DEPARTMENT OF NATIONAL RESOURCES

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record 1977/64

Engineering geology of the Queanbeyan urban area, NSW.

by

G. Briscoe and J.R. Kellett

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SUMMARY

The City of Queanbeyan is built mainly on folded and faulted Ordovician metasediments of the Pittman Formation and Acton Shale. Lower and Middle Silurian sediments crop out on Mount Jerrabomberra and to the west of it, and Middle Silurian volcanic rocks and interbedded sediments crop out to the south of the city.

A dissected linear escarpment to the east of the city marks the upthrown block to the east of the Queanbeyan Fault, known as the Cullarin Horst, on which a thin veneer of skeletal soil is associated with extensive rock outcrop. West of the fault, well-developed podzolic soils and earths overlie extremely to moderately weathered rock. Colluvium has accumulated at the foot of the escarpment and on the lower slopes around Mount Jerrabomberra. Alluvium up to 10 m thick lies beneath the low-lying central part of the city and extends along the banks of the Queanbeyan River.

The main constraints on urban development within the City of Queanbeyan will be associated with steep slopes, hard rock close to the surface in some areas, and with poorly drained clay soils in the central part of the city. Other constraints are the problems of erosion and soil stability of podzolic soils on slopes of more than 5 degrees.

The construction of Googong Dam upstream on the Queanbeyan River is expected to reduce the incidence of flooding of the low-lying areas of the city.

Foundation investigations should be required for major buildings in the city, and piled foundations may be required in locations with thick alluvium.

INTRODUCTION

The City of Queanbeyan adjoins the eastern boundary of the A.C.T. (see Fig. 1). It lies to the south of the Molonglo River, and straddles the Queanbeyan River. As the town grew, settlement spread over the adjacent undulating hills and across the river to the east. Urban development is now impinging on the slopes of Mount Jerrabomberra, and has invaded the higher ground to the east of the Queanbeyan Fault, known as The Ridgeway, part of which extends beyond the City of Queanbeyan boundary into Yarrowlumla Shire.

A study of the geology and soils of the City of Queanbeyan was undertaken by the Bureau of Mineral Resources (BMR) during 1975 in conjunction with the broader geological investigations for the Canberra-Queanbeyan Relationship Study (Briscoe, Kellett, & Joacobson, in prep). The area included in this study of the Queanbeyan urban area is shown in Figure 1.

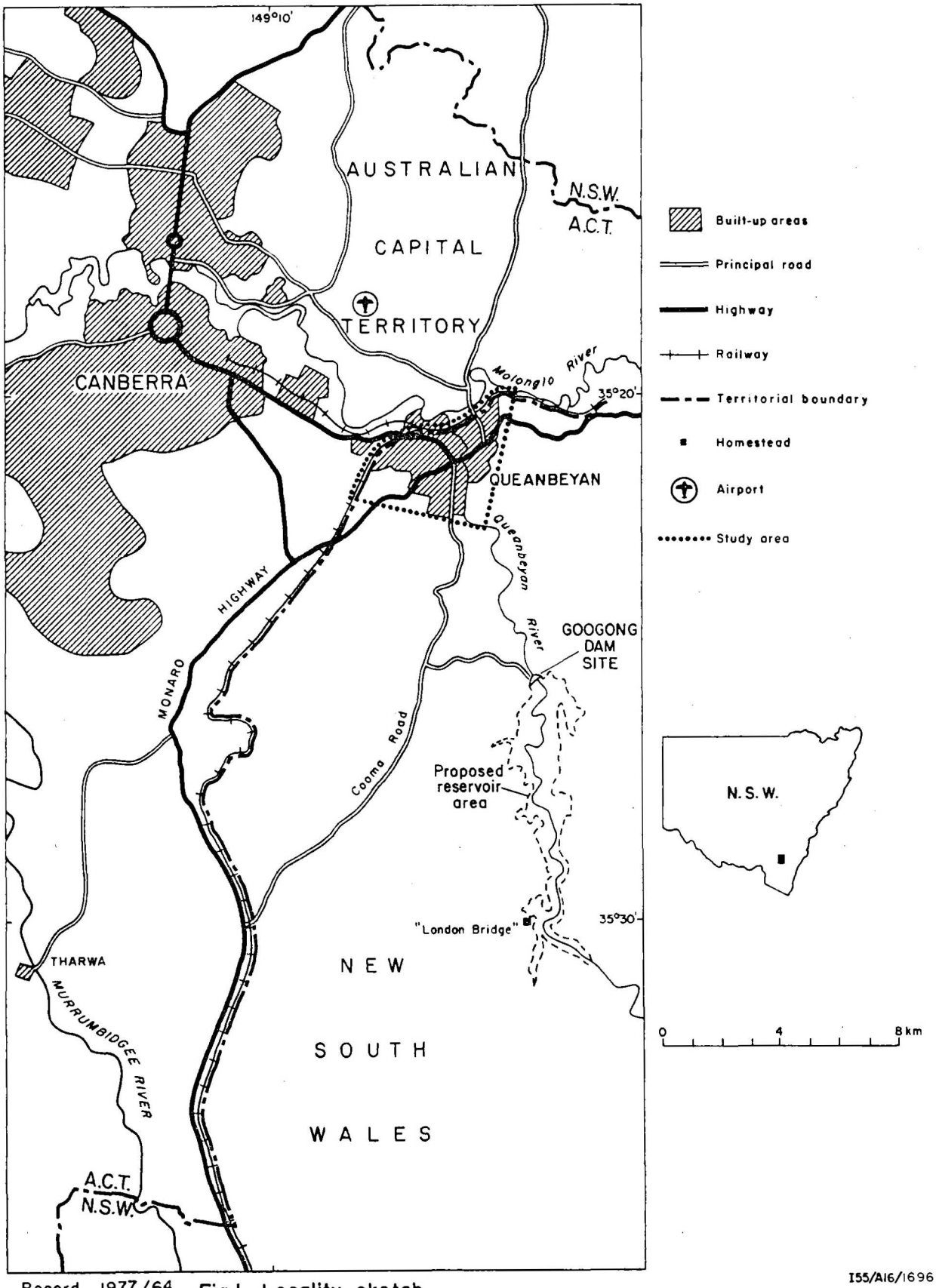
The study was aimed at identifying engineering geological constraints on Queanbeyan's future development.

GEOLOGY

The geology of the City of Queanbeyan is shown in Plate 1, and rock descriptions and engineering characteristics of the geological formations are tabulated in Table 1. Previous work in the area was reported on by Phillips (1956) and Ceplecha (1975).

Surface mapping, supplemented by 15 diamond-drill holes in soil-covered sections, delineated the soil and rock types, thickness of soil, and the depth to groundwater (Fig. 2).

The shopping centre stands on low-lying alluvial flats on the adjacent slopes where clay soils and colluvium overlie sandstone and siltstone of various degrees of weathering. Topographic features were formed by dissection of a thick weathered profile of tightly folded Palaeozoic rocks. Gullying has dissected the area known as 'The Ridgeway' that lies to the east of the Queanbeyan Fault, and the steep slopes of the escarpment have thick outwash fans of colluvium at the foot of the slopes; similar outwash deposits of colluvium are located around the lower slopes of Mount Jerrabomberra. The fans have subsequently been dissected by steepsided gullies.



Record 1977/64 Fig 1 Locality sketch

I55/A16/1696

Most of the City of Queanbeyan is underlain by folded Ordovician metasediments comprising meta-sandstone and siltstone of the Pittman Formation and silicified slate of the Acton Shale; these rocks are unconformably overlain by Silurian sandstones and siltstones at Mount Jerrabomberra (Fig. 3). Sullivans Fault is an old structure with no surface expression, and Siluro-Devonian sediments and volcanics of the Canberra Group and the Ainslie Volcanics occupy the gentle slopes to the west of Sullivans Fault. Foliated volcanic rocks of the Colinton Volcanics and minor intrusives crop out along the Queanbeyan River to the southeast of the urban area.

Alluvium up to 10 m thick overlies the Pittman Formation in the business area of the city, which is centred around the intersection of Crawford and Monaro Streets.

Rocks of the Pittman Formation have been tightly folded, and overturned bedding can be recognised by the orientation of graded bedding in the meta-sandstone. Low-grade metamorphism is evident in the mineral assemblages of the sedimentary rocks; the dominant mineral assemblage is quartz-muscovite-chlorite. Axial plane cleavage is well developed throughout the area, and later deformation is evident from the development of strain-slip cleavage and irregular shear zones in rock exposures.

