DEPARTMENT OF MINES
SOUTH AUSTRALIA

REPORT ON THE GEOLOGY OF KANGAROO CREEK DAM

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INTRODUCTION

The site for the Kangaroo Creek Dam is on the Torrens River, 14 miles northeast of Adelaide (Fig. 1). The dam is to provide 250,000 acre feet of storage for the Adelaide metropolitan water supply system. A diversion tunnel in the right bank, constructed during 1966, will provide permanent outlet works during operation of the reservoir.

Details of the proposed dam are as follows:-

Rock fill, concrete slab upstream face.

Upstream face 1.3 : 1, Downstream face 1.4 : 1

Total volume of rockfill 450,000 cu. yds.

Maximum height above stream bed 190ft.

Crest length 440ft.

Dam crest level, R.L. 910ft.

Full supply level R.L. 900ft.

A channel spillway, crest level R.L. 900ft. in the left bank is designed to pass a maximum flood of 40,000 cusecs. It is proposed to use rock from the spillway excavation as rockfill in the dam.

Geological investigations of the site have included the following:

..... Regional geological mapping. Use was made of aerial photos and 1-inch to 1-mile maps of the Geological Survey of South Australia (Ref. 2 and Fig. 1).

..... Detailed geological mapping. Outcrop maps, sections and profiles were prepared on scales of 1in. = 40ft. and 1in. = 10ft. (Figs. 2,3,5,6, and 8,9,10).

..... Detailed logging of cuttings along Old Gorge Road, Gorge Road Deviation and Access Road (Fig. 3).

..... Diamond drilling. 27 holes were drilled using NX and NMLC equipment (Appendix A).

..... Water pressure testing of drill holes (Appendix A).

..... Exploratory adits. Two adits were constructed in the left bank, upstream from the site and logs were prepared on a scale of 1in. = 10ft. (Appendix B.)

..... Diversion tunnel. Logs were prepared on a scale of 1in. = 20ft. (Appendix C).

..... Laboratory tests on rocks. Samples were tested for strength and durability (Appendices D & E.)

GEOLOGY OF REGION

Adelaide is situated on an uplifted coastal plain at the eastern margin of the Gulf St. Vincent. The plain is bounded to the east by the Mount Lofty Ranges, a series of step-faulted ridges and plateaus trending roughly northeast. The River Torrens is the largest of several streams deeply entrenched into the western part of the ranges, and discharging on to the coastal plain. Between the headwaters and the plain the Torrens flows through a gorge about six miles long.

The geology of the Adelaide region is shown on Fig. 1 and is described by Stapledon (Ref. 1) and Campana (Refs. 2 and 3).

The succession is summarised as follows:-

AGE	DESCRIPTION	LOCATION
Recent to Pleistocene	Unconsolidated marine clays and sands; alluvial clays, sands and gravels.	Coastal Plain
Tertiary	Marine sediments; fossiliferous limestone, calcareous sandstones, marls, sands and clays.	Coastal Plain
	Lacustrine sediments; sands, clays and lignites.	Coastal Plain
Proterozoic	Slates, phyllites, sandstones, quartzites, limestones, dolomites and tillites.	Mt. Lofty Ranges
Archaean	Schists and gneisses.	Mt. Lofty Ranges

The dam site is located near the southern tip of an elongated belt of Archaean rocks, known as the Houghton Complex. The Archaean rocks are bounded on both sides and to the south by Proterozoic rocks of the Torrens Group. The Kitchener Fault crosses the river about 600ft. upstream from the dam site and dips 40° to 50° to the southeast (downstream), forming the eastern boundary between the Torrens Group and Houghton Complex rocks. It is a zone, several hundred feet wide, containing numerous narrow crushed seams.

GEOLOGY OF SITE AREA

Topography

The dam site is located close to the upstream entrance to the steepest portion of the Torrens Gorge. In the site area the gorge is up to 700ft. deep. The river follows a straight course for 1,000ft., in a direction slightly north of west. The gradient is approximately 1 in 35.

The valley is generally asymmetric with the left and right banks in marked contrast. On the right bank the ridge rises 600 to 800ft. above river level and in the lower 250ft. consists mainly of rock outcrops. Slopes range from 30° to 45° near the downstream toe of the dam to 45° to vertical on the upstream side of the dam axis. The left bank ridge rises up to

550ft. above the river level and consists of rock outcrops in minor ridges trending upslope and separated by soil-filled gullies. Slopes are mainly 30° to 45°, flattening near the top of the ridge. The valley floor is from 30 to 60ft. wide and is mainly occupied by the river bed.

Rock Types

Type and Distribution

The terms "rock material" and "rock mass" are used, as defined by John (Ref. 4, p. 3).

Three main types of rock material have been recognised.

Schist. This is a rather weak, fissile rock consisting essentially of extremely fine-grained sericite and quartz which enclose quartz augen or lenses generally less than 2mm. thick. It shows pronounced planar foliation along which it breaks readily into platy or tabular fragments under a light hammer blow.

Gneiss. This consists essentially of quartz, feldspar, sericite and chlorite. It is coarser grained, and has a more banded appearance than the schist. The banded appearance is due to a pronounced gneissic foliation, but the rock is appreciably stronger and less fissile than the schist.

Granitic gneiss. This consists essentially of quartz and feldspar crystals 1 to 10mm. across. Foliation is either absent or poorly developed. The rock commonly contains thin bands or lenses of schist, and quartz in veins or mineralised vugs. The bands of granitic gneiss are up to 15ft. thick and generally occur at intervals of 20 to 50ft.

The rock mass at the dam site is composed of alternating layers and lenses of these three rock types. The boundaries between the layers and lenses are generally parallel to the foliation planes in the rocks, and are usually not clearly

defined; there is a gradation from one type to the other. The left bank is underlain almost entirely by schist, and the right bank mainly by gneiss, with localized bands of schist and granitic gneiss.

Physical Properties

The results of unconfined compression tests on dry cores of the three types of rock material are given in Appendix D. Table 1 summarises the results.

TABLE I

PHYSICAL PROPERTIES OF ROCK MATERIALS

ROCK TYPE	NO. OF SAMPLES	UNCONFINED COMPRESSION STRENGTH lb / sq. in.		MODULUS OF ELASTICITY lb / sq. in. x 10^6	
		Average	Range	Average	Range
Schist	11	3,650	3,040	2.5	4.4
Gneiss	9	10,660	7,660	7.3	8.0
Granitic Gneiss	4	11,300	8,800	5.9	0.5

A further series of unconfined compression strength tests were conducted on paired samples of schist. One of each pair was tested dry: the other after soaking in water for one or two weeks. The test results are given in Appendix D. The samples showed between 20 and 70% loss of strength after soaking.

In both the wet and dry tests the unconfined compressive strength shows a marked increase as the angle between foliation planes and applied stress directions changes from 40° to 90°.

The results of laboratory tests on rock spoil from the exploratory adits and on drill cores and rock spalls are given in Appendices D and E.

Geological Structures

Although the rock materials are relatively strong and compact in small samples, the rock mass is weakened to varying degrees by geological defects of the type shown in Fig. 4. In this figure, and in the following text, the terms spacing and extent are used as defined by John (Ref. 4). The orientations of most types of defect are shown in the diagram on Fig. 3.

Foliation, strikes N.320° to 360°E (i.e. 45° to 60° to the river direction) and dips 45° to 60°E (upstream). The foliation is the oldest structure and is a defect inherent in most of the rock material.

Joints occur in 4 main sets. The spacings of the joints within each set are variable over the site area.

Set (i) joints strike N 320° to 360°E. dip 45° to 65°E (i.e. parallel to the foliation). They generally extend 50ft. or more. They have slickensided surfaces and appear to have been formed by shearing. They are planar or slightly curved so as to intersect each other and divide the rock into platy slabs. Where exposed in sections of the diversion tunnel unaffected by weathering, most Set (i) joints are spaced between 3 and 15ft. and are tightly closed. In sections of the Adits which have been affected by weathering, Set (i) joints are commonly slightly open and partly clay-filled.

Set (ii) joints strike N 65° to 75°E, (i.e. approx. 35° to river direction) dip 45° to 80°N. They have rough and slightly irregular surfaces and commonly occur en echelon (Fig. 4). In the diversion tunnel Set (ii) joints are spaced between 5 and 30ft. and are commonly slightly open. They are the source of many water seepages into the tunnel. Surface exposures on the right bank show Set (ii) joints extending from 10 to 50ft.

Set (iii) joints strike N 120° to 145°E, (i.e. parallel to the river direction) dip 75° N through vertical to 75° S. Their surfaces are generally rough and irregular. Cliff exposures on the right bank show them spaced from 2 to 40ft. and extending from 50 to 80ft.

Set (iv) joints strike N 15° to 25° E (i.e. approximately perpendicular to the main river direction) and dip 65° to 75° W (downstream). They are similar in appearance and occurrence to Set (ii) joints.

Minor Faults are mainly parallel to Set (i) joints. Two types of faults occur, and are distinguished on the basis of the engineering properties of the fault materials (Fig. 4).

.... Crushed Seams consist mainly of material with soil properties, usually a silt soil with fragments of rock (ML to GP in the Unified Soils Classification System, Ref. 5, p. 14).

.... Sheared Zones are very fissile but may have essentially rock properties if the joints are cemented, or they may behave as soils (gravels) if the joints are clay-coated.

The majority of the minor faults in the site area consist of sheared zones up to 1ft. thick containing one or more crushed seams up to 0.05ft. thick. In the diversion tunnel these faults are exposed at intervals of 5 to 100ft. (Appendix C).

Bankung or exfoliation joints occur more or less parallel to the natural ground surface. They are believed to be formed as a result of weathering processes, and are discussed below.

Weathering

Weathering is defined here as disintegration of rock due to the action of surface agencies and phenomena. Two distinct types of weathering have been recognized, namely mechanical and chemical.

Mechanical Weathering. This is mechanical failure of the rock due to the opening up of joints near the ground surface, and is believed to be initiated by the redistribution and release of stresses within the rock mass when overburden is removed by erosion. Once fine cracks develop, the mechanical weathering process is continued by the roots of vegetation which grow down along them, and perhaps by deposition of clays with expansive properties. Other factors, e.g. climatic, probably also contribute.

In rocks which contain few joints of tectonic origin, irregular joints almost parallel to the ground surface tend to form as part of the mechanical weathering process. Keislinger (Ref. 6) describes these as Bankung or exfoliation joints. They are clearly formed by failure of the rock across its fabric.

On the right bank Bankung type joints are exposed in road cuttings and cliffs, spaced from 4 to 20ft. They are mostly open, commonly as much as 0.3ft., or filled with plastic soils. Much of the ground surface near the downstream toe of the dam is formed by one or more of these joints. In the downstream section of the diversion tunnel the rock mass is partly loosened within 15ft. of the ground surface and several Bankung joints are exposed in the portal excavation. In the tunnel, near the upstream portal, the rock mass is considerably loosened due to mechanical weathering at depths of up to 40ft. below the ground surface.

On the left bank there are very few typical Bankung joints, and it is clear that mechanical weathering has resulted in small movements along joints and faults of tectonic origin.

Trench 1 beside the Old Gorge Road (Fig. 3) exposes joints containing infilled clay up to 0.4ft. thick and penetrated by roots, up to 0.2ft. diameter. The base of this trench is 15ft. below the original ground surface. In parts of Adit No. 2 up to 70ft. vertically below the ground surface, several joints and minor faults contain seams of infilled clay up to 0.05ft thick.

Chemical Weathering. This is decomposition of the rock material due largely to the action of groundwaters. The rock materials are virtually impermeable and the groundwater has gained access to the rock mass mainly by percolating along joints and faults. The degrees of chemical weathering are defined according to the physical properties of the weathering products, as set out in Table II

TABLE II

WEATHERING PRODUCTS OF ROCKS

TERM	ABBREVIATION	DEFINITION
Fresh	Fr.	The rock shows no discolouration, loss of strength or any other effect due to weathering.
Slightly weathered	SW	The rock is slightly discoloured, but not noticeably weaker than the fresh rock.
Moderately weathered	MW	The rock is discoloured and noticeably weakened, but NX drill cores cannot be broken up by hand across the rock fabric.
Highly weathered	HW	The rock is discoloured and weakened to such an extent that NX drill cores can be broken up readily by hand, across the rock fabric. Wet strength usually much lower than dry strength.
Completely weathered	CW	The rock is discoloured and is entirely changed to soil, but the original rock fabric is mostly preserved. The properties of the soil depend upon the composition and structure of the parent rock.

The change from rock to soil properties is gradational, but is placed nominally between the highly and completely weathered states. Material is defined as soil when it can be excavated by hand methods or sampled by driven tube methods without assistance from structural defects such as joints.

The depth and degree of chemical weathering in the rock at the dam site are extremely variable, as they are related more

to the pattern of joints and faults than to the depth below the ground surface.

On the left bank, drill cores and adits show mainly slightly to highly weathered materials in the first 10 to 40ft. vertically below the ground surface. Below this, much of the schist is fresh, but highly weathered adjacent to some joints and faults. The right bank is formed mainly by fresh or slightly weathered gneiss outcrops. At the upstream end of the diversion tunnel the gneiss was mainly slightly weathered, with some moderately to highly weathered material near joints, up to 35ft. below the ground surface. The gneiss is fresh throughout the remainder of the tunnel, except for locally weathered zones adjacent to a few minor faults, and in the roof near the downstream portal. (Appendix C).

In many places on both banks the outcrops contain shallow, irregular cavities, generally up to 2ft. in the largest dimension. A few deeper cavities are developed at the intersection of joints and range from 10 to 20ft. in the largest dimension. They appear to have resulted from differential weathering of zones rich in accessory sulphide minerals.

Superficial Deposits

Spoil from construction of the Gorge Road Deviation fills the river channel and covers most of the ground surface on the lower slopes of the right bank, extending in several gullies up to R.L. 860. The spoil consists of rock fragments ranging from silt sizes to boulders 6ft. across, the larger fragments occurring mainly at lower levels. Drill Hole KC30 encountered 16ft. of spoil before entering bedrock at R.L. 718ft. (Fig. 3). At the upstream portal of the diversion tunnel, rock in-situ was 10 to 20ft. below the surface of the spoil. At the downstream portal, bedrock was under a veneer of spoil (Appendix C). Natural soil (up to 6ft. deep in drill hole benches) covers

most of the right bank above Bachelor's Bridge (Fig. 3), and occurs in some places under the road spoil at the site.

On the left bank, soil covers up to 50% of the ground surface. It occurs mainly as a veneer 1 to 3ft. deep over in-situ schist, but thicknesses in excess of 5ft. have been exposed in benches for Drill Holes KC25 and KC27. Landslide debris occurs in isolated deposits, as shown on Fig. 3.

Stability of Natural Slopes

Surface mapping at the dam site has shown scars of numerous landslides, mainly on the left bank (Fig. 3). These can be classified into two distinct types.

Soil slides are recognized by surface morphology. They form saucer shaped depressions having a steep back and sides, with a mound of soil and obviously disturbed boulders some distance down-slope. They occur mainly in the floors and on the sides of soil-filled gullies on the left bank. Their depth has not been determined.

Block slides are relatively intact blocks of rock, isolated from the main rock mass by seams and joints along which they have moved, usually only 2 or 3ft., downslope. A small slide mass of this type occurs immediately downstream from the upstream face on the left bank (Fig. 3).

Road excavations show several V-shaped re-entrant gullies extending 50 to 80ft. above road level. These have clearly been formed by the removal, by sliding, of small wedges of rock during or since construction of the roads.

Groundwater

Water levels in diamond drill holes on the left bank suggest a water table corresponding closely to river level.

Measured water levels on the right bank are higher but do not suggest a simple water table. Wide variations occur from place to place, probably due to disconnected or partly connected bodies of water within the rock mass. This is typical of ground-water in jointed rocks (Ref. 7).

During winter months numerous seepages occur from and immediately above the steep cliff slopes on the right bank. Numerous seepages and small flows up to 10 gal./hr. occurred in the Diversion Tunnel as it was excavated (Appendix C). Most of these diminished or disappeared during the following three months.

Permeability of Rock Mass

Diamond drill holes at the dam site were water pressure tested by the Lugeon Method (Appendix A). Most holes showed moderate leakages of 10 to 40 Lugeons in the first 20 to 50ft. vertically below ground surface. Tests below these levels gave generally very low leakages (0 to 3 Lugeons), with moderate leakages in some isolated sections.

GEOLOGY OF INDIVIDUAL FEATURES

Cut-off Trench

The cut-off trench will be located at the upstream edge of the dam embankment. It will be approximately 700ft. in length, and sufficiently deep and wide to expose groutable rock over a minimum horizontal width of 12ft. Details of the design are shown on Fig. 7.

Left Bank

The surface geology is shown in plan on Fig. 3 and in sections on Fig. 5. The position of the concrete grout cap is approximate, and will depend on the depths of excavation. The surface geology is summarised in the following table.

TABLE III

CUT-OFF TRENCH, LEFT BANK, NOTES ON GEOLOGY

R.L.(ft.) From	To	Approx. Horizontal Distance (ft.)	Notes on Surface Geology
735	753	60	Old Gorge Road and embankment. Fill consists of unsorted schist fragments up to 4ft. across. Position of in-situ rock under fill is unknown.
753	775	20	Cutting exposes fresh to slightly weathered schist and granitic gneiss, joints open up to 0.05ft. Slide block immediately downstream (Fig. 3).
775	800	25	V-shaped re-entrant gully formed during or since excavation of road. Cleanup (Trench 2) reveals sheared zone, 2 to 3ft. wide, with highly to completely weathered rock, in the base of the gully.
800	815	30	Rocky ridge - mainly fresh to slightly weathered schist at surface. Set (i) joints open up to 0.1ft., partly soil-filled.
815	830	30	Numerous small outcrops and loose boulders separated by soil.
830	860	50	Grass covered, soil-filled gully. Where this gully meets the gorge road, it is underlain by relatively weak, fissile schist containing several crushed seams up to 0.2ft. thick, soil-filled in part, with plant roots up to 0.2ft. wide. These are exposed in Trench 1.
860	885	45	Schist and gneiss boulders up to 3ft. with some outcrops, separated by soil.

River Channel

The river channel has been filled with spoil from road excavations. The spoil has been washed by several floods since its deposition. During normal flows (discharge from Millbrook reservoir) the water moves at depth through the spoil, and the upper few feet remain dry.

The spoil exposed at the surface is mainly fresh or slightly weathered schist and gneiss fragments, ranging in size from less than 0.1ft. up to 6ft. in the largest dimension. Drill Hole KC30, 80ft. upstream from the cut-off trench, passed through 16ft. of rock spoil before entering fresh rock at RL 718ft.

The rock recovered was in core lengths less than 0.5ft.

The spoil also contains some timber debris. Some of this is probably the remains of timber and vegetation in the channel prior to filling with spoil, and the remainder has been brought down by floods during and since deposition of the spoil.

Mapping upstream and downstream from the site, and inspection of old photos, suggests that originally the river bed occupied most of the valley floor, and it is expected that the river bed beneath the spoil consists mainly of fresh rock outcrops.

Minor faults located during mapping and drilling of the valley sides mostly strike obliquely to the river channel. It is usually found that where such localized weak zones occur in a stream bed, they have been eroded deeper by the river to form trenches or slots. Such slots are usually backfilled with alluvial materials.

Right Bank

The surface geology is shown in plan on Fig. 3, and in cross section on Fig. 6. Table IV summarizes the geology along the line of the Cut-off Trench shown in plan on Fig. 6. Section KK' on Fig. 6 is up to 20ft. upstream of this line.

TABLE IV

CUT-OFF TRENCH, RIGHT BANK, NOTES ON GEOLOGY

R.L.(ft.) From	To	Approx. Horizontal Distance (ft.)	Notes on Geology
735	775	145	Spoil from road excavation. Boulders of gneiss and schist up to 4ft. across. Generally larger sizes at lower levels. The Inlet Portal excavation, upstream of the cut-off trench, and between RL's 720 and 770, exposed in-situ gneiss beneath up to 20ft. of road spoil. The gneiss is mainly fresh to slightly weathered, with joints slightly open or clay-filled.
775	880	170	Outcrop, mainly of gneiss, with some granitic gneiss. Fresh to slightly weathered. Set (ii) and (iii) joints form steep cliffs. Joints are mainly tightly closed, but open in a few places up to 0.5ft. At RL 805 there is a pocket of soil with swamp type grasses. Seepages occur from joints upslope.
			Between RL 840 and RL 870, the line of the upstream face is up to 4ft. inside the proposed boundary of the knob to be removed i.e. the cut-off trench will be excavated within the knob excavation (Fig. 6 Section 00', See also section of report "Right Abutment Block and Access Bridge").

Rock Fill Zones

Left Bank

Slopes in the left bank foundation area range from 40° to 60° in the lower part including the cutting of the Old Gorge Road, to 30° at higher levels.

About 20% of the ground surface consists of schist outcrops, mainly slightly weathered. The rock outcrops mainly form ridges trending upslope. Joints in the outcrops are generally open at the surface up to 0.2ft. and partly filled with soil and plant roots up to 0.2ft. diameter.

A further 50% of the ground surface is covered by soil, mainly in gullies between the ridges. Where exposed in the road cutting, drill benches and exploratory adits, this soil is seen to be mainly less than 5ft. deep, extending to greater depths in isolated pockets along joint planes. In the road exposures, the soil overlies partly weathered and loosely jointed rock similar to that forming the outcrops.

The remaining 30% of the ground surface is covered by landslide scars and slide debris. The depth to which the slides affect the ground has not been determined. The slide material at the surface consists of angular schist boulders ranging from 1 to 10ft. across, loosely packed, in a clayey soil matrix.

River Channel

The river channel is filled mainly by road spoil with some timber debris, as discussed above under "Cut-off Trench."

Right Bank

Slopes on the right bank foundation area range from 20° on the road spoil near the river to 50° on the upper slopes, with several near-vertical cliffs up to 35ft. high.

Rock outcrop forms about 50% of the ground surface. It is mainly gneiss, containing bands and lenses of schist and granitic gneiss. The rock exposed is mainly fresh. However, road cuttings above the dam show loosely jointed, slightly to moderately weathered rock in several places. The bands of schist and granitic gneiss are generally more weathered than the gneiss.

Most joints are tightly closed. The intersection of partly open joints in a few places gives rise to semi-detached blocks up to 5 cu. yd. in size.

Foliation in the rocks strikes obliquely to the valley side, and dips into the bank. The rock is intersected by several crushed seams and sheared zones parallel to the foliation. In outcrop they are often partly cemented with limonite, or indicated as narrow slots and soil-filled channels. Road

cuttings show that the sheared zones are mostly less than 1ft. wide, containing seams of crushed rock and clay up to 0.1ft. thick. The rock within and near the zones is usually partly weathered.

Bankung joints occur at the surface in several places and are exposed within 10ft. of the surface in road cuttings.

Road spoil covers the remaining 50% of the ground surface. It occurs mainly at lower levels near the river and extends up the gullies. A study of old photos suggests that the spoil is mainly underlain by rock outcrops, similar in appearance to those exposed on the slopes above, and that natural soil and talus are present locally beneath it.

Channel Spillway

The spillway is shown in plan on Fig. 3 and in sections on Fig. 7. The dimensions of the cutting are as follow:

	Feet
Length (horizontal distance)	900
Width of channel floor	36 to 44
Maximum vertical height, upslope face	210
Maximum depth on centre line	80
Width of berms	15
Vertical distance between berms	50
	Degrees
Cutting angle upslope side (between berms)	45°
Overall angle top to bottom (including berms)	38° to 40°
Cutting angle downslope side	60°

Section J J', Fig. 7 shows the geological conditions at the surface along a line close to the deepest part of the spillway cutting. Sections KK', LL', MM' and NN' show the surface geology along lines across the spillway channel. Sub-surface information from nearby drill holes and exploratory adits is shown in summarized form on the sections.

The foliation strikes at about 30° to the proposed cutting, and dips 45° to 60° N.E., towards the river. Narrow crushed seams (mostly 0.01 to 0.05ft. wide) and clay-filled joints with partly weathered rock adjacent, occur at intervals of 5 to 10ft. throughout holes drilled in the spillway area. Exposures in the Old Gorge Road cutting indicate that the intersection of crushed seams parallel to the foliation, and Set (ii) joints, tend to divide the rock into V-shaped wedges with the long axes dipping downslope at 45°to 60°.

Exposures in road cuttings and the results of drilling (Holes KC.20 and KC.27)show that there are several crushed seams roughly parallel to the foliation which dip at angles of less than 35°.

More detailed information is given in Table V.

TABLE V

CHANNEL SPILLWAY EXCAVATION

Station From	Station To	Horiz. Distance (feet)	Notes on Geology
0+00	5+35	535	Approx. 90% soil-covered, 10% outcrops and loose blocks, mainly of schist. Drill benches show soil generally less than 5ft. deep. Soil and boulders locally deeper in deposits of slide debris in gullies. Adit No. 2 gives an indication of the depth of near-surface chemical and mechanical weathering under the ridge (Appendix B). The bench for Drill Hole KC27 shows 4ft. of soi Drill Hole KC27 (Appendix A) shows:- 0 to 10ft. (45" core recovered) Schist and gneiss, fresh to slightly weathered, fractures spaced 0.1 to 0.5ft. 10 to 105ft. (100" core recovered) Schist, mainly fresh, fractures spaced 0.2 to 3ft., some clay filled joints.
5+35	6+85	150	Approx. 80% soil-covered, 20% outcrops of very flaky schist. Drill Holes KC19 and KC20, sho closely-jointed and seamy, very flaky schist (Appendix A).
6+85	8+85	200	Approx. 50% fresh gneiss outcrops, 50% shallow soil containing gneiss blocks. Road cutting below the spillway discharge point shows fresh to slightly weathered gneiss. The bench for Drill Hole KC20 shows 2ft. of soil. Drill Hole KC20 (Appendix A) shows: 0 to 10ft. (85% core recovered) Schist, slightly weathered.

Station From	Station To	Horiz. Distance (feet)	Notes on Geology
cont.		10 to 50ft. (100% core recovered)	Schist and granitic gneiss, moderately weathered to fresh, fractures spaced mainly 0.1 to 0.8ft.
		50 to 120ft. (100% core recovered)	Schist, gneiss and granitic gneiss, mainly fresh, fractures spaced mainly 0.1 to 1.5ft.

Left Abutment Block

The left abutment block will be a concrete gravity structure at the southern end of the dam and will also form the northern spillway wall between Spillway STA 251 and STA 350. (Fig. 8, Section LL'). The block will be 25 to 30ft. wide at the base and will be 37 to 42ft. high with a horizontal crest at RL.910ft. It will be constructed on a rock foundation made by horizontal continuation of the spillway cutting. The foundation ranges from 10 to 38ft. below the natural ground surface.

The ground surface at the site of the block is hummocky with several deposits of slide material (Fig. 3). It is covered mainly by soil and rock fragments, with several areas of schist outcrop. The bench for drill hole KC27, 50ft. south, exposed 4ft. of soil. The drill core shows:-

0 to 10ft. Schist and gneiss, fresh to slightly weathered. Core recovery 45 %.

10 to 105ft. Schist, mainly fresh, some clay-filled joints and several sheared zones approximately parallel to the foliation. Core recovery 100%.

Right Abutment Block and Knob Excavation

The Right Abutment Block (Fig. 9) will be a concrete gravity structure 63ft. long, 23ft. wide and up to 32ft. high.

The block will be linked with the Gorge Road Deviation by the existing access road which will be deepened near the top of the dam to give a horizontal surface at RL. 913.5ft. (Sections BB', DD' and FF', Fig. 9). The access road will be extended further to the east by filling to the same level.

Part of the right abutment consists of a steep, in places overhanging, knob with open joints and cavities in the lower part. This knob is to be excavated using a smooth blasting technique to produce a surface dipping towards the river at 50°. The knob is shown in plan and section on Fig. 9.

The surface geology is shown on Fig. 3. Exposures are mainly of slightly weathered and fresh gneiss, with several bands of slightly weathered granitic gneiss. Several sheared zones up to 0.5ft. thick and dipping 45° to 60° upstream, pass through the area. There are also several Bankung joints, approximately parallel to the slope. One of these, exposed in the cutting of the existing access road at about 7ft. below the original ground surface (Fig. 9, Section FF'), contains up to 0.5ft. of clay.

Intake Structure

The intake works will be housed in a 240ft. long inclined tower above the inlet portal of the diversion tunnel. Before commencement of the main dam works, it is proposed that a trench up to 16ft. deep and 20ft. wide will be excavated for the structure and the base of the inlet portal excavation deepened to expose a horizontal rock foundation for a concrete base. A steep faced knob of rock upstream of the intake structure (Fig. 10) will also be removed.

The surface geology of the area at present, is shown in plan on Fig. 3 and in sections on Fig. 10. Further information is given in Table VI.

TABLE VI

GEOLOGICAL CONDITIONS FOR INTAKE STRUCTURE

RIGHT BANK

R.L. (ft.) From	To	Approx. Slope Distance(ft.)	Notes on Geology
720	780	68	Mainly slightly weathered to fresh gneiss outcrops at the surface. Numerous Set (i) joints, some open up to 0.2ft. and clay-filled, intersect with Set (ii) and Set (iv) joints to form semi-detached blocks. Several soil-filled channels trend upslope. A steep, partly overhanging knob of rock occurs immediately upstream of the site for the Intake Structure (Fig. 10 Section DD', Elevation EE'). Upstream of the knob a Bankung joint forms a face dipping 40 to 65° towards the river, and appears to continue underneath the knob. Cracks near the top of the knob suggest that there has been some downslope movement.
780	822	53	Fresh to slightly weathered gneiss outcrops at the surface. Joints mainly tight; few are open to 0.02ft.
822	845	27	Slightly weathered granitic gneiss outcrops at the surface. Few joints, tightly closed.
845	905	95	Surface partly covered by thin veneer of road spoil. Outcrops are mainly slightly to moderately weathered gneiss with lenticular bands of granitic gneiss, mainly moderately weathered.

