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DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENGINEERING DIVISION

MURRAY BRIDGE - ONKAPARINGA PIPELINE

SUMMIT STORAGE
MOUNT BARKER JUNCTION

Secs. 4262, 4263, 5214, Hd. Onkaparinga, and
Sec. 4412, Hd. Macclesfield

GEOLOGICAL INVESTIGATIONS, PROGRESS REPORT NO.1

Client: Engineering & Water Supply Department

TEXT and APPENDICES

by

R. TARVYDAS
GEOLOGIST
ENGINEERING GEOLOGY SECTION

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10th August, 1970

Rept.Bk.No.70/118

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SUMMARY AND CONCLUSIONS

1. A tributary of the Onkaparinga River is to be dammed by an earth-and-rock embankment with a crestal length of some 1,200 ft. and a height of up to 48 ft. A ridge behind the reservoir will be excavated to a maximum depth of about 42 ft. to provide an inlet channel about 1,800 ft. long.

2. Geological mapping, trenching, diamond and auger drilling have shown that the valley slopes (usually less than 10^{0}) are soil-covered to a depth of about 3 ft., the soil resting on variably weathered bedrock of schists, metasandstones and intrusives. Alluvium in the valley is up to 20 ft. at the dam site.

3. Groundwater rises to the valley floor in winter and is at least 12 ft. below ground surface beneath the abutments.

4. An earth-and-rock-filled dam is feasible at the site proposed. Much of the material to be excavated from the inlet opencut will be suitable for use in the embankment. A portion of this material has rock properties; the fresher material from near the floor of the opencut should be suitable for use in a toe drain, although the addition of finer material may be necessary. Adequate material to complete the embankment will be available at the top of the right abutment.

5. A cut-off beneath the embankment could be obtained on the abutments by excavating to a depth of 5 ft. into bedrock and than backfilling. In the valley floor two methods are suggested:

(1) excavation of a bentonite slurry trench about 2 ft. into bedrock and then backfilling with impermeable material.

(2) excavation of sufficient alluvium to allow continuation of the abutment cut-off trench across the valley floor.

6. A concrete spillway would have adequate support in the underlying weathered metasandstone which occurs within 2 ft. of the ground surface on the right abutment. However any steep faces excavated in this material would require support until covered with concrete. Any permanent batters should be at a slope of 1 on 1.5 (33^{o}).

7. Leakage through the soils surrounding the proposed outlet conduit is unlikely. For installation of the pipe it would be possible to excavate a trench with vertical walls provided temporary supports are installed.

8. The material in the inlet opencut should be easy to excavate using earthmoving equipment. Some of the material with rock properties will require ripping. Batter angles of 1 on 1 (45^{o}) in materials with rock properties and 1 on 1.5 (33^{o}) in materials with soil properties are suggested.

9. No significant leakage is likely from the reservoir during operation and no instability of the valley walls should occur.

10. No indications of faulting have been observed at the site. However earthquakes of magnitude 8 on the modified Mercalli scale have been recorded in this area.

INTRODUCTION

A request to carry out geological investigations for the Summit Storage feature of the Murray Bridge-Onkaparinga Pipeline was received from the Director and Engineer-in-Chief, Engineering and Water Supply Department, in a letter dated 2 April, 1969.

The Murray Bridge-Onkaparinga pipeline is being constructed to carry additional water into the Adelaide metropolitan supply system. The water will be picked up at Murray Bridge and pumped uphill by three pumping stations to discharge into a storage system 5/8 mile due north of Mount Barker Junction, near the highest point on the pipeline route. From this reservoir the water will gravitate through a pipe to be released into the Onkaparinga River near Hahndorf. (Fig. 1).

The system, known as Summit Storage, consists of a dam on a tributary - an intermittently running stream - of the Onkaparinga River.

At full operating capacity an earth-and-rock embankment, some 1,200 ft. long and 48 ft. high over the stream bed, will hold back 100×10^6 gallons of water. A spillway will be built at the top of the right abutment, but in normal use the water will leave the reservoir via an outlet conduit consisting of a pipe buried beneath the embankment on the left abutment.

A ridge behind the reservoir, rising about 40 ft. above the highwater level will have an opencut some 1,800 ft. long to allow the water into the reservoir either along a concrete-lined channel or through a buried pipe.

The objectives of the geological investigation were as follows:

1) To classify and prove quantities of materials for use in the dam embankment from the area of the inlet opencut and other sources if required.

2) To provide sufficient other data on materials along the opencut to enable the design of stable batters and to predict excavation conditions.

3) To determine foundation conditions for an earth-and-rockfilled dam embankment.

4) To determine foundation conditions for a spillway and an outlet conduit resting on basement rock.

5) To assess the possibility of leakage out of the storage area under operating conditions.

6) To assess the stability of the slopes during reservoir operation.

7) To assess the seismicity of the storage area.

To help achieve these objectives the following exploration was carried out between April, 1969 and May, 1970. (See Fig. 2 for locations).

1) Bulldozer trenching (Trenches 1 to 10) along the inlet opencut and the area of the dam abutments; total length 2,865 ft.
2) Backhoe trenching (Trench 11), 295 ft. long, for outlet-conduit foundation investigations.
3) Diamond drilling of 3 holes (DH4, 5 and 6) to a maximum depth of 80 ft. (For logs see Appendix 1).
4) A seismic-refraction traverse of 1,650 ft. along the inlet opencut (Appendix 2).
5) Auger drilling of 4 holes (AHV 1 to 4) in the valley floor on the centreline of the dam embankment; maximum depth 20 ft. (For logs see Appendix 3).
6) Drilling for permeability testing of 6 auger holes (AHP 1 to 6) on the abutments of the dam.
7) Drilling of 19 auger holes (AHM) and excavation of 9 trenches (TRM) for materials' exploration on the right bank above high-water level.
8) Excavation of 3 trenches (TRS) across the proposed spillway.

In addition, auger holes drilled earlier by the E. & W. S. Department around the perimeter of the reservoir are shown on Figure 2. Some use has also been made of the logs of a number of test pits put down along the present centreline of the opencut during investigations in about 1961.

Gibson (1963) reported on a damsite previously considered for Section 4215, Hundred Onkaparinga, some 850 ft. downstream of the present site. His recommendations for exploration were carried out and reported on by Steel (1963). Eight cable-tool holes were put down along the dam axis, as were two test pits somewhere along the present centreline of the inlet opencut.

Boucaut (1969) reported on diamond drilling of three hillcrests on the pipeline's approaches to the reservoir. A hole was drilled on each crest down to invert level to determine geologic conditions for excavation and to investigate the possibility of using the excavated material in the dam embankment. Of the three holes drilled, hole DH 1 is within the area of the present investigation. (See Fig. 2 for location and Appendix 1 for log).

REGIONAL GEOLOGY

Topography

The project area has a mature landscape, with relief of about 100 ft. over horizontal distances of the order of 2,000 ft. The valley, normally dry, has an average fall of about 1^{o} towards the west. About five hundred feet upstream of the dam axis the valley bifurcates into gullies with average gradients of 3^{o}. A broadly convex semicircular ridge rises about 80 ft. above the dam base and forms a divide at the back of the storage area.

The sides of the valley and gullies generally have gentle slopes, (3^{o} to 9^{o}). The valley is in the shape of a shallow V with a flat floor; the slopes are even, except for local convex areas. The gullies are broadly U-shaped.

Geology

The area represented in Figure 2, is in the northeastern portion of the Echunga sheet, 1:63,360 series (Sprigg & Wilson, 1954). According to this sheet, the area within one mile of the centre of the reservoir is underlain by metamorphic rocks, belonging to the Torrensian Series*, which were originally laid down as sediments in a geosynclinal trough, were later metamorphosed, and are now weathered; no specific rock-types are given for the area of investigation, but elsewhere on the sheet area there are slates, phyllites, dolomites, sandstones and quartzites.

The same Echunga sheet indicates that the reservoir area lies almost on the axis of a major anticline, i.e. an upfold, plunging on a bearing of about 170^{o} from true north. The anticline appears to be symmetrical about its axis and passes laterally westwards into a syncline (downfold), the two axes being about 1.5 miles apart. The structure to the east of the anticline is not shown.

Although folding is evident from the exploration of project area, no major fold axis was intersected during exploration.

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*Now redefined as part of the Burra Group of formations (Thomson et al, 1964).

INLET OPENCUT

Site Geology

Notes on Relevant Figures.

Figures 5 and 6 show detailed geology gathered from field observations and exploration, a summary of the details appearing in Figure 2. Figures 7 and 8 show geological sections across the inlet opencut. In Figure 11 an attempt has been made to relate the attitude of joints to the centreline for geologically similar areas of the inlet opencut.

On Figures 5 and 6 have been plotted rock and soil substances thicker than 0.5 ft. and substance defects such as clay seams and vegetation roots. The materials have been classified geologically from an engineering aspect according to the classification in Table 1. Some of the dips and strikes of joints, and of schistosity, (which may be thought of as bedding due to metamorphism) were measured in the walls of trenches, but have been plotted in plan for easier representation; there are no floor plans for Trenches 5 to 8 because of insufficient exposure of geology. The structural trendlines are interpretations of structure, based on the field measurements of schistosity shown, and have been used in constructing sections across the opencut (Figs. 7 and 8).

Figure 2 contains a summary of geological information of Figures 5 and 6, and the definitions of rock types in Figure 2 have been broadened accordingly. The arrangement of rock types in the legends of any of these maps is not necessarily in the order of stratigraphic occurrence. Petrological descriptions of some of the rocks may be found in Appendix 4. The rocks mapped could not readily be assigned to known formations.

Topography

The inlet opencut straddles a broad convex ridge, semi-circular in plan, trending 020° to 200° from true north. The centreline of the opencut cuts the axis of the ridge at approximately 60°.

A broad, flat area at the top of the ridge gives way to evenly sloping sides with slopes of up to 6° near the ends of the opencut. The evenness of the slopes appears to be related to the uniform weathering of the underlying rocks.

Soil and Rock Types

These are summarised in Tables 2 and 3. For their distribution, see Figures 5 and 6.

TABLE

CLASSIFICATION OF ROCK CONDITIONS AND STRENGTH OF ROCK SUBSTANCE

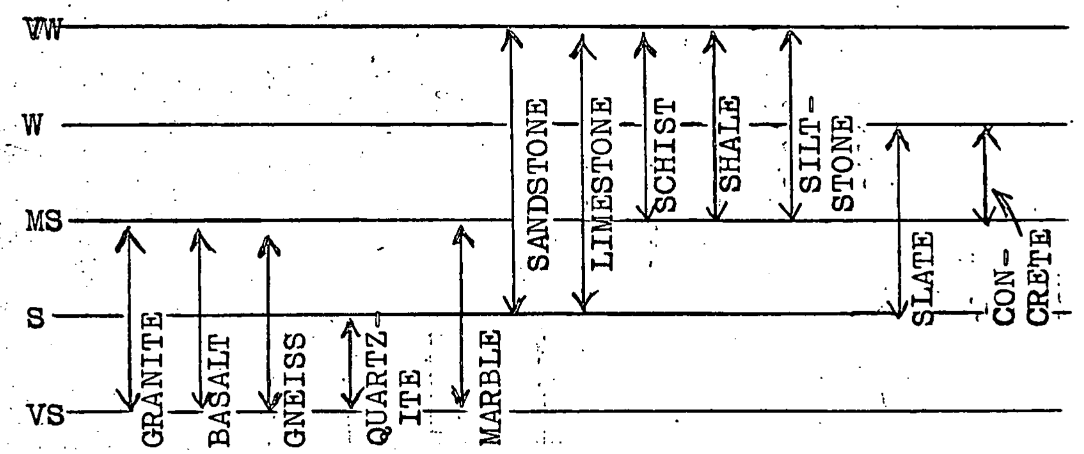
1. ROCK CONDITION TERMS

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 / Weathered / Altered)	(XD) (XW) (XA)	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).

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

TABLE 2: PRINCIPAL SOIL TYPES IN AREA OF INLET OPENCUT

UNIT	THICKNESS IN FEET Max.	Avr. (estimated)	ENGINEERING PROPERTIES	REMARKS
TOPSOIL	2.5	1	SAND, discrete patches with excess silty fines (SM); grey; typically 70% sand (to 0.3mm), 20% silty fines, 10% gravel, usually at base and GRAVEL, various, (GW through GC); maximum sizes 3 to 15cm; sand to 40%, fines 10% to 20%.	Topsoil as exposed in trench walls estimated at 95% SAND and 5% GRAVEL.
SUBSOIL	6	2	SILT SOIL, discrete patches with low to high plasticity (ML to MH); 10% mica, with flakes to 2mm. across. and CLAY SOIL, high plasticity (CH) mottled yellow and brown; up to 10% fine sand in places; with increasing mica content grades into Silt Soil.	Subsoil as exposed in trench walls estimated at 10 to 20% SILT SOIL and 80 to 90% CLAY SOIL.

TABLE 3: PRINCIPAL BASEMENT-ROCK TYPES IN AREA OF INLET OPENCUT

ROCK TYPE	GEOLOGICAL DESCRIPTION	ENGINEERING FEATURES	REMARKS
SCHIST albite-biotite.	Evenly laminated with dark and light grey mineral bands 0.2mm to several mm thick; mica-schist interbeds about 1 ft. thick occur at about 100 foot intervals (Fig.5)	Weathered (medium-strong) to extremely weathered (soil properties); joints with various attitudes and orientations (Fig. 5 & 11); some joints coated with white clay to 10mm (average 1 to 2 mm).	Joints with clay coatings and weathered mineral bands are potential slip-planes
SCHIST mica-actinolite.	Yellow-brown, earthy; boulders and veins of quartz-actinolite rock.	Weathered (very weak) to extremely weathered (soil properties, CH/CL).	Boulders (near-surface) and veins of weathered (strong) quartz-actinolite are estimated about 1% of total volume
SCHIST, mica undifferentiated.	Rocks of green-grey colour containing mica, ferro-magnesians and feldspar.	Weathered (very weak); prominent fissility parallel to schistosity.	
META-SANDSTONE schistose	Fine-grained, weathered to sandstone.	Weathered, (very weak to medium-strong); frequent jointing normal to schistosity.	Infills of high-plasticity brown clay, 2 to 10cm. thick, parallel to schistosity, and spaced about 2 ft. and penetrating at least 5 ft. below ground surface.
META-SANDSTONE	Medium to coarse-grained feldspathic.	Weathered (very weak to medium-strong).	No planar joints observed.

Structure

Strata in the upstream portion of the opencut, are considerably folded, the beds striking the centreline at between 0° and 90°; accordingly, the strata dip both upstream and downstream, at angles of 0° to 70°. At the downstream portion of the cut the strata strike the centreline at about 60° and usually dip upstream at between 20° and 30°.

As can be seen from Figures 5 & 11 the joints in the inlet opencut are diversely oriented. Even when broken down into areas of similar geology, as in Figure 11, not all the joints fall into obvious sets. Some of these variously oriented joints are coated with an average of 1 to 2mm of white to pale brown clay.

Strength of Rock-substances

No fresh rock was encountered during exploration. All rock is weathered, some completely to soil substances. A summary of the strengths of various rock-types appears in Tables 4 and 5, using the items defined in Table 1.

TABLE 4: Conditions and rock strengths of materials visible in trenches of the Inlet Opencut.

ROCK TYPE	←———	——— weathered	———	———	———→	Extremely weathered
	very strong	strong	medium strong	weak	very weak	soil properties
SCHIST, albite-biotite			←———	———	———	SM,GM ———→
SCHIST, mica-actinolite					←———	CH-CL ———→
SCHIST, mica, undifferentiated					←——→	
METASANDSTONE, schistose			←———	———	———→	
METASANDSTONE, massive			←———	———	———	SC-CH ———→

TABLE 5: Summary of results of seismic-refraction survey (Appendix 2) for the Inlet Opencut.

Name of layer	Thickness in feet	Seismic velocity (feet per sec.)	Above/below opencut invert.	Remarks
surface	6 to 10	1,750-3,000	above	Soil horizon and weathered basement.
inter-mediate	50 to 110	3,000-8,000	above/below	Less weathered basement.
high-velocity	below 50 to 110	14,500	below	Relatively fresh basement.

3,000

Within the intermediate layer there is some correlation between velocity, and the type and strength of rock. (Section A-A of Fig. 2).

Excavation Conditions

The soil cover will be easy to excavate using earthmoving equipment; however, under wet conditions the high-plasticity clay would be "sticky" to work.

From observation of the strength of materials in cuttings and drill cores, and from the seismic profile, it appears that all the basement rock will be rippable with heavy-duty equipment. Seismic velocities beneath Trench 1 reach 8,000 feet per second within the area of the cut, but the jointed nature of the rock will probably preclude the need to blast.

Monitoring of drillholes has disclosed that the water-table does not rise above the invert level, even after winter rains. Local water-tables perched by impervious layers may be encountered during excavation.

Stability of Slopes

Clay-coated joints and weathered crush-zones occur to depths of 50 ft. below the surface (see logs of drillholes DH1 and 6, Appendix 1). However, not all the clay-coated joints shown in figures 5 and 6 are expected to continue to such depths. In Figure 11 an attempt has been made to show the relation between joints and the cut.

Cleavages develop in and between the mineral layers of the more weathered albite-biotite schist in the upper portion of the opencut, especially along the feldspar-rich layers which are liable to weather to kaolinitic clay. Hence, the schistosity of this rock-type must be considered as a potential slip-plane.

The following maximum batter slopes are suggested on the basis of jointing and rock-strength as observed in drillcores and trenchwalls:

area of Trenches 1 and 2 (chainage 24M/4120 ft. to 24M/4900 ft.)	1 on 1.5 (33^o) in upper 15 ft. 1 on 1 (45^o) below 15 ft.
area of other trenches (chainage 24M/4900 ft. to 25M/0656 ft.)	1 on 1.5 (33^o)

DAMSITE

Site Geology

Notes on Relevant Figures

Figures 3 and 4 are essentially geological logs of Trenches 9 and 10 on the abutments of the dam; a summary of this appearing in Figure 2.

Most of the comments relating to drawings of the Inlet Opencut apply to the above Figures. In addition, the following points may be noted:

1) Subdivision of the undifferentiated mica schists and the intrusive rocks is not considered warranted for this investigation.

2) Some of the undifferentiated mica schists may be "fresh" rather than "weathered" (see Appendix 4, petrological description of sample P.111/69); however, this possibility does not alter the strength of the material.

3) The correlation between the geological successions of the inlet opencut and the dam abutments is uncertain.

Topography

The centreline of the dam embankment is located to take advantage of the locally steepened valley walls, with average slopes of about 6^{o} on the left bank and 9^{o} on the right bank. The slopes are even, except for a flattening out to about 4^{o} at the top of the left abutment and at the bottom of the right abutment.

The valley, some 200 ft. across, is flat, except for small hummocks about 0.5 ft. high, in cracked ground of the creekbed.

Soil & Rock Types

The pedogenetic soils developed on the abutments and the alluvial soils of the creekbed are described in Table 6.

The basement sequence as revealed by exploration is composod of concordantly bedded metasediments consisting predominantly of schists and metasandstones, intruded by a number of igneous dikes in the left abutment. Details of rock types and their distribution appear in Table 7 and in Figures 3 and 4.

The original rock types of the metasandstone sequence at the top of the right abutment are not known, because of severe weathering since their formation. Portions of this sequence reveal relict schistose structures, while others appear massive. It is likely that the finer-grained materials exposed in this region were originally slates.

TABLE 6: PRINCIPAL SOIL TYPES, DAMSITE

UNIT	THICKNESS IN FEET Max.	Avr. (estimated)	ENGINEERING PROPERTIES	REMARKS
TOPSOIL	2.5	1.5	SAND, excess silty fines (SM), dark grey; average of 10% gravel to 3 cm.	Sand grades into gravels in places.
SUB-SOIL	3.5	2	CLAY SOIL, high plasticity, (CH), mottled brown and yellow, red-brown or grey.	Expansive, with movements of perhaps 1 in; in places grades into MH/CH by increase in mica content.
			and	
	4	2	SAND, excess fines (SM/SC).	At bottom of right abutment, grading into valley alluvium.
			and	
	3	2	SILT SOIL, high plasticity (MH) with 10% 20% gravel.	At bottom of left abutment, grading into valley alluvium.
VALLEY ALLUVIUM	20	14	Mainly SANDS (mainly SC & SM) and GRAVEL (GC); basal gravel probably continuous between drillholes (Fig.4).	Some sands and gravels water-bearing. (Fig.4.)

TABLE 7: PRINCIPAL BASEMENT-ROCK TYPES AT DAMSITE

ROCK TYPE	GEOLOGICAL FEATURES	ENGINEERING FEATURES	REMARKS
SCHIST, mica, actinolite	pale yellow-green fissile rock to yellow brown earthy soil.	weathered (very weak) to extremely weathered (soil properties, MH): unjointed; quartz - actinolite veins and pods present.	
SCHIST, mica, undifferentiated	green-grey rocks with major amounts of mica and ferromagnesians.	weathered (very weak) to extremely weathered (soil properties, ML); seams of decomposed feldspar and infills of clay (CH) to 2 cm are likely to occur at random orientations.	in right abutment contains pods and veins of ironstone 1 to 10 cm thick.
METASANDSTONE undifferentiated	ranges from fine-grained with silty matrix to medium to coarse-grained with clayey matrix and clay interbeds.	weathered (medium-strong) to extremely weathered (soil properties, SC/CL and SM).	
SCHIST, albite-biotite.	evenly laminated from 1mm to 10mm, with light and dark grey minerals bands of feldspar and ferromagnesians.	weathered (medium-strong to weak). feldspar laminae not weathered to clay as in Inlet Opencut.	similar to schist from Trench 1 and 2 of the Inlet Opencut.
GRANULITE	bluish-grey, porous rock, with irregularly shaped segregations 0.1 to 3 cm wide, of white microcline (feldspar).	weathered (strong to weak); porous.	
INTRUSIVES undifferentiated.	dark grey metadolerites and other very weathered rocks with phenocrysts.	the stronger rocks are highly jointed	

Strength of Rock Substances

No fresh rocks were discovered during exploration, and some rocks have completely weathered to soil under the influence of near-surface agents such as groundwater, air and vegetation.

Table 8 is a summary of the condition (weathering) and strengths of the major rock types at the damsite in terms defined in Table 1.

Table 8: Condition and strength of materials exposed in Trenches 9 and 10 of the abutments (Figures 3 & 4).

ROCK TYPE	weathered					extremely weathered
	very strong	strong	medium strong	weak	very weak	soil properties
SCHIST, mica-actinolite					←	MH →
~~SCHIST~~, mica, undifferentiated					←	ML →
SCHIST, albite-biotite			←	→		
METASANDSTONE, undifferentiated			←	—	—	SC/CL SM →
GRANULITE		←	—	→		
INTRUSIVES			←	—	→	

Groundwater

Borehole DH4, on the dam axis, has been regularly observed for groundwater movements; the following extremes have been recorded:

17 March 1970, 6.6ft. below groundsurface, or RL 1399.4

6 August, 1969, 0.4ft. below groundsurface, or RL 1405.6

In the valley water appears on the surface only after heavy rains.

On the left abutment the water table is lower than 12ft. below groundsurface, as no water was cut or observed in hole AHP.1, (Fig.3).

The following observations of groundwater levels in other bores in the valley give an indication of the depth of the regional groundwater (Steel, 1963). The bores mentioned are in the valley sides, and are given as upstream (u/s) or downstream (d/s) of the centreline of the present dam embankment.

250ft. u/s, 75 to 80 ft. below groundsurface.

650ft. d/s, 21ft. below groundsurface.

700ft. d/s, 18ft. below groundsurface.

850ft. d/s, 10ft. below groundsurface.

950ft. d/s, 21ft. below groundsurface.

1050ft. d/s, 42 to 47ft. below groundsurface.

Water from the above holes has been analysed as containing between 220 ppm to 914 ppm of total dissolved salts.

Permeability

Abutments

On visual inspection, most of the basement appears to be relatively impervious. The following leakages have been calculated (E. & W.S.) from results of constant-head-permeability tests in augor holes (AHP) on the abutments. (Figures 3 & 4).

HOLE	ABUTMENT	K_{20} in ft./yr. Assumption (1)	K_{20} in ft./yr. Assumption (2)
AHP.1	left	10.5 ✓	28.0 ✓
AHP.2	left	5.5 ✓	13.0 ✓
AHP.3	left	3.3 ✓	9.5 ✓
AHP.4	left	4.2 ✓	10.0 ✓
AHP.5	right	1.6 ✓	-
AHP.6	right	4.1 ✓	-

Assumptions (1): $K_v = K_h$ material isotropic

K_h (2): K_h/K_v >10, i.e. measured quantity is essentially K_h.

Valley Floor

Water pressure testing of the mica-schist in hole DH4 showed leakages from 0.5 to 34 lugeons. (Appendix 1).

Most of the alluvium appears relatively impervious. However, the presence of probably lenseoid gravels indicates that the possibility of leakages under the embankment is present, particularly in the gravel bed at the top of the basement. (Figure 4).

SPILLWAY

Three trenches (TRS 1, 2 and 3) have been put down across the proposed centreline of the spillway (Fig.10) and their logs are shown in Figure 9.

The soil cover blankets a weathered basement where most of the materials have soil properties. The clayey nature of the matrix makes the materials prone to instability in steep faces, especially when wet.

OUTLET CONDUIT

Water will leave the reservoir through a conduit buried in bedrock in the left abutment. An exploratory trench (Trench 11, Figs. 2 and 12) was excavated along the originally proposed centreline which crossed the dam axis at about RL.1420. As a result of conditions observed, the position of the conduit has been re-sited to RL.1418 (approx.), where the geological conditions are likely to be very similar.

Features arising from the detailed logging of ~~the~~ Trench 11 are the generally very weak nature of the rock (undifferentiated mica schists and granulite) and the presence of many joints and non-tectonic fractures filled in with clay. Lime occurs locally as pockets, and tube casts.

Only infills thicker than about 3mm have been mapped, and only a portion of these were exposed sufficiently during fieldwork in order to measure their dips and strikes. The infilled material is estimated to consist of 90% to 95% clay and 5% to 10% sand and fine gravel to a maximum size of about 3mm. The clay is mottled brown, brownish-red and grey; it has high plasticity, and is probably slightly to moderately reactive. Some infills, especially those parallel to the schistosity, are mixed with clay decomposed from feldspar mineral bands and veins. Other infills have been emplaced in bands of particularly micaceous schist.

