DEPARTMENT OF MINERALS AND ENERGY

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1974/38

GEOLOGICAL SITE INVESTIGATION, GOOGONG WATER TREATMENT PLANT, N.S.W., 1973

by

P.A. Lang

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1 Locality map Googong Dam site and Water Treatment Plant

2 Regional Geology of the Googong Water Treatment Plant, Pump station and Pipeline Area.

PLATES

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3 Interpretative seismic sections A, B and C showing weathering conditions in drill-holes 1-5, scale 1:200

4 Interpretative seismic sections J and K showing weathering conditions in drill-holes 6-10, scale 1:200

SUMMARY

In response to a request from the Commonwealth Department of Works (CDW) the Bureau of Mineral Resources carried out a geological site investigation of the proposed site for the Googong Water Treatment Plant.

The site was geologically mapped, 18 seismic refraction traverses were carried out by CDW, and ten diamond-drill holes were drilled under contract to CDW.

The proposed site is located on a ridge of the Googong Granite. The granite is variably and irregularly weathered, and outcrops are small and scattered. Diamond-drill core and seismic velocities indicate that about 60 percent of the volume of material to be excavated will require blasting.

No major geological defects were found at the site; vertical excavation faces in slightly weathered to fresh granite are expected to be stable if presplit. Battered cuts in completely and highly weathered granite are expected to be stable if slightly weathered to fresh boulders are removed from the faces.

INTRODUCTION

In May 1973 the Commonwealth Department of Works (CDW) requested the Bureau of Mineral Resources (BMR) to carry out a geological site investigation of the proposed site for the Googong Water Treatment Plant.

The proposed site is 8 km south of Queanbeyan and 1.5 km west-northwest of Googong Dam Site (Fig. 1).

The treatment plant will include a wash water reservoir, eight clarifier tanks, eight filter beds, and a clear water storage tank.

The proposed maximum depth of excavation is 13 m. The wash water reservoir will be excavated down to RL 715 m, the clarifier tanks and filter beds to RL 707.5 m, and the clear water storage tank to RL 696.5 m. Details of the design layout are shown in Plates 1 and 2.

INVESTIGATION METHODS

The area was geologically mapped by G.B. Simpson and field data were plotted at a scale of 1:500 (Plates 1 and 2). Eighteen seismic refraction traverses totalling 1920 m in length were carried out by CDW Central Testing and Research Laboratories (CTRL). Seismic traverse locations are shown in Plates 1 and 2, and five of the seismic profiles A, B, C, J and K are shown in Plates 3 and 4.

Ten diamond-drill holes totalling 104 m were drilled by Stewart Bros. Pty Ltd under contract to CDW. The holes were drilled using a Longyear drilling machine with an NMLC triple-tube core barrel with a stationary split-inner tube. Geological logs of drill core are given in Appendix 2.

GEOLOGY OF THE SITE

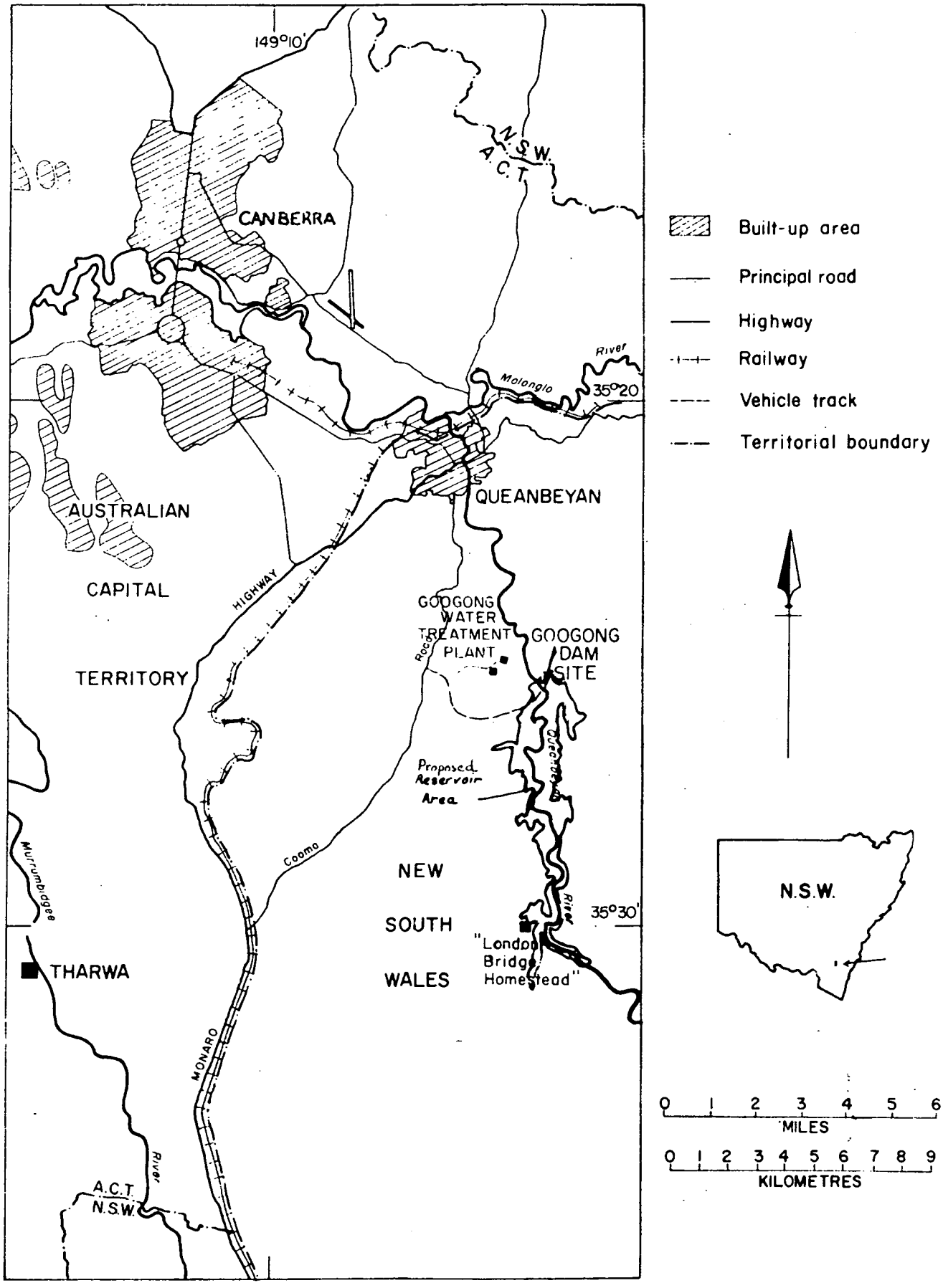
The proposed treatment plant is located on a ridge of the Googong Granite (Fig. 2). The Googong Granite is a small adamellite stock which intruded the Colinton Volcanics during Late Silurian to Early Devonian time (Stauffer, 1967).

