DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENGINEERING DIVISION

PROPOSED SUBDIVISION - HAPPY VALLEY

PT. Sec. 544 and 556, Hd. Noarlunga

REPORT ON GEOLOGICAL INVESTIGATION

Client: State Planning Office

by

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GEOLOGIST
ENGINEERING GEOLOGY SECTION

Rept.Bk.No.71/169

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SOUTH AUSTRALIA

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Rept.Bk.No. 71/169
G.S. No. 4742
D.M. No. 909/71

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SUMMARY AND CONCLUSIONS

A proposed subdivision at Happy Valley has been examined with reference to the suitability of the site for residential development.

It was found that most of the area is underlain by quartzite and slate at shallow depth (about 3ft. (0.9m)). The top soil is a silt soil which becomes saturated during the winter months producing areas of active soil creep on some of the hill slopes. There are several quarries up to 20ft (6m) deep, and escarpments up to 10ft. (3m) high in the proposed area of residential dwellings.

If it is proposed to back fill these quarries and escarpments to produce a level surface then it is recommended that:

(a) suitable fill material without any organic matter be used and properly compacted.

(b) all potential buyers of lots affected by quarries and escarpments should be informed that these features lie buried on the land.

(c) no building should be constructed partly on the fill and partly on undisturbed ground as differential

settlement is likely to occur.

It is also recommended that the areas of soil creep should be properly drained during construction and adequate permanent drains installed. A safety fence should be built around a steep quartzite escarpment, which is about 40ft. (12m) high.

During site inspections it was observed that two important topographic features were not located on the survey plan, and it is recommended that these should be located in relation to the subdivision allotments and roads.

It is considered that the site is suitable for residential development provided that the above recommendations are borne in mind.

INTRODUCTION

Investigation of a proposed subdivision at Happy Valley to determine the suitability of the site for residential development was requested in a letter dated 5th August, 1971 from the Director of Planning.

The location of the proposed subdivision, together with the relevant geological and geomorphological information is shown on Figures 1 and 2.

REGIONAL GEOLOGY

The proposed subdivision is situated on the uplifted Clarendon Block and a normal fault, which was active during early Cainozoic Time, lies about ¼ mile (400m) to the west. The uplifted block is one of a number of elongate faulted crustal blocks that make up the Mt. Lofty Ranges.

The area is made up of rocks from the Adelaide System (Proterozoic Age) and consists of quartzites (Sturtian) with

local pebbly beds and thinly laminated blue-grey slates (Terrenaian) with some siltstone interbeds (Thompson, 1962).

SITE GEOLOGY

The site (Fig.2) is situated on the western slope of a north-south trending ridge. The topography is dominated by two east-west trending valleys, up to 60ft. (18m) deep, that cut across the proposed subdivision. The valley sides slope at angles ranging from 12° to almost vertical. The rest of the area is gently undulating with slopes ranging from 5° to 10°. There are numerous rock outcrops, the most prominent being a near vertical north-east trending, 40ft. (12.2m) high, quartzite escarpment over which a water-fall flows (Fig.1). There are three quarries up to 20ft. (6m) deep and several escarpments up to 40ft. (12.2m) high on the proposed site. Grass, gum trees, moss and dense bush cover most of the area.

Soil and Rock Types

The soil cover mainly consists of a SILT SOIL (ML)* of low plasticity and is generally about 2ft. (60cms) to 3ft. (1m) thick and overlies quartzite or slate bed rock. In the vicinity of Dean Place (Fig. 1) the soil cover appears to be up to 6ft. (1.8m) deep with a SILT SOIL (ML) of low plasticity up to 1ft (30cms) thick overlying a yellow-white high plasticity CLAY SOIL (CH) with some rock fragments up to 0.2ft. (5cms) in size.

