Section

REPT.BK.NO. 74/165

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ENG. GEOLOGY SECTION

PROPOSED SUBDIVISION - MAGILL

Pt. Secs. 1055 & 1059 Hd. Adelaide

REPORT ON GEOLOGICAL INVESTIGATION

State Planning Office Docket No. 515/74

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&

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South Australia

74/165

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DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENGINEERING DIVISION

PROPOSED SUBDIVISION - MAGILL

Pt. Secs. 1055 & 1059 Hd. Adelaide

REPORT ON GEOLOGICAL INVESTIGATION

Client: State Planning Office (Docket 515/74)

BY

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Rept.Bk.No.74/165
G.S. No.5483
D.M. No.533/74
Eng. Geol. No.1974/45

16 August, 1974

CONTENTS PAGE

FIGURES

DEPARTMENT OF MINES
SOUTH AUSTRALIA

Rept.Bk.No.74/165
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PROPOSED SUBDIVISION - MAGILL

Pt. Secs. 1055 & 1059 Hd. Adelaide

REPORT ON GEOLOGICAL INVESTIGATION

State Planning Office Docket No. 515/74

SUMMARY AND CONCLUSIONS

A subdivision at Magill has been inspected with respect to its suitability for residential development.

The subdivision straddles three north running spurs having average slopes of 15° (steeper in the reserves). Two deep gullies separate the spurs. Phyllite and quartzite bedrock probably lie at shallow depth beneath the entire subdivision with a thin cover (less than 1 m) of brown <u>clay soil</u>, low plasticity (CL)* containing gravel fragments.

Proximity to the Eden and Montacute Fault lines means that the area may be subject to future seismic activity.

It is considered that the area is suitable for residential development provided attention is given to the following points:-

.... Housing foundations should be placed on bedrock as a precaution against possible seismic activity.

.... Due to conditions of potential instability caused by unfavourable orientation of bedrock defects, rock cuts should not exceed 1 m in depth. Vegetation should be planted on reserve slopes to reduce risk of long term soil erosion

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* Terms underlined and in brackets are defined in Appendix I.

.... Adequate drainage easements must be left to cope with runoff along the two steep gullies. To allow for this Lot 36 should be excised and Lots 18, 19 and 25, 26 combined.

The subdivision overlooks an active clay pit and brickworks. Possible additional clay reserves occur on the subdivision but these are considered of less importance than reserves already proved to the north and east of the brick works.

INTRODUCTION

A letter from the State Planning Office dated 7th May 1974 requested this Department to assess the suitability of the land for residential development.

REGIONAL GEOLOGY AND SEISMICITY

The subdivision is located on the western edge of the Eden Fault Block, one of the elongated fault blocks which make up the Mt. Lofty Ranges. The active Eden Fault lies about 500 m to the north west and the Montacute Fault about 1 km to the east. Because of its proximity to these faults there is a possibility that future seismic activity could affect the subdivision.

Rocks in the area are phyllite, siltstone and quartzite of late Proterozoic age. These dip to the east at about 20°.

SITE GEOLOGY

Topography and vegetation

The proposed subdivision straddles three north-trending spurs varying from an altitude of from 100 to 200 m above sea level. Slopes on the parts proposed for development reach a maximum of about 15° (1 on 3.75) although elsewhere on the reserves became steeper. Two deep gullies run northwards across the area.

Vegetation consists of bare pasture with a small patch of native gums at the top of the hill. The eastern gully is thickly bushed while the western gully is bare.

Soil and Rock Types

Surface evidence from the numerous scattered boulders indicates siltstone or quartzite bedrock lies at shallow depth. This is covered by a thin layer of brown clay soil, low plasticity (CL) containing angular rock gravel.

A housing bench cut at the bottom of Palomino road shows 0.8 m of calcareous clay residual soil resting on weak, weathered purple phyllite bedrock which dips east at 20°.

EXTRACTIVE MINERALS

The suitability of decomposed Pre-Cambrian phyllites as a source of clay for brickmaking was first recognised in 1926.