Access Shaft

The Access Shaft will be located at the northern end of the berm on the downstream face of the dam embankment, directly above the diversion tunnel at STA 2 + 67 (Appendix C). An Access House at the top of the shaft will be sited in a cutting which will provide a horizontal base 25ft. wide.

The shaft will be 8ft. in diameter and will extend approx. 37ft. below the base of the cutting, to the roof of the tunnel.

Mainly slightly weathered to fresh gneiss and granitic gneiss forms the ground surface over the shaft site (Fig. 3). Several bankung joints dipping towards the river at 35° to 45° form part of the surface in the vicinity of the proposed cutting.

The tunnel between Sta. 2 + 60 and Sta. 3 + 20 shows mainly fresh gneiss, with few tightly closed persistent Set (i) joints, and discontinuous, tightly closed Set (ii) joints.

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GEOLOGIST
HYDROGEOLOGY SECTION

J.P. TRUDINGER
GEOLOGIST
ENGINEERING GEOLOGY SECTION

JACP:JPT:SMA

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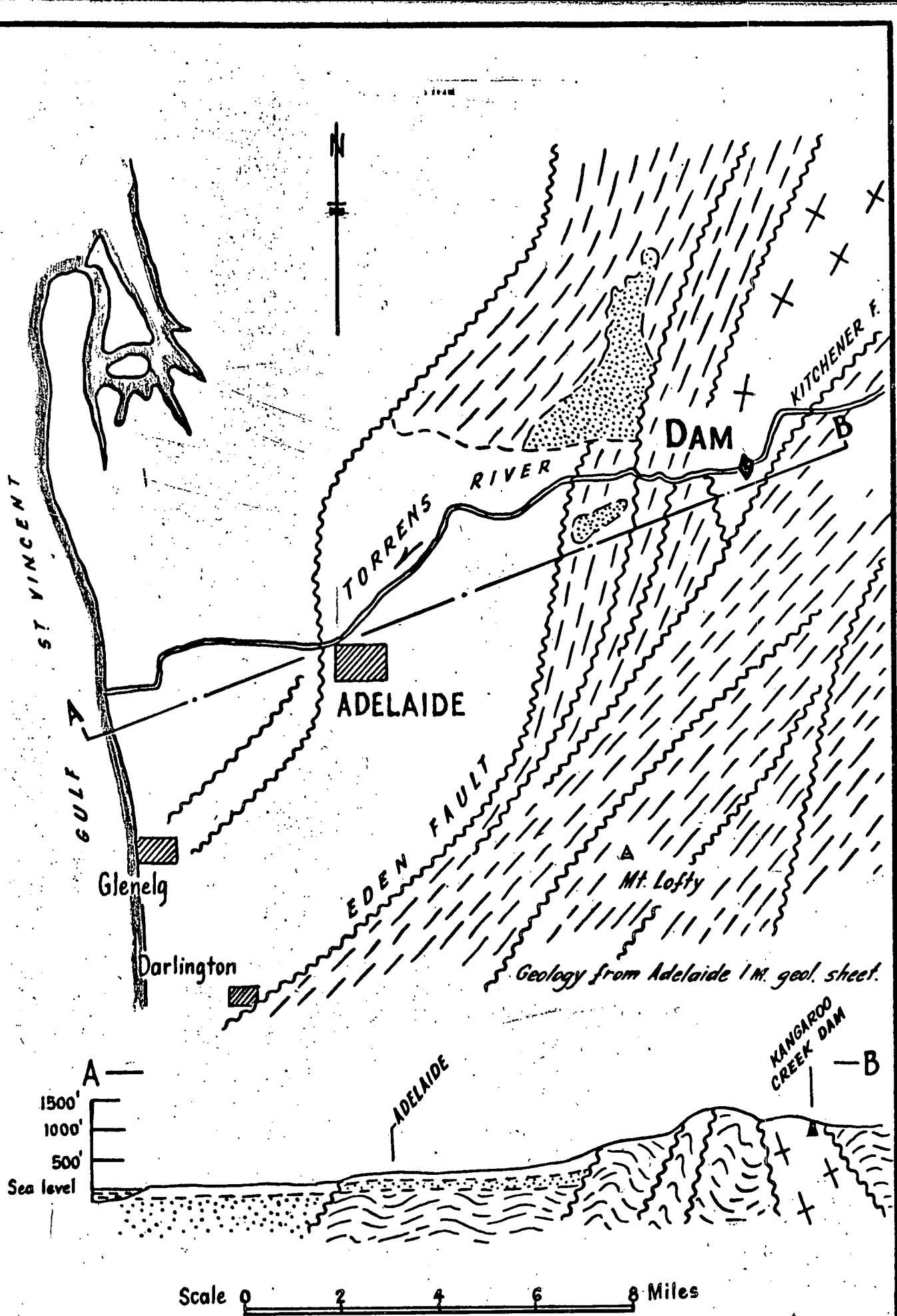


FIG. 1

DEPARTMENT OF MINES — SOUTH AUSTRALIA

ENGINEERING GEOLOGY SECTION	Drn. D.H.S	KANGAROO CREEK DAM LOCALITY PLAN & DIAGRAMMATIC SECTION	SCALE: As shown.
	Tcd. B.S.G.		S·5714 Ha 5+7
Director of Mines	Ckd. D.H.S		DATE: 7th Feb. 1967.
	Exd.		

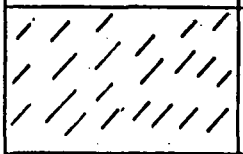
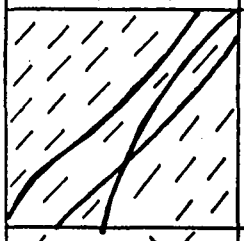
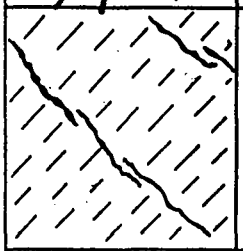
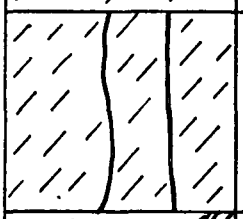
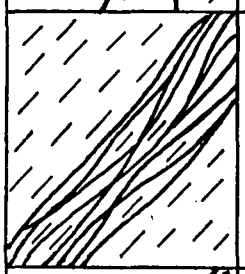
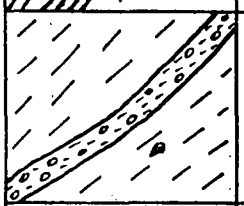
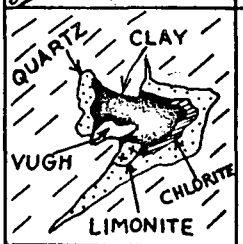
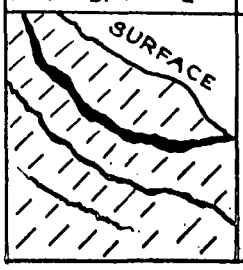
DEFECT	NAME	DESCRIPTION
	FOLIATION or SCHISTOSITY	Laminar structure formed by the parallel arrangement of tabular minerals — chlorite and sericite schist.
	JOINTS Set (i)	Almost planar, slightly curved, intersect with one another at 20 to 50 ft. intervals. Surfaces slickensided down dip; chlorite, limonite, and clay coatings.
	JOINTS Set (ii) & Set (iv)	Almost planar, mostly en echelon— single joints generally persist less than 50 ft. Surfaces rough, irregular. Slightly open or limonite- and clay-filled.
	JOINTS Set (iii)	Almost planar, slickensided
	SHEARED ZONE Set (i)	Zone of near-parallel slickensided joints which intersect one another and divide the rock into thin platy or wedge-shaped blocks. Narrow crushed seams usually present.
	CRUSHED SEAM Set (i)	Almost planar seam of mechanically disintegrated rock; commonly composed of small rock fragments in silty matrix
	QUARTZ VEINS WITH VUGHS	Irregularly shaped veins and masses composed of quartz, chlorite limonite and clay and containing irregular cavities or vughs generally less than 2 cm. across. Not a continuous planar defect
	EXFOLIATION JOINTS (BANKUNG)	Curved, irregular joints, almost parallel to ground surface. Many gaping or clay-filled within 10 ft. of ground surface. Generally tighter at greater depths.

FIG. 4

DEPARTMENT OF MINES — SOUTH AUSTRALIA

ENGINEERING GEOLOGY SECTION	Drn. DHS	KANGAROO CREEK DAM	SCALE: —
	Tcd. JPT	DEFINITIONS OF ROCK DEFECTS	S 5746 Ha 5+7
Director of Mines	Ckd.		DATE: 21 MARCH '67
	Exd.		

APPENDIX A

KANGAROO CREEK DAM

LOGS OF DIAMOND DRILL HOLES

WITH EXPLANATORY NOTES

APPENDIX A

LOGS OF DIAMOND DRILL HOLES

EXPLANATORY NOTES

INTRODUCTION

Twenty-seven holes totalling 2775ft. in depth have been drilled in the site area as part of the geological investigations for Kangaroo Creek Dam. Details of the holes are summarised below:

Hole No.	Co-ordinates*(Ft.) E	N	Angle to Horizontal	Direction	Depth (Feet)
KC1	22,551	6,795	90°	-	176.7
KC2	22,605	6,815	90°	-	100.1
KC3	22,650	6,835	90°	-	75.2
KC4	22,674	6,865	45°	025°	100.0
KC5	22,703	6,933	90°	-	75.8
KC6	22,745	6,989	90°	-	75.1
KC7	22,726	7,034	90°	-	50.5
KC8	22,718	7,068	90°	-	176.0
KC10	22,477	6,751	50°	270°	70.1
KC11	22,479	6,752	55°	090°	143.3
KC12	22,721	7,159	60°	336°	135.7
KC13	22,628	6,772	65°	069°	125.2
KC14	22,630	6,773	50°	249°	131.9
KC15	22,773	7,007	70°	204°	134.8
KC17	22,691	6,810	90°	-	71.7
KC18	22,572	6,821	60°	260°	127.5
KC19	22,054	6,996	60°	225°	114.5
KC20	21,931	6,933	45°	236°	120.0
KC23	22,423	6,795	45°	265°	101.9
KC25	22,267	6,903	90°	-	99.3
KC26	22,263	6,905	40°	184°	53.3
KC27	22,249	6,786	90°	-	121.3
KC28	22,596	6,875	90°	-	100.3
KC29	22,651	7,173	60°	185°	140.0
KC30	22,624	6,974	90°	-	51.5
KC31	End of Adit No. 2		+1°	248°	50.8
KC32	End of Adit No. 1		+1°	240°	52.5

The geological logs of the holes are arranged in the same order as in this table. The notes below explain the procedures adopted in the drilling, and the various details entered on the log sheets.

*The co-ordinates used here are in feet, and are obtained from the state grid co-ordinates (given in yards) by multiplying the last four figures by 3.

NOTES ON DRILLING PROCEDURES

Equipment

The core sizes are as follows:-

Symbol	Nominal Diameter of Cores	
	Inches	Centimetres
NXC (NX casing)	2.8	7.2
NMLC	2.0	5.1
NMS	1.8	4.6

The NMS and NMLC cores were obtained with "M" type stationary inner tube core barrels fitted with bottom discharge bits. The inner tubes were of the split type, ensuring minimum disturbance of the core during removal from the barrel.

Storing and Marking of Core

Cores are stored in wooden boxes, each compartment of which is designed to contain five feet of core. The internal length of each compartment is actually five feet one inch, to allow for 100 per cent core recovery, when roughness of the ends of the core, and small inaccuracies in measurement when breaking it to fit the box, make it difficult to fit five feet of core in a compartment of exactly that length. The boxes are marked with consecutive compartment numbers at one end, and the drilled depths from the surface in feet at the other.

The cores of most holes were boxed in this manner at the drill sites, the core being placed in its appropriate place in the box as soon as it was extracted from the core barrel. The bottom of each lift was marked with paint immediately it was placed in the box, and a corresponding paint mark was made on the side of the core box. The measured depth of the hole in feet from the surface was painted on the side of the core box and on the core. Core losses where their position was not known, were assumed to occur at the bottom of each lift. Timber blocks cut to the correct length were used to indicate core not recovered, or core removed for testing.

The cores of Drill Holes KC1 to KC8 inclusive were originally boxed by a different method, but have been re-arranged in the manner described above.

All of the cores are available for inspection at the Department of Mines, Drilling and Mechanical Branch, Dalgleish Street, Thebarton, South Australia.

NOTES ON DETAILS SHOWN ON LOG SHEETS

At the head of the sheet, details of the hole are given, consisting of co-ordinates, reduced level at ground surface, angle from horizontal and direction of hole.

The angle from horizontal and direction given are as measured at the ground surface. The drill holes were not surveyed at depth, and there may be some slight deviation at depth from the figures given.

The logs are plotted on a scale of 1 inch = 10 feet (1:120). In the column headed "Log", places where core was obtained are shown by stippling, and the traces of bedding, joints, faults, and seams are shown diagrammatically by means of symbols.

Places where core was lost are shown by blank spaces. The descriptions given on the log sheet refer only to material recovered as core. Core is lost by the material being ground or washed away during the drilling process; it may usually be inferred that such material is relatively weak. Near the surface this weakness may arise from the unconsolidated nature of soils or weathered rocks. At greater depths the weakness may arise from weathering confined to narrow seams in otherwise fresh rock, or from sheared, crushed or jointed rock. It cannot always be assumed that the material not recovered is weak, since even solid rock core may be ground away and lost during drilling operations.

The core size symbol is shown on the log sheets under the heading "Size of Core."

The drilling lifts and the approximate percentage core recovery are shown in the column "Lift and Core Recovery."

In the column "Structures", angles shown on joints, bedding or other geological structures are the angles they make with the plane at 90° to the axis of the core, unless noted otherwise.

Results of water pressure tests carried out on the drill holes, to obtain some measure of the permeability of the rock mass, are shown in the column headed "Water Pressure Test."

NOTES ON WATER PRESSURE TESTING

Procedures

Drill Holes KC1 to KC8 inclusive were tested at various intervals during the drilling by sealing the hole with an expandable rubber packer placed at the base of the casing, and pumping in water at measured pressures. Considerable difficulties were experienced with these tests, and the results should be viewed with caution.

All other holes, with the exceptions of KC31 and KC32, were water pressure tested using the single-packer method, as follows:

a. Immediately after drilling of the test section, usually 20 feet long, the hole was cleaned out by flushing with water pumped down through the drill rods, until the returning water was clear;

b. A mechanically expandable rubber packer in series with NX drill rods, was placed down the hole at the top of the test section and expanded to form a seal against the walls of the hole;

c. Water was pumped into the test section between the packer and the bottom of the hole at a constant pressure measured by a pressure gauge. The pressure was maintained for a period of 15 minutes and the quantity of water pumped into the hole during this time was measured by a water meter. Without moving the packer the test was repeated at increased pressures, usually by increments of about 20lb. per sq. in., up to a maximum pressure not exceeding the weight of a column of rock of the same height as the depth of the packer below the surface;

d. Drilling was resumed and the hole deepened a further 20 feet; this new section was then tested in the manner described above.

These tests are considered to have given reliable results. The results have been used to calculate permeability figures for the rock mass, as described below.

Calculation of Permeability Figures

The results of water pressure testing of most drill holes have been plotted as Lugeon units in the form of histograms on the logs.

One Lugeon unit is defined in Talobre (1957 p. 151-5) as a water loss of 1 litre per minute per metre of drill hole of diameter 46 to 76 mm at a pressure of 10 bars (10.2 kg/cm^2) maintained for 10 minutes.

The testing procedure used on these holes has been described above. The conditions of test differed in some respects from those required by the above definition, but were sufficiently close to warrant the use of Lugeon units.

The drill holes tested were 72 mm in diameter. The length of test section was 20 feet. The water pressure applied to the test section was measured on a pressure gauge at ground surface, and maintained for a period of 15 minutes. Usually each section was tested at three different pressures.

In computing the Lugeon units in holes commenced above the water table, corrections were applied to the test data to allow for the weight of the column of water in the drill rods which thereby increased the effective pressure at the top of the test section. The leakage rate per minute was plotted in graphical form against the effective pressure acting on the test section. In no case did the effective pressure reach 10.2 kg/cm^2 (148 lb/sq. in.); it was assumed that the leakage was directly proportional to the effective pressure and accordingly the graph of effective pressure - leakage rate per minute per metre was extrapolated to the value of 10.2 kg/cm^2.

In some tests water was pumped into the test section at full pump capacity without registering any pressure in the gauge at the surface. In these places the Lugeon value has been calculated assuming that the drill rods were filled with water, although it is most likely that the rods were only partly filled because no pressure was registered. In cases such as these the actual Lugeon value would be more than that calculated and is therefore shown on the detailed log as a "minimum value."

The results of water pressure testing of drill holes has been described using the following terminology:

Low leakages	1 to 5 Lugeon units
Moderate leakages	5 to 20 " "
High leakages	20 to 50 " "

Talobre, J. (1957) La Mechanique des Roches (Dunod: Paris)

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 1

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM. CO-ORDINATES E 22,551 N 6,795 R.L. 847·3 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION °

LOCATION LEFT ABUTMENT SECTION 335 ANGLE FROM HORIZONTAL Vertical°

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	CASING R.L. (FEET)	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	NOTES Water Level (Date) Drilling Water Return Character of Drill Cuttings	PERCOLATION TEST Depth (Ft.) From	To	Loss in GPM	Pressure PSI	length of Test Min.
HIGH	Core in fragments up to 0·3ft.				100	Schistosity dips 45°. Joints, spaced 0·2 to 2·0, mainly 1·0ft, mainly parallel to schistosity, usually, irregular, limonite coated, occasional traces of clay.	No water return at 3·5ft.					
No core					100							
			NXC		100							
		840	10		77·5							
No core					53·5							
						Mechanical test Samples.						
No core			NX		100							
		830	20									
					78·5	Several joints dip 60°, limonite stained and coated, irregular, traces of clay.						
No core												
Mainly SLIGHT, fresh in few parts, moderate near joints	Pale grey and Green, intensely foliated, few mineralised veins and thin seams, gneissic in part with banded quartz and felspars.											
	Core in 0·2 to 3·0, mainly 1·0ft. lengths, broken mainly along schistosity.											
		820	30		100							
						Joint, near vertical, open in parts up to 0·02 ft, limonite coated.	Full water return					
		810	40									
					100							
		800	50									
	Core in 0·3 to 3·0, mainly 2·0ft. lengths, broken mainly along schistosity.				100							
		790	60									
					100	No Joints						
		780	70									
HW					100	Quartz vein, vuggy, open up to 0·05 ft, limonite stained, traces of clay						
		770	80			Joints, dip 10° to 30°, limonite coated up to 0·03 ft, traces of clay in HW zone 0·3ft. wide.						
SW					100	Vuggy mineralised quartz veins open in parts up to 0·03 ft, limonite coated in SW zone 1·5 ft. wide.						
		760	90									
SW					100	Joints dip 30°, limonite coated, up to 0·02 ft. clay, 0·1ft SW rock adjacent.	½ water return.					
mainly SCHIST, gneissic in part, with some GRANITIC GNEISS FRESH, slight near few joints.	Core in 0·1 to 2·0 mainly 1·0ft lengths.	750·3	100									

15 — NOT TESTED

29·8 — Nil 20 5; Nil 50 5

31·3 — Nil 20 5; Nil 50 10

50·8 — Nil 20 5; Nil 50 5

79 — Nil 20 5; Nil 50 5

HW highly weathered
SW slightly " "

SCHIST GRANITIC GNEISS

Drill No. 16 DD 95/60
Type Mindrill 1000
Driller N. Thompson
Commenced 5 Feb '60
Completed 18 Feb '60

Logged J.A.C.P.
Sheet No.
Drawn D.E.
Checked D.I.S.
Submitted

1 ins to 10 ft. Vert. Scale

Sheet 1 of 2

S 3802 Drawing No. H.G.S.7

250—7.60 8036

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 1

GEOLOGICAL LOG OF DRILL HOLE

E 22,551

PROJECT KANGAROO CREEK DAM — CO-ORDINATES N 6,795 — R.L. 847·3 FT

FEATURE FOUNDATION — HUNDRED ONKAPARINGA — DIRECTION —°

LOCATION LEFT ABUTMENT — SECTION 335 — ANGLE FROM HORIZONTAL Vertical °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	CASING R.L. (FEET)	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	NOTES Water Level (Date) Drilling Water Return Character of Drill Cuttings	PERCOLATION TEST Depth (Ft.) From	To	Loss in GPM	Pressure PSI	Length of Test Min.
SCHIST FRESH	Core in 0·1ft fragments. No core. Pale grey, grey-green, mainly intensely foliated. SW →	740	NX 110		100	Joint, dip 45°, limonite and clay coated. Schistosity dips 40° to 60°, contorted in parts. Joints dip 40° to 60°, Spaced 0·2 to 2·0ft., mainly 0·5ft, mainly along schistosity, usually limonite stained.	½ water return	FROM 15ft.		6	20	5
GNEISS FRESH	Pale grey and whitish, banded, medium grained.	730	120		100 50 80	Joints, irregular dip 30° to 60°, limonite coated SW rock adjacent.				26	50	5
mainly SCHIST, some GRANITIC GNEISS	No core. Core in 0·1 to 2·0, mainly 0·7ft. lengths, broken mainly along schistosity.	720	130		100	Vuggy quartz, irregular, mineralised, open in parts up to 0·03ft, limonite stained.	No water return at 127·6ft. 18 Feb '60	109				
FRESH	No core.	710	140		95 100	Joints, irregular, limonite coated, mineralised, dip 70° to 80° Sample.	Hole cemented	127·5		20	20	10
	No core.	700	150		98					46	50	4
GNEISS FRESH TO SLIGHT	No core. Pale grey to whitish, medium to coarse grained.	690	160		100 100		½ water return.	131·3		20	20	8
SCHIST FRESH		680	170		100 100 100	Mineralised quartz vein, Vuggy, open in parts up to 0·05ft, limonite coated. Sample. Joints dip 30 to 70°, limonite coated, mineralised. Joints, near vertical, limonite stained, mineralised.		136·5		15	20	12
		673·7						144·4		15	20	8
	176·7 Feet. END OF HOLE.							154·2		14	20	10
								176·7		12	20	8

Drill No. 16 DD 95/60
Type Mindrill 1000
Driller N. Thompson
Commenced 5th Feb. 1960
Completed 18 Feb. 1960

EXPLANATION
SCHIST
GRANITIC GNEISS
SW. slightly weathered
water level, data

Logged J.A.C.P.
Sheet No.
Drawn D.E.
Checked DHS
Submitted

1 inch = 10 feet.
Vert. Scale

Sheet 2 of 2
33802a Has 7
Drawing No.

250 · 7.60 8035

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 2

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM

CO-ORDINATES E 22,605 N 6815

R.L. 800·6 FT

FEATURE FOUNDATION

HUNDRED ONKAPARINGA

DIRECTION °

LOCATION LEFT ABUTMENT

SECTION 335

ANGLE FROM HORIZONTAL Vertical °

ROCK TYPE (Degree of Weathering Shown in Core)	DESCRIPTION	CASING R.L. (FEET)	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES (Joints, Veins, Seams, Faults, Crushed Zones)	NOTES (Water Level (Date) Drilling Water Return Character of Drill Cuttings)	PERCOLATION TEST Depth (Ft.) From	To	Loss in GPM	Pressure PSI	Length of Test Min.
SLIGHT TO COMPLETE	No Core											
	Pale grey and green, intensely foliated, occasionally contorted, few mineralised veins and thin seams gneissic in part with banded quartz and felspars. Core in pieces and fragments up to 0·3 ft. Core in 0·1 to 1·5 ft lengths mainly 0·5 ft broken along schistosity.	800			100	Schistosity dips 45° to 60°, contorted in parts.						
Mainly SLIGHT, fresh in parts, moderate near joints.	No Core				99·7							
					100							
		790	10		45·8	Joint, irregular, near vertical, limonite coated.						
					100	Mech. Test Samples						
					100	Mineralised quartz vein 0·1 ft wide limonite coated. Joints spaced 0·1 to 1·5 mainly 0·5 ft, irregular, limonite coated, mainly parallel to schistosity.		15				
SW-MW	No Core	780	20		100							
	Core in fragments up to 0·2 ft.				100	Joint, near vertical, limonite and clay coated, up to 0·02 ft.						
					100		Full water return.					
		770	30		100	Joint, dip 70°, limonite and clay coated, up to 0·02 ft. thick.						
	No Core				100							
Mainly SCHIST with few bands of GNEISS, as shown. FRESH		760	40		100							
					100	Sample						
		750	50		100							
					100		½ water loss					
		740	60		100							
					100							
		730	70		100	Joint, near vertical, irregular, limonite stained	29 Feb '60					
FRESH to SLIGHT						Joint, dip irregular — 70° slickensides dip 60°, 0·02 ft recemented gouge, vuggy, limonite coated.	Full water return.					
		720	80		98							
	No Core											
Core in 0·2 to 2·0, mainly 0·5 ft lengths, broken mainly along schistosity.					95							
		710	90		90							
	No Core											
			100									

NOT TESTED

From	To	Loss in GPM	Pressure PSI	Length of Test Min.
	24·3	25	20	10
	47·5	2	20	10
	66·3	4	20	10
	84	32	20	15

100·1 FEET. END OF HOLE.

Drill No. 16DD105/60

Type Mindrill E1000

Driller N. Thompson

Commenced 24 Feb '60

Completed 29 Feb '60

SCHIST

GRANITIC GNEISS

29 Feb. '60 WATER LEVEL, DATE

Logged J.A.C.R.

Sheet No.

Drawn D.E.

Checked DJS

Submitted

10 feet = 1 inch. Vert. Scale

Sheet 1 of 1

53801 Ha5-7 Drawing No.

250—7.60 8038

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 3

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,650 N 6,835 R.L. 756·7 FT

FEATURE LEFT ABUTMENT HUNDRED ONKAPARINGA DIRECTION — °

LOCATION TORRENS GORGE SECTION 335 ANGLE FROM HORIZONTAL 90°

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	Casing & R.L. in Feet	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	NOTES Water Level (Date) Drilling Water Return Character of Drill Cuttings	PERCOLATION TEST Depth (Ft.) From	To	Loss in GPM	Pressure PSI	Length of Test Min.
CLAY SOIL with rock fragments												
SW to MW — NO CORE — slight — NO CORE — Slight — SCHIST	Banded white and grey-green intensely foliated, bleached white to pale brown due to weathering	750	NXC 10		60 80 40 80	Schistosity dips 45° Joints, mainly parallel to schistosity, rough, irregular surfaces, limonite coated, are spaced 0.2 to 2 ft.	Water lost at 1 ft., returned at 11.2 ft when casing set					
GNEISS slight	Pale grey to white, fine grained	740	NX 20		95 99	SAMPLES, MECHANICAL TESTS; Quartz vein 0.2 ft. wide, partly leached, dip 30°		20				
Mainly slight, moderate to high near joints — NO CORE — NO CORE — SCHIST — FRESH	Banded white and grey-green, intensely foliated; contains many lenticular mineralized zones up to 0.05 ft. thick, some of which are partly leached open.	730 30 720 40 710 50 700 60			100 95 100 90 100 100 100 98 100	Several joints, irregular, limonite coated, and lenticular quartz veins up to 0.05 ft. thick, partly leached open and moderately to highly weathered. Joints spaced between 1 and 5 ft., mostly curved, slickensided, tightly closed, dip 45° to vertical. Joint with up to 0.1 ft. pyritic material. Joint dip 80° quartz coated, slightly open	FULL WATER RETURN; 16 March 1960; drilling water lost	39.9	1 2	50 75	10 5
Slight — FRESH		690 70 681.5			90 100	Mineralized vein, irregular, 0.1 ft. wide, contains many vughs.	Half water return	68.6 75.2		18 18	50 50	5 5

75.2 FEET, END OF HOLE

NOT TESTED

EXPLANATION

Casing

Static Water Level ← 10 March '60

Drill No. 7 DD 100/60
Type Mindrill E1000
Driller N. Thompson M. Sharrad
Commenced 2 Mar. '60
Completed 16 Mar. '60

Logged E. R. Hillwood D. Stapledon
Sheet No.
Drawn D.H.S.
Checked
Submitted

10 ft. to 1 inch Vert. Scale

Sheet 1 of 1

S: 3691 Drawing No. Ha 547

250—7.60 8030

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 4

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,674 N 6,865 R.L. 724 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 025 °

LOCATION RIVER CHANNEL SECTION 335 ANGLE FROM HORIZONTAL 45 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L. & Casing	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	NOTES Water Level (Date) Drilling Water Return Character of Drill Cuttings	PERCOLATION TEST Depth (Ft.) From	To	Loss in GPM	Pressure PSI	Length of Test Min.
MW to HW	Core in pieces and fragments, 0·1 to 0·5ft											
Mainly SLIGHT, moderate near joints and seams	No core											
	No core	720	NXC		50	Schistosity variable, dips 40 to 80° contorted in parts, often not visable. Joints spaced 0·4 to 1 ft., mainly 0·5 ft., mainly along foliation, limonite stained and coated, usually some SW rock adjacent. Many vughs open up to 0·04 ft.	25 March 60					
	No core		10		30	Pet. Sample; Numerous vuggy seams						
	Core in 0·2 to 1·0 mainly 0·4 ft lengths, broken along joints					Mech. test samples; Joint, up to 0·01 ft clay.						
		710	20		100	Pet. and Mech. test samples; vuggy seams		15				
Green to Greenish-grey and greyish-white, mainly fine grained, coarser grained in parts with banded quartz and felspars, often pegmatitic, weakly foliated, core tends to break across the fabric of the rock. Micaceous, mineralised in part.					100	Vuggy quartz and mineralisation.						
Mainly FRESH slight near few joints, slight to moderate in numerous vughs			30		100	Joint, dip 70°, rough, mineralised.						
		700				Joint, open, vuggy; Joint, limonite coated.						
			40		100	Joint, tight, some vughs						
						Joints, spaced 0·5 to 3, mainly 1 ft, mainly parallel to foliation, usually tight, occasionally limonite stained, rarely with traces of clay.						
	No core	690			95							
Mainly SCHIST, some GRANITIC GNEISS, as shown			50		100	Joint, dip 80°, rough, some mineralisation						
			60									
		680			100	Joint, rough, irregular, some mineralisation; Mineralised quartz vein						
			70		100							
FRESH		670				Joint, dip 70°, tight, rough, mineralised.						
	No core				100							
			80		95							
		660	90		100	Vuggy mineralised quartz vein.						
		653.2			100							

Core in 0·2 to 3, mainly 1 ft. lengths, broken mainly along joints

Full water return throughout.

