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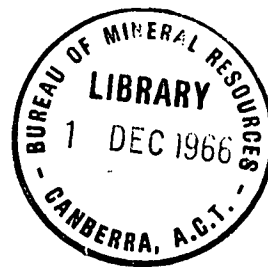
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COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT
BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS

RECORDS:

1966/138



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INVESTIGATION OF SOIL THICKNESS ALONG ROUTE OF WODEN-STROMLO
WATER MAIN, A.C.T. 1966.

Compiled by

D.E. Gardner & P.A. Lang

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INVESTIGATION OF SOIL THICKNESS ALONG ROUTE OF WODEN-STROMLO
WATER MAIN, A.C.T., 1966.

by

Compiled by D.E. Gardner and P.A. Lang from results of field
work by D. Tarlinton, P.A. Lang and J.P. Staunton

RECORDS 1966/138

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PLATES:

Plate 1: Locality map. 1 inch : 1600 feet.

Plates 2 to 9 : Woden - Stromlo Pipe line, thickness survey.
(Plans and sections).

Scale: Horizontal : 1 inch : 200 feet.

Vertical : 1 inch : 20 feet.

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Records 1966/138

SUMMARY

Geological and seismic traverses were conducted, and augering was done, along the route of the Woden-Stromlo Water Main, with the purpose of estimating the thickness of soil and weathered bedrock - collectively termed soil - that is soft enough to be excavated by trenching equipment. Experience in similar work has shown that this thickness is indicated approximately by the depth to which the power auger used in the investigation is capable of drilling.

The seismic velocities of the soil and underlying material can be related, empirically, to their amenability to mechanical excavation. Material with a seismic velocity greater than 5000 feet per second is generally too hard to excavate without some blasting.

The geological estimate, made during a brief reconnaissance along the route of the water main, is based on the commonly observed depths of weathering of the bedrock.

The estimates of soil thickness obtained by the three methods are generally in reasonable agreement. Locally, the auger stopped at shallow depths, presumably where it encountered hard rock fragments or boulders in the soil. At some localities the seismic results were indefinite, and the final estimate of soil thickness was based on results of augering.

INTRODUCTION

In response to a request by the Department of Works, geological and seismic investigations were carried out along the route of the Stromlo-Woden Water Main, with the purpose of estimating the thickness of soil and weathered bedrock that could be excavated without blasting (hereafter, in this report, termed excavatable soil).

Power augering along the route was arranged by the Department of Works; the holes were sunk mostly at 50-foot intervals. Auger holes were bored to 6-feet or to point of refusal, whichever was the shallower. Some holes were sunk to greater depths to provide more information about the underlying material.

A locality map showing the route of the water main is given in Plate 1; positions of seismic traverses and auger holes are shown in Plates 2 to 9.

GENERAL RECONNAISSANCE

In a reconnaissance traverse along the route, rough estimates were made of the thickness of soil and weathered rock that would be soft enough to be excavated with earth moving equipment (trenching machinery). The estimates are based on observations of depth of weathering in the same types of rock elsewhere in the Australian Capital Territory. They are probably very approximate but provide a means for interpreting results of seismic surveys and augering.

Along nearly all the route, the bedrock consists of dacitic tuff. This rock weathers deeply but irregularly, locally leaving small to large blocks of fresh, hard rock, surrounded by weathered rock.

The results of the reconnaissance are plotted on Plates 2 to 9.

SEISMIC TRAVERSES

Selected 100-foot sections of the pipeline were tested for thickness of excavatable soil by seismic methods. The equipment used was a Dyna Metric, model 117, seismic timer, which measures in milliseconds the time interval between the hammer impact, and the arrival of the seismic wave at the geophone.

Table 1 shows typical seismic velocities of soil and bedrock and gives estimates of velocities of material that can be excavated by various types of equipment, including a Caterpillar D8 with attached hydraulic ripper. The table is based on experience in the Canberra area, and is not necessarily applicable to other types of rock or other conditions of weathering.

TABLE 1

Seismic Velocities and Excavating Properties

Velocities (ft./sec.)	Excavating Properties
800 - 2000	Soil and sub-soil; readily excavatable
2000- 3500	Fairly soft; can be excavated with blade and shovel type equipment
Up to 4500 or 5000	Can be ripped
5000 - 6000	Usually requires some blasting before ripping
More than 6000	Hard to very hard; requires an increasing amount of blasting with increasing seismic velocities
10,000 - 20,000	Velocity range of the strongest rocks

Method

Traverses were 100 feet long. A geophone was placed at one end of the traverse and hammer stations were located 2.5, 5, 7.5, 10, 15, 20, 30, 40, 60, 80, 100 feet from the geophone. Five to seven time intervals were recorded at each station. When the traverse was completed from one end, the geophone was positioned at the other end of the traverse and hammer stations sited at 2.5, 5 feet, etc., from the geophone at that end.

Time-distance curves were plotted; seismic velocities were determined, and depth to refractors calculated by the methods outlined in the manual provided with the seismic timer.

The results of the traverses are plotted on Plates 2 to 9.

EVALUATION OF RESULTS

In general the results from the different methods are in fair agreement.

It is assumed that an auger hole will give the thickness of excavatable soil, except where it encounters a hard rock fragment within the soil. At some localities the seismic results indicate depths of excavatable soil greater than the auger penetrated. In these places the seismic results have been taken as the more reliable: it is assumed that local residuals of unweathered rock set in soft material, have stopped the auger. This interpretation is supported by the fact that adjacent holes penetrated to the 6-foot depth.