The Ridgeway has been dissected by gully erosion, and moderately to slightly weathered rock underlies the thin skeletal soils. To the west of the Queanbeyan Fault where most of the City is situated, the rocks are moderately to extremely weathered, the thick weathered profile has been dissected to produce rounded hills and valleys, and soil profiles are well developed throughout the area.

SOILS

A soils map of the Queanbeyan urban area forms Plate 2. A more detailed study of the soils of Mount Jerrabomberra is described in a separate report (Kellett, in prep.).

Skeletal soils

Thin gravelly soils occur extensively on The Ridgeway and on Mount Jerrabomberra. Generally these soils lack pedological differentiation except for some weak horizon development in minor landscape features, and rarely exceed 0.5 m in thickness.

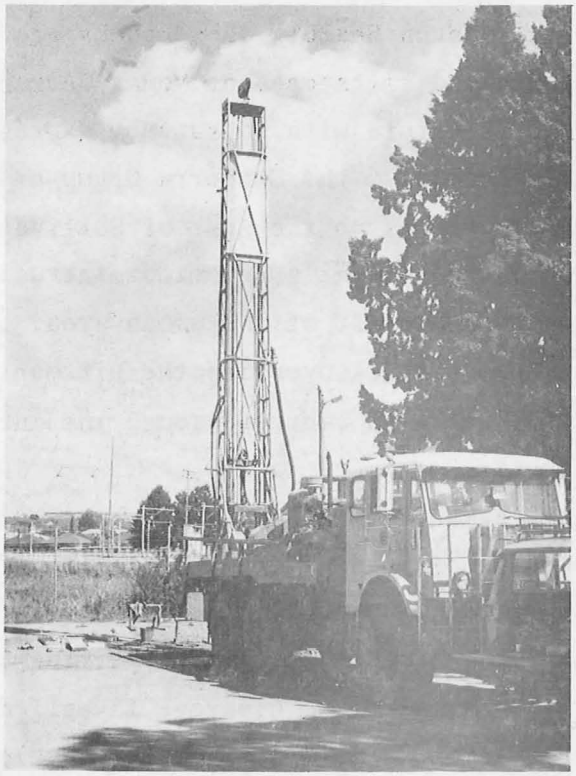


Fig. 2. Site investigation drilling, Queanbeyan.

Fig. 3. Refuse disposal site, Mount Jerrabomberra - An abandoned quarry in Ordovician and Silurian mudstone.

These soils are not a good engineering material because they lack sand-sized grains and contain excess silt, and they are easily eroded when the thin AO horizon is removed or disturbed. Excavation to depths greater than 0.5 m will encounter the underlying rock, and the degree of rock weathering will determine the ease of excavation.

Colluvium at the foot of Queanbeyan Fault scarp

The colluvium on the western side of the Queanbeyan Fault scarp is strongly anisotropic owing to the platy shape of the meta-sedimentary rock fragments, dominantly shale, which constitute the gravel-sized fraction. Generally the material is weakly cemen ted at depth by clay derived from weathered rock; the clay was moved deeper into the soil profile in a dispersed or suspended state and redeposited as a cement; some clayskins were observed at a depth of 0.5 m.

The colluvium is porous and massive; highly permeable sections are present as buried gully sands. In wet areas, springs develop on the upper slopes where movement of groundwater is restricted by a reduction in permeability of the colluvium with the decrease in grainsize of the sediments downslope.

Texturally, the colluvium is a clay-silt-gravel mixture, but it is not a good engineering material owing to the inhomogeneity of the deposits and the flakiness and softness of the rock fragments. Excavation in the colluvium will be further complicated by an irregular unpredictable groundwater regime, and the development of clayskins may increase instability in deep cuts.

Colluvium on Mount Jerrabomberra

Colluvium occupies the lower slopes of Mount Jerrabomberra. The material consists of cobbles and boulders of subangular sandstone and quartzite blocks in a silt-clay matrix, and there is a marked deficiency in sand-sized grains (Fig. 5). The colluvial material comprises several overlapping outwash fans and the lower beds are strongly indurated. Soft weathered shale underlies most of the colluvium at depths of up to 5 m.

Fig. 4. Slump in unconsolidated colluvium, road cutting on Mount Jerrabomberra, October 1974.

Fig. 5. Colluvium, Mount Jerrabomberra.

As an engineering material, the Mount Jerrabomberra colluvium is superior to the East Queanbeyan colluvium because of the more equidimensional shape of the rock fragments, and their greater durability; however, the high percent of silt and clay in the matrix precludes its use without upgrading. Slope instability is evident as soil creep, and minor slump structures (Fig. 4) are present in the colluvium. Erosion of the weathered shales from beneath the colluvium may produce undercutting and eventual collapse of slopes in deep cuts. Ephemeral springs are common at the change of slope and confined aquifers may be present in the colluvium farther downslope and pose problems of drainage of saturated soils.

PODZOLIC SOILS WEST OF THE QUEANBEYAN FAULT

Podzolic soils occur on rolling to undulating terrain west of the Queanbeyan Fault.

Soils on elevated ground consist of highly structured grey shallow clay with frequent red mottling, overlain by a thin A horizon. The total soil thickness never exceeds 1 m. The clays are highly plastic with small shiny peds. It appears that sheet erosion has removed most of an older and thicker clay soil profile leaving the highly structured grey clay, and that the A horizon was a later development with the formation of a younger soil.

Farther downslope the dominant soils are thin red podzolics, about 1 m thick, with strong yellow mottling. The B horizon is a friable plastic clay with shiny ped fabric and containing abundant sesquioxides; this soil also appears to be the remnants of an older thicker soil profile.

The youngest erosional ground surfaces, the gentle slopes adjacent to Jerrabomberra Creek, are covered by red-brown podzolic soils whose thickness, including transition zone, never exceeds 2 m. The A horizon is generally thicker than that of the older podzolics farther up the slope, and the B horizon boundary is not as sharp. In addition, the peds are larger and the fabric is earthier. These soils grade from sandy clays to plastic clays.

At their normal field moisture content, all the pediment podzolics should be easily workable and should not present any unusual engineering problems.

ALLUVIUM

Terraces of the Queanbeyan River underlie the commercial centre of Queanbeyan; surface clay overlies silt, which in turn overlies sand, gravel, and cobbles. The thickness of alluvium ranges to 10 m, and the contours of the underlying bedrock are shown in Fig. 6. Two interpretative cross-sections through the alluvium constitute Figure 7.

Red to yellow-brown earths and sandy clays derived from podzolization of aeolian sands or fine sediments occupy the uppermost terraces around the perimeter of the alluvium. These soils are up to 2 m thick.

