PRELIMINARY INVESTIGATION OF PROPOSED
WELL Site NEAR OLD TELEGRAPH STATION, ALICE SPRINGS

by

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SUMMARY

The Old Telegraph Station Dam site is located on the Todd River about 2 miles north of Alice Springs township.

Phases of the investigation carried out by Water Resources Branch, Northern Territory Administration, include drilling of 77 holes to determine depth of alluvium and weathered rock at damsite, 3 diamond drill holes continuously cored from hard rock to total depth to test the geology of the foundations, and 27 test pits dug in a possible borrow area to determine depth of gravel; surveying of damsite for a capacity survey was also carried out by Water Resources Branch.

The damsite is underlain by fresh strongly jointed gneiss. Some of the joints are open but water pressure testing of diamond drill holes was not carried out.

Results of this investigation indicate that the site is suitable for a gravity type dam.

Aggregate (river gravel) that will probably prove suitable for use either in a concrete or rock fill dam, is available within half a mile of the damsite. Should the gravel prove unsuitable, fresh strong gneiss can be quarried within a quarter of a mile of the site. It is unlikely that any impermeable material (clay etc.) suitable for use as an impermeable membrane in a rock-fill dam, will be found within several miles of the dam.
Preliminary Investigation of Proposed Dam at
Hey’s Old Telegraph Station, Alice Springs

In March 1964 C.C. Corbett made several recommendations concerning the Alice Springs town water supply (Corbett 1964). Among these were recommendations concerning the construction of the dam, one at Bigley Gorge (approximately three miles north of the Old Telegraph Station) and one at Junction Gorge, (approximately four and a half miles north of the Old Telegraph Station), to regulate the flow of the Todd River thereby increasing recharge into the Alice Springs Basin.

A topographic survey by Water Resources Branch, Northern Territory Administration, of the area to be flooded behind the Bigley Gorge damsite, has revealed that the capacity of such a dam would be too small to warrant further investigation. This was concluded earlier by Jones (1957) after a visual inspection of the site. At present the topographic survey for the Junction Gorge dam site has not been completed. Results of the topographic survey of the area which would be flooded behind a dam at a third site near the Old Telegraph Station are shown on Plates 3 and 3A.

The geological investigation of the site was conducted at the request of the District Engineer of Water Resources Branch, Northern Territory Administration.

Location and Access

The proposed site is situated two miles north of Alice Springs township, on the Todd River. Access to the site is provided by a road to the Old Telegraph Station and thence by car track to the site approximately a quarter of a mile north of the Old Telegraph Station, on the Alice Springs 1:250,000 sheet (8954-14). Australian Military Grid Reference is 8164300 8205400.

Use of Dam

It is proposed by Water Resources Branch (C. Forbes, per., etc.) that the dam should impound water during times of flow of the Todd River, and that this water be released to prolong the period of river flow over the intake beds of the Alice Springs Basin. This would increase the recharge into both the town groundwater basin and the Arum area groundwater basin.

Test Drilling by Water Resources Branch, Alice Springs

71 holes have been drilled in the bed of the Todd
River at the proposed dam site. 24 were drilled with a
Hydromaster 750 (percussion), 4 with a Hydromaster 2000
(percussion), 9 with Mcaco HR (rotary), 19 with Mcaco
HCR (rotary), 1 water jetted and 13 air jetted. (For
details of these holes see appendix 2). Some of these
holes were drilled to determine depth to water table,
others were drilled to determine depth to hard bedrock.
Three dime'd drill holes co-simously cored from hard
bedrock, have also been drilled. Two of these vertical
holes which were drilled in the bottom of two holes
already drilled to hard rock. The third hole is an
inclined hole (45° to horizontal) drilled into the
western abutment.

SITUATION

The problem of siltation has not been evaluated
quantitatively, but it is thought that it may prove
a problem. Further information on bed load is required.
Some information on suspended load has been collected
by Water Resources Branch, indicating a maximum of 17,600
parts per million of sediment at the height of a small
river flow.

PHYSIOGRAPHY

Small rocky hills of granite up to 120 feet high
occur in the area shown in Plate i, with higher hills
surrounding the area. Streams subsidiary to the Todd
River are largely controlled in this area by jointing.
Further north in the catchment area schist and quartzite
are dominant, forming ridges up to 150 feet high. Streams
on the schists and quartzites are largely controlled by
the strike of the schistosity in the rocks.