The major rock types exposed are quartzite and slate. The quartzite, which strikes at 050° and dips 20° to the south-east,

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* These terms defined in appendix.

is a strong to very strong, slightly weathered (Table 1), medium to coarse grained rock with some pebble layers up to 1ft. (30cms) wide. There are three sets of well developed, open (up to 4mm) joints, one strikes at 050° and dips 70° to the north-west, the other is vertical and strikes approximately north-south, and the other is a bedding plane joint. The quartzite outcrops as prominent escarpments up to 40ft. (12m) high and in the quarries (Fig. 1).

The slate is a slightly weathered, medium strong to strong, thinly laminated, blue-grey slate with some light coloured siltstone interbeds. The bedding strikes at 170° and dips 50° to the east and a well developed cleavage strikes at 060° and dips 30° to the south. The slate outcrops as prominent near vertical escarpments up to 5ft. (1.5m) high and in quarries.

STABILITY OF SUBDIVISION SLOPES AND QUARRIES

The area has been divided into 4 sub-areas (Fig.2) for ease of discussion and they will be discussed separately.

Area 1.

This area has generally stable slopes within the proposed residential area. In the vicinity of point A (Fig. 2), which is the head of a valley, there is considerable active soil creep in the saturated top soil. However bed rock lies close to the surface (within 2ft. (60cms)) and it is considered that with adequate drainage during construction this area should be suitable for building.

In the vicinity of point B the 40ft. (12m) high almost vertical quartzite escarpment comes within 10ft. (3m) of the proposed road way. However the escarpment appears to be quite

TABLE.1

CLASSIFICATION OF ROCK CONDITIONS AND STRENGTH OF ROCK SUBSTANCE

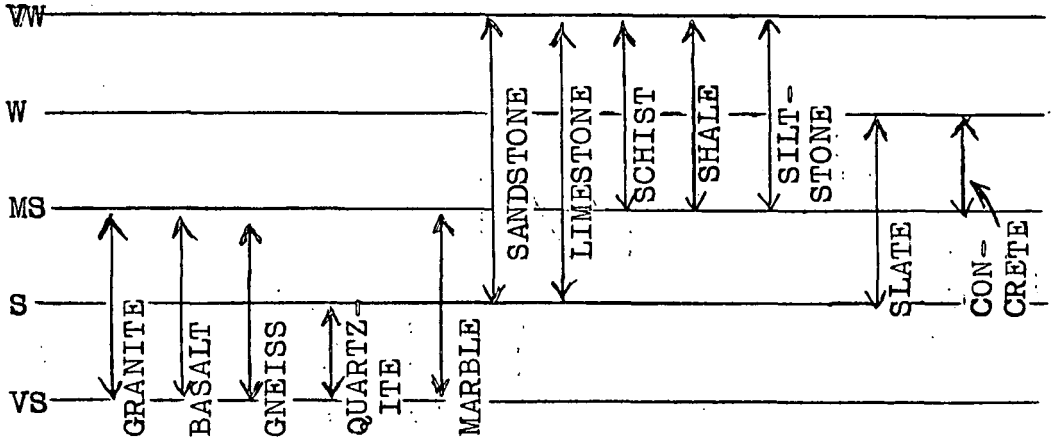
1. ROCK CONDITION TERMS

TERM	ABBRN	DEFINITION
Fresh	(F)	Substance shows no effects of chemical decomposition.
Chemically Decomposed	(D)	Substance is affected by chemical decomposition, but the exact process is not obvious.
Chemically Weathered	(W)	Substance shows effects of chemical decomposition processes which have occurred due to surface and near-surface agencies such as air and groundwater.
Chemically Altered	(A)	Substance shows effects of chemical decomposition processes which have occurred due to plutonic or volcanic fluids.
Extremely Decomposed	(XD)	Substance has been reduced to material which shows fabric of original rock, but which can be remoulded, i.e. soil substance. (Classified by Unified System).
Extremely Weathered	(XW)	
Extremely Altered	(XA)	

2. CLASSIFICATION OF ROCK SUBSTANCES BY UNCONFINED COMPRESSIVE STRENGTH

TERM	ABBRN	UNCONFINED COMPRESSIVE STRENGTH (Kg/sq.cm)	(lb/sq.in)
Very weak	VW	<70	≤ 1000
Weak	W	70 - 200	1000 - 3000
Medium strong	MS	200 - 700	3000 - 10,000
Strong	S	700 - 1800	10,000 - 25,000
Very strong	VS	>1800	$>25,000$

RANGE OF STRENGTHS OF SOME COMMON ROCK SUBSTANCES IN THE FRESH STATE*



*Samples of fresh rock tested to Australian Standard. For rocks showing planar anisotropy the long axis of the sample is normal to fabric planes.