Outcrops of granite are small, scattered, variably weathered, and cover less than 5 percent of the area to be excavated; some are solid but most are rubbly. Quartz veins crop out near the north end of the clear water storage tank and near the northeast corner of the clarifier tanks, and were encountered in drill-holes GT1, GT7, and GT8. These veins are generally closely fractured. In the granite, joint spacing measured from drill core ranges from 5 cm to 30 cm.

LOCALITY MAP

GOOGONG DAM SITE AND WATER TREATMENT PLANT

QUEANBEYAN RIVER, N.S.W.



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No dominant close-spaced joint set was detected at the site. Many joints have clay infillings from 0.1 cm to 5 cm thick.

WEATHERING

An approximate correlation between seismic velocity and degree of weathering in the diamond-drill core is tabled below. (See also Plates 3 and 4).

Degree of Weathering*	Seismic Velocity (m/s)
Completely weathered	<800
Highly weathered	800 - 1800
Moderately weathered	1200 - 3000
Slightly weathered	3000 - 4000
Fresh-stained and fresh	>4000

*See Appendix 1 for definitions of weathering terms.

Weathering in the granite was found to be fairly irregular. Fresh to slightly weathered boulders are often surrounded by highly to completely weathered granite; deep pockets of completely weathered rock also occur in zones of slightly to moderately weathered granite. The variation in weathering of the granite is considered partly responsible for the poor correlation between some intersecting seismic traverses and between some seismic and drilling results (Plates 3 and 4).

EXCAVATION CONDITIONS

It is expected that a Caterpillar D8 bulldozer with hydraulic rippers will be able to excavate completely and highly weathered granite, that is, granite with seismic velocities less than about 1800 metres per second (m/s). Granite with seismic velocities from 1600 to 2000 m/s will generally be rippable, but some blasting may be necessary in harder rock. Blasting will generally be necessary in zones of rock with seismic velocities greater than 2000 m/s.

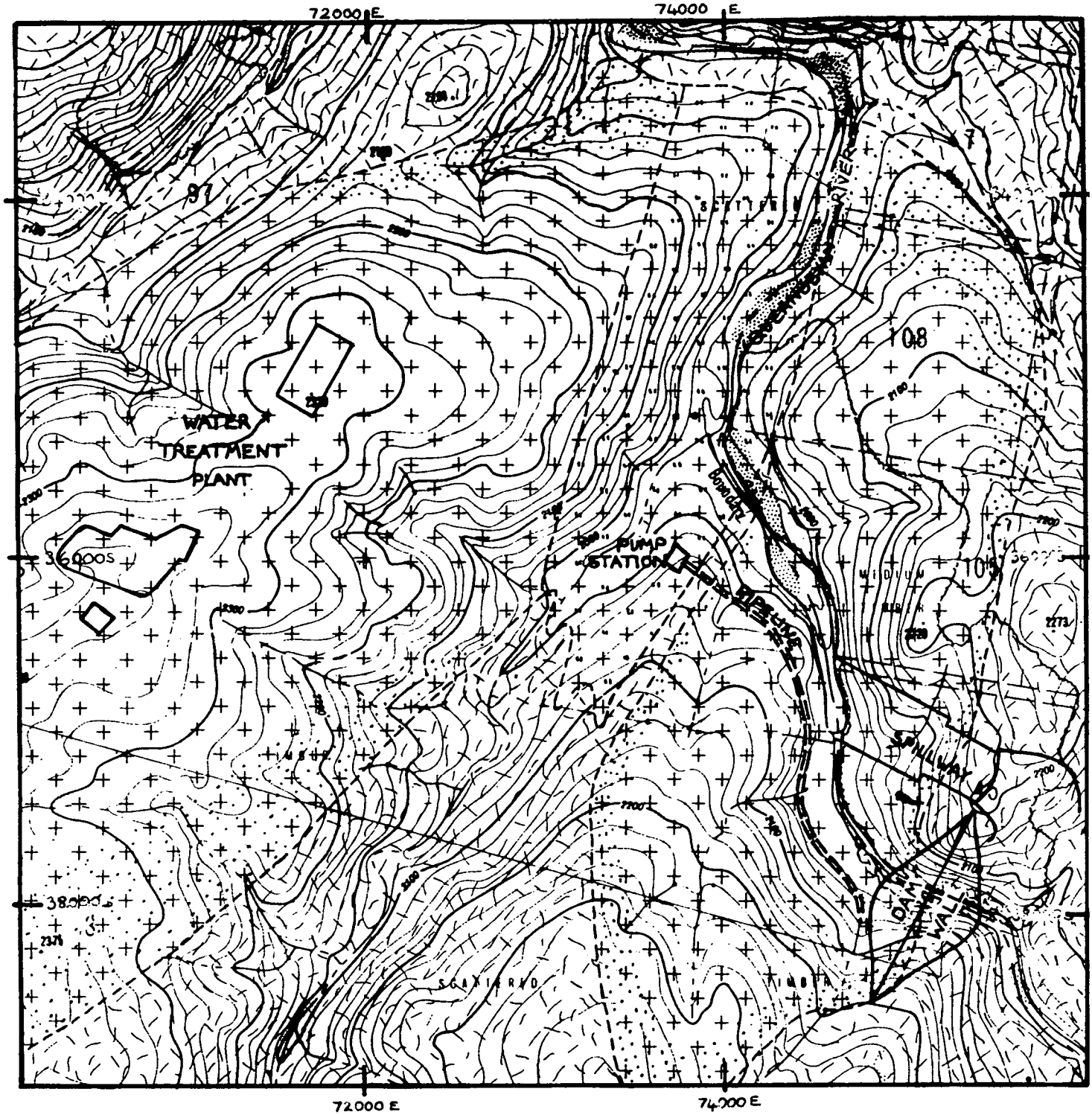

FIGURE 2. REGIONAL GEOLOGY OF THE GOOGONG WATER TREATMENT PLANT, PUMP STATION AND PIPELINE (after M.R. Stauffer 1967)

