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Record 1979/18

GEOLOGICAL DATA FROM DRILLING AND EXCAVATIONS ALONG THE MOLONGLO PARKWAY BETWEEN BLACK MOUNTAIN PENINSULA AND ACTON, CANBERRA, ACT, 1977-78.

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SUMMARY

Geological mapping of excavations and logging of drillholes along the Molonglo Parkway, between Black Mountain Peninsula and Acton, have yielded useful data towards understanding the stratigraphy and structure of the Canberra city area. A conformable contact of Black Mountain Sandstone overlying State Circle Shale was exposed at the southern foot of Black Mountain, and an extensive excavation at Acton revealed Camp Hill Sandstone unconformably overlying the Pittman Formation. Exposures of ?Fyshwick Gravel were also mapped.

The excavation conditions were compared with those predicted and showed good agreement. However, predictions of orientations of joints were of limited value, as the few exposures at which measurements could be made did not provide a representative sample.

INTRODUCTION

The Molonglo Parkway, at present under construction (July 1978), is to be a dual carriageway from the northern end of the Tuggeranong Parkway west of Black Mountain, via the northern shore of Lake Burley Griffin to Commonwealth Avenue. Geological and geophysical investigations were carried out along the section of the proposed route west of Sullivans Creek by BMR (Purcell & Goldsmith, 1975; Bishop & Dolan, 1973; Ramsay, 1975); the Sullivans Creek bridge site and Acton Saddle area were investigated by Ground Test Australia (1973). Several deep excavations between Black Mountain Peninsula and Acton, have since revealed rock exposures showing stratigraphic relations of importance is understanding the geology of the Canberra city area. Useful data have also been obtained from the drilling for the foundation investigation of the bridge across the mouth of Sullivans Creek. All the relevant geological data including information from previous mapping and drilling for other projects, were then assessed in an attempt to solve some of the stratigraphic and structural relations in the area. A comparison has also been made between predicted and actual excavation and foundation conditions for the structures associated with the Molonglo Parkway.

GEOLOGY

DESCRIPTIONS OF EXCAVATIONS

Head of Black Mountain Peninsula

Three separate cuttings were excavated in this area, two along the parkway and one on a realignment of Lady Denman Drive (see Plate 1).

Roadcut 1

Roadcut 1, the westernmost of the cuttings on the parkway, is an extension back into the slope of a previously existing cutting on the former alignment of Lady Denman Drive. The rock exposed consisted of laminated shale (Sls) containing the graptolite Monograptus exiguus, which indicates that the shale correlates with the State Circle Shale - of which the type locality is the cutting

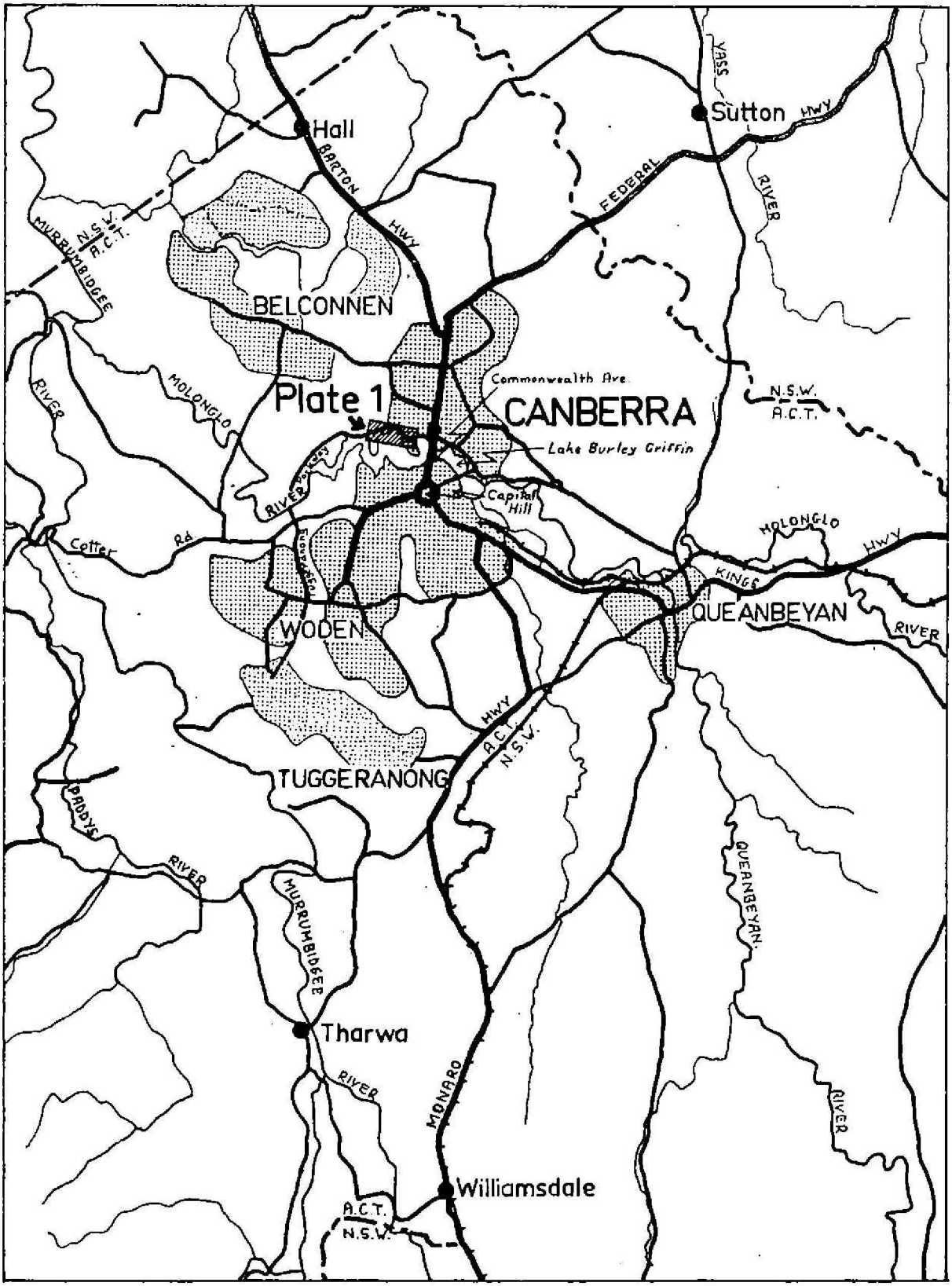
on the northwestern part of State Circle near Capital Hill (Fig. 1). The shale dips at moderate angles in a general northerly direction.

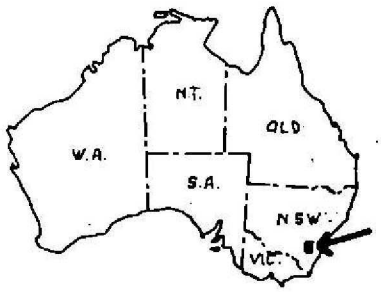
Roadcut 2

Roadcut 2 is on the parkway and crosses the ridge at the head of Black Mountain Peninsula. At the western end of the cutting, laminated shale similar to that in roadcut 1 dips east-northeast towards a north-trending vertical fault; pale grey siltstone and mudstone (Sl) lie to the east of the fault which is defined by a zone of silicification a few centimetres wide. The siltstone and mudstone sequence shows bedding in only one place on the southern side of the cutting, where it dips 64^{o} to the east; bedding is not evident on the northern side. The siltstone and mudstone sequence is massive, and contains oxidised pyrite negatives.
At the deepest point of the cutting a steeply dipping contact was observed between the siltstone and mudstone sequence and the superficial deposits to the east (see sketch in Plate 1). The superficial deposits on the southern side of the cutting are mostly fine polymictic gravel up to a metre thick, horizontally overlain by a metre of very pale grey to white silt with a brown zone of iron oxide enrichment at the contact with the gravel. The silt and gravel are shown together as Cz in Plate 1. On the northern side of the cutting the upper part of the batter consists of fanglomerate (Q) with some gravel (Cz) exposed in the lower part; however, the nature of the contact between the two is not clear. Except at the steeply dipping western contact, the gravel overlies the siltstone and mudstone horizontally a few centimetres above the base of the cut on each side.
At the eastern end of the cutting laminated shale (Sls) was exposed; the contact with the siltstone to the west is obscured by fanglomerate. The shale dips to the north, and is overlain respectively by a thin micaceous sandstone bed and clay with a trace of gravel at its base. Some of the geological mapping in this area and to the south-southwest and northeast was derived from a previous excavation for a sewerage pipe that was at a lower level than the present cutting.

Fig. 1

MOLONGLO PARKWAY
LOCATION MAP





SCALE 1:250,000

5 0 5 10 Km.

Built-up area
Highway
Secondary road
Railway
Territorial boundary

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Roadcut 3

Roadcut 3, in Lady Denman Drive immediately to the south of roadcut 2, exposed pale grey siltstone and mudstone (S1) overlain by gravel on the northern batter. Bedding is more in evidence at this exposure of the siltstone and mudstone than in roadcut 2; dips are as shown in Plate 1. The overlying gravel is mostly fine to medium (less than 2 cm), but with a few larger boulders. One disc-shaped well-rounded boulder of sandstone (probably Black Mountain Sandstone) measured about 50 cm across.

Between Black Mountain Peninsula and Sullivans Creek (roadcut 4)

Roadcut 4, midway between Black Mountain Peninsula and Sullivans Creek, exposed laminated shale with a bed of black shale dipping to the north at the western end; this is overlain successively by a bed of sandstone, another bed of laminated shale and, at the top, sandstone. The succession is conformable and the shale between the two sandstones yielded a specimen of Monograptus exiguus. Bedding attitudes indicate that the sandstone and shale occupy a syncline plunging north-northwest.

East of Sullivans Creek (roadcut 5)

Laminated siliceous shale dipping steeply to the southeast was exposed in roadcut 5 immediately east of Sullivans Creek. The shale, which has already been mapped from outcrop, is the Acton Shale, (Öpik, 1958), and this locality is the type locality of the formation. It contains graptolites of Late Ordovician age.

Acton saddle

The Parkway at Acton crosses a gentle saddle between Balmain Crescent and Liversidge Street. The design of the roadway in this area is a cut and cover tunnel, with the roadway level at a maximum of about 12 m below the original surface. A total length of about 400 m of rock was exposed in the excavation (Plates 1 and 2).

Near the crest of the saddle, the excavation revealed a central section of cleaved siltstone (Omp_1) with minor sandstone beds, overlain by sandstone and silty sandstone (Smc_1). Several steep to vertical faults, mostly ofasmall displacement cut the excavated section. the westernmost one, Fault X, is a vertical fault with somewhat larger displacement. Siltstone and silty mudstone (Smc_2) immediately west of Fault X the eastern limb of an anticlinorium whose core of sandstone and silty sandstone (Smc_1, Plate 1) lies to the west of Balmain Crescent. Sandstone and silty sandstone (Smc_1) were also exposed in most of the excavation east of Liversidge Street, except in one section on the southern side of the excavation where the succession passes up into siltstone and silty mudstone (Smc_2).

Minor excavations for a temporary road about 100 m south of the western section of the main cutting showed cleaved siltstone and sandstone (Omp_1) with dips indicating an anticline plunging south; this unit is overlain to the northwest by sandstone and siltstone (Smc_1) that dip to the northwest. Sandstone and siltstone (Smc_1) containing brachiopod fragments were exposed about 30 m to the north of the road in a pipeline trench (locality indicated by fossil symbol); small folds plunging north were evident in this exposure

The cleaved siltstone in the saddle in the centre of the main cutting (Omp_1) shows little evidence of bedding except in a few places where it is laminated or contains thin sandstone lenses. On the northern face of the cut small folds defined by these features plunge steeply to the north. A sandstone bed dipping steeply to the south overlies the siltstone on the southern face of the cut (section CD, Plate 2). Both the sandstone and cleaved siltstone at this location are overlain by the more gently dipping and silty sandstone (Smc_1), indicating an unconformity as shown in section CD (Plate 2). A few beds of coarse sandstone were exposed at and near the base of the sequence above the unconformity. Figure 2 shows the central part of the southern face of the cut at the easternmost exposure of the unconformity.