J.E. Ridgway (1949 and 1950) investigated the resources on sections 848, 849 and 1055 for the Magill Brick Works. The area is underlain by slates, phyllites, calcareous shales, dolomites, limestones and quartzite of the Adelaidean sequence folded into an anticline, the western limb of which was then being quarried for slate and phyllite. Drilling was carried out to the north and east of the quarry. This proved reserves of 500 000 tons of Tertiary clay and 650 000 tons of weathered slate and phyllite. Partially proved reserves included 600 000 tons of weathered slate and phyllite and possibly several hundred thousand tons of Tertiary clay and gravel. Extension of quarrying onto the eastern limb of the anticline would provide additional reserves. These reserves constitute approximately 60 to 70 years supply and it is unlikely that Gilburn Brick Company would need to extend quarrying further than its present Private Mine Lease. The proved reserves to the north and east of the quarry are far more significant than the possible reserves in section 1055.

FOUNDATIONS CONDITIONS

Bedrock on the subdivision is expected to occur at shallow depth and should make a suitable foundation for residential buildings.

Due to the topography and the recommended restrictions on depth of rock cuts (see below) it will probably prove necessary to found many houses on piles or piers.

Service trenches can probably be excavated by backhoe except in areas of quartzite where light blasting may be required.

SLOPE STABILITY

No evidence of soil slip or movement was seen on the subdivision and slopes are expected to be stable over the long term provided an adequate vegetation cover is introduced.

Joints and bedding in the bedrock phyllite, measured in a cut on Palomino road are plotted stereographically in Fig. I. This shows the trend and plunge of the major wedge failure directions resulting from the intersection of the joint and bedding planes. It serves to indicate the main directions of instability in potential rock cuts on the subdivision. The major directions of instability are:-

East and north east (bedding and 3 wedge failure directions)

West and south west (joint 4 and one wedge failure direction)

North west (one wedge failure direction)

North north west (joint 2)

South east (joint 3)

In view of these conditions of potential instability within the well jointed and slabby bedrock and the possibility of seismic activity it is recommended that as a safety precaution housing cuts should not be carried deeper than 1 m into bedrock.

GROUNDWATER AND FLOODING

Groundwater on the subdivision consists of minor seepages during wet periods and should not be a problem during excavation. Due to the shallow depth to bedrock, the clayey nature of the soil, and the arrangement of the proposed housing blocks, it is considered that reticulated sewerage will be essential.

During wet periods it is expected that considerable runoff will flow down the two gullies. This can be expected to increase as a result of residential development and adequate drainage easements should be left to cope with this. For this reason it is recommended that Lot 36 be excised and Lots 18, 19 and 25, 26 combined.

Protection of the winery in the south from increased runoff can be achieved by suitable drainage along Merlot Avenue.

ENVIRONMENT AND CONSERVATION

Slopes in the reserve areas should be vegetated as a precaution against future soil erosion.

The subdivision overlooks the Magill claypit and brickworks.