Along two traverses the auger holes penetrated to greater depths than would have been expected from the seismic results. However at these localities the results of the seismic work are not amenable to a unique interpretation. An alternative interpretation to the one that was adopted, is in agreement with the augering results. In these cases the auger holes are considered to give the better indication of excavatable depth.

Table 2 below, tabulates the estimated excavatable soil thickness at the localities where the auger and seismic results are not in agreement.

TABLE 2

Estimated Depths. Where Auger and Seismic Results Differ

Locality (Chainage)	Preliminary Estimate of Thickness of Excavatable Soil				Final Estimate	Remarks
(Plates 2-9)	Augering		Seismic (feet)	Geological Estimate	Based on seismic results except where otherwise indicated	
	Depth (feet)	Seismic velocity at this depth				
Sheet 2 ch. 1M 4400	2'3"*	1500	7'0"	5-7	7'0"	Beyond this section in both directions along the route on the main, auger holes went down generally to depths of six feet. Probably shallow holes in the section bottomed on hard residuals
Sheet 2 ch. 1M 4300	2'6"*	1800	25'6"	5-7	25'6"	
Sheet 2 ch. 1M 4100	2'6"*	1600	21'6"	5-7	21'6"	
Sheet 2 ch. 1M 4000	3'2"*	2300	16'6"	5-7	16'6"	
Sheet 2 ch. 1M 2500	3'0"*	2500	6'6"	3-5	6'6"	Auger probably stopped by hard residuals. Adjacent auger holes penetrated deeper.
Sheet 2 ch. 1M 2400	3'2"*	3000	12'0"	3-5	12'0"	
Sheet 3 ch. 1M 900	3'4"*	3000	11'0"	3-7	11'0"	
Sheet 3 ch. 4850	3'6"*	2500	6'6"	3-5	6'6"	
Sheet 4 ch. 2800	6'0" and 8'0"	5000	7'0"	5-7	8'0"(A)	Seismic results not definite. They can be re-interpreted to agree with auger results
Sheet 4 ch. 2700	6'0" and 9'0"	5000	5'0"	5-7	9'0"(A)	
Sheet 4 ch. 850	2'6"*	2600	20'0"	5-7+	20'0"	Auger probably stopped by hard residual. Adjacent auger holes penetrated deeper.

TABLE 2 (cont'd)

Sheet 5 ch.	4250	6'0" and 9'0"	5000	6'0"	5-7	9'0"(A)	Seismic results not definite. They can be re-interpreted to agree with auger results.
Sheet 5 ch.	4150	6'0" and 7'0"	4500	2'6"	5-7	7'0"(A)	
Sheet 6 ch.	2200	3'6"*	2400	5'6"	0-5	5'6"	Auger probably stopped by hard residuals.
Sheet 6 ch.	2100	3'0"*	3200	8'0"	3-7+	8'0"	
Sheet 7 ch.	600	2'8"*	1100	16'6"	5-7+	16'6"	Adjacent auger holes pene- trated deeper.
Sheet 7 ch.	700	2'8"*	1100	17'0"	5-7+	17'0"	
Sheet 7 ch.	1000	2'6"*	1450	10'0"	5-7	10'0"	
Sheet 8 ch.	4750	2'9"*	2500	11'6"	5-7	11'6"	
Sheet 8 ch.	4850	4'9"*	2400	19'6"	5-7	19'6"	

* Indicates auger refusal

(A) Estimate based on augering



LOCALITY MAP

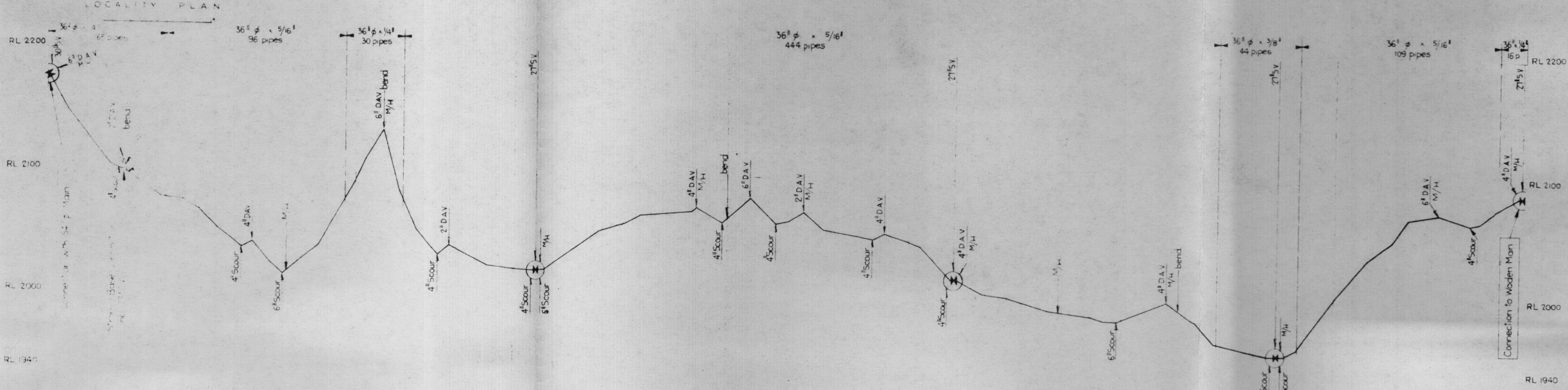
Scale 0 400 800 1600 FEET

NOTE: Plates 2 to 9 are not oriented in the same direction as this sheet.

