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DARWIN RIVER
WATER STORAGE SCHEME, NORTHERN TERRITORY, GEOLOGICAL INVESTIGATIONS
1963 - 1964

by

D.F. MAGGS and J. BARCLAY

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DARWIN RIVER WATER STORAGE SCHEME, NORTHERN TERRITORY, GEOLOGICAL INVESTIGATIONS 1963-64

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SUMMARY

The Darwin River damsite, 28 miles south-east of Darwin, and two alternative possible pondage sites, were investigated at the request of the Commonwealth Department of Works. The investigation included detailed geological mapping, diamond drilling and water-pressure testing of drillholes. Seismic investigations, carried out by the Geophysical Branch of the Bureau, have been reported on by Andrew (1964).

The country rock at the damsite consists of folded interbeds of hard, strong quartzite, quartz phyllite and weak, soft schist, of the Lower Proterozoic Acacia Gap Tongue of the Masson Formation, and the underlying, prominently-cleaved, carbonaceous, pyritic schist of the Golden Dyke Formation. Several tight overturned folds observed in a railway cutting have axial planes that dip 45° to the north-west; the folds plunge to the south-west at 35°. The occasional boudins of hard quartzite beds, slip cleavage in the incompetent soft schist interbeds and sheared quartz stringers along the bedding planes, are additional evidence of the strong deformation the strata have undergone.

Diamond drilling at DDH2 and DDH3 intersected numerous narrow shear zones at the base of the Acacia Gap Tongue. The shears appear to be stratigraphically controlled along the formation contact and are characterized by broken drill core with clay on partings, decomposition of the schist to a soft blue silty clay, and a high concentration of pyrite crystals. Drill core and water-pressure testing near the formation contact indicated a high fracture permeability. It will be necessary to have an effective grout curtain beneath the foundations to an average maximum depth of 100 feet. A chemical grout would be preferable to a cement grout since the foundations contain a high percentage of pyrite.

Two seismic low velocity zones were outlined by the Geophysical work near the proposed axis of the dam. Subsequent diamond drilling in the southern abutment (DDH1) indicated weathered rock of low compressive strength from a depth of 0-38 feet; strong fresh quartzite underlies the weathered rock. The strata were found to have a low to moderate permeability from 0-85 feet in depth.

Detailed geological mapping indicates that the low velocity zone east of the proposed axis of the dam, was probably the near-surface expression of the Acacia Gap-Golden Dyke Formation contact. Intersections by DDH2 and 3 at a depth of about 90 feet showed that the rock is sheared, highly permeable, and weathered near the formation contact. It is suggested that several pits be sunk in both low velocity zones and samples be taken for laboratory testing.

The foundations of the proposed dam consist of hard strong quartzite interbedded with soft weathered schist. The beds vary in thickness from 2 to 20 feet and it is expected that the schist will be found weathered and decomposed even at depth (Appendix 2). It is concluded that an earth or rock-fill dam would be best suited to the conditions at the site and, subject to further testing as indicated in the report, is feasible. Materials for a concrete, earth or rock-fill dam are available within the distance of economic transport, but further testing and proving of reserves will be needed.

Serious leakage is not expected through the saddle areas. However, further investigation of the second saddle site will be required on the completion of a topographic survey of the western part of the reservoir.

Geological mapping and diamond drilling at the proposed pondage sites has shown that, subject to the clays being stable, Site A would be preferable to Site B since extensive grouting of the foundations beneath the river would be required at Site B. The foundations at Site A are found to consist of impermeable clay with rare bands of quartzite and crystalline phosphate rock. It may be necessary to cut a deep slot in each bank at Site A and replace the weak material by rock fill to enhance the soundness of the abutments. The foundations at Site B are of slightly weathered sandstone from a depth of 5-50 feet and would be of adequate strength for a small dam.

INTRODUCTION

Water for Darwin is at present supplied by pipe-line from Manton Dam, 35 miles south-east of Darwin. Water-sheds to the south of Darwin are formed by narrow ridges of resistant arenaceous rock of the Precambrian Masson Formation. They separate flat alluvial plains which are commonly underlain by siltstone and slate of the Golden Dyke Formation. The hot climate and shallow average depth of possible reservoirs would result in high losses of stored water, relative to capacity. Generally the ratio of catchment area to stored water volume would also be unfavourable.

A request by the Commonwealth Department of Works, for a geological investigation of a damsite on the Darwin River, was received early in 1963.

The proposed scheme involves the construction of a dam across the Darwin River, and consideration was also given to a small pondage dam six miles farther downstream to reduce the length of pipeline to Darwin. The dam may have a maximum height of 75 feet and a crest length of 800 feet; a maximum storage capacity of the reservoir would be 143,000 acre/feet and the surface area 7,600 acres, representing 8% of the catchment area which is 78 square miles (Hays, 1962). Additional catchment would be added to the scheme by constructing the small pondage dam.

Location and Access

The Darwin River damsite lies in a gap in a north-north-west trending ridge of quartzite and schist metasediments, and is 28 miles south-south-east of Darwin (Plate 4). It is on the Darwin 1:250,000 sheet (SD52-4) at latitude 12°50', longitude 130°58'. The proposed axis of the dam is half a mile to the south-east of the Darwin River railway siding and a hundred feet to the west of the railway bridge (Plate 5).

Access to the site is by the tar-macadam Stuart Highway for 35 miles, thence 10 miles westerly along an all-weather gravel road to the former Royal Australian Air Force (RAAF) construction camp (used to house personnel working a nearby quarry), and one mile south by bush track along the Darwin River.

The two proposed pondage damsites are within a quarter of a mile of one another, and can be reached by bush track, 4 miles north-westerly from the Southport railway siding (Plate 4).

Previous Investigations

The geology of the region embracing the damsite, storage and catchment areas, and pondage sites is reported on by Malone (1962).

A preliminary geological investigation of several possible damsites was carried out by Hays (1962). He reported that the Darwin River site near the R.A.A.F. quarry was the most suitable of the four sites investigated. The site is not as favourable hydrologically as the Adelaide River site but has several economic advantages. The lower cost of the shorter pipeline and lower pumping charges would be partially offset by the need to re-route the railway line if the scheme was approved.

The strata at the Darwin River damsite are interbedded quartzite and phyllite of the Acacia Gap Member of the Lower Proterozoic Masson Formation. Hays reported that large faults are not apparent in a railway cutting through the damsite, where the rocks are well exposed. The sediments strike 015° to 025° and dip 40°-65° west-north-west; joints are well developed and dip easterly. Seismic testing and drilling, to determine depth of fresh rock and foundation conditions beneath the river banks were recommended.

The Darwin River pondage site was described (Hays, 1962) as extending for about a mile in a shallow gorge in the Upper Proterozoic Depot Creek Sandstone Member of the Buldiva Formation. The sandstone is strongly silicified and well jointed; bedding is flat to undulating, and joints are 'sealed' with sandstone breccia.

Barclay and Shields (1963) described the rocks of the railway cutting at the damsite, as interbedded quartzite, quartz phyllites, and red and grey banded shale with occasional black slates; they noted the presence of iron and copper pyrites near the centre of the cutting. Several tight, overturned folds with axial plane dips of 45° to the north-west, plunge at an angle of 35° to the south-west. Drag folds, sigmoidal (slip) cleavage in incompetent soft rocks, and occasional boudinage of hard quartzite beds were also mentioned by the writers.

The faults noted in the railway cuttings are mainly bedding plane slips with slickensides and sheared quartz stringers along the bedding planes. The writers observed a strong photo-linear feature trending north-west for a distance of 1½ miles through the damsite, and suggested it may represent a major fault zone. Seismic testing across the feature produced no evidence for a fault. Seismic testing of the damsite, two saddles and two possible minor pondages was carried out by the Geophysical Branch of the Bureau concurrently with the geological mapping (Andrew, 1964).

REGIONAL GEOLOGY

Stratigraphy (Plate 4)

Lower Proterozoic

The Batchelor Group of sediments are the oldest rocks in the area, and can be divided into four formations which tend to be lenticular and to be restricted to the Batchelor region. Total thickness of the group has been estimated at 5000 feet. Beestons Formation (1000 feet thick) of arkose, greywacke and conglomerate is the basal member of the group and has probably been deposited on basement. The Celia Dolomite (1000 feet), of silicified, and in part brecciated, algal dolomite, overlies the Beestons Formation and is overlain by quartz greywacke, siltstone and conglomerate of the Crater Formation (2000 feet). The Coomalie Dolomite (1000 feet) topmost member of the group, consists of silicified dolomite with some siltstone and calcilutite.

The Goodparla Group consists of three penecontemporaneous formations with lateral transitions from one to the other. The Mount Partridge Formation, of conglomerate and ripple-marked sandstone, is succeeded to the west by the Masson Formation, which is made up of lenses of quartz greywacke and siltstone. Farther to the west the Golden Dyke Formation intertongues with the Acacia Gap Tongue of the Masson Formation.

The Masson Formation ranges in thickness up to 10,000 feet; it consists of lenses of quartz greywacke intercalated with siltstone. The Acacia Gap Tongue of the Masson Formation consists of silicified and pyritic quartz greywacke or sandstone, interbedded with pyritic slate, schist and carbonaceous siltstone. The Member is about 3000 feet thick and interfingers with the Golden Dyke Formation of pyritic carbonaceous siltstone, marl and chert. The Golden Dyke Formation is readily recognised but rock types vary considerably from place to place from thin-bedded siltstone, marl and dolomite to massive and nodular chert, limonitic greywacke and pyritic carbonaceous dolomitic marl. It is about 9000 feet thick and conformably overlies the Coomalie Dolomite.

The sediments reflect geosynclinal conditions, with a shelf facies to the east, and deeper water sediments, probably formed by turbidity currents, in the west.

The Finniss River Group consists of two formations, also with a lateral facies relationship. The Noltenius Formation, of siltstone, greywacke and quartz pebble conglomerate, grades basinwards into the Burrell Creek Formation, of fine-grained greywacke and siltstone.

"Part of the Noltenius Formation was redistributed basinwards by turbidity currents, as a result of which lenses and tongues of coarse clastic material overlie and interfinger with finer clastics of the Burrell Creek Formation" (Malone, 1962).

The group is about 10,000 feet thick and structures typical of turbidity current deposition, such as graded bedding, are present.

Upper Proterozoic

The Depot Creek Sandstone Member of the Buldiva Sandstone consists of pink ripple-marked quartz sandstone with lenses of hematite breccia and quartz pebble conglomerate, unconformably overlying Lower Proterozoic rocks.

The sandstone occurs as remnants and in the Darwin River area, represents Upper Proterozoic sedimentation which is well-developed and widely preserved to the south.

Mesozoic - Lower Cretaceous

The Mullaman Beds consist of sandstone, conglomerate, radiolarian shale and porcellanite; they unconformably overlie the Lower Proterozoic rocks. The sediments are well exposed along the coastal cliffs of Darwin where they are up to 50 feet thick.

Much of the Tertiary lateritic material draped over the Mesozoic sediments has been derived from the Cretaceous sediments. A description of the alluvial sediments and ferricrete profile to east of the damsite is given in the section on earth materials (see Plates 5 and 7).

Rum Jungle Granite Complex

The Complex crops out two miles to the north of the township of Batchelor and has been divided into six major units by Rhodes (1964); 'these are in order of decreasing age, schist and gneisses, granite gneiss, metadiorite, coarse granite, large feldspar granite and leucocratic granite.'

The granites have formed a basement upon which metasediments rest unconformably, and folding of the Complex has resulted in the Lower Proterozoic metasediments being domed over granite. Low grade regional metamorphism, of the greenschist facies, has resulted in mineral assemblages previously interpreted as due to contact metamorphism around the periphery of the granite. A full account of the genetic relationships and distribution of rock types in the Complex is given by Rhodes (1964).

Structure (Plate 4)

A structural study of the Rum Jungle area by P. Williams of Consolidated Zinc (personal communication) has indicated that three major periods of folding are present: an early east-west folding, a period of north-west folding, and a subsequent folding sub-parallel to the Giants Reef Fault. The dominant fold direction in the Pine Creek Geosyncline is north-west. Fold axes trend almost due north in the northern part of the Finnis Graben (Malone, 1962) and synclines are well exposed.

Two major fault zones are shown on the regional map of Rum Jungle area (see Plate 4).

(i) The Giants Reef Fault, which is a horizontal tear fault of displacement three miles, along which the west block moved north.

(ii) The Mount Fitch Fault, although not well exposed at the surface, has been exposed during mining in the Mount Fitch Prospect. The throw has been estimated at 5000 feet (Malone, 1962). The Mount Fitch Fault passes close to the west of the damsite but lies outside the storage area and would not provide a leakage path from the proposed reservoir.

SEISMIC ACTIVITY

A seismological observatory was installed in Darwin, by the Bureau of Mineral Resources during 1961. Enquiries have indicated that before then an earth tremor with a possible intensity of IV (Modified Mercalli scale) occurred about 1950. Significant earth tremors recorded in Darwin since April 1961 are given in Table I.

Table I: Earth tremors recorded in Darwin, April 1961 - December 1963.

Date	Origin Time	Epicentre	Depth	Intensity at Darwin	Comment (Darwin)
14.2.63	07 04 40.8	7.2S 128.2E Banda Sea Area	197km	II - III	Felt by people at rest. Objects swung.
4.11.63	01 17 17	8S 129.5E	100km	V - VI	Some cracks in buildings and movement of stationary vehicles. People ran out of buildings.

About ten minor tremors of intensity less than I are recorded daily in Darwin.

The Northern Territory of Australia is not considered to be a seismically active region. Epicentres of earth tremors felt in Darwin generally originate to the north of New Guinea and it is considered unlikely that tremors of magnitude greater than VII (Modified Mercalli scale) would be experienced in the life of the dam.

DAMSITE GEOLOGY

Interbedded quartzite and schist of the Acacia Gap Member intertongue with pyritic carbonaceous siltstone* of the Golden Dyke Formation near the Darwin River railway bridge (see Plate 8). Acacia Gap metasediments crop out downstream from the bridge over a distance of about a mile, but the thickness of the formation is considerably less than this figure. Regionally the structure appears simple, with a regular bedding dip to the north-west, but in the R.A.A.F. aggregate quarry and the railway cutting, the complex structure is apparent. The strata have been regionally metamorphosed and contorted into isoclinal folds.

The Golden Dyke Formation tends to have sparse outcrop and to underlie low areas of the land surface; it is mainly covered by alluvium near the damsite. It has been intersected in power auger holes (Plate 5) to the west of the Darwin River and in diamond drill holes (Plate 13) to test the foundations of the dam. The formation near the railway is overlain by metasediments of the Acacia Gap Tongue; it dips at 50 degrees to the west and strikes at 040 degrees.

Many of the structural features noted in the Acacia Gap Tongue, such as very tight folding and boudinage, have formed because hard competent quartzite is interbedded with soft incompetent schist, and the area as a whole was subjected to intense regional pressures during Proterozoic time.

Areas to the east and west of the damsite are covered by a veneer of Recent pisolitic laterite (ferricrete) and by sediments deposited by the Darwin River. A description is given in the section on earth materials. (See Plate 5).

Metamorphism

Prior to deformation the strata of the Acacia Gap Tongue probably consisted of horizontally bedded sandstone, siltstone and shale. Strong regional stresses have altered the mineralogical composition and physical properties of these beds, to form compact regional metamorphosed rocks.

Schistosity, slaty cleavage, bedding plane slippage, and boudinage structures are features typical of strong deformation of interbedded competent and incompetent rocks; they are found where interbedded quartzite and schist are exposed in the costeans and railway cutting. The strata have been folded into isoclinal recumbent folds which plunge to the south-west at 35 degrees. (Plate 9 and Plate 1, Fig. 1). Fold axial planes in the railway cutting (Plate 9) generally strike south-west and dip 45 degrees to the north-west. The amplitude of the folds ranges from 1 to 20 feet; several folds of large amplitude (50 feet) were noted in the R.A.A.F. quarry. (Plate 1, Fig. 2). Boudins have formed where rigid beds of quartzite have parted in a zone of tension with recrystallization of quartz between the rounded segments. The boudins are invariably formed in zones of strong folding.

Faulting

Detailed geological mapping of the railway cutting, costeans, and both abutments of the dam has not revealed the presence of any major faults. Some evidence of differential movement of strata, such as bedding plane slips and faint slickensides, has been noticed. It is difficult to detect shearing

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* Petrographic examination of selected specimens of drill core suggests that the rock mapped at the surface and logged in drillholes variously as schist, phyllite, siltstone and shale is, in fact, quartz-sericite schist (commonly pyritic and carbonaceous) see Appendix 1 and 2.

in the schist beds unless it cuts across the stratification. The plane of least resistance to movement would be parallel to the cleavage in the schist and invariably minor adjustments have occurred along this plane.

Small zones of shattering and thin quartz veins were noticed at the eastern section of the railway cutting within 50 feet of the boundary of the seismic low velocity zone (see Plate 8).

Numerous narrow shear and shatter zones intersected by diamond drill holes 1, 2, 3, in the abutments and beneath the river (see Plates 10, 11, 12), were found to have several features in common viz.,

(a) The diamond drill core is broken into 1-3 inch lengths.

(b) Small shattered pieces ($\frac{1}{4}$ inch long) of schist or siltstone are thinly coated with kaolinitic clay.

(c) Thin quartz veins occur along the shear zones.

(d) A high percentage of pyrite crystals, up to $\frac{1}{4}$ inch across, are present in the zones.

(e) The zones invariably have a high permeability, in excess of 1000 feet/year.

Details of these crush and shear zones are noted in the drill logs (Appendix 2) and a summary is given under 'possible cause of water loss' in Table 3. (See also Plates 10, 11, 12).

A region of low seismic velocity to the east of the damsite was outlined in a seismic survey by the Geophysical Branch (Andrew, 1964), and postulated to be a shear zone. The approximate location was given as east of geophysical pegs F9, A8, D19, and C12 (see Plate 8). Detailed geological mapping indicates that the low velocity region coincides with the surface contact of the Acacia Gap Tongue on the west, and the Golden Dyke Formation. The Golden Dyke Formation, consisting mostly of carbonaceous, pyritic siltstone, would have a lower seismic velocity than the much more compact quartzite-schist interbeds of the Acacia Gap Tongue. The boundary between the two units has been intersected about 100 feet beneath the river by drill holes 2 and 3. Small shear zones were intersected during drilling, close to and on either side of the contact. The small shear and crush zones possibly extend to the surface along the Acacia Gap-Golden Dyke boundary (see Plate 13).

Andrew also recorded a low velocity zone, interpreted as a shear zone, from the river to the crest of the southern abutment 500 feet distant (Plate 8). The width of the zone was found to range from 40 feet near the river to 100 feet along C traverse. Drill hole DDH2 was drilled to enter the low velocity zone. The core, although broken, does not indicate a major fault or shear in the low velocity zone. Closely-jointed weathered quartzite, weathered phyllite and quartz phyllite, with some thin clay lenses (formed by weathering along the cleavage) were intersected. Water-pressure testing showed the strata to be nearly impermeable from 35 feet to a depth of 100 feet.

Jointing and Schistosity

The beds of the Acacia Gap Tongue are from several inches to 15 feet across with an average thickness of 5 feet. Tension joints are present in the quartzite near the 'nose' and along the flanks of folds (Plate 1, Fig. 1). Many of the joints are thinly filled with iron oxides and are perpendicular to the bedding; their intersection with the plane of schistosity of the quartzite (which is roughly parallel to the bedding), gives a 'blocky' shape to weathered exposed faces. Faint slickensides and bedding-plane slips are common features at the contact between beds of schist and quartzite. A well-developed fracture cleavage almost parallel to the bedding is present in the schist.

The bearing and inclination of joint planes recorded from outcrops of quartzite on both abutments have been plotted in stereogram form and as frequency diagrams in Plates 14 and 15. Two dominant directions of jointing and the plane of schistosity can be clearly discerned in each abutment:

North abutment

1. A prominent joint direction of 090° with an inclination of 70° to the south.
2. A strong set of joints with a bearing of 345° and inclination of 50° to the east.
3. The plane of schistosity has a bearing of 035° and an inclination of 38° to the west.

South abutment

1. A strong set of joints with a bearing of 080° and inclination of 75° to the south.
2. A set of joints, with a bearing of 355° and inclination of 60° to the east.
3. The plane of schistosity has a bearing of 020° and an inclination of 38° to the west.

In the holes drilled in the abutments of the damsite, at a depth of from 0-15 feet, the joints were found to be filled with a red iron oxide cement up to $\frac{1}{4}$ inch wide. From 15-35 feet the joints are filled with pale grey clay and some iron oxides and have an average width of 1/16 inch; below 35 feet depth the joints are closed or cemented with a thin film of pyrite. The joint spacing revealed in diamond drill core varies with rock type, degree of weathering, thickness of the beds, and proximity to shear zones. The number of fractures per linear foot of drill core has been recorded in the geological logs (see Appendix 2).

Plates 14 and 15 show a marked difference in the direction of the long axes of quartzite outcrops in the two abutments: in the south abutment most strike 360° but in the north abutment 035° is the main direction. Moreover there is a difference of 10 degrees in the bearing of the two major joint directions in the two abutments. Topography may explain part of the apparent variance in bearing of the outcropping quartzite beds but not the pronounced divergence of strike of both the schistosity and the joint planes.

ENGINEERING GEOLOGY

Permeability Testing

Technique

Equipment used is listed, with comment, in Table 2.

The length of each test section was governed by the nature of the rock. Generally a 20-foot section was used if the water loss was moderate and a 10-foot section used if the water loss was high (more than 0.8 gallons/minute/linear foot of test section). The position of the packer was selected from an inspection of the core.

A safe pressure of 1 pound per vertical foot of depth from the ground surface to the top of the test section, to a maximum gauge pressure of 40 psi, was used. This value was estimated to exceed the theoretical head of water impounded in the reservoir area. An effective pressure in the test pressure in the test section was calculated by adding the hydrostatic pressure of water above the water table to the gauge pressure, and subtracting the frictional loss of head in the pipes.

Permeability tests were run until stable conditions of pressure and flow of water into the strata were obtained. A test was considered satisfactory if three consistent water loss figures were obtained at four successive pressure increments. At the conclusion of each test the water loss in gallons per minute was plotted against gauge pressure.

Reliability of results

At the conclusion of each permeability test, the loss of water in the test section per unit time for each pressure increment, was plotted. In almost every test a linear plot of gallons of water loss per minute against pounds per square inch of gauge pressure, indicated a reliable value of the fracture permeability.

Permeability of the foundations

A sharp line of demarcation in permeability was found between sound unfractured rock and rock that had been subjected to shearing, shattering or closely-spaced open jointing, in the foundations at Darwin River. The sound unfractured rock generally had a permeability less than 150 feet/year and the sheared rock was found to range in fracture permeability from 800 feet/year to a maximum water loss of 2.1 g.p.m./linear foot with no back pressure, for the section 149-160 feet of hole No. 1.

The crush zones and shear zones are characterized by the broken nature of the recovered core (1" pieces), small quartz veins, decomposition of schist to a soft blue 'pug', and abundant pyrite crystals.

Nine regions of high water loss, with permeabilities of more than 800 feet/year have been distinguished from data obtained in drill holes 1, 2 and 3. A summary of the zones of high fracture permeabilities, possible causes of water loss, and reduced levels of each zone is given in Table 3.

Zones F and I (Plates 11 and 12)

Zones F (DDH2) and I (DDH3) were intersected between reduced levels -59 feet and -90 feet in the Golden Dyke Formation. The rock is closely shattered pyritic carbonaceous siltstone; some partings are thinly coated with clay. The permeability of Zone F was about 1100 feet/year, and of Zone I about 1200 feet/year.

The proximity of the two zones F and I, close agreement in permeability and position of intersection suggest that the same area of shattering has been intersected by the two diamond drill holes. The area of shattering would be at least 25 feet long between holes 2 and 3 and 30 feet wide.

An inclined diamond drill hole (50°E) placed near the centre of the river at grid reference 175N 25W, between bore holes No. 2 and 3, to a depth of 150 feet, should show if this area of shattered rock extends to the surface beneath the river. The hole would also serve to check if zones AB, DE, and H extend to the surface (see below), and give an estimate of the sediment thickness in the Darwin River.

Table 2 - Equipment for Permeability Testing at Darwin River Damsite

Equipment	Type	Make	Capacity	Comments
	Pneumatic	-	Internal constriction of 1 inch. BX size	The combination of a three-foot seal length and variable inflation pressure (max. 140 p.s.i.), proved effective in testing difficult foundation conditions: interbeds of soft and hard rock.
	Pneumatic	-	Internal constriction of 1½ inches NX size	Difficulty was experienced with 'blow outs' in the flexible plastic tubing connecting the air bottle to the packer.
Connecting Pipe	Ex casing	-	1½ inches diameter	The casing proved capable of delivering a large flow of water (50 gals/min) with small friction loss.
Gauges	Pressure	McPherson	0.75 p.s.i.	To maintain an accuracy of 2%, a sensitive flow meter was used to a maximum of 15 gals/min., and replaced by meter of larger capacity above this value.
	Flow	Dobbie Dico	800 gal/min. and 2,500 gal./min.	
Air-bottles	-	-	¼ cub. foot	Pressure fluctuations in the test section were reduced with a 1 cub. foot air bottle attached to the Mindrill piston pump. Two small air bottles were placed between the flow meter and the pressure gauge to prevent small pressure pulses.
			1 cub. foot	
Pumps	Piston reciprocating	Mindrill	1200 gal./hr	Suitable for supplying a small volume of water at a high pressure.
	Centrifugal	Rex	3000 gal/hr at 60 p.s.i.	Suitable for supplying a large volume of water at stable pressure.

Table 3 - Darwin River Damsite - Zones of High Water Loss in Drillholes during Water Pressure Testing

Hole Number	Zone	Intercept along diamond drill hole	Depth reduced level Darwin Town datum	Consisting of water pressure test sections	Fracture Permeability (feet/year)	Possible cause of water loss (footage refers to intercept along diamond drill hole)
1	A	133'6" to 178'9"	14' to -20'	133'6" to 150'9"	985	Shear zone from 131' to 164'; core very broken with clay and pyrite along partings.
				149'9" to 160'9"	4620	
				159'3" to 178'9"	1015	
	B	178'1" to 210'3"	-20' to -44'	178'1" to 196'1"	960	Core is very broken for one foot at 188' and 194'. Many small closed fractures and pyrite seams in Zone B.
				190'3" to 210'3"	1300	
2	C	6' to 17'	91' to 81'	6'0" to 17'4"	12,140(?)	Probably rock detritus in this zone consisting of angular weathered pieces of quartzite, some clay and iron oxides.
	D	108' to 146'	20' to -8'	108' to 128'	1090	A possible shear zone from 119' to 134'; very broken core, well-developed cleavage, and some clay.
				126'0" to 146'0"	1348	
	E	145' to 172'	-8' to -27'	145'9" to 165'9"	6650	Shear zone from 157' to 165', very broken core, soft and friable. Some quartz veins with pyrite.
				158'5" to 172'5"	2583	
	F	235' to 263'	-59' to -90'	235'4" to 250'4"	1014	Possible shear zone from 220' to 250'; core very broken with clay and some pyrite on partings.
				245'5" to 263'5"	1143	
3	G	93' to 134'	29' to 3'	93'0" to 113'	1422	Shear zone from 80' to 104'; schist is decomposed to a blue 'pug' with clay and much pyrite. Very broken core.
				110'0" to 133'0"	3540	
	H	160' to 179'	-16' to -30'	158'6" to 178'6"	4096	Shear zone from 161' to 180'; core broken to 1 inch pieces, clay and much pyrite present.
	I	225' to 250'	-61' to -80'	222'0" to 238'6" 233'0" to 250'6"	1303 1250	Shear zone from 226' to 250'. The zone is shattered to $\frac{1}{8}$" pieces, with clay on the partings.

Zones AB, DE and H (Plates 10, 11 and 12)

The zones fall within a depth range of 50 to 110 feet below the surface. Zones AB and DE lie at the base of the Acacia Gap Tongue and Zone H near the top of the Golden Dyke Formation. The fracture permeabilities calculated in the test sections range from 1000 feet/year to 6650 feet/year (Table 3).

The zones are all close to the steeply dipping Acacia Gap Tongue - Golden Dyke Formation contact (Plate 13). The surface expression of this contact has been outlined by Andrew (1964) as a seismic low velocity zone east of the damsite (Plate 8). The contact dips at about 50°W beneath metasediments of the Acacia Gap Tongue; it has been intersected at a depth of about 90 feet from the surface in drill holes 1 and 2 (Plate 13).

Numerous narrow shear zones, characterized by broken core with clay on the partings, decomposition of the rock, and a high concentration of pyrite crystals, are found in the contact zones. The fracturing and shearing has been stratigraphically controlled and follows the bedding. The high fracture permeability in these zones, is due to the narrow shears and fractures in the strata, and the water loss is believed to have been along them.

The likelihood of leakage along zones AB, DE, H, and along the formation boundary is not considered to be serious as there is no evidence to indicate that the fractures and shears are interconnected. Further, the formation boundary is steeply dipping at about 50°W and any possible path of leakage through the confining ridge would be at least 800 feet long. There is, however, the possibility that these stratigraphically controlled fractures and shears may extend around the eastern periphery of the Acacia Gap - Golden Dyke contact, a distance of about three miles. This should be checked by a shallow diamond drill hole through the formation contact, to the south of the damsite.

Pyrite (Appendix 1)

Three diamond drill holes at the damsite have intersected strata containing a rather high concentration of pyrite (0.5 to 3%) as fine-grained disseminations and thin veinlets up to ⅛ inch thick, below a depth of 35 feet. The pyrite has been partially leached from the surface outcrop by thorough tropical weathering. Relic pyrite casts and some fine disseminations of pyrite are to be found to a depth of 35 feet, in strata of the Acacia Gap Tongue.

The Golden Dyke Formation, below a depth of 120 feet, has numerous thin veinlets of pyrite up to ⅛ inch thick, parallel to the cleavage. From drill intersections it is estimated that one pyrite vein occurs per linear foot (Appendix 2). Regional mapping of the Rum Jungle area (Malone, 1962) has shown that the Golden Dyke Formation is characterized by a high pyrite content. The pyrite is syngenetic in origin; it was probably formed during deposition of the beds.

Abundant pyrite has been found along bedding planes of weathered schist and along thin veinlets of quartz in fracture zones. Crystals of pyrite from ⅛ to ¼ inch across, are present in these zones.

Pyrite is also found as thin 'films' along joint planes.

Reaction of pyrite with cement

In the presence of air, including air dissolved in water, pyrite tends to oxidize slowly to form iron sulphate and possibly some sulphuric acid. Small concentrations of either are highly aggressive to cement. However below the level of possible oxidation, cement would be unaffected by the presence of pyrite.

It should be noted that pyrite is present in all zones of high leakage, indicating only partial oxidation. Where oxidation is complete fractures and partings tend to be plugged by clay.

Strength of the Foundations

The quartzite is a moderately jointed, strong, hard, silicified rock with a high compressive strength and has been little affected by weathering. This is in contrast to the schist which has been weathered to depths of 100 feet, owing to the presence of small shear zones along which ground water has moved. The dark-grey schist has a prominent cleavage sub-parallel to the bedding, is soft, and of low compressive strength. Weathered schist in drill holes is a dark-blue, soft, friable silty clay with abundant pyrite crystals.

The seismic survey at the damsite indicated a change in seismic velocity along traverse A (Plate 13) from 3000 feet/second to 11,000 feet/second at a depth of 10 feet. Seismic profiles along traverses **D** and **E** indicate depths of 25 feet and 50 feet respectively for this same boundary. Andrew (1964) has pointed out that, "there may be further weak layers below the depths determined on the north-south traverses whereas in the east-west direction the depths determined are to continuous solid material". The high seismic velocities (11,000 feet/second) recorded at a depth range of 10 to 50 feet are from interbeds of hard silicified quartzite. However the seismic refraction method does not record the presence of low velocity weathered rock beneath a high velocity refractor: diamond drilling in the abutments of the dam have shown that weathered beds of schist are present to a depth of about 100 feet below the ground surface (Plates 11 and 12).

It is therefore considered that the seismic profile (3000-10,000 feet/second) as shown on Plate 13 does not indicate the depth to fresh bedrock but rather represents the top of hard rock interbedded with weathered rock.

Andrew (1964) postulated a shear zone in the southern abutment between geophysical pegs D6 to D7 and C7 to C9 (Plate 8). Subsequent diamond drilling of this zone at DDH1 has shown that weathered reddish-grey phyllite and bands of grey vuggy hard quartzite are present at a depth 0-7 feet; slightly weathered quartzite with some interbedded weathered phyllite occurs from 7-17 feet; weathered phyllite, rare thin bands of hard quartzite or quartz phyllite, with some decomposed phyllite (now thin bands of silty clay) are present from 17-38 feet. Hard fresh quartzite was intersected from 38 to 100 feet from the surface, and slightly weathered phyllite with interbedded bands of quartzite below this depth.

Several auger holes bored in the costean on the southern abutment (Plate 9) near grid reference 70N, 100W (Plate 8) showed complete decomposition of the schist to a soft blue silty clay. The holes were augered to a depth of 6 feet and the water table was intersected within a foot of the surface.

TABLE 4. SUMMARY OF AUGER HOLE DATA

Lithology	Clay Grid C	 Grid D	Silty clay	Sand. some silt	Silty sand	Clay sand and sandy clay Grid A	 Grid B	Ferruginous Detritus	Gravel and Sand	Rock Detritus and Silt
Distance from damsite in miles	0.8	0.5	1.3	1.5	2.3	2.3	1.2 to 1.4	0.5	2.3	0.5
Grid co-ordinates	C/2NOE- C/10NOE	D/8SOE- D/8NOE	B/18NOE- B/27NOE	B/0NOE- B/3NOE	A/3N3W- A/15N3W	A/3N3W A/15N3W	B/24NOE - B/33NOE B/9NOE - B/15NOE	D/8SOE-D/8NOE	A/9N3W- A/15N3W	D/4SOE-D/8NOE
Description	Pale green, silty in some sections.	Dark green. Slightly silty in some sections	Quartz grains, silt and clay present.	Composition approximately 90% quartz grains, 10% silt.	Fine grained quartz sand and some silt.	Coarse grained quartz sand, average grain size 2 mm., with silty fines; approx. composition is quartz sand 90% and silt 10%.	Composition approximately quartz sand 50% and silt or clay 50%, Uniform texture.	Ferruginous pisolites to ¼" across with a matrix of quartz sand and silt.	Subrounded pieces of ferruginous quartz sandstone from 0-½" across, generally weathered and friable.	Colluvial material, of rounded pieces of quartz and ferruginous pisolites to ¼" across, and a matrix of fine quartz silt.
Dimensions material assumed to extend 100 ft. either side of baseline.	-	1600'x5'x200'	800'x10' x 200'	300'x9' x 200'	1200'x6' x 200'	1200'x10' x 200'	Lenticular shape	1600'x4' x 200'	600'x3' x 200'	1200'x 2' x 200'
Possible reserves, assumption as above (in cubic yards).	+500	+40,000	50,000	20,000	30,000	60,000	80,000	+40,000	[illegible]	15,000
Plasticity	Moderate to high	Moderate to high	Moderate 1/16" thread	Moderate 1/16" thread	No cohesion	Moderate ⅛" thread crumbles easily.	Moderate 1/16" thread not easily crumbled.	No cohesion	No cohesion	No cohesion
Overburden to be stripped (depth in feet).	Soil, rock detritus and ferruginous gravel 7'.	Sand, gravel, and ferruginous gravel 8'.	Ferruginous gravel, soil, some clay, 4'-5'.	Soil 4'.	Gravel and sand 3'.	Silty sand 3'-10'.	Soil and ferruginous gravel some silt 4'-7'.	Sand and detritus 3'.	None	Trees and vegetation.
Water table	below 10'	11'	16' for hole B/21NOE on 12/10/63.	11' on 12/10/63.	10'-15' on 16/9/63.	15' on 16/9/63	15' on 12/10/63	Below 10'	15' on 16/9/63	Below 15' on 14/9/63
Remarks	Material variable in texture.	Total thickness of the clay is unknown as the material was not augered to full depth.						Underlain by plastic clay.		

Notes: Estimates of composition have been determined visually with a hand lens.

Detailed logs of all auger holes are held by the Bureau of Mineral Resources, Canberra.

Drilling has shown that weathered rock of poor compressive strength, as indicated by broken core and a fairly high core loss, is present between a depth of 0-38 feet in this zone; strong fresh rock of high compressive strength is below the weathered rock. The permeability of the rock in DDH1 was found to range from low to moderate (0.1 to 0.6 g.p.m./linear foot at 50 p.s.i.) to a depth of from 0-85 feet from the surface (Plate 10), and to increase to a high fracture permeability below this depth (Table 3). The zone may prove critical in the design of a dam and it is suggested that a test pit be sunk at grid point 50S 60W (Plate 8), to a depth of 10 or 15 feet. Undisturbed samples of the weathered rock should be taken for laboratory determination of the compressive strength, shear strength and permeability. Some seepage of ground water would be expected into this pit during the early part of the year.

A low velocity zone has been outlined (Andrew, 1964) to the east of geophysical pegs F9, A8, D10, C12 (Plate 8). Geological mapping and subsequent drilling indicates that the zone probably marks the contact of the Acacia Gap Tongue with the Golden Dyke Formation; along the contact the rock is sheared and high water loss occurred during permeability testing. The strata are almost certainly deeply weathered and weak. Several test pits should be sunk to a depth of at least 10 feet and undisturbed samples of rock taken, as above. Plate bearing tests would also be valuable. It is suggested that pits be sunk at 75N 75E and 475N 50E.

Construction Materials near Darwin River Damsite

Earth materials

A programme of augering and mapping was conducted to determine if suitable construction materials are available within an economic distance of the dam site. The investigation involved seventy five holes totalling 947 feet of augering, and geological mapping within a radius of three miles of the proposed damsite (see ~~Appendix~~ TABLE 4). Grid lines A, B, C and D were surveyed and augered (Plate 5).

Erosion of weathered Rum Jungle Granite, which had decomposed to clay and coarse grains of quartz, has supplied much of the alluvium along the Darwin River. Granite crops out three miles south-east of the damsite and it is considered that deposits of weathered granite, for impervious core material, could probably be located within a mile to the south east of Grid A on further prospecting and augering.

Small pockets of coarse-grained sand, with clay, were found at Grid A, less than three miles upstream from the dam site; the material, however, proved to be non-uniform in texture and to be intercalated with fine silty clay. Farther downstream, at Grid B, deposits of sandy clay and silty clay predominate. The beds intertongue and are about ten feet thick; they were formed by flooding of the Darwin River over alluvial flats. Auger holes on grids A and B are at 300 foot centres and are considered insufficient to prove reserves; for this purpose it would be necessary to auger at 100-foot or 50-foot centres (Plate 7). Calculations in this report (Table 4) of possible reserves assume continuity of the deposits to 100 feet on either side of the baseline of the grid. This assumption may not be valid, and the estimates given must be considered with caution until further augering has been completed.

Much of the region to the east of the damsite is covered by a veneer of ferruginous detritus (ferricrete) generally several feet deep. The detritus has been augered at a point half a mile to the south of the dam site at Grid D, where it consists of ferruginous pisolites ($\frac{1}{4}$ inch across) with a matrix of quartz sand and ferruginous silt (Plate 5), and overlies plastic green clays. The material is of low compressive strength but may be suitable for road surfacing material.

No instrumental field or laboratory tests were carried out on the materials described above; testing may show them, or some of them, to be unsuitable.

The countryside upstream of the proposed dam site is flat to gently undulating, and during the period from mid-November to March is subject to flooding. The augering for this report was completed at the end of the 'dry season' before heavy falls of rain had affected ground water conditions. Even then the water table was found to lie at about 10 feet below the ground surface. Excessive seepage of groundwater may occur in the pits. A study of the fluctuations of the water table at prospective pit localities, along the river flats, is desirable.

Rock Materials

Quartzite has been quarried by the Royal Australian Air Force within a mile of the proposed damsite, for use in aerodrome construction (Plate 5). The quarry has now been abandoned; a camp with water, sewerage, workshop facilities and railway siding, are still available. Run-of-quarry quartzite contains much pyrite. Use as concrete aggregate would involve selective quarrying and close quality control. It should be suitable as rock fill.