NOT TESTED

15	6	50	5		
27	7	5	6		
41·7					
8	50	6			
20	7	5	6		
76·7					
6	50	6			
20	7	5	6		

100 Feet END of HOLE

Drill No. 7DD 115/60

Type Mindrill E1000

Driller M. Sharrad

Commenced 18 March 60

Completed 25 March 60

MW Moderately Weathered

HW Highly Weathered

Water level

Pet. Petrographic

Mech. Mechanical

Date, water level.

Logged	J.A. Painter
Date	July '64
Drawn	D.E.
Checked	DJS
Submitted	

10ft. to 1 inch Vert. Scale

Sheet of

53832 Ha517 Drawing No.

250—7.60 8036

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 5

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,703 N 6,933 R.L 721·9 FT

FEATURE FOUNDATION HUNDRED YATALA DIRECTION —

LOCATION RIGHT ABUTMENT SECTION 5497 ANGLE FROM HORIZONTAL 90°

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L. & Casing	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	NOTES Water Level (Date) Drilling Water Return Character of Drill Cuttings	PERCOLATION TEST Depth (Ft.) From	To	Loss in GPM	Pressure PSI	Length of Test Min.
No core	No core	720										
SLIGHT	Dark grey to greenish grey foliated Micaceous Mainly very fine grained, coarser grained in parts with banded quartz and felspars becoming coarse grained and pegmatitic in parts.				95	Joint. rough, grooved, limonite coated. Foliation dips 30 to 50°.						
No core	No core	710	10		60	Joints spaced 0·3 to 1·5, mainly 1ft, mainly parallel to schistosity, mainly tight, limonite stained and coated above 15ft. Joints at angle to foliation, usually rough and irregular, often mineralised.						
No core	No core				85							
		700	20		100							
					100							
		690	30		100	Joints, dip 40 to 70°, irregular, limonite coated, some quartz mineralisation.	Full water return throughout					
					100	Joint, dip 70°, irregular, mineralised. Joints, dip 40°, tightly closed, limonite coated						
		680	40		100							
						Seam, 0·1ft, chlorite, quartz and pyrite Joints, rough, mineralised						
		670	50		100							
					100	Joint, 0·01ft, CW rock vuggy quartz adjacent						
		660	60		100							
						Mineralised seam, up to 0·03 ft., vuggy.						
		650	70		100							
		646·1										

NOT TESTED

10

15 50 3

257

Nil 50 4
Nil 75 4

68·4

Nil 50 2
Nil 75 2

75·5

Core in 0·4 to 1·5ft, mainly 1ft. lengths, broken mainly along foliation.

Mainly GNEISS, schistose in part, with some GRANITIC GNEISS as shown

FRESH

75·75 feet. END OF HOLE.

Drill No. 7 (D.D. 120/60)
Type Mindrill E1000
Driller M. Sharrad
Commenced 30 March 60
Completed 4 April 1960

GNEISS, schistose in part.
GRANITIC GNEISS

Logged LACP
Sheet No.
Drawn D.E.
Checked DHS
Submitted

10 feet to 1 inch Vert. Scale

Sheet 1 of 1
S3829 Ha5+7 Drawing No.

250—7.60 8036

S3829 Ha5+7

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 6

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,745 N 6,989 R.L 804·7 FT

FEATURE FOUNDATION HUNDRED YATALA DIRECTION —°

LOCATION RIGHT ABUTMENT SECTION 5497 ANGLE FROM HORIZONTAL 90°

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L. & Casing	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	NOTES Water Level (Date) Drilling Water Return Character of Drill Cuttings	PERCOLATION TEST Depth (Ft.) From	To	Loss in GPM	Pressure PSI	Length of Test Min.
SCHIST, gneissic in part	No core	800	NXC		95	Foliation dips 30 to 60°	Water lost at 3 and 13 ft.			NOT TESTED		
	Pale green to pinkish white, medium to coarse grained, foliated or weakly banded in parts, core tends to break across the foliation; micaceous, numerous vuggy and mineralised quartz veins, frequent pyritic mineralisation		10		95	Joint, limonite-coated. Sample. Irregular vuggy quartz vein, limonite and clay-coated. Sample. Joint, limonite-coated.		10				
		790			100	Joints spaced 0·2 to 2·5, mainly 1 ft., limonite stained and coated, often with traces of clay.		10	16·2	100	28	1
			NX		100			16·2	19	Nil	28	10
		780	20		100			19	35·3	13	28	10
					100	Irregular, vuggy quartz veins, limonite and clay coated.		35·3	51·6	25	28	5
		770	30		100	Joints, mainly parallel to foliation.		51·6	69·8	22	28	11
					100							
		760	40		100	Joints, rough, limonite coated. Vuggy quartz veins, clay and limonite coated.						
					100	Joints, limonite coated, up to 0·01 ft.						
		750	50		100	Vuggy quartz veins, SW to CW, limonite stained.						
			60				DRILLER'S NOTE "Water lost in cavity at 65 ft." 7 March 60 1/3 water return					
mainly GRANITIC GNEISS	SLIGHT, moderate to high near most joints and seams											
	FRESH to slight, moderate near few joints and seams.	740			90	Joint, limonite coated, vuggy quartz mineralisation.						
	No core		70			Vuggy quartz veins, limonite coated.						
		730			100							

core in 0·2 to 1·5, mainly 0·5 ft lengths, broken equally along joints, foliation and vuggy quartz veins.

Core in 0·2 to 2, mainly 0·7 ft lengths.

Full water return

75·1 ft. END of HOLE

Drill No. DD 107/60
Type Mindrill E1000
Driller M. Sharrad
Commenced 1 March '60
Completed 7 March '60

Water level ▽ Date

Logged J.A.C.P.
Sheet No.
Drawn D.E.
Checked D.H.S.
Submitted

10 ft to 1 inch. Vert. Scale

Sheet 1 of 1
S3830 Ha5+7 Drawing No.

250—7.60 8036

S3830

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 7

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES N 7,034 E 22,728 R.L. 835·8 FT

FEATURE FOUNDATION HUNDRED YATALA DIRECTION °

LOCATION RIGHT ABUTMENT SECTION 5497 ANGLE FROM HORIZONTAL 90 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L. & casing	Depth and Size of Core	Log	Lift and Core recy %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	NOTES Water Level (Date) Drilling Water Return Character of Drill Cuttings	PERCOLATION TEST Depth (Ft.) From	To	Loss in GPM	Pressure PSI	Length of Test Min.
GNEISS, schistose in part	SW to HW Core in fragments up to 0·2 ft					Schistosity dips 30° to 50°	Hole blocked at 12. Static water level not determined.					
	No Core					Joints spaced 0·2 to 1, mainly 0·5 ft., limonite coated, mainly parallel to foliation	Water lost at 6 ft. Full water return after casing seated.					
	SLIGHT, moderate to high near joints and seams. Dark grey to greenish grey, pinkish white were gneissic, closely foliated, very fine grained, coarser grained with banded quartz and felspars where gneissic, micaceous, common vuggy mineralised quartz veins	830	NXC	70	Vuggy quartz [Sample, MECH.]			0	10			NOT TESTED
		10	NX	100	[Samples, MECH. TEST]			10		18	15	10
		820		100		Joints, rough, limonite coated up to 0·03 ft.			17·7			
		20		100		Joint, dip 50°, limonite coated				Nil	15	9
		810		100		Joint, tight, irregular, limonite coated.			23·3			
		30				Vuggy quartz veins, limonite coated, mineralised.						
				100		Joints, rough, irregular, limonite coated.						
	No core											
	Core in 0·1 to 1, mainly 0·4 ft. broken along joints and foliation.	800										
		40		95		Joints, rough, limonite coated, some vuggy mineralisation.				25	15	10
	No core											
	Core in 0·2 to 2 mainly 1 ft lengths mainly broken along foliation	790		95		Joints spaced 0·4 to 4, mainly 1 ft. limonite coated, rough usually tightly closed						
		50							50·5			
	50·5 feet END OF HOLE											

Drill No. 7 (DD 102/60)
Type Mindrill E 1000
Driller M.E. Sharrad
Commenced 24 Feb 1960
Completed 26 Feb 1960

SW Slightly Weathered
HW Highly Weathered.

Logged J.A.C.P.
Sheet No.
Drawn D.E.
Checked D.N.S.
Submitted

10 feet to 1 inch Vert. Scale

Sheet 1 of 1
53831 Ho 5+7 Drawing No.

250—7.60 8033

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 8

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES N 7,068 E 22,716 R.L 849·5 FT

FEATURE FOUNDATION HUNDRED YATALA DIRECTION —°

LOCATION UPPER RIGHT ABUTMENT SECTION 5497 ANGLE FROM HORIZONTAL 90°

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	Casing R.L. feet.	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	NOTES Water Level (Date) Drilling Water Return Character of Drill Cuttings	PERCOLATION TEST Depth (Ft.) From	To	Loss in GPM	Pressure PSI	Length of Test Min.
Soil and rock fragments			NX									
NO CORE			NXC		25		FULL WATER RETURN Water lost.			NOT TESTED		
Moderately weathered		840	10		45		at 10 ft regained at 11 ft.					
No CORE												
GRANITIC GNEISS Mainly Slight, Moderate to high near Some joints and vughs.	Pale green to white-banded graniticgneiss		NX		13	SAMPLES, MECHANICAL TESTS						
					100	Foliation dips 30° to 40°	Full water return			Nil	10	10
		830	20			Joints spaced 0·2 to 1·5 feet, predominantly			20			
					100					3	10	10
						0.5 feet, limonite stained, irregular surfaces. Most joints parallel to foliation, few dip 60 to 80°. Several vuggy quartz veins, with lenticular cavities up to 0·05ft. across occur as shown.	½ water return					
		820	30		99							
Slightly weathered	White to pale grey, schistose, slightly banded, fine grained.				100					1	10	10
		810	40									
					100		Full water return					
		800	50						50			
					100							
		790	60							Nil	10	10
					97							
					100							
		780	70						70			
					100							
		770	80		100	Joints spaced 0·2 to 2 feet, mainly 1 foot. Most are parallel to foliation, few dip 70° to 80°. The joints are limonite stained or coated with irregular surfaces, polished in some cases. Several vuggy quartz veins with lenticular cavities up to 0·05 ft. across occur as shown.				Nil	10	10
SERICITE GNEISS, schistose in part Slightly weathered to fresh.												
GRANITIC GNEISS	Pale green, Coarse grained quartz felspar rock, with poorly developed foliation dipping approx 45	760	90		100							
		750	100						97·5			

Drill No. 7
Type Mindrill E1000
Driller M.E. Sharrad
Commenced 5 Feb '60
Completed 19 Feb '60

EXPLANATION
Casing
Static Water Level ← 10th March 1960

Logged E.R. Hillwood, D.H. Stapledon
Sheet No.
Drawn D.E.
Checked DH
Submitted

10 ft. to 1 inch Vert. Scale

Sheet 1 of 2

S 3774a Drawing No. Ha 5+7

250—7.60 6033

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 8

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,716 N 7,068 R.L. 849·5 FT

FEATURE FOUNDATION HUNDRED YATALA DIRECTION —

LOCATION RIGHT ABUTMENT SECTION 5497 ANGLE FROM HORIZONTAL 90°

ROCK TYPE (Degree of Weathering Shown in Core)	DESCRIPTION	R.L. & Casing	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES (Joints, Veins, Seams, Faults, Crushed Zones)	NOTES (Water Level (Date) Drilling Water Return; Character of Drill Cuttings)	PERCOLATION TEST Depth (Ft.) From	To	Loss in GPM	Pressure PSI	Month of Test Min.
GRANITIC GNEISS Fresh	Pale green, coarse grained, poorly foliated					Vuggy quartz vein dip 35°, 0·05 feet thick.		FROM 13 FEET				
		740	110		100		19 Feb '60					
					100	Joints spaced from 0·3 to 4 ft, predominantly 2 feet, mostly parallel to schistosity, few nearly vertical. Joint surfaces mostly clean.		1	5	10	10
GRANITIC GNEISS FRESH	Grey to white, shows pronounced banding, contorted in part.	730	120		100							
		720	130		100			126				
					100							
		710	140		100			2	10	15		
					100							
Mainly SERICITE GNEISS with some GRANITIC GNEISS, as shown.		700	150		100	Calcite vein, tightly sealed contacts.	FULL WATER RETURN					
		690	160		100			160				
	Becoming finer grained and less banded.							1	5	10	15	
		680	170		100							
GRANITIC GNEISS	Off-white, massive.	673·8						176				
						176 FEET, END OF HOLE						

Drill No. 7
Type Mindrill E1000
Driller M.E. Sharrad
Commenced 5 Feb 60
Completed 19 Feb 60

EXPLANATION
Casing
Static Water Level ← 10th March 1960

Logged E.R. Hillwood, D.H. Stapledon
Sheet No.
Drawn D.E.
Checked DWS
Submitted

10ft to 1inch Vert. Scale
Sheet 2 of 2
Drawing No. S3774
Ho 5+7

250—7.60 8036

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 10

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM — CO-ORDINATES E. 22,477 N. 6,751 — R.L. 916·0 FT

FEATURE FOUNDATION — HUNDRED Onkaparinga — DIRECTION 270°

LOCATION UPPER LEFT BANK — SECTION 335 — ANGLE FROM HORIZONTAL 50°

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L. & Casing	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
SOIL AND ROCK FRAGMENTS					32			
NO CORE		NX	NXC		85	Foliation dips 0° to 30° on core		NOT TESTED
Mainly SLIGHT, moderate to high near joints and seams	Grey to greenish grey, finely foliated, Core in 0.1 to 0.8, mainly 0.5 ft lengths	910	10	NMLC	70	Joints spaced 0.2 to 0.8 ft, mainly along foliation. Joint surfaces mainly rough, irregular, with limonite and clay veneers. Few joints with up to 0.05 ft. MW to HW rock adjacent. Several Crushed seams up to 0.02 ft thick as shown		
SW-HW	Core in 0.05 ft lengths	900	20		100	Sheared zone 1.5 ft. wide, joints spaced 0.05 ft, limonite and clay coated in part.	1 July '64	7.5
SCHIST, gneissic in part. Mainly FRESH slight to high near few joints and seams	Core in 0.2 to 2.0 mainly 0.5 ft lengths, mainly broken along foliation planes	890	30		100	SAMPLE, accelerated weathering test		
SW-CW			40		100	Joint, open, vuggy, dips 70° on core, irregular up to 0.03 red clay, up to 0.1 ft. SW-MW rock adjacent.		2.3 Initially 20
					100	Clay seam, up to 0.02 ft grey clay, dips 30° on core	31 Aug. '64	
MW to CW		880	50		100	Crushed seam, up to 0.03 ft. crushed rock and grey clay. Several joints, dip 70° to 80° on core, irregular, up to 0.03 ft red clay, up to 0.2 ft SW-HW rock adjacent		
					100	Joints, dip 70° on core, open, limonite coated, up to 0.1 ft SW-MW rock adjacent		
		870	60		100		Hole empty Dec '64	3.3
			70		100			
70·1 ft END OF HOLE								

Drill No. 24

Type MINDRILL E 1000

Driller J. Jensen

Commenced 25 June '64

Completed 1 July '64

EXPLANATION

SW slightly weathered — WATER LEVEL — DATE

MW moderately "

HW highly "

CW completely "

Logged J.A.C.P.

Date 2 July '64

Drawn J.A.C.P.

Checked DMS

Submitted

Vert. Scale 1" = 10 ft

Sheet 1 of 1

S 3767

Drawing No. Ho. 5+7

250—7.60 C036

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 11

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,479 N 6,752 R.L. 915 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 090 °

LOCATION UPPER LEFT BANK SECTION 335 ANGLE FROM HORIZONTAL 55° °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L. and Casing	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
NO CORE	SOIL and loose rock				20	Schistosity dips 60° to 90°, on core.		
NO CORE	Core in 0·1 to 0·3 ft. fragments	NX			50	Joints numerous		
SCHIST, GNEISSIC in part. Mainly SLIGHT, moderate near most joints, moderate to high near few joints and seams.	Grey to pinkish grey, intensely foliated, mainly banded with white to pinkish very fine grained quartz and felspar, mainly micaceous core tends to break along schistosity.	910	NXC		100	Joints dip 60° to 90° on core mainly along schistosity, spaced 1 ft to 4 ft, mainly 1 ft, limonite coated, open in part, occasionally clay coated, usually some SW rock adjacent. Few joints dip 30° to 40°.		NOT TESTED No water return below 7 feet.
		900	NMLC		100			
		890	30		100	Crushed seam, dip 60°, up to 0·2 ft. crushed rock and broken core.		5·7
					100	Joint, up to 0·01 ft. grey clay and fine roots.		
		880	40		100	Crushed seam, dip 30°, up to 0·1 ft crushed rock and broken core.		7·5
					100	Crushed seam, dip 50°, up to 0·04 ft. crushed rock.		
		870	50		100	Joint, dip 90°, irregular, limonite coated, up to 0·03 ft clay.		
					100	Crushed seam, dip 70°, up to 0·2 ft. clay and crushed rock. 0·1 ft. MW-HW rock adjacent.		
		860	60		100	Clay seam, dip 10°, up to 0·05 ft. red clay, few rock fragments, plant roots.		22·7
MW to HW	Core broken into fragments up to 0·2 ft.		70		100	Crushed seams, near vertical, irregular up to 0·03 ft. clay and crushed rock, limonite coated.		
					100	Joints, limonite coated; open in parts to 0·02 ft.		
Mainly FRESH, slight near most joints; slight to moderate near few joints and seams		850	80		100	Joint dip 70°, up to 0·04 ft. limonite coating and clay.		
					100			0·7
		840	90		100	Joint, irregular, dip 60°, up to 0·04 ft. limonite coated CW rock and clay		
					100	Joint, up to 0·02 ft clay.		
			100					

Core in 0·5 to 4 ft, mainly 1 ft. lengths.

Core in 0·5 to 4 ft, mainly 2 ft. lengths.

WATER LEVEL: 7 July 1964; 8 July 1964; 17 July 1964; 9 July 1964

Drill No. 24
Type Mindrill E 1000
Driller J. Jensen
Commenced 3 July 1964
Completed 17 July 1964

EXPLANATION
All dip measurements made on core.
SW Slightly weathered
MW Moderately "
HW Highly "
CW Completely "
WATER LEVEL ◁ DATE
Casing

Logged JACP
Date 17 July '64
Drawn JACP
Checked D.H.S.
Submitted

1 in. = 10 ft. Vert. Scale

Sheet 1 of 2
S3790 Ha5+7 Drawing No.

250—7.60 7306

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 11

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,479 N 6,752 R.L. 915 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 090°

LOCATION UPPER LEFT BANK SECTION 335 ANGLE FROM HORIZONTAL 55°

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L. and Casing	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
SCHIST, GNEISSIC in part. MAINLY FRESH, Slight to moderate near most joints and seams.	Grey, greenish grey and whitish, intensely foliated; Gneissic in part with coarse banding of quartz and felspars, micaceous, pyritic in parts. Core in 0·5 to 3 ft., mainly 2 ft lengths broken mainly along joints.	830	NMLC		100	← Joint, dip 10°, limonite coated, Joints spaced 0·5 to 4 ft., mainly 2 ft. Mainly limonite coated, at angles of 70° to 30° on core.		< 0.5
		820	110		100	← Joint, up to 0·01 ft. clay		
		810	120		100		Hole Empty. Dec '64	< 0.5
		800	130		100	Joint, limonite and clay coated up to 0·02 ft.		
			140		100	Several irregular mineralised quartz veins. ← Several joints, dip 10° to 60°, limonite and clay coated, up to 0·03 ft.		

143·3 feet. END OF HOLE.

Drill No. 24
Type Mindrill E1000
Driller J. Jensen
Commenced 3 July 64
Completed 17 July '64

EXPLANATION

WATER LEVEL ▽ DATE

Logged JACP
Date 17 July '64
Drawn JACP
Checked DHS
Submitted

1 ins = 10 ft. Vert. Scale

Sheet 2 of 2

53790a Ha5+7 Drawing No.

250—7.60 9033

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 12

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E. 22,721 N. 7,159 R.L. 904 FT

FEATURE FOUNDATION HUNDRED YATALA DIRECTION 338 °

LOCATION UPPER RIGHT ABUTMENT SECTION 5497 ANGLE FROM HORIZONTAL 60 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L. & casing	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
FILL / No core	Soil and fragments of GNEISS and SCHIST.	900	NXC		40			Full Drilling Water Return Throughout Hole
					5			
			NX		15			
					90			
No Core			10		80			NOT TESTED.
Mainly moderate, high to complete where shown. HW / HW-CW / HW	Grey-green to pale brown, banded due to alternating layers of felspar quartz and ferromagnesium minerals. Core in pieces mostly less than 0.5ft long.	890	NMLC		90	Irregular joints mostly dip 60° to 80° on core, have earthy coatings and fine roots.		
			20		100			
					100	Schist layer highly to completely weathered.		
					100	Joints with soil and fine roots		
		880			100	Quartz-chlorite vein, highly weathered	1 Sept '64	
Fresh to slight.	Recemented brecciated zone, contains several irregular quartz-chlorite veins.		30		100	Foliation dips 50° to 60° on core.		33 →
					100			
		870						
Mainly GNEISS, grading into SCHIST as shown. FRESH, with high to complete weathering in some vughs and along narrow seams where noted. high			40		100	Two joints irregular with up to 0.05 feet highly weathered rock between them.		
					100			0.5
		860	50		100			
	Grey-green to white medium to very coarse grained contains several quartz-chlorite veins partly open.				100			
		850	60		100	Irregular yuggy seam with up to 0.05 ft clay and limonite.		
					100			0.5
			70		100	Joints spaced 1 to 5 feet generally about 2 feet, mostly along foliation direction rough irregular surfaces, limonite stained.		
		840			100			
			80		100			
		830			100	CRUSHED seam completely weathered 0.05 ft. thick.		
			90		100			< 0.5
		820			100			
			100		100			

Core in 0.5 to 3 ft. mainly 2 ft. lengths.

Drill No. 24
Type E 1000
Driller Jensen
Commenced 25 Aug 64
Completed 2 Sept. 64

EXPLANATION
X GNEISS
SS SCHIST
HW Highly weathered
CW Completely weathered
WATER LEVEL ◁ DATE

Logged D.H.S.
Date 4 Aug 64
Drawn DE
Checked DHS
Submitted

10ft to 1inch Vert. Scale
Sheet 1 of 2
S3865 Ha5+7 Drawing No.

250—7.69 0036

DOCKET.....

SERIAL No.....

DEPARTMENT OF MINES — SOUTH AUSTRALIA

GEOLOGICAL LOG OF DRILL HOLE

HOLE No. 12

SHEET 2 OF 2

PROJECT KANGAROO CREEK DAM — CO-ORDINATES E.22,721 N.7159 — R.L. 904 FT.

FEATURE FOUNDATION — HUNDRED YATALA — DIRECTION 338°

LOCATION UPPER RIGHT ABUTMENT — SECTION 5497 — ANGLE FROM HORIZONTAL 60°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION OF CORE OR CUTTINGS WHERE CORE LOST	R.L. FEET → CASING	DEPTH FEET SIZE OF CORE	LOG	LIFT & CORE RECOVERY %	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL ETC.	WATER PRESSURE TEST LUGEON UNITS 10 20 30
Mainly SERICITE GNEISS, some GRANITIC GNEISS, as shown. HW = FRESH	Sericite gneiss is grey-green to white, intensely foliated. Granitic gneiss is very coarse grained quartz-felspar rock, with some chlorite & sericite. Chlorite-schist bands →	810	110		100	Limonite coated joints ←		< 0.5
Slight to high					100			
FRESH		800	120		100	irregular vuggy quartz veins ←		< 0.5
Fresh to slight					100			
FRESH		790	130		100	limonite stained joints ←		
					100	Foliation dips 45° on core. Joints spaced 1 to 5 feet, mostly 2 feet, mostly along foliation direction or dip 10° on core. Joint surfaces are rough, irregular, limonite stained or coated, some SW to MW rock adjacent.		

135.75 ft. END OF HOLE

DRILL No. 24

TYPE E1000

DRILLER Jensen

COMMENCED 25 Aug '64

COMPLETED 2 Sept '64

EXPLANATION

CASING IN HOLE DURING DRILLING ‖

WATER LEVEL IN DRILL HOLE ▯ ← (DATE)

× × SERICITE GNEISS

× × × GRANITIC GNEISS

SSSS CHLORITE SCHIST

HW Highly weathered

SW Slightly weathered

ENGINEERING GEOLOGY AND SOILS SECTION

LOGGED BY D.H.S

DRAWN BY D.E.

CHECKED BY D.V.S

DRAWING No. S3865a H05

200—8.64 8116

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 13

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,628 N 6,772 R.L. ..... FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 069°

LOCATION LEFT BANK SECTION 335 ANGLE FROM HORIZONTAL 65°

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L. & CASING	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams, Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
SLIGHT — No core / No core	Schist is green to greenish grey, more grey where slightly weathered, fine grained,		NX		0	Schistosity dips 40 to 70°. Joints dip 40° to vertical, spaced 0·5 to 3 ft, mainly 1 ft, limonite coated, rough, approx. 50% parallel to schistosity.		NOT TESTED
			30		75			
		800	NMLC		40			
			10			clay, 0·3 ft. thick.		
					100	Several joints and crushed seams, core largely HW. to CW. crushed rock.		
SLIGHT to COMPLETE	Gneiss is pale grey to pinkish-gray, consists of quartz and felspars; micaceous, pyritic, in part, few local developments of quartz veins				100	Quartz vein, 0·9 ft.		
SLIGHT, moderate to high near few joints and seams		790	20			Several irregular joints, near vertical, up to 0·02 ft clay, some crushed rock, plant rootlets up to 0·01 ft.	4 Aug 1964	
					100			
					100			
					100			
		780	30		100	Crushed seam, dip 70°, up to 0·03 ft clay and crushed rock.		
					100	Crushed seams up to 0·05 ft, clay and mica.		< 0·5
					100	Joint, irregular, dips 30°, clay veneer.		
HW MODERATE					100	Joint, rough, 0·03 ft earthy limonite, quartz up to 0·05 ft; hole caving		
		770	40		100		7 Aug '64	
SW					100	Several joints, rough, limonite coated.		
					100	Joints, irregular, limonite-coated, in parts up to 0·01 ft clay.		
SW to MW	Core in fragments up to 0·5 ft		50		67	Crushed seam up to 0·1 ft, limonite coated, crushed rock and clay		3·6
NO CORE								
HW		760			100	Several joints, limonite-coated, irregular, near-vertical, up to 0·01 ft clay.		
SW	Core crushed in fragments up to 0·2 ft.							
			60		100	Joints, rough, limonite-coated, in parts, earthy limonite and clay up to 0·02 ft.		
		750			100			
Mainly FRESH, slight near few joints.	Core in 0·5 to 3, mainly 1 ft lengths				100	Joints, irregular, up to 0·03 ft. earthy limonite		
			70		100			10·5
		740			100	Joint, irregular, limonite-coated, quartz and chlorite mineralisation.	12 Aug '64	
			80		100	Joints, up to 0·03 ft. earthy limonite.		
		730			100	Joints, limonite-coated up to 0·01 ft.		
					100	Vuggy, limonite-coated quartz.		
FRESH			90		100		31 Aug '64	< 0·5
	Core in 0·05 to 0·2 ft fragments				100	Joints, near vertical, rough, tight.		
		720			100			
	Core in 0·5 to 4 ft lengths		100		100			

SCHIST and GRANITIC-GNEISS as shown

Drill No. 24
Type Mindrill E1000
Driller J. Jensen
Commenced 30 July '64
Completed 12 Aug '64

EXPLANATION

WATER LEVEL ◁ DATE

HW Highly Weathered
SW Slightly Weathered
MW Moderately "

Schist

Granitic gneiss

Logged J.A.C.P.
Date 13 Aug '64
Drawn D.E.
Checked D.H.S.
Submitted

10 feet to 1 inch
Vert. Scale

Sheet 1 of 2
S3828 Ha5+7
Drawing No.