SCALE

0 500 1000 metres

N

Microdine - epidote band in Googong granite
Fine-grained porphyritic granite margin
Googong granite
} Siluro-Devonian

Dacite – Colinton Volcanics – Silurian

Geological boundary (approximate)

Seismic profiles A to P indicate that blasting will be necessary for approximately 40 percent of the material to be excavated for the clear water storage tank and 70 percent of the material to be excavated for the clarifier tanks and filter beds, i.e. about 60 percent of the total material to be excavated at these two sites. The seismic profiles indicate that rippable material may extend down to floor level in the wash water reservoir; however, some harder rock may occur near floor level, and may require blasting.

Groundwater was not intersected during drilling, and any inflows of water into the excavations will be restricted to minor seepages after rain.

STABILITY OF EXCAVATIONS

A layer of silty topsoil (mostly less than 0.5 m thick) occurs over parts of the site. When saturated, this layer loses bearing strength and becomes mobile; machinery may become bogged in it, and when saturated and disturbed it may flow into excavations.

Battered cuts in completely and highly weathered granite are expected to be stable. Boulders of slightly weathered to fresh rock, incorporated in completely to highly weathered rock and exposed on slopes, are likely to become unstable and should be removed; if vertical cuts are required, then the faces will need support. Vertical rock faces in slightly weathered or fresh granite, however, should generally be stable if the face has been carefully presplit. The orientation of joints is variable, no particular strong joint set being dominant; however, some blocks may become unstable during excavation and should be removed.

CONCLUSIONS

1) It is feasible to construct the proposed treatment plant at the site outlined in Plates 1 and 2. No major geological defects were found to cross the site.

2) Depths and degrees of weathering of the granite over the site are variable and are considered responsible for some anomalous seismic results.

3) Extensive blasting will be required in order to excavate the rock at the sites for the clarifiers, filters, and clear water storage tank. Of the material to be excavated, about 60 percent will need to be blasted.

4) Little if any blasting of material to be excavated for the wash water reservoir is envisaged.

5) All excavations will be located above groundwater level.

6) Except for some minor local instability of small blocks of rock, all planned excavation faces are expected to be fairly stable.

REFERENCES

STAUFFER, M.R., 1967 - The problem of conical folding around the Barrack Creek Adamellite, Queanbeyan, New South Wales. J. geol. Soc. Aust., 14(1), pp. 49-56.

APPENDIX 1

DEFINITIONS OF TERMS USED IN GEOLOGICAL DRILL LOGS

WEATHERING OF ROCK

FRESH	: No discolouration or loss in strength.
FRESH STAINED	: Limonitic staining along fractures, rock otherwise fresh and shows no loss of strength.
SLIGHTLY WEATHERED	: Rock is slightly discoloured, but not noticeably lower in strength than the fresh rock.
MODERATELY WEATHERED	: Rock is discoloured and noticeably weakened; N-size drill core generally cannot be broken by hand across the rock fabric.
HIGHLY WEATHERED	: Rock is discoloured and weakened; N-size drill core can generally be broken by hand across the rock fabric.
COMPLETELY WEATHERED	: Rock is decomposed to a soil, but the original rock fabric is mostly preserved.

PERCUSSIVE STRENGTH OF ROCK

STRONG TO VERY STRONG	: Cannot be broken by repeated blows with a hammer.
MODERATELY STRONG	: Rock broken by 3 or 4 blows.
WEAK	: Rock broken by one blow.

HARDNESS OF ROCK

HARD TO VERY HARD	: Impossible to scratch with knife blade.
MODERATELY HARD	: Shallow scratches with knife blade.
SOFT	: Deep scratches with knife blade.

APPENDIX 2

GEOLOGICAL LOGS OF DRILL CORE

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT GOOGONG WATER TREATMENT PLANT

LOCATION INTERSECTION OF SEISMIC TRAVERSES A and E

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION —

COORDINATES 221501E 589015N R.L. OF COLLAR 720.00M

HOLE NO GT1

SHEET 1 OF 1

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing	Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 0 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level	Fracture spacing (cm) 30 60 80 90
			No Core	0	NMLC 1	0 6 12 18+	0				
H.W. Granite	yellow-brown granite.			95			0	Highly fractured			
			N.Core	40	2		0				
H.W. Granite.	Yellow-brown granite.			60	3		23				
				100			66				50 25
M.W. Granite.	Yellow-brown granite.			95	4		62				18 12 50
				100	5		88				10 30
				100	6		65		6.75 to 7.00 Koalins. Quartz vein 90°		
				100	7		93				16 50
				100	8		68				10 15
				82	9		26	Highly fractured	Clayey fractured zone.		
			N.Core		10						
S.W. Granite.	Pale green granite.			100	11		85				15 20
F.S. Granite.	Hole ends 14m			100	12		95				20
					13						
					14						

R.Q.D. Rock Quality Designation expresses the percentage of core longer than 10cm per run of core.

Drill type LONGYEAR

Feed HYDRAULIC

Core barrel type NMLC TRIPLE SPLIT

Driller R. STEWARD

Commenced 3/7/73

Completed 4/7/73

Logged by P. LANG

Vertical scale 1cm = 1m

Checked by

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25cm of core occurring at specified intercept angle range.

Water Level Measurements — ▼ Level when hole in progress at specified depth. ▽ Level in completed hole on specified date.

Water Pressure Tests

* *Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.*

Core Photograph Negative No.