J. SELBY
SENIOR GEOLOGIST

W. McCALLUM
GEOLOGIST

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APPENDIX I

Soil and Rock Classification Charts

DEPARTMENT OF MINES - SOUTH AUSTRALIA

ENGINEERING CLASSIFICATION OF SOILS

The Unified Soil Classification System

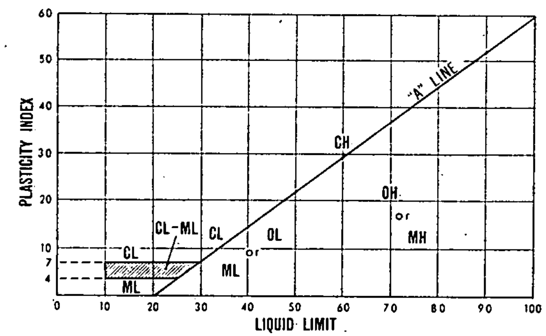
COARSE-GRAINED SOILS More than 50% of material is larger than No. 200 B.S. sieve size	FIELD INVESTIGATION PROCEDURES Excluding particles larger than 7·5cm and basing fractions on estimated weights			GROUP SYMBOL	GROUP NAME and typical materials	LABORATORY CLASSIFICATION CRITERIA	
	GRAVELS More than 50% of the coarse fraction is larger than 2mm. (retained on B.S.7 sieve)	CLEAN GRAVELS Little or no fines	Wide range in grain sizes, and substantial amounts of all intermediate particle sizes	GW	GRAVEL, well graded; gravel sand mixtures, little or no fines	$Cu = D_{60}/D_{10}$ Greater than 4 $Cc = (D_{30})^2/D_{10} \times D_{60}$ Between 1 and 3	
			Predominantly one size or a range of sizes, with some intermediate sizes missing	GP	GRAVEL, poorly graded; gravel sand mixtures, little or no fines	Not meeting all gradation requirements for GW	
		DIRTY GRAVELS Appreciable amount of fines	Non-plastic fines—for indentification see ML below	GM	GRAVEL, excess silty fines; poorly graded gravel-sand-silt mixtures	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
			Plastic fines—for identification see CL below	GC	GRAVEL, excess clayey fines; poorly graded gravel-sand-clay mixtures	Atterberg limits below "A" line or PI greater than 7	
	SANDS More than 50% of the coarse fraction is smaller than 2mm. (passing B.S.7 sieve)	CLEAN SANDS Little or no fines	Wide range in grain sizes, and substantial amounts of all intermediate particle sizes	SW	SAND, well graded; well graded sands, gravelly sands, little or no fines	$Cu = D_{60}/D_{10}$ Greater than 6 $Cc = (D_{30})^2/D_{10} \times D_{60}$ Between 1 and 3	
			Predominantly one size or a range of sizes, with some intermediate sizes missing	SP	SAND, poorly graded; poorly graded sands, gravelly sands, little or no fines	Not meeting all gradation requirements for SW	
		DIRTY SANDS Appreciable amount of fines	Non-plastic fines—for indentification see ML below	SM	SAND, excess silty fines; poorly graded sand-silt mixtures	Atterberg limits below "A" line or PI less than 4	Above "A" line with PI between 4 and 7 are borderline cases requiring use of dual symbols
			Plastic fines—for identification see CL below	SC	SAND, excess clayey fines; poorly graded sand-clay mixtures	Atterberg limits below "A" line or PI greater than 7	

GRAIN SIZE CURVES to be used to identify soil fractions

Coarse-grained soil classified on basis of percentage of fines, as follows

PERCENT OF FINES	GRAVELS	SANDS
Less than 5	GW GP	SW SP
More than 12	GM GC	SM SC
5 to 12	Borderline cases, use 2 symbols	

FINE-GRAINED SOILS More than 50% of material is smaller than No. 200 B.S. sieve size	FIELD INVESTIGATION PROCEDURES on fraction smaller than 0.4mm. (passing B.S. 36 sieve)	SOIL CAST (soil wet)	SOIL THREAD	SHINE	DILATANCY	ODOUR	DRY STRENGTH	GROUP SYMBOL	GROUP NAME and typical materials
	SILTS AND CLAYS Liquid limit less than 50	Forms fragile cast Cracks form when kneaded while moist	Thick crumbly thread; easily broken	None to very dull	Distinct	Not significant	None to slight	ML	SILT SOIL, low plasticity; inorganic silts and very fine silty or clayey sands, rock flour
		Cast maybe handled freely without breaking Can be kneaded moist without cracking Material adheres to the hand	Thread can be pointed as fine as a lead pencil but is fragile	Moderate	None to slight	Not significant	Moderate	CL	CLAY SOIL, low plasticity; inorganic clays of low to medium plasticity, gravelly clay, sand, clays, silty clays, lean clays
		Cast fragile to cohesive material will adhere somewhat to the hand	Soft, weak thread	None to very dull	Slight to distinct	Decayed organic matter	Low	OL	ORGANIC SOIL, low plasticity; organic silts and silt clays of low plasticity
	SILTS AND CLAYS Liquid limit more than 50	Moderately plastic and cohesive Material adheres somewhat to the hand	Weak to medium thread May be crumbly	Dull	None to slight	Not significant	Moderate Powdered soil feels floury	MH	SILT SOIL, high plasticity; inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		Very plastic and cohesive Material very sticky to the hand Greasy to touch	Very tough thread, can be rolled to a pin point	Very glossy	None	Strong earthy	High to very high Cannot be powdered by finger pressure	CH	CLAY SOIL, high plasticity; inorganic clays of high plasticity, fat clays
		Plastic and cohesive Feels slightly spongy Greasy to touch	Weak to medium thread Often soft and fibrous	Moderate to very glossy	None	Decayed organic matter	Moderate to high Powdered soil may be fibrous	OH	ORGANIC SOIL, high plasticity; organic clays of medium to high plasticity
		Readily identified by colour, odour, spongy feel and frequently by fibrous texture						Pt	PEATY SOIL; Peat and other highly organic soils



PLASTICITY CHART
FOR LABORATORY CLASSIFICATION OF FINE GRAINED SOILS

NOTE: BOUNDARY CLASSIFICATIONS: Soil possessing characteristics of two groups are shown as a combination of two group symbols, eg. GW-GC, well graded gravel with clay binder.