The infills appear to have some porosity through voids of the order of 0.1mm across, some of which have vegetation rootlets. However, the infills do not appear to have any great horizontal extent. The vertical extent of most of these infills is thought to be 10 to 20ft.

It is considered that leakage along the conduit is unlikely provided backfilling around the pipe and collars is carried out, using highly impervious material.

STORAGE AREA

Geology

No outcrop of rock has been found in the storage area, so that the geological conditions in this area are largely inferred from those observed at the damsite and the inlet opencut, and from physiography.

The storage area is probably underlain by a sandy (SM) topsoil about 1 ft. thick and a clayey subsoil (CH mainly) 1 to 3 ft. thick. Alluvium in the valley floor as shown in Figure 4 probably extends up the main valley and partly into the gullies.

Basement probably consists mainly of mica schists similar to those described as "undifferentiated" in Figures 2, 3 & 4, and metasandstone similar to that described in Figure 4. The boundary between these two rock types is somewhere to the right of the stream. An unsuccessful water-bore situated some 300 ft. upstream of the dam axis and some 50 ft. to the right of the stream was in "green schist" all the way to 325 ft. (fide M.E. Altmann, local farmer).

Permeability

With the existing continuous clay blanket overlying an impermeable, weathered bedrock, no significant leakage from the reservoir is likely.

Stability of Slopes

Except for soil creep at one locality (Sta. 3 & 13, Fig.4) there is no evidence of slumps either in the soil cover or in the basement. With the relatively flat slopes of the storage area, instability during reservoir operation is unlikely.

CONSTRUCTION MATERIALS

Requirements.

Preliminary estimates of materials required for a three-zone dam embankment are as follows:-

Upstream zone (semi-impermeable)	100,000 cu.yd.
Downstream zone (better quality material)	39,000 cu.yd.
Toe drain (rock and added fines?)	11,000 cu.yd.
Blanket: if existing clay unusable	14,000 cu.yd.
" " " reusable	5,000 cu.yd.

Sources

Inlet Opencut

Materials available - their type, location, suitability and volume - are listed in Table 9.

TABLE 9: Materials - type, location, volume and suitability - available from Inlet Opencut. Volumes calculated on basis of Figures 2, 7 & 8, assuming 10% of material is unsuitable (including topsoil).

CHAINAGE (AT CENTRELINE) FROM	TO	DISTANCE (feet)	TYPE OF MATERIAL BELOW SOIL COVER	VOLUME OF MATERIAL (cu. yd.)	SUITABILITY AS DAM FILL
24M 4120ft.	24M 4900ft.	780	SCHIST, albite-biotite minor mica schist and metasandstone.	50,000	All usable, with the possible exception of the minor mica schist. Material has rock properties.
24M 4900ft.	24M 5260ft.	360	SCHIST, as above and METASANDSTONE.	41,500	All usable, mixture of rock and material with soil properties
24M 5260ft.	25M 0110ft.	130	SCHIST, mica-actinolite.	17,500	?All usable, material with soil properties.
25M 0110ft.	25M 0260ft.	150	METASANDSTONE.	11,500	All usable, mixture of rock and material with soil properties.
25M 0260ft.	25M 0350ft.	90	SCHIST, mica-actinolite.	3,200	?All usable, material with soil properties.
25M 0350ft.	25M 0656ft.	306	SCHIST, mica; minor albite biotite schist.	1,600	Unsuitable, very high mica content.

The following approximate total volumes of material available have been calculated:

Usable rock	54,500 cu.yds.
Mixed material, rock and material with soil properties.	59,000 cu.yds.
??Usable material with soil properties (semi-impermeable)	23,000 cu.yds.
Waste (mica schist)	1,800 cu.yds.

Allowing for 10% wastage (stripping, etc.) from the usable and mixed quality material, the following volumes are deduced:

Usable rock	50,000 cu.yds.	(36% of total cut.)
Mixed material	53,000 cu.yds.	(38% of total cut.)
??Usable material with soil properties (semi-impermeable)	21,000 cu.yds.	(15% of total cut.)
Total wastage	14,500 cu.yds.	(11% of total cut.)

Storage Area

Indications are that no useful materials are present.

Right Bank of Dam

This bank has been investigated as a source of construction materials in the area between high-water mark and the formed road to the east. Nineteen auger holes and nine trenches were put down (see Figures 9 and 10, and Appendix 5 for logs).

The main rock is a feldspathic metasandstone with mica schists appearing in the northeastern corner of the area investigated (Fig.10). The metasandstone is schistose in places with interbeds and mineral bands of feldspar and/or kaolin to 3 ft. thick. Bands of mica-rich material up to several feet wide may have to be selectively wasted during quarrying.

On Figure 10 an area for quarrying is suggested, containing more than adequate volumes of material. Exploration has shown that in most places, the material should be easy to excavate with earthmoving equipment to a depth of at least 17 feet and perhaps even to 40 feet (AHM.12); one drillhole (AHM.17) struck hard rock at that depth of 14 feet. (Appendix 5).

SEISMICITY

Since 1883 earthquakes have been recorded from Mount Barker, Woodside, Hahndorf and Nairne, where the effects have ranged from plaster falling off ceilings to difficulty in remaining standing (Hunt, 1918). Also, several epicentres of scientifically recorded earthquakes since 1937 fall within a radius of 10 miles of Mount Bonython, thus including Mount Barker Junction (Sutton and White, 1967). The most severe of these earthquakes had a magnitude of 8 on the modified Mercalli scale (Priess, 1963).

The conclusion is that the possibility of the damaging effects of earthquakes in the investigation area cannot be overlooked, although no signs of faulting, either recent or from the geologic past, have been seen in the field.

R. Tarvydas

RT:PMM
10th August, 1970

R. TARVYDAS
GEOLOGIST
ENGINEERING GEOLOGY SECTION

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APPENDIX 1: Logs of diamond-drill holes DH.1, 4, 5 and 6 with results of water-pressure testing.

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF DIAMOND DRILL HOLE

HOLE No. DH1
SERIAL No.

PROJECT. MURRAY BRIDGE - ONKAPARINGA PIPELINE
FEATURE. SUMMIT STORAGE INLET OPENCUT
LOCATION MT. BARKER JUNCTION

ADJACENT SECTION 4412 HUNDRED MACCLESFIELD
CO-ORDINATES 8746 FT. N 2058 FT. E.
ANGLE FROM HORIZ. 90°. DIRECTION VERTICAL

R. L. Surface approx 1490 FT.
R.L. Collar . . . FT.
Datum E&WS, scaled.

DESCRIPTION OF CORE	② GROUP SYMBOL	① STRENGTH TERM (VS S MS W VW SO)	CORE SIZE, DEPTH R.L. FT.	LOG	③ FRACTURE LOG (1 4 16 64)	STRUCTURES (JOINTS, VEINS, SEAMS, SHEARED ZONES, CRUSHED ZONES)	LIFT CORE LOSS% (10, 5 50)	WATER LEVEL DATE	CASING	DRILL WATER LOSS % (0 100)	④ WATER PRESSURE TESTS LUGEONS (0.5 5 10 50 100)
TOPSOIL, sand, excess fines organic, dark brown.	SM		NX								
ADELAIDE SYSTEM - BURRA GROUP. Albite - biotite SCHIST, even dark and light laminations 0·1 to 0·5 FT. thick. Most beds micaceous, grey to blue in fresh state, yellow - brown when weathered. Core mainly in smooth surfaced continuous sticks. Some breakage to fragments in more weathered areas. Core broken to fragments at intersection of joints.			NMLC; 1480 – 10; 1470 – 20; 1460 – 30; 1450 – 40; 1440 – 50; 1430 – 60; 1420 – 70			Contorted. Sheared zone? weathered zone crushed? Schistosity, 10° to 20° on core; most joints parallel to schistosity, and spaced 0·1 to 0·8 ft, weakly cemented. A few joints at 75° to 90° on core, Most joints limonite stained. weathered zone crushed?		OCT. 69; JLY. 69		FULL RETURN	not tested

① ROCK SUBSTANCE

STRENGTH TERM
- VS–Very Strong
- S–Strong
- MS–Medium Strong
- W–Weak
- VW–Very Weak
- SO–Soil properties

CONDITION TERM
- Fresh
- Decomposed
- Weathered
- Altered
- Not Applicable

② Substances with soil properties remoulded and classified by Unified System

③ FRACTURE LOG
1 4 16 64 Natural fractures per foot of core
12 3 $\frac{3}{4}$ $\frac{3}{16}$ Equivalent length of core in inches

④ (3·5) Maximum effective pressure (bars) reached during test.
Min. = Minimum value.

ENGINEERING GEOLOGY SECTION

DRILL No. 16	LOGGED WRPB & RKT.
TYPE . DIAMOND	DATE 2 DEC. 68
DRILLER JENSEN	TRACED SLT.
START. 23 AUG. '68	CHECKED
FINISH 27. AUG '68	
SHEET 1 OF 2.	DRG. No. S 7696/6

MURRAY BRIDGE—

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF DIAMOND DRILL HOLE

HOLE NO. DH 1

SERIAL No.

PROJECT. ONKAPARINGA PIPELINE

FEATURE. SUMMIT STORAGE INLET OPENCUT

LOCATION M.T. BARKER. JUNCTION

SECTION ADJACENT 4412 HUNDRED MACCLESFIELD.

CO-ORDINATES 8746.FT.N. 2058. FT. E.

ANGLE FROM HORIZ. 90°. DIRECTION VERTICAL

R. L. Surface approx 1490 FT.

R.L. Collar . FT.

Datum E&WS, scaled

② GROUP SYMBOL	DESCRIPTION OF CORE	① STRENGTH TERM VS S MS W VW SO	CORE SIZE	DEPTH R.L. FT.	LOG	③ FRACTURE LOG 1 4 16 64	STRUCTURES JOINTS, VEINS, SEAMS, SHEARED ZONES, CRUSHED ZONES	LIFT CORE LOSS% 10 5 50	WATER LEVEL DATE	CASING	DRILL WATER LOSS % 0 100	④ WATER PRESSURE TESTS LUGEONS 0.5 1 5 10 50 100
BURRA GROUP	Core broken to fragments at intersection of joints at →			1410 80			As per sheet 1.					
							END OF HOLE 80 FT.					

① ROCK SUBSTANCE
STRENGTH TERM
VS–Very Strong
S–Strong
MS–Medium Strong
W–Weak
VW–Very Weak
SO–Soil properties

CONDITION TERM
Fresh
Decomposed
Weathered
Altered
Not Applicable

② Substances with soil properties remoulded and classified by Unified System

③ FRACTURE LOG
1 4 16 64 Natural fractures per foot of core
12 3 3/4 3/16 Equivalent length of core in inches

④ (3.5) Maximum effective pressure (bars) reached during test.
Min. — Minimum value.

ENGINEERING GEOLOGY SECTION

DRILL No. 16
TYPE. DIAMOND
DRILLER JENSEN
START. 23 AUG '68
FINISH 27 AUG '68

LOGGED WAPB. & R.K.T.
DATE 2 DEC '68
TRACED S.L.T.
CHECKED

SHEET 2. OF 2.

DRG. No. S7696-a/6

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF DIAMOND DRILL HOLE

HOLE NO. DH 4

SERIAL No.

PROJECT MURRAY BRIDGE — ONKAPARINGA PIPELINE
FEATURE. SUMMIT STORAGE
LOCATION MT BARKER JUNCTION

SECTION 5214. HUNDRED ONKAPARINGA
CO-ORDINATES 8645 FT.N 0230 FT.E.
ANGLE FROM HORIZ. 90°. DIRECTION VERTICAL

R.L. Surface 1406 FT.
R.L. Collar 1408 FT.
Datum E&WS

	DESCRIPTION OF CORE	② GROUP SYMBOL	① STRENGTH TERM (VS S MS W VW SO)	CORE SIZE / R.L. / DEPTH FT.	STRUCTURES: JOINTS, VEINS, SEAMS, SHEARED ZONES, CRUSHED ZONES
SOIL	SILT, low plasticity	ML			plant roots
SOIL	CLAY, high plasticity with up to 50% sand (quartz & mica) in places	CH CL		1400	
SOIL	SAND, excess clay fines	SC		10	sand bands 0·1 and 0·2 ft top and bottom, seperated by silty soil.
SOIL	SILT, high plasticity 10% fine sand	MH		1390 NXC	
SOIL	SAND, excess clay fines	SC			
SOIL	GRAVEL	GM-GC		NMLC	max. size 2 in +
ADELAIDE SYSTEM BURRA GROUP, ALBITE-BIOTITE SCHIST	Mica and feldspar 90% to 95%; mainly to 0·5 m.m. to end of hole.			20, 1380 NXC	Schistosity 45° to 70° to horizontal. Feldspar bands to 5 m.m. mostly parallel to schistosity. Throughout core irregularly spaced joints along weathered feldspar veins and schistocity. Joints often slickensided and coated with films (fraction of 1 m.m.) of white clay and limonite.
	no core				
				30	
	Fragments of core 0·5 to 3 in. across, greenish grey	no core			
	Core fragments average 0·5 ft. long.			1370 NMLC, 40	
	no core			1360	
				50	
	no core				
	END OF HOLE 52·0 FT.				NOTE: fracture log not applicable because of difficulty of distinguishing natural breaks from those induced mechanically.

WATER LEVEL / DATE: Aug, 69 July

DRILL WATER LOSS: full return

WATER PRESSURE TESTS (LUGEONS): (1·6), (2·3), (3·7)

① ROCK SUBSTANCE
STRENGTH TERM
VS–Very Strong
S–Strong
MS–Medium Strong
W–Weak
VW–Very Weak
SO–Soil properties

CONDITION TERM
Fresh
Decomposed
Weathered
Altered
Not Applicable

② Substances with soil properties remoulded and classified by Unified System

③ FRACTURE LOG
1 4 16 64 Natural fractures per foot of core
12 3 3/4 3/16 Equivalent length of core in inches

④ (3·5) Maximum effective pressure (bars) reached during test.
Min. = Minimum value.

ENGINEERING GEOLOGY SECTION

DRILL No. 24
TYPE Mindrill E 1000.
DRILLER JENSEN
START. 23 May '69
FINISH 26 May '69

LOGGED R. TARVYDAS
DATE 25 July '69
TRACED S.L.T.
CHECKED

SHEET 1 OF 1. DRG. No. S7697 Hcl

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF DIAMOND DRILL HOLE

HOLE NO. DH 5

SERIAL No.

PROJECT. MURRAY BRIDGE – ONKAPARINGA PIPELINE

FEATURE. SUMMIT STORAGE INLET OPENCUT

LOCATION MT. BARKER JUNCTION

SECTION 4262. HUNDRED ONKAPARINGA

CO-ORDINATES approx 7338 FT. N 1616 FT. E.

ANGLE FROM HORIZ. 90°. DIRECTION VERTICAL

R. L. Surface approx 1488. FT.

R.L. Collar . . FT.

Datum E&WS., SCALED

DESCRIPTION OF CORE	GROUP SYMBOL ②	STRENGTH TERM ① (VS S MS W VW SO)	CORE SIZE	DEPTH / R.L. FT.	LOG	FRACTURE LOG ③ (1 4 16 64)	STRUCTURES (JOINTS, VEINS, SEAMS, SHEARED ZONES, CRUSHED ZONES)	LIFT CORE LOSS% (10 5 50)	WATER LEVEL / DATE	CASING	DRILL WATER LOSS % (0 100)	WATER PRESSURE TESTS LUGEONS ④ (0.5 5 10 50 100)
SOIL: GRAVEL, excess silty fines GM.	GM		NXC									
SOIL: CLAY, high plasticity, silty; mottled brown & grey	CH		NXC									
no core												
BURRA GROUP: SCHIST, mica-kaolin, mica flakes aligned.			NMLC	1480								
no core				10								
SCHIST, mica-actinolite various shades of brown.				1470, 20, 1460, 30		applicable	root s.m.m. diam.: decomposed. STRUCTURES NOT DETECTABLE IN WEATHERED ROCK		no water observed or cut.		full return	not tested
no core				1450								
ADELAIDE SYSTEM: METASANDSTONE / medium grained, massive;												
no core				40								
feldspath to kaolinitic.						not						
SCHIST, mica-actinolite similar 12ft to 33ft.				1440								
no core				50								
METASANDSTONE, massive medium-grained, feldspathic; micaceous in places, similar 35ft to 39ft.				1430, 60								

END OF HOLE 52FT.

① ROCK SUBSTANCE

STRENGTH TERM
- VS–Very Strong
- S–Strong
- MS–Medium Strong
- W–Weak
- VW–Very Weak
- SO–Soil properties

CONDITION TERM
- Fresh
- Decomposed
- Weathered
- Altered
- Not Applicable

② Substances with soil properties remoulded and classified by Unified System.

③ FRACTURE LOG

1 4 16 64 Natural fractures per foot of core

12 3 3/4 3/16 Equivalent length of core in inches

④ (3-5) Maximum effective pressure (bars) reached during test.

Min. = Minimum value.

ENGINEERING GEOLOGY SECTION

DRILL No. 24	LOGGED J.P.T & R.K.T.
TYPE Mindrill E 1000.	DATE 26 Sept '69
DRILLER JENSEN	TRACED S.L.T.
START. 28 MAY '69	CHECKED
FINISH 29 MAY '69	
SHEET 1 OF 1	DRG. No. S 7698 Hcl

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF DIAMOND DRILL HOLE

PROJECT. MURRAY BRIDGE - ONKAPARINGA PIPELINE

FEATURE. SUMMIT STORAGE, INLET OPENCUT

LOCATION MT. BARKER JUNCTION

SECTION 4262 HUNDRED ONKAPARINGA

CO-ORDINATES 7068 FT. N 1744 FT. E

ANGLE FROM HORIZ. 90° DIRECTION VERTICAL

HOLE NO. DH6

SERIAL No.

R. L. Surface Approx.1483 FT.

R.L. Collar FT.

Datum E&WS, scaled

DESCRIPTION OF CORE	② GROUP SYMBOL	① STRENGTH TERM VS S MS W VW SO	CORE SIZE DEPTH R.L. FT.	LOG	③ FRACTURE LOG 1 4 16 64	STRUCTURES JOINTS, VEINS, SEAMS, SHEARED ZONES, CRUSHED ZONES	LIFT CORE LOSS% 5 10 50	WATER LEVEL DATE	CASING	DRILL WATER LOSS % 0 100	WATER PRESSURE TESTS LUGEONS ④ 0.5 5 10 50 100
no core			1480		NA						
ADELAIDE SYSTEM BURRA GROUP. SCHIST, albite-biotite fine-grained; grey to greenish grey; laminations of dark & light minerals of the order of 1mm thick, with bands of METASANDSTONE, fine-grained; quartz, feldspar & minor mica, white to pale brown.	no core		NMLC 10 1470		NA	On all core: 1) Schistosity dips 15° to 30° on core. 2) Joints parallel to schistosity are dominant. 3) Joints near perpendicular to schistosity dip 60° to 90° on core.		no water observed or cut		full return	not tested
			20 1460		NA						
no core					NA						
no core			30 1450		NA						
			40 1440		NA						
no core						Joint contains seam of kaolin to 2 m.m thick.					
					NA						
			50 1430		NA	Joints, contain seams of INFILLED sandy clay (CH) to 2 m.m. wide, yellow-brown.					
					NA	Two joints dip 70° to 80° on core.					
			60 1420		NA	Two joints dip 20° to 30° on core.					
SCHIST, micaceous, considerably disturbed					NA						
no core			70		NA						

Note: Hole drilled from base of Trench 3, 5ft. below ground surface.

LEGEND

NA. not applicable

METASANDSTONE

SCHIST, albite-biotite

SCHIST, micaceous

① ROCK SUBSTANCE

STRENGTH TERM

VS-Very Strong

S-Strong

MS-Medium Strong

W-Weak

VW-Very Weak

SO-Soil properties

CONDITION TERM

Fresh

Decomposed

Weathered

Altered

Not Applicable

② Substances with soil properties remoulded and classified by Unified System

③ FRACTURE LOG

1 4 16 64 Natural fractures per foot of core

12 3 3/4 3/16 Equivalent length of core in inches

④ (3-5). Maximum effective pressure (bars) reached during test.

Min. = Minimum value.

ENGINEERING GEOLOGY SECTION

DRILL No. 24

TYPE Mindrill E1000.

DRILLER JENSEN.

START. 2 June '69

FINISH 5 June '69

LOGGED J.P.T. & R.K.T.

DATE 29 Sept '69

TRACED S.L.T.

CHECKED

SHEET. 1 OF. 1. DRG. No. S 7699 Hc1

DEPARTMENT OF MINES · SOUTH AUSTRALIA
ENGINEERING GEOLOGY SECTION

WATER PRESSURE TEST · DIAMOND DRILL HOLE

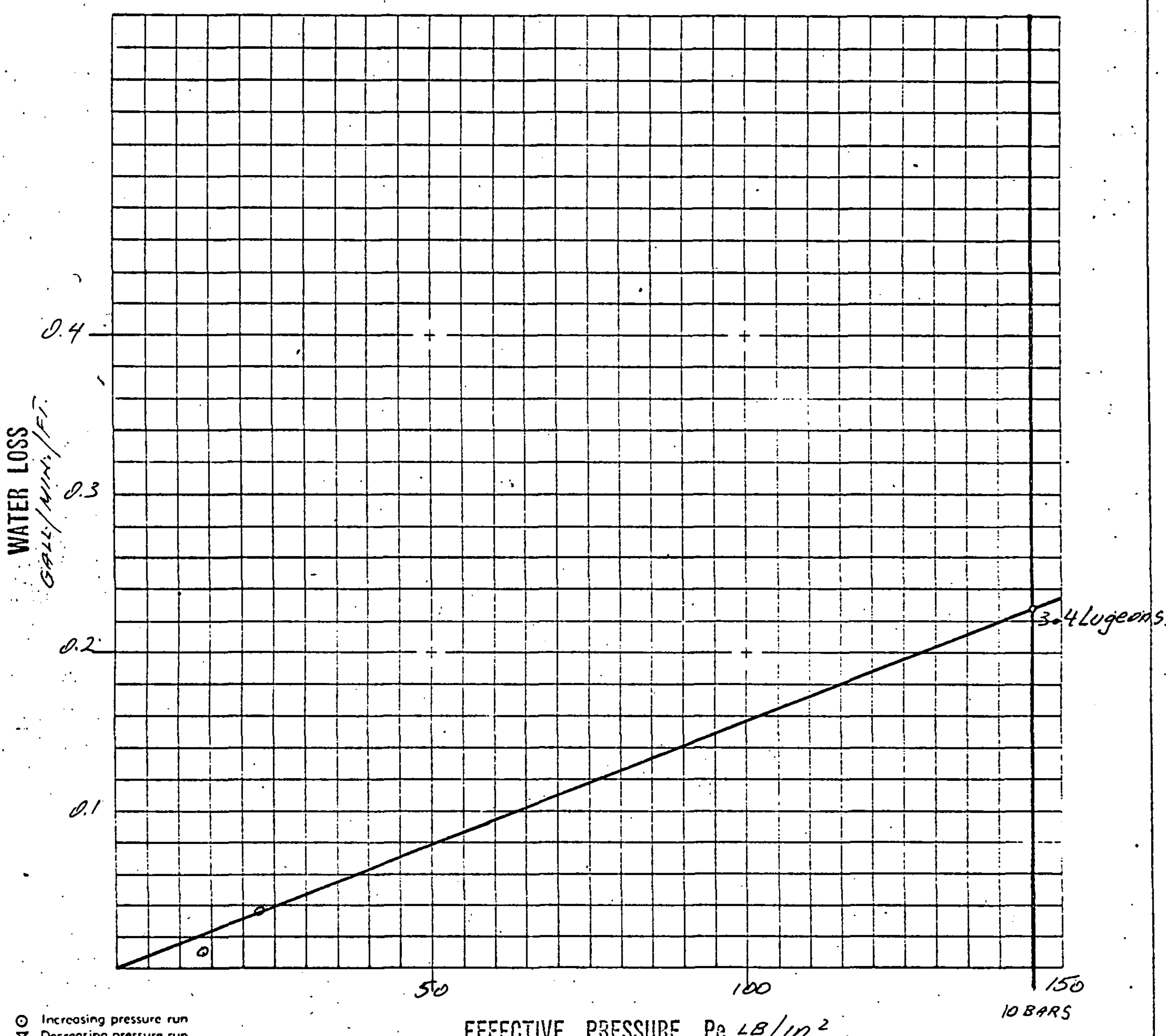
HOLE DH4

PROJECT MURRAY BRIDGE ONKAPARINGA - PIPE LINE CO-ORDINATES 8645 FT. N. 0230 FT. E.

FEATURE SUMMIT STORAGE DAM SITE ANGLE FROM HORIZONTAL 90° (Sine =) DIRECTION

LOCATION MT. BARKER JUNCTION R.L. Collar 1408 feet Datum E & W S

SECTION TESTED From 25 ft. To 35 ft. Mean Depth 30 ft.



⊙ Increasing pressure run
▽ Decreasing pressure run

Length of test section . . . . feet Height of pressure gauge above collar . . . . . feet

GAUGE PRESSURE Pg lb./in.²	WATER COLUMN CORRECTION Hm-feet	Hw-feet	Pw - lb./in.²	SUPPLY LINE CORRECTION Ps lb./in.²	EFFECTIVE PRESSURE Pe lb./in.²	WATER LOSS gall./min.	gall./min./ft.
10	31	9	3.87	3.9	13.9	0.12	0.012
20	31	9	3.87	3.9	23.9	0.36	0.036

PACKER TYPE SOFT

Groundwater level in hole

Depth feet	R.L. feet	Date
8	1398	23 June 69

NOTES: Hm is vertical mean depth of test section below pressure gauge.
Hw is vertical depth of ground water below pressure gauge.
Pw = Hm or Hw × 62·4/144 = Hm or Hw × 0·43 Use Hm if Hm<Hw, Hw if Hw<Hm
Ps is obtained from Drawing No. . . .
Pe = Pg + Pw − Ps. For general layout of water pressure tests see Drg. No. . . .