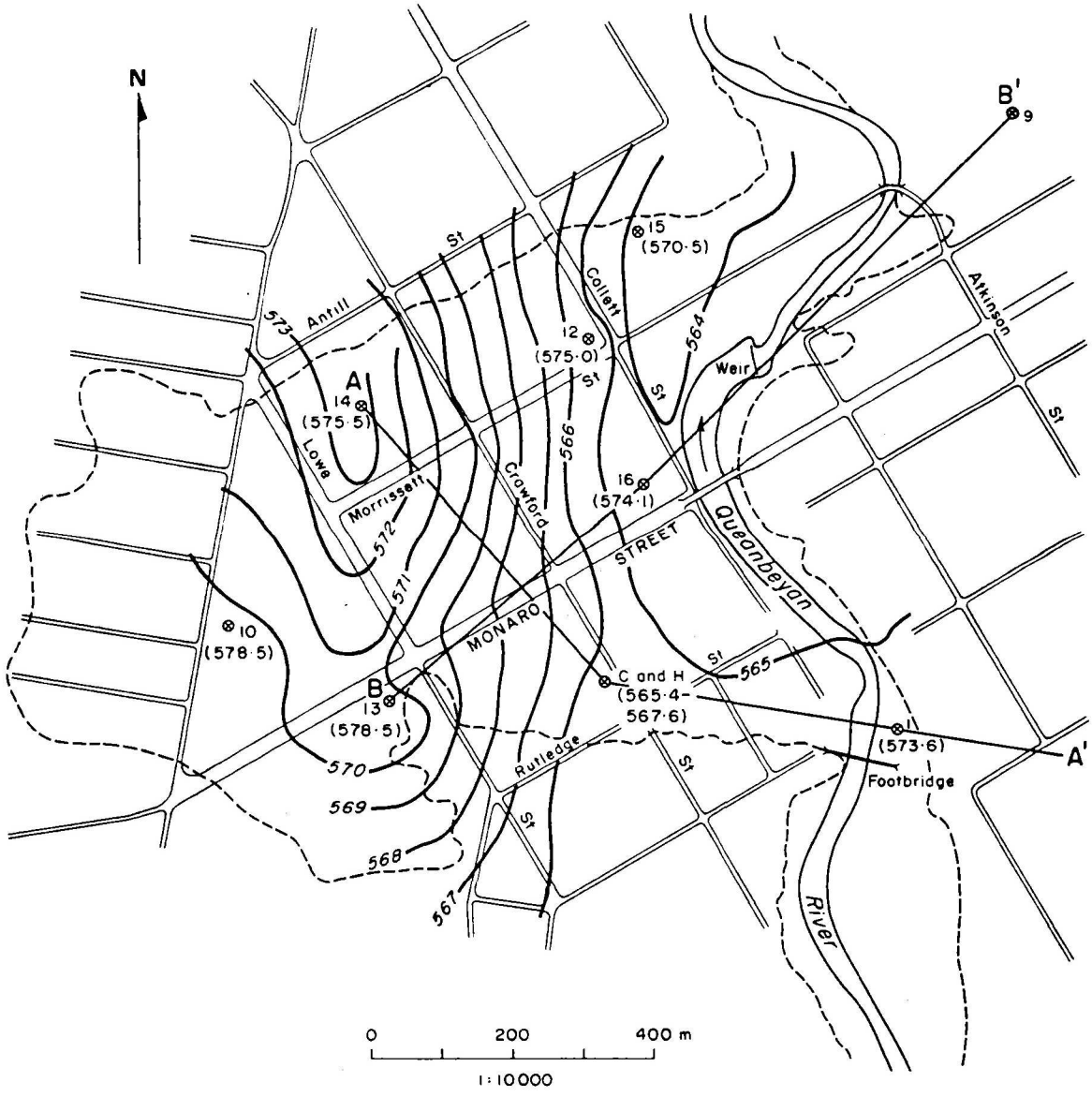
Lenticular bodies of dense dark grey humic gley soils of variable thickness are known to occur within the capillary fringe of the alluvium. These clays are apedal and their plasticity is very high; they are nearly always saturated and are very difficult to work. As their bearing capacity is poor, the dark grey clay soils should be removed from foundations.

The deeper coarser-grained sediments are dominantly rounded cobbles of durable rocks with sand and gravel layers. Large groundwater inflows are expected in excavations below the water-table, and a high potentiometric surface is common in aquifers confined below the gley soils.

Other deposits which are not directly related to the Queanbeyan River, such as the alluvial fill of Buttle Creek, are generally thinner and finer-grained. Deposits east of the Queanbeyan River are derived from reworked outwash fan material of the Queanbeyan Fault scarp and hence contain soft platy rock fragments.

ENGINEERING GEOLOGY

The engineering geological properties of the various rock units are given in Table 1. Some of the units which underlie the present urban area are discussed in more detail below.



—565— *Contours on bedrock surface, showing height in metres above sea level*

------- *Boundary of alluvium*

⊗ 15 (570·5) *Drill hole, (height of collar in metres)*

——— *Section*

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Fig. 6 Bedrock contours, Queanbeyan