Two useful marker beds of prominent white sandstone were mapped in the sandstone/siltstone sequence (Smc_1) east of Liversidge Street (Plate 2) Liesegang rings were well developed in this sandstone in some places, and also in other parts of the sandstone/siltstone sequence. Another useful marker defined by one or two very thin (5 mm) beds of chocolate brown mudstone occurs in the siltstone and silty mudstone between 15 and 30 m east of points A and C (Plate 2.)

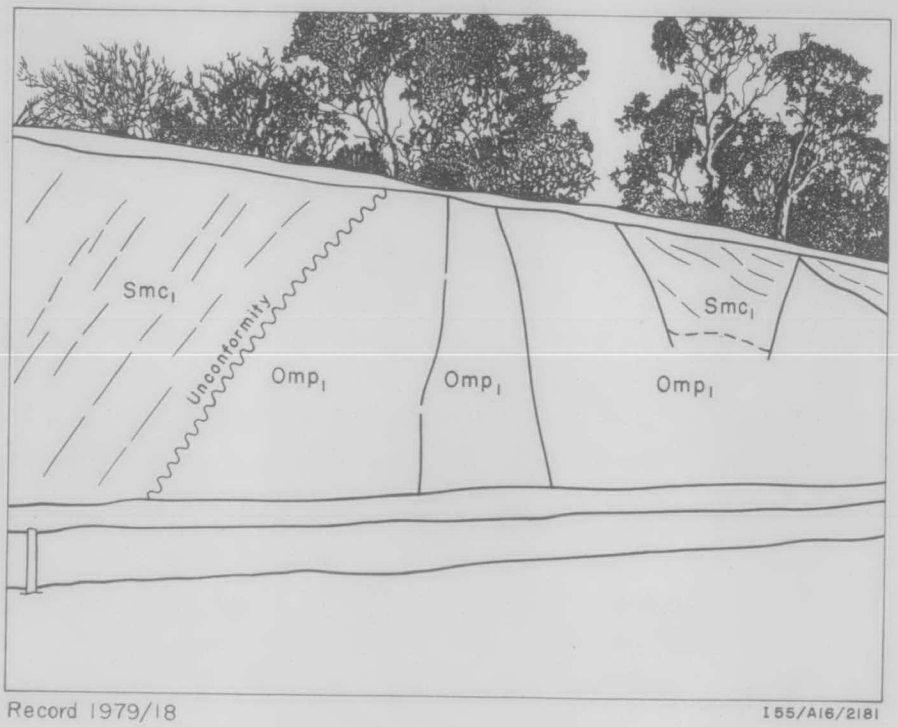

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Fig. 2 Central section of southern face of Acton Saddle cut showing location of unconformity between Pittman Formation (Omp_1) and Camp Hill Sandstone (Smc_1)

The boundary between the sandstone and mudstone facies (Smc_1 and Smc_2) is gradational, and is highlighted by a change in colour of the weathered rock from mainly white to pale yellow-brown in the sandstone facies to dark yellow-brown, red, and purple in the mudstone facies.

DRILLHOLE DATA

Graphic logs of all drillholes in the area of Plate 1 are shown in Figures 3 and 4. The full detailed logs appear in various reports as follows.

Holes MP4 - MP12	:	Purcell & Goldsmith (1975)
Holes 9-35	:	Ground Test (1971)
Holes 37-42	:	Ground Test (1973)
Holes DD5-DD12	:	Henderson (1970)
Hole C5	:	Henderson (1978)

In addition most of the holes 9-35 were logged independently by D.E. Gardner (BMR), and are included in Appendix 1 of this report. Full logs of holes 1 and 2B drilled at Sullivans Creek during construction are also included.

West of Sullivans Creek

Eight holes (MP4-MP12) were drilled to test the rock and soil to be excavated for the cuttings west of Sullivans Creek. A deep stratigraphic hole (C5) was completed at the head of Black Mountain Peninsula in 1972 (Henderson, 1978). All holes except C5 penetrated a single lithological unit below soil or superficial deposits. Hole MP4 penetrated fanglomerate (Q) overlying gravel (Cz), and the hole bottomed in mudstone. Hole C5 first penetrated shale (Sls) which then passed down into massive siltstone (Sl?) over a gradational zone corresponding to a zone of poor core recovery (see graphic log, Fig. 3).

Sullivans Creek area

Twelve holes (holes 27-42) were drilled from a barge in the mouth of Sullivans Creek to test possible locations for pile foundations in bridgeworks (Fig. 4). Other holes were drilled onshore to the east of the creek. Two additional holes (1 and 2B) were drilled during construction (Fig. 3).

The concealed geological boundary (dotted line) shown immediately west of holes 28 and 38 (Plate 1) represents a change in the lithology of the rock under the cover of superficial deposits. East of the boundary the rock beneath a relatively thin cover of alluvium (less than 10 m), is hard Acton Shale, similar to that exposed on the east bank. West of the boundary the rock is generally soft fine sandstone, siltstone and mudstone which in two holes (e.g., hole 40, Fig. 4) is highly weathered and soft to depths of more than 30 m. The superficial deposits are much thicker (up to about 30 m) over the soft rock. Hole 35 yielded a spiriferid brachiopod (see Appendix 1 for log of hole by D.E. Gardner).

Hole 1 and 2B (Fig. 3 and Appendix 1) were drilled after difficulties with driving piles during bridge construction. They revealed fanglomerate (below 16 m depth) overlying extremely weathered and altered siltstone and mudstone represented by grey and brown clay. Hard ironstone fragments were also recovered from both holes in the clay below the fanglomerate.

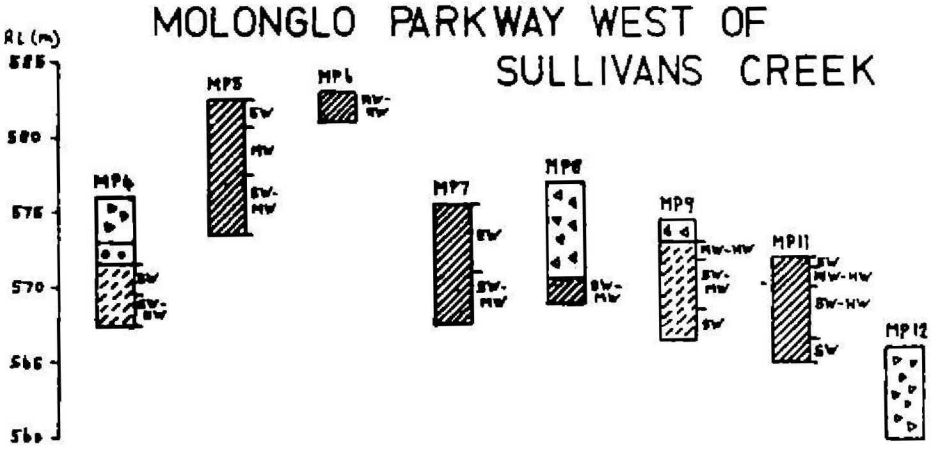
The composition and inferred origin of the superficial deposits in all the holes in the creek and in four other holes (holes 24, 24A, 25 and 26) to the east is shown on the graphic logs (Fig. 4). It is not clear from some of the logs whether material described as gravel is fanglomerate or alluvium.

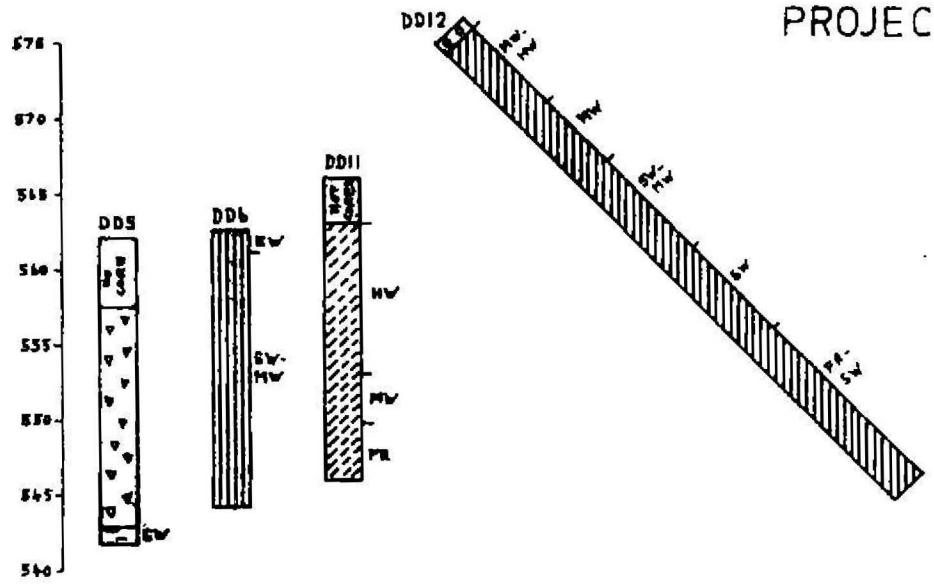
Acton saddle

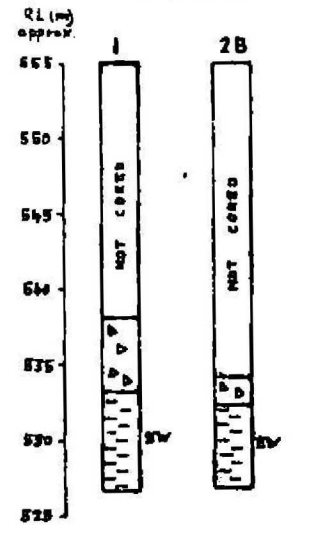
Fourteen holes were drilled within the area now excavated on the Acton saddle. Three of them (holes 12, 14, and 15) penetrated the high-level gravel (Cz, Plates 1 and 2) before passing into sandstone and siltstone. Two holes (holes 17 and 18) logged by D.E. Gardner (Appendix 1) penetrated the unconformity between units Omp_1 and Smc_1; in hole 17 the position of the unconformity is clear at 8.5 m (27 ft), but in hole 18 the lower part of the sandstone unit between 4.9 and 12.1 m (16-39.8 ft) is likely to be part of the sandstone bed mapped below the unconformity on the southern side of the cut (Plate 2, section CD).