Date of Test 24 June 69
Test by JENSEN
Calc. by R.K.T.
Checked H.W.D.
Drg. No. S 7652 Ho4c

PF 7603

DEPARTMENT OF MINES · SOUTH AUSTRALIA
ENGINEERING GEOLOGY SECTION

WATER PRESSURE TEST · DIAMOND DRILL HOLE

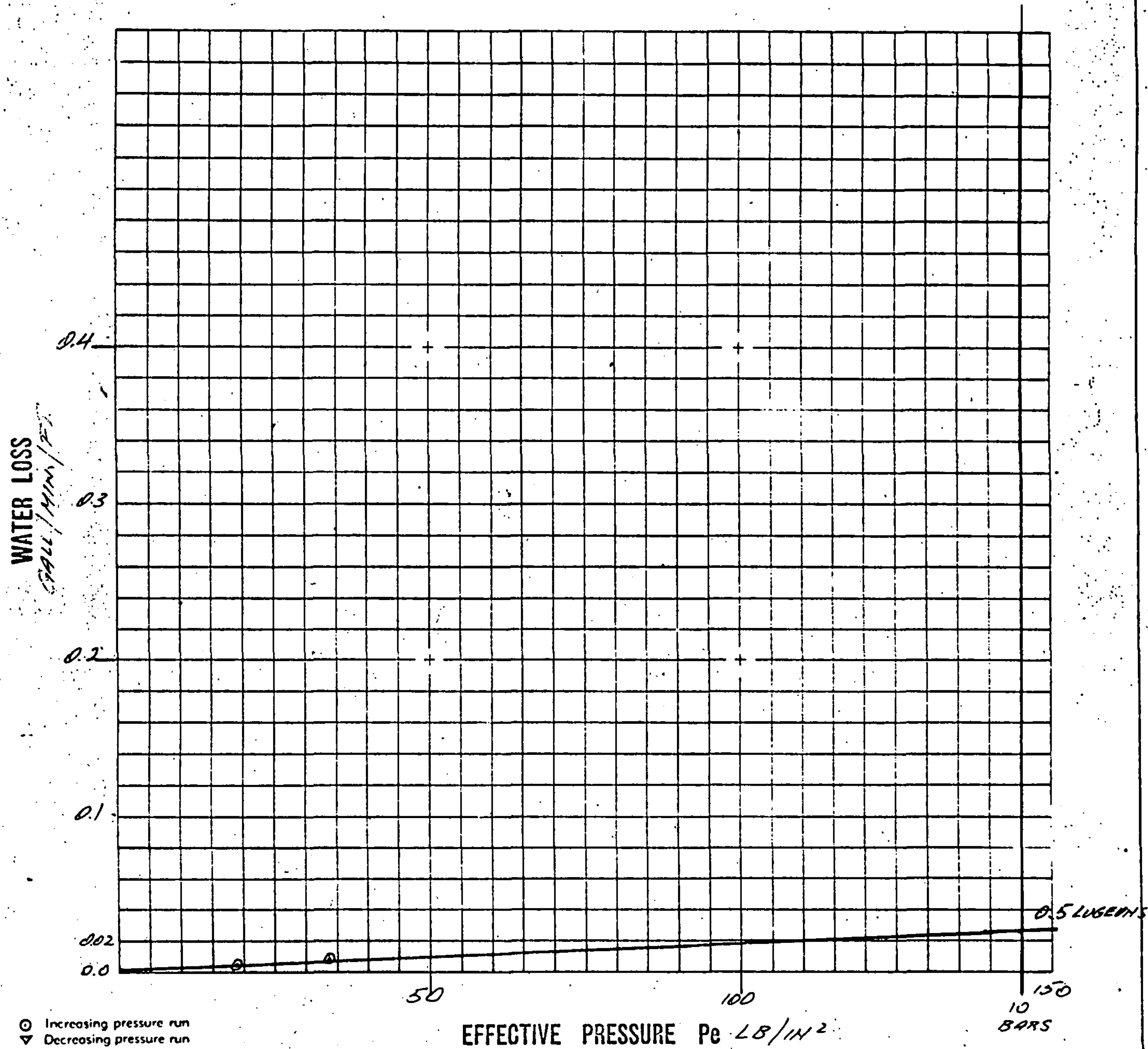
HOLE DH4

PROJECT MURRAY BRIDGE ONKAPARINGA PIPE LINE CO-ORDINATES 8645 FT. N. 0230 FT. E

FEATURE SUMMIT STORAGE DAM SITE ANGLE FROM HORIZONTAL 90° (Sine =) DIRECTION

LOCATION M.T. BARKER JUNCTION R.L. Collar 1408 feet Datum E & W.S.

SECTION TESTED From 35 ft. To 45 ft. Mean Depth 40 ft.



Length of test section . . . . feet Height of pressure gauge above collar . . . . feet.

GAUGE PRESSURE Pg lb./in.²	WATER COLUMN CORRECTION			SUPPLY LINE CORRECTION Ps lb./in.²	EFFECTIVE PRESSURE Pe lb./in.²	WATER LOSS	
	Hm·feet	Hw·feet	Pw·lb./in.²			gall./min.	gall./min./ft.
15	41.3	9.3	4.0	4.0	19.0	0.04	0.004
30	41.3	9.3	4.0	4.0	34.0	0.08	0.008

PACKER TYPE SOFT

Groundwater level in hole

Depth feet	R.L. feet	Date
8 FT	1398	23 JUNE 69

NOTES: Hm is vertical mean depth of test section below pressure gauge.
Hw is vertical depth of ground water below pressure gauge.
Pw = Hm or Hw × 62·4/144 = Hm or Hw × 0·43 Use Hm if Hm<Hw, Hw if Hw<Hm
Ps is obtained from Drawing No. . . . .
Pe = Pg + Pw − Ps. For general layout of water pressure tests see Drg. No. . . . .

Date of Test 24 JUNE 69
Test by JENSEN
Calc. by R.K.T.
Checked H.W.D.
Drg. No. S 7652 A

PF 7603

DEPARTMENT OF MINES · SOUTH AUSTRALIA
ENGINEERING GEOLOGY SECTION

WATER PRESSURE TEST · DIAMOND DRILL HOLE

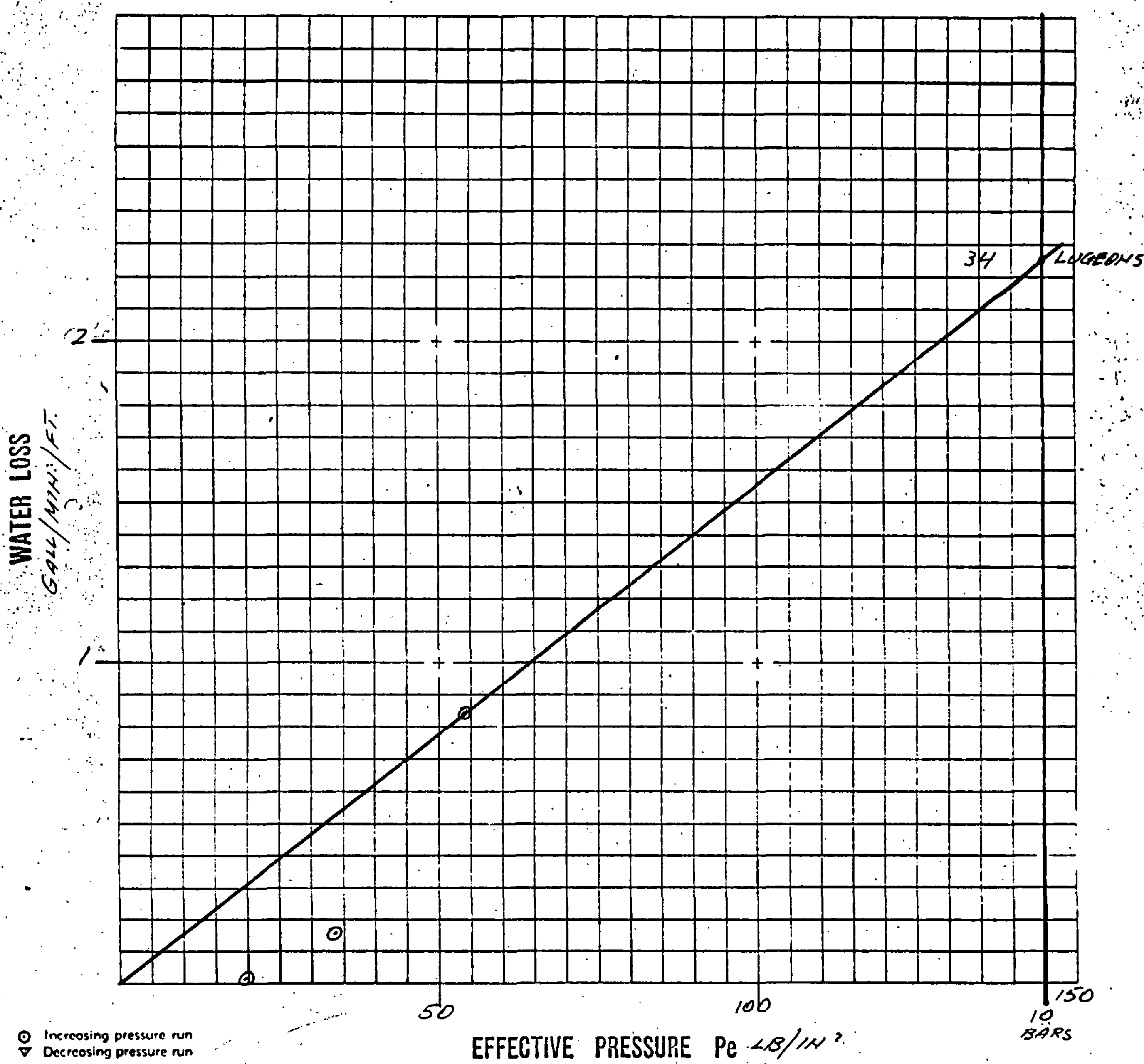
HOLE DH4

PROJECT MURRAY BRIDGE ONKAPARINGA PIPE LINE CO-ORDINATES 8645 FT N 0230 FT E

FEATURE SUMMIT STORAGE DAMSITE / DAM SITE ANGLE FROM HORIZONTAL 90° (Sine = . .)DIRECTION

LOCATION MT. BARKER JUNCTION R.L. Collar 1408 feet Datum E&WS

SECTION TESTED
From 42 ft.
To 52 ft.
Mean Depth 47 ft.



⊙ Increasing pressure run
▽ Decreasing pressure run

Length of test section . . . . feet Height of pressure gauge above collar . . . . feet

GAUGE PRESSURE Pg lb./in.²	WATER COLUMN CORRECTION			SUPPLY LINE CORRECTION Ps lb./in.²	EFFECTIVE PRESSURE Pe lb./in.²	WATER LOSS	
	Hm feet	Hw feet	Pw lb./in.²			gall./min.	gall./min./ft.
15	48	9	3.87	3.9	18.9	0.08	0.008
30	48	9	3.87	3.9	33.9	1.34	0.134
50	48	9	3.87	3.9	53.9	8.22	0.822

PACKER TYPE SOFT

Groundwater level in hole

Depth feet	R.L. feet	Date
8 FT.	1398	23 JUNE 69

NOTES: Hm is vertical mean depth of test section below pressure gauge.
Hw is vertical depth of ground water below pressure gauge.
Pw = Hm or Hw × 62·4/144 = Hm or Hw × 0·43 Use Hm if Hm<Hw, Hw if Hw<Hm
Ps is obtained from Drawing No. . . .
Pe = Pg + Pw − Ps. For general layout of water pressure tests see Drg. No. . . .

Date of Test 24 JUNE 69
Test by JENSEN
Calc. by RKT
Checked H.W.D
Drg. No. S 7652 B

PF 7603

APPENDIX 2: "Seismic Refraction Investigations over Part of the Murray Bridge - Onkaparinga Pipeline Route" by I.S. Rowan, S. Australian Department of Mines unpublished report, Dept.BR.No.69/60.

INTRODUCTION

At the request of the Engineering Geology Section of this Department a seismic refraction survey was carried out along the line of a proposed pipeline excavation over the crest of a small hill near Balhannah. The purpose of the survey was to ascertain the rippability of the material down to the level of the proposed excavation.

Three spreads were completed on 4th June, 1969. A 50 ft. geophone spacing was used; the recorder being a 12 channel SIE P19 mounted in a Land Rover.

The spreads were laid out along the proposed centre-line of the pipeline as surveyed by the Engineering and Water Supply Department and extended from 100 ft. northwest of Peg 5 to 145 ft. northwest of Peg 18.

RESULTS AND INTERPRETATION

The results and location of the spreads are shown on plan 69-467.

The quality of the records was excellent and the results should be accurate to within 15%. As shown on the plan 3 distinct velocity layers are present:-

A low velocity surface layer of 1,750 to 2,000 fps. and 6 to 10 ft. thick.

An intermediate layer of 3,000 fps to 8,000 fps. and 50 to 110 ft. thick.

A high velocity basement of 14,500 fps. and irregular depth corresponding to unweathered schist.

Although the unweathered schist does not rise above the level of the proposed excavation the high intermediate velocity layer between 300 N and 700 N may require blasting before ripping. No difficulty should be experienced in ripping between 0 - 300 N and 700 N - 1650 N due to the lower intermediate velocities in these areas. Although the rock type (schist) is the same along the line it has been noted that the grain size does vary in part from silt to sand size and this is thought to be the reason for the markedly different intermediate velocities in the weathered layers.

APPENDIX 3: Logs of auger holes ARV.1, 2, 3 and 4.

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE: AHV 1
SERIAL No.

PROJECT: MURRAY BRIDGE - ONKAPARINGA PIPELINE
FEATURE: SUMMIT STORAGE, DAMSITE
LOCATION: MT. BARKER JUNCTION

SECTION: 5214
HUNDRED: ONKAPARINGA
CO-ORDS: 8628 FT. N. 0212 FT. E. Datum. E.& W.S.

R.L. Surface: 1405.9 FT.
R.L. Collar: FT.

GEOLOGICAL NOTES AND CLASSIFICATION	DEPTH (FEET)	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966)	WATER LEVEL	MOISTURE CONTENT	Consistency Compct. Dens'y	FIELD TEST DATA
ALLUVIUM - Recent. quartz 95%, mica 5%	0–2	SM	SAND, silty fines to 45%, sand max. size 0·3 mm. average size 0·1 m.m.		H	MD	no tests
mica 10-20%	2–5	CH	CLAY, high plasticity; granular, with sheen faces; grey. sand 2m.m. maximum. 0·5m.m. average, 10%; gravel to 10m.m., 5%		M	St	
mica 60%, quartz 40%	5–6	MH	SILT, high plasticity (micaceous) mica to 2mm. quartz to 0·5 m.m.	WC	M	C	
mica 40%, quartz 60%	6–7	SP-SM	SAND, fines 10% to 20%		S	MD	
mica 5%	7–10	CH	CLAY, high plasticity, silt and sand (max 2m.m.) to 30%		M	F	
max size 10mm.	10	GC-GM	GRAVEL excess fines	WC	S		
	10	CH-MH	CLAY-SILT silt & fine sand to 30%		W	F	
	10	SM-SC	SAND to 2mm excess fines	WC	S	MD	
	10–12	MH-CH	SILT-CLAY, fine sand to 20%; high plasticity.		M	F	
quartz, laterite to 0·5m.m.	12	GM	GRAVEL, excess silty fines		M		
micaceous	12–14	MH	SILT, with fine sand to 40%; high plasticity.		M	MC	
micaceous, mottled brown and blue-grey	14–16	SM	SAND, excess silty fines, sand to 0·5m.m. average 0·3 m.m.		M	MD	
	16	SM	SILT & FINE SAND SLUDGE	WC ?			
micaceous, mottled brown and blue-grey.		SM	as above				
			CONTINUED SHEET 2				

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	WC Water cut	F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
					PL — Plastic Limit

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. E&WS No. 12
TYPE GEMCO
DRILLER G. COOPER
START 28 Nov. '69
FINISH 28 Nov '69

LOGGED BY R. TARVYDAS
DATE 28 Nov. '69
TRACED S.L.T.
CHECKED R.H.

SHEET 1 OF 2. DRG No. S7710

Ha7

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE AHV 1

SERIAL No.

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE.

SECTION 5214

FEATURE SUMMIT STORAGE, DAMSITE.

HUNDRED ONKAPARINGA.

LOCATION MT. BARKER JUNCTION

CO-ORDS 8628 FT. N. 0212 FT. E.

R.L. Surface 1405·9 FT.

R.L. Collar FT.

Datum E&WS

GEOLOGICAL NOTES AND CLASSIFICATION			R.L. DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Densy.	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
ALLUVIUM		as per Sheet 1			SM	SAND; as per Sheet 1			M	MD	-	
		0·1 to 1m.m; aver. 0·6 m.m.	18		SP	SAND, with 5-10% fines.			M	L		
		to 3 m.m.			GM	GRAVEL, excess silty fines.			M			
BASE-MENT	Burra Gp.	SCHIST, mica-feldspar, pale green.	19 20		not applicable	very weak rock		nil				
END OF HOLE 20·5 FT.			21			TUBE-SAMPLED ENTIRE DEPTH.						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	WC Water cut	F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
					PL — Plastic Limit

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. E&WS No. 12
TYPE GEMCO
DRILLER G. COOPER
START 28. Nov. '69
FINISH 28. Nov. '69

LOGGED BY R. TARVYDAS
DATE 28 Nov '69.
TRACED S.L.T.
CHECKED R.H.

SHEET 2 OF 2

DRG No. S 7710-a Ha7

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE AHV 2

SERIAL No.

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE

FEATURE SUMMIT STORAGE, DAMSITE.

LOCATION MT. BARKER JUNCTION.

SECTION 5214

HUNDRED ONKAPARINGA.

CO-ORDS 8595 FT. N. 0200 FT. E.

R.L. Surface 1406·8 FT.

R.L. Collar FT.

Datum E&WS.

GEOLOGICAL NOTES AND CLASSIFICATION		R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compact. Density	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
ALLUVIAL - Recent	max. grain size 2 m.m. average size 0·2 - 0·3 m.m.	1		SM	SAND, excess silty fines, dark grey.			H	MD	no tests	
		2, 3, 4		CH	CLAY SOIL, high plasticity; sand to 2 m.m up to 20%			HD	St		
				GC	GRAVEL, excess clay fines						
	granular structure with sheen faces; grains abt. 0·2 m.m. across, pale brown with 10-20% light grey mottling.	5, 6, 7, 8, 9		CH	CLAY SOIL, high plasticity scattered quartz grains to 2 m.m., to 5%			D	St		
	granular structure with sheen faces; grains abt. 1 m.m across; uniform brown-grey colour; micaceous.	10, 11, 12		CH	CLAY SOIL, high plasticity, with 20% silt and sand to 2 m.m.			D	St		
	pebbles to 2 cms.			GC	GRAVEL, excess clay fines.	WC		S			
BASEMENT BURRA GP.	SCHIST, mica-feldspar, pale green.	13, 14			very weak rock.						
	END OF HOLE 14·5 FT.	15			TUBE-SAMPLED ENTIRE DEPTH.						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	WC Water cut	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	Casing	F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. E&WS No. 12
TYPE GEMCO
DRILLER G. COOPER
START 8 Dec. '69
FINISH 8 Dec. '69

LOGGED BY R. TARVYDAS
DATE 8 Dec. '69
TRACED S.L.T.
CHECKED R.H.

SHEET 1 OF 1

DRG No. S7711

Ha7

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF AUGER HOLE

PROJECT MURRAY BRIDGE – ONKAPARINGA PIPELINE

FEATURE SUMMIT STORAGE, DAMSITE

LOCATION MT. BARKER JUNCTION

SECTION 5214

HUNDRED ONKAPARINGA

CO-ORDS 8680 FT. N, 0252 FT. E

HOLE AHV 3

SERIAL No.

R.L. Surface 1406·1 FT.

R.L. Collar FT.

Datum E & WS.

GEOLOGICAL NOTES AND CLASSIFICATION		R.L.	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compact. Dens'y	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units* 1 2 3 4
ALLUVIUM – Recent			1		ML	SILT SOIL, low plasticity, 20% fine sand, grey.			H	MC		
			2, 3, 4		CH	CLAY SOIL, high plasticity, granular structure, grey; 10-20% sand to 1m.m. scattered throughout. clay-bound pebbles to 2cm.			D	St	no tests	
	quartz 70%, mica 30%		5, 6		SM	SAND, excess silty fines			M	MD		
						SILT BAND, high plasticity, MH, micaceous	WC					
	quartz and mica grains to 1m.m., average 0·6m.m, clay 10-20%		7		SC	SAND, excess clay fines			S	Ls		
			8		CH	CLAY SOIL, high plasticity, brown.			LL	F		
			9, 10, 11, 12		CH	CLAY SOIL, high plasticity, 10-20% silt and fine sand; grey with pale brown mottlings.			M	St		
			13, 14, 15		SM-SC	SAND, excess fines, micaceous, fine grained.			W	D		
			16		SM	SAND, excess silty fines, medium- to coarse- grained; micaceous.	WC		W	D		
			17		GW	GRAVEL, well graded; max. size 1·5 cm. min. size 0·1m.m.			S			
BASEMENT BURRA GP.	SCHIST, mica-feldspar, pale green.		18			very weak rock.			D			

END OF HOLE 18·7 FT.

TUBE SAMPLED ENTIRE DEPTH

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level, (date) 7 Dec. 66	VS. — Very Soft	L's — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	WC Water cut	F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. E&WS No. 12
TYPE GEMCO
DRILLER G. COOPER.
START 9 Dec. 1969.
FINISH 9 Dec. 1969.

LOGGED BY R. TARVYDAS
DATE 9 Dec. 69
TRACED S.L.T.
CHECKED R.H.

SHEET 1 OF 1

DRG No. S 7712 Ha7

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE AHV 4

SERIAL No.

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE

FEATURE SUMMIT STORAGE, DAMSITE

LOCATION MT. BARKER JUNCTION

SECTION 5214

HUNDRED ONKAPARINGA

CO-ORDS 8712 FT.N. 0270 FT.E.

R.L. Surface 1406·8 FT.

R.L. Collar FT.

Datum E & WS

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	CASING	MOISTURE CONTENT	Consistency Compct. Densy.	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
ALLUVIUM - Recent. clay - silt - fine sand mixture	1–17	not applicable	not applicable	CLAY - SILT - SAND mixture from disturbed (auger) samples.	not observed or cut	nil	moist	not applicable - samples disturbed	no tests	
				CONTINUED SHEET 2						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	WC Water cut	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	Casing	F. — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. E&WS No. 12
TYPE GEMCO
DRILLER G. COOPER
START 9 Dec. 1969
FINISH 9 Dec. 1969

LOGGED BY R. TARVYDAS
DATE 9 Dec. 1969
TRACED S.L.T.
CHECKED R.H.

SHEET 1 OF 2 DRG No. S 7713 Ha7

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE AHV4

SERIAL No.

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE

FEATURE SUMMIT STORAGE, DAMSITE

LOCATION. MT. BARKER JUNCTION

SECTION 5214

HUNDRED ONKAPARINGA

CO-ORDS 8712 FT. N., 0270 FT. E

R.L. Surface 1406·8. FT.

R.L. Collar FT.

Datum. E&W.S.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Dens'y	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
ALLUVIUM: clay-silt-fine sand; ease of drilling easy, hardening	18, 19	NOT	APPLICABLE	CLAY-SILT-SAND mixture, samples disturbed	NIL	NIL	NOT	APPLICABLE	no tests	
BASEMENT Burra Group: very hard	20			QUARTZITE, weathered: with dark minerals.						

END OF HOLE approx. 20 ft.

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	WC Water cut	F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	V.C — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
					PL — Plastic Limit

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. E&WS No. 10
TYPE GEMCO
DRILLER G. COOPER
START 9 Dec. 1969
FINISH 9 Dec. 1969

LOGGED BY R. TARVYDAS
DATE 9 Dec 1969
TRACED S.L.T.
CHECKED R.H.

SHEET 2 OF 2. DRG No. S 7713-a Ha 7.

APPENDIX 4: "Seven Metamorphic Rocks, Mount Barker Junction" AMDEL petrological report MP.4521/69.

SEVEN METAMORPHIC ROCKS, MT. BARKER JUNCTION

SUMMARY

The two specimens SS1 and SS2 are altered dolerites, and both very similar, except that in SS1 the pyroxene has been completely converted to hornblende, and the rock is thus metadolerite, whereas in SS2 this process has not proceeded so far. In SS2 there are large phenocrysts of altered plagioclase, whereas SS1 is not porphyritic. Scapolite is present in both specimens, and occurs interstitially, or in SS1 in veins along joints. Alteration is the result of metamorphic effects, and not of weathering.

The remaining specimens are laminated schists, except for SS3, which is a granulite, notable for the fact that it consists largely of microcline and opaques (?hematite). Feldspar is also particularly abundant in the schists, but there it is untwinned albite. The relative proportions of quartz, albite and orthoclase are a little difficult to estimate in these rocks, as these minerals have such similar appearances in thin section. Biotite is the dominant ferromagnesian mineral in the schists, but others are varied. The proportions of the ferromagnesian minerals vary to some extent between the laminations. The assemblages in the schists indicates that they are from the upper greenschist facies of regional metamorphism.

Sample: SS1: P108/69: TS23394

Location:
Hd. of Onkaparinga, Sect 5214. Dam abutments, Summit storage, Mt. Barker Junction.

Rock Name:
Metadolerite.

Hand Specimen:
A medium grey (N5), fine-grained rock of igneous appearance. Some coarser, paler zones extend along possible former fractures, and are about 5 mm wide.

Thin Section:
An optical estimate of the constituents gives the following:

		%
	Plagioclase (labradorite)	50
	Amphibole (hornblende)	45
	Opaques	2
Veins:	Amphibole (hornblende)	40
	Scapolite	60

The plagioclase crystals are elongate and randomly oriented, and form a network in which the amphibole occurs interstitially. The grain size of both minerals is 0.1 to 0.5 mm. The texture is fairly clearly derived from an igneous rock such as a dolerite, and the feldspar in general is still original, though it has become rather cloudy and all the pyroxene (presumably originally present) has been wholly converted to amphibole. The presence of Carlsbad twins amongst the albite twins supports this view, as this combination is not generally observed in metamorphic feldspar. The opaques generally occur in the centres of the amphibole crystals, and are aggregates of small grains. Rarely the grains are regularly disposed in the aggregates, which then show square cross-sections, some concentric, probably inherited from the original ferromagnesian mineral.