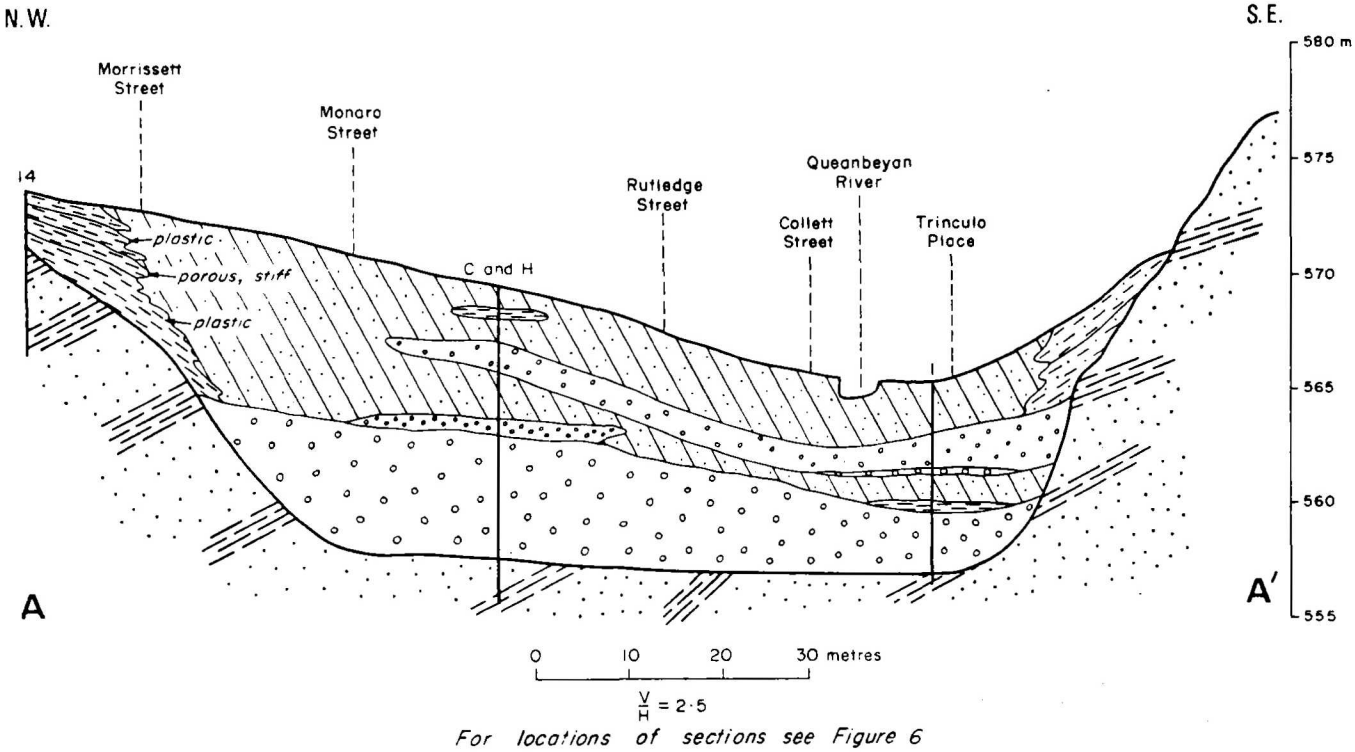
TABLE 1

ENGINEERING GEOLOGY OF QUEANBEYAN URBAN AREA

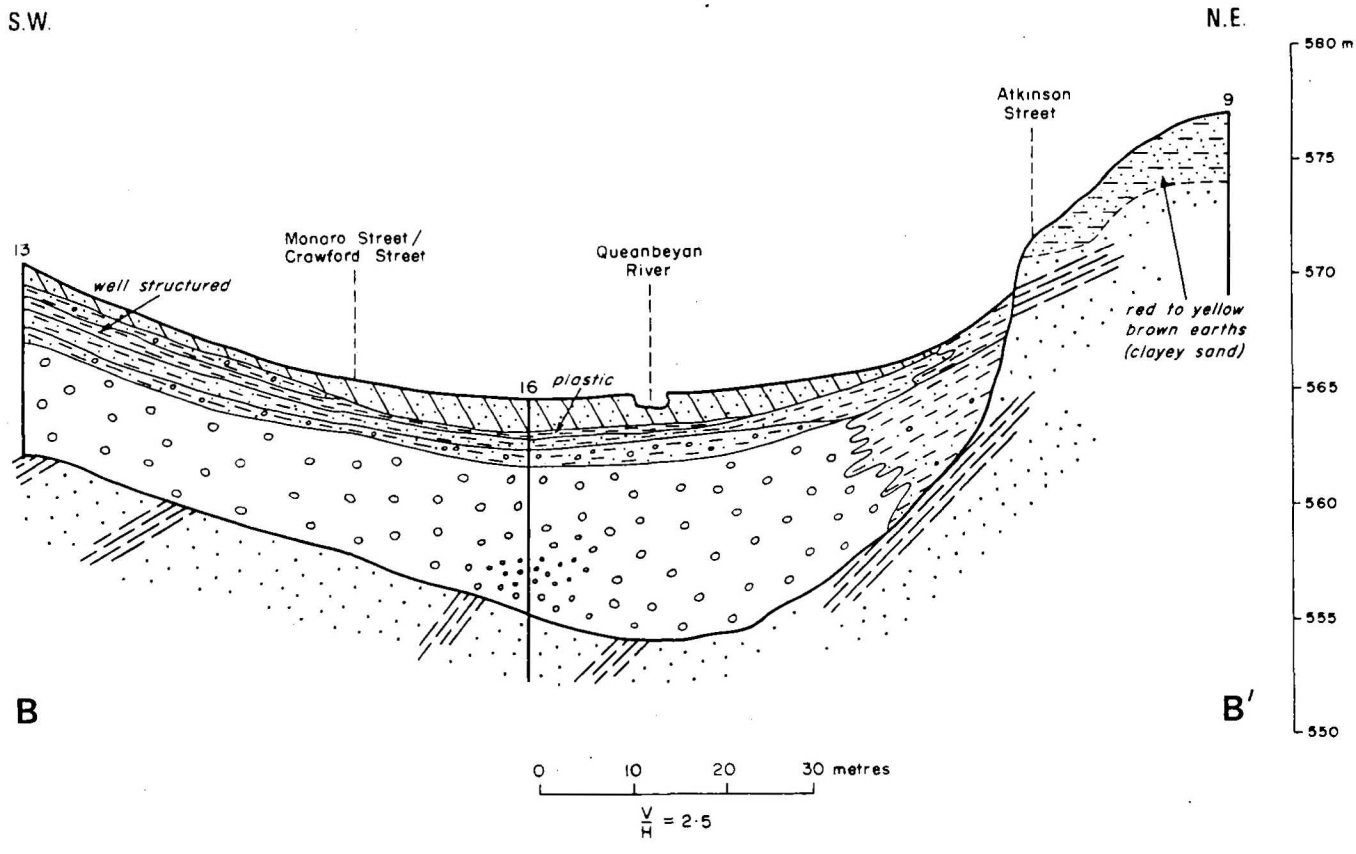
UNIT	GEOLOGICAL DESCRIPTION	OUTCROP TYPE	DISTRIBUTION
ALLUVIUM	Silty sand, clay, sand clay, silt, gravel	Along present course of Queanbeyan R, and some smaller drainage channels	Mechanical excavation excavation of alluvial material. Silty sand material stable to 3.0 m in vertical cut. easily eroded by flood-waters
AINSLIE VOLCANICS (Lower Devonian)	Coarse-grained rhyodacite; tuffaceous fine-grained porphyritic volcanics	Very poor (EW* HW) surface outcrop some small intru-sions with contact aureoles (HW-MW)	Low-lying undulating ground E of railway line, in SW of area
BARRACK CREEK ADAMELLITE (Siluro-Devonian)	Quartzo-feldspathic coarse-grained with variable texture and composition. Sheared and silici-fied at contacts; contains abundant xenoliths. Thrust-faulted against Pittman Formation to the west	Poor surface outcrop; often deeply weathered	On S boundary of area; E of Cooma Rd
CANBERRA GROUP (Middle Silurian)	Flaggy yellowish-brown quartzose sandstone, some siltstone and yellow calcareous fossiliferous shale and mudstone, tuff	Scattered surface outcrops of sand-stone	In a N-S wedge between railway line and Tharwa Rd
COLINTON VOLCANICS (Middle Silurian)	Altered dacite and crystal tuff, limestone, slate. Foliated, porphyritic	Rock project up to 0.5 m above surface. Thin skeletal soils between outcrops	In SE, on both sides of Queanbeyan R. Forms steep ridges
BLACK MOUNTAIN SANDSTONE (Lower Silurian)	Fine-grained, blocky white to yellow quartzose sandstone with thin shale interbeds	Surface outcrops of sandstone, up to 0.3 m above ground	Crops out on Mt Jerrabomberra
STATE CIRCLE SHALE (Lower Silurian)	Well-laminated reddish-brown shale. Unconformable on Ordovician metasediments	Poor, scattered surface outcrop. Occurs as HW fissile	Exposed in shale pit on NE flank of Mt Jerrabomberra, scattered outcrop on E side
ACTON SHALE (Upper Ordovician)	Fissile, blue-grey, finely laminated siliceous shale, and fine-grained white to yellow quartzose sandstone. Tightly folded	Low surface out-crops common, or overlain by shallow skeletal soil of red and grey mottled clay with abundant platy shale fragments	Outcrops on rises in W
PITTMAN FORMATION (Middle Ordovician)	Grey-brown greywacke, yellow quartzose sandstone & quartzite black chert bands, siltstone, and phyllite. Tightly folded, over-turned in places, foliated	Greywacke, quart-zite, and sandstone outcrop on the surface E of Quean-beyan Fault with thin skeletal soils (0.5 m); else-where clay soils to 2 m overlie MW-HW rock, some scattered outcrops	Underlies most of Queanbeyan on both sides of Qbn Fault

*Degree of weathering: see Appendix 2

EXCAVATION CONDS.	FOUNDATION CONDS.	GROUNDWATER & SOIL DRAINAGE	RESOURCES
Mechanical excavation of alluvial material. material. Silty sand material stable to 3.0 m in vertical cut. Easily eroded by flood-waters	For large buildings foundations will need to reach strong rock (8-15 m). In main alluvial area bedrock is sandstone with some weaker shale interbeds	Poorly drained, swampy areas occur especially along smaller water-courses. Water-table generally less than 2 m	Sand gravel topsoil
Variable depth to MW rock (2.0-6.0 m). Mechanical excavation suitable for most purposes, blasting in deeper excavations	Strong, MW rock is adequate to support large buildings	Some poorly drained areas. Water-table 3-5 m	Possible source of crushed rock but may contain some pyrite
Mechanical excavation EW-HW rock; blasting where silificied or HW rock close to surface	As for Ainslie Volcanics above	Well-drained, water-table ranges to depths of 10 m	Crushed rock from ABM Quarry HW-MW rock used as road aggregate from council quarry
MW sandstone occurs at the surface, will need blasting. Shale and mudstone more deeply weathered (0.5 ->4 m) suitable for mechanical excavation	Strong rock at 0 to 4.0 m except in faulted zones, where weathering is deep	Swampy areas have developed on the finer-grained sediments. Drainage of swampy areas required	Quarried as rough stone N of Molonglo R
Where MW rock occurs at the surface, blasting will be required. Ripping will be suitable for HW rock and closely jointed and/or foliated rock. Stability of cuts depends on direction and intensity of foliation shears, and joints	MW rock suitable for foundations of large structures at less than 3 m. Steep slopes and excavation difficulties may make areas less desirable for development	Generally well drained with thin soils	Suitable for crushed rock, but may contain some pyrite or produce unsuitable platy fragments
Fresh to HW rock at surface. Ripping may be sufficient for shallow excavations; blasting necessary for most purposes. Slope instability in cuts wherever joints and bedding planes are clay-lined and unfavourably oriented	Very strong rock for foundations close to surface; steep slopes	Well drained	Suitable for rough stone
Mechanical excavation for EW-MW shale. Slopes in EW-HW rock unstable due to clay minerals	Suitable foundation on MW rock	EW-HW shale poorly drained	Suitable for brick shale
MW rock occurs at surface to 3.0 m. Light blasting will probably be needed for most excavations. Minor slumping was noted in EW rock & clay in slopes greater than 50°	Generally good at 1 m	Seepages noted along Gilmore St., 0.5m below ground surface	Has been used as road aggregate; flaky with strong cleavage
Ripping possible in EW-HW rock; blasting in MW rock. Slopes stable in MW rock, but HW-EW rock slopes may be unstable	Strong foundation material 3 m from surface. Beneath alluvium MW-FR occurs at 2.0-12.0 m	Minor swampy areas develop in EW rock, especially in areas of low relief	Mudstone unit quarried on Mt Jerrabomberra for brickshale, now used for refuse disposal (Fig. 3)



For locations of sections see Figure 6



Silt

Clay

Sand

Gravel

Interbedded sandstone and shale bedrock

C and H Coffey and Hollingsworth drill hole

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Fig 7 Interpretative sections through alluvium

Central Queanbeyan

The business area of Queanbeyan is built on alluvium, and high-rise development is likely to continue. The results of the drilling program conducted in 1975 by BMR indicate that the alluvium consists of lenticular deposits of sand, silt, and clay overlying gravel to an average depth of 10 m (Fig. 7). Any large structures will require piled foundations to the underlying moderately weathered bedrock (Pittman Formation). Pad or raft foundations should be adequate for smaller structures, provided that gley soils are removed before construction. A detailed site investigation for all structures over 2 storeys is recommended. Contours of the bedrock surface beneath the alluvium are shown in Fig. 6.

Outside the central area

Apart from the colluvial fans, weathered rock occurs close to the surface, generally within 2 m, and the category of weathering will range from extremely to moderately weathered. Blasting will be required in moderately weathered rock for the excavation of foundations and the installation of services.