Bureau of Mineral Resources
Geology and Geophysics
June 1966

To accompany
Record No 1966/138

155/A16/416



NOTES

- Plan based on drwg. CD 55/342 B
- Future roads from NCDC drwg. TP 271/65/2

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Consulting Engineer
8th floor, 167 Kent St. Sydney Telephone 278495

In association with
Commonwealth of Australia
Department of Works

COMMONWEALTH OF AUSTRALIA
DEPARTMENT OF WORKS, A.C.T.

STROMLO-WODEN WATER MAIN
GENERAL ARRANGEMENT

For NCDC

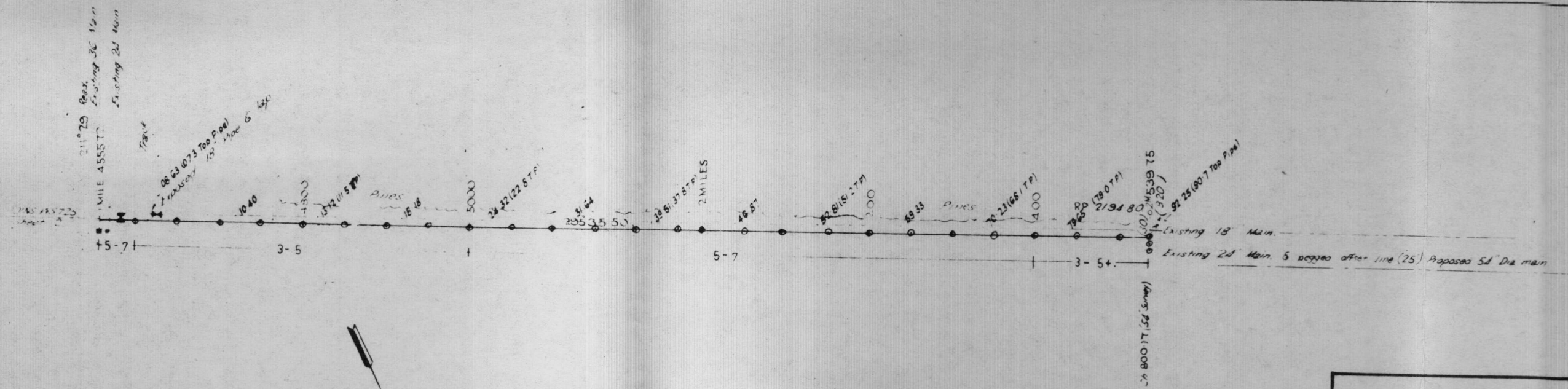
CD 65/5 Pipe Supply Contract
CD 65/6 Valve Supply Contract

DATE 10.2.66

CD 66/17 B

CONDENSED PROFILE

Scales Horizontal 1" = 400' Vertical 1" = 40'

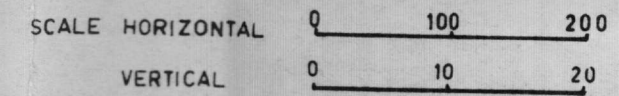


PLAN

eg 24.32 Not Surface 22.8 Top Pipe

SOIL THICKNESS SURVEY

(See footnote)



REFERENCE

PLAN

3-5+

Estimated range in feet of soil thickness based on geological observation and inference Seismic traverse.

Auger hole

SECTION

Estimated range in depth of bottom of soil based on geological observations and inference Dashed line indicates soil thickness is probably greater.

1500 Seismic velocity in feet per second.

Auger hole

Final estimate of soil thickness. Broken line indicates probable minimum thickness.

Note: Soil and weathered bedrock that can be excavated without blasting.

Seismic profile by Engineering Geology group, Geological Branch

Bureau of Mineral Resources, Geology and Geophysics June 1966 To accompany Record No 1966 155/A16/417

WODEN-STROMLO PIPELINE

DATUM WIDE SH 4

DEPARTMENT OF THE TERRITORY

1966

LEVELS ON 18" WATERMAIN K Jamison 11-1-66

WS 125

AMENDMENTS

AMENDMENTS

AMENDMENTS

ASSOCIATED DOCUMENTS

DEPARTMENT OF WORKS

CANBERRA BRANCH

WODEN-STROMLO PIPELINE SECTION "C"