3. EXAMPLES OF USE OF CLASSIFICATION

Geological Name	Rock Condition Term	Strength Term
Granite	Fresh	Strong
Granite	Weathered	Medium Strong
Schist	Fresh	Weak
Schist	Altered	Very Weak

stable with no likelihood of major rock slides or erosion under cutting the road way. It is suggested that a safety fence be constructed from about point B to point C along the escarpment. The escarpment as shown crosses lots 22,23, 61, 62, 83, 84, 114 and 115. If it is proposed to back fill these areas to make the surface level then it is recommended that no building be founded partly on fill and partly on rock as differential settlement could occur beneath the building.

At point D is a quarry (Fig.2) the position of which is only approximate, as it was not shown on the original Subdivision Plan, dated 6th April, 1971, thus it is suggested that its position be accurately located in relation to the allotments. The quarry is 15ft. (4.5m) to 20ft. (6m) deep and the upper 5ft. (1.5m) of the near vertical face, consisting of silt soil and weathered slate, appears to be unstable and subject to minor rock falls. If left unchecked this instability could under-cut Michael Boulevard, hence it is suggested that it be either back filled or the faces battered back to about 45°. Both these alternatives could be easily accomplished with earth moving equipment.

The remainder of area 1 is stable and suitable for residential development.

Area 2.

At point E (Fig. 2) there is a quarry up to 15ft. (4.5m) deep. The faces slope at 50° to 60° and appear to be quite stable. If the quarry is to be back filled then all potential buyers of lots 100, 101, 102, 108, and 107 should be informed that an old quarry lies partly beneath these lots, and it is recommended that no buildings be allowed to be constructed partly over the

infilled quarry as differential settlement of the fill may occur beneath the building.

Just west of this quarry (Fig.2) is a quartzite escarpment from 3ft. (90cms) to 6ft. (1.8m) high. Its position is only approximate as it was not shown on the original subdivision plan dated 6th April, 1971, and it is suggested that it be accurately located. This escarpment appears to lie in lots 107 and 108, and if it is proposed to add fill to make the surface level then it is recommended that no buildings be built across the buried escarpment as differential settlement could occur beneath the building. Also it is suggested that all potential buyers of lots 107 and 108 be informed that a buried escarpment lies on these lots.

In the vicinity of point F is a recent water course that has eroded channels up to 3ft. (90cms) deep. However with provision for adequate drainage this area should be suitable for residential dwellings.

The remainder of area 2 is stable and suitable for residential development.

Area 3.

In the vicinity of point G (Fig.2) is a large area of unstable soil up to 6ft. (1.8m) thick which surrounds a deeply incised (6ft. (1.8m)) water course that appears to carry considerable amounts of water during storm activity. This area affects lots 131, 132, 137, 138, 194, 195, 209, and 244, and it is suggested that a drain of adequate capacity be constructed along the existing channel to provide drainage for this area. With such drainage this area should be suitable for building purposes.

At point H (Fig. 2) is a quarry up to 15ft (4.5m) deep with near vertical faces. The upper 3ft. (90cms) to 4ft. (1.2m) of the faces, composed of silt soil and weathered jointed quartzite, appears to be unstable and subject to minor falls. This quarry lies entirely on lot 212 and it is recommended that potential buyers of this lot should be informed that an old quarry lies on this property. It is recommended that no building be founded partly on fill and partly on rock, as differential settlement of the fill may occur, beneath the building.

The remainder of the area appears to be stable and should be suitable for residential development.