Large structures on pad or raft footings can be founded on moderately weathered rock.

Part of the present urban area to the south, adjacent to the Queanbeyan River, is underlain by foliated volcanics of the Colinton Volcanics. The rock is moderately weathered at the surface with a near-vertical cleavage. Excavations for house foundations and the installation of services will not generally require blasting but this will probably be necessary for some road cuttings and deeper excavations. Instability in road cuts and excavations will depend on the orientation of joints and/or cleavage relative to the direction of roadcut.

The colluvial fans have a variable composition. The material is satisfactory for founding dwellings on the lower slopes; however, drains should be laid below any saturated soil before construction is undertaken. On the steeper slopes development will produce instability in road cuts and trenches, and unprotected slopes will be prone to gullying; the design of foundations should consider the affects of hillside creep and ensure adequate drainage of foundations. Maintenance of services will be more costly on the steeper slopes.

SEISMICITY

Queanbeyan is located in an area of minor seismic activity, and recent calculations by A.J. McEwin, BMR, indicate return period that at least one earthquake of felt intensity V on the Modified Mercalli Scale can be expected for a 50-year return period. Table 2 lists the earthquakes and felt intensities for the Queanbeyan-Canberra region recorded in historical times.

A number of faults occur close to the town; all except the Queanbeyan Fault are Palaeozoic features and seismic activity would be extremely unlikely along such faults. The Queanbeyan Fault was last thought to be active during the Late Tertiary to Quaternary periods (1 - 10 million years ago), and there is no evidence to indicate that recorded earthquake epicentres are associated with it. A very slight increase in low-level seismic activity, insufficient to increase seismic hazard significantly, may occur with the filling of the Googong Reservoir 4 km upstream on the Queanbeyan River.

Buildings founded on unconsolidated material such as alluvium and colluvium will be more susceptible to damage during a seismic event, and the effect of seismic activity should be considered in the design of any major structure in the area.

HYDROLOGY

The hydrology of the Queanbeyan River has been documented by the Commonwealth Department of Works (1968) in connection with Googong Dam, and rainfall details are given in Gunn et al. (1969).

TABLE 2

HISTORICAL LIST OF EARTHQUAKES AND THE CORRESPONDING FELT MODIFIED MERCALLI INTENSITIES WITHIN 250 km OF QUANBEYAN

Earthquake	Date	Epicentre Lat.	Epicentre Long.	Magnitude (Richter scale)	Max. felt intensity at epicentre (Modified Mercalli Scale)	Intensity felt in ACT & environs
Kurrajong	15 Aug 1919	33.5°S	150.7°E	4.6	V	I-II
Murrumbateman	6 Mar 1924	34.9°S	149.0°E	5.0	IV	I-II
Dalton-Gunning	10 Mar 1949	34.74°S	149.20°E	5.5	VIII	III-IV
Rock Flat	1 Sept 1958	36.40°S	149.24°E	4.0	V	I-II
Berridale	18 May 1959	36.22°S	148.66°E	5.0	VI	III
Robertson-Bowral	21 May 1961	34.55°S	150.50°E	5.6	VII	III
Mt Hotham	3 May 1966	37.04°S	147.13°R	5.7	V	II
Dalton	3 Nov 1971	34.76°S	149.16°E	4.2	V	III
Picton	9 Mar 1973	34.14°S	150.29°E	5.5	VI	IV
Bowning	30 Jun 1977	34.66°S	148.89°E	4.2	IV	III-IV
Bowning	4 Jul 1977	34.66°S	148.89°E	4.8	V	IV

The Queanbeyan River catchment is extensive (863 km^2) and heavy rainfall especially in its upper reaches usually results in flooding in Queanbeyan. Flooding of the city area has been recurrent throughout Queanbeyan's history (Lea-Scarlett, 1968), with the earliest recorded flood in 1852. The highest recorded flood occurred in 1925, wrecking the suspension bridge and inundating the lower parts of Monaro and Macquoid Streets. Construction of the Googong Reservoir upstream should cause a substantial reduction in flooding.

Some areas of poorly drained soils are present within the study area. Seepage near Stornaway Road is caused by water in the underlying fractured rock aquifers being confined under pressure by the overlying low-permeability clay soils; the clay soils become saturated and water seeps slowly to the surface. This seepage can only be controlled by setting rubble drains below the confining clay soils, at depths ranging from 1 to 2 m. To provide a fall for drainage from such an area, it is necessary for the problem to be recognised at the design stage of development to ensure that the invert of stormwater drains is set at the appropriate depth.

CONCLUSIONS

1. The urban development of Queanbeyan is constrained in a number of areas by steep slopes, rock outcrop at shallow depths, poorly drained soils, and the potential instability of some colluvial materials.

2. The steeper slopes of Mount Jerrabomberra and the Queanbeyan Fault scarp contain unmerous rock outcrops, and urban development would require deep cuts for access roads and the installation of services.

3. Blasting will be required in excavations for services wherever moderately weathered rock lies close to the surface, as at The Ridgeway.

4. Moderately weathered rock will provide adequate support for major buildings.

5. Major buildings sited on thick alluvium may require piled foundations.

6. Colluvium on the flanks of Mount Jerrabomberra erodes readily and would be potentially unstable in cuts and excavations.

7. Some areas of poorly drained soil will require drainage at depths of up to 2 m.

8. It is expected that the low-lying areas of Queanbeyan will be less prone to flooding after completion of Googong Dam.

9. Queanbeyan is located in an area of minor seismic activity, and buildings founded on unconsolidated material such as alluvium or colluvium are more susceptible to damage during a seismic event. Multi-level buildings should be designed according to specifications for Zone A of the standards Association of Australia Draft Code No DR 76100 "Draft Australian Standard Rules for the Design of Earthquake - Resistant buildings" 15 September 1976.

REFERENCES

BRISCOE, G., KELLETT, J.R., & JACOBSON, G., in prep - Canberra-Queanbeyan relationship study; geological factors in urban development. Bur. Miner. Resour. Aust. Rec.

CEPLECHA, J.P., 1975 - Preliminary geological investigation of south Queanbeyan urban development area, N.S.W. Bur. Miner. Resour. Aust. Rec. 1975/6 (unpubl.).

COMMONWEALTH DEPARTMENT OF WORKS, 1968 - Canberra water supply augmentation. Rep. for Nat. Cap. Devel. Comm., May 1968.

GUNN, R.H., STORY, R., GALLOWAY, R.W., DUFFY, P.J.B., YAPP, G.A., & MCALPINE, J.R., 1969 - Lands of the Queanbeyan - Shoalhaven area, A.C.T. and N.S.W. Sci. Ind. Res. Org. Melb. Land. Res. Ser. 24.

KELLETT, J.R., in prep - The soils of Mount Jerrabomberra, N.S.W. Bur. Miner. Resour. Aust. Rec.

LEA - SCARLETT, 1968 - QUEANBEYAN DISTRICT AND PEOPLE. Queanbeyan, Municipal Council.

PHILLIPS, J.R., 1956 - Geology of the Queanbeyan district. J. Roy. Soc. N.S.W., 89, 116-26.

UNIFIED SOIL CLASSIFICATION SYSTEM

CLASSIFICATION CHART

MAJOR DIVISIONS		SYMBOLS	TYPICAL NAMES
COARSE GRAINED SOILS (More than 1/2 of soil > No 200 sieve size)	GRAVELS (More than 1/2 of coarse fraction > no. 4 U.S. sieve size)	GW	Well graded gravels or gravel-sand mixtures, little or no fines*
		GP	Poorly graded gravels or gravel-sand mixtures, little or no fines
		GM	Silty gravels, gravel-sand-silt mixture
		GC	Clayey gravels, gravel-sand-clay mixture
	SANDS (More than 1/2 of coarse fraction > no. 4 U.S. sieve size)	SW	Well graded sands or gravelly sands, little or no fines
		SP	Poorly graded sands or gravelly sands, little or no fines
		SM	Silty sands, sand silt-mixtures
		SC	Clayey sands, sand-clay mixtures
FINE GRAINED SOILS (More than 1/2 of soil < No. 200 sieve size)	SILTS AND CLAYS Liquid limit > 50	ML	Inorganic silt and very fine sands, rock flour, silty or clayey fine sands or clayey silts with low plasticity
		CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays
		OL	Organic silts and organic silty clays of low plasticty
	SILTS AND CLAYS Liquid limit > 50	MH	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts
		CH	Inorganic clays of high plasticity, fat clays
		OH	Organic clays of medium to high plasticity, organic silty clays, organic silts
HIGHLY ORGANIC SOILS		Pt	Peat and other highly organic soils