The veins apparent in hand specimen appear to have been identical to the main mass of the rock, but the plagioclase has been entirely converted to scapolite, which occurs in perhaps slightly greater proportion in relation to the amphibole than in the rest of the rock. The veins occur along the walls of fractures suggesting that the fluids causing the alteration gained access to the rock along fractures. In order to form the scapolite from the labradorite (as appears to have happened) the fluids must have been rich in carbonate and chloride ions. A little scapolite is also present scattered interstitially through the body of the rock.

This rock, though altered from its original form, is very fresh, and weathering has had little effect, though a little iron-staining is present in some parts. Such alteration products as scapolite are not the result of weathering.

Sample: SS2: P109/69: TS23396

Rock Name:
Metadolerite.

Location:
As SS1.

Hand Specimen:
A dark grey (N3.5), altered, coarsely porphyritic fine to medium grained rock. The phenocrysts are very pale, and generally iron-stained.

Thin Section:
An optical estimate of the constituents gives the following:

		%
Phenocrysts:	Zeolites	3
	Plagioclase	2
	Ferromagnesian inclusions	trace
Groundmass:	Plagioclase	45
	Pyroxene	25
	Amphibole	20
	Opaques	5
	Zeolite	2

The groundmass of this rock is very similar to that in TS23395, but the conversion of pyroxene to amphibole has only partly taken place.

The phenocrysts were clearly originally plagioclase, and their outer zones still consist mainly of the original material, similar to that in the groundmass, plagioclase. It is partly cloudy, and the extinction between crossed nicols of the cloudy parts is different to that in the clear parts, suggesting that some variation in composition is taking place with the cloudiness. The main part of the phenocrysts, in the form of large central zones with euhedral boundaries, have been altered to one or two varieties of zeolite, some of which is isotropic and some weakly birefringent. Inclusions of ferromagnesians (possibly pyroxene and epidote) are common in the zeolite cores.

Though the pyroxene in the groundmass is much altered to hornblende, this is a metamorphic effect and not a weathering effect.

Scattered through the groundmass is fairly prominent interstitial scapolite, as in the veins in TS23395. This also is an effect of metamorphic or endomorphic action, and not a result of weathering. With regard to weathering, the rock is thus very fresh; the only alteration that could be a result of weathering the zeolitization of the feldspar phenocrysts, and even this is probably not a weathering effect.

Sample: SS3: P110/69: TS23397

Location:

Hd. of Onkaparinga, Sect 5214. Trenches along proposed open channel, Summit storage, Mt. Barker Junction.

Rock Name:

Microcline-hematite granulite.

Hand Specimen:

A streaked medium grey (N5) and yellowish grey (10 YR 8/1) rock. Raft-like, fine-grained grey bodies occur in slightly coarser material through which coarse black grains are scattered.

Thin Section:

An optical estimate of the constituents gives the following:

	% Grey	% Pale yellowish grey
Quartz	2	2
Microcline	70	85
Opaques	20	5
Muscovite	-	1
Sphene	-	5
?Pyroxene	10	-
Tourmaline	-	trace
?Apatite	?trace	trace

The rock is composed almost entirely of microcline which occurs in layers of differing grainsize and texture. The major part of the rock is composed of fine-grained, irregularly granoblastic feldspar. Layers of coarse granoblastic-polygonal to granoblastic-elongate texture are irregular in thickness; they appear to be lenticular. Insertion of a gypsum plate shows that the feldspar has a very high degree of preferred orientation. The grain size in the grey part is about 0.05 mm, and in the yellowish grey part is about 0.2 mm. In the grey part the opaques are somewhat finer than the microcline, and scattered fairly evenly throughout. The ?pyroxene is in very small prismatic crystals also scattered fairly evenly throughout the mosaic. It is not clear that this is not apatite; its identification is not definite and further work would be necessary for a definite identification. Both opaques and ?pyroxene occur more commonly within microcline grains than interstitially.

In the pale yellowish grey parts the texture is much less regular, as well as being coarser; the opaques occur in aggregates, and not scattered throughout. The sphene and ?apatite occur in aggregates of spheroidal to anhedral crystals, the ?apatite similar in grain size to the microcline, and the sphene considerably smaller. The tourmaline is pleochroic from green to yellow, and occurs in small prisms.

Sample: SS4: P111/69: TS23398

Location:
As for SS3.

Rock Name:
Albite-biotite-hornblende schist.

Hand Specimen:
A light olive grey (5Y 6/1), fine grained, fairly homogeneous schist.

Thin Section:
An optical estimate of the constituents gives the following:

	%	Grain Size
Albite	35	0.03-0.06 mm
Quartz	5	0.03-0.06 mm
Biotite	40	0.03-0.15 mm
Hornblende	15	0.03-0.10 mm
Epidote	2	0.1 mm
Opaques	2	0.03-0.15 mm
Sphene	1	0.03-0.05 mm

This rock has a fairly even texture, dominated by the biotite, which shows a fairly prominent alignment. Clots of the ferromagnesian minerals occur scattered through the rock, generally about 1 mm long, being a somewhat lensoid shape.

The rock is quite fresh, and it is presumably the high proportion of biotite that gives the rock its rather poorly consolidated appearance in hand specimen. It is rather remarkable in that there appears to be very little quartz present, and untwinned albite is abundant. However, as the two minerals appear so similar in thin section, it is possible that more quartz is present amongst the albite than was detected.

Sample: SS5: P112/69: TS23399

Location:

As for SS3.

Rock Name:

Albite-muscovite-biotite schist.

Hand Specimen:

A light olive grey (5Y 6/1), evenly laminated, fine grained schist.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Quartz	1
Albite	50
Biotite	35
Muscovite	10
Tourmaline	trace
Zircon	trace
Sphene	trace
?Amphibole	trace
Opaques	2

The range of ferromagnesian minerals present is much smaller than in SS4 andthe biotite is not so well aligned. The quartz tends to occur in individual crystals somewhat larger than the grain size of the albite and biotite (0.01 to 0.1 mm). The muscovite occurs similarly to the biotite, but generally in considerably smaller crystals. Much of the layering apparent in hand specimen is due to segregation of muscovite-rich and biotite-rich layers. Sphene and ?amphibole also appear to be segregated into a few very thin layers. As in TS23398, the albite is untwinned.

Sample: SS6: P113/69: TS23400

Location:

Hd. of Macclesfield, Sect. 4412. Trenches along proposed open channel, Summit Storage, Mt. Barker Junction.

Rock Name:

Albite-biotite schist.

Hand Specimen:

A light olive-grey (5Y 6/1), evenly laminated and well cemented schist.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Albite	65-90
Quartz	1
Biotite	5-30
Tourmaline	1-3
Zircon, rutile	trace

This rock is very similar to SS5, though in most parts the proportion of biotite is somewhat lower. It has a compositional layering (the laminations visible in hand specimen) parallel to a foliation due to the biotite, set in a rather granoblastic aggregate of feldspar. In the coarser layers the grain size may be up to 0.1 mm, but in the finer layers it is commonly 0.03 mm. The proportion of tourmaline is higher in the finer layers, but in contrast with SS5, no muscovite appeared to be present. The proportion of biotite is higher in the coarser layers. The alignment of all the elongate crystals (biotite and tourmaline) is considerably more pronounced than in SS5.

Sample: SS7: P114/69: TS23401

Location:

Hd. of Onkaparinga, Sect. 4262. Trench along proposed Open Channel, Summit Storage, Mt. Barker Junction.

Rock Name:

Quartz-albite-muscovite-biotite schist.

Hand Specimen:

A light olive-grey (5Y 6/0.5), evenly laminated schist similar to SS6, but containing numerous coarser crystals, resulting perhaps from more severe or prolonged metamorphism.

Thin Section:

An optical estimate of the constituents gives the following:

	%
Albite	30-65
K-feldspar	trace
Quartz	10-15
Biotite	10-30
Muscovite	5-25
Tourmaline	1
Zircon	trace

The laminations apparent in hand specimen are due more to variations in mineral proportions in this rock than to grain size, though this does vary. Layers vary from quartz-albite-biotite, through quartz-albite-muscovite-biotite to quartz-albite-muscovite. The tourmaline is scattered fairly evenly as a minor or trace constituent throughout the rock. Though similar in colour to that in the foregoing specimens, it has a slightly greyer aspect.

The presence of a greater proportion of quartz is a noteworthy point of distinction from SS3, 4, 5 and 6. The proportion is, however, a little doubtful, as the appearance of the feldspar and quartz is so similar.

APPENDIX 5: Logs of nineteen auger holes (AHM.1 to 15, 17 to 19, and 21) for materials' exploration, right bank.

Note that identifications of rock types are based on disturbed samples, and therefore may differ from those obtained from trenches (see Fig.10).

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF AUGER TOOL HOLE

HOLE AHM 1

SERIAL No.

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE/SUMMIT STORAGE

FEATURE MATERIALS SOURCE, RIGHT BANK

LOCATION MT BARKER JUNCTION

SECTION 4263

HUNDRED Onkaparinga

CO-ORDS 9244 FTN 1500 FTE

R.L. Surface 1471·8 FT.

R.L. Collar FT.

Datum E&W.S

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Densy.	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
SOIL	1470		SM	SAND, excess silty fines					NO TESTING	
	5 / 1465		CH	CLAY, high plasticity, mottled grey and brown; 5% sand to 0·5 m.m.						
BURRA GP. - BASEMENT SCHIST, quartz-feldspar mica, extremely weathered (Soil properties SM/SC) mica is muscovite, about 5% of total; quartz & feldspar in subequal amounts. Attitude of schistosity not known	10 / 1460 / 15 / 1455		SM / SC	SAND, excess fines (estimated 15%) max. sand size 2mm avge. " " 0·3mm grey to brownish-grey	No water cut	Nil	Not op	applicable		
				End of hole 19ft						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) 7 Dec. '66 Casing	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)		S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)		F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL	WC Water cut	V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test-SPT		H. — Hard			LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. E&WS

TYPE GEMCO AUGER

DRILLER RANNIKO

START 12 MAR. 1970

FINISH 12 MAR 1970

LOGGED BY R. TARVYDAS

DATE 10 June '70

TRACED G.M.

CHECKED

SHEET 1 OF 1

DRG No. S 7833 Ha7

PF Nº S6676 MB

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER TOOL HOLE

HOLE: AHM 2
SERIAL No.

PROJECT: MURRAY BRIDGE – ONKAPARINGA PIPELINE / SUMMIT STORAGE
FEATURE: MATERIALS' SOURCE, RIGHT BANK
LOCATION: MT BARKER JUNCTION

SECTION: 4263
HUNDRED: Onkaparinga
CO-ORDS: 9222 FTN 1530FTE

R.L. Surface: 1462·8 FT.
R.L. Collar: FT.
Datum: E&WS

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. / DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966)	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Densy	FIELD TEST DATA: BLOWS PER FOOT (20 40 60 80)	SOILTEST P'TR'METER Units * (1 2 3 4)
SOIL	1460 / 1		SM	SAND, excess silty fines (20%)	NO WATER CUT	NIL	NOT	APPLICABLE	NO TESTING	
	2, 3, 4		CH	CLAY, high plasticity						
BURRA GROUP: BASEMENT, METASANDSTONE or SCHIST, quartz-felspar-mica (5%), extremely weathered (soil properties, SM) attitude of schistosity not known.	5		SM	SAND, excess silty fines (15%) max. sand size 4mm avge. " " 0·4mm						
				END OF HOLE 5ft						

TYPE OF SAMPLE	CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)	St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL	V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT	H. — Hard			LL — Liquid Limit
				PL — Plastic Limit

Water level, (date): 7 Dec. '66
WC ▸ Water cut
Casing

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. E&WS 12
TYPE GEMCO AUGER
DRILLER RANNIKO
START 12 Mar 1970
FINISH 12 Mar 1970

LOGGED BY R Torvydas
DATE 10 June 70
TRACED G.M. 70
CHECKED

SHEET 1 OF 1
DRG No. S 7834 Ha 7

PF Nº S6676 MB

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER TOOL HOLE

HOLE AHM 3

SERIAL No.

PROJECT MURRAY BRIDGE – ONKAPARINGA PIPELINE / SUMMIT STORAGE

SECTION 4263

FEATURE MATERIALS SOURCE, RIGHT BANK

HUNDRED ONKAPARINGA

R.L. Surface ~~1485.2~~ 1477.8 FT.

R.L. Collar FT.

LOCATION MT BARKER JUNCTION

CO-ORDS 9318 FTN 1510 FTE

Datum E&W.S.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L.	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Densy.	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOIL TEST P'TR'METER Units * 1 2 3 4
SOIL				SM	SAND, excess silty fines (15%)	NO WATER CUT	NIL	NOT	APPLICABLE	NO TESTING	
	1475			CH	CLAY, high plasticity, mottled grey & brown; 5% sand to 0.5 mm.						
BURRA GROUP – BASEMENT: SCHIST, quartz-feldspar-mica (2-5%) extremely weathered (soil properties, SM/SC) attitude of schistosity not known.	1470	5		SC/SM	SAND, excess fines (30%) pale grey to brown grey; max. sand size 2 mm. avge. " " 0.3 mm.						
	1465	10									
	1460	15									
					END OF HOLE 18ft						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level, (date) 7 Dec. '66 Casing	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)		S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)		F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)	WC Water cut	St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. E&W.S 12

TYPE GEMCO AUGER

DRILLER RANNIKO

START 13 Mar '70

FINISH 13 Mar '70

LOGGED BY R. Tarvydas

DATE 10 Jun. '70

TRACED G.M.

CHECKED

SHEET 1 OF 1

DRG No. S 7835 H07

PF Nº SG676 MB

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER TOOL HOLE

HOLE AHM 4

SERIAL No.

PROJECT MURRAY BRIDGE – ONKAPARINGA PIPELINE / SUMMIT STORAGE

SECTION 4263

FEATURE MATERIALS' SOURCE, RIGHT BANK

HUNDRED ONKAPARINGA

LOCATION MT BARKER JUNCTION

CO-ORDS 9416 FT.N. 1498 FT.E.

R.L. Surface 1485·2 FT.

R.L. Collar FT.

Datum E&W.S.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Densy.	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
TOPSOIL			SM	SAND, excess silty fines	NO WATER CUT	NIL	NOT	APPLICABLE	NO TESTING	
			CH	CLAY, high plasticity						
BASEMENT – BURRA GROUP: SCHIST, felspar-quartz-mica; rock weathered (very weak) to extremely weathered (soil properties, SM/SC) pale grey. Attitude of schistosity not known.	1480 / 5; 1475 / 10; 1470 / 15		ROCK TO SM/SC	Material with soil properties is equivalent to SAND, excess fines; mica 5 to 10% max. sand size 1 mm, avge. sand size 0·2 mm.						
				END OF HOLE 18 ft.						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	WC Water cut	F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. E&W.S 12

TYPE GEMCO AUGER

DRILLER RANNIKO

START 13 MAR '70

FINISH 13 MAR '70

LOGGED BY R. TARVYDAS

DATE 19 MAR '70

TRACED G.M.

CHECKED

SHEET 1 OF 1

DRG No. S 7836 Ha 7

PF Nº S6676 MB

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER TOOL HOLE

HOLE AHM 5

SERIAL No.

PROJECT MURRAY BRIDGE — ONKAPARINGA PIPELINE SUMMIT STORAGE

SECTION 4263

R.L. Surface 1490·7 FT.

FEATURE MATERIALS SOURCE, RIGHT BANK

HUNDRED ONKAPARINGA

R.L. Collar FT.

LOCATION MT BARKER JUNCTION

CO-ORDS 9518 F.T.N. 1495 F.T.E. Datum E & W S

GEOLOGICAL NOTES AND CLASSIFICATION	R.L.	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Densy.	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units* 1 2 3 4
TOPSOIL	1490			SM	SAND, excess silty fines; 10% gravel to 1cm.	NO WATER CUT	NIL	NOT	APPLICABLE	NO TESTING	
				CH	CLAY, high plasticity, brown.						
BURRA GROUP-BASEMENT: MICA SCHIST, green rock weathered (very weak) to extremely weathered (soil properties, SM)	1485	5		ROCK to SM	Material with soil properties is equivalent to SAND, micaceous with excess fines (silty)						
note: orientation of schistosity not known					END OF HOLE 9ft.						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level, (date) 7 Dec. 66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	WC Water cut	F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. EWS 12

TYPE GEMCO AUGER

DRILLER RANNIKO

START 13 MAR. '70

FINISH 13 MAR. '70

LOGGED BY R. Torvydos

DATE 19 Mar '70

TRACED

CHECKED

SHEET 1 OF 1

DRG No. S 7837 No 7

R.F. No. SCG70 MB

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER TOOL HOLE

HOLE	AHM 6
SERIAL No.	

PROJECT MURRAY BRIDGE / ONKAPARINGA PIPELINE / SUMMIT STORAGE

SECTION 4263

HUNDRED ONKAPARINGA

FEATURE MATERIALS SOURCE, RIGHT BANK

LOCATION MT. BARKER JUNCTION

CO-ORDS 9616 FT.N. 1478 FT.E.

R.L. Surface 1498·7 FT.

R.L. Collar FT.

Datum EWS

GEOLOGICAL NOTES AND CLASSIFICATION	R.L.	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Densy.	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR METER Units * 1 2 3 4
TOPSOIL				SM	SAND; excess silty fines					NO TESTING	
	1495			CH	CLAY; high plasticity						
BURRA GP. – BASEMENT MICA SCHIST, green rock weathered (very weak) to extremely weathered (SOIL properties) SM) attitude of schistosity not known.	1490	5		Rock to SM	material with soil properties is equivalent to SAND, micaceous with excess silty fines.	No Water Cut	NIL	Not	Applicable		
	1485	10									
		15									
					End of hole 16 ft.						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) 7 Dec. 66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)		F — Firm		MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	C — Compact		W. — Wet
Sealed Tube - A Shoe - SAL	WC Water cut	V. St. — Very Stiff	VC — Very Compact	D — Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard		VD — Very Dense	LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. EWS 12
TYPE GEMCO AUGER
DRILLER RANNIKO
START 12 MAR '70
FINISH 12 MAR '70

LOGGED BY R. TARVYDAS
DATE 19 MAR '70
TRACED G.M.
CHECKED

SHEET 1 OF 1

DRG No. S 7838 / 467

PF Nº S6676 MB

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER TOOL HOLE

HOLE	AHM7
SERIAL No.	

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE/SUMMIT STORAGE

SECTION 4263

FEATURE MATERIALS SOURCE, RIGHT BANK

HUNDRED ONKAPARINGA

LOCATION. MT BARKER JUNCTION

CO-ORDS 9718 FT.N. 1472 FT.E.

R.L. Surface 1506·4 FT.

R.L. Collar FT.

Datum E&WS

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. (FEET)	DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Densy.	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
TOPSOIL	1505			SM	SAND, excess silty fines	NO WATER CUT	NIL	NOT	APPLICABLE	NO TESTING	
				CH	CLAY, high plasticity						
BURRA GROUP - BASEMENT: MICA SCHIST green, rock weathered (very weak) to extremely weathered (soil properties, SM); attitude of schistosity not known.	1500	5		Rock to SM	Material with soil properties is equivalent to SAND, micaceous, excess silty fines						
	1495	10									
	1490	15									
					END OF HOLE 17ft						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level, (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)		F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL	WC Water cut	V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. EWS 12

TYPE GEMCO Auger

DRILLER RANNIKO

START 12 MAR '70

FINISH 12 MAR '70

LOGGED BY R.TARVYDAS

DATE 18 MAR '70

TRACED G.M.

CHECKED

SHEET 1 OF 1

DRG No. S 7839 No 7

R.F. No. 56676 MB

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER TOOL HOLE

HOLE AHM 8

SERIAL No.

PROJECT MURRAY BRIDGE-ONKAPARINGA PIPELINE/ SUMMIT STORAGE

SECTION 4263

R.L. Surface 1475·9 FT.

FEATURE MATERIALS SOURCE, RIGHT BANK

HUNDRED ONKAPARINGA

R.L. Collar FT.

LOCATION MT BARKER JUNCTION

CO-ORDS 8986 FT.N. 1042 FT.E. Datum E+WS.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification; U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Densy.	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
TOPSOIL			SM	SAND, excess silty fines 10% gravel to 20mm.	NO WATER CUT	NIL	NOT	APPLICABLE	NO TESTING	
			SC	SAND, excess clayey fines; sand max. 3m.m. over 0.4mm						
BURRA GROUP - BASEMENT: METASANDSTONE, feldspathic; mica 5%; weathered rock (very weak) to extremely weathered (SOIL properties, SM)	1470, 5		Rock to SM	Material with soil properties equivalent to SAND, excess silty fines; sand fraction: max. size 3m.m. avge 0·3mm						
SCHIST, feldspar-quartz-mica (10%) rock weathered (very weak) to extremely weathered (soil properties, SM) mica 10%	1465, 10, 1460, 15		Rock to SM	Material with soil properties equivalent to SAND, excess silty fines. Sand fraction: max. size 2mm, average 0.2 to 0.3mm						
				END OF HOLE 17ft						

notes: (1) topsoil/basement boundary inferred from disturbed cuttings
(2) attitude of schistosity not known.

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)		F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)	WC Water cut	St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. EWS.12.
TYPE GEMCO AUGER
DRILLER RANNIKO
START 18 MAR '70
FINISH 18 MAR '70

LOGGED BY R. TARVYDAS
DATE 18 MAR '70
TRACED G.M.
CHECKED

SHEET 1 OF 1

DRG No. S 7840 Ha 7

P.E. Nº SG676 MB

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER TOOL HOLE

HOLE: AHM 9
SERIAL No.

PROJECT MURRAY BRIDGE – ONKAPARINGA PIPELINE/SUMMIT STORAGE
FEATURE MATERIALS' SOURCE, RIGHT BANK
LOCATION MT BARKER JUNCTION

SECTION 4263
HUNDRED ONKAPARINGA
CO-ORDS 9080 FT. N. 1024 FT. E.

R.L. Surface 1489.5 FT.
R.L. Collar FT.
Datum E&W.S

GEOLOGICAL NOTES AND CLASSIFICATION	R.L.	DEPTH (FEET)	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Densy.	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
TOPSOIL			SM	SAND, excess silty fines, humic	NO WATER CUT	NIL	NOT	APPLICABLE	NO TESTING	
			CH	CLAY, high plasticity; 10 to 20% sand; red-brown						
BURRA GROUP – BASEMENT: METASANDSTONE, felspathic; mica 5% rock weathered (very weak) to extremely weathered (soil properties, SM)	1485	5	ROCK TO SM	material with soil properties is equivalent to SAND, excess silty fines sand fraction: max. size 1mm average 0.2mm						
SCHIST, feldspar-quartz-mica (20%) rock weathered (very weak) to extremely weathered (soil properties SM)	1480, 1475	10, 15	ROCK TO SM	material with soil properties is equivalent to SAND with excess silty fines (micaceous) sand fraction and max. size 1mm. Average 0.2mm						
note: attitude of schistosity not known				END OF HOLE 17ft						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level, (date) 7 Dec. '66 Casing	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)		S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)		F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL	WC Water cut	V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test-SPT		H. — Hard			LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. EWS 12
TYPE GEM.CO. AUGER
DRILLER RANNIKO
START 18 Mar '70
FINISH 18 Mar '70

LOGGED BY R. TARVYDAS
DATE 18 MAR '70
TRACED GM
CHECKED

SHEET 1 OF 1
DRG No. S 7841 Ho7

PF Nº S6676 MB

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF AUGER TOOL HOLE

HOLE	AHM 10
SERIAL No.	
R.L. Surface	1501·2 FT.
R.L. Collar	FT.
Datum	E & WS

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE/SUMMIT STORAGE

SECTION 4263

FEATURE MATERIALS SOURCE, RIGHT BANK

HUNDRED ONKAPARINGA

LOCATION MT. BARKER JUNCTION

CO-ORDS 9172 FT.N. 1010 FT.E.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L.	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Densy.	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
TOPSOIL	1500			SM	SAND, excess silty fines; sand max. 2mm., average 0·4mm.	NO WATER CUT		NIL	NOT APPLICABLE	NO TESTING	
				CH	CLAY, high plasticity; micaceous; brown						
BURRA GROUP - BASEMENT: METASANDSTONE, felspathic; mica <5% rock weathered (very weak) to extremely weathered (soil properties, SP) attitude of schistosity not known.	1495	5		ROCK TO SP	material with soil properties is equivalent to SAND, poorly graded; fines 10%						
	1490	10									
	1485	15									
					END OF HOLE 17ft.						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A Shoe (SA)	Water level (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	WC Water cut	F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. E & WS 12	LOGGED BY R. TARVYDAS
TYPE GEMCO AUGER	DATE 18 MAR '70
DRILLER RANNIKO	TRACED GM.
START 12 MAR '70	CHECKED
FINISH 18 MAR '70	
SHEET 1 OF 1	DRG No. S 7842 H07

RE Nº SG676 MB

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER HOLE

PROJECT *MURRAY BRIDGE - ONKAPARINGA PIPELINE / SUMMIT STORAGE*

FEATURE *MATERIALS SOURCE, RIGHT BANK*

LOCATION *MT. BARKER JUNCTION*

SECTION *4263*

HUNDRED *ONKAPARINGA*

CO-ORDS 9274 FT. N. 0998 FT. E Datum *E.& W.S.*

HOLE *AHM 11*

SERIAL No.

R.L. Surface *1510·6* FT.

R.L. Collar FT.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL Casing	MOISTURE CONTENT	Consistency Compct. Density	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
TOPSOIL	*1510*		*SM*	*SAND, excess silty fines.*					
SOIL micaceous			*CH*	*CLAY, high plasticity; 20% sand.*					
BURRA GROUP - BASEMENT *METASANDSTONE, feldspathic; mica up to 5% in places, rock weathered (very weak) to extremeley weathered, (soil properties, SM/SC)* *Attitude of schistosity not known*	*1505* 5 *1500* 10		*ROCK to SM/SC*	*Material with soil properties is equivalent to SAND, excess fines; sand fraction: max. size 1 mm. average size 0·2 to 0·3 mm. 2 to 10 feet. 0·1 to 0·2 mm. 10 to 12 feet. mica 10% to 20% over 8 to 9 feet and 10 to 11 feet.*	*No Water Cut* *Nil*	*Not*	*Applicable*	*No Testing*	
				END OF HOLE 12 FT.					