The Todd River rises approximately 20 miles north
west of the proposed dam site, and together with sub-
sequent streams, drains an area of approximately 150 square
miles. In the mile or two immediately above the proposed
dam site the river has a gradient of approximately 37 feet
per mile.

GENERAL GEOLOGY

The storage and catchment areas of the proposed site
are underlain by rocks of the Arunta Complex consisting
of granite, schist, and quartzite which have been intruded
by pegmatite, dolerite and amphibolite.

The structure of the area is complex and obscure.
All rocks are strongly jointed and several sets of
joints are present. Faults are inferred in areas where
there are strong contemporaneous present on air photographs, and
... several feet.

**PETROLOGY**

Beds cropping out in the vicinity of the proposed dam site include a gneiss with a fairly well developed foliation, and some very minor pegmatite dykes. The largest of which has a maximum width of 4'. The foliation of the gneiss in general is the preferred orientation of the mineral; the strike of the foliation is fairly uniform (30°) but the dip varies from 5° to 60° to north-west. The orientation of the foliation is approximately the same in both strata of the proposed site.

The gneiss consists of quartz, a member of the plagioclase series, orthoclase, muscovite and biotite. The feldspars generally occur as porphyroblasts up to 2" in diameter.

The small pegmatite dykes which can generally be traced for about 20 feet are fairly restricted in distribution, and occur 70 or 80 feet above the river bed in the eastern stratum. Other isolated dykes occur but are minor. The pegmatite consists of quartz, orthoclase, and muscovite.

**METAMORPHISM**

The gneiss weathers ultimately to a sand consisting of muscovite, orthoclase and quartz. The biotite alters to muscovite, and the biotite to iron oxides and chlorite. Small looking cores of gneiss up to six feet in diameter on the sides of hills are often quite weathered, so that when hit by a highway they crumble to sand. Here the weathering products are being continually abraded by river action the gneiss is fresh and strong. Well halts have shown that the depth of weathering in the gneiss varies from a few inches down to ten feet. Significant weathering below ten feet is uncommon.

**STRUCTURE**

**Jointing**

The structure of the area in the immediate vicinity of the dam site is unknown. Only gneiss intruded by some small dolerite dikes and pegmatite dykes, drops out in the area.

Several joint systems are apparent. Joints in the more dominant sets tend to be further apart than those in weaker sets. Joints in the weaker set vary from a
few inches apart to five feet, while joints in the stronger
caves tend to be from 10 to 20 feet apart, except in
occasional zones where strong plate jointing has been
developed, in which joints are from a few inches to ten
feet apart. Diamond drilling has revealed that some
of strong joints persist to depths of at least 70 feet
below the surface; though many of the joints encountered
are tight, but at least some are open.

Displacements of several inches can be seen on
occasional joints (particularly on the western abutment
where a small pegmatitic vein has been cut by joints).
The dominant joint systems have attitudes as follows—
(figure before strike is the dip, figure after the strike,
direction of dip) 35/132, 30/40, 54/42, 25/300, 22/317,
54/222, 36/132, 71/2/4, 90/730.

Faulting.

Only minor faulting is obvious in the area (where
dolerite dykes are displaced a few feet). There is no
evidence for major faulting in the immediate vicinity of
the dam.

RESULTS OF DRILLING

From drilling results, a contour map on the hard
rock underlying the alluvium at the proposed dam site
has been drawn by Water Resources Branch (see Plate 7).
No distinction was drawn between alluvium and soft
weathered basement rock (grades). The map shows no
significant features. Plate 3 shows the cross section
through alluvium and rock along the centre line of the
proposed dam.

Three diamond drill holes H592, H560, and H575
(for location see Plate 2) have been drilled.
(continuously cored from hard rock to total depth).
Total depth are 76[5°, 77°9' and 87°11' respectively.
H592 and H560 are vertical holes and core was recovered
from these two holes with a single rotating core barrel.
H575 is an inclined hole (inclination 45°, bearing 267°
magnetic), and core was recovered from this hole with a
stationary inner tube core barrel. A fourth hole H576
inclination 45° bearing 267° magnetic, has been commenced,
but no information is available.