Area 4

At points I, J & K are areas of active soil creep. However bed rock appears to be within 3ft. (90cms) of the surface and with suitable drainage during construction on lots 227, 228, 233, 234, 235, 236, 237 and Michael Boulevard these areas should be suitable for residential development.

At point L there is evidence of an old soil slip into the creek and the top of the escarpment comes within 10ft. (3m) of Michael Boulevard. It is suggested that either a) Michael Boulevard should be located at least 20ft. (6m) from the top of the escarpment, and no drainage from the subdivision should be allowed to run into the old slip area, or b) a retaining wall should be constructed around the face of the " bank " to prevent any future slip under-cutting the roadway.

The remainder of the area is considered to be suitable for residential development.

GROUNDWATER

Due to the relatively high rain fall in this area

the top soil (up to 3ft. (9cms) thick) becomes saturated during the winter months and there is considerable surface run off in some areas. However, since the site is situated on the crest and sides of a ridge no permanent ground water is likely to be encountered in any excavation. However if construction was carried out during the winter months, near surface "perched" ground water would be likely to be encountered in many locations; and care should be taken during earthworks to ensure that the present areas of soil creep are not reactivated or that soil creep is not activated in new areas.

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5.10.71
BJM:JTS

REFERENCE

Thompson, B.D. and Horwitz, R.C. 1962. Barker map sheet,
Geol. Atlas of S.Aust. 1:250,000 series.
Geol. Surv. of S. Aust.

Appendix

Soils Classification Chart

ENGINEERING GEOLOGY SECTION

SOILS CLASSIFICATION CHART

DEPARTMENT OF MINES SOUTH AUSTRALIA

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 0.25 ft. and basing fractions on estimated weights)				GROUP SYMBOL	GROUP NAME and typical materials
COARSE GRAINED SOILS More than 50% of material is larger than No. 200 B.S. Sieve size.	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 size and substantial amounts of all intermediate particle sizes	GW	GRAVEL, well graded; gravel sand mixtures, little or no fines
			Predominantly one size, or a range of sizes, with some intermediate sizes missing.	GP	GRAVEL, poorly graded; gravel sand mixtures, little or no fines.
		DIRTY GRAVELS Appreciable amount of fines	Non-plastic fines – for identification see ML below.	GM	GRAVEL, excess silty fines; poorly graded gravel-sand-silt mixtures
			Plastic fines – for identification see CL below	GC	GRAVEL, excess clayey fines; poorly graded gravel-sand-clay mixtures
	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.
			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
		DIRTY SANDS Appreciable amount of fines	Non plastic fines – for identification see ML below	SM	SAND, excess silty fines; poorly graded sand-silt mixtures
			Plastic fines – for identification see CL below	SC	SAND excess clayey fines; poorly graded sand-clay mixtures.

FIELD INVESTIGATION PROCEDURES on fraction smaller than 0·4 mm. (passing B.S. 36 sieve)								GROUP SYMBOL	GROUP NAME (and typical materials)
FINE GRAINED SOILS More than 50% of material is smaller than No. 200 B.S. sieve size.		SOIL CAST (wet soil)	SOIL THREAD	SHINE	DILATANCY	ODOUR	DRY STRENGTH		
	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 clays, sandy 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 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.
HIGHLY ORGANIC SOILS		Readily identified by colour, odour, spongy feel and frequently by fibrous texture.						Pt	PEATY SOIL; Peat and other highly organic soils.

