No.: 8R-370-13-04-00

450

464,000E
464,500E
465,000E
465,500E
466,000E
466,500E
467,000E
467,500E
468,000E
468,500E
469,000E
469,500E
470,000E
470,500E
471,000E
P32-72
ODL 80-19
Medicine Creek
HC23-72
Onakawana River
B66
B64
Onakawana River
O.N.R.
ELEV
DATUM
60 m
50 m
40 m
30 m
20 m
10 m
0 m
-10 m
lower rider
LEGEND
Muskeg
Quaternary clay
Boulder clay (till)
Gravel
Sand & gravel
Sand
Cretaceous clay
Lignitic coal
Pre-Pleistocene ("bedrock") surface
Upper seam
Lower seam
Top member
Bottom member
SCALE
300
200
100
0 m
Vertical exaggeration x10
EE'
CROSS-SECTION
5,606,690 N
LATITUDE (UTM)
CLIENT
onakawana development limited
TITLE
ONAKAWANA LIGNITE DEPOSIT
SCHEMATIC CROSS-SECTION
DATE: JULY 1980
COMPILED BY: PSWG
DRAWN BY: KEC
PROJECT No: TM 370
Techman Ltd. • manalta coal ltd.
CHECKED BY
DRWG. No: BR-370-15-05-00
460

464,000E
464,500E
465,000E
465,500E
466,000E
466,500E
467,000E
467,500E
468,000E
468,500E
469,000E
469,500E
470,000E
470,500E
471,000E
ELEV
DATUM
60 m
50 m
40 m
30 m
20 m
10 m
0 m
-10 m
P34-72
P33-72
Medicine Creek
G303
Onakawana River
Onakawana River
825
867
823
O.N.R. 884
881
LEGEND
Muskeg
Quaternary clay
Boulder clay (till)
Gravel
Sand & gravel
Sand
Cretaceous clay
Lignitic coal
Pre-Pleistocene ("bedrock") surface
Upper seam
Lower seam
Top member
Bottom member
SCALE
300 200 100
Vertical exaggeration x10
FF'
CROSS-SECTION
5,606,385 N
LATITUDE (UTM)
CLIENT:
onakawana development limited
TITLE:
ONAKAWANA LIGNITE DEPOSIT
SCHEMATIC CROSS-SECTION
DATE: JULY 1980
COMPILED BY: PSWG, MLR
DRAWN BY: PLS
PROJECT No: TM 370
Techman Ltd. • manalta coal ltd.
CHECKED BY:
DRWG. No: BR-370-15-06-00
470

LEGEND

Muskeg	Sand & gravel
Quaternary clay	Sand
Boulder clay (till)	Cretaceous clay
Gravel	Lignitic coal

Pre-Pleistocene ('bedrock') surface

Ⓤ Upper seam

Ⓛ Lower seam: Top member / Bottom member

SCALE

300 200 100 0 m

0 5 10 m

Vertical exaggeration x10

GG'
CROSS-SECTION

5,606,060 N
LATITUDE (UTM)

CLIENT: onakawana development limited

TITLE: ONAKAWANA LIGNITE DEPOSIT
SCHEMATIC CROSS-SECTION

DATE: JULY 1980	COMPILED BY: PSWG, MLR	DRAWN BY: PLS	PROJECT No: TM 370
Techman Ltd. • monenco coal ltd.		CHECKED BY:	DRWG. No: BR-370-15-07-00

480

490

HH'
CROSS-SECTION

5,605,765 N
LATITUDE (UTM)

CLIENT: onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT SCHEMATIC CROSS-SECTION			
DATE: JULY, 1980	COMPILED BY: PSWG, MLR	DRAWN BY: KEC	PROJECT No.: TM 370
Techman Ltd. • monenco		CHECKED BY:	DWG. No.: BR-370-15-08-00

LEGEND

Muskeg
Quaternary clay
Boulder clay (till)
Gravel
Sand & gravel
Sand
Cretaceous clay
Lignitic coal
Pre-Pleistocene ("bedrock") surface
Upper seam
Lower seam — Top member, Bottom member

SCALE

300 200 100 0 m

Vertical exaggeration x 10

II'
CROSS-SECTION

5,605,470 N
LATITUDE (UTM)

CLIENT	**onakawana development limited**
TITLE	**ONAKAWANA LIGNITE DEPOSIT** SCHEMATIC CROSS-SECTION