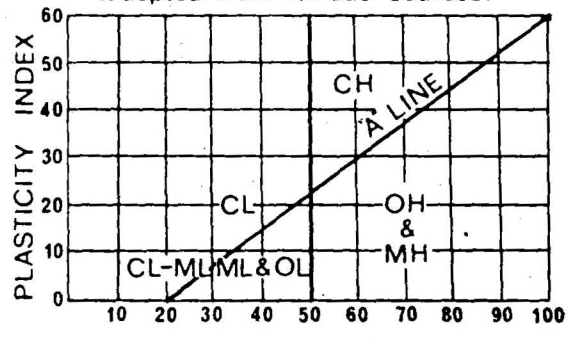
*fines - portion of a soil finer than a no. 200 sieve

GRAIN SIZE CHART

Classification	Range of grain size	
	U.S. Standard Sieve Size	Grain Size in Millimetres
BOULDERS	Above 12"	Above 305
COBBLES	12" to 3"	305 to 76·2
GRAVEL		
coarse	3" to No. 4 / 3" to 3/4"	76·2 to 4·76 / 76·2 to 19·1
fine	3/4" to No 4	19·1 to 4·76
SAND		
coarse	No. 4 to No. 200 / No. 4 to No. 10	4·76 to 0·074 / 4·76 to 2·00
medium	No. 10 to No. 40	2·00 to 0·420
fine	No. 40 to No. 200	0·420 to 0·074
SILT & CLAY	Below No. 200	Below 0·074

PLASTICITY CHART

(adopted from various sources)



APPENDIX 2

Degrees of weathering

Fresh (FR)	No discolouration or loss in strength.
Fresh stained (FRST)	Limonitic staining along fractures; rock otherwise fresh and shows no loss of strength.
Slightly weathered (SW)	Rock is slightly discoloured, but not noticeably lower in strength than the fresh rock.
Moderately weathered (MW)	Rock is discoloured and noticeably weakened; N-size drill core generally cannot be broken by hand across the rock fabric.
Highly weathered (HW)	Rock is discoloured and weakened, N-size drill core can generally be broken by hand across the rock fabric.
Extremely weathered (EW)	Rock is decomposed to a soil, but the original rock fabric is mostly preserved.

APPENDIX 3

LOGS OF DRILL HOLES, QUEANBEYAN CITY AREA

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT Queanbeyan Dailung Project

LOCATION Triangle Place, north of footbridge

HOLE NO. 1

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION -

COORDINATES 251338 (Canberra 1:50,000) R.L. OF COLLAR 573.6m

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) *
	No core										
Alluvium	Brown silt and yellow-grey clayey silt some clay bands.				1						
	Gravel, subrounded to 4cm				2 3						
	Yellowish-grey silt, some fine gravel				4						
	Grey & yellow mottled silty clay, porous, sesquioxides				5						
	Sandy clay and gravel										
	Cobbles, some clay and fine gravel				6 7						
M.W - S.W Sandstone	Grey, strong, fractured				8						
S.W. - FR ST Sandstone, Siltstone	Grey, micaceous sandstone and interbedded siltstone. Strong, fractured in places.				9 10				Bedding 45° to core. Steeply dipping continuous joints & slickensides and clay on less steply dipping joints. Thin quartz veins.		
	End of hole 10.06m				11 12 13 14 15 16 17 18 19 20						

Drill type Mayhew 1000

Feed Mechanical Pulldown

Core barrel type Triefus

Driller

Commenced Feb '75

Completed Feb '75

Logged by G. Briscoe

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 25 cm 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

M.W Moderately weathered

S.W Slightly weathered

FR ST Fresh, stained

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

I55/A16/1645

M/P 1946

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PROJECT QUEANBEYAN DRILLING PROJECT

LOCATION West of Ash Street

HOLE NO. 2

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION -

COORDINATES 234327 Canberra 1:50,000 R.L. OF COLLAR 618.7m

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) *
	No core				1.22						
E.W. - H.W. Siltstone	Grey-brown siltstone, clay; weak.				1.83				Fractured		
H.W. Siltstone	Khaki siltstone, slightly metamorphosed, banded, fractured.				2.44				Vertical bedding, parallel to cleavage. Foliation 70° to core. Fe, Mn on joints.		
H.W. - M.W. Siltstone	Brownish-pink siltstone, strong; fractured in places.				3.36				Fe, Mn on joints. Variable bedding directions. Steeply dipping joints.		
M.W. - S.W. Sandstone, siltstone	Grey-brown, fine grained micaceous sandstone with thin siltstone bands; strong becoming more silty.				4.96 5.27 5.93				Bedding 80° to core. Fe, Mn on steeply dipping irregular joints. Thin quartz veins. Slickensides in clay; siltstone more fractured.		
	End of hole 7.02m				5.79 6.1 6.6 6.71						

Drill type Mayhew 1000

Feed Mechanical Pull down

Core barrel type Triefus

Driller

Commenced Feb '75

Completed Feb '75

Logged by G. Briscoe

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.

E.W. Extremely weathered

H.W. Highly weathered

M.W. Moderately weathered

S.W. Slightly weathered.

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

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PROJECT QUEANBEYAN DRILLING PROJECT

LOCATION West of Thorne Road, near rubbish dump

HOLE NO. 3

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION -

COORDINATES 209328 (Canberra 1:50,000) R.L. OF COLLAR 597.4

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) *
	No core				.91						
Soil	Red-yellow-grey mottled clay; some gravel, sesquioxide				1.53						
Soil	Yellow-grey sandy clay and gravel, some cobbles of H.W. rock				2.25						
H.W. Porphyry	Coarse-medium grained, Yellow fawn with altered feldspars, little quartz.				3.66				Fe, Mn on joints		
H.W.-M.W. Porphyry	Medium grained, fawn porphyry, strong								Fe, Mn on joints		
	End of hole 5.18m										

Drill type Mayhew 1000

Feed Mechanical Pull down

Core barrel type Triefus

Driller

Commenced Feb '75

Completed Feb '75

Logged by G. Briscoe

Vertical scale 1:100

Checked by

Notes

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

M.W. Moderately weathered

H.W. Highly weathered

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

I55/A16/1647

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PROJECT Queanbeyan Drilling Project

LOCATION Council Depot, Burgendore Road

HOLE NO. 4

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION -

COORDINATES 257346 (Canberra 1:50000) R.L. OF COLLAR 586.7m

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) *
	No core				1.53						
Colluvium	Grey-brown-yellow mottled sandy clay, porous; some gravel.				2.14						
	No core				2.75						
Alluvium	Sub-rounded gravel (up to 5cm) in sandy clay				3.35						
Alluvium	Brown sandy clay & fine gravel				4						
"	Pale yellow-brown clay with gravel. Clay washed out in places. Gravel sizes 3mm - 10cm. Core loss				5						
					6.27						
H.W. Siltstone, Sandstone	Banded grey siltstone & yellow brown sandstone, weak				7				Bedding parallel to foliation, ~ 85° to core. Minor Fe, Mn		
					7.32						
H.W. Siltstone, Sandstone	Yellow-pink fine grained sandstone, grey siltstone Fractured.				8				Mn, Fe, clay on joints; Numerous discontinuous joints.		
					8.54						
					9						
					9.76						
E.W - H.W Siltstone, Sandstone	Grey-yellow rock & clay; weak				10				Fe, Mn, clay on joints		
					10.51						
					11						
					12						
	End of hole 12.20m										

Drill type Mayhew 1000

Feed Mechanical Pulldown

Core barrel type Triefus

Driller -

Commenced Feb '75

Completed Feb '75

Logged by G. Briscoe

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.