Based on "The Unified Soil Classification System" United States Department of the Interior, Bureau of Reclamation "Earth Manual" First Edition, Denver COLARADO 1960.

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ENGINEERING CLASSIFICATION OF ROCK MATERIAL

1. ROCK CONDITION

TERM	ABBRN	DEFINITION
Fresh	(F)	No weathering effects visible to naked eye.
Weathered	(W)	Shows visible effects of chemical decomposition caused by air and groundwater. Can be subdivided:
Slightly weathered	(SW)	- change in appearance but no loss in strength
Moderately weathered	(MW)	- change in appearance but with significant loss in strength.
Completely weathered	(CW)	- has soil properties and often shows complete change in appearance.
Altered	(A)	Shows chemical and physical alteration to rock fabric caused by temperature, pressure or injection of other material.

2. ROCK STRENGTH

Can be correlated with unconfined compressive strength tested in the laboratory.

TERM	ABBRN	Kg cm^2 (p.s.i.)	FIELD TEST	
Very weak	VW	70 (1 000)	Breaks and crumbles easily in the hands.	
Weak	W	70-200 (1 000-3 000)	Breaks easily with hammer tap.	(Normal (range
Medium strong	MS	200-700 (3 000-10 000)	Rings and breaks to firm hammer blow	(of (concrete
Strong	S	700-1 800 (10 000-25 000)	(Very difficult to break with (hammer	
Very strong	VS	>1 800 (>25 000)	(and requires sledge (	

3. USE OF CLASSIFICATION

Note that Condition and Strength terms do not necessarily correspond.

Strength depends on the type of rock while condition depends on external effects, e.g.