Geological descriptions of core from the diamond
drill holes are given in Appendix I. Generalized results
of examination of core recovered reveal the following:

(a) Rock is generally only moderately weathered
to a depth of ten feet below the rock surface.
Deeper than ten feet, the rock is fairly fresh
except for occasional very narrow zones (up to 6" wide) adjacent to joints.
(b) Zones of strongly jointed rock occur at intervals, to the total depth of the
holes drilled.
(c) Core was recovered from only one clay
zone, which occurred in D75, the only
hole drilled with a stationary inner tube
coring barrel. It is very likely that this
clay zone was the only one encountered during
the Drilled Drilling:
(d) Significant water losses were recorded in
D75. No attempt was made to record drilling
fluid losses in D75. In D99 a loss of 25
gallons per hour (g.p.h.) was recorded in the
interval 20 to 25 feet from top of casing,
350 g.p.h. in interval 25 to 31 feet, and 700
g.p.h. in interval 31 to 35 feet. Drilling
fluid was water with small amount of cutting
fluid.

SOUTHLAND AREA - SADDLES
Plates 3 and 3A, prepared by Water Resources Branch,
show data on storage area, volume etc. More detailed
work by Water Resources Branch has modified certain areas
on Plate 3, and the new data is shown on plates 4, 5 and
6.

Plates 4, 5 and 6 delineate a number of saddles. No
detailed geological work has been done in these areas,
but a quick reconnaissance has shown that all areas are
underlain by gravel. Data gathered at the proposed dam
site indicates that hard gravel occurs at less than ten
feet, and probably less than five feet beneath the sandy
soil cover in the area covered by Plate 4. In the saddles
shown in Plates 5 and 6, fresh hard gravel is probably less
than two feet beneath the surface.

Should the saddles become of importance two or three
shallow drill holes will be necessary to determine the
depth to hard rock in areas covered by Plates 4 and 6.

SPILLWAY

Present Water Resources Branch proposals are for
gates in the dam to let water out of the dam for
recharge of the town basin (C. Forbush, pers. com), and
then provision for a spillway would be included in the
dam. Alternatively, a spillway could be constructed
in one of the saddles near the proposed site.
CONSTRUCTION OF MALLISITE

Sources of aggregate for use in dam construction occur within half a mile of the dam site.

ROCK FILL

(a) Recent River Gravels

These occur approximately a quarter of a mile upstream from the proposed damsite. In an investigation of these gravels, 21 test pits were excavated by Water Resources Branch to determine the thickness of gravels, type of rock making up the gravels and to obtain material for site grading. Samples have been retained by Water Resources Branch. Details of depth are given in Appendix 3 and Location on Plate 9.

Two areas have been designated on Plate 9. The test pits in area 1 revealed shallow gravels of weathered rock, and in area 2 test pits reveal a total volume of approximately thirty-five thousand cubic yards of gravel. Area 25% to 35% of material in area 2 is weathered gravel, and the remainder is strong fresh gravel, with very minor amounts of fresh dolerite. Some upgrading of these gravels would be necessary before they could be used as aggregate.

(b) Dolerite

Fresh strong gravels crop out in several places in close proximity to the proposed damsite, but in every case it would be necessary to quarry. The only suitable site, which is the damsite, for a quarry in the side of a hill occurs on the south-eastern side of the hill forming the eastern abutment of the proposed site. A quarry anywhere else near the damsite would have to be in the face of a pit.

IMPERVIOUS MATERIAL

There are no clays visible in the immediate vicinity of the proposed dam site, and it is not anticipated that any will be found.

CONCLUSIONS

1. Rock at the damsite is gravels with a strong foliation dipping to the north-east at an average of 30°.
2. Maximum total thickness of alluvium and weathered gravels is 17 feet.
3. Weathering is generally very shallow (less than 3 feet) except in the vicinity of closely jointed rock.
4. Jointing is prominent and even joints persist to depths of at least 70 feet below the surface, though the majority of joints appear to be
fairly tight.

5. Present information suggests that the site is suitable only for a gravity type dam.

RECOMMENDATIONS

Should it be decided to construct a dam at this site, further information will be needed on which to base the design of the dam. In the present investigation there has been no pressure testing of the diamond drill holes. This information is necessary to calculate the permeability of the foundations for use in the design of a dam.