DATE:	COMPILED BY:	DRAWN BY	PROJECT No.
JULY 1980	PSWG, MLR	KEC	TM 370
Techman Ltd. • monenco		CHECKED BY	DRWG. No.: 88-370-13-09-00

500


464,000E
464,500E
465,000E
465,500E
466,000E
466,500E
467,000E
467,500E
468,000E
468,500E
469,000E
469,500E
470,000E
470,500E
471,000E
ELEV
DATUM
60 m
50 m
40 m
30 m
20 m
10 m
0 m
-10 m
Medicine Creek
HP-72
DH48
DH44
DH24
Onakawana River
B141
B92
B123
B101
B122
B121
B109
B110
B120
B119
B118
O.N.R.
Abitibi River
lower rider ?
LEGEND
Muskeg
Quaternary clay
Boulder clay (till)
Gravel
Sand & gravel
Sand
Cretaceous clay
Lignitic coal
Pre-Pleistocene ('bedrock') surface
Upper seam
Lower seam
Top member
Bottom member
SCALE
300
200
100
0 m
Vertical exaggeration x10
JJ'
CROSS-SECTION
5,605,190 N
LATITUDE (UTM)
CLIENT:
onakawana development limited
TITLE:
ONAKAWANA LIGNITE DEPOSIT
SCHEMATIC CROSS-SECTION
DATE: JULY 1980
COMPILED BY: PSWG, MLR
DRAWN BY: KEC
PROJECT No: TM 370
CHECKED BY:
DRWG. No: BR-370-15-10-00
Techman Ltd. • manalta coal ltd.
S10

KK'
CROSS-SECTION

5,604,840 N
LATITUDE (UTM)

CLIENT: onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT — SCHEMATIC CROSS-SECTION			
DATE: JULY 1980	COMPILED BY: PSWG	DRAWN BY: KEC	PROJECT No: TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY:	DRWG. No: BR-370-15-11-00

520

LEGEND

- Muskeg
- Quaternary clay
- Boulder clay (till)
- Gravel
- Sand & gravel
- Sand
- Cretaceous clay
- Lignitic coal
- Pre-Pleistocene ("bedrock") surface
- Ⓤ Upper seam
- Ⓛ Ⓣ Ⓑ Lower seam: Top member, Bottom member

SCALE

300 200 100 0 m

Vertical exaggeration x10

LL'
CROSS-SECTION

5,604,565 N
LATITUDE (UTM)

63.4121

CLIENT			
onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT — SCHEMATIC CROSS-SECTION			
DATE: JULY 1980	COMPILED BY: PSWG	DRAWN BY: KEC	PROJECT No: TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY: [signature]	DRWG. No.: BR-370-15-12-00

530


464,000E
464,500E
465,000E
465,500E
466,000E
466,500E
467,000E
467,500E
468,000E
468,500E
469,000E
469,500E
470,000E
470,500E
471,000E
ELEV
DATUM
60 m
50 m
40 m
30 m
20 m
10 m
0 m
-10 m
N10-72
DH48
DH46
DH36
"A"
DH34
DH31
ODL80-18
ODL80-09
DH27
Onakawana River
O N R
Abitibi River
lower rider
LEGEND
Muskeg
Quaternary clay
Boulder clay (till)
Gravel
Sand & gravel
Sand
Cretaceous clay
Lignitic coal
Pre-Pleistocene ("bedrock") surface
Upper seam
Lower seam
Top member
Bottom member
SCALE
Vertical exaggeration x10
MM'
CROSS-SECTION
5,604,185 N
LATITUDE (UTM)
CLIENT
onakawana development limited
TITLE
ONAKAWANA LIGNITE DEPOSIT
SCHEMATIC CROSS-SECTION
DATE JULY 1980
COMPILED BY PSWG
DRAWN BY KEC
PROJECT No TM 370
CHECKED BY
DRWG. No. BR-370-15-13-00
Teckman Ltd. • manalta coal ltd.
540


