
Investigation drilling at Tarooona

A. Waite

Introduction

An area of land at Tarooona, between the Channel Highway and the cliff line of the River Derwent, has been subject to previous investigations of ground movement issues, caused by both landslide and expansive soils. The area concerned is shown in Figure 1.

A recent review by Mineral Resources Tasmania (Latinovic *et al.*, 2001) identified a need for boreholes to be drilled in certain areas to further investigate the subsurface geology and for the installation of monitoring instrumentation.

MRT engaged contractors in June 2001 to drill a single deep borehole at a location on Flinders Esplanade, Tarooona. The drilling was completed in July 2001 and a Casagrande piezometer was installed in the hole to monitor groundwater.

This report presents a factual account of the work carried out.

Previous investigations

The ground movement problems in the area were examined by Stevenson (1975, 1976). Knights (1977) recognised a high potential for expansive clay effects close to the surface, while Donaldson (1977) identified landslide activity along the Channel Highway and in parts of the grounds of Tarooona High School.

Instrumentation was installed and monitoring of ground movement was carried out by the Division of Roads and Transport from 1977.

A field investigation was performed by MRT in 1999 and a review of existing and new data was undertaken in 2000 (Latinovic *et al.*, 2001). This review recognised the need for further deep drilling work to investigate the subsurface geology in certain areas and for the placement of piezometers to monitor groundwater levels.

The current investigation

In June 2001, MRT commissioned a drilling contractor to drill a deep borehole at the southern end of Flinders Esplanade, Tarooona, and recover continuous core samples of the strata encountered. The borehole was located on the western side of Flinders Esplanade, at AMG grid co-ordinates 528 537.63 mE, 5 245 087.19 mN (fig. 1).

The borehole was commenced using open-hole drilling to install conductor casing, and then continued using an HQ size triple tube wireline system to recover 76 mm nominal diameter core. A smaller NQ size system, producing 38 mm nominal diameter core, was used to penetrate below 58.40 metres depth because of the ground conditions encountered.

Below a very thin soil horizon, the materials recovered during the drilling works were essentially heterogeneous, consisting of interbedded firm to hard clay and extremely low strength mudstone and siltstone. Boulders, cobbles and gravel of various other more competent rocks were present throughout the sequence. Sand-size material was present as a secondary or minor component in many of the strata.

This geological succession corresponds to the Tertiary deposits identified by Latinovic *et al.* (2001) which formed along the then active Tarooona fault system.

Fissure surfaces and joints were observed at intervals throughout the recovered core, with particular concentrations between 24.95 m to 25.90 m, 27.60 m to 29.75 m, 40.00 m to 47.80 m and 50.90 m to 53.50 m. Most were observed to have moderate to high apparent dip angles. Below 43.20 m depth, the core recovered was non-intact over a large number of intervals. Because of the possibility of disturbance during sampling of the materials involved, the ascription of these non-intact intervals to *in situ* crush seams cannot be made with certainty, although between 43.50 m and 50.50 m large numbers of polished surfaces were observed.