Quartzite scree up to several feet deep occurs near the dam site; it is composed of rather 'blocky' pieces of quartzite up to 12 inches across. Quartzite scree should be tested with pits or costeans, to determine the nature of the material and possible reserves. The material is probably suitable for rip-rap or the outer zones of an earth dam.

SADDLE AREAS

First Saddle (Plate 16)

A prominent ridge composed of metasediments of the Acacia Gap Tongue extends southwards from the damsite. The saddle area is a shallow depression in the ridge 1.7 miles to the south.

The top of the ridge is more than 25 feet higher than the centre of the depression. The saddle is about 1000 feet wide at a reduced level of 150 feet (Darwin Town Datum).

Geology

Interbedded quartzite and phyllite of the Acacia Gap Tongue are present along the ridge and on both sides of the saddle area. The Saddle area is covered by a veneer of soil and rock detritus, and lacks outcrops. From the few sparse outcrops of quartzite mapped (Plate 16) it was not possible to determine the dip and strike of the meta-sediments; there was no surface evidence of faulting in the saddle area.

Diamond drilling and permeability testing (see Appendices 2 and 3)

A vertical diamond drill hole, designated drillhole I3, to a depth of 75 feet, was sited on geophysical peg I3. The strata intersected during drilling consist of soil from 0-5 feet, weathered quartzite from 5-27 feet, weathered phyllite and quartz phyllite from 27-50 feet, and quartzite from 50-75 feet.

The hole was tested for permeability in approximately ten-foot sections. Details of the method and equipment are given in Table 2. Two zones of high water loss were encountered: in the section 6'6" to 18'6" the loss was 2.9 gpm/foot with no back pressure, and from 18'4" to 32'4" the loss represented a calculated permeability of 1600 feet/year. The loss of water may have been along soft disintegrating bands of quartzite, present in the hard silicified quartzite and quartz phyllite from 5-50 feet. The meta-sediments were found to have a low permeability below 32 feet depth, which is about 9 feet below top water level if water were ponded to a depth of 70 feet at the dam site.

Geophysics

The geophysical report (Andrew, 1964) indicates that weathered rock, with a seismic velocity of 6500 feet/sec, is overlain by 7-13 feet of unconsolidated material, and extends to a depth of 72 feet near the centre of the saddle. Elsewhere the depth to fresh rock ranges from 30-86 feet.

Soil and unconsolidated material (1500 feet/sec.) was intersected in the drillhole from 0-5 feet, and fresh quartzite (15,000 feet/sec.) at 50 feet. The corresponding depths at I3, obtained geophysically, are given by Andrew as 11 feet and 51 feet respectively.

Second Saddle

The second saddle is a flat area at the southern end of the ridge of Acacia Gap meta-sediments, about 2.7 miles from the dam site.

Geological mapping has shown that some small outcrops of pisolitic laterite (ferricrete) are to be found near the geophysical base line; the area is otherwise covered by a soil mantle.

The seismic survey has shown that weathered rock, with a seismic velocity of between 4500-7000 feet/sec. extends to a depth greater than 120 feet. Further topographic mapping is required to determine the terrain configuration and lengths of possible leakage paths before exploratory drilling can be recommended.

PONDAGE DAMSITES

General

Consideration has been given to a small pondage dam no more than 25 feet high and 400 feet long, about seven miles to the north of the main dam site. The pondage dam would increase the total storage capacity, add a further 29 square miles to the catchment area and, more importantly, reduce the length of pipe line to Darwin.

Two alternative sites, about three miles south-west of Berry Springs, have been investigated by geological and geophysical surveys, and by three shallow diamond drill holes. The region between Berry Springs and the lower Darwin River has been geologically mapped by Barclay and Crohn (1963). Most of the region is covered by recent deposits of ferricrete which obscures the underlying geology except in river and creek sections. Lower Proterozoic rocks, consisting of steeply-dipping light-grey shale and siltstone with lesser amounts of chert, low-grade hornfels and spotted schist, were found to crop out near Berry Springs and in the Darwin River near its confluence with the Blackmore River. The sediments probably belong to the Golden Dyke Formation and were found to the north of a line from Berry Springs to the pondage dam sites.

To the south of this line sandstone, probably Upper Proterozoic Depot Creek Sandstone (a member of the Bulldiva Formation) unconformably overlies older sediments. The sandstone crops out along the Darwin River between the upper and lower pondage dam sites and is a pale medium-grained, silicified quartz sandstone. To the east of Berry Springs the formation is white and friable.

The bedding dips between 17° and 47° south-west at the lower pondage site and is apparently almost sub-horizontal at Berry Springs; the succession seems to be more than 100 feet thick.

Limestone underlies the sandstone at, and near Berry Springs. Three circular sink holes, the largest 40 feet in diameter and 7 feet deep, were recorded by Barclay and Crohn (1963). Dolomite was intersected in several holes drilled by Water Resources Branch east of Berry Springs. Water samples taken from Berry Springs and Darwin River indicated that the streams had passed through lime-rich strata; they had hardness equivalents of 200 parts per million calcium carbonate.

Upper Pondage Site A (Plate 2, Fig. 1 and Plate 17)

Geology

Upper Proterozoic

Pale pink quartzite, thought to belong to the Depot Creek Sandstone Member, crops out on the southern abutment of the pondage dam site. One large outcropping block of quartzite on the southern abutment, about 30 feet across, comprises nearly all of the exposed Proterozoic bedrock.

Several small outcrops of ferruginous conglomerate are found both upstream of the site and downstream near the old Bynoe road.

Recent

River gravel is present along the river flats near the pondage dam site and extends for more than ten feet up the river bank. The gravel is varied in composition and size range; rounded pebbles of conglomerate and quartzite, up to 4 inches across, are common and several large boulders of conglomerate, up to 3 feet across, have been observed.

Foundation rock

Two diamond drill holes have been drilled into poor quality rock at site A. Hole DD17 was drilled to a depth of 50 feet, through 17 feet of clay, then through clay with rare bands of quartzite and crystalline phosphate rock. Hole DD19 was drilled to 20 feet in hard quartzite with interbedded clay (weathered rock), much of which is phosphatic. Core loss was high in both holes (about 50%) and indicates the broken nature of the rock. Much of the core can be crushed with the fingers. The clay present may be a type that expands markedly in saturation with water (see Appendix I, FN145626).

The geophysical survey has indicated a profile of weathered rock (seismic velocity 4000 to 6500 ft/sec.) ranging in depth from 15 to 62 feet.

Permeability testing

The strata were tested over ten-foot test sections and found to have very low permeability (see Appendix 2). For details of the test procedure see Table 2.

Diamond drilling

Two vertical diamond drill holes, DD17 and 19, were drilled to test foundation conditions at the upper pondage site. They are located on the geophysical grid (Andrew, 1964) on the north and south banks respectively of the Darwin River.

DD17 was completed at a depth of 50'4". No. 19, scheduled to 25', was terminated at 20'4" after hard quartzite was encountered at 19'6".

Detritus and rare outcrops near the drill sites consist mainly of hard pink quartzite, commonly containing angular quartz fragments up to 3 inches in diameter. The quartzite may be a part of the Depot Creek Sandstone Member of Upper Proterozoic age.

The core from each hole revealed only minor amounts of hard quartzite at depth, the bulk of the material being a weathered rock consisting of stiff clay and angular quartz fragments. The quartzite and weathered rock are probably alteration products of the same source rock, produced by silicification and weathering respectively. They commonly react positively to the field test for phosphate, and soft, crystalline phosphate rock occurs in DD17 from 25'8" - 30'6".

Water pressure tests conducted over sections approximately 10 feet long showed that the strata are tight and impermeable; no fault zones, were recorded. The water level in DD17 stood at 4' on 22nd April, 1964, but dropped to 7'6" by 5th May, 1964, whereas in DD19 the standing water level was 1' below the surface throughout the period of drilling.

Leakage of water from the reservoir

There are no obvious springs or areas of seepage in the immediate vicinity of the dam site. A small spring was noticed 1½ miles upstream of the dam site.

Water pressure tests completed in diamond drill holes DD19 and DD17 show the strata to be impermeable.

Geophysical seismic traverses show:

(a) Probably no major fault zones cross the pondage dam axis.

(b) A change in seismic velocity, from 8000 to 12,000 ft/sec., is present at a depth of about 120 feet.

This seismic boundary may correspond to an unconformity between the Upper and Lower Proterozoic, and could be a zone of leakage, depending on the nature and attitude of the boundary. As the pressure of impounded water in the pondage dam would be low, this zone is not considered as a serious risk.

There is no geological evidence to suggest that a serious loss of water would occur, on building a small pondage dam at Site A.

Assessment of the site

(1) The maximum height of the pondage dam would possibly be 22 feet.

(2) The storage area would be small.

(3) Diamond drilling has indicated that weathered rock and clay are present to a depth of 50 feet in the northern abutment at DD17 and 20 feet in the southern abutment at DD19. The rock is of low strength and some could be crushed with the fingers.

(4) Seismic testing has shown that the weathered zone is continuous across the site and the depth is in excess of 30 feet.

(5) The strata intersected by the diamond drill holes were found to be tight and impermeable. No faults or fracture zones were encountered.

(6) The site appears suitable for an earth dam, provided expanding clay does not create serious problems and a suitable spillway could be provided at economic cost. To increase any

leakage path and enhance the soundness of the abutments a deep slot should be cut in each bank and replaced by fill material.

(7) No sampling or testing of possible construction materials was undertaken; this would need to be done. Possibly the material at the site would be suitable. Field and laboratory testing of the abutments, and of the foundations to determine properties of the material present and the required depth of excavation, would be needed.

Lower Pondage Site B (Plate 2, Fig 2 and Plate 19)

Geology

Upper Proterozoic

A pale pink silicified sandstone, thought to belong to the Depot Creek Sandstone Member of the Buldiva Formation, crops out for several hundred yards along the Darwin River at the pondage site. The sandstone is medium-grained, strong and hard, and prominently bedded; some bedding planes are ripple marked. The bedding strikes at about 090°M and dips about 20° south.

Small lenses of sandstone breccia are to be found in the succession (Plate 2, Fig. 2). The lenses are rather irregular and cannot be traced as a continuous zone for any distance. Angular pieces of pale pink sandstone are bonded to form a fairly strong rock with a matrix of quartz sand and silica. It is not known whether the breccia is tectonic as a series of crush zones, or is a sedimentary feature formed by slumping of the beds during sedimentation. The sandstone breccia may have low compressive strength and high permeability, and should be tested in the appropriate manner.

Quartz hematite breccia is exposed along a small creek section several hundred yards to the north-east of the pondage site. The breccia consists of large angular pieces of milk-white quartz in a matrix of hematite and silt. The origin of the breccia is not known but it is probably sedimentary, rather than tectonic in origin.

Recent

River gravel with rounded pebbles of sandstone and quartzite, up to 4 inches across, is present along the river flat to the east of the pondage site, to a thickness of several feet.

Diamond drilling

Diamond drill hole R11 was drilled to test foundation conditions at the lower pondage site. It was sited on the geophysical grid (Andrew, 1964), on the southern bank of the river, and was drilled on a bearing of 036°, at an angle of 45° from the horizontal (Plate 19). The direction of the drill hole is at right angles to the course of the river and the hole was drilled to 100'4", about 60 feet below river level.

The outcrops near the drill site consist of pink quartzite and pink friable sandstone assigned tentatively to the Depot Creek Sandstone Member of Upper Proterozoic age. The strata dip to the south, commonly at shallow angles - though dips up to 47° are recorded - and a zone of shattering passes through the site parallel to the strike of the beds.

The drill core consists of pink quartzite to a vertical depth of about 5 feet, below which is fawn sandstone to the end of the hole. The fawn sandstone is commonly slightly friable and contains a number of very friable zones in which core losses were high. It is believed that the pink quartzite is derived from the fawn sandstone by surface silicification, but core recovery was not sufficient for the transition to be observed.

The bedding is generally inclined at about 60° to the axis of the core, which is consistent, with the shallow southerly dips observed at the surface. Minor shear zones were noted at inclined depths of 43'7" - 44', 47'5" - 48'6", 59'1" - 59'6" (a minor fault at 10° to the core axis), 71' - 71'6" (minor fault parallel to core axis), and 82'1" - 82'10". No relation could be established between any of the minor shear zones observed in the drill hole and the shear zone mapped on the surface.

Geophysical survey (Andrew, 1964)

The contact between soil and weathered rock is given as approximately 5 feet below the ground surface on the south abutment and 10 feet on the north abutment. The base of the weathered rock is placed at 25-29 feet along traverse Q on the north bank and 27-30 feet along traverse BH, at the top of the south bank.

No interpretation is given of the nature of the rock and seismic velocities beneath the Darwin River.

Permeability testing

Water pressure tests were carried out over sections approximately 10 feet long. The greatest water loss was estimated to be 1.16 gallons per minute per linear foot at a maximum gauge pressure of 33.9 pounds/square inch, in the section from 85' - 100'4". The fracture permeability of the sandstone was found to increase with depth, from a low rate near the surface. At a vertical depth of 35 feet the permeability was less than 500 feet/year in the south abutment, increasing to 1700 feet/year at a depth of 55'.

It was reported by the drilling supervisor that water entered the river during pressure testing of the section from 67'11" - 85'3", which indicates a relation between two of the minor shear zones (from 71' - 71'6" and 82'1" - 82'10") and a possible shear in the river bed. The minor faults dip northwards at about 45°.

The water pressure testing appears to indicate that leakage of water from the pondage dam would take place directly beneath the river. A short diamond drill hole, length 75 feet bearing 216° and inclination of 45°, sited at geophysical peg P10 would give information on the permeability of the north abutment.

Jointing of sandstone

The Depot Creek Sandstone(?) has numerous small, closely-spaced, joints. More than 150 measurements of joint planes from the southern abutment are plotted on the bottom hemisphere of a Wulffnet in Plate 3. The stereogram indicates that the joint planes are almost random in orientation.

The intersection of vertical joint planes with the shallowly dipping (20 degrees) bedding plane, gives an unusual 'blocky' appearance to the rock.

Water tightness of reservoir

Water pressure testing of the foundations has shown a significant permeability directly beneath the river. Further testing by means of another drill hole from the north abutment to intersect R11 beneath the river is required if a complete assessment is needed.

Blanket grouting of a narrow area directly beneath the Darwin River between geophysical pegs P11 and R11 may be necessary to seal the foundations. It is not anticipated that serious leakage will occur at a higher level on the abutments at the Q and BH seismic traverse.

Quartz hematitic breccia is exposed several hundred yards to the north-east of the site, and in the storage area. The formation is likely to be permeable, however the trend of outcropping rock is not transcurrent to the reservoir, and serious leakage along this zone seems unlikely.

Assessment of the site

(1) The maximum height of the pondage dam would be about 25 feet; total storage area would be greater than for site A.

(2) Friable slightly weathered sandstone was intersected from 5' to 50' depth below the river. Adequate foundations for a concrete structure should be found at a depth of roughly 5-15 feet.

(3) Thorough grouting of the foundations and abutments would be necessary.

(4) Silicified sandstone and quartzite at the site should prove suitable as concrete aggregate.

CONCLUSIONS AND RECOMMENDATIONS

DAM SITE

(1) The investigation to date has not fully elucidated the geology of the damsite, or fully proved the suitability of the site for the erection of a dam. However it is thought that, subject to the qualifications given below, a dam - preferably of rock fill or earth construction - could be constructed at reasonable cost.

The maximum feasible height of the dam has not yet been established.

(2) Schist and quartzite interbeds of the Acacia Gap Tongue have been intersected by diamond drill holes 2 and 3 to a reduced level of -10 feet; below this is prominently cleaved carbonaceous pyritic siltstone of the Golden Dyke Formation (Plate 13). The quartzite is resistant to weathering, hard and strong, and is silicified at the surface. Weathering near the surface has resulted in a leaching of the schist and partial replacement by iron oxides (lateritization); at depth there are many zones of almost complete decomposition to a soft pale blue silty clay.

(3) An examination of the site has shown that the strata have been subjected to intense deformation and have been folded into isoclinal overturned folds, with shearing, quartz veining along the bedding, and boudin structures (see Plate 1 Fig. 1 and 2). Diamond drilling at close centres would be required to determine a complete geological interpretation of the foundations.

(4) A seismic survey of the dam site by the Geophysical Branch (Andrew, 1964) has indicated a low velocity zone in the southern abutment (see Plate 8). Diamond drilling at DDH1. has shown that weathered rock extends from a depth of 0-38 feet and slightly weathered hard quartzite is present from 38-100 feet. The rock has low to moderate permeability from 0-85 feet in depth (see Plate 10). A test pit should be sunk to a depth of 15 feet at 50S 60W and samples taken for laboratory testing.

(5) A seismic low velocity zone was outlined to the east of the dam site by Andrew (1964) (see Plate 8). Detailed geological mapping and diamond drilling has indicated that the zone probably represents the contact between the Acacia Gap Tongue and the Golden Dyke Formation. The formation contact was intersected at a depth of about 90 feet from the surface in DDH2 and 3. Shear and fracture zones were intersected at the base of the Acacia Gap Tongue near the formation contact, and the strata are highly permeable (see Table 3; Plate 13). The fracture and shear zones appear to be stratigraphically and structurally controlled along the contact and to reflect differing responses to stress by rocks of different mechanical properties.

As the formation contact is fractured and is almost certainly of weathered weak rock, and is within a hundred feet of the proposed axis of the dam, two pits should be sunk to test the rock. It is suggested that pits be sunk to a depth of at least ten feet at 75N, 75E and 475N, 50E, and samples of rock be taken for laboratory testing.

The Golden Dyke - Acacia Gap Formation contact extends for more than two miles along the eastern periphery of the reservoir area and there may be permeable fracture zones along the contact (Plate 5). The possibility requires further investigation.

(6) Several shear and fracture zones have been intersected in diamond drill holes DDH2 and 3 between a reduced level of +30 feet to -30 feet and -60 feet to -80 feet. High water losses were encountered in these sections (see Table 3; Plates 10, 11, 12).

An inclined, water pressure tested, diamond drill hole (50°E), 150 feet long, should be drilled at 175N 25W near the centre of the river to intersect the zones of high water loss DE, GH, F and I (Table 3) and show if the zones extend vertically to the surface beneath the river. The hole would also give information on the depth of alluvium in the river.

(7) Grouting the foundations of the dam will be costly and difficult. The interbedded soft and very hard rock is difficult and expensive to drill. The strata of the foundations does not stand in sections greater than ten feet for any period of time in drill holes.

A high percentage of pyrite (½%-3%) was found to be present in the strata. The pyrite is concentrated in weathered zones of schist. Chemical reaction with the cement grout is possible in places in the zone of oxidation during fluctuations of the water table. A non-reactive chemical grout would be preferable to cement.

Materials for the construction of a dam of earth, rock, or concrete should be obtainable within the distance of economic transport with further prospecting and proving. This opinion is based on field observations only and is subject to the normal testing of the prospective materials.

SADDLE AREAS

First Saddle (Plate 16)

(9) A diamond drill hole (I3) placed near the centre of the saddle area has shown that quartzite and phyllite interbeds of the Acacia Gap Tongue underlie the saddle; they are covered by a thin veneer of Recent soil and rock detritus. There is no geological evidence for permeable Cretaceous sediments in the saddle as suggested by Andrew (1964). For a dam with top water level about 70 feet above present river level some treatment of the saddle to prevent water leakage may be necessary, but no serious difficulties should be encountered.

Second Saddle

(10) Small outcrops of ferricrete were found near the geophysical base line; the area is otherwise covered with a mantle of soil. Further

topographic mapping is required to determine terrain configuration and lengths of possible leakage paths before exploratory drilling can be recommended.

PONDAGE DAMSITES

(11) Two shallow diamond drill holes sited on the abutments of Pondage Damsite A have indicated that the rock consists of clay with rare bands of quartzite and crystalline phosphate rock. Water pressure testing of the holes has shown that the strata have a very low permeability.

(12) Diamond drilling at Pondage Damsite B (R11) has shown that friable, slightly weathered, sandstone extends from 5-50 feet in depth beneath the river and would provide adequate foundations for a concrete or rock fill dam. However extensive grouting of the foundations and abutments would be necessary.

(13) Provided the pondage capacity is adequate at the upper site A, and the clay proves to be satisfactory, Site A is to be preferred to site B because of the lesser permeability of the foundations. It may be necessary to cut a deep slot in each bank at Site A and replace the clay by fill material to enhance the soundness of the abutments.

ACKNOWLEDGEMENTS

The assistance and co-operation of officers of the Department of Works, Darwin, is gratefully acknowledged. Mr. O. Gutmanis, drilling supervisor, is thanked for his interest and meticulous supervision of water pressure testing and diamond drilling during the investigation.

Geophysical grids at the dam site and pondage sites were surveyed by officers of the Water Resources Branch, Northern Territory Administration. The survey pegs were used extensively during the plane table mapping, and added greatly to the accuracy of the survey.

Mr. and Mrs. B. Brown of Darwin River provided accommodation and assistance on several occasions and the writers are sincerely grateful.

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APPENDIX I

Petrography of specimens of core from the Darwin River damsite and pondage sites, N.T.

by

W. Oldershaw

Fourteen samples of core from three diamond drill holes at the Darwin River damsite were submitted for petrographic examination. The country rocks are low grade metamorphics - quartzite and quartz-sericite schist - which were probably originally interbedded sandstone and carbonaceous pyritic siltstone. The rocks have been metamorphosed, folded and cleaved. The sandstone was converted to quartzite, and the siltstone was converted to pyritic carbonaceous quartz-sericite schist. Some quartz veins were injected and some pyrite veinlets emplaced.

All the samples contain pyrite. The pyrite in the argillaceous beds occurs as disseminated minute cubes, blebs and veinlets, whereas the pyrite in the arenaceous beds occurs as large cubes, up to 5mm across, and veins. Possibly the pyrite in the argillaceous beds is syngenetic and some of it migrated into the more porous interbedded arenaceous beds during tectonic deformation. Pyrite slowly oxidizes to limonite and sulphuric acid in the presence of water and oxygen. These will react with the alkalis in the cement used in concrete foundations and in grouting unless sulphate-resistant cements are used.

The high content of small granules of carbonaceous material in the schists may be deleterious. It may inhibit good bonding between the crumbly parts of the rock and any cement grouting.

F.N. 145614 T.S.R. 14483 Drillhole DD1, depth 143 feet

The sample is a small fragment, half an inch across, of dark grey fine-grained quartzite. The quartzite contains scattered cubes of pyrite upto 0.2 inches across which comprise about 5 percent of the rock.

Under the microscope the rock is seen to consist of interlocking crystals of quartz about 0.2mm. across, though a few are 0.5mm. across. The quartz crystals have smooth boundaries; there is no suturing and few strain shadows. The rock contains scattered ragged flakes of muscovite, some of which has been altered to penninite along the cleavage. Some of the grains of quartz have thin selvedges of granular carbon, probably a relict of the old bedding structure.

F.N. 145615 T.S.R. 14484 Drillhole DD1, depth 145feet

The specimen consists of small fragments of crumbly black schist crowded with pyrite which makes up 30 percent of the rock.

Under the microscope the rock is seen to consist of thin bands of quartzite separated by thicker bands of well-foliated carbonaceous quartz-sericite schist.

The quartzits consists of closely packed grains of quartz, 0.2mm across, and interstitial granules of carbon and flakes of sericite. The quartzite is crowded with crystals of pyrite 1 to 2 mm. across.

The schist consists of lenses, arranged parallel to one another, of fine-grained granular quartz; highly stressed elongate grains of quartz; groups of parallel flakes of sericite and chlorite; opaque masses of carbon, and minute grains of pyrite. The well-marked foliation parallel to the macroscopic banding is intersected at an angle of about 30 degrees by a later shear foliation.

F.N. 145616 T.S.R. 14485 Drillhole DD1, depth 153 feet.

The sample consists of a fragment of dark grey quartzite, 1.5 inches across, crowded with cubes of pyrite which comprise about 10 percent of the rock.

Under the microscope the rock is seen to consist of interlocking grains of quartz, ranging from 0.1mm. to 1mm. across, scattered flakes of muscovite, grains of pyrite and sparse interstitial siderite. The grains of quartz have smooth boundaries, but some of the larger grains may be porphyroblasts. The flakes of muscovite occur in the interstices between the grains of quartz and comprise 5 to 10 percent of the rock. The muscovite is fresh but ragged and in places appears to invade contiguous quartz grains. Some muscovite appears to have been altered to penninite along the cleavage planes. The pyrite occurs as cubes upto 2mm. across. The margins of some quartz grains are marked by wisps of carbon.

F.N. 145617 T.S.R. 14486 Drillhole DD1, depth 182 feet.

The sample, a one-inch length of core, is a fine-grained black schist with thin bands of pyrite parallel to the foliation and thin veinlets of pyrite intersecting the foliation. Examination under reflected light did not reveal any sulphide other than pyrite.

Under the microscope the rock was found to consist of masses of opaque carbonaceous material, cubes and veinlets of pyrite, ovoid grains of quartz, flakes of sericite and chlorite, all set in a mosaic of fine-grained quartz. The flaky minerals are orientated parallel to a thin composition banding, which may be bedding or an early metamorphic foliation. This banding is intersected at an angle of about 20 degrees by a shear foliation. Pyrite occurs as cubes scattered through the rock, in layers parallel to the composition banding, and as irregular veinlets intersecting the banding.

F.N. 145618 T.S.R. 14487 Drillhole DD2 depth 52 feet

The specimen is a two-inch core of contorted pyritic, carbonaceous, quartz schist.

Under the microscope the thin-section was found to consist of a mosaic of interlocking grains of quartz, 0.1 - 1mm. across, which make up 80 percent of the rock, wisps of orientated fresh ragged flakes of muscovite, and bands and veinlets of pyrite. The lenses of mica contain lenticles and trails of small granules of opaque carbonaceous material. The bands of quartzite contain parallel flakes of muscovite and trails of minute granules of carbon.

The pyrite occurs as cubes, lenses and veinlets in the quartzose bands and comprises 10-15 percent of the rock.

F.N. 145619 T.S.R. 14488 Drillhole DD2 depth 103 feet

The sample is a two-inch fragment of dark grey quartzite containing scattered cubes of pyrite, 1mm. across, which form about 5 percent of the rock.

Under the microscope the rock is seen to consist of anhedral interlocking grains of quartz, from 0.1 to 0.5mm. across, with interstitial granular carbonaceous material and flakes of chlorite (penninite). The quartz grains do not have sutured margins, but are highly strained. Examination of the sulphide under reflected light showed it to consist entirely of pyrite.

F.N. 145620 T.S.R. 14484 Drillhole DD2 depth 133 feet

The sample is a two-inch fragment of folded pyritic, carbonaceous, quartz-sericite schist.

Under the microscope the rock is seen to consist of bands of quartzite, crowded with cubes of pyrite 1 to 2mm. across, and bands of carbonaceous quartz-sericite schist. Some of the grains of quartz in the quartzite are granulated, many show strain shadows, but none have sutured margins. The quartz in the bands of schist occurs both as lenticular poikiloblastic crystals, upto 0.5mm long and crowded with flakes of sericite and wisps of carbon, and as small elongate granules. The sericite occurs as small, straight, ragged flakes parallel to the banding of the rock. The banding of the rock is also marked by wisps and trails of carbon. There is a well marked late-stage crinkle-jointing parallel to the axial plane of the minor fold visible in the thin-section.

F.N. 145621 T.S.R. 14490 Drillhole DD2 depth 201 feet

The specimen, a two-inch long piece of core, is a pyritic, carbonaceous, sericite-quartz schist. Examination of a polished section shows the sulphide to consist of cubes and lenses of pyrite, 0.2 to 0.5mm. across, disseminated through the rock and along the foliation.

Under the microscope the rock is seen to consist of a mosaic of poikiloblastic crystals of quartz, less than 0.1mm across and comprising 60 percent of the rock, crowded with parallel trails of minute specks of carbon and containing randomly orientated flakes of sericite less than 0.05mm. long. The bigger grains of pyrite occur in the bands of coarse-grained quartz.

F.N. 145622 T.S.R. 14491 Drillhole DD2 depth 242 feet

The specimen is a fragment of white quartz, two inches long, with a little pyrite and some brown stains and green stains along the cracks in the quartz.

Under the microscope the thin-section is seen to consist of irregularly shaped crystals of quartz upto 10mm. across. The crystals show intricate strain shadows and have sutured margins. The quartz crystals are crowded with groups and trails of minute inclusions and gas bubbles. The thin-section contains a few wisps and irregularly shaped masses, upto 5mm. long, of minute clay minerals with extensive iron-staining and silicification. Pyrite occurs as irregularly shaped masses, upto 1mm. across, in the wisps of clay minerals and as thin veinlets in the quartz crystals.

F.N. 145623 T.S.R. 14492 Drillhole DD3 depth 111 feet

The specimen, a two-inch length of core, is a dark grey quartzite containing minute specks of pyrite scattered along the fracture planes.

Under the microscope the rock is seen to consist of interbedding granules of quartz, about 0.2mm. across, and scattered larger grains upto 1mm. across. The larger grains have markedly irregular boundaries and may be glomeroporphyroblasts. Some rounded grains with irregular pellicles of secondary quartz were found. Calcite occurs as irregularly shaped interstitial masses and forms 5-10 percent of some parts of the rock. Chlorite, both penninite and clinochlore, formsinterstitial masses and also occursas scattered flakes between the grains of quartz. Granules of graphite occur in the interstices between the grains of quartz and as thin wisps through the rock. Cubes of pyrite, 0.2mm. across, are scattered through the rock and form less than one percent of the thin-section.

F.N. 145624 T.S.R. 14493 Drillhole DD3 depth 183 feet

The specimen, a one-inch fragment of core, is a well-foliated carbonaceous quartz-sericite schist, crowded with small pods of pyrite that are elongated parallel to the foliation and form about five percent of the rock.

Under the microscope the rock is seen to consist of small parallel flakes and wisps of sericite, scattered through a mosaic of intergrown, irregularly-shaped, elongate crystals of quartz, less than 0.05mm. long and crowded with granules of carbon.

Examination of a polished section shows the sulphide to be entirely pyrite. It occurs as cubes, prisms and blebs 0.2 to 1mm. long, scattered along the foliation planes.

F.N. 145625 T.S.R. 14494 Drillhole DD3 depth 230 feet

The specimen, a half-inch length of core, is a black, carbonaceous, quartz-sericite schist.

Under the microscope the rock is seen to consist of bands of fine-grained granular quartz alternating with bands of interlocking, irregular-shaped, crystals of quartz (0.05mm. across) with diffuse margins and crowded with granules of graphite and flakes of sericite. The flakes of sericite are parallel and intersect the composition banding at an angle of about 30 degrees. Some of the irregularly shaped grains of quartz are elongated parallel to the sericite flakes. The original rock appears to have been extensively recrystallised and to have had a cleavage imposed upon it.

Pyrite comprises 3 to 5 percent of the rock and occurs as cubes and blebs scattered through the rock; the cubes and blebs are larger in the more quartzose bands than elsewhere.

F.N. 145626 T.S.R. 14495 Drillhole DD17 depth 26 feet

The specimen, a one-inch length of core, is a crumbly, porous, pale grey and pink breccia. It gives a positive reaction to tests for phosphate. It effervesces in dilute hydrochloric acid and most of it dissolves, leaving a residue of red clay and quartz. On immersion in water the breccia breaks up into a mass of colourless fragments of calcite and quartz and red clay.

Some difficulty was encountered in making a thin-section of the rock. The thin-section consists of fragments of calcite of various shapes and sizes, set in a matrix of clay which is crowded with granules of quartz, hematite, limonite, and epidote. The phosphate-bearing mineral was not recognised.

This rock requires further examination. The clay may be one of the montmorillonite group - the expanding clays - and the source of the phosphate needs investigation.

F.N. 145627 T.S. 14496 Drillhole DD17 depth 36 feet

The sample, a two-inch length of core, consists of rounded fragments of quartz, 1 to 10 mm. across, set in a red silicified sandy matrix.

Under the microscope the large fragments of quartz are seen to consist of several interlocking crystals, upto 2mm. across, with strain shadows and sutured margins. Some fragments consist of quartzite composed of interlocking grains of quartz 0.2mm. across. The large fragments of quartz and quartzite have smooth rounded margins. These fragments are set in a matrix of irregularly shaped grains of quartz, 0.1 to 0.2mm. across, cemented together by a limonitic silica cement. Patches of colourless kaolin flakes occur in some of the interstices in the matrix. Many of the fragments of quartz and the small grains of quartz contain trails of minute unidentified inclusions. Some contain minute inclusions of limonite and twisted ribbons of rutile.

The rock is a silicified limonitic quartzite breccia.

APPENDIX 2

GEOLOGICAL LOGS OF DRILL HOLES

For locations of drill holes see:

Damsite drillholes - Nos. 1, 2 and 3 - Plate 8

Saddle drillhole - I3 - Plate 16

Pondage site A drillholes - Nos 17 & 19 - Plate 17

Pondage site B drillhole - R11 - Plate 19

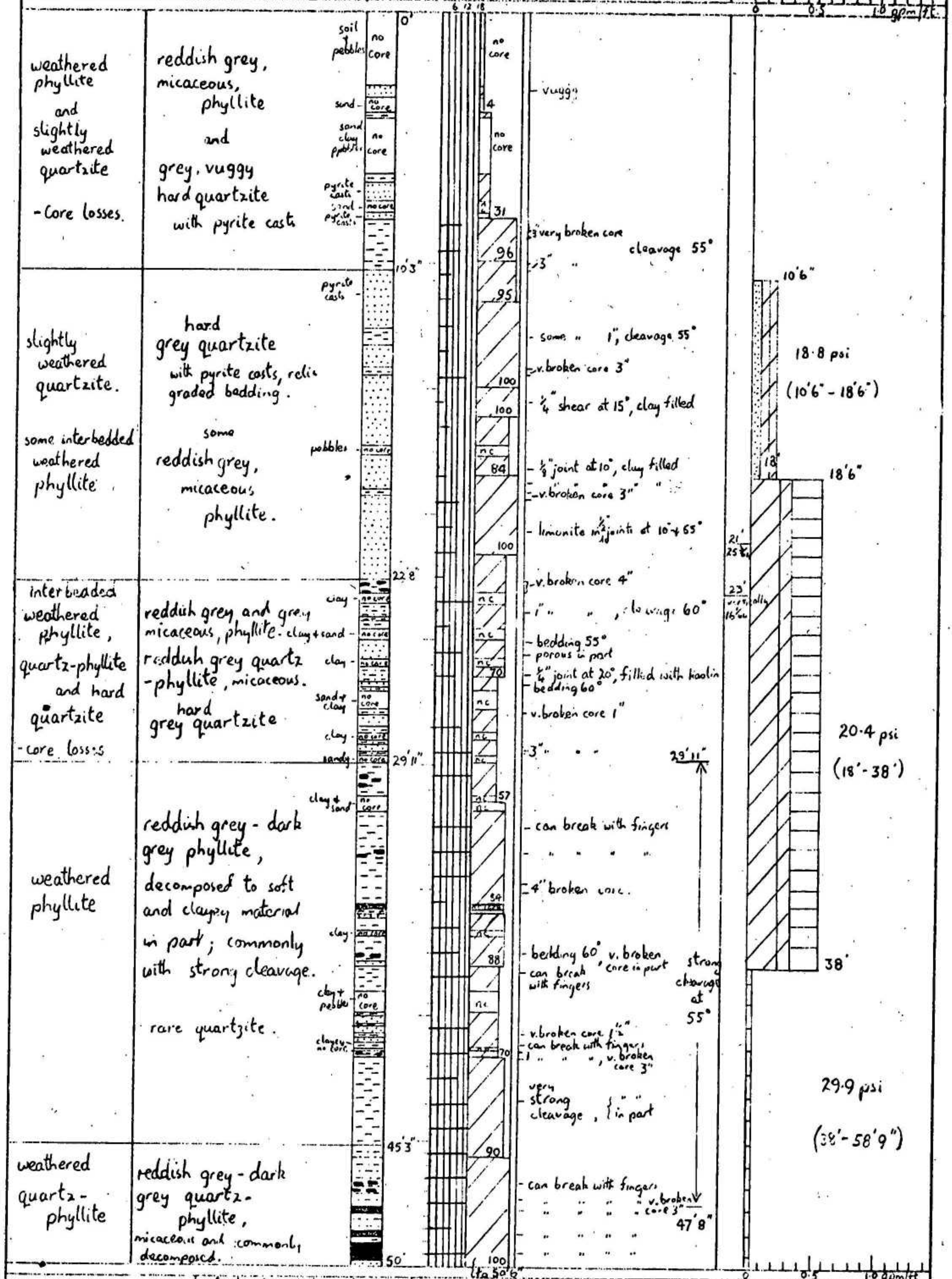
For calculation of water pressure test results see Appendix 3.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme HOLE NO 1 R.L. 117'

LOCATION South abutment of damsite ANGLE FROM HORIZONTAL -50° DIRECTION GB 44°



weathered phyllite and slightly weathered quartzite - Core losses.	reddish grey, micaceous, phyllite and grey, vuggy hard quartzite with pyrite casts	soil + pebbles no core sand - no core sand clay pebbles no core pyrite casts - sand - no core pyrite casts -	0'	no core 4 no core 31 96	- vuggy 3" very broken core cleavage 55° 3" "	
slightly weathered quartzite. some interbedded weathered phyllite	hard grey quartzite with pyrite casts, relic graded bedding. some reddish grey, micaceous phyllite.	pyrite casts - pebbles - no core	10'3"	95 100 100 nc 84 100	- some " 1", cleavage 55° - v. broken core 3" - ¼" shear at 15°, clay filled - ⅛" joint at 10°, clay filled - v. broken core 3" " - limonite in ½/1d joints at 10° + 65° 21' 25[illegible]	10'6" 18.8 psi (10'6" - 18'6") 18'6"
interbedded weathered phyllite, quartz-phyllite and hard quartzite -core losses	reddish grey and grey micaceous, phyllite. reddish grey quartz-phyllite, micaceous. hard grey quartzite	clay - no core clay + sand - no core clay - no core sand + clay - no core clay - no core sandy - no core	22'8"	nc nc nc 70 nc nc nc	- v. broken core 4" - 1" " " , cleavage 60° - bedding 55° - porous in part - ¼" joint at 20°, filled with kaolin - bedding 60° - v. broken core 1" - 3" " " " 23' vertically 16[illegible]	20.4 psi (18' - 38')
weathered phyllite	reddish grey - dark grey phyllite, decomposed to soft and clayey material in part; commonly with strong cleavage. rare quartzite.	clay + sand no core clay - no core clay + pebble no core clayey - no core	29'11"	nc 57 54 nc 88 nc 70 90	- can break with fingers - " " " " - 4" broken core. - bedding 60°, v. broken core in part - can break with fingers - v. broken core ½" - can break with fingers - 1" " " , v. broken core 3" - very strong cleavage, { " " in part 29'11" - strong cleavage at 55° - 47'8"	38' 29.9 psi (38' - 58'9")
weathered quartz-phyllite	reddish grey - dark grey quartz-phyllite, micaceous and commonly decomposed.		45'3" 50'	100 (to 50'6")	- can break with fingers - " " " " v. broken core 3" - " " " " - " " " "	

DRILL NO

TYPE E.1000 MINDRILL

DRILLER J. McGlade

COMMENCED 19.12.63

COMPLETED

Angle of inclination of joints, cleavage bedding is measured from the core axis.

fractures >18/ft = broken core

- ▤ quartz phyllite
- ⊟ phyllite
- ░ quartzite
- ■ clay and soft weathered phyllite

Water Pressure Testing

- ░ 0-10psi
- ▨ 10-20psi
- ▤ 20-30psi
- ▥ 30-40psi
- ▧ 40-50psi

LOGGED J Barclay

VERTICAL SCALE 1 inch : 5 ft.