250—7.69 8033

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 13

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,628 N 6,772 R.L. 807·5 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 069 °

LOCATION LEFT BANK SECTION 335 ANGLE FROM HORIZONTAL 65 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L.	Depth and Size of Core	Log	Lift and Core recy %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER PRESSURE TEST LUGEON UNITS 10 20 30
SCHIST FRESH	Green to greenish-grey, intensely foliated, very fine-grained, micaceous, common pyritic mineralisation. Core in 0·5 to 4 ft. mainly 2 ft lengths.	710	NMLC		100	Few joints, spaced 0·5 to 4 ft, tight, usually rough, mainly parallel to cleavage	33 → Minimum
		110			100		
					100	← Mineralised seam.	
	Core in 0·05 to 0·5 ft. fragments	700	120		100	SHEARED, partly crushed zone, 1 ft. wide ← Drill water lost	
		690·7			100	← Mineralised seam, friable, pyrite and chlorite.	NOT TESTED

125·2 feet. END OF HOLE

Drill No. 4
Type Mindrill E1000
Driller J. Jensen
Commenced 30 July '64
Completed 12 Aug. '64

EXPLANATION

WATER LEVEL ▽ DATE

Logged JACP
Date 13 Aug '64
Drawn D.E
Checked DMS
Submitted

10ft to 1 inch Vert. Scale

Sheet 2 of 2

S38238a Ha5+7 Drawing No.

250—7.69 [illegible] 0038

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 14

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,630 N 6773 R.L 805 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 249 °

LOCATION LEFT ABUTMENT SECTION 335 ANGLE FROM HORIZONTAL 50 °

ROCK TYPE / Degree of Weathering Shown in Core	DESCRIPTION	R.L. Casing	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
SOIL FILL								
HW Mainly Slight, Moderate to high near some joints	Pale greenish-grey to white, banded. Augen of felspar and quartz are abundant locally giving the rock a knotted appearance	NX 800	NXC		100	Joints spaced 0·1 to 1 ft., mostly along schistosity which dips 0° to 25° on core. Joints have limonite & clay coating		Full drilling water return throughout hole
Fresh to Slight			10		100	Quartz-Chlorite vein		NOT TESTED
FRESH			NMLC		100	Clay-coated joints		
Mainly SERICITE SCHIST		790	20		100	Highly weathered seam, 0·05 ft thick.	19 Aug '64	
					100	Joint, dip 85° on core, limonite-& clay-coated.		
MW Fresh to Slight			30		100	CLAY SEAM 0·05 ft. thick, with rock fragments		7.2
		780			100	2 joints along foliation, clay coated.		
FRESH			40		100	QUARTZ, Vughs open to 0·05 ft. Joints spaced from 0·1 to 1 ft. mostly 0·5 ft.		
		770			100	Most are along the schistosity, limonite coated.	31 Aug '64	
			50		100	Joints, rough, limonite-coated.		1.0
GRANITIC GNEISS Fresh to Slight	Several soft sericite schist bands up to 0·25 ft thick				100	Joint, rough, limonite-and clay-coated.		
Fresh		760	60		100			
SCHIST FRESH	Pale greenish grey to white banded, contains numerous felspar-quartz augen; grading into gneiss				100	Joints spaced from 0·2 to 5 ft., mostly 2 ft., with rough, limonite-coated surfaces; mostly along schistosity few dip 60° to 90° on core.		<0.5
		750	70		100			
					100			
			80		100	Several crushed seams, up to 0·02 ft. slickensided.		
Mainly Fresh to slight	Core in maximum 0·2 ft lengths	740			100	Joints, sericite & chlorite-coated, limonite-stained		<0.5
FRESH			90		100	Joint, dip 65°, rough, limonite-coated.		
	Core partly crushed in fragments and washers, 0·01 to 0·1 ft.				100	Partly crushed seam, 0·02 ft thick, limonite-stained. Crushed, partly-sheared seam, 0·05 ft. clay and crushed rock 0·1 ft. partly sheared rock adjacent.		2.7
		730			100	Partly sheared zone 0·3 ft. wide.		
		100						

Core in 0·2 to 2 ft. mostly 1 ft. lengths

Drill No. 24

Type Mindrill E1000

Driller Jensen

Commenced 14 Aug '64

Completed 19 Aug 64 — 29 Sept '64

EXPLANATION

SCHIST

GRANITIC GNEISS

HW Highly weathered

MW Moderately weathered

WATER LEVEL ◀ DATE

Logged D.H.S.

Sheet No. 20 Aug 64

Drawn T.P.S.

Checked DHS

Submitted

10 ft to 1 inch Vert. Scale

Sheet 1 of 2

S3836

Ha 5+7

250—7.60 B036

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 14

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,630 N 6773 R.L 805 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 249 °

LOCATION LEFT ABUTMENT SECTION 335 ANGLE FROM HORIZONTAL 50 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L.	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
SCHIST, Gneissic in part FRESH	Core in fragments and lengths 0.02 to 0.6ft. Green to grey-green, intensely foliated, very fine-grained, coarser-grained in parts with banding of quartz and felspars. Patches of mineralisation, including pyrite. Core in 0.1 to 2ft. mainly 1ft. lengths.	720	NMLC		100	Several thin (0.02ft.), partly sheared seams.	Hole empty Dec. '64	2.7
			110		100	Partly sheared, partly crushed seam, 0.2 to 0.3ft. thick, core in minute platey fragments with crushed rock.		
					100	Schistosity dips 0° to 20° on core, joints rare, dip 60°, core broken mainly along schistosity		
			120		100	Crushed seams, less than 0.06ft. thick, core fragmented.		
GRANITIC GNEISS SCHIST	Pale grey-green, coarse-grained, banding is not pronounced.	710			100	Vuggy quartz veins.		
			130		100			
	131.9 FT. END OF HOLE							

Drill No. 24

Type Mindrill E 1000

Driller J. Jensen

Commenced 14 Aug '64

Completed 29 Sept '64

EXPLANATION

SCHIST

GRANITIC GNEISS

WATER LEVEL ◀ DATE

Logged	J.A.C.P.
Date	5 Nov. '64
Traced	T.P.S.
Checked	DIS
Submitted	

Vert. Scale 10ft. = 1in

Sheet 2 of 2

S3836a

Ha 5+7

250—7.60 8036

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 5

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22773 N 7007 R.L. 825·6 FT

FEATURE FOUNDATION HUNDRED YATALA DIRECTION 204 °

LOCATION RIGHT ABUTMENT SECTION 5497 ANGLE FROM HORIZONTAL 70 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L.	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
CLAY SOIL, red-brown.								
No core					60			
HW to SW			NXC		5			
		820			5			NOT TESTED
Slight					40	Joints spaced 0·1 to 1 foot, mostly parallel to foliation with irregular, rough surfaces; earthy limonite and clay coatings, some roots.		
MW to HW	Banded dark to light grey-green, grades from soft sericite-chlorite schist to quartz-sericite gneiss.		10		100			
mainly slight		810	NMLC		100			
MW to HW			20		100	2 clay seams 0·03 ft. contain decomposed organic matter.		
SW to MW					100			9.0
GNEISS and SCHIST Mainly slight, except where shown.		800			100			
			30		100			
		790			100			
	Boundaries between quartz-sericite gneiss and granitic gneiss are gradational.		40		100	Vuggy quartz vein with clay and limonite pockets.		
MW to HW		780			100	Highly to completely weathered seam 0·05 ft. thick.		1.0
			50		100			
SW to MW					100	Foliation dips 40° to 50° on core. Joints mostly along foliation, some dip 50° to 70°, obliquely to foliation. They are spaced from 0·5 to 2 feet, and have rough irregular surfaces, limonite stained or coated. Irregular, vuggy quartz-limonite veins are numerous, spaced generally at less than 2ft. intervals along the core.		
Mainly fresh to slight. mainly SERICITE GNEISS, some SCHIST and GRANITIC GNEISS		770	60		100			
					100			1.0
		760	70		100		14 Sept. '64	
	Pale grey-green to mottled pale green Pale brown-coarse to very coarse grained, contains numerous veins and irregular masses of quartz up to 0·2 feet thick.				100			
		750	80		100			
					100			
		740	90		100	SHEARED ZONE, dip 70° to 90° on core, irregular, clay and limonite coated joints spaced 0·05 to 0·2 ft. Clay seam 0·1 ft thick at 95·5 ft.		2.0
GRANITIC GNEISS mainly fresh to slightly altered, highly weathered along vuggy quartz veins	Core in small fragments up to 0·2 ft long				100			
	Core in 0·2 to 1 foot lengths		100					

Drill No. 24
Type Mindrill E'1000
Driller Jensen
Commenced 4 Sept. '64
Completed 14 Sept. '64

EXPLANATION
SCHIST
GNEISS
GRANITIC GNEISS
WATER LEVEL
DATE

Logged DHS
Date 11 Sept. '64
Drawn D.R.P.E.
Checked DHS
Submitted

10 feet to 1 ins. Vert. Scale

Sheet 1 of 2
S3888 Ha5+7
Drawing No.

250—7.64 E038

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 15

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22773 N 7007 R.L 825·6 FT

FEATURE FOUNDATION HUNDRED YATALA DIRECTION 204 °

LOCATION RIGHT ABUTMENT SECTION 5497 ANGLE FROM HORIZONTAL 70 °

ROCK TYPE; Degree of Weathering Shown in Core	DESCRIPTION	R.L.	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
FRESH Mainly SERICITE CHLORITE SCHIST Some GNEISS as shown.	Core in 0·1 to 0·8 mainly 0·3 ft lengths.	730	NMLC		100	Joints spaced 0·1 to 0·5 ft.		Water lost at bit. (Drillers note)
	Grey-green to pale green, very fine-grained, intensely foliated, coarser grained in parts with banding of quartz and felspars, some pyrite mineralisation. Core in 0·2 to 2 mainly 0·4 ft lengths				100	Irregular vuggy quartz veins		9.0
		720	110		100	Joints spaced 0·2 to 2 mainly 0·4 ft, dip 40° to 70° mainly parallel to schistosity. Usually slightly rough and irregular, with traces of clay and coatings of sericite, often some mineralisation (pyrite) occasionally smooth and slickensided(?) when actually parallel to schistosity		
	Core in fragments up to 0·1 ft.				100			
		710	120		100			1.8
	Core in 0·2 to 2 mainly 0·4 ft. lengths				100	Irregular, near-vertical joints, discontinuous		
			130		100			
	Core in fragments up to 0·1 ft.	700			100	Crushed seam, up to 0·03 ft thick.		
	END OF HOLE 134·75 ft.							

Drill No. 24
Type Mindrill E1000
Driller Jensen
Commenced 4 Sept '64
Completed 14 Sept '64

EXPLANATION
WATER LEVEL ▼ DATE

Logged D.H.S.
Date 11 Sept 64
Drawn D.R.P.E.
Checked DK
Submitted

10 ft to 1 inch Vert. Scale

Sheet 2 of 2
S3888a Ha5
Drawing No.

250—7.60 8036

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 7

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES N6810 E22691 R.L. 757.5 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION —— °

LOCATION LOWER LEFT ABUTMENT SECTION 335 ANGLE FROM HORIZONTAL 90 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L.	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
No core			NXC					NOT TESTED
SW-MW		750	10		99	Joints spaced 0·1 to 1ft, limonite stained.		
MW					100	Several joints along schistosity with clay and roots, HW rock adjacent.		
MW					100			
Slight except where SW-MW	Pale greenish grey to white banded, core has gently undulating surface in some sections due to alternating bands of variable hardness.	740	NMLC 20		100	Irregular joints with limonite, clay and roots.		28·5
SW					100	Highly to completely weathered seam, 0·02 ft. thick, dip 60°		
SERICITE-CHLORITE SCHIST	Core in 0·1 to 1 ft. lengths	730	30		100	3 limonite stained joints along schistosity.		
FRESH	Core in 1 to 5 ft, mostly 2 ft lengths				100	Joints as shown, mainly with rough, irregular surfaces, some with vuggy quartz-chlorite coatings.		6.0
		720	40		100			
					100			13·5
		710	50		100			
					100			40
	Schist abundant quartz, some granitic gneiss as shown.	700	60		100	SHEARED, partly crushed zones; joints spaced 0·01 to 0·05 ft, slickensided. Several grey clay seams, 0·01 ft thick. Core can be crumbled in fingers.		
QUARTZ SCHIST					100			13·5
Slightly to highly altered	Grey to red, pitted where pinkish, clay mainly washed away during drilling. Contains irregular masses of pyrites.	690	70		100	QUARTZ vugh, open, dips 20°, contains pink clay pockets. CRUSHED seam 0·1 ft thick.		Pink brown water return.
	71·75 feet END of HOLE							

Drill No. 24

Type Mindrill E1000

Driller Jensen

Commenced 18 Sept '64

Completed 22 Sept '64

EXPLANATION

WATER LEVEL ◁ DATE

Logged	D.H.S.
Date	22 Sept 64
Drawn	D.R.P.E.
Checked	DHS
Submitted	

10 ft to 1 inch Vert. Scale

Sheet 1 of 1

S3889

Drawing No. Ha 5+7

250—7.60 8038

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 18

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES Not Obtained R.L 825 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 260 °

LOCATION LEFT ABUTMENT SECTION 335 ANGLE FROM HORIZONTAL 60 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L.	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
NO CORE								
MW to HW					68	Vuggy quartz with limonite stains.		
MW to HW		820	NXC		23			
MW	Banded dark to light grey-green sericite schist, grades to quartz-sericite-gneiss. Mineralized in bands.		10		79	Joints spaced 0·05 to 1ft., mainly 0·5 ft., mainly parallel to foliation, with rough surfaces, clay and limonite coatings. Some dip 30° to 60°, oblique to the foliation.		NOT TESTED
MW					100			
Mainly SCHIST, some GNEISS Mainly slightly weathered, except where shown		810	NMLC		100			
			20		100			
					100			
		800			100			
HW to MW	Mineralized zone along schistosity		30		100	Joints as shown, irregular with up to 0·01 ft. of limonite coatings.		6·5
		790	40		100			
					100	CRUSHED SEAM, 0·15ft. thick, clay and rock fragments. Foliation dips 5° to 20° on core. Joints along foliation and some 50° to 75° oblique to foliation. Spaced from 0·1 to 2ft., coated with limonite and clay.	26 Oct '64	
MW to HW	Mineralized zone							
		780	50		100			< 0·5
					100			
			60		100			
		770			100	Vuggy quartz, limonite coated		
Mainly FRESH limonite stained on some joints and seam.	Green to grey-green, intensely foliated, very fine grained, coarser grained in parts with banding of quartz and felspars.		70		100		27 Oct '64	
		760			100	Crushed and partly sheared seams, 0·02 to 0·05 ft., limonite stained.		5·0
			80		100	Joints, rough, limonite coated		
	Core in 0·1 to 1·5, mainly 0·7 ft. lengths.				100	Crushed seam, 0·1 to 0·2 ft. clay, crushed rock and quartz fragments.		
NO CORE		750				Quartz vein, fragmented.		
			90		93			< 0·5
NO CORE						Crushed seam, 0·3 ft. of crushed and fragmented rock.		
					100			
FRESH	Core in 0·01 to 0·2 ft. fragments	740				Partly sheared seams, development of chlorite.		
			100		100			

Drill No. 24

Type Mindrill E1000

Driller J. Jensen

Commenced 22 Oct '64

Completed 28 Oct '64

EXPLANATION

WATER LEVEL ◁ DATE

Logged	J.P.T. & J.A.C.P.	Vert. Scale 10ft.=1in.
Date	2 Nov. '64	Sheet 1 of 2
Traced	T.P.S.	S 3961
Checked	D.W.	Ha547
Submitted		

250—7.60 8036

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 18

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES Not Obtained R.L. 825 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 260 °

LOCATION LEFT ABUTMENT SECTION 335 ANGLE FROM HORIZONTAL 60 °

ROCK TYPE / Degree of Weathering Shown in Core	DESCRIPTION	R.L.	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
SCHIST gneissic in part.	Green to grey-green, foliated, very fine-grained, banded and gneissic in part, patches of chlorite and pyrite.				100	Partly sheared seam, 0·02 ft. thick, chloritic.		< 0.5
GRANITIC GNEISS	Pale grey to grey-green, coarse-grained, schistose in part, rich in quartz, common concentrations of mica and chlorite sericite.	730	110		100	Foliation dips 5° to 20° on core.		Drilling water lost
FRESH					100	Irregular vuggy quartz, with mica and chlorite.		14 Minimum value
					100	Joints not numerous, spaced 0·4 to 2 ft, mainly along foliation.		
SCHIST	Green to grey-green, intensely foliated. Core in 0·2 to 2 ft. mainly 1 ft. lengths. Occasionally in fragments up to 0·2 ft, broken mainly along foliation	720	120		100	Crushed seam 0·04 ft. thick, alteration of minerals to Kaolin.		
					100	Partly sheared zone, up to 0·2 ft. thick, chloritic.		

127·5 FT. END OF HOLE

Drill No. 24

Type Mindrill E1000

Driller J. Jensen

Commenced 22 Oct '64

Completed 28 Oct '64

EXPLANATION

SCHIST

GRANITIC GNEISS

MW Moderately weathered

HW Highly weathered

WATER LEVEL DATE

Logged J.P.T & J.A.C.P

Date 5 Nov '64

Traced T.P.S.

Checked D.W.S.

Submitted

Vert. Scale 10 ft = 1 in

Sheet 2 of 2

S 3961a

Ha5+7

250—7.60 8036

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 19

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22 054 N 6996 R.L. [illegible] FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 225 °

LOCATION LOWER LEFT ABUTMENT SECTION 335 ANGLE FROM HORIZONTAL 60 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L. & Casing	Depth and Size of Core	Log	Litt and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
No Core			NX	NXC	40	Schistosity dips 0° to 20° on core		
No Core					40			
	Pale grey to pale greenish grey, intensely foliated, micaceous, chloritic, sericitic, pyritic in parts, some haematite in parts.				100	Joints spaced 0·2 to 1 ft. mainly 0·5 ft., mainly parallel to foliation.		Intermittant partial drilling water returns throughout hole.
					80	Sheared partly crushed seams, 0·06 to 0·2 ft. thick, clay & HW to CW crushed & fragmented rock.		
				NMLC	100			Not Tested
		790				Crushed seams up to 0·01 ft. thick parallel to cleavage, spaced 0·5 to 2 ft. between 8 & 23 ft.		
					100			
					100	Crushed seam, up to 0·02 ft. thick, dips 50° & 20° on core.		
		780			100			
					100	Joints dip 50° on core, clay & limonite coated up to 0·01 ft.		
	White to very pale grey, micaceous, chloritic				100			
		770			100			
	haematitic				100	Sheared, partly crushed seam 0·04 ft. thick		
					100	Crushed seams 0·01 ft. thick, limonite		
					100			
		760			100	Sheared zone, core largely in thin platy laminae, few crushed seams up to 0·01 ft, parallel to foliation and dip 40° to 80° on core.		
Some SW					100			
	Haematite in bands and disseminated grains	750			100			
					100			
					100	Joint dips 10°, limonite stained		
		740			100			
					100			
					100	Joints, dip 10° & 40°, limonite coated		
		730			100			
					100			
					100	Joints, irregular, cemented, limonite up to 0·01 ft. thick		
		720			100			

SCHIST Gneissic in part — FRESH TO SLIGHT — Core in 0·1 to 1·5 ft., mainly 0·5 ft. lengths

FRESH — Core in 0·1 to 2 ft., mainly 1 ft. lengths

12 Feb '65

12 March '65

24

< 0·5

1·5

12·5

NOT TESTED

Drill No. 8
Type F 15
Driller A. Martin
Commenced 5 Feb. '65
Completed 12 Feb. '65

EXPLANATION
SW Slightly Weathered
MW Moderately "
HW Highly "
CW Compleatly "
WATER LEVEL ▽ DATE

Logged J.A.C.P.
Date 10 Feb. '65
Drawn J.A.C.P.
Checked DMS
Submitted

1 in. = 10 ft. Vert. Scale
Sheet 1 of 2
SA147 Ha 5+7 Drawing No.

250—7.60 C036

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 19

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,054 N 6996 R.L. 803 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 225 °

LOCATION LOWER LEFT ABUTMENT SECTION 335 ANGLE FROM HORIZONTAL 60 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L.	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
SCHIST, Gneissic in part FRESH	White to very pale grey	710	110		100 100 100	CRUSHED SEAM, dips 10° on core, 0·01 ft. thick		NOT TESTED

114·5 ft. END OF HOLE

Drill No. 8
Type F. 15
Driller A. Martin
Commenced 5 Feb. '65
Completed 12 Feb. '65

EXPLANATION

WATER LEVEL ◁ DATE

Logged	JACP/DHS
Date	15 Feb '65
Drawn	J.A.C.P.
Checked	DWS
Submitted	

1 in = 10 ft. Vert. Scale

Sheet 2 of 2

54147a Hasft

Drawing No.

250—7.60 6036

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 20

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 21,931 N 6933 R.L. 893 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 236 °

LOCATION UPPER LEFT ABUTMENT SECTION 335 ANGLE FROM HORIZONTAL 45 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L. Casing	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
No CORE								
SLIGHT	Pale greenish grey, intensely foliated, chloritic, sericitic, micaceous, talc rich in parts, pyritic in parts. Coarser grained and gneissic in parts and development of abundant quartz and felspar.					Schistosity dips 0° to 20° on core. Joints spaced 0·1 to 0·9 ft, limonite stained & coated, dip 0° to 20° on core, clay veneers. Sheared partly crushed seams 0·01 to 0·03 ft thick, up to 0·1 ft. MW rock adjacent dip 0° to 30° on core.		NOT TESTED. Full water return above 80 ft. 50% return below 80 ft.
No CORE								
SCHIST, gneissic in parts		890	NX		94			
				10	100			
			Core in 0·1 to 1 ft. mainly 0·4 ft. lengths.			Joint, limonite and clay veneer, ground away.		
		880			100	Crushed seams 0·01 ft. thick, 0·1 ft. SW rock adjacent.	21 Jan 65	
				20	100	Joints spaced 0·2 to 1 ft. mainly 0·6 ft, dip 0° to 20° on core, limonite stained & coated in parts.		1.0
			Core in 0·2 to 2 mainly 0·5 ft lengths.		100	Joint, limonite coated up to 0·01 ft, 0·1 ft SW rock adjacent.		
		870		30				
					100	Joint, very irregular, limonite coated, clay veneer.		
					100	Partly sheared zone. Rock tends to break into fine platey laminae.		
SW	FRESH, slight to moderate along and near most joints.					Few joints limonite coated up to 0·01 ft.		
			Core in fragments and lengths up to 0·4 ft.	40				
Pegmatitic gneiss	Pale greyish green to pale brown, coarsely and irregularly banded, extremely micaceous quartzitic.				100	Joints, dip 0° to 30° and 60° to 80° on core, limonite and clay coated up to 0·01 ft., some crushed rock.		
SW MW		860					22 Jan 65	
SW					100	Crushed seam, 0·02 ft. clay and crushed rock, dips 30° on core.		2.1
				50				
					100			
					100	Crushed seam, 0·03 to 0·05 ft. clay, some crushed rock, up to 0·4 ft. SW rock adjacent.		
				60				
		850			100	Sheared partly crushed zone 0·2 to 0·3 ft. wide, MW to HW, up to 0·7 ft. SW rock adjacent.		
HW SW					100	Joints, limonite and clay coated up to 0·01 ft, dip 0° to 30° on core.		
				70				1.2
	As above, pyritic, mainly disseminated.				100	Few joints, spaced 1 to 12 ft. Core broken mainly along schistosity.	23 Jan 65	
SCHIST, gneissic in parts		840						
					100			
				80				
			Core in 0·3 to 2 mainly 0·7 ft lengths.		100	Joints spaced 0·2 to 1·5, mainly 0·5 ft, mainly parallel to foliation.		
	Fresh, limonite-stained along and some joints.							
		830			100	Joints, limonite stained and coated up to 0·01 ft, up to 0·1 ft. SW rock adjacent.		
				90				0.5
					100		26 Jan 65	
SW								16
	Fresh, limonite-stained along most joints.				100	Joints, slightly rough and irregular, limonite coated up to 0·01 ft, up to 0·4 ft. SW rock adjacent.		
				100				

Drill No. 8

Type F15

Driller A. Martin

Commenced 19 Jan 65

Completed 26 Jan 65

EXPLANATION

SW Slightly weathered

MW Moderately weathered

HW Highly weathered

WATER LEVEL ◀ DATE

Logged J.A.C.P

Date 26 Jan 65

Drawn T.P.S.

Checked DMS

Submitted

1 in = 10 ft. Vert. Scale

Sheet 1 of 2

54515 Drawing No.

Ha 547

250—7.60 D336

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 20

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 21,931 N 6933 R.L. 893 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 236 °

LOCATION UPPER LEFT ABUTMENT SECTION 335 ANGLE FROM HORIZONTAL 45 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L.	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
Schist	Fresh to slight limonite stained & SW along and near most joints. Core in 0.2 to 2 mainly 0.5 ft lengths	820	NMLC			Partly crushed seam, 0.02 ft limonite and crushed rock.		
Gneissic pegmatitic	Fine to coarse-grained, foliated to banded in parts, common irregular vuggy quartz.				100	Joints spaced 0.2 to 1.5 mainly 0.5 ft, mainly dip 0° to 20° on core, parallel to foliation, limonite-stained and coated, in parts up to 0.1 ft. SW rock adjacent, a few dip 40° to 60° on core.		0.7
Schist		110			100			
Pegmatite	Massive white quartz and felspar	810			100			
Schist								
		120						

120 FT. END OF HOLE

Drill No. 8

Type F15

Driller A. Martin

Commenced 19 Jan. 65

Completed 26 Jan. 65

EXPLANATION

WATER LEVEL ◀ DATE

SW. Slightly weathered

Logged J.A.C.P.

Sheet No. 28 Jan 65

Drawn T.P.S.

Checked DMS

Submitted

1in = 10ft

Vert. Scale

Sheet 2 of 2

S.45150

Drawing No. Fig. 5.47

250—7.60 0036

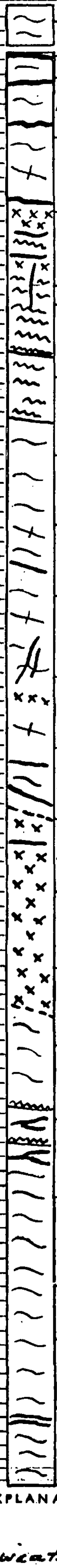
DOCKET.......................
SERIAL No....................

DEPARTMENT OF MINES — SOUTH AUSTRALIA
GEOLOGICAL LOG OF DRILL HOLE

HOLE No. 23
SHEET 1 OF 1

PROJECT: KANGAROO CREEK DAM — CO-ORDINATES: E 22,423 N 6795 — R.L. 890 FT.
FEATURE: FOUNDATION — HUNDRED: ONKAPARINGA — DIRECTION 265°
LOCATION: UPPER LEFT ABUTMENT — SECTION: 335 — ANGLE FROM HORIZONTAL 45°

Column headings: ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE | DESCRIPTION OF CORE OR CUTTINGS WHERE CORE LOST | R.L. FEET / CASING | DEPTH / SIZE OF CORE | LOG | LIFT & CORE RECOVERY % | STRUCTURES: JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES | WATER LEVEL ETC. | WATER PRESSURE TEST: LUGEON UNITS 10 20 30



Rock type & degree of weathering:

Mainly SCHIST with some GNEISS as shown.
- NO CORE (top)
- Fresh to slight, moderate to complete along & near some joints
- Slight
- Fresh to slight
- MW to HW zones up to 0.1 ft. wide near joints & seams

GRANITIC GNEISS — mainly slight, moderate near some joints & seams

SCHIST — mainly fresh to slight, moderate to high along and near some joints

Description of core:

Pale greenish-grey to white, mostly banded, chlorite-sericite schist. The more gneissic bands contain abundant quartz & felspar grains

Coarse grained, off-white, quartz-felspar-chlorite-sericite rock, gneissic. Core is pitted due to soft nature of partly weathered felspars.

Pale greenish-grey to white, banded in part, quartz-chlorite-sericite schist. Contains haematite as disseminated grains

Core lengths: Core in 0.1 to 1 ft. lengths; Core in 0.05 to 0.5 ft lengths; Core in 0.1 to 2 ft., mostly 0.5 ft lengths; 0.05 to 0.5 ft. lengths; Core in 0.1 to 2 ft. mostly 0.5 ft. lengths

R.L.: 880, 870, 860, 850, 840, 830, 820

Depth: 10, 20, 30, 40, 50, 60, 70, 80, 90, 100

Size of core: NXC; NMLC

Core recovery %: 85, 80, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100, 100

Structures:

Schistosity dips 0° to 10° on core

SEAMS of brown clay and completely to moderately weathered rock, up to 0.06 ft. thick, with roots

SHEARED zone; dip approximately 10° on core; joints spaced 0.05 to 0.5 ft, with slickensided limonite, chlorite & few clay veneers

CRUSHED seam, 0.03 ft. thick, micaceous silt with fine roots at 24 ft.