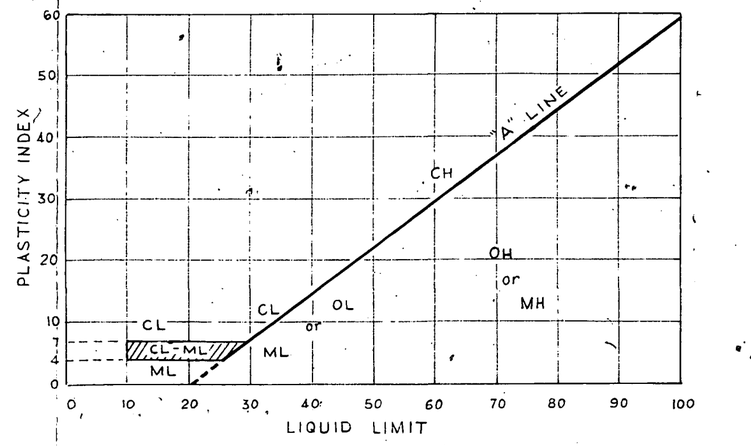
GRAIN SIZE CURVE to be used to identify soil fractions

LABORATORY CLASSIFICATION CRITERIA

Coarse grained soils classified on basis of percentage of fines, as follows

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

$Cu = \frac{D60}{D10}$ Greater than 4 $Cc = \frac{(D30)^2}{D10 \times D60}$ Between one and 3		
Not meeting all gradation requirements for GW		
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
Atterberg limits above "A" line with PI greater than 7		
$Cu = \frac{D60}{D10}$ Greater than 6 $Cc = \frac{(D30)^2}{D10 \times D60}$ Between one and 3		
Not meeting all gradation requirements for SW		
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
Atterberg limits above "A" line with PI greater than 7		



PLASTICITY CHART
FOR LABORATORY CLASSIFICATION OF FINE GRAINED SOILS

NOTE : BOUNDARY CLASSIFICATIONS : Soils possessing characteristics of two groups are shown as a combination of two group symbols, e.g. GW – GC, well graded gravel with clay binder.

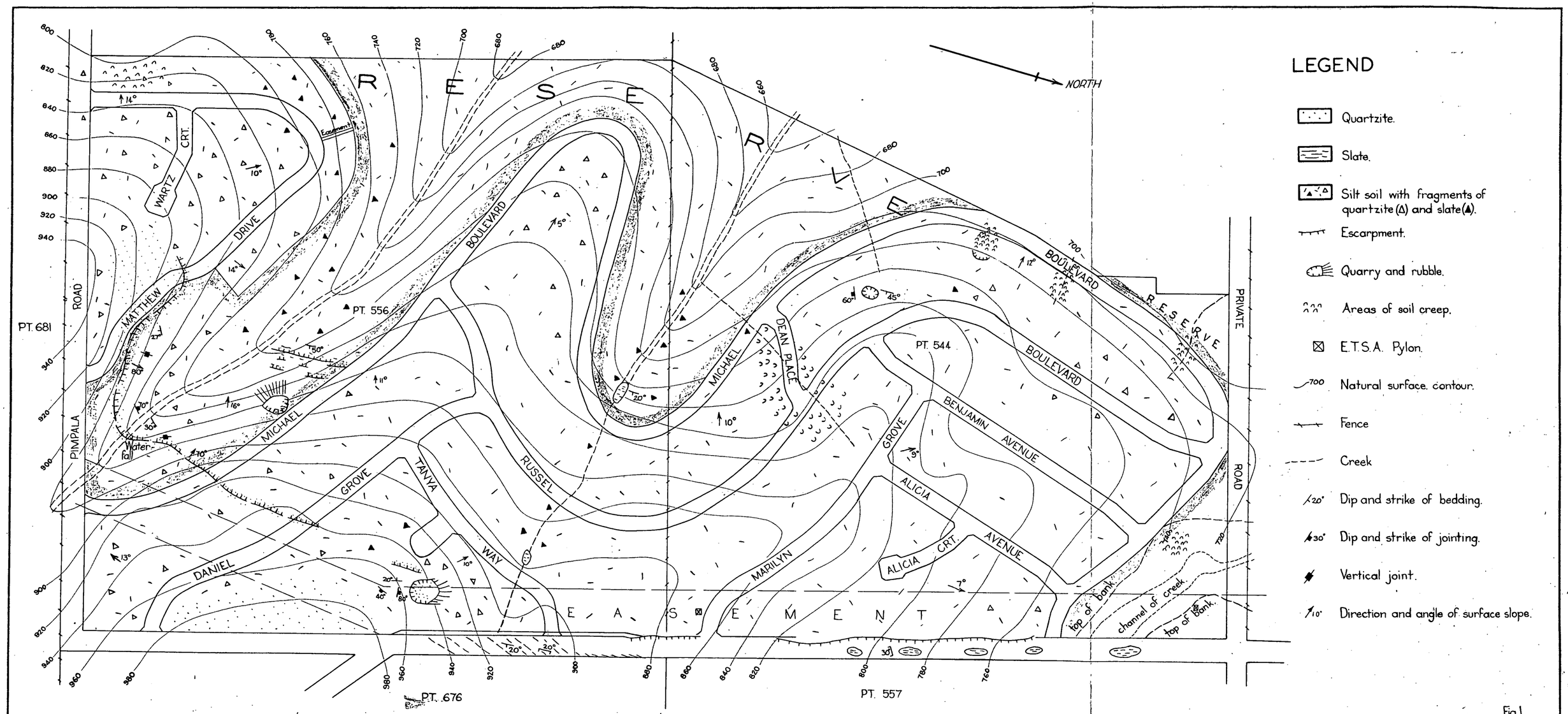
Based on "The Unified Soil Classification System" United States Department of the Interior, Bureau of Reclamation "Earth Manual" First Edition, Denver COLORADO 1960