Sheet 2

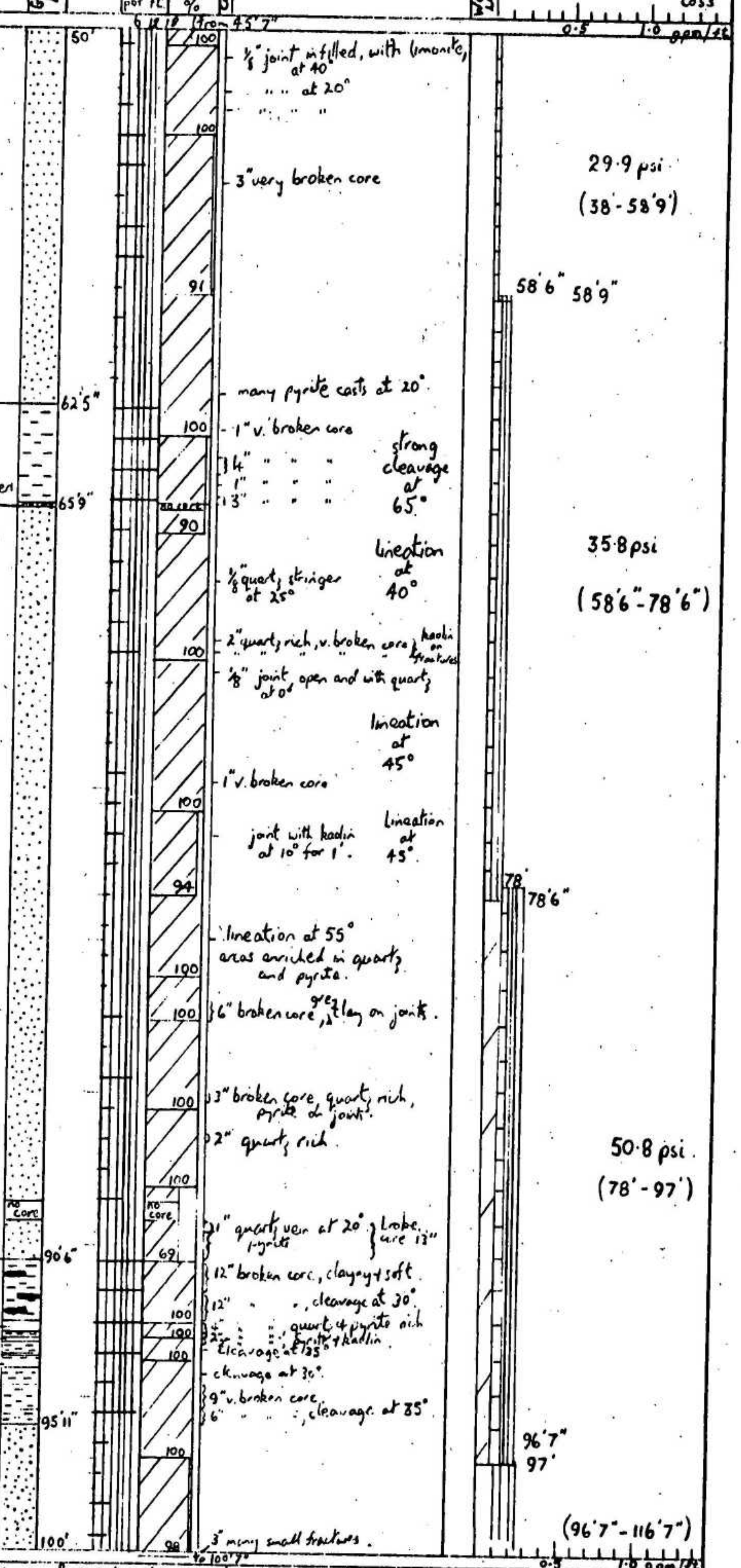
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme HOLE NO 1 R.L. 117'

LOCATION South abutment of damsite ANGLE FROM HORIZONTAL -50° DIRECTION G844°

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION
hard quartzite	pale grey, silicified quartzite
slightly weathered phyllite	fairly hard, dark grey pyritic phyllite, with softer parts can break with fingers
hard quartzite	grey, siliceous quartzite, pyritic in part.
slightly weathered phyllite	grey, micaceous phyllite. pyritic pyrite & quartz rich
hard quartzite	grey, micaceous quartzite pyritic in part



STRUCTURES

- 1/8" joint infilled, with limonite, at 40
- " " at 20°
- " " "
- 3" very broken core
- many pyrite casts at 20°.
- 1" v. broken core
- 14" " " "
- 1" " " "
- 13" " " "
- strong cleavage at 65°
- 1/8" quartz stringer at 25°
- lineation at 40°
- 2" quartz rich, v. broken core } kaolin on fractures
- " " " " "
- 1/8" joint at 0° open and with quartz
- lineation at 45°
- 1" v. broken core
- joint with kaolin at 10° for 1'.
- lineation at 45°.
- lineation at 55° areas enriched in quartz and pyrite.
- 6" broken core, grey clay on joints.
- 3" broken core, quartz rich, pyrite on joints.
- 2" quartz rich.
- 1" quartz vein at 20° pyrite } Lobe. core 13"
- 12" broken core, clayey + soft.
- 12" " ", cleavage at 30°.
- 4" " ", quartz & pyrite rich
- 2" " ", pyrite + kaolin
- cleavage at 35°
- cleavage at 30°.
- 9" v. broken core
- 6" " " ", cleavage at 85°
- 3" many small fractures.

Water Pressure Test

29.9 psi (38'-58'9')

35.8 psi (58'6"-78'6")

50.8 psi. (78'-97')

(96'7"-116'7")

TYPE E 1000 Mindrill

DRILLER J. McGlade

COMMENCED 19.12.63

COMPLETED

Angles of inclination of joints, cleavage, bedding are measured from the core axis.

fractures >18/ft. broken core.

⊟ phyllite	
⁘ quartzite	
■ clay and soft weathered phyllite	

Water Pressure Testing

⁘ 0-10 psi	▥ 30-40 psi
▨ 10-20 psi	▧ 40-50 psi
☰ 20-30 psi	

LOGGED J. Barclay.

VERTICAL SCALE 1 inch : 5 ft.

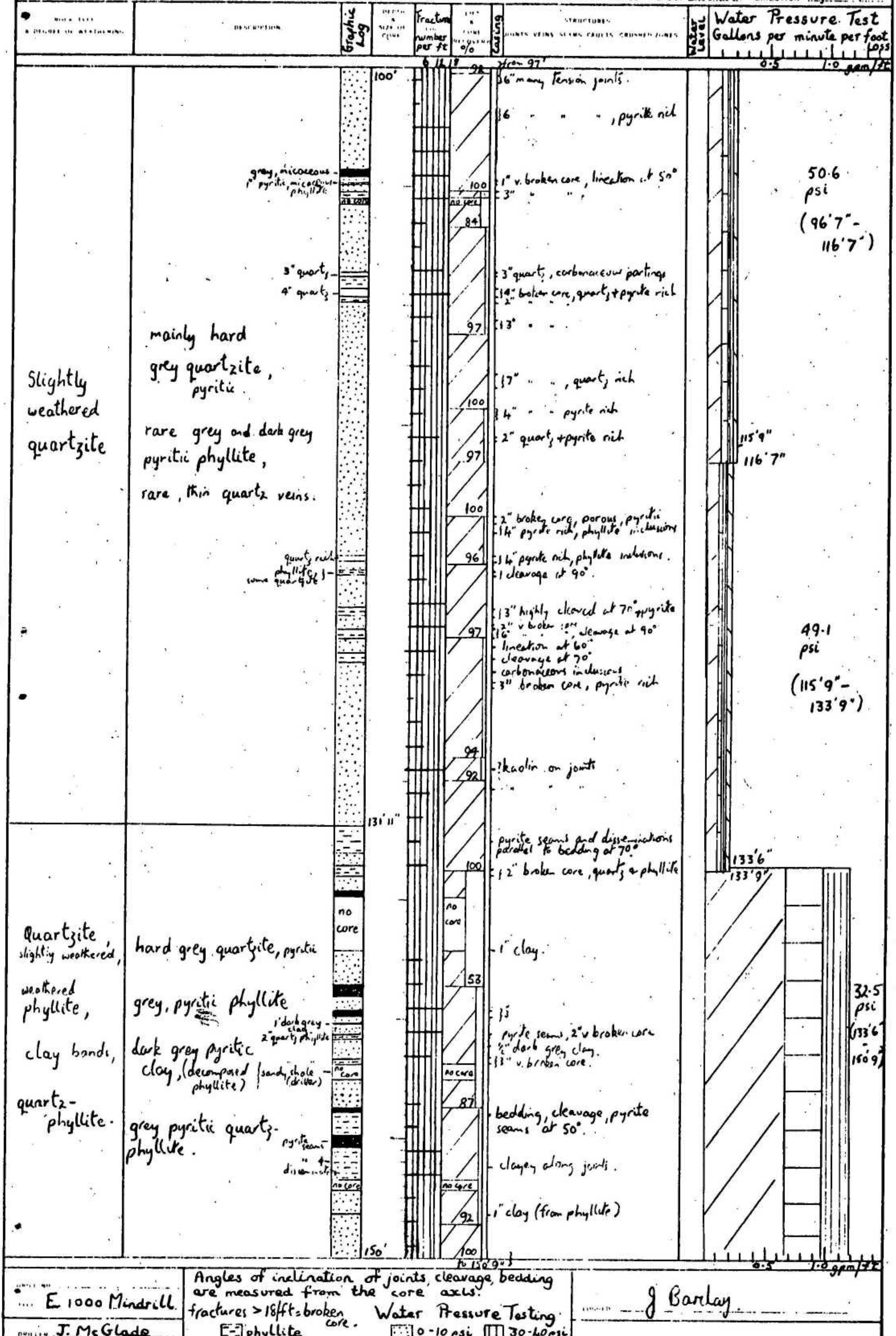
Sheet 3

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme HOLE NO 1 R.L. 117'

LOCATION South abutment of damsite ANGLE FROM HORIZONTAL -50° DIRECTION GB 44°



Slightly weathered quartzite

mainly hard grey quartzite, pyritic.

rare grey and dark grey pyritic phyllite,

rare, thin quartz veins.

grey, micaceous 1" pyritic, micaceous phyllite

3" quartz

4" quartz

quartz rich phyllite, some quartzite

Quartzite, slightly weathered, weathered phyllite, clay bands, quartz-phyllite.

hard grey quartzite, pyritic

grey, pyritic phyllite

1' dark grey clay

2" quartz phyllite

dark grey pyritic clay, (decomposed phyllite) sandy shale (driller)

grey pyritic quartz-phyllite.

pyrite seams

" + disseminations

from 97'

36" many tension joints.

36 " " ", pyrite rich

1" v. broken core, lineation at 50°

3" " " ,

3" quartz, carbonaceous partings

14" broken core, quartz + pyrite rich

2" " "

13" " "

17" " " , quartz rich

4" " " pyrite rich

2" quartz + pyrite rich

2" broken core, porous, pyritic

14" pyrite rich, phyllite inclusions

14" pyrite rich, phyllite inclusions.

1 cleavage at 90°.

13" highly cleaved at 70° pyrite

2" v broken core

16" " " , cleavage at 90°

lineation at 60°

cleavage at 70°

carbonaceous inclusions

3" broken core, pyrite rich

?kaolin on joints

" "

pyrite seams and disseminations parallel to bedding at 70°

12" broken core, quartz & phyllite

1" clay.

13"

pyrite seams, 2" v broken core

½" dark grey clay.

13" v. broken core.

bedding, cleavage, pyrite seams at 50°.

clayey along joints.

1" clay (from phyllite)

to 150' 9"

50.6 psi (96'7" - 116'7")

49.1 psi (115'9" - 133'9")

32.5 psi (133'6" - 150'9")

DRILL E 1000 Mindrill.

Angles of inclination of joints, cleavage, bedding are measured from the core axis.

fractures > 18/ft = broken core.

Water Pressure Testing

⬚ phyllite	⬚ 0-10 psi
⬚ quartzite	▨ 10-20 psi
■ clay and soft weathered phyllite	☰ 20-30 psi
⬚ quartz phyllite	▥ 30-40 psi
	▧ 40-50 psi

LOGGED J Barlay

DRILLER J. McGlade

COMMENCED 19.12.63

COMPLETED

VERTICAL SCALE 1 inch : 5 ft.

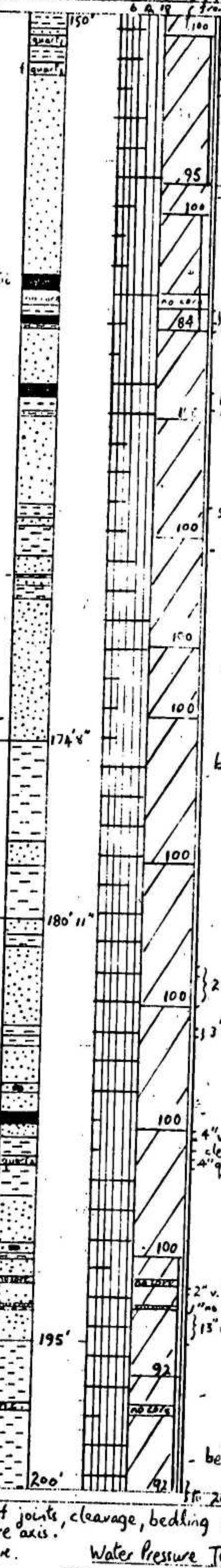
Sheet 4

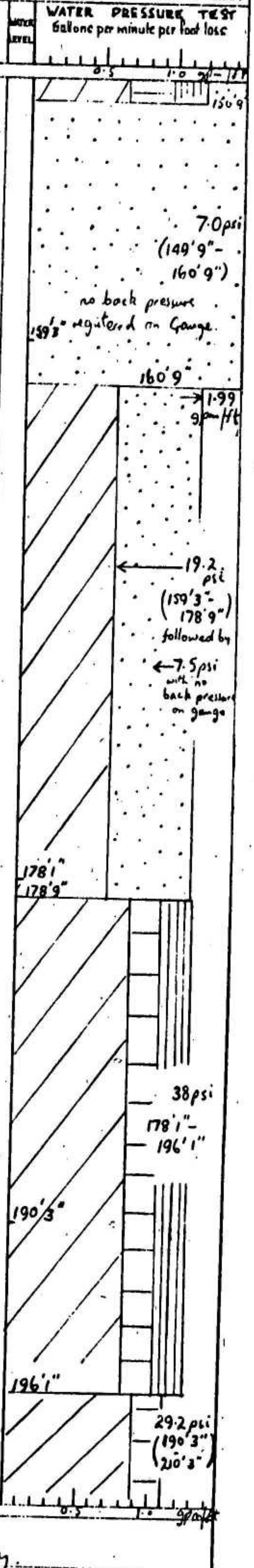
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

Darwin River Water Storage Scheme HOLE NO No 1 R.L. 117'
South abutment of damsite
ANGLE FROM HORIZONTAL -50° DIRECTION GB44

mainly hard quartzite. some slightly weathered phyllite with soft and clayey zones.	hard grey pyritic quartzite several beds of dark grey pyritic phyllite with soft and clayey decomposed zones. pyritic quartz rich -	14" v. broken core bedding " at 40° cleavage " " 60° 4" quartz, pyrite rich 7" pyrite rich 3" quartz, pyrite rich, very broken core. - quartz stringers. 5" v. broken core. 19" broken core, seams of pyrite. 2" pyrite seams at 70°. - pyritic clay - micaceous, pyrite seams. - seams of pyrite, bedding & cleavage at 45° - bedding & cleavage at 45°
slightly weathered phyllite.	dark grey phyllite with pyrite seams and disseminations. rare pyritic quartzite.	bedding & cleavage at 70°
Interbedded hard quartzite & slightly weathered phyllite.	hard grey pyritic quartzite and dark grey phyllite with pyrite seams and disseminations; soft and clayey decomposed zones.	28" v. broken core 3" quartz & pyrite 4" v. broken core cleavage & bedding at 70°, joints at 15°, 0, & 80° 4" quartz rich 2" v. broken core 1" no core 13" v. broken core
slightly weathered phyllite.	dark grey phyllite with pyrite seams & disseminations.	- bedding & pyrite seams at 10°.





E1000 Mindrill
F. Miller
19.12.'63

Angles of inclination of joints, cleavage, bedding are measured from the core axis.
fractures >18/ft - broken core.

▤	phyllite
▨	quartzite,
■	clay and soft weathered phyllite
▤	quartz-phyllite.

Water Pressure Testing

▨	0-10 psi
▧	10-20 psi
▤	20-30 psi
▥	30-40 psi
▧	40-50 psi

J. Barclay.

VERTICAL SCALE 1" : 5 ft.

Sheet 5

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

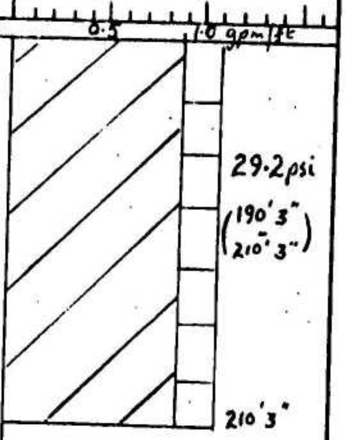
GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme HOLE NO No. 1 R.L. 117'

LOCATION South abutment of damsite ANGLE FROM HORIZONTAL -50° DIRECTION GB44

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	GRAPHIC LOG	DEPTH & SIZE OF CORE	Fracture number per ft.	CORE RECOVERY %	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES
				6 12 18	(from 196'1")	
hard quartzite	hard grey pyritic quartzite 1" no core	n.c.	200'		92 no core	34" no core many small closed fractures " " " 1" no core many small " " bedding, cleavage & pyrite seams at 60°.
			205'5"		92	
slightly weathered phyllite	dark grey, phyllite with pyrite seams & disseminations					cleavage at 70° bedding & pyrite seams at 60°.
		End of hole	210'3"		100	

Water Pressure Test
Gallons per minute per foot loss



DRILL NO. E1000 Mindrill
DRILLER F. Miller
COMMENCED 19.12.63
COMPLETED 14.6.64

Angles of inclination of joints, cleavage, bedding are measured from the core axis.

▤ phyllite
░ quartzite
■ clay + soft weathered phyllite.

Water Pressure Testing
░ 0-10psi
▨ 10-20psi
☰ 20-30psi
▥ 30-40 psi
▧ 40-50psi

LOGGED J. Barclay.

VERTICAL SCALE 1" : 5 ft.

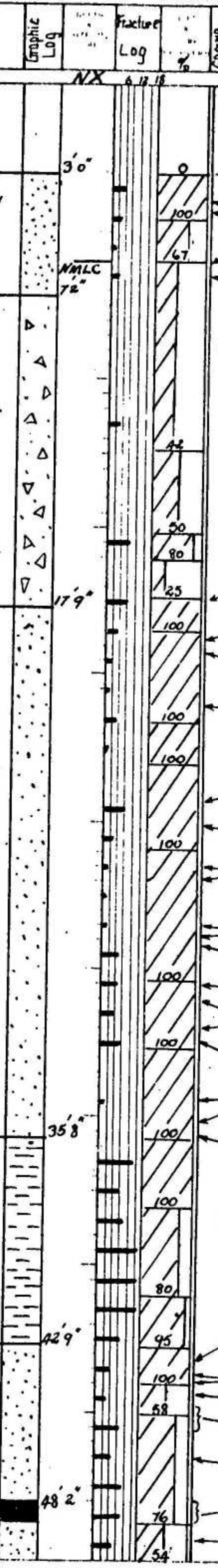
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme.. HOLE NO. Nº R R.L.

LOCATION South abutment of damsite ANGLE FROM HORIZONTAL -45 DIRECTION GB.AA.

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION
Soil & Scree.	
Slightly weathered quartzite.	Grey colour, strong hard massive & silicified. Broken to 6" pieces.
Rubble & colluvium.	Angular pieces of weathered quartzite, vein quartz, & quartz-phyllite to 1" size; sand and some clay. Material is reddish-brown (iron oxides) with patches of pale grey clay.
Slightly weathered quartzite	Dark grey colour, hard massive & silicified Broken to 4"-1'6" pieces mode 6"
Weathered schist.	Grey colour, soft and carbonaceous, weathered in parts to a blue 'paste', some clay. Can crush between the fingers. Broken to ½" pieces
Slightly. weathered quartzite	Grey colour, strong, massive & silicified. Broken 4" to 8" pieces mode 6"
Slightly weathered quartzite.	Grey colour, strong massive, slightly silicified.



2" pieces of vein quartz

Joints 55°, 25°, 30° with coating of iron oxides.

Joint 50° ½" filled with iron oxides.

Quartzite is weathered to a crumbly sandstone from 6'6" to 7'3"

Some 2" pieces of vein quartz.

Joint 70° filled ⅛" with red iron oxides.

Joint 50° coating of iron oxides.

Open joint 10° filled with ¼ thick seam of clay.

Joint 30° thin coating of clay & iron oxides.

Fracture filled with clay & iron oxides ½" wide

Joints 40°, 50° open & filled with iron oxides.

Joints 45° & 30° coating of white clay.

Core broken to 1" pieces coated with white clay.

Joint 55° thin film of white clay.

Joints 30°, 10° thin coating of white clay & iron oxides.

Joint 40° filled with white clay 1/16" thick. Core broken 2" pieces.

Joints 25°, 30°

Vein quartz 4"

Sheet jointing inclined 70° to core axis.

Joint 40°, thick coating of white clay ¼"

Joints 20° coating of white clay.

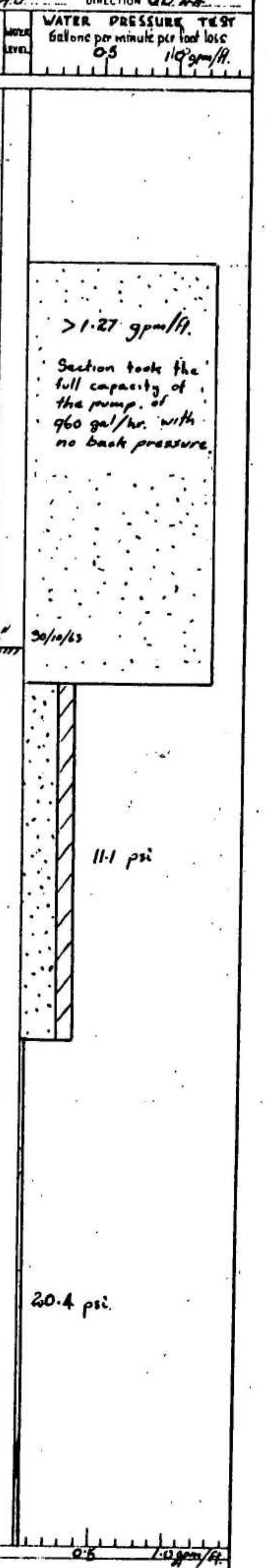
Some 2" pieces of vein quartz.

Vein quartz and muscovite (mica).

Open fractures partially coated with iron oxides

Weathered schist some clay.

Seam of pyrite ½" thick.



DRILL NO.

TYPE

DRILLER S. Jones

COMMENCED 18/10/63

COMPLETED

■	clay & weathered schist.
⊿▷	rubble
☰	schist
⁘	quartzite

Angle of inclination of joints is measured from the axis of the core.

Water pressure testing

⁘	0-10 psi
▨	10-20 psi
☰	20-30 psi.

LOGGED BY D. F. Maggs

VERTICAL SCALE 1 inch : 5 feet

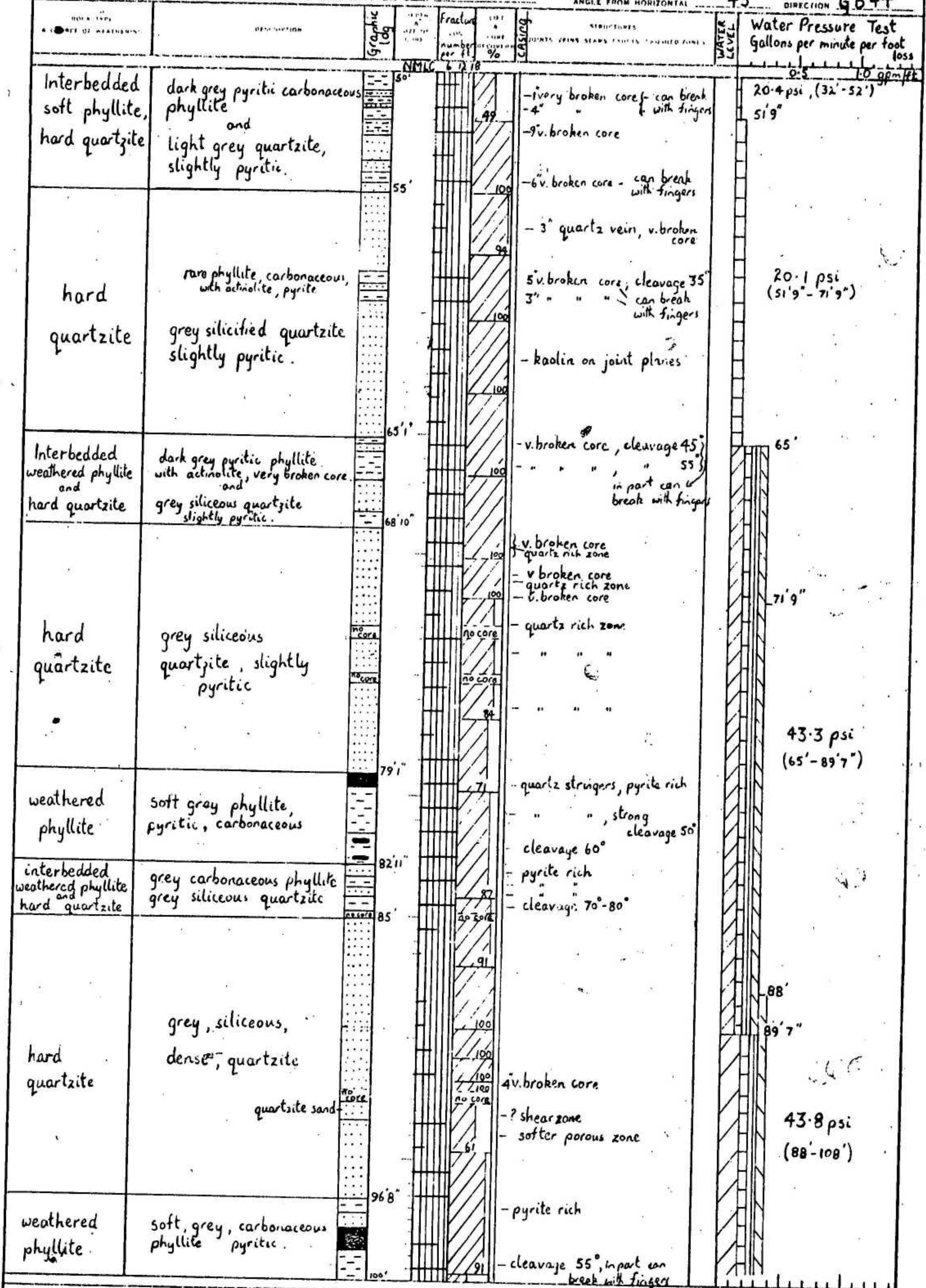
Sheet 2.

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme HOLE NO 2 R.L. 96'

LOCATION South abutment of damsite ANGLE FROM HORIZONTAL -45° DIRECTION GB44



ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	STRUCTURES JOINTS VEINS SEAMS FAULTS CRUSHED ZONES
Interbedded soft phyllite, hard quartzite	dark grey pyritic carbonaceous phyllite and light grey quartzite, slightly pyritic.	-1"very broken core } - can break with fingers -4" " } -9"v. broken core -6"v. broken core - can break with fingers
hard quartzite	rare phyllite, carbonaceous, with actinolite, pyrite grey silicified quartzite slightly pyritic.	- 3" quartz vein, v. broken core 5"v. broken core, cleavage 35° } can break with fingers 3" " " " } - kaolin on joint planes
Interbedded weathered phyllite and hard quartzite	dark grey pyritic phyllite with actinolite, very broken core. and grey siliceous quartzite slightly pyritic.	- v. broken core, cleavage 45° } in part can break with fingers - " " " , " 55° }
hard quartzite	grey siliceous quartzite, slightly pyritic	} v. broken core } quartz rich zone - v broken core - quartz rich zone - v. broken core - quartz rich zone - " " " - " " "
weathered phyllite	soft gray phyllite, pyritic, carbonaceous	- quartz stringers, pyrite rich - " " , strong cleavage 50° - cleavage 60°
interbedded weathered phyllite and hard quartzite	grey carbonaceous phyllite grey siliceous quartzite	- pyrite rich - " " - cleavage 70°-80°
hard quartzite	grey, siliceous, dense, quartzite quartzite sand	4"v. broken core - ? shear zone - softer porous zone
weathered phyllite	soft, grey, carbonaceous phyllite pyritic.	- pyrite rich - cleavage 55°, in part can break with fingers

20.4 psi, (32'-52')

20.1 psi (51'9"-71'9")

43.3 psi (65'-89'7")

43.8 psi (88'-108')

DRILL NO

TYPE E 1000 MINDRILL

DRILLER J. McGlade

COMMENCED 18.10.63

COMPLETED

Angle of inclination of joints, cleavage, bedding is measured from the core axis.

fractures > 18/ft = broken core.

⊟	phyllite
⬚	quartzite
■	clay and soft weathered phyllite

Water Pressure Testing

⬚	0-10 psi
▨	10-20 psi
☰	20-30 psi
▥	30-40 psi
▧	40-50 psi

LOGGED J. Barclay

VERTICAL SCALE 1 inch : 5 ft.

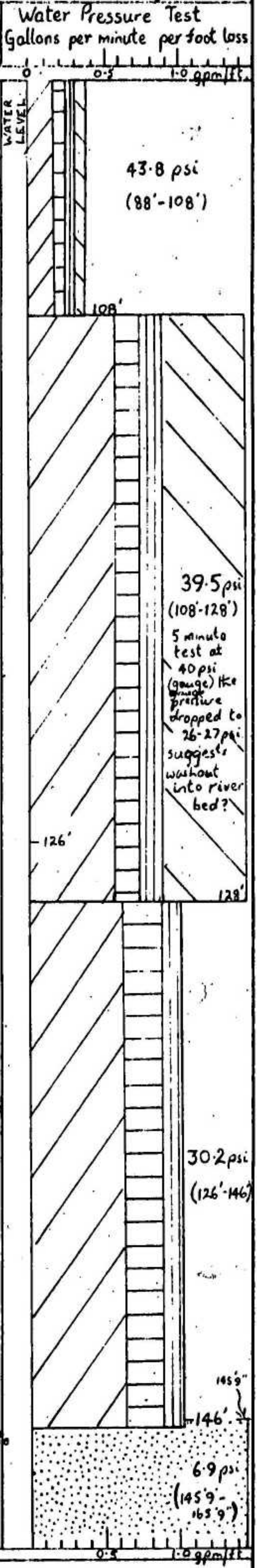
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme HOLE NO 2 R.L. 96'

LOCATION South abutment of damsite ANGLE FROM HORIZONTAL -45° DIRECTION G844.

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	Graphic log	DEPTH & SIZE OF CORE	LIFT & CORE RECOVERY %	STRUCTURES JOINTS VEINS SEAMS FAULTS CRUSHED ZONES
weathered phyllite with rare quartzite	grey, micaceous, pyritic, carbonaceous, phyllite and hard, grey quartzite with pyrite.	no core phyllite v. soft and clayey in part no core no core no core no core harder phyllite	100' 109'7"	no core no core no core 44 no core 67	very broken core, clayey in part. no core - soft, clayey in part. - softer, porous quartzite - pyrite seams and crystals - broken core, quartz, pyrite - broken core
hard silicified quartzite	hard, grey quartzite with pyrite.		118'3"	80 94	- rare vugs
weathered phyllite, core loss	grey, carbonaceous, pyritic phyllite	no core	120'2"	no core	- carbonaceous, pyrite, strong cleavage 55° - very broken core
hard quartzite with weathered phyllite	grey, silicified, quartzite with pyrite and dark grey, carbonaceous, pyritic phyllite	no core no core no core pyrite seams	131'6"	58 no core 91 no core 15 no core 71	- " " " - porous - contorted phyllite in quartzite - pyritic - bedding at 35° - v. strong cleavage at 65°
weathered phyllite, core loss.	dark grey, carbonaceous, pyritic phyllite soft, and clayey in part.	no core	133'11"	no core 72	- v.broken, clayey, pyritic. - v.broken core
hard quartzite rare weathered phyllite	grey, silicified quartzite and dark grey and black, carbonaceous, pyritic phyllite	black no core no core	149'2"	no core 86 89 no core 84 100	- strong cleavage at 30° - bedding at 60° - quartz stringer ½" at 0° with pyrite - quartz vein 1½" thick - bedding & cleavage at 60° - silicified vein material - " , pyrite { quartz/quartzite contact 60° - v. broken core, quartz rich pyrite
weathered phyllite	dark grey, carbonaceous, fairly hard		150'	96 to 153'3"	- pyrite seams



5 minute test at 40 psi (gauge) the pressure dropped to 26-27 psi suggests washout into river bed?

DRILL NO

TYPE E 1000 MINDRILL

DRILLER J. McGlade

COMMENCED 18.10.'63

COMPLETED

Angle of inclination of joints, cleavage, bedding is measured from the core axis.

fractures >18/ft • broken core.

☷	phyllite
⛆	quartzite
■	clay and soft weathered phyllite

Water Pressure Testing

⛆	0-10psi
▨	10-20psi
☰	20-30psi
▥	30-40psi
▧	40-50psi

LOGGED J.Barclay

VERTICAL SCALE 1 inch : 5 ft.

Sheet 4

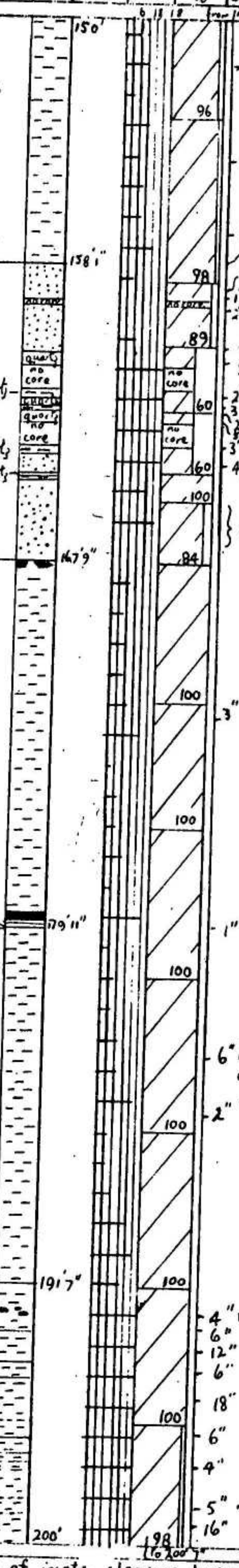
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

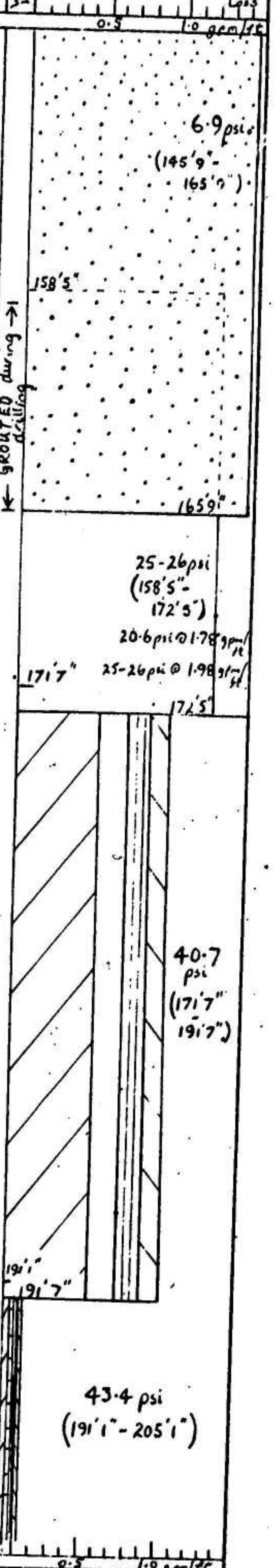
GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme HOLE NO 2 R.L. 96'

LOCATION South abutment of damsite ANGLE FROM HORIZONTAL -45° DIRECTION GB44

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	STRUCTURES JOINTS VEINS SEAMS FAULTS CRUSHED ZONES
slightly weathered phyllite	dark grey carbonaceous phyllite with pyrite in seams and disseminations. Fairly hard, with softer zones as marked opposite.	v. broken core 2" 1" can break + crush with fingers 1" " " " " " 1" " " " " " bedding + cleavage at 65°
mainly hard quartzite, some quartz-pyrite veins and phyllite.	mainly grey pyritic quartzite, some quartz-pyrite veins, (core losses) NB. large water losses from 159'-165'9".	1" broken core, can break with fingers " pyrite seam with quartzite. 9" broken core 5" quartz + pyrite, v. broken core 2" v. broken core can crush with fingers 3" " " " + quartz + pyrite 3" " " " " " 3" " " " " " 3" " " " " " 4" pyrite rich pyrite rich, core broken in part.
slightly weathered phyllite carbonaceous	fairly hard dark grey carbonaceous phyllite with pyrite disseminated but mainly in seams parallel to cleavage.	from this section, fractures coincide mainly with cleavage which is at 60° to core length. 3" v. broken core cleavage + bedding at 60°. 1" vuggy quartz + pyrite
slightly weathered phyllite grey.	fairly hard, grey phyllite, with pyrite disseminations and seams parallel to cleavage.	6" broken core 2" " " cleavage + bedding at 60° 1 joint at 5° for 2' cleavage + bedding at 60°.
slightly weathered interbedded carbonaceous and grey phyllites.	fairly hard, grey and dark grey carbonaceous phyllites	4" v. broken core, soft and clayey 6" " " 12" " " 6" " " 18" " " 6" " " 4" " " 5" " " " 16" " " " , kaolin on joints at 20° cleavage & bedding at 60°





E 1000 Mindrill

DRILLER J. McGlade

COMMENCED 18.10.63

COMPLETED

Angles of inclination of joints, cleavage, bedding are measured from the core axis.

fractures >18/ft = broken core

		Water Pressure Testing	
▤	phyllite	⛆ 0-10 psi	▥ 30-40 psi
⛆	quartzite	▨ 10-20 psi	▧ 40-50 psi
■	clay and soft weathered phyllite	▤ 20-30 psi	

LOGGED J. Barclay

VERTICAL SCALE 1 inch : 5 ft.

Sheet 5

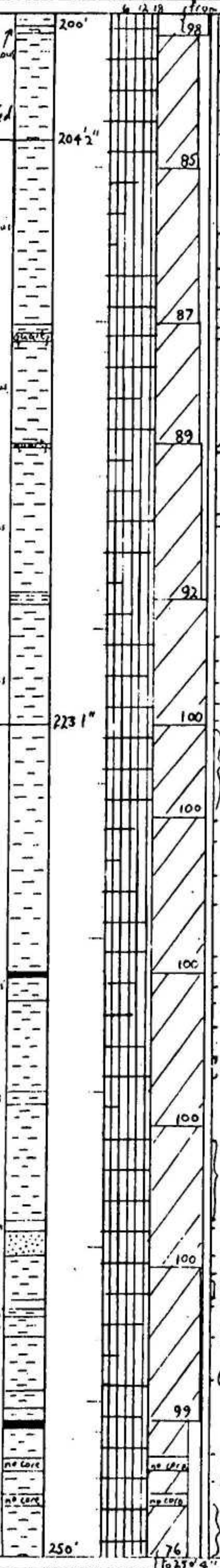
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme HOLE NO 2 R.L. 96'

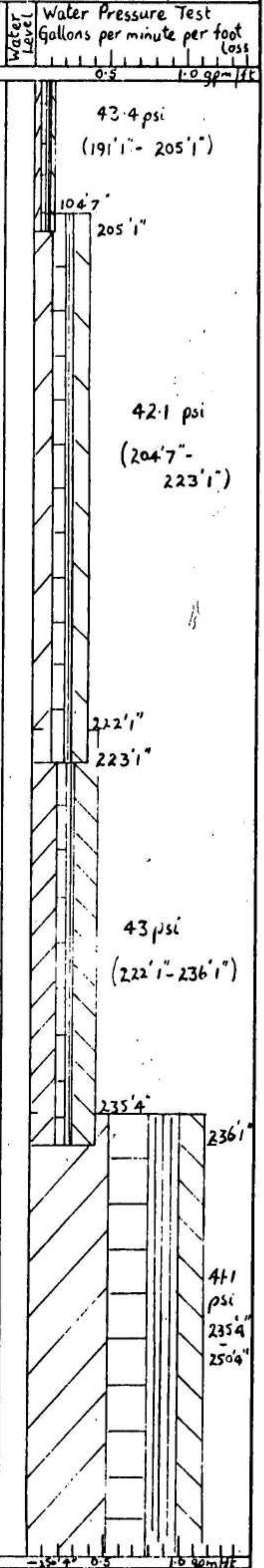
LOCATION South abutment of damsite ANGLE FROM HORIZONTAL -45° DIRECTION GB 44

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION
slightly weathered phyllite	grey, fairly hard banded phyllite, with pyrite in seams + disseminated
slightly weathered phyllite	mainly carbonaceous, grey with grey, phyllites and pyrite seams + dissemination
slightly weathered phyllite.	mainly grey, with some carbonaceous, grey phyllite, and pyrite seams & dissemination. rare silicified quartzite.