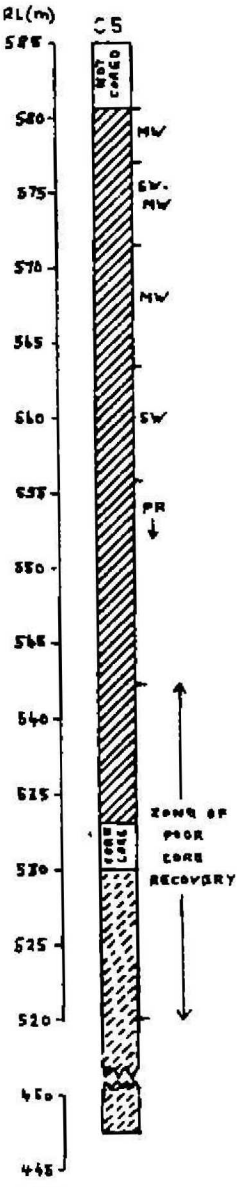
GRAPHIC LOGS OF DRILLHOLES VARIOUS LOCATIONS

Fig.3

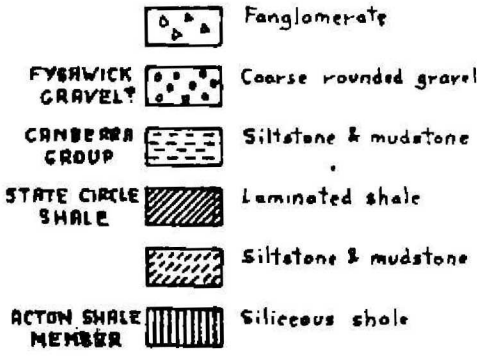








STRATIGRAPHIC HOLE - NORTH OF BLACK MOUNTAIN PENINSULA



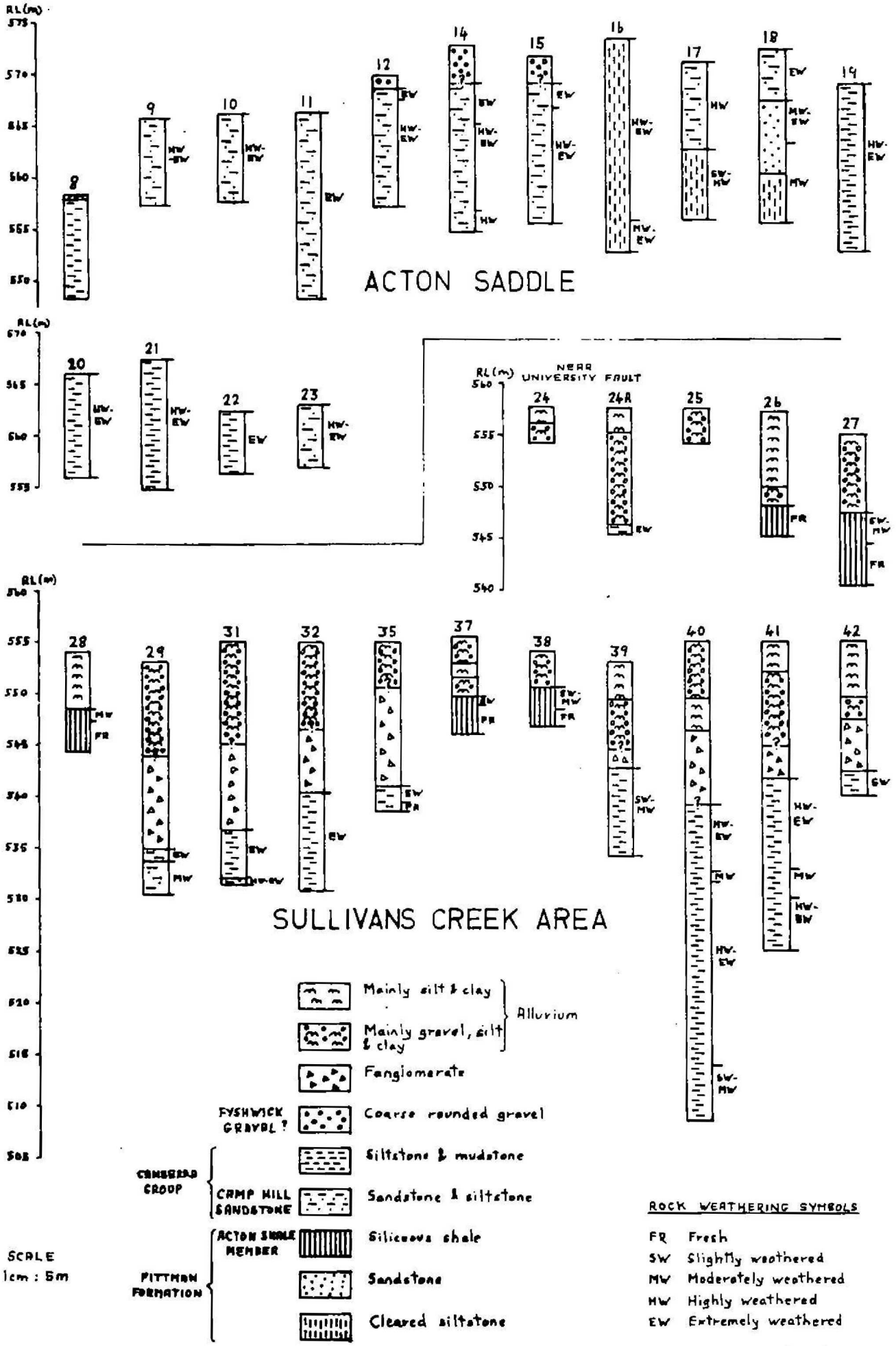
ROCK WEATHERING SYMBOLS

FR Fresh
SW Slightly weathered
MW Moderately weathered
HW Highly weathered
EW Extremely weathered

SCALE 1cm : 8m

GRAPHIC LOGS OF DRILLHOLES ACTON SADDLE AND SULLIVANS CK.

Fig. 4



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Each of the other holes penetrated only one of the lithological units shown in Plates 1 and 2.

North Molonglo Outfall Sewer Project

Four holes (DD5, DD6, DD11, and DD12) were drilled in 1969 for the proposed North Molonglo Outfall Sewer (see Plate 1 and graphic logs Fig. 3). Hole DD5, near Clunies Ross Street west of Sullivans Creek, penetrated fanglomerate overlying grey clayey altered mudstone, similar to that observed in holes 1 and 2B. Hole DD6, close to the east bank of Sullivans Creek, penetrated Acton Shale (Oua). Hole DD11 was drilled about 100 m south of the Research School of Physical Sciences; it penetrated siltstone (Sl?) with a thin bed of sandstone. Hole DD12 was drilled near the intersection of Balmain Crescent and Liversidge Street near University House; it penetrated Acton Shale.

STRATIGRAPHY

West of Sullivans Creek

Two named rock formations of early Silurian age are exposed to the west of Sullivans Creek in the area shown in Plate 1. They are the State Circle Shale (Sls), identified as such by the presence in two places of the graptolite Monograptus exiguus, and the Black Mountain Sandstone (Slb). Before the cuttings were excavated, the generally similar northerly dips in the two formations implied that the sandstone conformably overlies the shale (Strusz & Henderson, 1971), although the contact was not clearly exposed. The recent excavations for the cutting about half way between the head of Black Mountain Peninsula and Sullivans Creek have confirmed the conformable relation beyond doubt. Interbedded sandstone and shale mark the transition from State Circle Shale to Black Mountain Sandstone, but the location of this boundary is indistinct.

A third, unnamed, formation (Sl) also crops out on Black Mountain Peninsula. It was exposed in the Parkway cutting at the head of the peninsula in faulted contact with the State Circle Shale; Öpik (1958) showed this area, mapped as Sl, as Ordovician outcrop (Pittman Formation). The core log of drillhole C5 indicates a gradational change from State Circle Shale down into rock identified as probably Sl; unfortunately a fault

zone was also encountered at about the same depth as the gradational change, and obscured the relation. Despite the fault zone it is still arguable that unit S1 represents a lower, non-laminated part of the State Circle Shale and is therefore of probable early Silurian, rather than Ordovician, age.

The age of the high-level gravel (Cz) at the head of Black Mountain Peninsula is not known. It is probably significant that the elevation of the base of the gravel is about the same as that of the Fyshwick Gravel at Fyshwick, and this would seem to indicate that the two gravels could be contemporaneous. The age of the Fyshwick Gravel has been the subject of various interpretations. Öpik (1958) argued for a Permian age, but a Tertiary age has been considered more likely (Henderson, in prep.). The silt overlying the gravel shows extreme leaching, which indicates that it is at least as old as the oldest of the soil cycles of Van Dijk (1959; J.R. Kellett, BMR personal communication). The steep contact between the gravel and the siltstone/mudstone formation to the west of the gravel is probably the result of undercutting of the steep slope by the ancient (Molonglo) river that deposited the gravel. The silt overlying the gravel is of aeolian origin and would have been deposited after the ancient river changed its course. Later still, both the silt and the gravel would have been covered by the fanglomerate during the Pleistocene. The age of the fanglomerate on the lower slopes of Black Mountain is discussed by Costin & Polach (1973).

Sullivans Creek and Acton area

Rock units in the Sullivans Creek and Acton area range in age from Ordovician to Middle Silurian.

The rocks shown in Plate 1 as Ordovician (Pittman Formation) have been interpreted as such by their lithology and likely stratigraphic relation to the graptolite bearing Acton Shale Member which is of late Ordovician age. The rocks shown as Omp_1, which include the rocks exposed below the unconformity in the Acton saddle cutting, are regarded as underlying the Acton Shale Member because plunges are towards areas of Acton Shale outcrop; these areas are at Balmain Crescent to the south of the cut, and an area including the intersection of Balmain Crescent and Liversidge Street to the north of the cut (see log drillhole DD12). Exposures of sandstone

in the foundations of the Research School of Physical Sciences and in a trench on the opposite side of Mills Road (Plate 1) are down dip from the Acton Shale on the eastern side of Sullivans Creek; the sandstone is therefore regarded as overlying the shale, and has been shown as Omp_2.

Opik (1958) reported State Circle Shale (Lower Silurian) faulted against Acton Shale in the foundations of University House, as shown in Plate 1 (University Fault). Siltstone was later mapped in the trench to the east of Mills Road and is similar to the siltstone (Sl) which underlies the State Circle Shale at the head of Black Mountain Peninsula. No bedding was seen in the siltstone. Mapping of excavations at Giralang (Henderson, in prep.) has revealed an apparently conformable succession from Acton Shale to State Circle Shale, with intervening units similar to units Omp_2 and Sl at Acton. A similar conformable succession could be based on the outcrop and drillhole distribution of units Oua, Omp_2, Sl, and Sls in the Acton area.

The formations overlying the unconformity at the Acton saddle cut are regarded as Camp Hill Sandstone (Smc_1) passing up into higher parts of the Canberra Group (Smc_2) of which the Camp Hill Sandstone is the lowermost formation. This conclusion is based on lithology, on fragments of shelly fossils typical of the Canberra Group, and the presence of the unconformity which is only about 2 km from exposures of what is probably the same unconformity near Capital Hill. One exposure of Smc_2 (with dip 63°E) probably lies to the east of the Acton Fault, whose position in Plate 1 is that shown by Opik (1958).

The stratigraphic position of the deeply weathered sandstone, siltstone, and mudstone encountered by the drillholes in the western part of the Sullivans Creek is not known definitely. The spiriferid brachiopod noted in hole 35 by D.E. Gardner (Appendix 1) probably indicates correlation with the Canberra Group. Shelly fossils are known only in the Canberra Group and younger formations, and it is likely that some, if not all, the deeply weathered rocks in the creek also belong to the Canberra Group.

The high-level gravel (Cz) on the eastern side of the saddle cutting is probably of similar age to the gravel at the head of Black Mountain Peninsula, as it is at about the same elevation.

STRUCTURE

West of Sullivans Creek

Two phases of folding are evident in the Lower Silurian rocks west of Sullivans Creek. One of the fold phases is shown on the western edge of Plate 1, where stereoplots of bedding indicate folds plunging about 20° to the northeast. The other phase was evident in the cutting between Black Mountain Peninsula and Sullivans Creek where the syncline plunges about 18° to the north-northwest; other folds in the same system were mapped in a trench between 100 and 200 m northeast of this cutting.

The fault which is exposed in the cutting at the head of Black Mountain Peninsula indicates a vertical downward displacement of the Black Mountain Sandstone on the western side of about 100 m; however a horizontal component of displacement cannot be ruled out.

The inferred fault shown striking east-northeast across the head of Black Mountain Peninsula represents the most likely position of the fault intersected at depth in drillhole C5. The fault as shown could account for an apparent structural discordance between bedding in unit S1 and the State Circle Shale (S1s). The depth (50 m) of shale and the shallow dip (0-20°) in hole C5 probably favours the presence of a fault rather than an unconformity between the shale and unit S1, given the proximity of S1 in the cutting to the south of the drillhole.

Sullivans Creek and Acton area

A complex structural history is evident for the Ordovician and Middle Silurian rocks exposed in the Acton saddle cutting (see Plate 2). Plunging folds relate to roughly north-south cleavage where observed in both the Ordovician and Middle Silurian formations. The intensity of the cleavage is greatest in the finest-grained rocks; this cleavage is well developed in the Ordovician Siltstone (Omp_1) and in unit Smc_2. Folds are tighter and plunges steeper in the Ordovician siltstone then in most of the Middle Silurian rocks; however, tight folds with a moderately steep plunge were exposed in the Camp Hill Sandstone near point B on the northern face of the cut (plate 2 and Fig. 5).

A broad anticline trending northwest is interpreted as separating the southerly and northerly plunges in the Pittman Formation (Omp_1 in the central part of the cut. If this anticlinal axis is extended to the northwest and southeast it coincides roughly with the position of a broad syncline in the Canberra Group rocks above the unconformity, based on the northerly plunges of folds on the western side of the cutting and the southerly plunges on the eastern side.