Depth (m)	Black & White	Colour

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PROJECT GOOGONG WATER TREATMENT PLANT
LOCATION INTERSECTION OF SEISMIC TRAVERSES A and F

HOLE NO. GT2

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION —
COORDINATES 221556E. 588999 N. R.L. OF COLLAR 717.2 m

SHEET 1 OF 1

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing	Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle	Structures Joints, veins, seams, faults, etc	Water Level	Fracture spacing (cm)
					NMLC 0 6 12 18+			0 30 60 80 90			30 60 80 90
			No Core	0	1		0				
C.W - H.W. Granite	Pale green - grey clayey joints			50	2		0	3 3	Clay, shale chlorite on joints		
C.W - H.W. Granite	Pale green - grey clayey joints.		No Core	40	3		0		Clay, Kaolin and chlorite on joints. Limonite staining below 4.5m		
M.W. Granite	Pale green - grey granite		No Core	66	4		30	4 4 4 4 / 4 1 1 3 / 1 1 1 1	Kaolin clays in joints.		15
				70	5		16	3 3 2 / 3 7 1 / 1 2 2 1	Limonite staining on joints. Kaolin clays in joints.		10
M.W. Granite.	Pale green - grey decomposed granite.		N.Core	100	6		0	3 2 3 4	White clayey joints.		
				90	7		30	3 3 2 / 2 2 1 1 / 2 1 1 / 1 2	Rusty staining on joints, orange colour, limonite and clay.		20 20
S.W. Granite.	Green - grey granite.			95	8		45	3 2 1 / 2 1 2 1	Shear zone, decomposed rock		
				100	9		15	2 2 2 2	Shear zone, clay on joints.		
E.S. Granite.	Hole ends 11m			100	10 11		18	6 2 / 5 1	Highly fractured core Possibly due to vibrating rig		

R.Q.D. Rock Quality Designation expresses the percentage of core longer than 10cm per run of core.

Drill type LONGYEAR
Feed HYDRAULIC
Core barrel type NMLC TRIPLE TUBE
Driller R. STEWART
Commenced 3/7/73
Completed 4/7/73
Logged by P. LANG
Vertical scale 1cm = 1m

Checked by

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blocked in

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.

Water Level Measurements — ▼ Level when hole in progress at specified depth
▽ Level in completed hole on specified date.

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blocked in strips.

Core Photograph Negative No.

Depth (m)	Black & White	Colour

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PROJECT GOOGONG WATER TREATMENT PLANT
LOCATION INTERSECTION OF SEISMIC TRAVERSES B and D

HOLE NO GT3

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION —
COORDINATES 221495E 589061N R.L. OF COLLAR 717.1m

SHEET 1 OF 1

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing	Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 0 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level	Defect Frequency 0 30 60 90 90
			No Core	0	NMLC	0 6 12 18+	0				
H.W. Granite	Yellow-brown granite mod. soft			65	1		22	2 1 / 4 2			35
			No Core		2						
H.W. Granite	Yellow-brown granite mod. hard.			75	3		40	1 2 1 / 2 1 1 / 1 3 2			20 19
M.W. Granite				100	4		76	3 2			80 30 12
				88	5		37	2 2 / 2 1 3 2 1			25 27 20
			No core								
M.W Granite				100	6		54	2 3 2 1 1			10
S.W Granite.	Pale green-grey granite hard.			100	7		70	1 1 1 1 3 / 2 1 2 1			15 20
				100	8		95	2 1 1 / 1 2 / 2 1 2 1			18 30 20
				100	9		70	1 1 1 1 / 1 2 3 1	Fractured		
					10			2 1 1			20 13
core dropped	Hole ends 11m		No Core	60	11		95		core dropped		

R.Q.D. Rock Quality Designation expresses the percentage of core longer than 10cm per run of core.

Drill type LONGYEAR
Feed HYDRAULIC
Core barrel type NMLC TRIPLE TUBE
Driller A. STEWART
Commenced 5/7/73
Completed 6/7/73
Logged by P. LANG
Vertical scale 1cm=1m

Checked by

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.

Water Level Measurements — ▼ Level when hole in progress at specified depth. ▽ Level in completed hole on specified date.

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No.

Depth (m)	Black & White	Colour

To accompany Record 1974/38

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PROJECT GOOGONG WATER TREATMENT PLANT
LOCATION INTERSECTION OF SEISMIC TRAVERSES B and G

HOLE NO GT4

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 60° DIRECTION 287°
COORDINATES 221628E 589021N RL OF COLLAR 712.9

SHEET 1 OF 1

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing	Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 0 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level	Fracture Spacing (cm) 30 60 80 90
			No Core	0	NMLC 0 6 12 18+ 1		0				
Adamellite MW Granite	Coarse grained adamellite Pink orthoclase phenocrysts up to 1cm, weak, m. Hard			100	2		58	3 1 6 / 2 2 / 2 2 1 / 1 1 1 / 2 1 3 1 3	Clay seam 5cm wide at 60°		
				100			70		2.58 to 2.68 Clay seam Highly fractured Limonite staining on joints Some clay Quartz veining running down core No cavities No fracturing along vein		
				85	3		30				
				90				2 4 2 / 4 1 2			
S.W. Granite	Coarse grained adamellite hard.			100	4		40	2 2 1 / 3 3 1			
				100	5		62	4 / 1 4 1 1 1	Highly Fractured.		
				100	6		80	1 2 4 / 1 1			15 5
	Hole ends 7m			100	7		80	4 5 / 3 1	Fairly fractured.		10 8 25

RQD. Rock Quality Designation expresses the percentage of core longer than 10cm per run of core.

Drill type LONGYEAR
Feed HYDRAULIC
Core barrel type NMLC TRIPLE TUBE
Driller R. STEWART
Commenced 11/7/73
Completed 11/7/73
Logged by P. LANG
Vertical scale 1cm = 1m
Checked by

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.
Water Level Measurements — ▼ Level when hole in progress at specified depth. ▽ Level in completed hole on specified date.

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No.