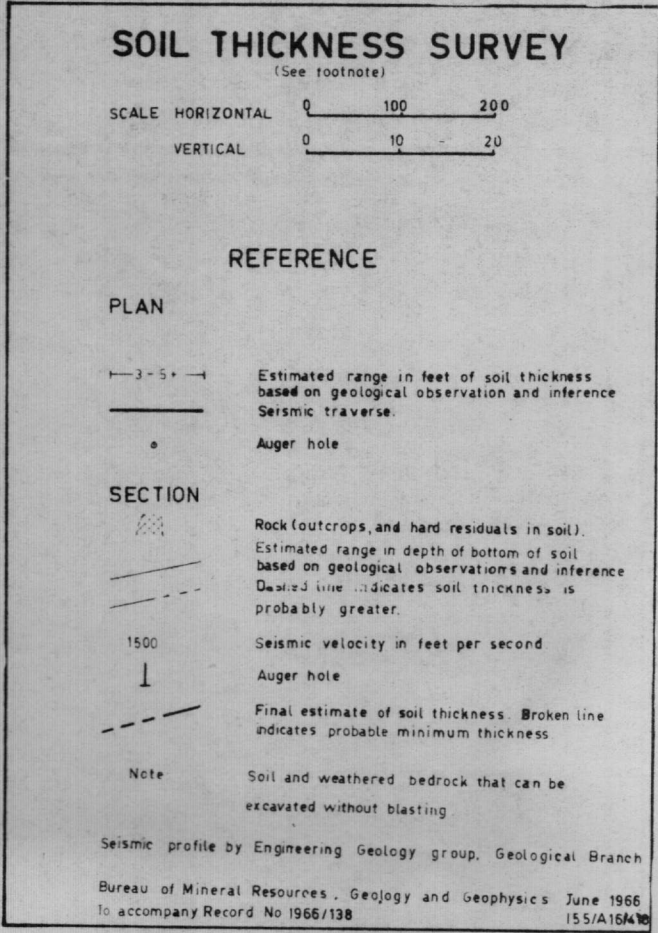
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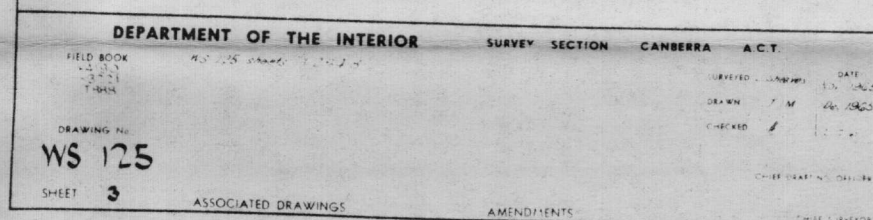
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On behalf of the National Capital Development Commission

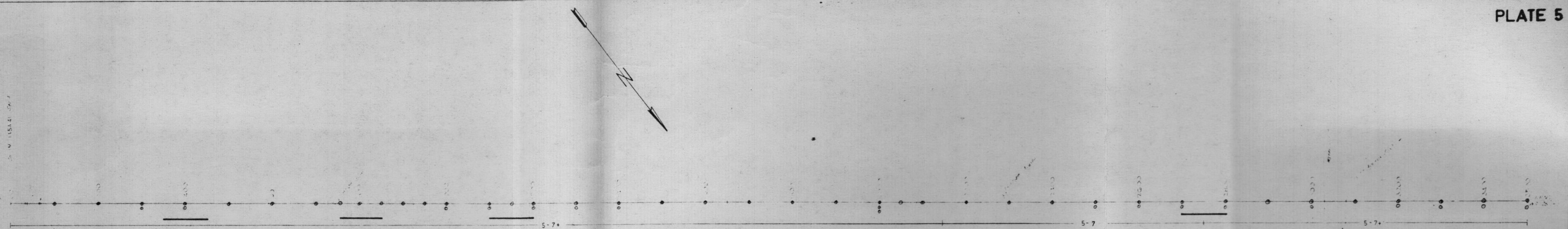
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SUPERVISING	ENGINEER	DESIGNED	BY	REVIEWED	BY	DATE





				DEPARTMENT OF WORKS		CANBERRA BRANCH	
				WODEN-STROMLO PIPELINE SECTION "C"		CROWN COPYRIGHT RESERVED	
				CHAINAGE 3800 TO 4100		DATE _____	
				(30 feet to an inch (horizontal))		SUPERVISING ENGINEER FILE _____	
				(40 feet to an inch (vertical))		JOB NO. _____	
				On behalf of the National Capital Development Commission		DESIGNING ENGINEER DRAWING NO. _____	
				THIS DRAWING SHALL BE VALID IN ACCORDANCE WITH THE REGULATION		DIRECTION OF WORKS _____	
No.	DESCRIPTION	DATE	INITIAL	No.	SUBJECT		
	AMENDMENTS				ASSOCIATED DOCUMENTS		



PLAN

SOIL THICKNESS SURVEY

(See footnote)

SCALE HORIZONTAL 0 100 200
VERTICAL 0 10 20

REFERENCE

PLAN

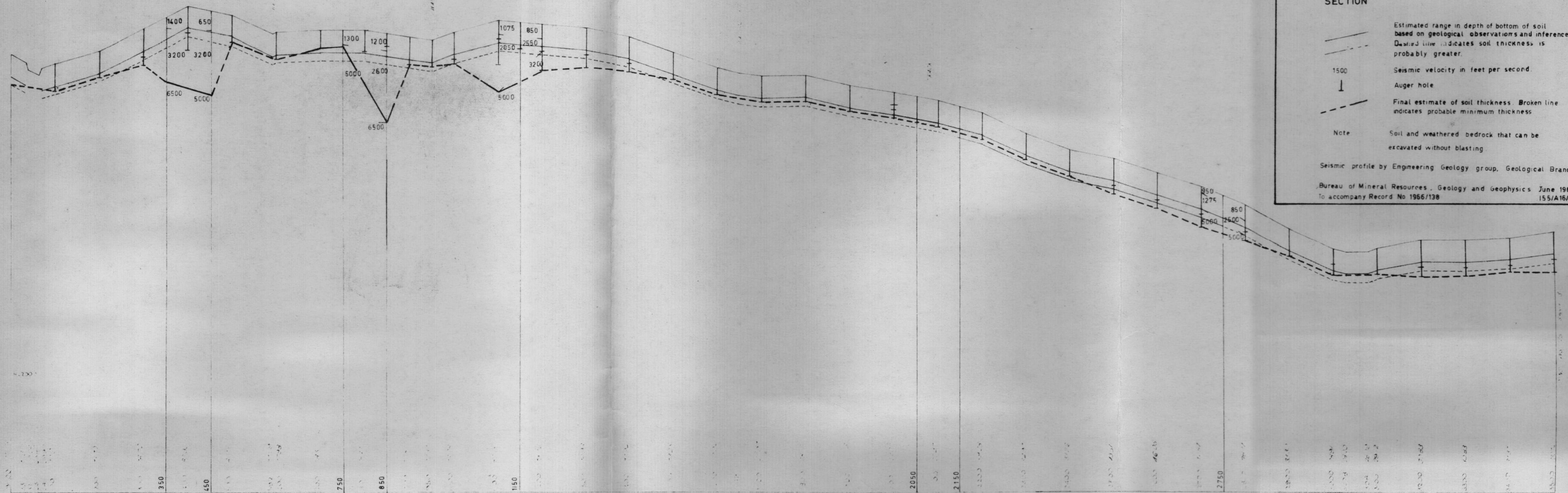
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• Auger hole