464,000E
464,500E
465,000E
465,500E
466,000E
466,500E
467,000E
467,500E
468,000E
468,500E
469,000E
469,500E
470,000E
470,500E
471,000E
68-43
DH 58
DH 50
Onakawana River
ONR
Abitibi River
ELEV
DATUM
60 m
50 m
40 m
30 m
20 m
10 m
0 m
-10 m
LEGEND
Muskeg
Quaternary clay
Boulder clay (till)
Gravel
Sand & gravel
Sand
Cretaceous clay
Lignitic coal
Pre-Pleistocene ('bedrock') surface
Upper seam
Lower seam
Top member
Bottom member
SCALE
300 200 100 0 m
0 5 10 m
Vertical exaggeration x 10
NN'
CROSS-SECTION
5,603,880 N
LATITUDE (UTM)
CLIENT
onakawana development limited
TITLE
ONAKAWANA LIGNITE DEPOSIT
SCHEMATIC CROSS-SECTION
DATE: JULY 1980
COMPILED BY: PSWG
DRAWN BY: PLS
PROJECT No. TM 370
CHECKED BY:
DRWG. No. BR-370-15-14-00
Techman Ltd. • manalta coal ltd.
550

LEGEND

- Muskeg
- Quaternary clay
- Boulder clay (till)
- Gravel
- Sand & gravel
- Sand
- Cretaceous clay
- Lignitic coal
- Pre-Pleistocene ("bedrock") surface
- Upper seam
- Lower seam: Top member, Bottom member

SCALE

300 200 100 0 m

0 5 10 m

Vertical exaggeration x10

OO'
CROSS-SECTION

5,603,570 N
LATITUDE (UTM)

CLIENT			
onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT SCHEMATIC CROSS-SECTION			
DATE: JULY 1980	COMPILED BY: PSWG	DRAWN BY: PLS	PROJECT No.: TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY:	DWG. No.: BR-370-15-15-00

S60

LEGEND

- Muskeg
- Quaternary clay
- Boulder clay (till)
- Gravel
- Sand & gravel
- Sand
- Cretaceous clay
- Lignitic coal
- Pre-Pleistocene ('bedrock') surface
- Upper seam
- Lower seam: Top member, Bottom member