Rock Material	Condition	Strength
Granite	Fresh	Strong
Schist	Fresh	Weak

APPENDIX II

Damage to Buildings during Earthquakes

APPENDIX II

DAMAGE TO BUILDINGS DURING EARTHQUAKES

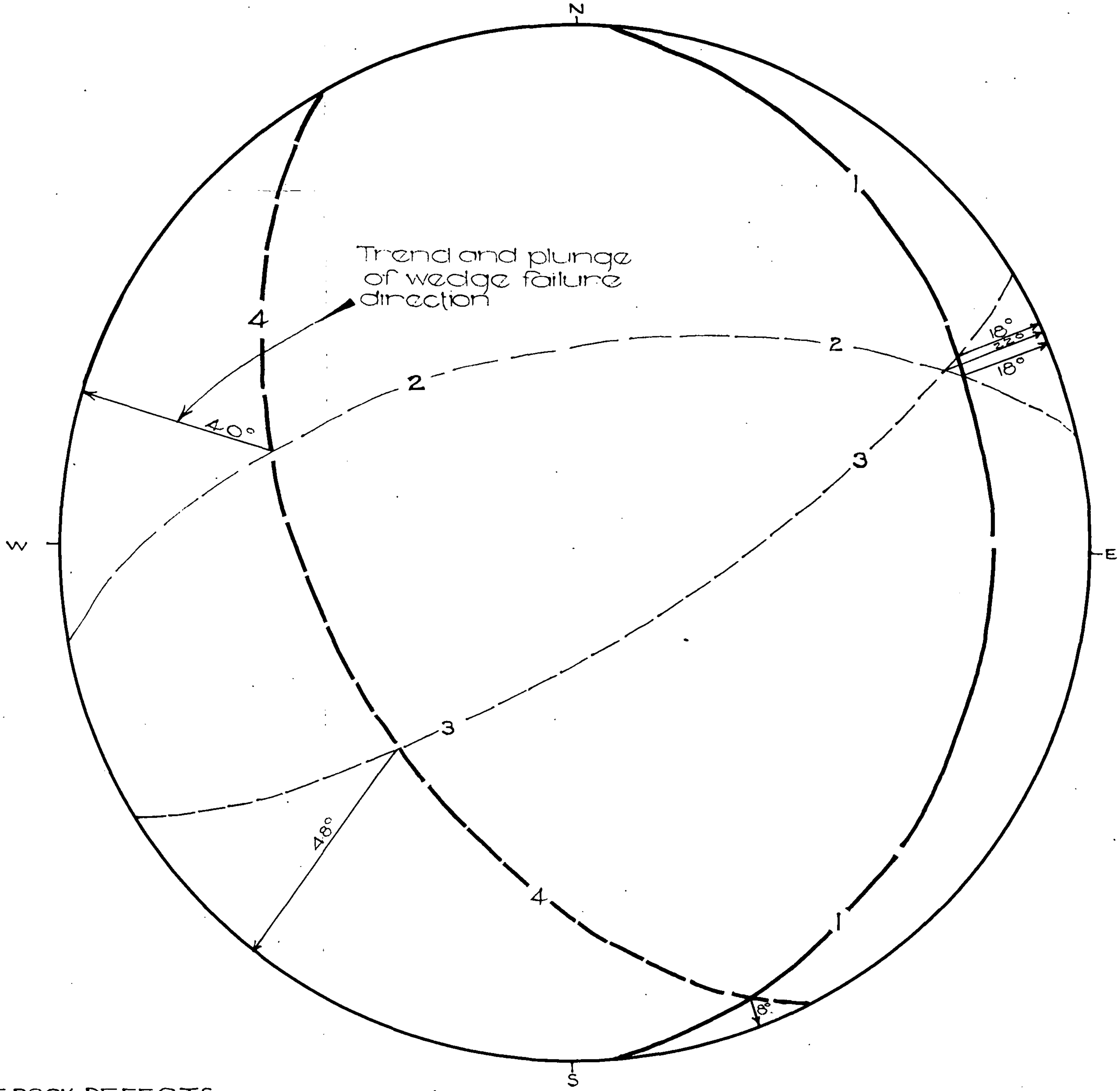
It is quite possible that during an earthquake a structure several hundred metres from the fault on which movement occurred could suffer similar damage to a structure immediately above it.

Detailed observations in those parts of the world where earthquakes are common have shown that there are three main factors which influence the amount of damage sustained by buildings during earthquakes, namely:

..... Distance from the epi-central zone. In some cases, there is visible dislocation of ground surface along the fault trace during earthquakes (eg. Mackering Meckering Earthquake, Western Australia). The zone in which ground dislocations occur is commonly termed the "complete destruction" zone.

..... The type of foundation material upon which buildings are located. In the majority of cases the greatest damage occurs to buildings located on unconsolidated fills and alluvial soils. Buildings located on rock usually sustain the least damage.

..... The type of construction. It has been found that structures can be designed and built so as to minimise, but not eliminate entirely, the damage due to earthquakes. Special building codes have been developed in countries or regions which have frequent earthquakes. However, even where structural collapse of buildings is prevented, there is still a relatively high danger of fire, and damage to services - water, gas and electricity. Proposed buildings codes for Australia (Building Act Advisory Committee, 1971) suggest that regulations to cover the design of buildings with relation to resistance to earthquakes should be the responsibility of Local Council bodies, and would depend on the likely seismicity in any areas.