To end of hole: Joints spaced 0.2 to 2 ft. generally 0.5 ft., mostly along schistosity dip 0° to 10°. Most have veneers of earthy limonite; several, where shown on log, have up to 0.01 ft. clay and limonite, and weathered rock adjacent

Foliation dips 10° on core

gradational boundary

Highly weathered zones 0.25 ft. thick possibly sheared, partly crushed

Several irregular joints with up to 0.01 ft. red-brown clay coatings

Moderately to highly weathered zone 0.2 ft. wide near joints

101.9 ft. END OF HOLE

Water level: 7 Jan. '65; Hole empty Dec '64

Water pressure test (Lugeon units): NOT TESTED. FULL WATER RETURN THROUGHOUT; 4.0; 2.0; 3.0; 1.2

DRILL No. 24
TYPE Mindrill E1000
DRILLER Jansen
COMMENCED 15 Dec '64
COMPLETED 7 Jan '64

EXPLANATION
CASING IN HOLE DURING DRILLING | WATER LEVEL IN DRILL HOLE ← (DATE)
MW Moderately weathered
HW Highly " "

ENGINEERING GEOLOGY AND SOILS SECTION
LOGGED BY DHS 23 Dec 64
DRAWN BY DHS
CHECKED BY
DRAWING No. S4073 Ha St7

200—8.64 8116

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 25

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,267 N 6903 R.L. 842 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION — °

LOCATION LEFT ABUTMENT SECTION 335 ANGLE FROM HORIZONTAL 90 °

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L.	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
		Casing						
NO CORE		840	NX		0	Schistosity dips 40° to 70°		NOT TESTED
					0			
					0			
	Pale greenish grey to whitish green, light brown where weathered. Closely foliated micaceous and pyritic in parts sericitic chlorite schist, rich in talc in parts. Coarser grained and gneissic in parts with abundant quartz and felspar				100	Joints spaced 0·1 to 1 mainly 0·4 ft, mainly parallel to foliation, also at 70° to 75° and 20° to 40° across foliation, limonite-stained and coated, up to 0·01 ft. clay veneers.		
					100			
		830	NMLC		100	Sheared partly crushed seam 0·04 ft thick, roofs 0·01 ft.		
					100	Massive quartz vein		
		820			100	Sheared partly crushed zone 0·5 ft. thick, crushed seams up to 0·03 ft., some quartz.		
					100	Sheared partly crushed zone 1·4 ft. wide, crushed seams 0·01 to 0·04 ft. thick dip 20° across foliation and 60° parallel to foliation.		
		810			100	Crushed seam 0·01 ft. thick, dip 65° parallel to foliation.		
					100			
		800			100	Joints spaced 0·5 to 1·5 mainly 1 ft. apart, dip 40° to 70°, a few at 10° to 30°, limonite-stained and coated, clay veneers in parts.		
					100	Several sheared partly crushed seams 0·01 to 0·03 ft. thick, dip 60° and one dips 30° across foliation.		
		790			100	Crushed seams 0·01 ft. thick. HW rock adjacent.		
					100	Joints, rough in parts irregular, limonite coated.		
		780			100	Crushed seam 0·01 ft. thick.		
					100	Sheared partly crushed seam 0·02 to 0·05 ft. thick, dips 60° to 80°, up to 0·1 ft. SW rock adjacent.		
					100			
		770			100	Joints spaced 0·2 to 3 mainly 2 ft, dip 40° to 70°, limonite stained in parts		
	Zone of mainly disseminated haematite and pyrite mineralization				100	Joint, tight, dip 40°, slickensides plunge 30°, chloritic.		
		760			100	Band of haematite & earthy limonite 0·1 ft. thick		
					100			
		750			100	Joints, dip 15° to 25°, limonite stained, lower joint is limonite-coated with clay veneers		
	Pale greenish grey, talc rich				100	Joints dip 40° parallel to foliation, limonite-coated, clay veneer in part		

SCHIST, slightly gneissic in part — MW to HW — Mainly SLIGHT, MW along and near joints and seams — Core fragmented — Core in 0·1 to 1·5 mainly 0·5 ft lengths

SW — Core in 0·1 to 0·3 ft lengths

SW — Fresh, SW to MW along and near most joints — Core in 0·5 to 4 mainly 1·5 ft lengths

FRESH

99·3 FT. END OF HOLE

18 Jan 65 — 19 Jan 65 — 20 Jan 65 — Hole empty Feb '65

10.0 | 1.2 | 0.5 | 0.5

Drill No. 24
Type Mindrill E100
Driller J. Jensen
Commenced 15 Jan 65
Completed 21 Jan 65

EXPLANATION

WATER LEVEL ◀ DATE

SW Slightly weathered
MW Moderately weathered
HW Highly weathered

Logged J.A.C.P
Date 22 Jan 65
Drawn T.P.S.
Checked DMS
Submitted

1 in = 10 ft. Vert. Scale
Sheet 1 of 1
54514 Drawing No. Ha5+7

250—7.60 8036

DEPARTMENT OF MINES — SOUTH AUSTRALIA

Hole No. 26

GEOLOGICAL LOG OF DRILL HOLE

PROJECT KANGAROO CREEK DAM CO-ORDINATES E 22,263 N 6905 R.L. 842 FT

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 184°

LOCATION LEFT ABUTMENT SECTION 335 ANGLE FROM HORIZONTAL 40°

ROCK TYPE Degree of Weathering Shown in Core	DESCRIPTION	R.L. Casing	Depth and Size of Core	Log	Lift and Core rec'y %	STRUCTURES Joints, Veins, Seams Faults, Crushed Zones	WATER LEVEL	WATER PRESSURE TEST LUGEON UNITS 10 20 30
CLAY CW NO CORE SCHIST, gneissic in part. SLIGHT MW in parts FRESH, slight to moderate along and near joints and seams	Red-brown rock fragments, roots up to 0·01 ft. Pale greyish green, chloritic, sericitic, talcose in parts, closely foliated, slightly coarser grained and gneissic in parts.	840 830 820 810	NX MMLC 10 20 30 40 50		100 25 50 100 100 100 100 100 100 100 100 100 100	Schistosity dips 30° to 40° on core Clay seam 0·1 ft. thick. Sheared partly crushed seam 0·1 ft. thick. Crushed seam 2·5 ft. thick, sharp contact with SW partly sheared but tightly jointed rock below. Crushed seams 0·02 and 0·05 ft. thick, roots less than 0·01 ft. Joints spaced 0·1 to 1·5 mainly 0·5 ft, mainly parallel to schistosity, a few dip 40° to 50° on core across schistosity. Mainly slightly rough, limonite coated, clay veneers on some, in parts up to 0·1 ft. SW rock adjacent Crushed seam, 0·01 to 0·03 ft. clay and CW crushed rock, 0·1 ft. SW rock adjacent, dips 20° on core across foliation Partly crushed seam, 0·02 ft. thick, limonite coated hard and recemented Clay seam 0·01 ft. Crushed seam 0·01 to 0·02 ft thick, parallel to foliation Joints spaced 0·5 to 3 ft., mainly 1 ft., mainly parallel to foliation, limonite-stained and coated, in parts up to 0·01 ft. thick, clay veneers in parts, up to 0·05 ft. SW rock adjacent in parts Partly crushed seam 0·01 ft. thick.	26 Jan 65	NOT TESTED FULL WATER RETURN THROUGHOUT 1·3 3·5
Core in 0·1 to 1·5 mainly along joints Core in 0·5 ft. lengths Core in 0·5 to 3 mainly 1 ft. lengths								

53·3 FT. END OF HOLE

EXPLANATION

WATER LEVEL ◀ DATE

SW – Slightly weathered
MW – Moderately weathered
CW – Completely weathered

Drill No. 24
Type Mindrill E1000
Driller J. Jensen
Commenced 22 Jan 65
Completed 26 Jan 65

Logged J.A.C.P.
Date 28 Jan 65
Drawn T.P.S.
Checked DMS
Submitted

1 in = 10 ft.
Vert. Scale

Sheet 1 of 1
54513
Drawing No. Na 547

250—7.60 0036

DOCKET.....

SERIAL No.....

DEPARTMENT OF MINES — SOUTH AUSTRALIA

GEOLOGICAL LOG OF DRILL HOLE

HOLE No. 27

SHEET 1 OF 2

PROJECT KANGAROO CREEK DAM — CO-ORDINATES E 22 249 N 6786 — R.L. 929 FT.

FEATURE FOUNDATION — HUNDRED ONKAPARINGA — DIRECTION .....°

LOCATION UPPER LEFT ABUTMENT — SECTION 335 — ANGLE FROM HORIZONTAL 90°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION OF CORE OR CUTTINGS WHERE CORE LOST	R.L. / DEPTH FEET — CASING → / SIZE OF CORE	LOG	LIFT & CORE RECOVERY %	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL ETC.	WATER PRESSURE TEST LUGEON UNITS 10 20 30

no core

no core

SLIGHT to FRESH limonite stained and SW near and along joints

light grey to pale greenish-grey, micaceous, sericitic, chloritic, slightly pyritic in parts, closely foliated, coarser grained in parts with tendancy towards banding of quartz and felspars. Few purplish patches of haematitic mineralisation

Core in fragments and lengths 0·1 to 0·4 ft.

NX

3½ in.

NMLC

Schist - gneissic in part

Mainly FRESH, limonite-stained along & near most joints

Core in 0·2 to 3 mainly 1 ft. lengths

disseminated haematitic mineralisation

haematitic

Common areas of haematitic

10 20 30 40 50 60 70 80 90 100

0 0 80 100 65

Joints spaced 0·2 to 3 mainly 0·5 ft., mainly parallel to foliation, limonite stained and coated, slightly irregular, a few dip 30° to 50° across foliation.

Crushed seam 0·02 ft. thick

Schistosity dips 30° to 60°

Joint, dips 40° across foliation, limonite coated up to 0·01 ft.,

Joint, irregular, dip 30°, limonite coated, 0·01 ft. clay

Joints, irregular, dip 30°, limonite coated, 0·01 ft. clay and limonite coated

Crushed seam 0·07 ft. thick, CW, 0·2 ft. SW and partly sheared rocks adjacent.

Joints spaced mainly 1·5 ft., limonite stained and coated, clay veneers in parts, mainly up to 0·1 ft. SW rock adjacent, mainly parallel to foliation

Joints, dip 50° to 70° across foliation, limonite coated and open in parts up to 0·01 ft.

Crushed seams, 0·2 and 0·02 ft. red clay and rock fragments, dips 10° to 30° near parallel to foliation, limonite cemented, 0·4 to 0·7 ft. SW rock adjacent

Joint, dip 60°, limonite coated, open up to 0·01 ft.

Irregular vughs, limonite coated, open 0·04 ft.

Numerous joints, tight, irregular, dips near vertical, limonite coated.

Partly sheared zone, dip 40°, several joints, spaced 0·01 to 0·04 ft., limonite and clay coated up to 0·01 ft., SW to MW 0·3 ft SW rock adjacent

NOT TESTED

Water lost at 20·7 ft.
50% water return to 50 ft.
No water return below 50 ft.

8 Feb. 65 — 0.5

5 Feb. 65 — 10.5

10 Feb. 65 — <0.5

3·5

DRILL No. 24

TYPE E1000

DRILLER J. Jensen

COMMENCED 4 Feb. 65

COMPLETED 10 Feb. 65

EXPLANATION

CASING IN HOLE DURING DRILLING

WATER LEVEL IN DRILL HOLE ← (DATE)

ENGINEERING GEOLOGY AND SOILS SECTION

LOGGED BY J.A.C.P.

DRAWN BY R.A.

CHECKED BY D.M.S.

DRAWING No. S4205 Ha 5 of 7

200—8.64 8116

DOCKET.....
SERIAL No.....

DEPARTMENT OF MINES — SOUTH AUSTRALIA

GEOLOGICAL LOG OF DRILL HOLE

HOLE No. 27
SHEET 2 OF 2

PROJECT KANGAROO CREEK DAM — CO-ORDINATES E 22,249 N 6786 — R.L. 929 FT.
FEATURE FOUNDATION — HUNDRED ONKAPARINGA — DIRECTION – °
LOCATION UPPER LEFT BANK — SECTION 335 — ANGLE FROM HORIZONTAL 90°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION OF CORE OR CUTTINGS WHERE CORE LOST	R.L. / DEPTH FEET: CASING →	SIZE OF CORE	LOG	LIFT & CORE RECOVERY %	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL ETC.	WATER PRESSURE TEST LUGEON UNITS 10 20 30
SCHIST Gneissic in part — FRESH	Pale grey to greenish grey, intensely foliated — core fragmented		NMLC		100	Joints mainly along schistosity		3.5
FRESH to SLIGHT	purple colour and concentrations of haematite. Core in 0·1 to 2 mainly 1 ft. lengths	110			100	CLAY SEAM, 0.1 to 0.2 ft. thick, dip 70°, red-brown, with 0.4 ft. SW to MW rock adjacent.		6·5
					100	Joints as shown, partly open		
		120			100	SHEARED, partly crushed seams 0.01 & 0.04 ft. thick SW to MW.		

121·25 ft. END OF HOLE

TEST PRESSURES SHOWN IN POUNDS PER SQ. INCH MEASURED AT GROUND SURFACE

DRILL No. 24
TYPE E1000
DRILLER J. Jansan
COMMENCED 4 Feb '65
COMPLETED 10 Feb '65

EXPLANATION
CASING IN HOLE DURING DRILLING |
WATER LEVEL IN DRILL HOLE ← (DATE)

ENGINEERING GEOLOGY AND SOILS SECTION
LOGGED BY J.A.C.P.
DRAWN BY R.A. D.H.S.
CHECKED BY DW
DRAWING No. S4205a Hu 5+7

200—8.64 8116

DOCKET.....
SERIAL No.....

DEPARTMENT OF MINES — SOUTH AUSTRALIA

GEOLOGICAL LOG OF DRILL HOLE

HOLE No. 28
SHEET 1 OF 1

PROJECT KANGAROO CREEK DAM — CO-ORDINATES E 22,596 N 6875 — R.L. 755 FT.
FEATURE FOUNDATION — HUNDRED ONKAPARINGA — DIRECTION — °
LOCATION LOWER LEFT ABUTMENT — SECTION 335 — ANGLE FROM HORIZONTAL 90°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION OF CORE OR CUTTINGS WHERE CORE LOST	R.L. (FEET)	DEPTH (FEET)	LOG	LIFT & CORE RECOVERY %	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL ETC.	WATER PRESSURE TEST LUGEON UNITS
Slightly weathered, limonite-stained	Core in pieces up to 0·5 ft.	750			20	Schistosity dips 50° to 70°.		NOT TESTED
FRESH, limonite stained, and SW in parts along and near most joints.	Grey to greenish grey, finely laminated, slightly micaceous, chloritic, sericitic, talc rich in part, coarser grained and gneissic in part with some banding of quartz and felspars.	740	10		50	To 37 ft., joints spaced 0·3 to 3 mainly 1 ft., mainly parallel to foliation, mainly tight, limonite stained and coated, a few dip 20° to 40° across foliation.		
					60	Crushed seam 0·02 ft. ← clay, some CW crushed rock, limonite coated.		
		730	20			Joint, open in parts up to 0·06 ft., partly filled with limonite and limonite-coated vuggy quartz.		
SW to MW	Core in 0·1 to 0·3 ft. lengths.	720	30			Crushed seam, dip 70° 0·05 ft. CW crushed rock, some clay and quartz, up to 1 ft SW rock adjacent.		7·5
SCHIST	Core mainly in 1 ft. lengths, broken mainly along foliation.	710	40			Crushed seam 0·01 ft. Joint dip 30°. Below 37 ft., few joints, widely spaced, tight, core breaks along foliations.		
FRESH		700	50			Partly sheared seams parallel to schistosity, 0·1 to 0·3 ft. thick, joints spaced 0·01 to 0·4 ft, chlorite and talc veneers		3·4
		690	60			Sheared zone 0·9 ft. wide, joints spaced 0·01 to 0·1 ft, mainly parallel to foliation, chlorite and talc coated, contains crushed seam 0·05 ft. thick at 71·5 ft.		1·6
FRESH to SLIGHT	Core mainly in 0·1 to 0·3 ft. lengths	680	70			← Sheared partly crushed zone 0·5 ft. wide, dip 40°		
	Core in 0·2 to 3 mainly 1 ft. lengths, broken mainly along foliation.		80			← Crushed seam 0·02 ft. thick, recemented in part. ← Crushed seam 0·03 ft. thick.		
FRESH	Very dark grey to dark greenish grey, finely laminated, but core tends to break in part across foliation.	670	90			Pyritic mineralisation, 0·3 ft. thick zone.		<0·5
		660						

100·3 FT. END OF HOLE

DRILL No. 24
TYPE E1000
DRILLER J. Jensen
COMMENCED .....
COMPLETED 19. Feb. 65

EXPLANATION
CASING IN HOLE DURING DRILLING
WATER LEVEL IN DRILL HOLE ← (DATE)

ENGINEERING GEOLOGY AND SOILS SECTION
LOGGED BY J.A.C.P.
DRAWN BY T.P.S.
CHECKED BY DHS
DRAWING No. S4204

200—8.64 8118

Ha5+7

DOCKET.....
SERIAL No.....

DEPARTMENT OF MINES — SOUTH AUSTRALIA

GEOLOGICAL LOG OF DRILL HOLE

HOLE No. 29
SHEET 1 OF 2

PROJECT KANGAROO CREEK DAM
FEATURE FOUNDATION
LOCATION UPPER RIGHT BANK

CO-ORDINATES E 22651 N 7173
HUNDRED YATALA
SECTION 5497

R.L. 905 FT.
DIRECTION 185½
ANGLE FROM HORIZONTAL 60°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION OF CORE OR CUTTINGS WHERE CORE LOST	R.L. FEET	DEPTH FEET	CASING / SIZE OF CORE	LOG	LIFT & CORE RECOVERY %	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL ETC.	WATER PRESSURE TEST LUGEON UNITS 10 20
NO CORE			0			0	Foliation dips 35° to 60° on core.		
GNEISS, Schistose in part, some GRANITIC GNEISS as shown FRESH, limonite stained along most joints SLIGHT (MW)	Mainly grey, medium to coarse grained, banded quartz and felspars, finer grained and intensely foliated in parts	900	10	NXC		100	Several CRUSHED seams, ←0·01ft. thick in zone 0·1ft wide		NOT TESTED
						100	Joints spaced 0·1 to 1, mostly 0·4 ft, dip 40° to 60° on core, parallel to foliation, also 0° to 20° across core and 50° to 80° on core across foliation. Limonite and clay coated.		
		890	20	NMLC		100	Several joints parallel to foliation, limonite-coated, vuggy, open up to 0·02 ft.		>30LU
						100	CLAY seam 0·04 ft. thick, containing few rock fragments.		
		880	30				←CRUSHED seams 0·01 ft thick, dip 70° and 40° on core, near parallel to foliation.		
SCHIST, gneissic in part	Mainly grey, intensely foliated, coarser grained gneissic bands.					100	CRUSHED seam, 0·01 ft thick		
mainly GRANITIC GNEISS, some SCHIST and GNEISS Mainly SLIGHT, moderate to high along many joints and seams FRESH to SLIGHT, limonite stained joints moderate	Grey to greenish grey, yellow-brown where weathered, fine to coarse grained, banded quartz-felspar rock. Much of the rock is a recemented breccia. Many lenticular voids are present, mostly parallel to foliation.					100	Joints mostly regular, rough in parts, limonite-stained and coated, clay veneers in parts.		
		870	40			100	CLAY seams 0·01 to 0·02 ft. thick along irregular joints as shown; SHEARED partly crushed seam, 0·03ft thick, limonite coated.		0·8LU
							←CRUSHED seams 0·03 ft. red clay, and limonite coated crushed rock, quartz.		
		860	50			100			
						100	SHEARED, partly crushed zones 0·1 to 0·3ft. wide ←up to 03ft. MW rock adjacent.		
	Grey, very fine to fine grained, equigranular, vague foliation		60						
		850				100	SHEARED partly crushed zones, 0·03 to 0·1ft wide, limonite coated. Partly sheared zones, ←0·02 to 0·04 ft. wide.		2·3LU
	Foliated quartz-felspar rock, some schistose bands.					100			
			70			100	Several irregular joints with clay veneers.		
		840		NMS					
						100	←Joint with moderately weathd. schist up to 0·01ft thick adjacent.		
SCHIST and GNEISS as shown FRESH, limonite stained and coated along most joints Slight	Grey to greenish-grey, intensely foliated, chloritic.		80			100	Joints, irregular as shown. ←Joints limonite-stained & coated up to 0·02 ft.		
		830				100			<0·5LU
			90			100	SHEARED partly crushed zone ←0·1 ft wide, limonite coated and SW to CW		
						100	Joints spaced 0·1 to 2ft., mostly along foliation, limonite coated.		
		820	100						

Core in 0·1 to 1·5 mainly 0·5 ft. lengths.
Core in 0·3 to 3 Mainly 1·5ft lengths.

DRILL No. 5
TYPE E.1000
DRILLER F. Gaden
COMMENCED 23 Mar. 65
COMPLETED 5 Apr. 65

EXPLANATION

CASING IN HOLE DURING DRILLING
WATER LEVEL IN DRILL HOLE ← (DATE)

MW - moderately weathered
SW - slightly
CW - completely
weathd. - weathered.

ENGINEERING GEOLOGY AND SOILS SECTION
LOGGED BY JACP & DHS
DRAWN BY R.H
CHECKED BY DS
DRAWING No. S4332?H5?

200—8.64 8116

DOCKET.....

SERIAL No.....

DEPARTMENT OF MINES — SOUTH AUSTRALIA

GEOLOGICAL LOG OF DRILL HOLE

HOLE No. 29

SHEET 2 OF 2

PROJECT KANGAROO CREEK DAM — CO-ORDINATES E 22651 N 7173 — R.L. 905 FT.

FEATURE FOUNDATION — HUNDRED YATALA — DIRECTION 185½°

LOCATION UPPER RIGHT BANK — SECTION 5497 — ANGLE FROM HORIZONTAL 60°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION OF CORE OR CUTTINGS WHERE CORE LOST	R.L.	DEPTH FEET	LOG	LIFT & CORE RECOVERY %	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL FT.	WATER PRESSURE TEST LUGEON UNITS
mainly SCHIST, some GRANITIC GNEISS, as shown — FRESH; High — SLIGHT; FRESH to Highly weathered	Pale grey-green to white, intensely foliated, quartz chlorite - sericite shist.	810	110		100	← VUGH, with pyrites grains. Joints. spaced 0·5 to 2 ft., mostly irregular, limonite- and clay-coated		1·0 LU
					100			
					100	CRUSHED seam 0·01 ft thick, completely weathered →		
					100	← VUGH, clay and limonite filled, irregular.		
			120		100			
		800			100	CRUSHED seam 0·05 ft. thick, with vuggy quartz ←		<0·5 LU
			130		100			
		790			100	← Vuggy quartz veins with pyritic minerals.		
			140		100	←		
	140 feet END OF HOLE							

DRILL No. 5

TYPE E100

DRILLER F. Gaden

COMMENCED 23 Mar. 65

COMPLETED 5 Apr. '65.

EXPLANATION

CASING IN HOLE DURING DRILLING |

WATER LEVEL IN DRILL HOLE |← (DATE)

ENGINEERING GEOLOGY AND SOILS SECTION

LOGGED BY J.A.C.P. + D.H.S.

DRAWN BY R.H.

CHECKED BY D.H.S.

DRAWING No. S4332-9 H5+7

200—8.64 8116

DOCKET.....
SERIAL No.....

DEPARTMENT OF MINES — SOUTH AUSTRALIA

GEOLOGICAL LOG OF DRILL HOLE

HOLE No. 30
SHEET 1 OF 1

PROJECT: KANGAROO CREEK DAM — CO-ORDINATES E 22624 N 6914 — R.L. 734 FT.
FEATURE: FOUNDATION — HUNDRED ONKAPARINGA — DIRECTION — °
LOCATION: RIVER BED — SECTION 335 — ANGLE FROM HORIZONTAL 90°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION OF CORE OR CUTTING'S WHERE CORE LOST	R.L. / DEPTH FEET (CASING / SIZE OF CORE)	LOG	LIFT & CORE RECOVERY %	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL ETC.	WATER PRESSURE TEST LUGEON UNITS
Scree boulders — MW / NO CORE / FR-SW / NO CORE / SW / NO CORE / FR-SW / NO CORE / SW	Erratic pebbles and boulders of schist and gneiss — talus debris from road cutting, fresh to slightly weathered ?	Core in fragments, lengths and fragments up to 0.5 ft.			Scree and talus debris	River Level Feb 65	NOT TESTED
730		NX			? Foliation dips 20° to 40°		
720		10			Few joints, widely spaced, tight, regular. Joint dip 60°, limonite stained.		
Schist — FRESH	Dark grey to greenish grey, very fine-grained, intensely foliated, chloritic, micaceous, sericitic, pyritic in parts	Core fragmented in up to 0.1 ft. lengths.			Joints dip 50°+80°, chlorite veneers, pyritic, tight.		
		20			Joints dip 60°, rough, chlorite veneers, tight.		
710					Partly crushed seam, talc veneer, less than 0.01 ft. crushed rock		18
Granitic gneiss	coarser grained, lighter grey	Core fragmented mainly 1.5 ft. lengths.			Several joints, irregular dip 30° to near vertical, chlorite veneers, tight.		
700		30			Joint, dip 50°, open, partly filled with up to 0.01 ft. quartz and calcite.		
Schist	intensely foliated.						
	grey to greenish grey, medium to coarse grained, schistose and intensely foliated in parts. Several vuggy, mineralized quartz veins						
Granitic gneiss		Core in 0.2 to 3 mainly			Core broken mainly along foliations.		6.8
690		40					
		50					

51.5 ft. END OF HOLE

DRILL No. 8
TYPE F15
DRILLER A. Martin
COMMENCED 22 Feb 65
COMPLETED 24 Feb 65

EXPLANATION
CASING IN HOLE DURING DRILLING
WATER LEVEL IN DRILL HOLE ← (DATE)

ENGINEERING GEOLOGY AND SOILS SECTION
LOGGED BY J.A.C.P.
DRAWN BY T.P.S.
CHECKED BY D.M.S.
DRAWING No. S4202

200—8.64 8110

Has+7

DOCKET.....

SERIAL No.....

DEPARTMENT OF MINES — SOUTH AUSTRALIA

GEOLOGICAL LOG OF DRILL HOLE

HOLE No. 31

SHEET 1 OF 1

PROJECT KANGAROO CREEK DAM CO-ORDINATES NOT OBTAINED R.L. ..... FT.

FEATURE FOUNDATION HUNDRED ONKAPARINGA DIRECTION 248°

LOCATION END OF ADIT 2, LEFT BANK SECTION 335 ANGLE FROM HORIZONTAL +1°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION OF CORE OR CUTTINGS WHERE CORE LOST	CORE LOSS LIFT %	CORE SIZE DEPTH RL. FT	LOG	FRACTURE LOG	STRUCTURES JOINTS, VEINS, SEAMS FAULTS CRUSHED ZONES	% DRILL WATER LOSS	WATER PRESSURE TESTS PERMEABILITY IN LUGEON UNITS
GNEISS — FRESH, limonite stained along and near all joints	No core → Fine to medium grained, coarser in parts, banded quartz and felspars, intensely foliated. Grey to light grey and greenish grey.		NXC NMS			Foliation dips 40° to 60° on core. SHEARED SEAM dips 20° on core, 0.03 ft. wide HW but limonite cemented 0.1 to 0.4 HW rock adjacent. Joint irregular, limonite-stained and coated. Several joints, dip parallel to foliation, limonite coated, clay veneer.		NOT WATER TESTED
SCHIST — SW-MW / MW-HW	Very fine grained, light grey, pinkish & brown where weathered, Intensely foliated.		10			Joints, limonite and clay coated.		
GNEISS, Schistose in parts — FRESH. few joints limonite stained — SW limonite stained joints	Light grey to grey and greenish. Fine to medium grained, coarser grained in parts. Quartz and felspars frequently banded. Intensely foliated.		20			Partly SHEARED ZONE, 3 ft. wide, joints spaced 0.1 ft, limonite- and clay-coated, with CRUSHED SEAM 0.04 to 0.1 ft. thick. Joints parallel to foliation, limonite coated, most have clay veneer		
			30			Few joints, limonite stained, occasionally with clay veneer, mainly parallel to foliation.		
			40			Irregular quartz and chlorite, few joints with clay.		
						Joints, limonite-coated, clay veneer, up to 0.04 ft. SW rock adjacent.		
SCHIST — SW	Intensely foliated grey to brownish purple, haematite		50			Quartz, vuggy limonite-coated, mineralised.		
				50.8 feet END OF HOLE				

DRILL No. E 1000

TYPE 24

DRILLER J. Jensen

COMMENCED 15. Sept. '65

COMPLETED 16. Sept. '65

EXPLANATION

CASING IN HOLE DURING DRILLING

WATER LEVEL IN DRILL HOLE ← (DATE)

FRACTURE LOG 1 4 16 64 — Breaks in core per foot or 1 / Diameter of fragments in feet.

12 3 3/4 3/16 Inches } Equivalent Diameter

1 .25 .06 .015 Feet }

ENGINEERING AND SOILS GEOLOGY SECTION.

LOGGED BY J.A.C.P.

DRAWN BY R.H.

CHECKED BY.....

DRAWING No. S 4726 Ha5+7

200—8.64 8116

DOCKET.....

SERIAL No.....

DEPARTMENT OF MINES — SOUTH AUSTRALIA

GEOLOGICAL LOG OF DRILL HOLE

HOLE No 32

SHEET 1 OF 1

PROJECT KANGAROO CREEK DAM. CO-ORDINATES NOT OBTAINED ..... R.L. ..... FT.