SCALE

300 200 100 0 m

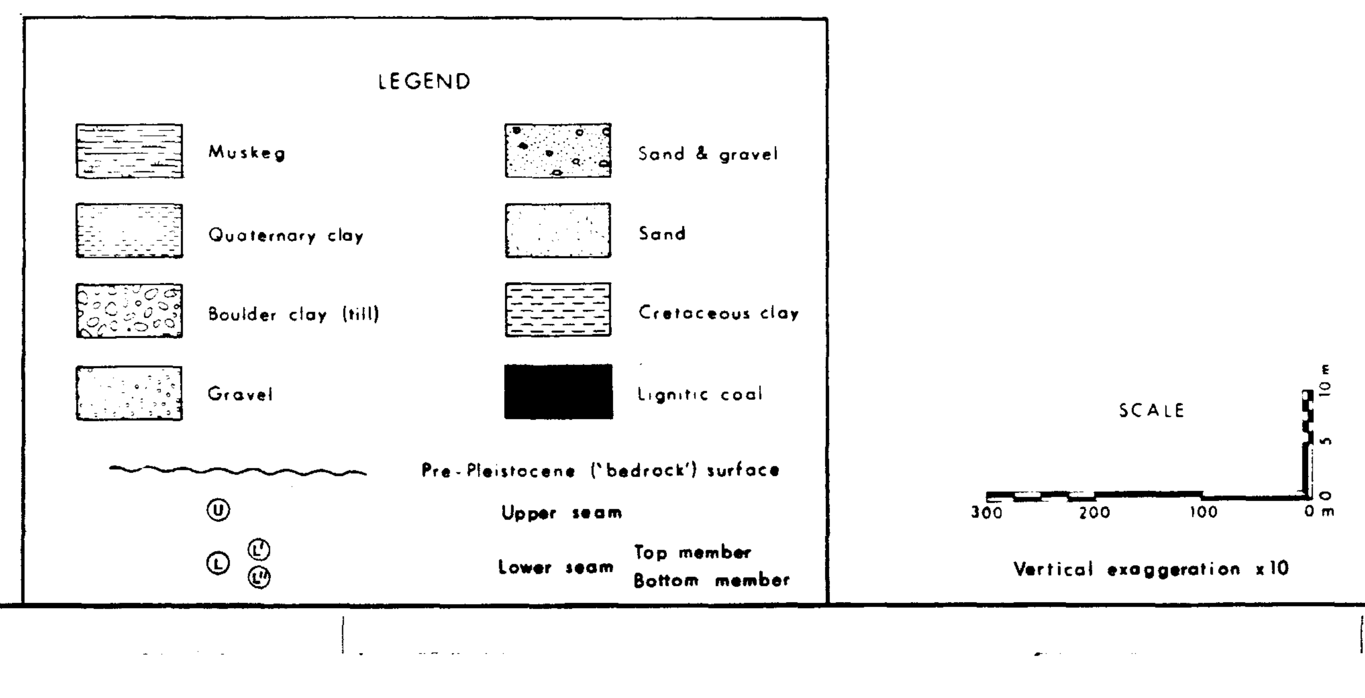
Vertical exaggeration x10

PP'
CROSS-SECTION

5,603,240 N
LATITUDE (UTM)

CLIENT: onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT — SCHEMATIC CROSS-SECTION			
DATE: JULY 1980	COMPILED BY: JHR	DRAWN BY: PLS	PROJECT No.: TM 370
Techman Ltd. • monenco		CHECKED BY: [signature]	DRWG. NO.: BR-370-15-16-00

570



580

QQ'
CROSS-SECTION

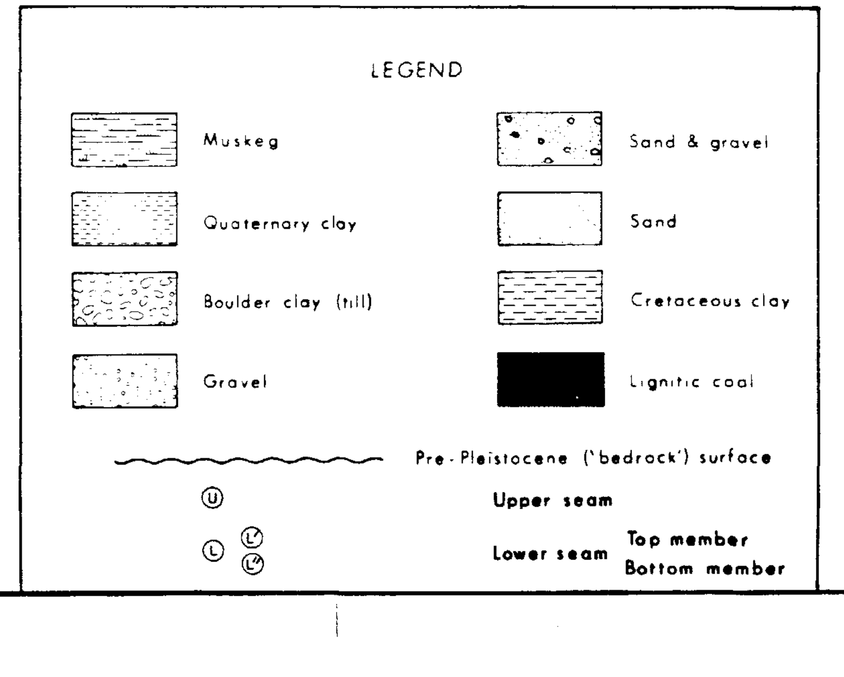
5,603,015 N
LATITUDE (UTM)

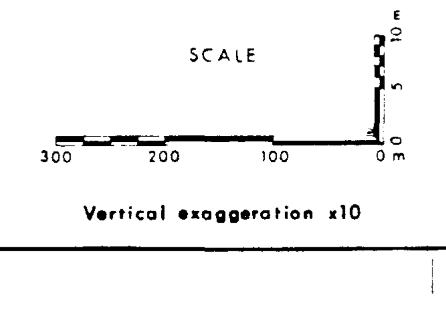
CLIENT: onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT SCHEMATIC CROSS-SECTION			
DATE: JULY 1980	COMPILED BY: JHR	DRAWN BY: KEC	PROJECT No: TM 370
Techman Ltd. • monalta c. of Ind.		CHECKED BY: [signature]	DRWG. No.: BR-370-15-17-00