A structural problem in the Acton area is posed by the University Fault (Öpik, 1958), which brings the Acton Shale and State Circle Shale into contact at University House. If the displacement is vertical only, a large downthrow on the northwest side of the order of 300 m would be necessary to remove units Omp_2 and S1. The fault of largest displacement in the Acton saddle cutting is on the western side of the central cut (Fault X). This fault was considered as a likely extension of the University Fault, but the displacement of the Camp Hill Sandstone on the western side probably does not exceed 20 or 30 m, which is considerably less than that of the University Fault. If Fault X is not the University Fault, then the University Fault must swing to the north of the cutting as shown in Plate 1. However, this would mean a downward displacement on the southeastern side west of Balmain Crescent, which would be the reverse of the displacement at University House. The solution to the problem probably involves a major left lateral strike-slip component of movement on the University Fault. One possibility is that the Fault X in the saddle cutting has been displaced westwards along the University Fault and resumes at Sullivans Creek to form the boundary between the Acton Shale and probable Canberra Group rocks in the centre of the creek (see sketch in Plate 1). The ironstone in holes 1 and 2B in Sullivans Creek possibly indicates a faulted contact between the Acton Shale and the probable Canberra Group to the west.

Another problem concerns the chocolate-coloured mudstone marker bed in the saddle cutting (see Plate 2) towards the western end of the main cut. The bed highlights a structural discordance between the northern and southern sides of the cut. On the northern side of the cutting the marker bed appears to lie well above the top of the Camp Hill Sandstone to the west. On the southern side, however, a syncline between the marker bed and the Camp Hill Sandstone indicates that the marker bed, should reappear immediately above the top of the Camp Hill Sandstone. No sign of the eastern limb of the syncline appears on the northern side of the cut. Possibly

the small fault on the southern side of the cutting shown on section CD extends to the northwest across the cutting and truncates both the syncline and the marker bed in the centre of the cutting. Alternatively the marker bed may lens out, or the chocolate-brown mudstone may occur at more than one level.

ENGINEERING GEOLOGY

EXCAVATION CONDITIONS

West of Sullivans Creek

The weathering characteristics and rippability of the rock and superficial deposits in the cuttings west of Sullivans Creek generally accorded with those predicted from the drillholes, costeans, and seismic refraction investigations (Purcell & Goldsmith, 1975; Bishop & Dolan, 1973; Ramsay, 1975). However, the orientations of joints, especially in the State Circle Shale, were more varied than expected, mainly because the few localities where the joints could be measured were not representative of the whole area. No stability problems related to joints were encountered, but this was due mainly to the moderate (1:1) batters of the cuttings. Parts of the batters on the northern side of the parkway were formed in considerable thicknesses of superficial deposits. All batters will be stabilised by covering them with topsoil and sowing with grass. This has already been done (July, 1978) for the batters on the northern side of the parkway, where in some places the topsoil and grass have slipped from the underlying rock surface following saturation by rainfall.

Acton saddle cutting

The exploratory drillholes and seismic refraction traverses in the Acton saddle (Ground Test, 1971; and Appendix 1, this report) indicated that most, if not all, the material to be excavated would be rippable. This assessment proved to be correct, although some difficulty with excavation was experienced in places where foundation trenches were dug in the floor of the cut. The hardest sections were in the Pittman Formation (Omp_1) in the central and deepest part of the cut.

Stability of the steep faces (about 1:4) of the central part of the cut was good. This can be attributed to the clay content of the weathered rocks and poorly developed joints in most rock units. Cleavage partings in some of the less weathered siltstone of the Pittman Formation did not pose a stability problem, as the cleavage was aligned almost at right-angles to the cut faces.

Slow but persistent seepage into foundation trench excavations in the floor of the central cut on the northern side at the western end was probably derived from the sandy and silty layers in the Camp Hill Sandstone and overlying siltstone and mudstone.

CONCLUSIONS

1. A better understanding of the geology of the Canberra area has been gained from the Molonglo Parkway excavations and investigation drilling, and from other projects in the area. It is now confirmed:

   (a) that the Black Mountain Sandstone conformably overlies the State Circle Shale at the southern foot of Black Mountain; and

   (b) that an extensive exposure of the Camp Hill Sandstone unconformably overlies the Pittman Formation at Acton.

2. The engineering geological investigations for the parkway accurately indicated the weathering state and rippability of soil and rock. However, measurements of joints in the few rock exposures near the head of Black Mountain Peninsula were not representative of joints in the roadcuts, and were of limited value in predicting the orientations of joints.

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APPENDIX 1

LOGS OF DRILLHOLES 1, 2B, 9, 10, 11, 12, 14, 15, 16, 17, 18, 19, 20, 21, 22, 23, 27, 29, 31, 32, 35.

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT MOLONGLO PARKWAY, SULLIVANS CREEK BRIDGE
LOCATION WEST PILE SITE
ANGLE FROM HORIZONTAL (θ) 90° DIRECTION
COORDINATES E209075 N605550 (approx) R.L. OF COLLAR 557m (approx).
Stromlo metric

HOLE NO. 1
SHEET 1 OF 1

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing	Graphic Log	Lift and % core recovery	Depth and size of Core	Fracture Log (0 6 12 18+)	RQD	Defect Frequency: Intercept Angle (0 30 60 80 90)	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
	NOT CORED				16·84						
CONGLOMERATE	SW Sandstone pieces & CORE LOSS				17·70						
	CORE LOSS in "SS & sandy clay"				18·60						
	SW-MW Sandstone pieces				19·43						
	CORE LOSS in "sand, silt & clay"				20·75						
	Cemented sandy silt				21·24						
	SW Sandstone piece; Grey silt				21·75						
MUDSTONE EW ?	CORE LOSS in "brown clay"				24·25						
MUDSTONE EW	CORE LOSS in "blue-grey clay (GW shale)"				25·11						
	Pale grey clay				25·75						
	CORE LOSS in "blue-grey GW shale"				26·35						
	Pale grey clay				26·90						
	Buff-brown clay				27·25						
	CORE LOSS in "brown EW clayey shale"				28·00						
	CORE LOSS in "EW-HW brown shale"				28·40						
"SHALE" & IRONSTONE	Black & yellow-brown (limonite) ironstone fragments; CORE LOSS in EW red-brown shale										
	END OF HOLE								28·40m		

Drill type
Feed
Core barrel type
D.C. Roads 2
Driller BRIDGES
Commenced
Completed May 1978
Logged by G.A.M. Henderson
Vertical scale 1:100
Checked by

Notes

Fracture Log — Number of fractures per 25cm of core. Zones of core loss blacked in.
Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.
Defect Frequency — Number of natural defects (shears, joints, fractures) per 25cm of core occurring at specified intercept angle range.
Water Level Measurements — ▼ Level when hole in progress at specified depth. ▽ Level in completed hole on specified date.

Core loss material as reported by driller

Water Pressure Tests

* Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.

Core Photograph Negative No.

Depth (m)	Black & White	Colour

I 55/A16/2192

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT MOLONGLO PARKWAY, SULLIVANS CREEK BRIDGE — HOLE NO. 2B

LOCATION WEST PILE SITE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION

COORDINATES E209075 N603550 (approx.) Strom. metric — R.L. OF COLLAR 557m (approx.) — SHEET 1 OF 1

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Depth and size of Core	Fracture Log	RQD	Defect Frequency Intercept Angle 0 30 60 80 90	Structures Joints, veins, seams, faults, etc	Water Level	Water Pressure Test Losses (Lugeons) *
	NOT CORED	20.78						
CONGLOMERATE	CORE LOSS in "sand, clay, sandstone & quartzite cobbles"	21.56						
	Small sandstone pieces	21.77						
CONGLOMERATE & EW MUDSTONE ?	CORE LOSS in "EW brown shale"	22.10						
	SS pieces & brown clay							
	CORE LOSS	23.64						
"SHALE" & IRONSTONE	Dark brown & yellow-brown (limonite) ironstone frags. Mostly < 2cm diam; some pieces to 7cm diam below 23.80	24.15						
	CORE LOSS in "clayey brown shale"	24.95						
	Brown clay & ironstone pcs							
	CORE LOSS in "EW brown shale & some narrow bands of HW shale"	26.00						
	Small ironstone fragments in brown clay	26.62						
	Core loss in "EW-HW brown shale with some soft bands of 100mm"	27.81						
	Ironstone frags to 5cm diam	28.12						
	END OF HOLE					28.12 m		

Drill type

Feed

Core barrel type

Driller D.C. ROADS & BRIDGES

Commenced

Completed May 1978

Logged by G.A.M. Henderson

Vertical scale 1:100

Checked by

Notes

Fracture Log — Number of fractures per 25 cm of core. Zones of core loss blacked in.

Bedding and Joint Planes — Angles are measured relative to a plane normal to the core axis.

Defect Frequency — Number of natural defects (shears, joints, fractures) per 25cm of core occurring at specified intercept angle range.

Water Level Measurements — ▼ Level when hole in progress at specified depth. ▽ Level in completed hole on specified date.

Core loss material as reported by driller

Water Pressure Tests

* *Values in lugeons should be read in conjunction with computation sheets. Test sections are indicated by blacked in strips.*

Core Photograph Negative No.

Depth (m)	Black & White	Colour

155/A16/2193

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ACTON SADDLE MAJOR ROAD LINK.

LOCATION 300 feet south-east of Liversidge St, ACTON. A.C.T.

ANGLE FROM HORIZONTAL 90° DIRECTION Vertical

COORDINATES E 209849 N 6103292 (Stromlo metric) R.L. 565·7m

HOLE NO. 9

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH (ft)	FRACTURE LOG	CORE RECOVERY	CASING	STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST Loss in gallons per minute per foot
	NOT CORED	A	4			B		1·2 m
Fine-grained sandstone, highly weathered and Siltstone, highly to completely weathered Appears to be Riverside Formation.	Yellow brown and pale brown White In places prominent liesegang markings.	8 1 14 60% 15	8 11·5 15·2 17 20·2 22·5 28				·04-1 (·3) Bedding dip 30° ·04-1 (·3) Mainly Short Split Core lengths 1-6" norm 3° ·25-1·5 (·5) Clay and Fragments to 2·0 Dip 10° Clay and small Fragments.	5m 8·5 m
	END OF HOLE							

Column A

Clay in inches 8

60% clay 14

For 14 inches 60%

Column B

Core Fragmented giving size range in inches. (norm bracketed)

DRILL TYPE PENNDRILL

FEED HYDRAULIC

CORE BARREL TYPE NMLC TRIPLE TUBE

DRILLER GROUNDTEST

COMMENCED

COMPLETED 6-10-76

LOGGED BY D.E. GARDNER

VERTICAL SCALE 1" = 10 Feet

NOTES

FRACTURE LOG Number of fractures per foot of core. Zones of core loss are blacked in.

BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

All easy excavation, partly blade, partly ripping. Foundation for moderate loading reasonably good at 4', poor below 22'

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures. Test sections are indicated graphically by blacked in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

155/A16/2194

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ACTON SADDLE MAJOR ROAD LINK

LOCATION 200 East south-east of Liversidge Street ACTON A.C.T.

ANGLE FROM HORIZONTAL 90° DIRECTION Vertical

COORDINATES E 209837 N 603274 (Stromlo metric) R.L. 566.1m

HOLE NO 10

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH (ft.)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST Loss in gallons per minute per foot	CORE BOX	CORE BARREL
	Not Cored.	A	6			B	1-1.5	1.8 m		
Claystone and Silty Claystone Highly and Completely Weathered Probably Riverside Formation	Cream, Yellow, and white Soft. A fairly large proportion of clay Probably little Swelling.	6	10				·15-2 (1) Dust--5 (Dust)			
			14				1-1.5			
			16.5				Dip of bedding 25-30° Predominantly	5m		
		6	18				·25-2 (1.5)			
		4	21							
		24	22				Dust, clay & Frgts to 2" (<.5)			
			26							
		10	28				(<.5)	8.5 m		
	End of Column A	A				B	Hole Column B			
	Clay in inches	6					Core Fragmented, showing size range in inches. (mode bracketed)			

DRILL TYPE PENNDRILL
FEED HYDRAULIC
CORE BARREL TYPE NMLC Triple tube
DRILLER GROUNDTEST
COMMENCED
COMPLETED 7-10-70
LOGGED BY D.E. GARDNER
VERTICAL SCALE Inch = 10 Feet

NOTES

FRACTURE LOG Number of fractures per foot of core. Zones of core loss are blocked in.