FEATURE FOUNDATION. HUNDRED ONKAPARINGA. ..... DIRECTION 240°

LOCATION END OF ADIT No. 1. SECTION ..... ANGLE FROM HORIZONTAL +1°

ROCK TYPE & DEGREE OF WEATHERING SHOWN IN CORE	DESCRIPTION OF CORE OR CUTTINGS WHERE CORE LOST	CORE LOSS LIFT %	CORE SIZE DEPTH RL. FT	LOG	FRACTURE LOG	STRUCTURES JOINTS, VEINS, SEAMS FAULTS, CRUSHED ZONES	% DRILL WATER LOSS	WATER PRESSURE TESTS PERMEABILITY IN LUGEON UNITS
FRESH limonite coatings on most joints. GNEISS generally schistose. FRESH	Grey to greenish-grey, mainly fine- to medium-grained, banded quartz and felspars, intensely foliated.		NX NMLC 10 20 30 40 50			Foliation dips 40° to 60° on core. SHEARED seams 0·02 to 0·1 ft. thick, limonite stained and SW in parts. Most joints limonite coated, often with veneer of red-brown clay, mainly parallel to foliation. vuggy quartz, limonite coated. Partly SHEARED zone 0·5 ft. wide. SHEARED ZONE 1·8 ft. wide, talc rich, sericitic, several CRUSHED seams up to 0·1 ft. thick, limonite stained and SW in parts, red-brown clay on joints. CRUSHED seam 0·1 ft. thick, with quartz sericitic, talc rich. Partly SHEARED ZONE 2·5 ft. wide, joints spaced 0·01 to 0·2 ft., chlorite and some calcite on joints, possibly SW. Partly SHEARED partly CRUSHED ZONE 0·5 ft. wide, mineralised with Chalcopyrite, pyrite, etc. Numerous joints, spaced 0·01 to 0·3 ft. SHEARED partly CRUSHED zone 0·04 to 0·12 ft. wide.		NOT TESTED
	END OF HOLE 52·5 ft.							

DRILL No. 24.

TYPE E100

DRILLER J. Jensen.

COMMENCED 21 Sept. 1965

COMPLETED 23 Sept. 1965

EXPLANATION

CASING IN HOLE DURING DRILLING

WATER LEVEL IN DRILL HOLE ← (DATE)

FRACTURE LOG 1 4 16 64 Breaks in core per foot or 1 / Diameter of fragments in feet.

12 3 3/4 3/16 Inches } Equivalent

1 ·25 ·06 ·015 Feet } Diameter

ENGINEERING AND SOILS GEOLOGY SECTION.

LOGGED BY J. A. C. P.

DRAWN BY S. W.

CHECKED BY.....

DRAWING No. S 4818 aHa 5-7

200—8.64 8116

APPENDIX B

LOGS OF EXPLORATORY ADITS, WITH EXPLANATORY NOTES

FIGURES	DWG. NO.
Kangaroo Creek Dam, Exploratory Adit No. 1, Geological Log	65-816
Kangaroo Creek Dam, Exploratory Adit No. 2, Geological Log	65-827
Kangaroo Creek Dam, Exploratory Cross Adits 1 & 2, Geological Log	65-817
Kangaroo Creek Dam, Exploratory Adits Geological Section	~~64-330~~ 65-320

APPENDIX B

LOGS OF EXPLORATORY ADITS WITH EXPLANATORY NOTES

INTRODUCTION

Two horizontal adits 6.5ft. wide and 9ft. high were constructed as part of the geological investigations for Kangaroo Creek Dam. Details are summarised below:

ADIT NO.	INVERT R.L. (FT.)	BEARING	LENGTH (FT.)
1	757	240°	120
2	847	248°	139

NOTES ON DETAILS SHOWN ON LOG SHEETS

The title block in the lower right hand corner shows the scale and the position of the sheet in the sequence when more than one log sheet is used. Headings on the left hand side indicate the type of information contained in the horizontal columns.

Tunnel Stations

Positions in the tunnel are given by stations, one station being equal to 100ft. measured horizontally along the centre line of the tunnel, e.g. Sta. 1 + 15 is 115ft. from the Datum, Sta. 0 + 00.

Progress

The position of the heading at the end of each working day is recorded.

Rock Type

The rock types shown graphically elsewhere on the log sheet are here described in words. Degrees of weathering are also described.

Log of Roof and Walls

Geological information is projected on to three strips representing the roof and walls of the tunnel.

The strips are obtained geometrically by rotating the walls about their join lines with the roof outwards through 90°, and then projecting them, together with the roof, on to a horizontal plane tangential to the roof. (The method is shown in a diagram on the log sheet). This projection enables the user of the log to obtain a 3-dimensional picture of the tunnel, by folding the wall strips downwards. The roof and walls are drawn as if viewed from outside the tunnel, and this must be borne in mind when using the log sheets during an inspection of the tunnel.

The information plotted graphically includes the rock types and the traces of structural features in the rock. The true strike and dip of these geological features in relation to the tunnel direction, are plotted by conventional symbols in the lines labelled "Plan", above the below the graphic strips.

Excavation Condition

The figure in this column describes the condition of the rock surrounding the completed excavation, taking into account the rock material, the geological defects (joints, seams etc.) and their orientation, and the effects of blasting and stress re-distribution. The figures used are from the following table, based on tables by Talobre and Terzaghi (Refs. 1 and 2).

CLASSIFICATION	CHARACTERISTICS
5	The rock mass is perfectly sound and very compact.
4	The rock mass is sound, but somewhat loosened along joints.
3	The rock mass is considerably loosened along joints.
2	The rock mass is very loosely jointed and seamy, requiring continuous support.
1	The rock mass exerts considerable pressure on supports.

Percent Breakage along Joints

The percentage of the area of the roof and walls of the tunnel which consist of natural joint faces (as distinct from fresh fractures across the rock fabric) is estimated to the nearest 10 per cent.

Support During Construction

Steel supports are shown as thick vertical lines.

Excavation

The distance the tunnel has advanced in each cycle is shown by a vertical line. The number of holes drilled and their length, and the weight (in pounds) of explosives used per round is recorded. When records have been incomplete a summary in words is used to cover the appropriate length of tunnel.

REFERENCES

1. TALOBRE, J. (1957) La Mechanique des Roches (Dunod: Paris) p.16.

2. TERZAGHI, Karl (1946) Rock Tunneling with Steel Supports (The Commercial Shearing and Stamping Co: Youngstown, Ohio) p. 91.

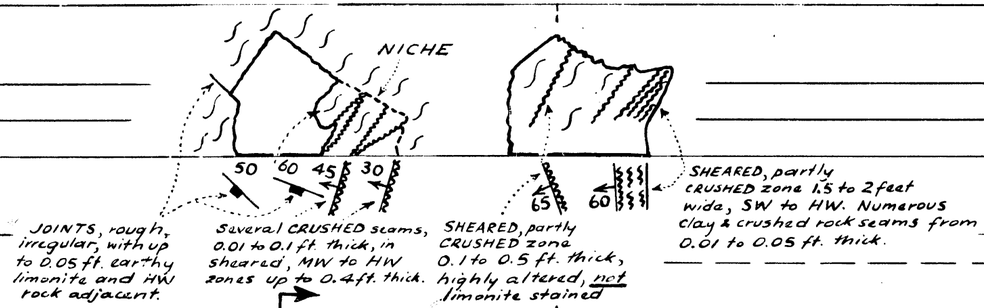
TUNNEL STATIONS: 0+00 CROSS ADIT NO. 2 — 0+50 — 0+00 CROSS ADIT Nº 1

DIRECTION, INVERT LEVEL, SLOPE

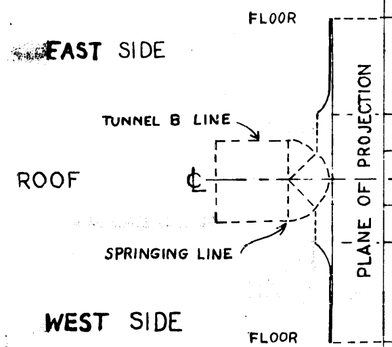
PROGRESS HEADING AT, DATE: 27 July | 28 July | 30 July | 31 July | 13 July | 14 July.

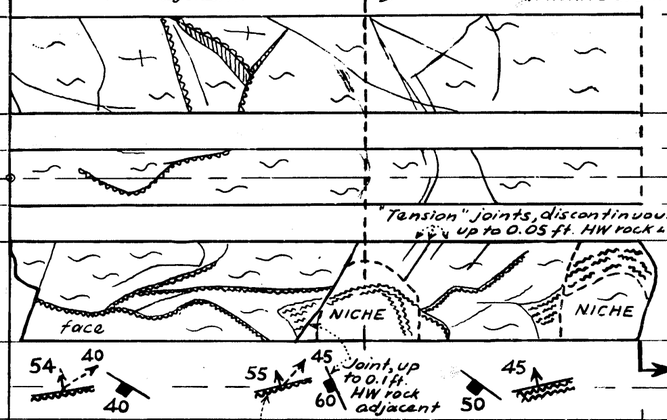
ROCK TYPE and DEGREE of WEATHERING: SECTION STA. 0+28 / FACE STA. 0+49 — SCHIST and GNEISS Mainly FRESH, moderate to high in mineralised zones

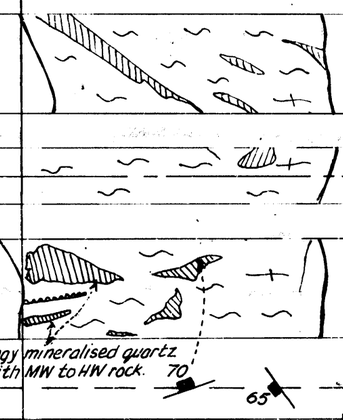
LOG OF FACE
Looking in direction of tunnel stations
AND
SECTIONS SHOWING OVERBREAK



PLAN, 4 feet above floor







STRUCTURES
JOINTING PATTERN-ATTITUDE, SPACING, PERSISTENCE, CHARACTER SURFACE, SEPARATION COATING
FAULTS SHEARED AND CRUSHED ZONES, ATTITUDE, RELATIVE DISPLACEMENT, WIDTH, CHARACTER OF MATERIAL

EXCAVATION CONDITION: 4 - 3 | 4
PERCENT BREAKAGE ALONG JOINTS: 45 | 40
SUPPORT DURING CONSTRUCTION (Springing line: SOUTH SIDE / ROOF / NORTH SIDE)
EXCAVATION STRIPPING — ADVANCE Nº of HOLES, EXPLOSIVES, lbs.: Rounds of mainly 21 holes, 5 ft. long, 23 to 30 lbs An 75, 4 to 5 ft. advances. | Rounds of mainly 20 holes 5 ft. long, 27 to 30 lbs An 60, 5 ft. advances.
GROUND WATER — INITIAL QUANTITY, DATE: Mainly dry, Some seepages | Dry
QUANTITY, DATE: Dry. (May '67) | Dry (May '67)
TEMPERATURE
FEELER HOLES & GROUTING
PHOTOGRAPHS CATALOGUE Nº: KC 63/8/65 ♂ ♀ KC 61/8/65 KC 55/8/65 KC 56/8/65 KC 58/8/65 KC 59/8/65 ♀ KC 57/8/65 ♀ | KC 29/7/65 ♂ KC 30/7/65 ♂
FINAL SUPPORT OR LINING ESTIMATED / AS CONSTRUCTED

LEGEND

- STRIKE & DIP OF JOINT (60)
- STRIKE OF VERTICAL JOINT
- HORIZONTAL JOINT
- STRIKE & DIP OF SCHISTOSITY (40)
- STRIKE & DIP OF BEDDING (30)
- HW HIGHLY WEATHERED
- CW COMPLETELY WEATHERED
- CRUSHED SEAM Showing dip (80)
- SHEARED or CRUSHED ZONE Showing dip and width. (70, 2')
- FAULT Showing relative movement.
- 200 ⊗ WATER INFLOW 200 gallons per hour.
- S SEEPAGE
- O PHOTO BLACK & WHITE
- ● PHOTO COLOUR
- SCHIST
- GNEISS
- • SPECIMEN COLLECTED
- TUNNEL SUPPORTS: STEEL SETS, WALL PLATES, ROCK BOLTS, MESH, GUNITE

ENGINEERING GEOLOGY SECTION

LOGGED DHS JPT	J.P. Trudinger GEOLOGIST
DRAWN DHS	SENIOR GEOLOGIST

S. A. DEPARTMENT OF MINES

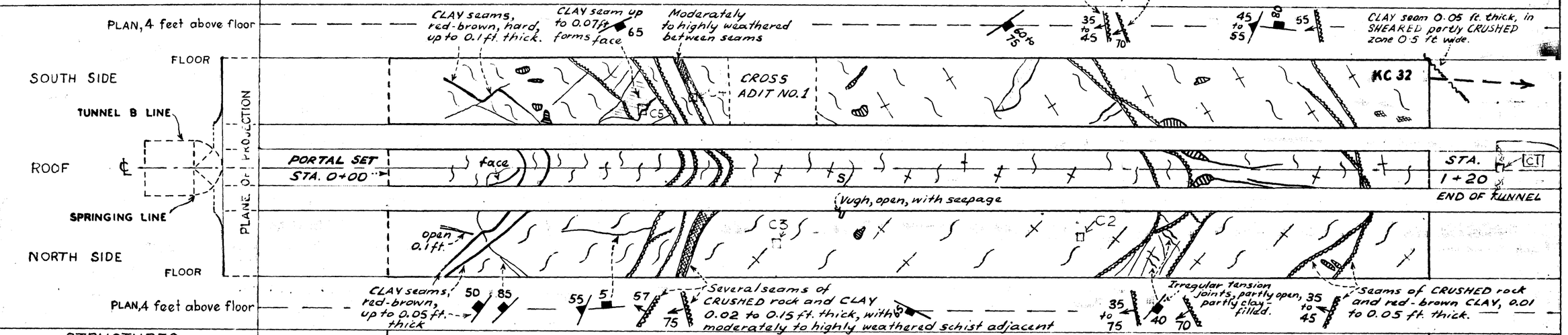
KANGAROO CREEK DAM
EXPLORATORY CROSS ADITS 1 & 2
GEOLOGICAL LOGS

DATE 31 July '65 | SCALE 1in = 10ft. | SHEET 1 OF 1

65-817 Ho5+7

TUNNEL STATIONS	0+00	0+50	1+00	1+20
DIRECTION, INVERT LEVEL, SLOPE				
PROGRESS HEADING AT, DATE		2 July | 3 July | 5 July | 6 July | 7 July | 8 July | 9 July | 10 July | 12 July | 13 July		
ROCK TYPE and DEGREE of WEATHERING		SCHIST: Mainly SLIGHT, moderate to high near joints and seams	SCHIST and GNEISS: FRESH with some limonite stained joints and vughy quartz veins	Mainly FRESH, slight to high near joints and seams

LOG OF FACE
Looking in direction of tunnel stations
AND
SECTIONS SHOWING OVERBREAK



STRUCTURES	JOINTING: PATTERN-ATTITUDE, SPACING, PERSISTENCE, CHARACTER SURFACE, SEPARATION COATING FAULTS: SHEARED AND CRUSHED ZONES, ATTITUDE, RELATIVE DISPLACEMENT, WIDTH, CHARACTER OF MATERIAL	
EXCAVATION CONDITION	2 | 4 | 5 | 4	
PERCENT BREAKAGE ALONG JOINTS	15 | 5 | 40	
SUPPORT DURING CONSTRUCTION	SOUTH SIDE / Springing line / ROOF / NORTH SIDE	Unsupported
EXCAVATION STRIPPING	ADVANCE No of HOLES EXPLOSIVES, lbs.	Rounds of C & S holes 3 ft to 4 ft, 2-3 lbs Am 60 — Rounds of mostly 21 holes, 5 ft long, with 23 to 30 lbs An 60, 4 ft to 5 ft advance
GROUND WATER	INITIAL QUANTITY, DATE QUANTITY, DATE TEMPERATURE	Mainly dry, several areas of seepage Dry, (May '67)
FEELER HOLES & GROUTING		None
PHOTOGRAPHS	CATALOGUE No	KC 36/7/65 · KC 39/7/65, KC 38/7/65, KC 37/7/65 · KC 34/7/65 · KC 31/7/65 · KC 40/7/65 · KC 41,2,3/7/65, KC 32/7/65 · KC 35/7/65 · KC 34/7/65
FINAL SUPPORT OR LINING	ESTIMATED AS CONSTRUCTED	

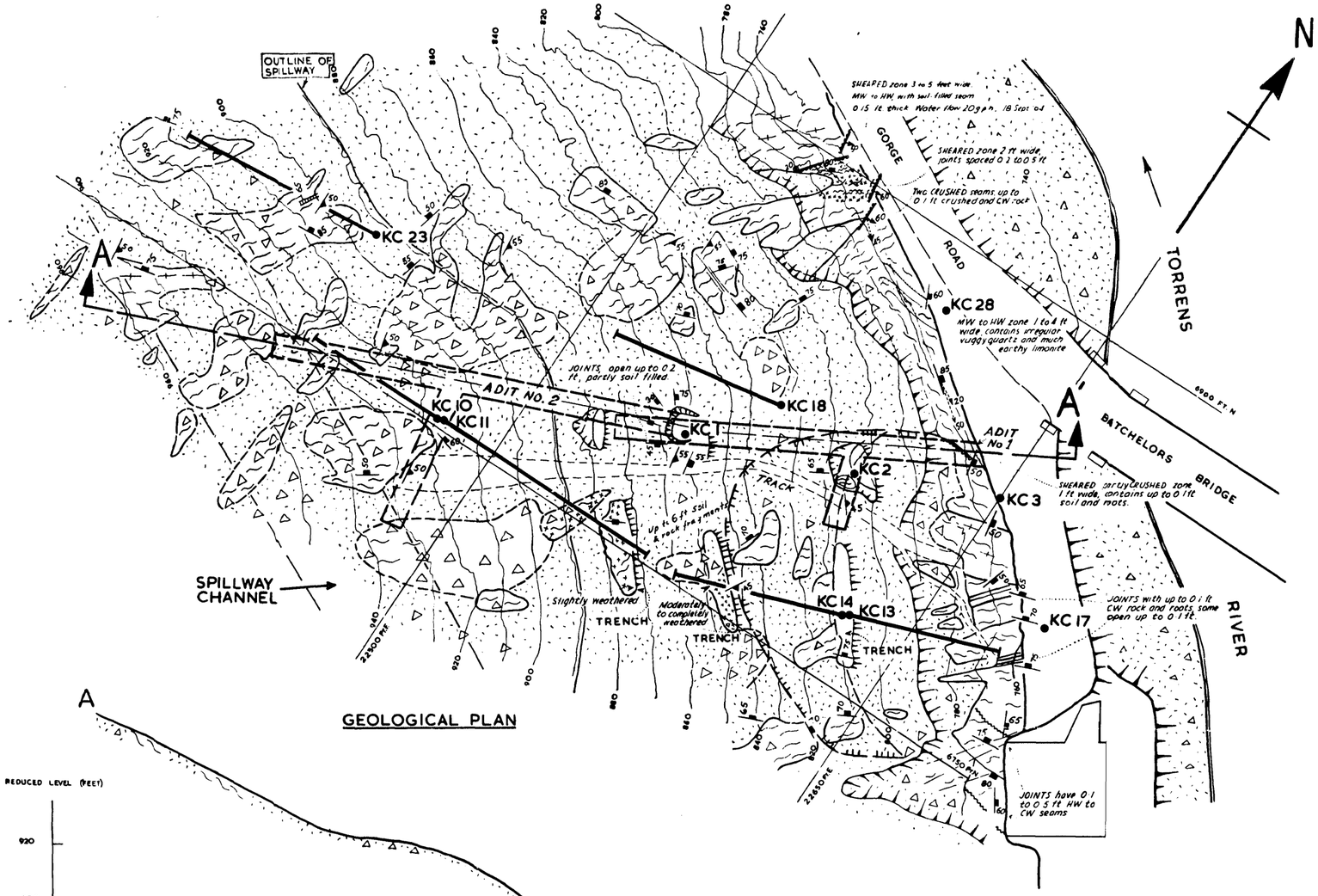
Trim

LEGEND

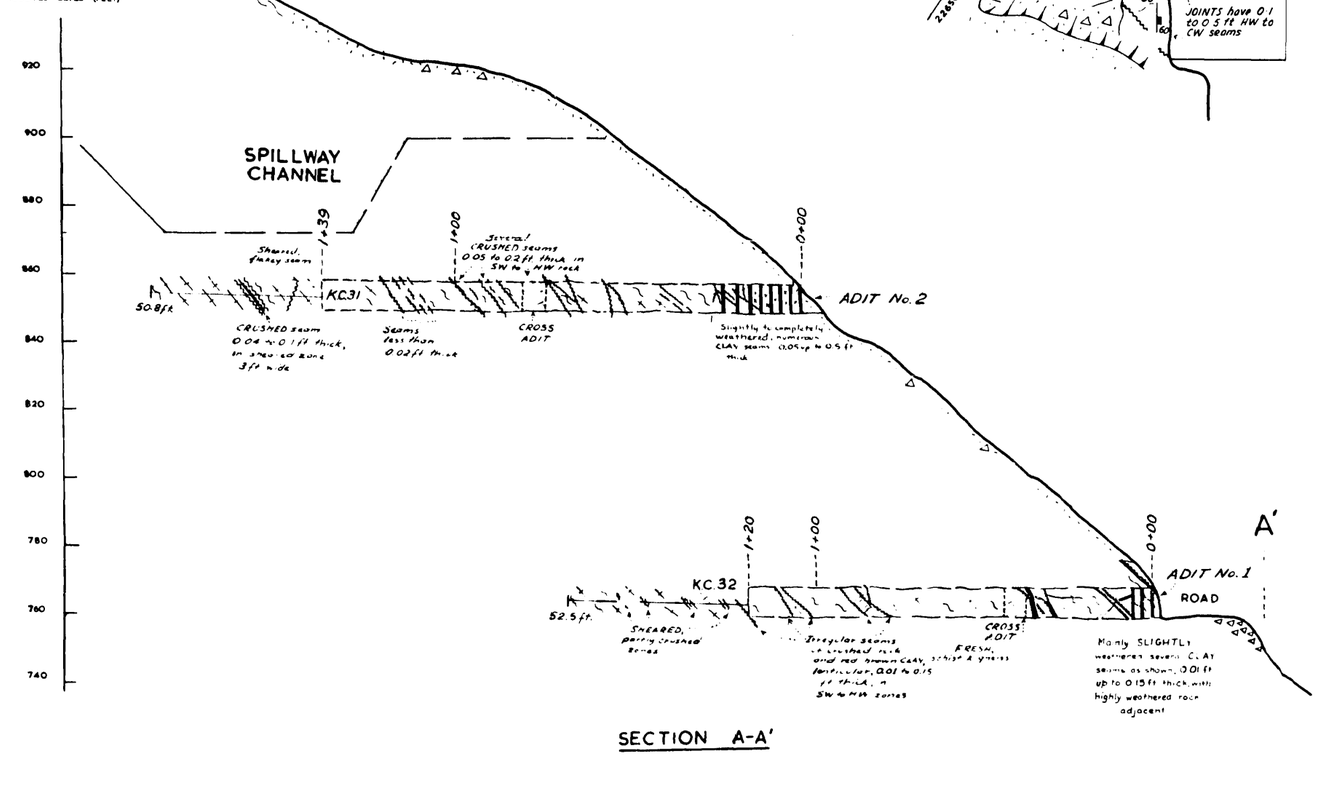
- STRIKE & DIP OF JOINT
- STRIKE OF VERTICAL JOINT
- HORIZONTAL JOINT
- STRIKE & DIP OF CLEAVAGE
- STRIKE & DIP OF SCHISTOSITY
- HW HIGHLY WEATHERED
- CW COMPLETELY WEATHERED
- CRUSHED SEAM Showing dip
- SHEARED or CRUSHED ZONE Showing dip and width.
- FAULT Showing relative movement.
- 200 ⊗ WATER INFLOW 200 gallons per hour.
- S SEEPAGE
- O PHOTO BLACK & WHITE
- ● PHOTO COLOUR
- Vein of QUARTZ/PEGMATITE
- SCHIST
- GNEISS
- C2 CLEANUP POSITION.
- • SPECIMEN COLLECTED
- TUNNEL SUPPORTS: STEEL SETS, WALL PLATES, ROCK BOLTS, MESH, GUNITE

ENGINEERING SERVICES SECTION		S. A. DEPARTMENT OF MINES
LOGGED J.P.T.	J.P. Trudinger GEOLOGIST	KANGAROO CREEK DAM EXPLORATORY ADIT No. 1 GEOLOGICAL LOG
DRAWN D.H.S.	SENIOR GEOLOGIST	SCALE: 1 in. = 10 ft. | DATE: 28 July '65 | SHEET 1 OF 1

65 – 816 Ha 5+7

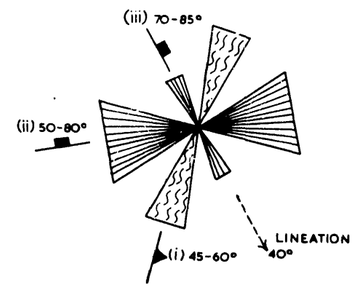


GEOLOGICAL PLAN



SECTION A-A'

DIAGRAM SHOWING DIRECTION OF GEOLOGICAL STRUCTURES



LEGEND

ROCK TYPE

- GNEISS
- SCHIST
- GRANITIC GNEISS
- SOIL
- BOULDERS, LOOSE BLOCKS

STRUCTURES

- STRIKE AND DIP OF JOINT
- STRIKE OF VERTICAL JOINT
- STRIKE AND DIP OF FOLIATION
- TREND AND PLUNGE OF LINEATION
- STRIKE AND DIP OF CRUSHED OR SHEARED ZONE

WEATHERING

- MW MODERATELY WEATHERED
- HW HIGHLY WEATHERED
- CW COMPLETELY WEATHERED

KC 14 DIAMOND DRILL HOLE SLOPED

KC 3 DIAMOND DRILL HOLE VERTICAL

- GEOLOGICAL BOUNDARY. DEFINITE
- SCHIST OUTCROP
- GEOLOGICAL BOUNDARY. APPROXIMATE OR INDEFINITE
- SCHIST BOULDERS. ESSENTIALLY IN SITU. DISTURBED IN PART
- TOP OF CUTTING OR FILL
- CONTOUR INTERVAL 10 FEET. FROM E&WS DRG No 181/1964
- APPROXIMATE BOUNDARY OF LANDSLIP SCAR

SCALE OF FEET
20 0 20 40 80
VERTICAL AND HORIZONTAL

Geology of Adits added DMS 21 July 65 Amdt 31 21 Sept 65

DEPARTMENT OF MINES — SOUTH AUSTRALIA

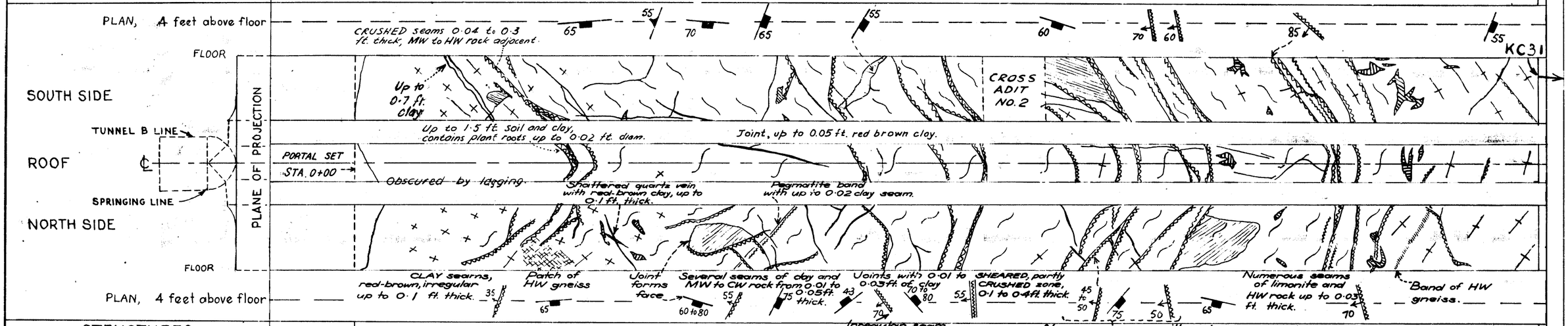
KANGAROO CREEK DAM
EXPLORATORY ADITS
GEOLOGICAL PLAN AND SECTION

ENGINEERING GEOLOGY SECTION	J P Trudinger GEOLOGIST	Drn. DMS	SCALE: AS SHOWN
		Tcd. [illegible]	65-320 Ha 5+7
Director of Mines	SENIOR GEOLOGIST	Chd. DMS	
		Exd.	DATE: 6 Apr 65

TUNNEL STATIONS	0+00			0+50			1+00				1+40
DIRECTION, INVERT LEVEL, SLOPE											
PROGRESS HEADING AT, DATE	15 July '65	16 July	19 July	20 July '65	21 July		22 July	23 July	24 July	26 July	27 July	28 July	29 July '65
ROCK TYPE and DEGREE of WEATHERING	GRANITIC GNEISS and SCHIST. Mainly moderate to high. SLIGHT to MODERATE MW to HW along and near joints and seams.						SCHIST and GNEISS. Mainly FRESH to SLIGHT. Moderate to high near joints and seams.						

LOG OF FACE
Looking in direction of tunnel stations
AND
SECTIONS SHOWING OVERBREAK

PLAN, A feet above floor



STRUCTURES

JOINTING	PATTERN-ATTITUDE, SPACING, PERSISTENCE, CHARACTER SURFACE, SEPARATION COATING
FAULTS	SHEARED AND CRUSHED ZONES, ATTITUDE, RELATIVE DISPLACEMENT, WIDTH, CHARACTER OF MATERIAL

EXCAVATION CONDITION	2	4 - 3			4 - 3	
PERCENT BREAKAGE ALONG JOINTS	25	45	20		60	5
SUPPORT DURING CONSTRUCTION — SOUTH SIDE / Springing line / ROOF / NORTH SIDE	1 — 8	Unsupported				
EXCAVATION STRIPPING — ADVANCE No of HOLES / EXPLOSIVES, lbs.	Jack pick	6 to 12 holes 1 to 2 ft. long, 1 to 4 lbs. AN 60	Rounds mainly 19 to 21 holes, 4 to 5 ft. long, with 25 to 30 lbs AN 60 gelignite, 4 to 5 ft. advance.			
GROUND WATER — INITIAL QUANTITY, DATE	Mainly dry, several areas of seepage					
GROUND WATER — QUANTITY, DATE	Dry. (May '67)					
GROUND WATER — TEMPERATURE						
FEELER HOLES & GROUTING	None					
PHOTOGRAPHS CATALOGUE No	KC 49/8/65 KC 48/8/65 KC 60/8/65 KC 54/8/65 KC 51/8/65 KC 46/8/65 KC 47/8/65		KC 50/8/65 KC 62/8/65 KC 52/8/65 KC 45/8/65		KC 53/8/65	
FINAL SUPPORT OR LINING — ESTIMATED / AS CONSTRUCTED						

Trim

STRIKE & DIP OF JOINT
STRIKE OF VERTICAL JOINT
HORIZONTAL JOINT
STRIKE & DIP OF FOLIATION
STRIKE & DIP OF BEDDING

HW HIGHLY WEATHERED
CW COMPLETELY WEATHERED
CRUSHED SEAM Showing dip
SHEARED or CRUSHED ZONE Showing dip and width.
FAULT Showing relative movement.