Depth (m)	Black & White	Colour

To accompany Record 1974/38

I55/A16/1133(4)

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PROJECT GOOGONG WATER TREATMENT PLANT
LOCATION INTERSECTION OF SEISMIC TRAVERSES C and E

HOLE NO. GT 5

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90°
DIRECTION —
COORDINATES 221563E 5890710N
R.L. OF COLLAR 113 ± m
SHEET 1 of 1

Rock Type and Degree of Weathering	Description Lithology, Colour, Strength, etc	Casing	Graphic Log	Lost and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 0 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level	Point Load Strength Index
					NMLC	0 6 12 18+					30 60 80 90
		No Core		0	1		0				
MW Granite	Yellow-brown Granite			90			0	4 2	Some clay seams		3
SW Granite	green-grey Granite.			95	2		65	2 1	Fairly fractured Some clay on joints		
FR Granite				100	3		85	1 1 1 1 1 2 1	Fractured		20
					4			1 2			30 20
				100	5		80	2 1 1			35
				100			100	1			
				100	6		80	2 1			
				100	7		80	1 3 1			30
Core dropped	Hole ends 8m			55	8				Core dropped		

R.Q.D. Rock Quality Designation expresses the percentage of core longer than 10cm per run of core.

Drill type LONGYEAR
Feed HYDRAULIC
Core barrel type NMLC TRIPLE TUBE
Driller R STEWART
Commenced 26.7.73
Completed 27.7.73
Logged by P. ANG
Vertical scale 1cm = 1m.

Checked by

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25cm of core occurring at specified intercept angle range.

Water Level Measurements — ▼ Level when hole in progress at specified depth. ▽ Level in completed hole on specified date

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No.

Depth (m)	Black & White	Colour

To accompany Record 1974/38

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GEOLOGICAL LOG OF DRILL HOLE

PROJECT GOOGONG WATER TREATMENT PLANT
LOCATION INTERSECTION OF SEISMIC TRAVERSES H and J
ANGLE FROM HORIZONTAL (θ) 60° DIRECTION 062°
COORDINATES 221538E 588936N R.L. OF COLLAR 720·6m

HOLE NO. 3T
SHEET 1 OF

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing	Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 0 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level
			No Core	0	NMLC		0			
C.W. Granite	Granite. Clay in top 10cm.			60	1		0			
			No Core	16	2		0			
C.W Granite	Granite. Yellow clay seam.									
			No Core	0	3		0			
C.W Granite	Decomposed granite.			30	4		0		Clay on joints	
M.W – H.W Granite	Decomposed granite			80			0	4/7 3/2 1/3 2	yellow & white clays in joints.	
			Core		5					
M.W – H.W Granite	Decomposed granite			50			0	4 2 1 1	Yellow & white clays in joint	
	Decomposed granite (layey) Pale grey.			100	6		0			
			No Core	0			0			
S.W. Granite. F.S. granite	Grey-green granite.			100	7		82	2/1 1 3 2/2 3 2/2 1 4 2		40 25 25 20
	Hole ends 9m			100	8		50	1/1 2 1/3 2 7 1 1		
					9					

R.Q.D. Rock Quality Designation expresses the percentage of core longer than 10cm per run of core.

Drill type LONGYEAR
Feed HYDRAULIC
Core barrel type NMLC TRIPLE TUBE
Driller B. STEWART
Commenced 9/7/73
Completed 10/7/73
Logged by P. LANG
Vertical scale 1cm = 1m
Checked by

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25cm of core occurring at specified intercept angle range.
Water Level Measurements — ▼ Level when hole in progress at specified depth. ▽ Level in completed hole on specified date.

Water Pressure Tests

* *Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.*

Core Photograph Negative No.

Depth (m)	Black & White	Colour

To accompany Record 1974/38

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PROJECT GOOGONG WATER TREATMENT PLANT

LOCATION INTERSECTION OF SEISMIC TRAVERSES K and L

HOLE NO GT 1

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION —

COORDINATES 221936E 589372N R.L. OF COLLAR 198·0m

SHEET 1 OF 1

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing	Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 0 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level	Fracture Spacing (cm)
			No Core	0	NMLC 0 6 12 18		0				
	Granite				1				Creamy Pink to colourless Hard pegmatite vein Orthoclase quartz vein		
				95	2		0	10 1 2 1	Quartz veins and clay seams. Vertical pegmatite vein Quartz vein down centre.		2
				100	3		0				
				35	4		0				
			N.Core								
Rock ROLLED No core.			No Core	0	5		0				
M.W. Granite	Granite.			100	6		75	1 1 1 1			
				95			25	5 1 1 1			7
S.W. Granite				100	7		30	2 3 1 1 1 2			3 6 18
				100	8		65	1 5 2 2 1 1 1 1			
F.S. Granite.				100	9		70	1 1	Clay seam 5cm wide. Pyrite in granite.		
				100			80	1 1 1			
				100	10		60	1 2 1 3 3 2			40 10
				100	11		80	1 1 3 2			8 5
	Hole ends 11·62m.			100			60	2 2 1			10

R.Q.D. Rock Quality Designation expresses the percentage of core longer than 10cm per run of core

Drill type LONGYEAR

Feed HYDRAULIC

Core barrel type NMLC TRIPLE TUBE

Driller R. STEWART

Commenced 18/7/73

Completed 20/7/73

Logged by P. LANG

Vertical scale 1CM = 1M

Checked by

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25cm of core occurring at specified intercept angle range.

Water Level Measurements — ▼ Level when hole in progress at specified depth. ▽ Level in completed hole on specified date.

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No.