SECTION

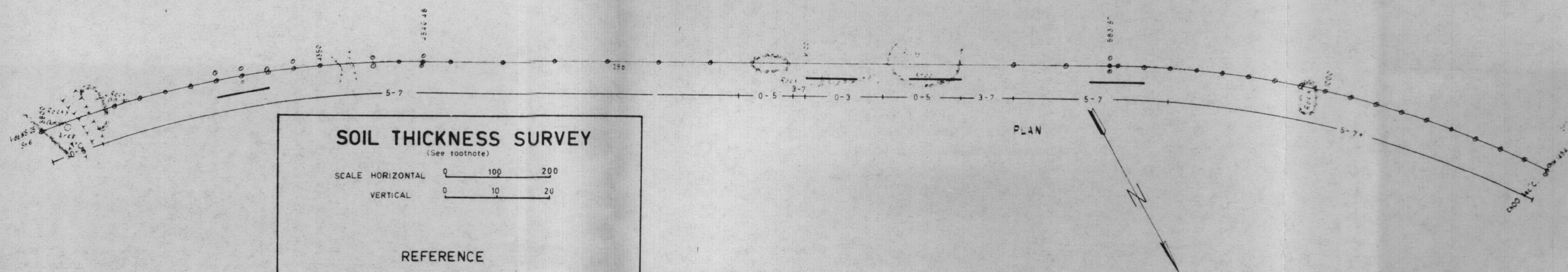
— Estimated range in depth of bottom of soil based on geological observations and inference. Dashed line indicates soil thickness is probably greater.
1500 Seismic velocity in feet per second.
I Auger hole
— Final estimate of soil thickness. Broken line indicates probable minimum thickness.
Note Soil and weathered bedrock that can be excavated without blasting.

Seismic profile by Engineering Geology group, Geological Branch

Bureau of Mineral Resources, Geology and Geophysics June 1966
To accompany Record No 1966/138 155/A16/420



16

**SOIL THICKNESS SURVEY**
(See footnote)SCALE HORIZONTAL 0 100 200
VERTICAL 0 10 20**REFERENCE****PLAN**

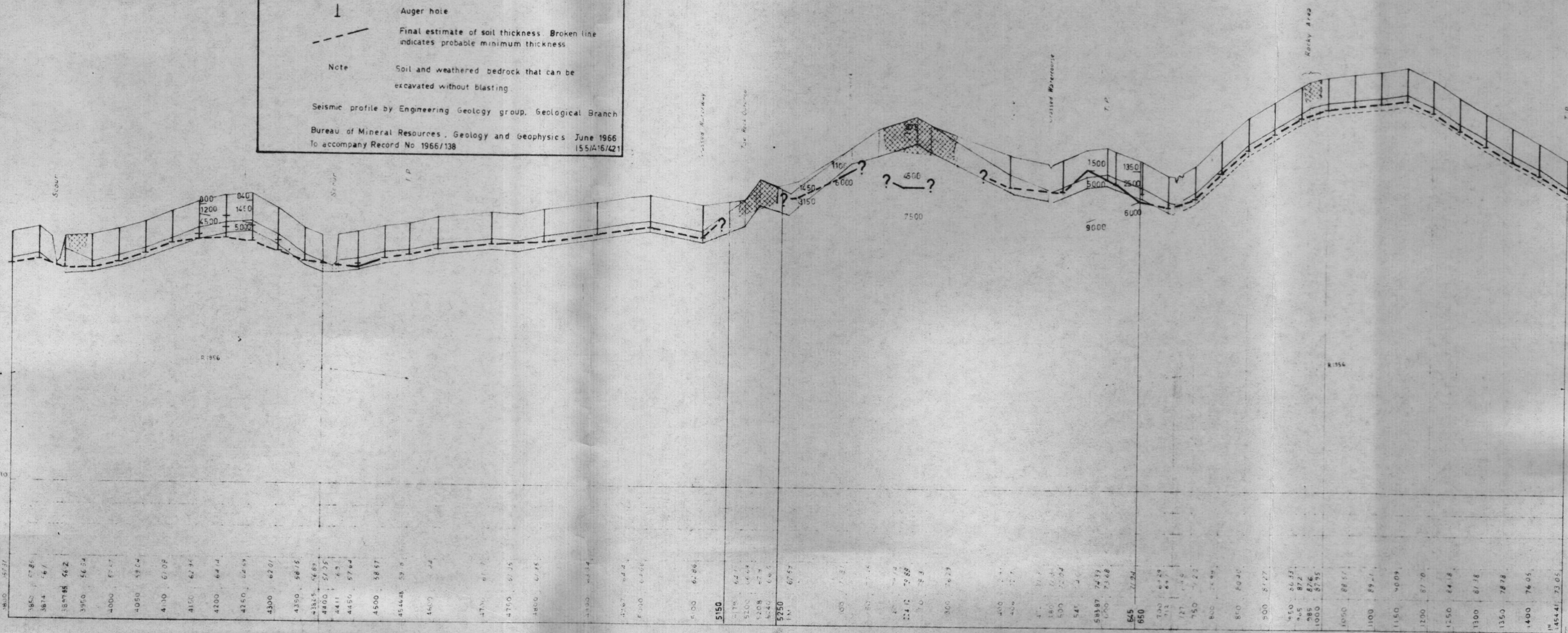
- 3-5+ Estimated range in feet of soil thickness based on geological observation and inference seismic traverse.
- o Auger hole