BEDDING AND JOINT PLANES – Angles are measured relative to a plane normal to the core axis

No sound foundation here.

WATER PRESSURE TESTS

PACKER TYPE
SUPPLY LINE
VERTICAL SCALE
Figures given are gauge pressures. Test sections are indicated graphically by packed in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE
COLOUR

155/A16/2195

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ACTON SADDLE MAJOR ROAD LINK.

LOCATION 300 Feet South-east of Liversidge Street, ACTON. A.C.T

ANGLE FROM HORIZONTAL 90° DIRECTION Vertical

COORDINATES E 209330 N 603251 (Stromlo metric) R.L. 566·3m

HOLE NO. 11

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC)	GRAPHIC LOG	DEPTH (ft)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES)	WATER PRESSURE TEST Loss in gallons per minute per foot	PHOTO REF NO. CORE BOX	PHOTO REF NO. CORE SAMPLE
	Not Cored.		12					3·7 m		
Claystone and silty Claystone	Completely weathered, Clayey Yellow-brown and Cream-Coloured. Ferrug. vein 0.5" Silicified Ferrug. 23·7 24 boxwork		16 20 21·5 22·8 24·9 26·5 31				Bedding dip 10°	5m 10m		
Siltstone and fine-grained Sandstone medium-grained, Current bedded.	Pale brown Completely weathered Pale brown Clayey Siltstone Fairly hard	A	36 39·75 40·7 44 46 52 54 57·5 59·5	? ? ?	B		0·5-2 (1) Irregular {current bedded Joints, Coated with Fe-oxide ? Snd-2 (1) Core lengths 1-2"	15 m 18·1 m		
	Soft down to 57·5 where broken core is fairly hard.									

DRILL TYPE PENNONI LL

FEED HYDRAULIC

CORE BARREL TYPE NMLC TRIPLE TUBE

DRILLER GROUND TEST

COMMENCED

COMPLETED 2-10-70

LOGGED BY D.E. GARDNER

VERTICAL SCALE 1" = 10 Feet

NOTES

FRACTURE LOG Number of fractures per foot of core. Zones of core loss are blocked in.

BEDDING AND JOINT PLANES – Angles are measured relative to a plane normal to the core axis

Column A

Clay A

Column B

Core fragmented, giving size range in inches (norm bracketed)

Snd. Sand size B

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures. Test sections are indicated graphically, by blocked in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

[55/A16/2196

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ACTON SADDLE MAJOR ROAD LINK

LOCATION 100 FEET SOUTH-EAST OF LIVERSIDGE ST. ACTON, A.C.T.

ANGLE FROM HORIZONTAL 90° DIRECTION VERTICAL

COORDINATES E 209805 N 603265 (Stromlo metric) RL 569.9m

HOLE NO 12

SHEET 1 OF 1

WEATHERING	DESCRIPTION	GRAPHIC LOG	DEPTH (ft.)	FRACTURE LOG	% CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST Loss in gallons per minute per foot	CORE LOSS	CORE SAMPLES
	NOT CORED		8					2.4m		
	SILTSTONE, ARGILLITIC, YELLOW BROWN. HIGHLY TO COMPLETELY WEATHERED.	17	12.3							
			16.7					5m		
		2	18.2							
		10	20.4							
		3	25.3							
		8	27.2							
		4								
		5								
	50% CLAY	4	31.7					10m		
	SEVERAL SEAMS 0.5-1" ON BEDDING.									
	PLASTIC	8								
		7	37.4							
	PLASTIC	14								
			42					12.8m		
	END OF HOLE.									

DRILL TYPE PENNDRILL

FEED HYDRAULIC

CORE BARREL TYPE N.M.L.C. TRIPLE TUBE

DRILLER GROUNDTEST

COMMENCED

COMPLETED 29-9-70

LOGGED BY D.E. GARDNER

VERTICAL SCALE 1 INCH : 10 FEET

NOTES

FRACTURE LOG Number of fractures per foot of core. Zones of core loss are shaded in.

BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

COLUMN 4

CLAY IN INCHES

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures.
Test sections are indicated diagrammatically, as shaded in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

155/A16/2197

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ACTON SADDLE MAJOR ROAD LINK

LOCATION LIVERSIDGE STREET, ACTON, A.C.T.

ANGLE FROM HORIZONTAL 90° DIRECTION VERTICAL

COORDINATES E 209750 N603277 (Stromlo metric) RL 572.7m.

HOLE NO. 14

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH (FT)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST Loss in Gallons per minute per foot	PHOTO REF NO CORE DRY	PHOTO REF NO CORE WET

NOT CORED

A 25 B

5m

7.6 m

SANDSTONE HIGHLY TO COMPLETELY WEATHERED

FINE GRAINED CLAYEY SANDSTONE SOFT — TWO CORE LENGTHS 2" & 5"

26.8 — 96 — 50%

34.8

PROBABLY MUCH CLAY IN LOST CORE

84 — 20%

41.8

WHITE AND PALE BROWN

60 — 50%

46.8

44 — 30%

60% — 51.5

HIGHLY WEATHERED

FAIRLY HARD 52.5 - 54, 58 - 59 — CORE LENGTHS 1.5 - 4"

1 — 1 — 54.5

56.5

30 — 40% — 59

0.5 - 2 (1)
SND - 2 (AND CLAY)

DIP OF BEDDING 50°

10 m

SND - 3" (<1) AND CLAY @ CORE LENGTH 2 - 5"

SND - 3" (<1) AND CLAY

15 m

AS ABOVE

SND, BROKEN CORE TO 3" TO 1" (<0.5) AND CLAY

SND - 1 (SND)
0.5 - 1.5 (1)
SND - 1

18.0 m

END OF HOLE

COLUMN A

CLAY IN INCHES 1

50% CLAY FOR 60 INCHES — 60 — 50%

COLUMN B

CORE FRAGMTD. GIVING SIZE RANGE IN INCHES (AND MODE IN BRACKETS)

SND : SANDSIZE

DRILL TYPE PENNDRILL

FEED HYDRAULIC

CORE BARREL TYPE N.M.L.C. TRIPLE TUBE

DRILLER GROUNDTEST

COMMENCED

COMPLETED 21-9-70

LOGGED BY D.E. GARDNER

VERTICAL SCALE 1 INCH : 10 FEET

NOTES

FRACTURE LOG Number of fractures per foot of core. Zones of core loss are shaded in.

BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

JOINTS ABOUT 50° AND ALMOST VERTICAL; LINED WITH FE. OXIDE.

MUCH OF THE CORE HAS A SLATY OR FRACTURE CLEAVAGE, ABOUT 80° DIP.

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures.
Test sections are indicated graphically & packed in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

155/A16/2198

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: ACTON SADDLE MAJOR ROAD LINK

LOCATION: 50 FEET SOUTH-EAST OF LIVERSIDGE ST. ACTON, A.C.T.

ANGLE FROM HORIZONTAL: 90° DIRECTION: VERTICAL

COORDINATES: E 209724 N 603237 (Stromlo metric) R.L. 571·7m

HOLE NO. 15

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC)	GRAPHIC LOG	DEPTH (F.T.)	FRACTURE LOG	CORE RECOVERY %	CASING	STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES)	WATER PRESSURE TEST (Loss in gallons per minute per foot)	CORE BOX	CORE SAMPLE
	NOT CORED Ø CORE LENGTHS		16			B		4·9 m		
FELDSPATHIC OR ARGILLACEOUS SANDSTONE, HIGHLY TO COMPLETELY WEATHERED.	FINE TO MEDIUM GRAINED. CLAYEY, SOFT MATRIX. PALE YELLOW-BROWN AND GREY. 2·5 (4)		18				SND – 1 (0.5) SND AND CLAY			
	2·5 (3)		22.1				SND – 2 (1)			
	3·6 (4)		26.5				SND – 2 (0.5)			
	3·7 (3)		33.5				SND – 0.25 SND SOFT SLIVERS TO 3" (1.5)	10 m		
			38.5				CLAYEY SAND 0.25 – 2 (CORE 1") CORE SOFT, SPLINTERY			
	3·8 (3) MUCH CRUSHED AND SPLIT.		40.1				SND – 2" (0.5) SOFT TWO CORES, 3"			
			44.3							
	4·9 (6)		46.3							
			49.8				SND – 2 (1) #	15 m		
	2·8 (5)		53				GRANULE – 1 (0.5)	16.2 m		
	END OF HOLE									

Ø MORE THAN HALF THE FIRST BOX (TO 28 FEET) CONSISTS OF CORE LENGTHS; MORE THAN HALF THE SECOND BOX CONSISTS OF FRAGMENTS

B COLUMN B. CORE FRAGMENTED GIVING SIZE RANGE IN INCHES (MODE IN BRACKETS)

SND: SANDSIZE.

DRILL TYPE: PENN DRILL
FEED: HYDRAULIC
CORE BARREL TYPE: N.M.L.C. TRIPLE TUBE
DRILLER: GROUNDTEST
COMMENCED:
COMPLETED: 25-9-'70
LOGGED BY: D.E. GARDNER
VERTICAL SCALE: 1 INCH : 10 FEET

NOTES

FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in.
BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

Jointing 70° and 40°

Some vertical and irregular with gossanous iron oxide scattered throughout.

Partly hardened by ferruginization (and silicification)?

Ø Giving range of length in inches (mode bracketed)

WATER PRESSURE TESTS

PACKER TYPE:
SUPPLY LINE:
VERTICAL SCALE:

Figures given are gauge pressures. Test sections are indicated graphically by blocks in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:
COLOUR:

155/A16/2199

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: ACTON SADDLE MAJOR ROAD LINK

LOCATION: LIVERSIDGE STREET, ACTON, A.C.T.

ANGLE FROM HORIZONTAL: 90° DIRECTION: VERTICAL

COORDINATES: E 209685 N 603258 (Stromlo metric) R.L.: 573.4m

HOLE NO. 16

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH (ft)	FRACTURE LOG	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST Loss in gallons per minute per foot	PHOTO REF NO. CORE BOX / CORE SAMPLE
	NOT CORED	A	8		B		2.4 m	
SILTSTONE AND SILTY, SLATY MUDSTONE HIGHLY TO COMPLETELY WEATHERED FROM 10'-17' RESEMBLES SEDIMENTARY BRECCIA OF STATE CIRCLE SHALE	WHITE AND YELLOW OR PALE BROWN. SOFT; EASY EXCAVATION BY BLADE (PROBABLY SOME RIPPING) IN SITU, WOULD SUPPORT MODERATE LOADING		10.8			0.5-2" (1") SND. - 0.25" BEDDING FAINT, ABOUT 25°		
			15.3			0.5-1" 0.5-1" n. DST 0.1-3" (1") CLEAVAGE DISTINCT ALMOST VERTICAL IN SILTY MUDSTONE FEW JOINTS 70° + 20°	5m	
			20.5			CORE 3"-7" 1-3" (1.5") 1-3" (1.5")		
	VERY EASY EXCAVATING CORE 3" x 4"		26.6			CORE 1"-7" MODE 4" BEDDING ABOUT 25° SND.-2" (0.75") 1-2" (1.5) 1" DST.-2" (1") 0.25-2 (0.5) SMALL SCALE SLUMP STRUCTURES		
	CORE 2" x 3"		30.3				10 m	
	POOR FOUNDATION CORE SPLIT 4" (two)		34.9			SND.-1" (0.5) 0.1-2" (1")		
	VEIN QUARTZ FRAGMENTS 36" 40%		38.7			SND.-1 (0.25) CORE BROKEN, 3"		
	12" 40%		40.7			DST.-1.5" 0.1-3" (1") PROBABLE FAULT ZONE		
	21" 40%		45.8			CLEAVAGE FLAKES		
	A FEW QUARTZ FRAGMENTS					0.1-2" (1")	15 m	
SLATY MUDSTONE MODERATELY TO COMPLETELY WEATHERED.	CORE LENGTHS FIRM; RIPPING DURING EXCAVATION 3" 1" 1"		50.8			SND.-1" (0.5) CORE 2"-8" (4")		
	3" 3"		55.9			SND.-0.5 (0.25)		
	CORE 2"-6" (4") 4"		57.9			0.5-2 (1.5) CORE 1"-2" 0.1-1 (0.25) SND.-1.25 (0.1) 2"-6"		
	CORE 1.5"-4" (3") 2" 2" 4"		63.1			CLEAVAGE SLIVERS LENGTH 0.25-1.5 SND.-0.25 (0.1)		
	CORE 2"-3" x 6" 4"		66.6			2-3" SOME SND	20 m	
	END OF HOLE		68				20.7 m	

DRILL TYPE: PENNDRILL

FEED: HYDRAULIC

CORE BARREL TYPE: H.M.L.C. TRIPLE TUBE

DRILLED: GROUNDTEST

COMMENCED:

COMPLETED: 16.9.'70

LOGGED BY: D.E. GARDNER

VERTICAL SCALE: 1 INCH : 10 FEET

NOTES

FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blacked in.

BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

DRILLED DRY (AIR-COOLING) TO 63.1'
BEDROCK TOO MOIST BELOW THIS AND DRILLED WITH WATER

COLUMN A

CLAY IN INCHES

40% CLAY FOR 36 INCHES

COLUMN B

CORE FRAGMENTED, GIVING SIZE RANGE AND MODE (..)
SND. = SANDSIZE
DST. = DUST

WATER PRESSURE TESTS

PACKER TYPE:

SUPPLY LINE:

VERTICAL SCALE:

Figures given are gauge pressures. Test sections are indicated graphically, or blacked in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:

COLOUR:

155/A16/2200

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: ACTON SADDLE MAJOR ROAD LINK.

LOCATION: BETWEEN LIVERSIDGE ST. AND BALMAIN CRESCENT, ACTON, A.C.T.

ANGLE FROM HORIZONTAL: VERTICAL DIRECTION:

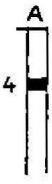
COORDINATES: E209652 N603283 (Stromlo metric) R.L. 571·1m

HOLE NO: 17

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC)	GRAPHIC LOG	DEPTH (ft.)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES)	WATER PRESSURE TEST (Loss in gallons per minute per foot)	PHOTO REF BOX	PHOTO REF CORE NO
	NOT CORED		A 8			B		2·4 m		
SILTSTONE, HIGHLY WEATHERED	MAINLY FIRM; WOULD PROBABLY SUPPORT MODERATE LOADINGS		9.3 10.7 14.3 18.4 20.6 25.9 28.9	4 1 1 4 1 1 3			CORE LENGTHS: 2 TO 8 INCHES MODE 4 INCHES BEDDING FAINT; DIP 25°? JOINTS COATED FE. OXIDE DIP 40-50° OTHERS CLEAN OR STAINED DIP 70°	5m		
SILTSTONE, FINE-GRAINED SANDSTONE AND SLATY MUDSTONE, MODERATELY TO HIGHLY WEATHERED FOOTNOTE † MINOR SLUMP STRUCTURES	MAINLY HARD; WOULD SUPPORT HEAVY LOADINGS		31.1 36.7 37.9 40.2 42.3 46.4 48.6 50	4			CORE LENGTHS 2 TO 12 INCHES MODE ABOUT 5 INCHES CLEAVAGE 75°- BEDDING ABOUT 75° BEDDING 60° BEDDING 45°	10 m 15·2 m		
† LOCALLY SLIGHTLY WEATHERED (GREY) SOME BEDS HIGHLY TO COMPLETELY WEATHERED (BROWN)	END OF HOLE									

COLUMN A



SOFT, FRIABLE OR CLAYEY IN INCHES

COLUMN B

BROKEN AND FRAGMENTED IN INCHES.

X · BROKEN AT INTERSECTING JOINTS

Y BRECCIATION; SOME JOINTS FILLED WITH FE-OXIDE SOME WITH SiO_2

DRILL TYPE: PENNDRILL
FEED: HYDRAULIC
CORE BARREL TYPE: N.M.L.C. TRIPLE TUBE
DRILLED: GROUNDTEST
COMMENCED:
COMPLETED: 9-9-70
LOGGED BY: D.E. GARDNER
VERTICAL SCALE: 1 INCH : 10 FEET

NOTES

FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in.
BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

\\\ QUARTZ - FILLED FRACTURES ¼ - 1 INCH WIDE

LITHOLOGY. ABOVE 28', CORE RESEMBLES CAMP HILL SANDSTONE. BELOW 28' CORE RESEMBLES PITTMAN FORMATION. IN BOX 3 (48-50 FEET) IT RESEMBLES CITY HILL SHALE (!) IN DRILL CORE AT ALBERT HALL.

WATER PRESSURE TESTS

PACKER TYPE:
SUPPLY LINE:
VERTICAL SCALE:
Figures given are gauge pressures. Test sections are indicated graphically, by shaded in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:
COLOUR:

155/A16/2201

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: ACTON SADDLE, MAJOR ROAD LINK

LOCATION: LIVERSIDGE St. ACTON, A.C.T

ANGLE FROM HORIZONTAL: Vertical DIRECTION:

COORDINATES: E209641 N603236 (Stromlo metric) RL 572.3m

HOLE NO 18

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH (ft.)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST Loss in gallons per minute per foot	CORE LOSS	REMARKS
	Not Cored									
Sandstone (calcareous) completely weathered:	Cream grey pale brown white medium to Siltst. coarse grained mudstone Sandstone, Siltstone, & Vein Qtz		4 5 5.6 6.75 7.7 9.4 10.5 12 14 15 16				Core lengths to 4" mainly frgts, dust size to 3 inch Frgts white vuggy qtz between 9.4'-16'. Also Silic. Siltstone. Dip 70°-75°	1.2 m 5m		
Completely to moderately weathered	Clayey sandstone & silic hard sst.		19.5				Mainly fragmented, clayey, friable.			
Fossil moulds at 4'-5' 12'-14'?	Pale brown and grey Medium to fine grained		23 24.2							
Moderately weathered	Siltst & F.G. Sandstone mainly decomposed clayey		30 33.3 35.75 37.75 39.8				?	10 m		
Slaty shale mudstone and silty mudstone mainly moderately weathered	Clayey Siltstone & mudstone 6-10" Brown clay → Moderately weathered Fairly strong Moderately to highly weathered		40.8 42.4 43.3 44.1 49.6 53.6 55.1				Cleavage or lamination nearly vertical. Core & split core, 4"-7" Jointing 80°-90° last 17", two core lengths; Remainder cut by Joints 0°-10°, coated Fe oxide	15 m 16.8 m		
	END OF HOLE									

DRILL TYPE: PENNDRILL
FEED: HYDRAULIC
CORE BARREL TYPE: NMLC Triple Tube
DRILLER: Groundtest
COMMENCED:
COMPLETED: 7-9-70
LOGGED BY: D.E.G.
VERTICAL SCALE: 1" : 10 feet

NOTES

FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blacked in.
BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

The mudstone below 44'1" is mainly fairly hard and capable of moderately heavy loading.

Sandstone

Slaty mudstone

WATER PRESSURE TESTS

PACKER TYPE:
SUPPLY LINE:
VERTICAL SCALE:
Figures given are gauge pressures
Test sections are indicated graphically as proposed in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:
COLOUR:

I55/A16/2202

Record: 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ACTON SADDLE, MAJOR ROAD LINK

LOCATION Between Balmain Crescent & Liversidge St. ACTON, A.C.T.

ANGLE FROM HORIZONTAL Vertical DIRECTION

COORDINATES E209615 N603263 (Stromlo metric) R.L. 569.0m

HOLE NO. 19

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH (ft.)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST Loss in gallons per minute per foot	PHOTO REF	CORE BOX

SOIL

Not CORED

Mudstone and silty mudstone; highly to completely weathered

Pale brown, red-brown and yellow-brown

Soft friable or clayey (inches) Remainder is firm

Moderate load bearing capacity at 6'

9, 6, 8·2, 3, 3, 9, ? 15, 14·6, 16·6, 20·4, 5

Fossil casts

Pale brown and red-brown

2, 2, 24·75, 25·5, 28·8

Silty mudstone Siltstone, mudstone and fine grained sandstone

40% firm frgts

2, 30, 31·3, 1, ? 14, 37·2, 5

40% firm frgts

14, 40·75

10% firm frgts

19, 42·75, 16, 44·2, 45·2, 46·2, 3, 4, 47·5, 4, 50

20% firm frgts

19, 51·5, 53

1·5 m

5m

Jointing commonly 30°-40° and 70°

Commonly coated with Fe-Mn oxide

Fragmented, showing size range and common size of fragments

Bedding dips about 30°

0·25-3" norm 0·75"

Sand size to 1·5", norm < 0·5"

Sand size to 2", norm 0·75"

10 m

? Joints 40°, 60°, 80-90° commonly coated with Fe-Mn oxide

Sand size to 2" norm 1"

Joints 70°-90°

norm 0·5"

15 m

16·2 m

END OF HOLE

DRILL TYPE PENNDRILL

FEED HYDRAULIC

CORE BARREL TYPE NMLC Triple Tube

DRILLER Groundtest

COMMENCED

COMPLETED 7-9-70

LOGGED BY D.E. Gardner

VERTICAL SCALE 1 inch : 10 feet

NOTES

FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are shaded in.

BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures. Test sections are indicated graphically by blocked in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

I55/A16/2203

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ACTON SADDLE MAJOR ROAD LINK

LOCATION DALMAIN CRESCENT, ACTON, A.C.T.

ANGLE FROM HORIZONTAL 90° DIRECTION VERTICAL

COORDINATES E209587 N603293 (Stromlo metric) R.L. 566.0m

HOLE NO 20

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH (ft)	FRACTURE LOG	% CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST LOSS IN GALLONS PER MINUTE PER FOOT	CORE BOX	CORE SAMPLE
	NOT CORED	A	4			B		1-2 m		
MUDSTONE, HIGHLY TO COMPLETELY WEATHERED. RESEMBLES RIVERSIDE FORMATION OR CITY HILL SHALE.	PALE BROWN, YELLOW AND PALE PURPLE CORE 3"-6" norm 4" VERY EASILY SCRATCHED, POSSIBLE SWELLING 21 12 8		9				DIP 30-50° SMALL SCALE SLUMPING			
	VERY FINE SANDSTONE		12.6			0.25-4 (1)				
	FINE SANDSTONE OR SILTSTONE 14		15.6			0.5-1.5 (1)		5m		
	INTRICATE LIESE - GANG STRUCT. FIRM. PROBABLY NEEDS RIPPING. SOFT; BLADE EXCAV. VERY POOR FOUND. 3 2 9 15		19			SND-0.75	BEDDING-DIP 45° CORE 2"-8" norm 5"+			
			24			0.25-2				
			27.8			SND-1 (0.25)				
			33			0.5-2 (1)		10.1m		
	END OF HOLE									

DRILL TYPE PENN DRILL
FEED HYDRAULIC
CORE BARREL TYPE N.M.L.C. TRIPLE TUBE
DRILLER GROUNDTEST
COMMENCED
COMPLETED 18-9-'70
LOGGED BY D.E. GARDNER
VERTICAL SCALE 1 INCH : 10 FEET

NOTES

FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in.
BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

COLUMN A

CLAY IN INCHES 3

COLUMN B

CORE FRAGMENTED, GIVING SIZE RANGE (INCHES) AND MODE (IN BRACKETS)

WATER PRESSURE TESTS

PACKER TYPE
SUPPLY LINE
VERTICAL SCALE
Figures given are gauge pressures
Test sections are indicated graphically by blocked in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE
COLOUR

T55/A16/2204

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ACTON SADDLE - MAJOR ROAD LINK

LOCATION Balmain Cresc. / Liversidge St. ACTON, A.C.T.