STRUCTURES JOINTS VEINS SEAMS FAULTS CRUSHED ZONES

3" v. broken core, soft + clayey.
broken core 9"
" " 9"
" " 14"
" " 5"
" " 9"
½" vuggy quartz vein
v. broken core 3"
broken core 6"
v. broken core 10"
" " 2"
3" vuggy quartz + pyrite
cleavage at 60°
1" vuggy quartz + pyrite
broken core 1"
" " 2"
kaolin on joints
cleavage = bedding at 60°
v. broken core 2"
" " 3"
" " 4"
" " 2"
" " 3", irregular joint at approx. 0°.
cleavage = bedding at 60°
37" v. broken core.
1" " "
2" " "
1" " "
2" " "
kaolin on many joints
cleavage & bedding at 60°
3" " "
1" clay seam
1" broken core
2" " "
1" " "
6" " "
cleavage & bedding at 60°
32" broken core.
5" quartz rich
3" broken core.
4" " "
9" pyrite rich - joints at 10°
3" " " & quartz.
2" broken core
6" broken core
cleavage & bedding at 60°.
7" " "
4" " "
20" " " - a shattered zone.



DRILL NO

TYPE E 1000 Mindrill

DRILLER J. McGlade

COMMENCED 18.10.63

COMPLETED

Angles of inclination of joints, cleavage, bedding are measured from the core axis.

fractures >18/ft = broken core.

			Water Pressure Testing		
☷	phyllite	▒	0-10psi	▥	30-40psi
▒	quartzite	▨	10-20psi	⧅	40-50psi
■	clay and soft weathered phyllite	▤	20-30psi		

LOGGED J. Barclay

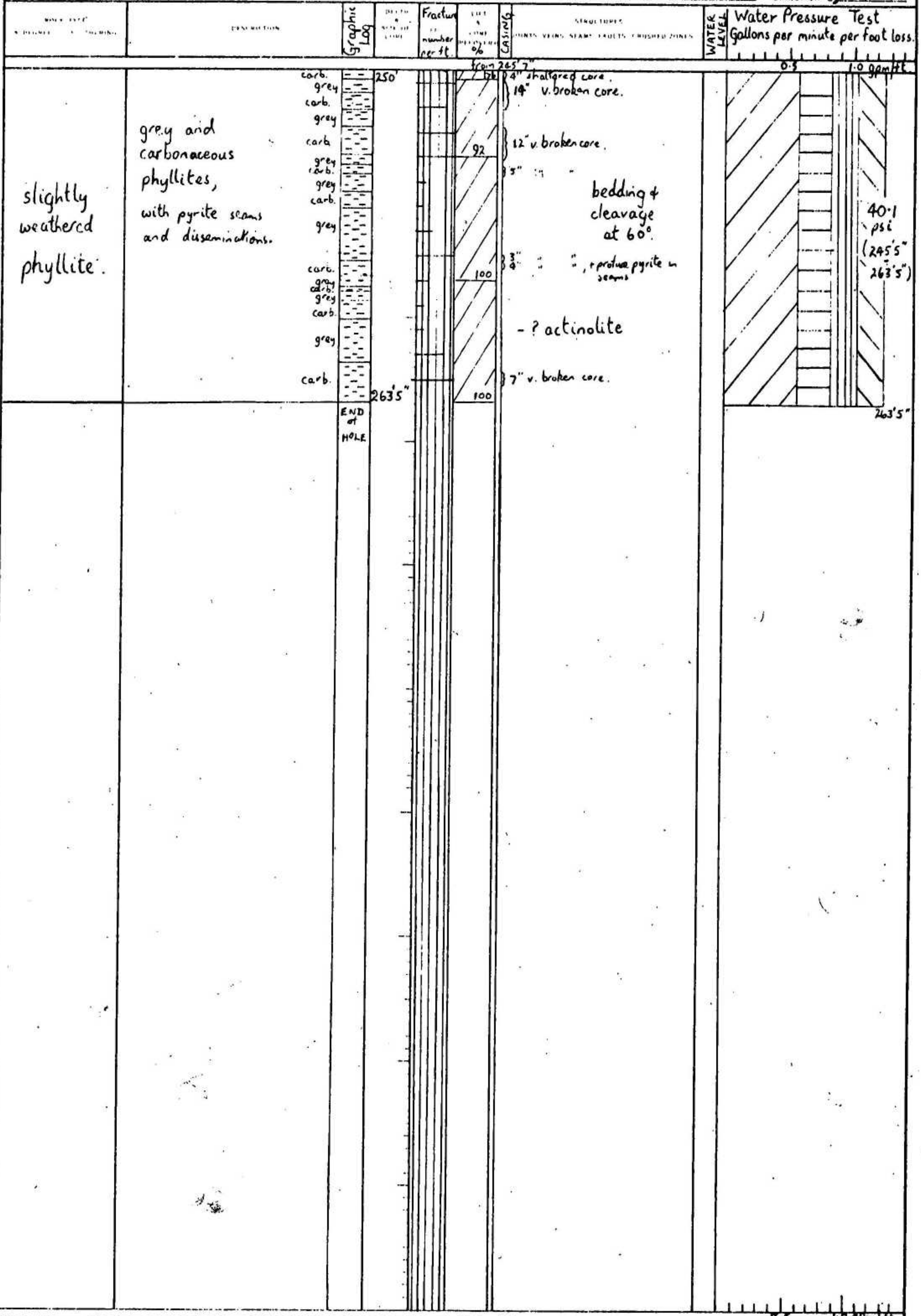
VERTICAL SCALE 1 inch : 5 ft.

Sheet 6

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme
HOLE NO. 2
R.L. 96'
LOCATION South abutment of damsite.
ANGLE FROM HORIZONTAL -45°
DIRECTION G 844°



ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	Graphic Log	DEPTH	Fracture number per ft.	CORE RECOVERED %	CASING	STRUCTURES JOINTS VEINS SEAMS FAULTS CRUSHED ZONES	WATER LEVEL	Water Pressure Test Gallons per minute per foot loss.
slightly weathered phyllite.	grey and carbonaceous phyllites, with pyrite seams and diseminations.	carb. grey carb. grey carb grey carb. grey carb. grey carb. grey carb. grey carb. grey carb.	250' 263'5"		from 265'7" 76 92 100 100		4" shattered core. 14" v. broken core. 12" v. broken core. 5" " " bedding & cleavage at 60°. 3/4" " ", + profuse pyrite in seams - ? actinolite 7" v. broken core.		0.5 1.0 gpm/ft 40.1 psi (245'5" - 263'5") 263'5"
		END of HOLE							

0.5 1.0 gpm/ft

DRILL NO.
TYPE E1000 MINDRILL
DRILLER J. McGLADE
COMMENCED 18.10.63.
COMPLETED

Angles of inclination of joints, cleavage, bedding are measured from the core axis.
fracture >18/ft = broken core.

- ☷ phyllite
- ⛆ quartzite
- ■ clay + soft, weathered phyllite

Water Pressure Testing.

- ⛆ 0-10 psi
- ▨ 10-20 psi
- ☰ 20-30 psi
- ▥ 30-40 psi
- ▧ 40-50 psi

LOGGED J. Barclay.

VERTICAL SCALE 1 inch : 5 ft.

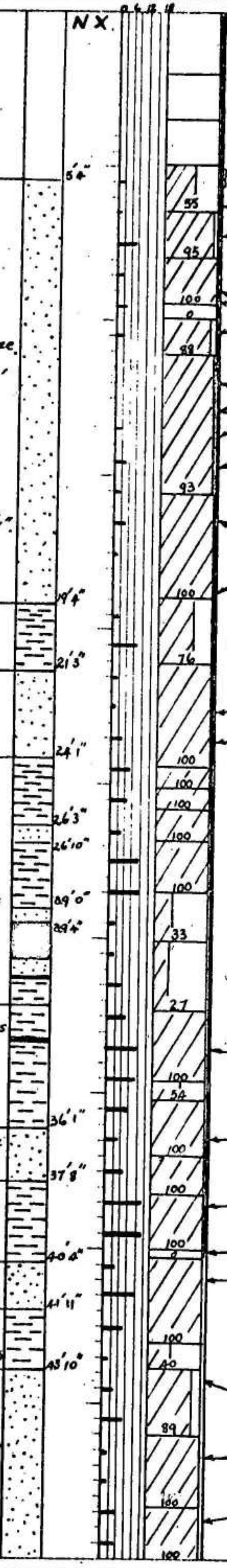
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT DARWIN RIVER WATER STORAGE SCHEME. HOLE NO N°3 R.L. 97' approx.

LOCATION North abutment of dam site. ANGLE FROM HORIZONTAL -45° DIRECTION G.B 130°

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH
Overburden	Weathered pieces of schist and quartzite, with soil and clay.	NX 5'4"
Slightly weathered quartzite	Pale grey colour, strong, massive & silicified Some small crystals of pyrite, less than 1mm size. Water loss at 12' Core broken in 1 ft. pieces. Vein quartz 16'10" to 17'1".	19'4"
Some pieces of phyllite	Cuttings of phyllite, pale grey colour, micaceous & talcose, very soft & weathered to a pale green clay.	21'3"
Slightly weathered quartzite	Strong hard, silicified and massive.	24'1"
Slightly weathered schist	Dark grey colour, finely laminated perpendicular to core axis. Core broken ½"-2" pieces mode 1". 1" of green clay at 31'4"	26'3" 26'10" 29'0" 29'4"
Slightly weathered schist.	Dark grey colour, micaceous and finely laminated. 2" of green clay at 33'3"	36'1"
Slightly weath. quartzite	Strong, hard massive, some fine grains of pyrite less than 1mm. size 6" pieces.	37'8"
Weathered phyllite.	Grey colour, very soft, can crush with the fingers, micaceous – fine sericite Sheet jointing. ½" pieces.	40'0"
Slightly weath. quartzite.	Massive and strong, pale grey colour, some cavities.	41'11"
Weathered phyllite	Dark grey colour, very soft can crush to powder with fingers finely laminated. ½" pieces	43'10"
Slightly weathered quartzite.	Thinly laminated at 45° from 43'10" to 44'4". Stringers of vein quartz and iron oxide. Strong massive and silicified. Broken 2"-10" pieces mode 4".	



STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES)

Several inches of core lost 5'0" - 5'10". Quartzite is very weathered & friable, and stained with iron oxides.

Joints 40°, and 15° iron oxide coating.

Joints 30°, 45°, 35° iron oxide coating.

Joints 55°, 50°, 30° iron oxide coating.

Joint 0° thin coating of rock flower. The joint continues from 14'0" - 16'8" parallel to the core axis. Joint is open, much hematite & siderite.

Joints 45°, 40° stained with iron oxides.

Most of this section has been washed out. Some angular fragments of vein quartz with inclusions of phyllite.

Joint 19° with thin coating of yellow clay

Irregular fracture length 6" coated with yellow & pink clay.

20'3" blue clay with some angular fragments of vein quartz.

Schist is finely laminated and has sheet jointing at an angle of 75°.

Core lost at 29'5" - 30'8" clay recorded by driller. Clay is pale grey colour, slightly plastic, low dry strength.

Grinding of core 31'5"

Joint 80° clay coated.

Large open joint 10° filled with pale grey sericitic clay.

Cleavage at 80°

Water loss and clay

Irregular open joints & cavities (¼" size) in quartzite with secondary quartz & iron oxides. At 5° to core axis

Thin band (2") of schist at 44'2"

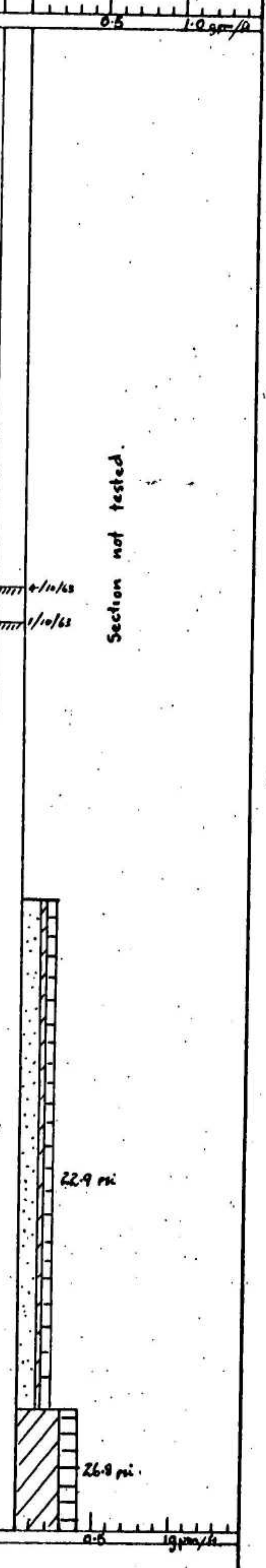
Irregular fracture coated with iron oxide

Open fracture along axis of core 48'0" to 50'0" filled with iron oxides & white clay

WATER LEVEL

18'9" 4/10/63

19'11" 1/10/63



DRILL No

TYPE Mindrill E1000

DRILLER S. Jones

COMMENCED 14/9/63

COMPLETED

Angle of inclination for joints & for schistosity are measured from the axis of the core.

▩	Clay
☰	Schist & phyllite
⁘	Quartzite

Water pressure testing

⁘	0-10 psi
▨	10-20 psi
☰	20-30 psi

LOGGED D F Maggs

VERTICAL SCALE 1" : 5'

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT *Darwin River Water Storage Scheme* HOLE NO *Nº 3* R.L. *97′ approx.*
LOCATION *North abutment of proposed damsite* ANGLE FROM HORIZONTAL *−45°* DIRECTION *GB 130°*

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	DEPTH & SIZE OF CORE	STRUCTURES JOINTS VEINS SEAMS FAULTS CRUSHED ZONES
		NX	
Slightly weathered schist.	Dark grey, carbonaceous soft – can cut with a knife Thin seams of pyrite parallel to the jointing. (schistosity). Sheet jointing inclined at 50° to core axis. Broken to 2" pieces.	50′11″ 54′8″ 53′2″ 57′10″ 60′3″	Hole caving from 56′ – 58′ Joint 50° Seam of pyrite and chalcopyrite ¼" thick, inclined at 45° to core axis
Fresh quartzite.	Pale blue colour, strong, massive & silicified Fine grains of pyrite 1/32" size. Broken 1 foot pieces. Vein quartz broken to 1" pieces, grains of pyrite to ¼" size Pale grey to white clay in the fractures	67′1″	Joint 35° with thin film of pyrite. Joint 24° thin coating of white clay. Joint 30° thin coating of white clay & film of pyrite Joint parallel to axis of core, coating of white clay. Joint 20° pyrite film.
Slightly weathered phyllite.	Pale blue colour, carbonaceous, soft – can crush with the fingers Thin seams of pyrite parallel to jointing.	68′8″	Sheet jointing inclined at 80° to axis of core.
Fresh quartzite	Pale grey colour, hard, massive, slightly porous, fine crystals of pyrite	69′9″	
Slightly weathered Siltstone	Dark grey colour, carbonaceous soft can cut with a knife, finely laminated. Some thin seam of Pyrite.	71′11″	Thin seams of pyrite ⅛" thick, inclined 50° Thin seams of pyrite ⅛" thick inclined 50° & 90°
Some pieces of Vein quartz.	Some 2" pieces of vein quartz coated with white clay. Crystals of pyrite & chalcopyrite to ¼" size.	73′5″	
Slightly weathered Siltstone	Dark grey colour, carbonaceous soft, with thin seams of pyrite parallel to the bedding.	75′0″	Sheet jointing at 80° to core axis Broken to 2" pieces
Slightly weathered Siltstone.	Black carbonaceous strong, with thin seams of pyrite parallel to the bedding.	76′10″	Several veinlets of pyrite to ½" thickness.
Slightly weathered quartzite	Pale grey colour, hard and silicified, contains cubic crystals of pyrite to ⅛" size, also fine grains of pyrite to give a visual estimate of 2%.	BMLC 79′11″	Broken to 5" pieces Fractures clay coated Joints 30°, 25° coated with white clay.
Very weathered Siltstone	Grey colour, and is almost completely weathered to a blue carbonaceous paste, some clay. forms a mud on wetting.	81′10″	
Slightly weathered quartzite	Grey colour, massive & silicified. Speckled with fine grains of pyrite about 2%. Broken to 6" pieces.	86′6″	Joint 25° thin clay coating
Very weathered Siltstone	Carbonaceous and almost completely weathered to a blue paste, High percentage of pyrite crystals to ⅛" size.	87′10″	
Fresh quartzite	Pale grey colour, moderately hard and strong. Some fine grains of pyrite. Broken to 6" pieces.	89′10″	Joints 50°, 40°, 10° coated with white clay. Clay seam 89′4″
Very weathered Siltstone	Carbonaceous and almost completely weathered to a blue 'paste', some clay present High percentage of pyrite, crystals to 1/16" size.	92′2″	
Slightly weathered quartzite.	Pale grey colour, strong Broken 4" pieces.		Joint 18° thin clay coating.
Very weathered Siltstone	Has almost completely weathered to a blue, carbonaceous 'paste', very soft, some clay present.	95′8″	
Slightly weathered vein quartz and quartzite.	Colourless, strong and hard white clay in fractures and seams of pyrite.	97′4″	Vein quartz contains seams of pyrite ½" thick Broken 1" pieces.
Some pieces of Carbonaceous siltstone.	Some pieces of a blue carbonaceous 'paste' and clay. Probably very weather. carb. siltstone		

Fracture Log: 0 6 18 18

LIFT & CORE RECOVERY %: 100, 93, 100, 100, 95, 100, 100, 100, 64, 70, 59, 32, 100, 30, 100, 83, 60, 79, 100, 57

WATER PRESSURE TEST Gallons per minute per foot loss 0·5 1·0

26·8 psi

37·1 psi

41·1 psi

26·9 psi

DRILL NO
TYPE *Mindrill E1000*
DRILLER *S. Jones*
COMMENCED *14/9/63*
COMPLETED

		Water pressure testing	
▩	Clay or very weathered schist.	⬚	0 – 10 psi
☰	Schist, ~~phyllite, shale~~	▨	10 – 20 psi
⁘	Quartzite	☰	20 – 30 psi
		▧	30 – 40 psi

LOGGED *D. F. Maggs*

VERTICAL SCALE *1 inch : 5 feet*

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme.

HOLE NO 3

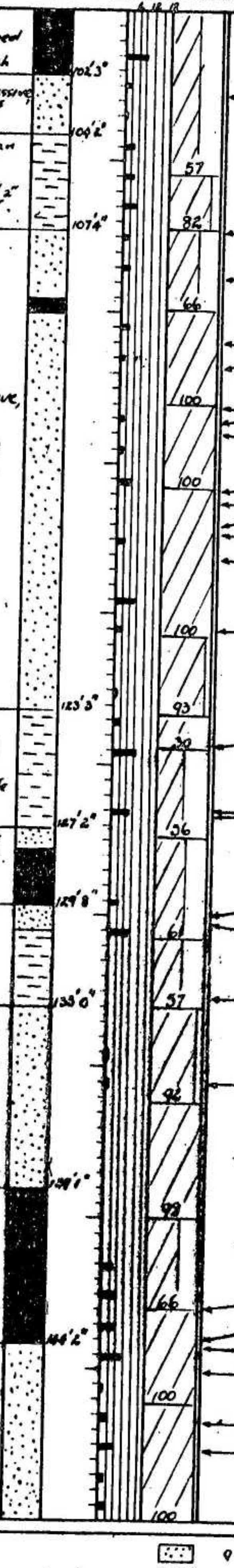
R L 97' approx.

LOCATION Northern abutment of dam site

ANGLE FROM HORIZONTAL -45°

DIRECTION GB 130

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION
Very weathered siltstone.	Dark grey carbonaceous in some segments weathered to a blue 'paste'. Fine crystals of pyrite. Soft can crush with the fingers.
Slightly weathered quartzite.	Grey colour, strong and massive with some small crystals of pyrite ⅛" size.
Weathered siltstone.	Dark grey colour, soft - can cut with a knife, some fine grains of pyrite, carbonaceous. Very weathered 105'6"-106'2" to a grey-blue 'paste'.
Slightly weathered quartzite.	110'-111' pyrite content estimated at 3% Grey colour, strong, massive, slightly pitted. Possible that the small voids have been formed by weathering out pyrite crystals. Some weathered pyrite crystals are present, in the voids to a size of 1/16". Broken 1" — 1'6" pieces mode 9".
Weathered siltstone	Dark grey carbonaceous with thin bands (1/32" thick) of pyrite parallel to the bedding. Shale is quite soft and can be easily cut with a knife Broken ½" pieces.
Very weathered siltstone	Pale blue carbonaceous 'paste' soft - can crush with the fingers. Many fine crystals of pyrite 1/16" size. Forms a mud on wetting.
Weathered siltstone	Dark grey carbonaceous with thin veinlets of pyrite 1/32" parallel to the bedding. Sheet jointing at
Slightly weathered quartzite	Grey colour, hard, massive and silicified. Slightly porous in some segments with crystals of pyrite to ⅛" size. Visual estimate of pyrite content is 1%. Broken to 8" pieces.
Very weathered siltstone	Pale blue carbonaceous 'paste' forms a mud on wetting, soft can crush with the fingers.
Slightly weathered quartzite	Grey colour, strong, massive, slightly silicified. Broken to 2"-9" pieces mode 6"



STRUCTURES
JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES

Joint 20° with thin acicular crystals of tremolite?

Sheet jointing at an angle of 55° to core axis.

Pyrite seam ⅛" thick inclined at 55°.

Joint 30° thin coating of pyrite crystals.

Joints 80°, 20°, thin coating of pyrite crystals.

Joints 30°, 20° thin film of pyrite.

Fracture - thin film of pyrite.

Water loss at 115'10"

Joints at 40°, 60° thin film of pyrite.

Joint 35° thin coating of white clay.

Joint 30°.

Joint 5° thin film of pyrite.

Several bands of pyrite ⅛" thick inclined 50°

Thin bands of pyrite ⅛" thick, inclined 60°

Joint 5°, with thin coating of pyrite.

Thin seam of pyrite ⅛" thick.

Seams of pyrite to ⅛" thick.

Joint 30°, thin film of pyrite.

⅛" thick seams of pyrite

Broken 2" pieces

Thin seam of pyrite ⅛" thick.

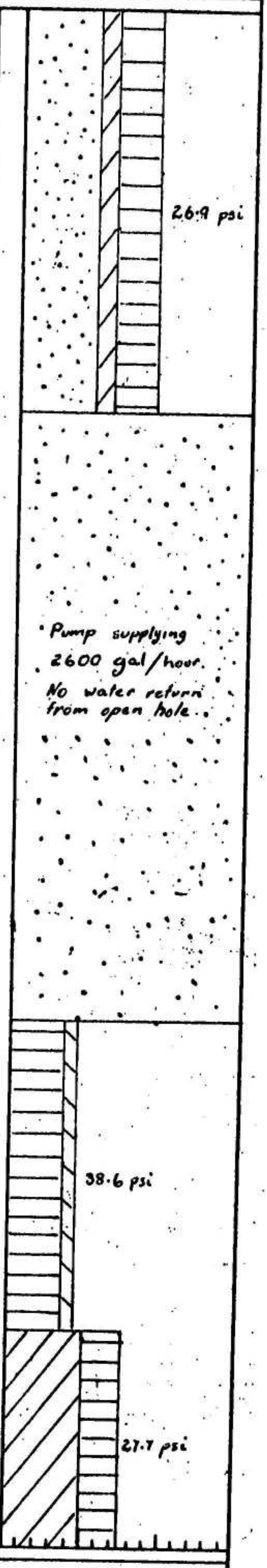
Joint 25°, thin coating of pyrite.

Joint 30°

Joint 15°, thin coating of pyrite.

WATER LEVEL

WATER PRESSURE TEST
Gallons per minute per foot loss



Pump supplying 2600 gal/hour. No water return from open hole.

DRILL NO
TYPE Mindrill E1000
DRILLER S. Jones
COMMENCED 14/9/63
COMPLETED 1/12/63

▨	Quartzite
☰	Siltstone
■	Very weathered siltstone.

▨	9 - 10 psi
▨	10-20 psi
☰	20-30 psi
▨	30-40 psi
☐	40-50 psi

LOGGED D.F. Maggs

Sheet 3 of 5

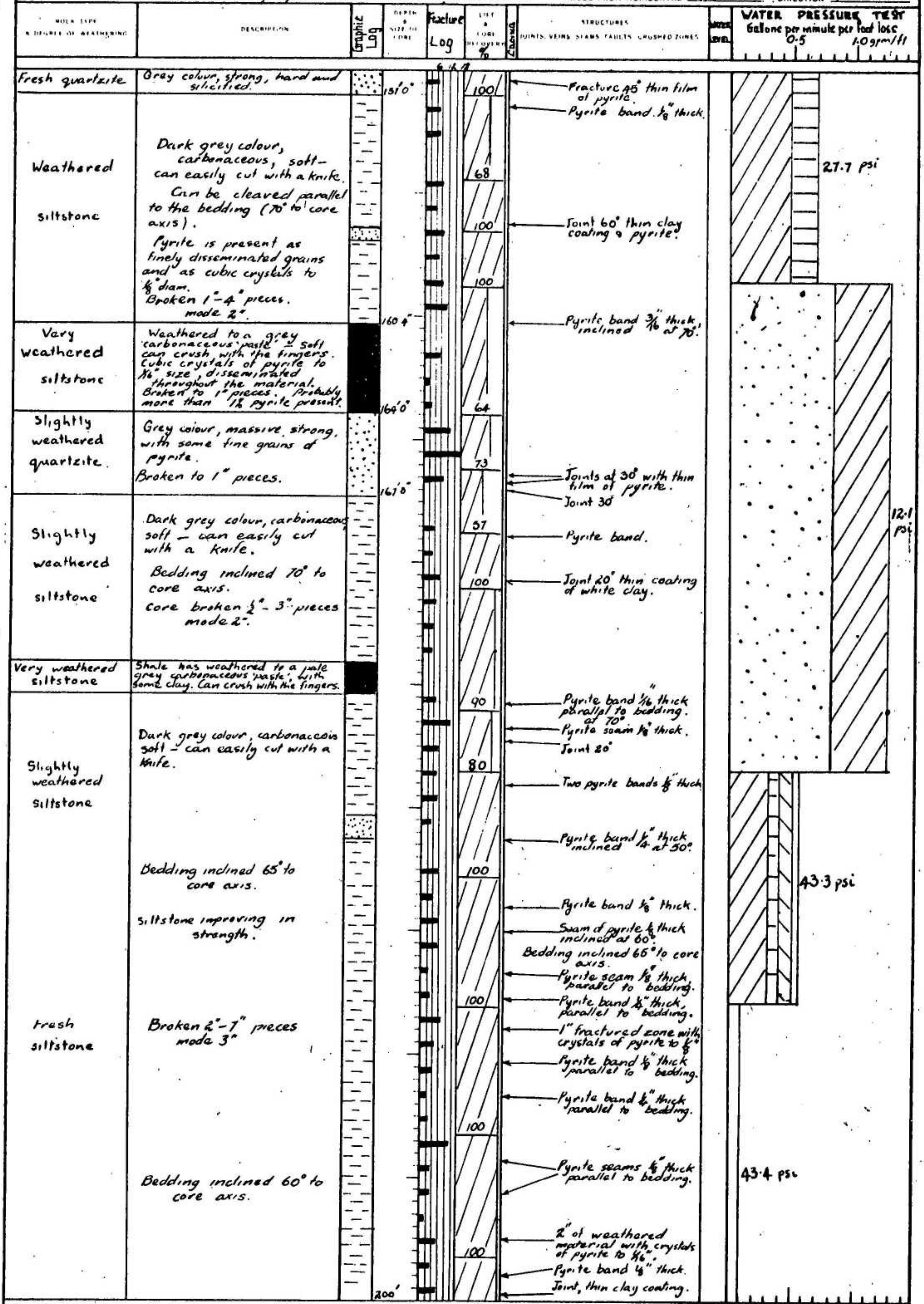
VERTICAL SCALE 1 inch : 5 feet

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme HOLE NO 3 R.L 97' approx.

LOCATION Northern abutment of proposed dam site. ANGLE FROM HORIZONTAL -45 DIRECTION GN 130



ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION
Fresh quartzite	Grey colour, strong, hard and silicified.
Weathered siltstone	Dark grey colour, carbonaceous, soft – can easily cut with a knife. Can be cleaved parallel to the bedding (70° to core axis). Pyrite is present as finely disseminated grains and as cubic crystals to 1/8" diam. Broken 1"-4" pieces. mode 2".
Very weathered siltstone	Weathered to a grey 'carbonaceous paste' – soft can crush with the fingers. Cubic crystals of pyrite to 1/16" size, disseminated throughout the material. Broken to 1" pieces. Probably more than 1% pyrite present.
Slightly weathered quartzite.	Grey colour, massive strong, with some fine grains of pyrite. Broken to 1" pieces.
Slightly weathered siltstone	Dark grey colour, carbonaceous soft – can easily cut with a knife. Bedding inclined 70° to core axis. Core broken ½"- 3" pieces mode 2".
Very weathered siltstone	Shale has weathered to a pale grey carbonaceous 'paste', with some clay. Can crush with the fingers.
Slightly weathered Siltstone	Dark grey colour, carbonaceois soft – can easily cut with a knife. Bedding inclined 65° to core axis. Siltstone improving in strength.
Fresh siltstone	Broken 2"-7" pieces mode 3" Bedding inclined 60° to core axis.

STRUCTURES
JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES

- Fracture 45° thin film of pyrite.
- Pyrite band 1/8" thick.
- Joint 60° thin clay coating & pyrite.
- Pyrite band 3/16" thick, inclined at 70°.
- Joints at 30° with thin film of pyrite.
- Joint 30°
- Pyrite band.
- Joint 20° thin coating of white clay.
- Pyrite band 1/16" thick parallel to bedding. at 70°
- Pyrite seam 1/8" thick.
- Joint 20°
- Two pyrite bands 1/8" thick
- Pyrite band 1/4" thick inclined at 50°.
- Pyrite band 1/8" thick.
- Seam of pyrite 1/8" thick inclined at 60°.
- Bedding inclined 65° to core axis.
- Pyrite seam 1/8" thick parallel to bedding.
- Pyrite band 1/4" thick, parallel to bedding.
- 1" fractured zone with crystals of pyrite to 1/8"
- Pyrite band 1/8" thick parallel to bedding.
- Pyrite band 1/4" thick parallel to bedding.
- Pyrite seams 1/8" thick parallel to bedding.
- 2" of weathered material with crystals of pyrite to 1/16".
- Pyrite band 1/8" thick.
- Joint, thin clay coating.

DRILL NO

TYPE Mindrill E1000

DRILLER G Jones

COMMENCED 14/9/63

COMPLETED 1/12/63

⁙	Quartzite
☰	siltstone
■	very weathered siltstone.

⁙	0–10 psi
▨	10–20 psi
☰	20-30 psi
▧	30-40 psi
☐	40-50 psi

LOGGED D.F. MAggs

Sheet 4 of 5

VERTICAL SCALE 1 inch : 5 feet.

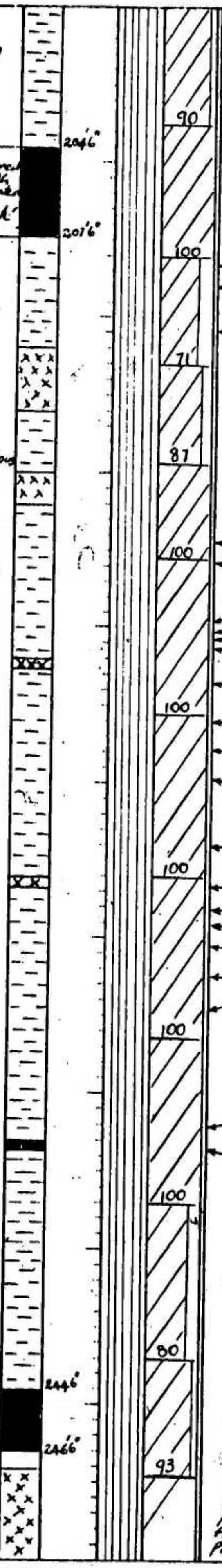
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT *Darwin River Water Storage Scheme.* HOLE NO. *3* R.L. *97' approx.*

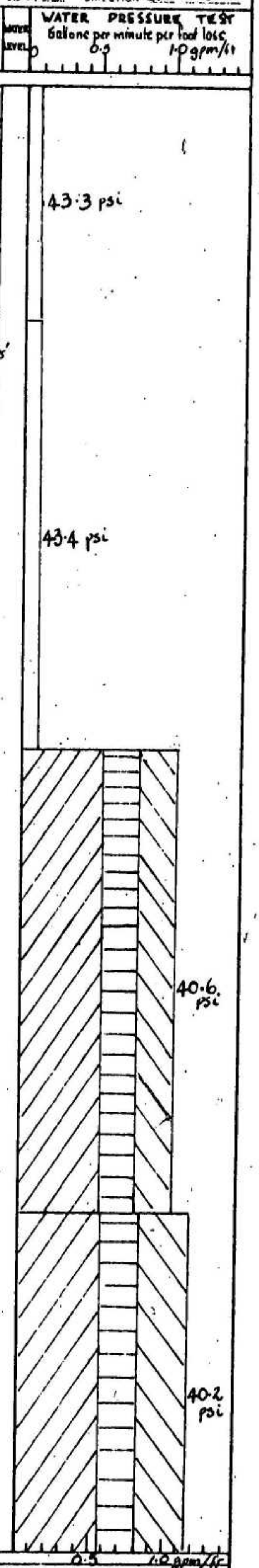
LOCATION *Northern abutment of dam site* ANGLE FROM HORIZONTAL *-45* DIRECTION *GN 130*

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION
Fresh siltstone	Grey colour, bedding inclined at 60° Broken ½" – 3" pieces mode 1"
Weathered siltstone	Grey colour, very weathered and soft – can crush with the fingers, finely disseminated pyrite. Remnant bedding seen. Weathered to a 'plush' some clay.
Slightly weathered siltstone	Broken ½" - 3" pieces mode 1". Grey coloured, carbonaceous pyritic siltstone. Pyrite very fine and disseminated. Visual estimate of pyrite content is 1%. Broken 2"-6" pieces mode 3". Broken 1"- 2" pieces mode 1" Broken 1"-4" pieces mode 2"
Weathered siltstone.	Weathered to a dark grey carbonaceous 'paste', soft – easily crushed in the fingers. Some white clay.
Slightly weathered siltstone	
Bottom	of hole 250' 6"



STRUCTURES

- Joint clay coated.
- Pyrite seam ¼" thick inclined 50°.
- Vein quartz with 'stringers' of pyrite.
- Joint 40°, white clay coating.
- Closely jointed probably a shatter zone.
- Shatter zone.
- Pyrite band 1/16" thick, inclined 65°.
- Joint 35°, thin clay coating.
- Joint 35°
- Fracture, thin clay coating.
- Joint 60°, thin clay coating.
- Pyrite band ⅛" thick, inclined 65°.
- Pyrite bands 1/16" thick inclined 65°.
- Pyrite band ⅛" thick inclined 65°.
- Joint 70° thin clay coating.
- Joint 70° clay coating.
- Joint 5°, thin clay coating.
- Joint 25°, thin clay coating
- Joint. clay coated.
- Joint 20°, rock flour, slickensided.
- Joint 60° thin clay coating
- Joint 70°, thin clay coating.
- 2" seam of white clay.
- 4" weathered shale and clay.
- Broken to ¼" pieces. Pieces coated with a thin film of clay. Probably a shatter zone.



DRILL NO.
TYPE *Mindrill E1000*
DRILLER *S. Jones*
COMMENCED *14/9/63*
COMPLETED *1/12/63*

▒	Quartzite
☰	siltstone
■	very weathered siltstone.

▒	0-10 psi
▨	10-20 psi
☰	20-30 psi
▧	30-40 psi
☐	40-60 psi

LOGGED *D.F. Maggs*
Sheet 3 of 3
VERTICAL SCALE *1 inch : 5 feet.*

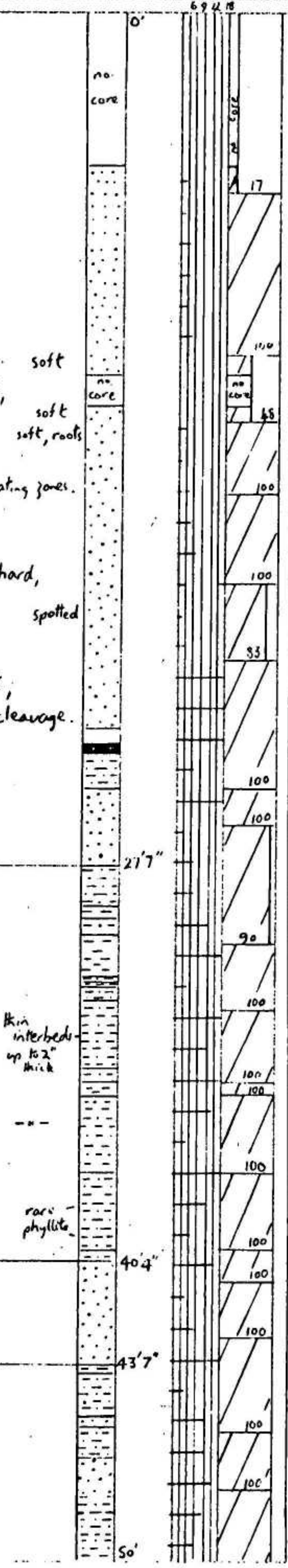
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

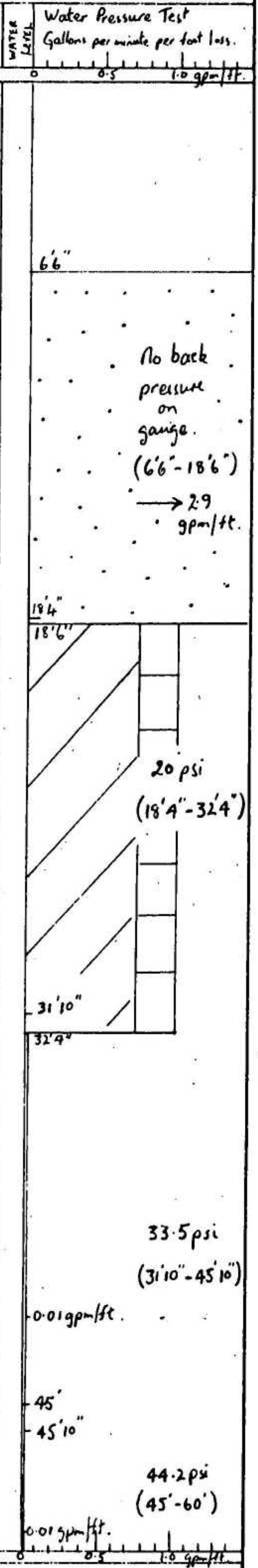
GEOLOGICAL LOG OF DRILL HOLE

PROJECT DARWIN RIVER WATER STORAGE SCHEME HOLE NO. I.3 R.L. 176·6'

LOCATION 1st. SADDLE ANGLE FROM HORIZONTAL Vertical DIRECTION

Hard Quartzite. (rare weathored quartz-phyllite, soft phyllite and soft, disintegrating weathered quartzite.)	Quartzite; hard, light grey, silicified; rare, soft disintegrating zones. Quartz-phyllite, dark grey, fairly hard, distinct cleavage. Phyllite, light grey, soft, greasy, distinct cleavage.	lineation 35° 6" quartz vein at 45° cleavage at 45°
Interbedded weathered quartz-phyllite and soft weathered phyllite	as above.	cleavage and bedding at 40°
hard quartzite.	as above	
Interbedded quartz-phyllite, phyllite, quartzite, as above	as above	cleavage and bedding at 45°





Inclination of bedding, etc, is measured from core length.

E1000 Mindrill

H. Cavell.
30. 6. '64
7. 7. '64

Reference.