LEGEND

200 ⊗ WATER INFLOW 200 gallons per hour
S SEEPAGE
PHOTO BLACK & WHITE
PHOTO COLOUR

Vein of QUARTZ
SCHIST
GNEISS
GRANITIC GNEISS
SPECIMEN COLLECTED

TUNNEL SUPPORTS
STEEL SETS
WALL PLATES
ROCK BOLTS
MESH
GUNITE

ENGINEERING GEOLOGY SECTION		S. A. DEPARTMENT OF MINES			
		KANGAROO CREEK DAM EXPLORATORY ADIT No 2 GEOLOGICAL LOG			
LOGGED J.P.T.	J.P. Trudinger GEOLOGIST				
DRAWN J.P.T.	D.M. Shepherdson SENIOR GEOLOGIST	SCALE 1 in = 10 ft	DATE LOGGED 2 Aug. '65	SHEET 1 OF 1	65-827 No. 5+7

APPENDIX C

LOGS OF DIVERSION TUNNEL

The explanatory notes in Appendix B also apply to Appendix C.

FIGURES	DWG. NO.
Kangaroo Creek Dam, Diversion Tunnel, Geological Log Sheet 1	66-831
Kangaroo Creek Dam, Diversion Tunnel, Geological Log Sheet 2	66-980
Kangaroo Creek Dam, Diversion Tunnel, Geological Log Sheet 3	66-991
Kangaroo Creek Dam, Diversion Tunnel, Geology of Completed Tunnel	66-836

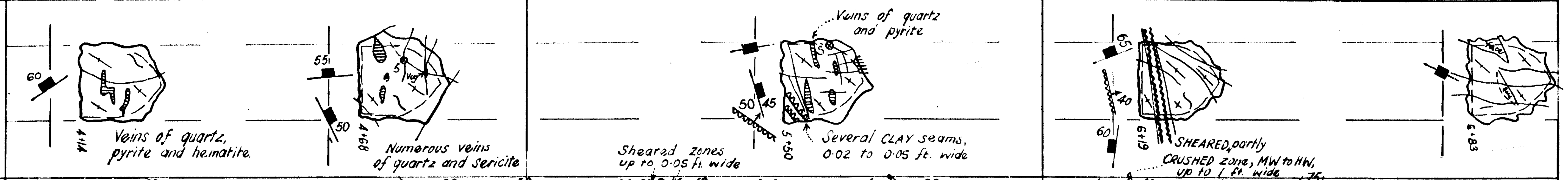
4+00 5+00 6+00 7+00

Item	Record
TUNNEL STATIONS	4+00 to 7+00
DIRECTION, INVERT LEVEL, GRADE	DIRECTION 283° 33' GRADE 1 IN 143 (APPROX) ←
PROGRESS, DATE	13 Sept '66 | 14 Sept '66 | 15 Sept '66 | 16 Sept '66 | 17 Sept '66 | 19 Sept | 20 Sept '66 | 21 Sept '66 | 22 Sept '66 | 26 Sept '66 | 27 Sept '66 | 28 Sept '66 | 29 Sept '66 | 30 Sept
ROCK TYPE	Mainly GNEISS, schistose in part. Some GRANITIC GNEISS
DEGREE OF WEATHERING	Mainly FRESH Numerous patches of SLIGHTLY to MODERATELY WEATHERED rock in GRANITIC GNEISS, numerous vugs.

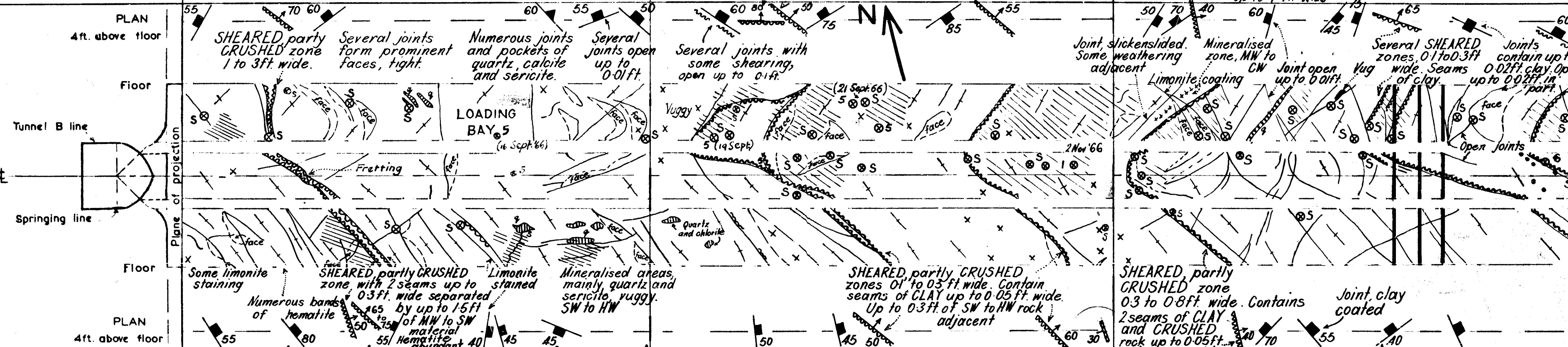
LOG OF FACE

Looking in direction of increasing tunnel stations.

SECTIONS SHOWING OVERBREAK



GRAPHIC LOG



GEOLOGICAL STRUCTURES — Foliation, joint pattern, crushed seams and sheared zones.

(Set (ii) joints spaced 0.3 to 5ft. apart) (Set (ii) joints spaced 0.5 to 4ft. apart) Set (ii) joints spaced 0.5 to 10ft. apart. Some open up to 0.01ft.

Foliation strikes 30 to 60° to tunnel direction (ie. 310° to 340°) dips 45 to 65° upstream (east). Minor faults near parallel to foliation direction. TWO main joint sets are:- Set (i) Near-parallel to foliation, smooth, slightly curved or planar, some limonite stained, mainly tight, spaced 5 to 15 ft. Set (ii) Strike 25° to 50° to tunnel direction (ie. 60° to 85°), dip 45 to 70° to north, planar or curved, smooth or irregular, tight or open up to 0.01 ft. Spaced mainly 15 to 30 ft. apart except in sections shown, persist 3 to 10ft. commonly en echelon. Joints rare in granitic gneiss. Flows and seepages mainly from minor faults, set (ii) joints (slightly open) and vuggy quartz veins; occur mainly in north wall and north side of roof.

Item	Record
EXCAVATION CONDITION	4 | 4 | 4 | 3 to 4 | 4
BREAKAGE ALONG DEFECTS, PERCENT	10 to 20% walls and roof | Roof and north wall 30 to 40% South wall 10 to 20% | Walls 20 to 30%. Roof 20% | Walls 20% Roof 40% | Walls 20% Roof 15% | Roof and South wall 25% North wall 30 to 40%
SUPPORT DURING CONSTRUCTION (South side / Roof / North side)	None | None | None | 4 5 6 (steel supports)

EXCAVATION

Number of holes	Length, Ft.	Explosive, lbs
56	6	105
50	5½	121
50	5	121
48	6	127
49	5	121
50	6	129
48	6	128
57	6	117
56	6	130
50	6	127
48	6	125
53	6	125
52	6	112
43	6	91
56	12×8 42×6	136
51	6	125
53	6	125
51	6	113
55	6	112
52	6	130
54	6	126
53	6	125
49	6	113
51	6½	121
54	5	130
90	5½	200
90	6½	280
54	6	113
60	6	136
54	6	123
55	6	150
53	6	150
48	6	113
48	6	91
56	6	132
56	6	136
53	6	150
53	6	150
51	6	107
49	6	102
56	6	122
51	6	170
52	6	150
[illegible]8	6	120
49	6	102
54	6	121
49	6	115
54	6	125
54	6	125
51	6	115
50	6	121
54	6	124
55	6	175
55	6	125
55	5½	124
53	6	127
54	6	121
53	6	121
54	6	125
54	6	125
56	5½	121
86	6	136
52/20	6/3	113
54	5	91
54	5	86
54	6	125

Item	Record
GROUNDWATER — Initial quantity	Several seepages and flows as shown ↑5 | ↑5 Numerous flows and ↑5 ↑5 seepages | Numerous ↑1 Seepages as shown
GROUNDWATER — Quantity	Several seepages and damp patches | Numerous seepages ↑2 ↑1 | Dry | Numerous seepages, mainly from north wall and roof.
FEELER HOLES, GROUTING (10 ft. holes)	7 Bags: 6, 6, 6
PHOTOGRAPHS	P15616, P15617, P15615, P15622; P15612, P15610; P15614, P15613; P15611; P15609; P15608; 15581; P15624
SPECIMENS	7095, 7098; 7097, 7095; 7094; 7092; 7093, 7099
FINAL SUPPORT OR LINING, DRAINAGE — Inspection (21 Nov. '66) / As constructed	P.A.M. | 2×6 ft. 3×8 ft. 5×6 ft. Rockbolts | P.A.M. Rock bolts | PROPOSED PLUG | Concrete line.

LEGEND

- STRIKE AND DIP OF JOINT
- STRIKE OF VERTICAL JOINT
- STRIKE AND DIP OF BANKUNG
- STRIKE AND DIP OF FOLIATION
- TREND AND PLUNGE OF LINEATION
- STRIKE AND DIP OF CRUSHED SEAM OR SHEARED ZONE
- PHOTO, BLACK & WHITE
- PHOTO, COLOUR
- SPECIMEN COLLECTED
- FR FRESH
- SW SLIGHTLY WEATHERED
- MW MODERATELY "
- HW HIGHLY "
- CW COMPLETELY "
- (A = ALTERED)
- ⊗200 WATER INFLOW 200 gallons/hour
- S SEEPAGE
- STEEL SUPPORTS
- R. ROCK BOLTS
- PROPOSED ROCK BOLTS.
- MESH
- CONCRETE LINING
- G. GUNITE
- R.M.G. ROCK BOLTS MESH & GUNITE
- SCHIST
- GNEISS
- GRANITIC GNEISS
- DAMP
- VEIN (QUARTZ)

DEPARTMENT OF MINES — SOUTH AUSTRALIA

KANGAROO CREEK DAM
DIVERSION TUNNEL
GEOLOGICAL LOG SHEET 2

ENGINEERING GEOLOGY SECTION	[signature] GEOLOGIST	LOGGED: J.P.T.	SCALE: 1 inch = 20 feet
		TCD: R.H.	SHEET 2 OF 3
[signature] Director of Mines.	[signature] SENIOR GEOLOGIST	CKD: DWS	DWG: Nº 66-980 Ha5+7
		EXD:	DATE: 3 Nov '66

DIVERSION TUNNEL
GEOLOGY OF COMPLETED TUNNEL

SECTION A-A' ALONG CENTRE-LINE OF TUNNEL

SECTION B-B'

SECTION C-C'

SECTION D-D'

SECTION E-E'

ORIENTATIONS OF GEOLOGICAL STRUCTURES

LEGEND

ROCK TYPES

GEOLOGICAL STRUCTURES

SURFACE FEATURES

WEATHERING

SCALE IN FEET

NOTE: FOR ACCESS SHAFT DETAILS SEE E&WS DRAWING NO. 67231.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

KANGAROO CREEK DAM

DIVERSION TUNNEL

GEOLOGY OF COMPLETED TUNNEL

ENGINEERING GEOLOGY SECTION

GEOLOGIST

SENIOR GEOLOGIST

Drn. J.P.

Tcd. J.P.

Chd. D.H.S.

Rcd.

SCALE AS ABOVE

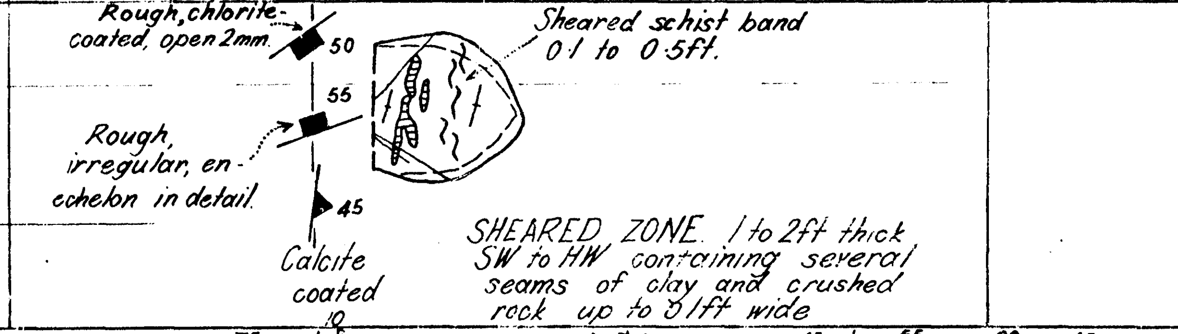
66-836 Ha 5+7

DATE: 21.04.66

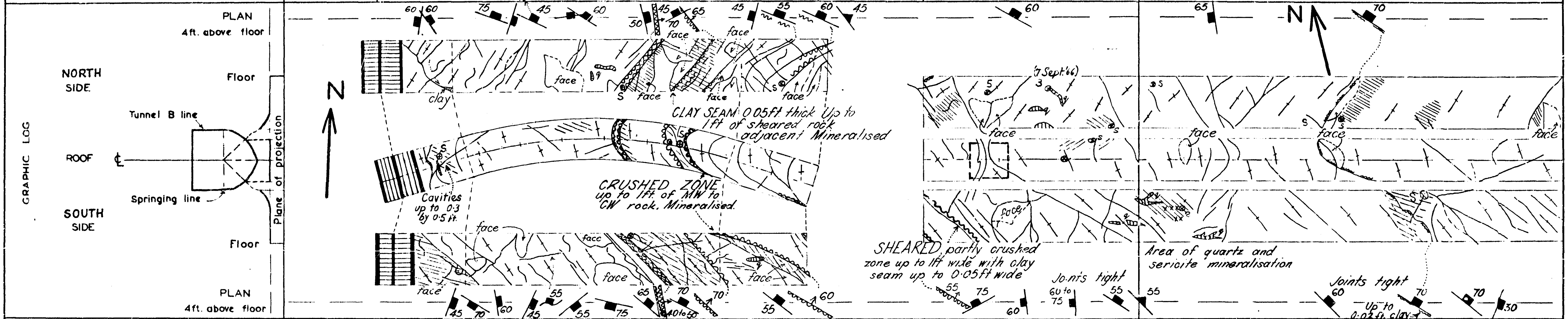
TUNNEL STATIONS	1+50 · T.P 1+67 · 2+00 · T.P 2+30 · 2+50	2+50 · 3+00	4+00
DIRECTION, INVERT LEVEL, GRADE	INVERT LEVEL 715 ft. RADIUS OF CURVATURE 107.5 FT.	DIRECTION 70°00'	GRADE 1 IN 143 (APPROX)
PROGRESS, DATE	26 Aug · 27 Aug · 28 Aug '66 · 30 Aug · 1 Sept · 2 Sept '66 · 3 Sept · 5 Sept	5 Sept · 6 Sept '66 · 7 Sept	8 Sept · 9 Sept · 10 Sept '66 · 12 Sept
ROCK TYPE DEGREE OF WEATHERING	GNEISS, Mainly SLIGHT · GNEISS Schistose in parts as shown. FRESH. Slight to high near few joints and seams		

LOG OF FACE
Looking in direction of increasing tunnel stations

SECTIONS SHOWING OVERBREAK



GRAPHIC LOG



GEOLOGICAL STRUCTURES
Foliation, joint pattern, crushed seams and sheared zones.

Set I joints spaced 0.5 to 5 ft. apart. Some limonite staining, some shearing.

Foliation strikes 30° to 60° to main tunnel direction (ie 310 to 340°) dips 45 to 65° upstream (east). Minor faults near parallel to foliation direction. TWO main joint sets are:- Set (i) Near parallel to foliation, smooth, slightly curved or planar, some limonite stained, mainly tight. Spaced mainly 5 to 15 ft. Set (ii) Strike 25 to 50° to main tunnel direction (ie 60-85°), dip 45° to 70° north, planar or curved, smooth or irregular, tight or open up to 0.01 ft. Spaced 15 to 30 ft. apart exept in sections shown, persist 3 to 10 ft, commonly en-echelon. Joints rare in granitic gneiss Flows and seepages mainly from minor faults, set (ii) joints (slightly open) and vuggy quartz veins; occur mainly in north wall & north side of roof

EXCAVATION CONDITION	4	4	4
BREAKAGE ALONG DEFECTS, PERCENT	Walls, 20 to 40%. Roof, 10 to 20%.	Walls, 15%.	Roof, 10%
SUPPORT DURING CONSTRUCTION (South side / Roof / North side)	1 2 3 · None	None	None

EXCAVATION (Number of holes / Length, Ft. / Explosive, lbs.)

Number of holes	67	70	68	66	69	54	62	272	60	55	55	59	58	50	50	45	46	54	45	50	48	46	48
Length, Ft.	5	5	5	7	5	6	5	5	5	5	5	5	6	5	5	5	5	6	6	5	5	5	5
Explosive, lbs.	97	98	98	128	83	89	15	92	85	89	105	130	85	98	98	38	9	88	75	98	78	91	91

Number of holes	48	45	48	51	45	50	46	46	40	50	50
Length, Ft.	5	5	5	5	5	5	6	5	5	5	5
Explosive, lbs.	81	75	86	91	78	76	100	320	300	260	260

Number of holes	49	50	52	60	52	52	48	50	48	56	54	54	55	46	54	56	58	45	46	46	46	52	59	48	54
Length, Ft.	6	6	5	5	6	6	6	6	5	5	6	6	6	6	5	5	6	6	6	5½	6	6	6	6	6
Explosive, lbs.	106	105	91	106	69	69	114	114	109	121	124	124	112	100	115	114	113	113	109	121	130	113	114	113	100

GROUNDWATER — Initial quantity	Numerous seepages, mainly from north side and roof (S)	Numerous seepages (S, 3) Several flows (S)	Few seepages
GROUNDWATER — Quantity	Mainly dry, few seepages and damp patches as shown	Few seepages and damp patches	Few seepages
FEELER HOLES, GROUTING	None	None	None
PHOTOGRAPHS	P15618 · 7091 · 15582	P15620	
SPECIMENS			
FINAL SUPPORT OR LINING, DRAINAGE — Inspection (21 Nov '66)	Concrete line · P.A.M. · P.A.M. · Rock bolts 4 x 6 ft.	Rockbolt (6 ft.)	
As constructed	4 x 6 ft. Rock bolts	1 x 6 ft. Rockbolt	

STRIKE AND DIP OF JOINT
STRIKE OF VERTICAL JOINT
STRIKE AND DIP OF BANKUNG
STRIKE AND DIP OF FOLIATION
TREND AND PLUNGE OF LINEATION
STRIKE AND DIP OF CRUSHED SEAM OR SHEARED ZONE
PHOTO, BLACK & WHITE
PHOTO, COLOUR
SPECIMEN COLLECTED

FR FRESH
SW SLIGHTLY WEATHERED
MW MODERATELY "
HW HIGHLY "
CW COMPLETELY "
(A = ALTERED)
WATER INFLOW 200 gallons/hour
S SEEPAGE
DAMP

STEEL SUPPORTS
R. ROCK BOLTS
MESH
CONCRETE LINING
G. GUNITE
R.M.G. ROCK BOLTS MESH & GUNITE

SCHIST
GNEISS
GRANITIC GNEISS
VEIN (Quartz)

DEPARTMENT OF MINES — SOUTH AUSTRALIA

KANGAROO CREEK DAM

DIVERSION TUNNEL

GEOLOGICAL LOG SHEET 1.

ENGINEERING GEOLOGY SECTION	GEOLOGIST	LOGGED: J.P.T.	SCALE: 1 inch - 20 feet
		TCD: R.H.	SHEET 1 OF 3
Director of Mines.	SENIOR GEOLOGIST	CKD: DHT	DWG: No 66-831 Ha5+7
		EXD:	DATE: 20 Sept '66

TUNNEL STATIONS

DIRECTION, INVERT LEVEL, GRADE

PROGRESS, DATE

ROCK TYPE
DEGREE OF WEATHERING

LOG OF FACE

Looking in direction of increasing tunnel stations.

SECTIONS SHOWING OVERBREAK

GRAPHIC LOG

PLAN
4ft. above floor

NORTH SIDE

Floor

Tunnel B line

ROOF ℄

Springing line

SOUTH SIDE

Floor

Plane of projection

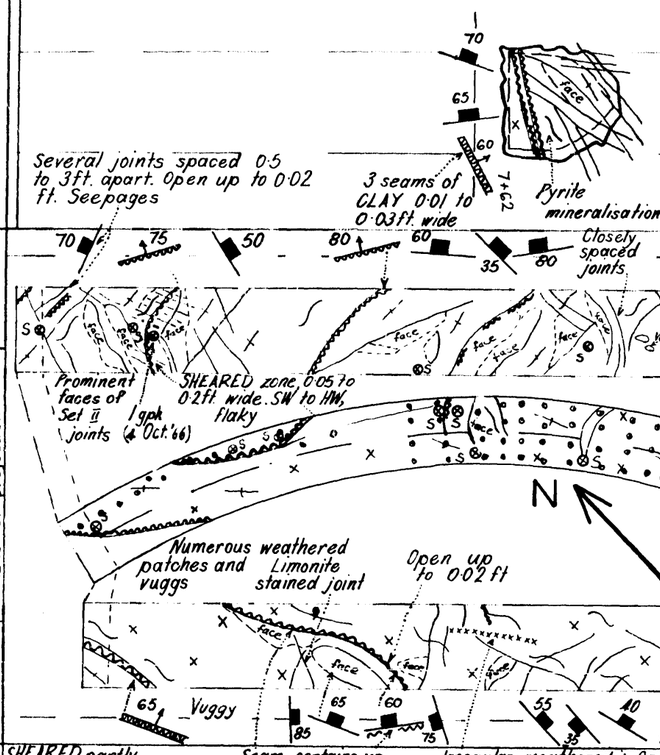
PLAN
4ft. above floor

7+00 T.P. 7+50 8+00 T.P. 8+08 8+20

283°33' RADIUS OF CURVATURE 107·5 FT. GRADE 1 IN 143 (APPROX.)

30 Oct '66	4 Oct '66	5 Oct '66	6 Oct '66	7 Oct '66	11 Oct	12 Oct

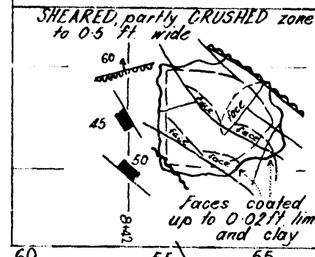
Mainly GNEISS and GRANITIC GNEISS. Some SCHIST.
Mainly FRESH. SLIGHT to MODERATE patches in GRANITIC GNEISS
SLIGHT near joints and seams

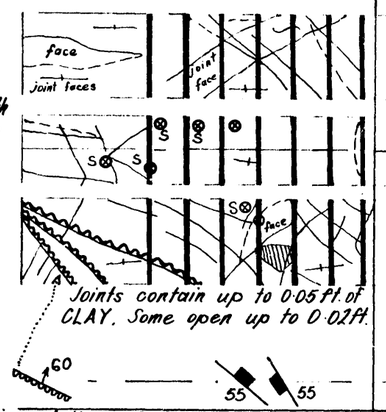


DIRECTION 161°30' INVERT LEVEL RL 720 FT.

13 Oct.	14 Oct.	17 Oct '66	18 Oct	20 Oct	21 Oct	24 Oct.

Mainly GNEISS
FRESH to SLIGHT.





GEOLOGICAL STRUCTURES
Foliation, joint pattern, crushed seams and sheared zones.

SHEARED partly CRUSHED zone, 0·5 to 1·5 ft. wide, SW to CW rock with several CLAY seams, up to 0·05 ft. wide

Seam contains up to 0·05 ft. of grey CLAY and CW rock

Irregular weathered seam, up to 0·3 ft wide

Open up to 0·01ft

Open up to 0·02 Ft.

Foliation strikes 30-60° to main tunnel direction (ie. 310 to 340°), dips 45 to 65° upstream (east). Minor faults near parallel to foliation direction. TWO main joint sets are: Set (i) Near parallel to foliation, smooth, slightly curved or planar, some limonite stained, mainly tight. Spaced 5 to 15 ft. Set (ii) Strike 25 to 50° to main tunnel direction (ie 60 to 85°), dip 45 to 70° north, planar or curved, smooth or irregular, tight or open up to 0·01 ft. Spaced mainly 15 to 30ft apart, except in sections shown, persist 3 to 10 ft., commonly en echelon. Joints rare in granitic gneiss. Flows and seepages mainly from minor faults, set (ii) joints (slightly open), and ruggy quartz veins; occur mainly in north wall and north side of roof.

EXCAVATION CONDITION — 4 | 4 3

BREAKAGE ALONG DEFECTS, PERCENT — 20 to 40% in walls, 25% in roof | North wall 70%. South wall 30%. Roof 20 to 40%

SUPPORT DURING CONSTRUCTION — South side / Roof / North side: None

EXCAVATION																											
Number of holes	54	55	51	51	50	53	53	53	51	50	56	52	53	52	48	53	52	51	48	54	60	51	53	54	52	53	52
Length, Ft.	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6
Explosive, lbs.	125	113	113	113	112	125	125	121	112	123	112	113	115	121	112	121	121	115	112	110	113	380	102	112	112	134	136

GROUNDWATER		
Initial quantity	Numerous seepages	Few seepages
Quantity	Numerous seepages and damp patches	Mainly dry

	62	54 55 54 52 45 53 58 54
	6	6 6 6 6 3 5 5 5
	125	125 136 125 125 150 112 125 125
		Numerous seepages
		Numerous seepages

FEELER HOLES, GROUTING — Feeler Holes

PHOTOGRAPHS — P15623 P15607 P15619 7100 | P15621

SPECIMENS

FINAL SUPPORT OR LINING, DRAINAGE — Inspection (21 Nov. 66) As constructed — Concrete Line

75 STRIKE AND DIP OF JOINT
STRIKE OF VERTICAL JOINT
45 STRIKE AND DIP OF BANKUNG
60 STRIKE AND DIP OF FOLIATION
30 25 TREND AND PLUNGE OF LINEATION
75 STRIKE AND DIP OF CRUSHED SEAM OR SHEARED ZONE

● PHOTO, BLACK & WHITE
○ PHOTO, COLOUR
⊙ SPECIMEN COLLECTED

FR FRESH
SW SLIGHTLY WEATHERED
MW MODERATELY "
HW HIGHLY "
CW COMPLETELY "
(A = ALTERED)

⊗ 200 WATER INFLOW 200 gallons/hour
S SEEPAGE

STEEL SUPPORTS
R. ROCK BOLTS
°. PROPOSED ROCK BOLTS
MESH CONCRETE LINING
G. GUNITE
R.M.G. ROCK BOLTS MESH & GUNITE

SCHIST
GNEISS
GRANITIC GNEISS
VEIN (Quartz)
DAMP

DEPARTMENT OF MINES — SOUTH AUSTRALIA

KANGAROO CREEK DAM

DIVERSION TUNNEL

GEOLOGICAL LOG SHEET 3

ENGINEERING GEOLOGY SECTION	GEOLOGIST J.P. Tuckniger	LOGGED: J.P.T	SCALE: 1 inch - 20 feet
		TCD: R.H.	SHEET 3 OF 3
Director of Mines	SENIOR GEOLOGIST D.B. Stapleton	CKD: D.M.S	DWG: No 66-991 Ha5+7
		EXD:	DATE: 29 Nov. '66

APPENDIX D

KANGAROO CREEK DAM

LABORATORY TESTS ON ROCK MATERIALS

CONTENTS

TABLE 1. Spoil from Exploratory Adits, Particle Size Distribution.

TABEL 2 Spoil from Exploratory Adits, Results of Laboratory Tests

TABLE 3 Kangaroo Creek Dam, Strengths of Rocks, Results of Unconfined Tests

TABLE 4 Kangaroo Creek Dam, Wet/Dry Strengths of Rocks, Results of Unconfined Tests

FIGURE 1 Kangaroo Creek Dam, Wet/Dry Strengths of Schist, Effect of Anisotropy on Strength.

NOTE Tables 1 and 2 by E. & W.S. Concrete Laboratory, Sassafrass

Tables 3 and 4 and Figure 1, from Unconfined Compressive Tests by Dams Section, E. & W.S. Department.