SUMMARY OF ROCK DEFECTS

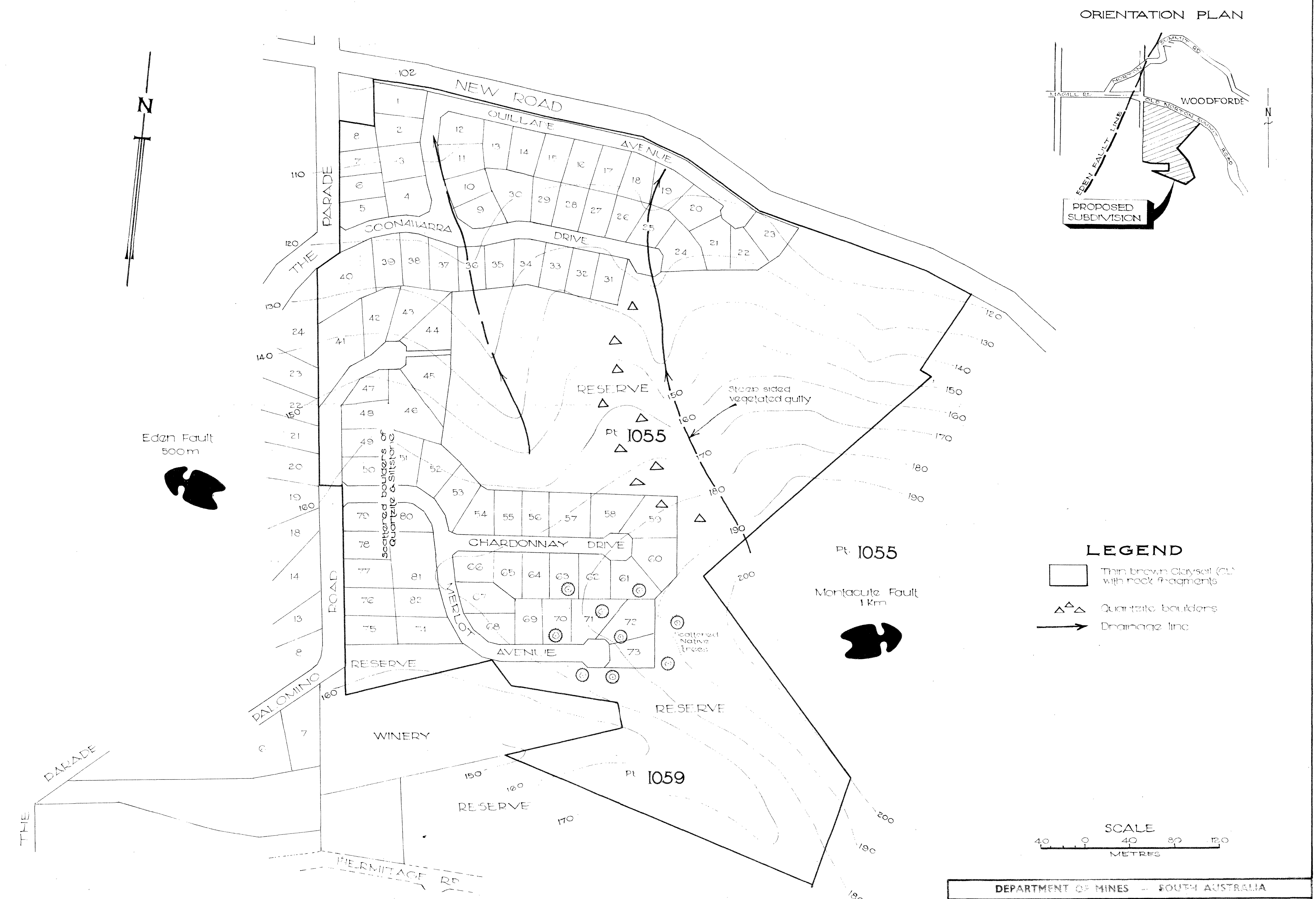
	STRIKE	DIP	TYPE
1	000°	20°E	Bedding
2	075°	60°N	Joint
3	055°	75°SE	Joint
4	150°	50°SW	Joint

DEPARTMENT OF MINES — SOUTH AUSTRALIA

PROPOSED SUBDIVISION — MAGILL

STEREOGRAPHIC PROJECTION OF ROCK DEFECTS

ENGINEERING GEOLOGY SECTION	GEOLOGIST	**Drn.** J.S	**SCALE:** Diagrammatic
		Tcd. R.B.	S10948 Ha6
		Ckd. A.F.	
.... **Director of Mines**		**Exd.**	**DATE:** 16th August 1974



DEPARTMENT OF MINES — SOUTH AUSTRALIA

PROPOSED SUBDIVISION – MAGILL
PT. SECS. 1055 & 1059 HD. ADELAIDE
GEOLOGICAL PLAN

ENGINEERING GEOLOGY SECTION	GEOLOGIST	Compiled J Selby	Scale 1:2000
			Date 16 July 1974
		R B	Drg. No. 74-532
Director of Mines		Ckd. A.F.	HaC