- ⛆ quartzite
- ⛆ quartz phyllite
- ⛆ phyllite
- ■ weathered clayey phyllite

Water Pressure Testing

- ⛆ 0-10psi
- ▨ 10-20psi
- ☰ 20-30psi
- ▥ 30-40psi
- ▧ 40-50psi

J Barlay.

VERTICAL SCALE 1 inch : 5 feet.

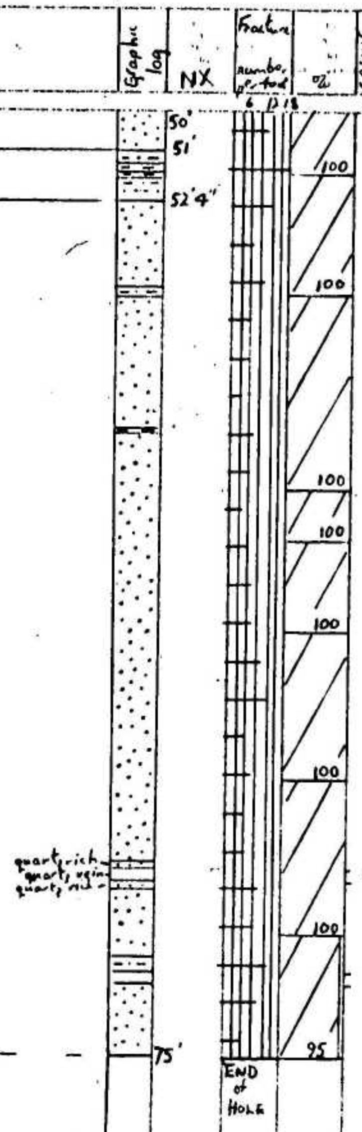
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT DARWIN RIVER WATER STORAGE SCHEME   HOLE NO. I.3   R.L. 176·6'

LOCATION 1st Saddle   ANGLE FROM HORIZONTAL vertical   DIRECTION

hard quartzite	as above
phyllite, quartz-phyllite	as above
hard quartzite. rare phyllite and minor quartz veins.	as above.

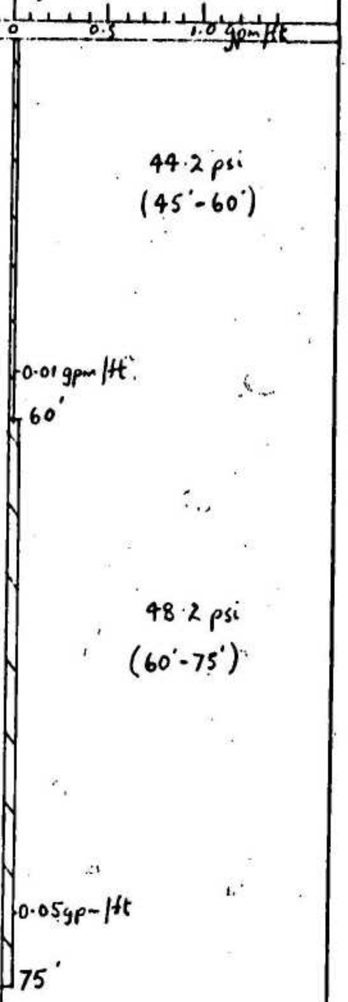


bedding and cleavage at 45°

4" quartz vein

2" quartz vein.

Water Pressure Tests
Gallons per minute per linear foot



44·2 psi
(45'-60')

0·01 gpm/ft.

48·2 psi
(60'-75')

0·05gp-/ft

E1000 Mindrill

H. Cavell

30.6.64

7.7.64

Inclination of bedding,etc, is measured from core length.

Reference
- ▨ quartzite
- ▤ quartz-phyllite
- ▤ phyllite
- ■ weathered clayey phyllite

Water Pressure Testing
- ▨ 0-10 psi
- ▨ 10-20 psi
- ▤ 20-30 psi
- ▥ 30-40 psi
- ▧ 40-50 psi

J. Barclay

1 inch : 5 feet.

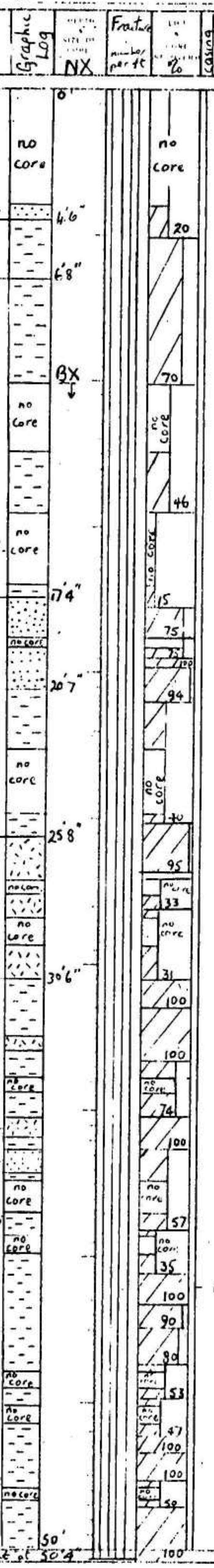
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Darwin River Water Storage Scheme HOLE NO 17 R.L. 39.4'

LOCATION Upper Pondoge Site "A" ANGLE FROM HORIZONTAL Vertical DIRECTION N/a

Overburden	Soil, pebbles of pink quartzite. fragments red quartzite –
Clay with quartz fragments (weathered rock)	Clay, white with some light brown, fairly stiff, contains angular quartz fragments.
Clay with quartz fragments (weathered rock).	Clay, light brown with some white, fairly stiff, contains angular quartz fragments; gives positive reaction to field phosphate test; can break with fingers. clayey + sandy
Hard Quartzite	Quartzite, hard, pink, phosphatic. In part contains angular quartz fragments.
Clay with quartz fragments (weathered rock)	Clay, darker brown clay with white parts; contains angular quartz fragments; phosphatic; can break with fingers.
Friable-clayey weathered ?phosphate rock.	Crystalline phosphate rock; friable to clayey; pink; can break with fingers.
Clay with quartz fragments (weathered rock). rare hard bands of phosphate rock and quartzite.	Hard – Hard – Hard – Clay, brown with some white, greasy dark grey fraction, angular quartz fragments; phosphatic; can break with fingers. Hard phosphate rock, pink and crystalline Hard pink quartzite, contains angular quartz fragments, phosphatic.



Certain faint structures, for instance faint joints and rare quartz veins, indicate that the clay, with angular quartz fragments, is derived as a result of rock weathering. (from the same source as the quartzite).
A fracture log could not be made because of the nature of the above mentioned weathered rock. The hard quartzite and phosphate rock were cored in pieces up to 6" long and were too rare for fracture logging.

1" quartz vein.

water level

22 4/64

29 9/64

5 5/64

Water Pressure Test
Gallons per minute per foot loss

0 0.5 1.0 gpm/ft

Gravity tests:

Nil losses.

(0'- 10'2")
and
(0'- 19'9"

10'2"

19'9" 19'6"

17.4 psi
Nil losses
(19'6"-30'6")

30'6"

33.5 psi
Max^m loss 0.01
(30'6" - 40'2")

36'4"

40'2"

43.5 psi
Nil losses
(36'4" - 50'4").

50'4"

0 0.5 1.0 gpm/ft

E1000 Mindrill

F. Miller
16.4.64
5.5.64

⬚ clay (weathered rock)
⬚ phosphate rock
⬚ quartzite

Water Pressure Testing
⬚ 0-10psi
▨ 10-20psi
▤ 20-30psi
▥ 30-40psi
▧ 40-50psi

J Barclay

VERTICAL SCALE 1 inch: 5 ft

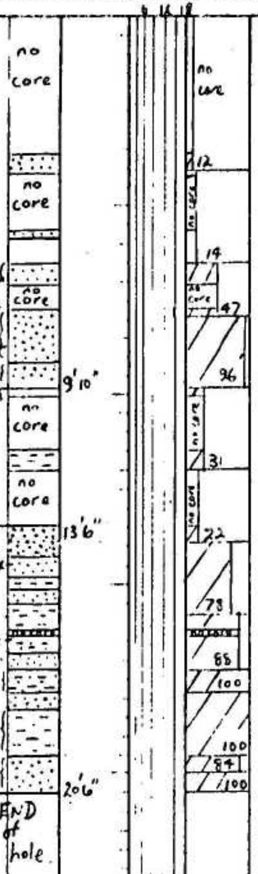
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT DARWIN RIVER WATER STORAGE SCHEME HOLE NO 19 R.L. 43'

LOCATION UPPER PONDAGE SITE A ANGLE FROM HORIZONTAL Vertical DIRECTION

Graphic Log | NX | Fracture number per foot | % | CASING | WATER LEVEL | Water Pressure Test Gallons per minute per ft. loss



Hard quartzite. Soft sand & clay (weathered rock)	low core recovery: quartzite - hard, pink. sand + clay from "no core" sections, (driller's comment)	It is apparent that the clay is derived from the same source rock as the quartzite. 7" sheared rock.	Gravity tests 0.5 psi (0'-13'11")
Clay, sandy and with angular quartz fragments (weathered rock)	low core recovery. Clay, sandy with angular quartz fragments, white and fawn - derived from rock weathering	A fracture log could not be made because of the nature of the above mentioned weathered rock. The quartzite was also recovered in short lengths up to 6" long.	
Hard quartzite Soft, sandy clay with angular quartz fragments. (weathered rock)	quartzite, pink, contains angular quartz fragments clay, sandy, pink, fawn and white. (weathered rock).	12" sheared. 9" sheared 15" sheared	10.4 psi nil losses (13'6"-20'6")

WATER LEVEL: 11/5/64

Water Pressure Test scale: 0, 0.5, 1.0 gpm/ft

13'6"
13'9"
20'6"

E1000 MINDRILL

F. MILLER.

6-5-64

11-5-64

▤ clay (weathered rock)
▦ quartzite.

Water Pressure Testing
▦ 0-10 p.s.i.
▨ 10-20 p.s.i.
▤ 20-30 p.s.i.
▥ 30-40 p.s.i.
▧ 40-50 p.s.i.

J. Barclay.

VERTICAL SCALE 1 inch : 5 ft.

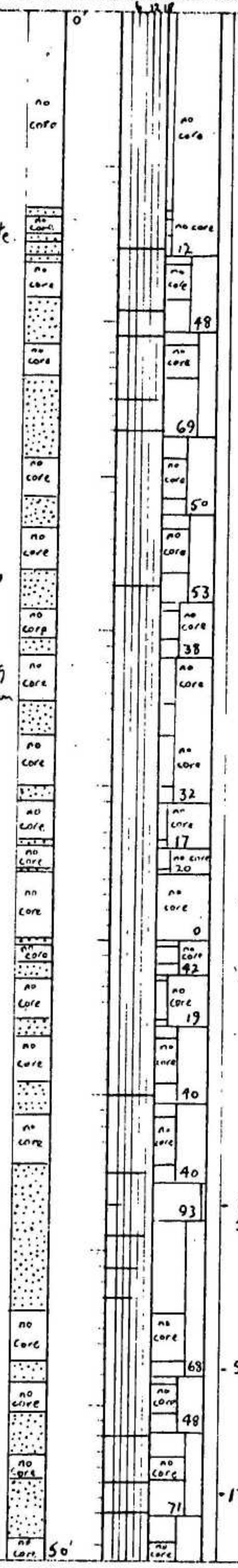
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

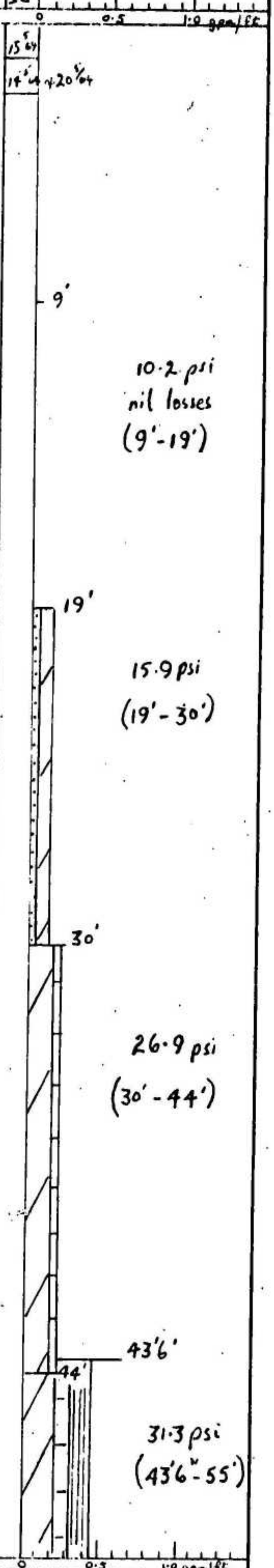
PROJECT DARWIN RIVER WATER STORAGE SCHEME HOLE NO R11 R.L. 22'

LOCATION LOWER PONDAGE SITE B ANGLE FROM HORIZONTAL 45° DIRECTION 36° mag.

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION	Graphic Log	DEPTH & SIZE OF CORE	Fracture number per ft.	CORE RECOVERY %	CASING	STRUCTURES JOINTS VEINS SEAMS FAULTS CRUSHED ZONES	WATER LEVEL	Water Pressure Test Gallons per minute per ft. loss
friable sandstone	sandstone; pinkish fawn, fine-medium grained, slightly friable to strongly friable (causing large core losses), medium hard to soft.								



- bedding at 60° faint cleavage at 50°
- 5" sheared
- 12" sheared, bedding at 55°



DRILL NO

TYPE E1000 MINDRILL

DRILLER

COMMENCED 13-5-64

COMPLETED

Angle of inclination of bedding, cleavage, faults is measured from the long axis of the core.

⁙ sandstone

Water Pressure Testing

- ⁙ 0-10 psi
- ▨ 10-20 psi
- ☰ 20-30 psi
- ▥ 30-40 psi
- ▧ 40-50 psi

LOGGED J Barlay

VERTICAL SCALE 1 inch : 5 ft.

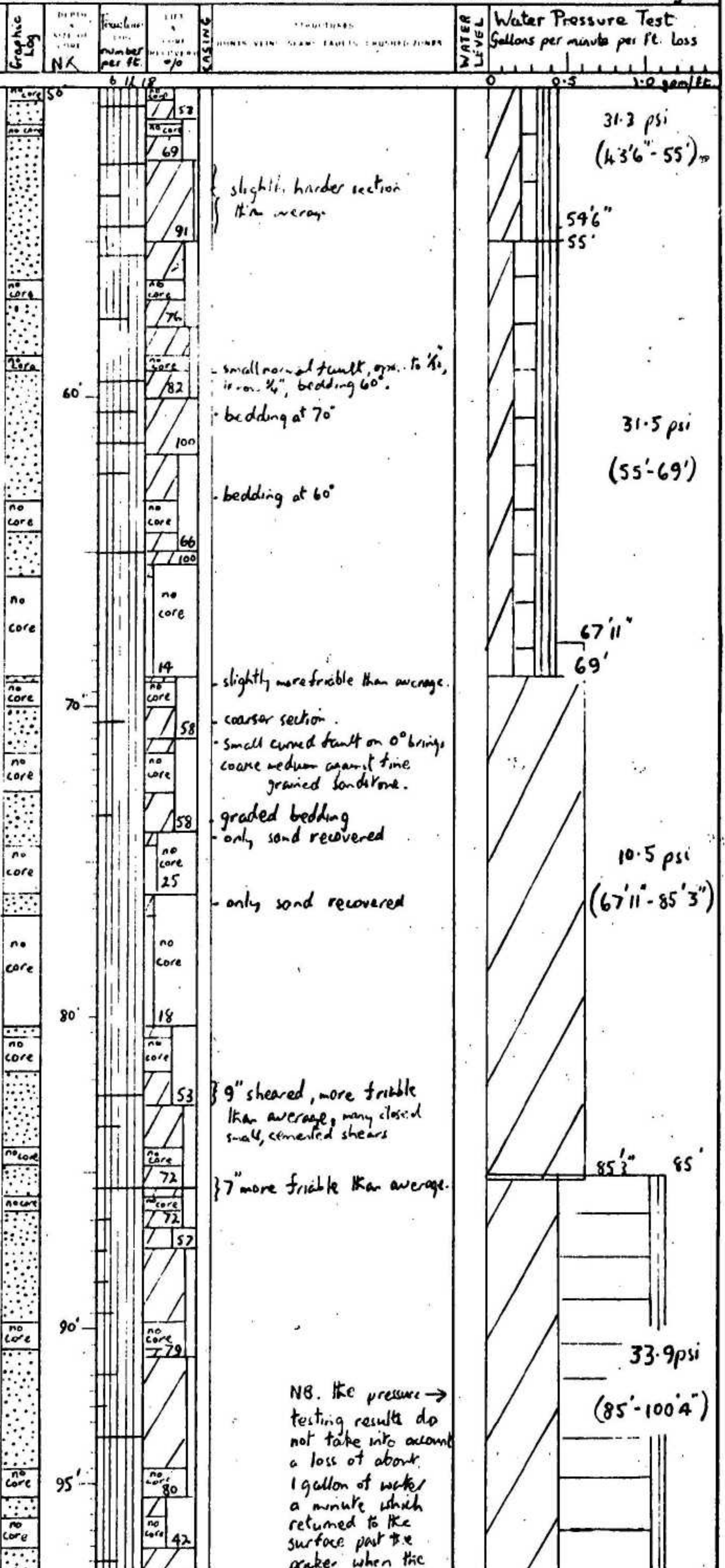
BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT DARWIN RIVER WATER STORAGE SCHEME HOLE NO R 11 R.L. 22'

LOCATION LOWER PONDAGE SITE B ANGLE FROM HORIZONTAL 45° DIRECTION 36° mag.

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION
friable sandstone	sandstone, pinkish fawn, fine-medium grained, slightly friable to strongly friable (causing large core losses), medium hard to soft.
	from 95' the sandstone becomes harder and stronger, more quartzitic with depth.



- slightly harder section than average
- small normal fault, apx. to 1/2", iron. 1/4", bedding 60°.
- bedding at 70°
- bedding at 60°
- slightly more friable than average.
- coarser section.
- Small curved fault on 0° brings coarse medium against fine grained sandstone.
- graded bedding
- only sand recovered
- only sand recovered
- 9" sheared, more friable than average, many closed small, cemented shears
- 7" more friable than average.

NB. the pressure → testing results do not take into account a loss of about 1 gallon of water a minute which returned to the surface past the packer when the gauge pressure registered 30 to 34.5 psi.

END OF HOLE AT 100'4"

DRILL NO

TYPE E 1000 MINDRILL

DRILLER F. Miller

COMMENCED 13-5-64

COMPLETED 28.5.64.

Angle of inclination of bedding cleavage, faults is measured from the long axis of the core.

⛆ sandstone

Water Pressure Testing

- ⛆ 0-10 psi
- ▨ 10-20 psi
- ☰ 20-30 psi
- ▥ 30-40 psi
- ▧ 40-50 psi

LOGGED J. Barclay

VERTICAL SCALE 1 inch : 5 ft.

APPENDIX 3

WATER PRESSURE TEST RESULTS

The key to the symbols in the column headings of the water pressure test result sheets is as follows:

* measured along the inclination of the hole.

‡ use 1 - when water table is <u>below</u> the test section
use 2 - " " " " <u>above</u> " " "

\+ Factor e for head loss is read from standard graphs.

For location of drillholes 1, 2 & 3 (damsite) - see Plate 8
" " " " I3 (1st saddle) " " 16
" " " " 17 & 19 (pondage site A) " " 17
" " " " R11 (pondage site B) " " 19

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED		TIME OF START OF TEST	TIME OF TEST	GAUGE PRESSURE	WATER METER READINGS		WATER LOSS	LEAKAGE RATE	SEALING PROPERTIES	LENGTH OF SECTION	DEPTH OF STANDING WATER (Ft)	SIZE OF ROD	WATER COLUMN PRESSURE	FRICTION HEAD LOSS	EFFECTIVE TEST PRESSURE	WATER LOSS
	FROM (feet)	TO (Feet)		(min.)	(p.s.i.)	START (gall.)	FINISH (gall.)	(gall.)	(g.p.m.)		(Feet)			(p.s.i.)	(p.s.i.)	(p.s.i.)	(g.p.m. per Ft)
	a	b		t	p	k	l	l − k = m	$\frac{m}{t}$		b − a = c	d*		$\pm \begin{smallmatrix}0.44 \sin\theta(a+h)\ 1\\ 0.44 \sin\theta(d+h)\ 2\end{smallmatrix}$	$\frac{(a+h)e^t}{10} = f$	p + w − f − P	$\frac{m}{Ec}$
Hole No.1																	
20/12/63	10' 6"	18' 6"	9.30 am	5	5	344.0	345.6	1.6	0.3	Good	8'	10' 8"		3.8	0.0	8.8	0.04
				"	"	345.6	347.1	1.5	0.3	"		(vert)		"	"	"	0.04
				"	"	347.1	348.6	1.5	0.3					"		"	0.04
				"	10	350.5	353.9	3.4	0.7					"	"	13.8	0.10
				"	"	353.9	357.2	3.3	0.7	"				"	"	"	0.10
				"	"	357.2	360.6	3.4	0.7	"				"	"	"	0.10
				"	15	373.5	379.3	5.8	1.2					"	"	"	0.15
				"	"	379.3	385.3	6.0	1.2					"	"	18.8	0.15
				"	"	385.3	391.3	6.0	1.2					"	"	"	0.15
16/1/64	18'	38'	2.45 pm	5	5	587.0	610.0	23.0	4.6	Satisfactory	20'	23'		6.1	0.0	11.1	0.23
				"	"	610.0	633.0	23.0	4.6					"	"	"	0.23
				"	"	633.0	653.5	20.5	4.1					"	"	"	0.21
				"	10	665.0	697.0	32.0	6.4	"				"	0.2	15.9	0.32
				"	"	697.0	730.0	33.0	6.6					"	"	"	0.33
				"	"	730.0	763.0	33.0	6.6	"				"	"	"	0.33
				"	15	790.0	847.0	57.0	11.4	"				"	0.7	20.4	0.57
				"	"	847.0	902.0	55.0	11.0	"				"	"	"	0.55
				"	"	902.0	959.0	57.0	11.4	"				"	"	"	0.57
6/2/64	38' 0"	58' 9"	1·35 p.m.	5	5	48·9	49·4	0·5	0·1	Satisfactory	20' 9"	22'		9·9	–	14·9	0·01
				"	"	49·4	50·4	1·0	0·2	"		vertically		"	–	"	0·01
				"	"	50·4	51·45	1·1	0·2	"				"	–	"	0·01
				"	10	52·0	53·5	1 5	0·3	"				"	–	19·9	0·02
				"	"	53·5	55·0	1·5	0·3	"				"	–	"	0·02
				"	"	55·0	56·36	1·4	0·3	"				"	–	"	0·02
				"	15	56·9	58·7	1·8	0·4	"				"	–	24·9	0·02
				"	"	58·7	60·4	1·7	0·3	"				"	–	"	0·02
				6	"	60·4	62·5	2·1	0·4	"				"	–	"	0·02
				5	"	62·5	64·2	1·7	0·3	"				"	–	"	0·02
				"	20	65·0	67·1	2·1	0·4	"				"	–	29·9	0·02
				"	"	67·1	69·3	2·2	0·4	"				"	–	"	0·02
19/2/64	58' 6"	78' 6"	2·50 p.m.	5	10	589·0	596·8	7·8	1·6	Good	20'	23'		10·8	–	20·8	0·08
				"	"	597·7	604·8	7·1	1·4	"		vertically		"	–	"	0·07
				"	"	604·8	611·8	7·0	1·4					"	–	"	0·07
				"	15	614·0	622·7	8·7	1·7					"	–	25·8	0·09
				"	"	622·7	631·1	8·4	1·7					"	–	"	0·09
				"	"	631·1	639·7	8·6	1·7	"				"	–	"	0·09
				"	20	644·0	654·1	10·1	2·0	"				"	–	30·8	0·10
				"	"	654·1	664·0	9·9	2·0					"	–	"	0·10
				"	"	664·0	673·9	9·9	2·0	"				"	–	"	0·10
				"	25	676·0	687·7	11·7	2·4	"				"	–	35·8	0·12
				"	"	687·7	699·1	11·4	2·3	"				"	–	"	0·12
				"	"	699·1	710·4	11·3	2·3	"				"	–	"	0·12

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

Hole No. 1.

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED		TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS		WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (Ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per Ft.)
	FROM (feet)	TO (feet)				START (gall.)	FINISH (gall.)										
	a	b		t	p	k	l	l-k = m	$\frac{m}{t}$		b′-a = c	d*		‡$0{\cdot}44\sin\theta(a+h)$ 1. $0{\cdot}44\sin\theta(d+h)$ 2.	$\frac{(a+h)e^{\dagger}}{10}=f$	p+w-f = P	$\frac{m}{tc}$
2-3-64	78′ 0″	97′ 0″	10-25am	5	10	766·0	778·0	12·0	2·4	Satisfactory	19′	23′		10·8	0·0	20·8	0·13
						778·0	788·5	10·5	2·1			vertically				"	0·11
						788·5	800·0	11·5	2·3							"	0·12
					20	810·0	824·5	14·5	2·9							30·8	0·15
						824·5	840·0	15·5	3·1							"	0·16
						840·0	854·0	14·0	2·8							"	0·15
						854·0	869·0	15·0	3·0							"	0·16
					30	876·0	894·5	18·5	3·7							40·8	0·19
						894·5	913·0	18·5	3·7							"	0·19
						913·0	931·0	18·0	3·6							"	0·19
					40	937·0	962·0	25·0	5·0							50·8	0·26
						962·0	987·0	25·0	5·0							"	0·26
						987·0	1012·0	25·0	5·0							"	0·26
6-3-64	96′ 7″	116′ 7″	10.00 a.m.	5	10	100·0	112·0	12·0	2·4	Good	20′	21′		10·6	0·0	20·6	0·12
						112·0	124·0	12·0	2·4			vertically				"	0·12
						124·0	135·0	11·0	2·2							"	0·11
					20	139·0	156·0	17·0	3·4							30·6	0·17
						156·0	172·0	16·0	3·2							"	0·16
						172·0	188·5	16·5	3·3							"	0·17
					30	194·0	215·5	21·5	4·3							40·6	0·22
						215·5	237·25	21·75	4·35							"	0·22
						237·25	259·0	21·75	4·35							"	0·22
					40	268·0	294·0	26·0	5·2							50·6	0·26
						294·0	319·0	25·0	5·0							"	0·25
						319·0	344·0	25·0	5·0							"	0·25
16-3-64	115′ 9″	133′ 9″	1-30 p.m.	5	10	281·0	289·5	8·5	1·7	Good	18′	21′		9·1	0·0	19·1	0·095
						289·5	298·0	8·5	1·7							"	0·095
						298·0	306·0	8·0	1·6							"	0·09
					20	310·0	321·3	11·3	2·3							29·1	0·13
						321·3	332·0	10·7	2·1							"	0·12
						332·0	343·0	11·0	2·2							"	0·12
					30	346·0	360·3	14·3	2·9							39·1	0·16
						360·3	374·2	13·9	2·8							"	0·16
						374·2	388·0	13·8	2·8							"	0·16
					40	394·0	411·2	17·2	3·4							49·1	0·19
						411·2	428·0	16·8	3·4							"	0·19
						428·0	444·5	16·5	3·3							"	0·18
20-3-64	133′ 6″	150′ 9″	9-05 a.m.	5	10	170·0	244·0	74·0		Satisfactory							
						244·0	314·0	70·0									
						314·0	382·0	68·0		SUPPLY LINE BROKEN - REPAIRED FROM 10-00 TO 10-45 A.M.							
						"REX" W.P. OUT OF ORDER FROM 10-30 A.M. TO 1-30 P.M.											
			1-35 p.m.	5	5	462·0	505·0	43·0	8·6		17·3′	21′		9·5	0·6	13·9	0·50
						505·0	[illegible]	49·0	9·8							"	0·57
						554·0	606·0	52·0	10·4							"	0·60
(continued)						606·0	658·0	52·0	10·4							"	0·60

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

Hole No. 1.

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED FROM (feet)	SECTION TESTED TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS START (gall.)	WATER METER READINGS FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per ft.)
	a	b		t	p	k	l	l − k = m	$\frac{m}{t}$		b − a = c	d*		‡ 0·44 sin θ(a+h) 1. 0·44 sin θ(d+h) 2.	$\frac{(a+h)e^{\dagger}}{10} = f$	p + w − f = P	$\frac{m}{tc}$
20·3·64	133′ 6″	150′ 9″	1·35 p.m.	5	10	670·0	738·0	68·0	13·6	Satisfactory	17·3′	21′		9·5	1·1	18·4	0·78
						738·0	804·0	66·0	13·2							"	0·77
						804·0	869·0	65·0	13·0							"	0·76
					15	912·0	991·0	79·0	15·8						1·5	23·0	0·92
						991·0	1068·0	77·0	15·4							"	0·88
						1068·0	1144·0	76·0	15·2							"	0·86
					20	1165·0	1253·0	88·0	17·6						1·7	27·8	1·02
						1253·0	1341·0	88·0	17·6							"	1·02
						1341·0	1429·0	88·0	17·6							"	1·02
					25	1480·0	1579·0	99·0	19·8						2·0	32·5	1·14
						SUPPLY	LINE	BROKEN									
						1690·0	1794·0	104·0	20·8						2·2	32·3	1·20
						1794·0	1897·0	103·0	20·6							"	1·20
25-3-64	149′ 9″	160′ 9″	9·40 a.m.	10	0	40·0	259·0	219·0	21·9	Satisfactory	11′	21′		9·5	2·5	7·0	1·99
						259·0	473·0	214·0	21·4							"	1·95
						473·0	686·0	213·0	21·3								1·94
				5	0	775·0	893·0	118·0	23·6						2·8	6·7	2·14
						893·0	1012·0	119·0	23·8							"	2·16
						1012·0	1131·0	119·0	23·8							"	2·16
						1131·0	1248·0	117·0	23·4							"	2·12
					0	1259·0	1366·0	107·0	21·4						2·5	7·0	1·85
						1366·0	1473·0	107·0	21·4							"	1·85
						1473·0	1580·0	107·0	21·4							"	1·85
4-4-64	159′ 3″	178′ 9″	2-30 p.m.	5	10	310·0	369·0	59·0	11·8	Satisfactory	19·5′	21·6′		10·0	0·8	19·2	0·61
						369·0	431·0	62·0	12·4						0·9	19·1	0·64
						431·0	492·0	61·0	12·2						0·9	19·1	0·63
					20	545·0	585·0	after 2½ min. gauge pressure → 0 Lbs.									
					0	605·0	729·0	114·0	22·8						2·5	7·5	1·17
						729·0	850·0	121·0	24·2						2·8	7·2	1·24
						850·0	972·0	122·0	24·4						2·8	7·2	1·25
8-4-64	178′ 1″	196′ 1″	2-35 p.m.	5	5	50·0	116·0	66·0	13·2	Satisfactory	18	22′		10·5	1·0	14·5	0·74
						116·0	177·0	61·0	12·2						0·9	14·6	0·68
						177·0	239·0	62·0	12·4						0·9	14·6	0·69
					10	265·0	340·0	75·0	15·0						1·4	19·1	0·84
						340·0	409·0	69·0	13·8						1·1	19·4	0·77
						409·0	478·0	69·0	13·8						1·1	19·4	0·77
					15	505·0	588·0	83·0	16·6						1·5	24·0	0·92
						588·0	669·0	81·0	16·2						1·5	24·0	0·90
						669·0	750·0	81·0	16·2						1·5	24·0	0·90
					20	765·0	858·0	93·0	18·6						1·8	28·7	1·03
						858·0	949·0	91·0	18·2						1·8	28·7	1·01
						949·0	1040·0	91·0	19·2						1·8	28·7	1·01
					25	1085·0	1185·0	100·0	20·0						2·1	33·4	1·11
						1185·0	1285·0	100·0	20·0						2·1	33·4	1·11
						1285·0	1384·0	99·0	19·8						2·0	33·5	1·10
					30	1425·0	1535·0	110·0	22·0						2·5	38·0	1·22
						1535·0	1647·0	112·0	22·4						2·5	38·0	1·25
						1647·0	1757·0	110·0	22·0						2·5	38·0	1·22

Hole No. 1.

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED FROM (feet)	TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS START (gall.)	FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (Ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per Ft.)
	a	b		t	p	k	l	l-k = m	$\frac{m}{t}$		b-a = c	d*		‡0·44 sin θ(a+h) 1. 0·44 sin θ(d+h) 2.	$\frac{(a+h)e^{\dagger}}{10}=f$	p+w-f = P	$\frac{m}{tc}$
14-4-64	190' 3"	210' 3"	8-50 a.m.	5	5	50·0	121·0	71·0	14·2	Satisfactory	20'	22'		11·4	1·1	15·3	0·71
			10-30 a.m.			121·0	189·0	68·0	13·6			vertically			1·0	15·4	0·67
						189·0	257·0	68·0	13·6						1·0	15·4	0·67
					10	280·0	371·0	91·0	18·2						1·7	19·7	0·91
						371·0	458·0	87·0	17·4						1·6	19·8	0·87
						458·0	544·0	86·0	17·2						1·6	19·8	0·86
					15	570·0	673·0	103·0	20·6						2·1	24·3	1·03
						673·0	773·0	100·0	20·0						2·1	24·3	1·00
						773·0	872·0	99·0	19·8						2·0	24·4	0·99
					20	930·0	1042·0	112·0	22·4						2·3	29·1	1·12
						1042·0	1150·0	108·0	21·6						2·2	29·2	1·08
						1150·0	1258·0	108·0	21·6						2·2	29·2	1·08

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED		TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS		WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (Ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per Ft.)
	FROM (feet)	TO (feet)				START (gall.)	FINISH (gall.)										
	a	b		t	p	k	l	$l-k=m$	$\frac{m}{t}$		$b-a=c$	d*		‡$0{\cdot}44\sin\theta(a+h)$ 1. ‡$0{\cdot}44\sin\theta(d+h)$ 2.	$\frac{(a+h)e^t}{10}=f$	$p+w-f=P$	$\frac{m}{tc}$
Hole N°. 2.																	
19/10/63	6' 0"	17' 4"	1.30 pm	5				72	14.4	Satisfactory	11' 4"	No water in hole	EX flush jointed casing.				1.27
			Stop watch timing		No pressure recorded.		Hole took the capacity of the pump 960 gal/hour										
30/10/63	20' 6"	32' 8"	8.15 am	5	1	139.3	155.0	15.7	3.14	Satisfactory	12' 2"	19' 3"		6.1	0.0	7.1	0.26
				"	"	155.0	161.6	12.6	2.52	"	" "	"	Ex flush jointed casing.	"	"	"	0.21
			Stop watch timing	"	"	167.6	178.4	10.8	2.16	"	"	"		"	"	"	0.18
				"	6	183.0	199.0	16.0	3.20	"	"	"		"	"	11.1	0.26
				"	"	199.0	215.3	16.3	3.26	"	"	"		"	"	"	0.27
				"	"	215.3	232.7	17.4	3.49	"	"	"		"	"	"	0.29
5/11/63	32' 0"	52' 0"	11.20 am	5	5	103.5	105.8	2.30	0.46	good	20' 0"	15' 7"		5.4	0.0	10.4	0.02
				"	"	105.8	107.65	1.85	0.37	"	"	"		"	"	"	0.02
				"	"	107.6	109.35	1.75	0.35	"	"	"		"	"	"	0.02
				"	10	110.6	112.75	2.15	0.43	"	"	"		"	"	15.4	0.02
			Stop watch timing	"	"	112.75	114.5	1.75	0.35	"	"	"	EX flush jointed casing.	"	"	"	0.02
				"	"	114.5	116.0	1.50	0.30	"	"	"		"	"	"	0.01
				"	15	130.0	134.5	4.50	0.90	"	"	"		"	"	20.4	0.04
				"	"	134.5	138.5	4.00	0.80	"	"	"		"	"	"	0.04
				"	"	138.5	142.35	3.85	0.77	"	"	"		"	"	"	0.04
				"	10	144.0	146.15	2.15	0.43	"	"	"		"	"	15.4	0.02
					5	146.7	147.4	0.70	0.14	"	"	"		"	"	10.4	0.01
8/11/63	51' 9"	71' 9"	1.20 pm	5	5	153.2	157.6	4.4	0.8	Satisfactory	20' 0"	15' 5"		5.5	0.0	10.5	0.04
					"	157.6	161.5	3.9	0.8	"				"	"	"	0.04
					"	161.5	165.1	3.6	0.7	"				"		"	0.04
					10	167.8	173.0	5.2	1.0	"			EX flush jointed casing	"	"	15.5	0.05
			Stop watch timing.		"	173.0	178.0	5.0	1.0	"				"	"	"	0.05
					"	178.0	183.1	5.1	1.0	"				"	"	"	0.05
					15	188.0	194.7	6.1	1.3	"				"	"	20.5	0.07
					"	194.7	201.4	6.7	1.3	"				"	"	"	0.07
					"	201.4	207.8	6.4	1.3	"				"	"	"	0.06
					20	216.4	224.5	8.1	1.6	"				"	"	25.5	0.08
					"	224.5	232.3	7.8	1.6	"				"	"	"	0.08
					"	232.3	240.0	7.7	1.5	"				"	"	"	0.08
					15	247.7	254.1	6.4	1.3	"				"	"	20.5	0.06
					10	255.7	260.6	4.9	0.9	"				"	"	15.5	0.05

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED FROM (feet)	TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS START (gall.)	FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (Ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per ft.)
	a	b		t	p	k	l	l-k = m	$\frac{m}{t}$		b-a = c	d*		‡ $0.44 \sin\theta(a+h)$ 1. $0.44 \sin\theta(d+h)$ 2.	$\frac{(a+h)e^{\dagger}}{10}=f$	p+w-f = P	$\frac{m}{tc}$
Hole No 2																	
21/12/63	65'	89' 7"	8.10 am	5	10	690.0	704.0	14.0	2.8	good	24' 7"	7' 2"		3.7	0.0	13.7	0.11
				"	"	704.0	717.5	13.5	2.7	"		(Vert)		"	"	"	0.11
				"	"	717.5	730.5	13.0	2.6	"				"	"	"	0.11
				"	20	745.0	765.0	20.0	4.0	"				"	"	23.7	0.16
				"	"	765.0	784.5	19.5	3.9	"				"	"	"	0.16
				"	"	784.5	803.5	19.0	3.8	"				"	"	"	0.15
				"	30	818.0	847.0	29.0	5.8	"				"	"	33.7	0.24
				"	"	847.0	874.0	27.0	5.4	"				"	"	"	0.22
				"	"	874.0	901.0	27.0	5.4	"				"	"	"	0.22
				"	40	942.0	979.5	37.5	7.5	"				"	0.4	43.3	0.31
				"	"	979.5	1015.5	36.0	7.2	"				"	0.4	"	0.29
				"	"	1015.5	1051.5	36.0	7.2	"				"	0.4	"	0.29
8/1/64	88'	108'	1.20 pm	5	10	9220.0	9238.0	18.0	3.6	good	20.0"	7' 0"		4.2	0.0	14.2	.18
				"	"	9238.0	9254.5	16.5	3.3	"		(vert)		"	"	"	.17
				"	"	9254.5	9271.0	16.5	3.3	"				"	"	"	.17
				"	20	9299.5	9324.5	25.0	5.0	"				"	"	24.2	.25
				"	"	9324.5	9348.0	23.5	4.7	"				"	"	"	.24
				"	"	9375.0	9398.0	23.0	4.6	"				"	"	"	.23
				"	30	9514.0	9545.5	31.5	6.3	"				"	"	34.2	.32
				"	"	9545.5	9576.0	30.5	6.1	"				"	"	"	.31
				"	"	9576.0	9605.0	29.0	5.8	"				"	"	"	.29
				"	"	9605.0	9635.0	30.0	6.0	"				"	"	"	.30
				"	40	9650.0	9686.5	36.5	7.3	"				"	0.4	43.8	.37
				"	"	9686.5	9724.0	37.5	7.5	"				"	"	"	.38
10/1/64	108'	128'		5	10	20.0	77.0	57.0	11.4	Satisfactory	20' 0"	6' 2"		3.0	0.7	12.3	0.57
				"	"	77.0	130.5	53.5	10.7	"				"	0.6	12.4	0.54
				"	"	130.5	184.0	54.0	10.8	"				"	0.6	12.4	0.54
				"	20	215.0	292.0	77.0	15.4	"				"	1.3	21.7	0.77
				"	"	292.0	366.0	74.0	14.8	"				"	1.2	21.8	0.74
				"	"	366.0	438.0	72.0	14.4	"				"	1.2	21.8	0.72
				"	"	438.0	508.0	70.0	14.0	"				"	1.2	21.8	0.70
				"	30	560.0	649.0	89.0	17.8	"				"	1.5	31.5	0.89
				"	"	649.0	736.5	87.5	17.5	"				"	1.5	31.5	0.88
				"	"	736.5	824.0	86.5	17.3	"				"	1.5	31.5	0.87
					Gauge pressure dropped from 40 → 26-27	1037.0	1180.0	143.0	28.6					"	3.5	39.5 → 25.5-26.5	1.43
16/1/64	126' 0"	146' 0"		5	10	1692.0	1757.0	65.0	13.0	Satisfactory	20' 0"	5' 6"		2.7	1.0	11.7	0.65
				"	"	1757.0	1818.5	61.5	12.3	"				"	0.9	11.8	0.62
				"	"	1818.5	1880.0	61.5	12.3	"				"	0.9	11.8	0.62
				"	20	1924.0	2013.0	89.0	17.8	"				"	1.5	21.2	0.89
				"	"	2013.0	2101.0	88.0	17.6	"				"	1.5	21.2	0.88
				"	"	2101.0	2187.0	86.0	17.2	"				"	1.5	21.2	0.86
				"	"	2187.0	2273.0	86.0	17.2	"				"	1.5	21.2	0.86
				"	30	345.0	456.0	111.0	22.5	"				"	2.5	30.2	1.13
				"	"	456.0	564.0	108.0	21.6	"				"	2.5	30.2	1.08
				"	"	564.0	672.0	108.0	21.6	"				"	2.5	30.2	1.08

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

Hole No. 2.