APPENDIX

FIG.

64-246
M.G.

TRIM LINE



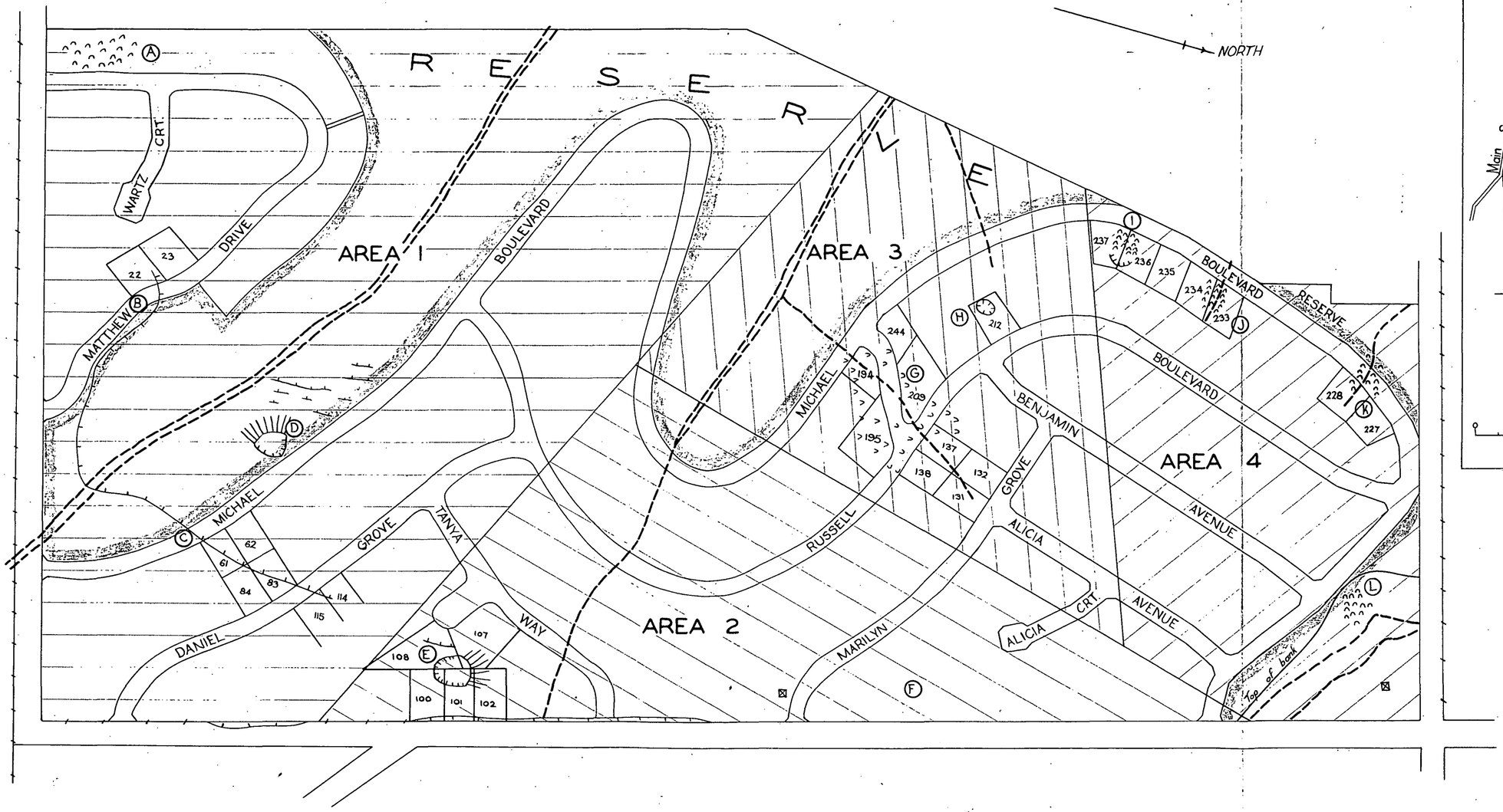
LEGEND

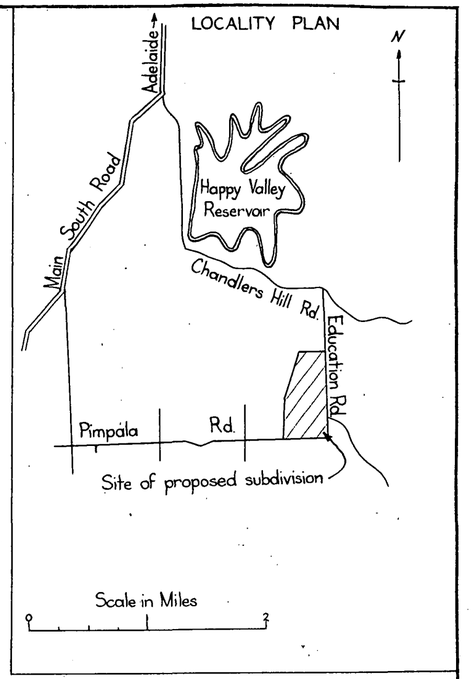
- Quartzite.
- Slate.
- Silt soil with fragments of quartzite (Δ) and slate (▲).
- Escarpment.
- Quarry and rubble.
- Areas of soil creep.
- E.T.S.A. Pylon.
- 700 Natural surface contour.
- Fence
- Creek
- 20° Dip and strike of bedding.
- 30° Dip and strike of jointing.
- Vertical joint.
- 10° Direction and angle of surface slope.

Fig.1

ENGINEERING GEOLOGY SECTION	**DEPARTMENT OF MINES — SOUTH AUSTRALIA**	Scale: As shown
Compiled: B.J.M.	PROPOSED SUBDIVISION — HAPPY VALLEY, PT. SECS. 556 544 HD. NOARLUNGA GEOLOGICAL PLAN	Date: 6 Oct. 1971
Drn. S.J.C. Ckd. B.J.M.		Drg. No. 71-754 Ha9

1M—2.70 A1811





For legend, see Fig. 1

Fig. 2

ENGINEERING GEOLOGY SECTION	**DEPARTMENT OF MINES – SOUTH AUSTRALIA**	Scale: As shown
Compiled: B. J. M.	**PROPOSED SUBDIVISION – HAPPY VALLEY**	Date: 6 Oct. 1971
Drn. S.J.C. | Ckd. B.J.M.	**PT. SECS. 556 544 HD. NOARLUNGA**	Drg. No. 71-755 Ha9
	PLAN OF SUB-AREAS & FEATURES	