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) *7 Dec. '66*	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	WC Water cut	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	Casing	F. — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
					PL — Plastic Limit

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. *E.& W.S. 12*
TYPE *GEMCO AUGER*
DRILLER *RANNIKO*
START *18 MARCH 1970*
FINISH *18 MARCH 1970*

LOGGED BY *R. TARVYDAS*
DATE *18 MAR' 1970*
TRACED *S.v.C.*
CHECKED *L.V.W.*

SHEET *1* OF *1*

DRG No. S 7804 Ha7

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE	AHM 12
SERIAL No.	
R.L. Surface	1513·4 FT.
R.L. Collar	FT.
Datum	E. & W.S.

PROJECT *MURRAY BRIDGE - ONKAPARINGA PIPELINE/SUMMIT STORAGE*

SECTION *4263*

FEATURE *MATERIALS SOURCE RIGHT BANK*

HUNDRED *ONKAPARINGA*

LOCATION *MT. BARKER JUNCTION*

CO-ORDS 9378 FT. N 0982 FT. E

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. (FEET) DEPTH	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966
TOPSOIL		SM	*SAND, excess silty fines; max. size 2mm. average 0·4mm.; grey.*
	1510	CH	*CLAY, high plasticity; sand (max. size 1·5mm, average 0·4mm.) 10%; mottled red brown and grey.*
SCHIST feldspar-quartz-mica (20%)	5	CL	*CLAY, moderate plasticity; sand (max. 2mm., average 0·3mm) 40%; grey to pale brown; micaceous.*
Rock weathered (very weak) to extremely weathered (soil properties, ML) *BASEMENT - BURRA GROUP* *Attitude of schistosity not known.*	1505, 10, 1500, 15, 1495, 20, 1490, 25, 1485, 30, 1480	ROCK to ML	*Material with soil properties is equivalent to SILAT, low plasticity; sand fraction 7 to 9 ft. 20% of total max. size 4mm. average 0·1 mm. 9 to 35 ft. 30 to 40% total max. size 2mm. average 0·3mm.*
	35, 1475	ROCK to ML	*Material with soil properties is equivalent to SILT-CLAY, moderate plasticity; sand fraction 10 to 20% total max. size 1mm. average 0·2 mm.*
	40	CL	*END OF HOLE 40 FT.*

WATER LEVEL: *No Water Cut*
CASING: *Nil*
MOISTURE CONTENT / CONSISTENCY COMPCT. DENSY: *Not Applicable*

FIELD TEST DATA — BLOWS PER FOOT 20 40 60 80 — SOILTEST P'TR'METER Units* 1 2 3 4: *NO TESTING*

TYPE OF SAMPLE	CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)	St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL	V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Pene-tration Test-SPT	H. — Hard			LL — Liquid Limit
				PL — Plastic Limit

Water level, (date) → 7 Dec. '66; WC ▶ Water cut; Casing

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. *E. & W.S. 12*
TYPE *GEMCO AUGER*
DRILLER *RANNIKO*
START *17 MARCH 1970*
FINISH *17 MARCH 1970*

LOGGED BY *R. TARVYDAS*
DATE *17 MAR 1970*
TRACED *S.V.C.*
CHECKED *L.V.W.*

SHEET *1* OF *1*   DRG. No. S 7805   Ha7

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE AHM 13

SERIAL No.

PROJECT *MURRAY BRIDGE - ONKAPARINGA PIPELINE/ SUMMIT STORAGE* SECTION *4263*

FEATURE *MATERIALS SOURCE, RIGHT BANK* HUNDRED *ONKAPARINGA*

LOCATION *MT. BARKER JUNCTION* CO-ORDS 9468 FT.N. 0965 FT.E.

R.L. Surface *1510·9* FT.

R.L. Collar FT.

Datum *E.& W.S.*

GEOLOGICAL NOTES AND CLASSIFICATION	R.L.	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	CASING	MOISTURE CONTENT	Consistency Compct. Dens'y	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units* 1 2 3 4
TOPSOIL	1510			SM	SAND, excess silty fines; humic, grey.						
				CH	CLAY, high plasticity; 20% sand to 2mm; red brown.						
BURRA GROUP - BASEMENT. SCHIST, feldspar - mica - quartz. Extremely weathered; (soil properties, ML); Attitude of schistosity not known	1505, 1500, 1495	5, 10, 15		ML	Material with soil properties is equivalent to SILT, low plasticity, micaceous, grey; sand fraction 3 to 9 ft. 10 to 20% total, to 0·5 mm. 9 to 17 ft. 20%, to 1·5mm.	No Water Cut	Nil	Not	Applicable	No Testing	
					END OF HOLE 17 FT.						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC. — Moderately Compact	L — Loose	D — Damp
E " (SE)		F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL	WC Water cut	V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test		H. — Hard			LL — Liquid Limit
					PL — Plastic Limit

* These values refer to clay soils only and provide no indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. *E.& W.S. 12.*
TYPE *GEMCO AUGER*
DRILLER *RANNIKO*
START *17 MARCH 1970*
FINISH *17 MARCH 1970*

LOGGED BY *R. TARVYDAS*
DATE *17 MAR 1970*
TRACED *S.V.C.*
CHECKED *L.Y.W.*

SHEET *1* OF *1*

DRG No. S 7806 Ha7

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE AHM 14

SERIAL No.

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE/SUMMIT STORAGE

SECTION 4263

FEATURE MATERIALS SOURCE, RIGHT BANK

HUNDRED ONKAPARINGA

LOCATION MT. BARKER JUNCTION

CO-ORDS 9568 FT. N 0950 FT. E

R.L. Surface 1506·8 FT.

R.L. Collar FT.

Datum E.& W.S.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. (FEET) DEPTH	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966)	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Dens'y	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units* 1 2 3 4
TOPSOIL, micaceous	1506	SM	SAND, excess silty fines.						
		CH	CLAY, high plasticity; 10% sand						
BURRA GROUP - BASEMENT. SCHIST, mica - feldspar - quartz; quartz vein; MICA - QUARTZ SCHIST mica + feldspar 80% total. rock weathered (very weak) to extremely weathered (soil properties ML). Attitude of schistosity not known.	5, 1500, 10, 1496, 15, 1490	ROCK to ML	Material with soil properties is equivalent to SILT, low plasticity, micaceous; sand fraction 3 to 6 ft. max. size 1mm. 6 to 17 ft. max. size 0·5mm.	No Water Cut	Nil	Not	Applicable	No Testing	
			END OF HOLE 17 FT.						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A Shoe (SA)	Water level (date) 7 Dec. 66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)		F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)	WC Water cut	St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Pene-tration Test-SPT		H. — Hard			LL — Liquid Limit
					PL — Plastic Limit

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. E.& W.S. 12.
TYPE GEMCO AUGER
DRILLER RANNIKO
START 17 MARCH 1970
FINISH 17 MARCH 1970

LOGGED BY R. TARVYDAS.
DATE 18. MAR 1970
TRACED S.v.O.
CHECKED L.V.W.

SHEET 1 OF 1

DRG No. S 7807 Ha7

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE	AHM 15
SERIAL No.	
R.L. Surface	1455·9 FT.
R.L. Collar	FT.
Datum	E. & W.S.

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE / SUMMIT STORAGE

SECTION 4263

FEATURE MATERIALS SOURCE, RIGHT BANK

HUNDRED ONKAPARINGA

LOCATION MT. BARKER JUNCTION

CO-ORDS 8872 FT.N. 1064 FT.E.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. (FEET)	DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compact. Dens'y	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
TOPSOIL	1455			SM	SAND, excess silty fines; max. diameter 2 cm.	No Water Cut	Nil	Not	Applicable	No Testing	
				CH	CLAY, high plasticity, 10% sand; micaceous in places.						
BURRA GROUP - BASEMENT: METASANDSTONE, feldspathic; rock weathered (very weak) to extremely weathered (soil properties: SM, SC and SM/SC)	1450	5		ROCK to SM/SC	SAND, excess fines; sand fraction max. size 2mm., pale brown.						
Attitude of schistosity not known.				ROCK to SC	*CLAY, low plasticity; sand fraction to 3 mm.; pale grey.						
	1445	10		ROCK to SM	*SAND, excess silty fines max. size 3 mm., pale brown.						
				ROCK to SM/SC	*SAND, excess fines; sand fraction max. size 3 mm., average 0·3-0·4 mm., pale grey.						
	1440	15		ROCK to SM	*SAND, excess silty fines; sand fraction max. size 5 mm.						
					END OF HOLE 17 FT						

* Material with soil properties is equivalent to ....

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)		F — Firm		MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	C — Compact		W — Wet
Sealed Tube - A Shoe - SAL	WC Water cut	V. St. — Very Stiff	VC — Very Compact	D — Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard		VD — Very Dense	LL — Liquid Limit
		* These values refer to clay silt and sand, provide no indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. E. & W.S. 12	LOGGED BY R. TARVYDAS
TYPE GEMCO AUGER	DATE 19 MAR 1970
DRILLER RANNIKO	TRACED S.v.C.
START 19 MARCH 1970	CHECKED L.V.W.
FINISH 19 MARCH 1970	
SHEET 1 OF 1	DRG No. S780 a7

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE	AHM 17
SERIAL No.	
R.L. Surface	1465·0 FT.
R.L. Collar	FT.
Datum	E.& W.S.

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE / SUMMIT STORAGE

SECTION 4263

FEATURE MATERIALS SOURCE, RIGHT BANK

HUNDRED ONKAPARINGA

LOCATION MT. BARKER JUNCTION

CO-ORDS 9212 FT N. 0438 FT E.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L.	DEPTH (FEET)	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME (Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966)	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compact Dens'y	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units* 1 2 3 4
TOPSOIL			SM	SAND, excess silty fines						
			CH	CLAY, high plasticity; 40% sand max. size 2mm. average 0·3 mm.						
METASANDSTONE, feldspathic, micaceous (10 to 20% of total) rock weathered (very weak) to extremely weathered (soil properties, SM). Attitude of schistosity not known. BURRA GROUP - BASEMENT	1460	5		Material with soil properties is equivalent to SAND, excess silty fines of low plasticity; grey to pale brown; micaceous; sand fraction max. size 1·5mm. average 0·2 mm.	No Water Cut	Nil	Not	Applicable	No Testing	
	1455	10								
	1450	15								
	1445	20	ROCK to SM							
	1440	25								
	1435	30								
	1430	35								
	1425	40		END OF HOLE 40 FT.						

TYPE OF SAMPLE	Water level (date)	CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	7 Dec. 66	VS. — Very Soft	L — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	WC — Water cut	F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - Spt		H. — Hard			LL — Liquid Limit
					PL — Plastic Limit

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. E.& W.S. 12	LOGGED BY R. TARVYDAS
TYPE GEMCO AUGER	DATE 20 MAR 1970
DRILLER RANNIKO	TRACED S.V.C.
START 20 MARCH 1970	CHECKED L.V.W.
FINISH 20 MARCH 1970	
SHEET 1 OF 1	DRG No. S7809 Ha7

DEPARTMENT OF MINES · SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE	AHM 18
SERIAL No.	

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE/SUMMIT STORAGE

SECTION 4263

FEATURE MATERIALS SOURCE, RIGHT BANK

HUNDRED. ONKAPARINGA

LOCATION. MT. BARKER JUNCTION

CO-ORDS 9308 FT. N. 0412 FT. E.

R.L. Surface 1404·9 FT.

R.L. Collar FT.

Datum E. & W.S.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. (FEET)	DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct. Dens.	FIELD TEST DATA BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
TOPSOIL				SM	SAND, excess silty fines	No Water Cut	Nil	Not	Applicable	No Testing	
				CH	CLAY, high plasticity, 20% sand.						
METASANDSTONE, feldspathic mica 5 to 10% rock weathered (very weak) to extremely weathered (soil properties, SM, CH and SM/SC)	1400	5		ROCK to SM/SC	Material with soil properties is equivalent to SAND, excess fines; sand max. size 1 mm, average 0·3 mm. yellow and brown.						
				CH	CLAY, high plasticity; sand 40%						
BURRA GROUP - BASEMENT. Attitude of schistosity not known	1395	10		ROCK to SM	Material with soil properties is equivalent to SAND, excess silty fines; max. size 2 mm. average 0·2 to 0·3 mm. pale grey.						
	1390	15									
					END OF HOLE 17 FT.						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A Shoe (SA)	Water level (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)		S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)		F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)	WC Water cut	St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL	Casing	V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
					PL — Plastic Limit

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. E. & W.S. 12

TYPE GEMCO AUGER

DRILLER RANNIKO

START 20 MARCH 1970

FINISH 20 MARCH 1970

LOGGED BY R. TARVYDAS

DATE 20. MAR. 1970

TRACED S. & C.

CHECKED L.V.W.

SHEET 1 OF 1

DRG No. S 7810 Ha7

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE AHM 19

SERIAL No.

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE/SUMMIT STORAGE

SECTION 4263

FEATURE MATERIALS SOURCE, RIGHT BANK

HUNDRED. ONKAPARINGA

LOCATION. MT. BARKER JUNCTION

CO-ORDS 9406 FT. N 0390 FT E

R.L. Surface 1460·7 FT.

R.L. Collar FT.

Datum E. & W.S.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L.	DEPTH (FEET)	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL / Casing	MOISTURE CONTENT	Consistency / Compact. Density	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units * 1 2 3 4
TOPSOIL	1460			SM	SAND, excess silty fines.					
				CH	CLAY, high plasticity 10% sand.					
BURRA GROUP - BASEMENT METASANDSTONE, feldspathic; mica 5 to 10% rock weathered (very weak to extremely weathered (soil properties, SM) Attitude of schistosity not known.	1455 1450 1445	5 10 15		ROCK to SM	Material with soil properties is equivalent to SAND, excess silty fines; sand fraction, 3 to 10 ft. max. size 2mm. average 0·2mm. 10 to 17 ft. max. size 2mm.	No Water Cut / Nil	Not	Applicable	No Testing	
					END OF HOLE 17 FT.					

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A shoe (SA)	Water level (date) 7 Dec. 66 / Casing	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	WC Water cut	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)		F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
		* These values refer to clay soils only and provide an indication of their consistency.			PL — Plastic Limit

ENGINEERING GEOLOGY SECTION

DRILL No. E. & W.S. 12

TYPE GEMCO AUGER

DRILLER RANNIKO

START 20 MARCH 1970

FINISH 20 MARCH 1970

LOGGED BY: R. TARVYDAS

DATE 20 MAR 1970

TRACED S. & C.

CHECKED L.V.W.

SHEET 1 OF 1

DRG No. S7811 Ha7

DEPARTMENT OF MINES SOUTH AUSTRALIA

LOG OF AUGER HOLE

HOLE AHM 21

SERIAL No.

PROJECT MURRAY BRIDGE - ONKAPARINGA PIPELINE/ SUMMIT STORAGE SECTION 4263

FEATURE MATERIALS SOURCE, RIGHT BANK

HUNDRED ONKAPARINGA

LOCATION MT. BARKER JUNCTION

CO-ORDS 9506 FT. N. 0368 FT. E

R.L. Surface 1468·9 FT.

R.L. Collar FT.

Datum E. & W.S.

GEOLOGICAL NOTES AND CLASSIFICATION	R.L. (FEET) DEPTH	GRAPHIC LOG	GROUP SYMBOL	SOIL DESCRIPTION GROUP NAME Unified Soil Classification, U.S.B.R. Earth Manual 2nd Edition 1966	WATER LEVEL	Casing	MOISTURE CONTENT	Consistency Compct, Dens'y	FIELD TEST DATA: BLOWS PER FOOT 20 40 60 80	SOILTEST P'TR'METER Units* 1 2 3 4
TOPSOIL			SM	SAND, excess silty fines; sand max. size 5mm., average						
	1465		CH	CLAY, high plasticity; 20% sand in places.						
BURRA GROUP - BASEMENT: METASANDSTONE, feldspathic 4 to 10 ft. rock weathered (very weak) to extremely weathered (soil properties, SM/SC) 10 to 17 ft. rock weathered (very weak) to weak rock (drilling much harder) mica 5 to 10% 12 to 17 ft. Attitude of schistosity not known	5, 1460, 10, 1455, 15		ROCK to SM/SC	Material with soil properties is equivalent to SAND, excess fines (15%) sand fraction max. size 1mm. 10% mica at 12 to 17 feet.	No Water Cut	Nil	Not	Applicable	No Testing	
				END OF HOLE 17 FT.						

TYPE OF SAMPLE		CONSISTENCY (Clays)	COMPACTNESS (Silts)	RELATIVE DENSITY (Sands)	MOISTURE CONTENT
A Shoe (SA)	Water level (date) 7 Dec. '66	VS. — Very Soft	Ls — Loose	VL — Very Loose	H — Humid
D " (SD)	Casing	S — Soft	MC — Moderately Compact	L — Loose	D — Damp
E " (SE)	WC Water cut	F — Firm	C — Compact	MD — Medium Dense	M — Moist
G " (SG)		St. — Stiff	VC — Very Compact	D — Dense	W — Wet
Sealed Tube - A Shoe - SAL		V. St. — Very Stiff		VD — Very Dense	S — Saturated
Standard Penetration Test - SPT		H. — Hard			LL — Liquid Limit
					PL — Plastic Limit

* These values refer to clay soils only and provide an indication of their consistency.

ENGINEERING GEOLOGY SECTION

DRILL No. E. & W.S. 12.

TYPE GEMCO AUGER

DRILLER RANNIKO

START 19 MARCH 1970

FINISH 19 MARCH 1970

LOGGED BY R. TARVYDAS

DATE 19 MAR 1970

TRACED S. V. C.

CHECKED L. V. W.

SHEET 1 OF 1

DRG No. S7812 Ha7

APPENDIX 6: Chainages and Reduced Levels of pegs on centreline of Inlet Opencut.

<u>APPENDIX 6</u>

E. & W.S. PEG NO.	CHAINAGE FROM MURRAY BRIDGE mi/ft/in.	REDUCED LEVELS
19	25/502/4	1451.7
18	25/302/11	1467.7
17	25/250/4	1472.3
16	25/142/4	1483.9
15	25/103/3	1486.5
14	25/ 61/3	1488.1
13	24/5183/2	1487.7
12	24/4982/10	1487.5
11	24/4959/1	1487.5
10	24/4782/5	1488.4
9	24/4647/7	1490.2
8	24/4581/8	1488.2
7	24/4381/0	1474.5
6	24/4181/8	1454.3

6327 I

DEPARTMENT OF MINES
SOUTH AUSTRALIA

GEOLOGICAL SURVEY
ENGINEERING DIVISION

MURRAY BRIDGE - ONKAPARINGA PIPELINE

SUMMIT STORAGE
MOUNT BARKER JUNCTION

Secs. 4262, 4263, 5214, Hd. Onkaparinga, and
Sec. 4412, Hd. Macclesfield

GEOLOGICAL INVESTIGATIONS, PROGRESS REPORT NO.1

Client: Engineering & Water Supply Department

FIGURES

by

R. TARVYDAS
GEOLOGIST
ENGINEERING GEOLOGY SECTION

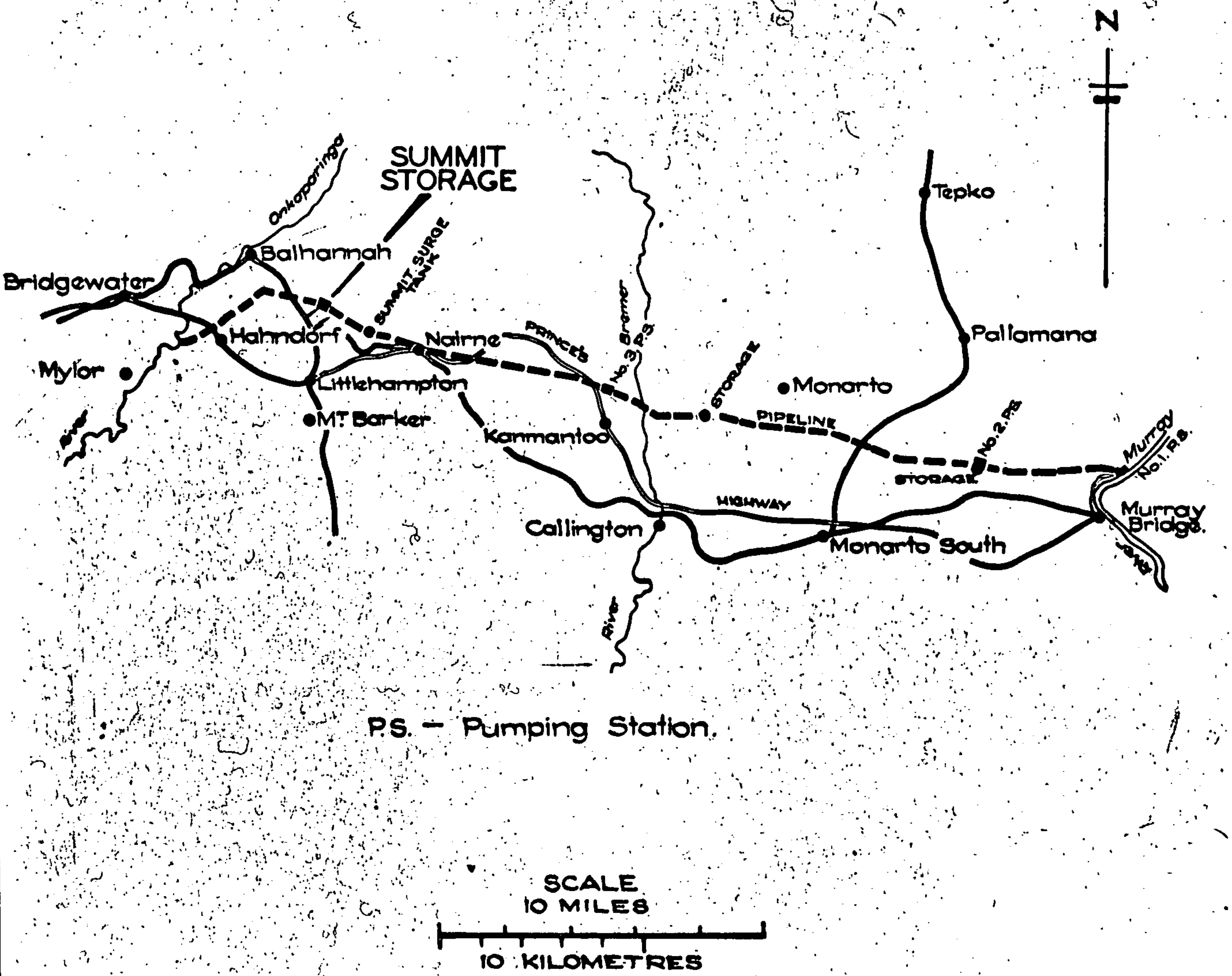
IIB. 13/2 02

10th August, 1970

Rept.Bk.No.70/118

64-15

70/118 B



P.S. — Pumping Station.

FIG.1

ENGINEERING GEOLOGY SECTION	DEPARTMENT OF MINES - SOUTH AUSTRALIA	Scale: AS SHOWN
Compiled: R.T.	MURRAY BRIDGE—ONKAPARINGA PIPELINE	Date: 11 Nov '69
Drn. AMcD Ckd. L.V.W.	PROPOSED ROUTE	Drg. No S7556 Hab.