464,000E
464,500E
465,000E
465,500E
466,000E
466,500E
467,000E
467,500E
468,000E
468,500E
469,000E
469,500E
470,000E
470,500E
471,000E
ELEV
DATUM
60 m
50 m
40 m
30 m
20 m
10 m
0 m
-10 m
OOL80-22
Onakawana River
O.N.R.
Abitibi River
LEGEND
Muskeg
Quaternary clay
Boulder clay (till)
Gravel
Sand & gravel
Sand
Cretaceous clay
Lignitic coal
Pre-Pleistocene ('bedrock') surface
Upper seam
Lower seam
Top member
Bottom member
SCALE
300
200
100
0 m
Vertical exaggeration x10
RR'
CROSS-SECTION
5,602,730 N
LATITUDE (UTM)
CLIENT
onakawana development limited
TITLE:
ONAKAWANA LIGNITE DEPOSIT
SCHEMATIC CROSS-SECTION
DATE: JULY 1980
COMPILED BY: JHR
DRAWN BY: KEC
PROJECT No: TM 370
Techman Ltd. • manalta coal ltd.
CHECKED BY:
DRWG. No: BR-370-15-18-00
590


464,000E
464,500E
465,000E
465,500E
466,000E
466,500E
467,000E
467,500E
468,000E
468,500E
469,000E
469,500E
470,000E
470,500E
471,000E
Onakawana River
ONR
Abitibi River
ELEV
DATUM
60 m
50 m
40 m
30 m
20 m
10 m
0 m
-10 m
LEGEND
Muskeg
Quaternary clay
Boulder clay (till)
Gravel
Sand & gravel
Sand
Cretaceous clay
Lignitic coal
Pre-Pleistocene ('bedrock') surface
Upper seam
Lower seam
Top member
Bottom member
SCALE
300
200
100
0 m
Vertical exaggeration x10
SS'
CROSS-SECTION
5,602,300 N
LATITUDE (UTM)
onakawana development limited
ONAKAWANA LIGNITE DEPOSIT
SCHEMATIC CROSS-SECTION
JULY 1980
JHR
KEC
TM 370
Teckman Ltd. + monalta
88-370-15-19-00
600


464,000E
464,500E
465,000E
465,500E
466,000E
466,500E
467,000E
467,500E
468,000E
468,500E
469,000E
469,500E
470,000E
470,500E
471,000E
Onakawana River
O.N.R.
Abitibi River
ELEV.
DATUM
60 m
50 m
40 m
30 m
20 m
10 m
0 m
-10 m
LEGEND
Muskeg
Quaternary clay
Boulder clay (till)
Gravel
Sand & gravel
Sand
Cretaceous clay
Lignitic coal
Pre-Pleistocene ("bedrock") surface
Upper seam
Lower seam
Top member
Bottom member
SCALE
300
200
100
0 m
Vertical exaggeration x 10
TT'
CROSS-SECTION
5,602,000 N
LATITUDE (UTM)
CLIENT
onakawana development limited
TITLE
ONAKAWANA LIGNITE DEPOSIT
SCHEMATIC CROSS-SECTION
DATE
JULY 1980
COMPILED BY:
JHR
DRAWN BY:
PLS
PROJECT No
TM 370
Techman Ltd. • manalta coal inc.
CHECKED BY
DRWG. No.:
BR-370-15-20-00





UU'
CROSS-SECTION

5,601,660 N
LATITUDE (UTM)

CLIENT: onakawana development limited

TITLE: ONAKAWANA LIGNITE DEPOSIT
SCHEMATIC CROSS-SECTION

DATE: JULY 1980	COMPILED BY: MLR, JHR	DRAWN BY: PLS, MLR	PROJECT No: TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY: [signature]	DRWG. No.: BR-370-15-21-00

620

LEGEND

- Muskeg
- Quaternary clay
- Boulder clay (till)
- Gravel
- Sand & gravel
- Sand
- Cretaceous clay
- Lignitic coal
- Pre-Pleistocene ("bedrock") surface
- Ⓤ Upper seam
- Ⓛ Lower seam: Ⓣ Top member, Ⓑ Bottom member

SCALE

300 200 100 0 m

10 5 0 m

Vertical exaggeration x10

XX′
CROSS-SECTION

AS SHOWN
LOCATION

CLIENT: onakawana development limited			
TITLE: ONAKAWANA LIGNITE DEPOSIT — SCHEMATIC CROSS-SECTION			
DATE: AUGUST 1980	DATE: PSWG, MLR	DRAWN BY: MLR	PROJECT No.: TM 370
Techman Ltd. • manalta coal ltd.		CHECKED BY: [signature]	DRWG. No.: BR-370-15-22-00

630