Depth (m)	Black & White	Colour

To accompany Record 1974/38

I55/A16/1132 (7)

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PROJECT GOOGONG WATER TREATMENT PLANT
LOCATION INTERSECTION OF SEISMIC TRAVERSES K and N

HOLE NO GT8

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION —
COORDINATES 221843E 589292N R.L. OF COLLAR 705.5m

SHEET 1 OF 1

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing	Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log (0 6 12 18+)	RQD	Defect Frequency Intercept Angle (0 30 60 80 90)	Structures Joints, veins, seams, faults, etc	Water Level	(0 30 60 80 90)
			No Core	0	NMLC 0		0				
C.W Granite / H.W. Granite	Yellow brown granite with pink orthoclase			75	1		16	1 1 2 / 3 1 / 1 1 5	Gravel and clay. Gravel seam ·25 – ·33		9 4
			No Core		2						
H.W. Granite	Yellow brown granite.			55			17	2 1 / 1 2 / 2			7
				85	3		18	2 1 2 / 2 1 1 / 1 1 2	Clay seams on joints.		5
				80	4		0	4 / 2	Clay seams up to 3cm wide		5 6
				90	5		50	2 / 2 2 / 4 3	Clay on joints.		13 20
				85	6		33	3 / 2 2 / 2 4			6
				100			0	4 1 2 / 4 1	Clay seam 0.5cm Highly fractured.		7 6
M.W. Granite				95	7		40	4 1 / 2 2	Clay on joints Siliceous joints Clay seam.		5
				97	8		28	4 2 / 5 4 1 / 3 / 2 1 / 5 2	Highly fractured. Clay on joints. Highly fractured.		15
				100	9		16	2 2 / 8 2 1 / 4 2 3 1 / 4 2	Highly fractured.		10 3
				98	10		35	1 / 2 / 6 / 1 1 1 2 1	Gravel		18 3 6 / 10 20 / 20 16
C.W. Granite			No Core		11						
C.W. Granite / M.W. Granite	Yellow brown granite.			65			32	2 / 1 / 4 / 4 3 1 / 1 / 3 7	Gravel.		7 3
H.W. Granite	Hole ends 12·80			100	12		40		Gravel.		

RQD. Rock Quality Designation expresses the percentage of core longer than 10cm per run of core.

Drill type LONGYEAR
Feed HYDRAULIC
Core barrel type NMLC TRIPLE TUBE
Driller R. STEWART
Commenced 12/7/73
Completed 12/7/73
Logged by P. LANG
Vertical scale 1cm = 1m
Checked by

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25 cm of core occurring at specified intercept angle range.

Water Level Measurements — ▼ Level when hole in progress at specified depth. ▽ Level in completed hole on specified date.

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No.

Depth (m)	Black & White	Colour

To accompany Record 1974/38

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PROJECT GOOGONG WATER TREATMENT PLANT
LOCATION INTERSECTION OF SEISMIC TRAVERSES KGNG2 HOLE NO GT3

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ). 60° DIRECTION 037°
COORDINATES 221813E. 589251N. R.L. OF COLLAR 703·7 SHEET 1

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing	Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 0 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level
			No Core		NMLC	0 6 12 18+				30 60 80 30
H.W. Granite	Pink granite			90	1		0	5 3		3 3
				90			18	2	5c. clay seam	10
			No Core		2					
H.W. Granite	Pink granite			70			0		Clay seams up to 5cm	
				80	3		0	3 2 1 1	clay on joints	12
S.W. Granite				95			0	6 2 1 2 1		5 3 5
				100	4		20	3 2 11 2		6
M.W Granite.				100			35	3 1 2 4 5 2	Silicified shear zone highly fractured.	5
				80	5		0			5
M.W Granite.	Pink granite.			100			0		Highly fractured.	
				85	6		10	4 4 2 4 2 7 4 2		5 5
			Not Core		7					
M.W. Granite.	Pink granite		Not Core	75			0			
S.W. Granite	Pink granite.			95	8		22	3 2 3 4 4 5 7 1		6 8
M.W. Granite				100	9		0	4 1 2 4 3 2 5 1 5	Clay seam.	7
				95	10		0	6 2 5 5 6 1		3
				100	11		0		Highly Fractured.	
	Hole ends 12.0m.			80	12		0	4 1 5 5 2 3 2 3 1	Highly Fractured.	5

RQD. Rock Quality Designation expresses the percentage of core longer than 10cm per run of core.

Drill type LONGYEAR
Feed HYDRAULIC
Core barrel type WM-6 TRIPLE TUBE
Driller R. STEWART
Commenced 13.7.73
Completed 17.7.73
Logged by P.LANG
Vertical scale 1cm = 1m
Checked by

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25cm of core occurring at specified intercept angle range
Water Level Measurements — ▼ Level when hole in progress at specified depth. ▽ Level in completed hole on specified date.

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No.

Depth (m)	Black & White	Colour

To accompany Record 1974/38

155/A16 (1.73)

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT GOOGONG WATER TREATMENT PLANT
LOCATION ON SEISMIC TRAVERSE k at K17.9m
ANGLE FROM HORIZONTAL (θ) 60° DIRECTION 037°
COORDINATES 221777E 589205N R.L. OF COLLAR 703.8m

HOLE NO GT 10
SHEET 1 OF 1

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Lift and % core recovery	Depth and size of Core	Fracture Log	RQD	Defect Frequency — Intercept Angle (0 30 60 80 90)	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
		No Core	NMLC 1						
C.W. Granite ↓ H.W. Granite. M.W. Granite ↓	Granite.	60	2		0				
		100			0		clay seam.		
		100			8		joints clay coated		
		100	3		8		Quartz vein.		
		100			0				
		60			0				
		95	4		40	3 1 1 / 5 2 1 / 7 3 1 4	Crushed zone. } clay on joints.		7 10 2
		100			0	3 1 2 3	Highly fractured. }		2
		100	5		0				
		60			0				
Quartz veins. M.W.	Quartz Quartz rich granite riddled Quartz veins.	90	6		25	4 1 2 Lightly fractured	Quartz vein.		
ROCK ROLLED NO CORE		No Core.	7						
M.W. Granite.	Granite.	95			0	Highly fractured 2 10	Slickensides, clay on joints		2
H.W. Granite.		70	8		0	Lightly fractured }	Clay on defect surfaces		
M.W. Granite.	Hole ends 9m.	50			0				
		100	9		25	4 1 2	Clay on joint surfaces		

R.Q.D. Rock Quality Designation expresses the percentage of core longer than 10cm per run of core.

Drill type LONGYEAR
Feed HYDRAULIC
Core barrel type NMLC TRIPLE TUBE
Driller R. STEWART
Commenced 23/7/73
Completed 24/7/73
Logged by P. LANG
Vertical scale 1cm = 1m
Checked by

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25cm of core occurring at specified intercept angle range.
Water Level Measurements — ▼ Level when hole in progress at specified depth. ▽ Level in completed hole on specified date.