APPENDIX D

KANGAROO CREEK DAM LABORATORY TESTS ON ROCK MATERIALS - SPOIL FROM EXPLORATORY ADITS

TABLE 1 - PARTICLE-SIZE DISTRIBUTION

		Sieve Sizes % Weight Passing																
		18"	12"	9"	7"	6"	5"	4"	1½"	¾"	⅜"	3/16"	7"	14"	25	52	100	200
		100.0	97.3	94.8	91.8	88.8	83.4	76.2	60.2	44.2	31.1	20.4	17.1	12.6	9.2	6.7	5.3	4.5
% Weight Retained			2.7	2.5	3.0	3.0	5.4	17.2	16.0	16.0	13.1	10.7	3.3	4.5	3.4	2.5	1.4	0.8
% Weight of each type retained	Schist		1.4	1.3	1.5	1.3	2.0	2.8										
	Gneiss		1.3	0.8	1.3	1.3	2.2	3.4										
	Granite Gneiss		-	0.4	0.2	0.4	1.2	1.0										

APPENDIX D (CONT'D)

TABLE 2 - RESULTS OF LABORATORY TESTS

		Size	Los Angeles %	S.G. S.S.D.	Absorption %	Soundness 5 cycles Av. % Loss	Elongation Index %	Flakiness Index %	Liquid Limit	Plastic Limit	Plasticity Index	Linear Shrinkage	Shrinkage Ratio
Only 1 rock was taken for each test due to large size	Schist	+6"		2.80	0.242	0.22							
	Gneiss	+6"		2.74	0.400	0.75							
	Granite Gneiss	+6"		2.68	0.475	0.80							
	Schist	-1½" + 1"	42.6 +4" Material broken down to 3" +1½"	2.68	0.780	2.71	64.1 Combined Granite Gneiss and Gneiss 55.20	50.7 16.20					
	Gneiss	-1½" + 1"	36.2	2.71	0.580	5.45							
	Granite Gneiss	-1½" + 1"	38.2	2.62	0.695	5.04			Minus	36+ fraction			
	Combined Sample	-3"	38.6	2.70	0.570	2.45			22.8	12.3	10.5	1.3	1.79

SIZE OF CORE SAMPLE IN MMS. 1.	DRILL HOLE	DEPTH (ft) 2.	ROCK TYPE	FOLIATION	ANGLE 3.	WEATHERING	OTHER GEOLOGICAL FEATURES	U.C.S. 4.	YOUNGS MODULUS 5.	FRACTURE
54 × 101	KC3	13	Schist	Intensely foliated.	35°	Fresh. Limonite Stained along foliation in part	Sericitic Some disseminated haematite and pyrite	2210	800,000	Two fractures, 60° to 80°, irregular very rough Few Sericite coatings.
54 × 139	KC6	10	Schist	Intensely foliated to banded, abundant quartz and felspar.	40°	Slightly weathered common limonite staining.	Abundant sericite. Abundant pyrite and "leached haematite"?	3020	2,100,000	Single fracture, 60°. Planar, regular. Slightly rough, sericite coated.
54 × *	KC6	11	Schist	Mainly intensely foliated, few distinct coarser bands	40°	Slight to moderate, limonite Stained throughout.	Abundant sericite and "leached haematite"?	6100	5,500,000	Complex fracture Several at 60° to 90°
46 × 144	KC1	16	Schist	Intensely foliated, commonly coarser grained and banded	45°	Fresh to Slight. limonite stained in parts, limonite coated on joints.	Sericite rich, some pyrite and haematite. Several Joints.	2880	1,800,000	Two fractures 65°, Planar. Slightly irregular, slightly rough, part influenced by joints.
46 × *	KC1	15	Schist	Intensely foliated, few coarser grains, banded in part	50°	Slight. limonite stained throughout	Sericite rich.	3120	1,400,000	? Single fracture, 60°. Planar, slightly rough
54 × 121	KC3	12	Schist	Intensely foliated, very irregular in part	50°	Fresh. Some slight limonite staining	Some haematite and crystalline pyrite. Sericitic	2970	920,000	Single fracture, 65°. Planar. Slightly irregular, very rough. Common Sericite coatings.
54 × 127	KC2	15·5	Schist	Intensely foliated to coarse grained and banded, irregular	50°	Slight to moderate, limonite stained and coated throughout	Sericite in schistose bands.	5250	5,200,000	Complex. Main fracture 70°, planar but irregular, rough. Several other breaks.
46 × 152	KC1	17	Schist	Intensely foliated	50°	Fresh. Slight to moderate along joint near top of core.	Sericitic. Joint parallel to foliation at top of core	3980	2,350,000	Two fractures. One part parallel to, part steeper than foliation. Other along joint
62 × 149	KC2	12	Schist	Intensely foliated, banded in part	50°	Slight to moderate Abundant limonite Staining throughout.	Sericitic, some disseminated haematite.	4320	2,200,000	Single fracture, 65°, planar, slightly irregular, slightly rough
54 × 152	KC6	14	Schist	Intensely foliated to banded, coarse to very coarse grained in part	50°	Slight. limonite stained throughout, limonite coated on joints.	Sericite rich. Some pyrite and haematite Several joints.	4500	5,000,000	Two near vertical fractures. one across fabric, one along joint.
62 × 151	KC2	13	Schist	Intensely foliated to banded, commonly irregular	60°	Slight to moderate, limonite stained throughout.	Sericitic. Abundant disseminated haematite.	2880	2,700,000	Single fracture, 65°. Planar to very irregular, slightly rough Sericite coatings.
54 × 152	KC3	15	Schist	Intensely foliated, Slightly banded in few parts.	70°	Slight. Abundant limonite staining through fabric of rock.	Sericitic. Some disseminated pyrite and haematite.	5030	2,600,000	Single fracture, 70°. Planar, slightly irregular, Slightly rough. Near parallel to foliation.
54 × 152	KC4	16	Gneiss	Banded to intensely foliated,	20°	Slight. Mainly limonite stained through fabric of rock.	Abundant Sericite, some pyrite. Several joints.	12,300	7,400,000	Single fracture, 70° very irregular, rough. Several other cracks along joints.
54 × 128	KC5	11	Gneiss	Intensely foliated to banded. Mainly fine to very fine grained	30°	Fresh.	Some sericite in foliated bands Some disseminated pyrite.	12,400	12,000,000	Complex. Main fracture irregular, very slightly rough. Fair sericite coatings. Several other breaks.
54 × *	KC7	10·5	Gneiss	Mainly fine grained, banded to closely foliated, poorly developed	30°	Slight, limonite stained throughout	Some sericite and disseminated haematite.	10,600	4,300,000	Complex fractures.
54 × 152	KC4	15	Gneiss	Mainly intensely foliated. few coarser bands, often irregular	40°	Fresh to slight. Some limonite Staining.	Abundant disseminated pyrite and haematite.	11,600	7,000,000	Single fracture, 70°, along limonite coated joint. Few other breaks accross core.
54 × 151	KC5	13	Gneiss	Mainly intensely foliated Slightly banded in part	40°	Fresh	Some disseminated pyrite	10,000	8,400,000	Single fracture. Very irregular. Part along foliation, smooth, part across fabric, rough.
54 × 152	KC7	13	Gneiss	Banded, intensely foliated in parts. Coarse grained.	40°	Slight. Mainly limonite stained throughout.	Abundant sericite. Pyrite disseminated and in crystals	5,440	4,000,000	Single fracture, 70°. Planar, slightly irregular, rough, few sericite coatings.
54 × 134	KC5	12	Gneiss	Intensely foliated, few coarser bands, mainly poorly developed	45°	Fresh.	Some disseminated pyrite.	8700	12,000,000	Single fracture, 65° Planar, slightly irregular, slightly rough Few other cracks
54 × 152	KC7	12	Gneiss	Mainly banded, intensely foliated in part	50°	Fresh to slight, some limonite staining.	Sericitic. Disseminated pyrite and haematite.	11,100	5,000,000	Complex. Main fracture 65°, planar, irregular, rough. Several other irregular fractures.
54 × 151	KC4	21	Granitic Gneiss	Very coarse grained, foliation very poorly developed	20°	Fresh. Slight limonite staining in few parts.	Mainly quartz & felspar crystals	13,100	5,600,000	Two fractures, very rough, irregular, 70° to 90°
46 × 150	KC8	16	Granitic Gneiss	Mainly coarse grained, banded, closely foliated in part	30°	Fresh to Slight. Some limonite staining in coarser bands.	Some disseminated haematite.	10,800	6,000,000	Single fracture, 70°. Planar, slightly irregular, rough. Few other breaks
46 × 131	KC8	13·5	Granitic Gneiss	Mainly banded, intensely foliated in few parts.	40°	Fresh.	Coarse to very coarse grained. Some sericite.	13,400	6,000,000	Single fracture, very irregular, very rough. Few other irregular fractures.
46 × *	KC8	14	Granitic Gneiss	Banded to intensely foliated, poorly developed.	40°	Fresh. Some limonite staining in parts.	Coarse to very coarse grained	14,900	6,000,000	Complex. Two fractures at 70° to 90°

NOTES

1. Size of core samples in millimetres, diameter × length
2. Approximate depth to top of sample
3. Approximate angle between plane of foliation and the plane normal to the longitudinal axis of the core. ie dip of foliation on core (β)
4. Unconfined compressive strength, pounds per square inch
5. Youngs Modulus, E. pounds per square inch. Calculated at a stress of 1000 or 2,000 lb/sq inch

* Not known

TESTS CARRIED OUT BY E&WS DEPT — DESIGN BRANCH

TABLE 3

DEPARTMENT OF MINES — SOUTH AUSTRALIA

KANGAROO CREEK DAM

STRENGTHS OF ROCKS

RESULTS OF UNCONFINED TESTS

ENGINEERING GEOLOGY SECTION	GEOLOGIST	Drn. J P	SCALE: —
		Tcd. A L T	66-251
for Director of Mines	SENIOR GEOLOGIST	Chd. L V W	Ho 5+7
		Encl.	DATE: 5 A 1966.

SAMPLE No	DRILL HOLE	DEPTH (feet) (1)	ROCK TYPE	FOLIATION	ANGLE (2)	WEATHERING (3)	OTHER GEOLOGICAL FEATURES	U.C.S. DRY	U.C.S. WET (4)	YOUNGS MODULUS DRY	YOUNGS MODULUS WET (5)	FRACTURE
P1362/65	KC10	13·8	SAMPLE DESTROYED BEFORE TESTING.									
P1363/65	KC10	14·2	Schist	Mainly banded, closely foliated in parts.	30°	Slight Limonite staining common through fabric of rock	Abundant sericite and disseminated haematite	–	3250 (2wks)	–	530,000	Single fracture, irregular Surface rough, irregular, part coated with sericite
P1366/65	KC23	12·1	Schist	Banded, mainly coarser grained	10°	Slight Limonite stained	Some sericite	7100	–	1,090,000	–	–
P1367/65	KC23	12·5	SAMPLE DESTROYED BEFORE TESTING.									
P1371/65	KC27	31·9	Schist	Presumed as below	45°	Presumed as below		3600	–	1,310,000	–	–
P1370/65	KC27	31·5	Schist	Part banded, part intensely foliated	45°	Slight to moderate Abundant limonite staining throughout	Abundant sericite, some disseminated haematite.	–	2000 (2wks)	–	570,000	Two fractures at 60°. Several discontinuous cracks Surfaces rough, irregular.
P29/66	KC27	93·1	Schist	Mainly banded, foliated in part	40°	Fresh	Sericite rich. Common disseminated haematite.	2320	–			Single fracture, planar, slightly rough. Common sericite coatings (6)
P28/66	KC27	92·7	Schist	Close foliation more common.	40°	Fresh. Some slight limonite staining	As above	–	3470 (2 wks)	–	–	As above. More irregular.
P1369/65	KC23	45·7	Schist	Presumed as below	10°	Presumed as below		6,400	–	415,000		
P1368/65	KC23	45·3	Schist	Foliated to banded, irregular, poorly developed	10°	Fresh to Slight Some limonite staining within fabric of rock	Abundant sericite and disseminated haematite	–	4450 (1wk.)	–	417,000	Single fracture. Planar, very rough.
P22/66	KC20	31·8	Schist	Foliated to banded	10°	Fresh	Abundant sericite, some pyrite in coarser bands	5800	–			Single fracture, very irregular, rough. Common sericite coatings.
P23/66	KC20	32·3	Schist	As above, but coarser grained, more banded.	10°	Fresh	As above.	–	4140 (2 wks)			Complex fracture, numerous cracks. "Cone" failure evident
P25/66	KC23	32·6	Schist	Fine grained, foliation very poorly developed	0°	Fresh.	Some disseminated haematite	12,830	–			Complex fracture, numerous cracks "Cone" failure evident.
P24/66	KC23	32·2	Schist	As above.	0°	Fresh	As above	–	8,280 (2 wks.)			Single fracture, planar, rough. Several parallel discontinuous cracks.
P1373/65	KC20	28·2	Schist	Presumed as below	0°	Presumed as below		7100	–	336,000	–	–
P1372/65	KC20	27·7	Schist	Intensely foliated, few coarser bands, irregular	0°	Fresh	Sericite rich	–	5450 (1wk)	–	310,000	Single fracture. Very irregular, rough. few sericite coatings
P1364/65	KC10	56·1	Schist	Mainly intensely foliated, few coarser bands	20°	Fresh. Some limonite staining in coarser bands.		5300	–	614,000	–	–
P1365/65	KC10	56·5	Schist	As above.	20°	As above		–	3,800 (1wk)	–	547,000	Single fracture, planar, smooth to slightly rough, Sericite coated (pre-existing fracture?)
P26/66	KC25	92·6	Schist	Intensely foliated. Coarser grains not banded.	50°	Fresh	Sericite rich, some pyrite	3,660	–			Single fracture. Mainly planar, irregular in part, rough. Rare Sericite coatings
P27/66	KC25	93·0	Schist	As above	50°	Fresh.	As above, with some disseminated haematite	–	1300 (2wks)			Single fracture Planar, slightly rough

NOTES

1. Approximate depth to top of sample.
2. Approximate angle between plane of foliation or fracture and the plane normal to the longitudinal axis of the core ie dip of foliation on core (β)
3. Degrees of weathering are defined as follows:
   - Fresh: The rock shows no discoloration or loss of strength
   - Slight: The rock is slightly discolored but not noticeably lower in strength than the fresh rock
   - Moderate: The rock is usually discolored and noticeably weakened, but NMLC or NMS cores cannot be broken in unaided hands
4. Unconfined compressive strength, pounds per square inch. Samples were tested in pairs. One of each pair was tested dry. The other of the pair was soaked in water for 1 or 2 weeks before testing. [Indicated under test value (2wks)]
5. Youngs Modulus was evaluated for each specimen under a stress of 1000 lb/sq inch
6. Low dry strength may be due to error in testing procedure

TESTS CARRIED OUT BY E&W S DEPT – DESIGN BRANCH

TABLE 4

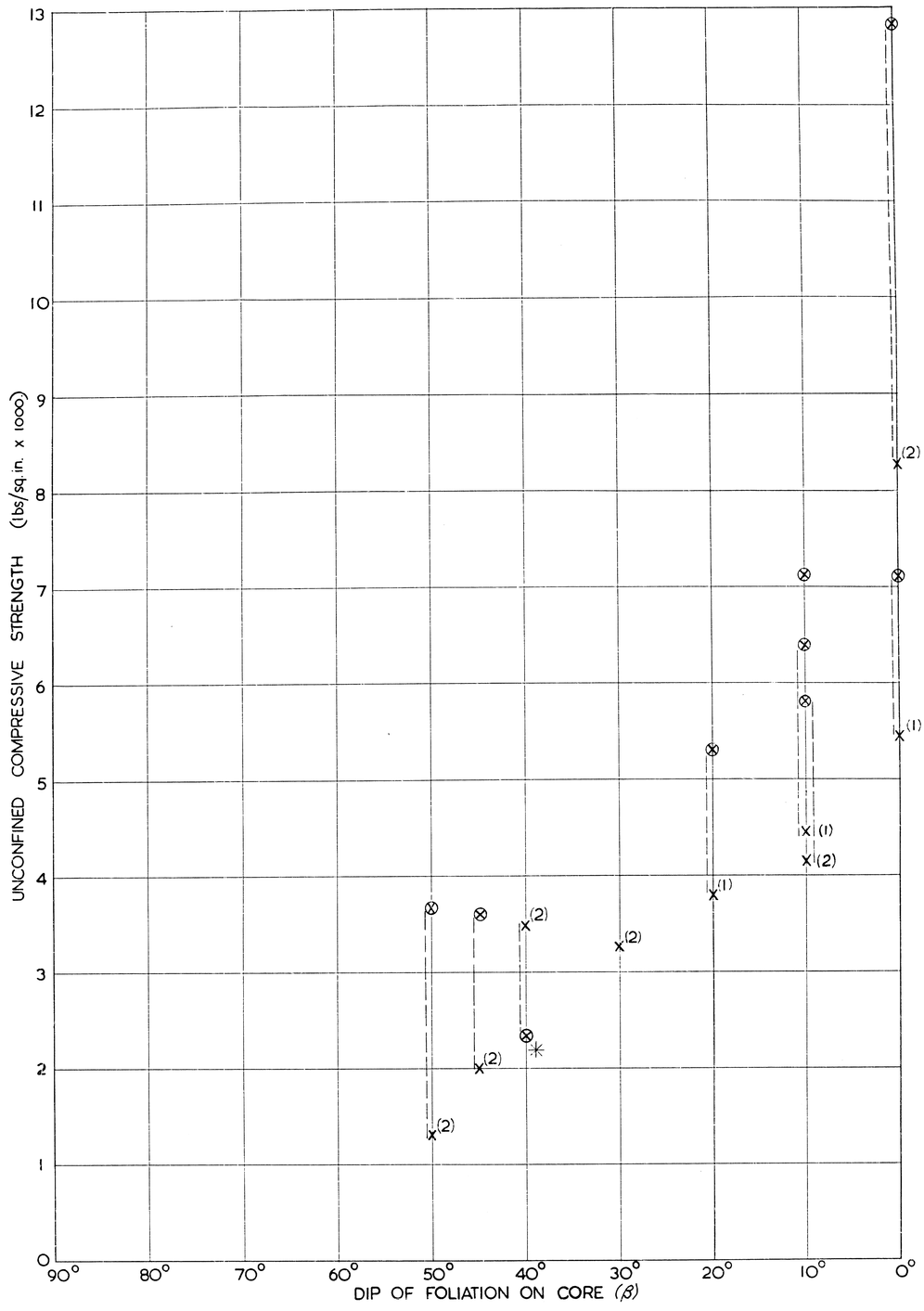
DEPARTMENT OF MINES — SOUTH AUSTRALIA

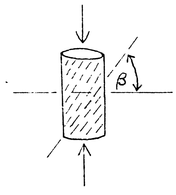
KANGAROO CREEK DAM

WET/DRY STRENGTHS OF ROCKS

RESULTS OF UNCONFINED TESTS

ENGINEERING GEOLOGY SECTION	GEOLOGIST	Drn. J.P.	SCALE: —
		Tcd. R.L.T	66-256
Director of Mines	SENIOR GEOLOGIST	Chd. L.V.W	Ha 5+7
		Exd.	DATE: 6.4.66





NOTES

1. FOR DETAILS OF SAMPLES AND TYPES OF FAILURE SEE DRAWING NO. 66-256.
2. ⊗ AIR DRY SAMPLE.
   X WET SAMPLE.
   (1) SOAKED FOR 1 WEEK.
   (2) SOAKED FOR 2 WEEKS.
3. ⊗ / X PAIRED SAMPLE.

✳ AN ERROR OCCURED IN EXPERIMENTAL PROCEDURE DURING TESTING OF AIR DRY SAMPLE.

DEPARTMENT OF MINES — SOUTH AUSTRALIA

KANGAROO CREEK DAM

WET/DRY STRENGTHS OF SCHIST

EFFECT OF ANISOTROPY ON STRENGTH

ENGINEERING GEOLOGY SECTION	GEOLOGIST.	Drn. J.P.	SCALE:
J.W.P.		Tcd. M+D.	66-346 Ho 5+7.
c/ Director of Mines	SENIOR GEOLOGIST	Ckd. L.V.W.	
		Exd. J.W.P.	DATE: 18-5-66

FIGURE 1

TESTING CARRIED OUT BY E.&W.S. DEPT. – DESIGN BRANCH.

APPENDIX E

ACCELERATED WEATHERING TESTS ON SCHIST

REPORT BY HIGHWAYS AND LOCAL GOVERNMENT DEPARTMENT

C.R. SANDMAN
Testing Officer

H. & L.G.D. 3008/64
Laboratory Project No. 120

1.12.1964.

1. INTRODUCTION

In connection with dam site investigations at Kangaroo Creek being conducted by the Department of Mines on behalf of the Engineering and Water Supply Department, the following laboratory test work was carried out.

(1) Specific Gravity and water absorption tests on bulk samples on crushed aggregate.

(2) Standard wet/dry weathering test as conducted by D.M.R. (N.S.W.).

(3) Combined effect of temperature cycles and weak salt solutions: A.S.T.M. C218 - 48T.

(4) Chemical analysis of extract waters recovered from weathering tests.

(5) Sodium sulphate soundness test.

2. SUMMARY

Specific Gravity and water absorption results (see Table 1) show that there was no significant difference between the diamond drill core samples and the spall material. Water absorption of all samples tested was comparatively low, ranging from 1.05 to 1.21%. Weathering tests conducted on spall samples and on crushed aggregate showed that they could withstand repeated conditions of wetting and drying, without suffering any significant mechanical disintegration. No physical breakdown of spall samples occurred during 20 wet/dry cycles, and only slight breakdown of crushed aggregate was apparent after 10 wet/dry cycles (see Table 4).

Chemical analyses of extract water recovered from the 1st, 5th and 10th wet cycle of weathering (spalls and $-\frac{3}{4}$ inch material) showed no significant increase in soluble salt content. However, there was a sharp increase in soluble salt concentration after 20 wet/dry cycles (see Tables 2 and 3). The combined effect of temperature and weak salt solutions (A.S.T.M. C218 - 48T) indicated no significant trends in the behaviour of the test specimens. The results (see Table 5) show that absorptions varied in the range -4.3 to + 7.0% and volumes in the range -0.39 to +2.43%. One test specimen C3-5, from Hole 11 failed completely after 30 cycles. This particular specimen showed partial failure prior to testing. All other specimens tested were not visibly affected after 30 cycles.

The resistance of crushed aggregate ($-1\frac{1}{2}$"+3/16") to disintegration by saturated sodium sulphate solution was 7.5%. This figure indicates that the material would not be subject to serious disintegration when exposed to normal conditions of weathering and frost action.

3. MATERIAL EXAMINED

Three samples of fresh rock material were submitted for testing, namely,

(1) Spalls from an excavation on the left bank
(2) Core from Drill Hole K.C. 10, 30 to 31-1ft., schistosity at 90° to core.
(3) Core from Drill Hole K.C. 11, 78 to 80ft., schistosity at 10° to core.

4. SAMPLE PREPARATION

Because of the small amount of drill core available only a limited number of specimens could be prepared for testing as in A.S.T.M. 218 - 48T. Wherever possible core specimens measuring 3 inches in length were cut using a diamond saw operated with a copious flow of water. In similar fashion irregular cubes were cut from individual spalls considered representative of the rock type. It was not possible to obtain perfect cubes as specified. Samples of crushed material used for Specific Gravity determinations and for the D.M.R. (N.S.W.) Weathering Test were prepared by stage crushing designed to minimise the production of fines.

5. EXPERIMENTAL PROCEDURE

5.1 Specific Gravity and Water Absorption

This test work was conducted according to the test method described in British Standard 812:1960. Test results are given in Table 1.

5.2 Weathering Tests

Accelerated weathering tests were done on lump material and on aggregate stage-crushed to pass a $\frac{3}{4}$ inch sieve. Distilled water was used for each of the soaking cycles and controlled drying was effected by use of sand baths. At the end of the 1st, 5th, 10th and 20th wet cycles, sufficient water was syphoned from each test on which to conduct analyses for total soluble salts. The results of these analyses are shown in Tables 2 and 3.

Table 1 Specific Gravity and Water Absorption

Sample	Specific Gravity and Water Absorption
Spall samples	S.G. (Appt.) = 2.80 S.G. (S.S.D.) = 2.75 S.G. (Bulk) = 2.72 Water Absorption % = 1.11
Crushed Spall Samples $-\frac{3}{4}" +\frac{3}{8}"$	S.G. (Appt.) = 2.80 S.G. (S.S.D) = 2.75 S.G. (Bulk) = 2.72 Water Absorption % = 1.09
Core specimens Hole K.C. 10	S.G. (Appt.) = 2.79 S.G. (S.S.D) = 2.74 S.G. (Bulk) = 2.70 Water Absorption % = 1.21
Core Specimens Hole K.C. 11	S.G. (Appt.) = 2.80 S.G. (S.S.D) = 2.75 S.G. (Bulk) = 2.72 Water Absorption % = 1.05

NOTE: S.G. (S.S.D) Denotes Specific Gravity on surface saturated dry basis.

S.G. (Bulk) Denotes Specific Gravity on surface dry basis.

Table 2 Chemical Analysis of Decant Water from Weathering of Spall Samples

Assumed Composition	Soluble Salt Concentration gr./gal.			
	After 1st Cycle	After 5th Cycle	After 10th Cycle	After 20th Cycle
$CaCO_3$	0.87	0.66	1.32	1.71
$CaSO_4$	-	-	-	2.65
$CaCl_2$	-	-	-	-
$MgCO_3$	0.83	0.31	0.83	-
$MgCl_2$	-	-	-	0.04
$MgSO_4$	-	-	-	0.75
Na_2CO_3	1.22	1.70	-	-
Na_2SO_4	0.85	0.68	1.25	-
NaCl	1.48	1.12	1.42	2.76
$NaNO_3$	0.10	0.15	0.10	0.10
KCl	-	-	-	-
Total	5.35	4.62	4.92	8.01

Table 3 Chemical Analysis of Decant Water from Weathering of $-\frac{3}{4}$" Aggregate

Assumed Composition	Soluble Salt Concentration gr./gal.			
	After 1st Cycle	After 5th Cycle	After 10th Cycle	After 20th Cycle
$CaCO_3$	0.50	1.51	2.04	6.64
$CaSO_4$	-	1.20	1.20	15.30
$CaCl_2$	-	-	-	2.82
$MgCO_3$	0.62	-	-	-
$MgCl_2$	-	-	-	1.54
$MgSO_4$	-	0.13	2.32	-
Na_2CO_3	1.34	-	-	-
Na_2SO_4	0.85	2.19	0.57	8.75
NaCl	0.49	0.75	0.87	-
$NaNO_3$	0.10	0.10	0.10	0.10
KCl	-	-	-	-
Total	3.90	5.88	7.1	35.15

Table 4 Weathering Test on Stage-Crushed minus ¾" Material

Sieve Size B.S.S.	Grading % Passing	
	Before Weathering	After Weathering
¾ inch	100	100
⅝ "	83	90
½ "	55	59
⅜ "	34	39
¼ "	22	29
3/16 inch	18	24
7 mesh	11	18
14 "	7	13
25 "	5	10
36 "	4	9
52 "	3	8
100 "	3	7
200 "	2	6

5.3 Effect of Temperature and Weak Salt Solutions

A.S.T.M. Designation: C218 - 48T.

This test is designed to determine the effect of temperature cycles and weak salt solutions on crystalline natural building stones, exposed to the weather above ground level.

Test specimens were prepared from drill cores and spall samples submitted, and subjected to 30 wet/dry cycles as specified in the test.

Generally most of the specimens showed no visible changes in physical characteristics except in one specimen (C3-5 from Hole 11), which showed distinct failure prior to test. Results of the tests are shown in Table 5.

Table 5 Absorption and Volume Changes - A.S.T.M. C218 - 48T

Sample	W_1	W_2	W_3	W_4	W_5	Increase in Absorption %	Increase in Volume %
Core From Hole 10							
C2-1	427.35	433.44	274.13	433.18	274.40	-4.3	-0.35
C2-2	360.84	365.96	231.85	366.15	232.80	3.5	0
C2-3	400.22	405.35	255.12	405.42	254.99	1.56	0.41
C2-4	143.28	145.00	92.35	145.04	92.32	2.5	0.12
Core From Hole 11							
C3-1	422.35	427.85	273.03	427.15	269.75	7.0	2.43
C3-2	423.88	428.85	271.83	429.11	271.95	5.1	0
C3-3	426.81	431.41	274.92	431.44	273.95	0.65	0.60
C3-4	428.89	433.55	277.27	433.79	277.10	5.1	0.4
C3-5	426.80	431.64	273.75	430.80	273.10	-0.14	-0.39
Spalls-							
Cube 1	701.88	712.45	441.45	713.04	442.50	4.98	-0.16
" 2	630.33	642.65	402.39	643.10	401.98	4.10	0.52
" 3	615.08	622.86	395.24	622.92	393.95	0.79	0.55
" 4	716.79	720.27	457.55	720.74	458.40	0.24	-0.17

NOTE: W_1 = Original weight of oven dried specimen.

W_2 = Original weight of surface-dried specimen after 24 hours immersion in water.

W_3 = Original weight of specimen suspended in water, after 24 hours immersion in water.

W_4 = Final weight of surface-dried specimen after 30 cycles of the test and 24 hours immersion in water.

W_5 = Final weight of specimen suspended in water, after 30 cycles of the test and 24 hours immersion in water.

APPENDIX F

INCHES TO DECIMAL FEET - CONVERSION

Inches	Feet	Usually adopted	Inches	Feet
12	1.00	1.0	1	0.08
11	0.91	0.9	1/2	0.04
10	0.83	0.8	1/4	0.02
9	0.75	0.75		
8	0.66	0.7	1/8	0.01
7	0.58	0.6		
6	0.50	0.5	1/16	0.005
5	0.42	0.4		
4	0.33	0.3		
3	0.25	0.25		
2	0.17	0.2		
1	0.08	0.1		