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED		TIME OF START OF TEST	TIME OF TEST (min)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS		WATER LOSS (gall)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (Ft)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i)	FRICTION HEAD LOSS (p.s.i)	EFFECTIVE TEST PRESSURE (p.s.i)	WATER LOSS (g.p.m. per ft)
	FROM (feet)	TO (feet)				START (gall.)	FINISH (gall.)										
	a	b		t	p	k	l	l-k = m	$\frac{m}{t}$		b-a = c	d*		‡ 0·44 sin θ(a+h) 1 0·44 sin θ(d+h) 2	$\frac{(a+h)e^{\dagger}}{10}$ ‡	p+w-f = P	$\frac{m}{tc}$
10-2-64	145' 9"	165' 9"		5	8	591·0	732·0	146·0	29·2	Satisfactory	20'	5·4 vertically		2·9	4·0	6·9	1·46
				"	"	737·0	883·5	146·5	29·3	"					"	"	1·46
				"	"	883·5	1029·5	146·0	29·2	"					"	"	1·46
13-2-64	158' 5"	172' 5"	10·40 a.m.	5	10	5132·0	222·0	90·0	18·0	"	14'	5·3 vertically		3·5	1·6	11·9	1·28
				"	"	222·0	310·0	88·0	17·6	"					"	"	1·26
				"	"	310·0	398·0	88·0	17·6	"					"	"	1·26
				"	20	560·0	684·0	124·0	24·8	"					2·9	20·6	1·78
				"	"	684·0	804·0	120·0	24·0	"					"	"	1·72
				"	"	804·0	924·0	120·0	24·0	"					"	"	1·72
				"	25-26	5970·0	6109·0	139·0	27·8	"					3·5	25-26	1·98
				"	"	6109·0	6247·5	138·5	27·7	"					"	"	1·98
				"	"	6247·5	6386·0	138·5	27·7	"					"	"	1·98
14-2-64	171' 7"	191' 7"	1·50 p.m.	5	10	6450·0	6505·5	55·5	11·1	Good	20'	5·3 vertically		2·6	0·7	11·9	0·56
				"	"	505·5	560·0	55·0	11·0	"					"	"	0·55
				"	"	560·0	613·0	53·0	10·6	"					"	"	0·53
				"	"	613·0	666·5	53·5	10·7	"					"	"	0·53
				"	20	690·0	764·5	74·5	14·9	"					1·1	21·5	0·75
				"	"	764·5	836·5	72·0	14·4	"					"	"	0·72
				"	"	836·5	908·0	72·0	14·4	"					"	"	0·72
				"	30	940·0	7028·5	88·5	17·7	"					1·5	31·1	0·89
				"	"	7028·5	115·0	86·5	17·3	"					"	"	0·87
				"	"	115·0	200·0	85·0	17·0	"					"	"	0·85
				"	"	200·0	285·0	85·0	17·0	"					"	"	0·85
				"	39-40	310·0	409·5	99·5	19·9	"					1·9	39·7-40·7	1·0
				"	40	409·5	507·5	98·0	19·6	"					"	40·7	0·98
17-2-64	191' 1"	205' 1"	1·00 p.m.	5	10	06·8	10·50	3·7	0·74	Satisfactory	14'	5·2 vertically		3·4	–	13·4	0·05
				"	"	10·5	14·10	3·6	0·72	"					–	"	0·05
				"	"	14·1	17·80	3·7	0·74	"					–	"	0·05
				"	20	18·5	24·10	5·6	1·12	"					–	23·4	0·08
				"	"	24·1	29·50	5·4	1·08	"					–	"	0·08
				"	"	29·5	34·80	5·3	1·06	"					–	"	0·08
				"	30	35·5	42·65	7·15	1·43	"					–	33·4	0·10
				"	"	42·65	49·70	7·05	1·41	"					–	"	0·10
				"	"	49·7	56·60	6·9	1·38	"					–	"	0·10
				"	40	59·0	67·70	8·7	1·74	"					–	43·4	0·12
				"	"	67·7	76·3	8·6	1·72	"					–	"	0·12
				"	"	76·3	84·8	8·5	1·70	"					–	"	0·12
19-2-64	204' 7"	223' 1"		5	10	155·5	168·4	12·9	2·58	"	18·5'	5·3 vertically		2·8	–	12·8	0·14
				"	"	168·4	181·4	13·0	2·6	"					–	"	0·14
				"	"	181·4	193·8	12·4	2·48	"					–	"	0·14
				"	20	218·5	238·4	19·9	3·98	"					–	22·8	0·22
				"	"	238·4	258·0	19·6	3·92	"					–	"	0·21
				"	"	258·0	277·3	19·3	3·86	"					–	"	0·21
				"	30	293·0	317·5	24·5	4·90	"					–	32·8	0·27
				"	"	317·5	341·7	24·2	4·84	"					–	"	0·26
				"	"	341·7	365·5	23·8	4·76	"					–	"	0·26
				"	40	408·0	442·3	34·3	6·86	"					0·7	42·1	0·37
				"	"	442·3	476·4	34·1	6·82	"					"	"	0·37
				"	"	476·4	510·4	34·0	6·80	"					"	"	0·37

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

Hole No. 2.

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED FROM (feet)	SECTION TESTED TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i.)	WATER METER READINGS START (gall.)	WATER METER READINGS FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per ft.)
	a	b		t	p	k	l	l−k = m	$\frac{m}{t}$		b − a = c	d*		‡ $0{\cdot}44\sin\theta(a-h)$ 1. $0{\cdot}44\sin\theta(d+h)$ 2.	$\frac{(a+h)e^{t}}{10}=f$	p + w − f = P	$\frac{m}{tc}$
21-2-64	222' 1"	236' 1"	8-35a.m.	5	10	760·50	772·30	11·8	2·36	Satisfactory	14'	5·5'		3	–	13	0·17
					"	772·30	783·45	11·15	2·23			vertically		"	–	"	0·16
					"	783·45	794·20	10·75	2·15					"	–	"	0·15
					"	794·20	805·00	10·8	2·16					"	–	"	0·15
					20	809·00	825·40	16·4	3·28					"	–	23	0·23
					"	825·40	841·30	15·9	3·18					"	–	"	0·23
					"	841·30	856·90	15·6	3·12					"	–	"	0·22
					30	871·00	892·00	21·0	4·20					"	–	33	0·30
					"	892·00	912·80	19·2	3·84					"	–	"	0·27
					"	912·80	933·30	20·5	4·10					"	–	"	0·29
					40	948·50	976·40	27·9	5·58					"	–	43	0·40
					"	976·40	1006·00	29·6	5·92					"	–	"	0·42
					"	1006·00	1039·40	33·4	6·68					"	–	"	0·48
24·2·64	235' 4"	250' 4"	1-30p.m.	5	10	120·0	159·5	39·5	7·9	Satisfactory	15'	5·1'		2·6	–	12·6	0·53
					"	159·5	199·0	39·5	7·9			vertically		"	–	"	0·53
					"	199·0	237·0	38·0	7·6					"	–	"	0·51
					20	260·0	321·0	61·0	12·2					"	0·8	21·8	0·82
					"	321·0	380·0	59·0	11·8					"	0·8	"	0·79
					"	380·0	438·0	58·0	11·6					"	0·8	"	0·77
					30	465·0	537·0	72·0	14·4					"	1·3	31·3	0·96
					"	537·0	608·0	71·0	14·2					"	1·4	31·2	0·95
					"	608·0	676·5	68·5	13·7					"	1·1	31·5	0·92
					40	720·0	805·0	85·0	17·0					"	1·5	41·1	1·14
					"	805·0	894·0	89·0	17·8					"	1·7	40·9	1·18
					"	894·0	982·0	88·0	17·6					"	1·6	41·0	1·18
29-2-64	245' 5"	263' 5"	9-10a.m.	5	10	220·0	273·0	53·0	10·6	Satisfactory	18'	5·5'		2·7	0·6	12·1	0·59
					"	273·0	324·0	51·0	10·2			vertically		"	0·6	"	0·57
					"	324·0	374·0	50·0	10·0					"	0·6	"	0·55
					20	415·0	491·0	76·0	15·2					"	1·4	21·3	0·84
					"	491·0	564·0	73·0	14·6					"	1·3	21·4	0·81
					"	564·0	636·0	72·0	14·4					"	1·3	"	0·80
					30	700·0	795·0	95·0	19·0					"	1·9	30·8	1·06
					"	795·0	888·0	93·0	18·6					"	1·8	30·9	1·03
					"	888·0	981·0	93·0	18·6					"	1·8	"	1·03
					40	025·0	138·0	113·0	22·6					"	2·6	40·1	1·25
					"	138·0	250·0	112·0	22·4					"	2·6	"	1·24
					"	250·0	367·0	117·0	23·4					"	2·6	"	1·30

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED FROM (feet)	SECTION TESTED TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS START (gall.)	WATER METER READINGS FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (Ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per Ft.)
	a	b		t	p	k	l	$l - k = m$	$\frac{m}{t}$		$b - a = c$	d^{*}		‡$0.44 \sin\theta(a+h)$ 1. ‡$0.44 \sin\theta(d+h)$ 2.	$\frac{(a+h)e^{\dagger}}{10} = f$	$p + w - f = P$	$\frac{m}{tc}$
Hole No. 3																	
1/10/63	29' 0"	46' 0"	1.25 pm	5	5	263.5	274.9	11.4	2.28	Satisfactory	17' 0"	19' 11"	EX flush jointed casing 1½" dia.	7.9	0.0	12.9	0.13
"	"	"	1.30	"	"	274.9	286.4	11.5	2.30	"	"	"		"	"	"	0.13
"	"	"	1.35	"	"	286.4	297.2	10.8	2.16	"	"	"		"	"	"	0.13
"	"	"	1.40	"	"	297.2	308.1	10.9	2.18	"	"	"		"	"	"	0.13
"	"	"	2.09	"	10	363.1	377.5	14.4	2.88	"	"	"		"	"	17.9	0.17
"	"	"	2.14	"	"	277.5	391.3	13.8	2.76	"	"	"		"	"	"	0.16
"	"	"	2.19	"	"	391.3	404.9	13.6	2.72	"	"	"		"	"	"	0.16
"	"	"	2.24	"	"	404.9	418.6	13.7	2.74	"	"	"		"	"	"	0.16
"	"	"	2.44	"	15	451.5	469.8	18.3	3.66	"	"	"		"	"	22.9	0.21
"	"	"	2.49	"	"	469.8	487.7	17.9	3.58	"	"	"		"	"	"	0.21
"	"	"	2.54	"	"	487.7	505.4	18.7	3.74	"	"	"		"	"	"	0.22
"	"	"	2.59	"	"	505.4	522.8	17.4	3.48	"	"	"		"	"	"	0.21
"	"	"	3.04	"	"	522.8	540.5	17.7	3.54	"	"	"		"	"	"	0.21
"	"	"	3.14	"	10	556.1	569.2	13.1	2.62	"	"	"		"	"	17.9	0.15
"	"	"	3.22	"	5	574.2	584.0	6.3	1.26	"	"	"		"	"	12.9	0.07
8/10/63	45' 6"	60' 3"	1.52 pm	5	5	• 1077.0	1094.4	17.4	3.48	Satisfactory	14' 9"	18' 8"	EX flush jointed casing 1½" dia.	6.9	0.0	11.9	0.23
"	"	"		"	"	1094.4	1109.8	15.4	3.00	"	"	"		"	"	"	0.21
"	"	"		"	"	1109.8	1126.4	16.6	3.32	"	"	"		"	"	"	0.22
"	"	"		"	"	1126.4	1142.4	16.0	3.20	"	"	"		"	"	"	0.21
"	"	"		"	"	1142.4	1168.3	15.9	3.18	"	"	"		"	"	"	0.21
"	"	"	2.28	"	10	1171.0	1192.1	21.1	4.22	"	"	"		"	0.1	16.8	0.28
"	"	"		"	"	1192.1	1212.8	20.7	4.14	"	"	"		"	"	"	0.28
"	"	"		"	"	1212.8	1232.8	20.0	4.00	"	"	"		"	"	"	0.27
"	"	"	2.46	"	15	1257.0	1281.6	24.6	4.22	"	"	"		"	"	21.8	0.35
"	"	"		"	"	1281.6	1305.9	24.3	4.86	"	"	"		"	"	"	0.33
"	"	"		"	"	1305.9	1329.7	23.8	4.76	"	"	"		"	"	"	0.32
"	"	"		"	"	1329.7	1353.3	23.6	4.72	"	"	"		"	"	"	0.32
"	"	"	3.20	"	20	1427.0	1456.8	29.8	5.96	"	"	"		"	"	26.8	0.40
"	"	"		"	"	1456.8	1456.8	30.3	6.06	"	"	"		"	"	"	0.40
"	"	"		"	"	1487.1	1487.1	30.2	6.04	"	"	"		"	"	"	0.40
15/10/63	59' 6"	76' 10"	9.30 am	5	5	0027.0	0031.7	4.7	0.94	Good	17' 4"	17' 3"	EX flush jointed casing 1½" dia.	7.1	0.0	12.1	0.05
"	"	"		"	"	0031.7	0034.6	2.9	0.58	"	"	"		"	"	"	0.03
"	"	"		"	"	0034.6	0036.3	1.7	0.34	"	"	"		"	"	"	0.00
"	"	"		"	"	0036.3	0036.3	0.0	0.00	"	"	"		"	"	"	0.00
"	"	"		"	10	0039.0	0041.8	2.8	0.56	"	"	"		"	"	17.1	0.03
"	"	"	stop watch timing	"	"	0041.8	0043.8	2.0	0.40	"	"	"		"	"	"	0.02
"	"	"		"	15	0045.0	0050.5	5.5	1.10	"	"	"		"	"	22.1	0.06
"	"	"		"	"	0050.0	0055.4	4.9	0.98	"	"	"		"	"	"	0.06
"	"	"		"	20	0059.0	0066.5	7.5	1.50	"	"	"		"	"	27.1	0.09
"	"	"		"	"	0067.7	0074.0	6.7	1.34	"	"	"		"	"	"	0.08
"	"	"		"	"	0074.0	0080.0	6.0	1.20	"	"	"		"	"	"	0.07
"	"	"		"	25	0083.0	0091.3	8.3	1.66	"	"	"		"	"	32.1	0.09
"	"	"		"	"	0091.5	0099.3	8.0	1.60	"	"	"		"	"	"	0.09
"	"	"		"	30	0106.0	0115.7	9.7	1.94	"	"	"		"	"	37.1	0.11
"	"	"		"	"	0115.7	0127.9	9.2	1.84	"	"	"		"	"	"	0.10

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED FROM (feet)	SECTION TESTED TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS START (gall.)	WATER METER READINGS FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (Ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per ft)
	a	b		t	p	k	l	l - k = m	$\frac{m}{t}$	·	b - a = c	d*		‡0·44 sin θ(a+h) 1. 0·44 sin θ(d+h) 2.	$\frac{(a+h)e^{t}}{10}=f$	p + w - f = P	$\frac{m}{tc}$
Hole N° 3.																	
26/10/63	78' 0"	95' 8"	7.53 am	5	15	153·6	156·0	2·4	0·48	good	17' 8"	17' 4"		6·1	0·0	21·1	0·03
				"		156·0	158·1	2·1	0·42	"	"	"	EX flush jointed casing 1½" dia.	"	"	"	0·02
				"		158·1	160·1	2·0	0·40	"	"	"		"	"	"	0·02
				"	20	160·1	163·6	3·5	0·70	"	"	"		"	"	26·1	0·04
				"		163·6	166·1	2·5	0·50	"	"	"		"	"	"	0·03
			Stop watch timing.	"		166·1	168·4	2·3	0·46	"	"	"		"	"	"	0·03
				"	25	170·0	173·0	3·0	0 60	"	"	"		"	"	31·1	0·03
				"		173 0	175·8	2·9	0·58	"	"	"		"	"	"	0 03
				"		175·9	178·0	2·1	0·56	"	"	"		"	"	"	0·03
				"	30	180·8	184·2	3·4	0·68	"	"	"		"	"	36·1	0·04
				"		184·2	187·4	3·2	0 64	"	"	"		"	"	"	0·04
				"		187·4	190·7	3·3	0·66	"	"	"		"	"	"	0·04
				"	35	192·5	196·3	5·6	1·12	"	"	"		"	"	41·1	0·06
				"		196·3	199·9	3·6	0·72	"	"	"		"	"	"	0·04
				"		199·9	203·7	3·8	0·76	"	"	"		"	"	"	0·04
				"		203·7	207·4	3·7	0·74	"	"	"		"	"	"	0·04
				"	30	208·4	211·6	4·2	0·84	"	"	"		"	"	36·1	0·05
				"	25	212·8	215·6	2·8	0·56	"	"	"		"	"	31·1	0·03
30/10/63	93' 0"	113' 0"	11.05 am	5	5	160	208½	48½	9·7	Satisfactory	20' 0"	9' 1"		3·4	0·6	7·8	0·48
						270	328	58	11·6	"	"	"		"	"	"	0·58
						385	442	57	11·4	"		"		"	"	"	0·57
					10	480	548	68	13·6	"	"	"		"	0·9	12·5	0·68
						548	615	67	13·4	"	"	"	EX flush jointed casing 1½" dia.	"	"	"	0·67
			Stop watch timing.			615	681	66	13·2	"	"	"		"	"	"	0·66
					15	760	837	77	15·4	"	"	"		"	1·1	17·3	0·77
						837	910	63	12·6	"	"	"		"	0·8	17·6	0·63
						910	983	73	14·6	"	"	"		"	1·0	17·4	0·73
						983	1056	73	14·6	"	"	"		"	1·0	"	0·73
					20	1100	1186	86	17·2	"	"	"		"	1·5	21·9	0·86
						1300	1385	85	17·0	"	"	"		"	1·5	"	0·85
						1385	1467	82	16·4	"	"	"		"	1·3	22·1	0·82
					25	1630	1719	89	17·8	"	"	"		"	1·5	26·9	0·89
						1719	1806	87	17·4	"	"	"		"	"	"	0·87
						1806	1893	87	17·4	"	"	"		"	"	"	0·87
					20	1940	2016	76	15·2	"	"	"		"	1·1	22·3	0·76
					15	2025	2090½	65½	13·1	"	"	"		"	0·8	17·6	0·66
5/11/63	110' 0"	133' 0"	9.00 am	15		—	—				23' 0"	8' 7"					
					No back pressure				+ 44 gal/min	Open hole			EX flush jointed casing.				In excess of 1·9 g/m/ft.

Pump supplying 2600 gal per hour.
No water return from hole.

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

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DATE	SECTION TESTED FROM (feet)	SECTION TESTED TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS START (gall.)	WATER METER READINGS FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per ft.)
	a	b		t	p	k	l	l-k = m	$\frac{m}{t}$		b-a = c	d*		$^{\dagger}0.44 \sin\theta(a+h)$ 1. $0.44 \sin\theta(d+h)$ 2.	$\frac{(a+h)e^{\dagger}}{10}=f$	p+w-f = P	$\frac{m}{tc}$
~~Hole~~ No 3.																	
13/11/63	133' 0"	145' 0"	8.00 am	5	20	2358.0	2383.5	25.5	5.1	Satisfactory	10' 0"	9' 5"	EX flush jointed casing.	3.8	0.2	23.6	0.51
					"	2383.5	2410.5	27.0	5.4					"	0.2	23.6	0.54
					"	2410.5	2437.5	27.0	5.4					"	0.2	23.6	0.54
					25	2451.0	2497.0	46.0 (?)	9.2	Pressure				"	0.6	28.1	0.92 (?)
					"	2497.0	2514.0	17.0	3.4	of				"	0.1	28.7	0.34
					"	2514.0	2531.0	17.0	3.4	packer				"	0.1	28.7	0.34
					30	2546.0	2564.5	18.5	3.7	increased				"	0.1	33.7	0.37
					"	2564.5	2582.5	18.0	3.6	from 85 psi				"	0.1	33.7	0.36
					"	2582.5	2600.0	17.5	3.5	to 100 psi				"	0.1	33.7	0.35
					35	2620.0	2650.5	30.5 (?)	6.1	at a				"	0.3	38.5	0.61 (?)
					"	2650.5	2673.0	22.5	4.5	gauge				"	0.2	38.6	0.45
					"	2673.0	2694.5	21.5	4.3	pressure				"	0.2	38.6	0.43
					30	2700.0	2719.5	19.5	3.9	of 35 psi				"	0.1	33.7	0.39
					25	2723.0	2738.5	15.5	3.1					"	0.1	28.7	0.31
					20	2741.0	2755.5	14.5	2.9					"	0.1	23.7	0.29
15/11/63	139' 0"	158' 9"	1.35 pm	5	10	2830.4	2879.0	48.6	9.7	Good	19' 9"	10' 5"	EX flush jointed casing	4.0	0.8	13.2	0.49
					"	2879.0	2925.0	46.0	9.2	"				"	0.7	13.3	0.47
					"	2925.0	2970.0	45.0	9.0	"				"	0.7	13.3	0.46
					15	2990.0	3044.5	54.0	10.8	"				"	0.8	18.2	0.55
					"	3044.5	3098.0	54.0	10.8	"				"	0.8	18.2	0.55
					"	3098.0	3152.0	54.0	10.8	"				"	0.8	18.2	0.55
					20	3181.0	3243.5	62.5	12.5	"				"	1.1	22.9	0.63
					"	3243.5	3305.0	61.5	12.3	"				"	1.1	22.9	0.62
					"	3305.0	3367.0	62.0	12.4	"				"	1.1	22.9	0.63
					25	3395.0	3467.0	72.0	14.4	"				"	1.3	27.7	0.73
					"	3467.0	3538.0	71.0	14.2	"				"	1.3	27.7	0.72
					"	3538.0	3607.5	69.5	13.9	"				"	1.3	27.7	0.71
					"	3607.5	3677.0	69.5	13.9	"				"	1.3	27.7	0.71
					20	3695.0	3757.0	62.0	12.4	"				"	1.1	22.9	0.63
					15	3765.0	3817.0	52.0	10.4	"				"	0.8	18.2	0.53
22/11/63	158' 6"	178' 6"	2.50 pm	5	5	4020	4103	83	16.6	Good	20' 0"	8' 2"	EX flush jointed casing	2.8	2.2	5.6	0.83
					"	4103	4186	83	16.6	"				"	2.2	5.6	0.83
					"	4186	4268	82	16.4	"				"	2.2	5.6	0.82
					10	4310	4421	111	22.2	"				"	4.4	8.4	1.11
					"	4421	4530	109	21.8	"				"	3.6	9.2	1.09
					"	4530	4638	108	21.6	"				"	3.6	9.2	1.08
					15	4700	4834	134	26.8	"				"	5.8	12.0	1.34
					"	4834	4967	133	26.6	"				"	5.7	12.1	1.33
					"	4967	5098	131	26.2	"				"	5.2	12.6	1.31
					10	5140	5244	104	20.8	"				"	3.3	11.5	1.04
					5	5270	5342	72	14.4	"				"	1.7	6.1	0.72

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

For explanatory notes, see page 1 of Append

DATE	SECTION TESTED FROM (feet)	SECTION TESTED TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS START (gall.)	WATER METER READINGS FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per ft)
	a	b		t	p	k	l	l - k = m	$\frac{m}{t}$		b - a = c	d*		‡ $0{\cdot}44 \sin\theta(a+h)$ 1. ‡ $0{\cdot}44 \sin\theta(d+h)$ 2.	$\frac{(a+h)e^{t}}{10} = f$	p + w - f = P	$\frac{m}{tc}$
Hole	N°3.																
25/11/63	178' 0"	188' 0"	8.40 am Stop watch timing	5	10	381.0	402.7	15.7	3.1	Satisfactory	10' 0"	7' 10"	EX flush jointed casing.	3.7	0.1	13.8	0.31
					"	402.7	417.4	14.1	2.9	"				"	0.1	"	0.29
					"	417.4	431.5	14.1	2.8	"				"	0.1	"	0.28
					"	431.5	445.1	13.6	2.7	"				"	0.1	"	0.27
					20	463.3	482.7	19.4	3.9	"				"	0.2	23.5	0.39
					"	482.7	501.6	18.9	3.8	"				"	0.2	"	0.38
					"	501.6	520.1	18.5	3.7	"				"	0.2	"	0.37
					30	546.0	570.2	24.2	4.8	"				"	0.2	33.5	0.48
					"	570.2	594.2	24.0	4.8	"				"	0.3	"	0.48
					"	594.2	617.7	23.5	4.7	"				"	0.3	"	0.47
					40	646.0	673.7	27.7	5.5	"				"	0.4	43.3	0.55
					"	673.7	700.9	27.2	5.4	"				"	0.4	"	0.54
					"	700.9	727.9	27.9	5.6	"				"	0.4	"	0.56
					30	735.0	757.0	22.0	4.4	"				"	0.3	33.4	0.44
					20	766.0	783.1	17.1	3.4	"				"	0.2	23.5	0.34
					10	787.0	797.2	10.2	2.0	"				"	0.0	13.7	0.20
26/11/63	187' 0"	208' 0"	1.40 pm Stop watch timing	5	10	807.0	810.5	3.5	0.7	Satisfactory	21' 0"	8' 4"	EX flush jointed casing	3.4	0.0	13.4	0.03
					"	810.5	814.0	3.5	0.7	"	"			"	"	"	0.03
					"	814.0	817.6	3.6	0.7	"	"			"	"	"	0.03
					20	819.0	824.9	5.9	1.2	Some leakage of packer	"			"	"	23.4	0.05
					"	824.9	831.4	6.5	1.3		"			"	"	"	0.06
					"	831.4	840.1	8.7	1.7		"			"	"	"	0.08
					"	840.1	847.4	7.3	1.5		"			"	"	"	0.07
					30	868.0	875.1	7.1	1.4		"			"	"	33.4	0.07
					"	875.1	882.0	6.9	1.4	Satisfactory	"			"	"	"	0.01
					"	882.0	888.8	6.8	1.4	"	"			"	"	"	0.07
					40	892.2	902.3	10.1	2.0	"	"			"	"	43.4	0.09
					"	902.3	912.9	10.6	2.1	"	"			"	"	"	0.10
					"	912.9	922.9	10.0	2.0	"	"			"	"	"	0.09
					30	924.1	930.4	6.3	1.3	"	"			"	"	33.4	0.06
					20	931.5	936.0	4.5	0.9	"	"			"	"	23.4	0.04
29/11/63	207' 0"	222' 9"	9.30 am. Stop watch timing.	5	10	982.5	986.6	4.1	0.8	Satisfactory	15' 9"	7' 11"	EX flush jointed casing.	3.2	0.0	13.2	0.05
					"	986.6	990.9	4.3	0.9	"				"	"	"	0.05
					"	990.9	994.9	4.0	0.8	"				"	"	"	0.05
					20	1013.4	1019.1	5.7	1.1	"				"	"	23.2	0.09
					"	1019.1	1024.9	5.8	1.2	"				"	"	"	0.10
					"	1024.9	1030.3	5.4	1.1	"				"	"	"	0.07
					30	1035.0	1043.8	8.8	1.8	"				"	"	33.2	0.11
					"	1043.8	1051.9	8.1	1.6	"				"	"	"	0.10
					"	1051.9	1060.1	8.2	1.6	"				"	"	"	0.10
					40	1062.0	1071.8	9.8	1.9	"				"	"	43.2	0.12
					"	1071.8	1081.6	9.8	1.9	"				"	"	"	0.12
					"	1081.6	1091.1	9.5	1.9	"				"	"	"	0.12
					30	1093.0	1100.6	7.6	1.5	"				"	"	33.2	0.10
					20	1112.5	1118.2	5.7	1.1	"				"	"	23.2	0.07
					10	1119.3	1123.0	3.7	0.7	"				"	"	13.2	0.05

BUREAU OF MINERAL RESOURCES

DARWIN RIVER WATER STORAGE SCHEME

WATER PRESSURE TEST RESULTS

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED		TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS		WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (Ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per Ft.)
	FROM (feet)	TO (feet)				START (gall.)	FINISH (gall.)										
	a	b		t	p	k	l	l-k = m	$\frac{m}{t}$		b-a = c	d*		‡0·44 sin θ(a+h) 1. ‡0·44 sin θ(d+h) 2.	$\frac{(a+h)e^{\dagger}}{10}=f$	p+w-f = P	$\frac{m}{tc}$
Hole N°3																	
30/11/63	222' 0"	238' 6"	3.15 pm	5	10	5475	5524	49	9.2	Satisfactory	16' 6"	8' 1"	Ex flush jointed casing.	3.1	0.7	12.4	0.56
			Stop watch timing	"		5524	5572	48	9.6					"	0.8	12.3	0.57
				"		5572	5620	48	9.6					"	0.8	12.5	0.58
				"	20	5668	5737	69	13.8					"	1.4	21.7	0.84
				"		5737	5805	68	13.6					"	1.4	21.7	0.82
				"		5805	5873	68	13.6					"	1.4	21.7	0.82
				"	30	5920	6003	83	16.6					"	2.0	31.1	1.00
				"		6003	6083	80	16.0					"	1.9	31.2	0.97
				"		6083	6160	77	15.4					"	1.7	31.4	0.93
				"	40	6195	6290	95	19.0					"	2.5	40.6	1.15
				"		6290	6384	94	18.8					"	2.5	40.6	1.14
				"		6384	6472	88	17.6					"	2.2	40.9	1.07
				"		6472	6562	90	18.0					"	2.3	40.8	1.09
				"	30	6580	6653	73	14.6					"	1.6	31.5	0.88
				"	20	6668	6723	55	11.0					"	1.0	22.1	0.67
				"	10	6735	6773	38	7.6					"	0.4	12.7	
6/12/63	233' 0"	250' 6"	9.55 am	5	10	7260	7308	48	9.6	Satisfactory	17' 6"	8' 9"	Ex flush jointed casing	3.0	0.8	12.2	0.55
			Stop watch timing.	"		7308	7358	50	10.0					"	0.8	12.2	0.57
				"		7358	7407	49	9.8					"	0.8	12.2	0.56
				"	20	7460	7532	72	14.4					"	1.5	21.5	0.82
				"		7532	7601	69	13.8					"	1.5	21.5	0.79
				"		7601	7671	70	14.0					"	1.5	21.5	0.80
				"	30	7750	7836	86	17.2					"	2.15	30.9	0.98
				"		7836	7922	86	17.2					"	2.1	30.9	0.98
				"		7922	8006	84	16.8					"	2.0	31.0	0.96
				"	40	8070	8172	102	20.4					"	2.8	40.2	1.17
				"		8172	8274	102	20.4					"	2.8	40.2	1.17
				"		8274	8374	100	20.0					"	2.8	40.2	1.14
				"	30	8430	8512	82	16.4					"	2.0	31.0	0.94
				"	20	8530	8692	62	12.4					"	1.2	21.8	0.71

WATER PRESSURE TEST RESULTS

1st Saddle I.3.

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED FROM (feet)	SECTION TESTED TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS START (gall.)	WATER METER READINGS FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (Ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per Ft.)
	a	b		t	p	k	l	l-k = m	$\frac{m}{t}$		b - a = c	d*		‡ 0·44 sin θ(a+h) 1. 0·44 sin θ(d+h) 2.	$\frac{(a+h)e^{\dagger}}{10}=f$	p + w - f = P	$\frac{m}{tc}$
30-6-64	6' 6"	18' 6"	3.50 p.m.	5	No pressure obtained	475·0	535·0	60·0	12·0	Good	12'	-		4·24	0·8	4·16	1·00
						535·0	592·0	57·0	11·4						"	"	0·95
						592·0	648·0	56·0	11·2						"	"	0·93
1-7-64	6' 6"	18' 6"	8.30 a.m.	5	"	685·0	855·0	170·0	34·0	Good	12'	-		4·24	5·0	0·00	2·80
						855·0	1026·0	171·0	34·2						"	"	2·90
	Re-tested with Rex Pump (2680 gph)					1026·0	1197·0	171·0	34·2						"	"	2·90
						197·0	369·0	172·0	34·4						"	"	2·90
2-7-64	18' 4"	32' 4"	8-45 a.m.	5	4	430·0	483·0	53·0	10·6	Good	14'	19' 4"		9·2	0·5	12·7	0·75
						483·0	535·0	52·0	10·4						"	"	0·74
						535·0	587·0	52·0	10·4						"	"	0·74
					8	650·0	713·0	63·0	12·6						0·8	16·4	0·90
						713·0	776·0	63·0	12·6						"	"	0·90
						776·0	838·0	62·0	12·4						"	"	0·89
					12	860·0	930·0	70·0	14·0						1·2	20·0	1·00
						930·0	999·0	69·0	13·8						"	"	0·98
						999·0	1069·0	70·0	14·0						"	"	1·00
3-7-64	31' 10"	45' 10"	10-30 a.m.	5	8	87·0	88·0	1·0	0·2	Good	14'	18' 4"		9·5		17·5	0·01
						88·0	88·5	0·5	0·1							"	0·01
						88·5	89·0	0·5	0·1							"	0·01
					16	90·0	90·5	0·5	0·1							25·5	0·01
						90·5	91·5	1·0	0·2							"	0·01
						91·5	92·5	1·0	0·2							"	0·01
					24	93·0	94·0	1·0	0·2							33·5	0·01
						94·0	95·0	1·0	0·2							"	0·01
						95·0	96·0	1·0	0·2							"	0·01
4-7-64	45'	60'	11·00 a.m.	5	12	101·5	101·5	0·00	0·00	Good	15'	18' 3"		8·2		20·2	0·00
						101·5	101·5	0·00	0·00							"	0·00
						101·5	101·5	0·00	0·00							"	0·00
					24	102·0	102·0	0·00	0·00							32·2	0·00
						102·0	102·0	0·00	0·00							"	0·00
						102·0	102·0	0·00	0·00							"	0·00
					36	104·0	105·0	1·0	0·2							44·2	0·01
						105·0	106·5	1·5	0·3							"	0·02
						106·5	107·5	1·0	0·2							"	0·01
7-7-64	60'	75'	10-20 a.m.	5	10	38·0	38·5	0·5	0·1	Good	13'	18' 2"		8·2		18·2	0·01
						38·5	39·5	1·0	0·2							"	0·01
						39·5	40·0	0·5	0·1							"	0·01
					20	40·5	42·0	1·5	0·3							28·2	0·02
						42·0	43·0	1·0	0·2								0·01
						43·0	44·5	1·5	0·3								0·02
					30	45·0	47·0	2·0	0·4							38·2	0·03
						47·0	49·5	2·5	0·5								0·03
						49·5	51·5	2·0	0·4								0·03
					40	52·5	56·0	3·5	0·7							48·2	0·05
						56·0	59·5	3·5	0·7								0·05
						59·5	62·5	3·0	0·6								0·04

D.D.17.

WATER PRESSURE TEST RESULTS

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED FROM (feet)	TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS START (gall,)	FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (Ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per ft.)
	a	b		t	p	k	l	L-k = m	$\frac{m}{t}$		b - a = c	d*		‡0·44 sin θ(a+h) 1. ‡0·44 sin θ(d+h) 2.	$\frac{(a+h)e^{\dagger}}{10}=f$	p + w - f = P	$\frac{m}{tc}$
17.4.64	0	10'2"	Gravity Tests					0.00		Good	10'2"	4'		00	0	0	0.00
22.4.64	0	19'9"	•	15 mins				0.00			19'6'	4'		00			0.00
29.4.64	19'6"	30'6"	1.05 Pm	5	5	622.8	622.8	0.00	0:00	•	11'	4'11"		2.4	0	7.4	0.00
						622.8	622.8	0.00	0.00							"	0.00
						622.8	622.8	0.00	0.00							"	0.00
				10	10	623.0	623.1	0.10	0.01							12.4	0.00
						623.1	623.2	0.10	0.01							"	0.00
					15	623.4	623.6	0.20	0.02							17.4	0.00
						623.6	623.7	0.10	0.01							"	0.00
						623.7	623.8	0.10	0.01							"	0.00
30.4.64	30'6"	40'6"	4.45 Pm	5	10	626.8	627.1	0.3	0.06	•	10'	4'7"		3.7	0	13.7	0.01
						627.1	627.3	0.2	0.04							•	0.00
						627.3	627.5	0.2	0.04							•	0.00
					20	627.6	627.8	0.2	0.04							23.7	0.00
						627.8	628.1	0.3	0.06							•	0.01
						628.1	628.3	0.2	0.04							•	0.00
					30	628.7	629.3	0.6	0.12							33.7	0.01
						629.3	629.7	0.4	0.08							•	0.01
						629.7	630.2	0.5	0.10							"	0.01
5.5.64	36'4"	50'4"	2.45 Pm	5	10	631.9	631.9	0.00	0.00		14'	7'6"		3.5	0	13.5	0.00
						631.9	631.9	0.00	0.00							•	0.00
						631.9	631.9	0.00	0.00							•	0.00
					20	632.4	632.4	0.00	0.00							23.5	0.00
						632.4	632.4	0.00	0.00							•	0.00
						632.4	632.4	0.00	0.00							•	0.00
					30	632.6	632.7	0.10	0.02							33.5	0.00
						632.7	632.8	0.10	0.02							•	0.00
						632.8	632.9	0.10	0.02							"	0.00
					40	633.1 air Supply	Plastic Tube - 'blow out'									43.5	

DARWIN RIVER WATER STORAGE SCHEME - UPPER PONDAGE SITE "A"

Bureau of Mineral Resources

D.D.19.

WATER PRESSURE TEST RESULTS

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED FROM (feet)	SECTION TESTED TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS START (gall.)	WATER METER READINGS FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per ft.)
	a	b		t	p	k	l	$l-k=m$	$\frac{m}{t}$		$b-a=c$	d^{*}		$\ddagger 0.44\sin\theta(a+h)$ 1. $0.44\sin\theta(d+h)$ 2.	$\frac{(a+h)e^{\dagger}}{10}=f$	$p+w-f=P$	$\frac{m}{tc}$
8.5.64	0'	13'11"	GRAVITY TESTS	2 min 54 secs				1.00	0.35	GOOD	13.9'	1'2"		0.5	0	0.5	0.03
				2 min 40 secs				1.00	0.38							"	0.03
				2 min 5 secs				1.00	0.48							"	0.03
				2 min 60 secs				1.00	0.36							"	0.03
11.5.64	13'6"	20'6"	11 am	5	3	637.10	637.10	0.00	0.00	"	7'	1'2"		1.4	0	4.4	0.00
						637.10	637.20	0.10	0.02							"	0.00
						637.20	637.30	0.10	0.02							"	0.00
					6	637.5	637.6	0.10	0.02							7.4	0.00
						637.6	637.7	0.10	0.02							"	0.00
						637.7	637.7	0.00	0.00							"	0.00
					9	637.8	637.9	0.10	0.02							10.4	0.00
						637.9	638.0	0.10	0.02							"	0.00
						638.0	638.1	0.10	0.02							"	0.00

DARWIN RIVER WATER STORAGE SCHEME-UPPER PONDAGE SITE "A"

BUREAU OF MINERAL RESOURCES

D.D.R11.