E.W. Extremely weathered

H.W. Highly weathered

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

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT QUEANBEYAN DRILLING PROJECT

LOCATION Carwoola St, south of intersection with Silva Avenue

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION -

COORDINATES 261354 (Bungendore 1:50,000) R.L. OF COLLAR 608.5m

HOLE NO. 5

SHEET 1 OF 1

Rock Type and Degree of Weathering	Description Lithology, colour, strength, etc	Casing	Graphic Log	Litt 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) *
	No core				1.91						
Colluvium	Khaki-grey, well structured, porous sandy clay, some gravel.				2.14						
E.W. - H.W. Sandstone, Siltstone	Pink-white-grey clay and weak rock				3.96						
M.W. - S.W. Sandstone, Siltstone.	Pinkish grey fine-grained sandstone & siltstone. Strong in larger core pieces (<10cm). Fractured zones with clay.				5.18 6.1				Fe, Mn, clay on steeply dipping joints. Foliation parallel to bedding at 80° to core.		
M.W. - S.W. Sandstone, Siltstone	Pink-grey foliated sandstone siltstone, moderately strong				8.04				Bedding parallel to foliation at 70° to core. Fractured zones.		
H.W. Sandstone	Pink, fine-grained, micaceous sandstone, weak. Some clay & fractured rock				8.84				Mn on discontinuous joints, Sub-horizontal fractures 9.2 - 8.8.		
H.W. Sandstone Siltstone	Reddish, grey, fractured sandstone and siltstone, pink-brown clay. Not fractured 9.8 - 10.0m				10.69				Fractured.		
S.W. - M.W. Sandstone, Siltstone	Reddish brown fine-grained sandstone and interbedded grey to reddish siltstone. Fractured 10.68 - 11.75 - core loss.								Bedding dips 70° to core. Mn, Fe on discontinuous joints. Foliation parallel to bedding.		
	End of hole 12.18m										

Drill type Mayhew 1000

Feed Mechanical Pulldown

Core barrel type Triefus

Driller -

Commenced Feb '75

Completed Feb '75

Logged by G. Briscoe

Vertical scale 1:100

Notes

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

E.W. Extremely weathered
H.W. Highly weathered
M.W. Moderately weathered
S.W. Slightly weathered

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

FEB/AU/11.10

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PROJECT QUEANBEYAN DRILLING PROJECT

LOCATION Northern side of Gilmore Rd in Gilmore Parks

HOLE NO 6

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION -

COORDINATES 232335 (Canberra 1:50,000) R.L. OF COLLAR 595.8m

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) *
•	No core				0.91						
H.W. Sandstone	Yellow medium grained micaceous sandstone				1.53				Steeply dipping joints with Fe, clay. Fractured		
H.W. - M.W. Sandstone, Siltstone, Claystone,	Yellow to whitish grey claystone, grey siltstone, with interbedded fine-grained micaceous, yellow to white sandstone; weak.				2.74 2.75 4.27 5.18 6.1				Fe, Mn on discontinuous joints. Clay on open joints. Quartz veins. Sub-horizontal bedding and foliation. Fractured zones with clay + rock.		
	Fine gravel				7.32						
M.W. - H.W. Claystone, Sandstone	As above				7.93 8.54 8.84 9.96				Mn, Fe, clay on numerous discontinuous joints. Complex folding in core. Fractured zones with clay + fine gravel.		
M.W. - H.W. Shale	Blue-black laminated shale, tough				10.37 10.68				Numerous iron stained joints; Pyrite + quartz. Folded. Clay, slickensides on joints Fractured 10.4 - 11.0 m		
	End of hole 11.0m				11 12 13						

Drill type Mayhew 1000

Feed Mechanical Pull down

Core barrel type Triefus

Driller

Commenced Feb '75

Completed Feb '75

Logged by G. Briscoe

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 25 cm 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.

H.W. Highly weathered

M.W. Moderately weathered

Water Pressure Tests

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

Core Photograph Negative No.

Depth (m)	Black & White	Colour

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PROJECT QUEANBEYAN DRILLING PROJECT
LOCATION Between Clifton & Multibrick Quarries

HOLE NO. 7

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION —
COORDINATES 262342 (Bungendore 1:50,000) R.L. OF COLLAR 668.0m

SHEET 1 OF 2

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) *
	No core				.91						
Colluvium	Reddish brown silty clay, some sand				1.82						
	Red-grey mottled sandy clay, porous, sesquioxides, some gravel				2.13						
	Brown-grey mottled clay with gravel. Gravel is sub-rounded to sub-angular. Poor core recovery			0 1 0 1 0 1 0 1 0 1 0	2.74						
E.W. - H.W. Shale	White to pale brown shale, sandy in places. Fractured, weak.				5.48				Fe, Mn on joints. Thin quartz veins.		
					6.9						
					8.52						
					11.59						
					13.11						
					14.31						
					15.24						
					16.53						
					17.98						

Drill type Mayhew 1000
Feed Mechanical Pulldown
Core barrel type Triefus
Driller
Commenced March '75
Completed March '75
Logged by G. Briscoe
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 25 cm 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.

E.W. Extremely weathered
H.W. Highly weathered

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

I55/A16/1651

M(P)1146

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT QUEANBEYAN DRILLING PROJECT

LOCATION

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION

COORDINATES R.L. OF COLLAR

HOLE NO. 7

SHEET 2 OF 2

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) *
E.W. Shale	As above				21 22 23				Heavy iron staining + quartz		
H.W Shale	Brown-grey shale with clay and fine gravel.				24 25						
H.W Shale	Khaki to brown shale. Fractured zones with clay; weak				26 27				Closely jointed; Bedding at 70° to core.		
	End of hole 27.13m				28 29						

Drill type

Feed

Core barrel type

Driller

Commenced

Completed

Logged by

Vertical scale

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 25 cm 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.

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

I55/A16/1651

M(P) 46

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT QUEANBEYAN DRILLING PROJECT

LOCATION Northern side of Queanbeyan Rd, in park

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION

COORDINATES 242321 (Canberra 1:50,000) R.L. OF COLLAR 601.0m

HOLE NO. 8

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) *
	No core				1 2						
H.W. - S.W. Sandstone	Brown, fine-grained micaceous sandstone. Fractured zones with weak rock and clay.				3				Numerous thin (1mm) quartz veins. Clay, Fe. on joints. Alteration in rock adjacent to joints. Closely jointed. Fractured		
	End of hole 3.65m.				4 5 6 7						

Drill type Mayhew 1000
Feed Mechanical Pulldown
Core barrel type Triefus
Driller
Commenced March '75
Completed March '75
Logged by G. Briscoe
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.

H.W. Highly weathered

S.W. Slightly weathered

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

TEE/A16/1652

MIP#4146

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT QUEANBEYAN DRILLING PROJECT
LOCATION Campbell St. side of Queanbeyan Park
ANGLE FROM HORIZONTAL (θ) 90° DIRECTION -
COORDINATES 240338 (Canberra 1:50,000) R.L. OF COLLAR 578.5m

HOLE NO. 10
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) *
	No core				0.91						
Alluvium	Grey-white-yellow-orange mottled clay, some fine gravel				1						
					2						
	Orange-grey-white sandy clay, porous 1cm peds with thin clay skins, sesquioxides; gravel bands.				2.75 3 3.56 3.96 4						
	Clay content increases downwards, becoming orange-brown mottled clay.				5 5.18 5.99 6						
	Friable silty clay; grey-orange-yellow; sesquioxides				6.4 7 8						
	Cobbles in clay										
H.W. - M.W. Sandstone, Siltstone	Brown micaceous, fine-grained sandstone, with brown-grey siltstone interbeds				8.84 9 9.16 9.76 10				Bedding at 70° to core Quartz veins Fe, Mn, clay on joints Close, tight joints		
	End of hole 10.68m				11 12 13						

Drill type Mayhew 1000
Feed Mechanical Pull down
Core barrel type Triefus

Driller
Commenced March '75
Completed March '75
Logged by G. Briscoe
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 25 cm 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.

H.W. Highly weathered
M.W. Moderately weathered

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

I55/A16/1654

M(P)1246

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PROJECT QUEANBEYAN DRILLING PROJECT

LOCATION North-eastern flank of Mt Jerrabomberra

HOLE NO. 11

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION

COORDINATES 222323 (Canberra 1:50,000) R.L. OF COLLAR 661.4m

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) *
	No core				1 2 3.06						
M.W.-S.W. Claystone	Pink-grey claystone, slightly metamorphosed; fractured				3.44				Sub-vertical cleavage Fe, Mn on joints; slickensides		
H.W. - M.W. Claystone	Whitish grey & khaki claystone foliated. Closely fractured zones with clay.				4 4.93 5 5.45				Fractured		
M.W. Claystone	Brown-grey				6				Clay, Fe, Mn, Slickensides on joints		
S.W. - FR. ST. Claystone	Brown silty claystone, some sandy bands Strong. Fractured zones with grey clay				6.1 6.8 7				Vertical bedding parallel to foliation. Tight continuous joints, widely spaced, with Mn. Fe, clay on open, irregular joints.		
	End of hole 7.32m				8 9						

Drill type Mayhew 1000

Feed Mechanical Pulldown

Core barrel type Triefus

Driller

Commenced March '75

Completed March '75

Logged by G. Briscoe

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 25 cm 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.