The following are recommendations for further investigations:

1. Pressure testing of existing and future diamond drill holes.

2. Laboratory testing of possible construction materials to determine suitability of aggregate for concrete, and for use in a rockfill dam.

3. The drilling and coring of a minimum of three more diamond drill holes along the entire line of the dam, in the bed of the river, and one possibly two, diamond drill holes in the dam area.

4. Should the saddle areas become important (this depends on the height of the dam), some drilling will be necessary to test the depth of the river bed in the rock and determine the permeability of the rock in saddle areas.

ACKNOWLEDGEMENTS

The assistance and cooperation of officers of the Water Resources Branch of the Northern Territory Administration who were responsible for the drilling at the dam site, the test sites for the investigation of construction materials, surveying, compilation and drawing of some of the maps included in this report, is acknowledged.

I am particularly indebted to Mr. D. G. G. Gardner (Engineering Geologist) Bureau of Mineral Resources, Canberra. The site was visited by Mr. Gardner and much valuable advice and assistance was given by him with the site investigation.

ALIEN MA

TECHNICAL DESCRIPTION OF CORE BORING AT DIAMOND

MILLING ENDED 8/31/69 23/69 8/75 AT TESTED MILL

SITES NEAR OLD TELEPHONE STATION

Size of Core 1" Diameter

Drilled by Water Resources Branch

Locations of holes are shown on Plate 2

23/69, 25/69 drilled with a 10 foot rotating core barrel
23/75 drilled with stationary inner tube core barrel
### Description of Core Recovered from Drilled Section

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<th>Depth</th>
<th>Lift No.</th>
<th>Core Recovery</th>
<th>Comments</th>
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<tr>
<td>16' 11&quot; - 17' 4&quot;</td>
<td>Left No.</td>
<td>Core Recovery 4/4 (100%)</td>
<td>Hard, slightly weathered granite; one tight joint (at right angle to foliation).</td>
</tr>
<tr>
<td>17' 4&quot; - 20'</td>
<td>Left No.</td>
<td>Core Recovery 9&quot; (20%)</td>
<td>Fragments 1&quot; to 2&quot; core length. Lithology as above.</td>
</tr>
<tr>
<td>20' - 21' 4&quot;</td>
<td>Left No.</td>
<td>Core Recovery 101/1 (65%)</td>
<td>One 9&quot; core length. Lithology as above; very slight weathering, iron-staining on some joints; joints in core length are welded.</td>
</tr>
<tr>
<td>21' 4&quot; - 22' 8&quot;</td>
<td>Left No.</td>
<td>Core Recovery 101/1 (37%)</td>
<td>Fragments 1&quot; to 1&quot;. Joints iron-stained and apparently slightly open.</td>
</tr>
<tr>
<td>22' 8&quot; - 22&quot;</td>
<td>Left No.</td>
<td>Core Recovery 101/1 (37%)</td>
<td>Fragments 1&quot; to 1&quot;. Joints and lithology as for last section.</td>
</tr>
<tr>
<td>25' - 26' 10&quot;</td>
<td>Left No.</td>
<td>Core Recovery 15&quot; (6%)</td>
<td>Fresh; mainly core lengths 1/2&quot; - 1&quot;. Some iron-stained joints; a welded joint.</td>
</tr>
<tr>
<td>26' 10&quot; - 26' 1&quot;</td>
<td>Left No.</td>
<td>Core Recovery 15&quot; (100%)</td>
<td>Fairly fresh; core lengths mainly 1&quot; to 4&quot;. Some iron-stained joints.</td>
</tr>
<tr>
<td>26' 1&quot; - 26' 5&quot;</td>
<td>Left No.</td>
<td>Core Recovery 15&quot; (94%)</td>
<td>Core 1/2&quot; to 5&quot;. Joints mainly clean. Fairly fresh.</td>
</tr>
<tr>
<td>26' 5&quot; - 27' 1&quot;</td>
<td>Left No.</td>
<td>Core Recovery 9&quot; (19%)</td>
<td>Core 1&quot; to 5&quot; as above.</td>
</tr>
<tr>
<td>27' 1&quot; - 30' 8&quot;</td>
<td>Left No.</td>
<td>Core Recovery 61/2 (93%)</td>
<td>Very little staining. Core 1&quot; to 3&quot; as above.</td>
</tr>
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<td>No. 1 Core Recovery 1&quot;</td>
<td>Marked 1/2&quot; and 1&quot; split core (by vertical joint). Some 1st day iron staining; moderate weathering.</td>
</tr>
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<td>No. 2 Core Recovery 41/2&quot;</td>
<td>Fresh, fairly hard; very slight staining of joints.</td>
</tr>
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<td></td>
<td>No. 3 Core Recovery 31/2&quot;</td>
<td>Similar to No. 2 Core 1/2&quot; to 1&quot;.</td>
</tr>
<tr>
<td>31' 11&quot; - 32' 3/4&quot;</td>
<td>Left No.</td>
<td>Core Recovery 31/4 (100%)</td>
<td>Fairly fresh; core length broke by a joint.</td>
</tr>
<tr>
<td>32' 1/2&quot; - 35' 11&quot;</td>
<td>Left No.</td>
<td>Core Recovery 42&quot; (96%)</td>
<td>Fresh, core length to 14&quot;. Joints not stained.</td>
</tr>
<tr>
<td>35' 11&quot; - 36' 3/4&quot;</td>
<td>Left No.</td>
<td>Core Recovery 291/2 (90%)</td>
<td>A 1/2&quot; weathered fragment at top; remainder fresh, as before; core lengths 3/4&quot; to 101/2&quot;; one slightly stained joint. Most breaks along foliation.</td>
</tr>
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38'6" - 42'10" Lift No. 4 Core Recovery 53" (103%) Top foot slightly weathered, ½" to 3" core lengths; jointed, not stained. Remainder fresh, 2" to 1½" core; two iron-stained joints; the other breaks are on foliation.