ANGLE FROM HORIZONTAL Vertical DIRECTION

COORDINATES E209569 N603248 (Stromlo metric) RL 567·4m

HOLE No. 21

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH (ft.)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST Loss in gallons per minute per foot	CORE SIZE	CASING SIZE
			Feet							
DRILLER'S LOG										
Brown clay			4					1·2m		
Soft Shale; brown							Standard penetration Tests; copy of results to be obtained			
Mudstone and silty mudstone highly to completely weathered. Resembles weathered beds of Riverside Formation or City Hill Shale	Red brn, pale purple brn and yellow brn		15·5				Soft core ½"–2" total 1' Remainder clay and soft frgts	5m		
	As above; clay is pale brown		19				Core 2·5"–7", highly weath, bot firm, totals 2·5'; remainder is clay and soft frgts			
	A 5" core length highly to completely weathered; no core for remainder of this lift		23				Bedding dips about 20° at 19'–19'6			
	Pale brown. Soft core 3"–7" lengths		32·5				Last 9" broken, drilling, 1-5"–2", at two inters. 70° joints.	10m		
	Core 3"–8", highly weath 10% Completely Weath Pale brown		37				34–35 Bedding dip about 30° Bedding dip about 40°			
	End of hole		42					12·9m		

DRILL TYPE PENN DRILL

FEED HYDRAULIC

CORE BARREL TYPE NMLC Triple tube

DRILLER Groundtest

COMMENCED

COMPLETED 3-9-70

LOGGED BY D.E Gardner

VERTICAL SCALE 1inch : 10Feet

NOTES

FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in.

BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

Bedding appears to show small scale slump structure

Joints stained with Fe & Mn oxides

Low strength; can support light loadings

Excavation by bulldozer, easy ripping

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures

Test sections are indicated graphically by brackets in strip

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

I55/A16/2205

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: ACTON SADDLE MAJOR ROAD LINK.

LOCATION: 200 FEET WEST OF BALMAIN CRESCENT, ACTON, A.C.T.

ANGLE FROM HORIZONTAL: 90° DIRECTION: VERTICAL

COORDINATES: E209530 N603304 (Stromlo metric) R.L. 562·3m

HOLE NO. 22

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH (ft.)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST Loss in gallons per minute per foot
	NOT CORED							1·2 m
SLATY, SILTY MUDSTONE AND FINE SANDSTONE COMPLETELY WEATHERED	FIRM, PROBABLY NOT SWELLING WEATHERED TO CLAYEY FINE SAND FINE SANDSTONE WEATHERED TO CLAYEY SILT AND CLAYEY FINE SAND.		4 7.8 10 11.5 12 16 20				TRACES OF BEDDING? DIP ABOUT 60°	5m 6·1 m
	END OF HOLE.							

DRILL TYPE: PENNDRILL
FEED: HYDRAULIC
CORE BARREL TYPE: N.M.L.C. TRIPLE TUBE
DRILLER: GROUNDTEST
COMMENCED:
COMPLETED: 12.9.70
LOGGED BY: D.E. GARDNER
VERTICAL SCALE: 1 INCH : 10 FEET

NOTES

FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in.
BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

RESEMBLES SHALE BEDS AS SEEN IN LENNOX CROSSING DRILL HOLES, BUT COMPLETELY WEATHERED.

WATER PRESSURE TESTS

PACKER TYPE:
SUPPLY LINE:
VERTICAL SCALE:
Figures given are gauge pressures
Test sections are indicated graphically by blocked in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:
COLOUR:

I55/A16/2206

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: ACTON SADDLE MAJOR ROAD LINK

LOCATION: 200 FEET WEST OF JUNCTION OF LIVERSIDGE STREET AND BALMAIN CRESCENT

ANGLE FROM HORIZONTAL: 90° DIRECTION: VERTICAL

COORDINATES: E209518 N603270 (Stromlo metric) R.L. 563.0 m

HOLE NO: 23

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION: LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH (ft)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES: JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST: Loss in gallons per minute per foot	PHOTO REF: CORE BOX	PHOTO REF: CORE BARREL NO
	A						B	0.6 m		
SILTSTONE AND FINE-GRAINED SANDSTONE; A BAND OF SILTY CLAYSTONE HIGHLY TO COMPLETELY WEATHERED	PALE YELLOW-BROWN AND PALE BROWN SILTY CLAYSTONE	2 / 43 60% / 9 / 18 40%	2 / 5.4 / 8.9 / 13.5 / 17.5 / 20				SND. TO 2" (1½°) BEDDING DIP; SND. TO 3" (2") ABOUT 40°; SND. TO 2" (1"); SND. TO 3" (1") ABOUT 45°; SILTSIZE TO 0.5" AND CLAY	5m; 6.1 m		
	END OF HOLE									

PROBABLE FOUNDATION FOR MODERATE LOADING ON SPREAD FOOTING AT 2.75 FEET DEPTH

DRILL TYPE: PENNDRILL
FEED: HYDRAULIC
CORE BARREL TYPE: N.M.L.C. TRIPLE TUBE
DRILLER: GROUNDTEST
COMMENCED:
COMPLETED: 15-9-'70
LOGGED BY: D.E. GARDNER
VERTICAL SCALE: 1 INCH = 10 FEET

NOTES

FRACTURE LOG: Number of fractures per foot of core. Zones of core loss are blocked in.

BEDDING AND JOINT PLANES: Angles are measured relative to a plane normal to the core axis.

COLUMN A

CLAY IN INCHES: 2

60% CLAY FOR 43 INCHES: 43 60%

COLUMN B

CORE FRAGMENTED, GIVING SIZE RANGE AND MODE (IN BRACKETS)

SND.: SANDSIZE.

WATER PRESSURE TESTS

PACKER TYPE:

SUPPLY LINE:

VERTICAL SCALE:

Figures given are gauge pressures.
Test sections are indicated graphically by blocked in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:

COLOUR:

155/A16/2207

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ACTON : SADDLE, MAJOR ROAD LINK

LOCATION In lake, near mouth of Sullivans Creek
ACTON . A.C.T.

ANGLE FROM HORIZONTAL Vertical DIRECTION

COORDINATES E209111 N603512 (Stromlo metric) RL 555m approx.

HOLE No. 27

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH (Ft)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER PRESSURE TEST Loss in gallons per minute per 10ft
			Feet					
Water								
Mud and alluvium ?	Not cored		6.5				Standard penetration tests. Copy of results to be obtained.	2.0 m; 5m
Black shale, fresh to slightly weathered	Hard black Siliceous shale; easily breaks on bedding. Frgts, 1"–3". Common 2". Frgts 0.5–3". Three core lngths 2"–3.5". Core 2"–4". Frgts & core .25 – 5". Core 3" – 7". Core 1.5"–7". Core 1.5 – 6", finely lamin. Sulphide dissem 46–46.1. End of hole		27; 32.1; 35; 36.1; 38; 40.1; 43.2; 46; 48.25				Laminated 1–2 mm Dip about 60°. Frgtd. drilling, at two 90° Joints. 36'9 – 37'6, Shear 70° and 80°; Sulphide smears. 41'1 – 41'7 frgtd drilling .25"–.5" at two 90° joints. Some of Core split in two by 2 joints 70 – 75°. Last 6" frgtd. 1"–4" at 80° shear joint	8.2 m; 10 m; 14.7 m

DRILL TYPE PENN DRILL
FEED HYDRAULIC
CORE BARREL TYPE NMLC Triple tube
DRILLER Groundtest
COMMENCED
COMPLETED 1 · 8 · 70
LOGGED BY D.E.G
VERTICAL SCALE 1" : 10 feet

NOTES

FRACTURE LOG – Number of fractures per foot of core. Zones of core loss are blocked in.
BEDDING AND JOINT PLANES – Angles are measured relative to a plane normal to the core axis.

33 shear

Bedding planes commonly smeared with smooth carbon – polished through slip, and part easily

Shale too hard to scratch with knife.

High compressive + shear strength; Low tensile strength normal to bedding.

WATER PRESSURE TESTS

PACKER TYPE
SUPPLY LINE
VERTICAL SCALE

Figures given are gauge pressures
Test sections are indicated graphically by brackets or shading

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE
COLOUR

155/A16/2208

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ACTON SADDLE MAJOR ROAD LINK.

LOCATION IN LAKE, NEAR MOUTH OF SULLIVANS CREEK, ACTON, A.C.T.

ANGLE FROM HORIZONTAL 90° DIRECTION VERTICAL

COORDINATES E209055 N603524 (Stromlo metric) R.L. 553m approx.

HOLE NO 29

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC)	GRAPHIC LOG	DEPTH (ft)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES)	WATER PRESSURE TEST Loss in gallons per minute per foot	PHOTOS REF. No. CORE BOX	PHOTOS REF. No. CORE SAMPLE
	NOT CORED							5m		
TUBE SAMPLE PEBBLES 1 - 1.5 cm. COARSE SAND 2 - 6 mm.			30					10 m		
TUBE SAMPLE GRANULES AND SMALL GRAVEL 2 - 8 mm. A FEW PEBBLES.	NOT CORED		42					15 m		
			60					19.3 m		
THIN BEDDED TO LAMINATED FINE GRAINED QUARTZ SANDSTONE. Oud (?)	BEDROCK HARD CORE LENGTHS 2" TO 8" NORM 4" PALE BROWN AND CREAM GREY PLASTIC CLAY		63.25 67.4 68.9 69.3 71.4 74.2				DIP OF BEDDING ABOUT 20° TO 30°. SMALL IRREGULAR FRACTURES ASSOCIATED WITH SHEARING AT ABOUT 60° ø FROM 73'4 TO 73'8, SHATTERED TO HARD WEDGE SHAPES AND SPLINTERS	20 m 22.8 m		
	END OF HOLE									

DRILL TYPE PENNDRILL

FEED HYDRAULIC

CORE BARREL TYPE N.M.L.C. TRIPLE TUBE

DRILLER GROUNDTEST

COMMENCED

COMPLETED 12-9-'70

LOGGED BY D.E. GARDNER

VERTICAL SCALE 1 INCH : 10 FEET

NOTES

FRACTURE LOG Number of fractures per foot of core. Zones of core loss are blocked in.

BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

ø FRACTURES FILLED WITH LIMONITE, PARTLY BOXWORK, ROUGHLY VERTICAL.

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures. Test sections are indicated graphically by blocked in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

155/A16/2209

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: ACTON SADDLE MAJOR ROAD LINK

LOCATION: LAKE BURLEY GRIFFIN, NEAR MOUTH OF SULLIVANS CREEK, ACTON, A.C.T.

ANGLE FROM HORIZONTAL: 90° DIRECTION: VERTICAL

COORDINATES: E 208997 N 603519 (Stromlo metric) RL 555m approx.

HOLE NO: 31

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC)	GRAPHIC LOG	DEPTH (ft)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES)	WATER LEVEL	WATER PRESSURE TEST (Loss in gallons per minute per foot)	CORE BOX	CORE SAMPLE
	NOT CORED.							5m			
								10m			
	TUBE SAMPLE:		50					15m			
	MEDIUM GRAINED SAND SOME CLAY		51.5								
	GREY CLAY (DECOMPOSED BEDROCK)		60				75'-77' BROKEN CORE FRAGMENTS 0.5-2" CORE LENGTHS 2-4"				
			61.5				77'-77.9' COMPLETELY WEATHERED CLAYEY SANDSTONE FRAGMENTS SANDSIZE TO 2" MODE 0.5"	20m			
			75					22.9m			
SANDSTONE WEATHERED Ø							BEDDING 55° CLEAVAGE 80°	23.7m			
	END OF		77.8				HOLE				

DRILL TYPE: PENNDRILL
FEED: HYDRAULIC
CORE BARREL TYPE: N.M.L.C. TRIPLE TUBE
DRILLER: GROUNDTEST
COMMENCED:
COMPLETED: 21-9-70
LOGGED BY: D.E. GARDNER
VERTICAL SCALE: 1 INCH : 10 FEET

NOTES

FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in.
BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

NUMEROUS SMALL FRACTURES, LINED AND FILLED WITH IRON OXIDE

Ø HIGHLY TO COMPLETELY

WATER PRESSURE TESTS

PACKER TYPE:
SUPPLY LINE:
VERTICAL SCALE:
Figures given are gauge pressures.
Test sections are indicated graphically by blocked in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE:
COLOUR:

155/A16/2210

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ACTON SADDLE MAJOR ROAD LINK

LOCATION LAKE BURLEY GRIFFEN, NEAR MOUTH OF SULLIVANS CREEK, ACTON, A.C.T.