SECTION

- Rock (outcrop and hard residuals in soil). Estimated range in depth of bottom of soil based on geological observations and inference. Dashed line indicates soil thickness is probably greater.
- 1500 Seismic velocity in feet per second.
- Auger hole
- Final estimate of soil thickness. Broken line indicates probable minimum thickness.

Note Soil and weathered bedrock that can be excavated without blasting.

Seismic profile by Engineering Geology group, Geological Branch
Bureau of Mineral Resources, Geology and Geophysics June 1966
To accompany Record No. 1966/138 155/A/16/421



FILL
CUT
DESIGN LEVEL
WATER MAIN
NATURAL SURFACE
CHAINAGE

DEPARTMENT OF THE INTERIOR SURVEY SECTION CANBERRA A.C.T.

DRAWING No. WS125
SHEET 5
ASSOCIATED DRAWINGS
AMENDMENTS

DEPARTMENT OF WORKS CANBERRA BRANCH

WODEN
WODEN-STROMLO PIPELINE
Ch 3800-1M145441

Scales Vertical - 10 FT to an inch
Horizontal - 100 FT to an inch
On behalf of the National Capital Development Commission

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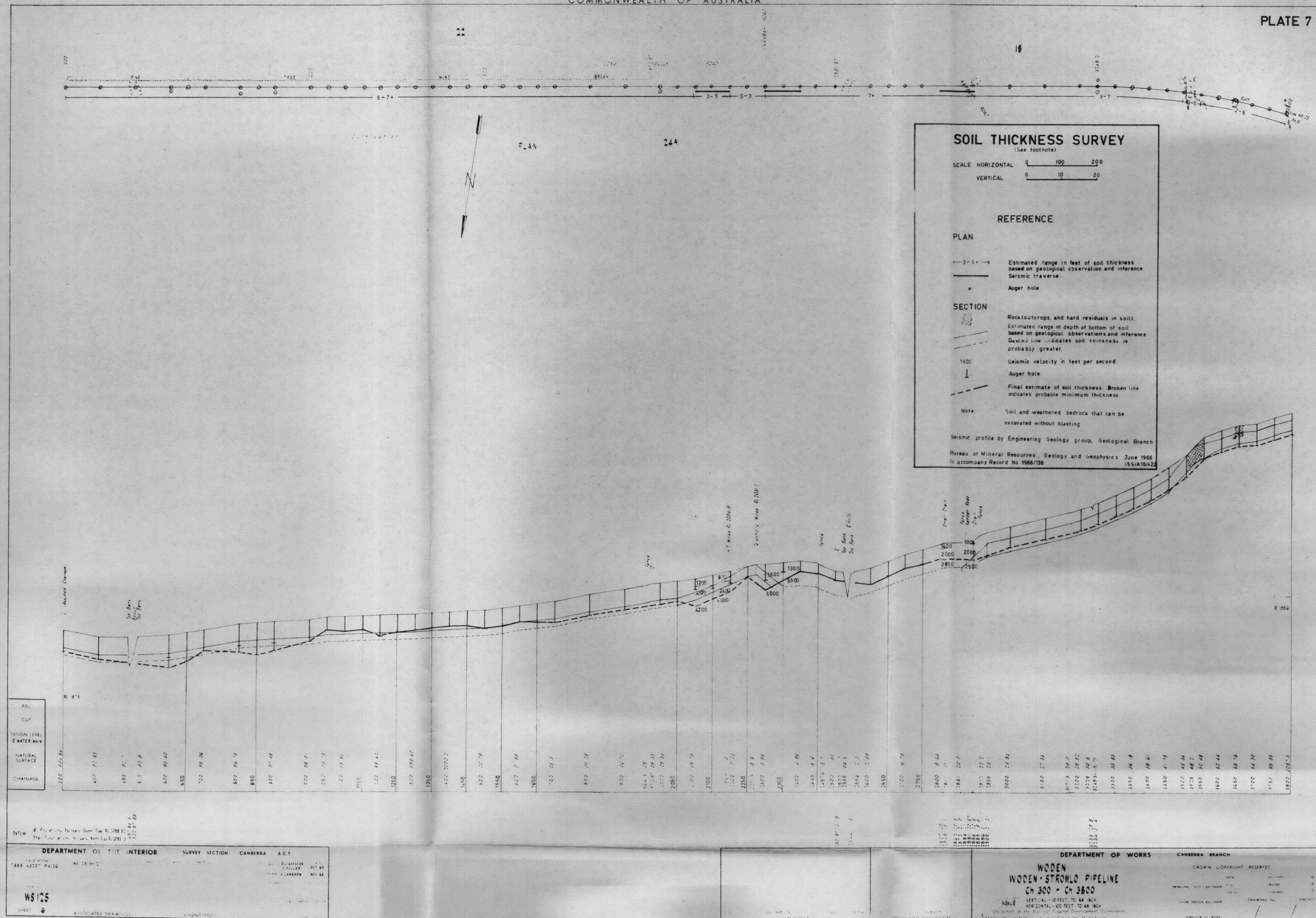
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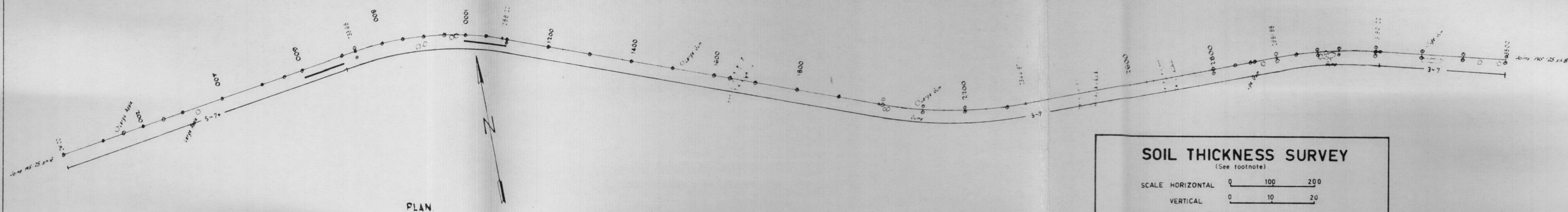
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DIRECTION OF WORKS