42'10" - 45'10½" Lift No. 5 Core Recovery 30" (82%) Top foot, fragments ½" - 1", but fairly fresh; numerous joints, only slightly iron-stained; following foot fresh, core ½" and 7½" last 6" fragments ½" to 1" fairly fresh.

45'10½" - 50'18½" Lift No. 6 Core Recovery 58½" (115½) Top couple of inches, fragments ½" to ½" partly weathered; remainder fresh, core 2" to 15" (55" in all); bottom ½" fragments ½" to 1½", joints, a few with ironstaining, 2 with clay.

50'18½" - 52'12" Lift No. 7 Core Recovery 57" (100%) Nearly all fresh, core about 1½" to 6½". One or two joints slightly stained, three with clay, others tight; fresh rock; most breaks in foliation.

52'12" - 54'13½" Lift No. 8 Core Recovery 17" (94%) Fresh, mainly 1½" to 2½", a few ½" fragments; about 4 joints per foot; a few ironstained and clayfilled joints near bottom.

54'13½" - 58'14½" Lift No. 9 Core Recovery 45" (92½%) Fresh; core lengths 2½" to 7½" joints tight, about 1½" in 2" slight ironstaining; thin clay on a few; single set of joints, across foliation.

58'14½" - 62'11½" Lift No. 10 Core Recovery 47" (85%) In upper 2 feet 4" one joint per 2'-2½". Fairly tight, slight iron staining; core generally 1½" to 3½", one length 18½". Fresh rock; Note: the clay joints from one set, distinct from the ironstained joints; both cut the foliation.

62'11½" - 63'1½" Lift No. 11 Core Recovery 2" (100%) Fresh core length; slightly clayey joint at one end. (A correction in drilling log gives 64'2½")

63'1½" - 66'5" Lift No. 12 Core Recovery 57½" (?) Fresh core, breaks along foliation; one iron stained joint; core 1½" to 4½" and a 17½" length.

66'5" - 66'8½" Lift No. 13 Core Recovery 18½" (?) Very slight weathering in micaceous bands in top 8", where fragments are 1½" to 1½", joints slightly iron-stained; remainder fairly fresh 1½" to 1½" joints slightly ironstained about four per foot.

66'8½" - 67'1½" Lift No. 14 Core Recovery 31½" (?) Fresh; core length except a few weathered fragments, which probably fell down the hole.