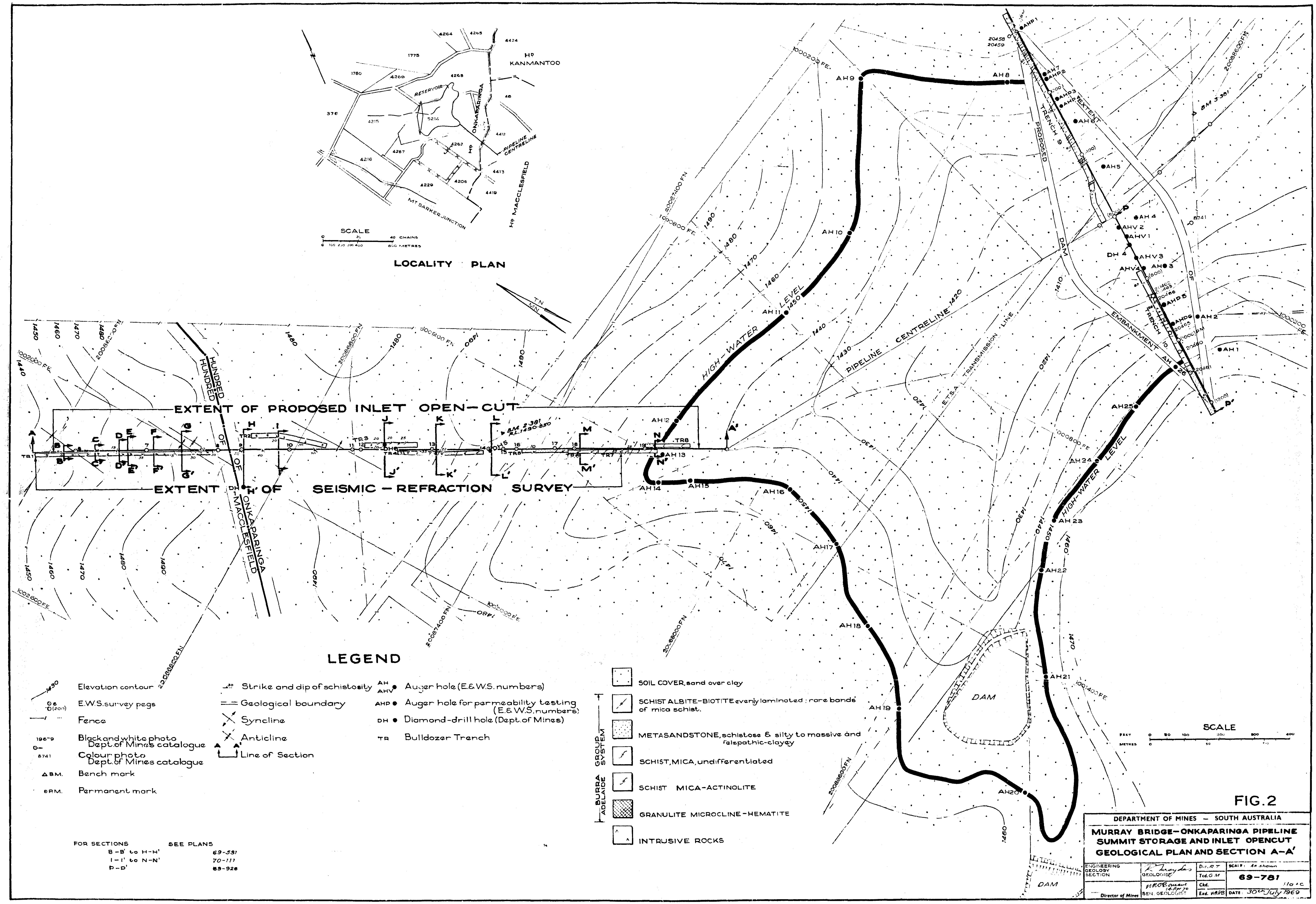
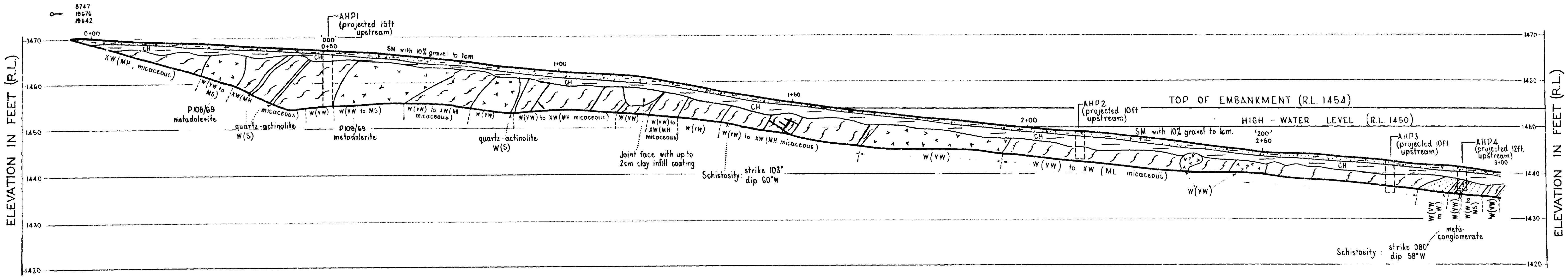


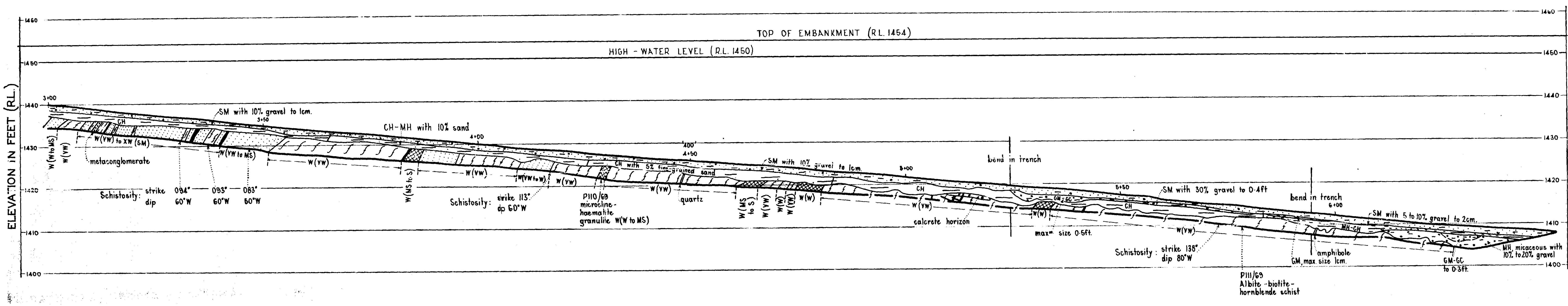
FIG. 2

DEPARTMENT OF MINES – SOUTH AUSTRALIA

MURRAY BRIDGE–ONKAPARINGA PIPELINE
SUMMIT STORAGE AND INLET OPENCUT
GEOLOGICAL PLAN AND SECTION A–A'

ENGINEERING GEOLOGY SECTION	GEOLOGIST	Dr. R.T. / Trd. G.M.	SCALE: As shown
	SEN. GEOLOGIST	Chd.	69-781
Director of Mines		Exd. WAPB	DATE: 30th July 1969





CONDITION OF ROCK SUBSTANCE

F FRESH
D DECOMPOSED
W WEATHERED
A ALTERED
XW EXTREMELY WEATHERED, i.e. having SOIL PROPERTIES (followed by 'Unified' symbol.)

STRENGTH OF ROCK SUBSTANCE

(VS) VERY STRONG
(S) STRONG
(MS) MEDIUM STRONG
(W) WEAK
(VW) VERY WEAK

SOIL TYPES

'Unified' Soils Classification

GRAVEL	GM	excess silty fines
	GC	excess clayey fines
SAND	SM	excess silty fines
SILT	ML	low plasticity
	MH	high plasticity
CLAY	CH	high plasticity

SCALE IN FEET 0 10 20 30 40

0 5 10 SCALE IN METRES

ROCK TYPES

SCHIST, mica-actinolite, with pods of reddish-brown iron oxide and veins of quartz-actinolite rock; yellow-brown "earthy" soil to pale yellow green fissile rock

METASANDSTONE, fine grained, silty; white to brown, with grey micaceous bands 1 to 50mm wide

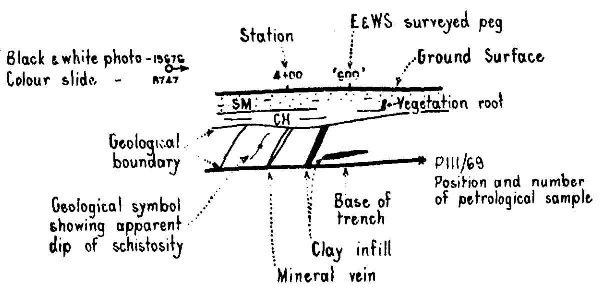
SCHIST, MICA, undifferentiated; rocks of green and grey colours containing major mica and ferromagnesians, and minor feldspar

GRANULITE, microcline-haematite, mottled blue and white

INTRUSIVE ROCKS, undifferentiated, including metadolerite and a very weathered green rock with feldspars to 5mm. across

TYPICAL SECTION

Dept. Mines catalogue { Black & white photo - 19676 / Colour slide - 8747



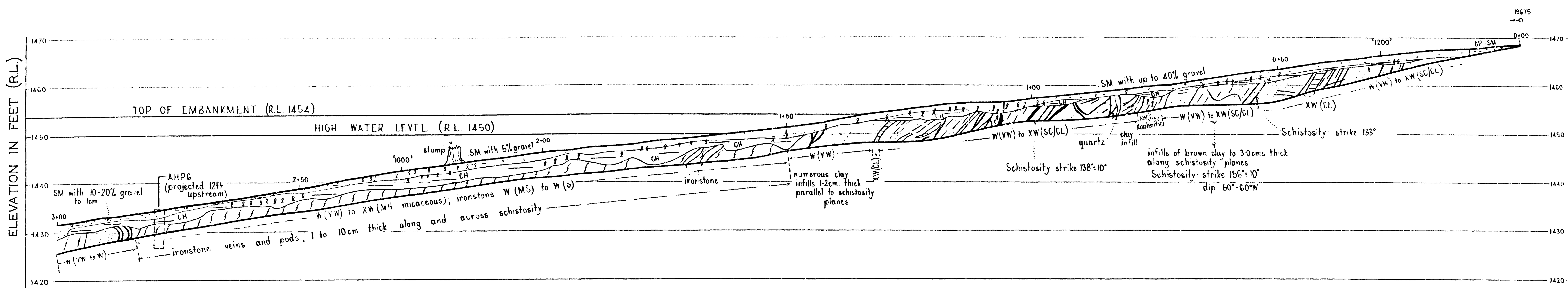
AHP : Auger hole for permeability test (E&WS)

Note: strikes measured from True North.

FIG. 3

DEPARTMENT OF MINES — SOUTH AUSTRALIA			
MURRAY BRIDGE — ONKAPARINGA PIPELINE			
SUMMIT STORAGE			
LEFT ABUTMENT GEOLOGICAL LOG OF TRENCH 9			
ENGINEERING GEOLOGY SECTION	R. Tarrington GEOLOGIST	Drn. R.T	SCALE: As shown
		Tcd. R.H.	69 - 927 Ha+c
		Ckd. L.V.W.	
Director of Mines	SEN. GEOLOGIST	Exd.	DATE: 10 Nov 1969

P'



P

ROCK TYPES

- METASANDSTONE: medium- to coarse-grained; Kaolinitic matrix
- METASANDSTONE: fine- to coarse-grained, feldspathic; schistose to massive
- SCHIST, MICA, undifferentiated; contains rocks of green and grey colours containing major mica and ferromagnesian minerals, and minor feldspar
- SCHIST, ALBITE-BIOTITE; evenly laminated; similar to that of Trench 1, Inlet Open-cut (see plan 70-82)

SOIL TYPES

('Unified' Soils Classification)

- GRAVEL — GW well graded; GP poorly graded; GM excess silty fines; GC excess clayey fines
- SAND — SP poorly graded; SM excess silty fines; SC excess clayey fines
- SILT — ML low plasticity; MH high plasticity
- CLAY — CL low plasticity; CH high plasticity

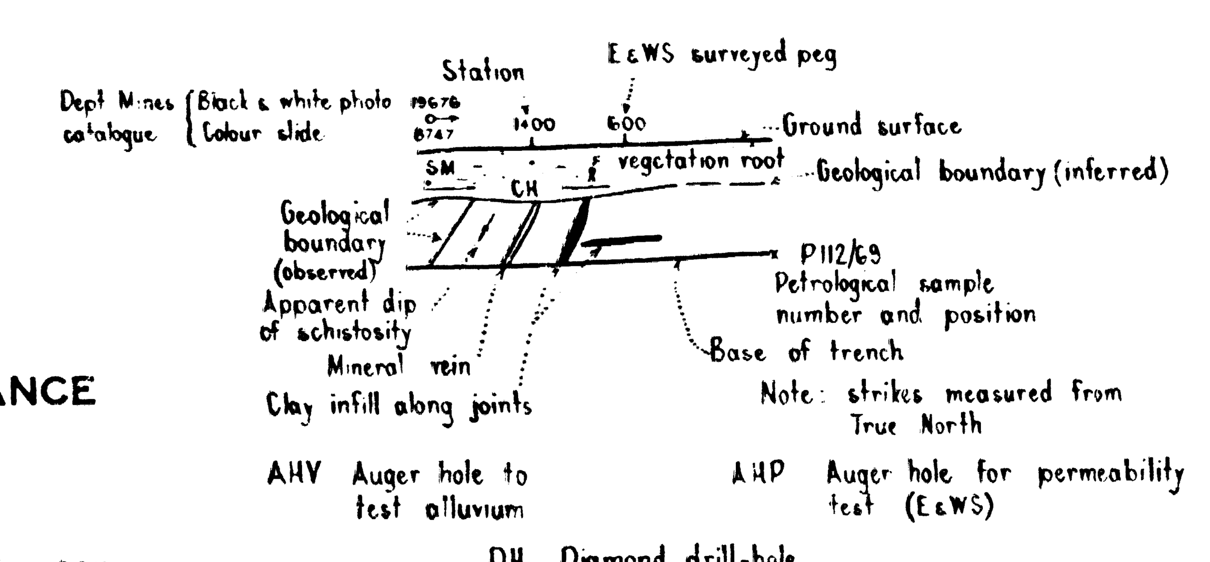
STRENGTH OF ROCK SUBSTANCE

- (VS) VERY STRONG
- (S) STRONG
- (MS) MEDIUM STRONG
- (W) WEAK
- (VW) VERY WEAK
- (SO) SOIL SUBSTANCE

CONDITION OF ROCK SUBSTANCE

- F FRESH
- W WEATHERED
- XW EXTREMELY WEATHERED ie having SOIL PROPERTIES (followed by 'Unified' symbol.)

TYPICAL SECTION



AHV Auger hole to test alluvium
AHP Auger hole for permeability test (E&WS)
DH Diamond drill-hole

SCALE IN FEET (0 10 20 30 40)

SCALE IN METRES (0 5 10)

For location of Section see plan N° 69-781

FIG. 4

DEPARTMENT OF MINES — SOUTH AUSTRALIA

MURRAY BRIDGE — ONKAPARINGA PIPELINE
SUMMIT STORAGE

DAMSITE — GEOLOGICAL SECTION P—P'

ENGINEERING GEOLOGY SECTION	GEOLOGIST	Drn. R.T.	SCALE As shown
Director of Mines	SEN GEOLOGIST	Trd. R.H. / Chd. L.V.W. / Exd.	69-926 / DATE 10 Nov 1969

Alterations	Date	By
Addition of exploratory pit	23-2-72	B.J.M.

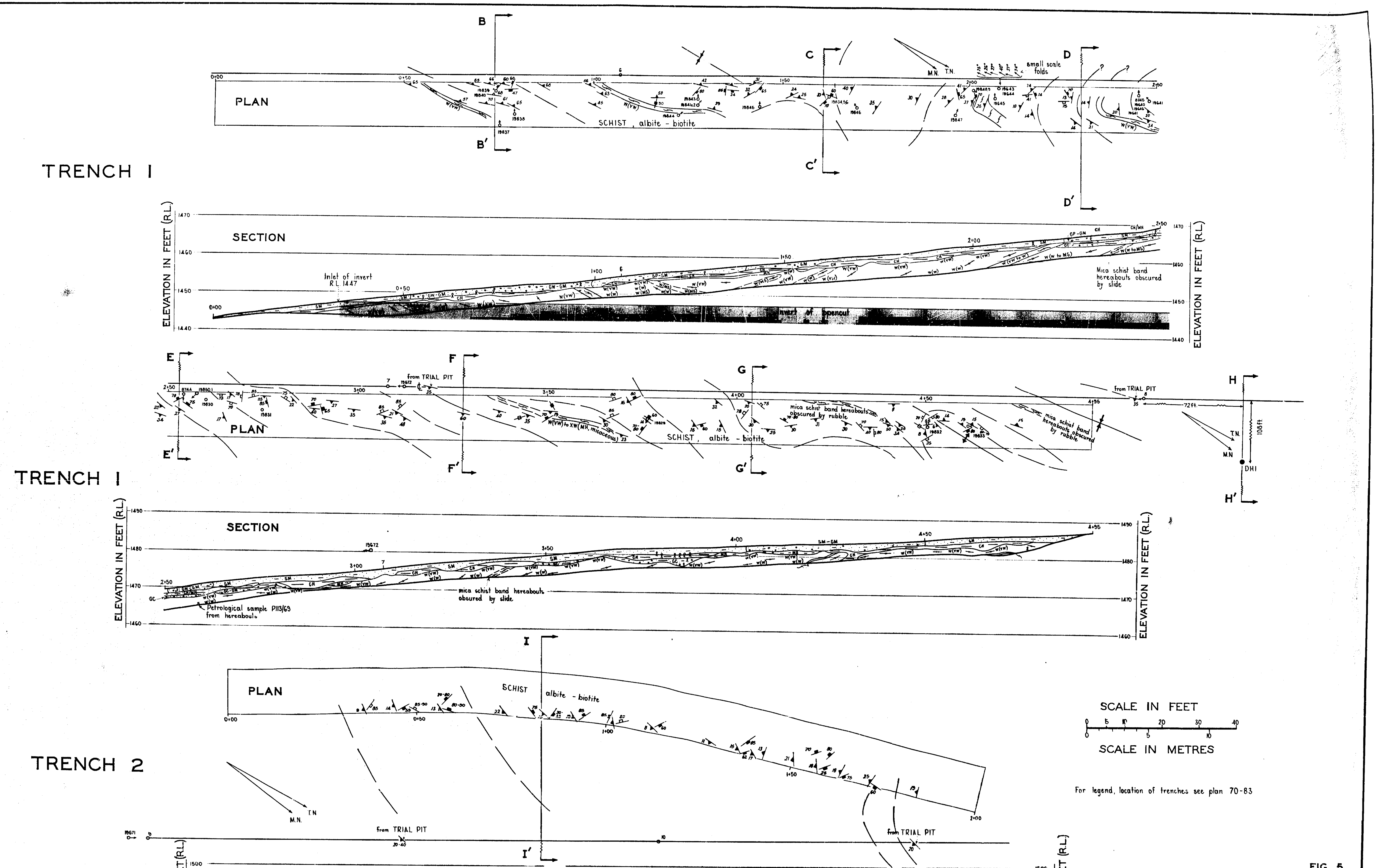
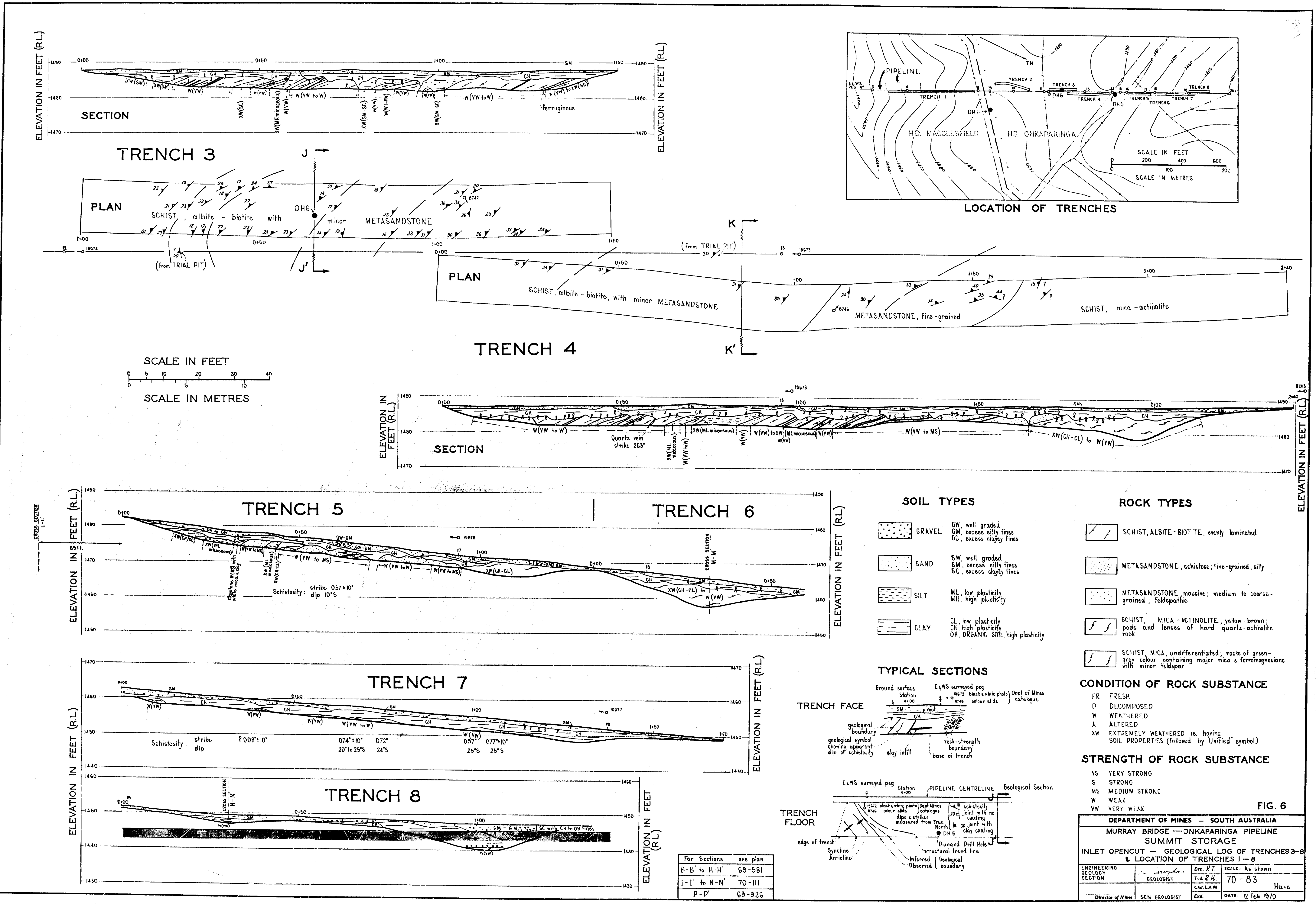
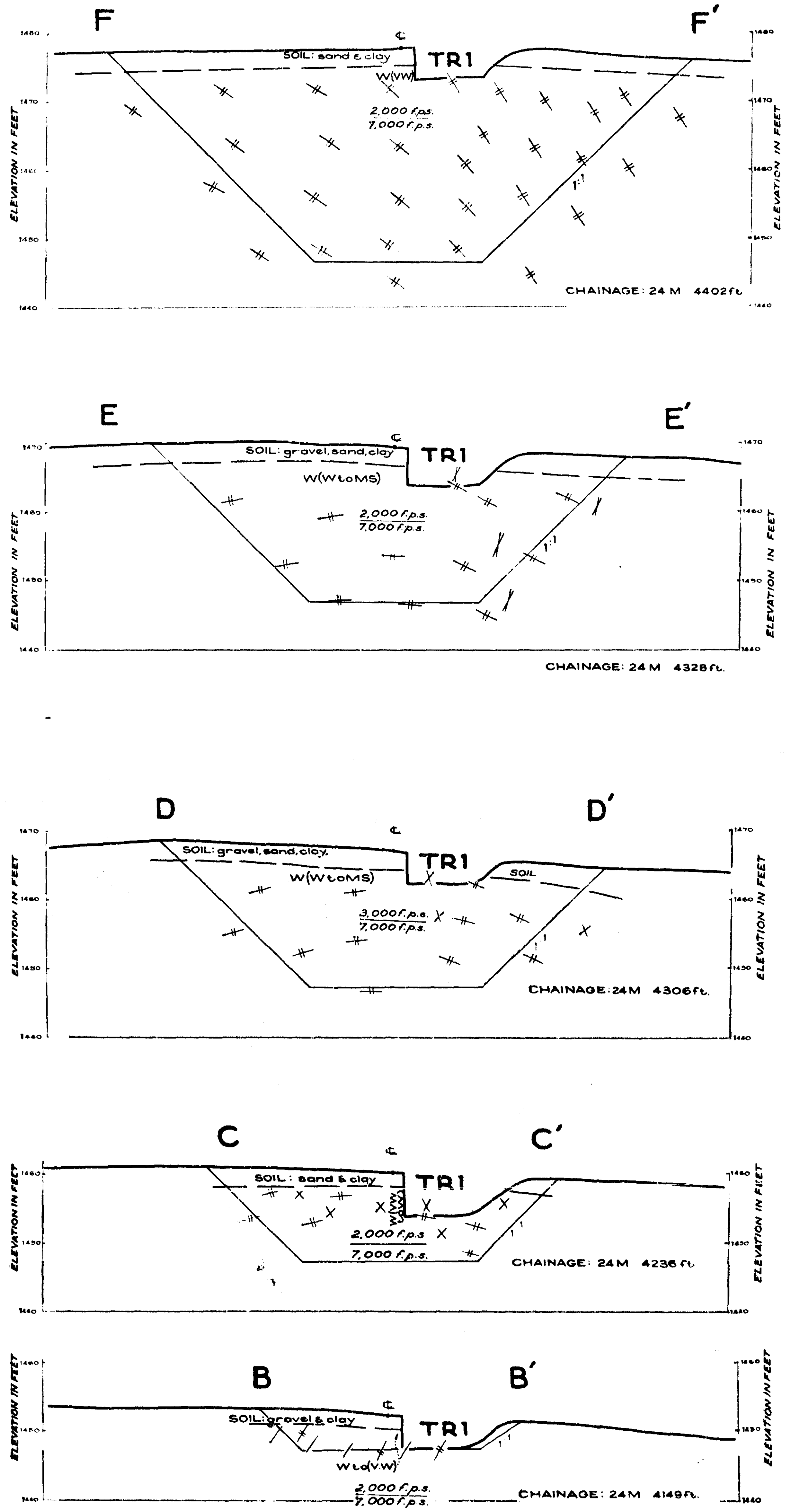
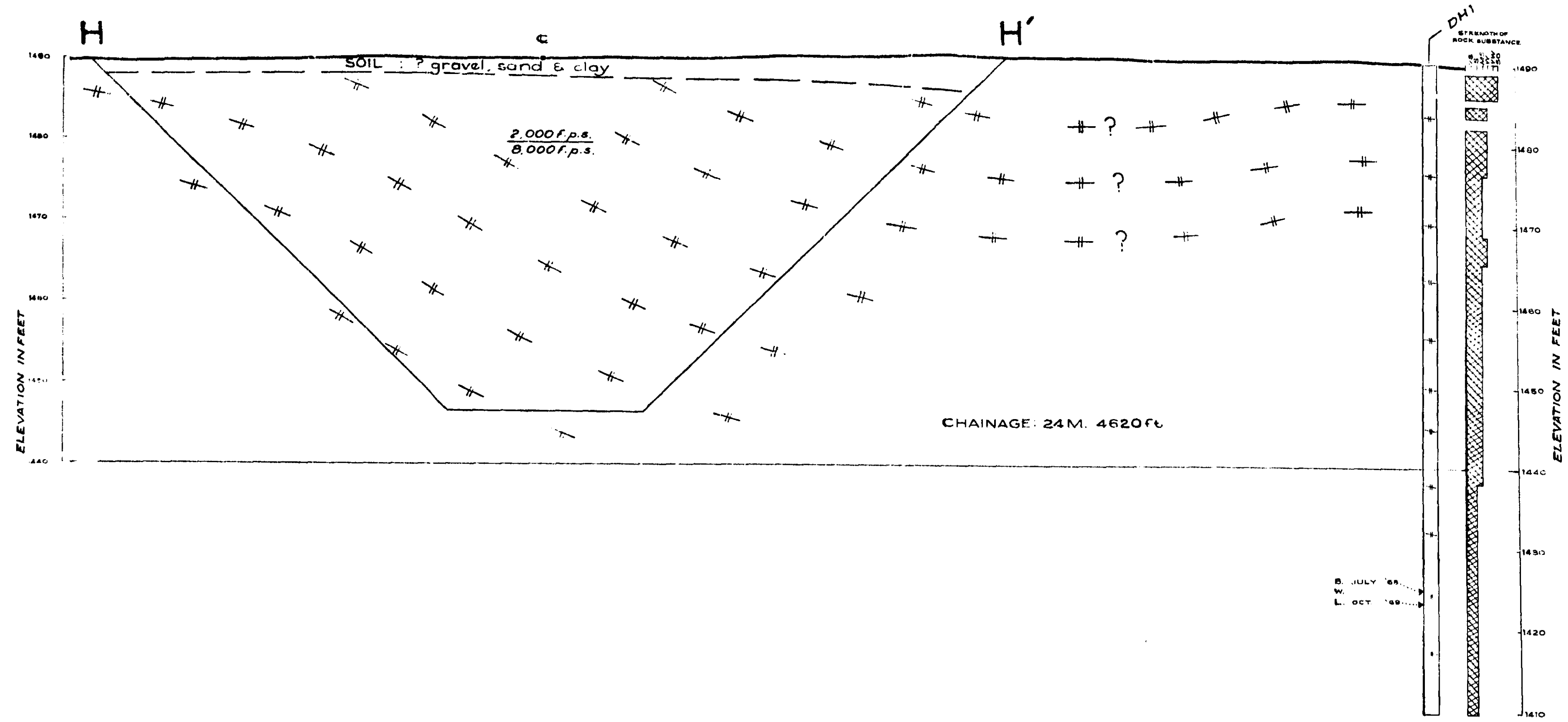