WATER PRESSURE TEST RESULTS

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED FROM (feet)	SECTION TESTED TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS START (gall.)	WATER METER READINGS FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (Ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per Ft.)
	a	b		t	p	k	l	l-k = m	$\frac{m}{t}$		b - a = c	d*		‡0·44 sin θ(a+h) 1. 0·44 sin θ(d+h) 2.	$\frac{(a+h)e^{†}}{10}=f$	p + w - f = P	$\frac{m}{tc}$
14.5.64	9'	19'	3.35 Pm	5	3	640.3	640.3	0.00	0.00	Satisfactory	10'	2.1'		1.2	0	4.2	0.00
						640.3	640.4	0.10	0.02			vertically				"	"
						640.4	640.5	0.10	0.02							"	"
					6	640.6	640.7	0.10	0.02							7.2	"
						640.7	640.7	0.00	0.00							"	"
						640.7	640.7	0.00	0.00							"	"
					9	640.8	640.8	0.00	0.00							10.2	"
						640.8	640.9	0.10	0.02							"	"
						640.9	640.9	0.00	0.00							"	"
15.5.64	19'	20'	1.20 Pm	5	5	643.2	645.5	2.3	0.46	"	11'	12'		0.9	0	5.9	0.04
						645.5	647.9	2.4	0.48							"	0.04
						647.9	650.1	2.2	0.44							"	0.04
					10	651.5	655.4	3.9	0.78							10.9	0.07
						655.4	659.1	3.7	0.74							"	0.07
						659.1	663.0	3.9	0.78							"	0.07
					15	664.0	669.7	5.7	1.14							15.9	0.10
						669.7	675.2	5.5	1.10							"	0.10
						675.2	680.7	5.5	1.10							"	0.10
16.5.64	30'	44'	1.50 Am	5	10	300.0	305.0	5.0	1.0	"	14'	1.7'		0.9	0	10.9	0.07
						305.0	309.5	4.5	0.9							"	0.07
						309.5	313.5	4.0	0.8							"	0.06
					18	316.0	326.6	10.5	2.1							18.9	0.15
						326.5	335.0	9.0	1.8							"	0.13
						335.0	342.5	7.5	1.5							"	0.11
						342.5	351.0	8.5	1.7							"	0.12
					26	354.0	366.0	12.0	2.4							26.9	0.17
						366.0	377.5	11.5	2.3							"	0.16
						377.5	389.0	11.5	2.3							"	0.16
19.5.64	43'6"	55'0"	1.30 pm	5	10	113.0	127.0	14.0	2.8	"	11'6"	1.6'		1.3	0	11.3	.24
						127.0	140.0	13.0	2.6							"	.23
						140.0	152.5	12.5	2.5							"	.22
					20	171.0	192.0	21.0	4.2							21.3	.35
						192.0	211.5	19.5	3.9							"	.33
						211.5	231.0	19.5	3.9							"	.33
					30	240.0	266.0	26.0	5.2							31.3	.45
						266.0	292.0	26.0	5.2							"	.45
						292.0	316.5	24.5	4.9							"	.42
						316.5	341.0	24.5	4.9							"	.42
20.5.64	54'6"	69'0"	2.00 Pm	5	10	350.0	367.0	17.0	3.4	Good	14'6"	2.1'		1.5	0	11.5	.23
						367.0	381.0	14.0	2.8							"	.19
						381.0	393.0	12.0	2.4							"	.17
						406.5	406.5	13.5	2.7							"	.18
					20	417.0	442.5	25.5	5.1							21.5	.35
						442.5	467.0	24.5	4.9							"	.34
						467.0	491.0	24.0	4.8							"	.33
					30	503.0	535.5	32.5	6.5							31.5	.45
						535.5	568.0	32.5	6.5							"	.45
						568.0	598.0	30.0	6.0							"	.42

DARWIN RIVER WATER STORAGE SCHEME - LOWER PONDAGE SITE "B"

Bureau of Mineral Resources

D.D.R11.

WATER PRESSURE TEST RESULTS

For explanatory notes, see page 1 of Appendix.

DATE	SECTION TESTED FROM (feet)	SECTION TESTED TO (feet)	TIME OF START OF TEST	TIME OF TEST (min.)	GAUGE PRESSURE (p.s.i)	WATER METER READINGS START (gall.)	WATER METER READINGS FINISH (gall.)	WATER LOSS (gall.)	LEAKAGE RATE (g.p.m.)	SEALING PROPERTIES	LENGTH OF SECTION (Feet)	DEPTH OF STANDING WATER (ft.)	SIZE OF ROD	WATER COLUMN PRESSURE (p.s.i.)	FRICTION HEAD LOSS (p.s.i.)	EFFECTIVE TEST PRESSURE (p.s.i.)	WATER LOSS (g.p.m. per Ft.)
	a	b		t	p	k	l	l-k = m	$\frac{m}{t}$		b - a = c	d*		‡0.44 sin θ(a+h) 1. 0.44 sin θ(d+h) 2.	$\frac{(a+h)e^{\dagger}}{10}=f$	p + w - f = P	$\frac{m}{tc}$
21.5.64	68' 9"	85' 3"	1.45 pm	5	10			Packer Blow-Out		SATISFACTORY	16' 6"						
	67' 11"	85' 3"	2.30 pm	5	9	666.0	720.0	54.0	10.8		17' 4"	1.8		1.5	0.6	10.5	0.63
						720.0	772.5	52.5	10.5						"	"	0.61
						772.5	825.5	53.0	10.7						"	"	0.62
	74' 0"	85' 3'	3.45 pm			HIGHER PRESSURE CAN NOT BE OBTAINED.					11' 3"						
						NOTE: LARGE WATER LOSSES PAST PACKER AT 74'. STRATA VERY POROUS											
29.5.64	85'	100' 4"	9.10 am	5	10	450.0	489.0	39.0	7.8	GOOD	15' 4"	1.1		0.9	0.4	10.5	0.51
						489.0	526.0	37.0	7.4						0.4	"	0.48
						526.0	563.0	37.0	7.4						0.4	"	0.48
					20	585.0	647.0	62.0	12.4						0.9	20.0	0.81
						647.0	708.5	61.5	12.3						0.9	"	0.81
						708.5	769.0	60.0	12.0						0.9	"	0.79
					30	800.0	883.5	83.5	16.7						1.4	29.5	1.09
						883.5	964.0	80.5	16.0						1.4	"	1.04
						964.0	1045.0	81.0	16.2	WATER BY-PASSING SEAL, FLOWING OUT OF					1.4	"	1.06
					34.5	1105.0	1194.0	89.0	17.8	HOLE APPROX. 5.7 GALLS PER 5MINS,					1.5	33.9	1.16
						1194.0	1283.0	89.0	17.8	CHECKED WITH 1GALL. TIN.					1.5	"	1.16
						1283.0	1372.0	89.0	17.8						1.5	"	1.16

DARWIN RIVER WATER STORAGE SCHEME - LOWER PONDAGE SITE "B"

Bureau of Mineral Resources

Fig. 1

Darwin River Dam Site - Railway cutting, northern face. Interbeds of schist and quartzite are contorted into a recumbent anticlinal fold, plunging to the south-west at 35 degrees.

Fig. 2

Darwin River R.A.A.F. quarry. Interbeds of quartzite and schist have been folded into a tight anticlinal structure; the axis of the fold plunges 30°S.

Fig. 1

Upper Pondage Site A - southern abutment. Sandstones of the Depot Creek Sandstone Member (?) have been silicifed to a closely jointed pale pink orthoquartzite. Seismic evidence indicates deep weathering at the site.

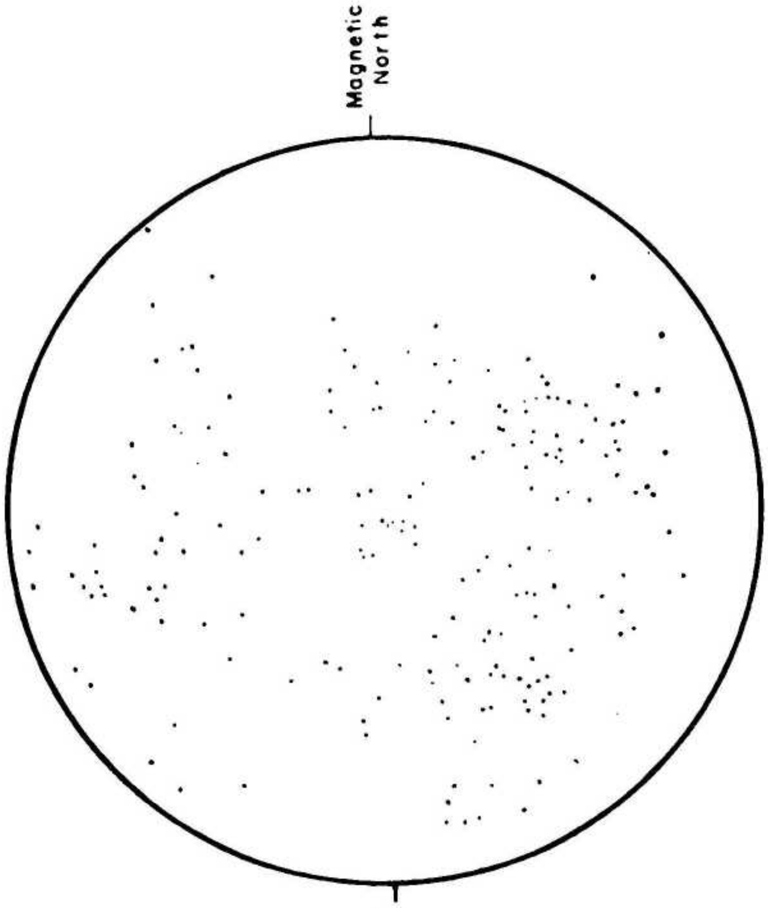
Fig. 2

Lower Pondage Site B - northern abutment. The Depot Creek Sandstone Member(?) strikes at 090° and dips at approximately 20° to the south. A lens of sandstone breccia can be seen in pale pink closely jointed sandstone.

PLATE 3

DARWIN RIVER WATER STORAGE SCHEME

JOINT STEREOGRAM OF PONDAGE SITE B



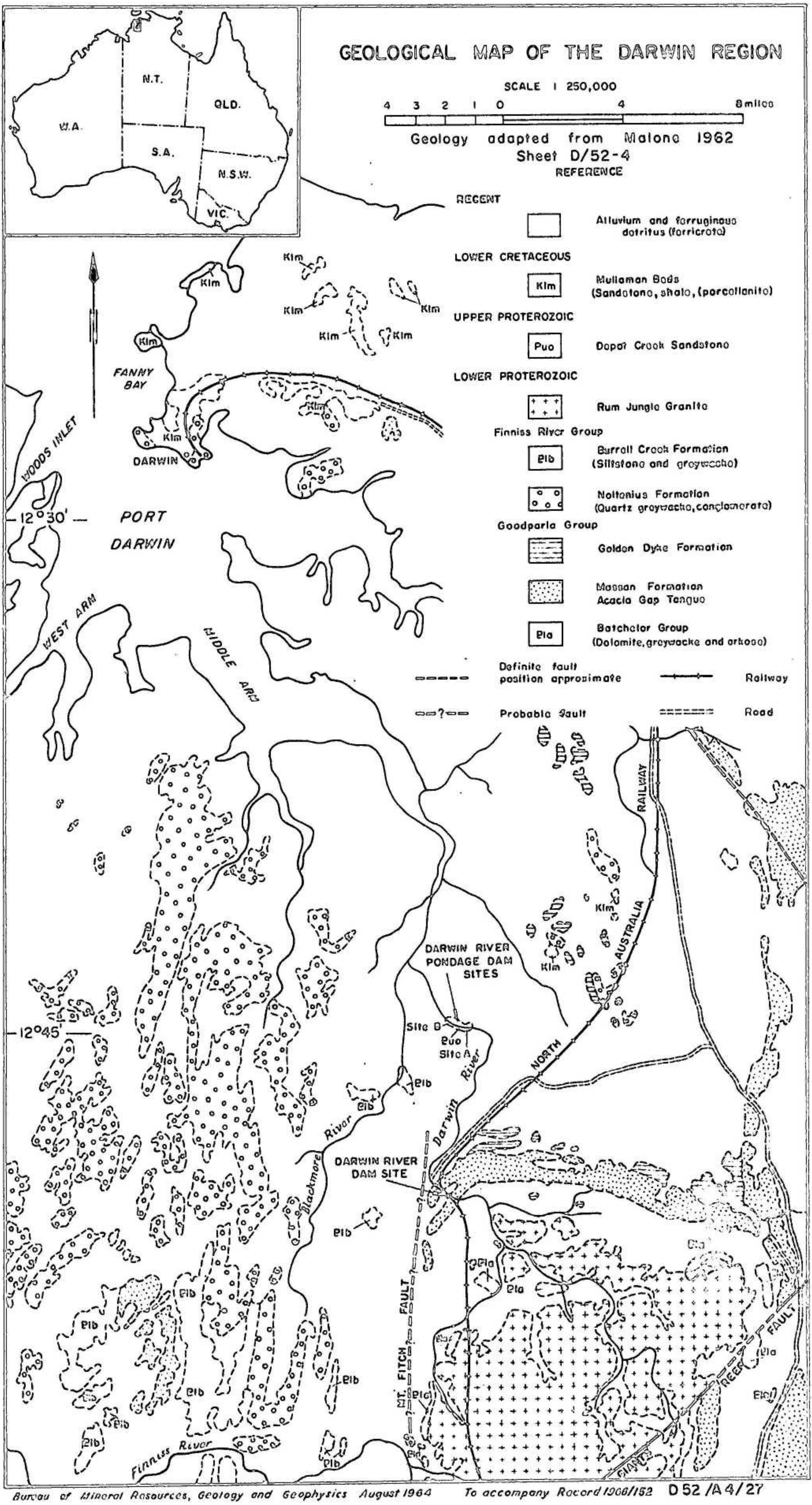
Poles of joint planes are plotted on Wulff net.

Bottom Hemisphere Projection

D52/A4/50

Bureau of Mineral Resources, Geology and Geophysics August 1965 To accompany Record 1966/152

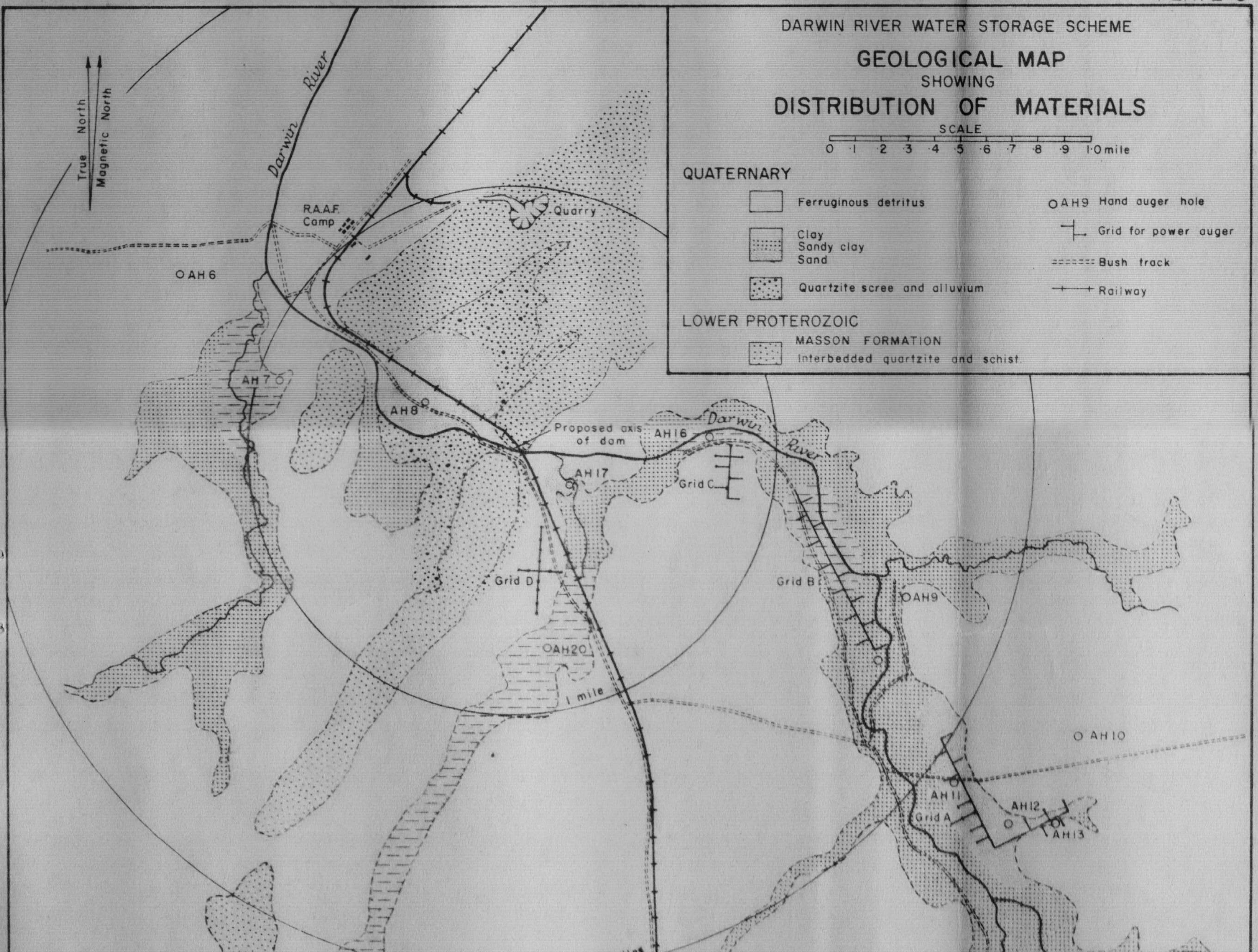
PLATE 4



GEOLOGICAL MAP OF THE DARWIN REGION

Bureau of Mineral Resources, Geology and Geophysics August 1964 To accompany Record 1968/162 D52/A4/27

PLATE 5



Bureau of Mineral Resources, Geology and Geophysics September 1964

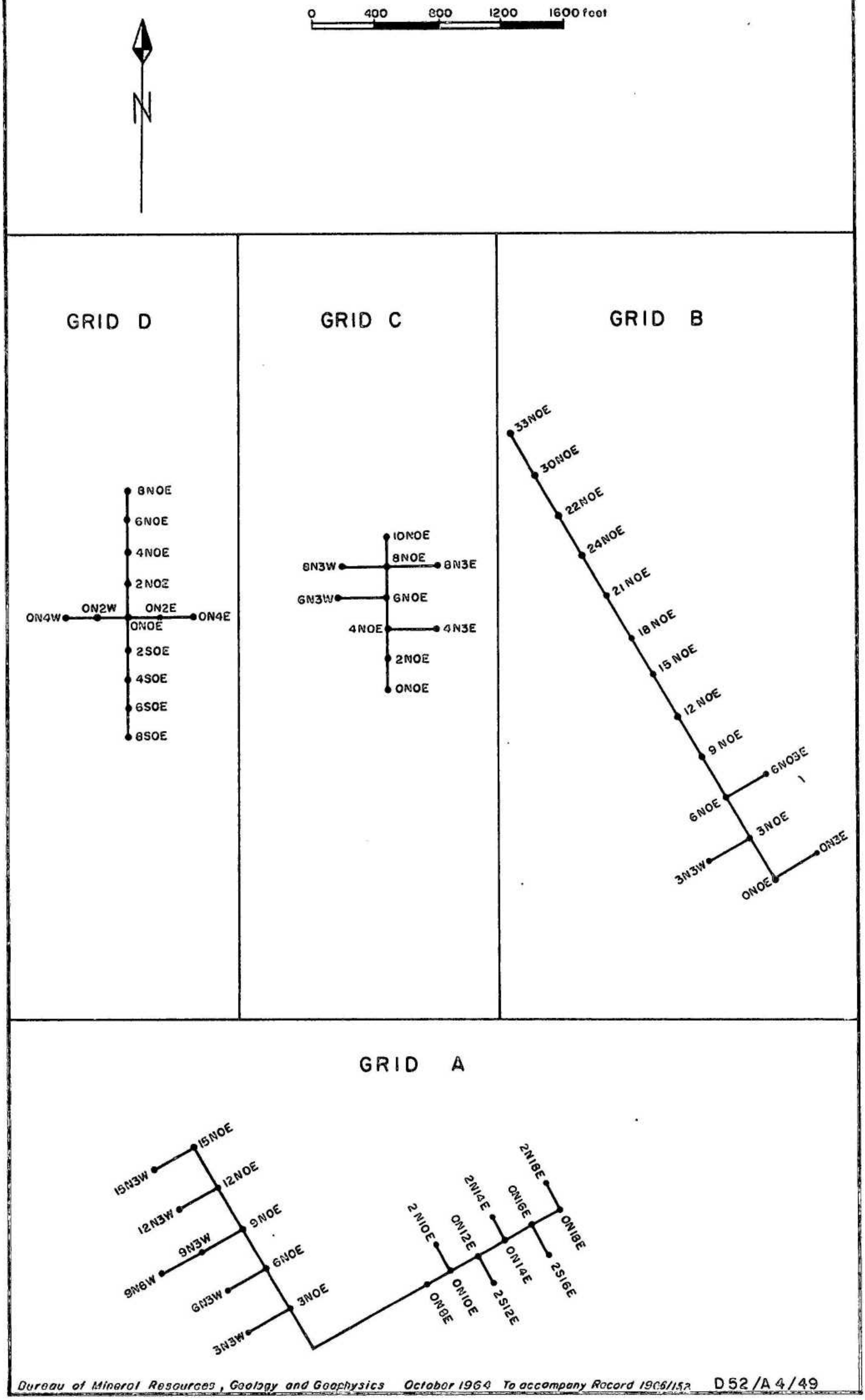
To accompany Record No 1966/152

D52/A4/28

PLATE 6

DARWIN RIVER WATER STORAGE SCHEME

Layout of auger holes for construction materials
Sections shown on plate 7 and locality on plate 5



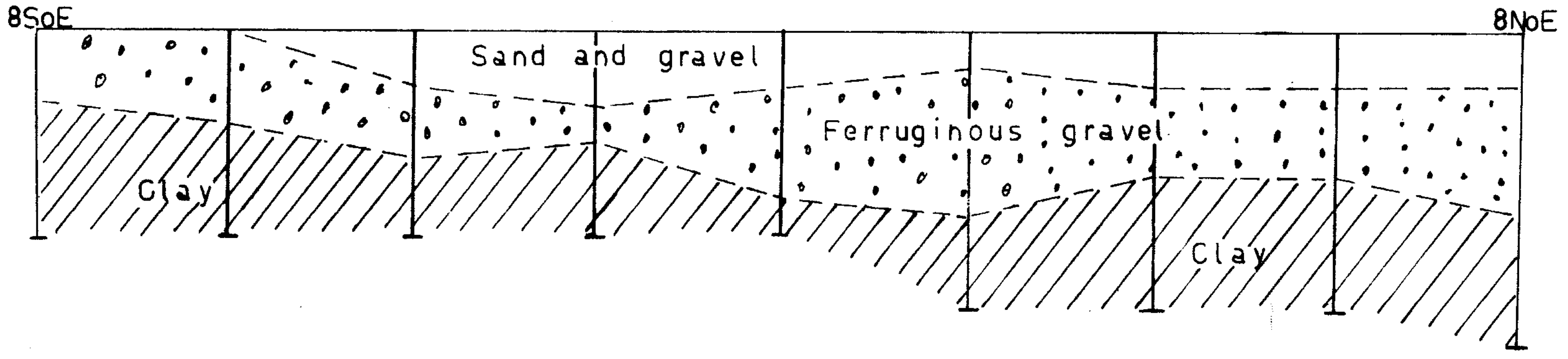
Bureau of Mineral Resources, Geology and Geophysics October 1964 To accompany Record 1966/152 D52/A4/49

DARWIN RIVER WATER STORAGE SCHEME

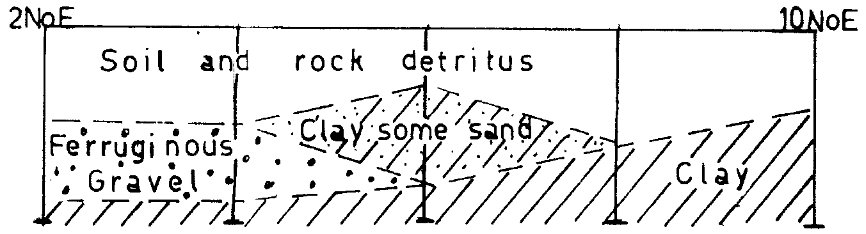
Interpretative geological sections through auger holes.

SCALE 0 100 200 300 400 FEET

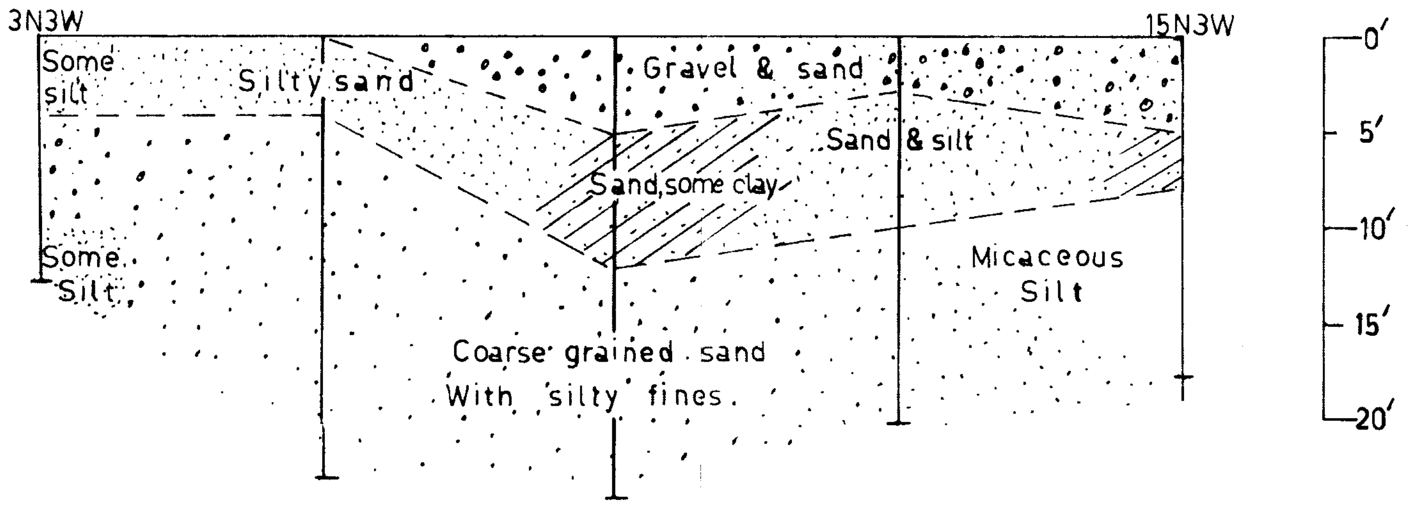
GRID D



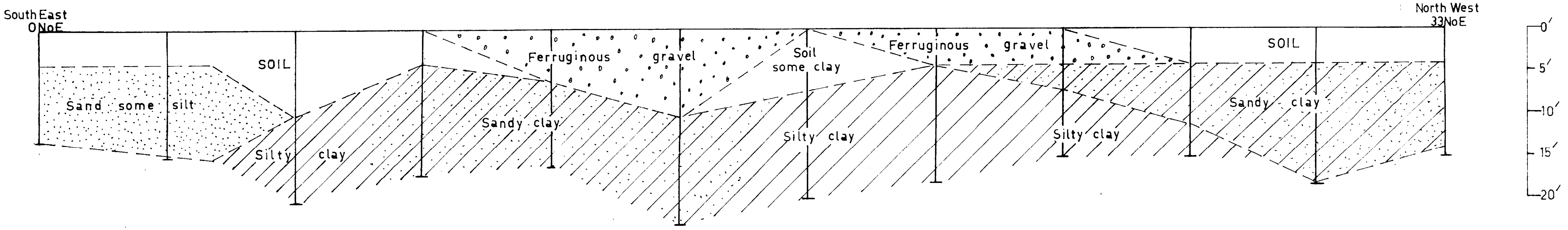
GRID C

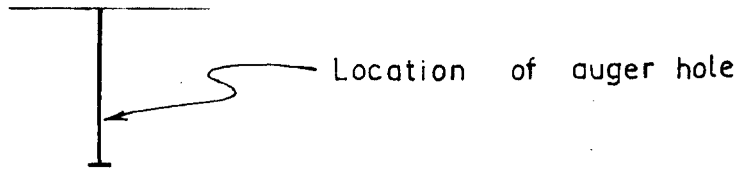


GRID A



GRID B



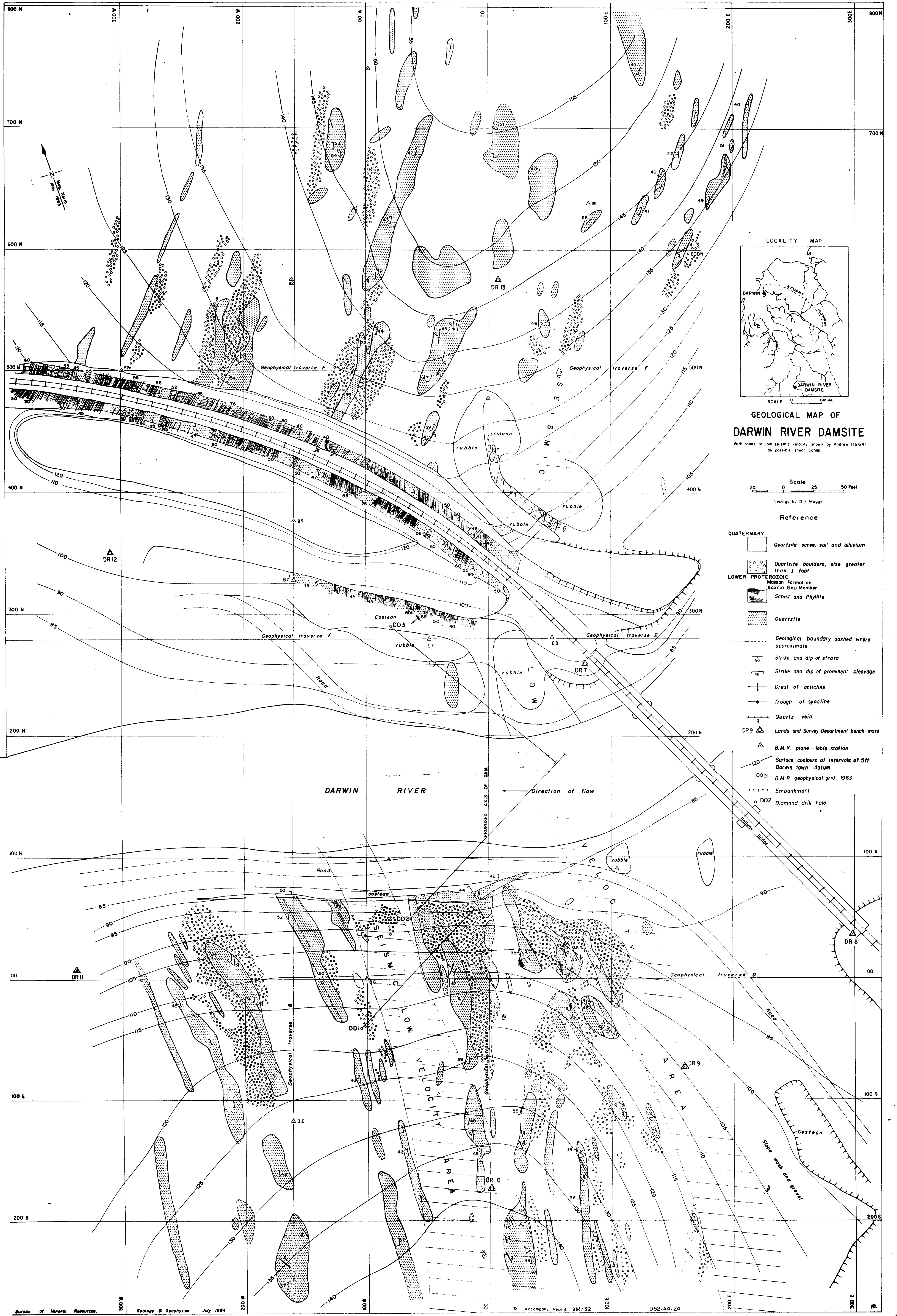


Bureau of Mineral Resources, Geology and Geophysics. August 1964.

D 52/A4/51

To accompany Record *1966/152*

PLATE 8


GEOLOGICAL MAP OF
DARWIN RIVER DAMSITE
With zones of low seismic velocity shown by Andrew (1964) as possible shear zones

Bureau of Mineral Resources, Geology & Geophysics. July 1964.

To Accompany Record 1968/152

D52/A4/24

PLATE 9

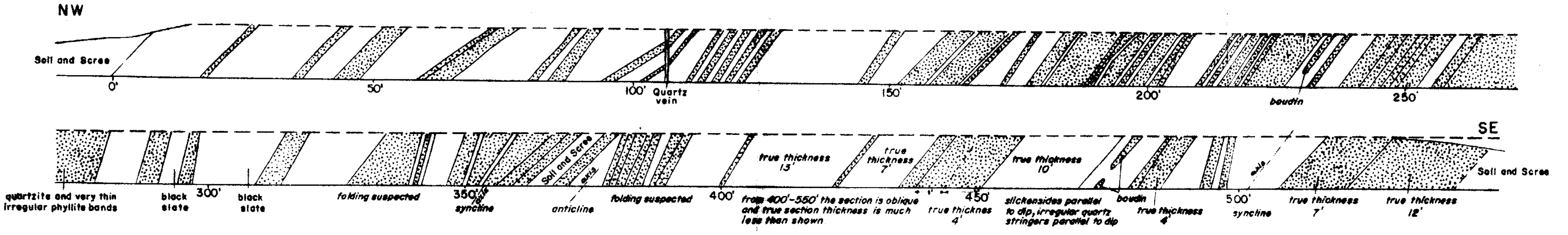
DARWIN RIVER DAM SITE

VERTICAL SECTIONS ALONG RAILWAY CUTTING AND COSTEANS SHOWING GEOLOGICAL OBSERVATIONS

(See Plate 8 for location)

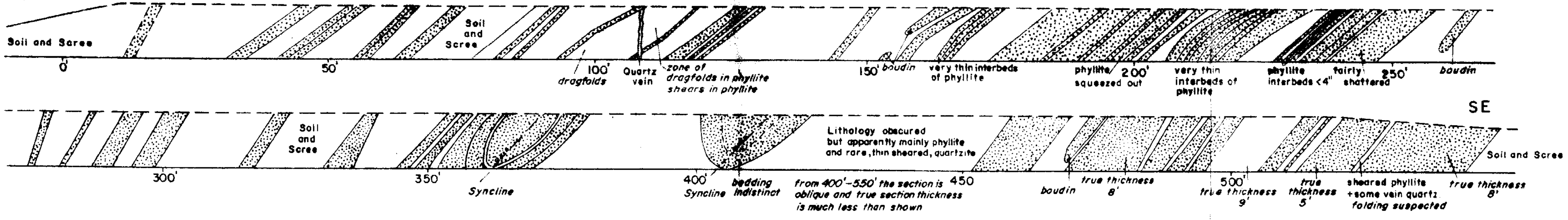
NE. Face of Railway Cutting (looking from SW)

Shows bottom 10' only

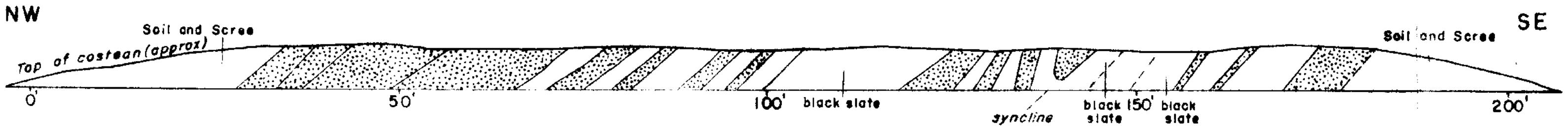


SW. Face of Railway Cutting (looking from SW)

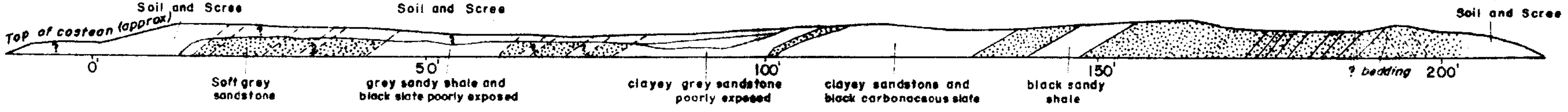
Shows bottom 10' only



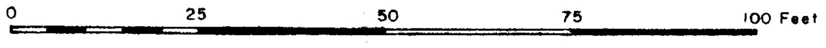
Face of Costean on NW side of River (looking from SW)



Face of Costean on SE side of River (looking from SW)



Horizontal and Vertical scale



▨ *Quartzite*

☐ *Phyllite, shale*

geology by J. Barclay and J. Shields

Bureau of Mineral Resources. Geology and Geophysics *April 1964* *To accompany Record 1966/152*

D52/A4/21

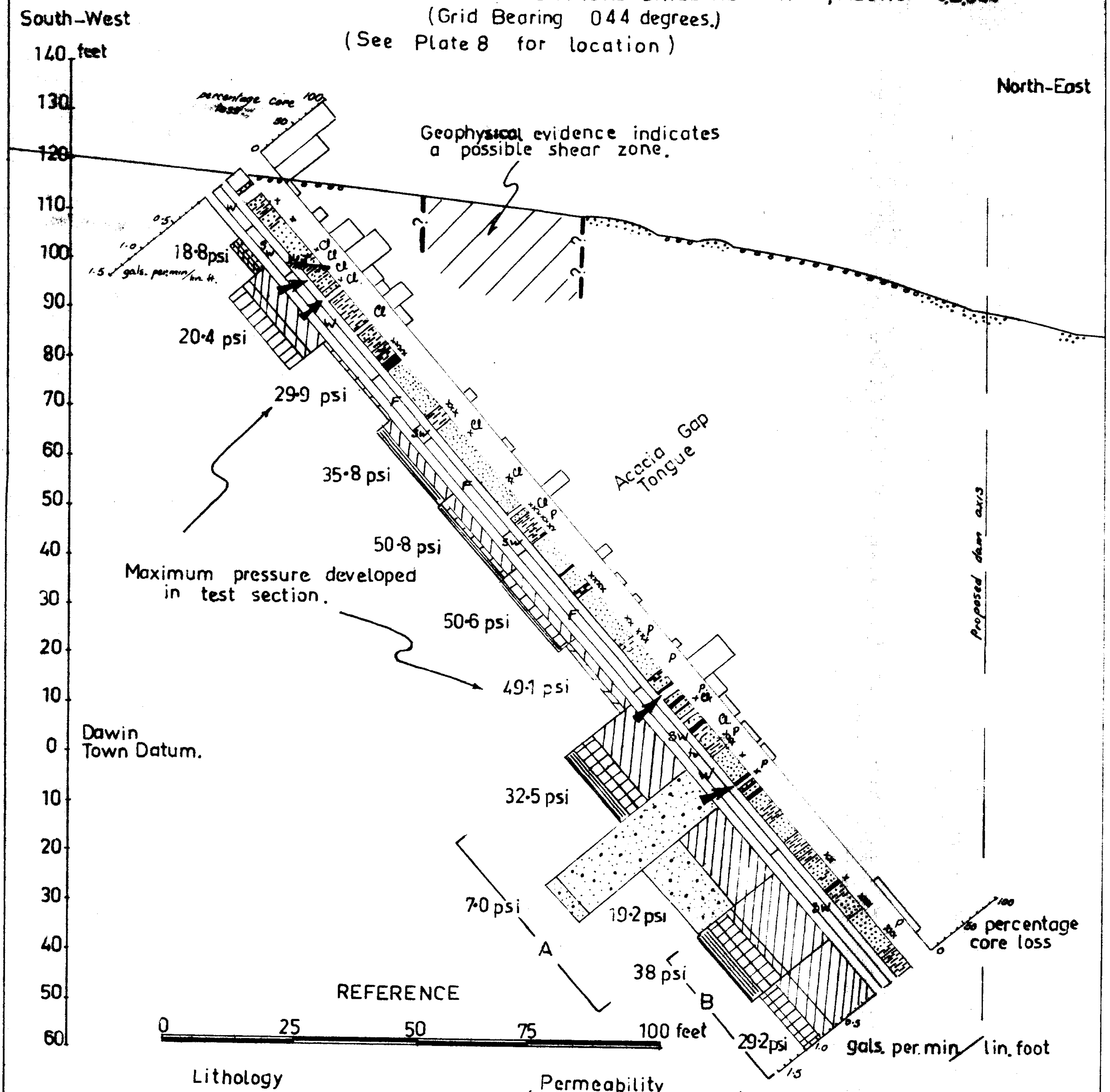
JK

PLATE 10

Darwin River Water Storage Scheme

INTERPRETATIVE SECTION THROUGH DIAMOND DRILL HOLE Nº1, ALONG GB044

(Grid Bearing 044 degrees.)
(See Plate 8 for location)



Lithology

Recent
- ▩ Quartzite boulders

Proterozoic
- ▒ Quartzite
- ☰ Schist & siltstone
- ■ Decomposed schist & clay

Permeability (corrected pressures)
- ▩ 0 – 10 psi
- ▥ 10 – 20 psi
- ▨ 20 – 30 psi
- ▧ 30 – 40 psi

⌐— A —¬ Region of high water loss, possible zone of leak shown with arrow.