67'1½" - 68'12½" Lift No. 15 Core Recovery 15" (8%) Fresh at about 6½" to 1½. Core lengths ½" discs, by jointing across core; remainder ½" to 5"
64'10"-70'3" Lift No.16 Core Recovery 16"(41cm)
Fossilified 1" fragments 2" to 1" remainder good core 3" to 5" and a remnant vertical joint with some clay and iron staining
70'5"-75'4" Lift No.17 Core Recovery 24"(60cm)
About 1"5" short core Lengths and remainder fragments 4" to 1" Also fragments in interval 10" to 12" from top All hard fragments slight iron staining: not much clay: three directions of jointing.
75'4"-78'5" Lift No.18 Core Recovery 31"(80cm)
Fresh good core 3" length and some fragments: 1 joint; other breaks along foliation.
OPEN FILL THRU 3/10

(Depths measured from top of casing) 3' 5" above B.L.
No Core recovery on Lift No.1
46'11"-50'1" Lift No.1 Core Recovery 16"(41cm)
Lithology is the same throughout the core – gneiss – with an intensity due to pretension of片 in rock. First 4" fairly fresh gneiss followed by 14" of slightly weathered strongly jointed gneiss. Joints are mostly iron stained, some with small amount of white clay on their surface. One set of fairly strongly developed joints – practically all iron-stained – occur at approximately right angles to the schistosity. Fragments of core vary in size from 1" to 23" in length – average size 1" to 2".
70'9"-72'1" Lift No.1 Core Recovery 36"(90cm)
Length: up to 11' – randa 6" to 10", average size 1" to 1".
Top 8" is slightly weathered – mafite weathering leaving iron staining; feldspars slightly weathered to kaolinite All joints in this interval are iron-stained and have small amounts of white clay on them. Most of this core is fairly fresh hard gneiss. Joints are clay. (During this lift losing drilling fluid at a rate of approximately 25 gals./hr.)
37'3"-51'1" Lift No.8 Core Recovery 22"(56cm)
(22" from top of core water loss of 300 gph)
Range in length 1" up to 11". Remaining lengths 1" to 13". Rock all hard and fairly fresh. Only occasional joints are iron stained (12" – 44" – fluid loss 200 gph)
31'1"-33'1" Lift No.5 Core Recovery 45"(90cm)
Range in length ½" to 2". Remaining length: 11" to 71". Rock all hard and fairly fresh. Only one joint iron stained.
33'1"-40'4" Lift No.6 Core Recovery 26"(65cm)
1" to 22" in length, 1" to 1". Fragments of core are all
Approximately 1' to 2' for intervals of 2 - 3' at (a) top of core 6 (b) 28-29' from top (c) 31 to 33' from top. It is not known where the 3' or so of uncored core occurred.

Joint occur at a rate of 1 to 3 per foot and some of

shall have been cut or broken by

15' to 17' core. The 11' section is slightly bedded

The highest point is 2' long from to 1/2'. Bound Length 11'.

Core has broken along the consistently weakly - joints are approximately 1/foot. Joints are fairly clean with only

small amount of clay on them.

Lithology as before - fairly fresh white sandstone slightly altered to kaolin. Core lengths 1' to 2'. Dominant length about 1'. 13' from top or core (b) to 23', core is slightly more weathered with some iron staining. Pieces of core are from 1' to 2' in length. Most of fractures are parallel with subhorizontal, joints are rare.

0.10 - 0.20' 

Lithology: slightly fresh quartz with white sandstone slightly altered to kaolin. Pieces of core vary from 1' to 2'.

Dominant length 11'. All breaks are parallel to subhorizontal cannot approximately one per 2' interval.

0.20 - 0.30' 

Lithology: Fairly fresh quartz with white sandstone slightly altered to kaolin. Core is broken into fairly uniform lengths of 1' to 2' except for interval of approximately 2' at 6' to 8' from top of core 10. In this interval some of the beds are so thin that all pieces can be fitted together to make a continuous core. Joints occur about 1 per 2 foot interval. A 1' piece of core missing probably from 6' to 8' interval.

Dominant length of pieces of core is 3'. Most weathering of algin occurs from 1' to 2' in a couple of isolated instances.

0.30 - 0.50' 

Lithology as for 0.10'; lengths of pieces of core from 3' up to 10'. Dominant length about 2'. Joints are rare in whole length and apparently closed joints.