PLAN

SOIL THICKNESS SURVEY

(See footnote)

SCALE HORIZONTAL 0 100 200
 VERTICAL 0 10 20

REFERENCE

PLAN

— 3-5+ — Estimated range in feet of soil thickness based on geological observation and inference seismic traverse.

• Auger hole

SECTION

— Estimated range in depth of bottom of soil based on geological observations and inference. Dashed line indicates soil thickness is probably greater.

1500 Seismic velocity in feet per second.

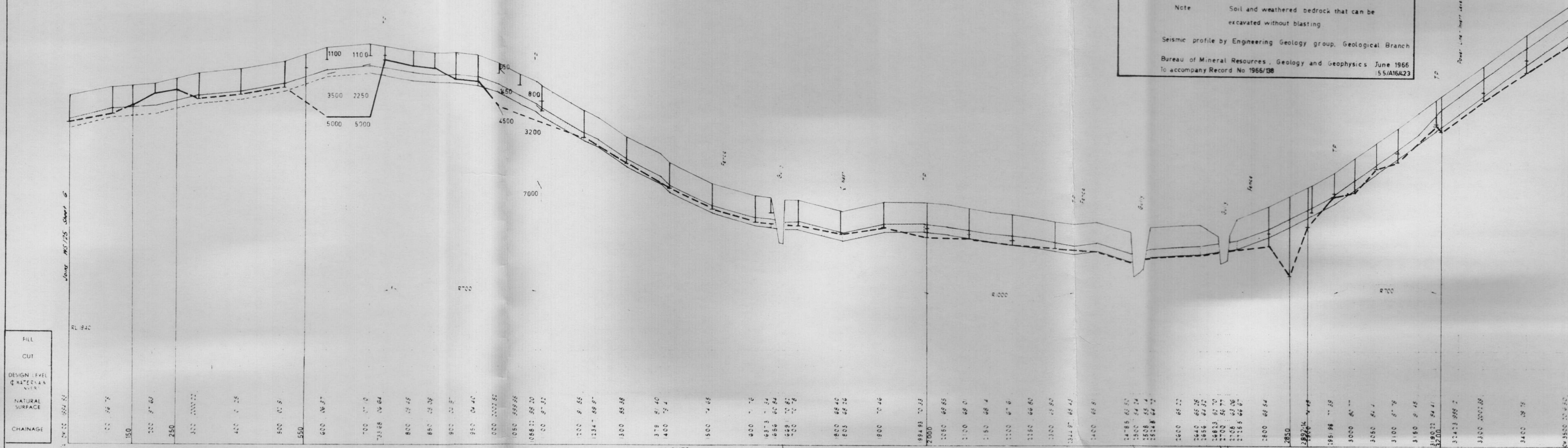
Auger hole

Final estimate of soil thickness. Broken line indicates probable minimum thickness.

Note Soil and weathered bedrock that can be excavated without blasting.

Seismic profile by Engineering Geology group, Geological Branch

Bureau of Mineral Resources, Geology and Geophysics June 1966
 To accompany Record No 1966/108 55/A16A23



WODEN-STROMLO PIPELINE

FB PA173

DEPARTMENT OF THE INTERIOR

SURVEY SECTION CANBERRA A.C.T.