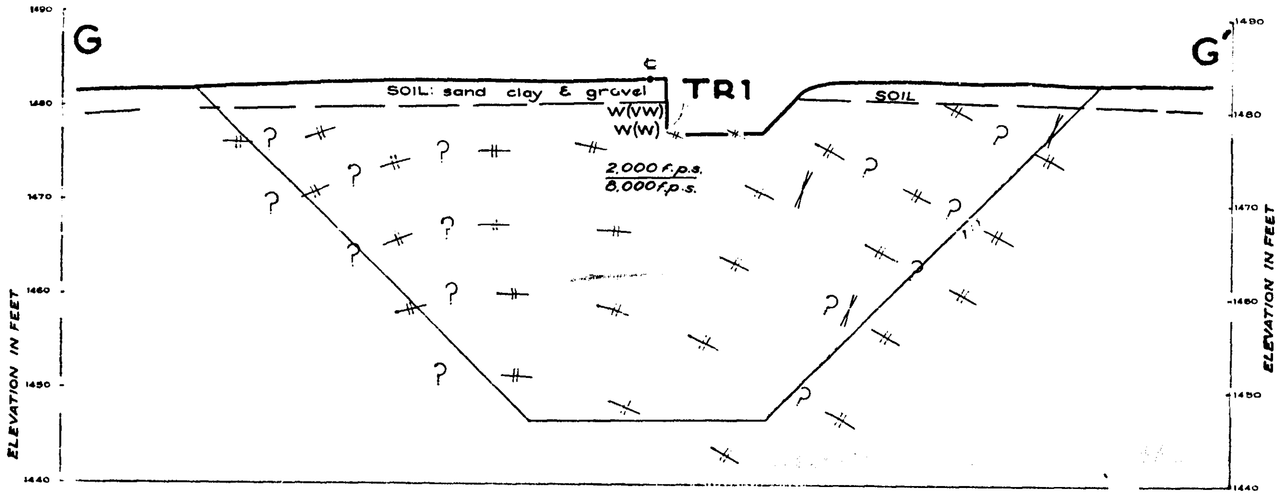
FIG. 5

DEPARTMENT OF MINES – SOUTH AUSTRALIA			
MURRAY BRIDGE — ONKAPARINGA PIPELINE SUMMIT STORAGE INLET OPENCUT — GEOLOGICAL LOG OF TRENCHES 1 & 2			
ENGINEERING GEOLOGY SECTION	GEOLOGIST	Drn. R.T. Trd. R.H. Ckd. L.V.W.	SCALE: As shown 70-82 Ha+c
Director of Mines	SEN. GEOLOGIST	Exd.	DATE: 12 Feb 1970


TRENCH 3
SECTION
PLAN
SCHIST, albite - biotite with minor METASANDSTONE
(from TRIAL PIT)
TRENCH 4
SCHIST, albite - biotite, with minor METASANDSTONE
METASANDSTONE, fine - grained
SCHIST, mica - actinolite
Quartz vein strike 263°
ELEVATION IN FEET (R.L.)
SCALE IN FEET
SCALE IN METRES
LOCATION OF TRENCHES
PIPELINE
HD. MACCLESFIELD
HD. ONKAPARINGA
TRENCH 5
TRENCH 6
Schistosity: strike 057°±10° dip 10°S
TRENCH 7
Schistosity: strike dip
TRENCH 8
SOIL TYPES
GRAVEL GW, well graded GM, excess silty fines GC, excess clayey fines
SAND SW, well graded SM, excess silty fines SC, excess clayey fines
SILT ML, low plasticity MH, high plasticity
CLAY CL, low plasticity CH, high plasticity OH, ORGANIC SOIL, high plasticity
ROCK TYPES
SCHIST, ALBITE - BIOTITE, evenly laminated
METASANDSTONE, schistose; fine-grained, silty
METASANDSTONE, massive; medium to coarse-grained; feldspathic
SCHIST, MICA - ACTINOLITE, yellow - brown; pods and lenses of hard quartz-actinolite rock
SCHIST, MICA, undifferentiated; rocks of green-grey colour containing major mica & ferromagnesians with minor feldspar
CONDITION OF ROCK SUBSTANCE
FR FRESH
D DECOMPOSED
W WEATHERED
A ALTERED
XW EXTREMELY WEATHERED ie. having SOIL PROPERTIES (followed by Unified symbol)
STRENGTH OF ROCK SUBSTANCE
VS VERY STRONG
S STRONG
MS MEDIUM STRONG
W WEAK
VW VERY WEAK
TYPICAL SECTIONS
TRENCH FACE
TRENCH FLOOR
For Sections see plan
R-B' to H-H' 69-581
I-I' to N-N' 70-111
P-P' 69-926
FIG. 6
DEPARTMENT OF MINES — SOUTH AUSTRALIA
MURRAY BRIDGE — ONKAPARINGA PIPELINE
SUMMIT STORAGE
INLET OPENCUT — GEOLOGICAL LOG OF TRENCHES 3-8 & LOCATION OF TRENCHES 1-8
ENGINEERING GEOLOGY SECTION
GEOLOGIST
SEN. GEOLOGIST
Director of Mines
SCALE: As shown
70-83
DATE: 12 Feb 1970

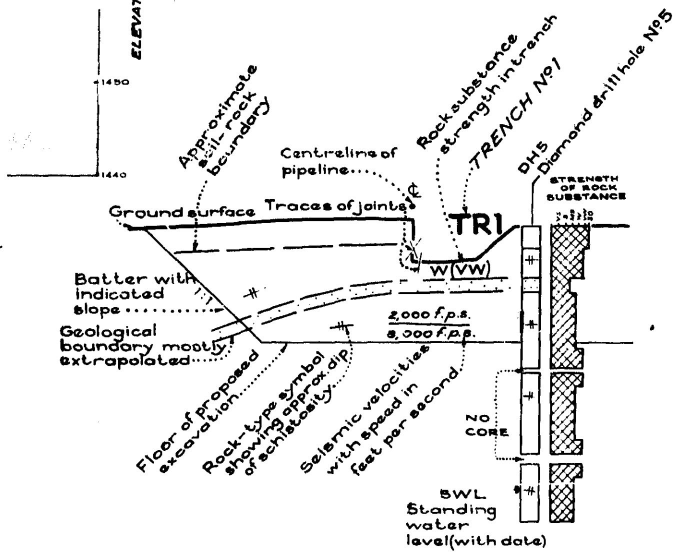






CHAINAGE: 24 M 4477 ft.

LEGEND



CONDITION OF ROCK-SUBSTANCE

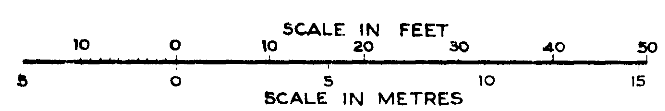
F	FRESH
D	DECOMPOSED
W	WEATHERED
A	ALTERED
XW	EXTREMELY WEATHERED i.e. HAVING SOIL PROPERTIES (FOLLOWED BY 'UNIFIED' SYMBOL)

STRENGTH OF ROCK-SUBSTANCE

VS	VERY STRONG
S	STRONG
MS	MEDIUM STRONG
W	WEAK
VW	VERY WEAK
SO	SOIL PROPERTIES

REFERENCE

- SCHIST, albite-biotite, evenly laminated; rare bands mica schist & metasandstone
- METASANDSTONE, schistose, fine-grained, silty.
- SCHIST, mica-actinolite
- SCHIST, mica, undifferentiated
- SCHIST, mica-kaolin



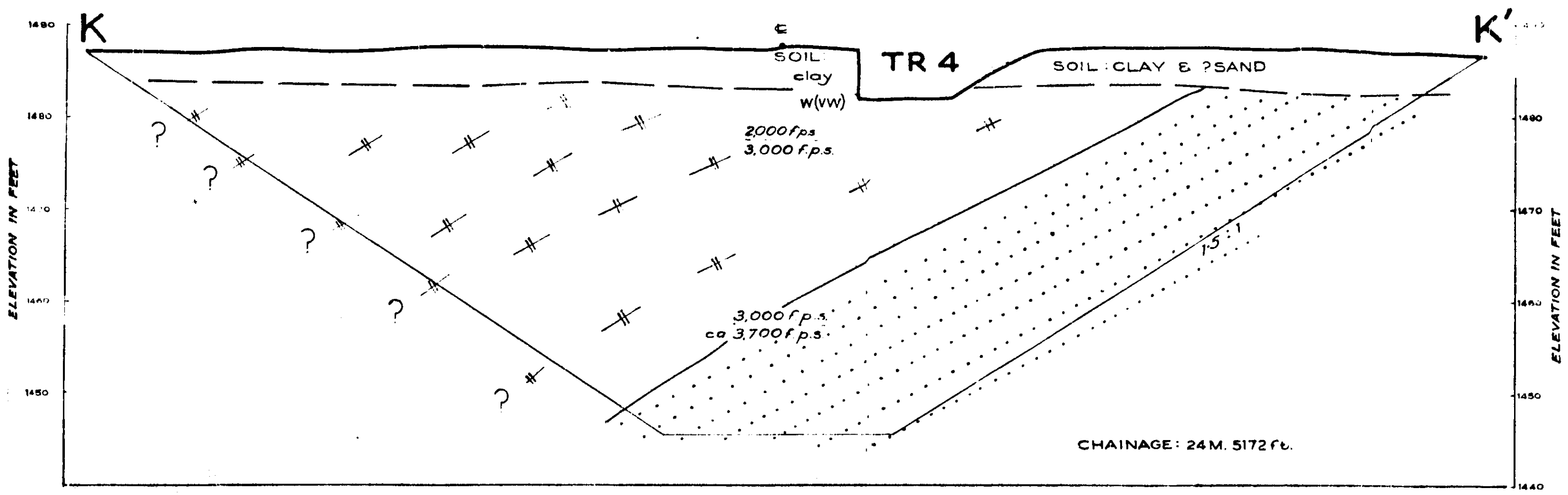
For location of sections see plan 69-781

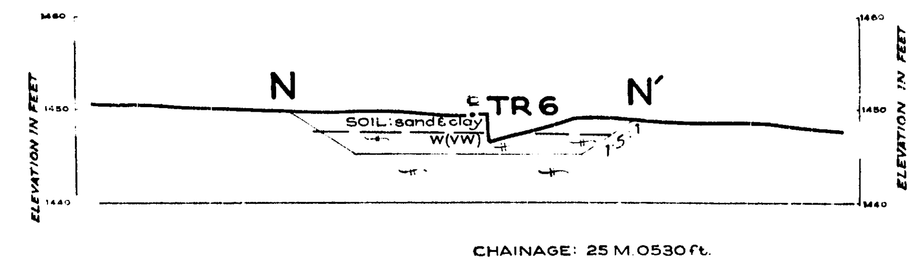
FIG. 7

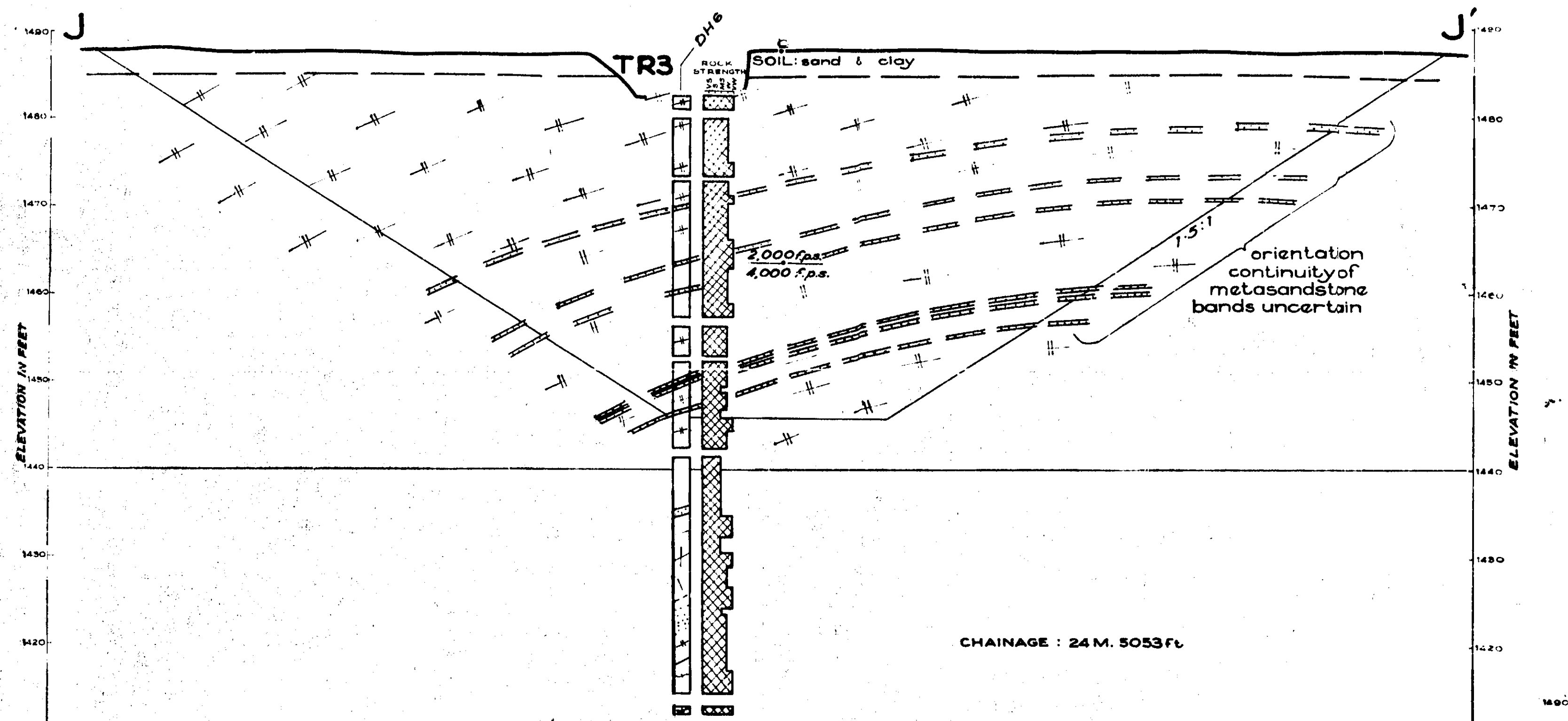
DEPARTMENT OF MINES — SOUTH AUSTRALIA

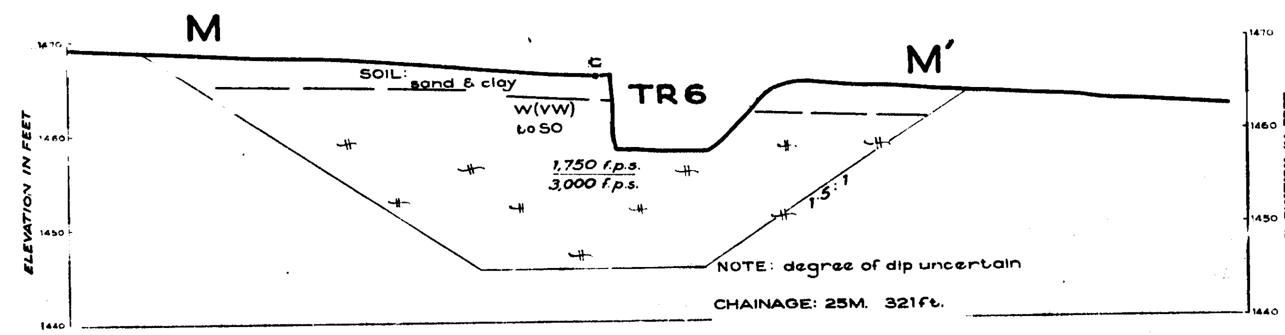
MURRAY BRIDGE-ONKAPARINGA PIPELINE SUMMIT STORAGE AND INLET OPENCUT SECTIONS B-B' TO H-H'

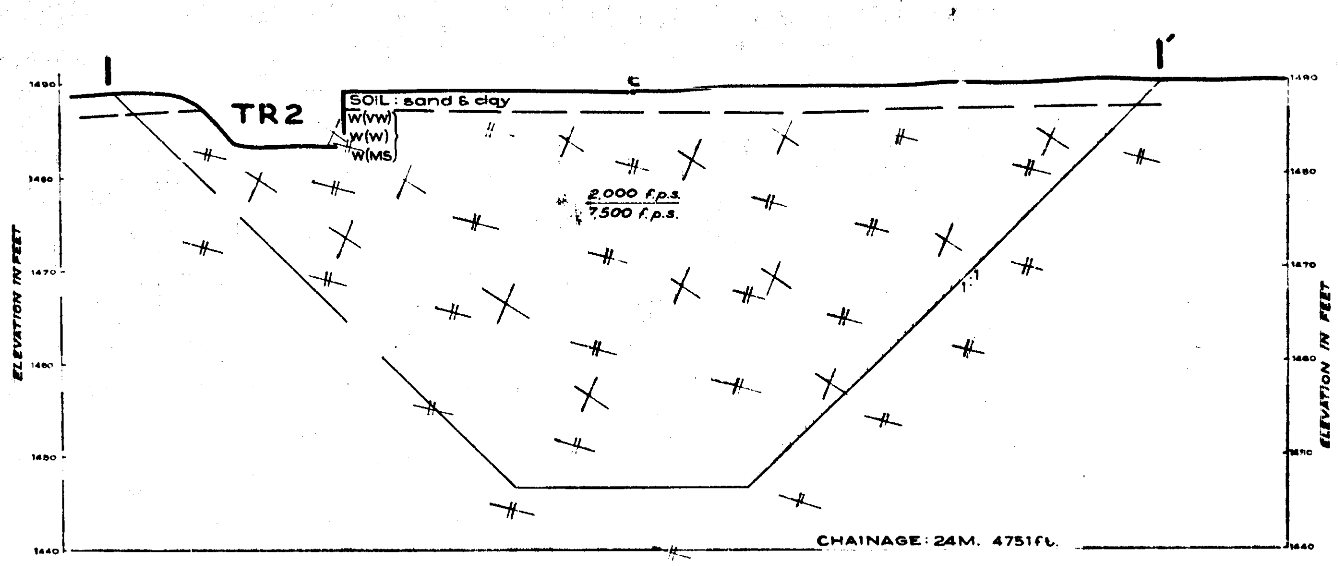
ENGINEERING GEOLOGY SECTION	R. [signature] GEOLOGIST	Drn. G.M.	SCALE: As above
		Tcd. R.T.	69-581
	[signature] SEN. GEOLOGIST	Ckd.	Ha+c
Director of Mines		Exd.	DATE 7 Oct '69

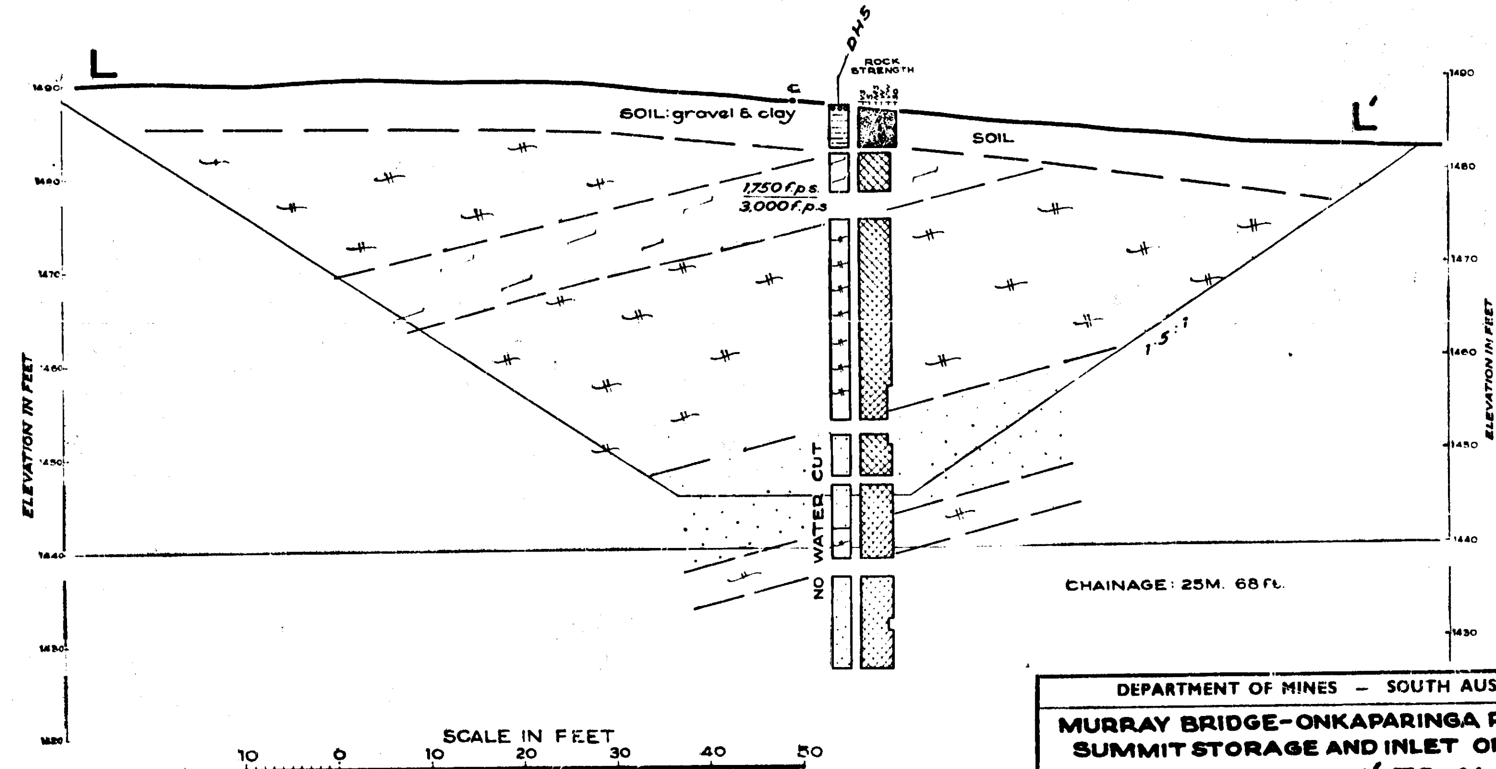












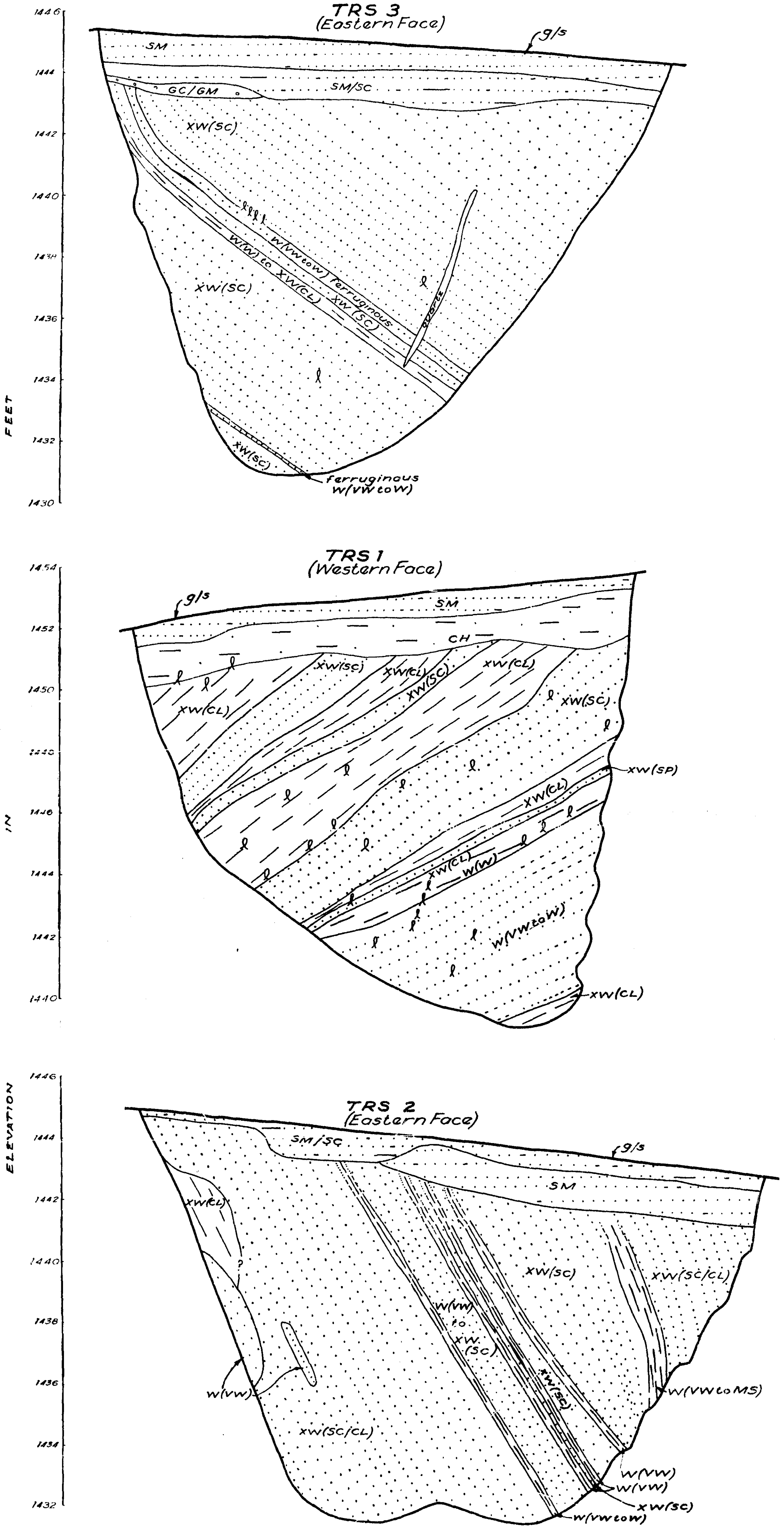
SCALE IN FEET
10 0 10 20 30 40 50
5 0 5 10 15
SCALE IN METRES