0.50 - 0.70' 

Lithology as above; lengths of pieces from 1' to 5'.

15' from top is first place where core pieces can't be matched and end at 21' from top. No joints visible; in total length of core, all breaks taken parallel with subhorizontal.

0.70 - 0.90' 

Lithology as above: lengths of pieces from 1' to 11'. Dominant length 2' joints are rare. Several small broken fragments
occur at top of core - next break in core at 16¾" from top -
32½" from top to 47½" consists of pieces ½" to 3" long, most of
which don't fit together - next break at 57½". No joints obvious
in whole length of core. Majority of breaks are parallel to
schistosity. Some are irregular break approximately perpen-
dicular to length of core.

75:12”-75:10” Lift No. 14 Core Recovery 42½" (37½"
Lengths of fragments ½" to 3½". Dominant, approximately 2½"
No breaks in core all can be fitted together to make one
complete length. Bottom of core 13 doesn't fit top of Core 14.
No joints in this core.

75:10”-81:1” Lift No. 15 Core Recovery 24" (86½"
Lithology as above - white feldspar slightly weathered. Fragments
½" to 2½". Core is complete except for bottom inch which doesn't
match fragment above. Fractures parallel with schistosity but
majority across schistosity.

DE/75 (All measurements from Ground Level)

Lift No. 1 Core Recovery 8½"
Lengths from 1½" to 3½" - moderately weathered biotite strongly
iron stained rock. Joints 5 in total length all strongly iron
stained and with some white clay.

-5½” Lift No. 2 Core Recovery 6½"
Lengths 2 - 1½ and 3½". Rock fairly strongly weathered. Joints -
one visible - strongly iron stained.

5½”-6½” Lift No. 3 Core Recovery 10½"
Length 1½" to 2½". Some 3½" to 6½ from top of core recovered
consists of pieces of rock ½" to 1½" in diameter - probably
fracture cone - most of bits only slightly weathered. Only
two pieces of core can be fitted together - rest has ends
ground by drill. Only joint identified is clay covered.

8½”-12½” Lift No. 4 Core Recovery 10½"
Lengths vary from ½" to 7½". Core is mostly fairly fresh, but
is moderately weathered near some joints. The core can't be
matched at 2½", 36½", 47½", from top of core (4). Joints occur
at a rate of approximately 3 per foot, and are very strongly
iron stained. The rock next a joint at 36½" is very strongly
weathered (kaolinised)

12½”-14½” Lift No. 5 Core Recovery 24½"
Lengths from ½" to 1½". Breaks where core doesn't match occur
6½", 12, 14½, 22½, 24½ from top of core; core is fairly fresh.
Joints occur at a rate of about 1 per foot. Some pyrite occurs
in small veins and in a vein in core. Joints are strongly stained
by iron and clay.

14½”-14½” Lift No. 6 Core Recovery 7½"
Lengths from 1½" to 2½". 2½ lengths of core at top is strongly
fractured with iron stained joints, and moderately weathered. Three of the 5 pieces can be fitted together leaving 2 gaps.

21'-32" - 15'1" Lift No. 7 Core Recovery 3"
Fragments %" to 1" core fairly fresh, 2 strongly iron stained joints.

15'1" - 15'7/8" Lift No. 8 Core Recovery 7"
Lengths from %" to 1". Rock fairly fresh, two iron stained joints with clay.

15'7/8" - 20'1/4" Lift No. 9 Core Recovery 49"
Lengths =" to 11". Rock fairly fresh. Joints all iron stained and with clay. 11 joints for total length. 91" from top there is %" some of tiny fragments of fresh rock - some showing iron stained joints.

20'1/4" - 24'1/2" Lift No. 10 Core Recovery 40"
Lengths of core %" to 5". Intact %" 4 iron stained joints with clay - belong to 3 sets of joints; 4 iron stained joints in interval 4%" to 30". 30" to 36" slightly more weathered and broken into numerous pieces by iron and clay stained joints approximately 8 major joints in 6" interval. Remainder only one joint with small amount of clay.

24'1/2" - 27'1/2" Lift No. 11 Core Recovery 34"
This core is broken into numerous small pieces. Core is generally fresh. Joints account for perhaps 25% of breaks occurring at the rate of approximately 5 per foot. Most are only slightly iron stained.