FIELD BOOK
 PA173
 43708

DATE
 1965

DRAWN BY G. D.M. Dec 1965

CHECKED BY

CHIEF DRAWING OFFICE

WS 125

SHEET 1

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CANBERRA BRANCH

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WODEN-STROMLO PIPELINE

SECTION 'B'

CHAINAGES 00 to 3500

Scale 10 feet to an inch (Vertical)

Scale 100 feet to an inch (Horizontal)

On behalf of the National Capital Development Commission

THIS DRAWING SHALL BE READ IN CONJUNCTION WITH THE SPECIFICATION

DATE

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JOB NO

DRAWING NO

AMEND

DIRECTOR OF WORKS

PLAN

SOIL THICKNESS SURVEY

(See footnote)

SCALE HORIZONTAL 0 100 200
VERTICAL 0 10 20

REFERENCE

PLAN

— 3-5 — Estimated range in feet of soil thickness based on geological observation and inference
Seismic traverse

• Auger hole

SECTION

Rock (outcrop and hard residuals in soil)
Estimated range in depth of bottom of soil based on geological observations and inference
Dashed line indicates soil thickness is probably greater

1500 Seismic velocity in feet per second

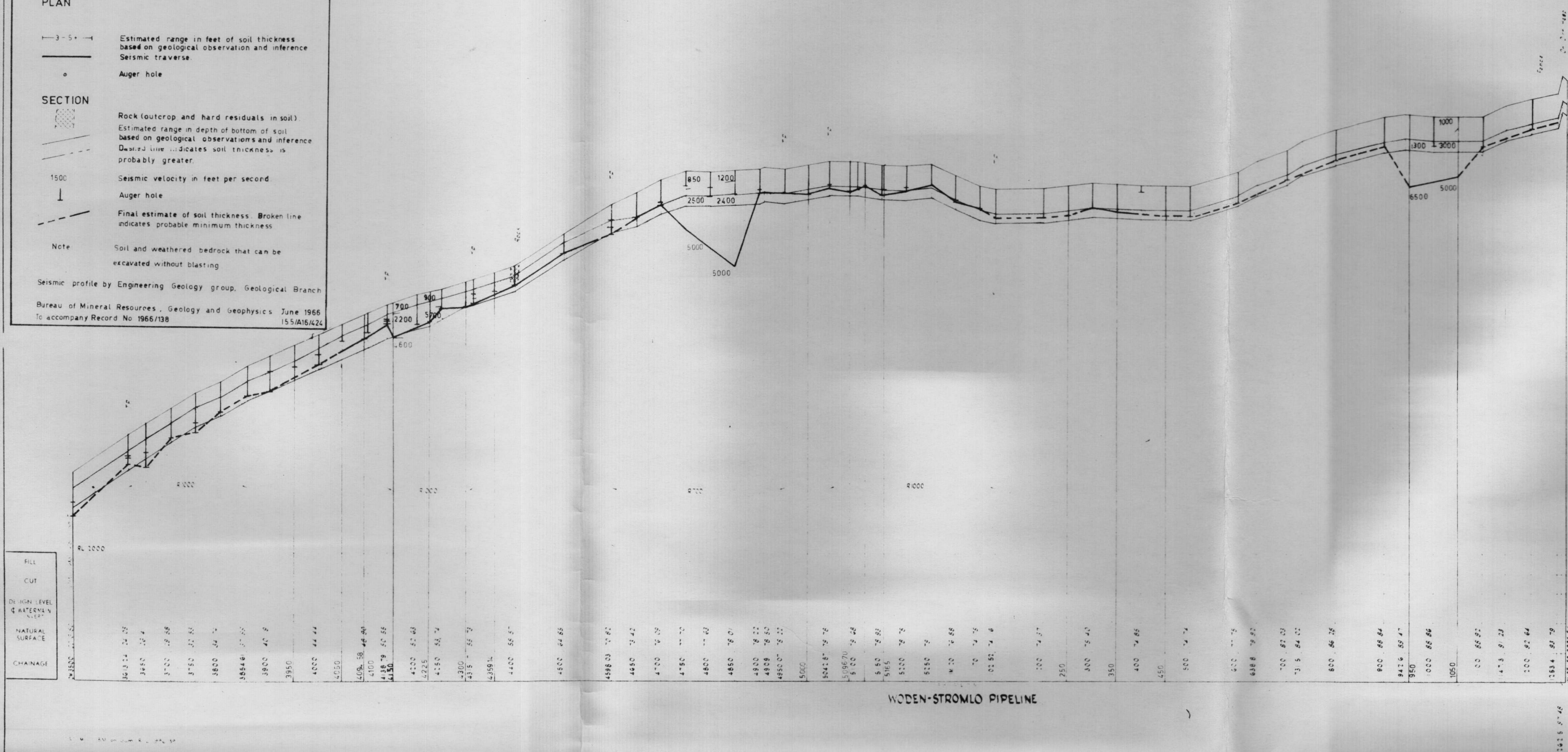
↑ Auger hole

Final estimate of soil thickness. Broken line indicates probable minimum thickness

Note Soil and weathered bedrock that can be excavated without blasting

Seismic profile by Engineering Geology group, Geological Branch

Bureau of Mineral Resources, Geology and Geophysics June 1966
To accompany Record No 1966/138 155/A16/424



WODEN-STROMLO PIPELINE

DEPARTMENT OF THE INTERIOR SURVEY SECTION CANBERRA A.C.T.

DRAWING NO. WS 125
SHEET 8
ASSOCIATED DRAWINGS
AMENDMENTS

DEPARTMENT OF WORKS CANBERRA BRANCH

WODEN-STROMLO PIPELINE
SECTION "B"

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