W	Weathered rock
SW	Slighty weathered rock
F	Fresh rock
×	Core very broken (Fracture zone?)
W.T.	Water table
P	Pyrite (along partings)
Cl	Clay " "

Bureau of Mineral Resources, Geology & Geophysics July 1964. *To accompany Record 1964/52*

D52/A4/52

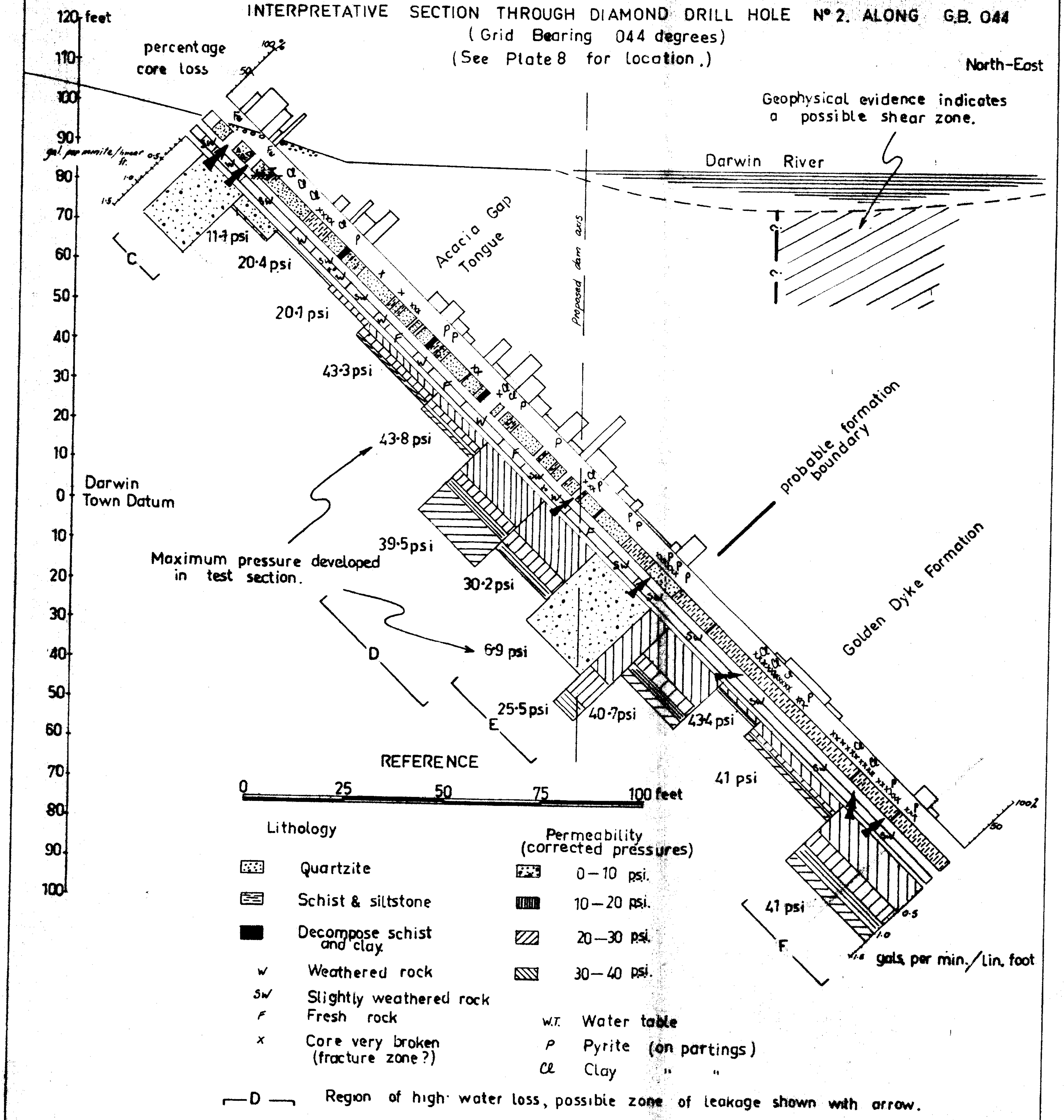
Darwin River Water Storage Scheme

PLATE 11.

INTERPRETATIVE SECTION THROUGH DIAMOND DRILL HOLE Nº 2. ALONG G.B. 044

(Grid Bearing 044 degrees)

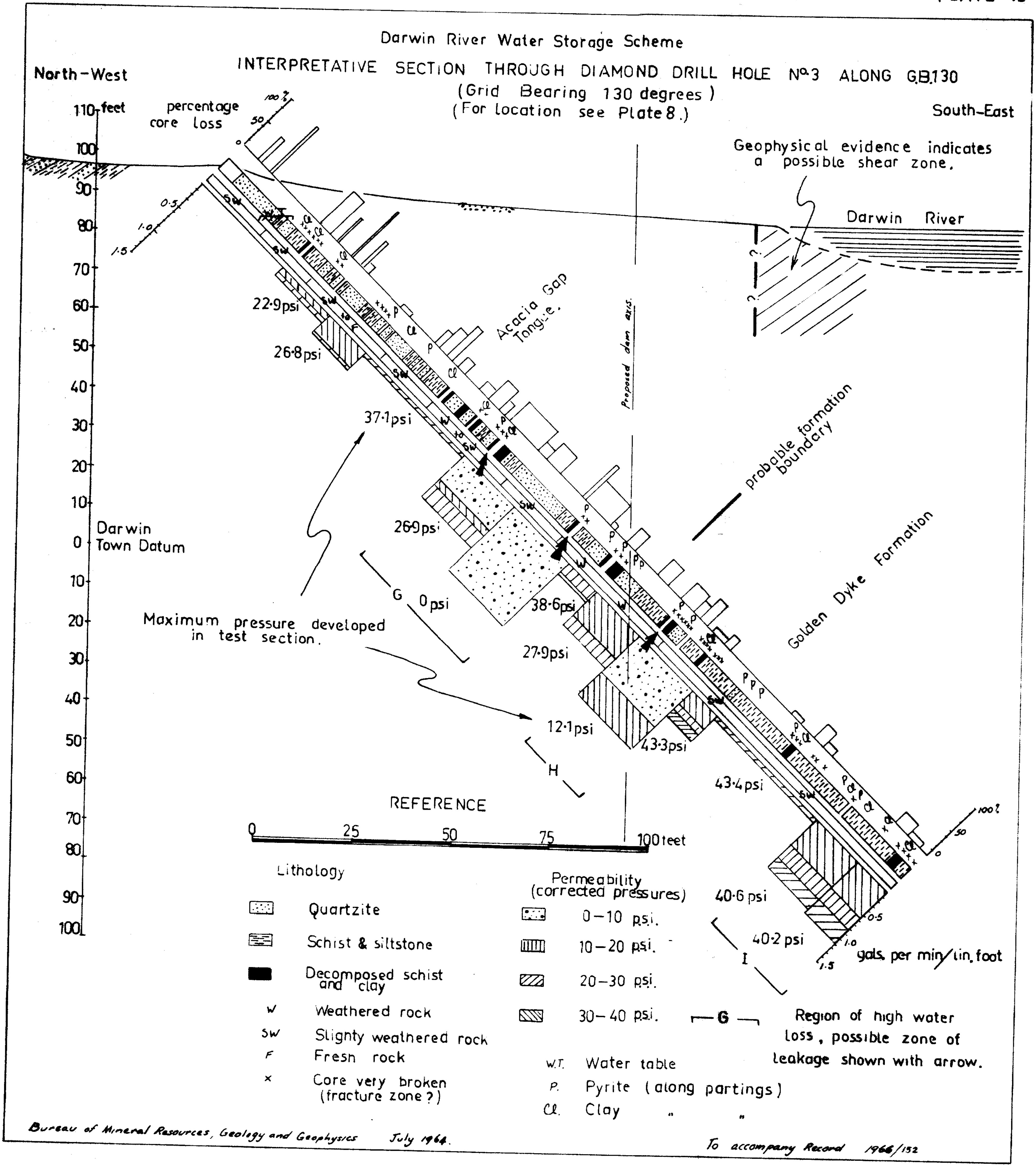
(See Plate 8 for location.)



Bureau of Mineral Resources, Geology & Geophysics July, 1964

To accompany Record 1964/152

D52/A4/53



Darwin River Water Storage Scheme

INTERPRETATIVE SECTION THROUGH DIAMOND DRILL HOLE No. 3 ALONG G.B.130

(Grid Bearing 130 degrees)
(For location see Plate 8.)

Bureau of Mineral Resources, Geology and Geophysics July 1964.

To accompany Record 1966/152

DARWIN RIVER WATER STORAGE SCHEME.

INTERPRETATIVE SECTION ALONG PROPOSED AXIS OF DAM

(Along Geophysical E-W Grid line 00 see Plate 8.)

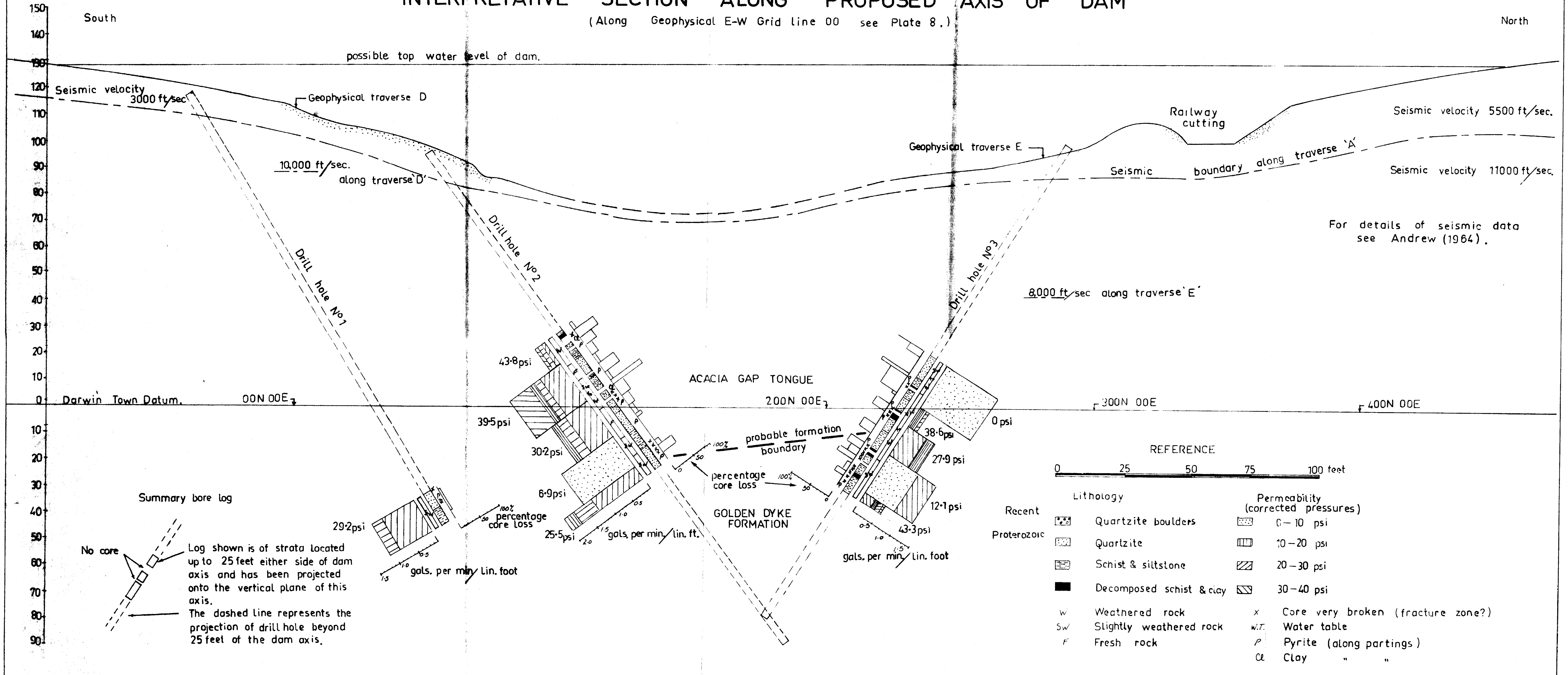
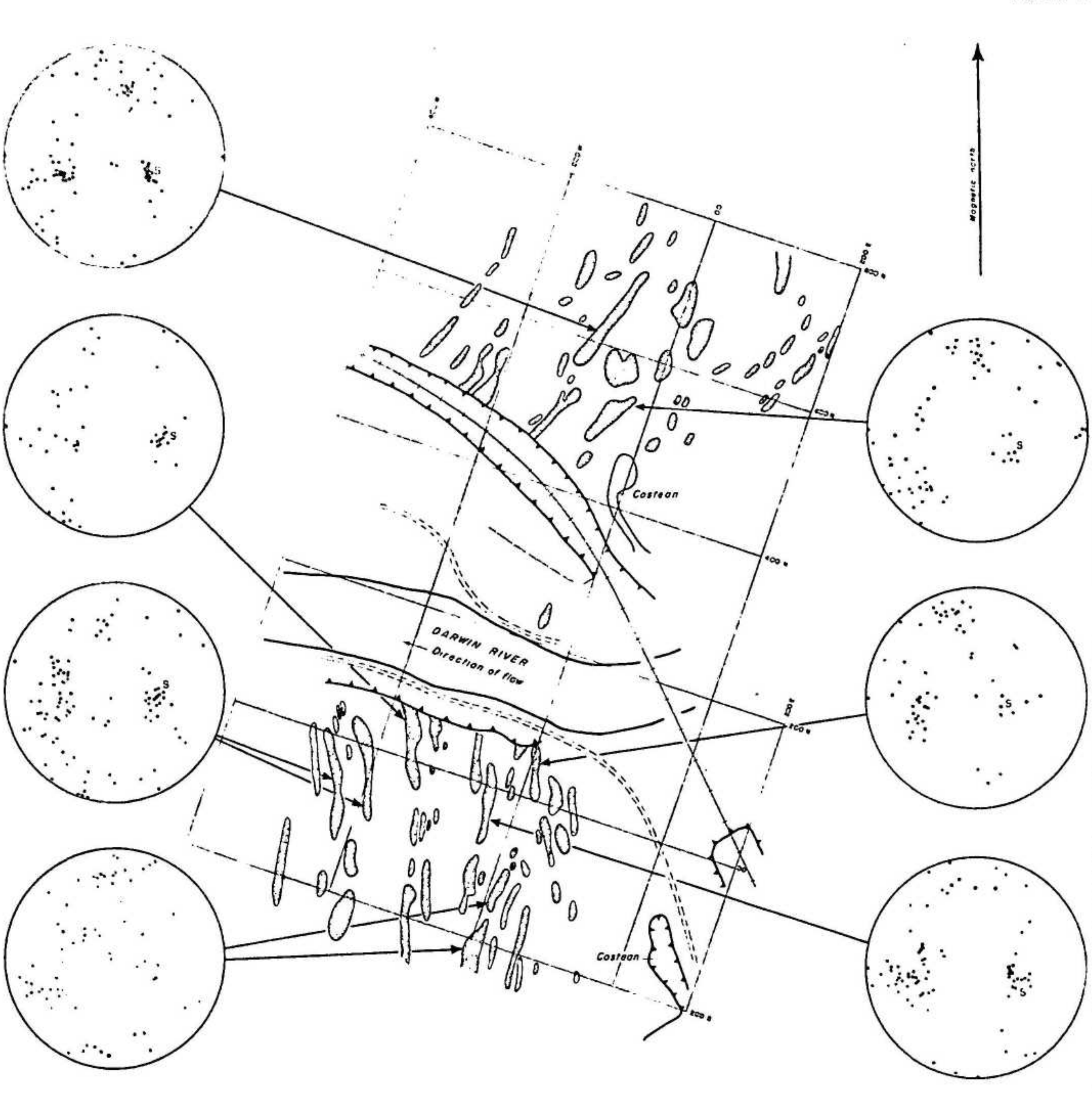


PLATE 14



DARWIN RIVER DAM SITE

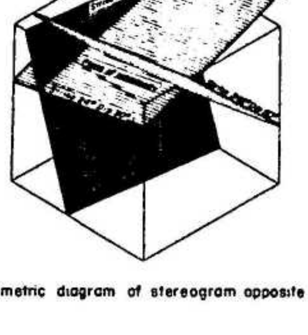
SCHISTOSITY AND JOINT STEREOGRAMS

Scale

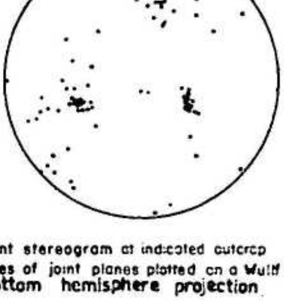
100 50 0 100 200 Feet

Reference

- Quartzite outcrop
- Geological boundary, position accurate
- Embankment
- Railway line
- Vehicle track
- S Poles of plane of schistosity

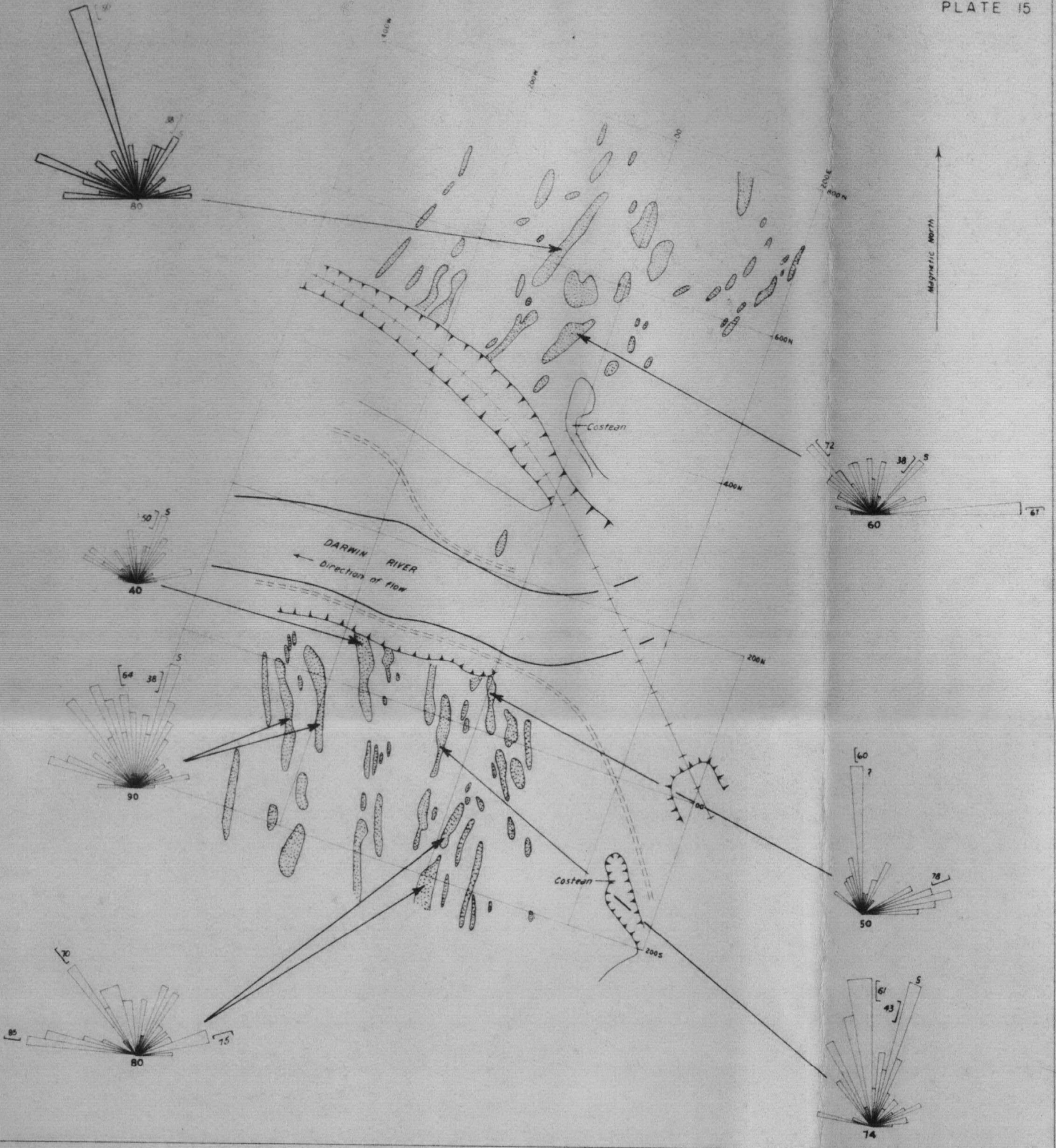


Isometric diagram of stereogram opposite



Joint stereogram at indicated outcrop
Poles of joint planes plotted on a Wulff net
Bottom hemisphere projection

PLATE 15



DARWIN RIVER DAM SITE

JOINT FREQUENCY DIAGRAMS

SCALE

Feet 100 50 0 100 200 Feet

REFERENCE

▨ *Quartzite outcrop*

— *Geological boundary, position accurate*

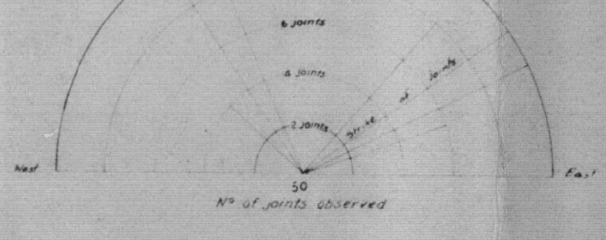
64 *Average dip of joint*

S *Schistosity*

Embankment

Railway line

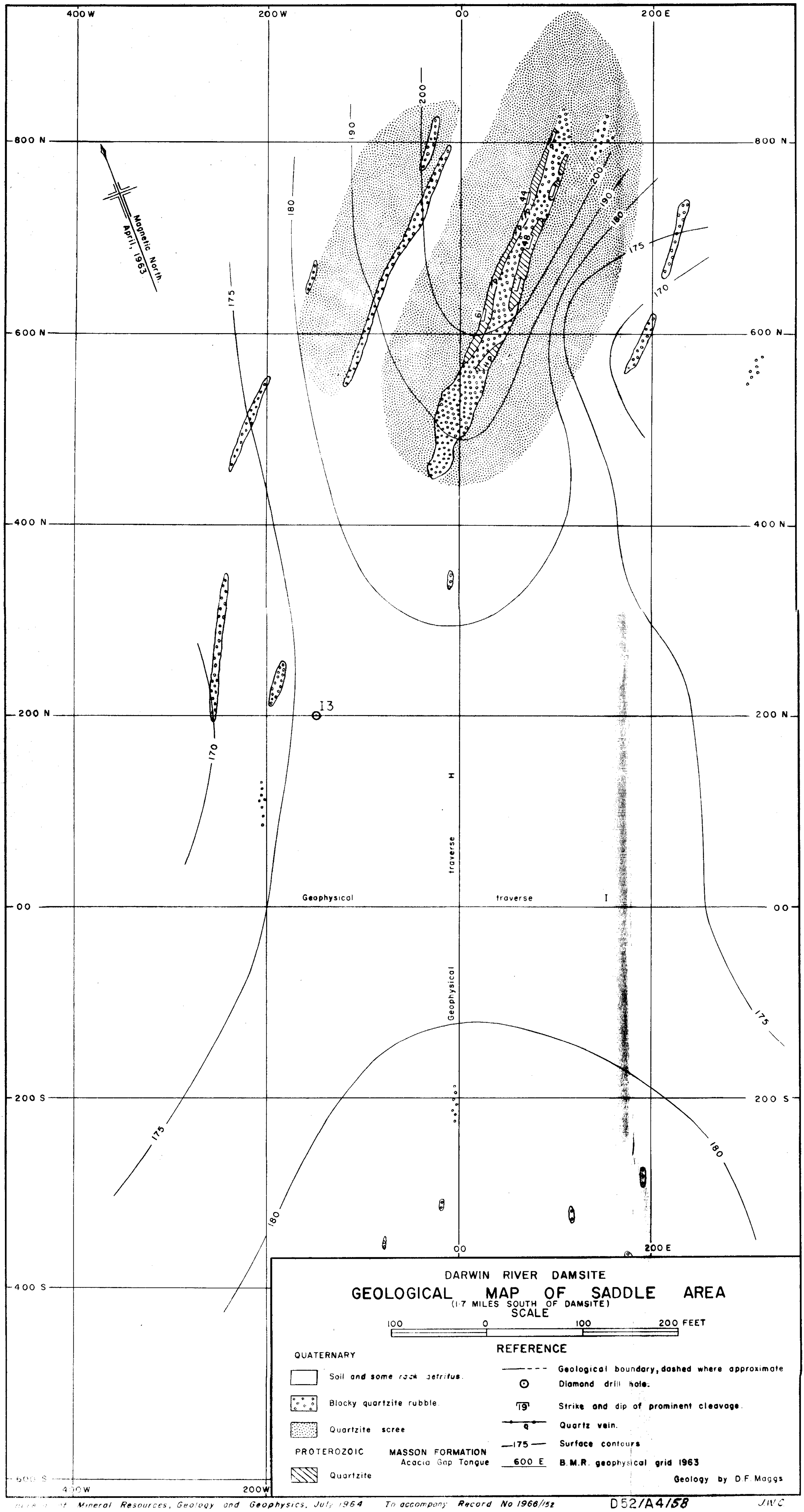
Vehicle track



Nº of joints observed

Bureau of Mineral Resources, Geology and Geophysics November 1963 To accompany Record No 1966/152 D52/A4/59

Geology by D.F. Maggs
Drawn by R.G. Winchester.



DARWIN RIVER DAMSITE

GEOLOGICAL MAP OF SADDLE AREA

(1·7 MILES SOUTH OF DAMSITE)

SCALE

100 0 100 200 FEET

REFERENCE

QUATERNARY

- ☐ Soil and some rock detritus.
- Blocky quartzite rubble.
- Quartzite scree

PROTEROZOIC MASSON FORMATION
Acacia Gap Tongue

- ▨ Quartzite

—— - - - Geological boundary, dashed where approximate

⊙ Diamond drill hole.

19 Strike and dip of prominent cleavage.

q Quartz vein.

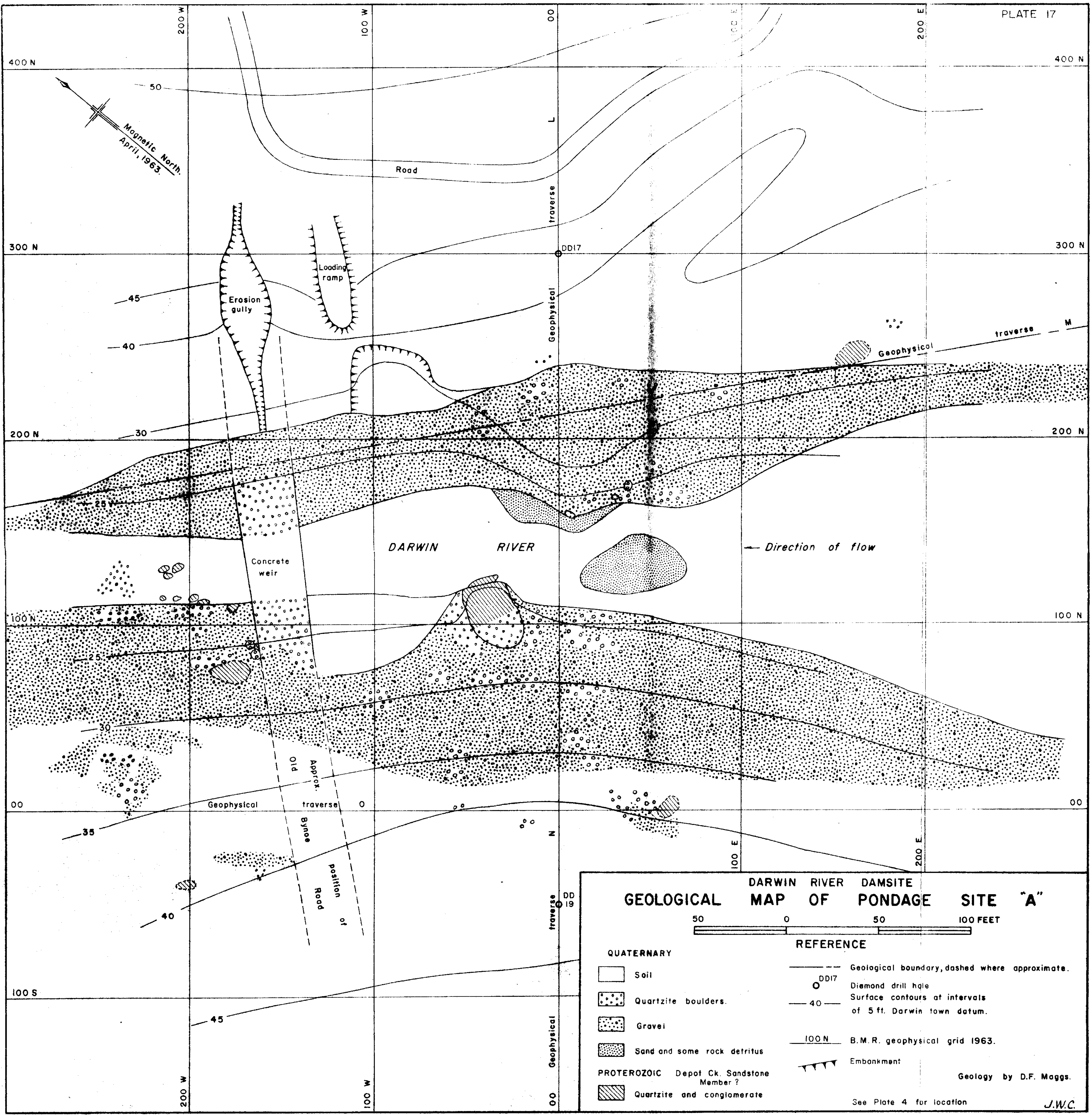
—175— Surface contours

600 E B.M.R. geophysical grid 1963

Geology by D.F. Maggs

Bureau of Mineral Resources, Geology and Geophysics, July 1964 To accompany Record No 1966/152 D52/A4/58 JWC

PLATE 17



DARWIN RIVER DAMSITE

GEOLOGICAL MAP OF PONDAGE SITE "A"

50 0 50 100 FEET

REFERENCE

QUATERNARY

- Soil
- Quartzite boulders.
- Gravel
- Sand and some rock detritus

PROTEROZOIC Depot Ck. Sandstone Member ?

- Quartzite and conglomerate

Geological boundary, dashed where approximate.

DD17 Diamond drill hole

—40— Surface contours at intervals of 5 ft. Darwin town datum.

100 N B.M.R. geophysical grid 1963.

Embankment

Geology by D.F. Maggs.

See Plate 4 for location

J.W.C.

Bureau of Mineral Resources, Geology and Geophysics. July, 1964.

To accompany Record No 1966/152

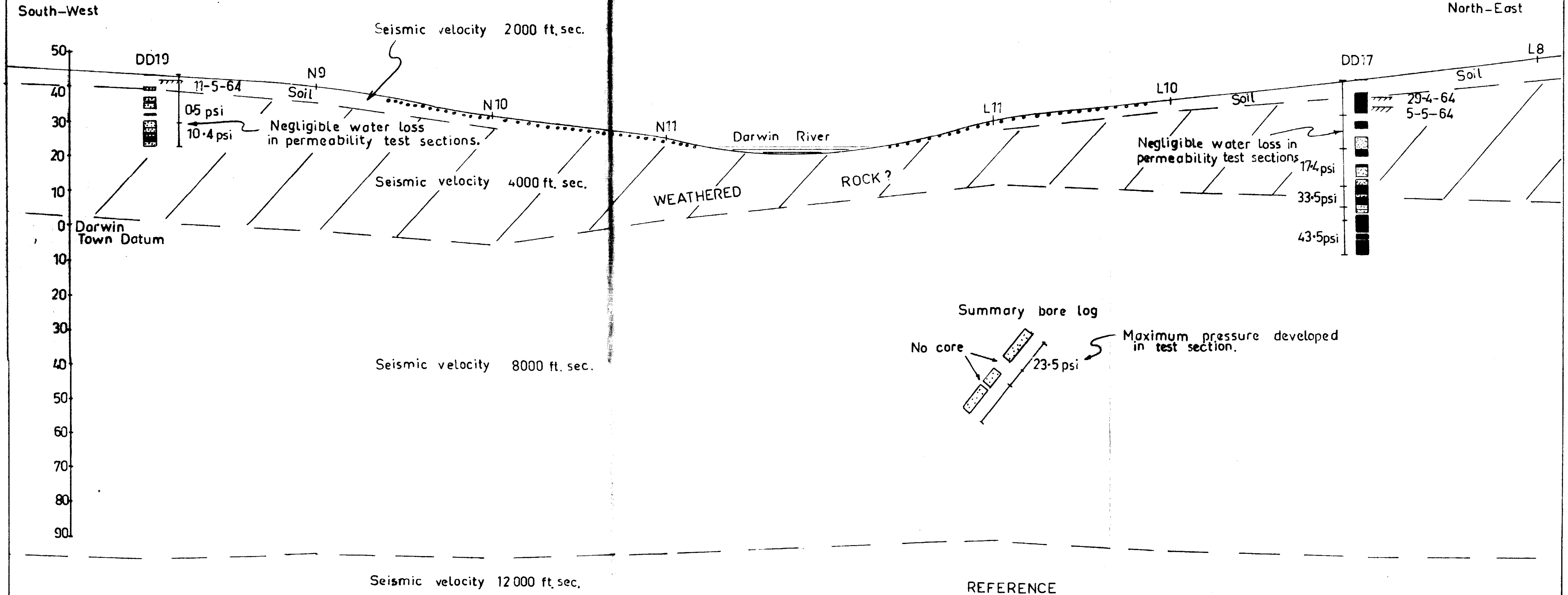
D52/A4/ 57

PLATE 18

DARWIN RIVER WATER STORAGE SCHEME

INTERPRETATIVE SECTION ALONG GEOPHYSICAL TRAVERSE L–N

PONDAGE DAM SITE 'A' (See Plate 17 for location)



REFERENCE

0 25 50 75 100 feet

Recent	▨	River gravel.
	■	Clay & weathered rock.
Proterozoic	▨	Sandstone (Depot Creek Sandstone Member?)
	▨	Crystalline phosphate rock.

— — Approximate position of seismic boundary. For details see Andrew (1964).

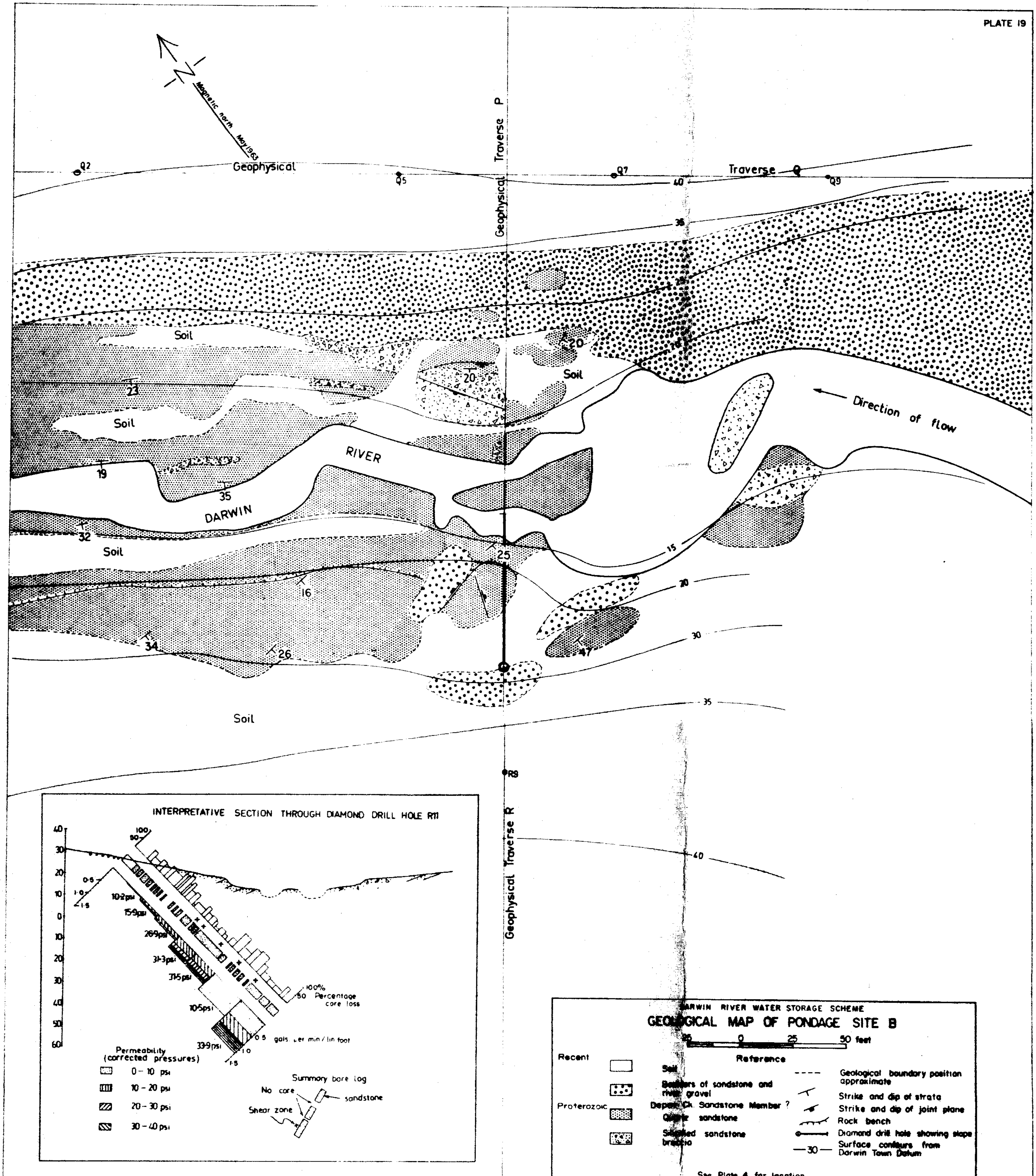
Water table and date of recorded depth.

Bureau of Mineral Resources, Geology and Geophysics July 1964.

To accompany Record 1966/152

D52/A4/56

PLATE 19



DARWIN RIVER WATER STORAGE SCHEME

GEOLOGICAL MAP OF PONDAGE SITE B

25 0 25 50 feet

Reference

Recent
☐ Soil
⁘ Boulders of sandstone and river gravel

Proterozoic
Depot Ck. Sandstone Member ?
▩ Quartz sandstone
▨ Silicified sandstone breccia

- - - - Geological boundary position approximate
Strike and dip of strata
Strike and dip of joint plane
Rock bench
Diamond drill hole showing slope
—30— Surface contours from Darwin Town Datum

See Plate 4 for location

Bureau of Mineral Resource, Geology & Geophysics. July 1964.

To accompany Record No. 1964/152 D 52/A4/60