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No

Depth (m)	Black & White	Colour

To accompany Record 1974/38

I55/A16/1133(10)

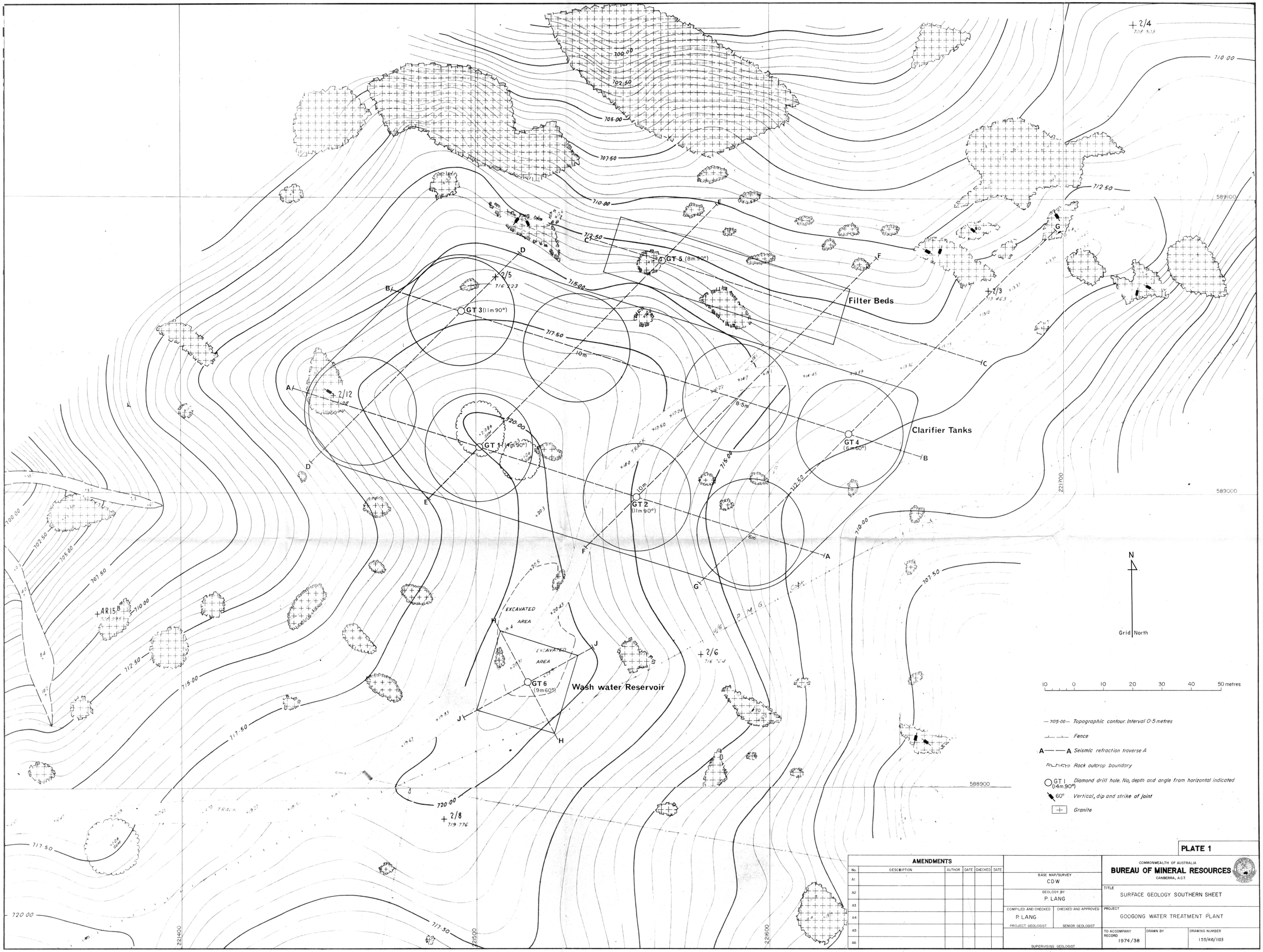


PLATE 1

AMENDMENTS					
No.	DESCRIPTION	AUTHOR	DATE	CHECKED	DATE
A1					
A2					
A3					
A4					
A5					
A6					

BASE MAP/SURVEY: CDW

GEOLOGY BY: P. LANG

COMPILED AND CHECKED: P. LANG — PROJECT GEOLOGIST

CHECKED AND APPROVED — SENIOR GEOLOGIST

SUPERVISING GEOLOGIST

COMMONWEALTH OF AUSTRALIA
BUREAU OF MINERAL RESOURCES
CANBERRA, A.C.T.

TITLE: SURFACE GEOLOGY SOUTHERN SHEET

PROJECT: GOOGONG WATER TREATMENT PLANT

TO ACCOMPANY RECORD: 1974/38

DRAWN BY:

DRAWING NUMBER: 155/A16/1103

Clear Water Storage Tank
696·5 m

GT 7
(11·62 m 90°)

GT 8
(12·8 m 90°)

GT 9
(12 m 60°)

GT 10
(9 m 60°)

Qtz floaters

Granite floaters

ROAD

N 589400

N 589300

N 589200

221800

221900

222000

222100

10 0 10 20 30 40 50 metres

N
Grid North

— 705·00 — Topographic contour. Interval 0·5 metres

Fence

A —— A Seismic refraction traverse A

Rock outcrop boundary

GT 1 (14 m 90°) Diamond drill hole. No, depth and angle from horizontal indicated

60° Vertical, dip and strike of joint

Granite

Excavation cut

Fairly close joint

PLATE 2

AMENDMENTS					
No.	DESCRIPTION	AUTHOR	DATE	CHECKED	DATE
A1					
A2					
A3					
A4					
A5					
A6					

BASE MAP/SURVEY: CDW

GEOLOGY BY: P.LANG

COMPILED AND CHECKED: P. LANG — PROJECT GEOLOGIST

CHECKED AND APPROVED — SENIOR GEOLOGIST

SUPERVISING GEOLOGIST

COMMONWEALTH OF AUSTRALIA
BUREAU OF MINERAL RESOURCES
CANBERRA, A.C.T.