27'1/2" - 32'1/2" Lift No. 12 Core Recovery 47"
Joints average approximately 4/foot, through all joints occur in interval from 14" to 47". All joints are strongly iron stained and show a lot of clay. The bottom 8" of core is moderately weathered and strongly iron stained.

32'1/2" - 35'1/2" Lift No. 13 Core Recovery 46"
Core is slightly weathered in places. Lengths from %" to 10".
6 (unbroken) partially closed joints, strongly iron stained occur in whole length. All broken joints are clay covered. Pieces of core do not match at 13", 17", 31", 34", 35".

35'1/2" - 40'1/4" Lift No. 14 Core Recovery 49"
Lengths from %" to 4". Core fresh. Gaps occur at 0-2", and 43". Joints iron stained 1 to 12-18". Clay covered joints 1 per 6", Average. Rock fairly fresh.

40'1/4" - 43'7/8" Lift No. 15 Core Recovery 31" + 1/8" clay
Lengths %" to 4" - average lengths approximately %". Iron stained joints numerous. Rock fairly fresh. Small amounts of clay on most joints. Joint approximately 1 per 2". Last 1/8" of core consists of pure kaolin containing small amounts of quartz.
4'7/8"-45'104"
Lift No. 16
Cores Recovery 36"

Lengths 1" - 91". Core very fresh. Iron stained joints occur at a rate of approximately 1 per 9". Iron staining only light - no clay.

46'105"-49'216"
Lift No. 17
Cores Recovery 34"

Lengths 4" - 64". Core fresh rock. Falls at 24° - 32°. Interval 19" to 23" broken into pieces 1" and lens joints rare - only one very slightly iron stained.

49'926"-53'101"
Lift No. 18
Cores Recovery 8"

Length 1" - 11". Rock only slightly weathered - slight iron stained. None of the pieces had. Joints slightly iron stained and containing clay occur at a rate of 1 per 2" approximately.

53'101"-57'841"
Lift No. 19
Cores Recovery 30"

Lengths 1" - 51". Rock fairly fresh, slightly weathered. Joints are numerous. All joints are iron stained, some contain clay. Approximately 20 joints belonging to 2 sets occur in the whole length of core. Maximum of joints approximately 4/inch.

57'841"-62'131"
Lift No. 20
Cores Recovery 20"

Length 4" to 53". Rock fairly fresh only slightly weathered. Joints are numerous from 19" to 32". One per 2". Majority of these are only slightly iron stained.

62'131"-66'1"
Lift No. 21

Lengths 1" to 2". Rock only very slightly altered. Joints approximately 1/3 inch - all containing clay and only very lightly iron stained.

66'1"-70'12"
Lift No. 22
Cores Recovery 7"

Lengths 1" - 1". Fragments recovered are fresh and evidence of jointing is minor. Joints seen are slightly iron stained with small amount of clay.

70'12"-74'141"
Lift No. 23
Cores Recovery 30"

Lengths 4" to 4". Rock fresh only inci'dently altered. Interval from 21" to 30" very badly broken though rock is fresh. Joints are all iron stained - very little clay present. Joints average approximately 1 per 25" over length of recovered core.

74'141"-78'81"
Lift No. 24
Cores Recovery 13"

Lengths 4" to 12". Rock slightly weathered only. Visible joints average 1 per 2".

78'81"-82'911"
Lift No. 25
Cores Recovery 13"

Lengths 1" to 7". Top 41" mostly of very small fragments. From 41" to 33 1/2" 1 joint per 15". Rock all very fresh. Joints strongly iron stained.

82'911"-87'111"
Lift No. 26
Cores Recovery 50"

Lengths from 1" to 131". Rock fresh, slightly weathered where joints are concentrated - interval 36° to 42°. In interval 25° to 50° joints occur at rate of about 1 per 1". They are strongly iron stained and contain some clay.
NOTES: Details of penetration rate don't appear to mean very much. Variations in rate depending on state of wear on bit, where on a stroke the rate is measured, mask effects due to type of rock. Loss of drilling fluid not measured, as surface casing was not cemented to hard rock properly, lands fluid was returning to surface around casing.
## Appendix 1

### MILLING DATA

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### APPENDIX A

#### Test Fills - Depth of Gravel

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