H.W. Highly weathered

M.W. Moderately weathered

S.W. Slightly weathered

FR. ST. Fresh, stained

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

I55/A16/1655

M(P)146

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT: QUEANBEYAN DRILLING PROJECT

LOCATION: Eastern corner of intersection of Collett and Morisett Streets

ANGLE FROM HORIZONTAL (θ): 90° DIRECTION: -

COORDINATES: 246344 (Canberra 1:50,000) R.L. OF COLLAR: 575.0m

HOLE NO. 12

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) *
	No core				0-4						
Alluvium	Reddish brown silt				1						
	Fine & medium sand in clay										
	Coarse gravel				2						
	Fine gravel in sandy clay				3						
	Coarse gravel & cobbles				4						
					4.88 5						
	Coarse gravel				6						
	Fine gravel				7						
					8						
					9						
					9.76 10						
S.W. Sandstone	Grey, fine grained, foliated; strong.				10.22				Fe, Mn on joints, slickensides.		
	End of hole 10.37m				11						
					12						

Drill type: Mayhew 1000
Feed: Mechanical Pulldown
Core barrel type: Triefus

Driller:
Commenced: March '75
Completed: March '75
Logged by: G. Briscoe
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 25 cm 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.

S.W. Slightly weathered

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

I55/A16/1656

M(P)1146

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PROJECT QUEANBEYAN DRILLING PROJECT

LOCATION Between Monaro St. & Showground

HOLE NO. 13

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION -

COORDINATES 242337 (Canberra 1:50,000) R.L. OF COLLAR 578.5 m

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) *
	No core				1						
Alluvium	Orange-red-yellow gravelly silt, some clay bands				1.52						
	Clayey silt - mottled yellow-orange; porous; sesquioxides				2.13 2						
	Grey-red orange silty clay porous				2.74						
	Orange brown clayey silts gravel; sesquioxides				3.36 3 4						
	Silty clay, yellow grey Poor core recovery				5						
	Gravel - cobbles to fine gravel; sub-angular to sub-rounded				6.41 6 7 7.62 8						
H.W. - M.W. Siltstone, Sandstone	Grey-brown fine grained sandstone and grey siltstone. Moderately strong				8.23 8.78 9 10				Bedding 60° to core Tight joints with Fe, Mn, fractured.		
	End of hole 10.06m				11 12						

Drill type Mayhew 1000

Feed Mechanical Pull down

Core barrel type Triefus

Driller

Commenced March '75

Completed March '75

Logged by G. Briscoe

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 25 cm 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.

H.W. Highly weathered.

M.W. Moderately weathered.

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

I55/A16/1657

M(Pf)146

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PROJECT QUEANBEYAN DRILLING PROJECT

LOCATION Block bounded by Antill, Lane, Morisset, Crawford Streets

HOLE NO. 14

GEOLOGICAL LOG OF DRILL HOLE

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION -

COORDINATES 742344 (Canberra 1:50,000) R.L. OF COLLAR 575.5m

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) *
	No core				.91						
Alluvium	Red-orange-grey sandy clay; porous, sesquioxides; some gravel										
	Grey plastic clay, sand, gravel				2.14						
	Orange-grey sandy clay, sesquioxides.				2.75						
	Yellow to pale brown clay, silt, minor sand, gravel				3.55						
					4.99						
H.W. - M.W. Siltstone, Sandstone	Khaki to grey siltstone and micaceous, fine-grained sandstone. Weak zones with clay & platy rock fragments.				5.13				Fractured Mn, Fe, Clay on joints. Slickensides. Foliation parallel to bedding at 70° to core.		
					5.79						
					6.71						
	End of hole. 7.32m										

Drill type Mayhew 1000

Feed Mechanical Pulldown

Core barrel type Triefus

Driller

Commenced March '75

Completed March '75

Logged by G. Briscoe

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 25 cm 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.

H.W. Highly weathered

M.W. Moderately weathered

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

I55/A16/1658

M(P)46

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT QUEANBEYAN DRILLING PROJECT

LOCATION Western side of intersection between Collett & Monaro Streets

ANGLE FROM HORIZONTAL (θ) 90° DIRECTION -

COORDINATES 24634.2 Canberra 1:50,000 R.L. OF COLLAR 574.1m

HOLE NO. 16

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) *
	No core				1						
Alluvium	Red-orange silt, some gravel				0.83 2						
	Grey clay with brown silty clay				2.6 3 3.96						
	Sub-rounded to rounded gravel, cobbles. Poor core recovery				4 5 6						
	Red-orange silt, some gravel Grey red clayey silt, gravel				7 7.62						
	Sub-rounded to rounded gravel, cobbles.				8 9						
	Coarse sand				9.45						
	Fine gravel Coarse gravel				10 11						
H.W. - M.W. Sandstone Siltstone	Fawn-yellow micaceous sandstone; grey siltstone interbeds. Weak zones with clay. M.W. rock strong.				11.89 12				Bedding 80° to core Tight joints Fractured closely in places.		
	End of hole 12.81m				13 14						

Drill type Mayhew 1000

Feed Mechanical Pull down

Core barrel type Triefus

Driller

Commenced March 75

Completed March 75

Logged by G. Briscoe

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 25 cm 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.

H.W. Highly weathered

M.W. Moderately weathered

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

I55/A16/1659

MP 46

PLATE 1

QUEANBEYAN URBAN AREA : GEOLOGY

149°10'

149°15'

35°20'

35°25'

CANBERRA

Fyshwick

"Greenbank"

"Bonshaw"

"Callum Brae"

"Woden"

"Casa Maria"

"Poplars"

"Stonyhurst"

"Jerrabomberra"

"Tralee"

"Couranga"

HMAS Harman

Queanbeyan

Mt Jerrabomberra

E.L.G.

CANBERRA AVENUE

HINDMARSH DRIVE

JERRABOMBERRA AVENUE

Jerrabomberra Creek

MOLONGLO RIVER

SUTTON ROAD

THARWA ROAD

STATE BOUNDARY ALONG RAILWAY LINE

Uriarra Rd

Cooma Rd

The Ridgeway

Queanbeyan Fault

CULLARIN HORST

KINGS HWY

QUEANBEYAN RIVER

Sullivans Fault

Gilmore Fault

Monaro Highway

Australian Capital Territory

New South Wales

Monaro Railway

Goulburn Cooma Railway

RECENT

- Alluvium — Qa — *Sand, silt, clay, gravel*

DEVONIAN

- Acid intrusives, coarse-grained
- Ainslie Volcanics — Dla — *Coarse-grained porphyritic rhyodacite*

SILURIAN

- Barrack Creek Adamellite — amb — *Coarse-grained adamellite*
- Canberra Group — Smc — *Calcareous mudstones, tuff, sandstones*
- Colinton Volcanics — Smv — *Foliated crystal tuff, dacite, state, marble*
- Black Mountain Sandstone — Slb — *Quartz sandstone with interbedded siltstone*
- State Circle Shale — Sls — *Laminated shale and siltstone with some sandstone interbeds*

ORDOVICIAN

- Acton Shale — Oua — *Blue-grey finely laminated siliceous shale, some quartz sandstone*
- Pittman Formation — Omp — *Greywacke, sandstone, quartzite, shale, phyllite, chert*

- *Geological boundary*
- *Fault*
- 60 — *Strike and dip of bedding*
- 73 — *Strike and dip of cleavage, measured*
- *Strike and dip of cleavage, vertical*
- *Fossil locality*
- 5 (4·3) — *Drill hole (with depth to rock in metres)*
- C H (11·0) — *Coffey and Hollingsworth drill hole*
- *Disused quarry*
- *1974 flood level*
- 2000 — *Topographic contour in feet*

0 500 1000 m

0 1000 2000 3000 ft

1 : 25 000

QUEANBEYAN URBAN AREA : SOILS

	Thickness	Soil type
	<0·5m	*Rock outcrops and gravelly skeletal soil*
	<1m	*Red and yellow friable clays (podzolic soils)*
	<2m	*Red and yellow friable clays (podzolic soils)*
	Up to 5m	*Weakly cemented colluvium; >50% sand and gravel size, platy fragments*
	Up to 5m	*Weakly cemented colluvium; <50% sand and gravel size, platy fragments*
	Up to 5m	*Cohesionless coarse colluvium; >50% sand and gravel size, blocky fragments*
	Up to 7m	*Clays developed on stratified sands and gravels*
	Up to 10m	*Clays developed on stratified sands, gravels cobbles and boulders, includes dark grey gley soils*

0 500 1000 m
0 1000 2000 3000 ft

1:25000

Record 1977/64

155/A16/1539