TITLE: SURFACE GEOLOGY NORTHERN SHEET

PROJECT: GOOGONG WATER TREATMENT PLANT

TO ACCOMPANY RECORD: 1974/38

DRAWN BY:

DRAWING NUMBER: 155/A16/1105

PLATE 3

AMENDMENTS					
No	DESCRIPTION	AUTHOR	DATE	CHECKED	DATE
A1					
A2					
A3					
A4					
A5					
A6					

BASE MAP/SURVEY: CDW
GEOLOGY BY: P. LANG
COMPILED AND CHECKED: P. LANG, PROJECT GEOLOGIST
CHECKED AND APPROVED: SENIOR GEOLOGIST

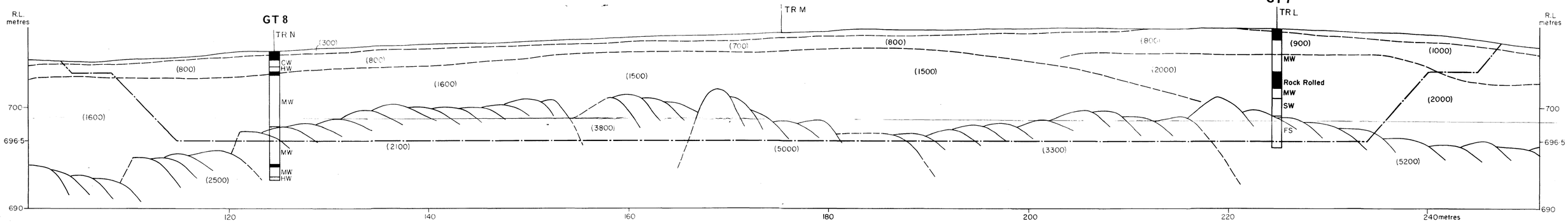
COMMONWEALTH OF AUSTRALIA
BUREAU OF MINERAL RESOURCES
CANBERRA, A.C.T.

TITLE: INTERPRETATIVE SEISMIC SECTIONS A, B and C SHOWING WEATHERING CONDITIONS IN DRILL HOLES 1–5

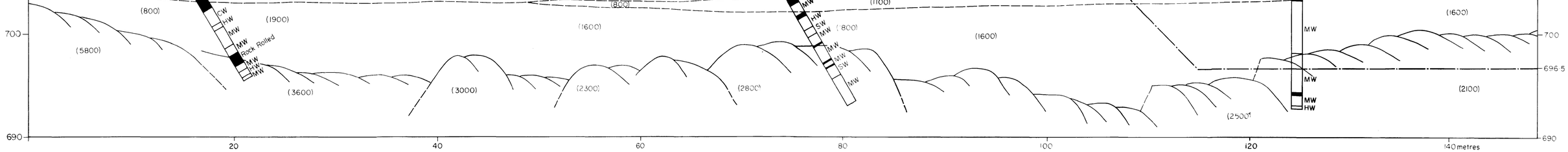
PROJECT: GOOGONG WATER TREATMENT PLANT

TO ACCOMPANY RECORD: 1974/38
DRAWN BY: P. BLYTHE
DRAWING NUMBER: 155/A16/1106

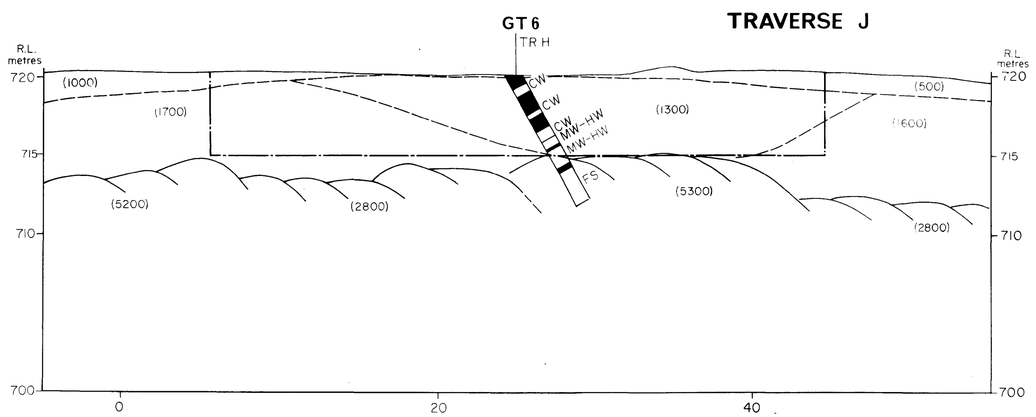
TRAVERSE K



TRAVERSE K



TRAVERSE J



GT 1 *Diamond-drill hole number GT 1*

TR *Seismic traverse intercept*

Seismic refractor

High velocity refractor

(800) *Seismic velocity (m/sec)*

Tank section

Summary Log

- *No core recovered*
- CW *Completely weathered granite*
- HW *Highly weathered granite*
- MW *Moderately weathered granite*
- SW *Slightly weathered granite*
- FS *Fresh stained granite*
- FR *Fresh granite*

0 5 10 15 20 **25 metres**

PLATE 4

AMENDMENTS					
No.	DESCRIPTION	AUTHOR	DATE	CHECKED	DATE
A1					
A2					
A3					
A4					
A5					
A6					

BASE MAP/SURVEY: C D W

GEOLOGY BY: P. LANG

COMPILED AND CHECKED: P. LANG — PROJECT GEOLOGIST

CHECKED AND APPROVED — SENIOR GEOLOGIST

SUPERVISING GEOLOGIST

COMMONWEALTH OF AUSTRALIA
BUREAU OF MINERAL RESOURCES
CANBERRA, A.C.T.

TITLE: **INTERPRETATIVE** SEISMIC SECTIONS J and K SHOWING **WEATHERING** CONDITIONS IN DRILL HOLES 6–10

PROJECT: GOOGONG WATER TREATMENT PLANT

TO ACCOMPANY RECORD: 1974/38

DRAWN BY: P.L. BLYTHE

DRAWING NUMBER: 155/A16/1104