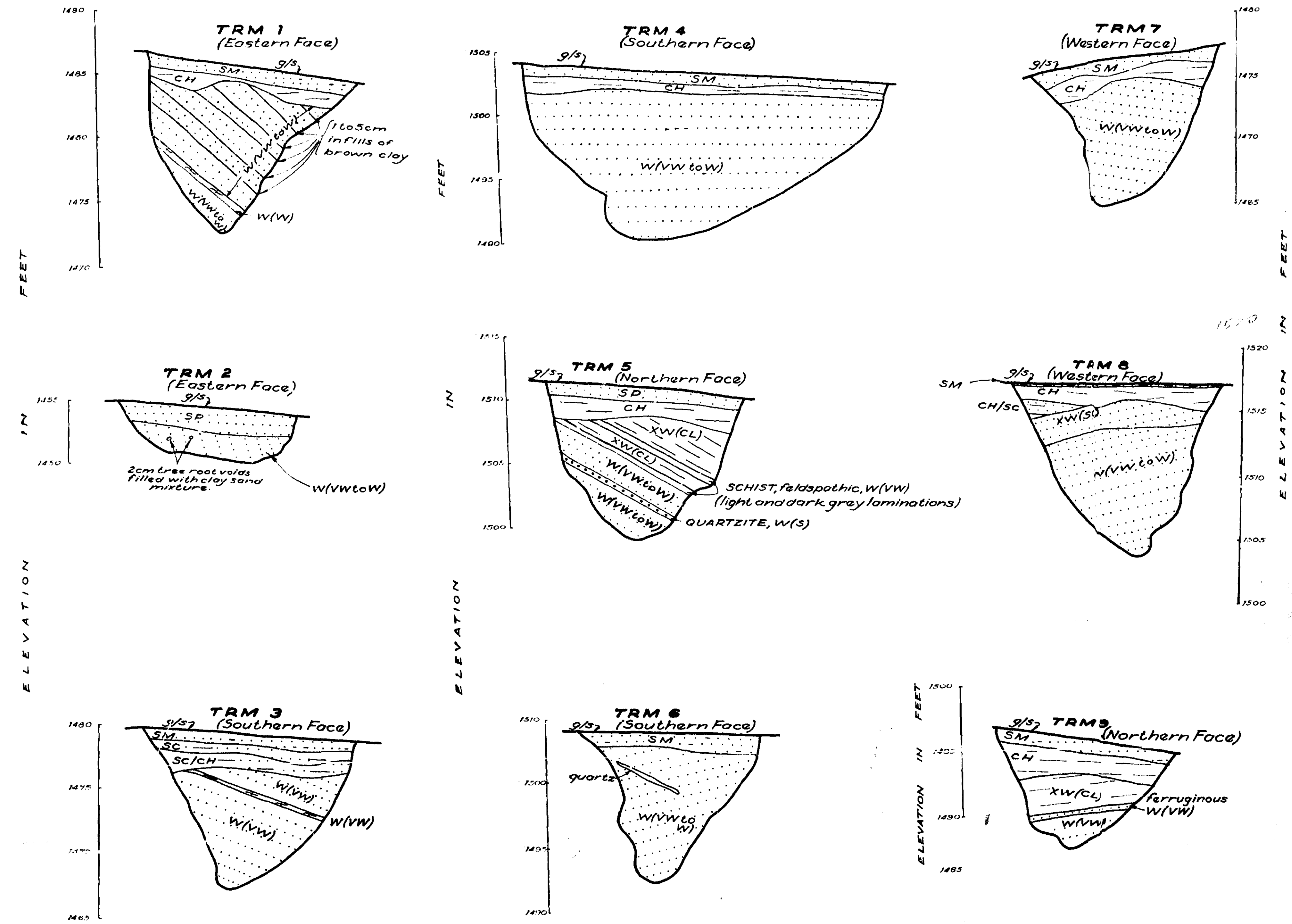
*For **LEGEND** see plan 69-581*

For location of sections see plan 69-781

FIG.8

DEPARTMENT OF MINES – SOUTH AUSTRALIA		
MURRAY BRIDGE-ONKAPARINGA PIPELINE **SUMMIT STORAGE AND INLET OPENCUT** **SECTIONS I-I' TO N-N'**		
ENGINEERING GEOLOGY SECTION	R. Tauyla GEOLOGIST	Drn. RT	SCALE: As shown
		Trd. G.M.	70-111
	SEN. GEOLOGIST	Chd. LVW	Ha+c
Director of Mines		Exd.	DATE: 26 Feb. 1970





SOIL TYPES

according to the Unified Soils Classification

GRAVEL	GM	excess silty fines
	GC	excess clayey fines
SAND	SP	poorly graded
	SM	excess silty fines
	SC	excess clayey fines
SILT		
CLAY	CL	low plasticity
	CH	high plasticity

MAJOR ROCK TYPES

- CLAYSTONE, kaolinitic, pale grey; XW(CL) to W(MS)
- SCHIST, muscovite-feldspar-quartz, light grey; W(VW to W)
- METASANDSTONE, quartz-feldspar/kaolin-mica; medium-to coarse-grained, schistose; XW(SC, SC/CL) to W(W)

Rocks belong to the BURRA GROUP of formations of Adelaidean Age

CONDITION OF ROCK SUBSTANCE

- Fr FRESH
- W WEATHERED
- XW EXTREMELY WEATHERED, classifiable by 'UNIFIED' system for soils

REFERENCE

- ℓ Vegetation root
- g/s Ground surface
- RL Reduced level based on plan
- TRM Trench for materials exploration
- TRS Trench for spillway investigation

STRENGTH OF ROCK SUBSTANCE

- (VS) VERY STRONG
- (S) STRONG
- (MS) MEDIUM-STRONG
- (W) WEAK
- (VW) VERY WEAK

FOR LOCATION OF TRENCHES SEE DWG. Nº 70-670

FIG. 9

DEPARTMENT OF MINES - SOUTH AUSTRALIA

MURRAY BRIDGE ONKAPARINGA PIPELINE SUMMIT STORAGE

SPILLWAY AND MATERIALS SOURCE, RIGHT BANK

GEOLOGICAL LOGS OF TRENCHES

ENGINEERING GEOLOGY SECTION	GEOLOGIST	Compiled I.K.T	Scale: As shown; Date: 7 Aug. '70
Director of Mines	SEN. GEOLOGIST	Drn. G.M.; Ckd.	Drg. No. 70-629 H o+c

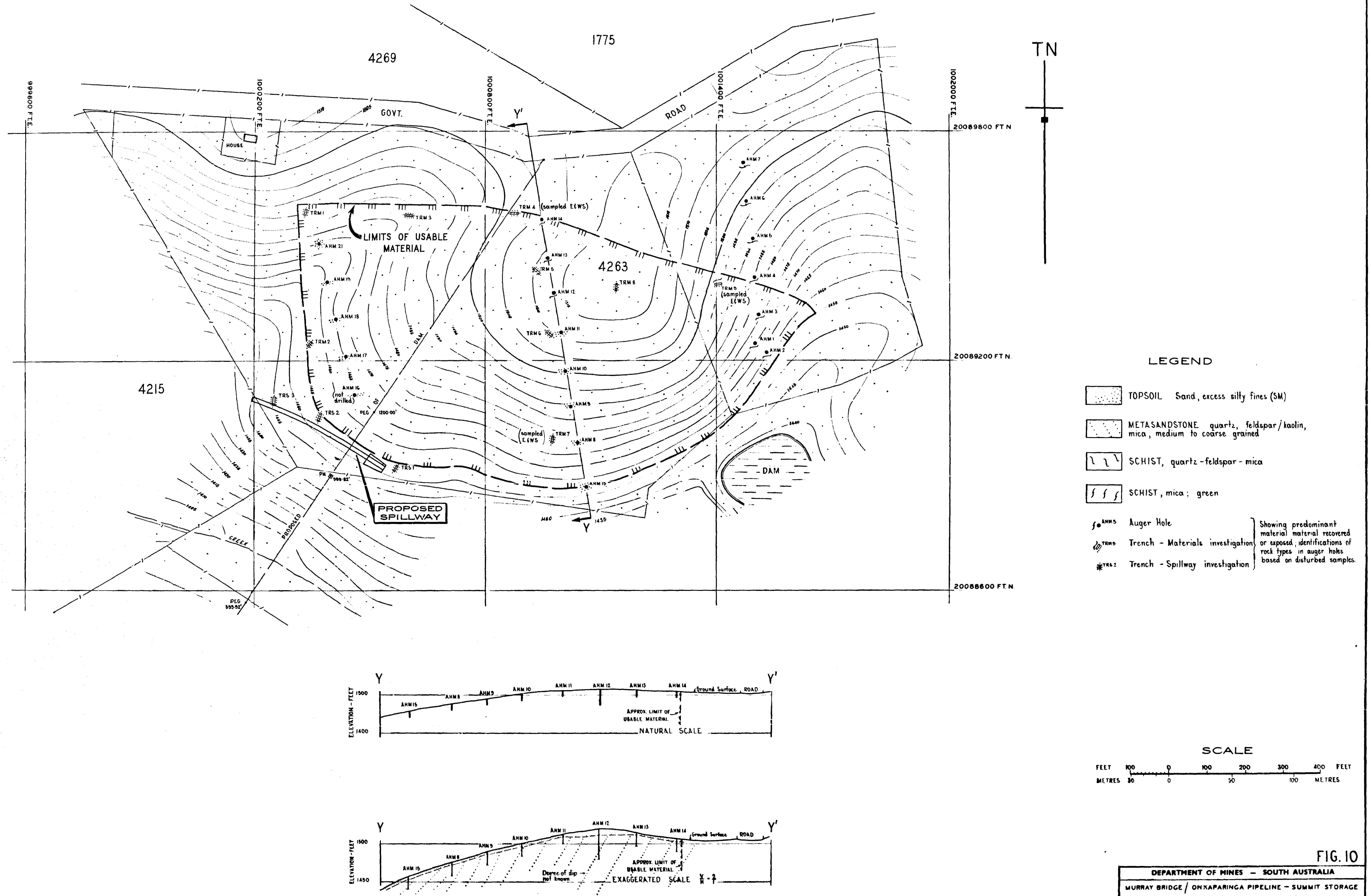
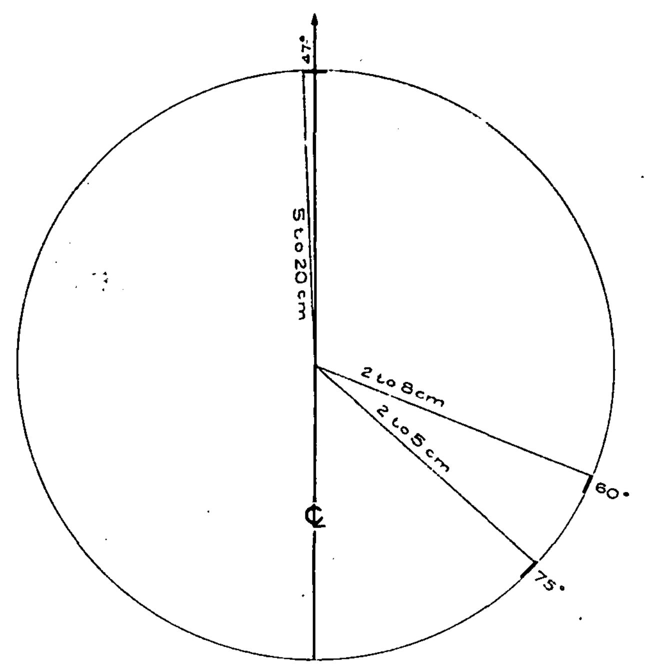
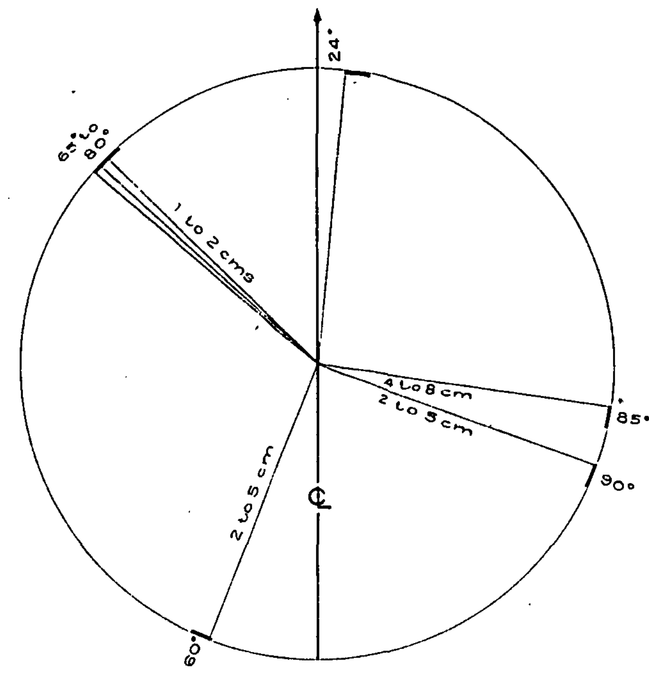


FIG. 10

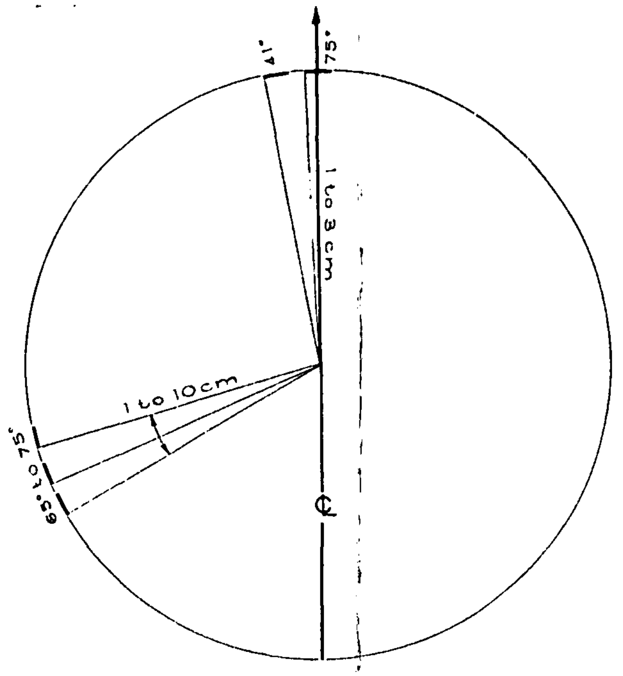
DEPARTMENT OF MINES — SOUTH AUSTRALIA			
MURRAY BRIDGE / ONKAPARINGA PIPELINE — SUMMIT STORAGE			
MATERIALS SOURCE — RIGHT BANK			
LOCATION OF EXPLORATION & GEOLOGICAL SECTION			
ENGINEERING GEOLOGY SECTION	GEOLOGIST	Compiled WRPB	Scale As shown
			Date 28 July 1970
Director of Mines	SUP. GEOLOGIST	Drn. R.H. / Chd. WRPB	Drg. No. 70-670



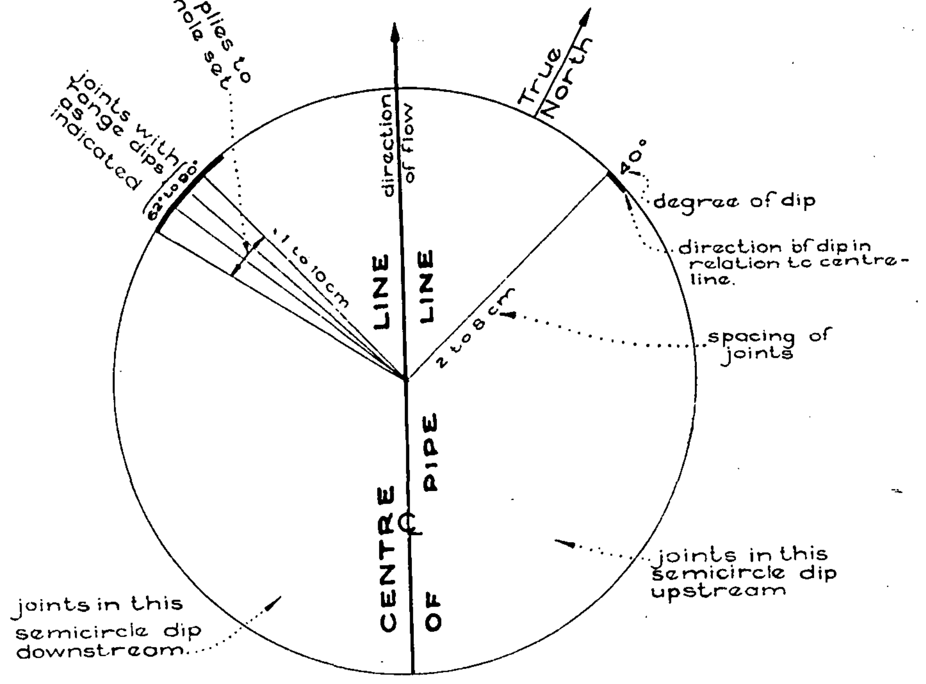
(i) TRENCH 1
Sta 0+00 to 1+00



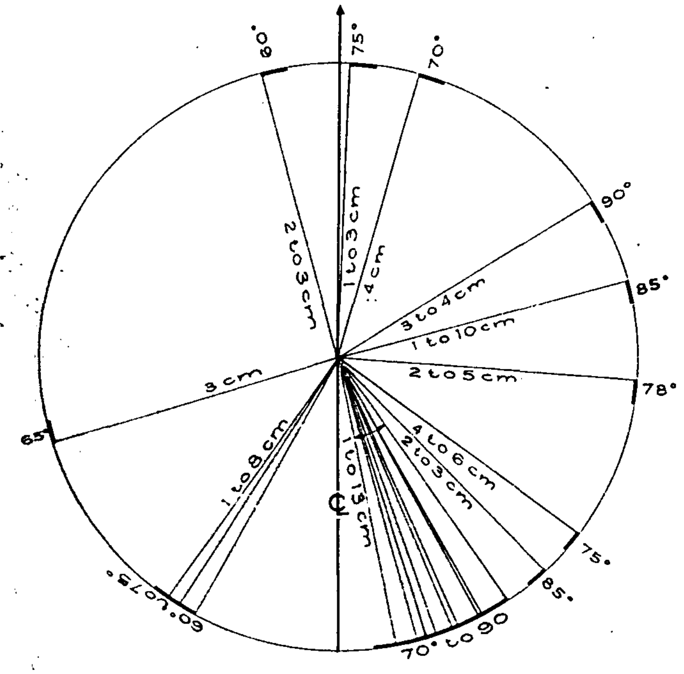
(ii) TRENCH 1
Sta 1+00 to 1+80



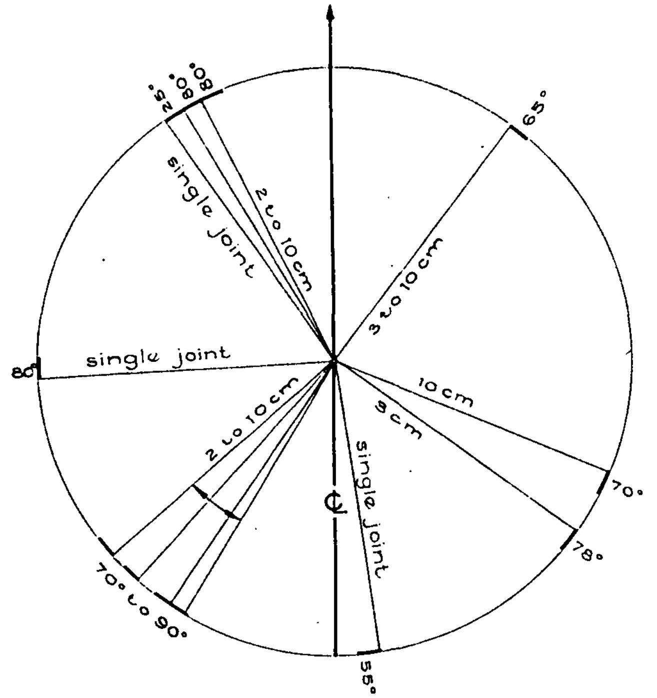
(iii) TRENCH 1
Sta 1+80 to 2+40



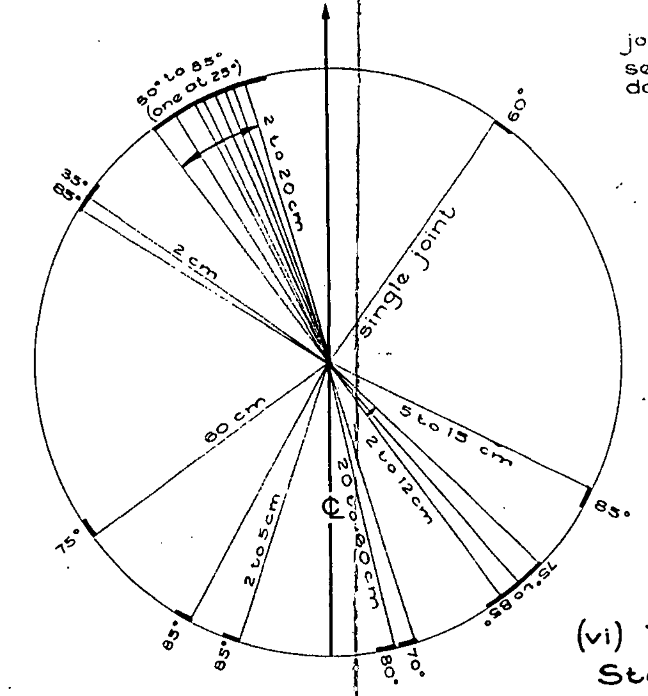
(vii) EXPLANATORY DIAGRAM



(iv) TRENCH 1
Sta 2+40 to 3+90



(v) TRENCH 1
Sta 3+90 to 4+95 (end)



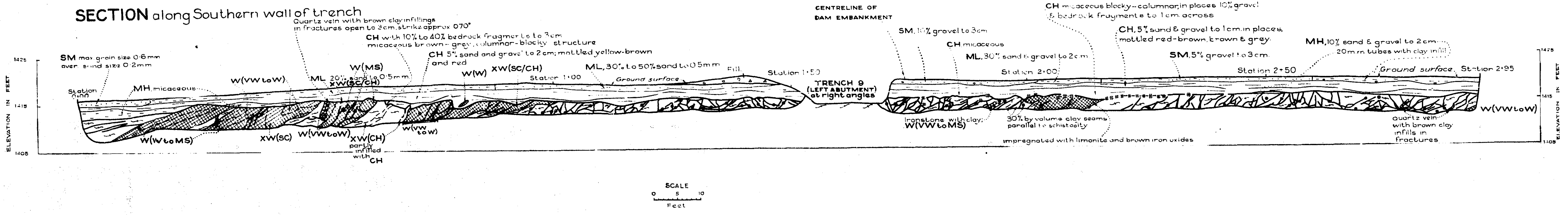
(vi) TRENCH 2
Sta 0+00 to end

FIG 11

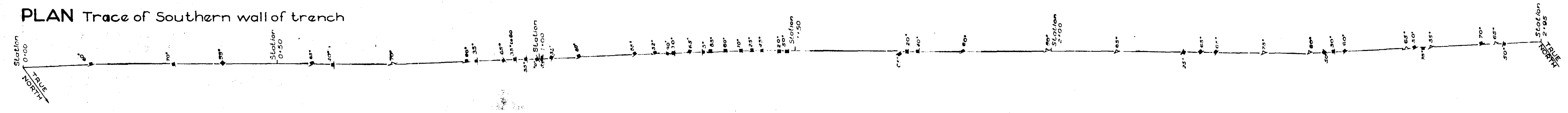
	DEPARTMENT OF MINES – SOUTH AUSTRALIA	Scale: DIAGRAMMATIC
Compiled: R.K.T.	MURRAY BRIDGE – ONKAPARINGA PIPELINE SUMMIT STORAGE, INLET OPENCUT ORIENTATION, ATTITUDE AND SPACING OF JOINTS IN TRENCHES 1 & 2	Date: 1 JULY '70
Drn. G.M. Ckd.		Drg. No. 70-630
		Hotc

1M–2.70 A1811

SECTION along Southern wall of trench



PLAN Trace of Southern wall of trench



LEGEND

- Dip & strike of schistosity
- Trace in trench wall of infilled joint, dip and strike measured and shown as
- Trace in trench wall of infilled joint or non-tectonic fracture unmeasured

Infill in above joints and fractures is CLAY, mostly of high plasticity, calcareous or micaceous in places, maximum thickness 150m.m.; infills <3m.m. not shown

ROCK TYPES

- MICA SCHIST, undifferentiated
- GRANULITE, microcline-hematite

All rock very weak rock unless otherwise indicated in the section

LIME, earthy to nodular

'Unified' SOILS CLASSIFICATION

SM	SAND, excess silty fines
ML	SILT, low plasticity
MH	SILT, high plasticity
CH	CLAY, high plasticity

STRENGTH OF ROCK SUBSTANCE

VS	very strong
S	strong
MS	medium-strong
W	weak
VW	very weak

CONDITION OF ROCK SUBSTANCE

F	fresh
W	weathered
XW	extremely weathered i.e. possessing soil properties and classified by 'Unified' classification

FIG.12

DEPARTMENT OF MINES - SOUTH AUSTRALIA			
MURRAY BRIDGE-ONKAPARINGA PIPELINE SUMMIT STORAGE, OUTLET CONDUIT GEOLOGICAL LOG TRENCH 11, SOUTHERN WALL SEC. 5214 Hd ONKAPARINGA			
ENGINEERING GEOLOGY SECTION	GEOLOGIST	Compiled R.W.T.	Scale: As above
			Date: 17 July 1973
Director of Mines	SEN GEOLOGIST	Drn. G.M.	Drg. No. 70-679
		Ckd.	Hote