ANGLE FROM HORIZONTAL 90° DIRECTION VERTICAL

COORDINATES E 208964 N 603582 (Stromlo metric) R.L. 555m approx

HOLE NO 32

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC)	GRAPHIC LOG	DEPTH (F.C.)	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES)	WATER PRESSURE TEST: LOSS OF GALLONS PER MINUTE PER FOOT	CORE BOX No.	CORE PHOTO No.
ALLUVIUM BOULDERS, PEBBLES, SAND, SILT, CLAY.	COARSE QUARTZ SAND (GRANULES)		40					5m		
			45							
	SILTY CLAY; PALE GREY, FAINTLY GREEN.		50					10m		
			51.5							
	SILT; PALE GREEN GREY.		55							
			56.5					15m		
	PALE GREEN SILTY CLAY (DECOMPOSED BEDROCK)		65 66.3							
	FRAGMENTS OF SST. BLDRS.	A	70			B		20m		
MUDSTONE, SLATY, IN PART SILTY. COMPLETELY WEATHERED.	PALE GREY AND GREEN CLAY		72							
	FRAGMENTS OF SST. BLDRS.		73.1 75.9				SPLINTERY FRGMTS AND CLAY 3" AND 1" CORE .05 - 2 (.25)			
	CLAY AND FIRM SPLINTERY FRGMTS		77							
	END OF HOLE		79.3					21.3m 24.2		

DRILL TYPE PENNDRILL

FEED HYDRAULIC

CORE BARREL TYPE N.M.L.C. TRIPLE TUBE

DRILLED GROUNDTEST

COMMENCED

COMPLETED 28.9.'70

LOGGED BY D.E. GARDNER

VERTICAL SCALE 1 INCH = 10 FEET

NOTES

FRACTURE LOG - Number of fractures per foot of core. Zones of core loss are blocked in.

BEDDING AND JOINT PLANES - Angles are measured relative to a plane normal to the core axis.

SLATY CLEAVAGE VERTICAL

COLUMN A

CLAY

COLUMN B

CORE FRAGMENTED

GIVING SIZE RANGE IN INCHES (MODE IN BRACKETS)

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures. Test sections are indicated graphically by blocked in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

I55/A16/2211

Record 1979/18

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT ACTON SADDLE MAJOR ROAD LINK

LOCATION LAKE BURLEY GRIFFEN, NEAR MOUTH OF SULLIVANS CREEK, ACTON, A.C.T.

ANGLE FROM HORIZONTAL 90° DIRECTION VERTICAL

COORDINATES E 208890 N 603351 (Stromlo metric) R.L. 555m approx

HOLE NO 35

SHEET 1 OF 1

WEATHERING	DESCRIPTION (LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC)	GRAPHIC LOG	DEPTH (ft)	CORE LOSS	% CORE RECOVERY	CORE SIZE	STRUCTURES (JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES)	WATER PRESSURE TEST (LOSS OF GALLONS PER MINUTE PER FOOT)	CORE PIECES PER FOOT	CORE LOSS REMARKS

NOT CORED

TUBE SAMPLES

PALE BROWN PLASTIC CLAY. 25 – 26

BROWN CLAYEY SAND COARSE GRAINED. 30 – 30.5

BROWN QUARTZ SAND (GRANULES) AND CLAY. 40 – 41.5

SANDY BROWN CLAY WITH ROCKFRAGMENTS 45 – 46.5

5m 10m 15m 16.6m

A 51.25 B

FINE GRAINED SANDSTONE, SILTSTONE AND SILTY MUDSTONE

GREY BLACK MOD. HARD BRITTLE

A: 4 / 3

54.1

SND – 1 (0.5)

0.25 – 2 (0.75)

BEDDING DIP 40°

16.9m

55.5

END OF HOLE

WHERE NOT FRIABLE OR FINELY FRAGMENTED, THE CORE IS BROKEN TO ANGULAR PIECES 0.5 – 3 INCH MODE 2 INCH

A MOULD OF A SILURIAN SPIRIFERID AT 52.3'.

INDISTINCTLY LAMINATED.

BEDDING DIP 25° (NEAR 54.1', CURRENT BEDDING?)

JOINTS 85° AND 40° (ON BEDDING OR LAMINATION)

DRILL TYPE PENNDRILL

FEED HYDRAULIC

CORE BARREL TYPE N.M.L.C. TRIPLE TUBE

DRILLER GROUNDTEST

COMMENCED

COMPLETED 2-10-'70

LOGGED BY D.E. GARDNER

VERTICAL SCALE 1 INCH : 10 FEET

NOTES

FRACTURE LOG – Number of fractures per foot of core. Zones of core loss are blocked in.

BEDDING AND JOINT PLANES – Angles are measured relative to a plane normal to the core axis.

COLUMN A

DECOMPOSED, FRIABLE, SANDY. (IN INCHES)

A: 4

COLUMN B

CORE FRAGMENTED, GIVING SIZE RANGE (INCHES) AND MODE (IN BRACKETS)

SND : SANDSIZE

B

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures. Test sections are indicated graphically by crosses in strips.

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

155/A16/2212

Record 1979/18

PLATE 1
BLACK MOUNTAIN PENINSULA
ACTON
LAKE BURLEY GRIFFIN
MOLONGLO PARKWAY
ROADCUT 1
ROADCUT 2
ROADCUT 3
ROADCUT 4
ROADCUT 5
LADY DENMAN DRIVE
CLUNIES ROSS STREET
SULLIVANS CREEK
MILLS ROAD
UNIVERSITY HOUSE
RESEARCH SCHOOL OF PHYSICAL SCIENCES
BALMAIN CRES
UNIVERSITY FAULT
LIVERSIDGE STREET
LAWSON CRES
ACTON FAULT
Fault
LAKE
SKETCH OF PART OF NORTHERN BATTER OF ROADCUT 2
SKETCH SHOWING POSSIBLE LEFT LATERAL DISPLACEMENT OF ACTON SHALE (Oua) AND CANBERRA GROUP (Smc) ALONG UNIVERSITY FAULT
RECENT | Qa | Alluvium
PLEISTOCENE | Q | Fanglomerate
TERTIARY? | FYSHWICK GRAVEL? Cz | Coarse to fine rounded gravel
MIDDLE SILURIAN | CANBERRA GROUP | Smc2 | Siltstone and silty mudstone
CAMP HILL SANDSTONE Smc1 | Sandstone and siltstone
EARLY SILURIAN | BLACK MOUNTAIN SANDSTONE Slb | Sandstone, minor shale
STATE CIRCLE SHALE Sls | Laminated shale, minor sandstone
EARLY SILURIAN? | Sl | Siltstone and mudstone
LATE ORDOVICIAN | PITTMAN FORMATION | Omp2 | Sandstone, minor shale
ACTON SHALE MEMBER Oua | Grey, laminated, siliceous shale
MIDDLE ORDOVICIAN | Omp1 | Cleaved siltstone, minor sandstone
Geological boundary
Unconformity
Anticline, showing plunge
Syncline, showing plunge
Vertical fault
Fault, showing dip
Where location of boundaries, folds and faults is approximate line is broken, where inferred queried; where concealed boundaries are dotted, faults are shown by short dashes
Plunge of small fold
Strike and dip of strata
Strike of vertical cleavage
Fossil locality
Rock outcrop or temporary exposure in excavation
Diamond-drill hole, Molonglo Parkway project
Diamond-drill hole, other projects
Inclined diamond-drill hole showing inclination and direction
Topographic contour in metres
AMENDMENTS
No. | Description | Author | Checked
A1
A2
A3
A4
A5
SCALE 0 25 50 75 100 125m
Base map/survey A.C.T. 1:2500 SERIES B2080-6030
Geology by G.A.M. Henderson (formations beneath University House after Öpik, 1958)
Compiled and checked G.A.M.H. Project geologist
Checked and approved Senior geologist
E.G. WILSON Supervising geologist
COMMONWEALTH OF AUSTRALIA
BUREAU OF MINERAL RESOURCES
CANBERRA, A.C.T.
TITLE GEOLOGICAL MAP OF AREA ALONG PARKWAY ROUTE-BLACK MOUNTAIN PENINSULA TO ACTON
PROJECT MOLONGLO PARKWAY
To accompany Record 1979/18
Drawn by G.A.M.H.
Drawing No. I55/A16/2183

PLATE 2

GEOLOGICAL MAP OF EXCAVATION FOR MOLONGLO PARKWAY AT ACTON

2094500E 2093500E 2094800E 2094850E

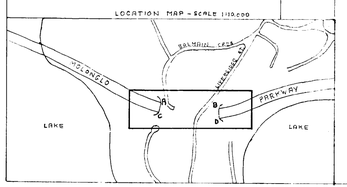
603300N 603250N

SCALE 1:500

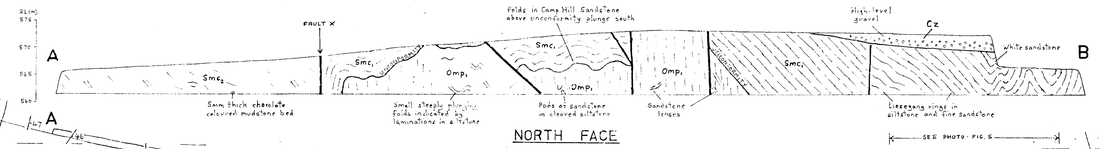
0 10 20 30 40 50 m

TN MN

LOCATION MAP - SCALE 1:10,000

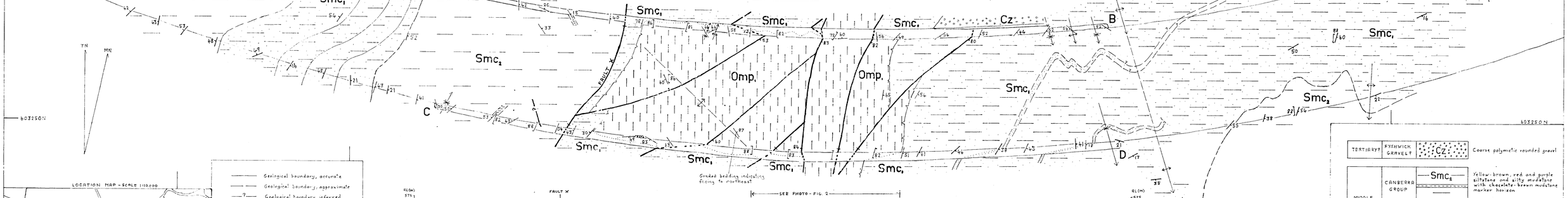


- Geological boundary, accurate
- Geological boundary, approximate
- ?— Geological boundary, inferred
- Unconformity
- Anticline, showing plunge
- Syncline, showing plunge
- Vertical fault
- 63 Inclined fault, showing dip
- 46 Strike and dip of strata
- 83 Strike and dip of cleavage
- Strike of vertical cleavage

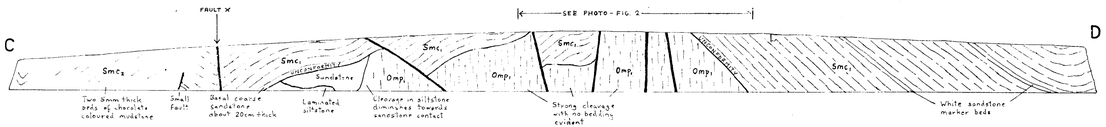


NORTH FACE

SEE PHOTO - FIG. 5



SEE PHOTO - FIG. 2



SOUTH FACE
(REVERSE PROJECTION)

2094600E 2094650E 2094700E 2094750E 2094800E

TERTIARY?	FYSHWICK GRAVEL?	Cz	Coarse polymictic rounded gravel
MIDDLE SILURIAN	CANBERRA GROUP	Smc2	Yellow-brown, red and purple siltstone and silty mudstone with chocolate-brown mudstone marker horizon
	CAMP HILL SANDSTONE	Smc1	Cream to pale yellow-brown silty sandstone and siltstone with marker beds of fine white quartz sandstone; thin coarse sandstone lenses near base
MIDDLE ORDOVICIAN	PITTMAN FORMATION	Omp1	Buff-brown to green-grey cleaved siltstone with bed of medium to fine sandstone; siltstone laminated close to sandstone bed and other thin sandstone lenses

Geology by G.A.M. Henderson

Maunsell & Partners
Base maps Orig. No. 81/9/1/OUT
81/9/1/1005

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