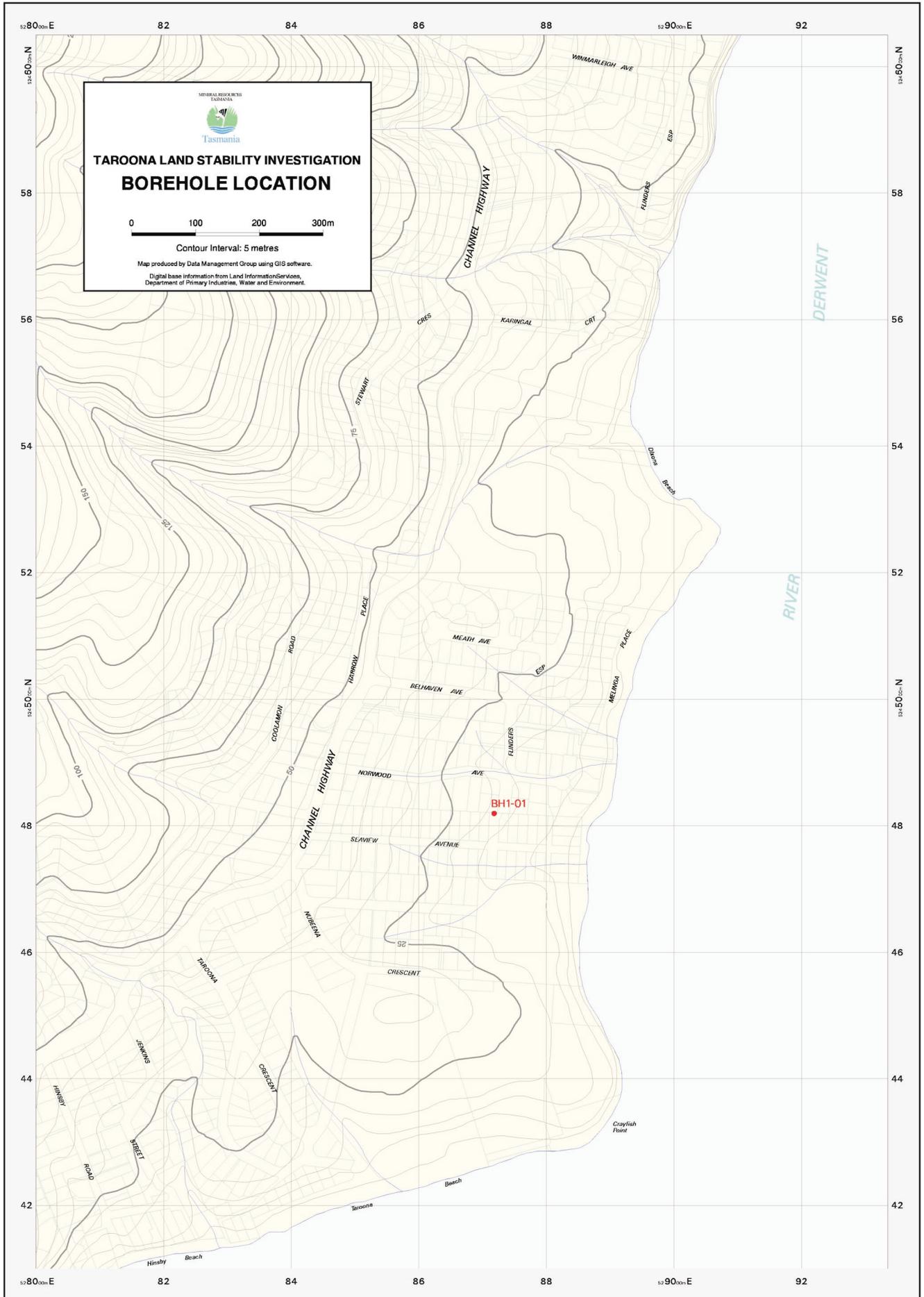


Figure 1

Difficult ground conditions were encountered during drilling; expansive clays are present as the fine fractions of many of the lithologies drilled, with large fragments of redeposited, more competent rocks also present. High groundwater pressures were also reported by the driller below 58 m depth.

A Casagrande piezometer was installed in the hole, with its tip set at 45 m depth. The borehole log and details of the installation are shown Appendix 1. Photographs of the recovered core are shown in Appendix 2.

Conclusions

Further information on the subsurface geology at Tarooma has been obtained, and instrumentation installed to allow long-term monitoring of groundwater levels.

Recommendation

The piezometer should be regularly monitored to provide information on the deep groundwater conditions in the area.

References

- DONALDSON, R. C. 1977. Road foundation failures, Channel Highway, Tarooma. *Unpublished Report Department of Mines Tasmania 1977/36.*
- KNIGHTS, C. J. 1977. House damage in the Tarooma area. *Unpublished Report Department of Mines Tasmania 1977/35.*
- LATINOVIC, M.; WAITE, A.; CALVER, C. R.; FORSYTH, S. M. 2001. An investigation of land stability in the Tarooma area. *Record Tasmanian Geological Survey 2001/01.*
- STEVENSON, P. C. 1975. Ground movement at Tarooma. *Unpublished Report Department of Mines Tasmania 1975/69.*
- STEVENSON, P. C. 1976. Ground stability at Tarooma High School. *Unpublished Report Department of Mines Tasmania 1976/12.*

[1 November 2001]

APPENDIX 1

Borehole Logs

ENGINEERING LOG - CORED BOREHOLE

| | | | | | |
|--------------|-----------------------------|--------------|--|-----------------------------|----------|
| project | TAROONA INVESTIGATION | | location | FLINDERS ESPLANADE, TAROONA | |
| co-ordinates | 528717.98mE 5244819.55mN | drill type | Rotary | hole commenced | 21/06/01 |
| R.L. | +18.85m AHD | drill method | Continuous coring using Triple tube wireline techniques to recover 76mm nominal diameter core to 57.40m and 38mm nominal diameter core to 68.15m. | hole completed | 9/07/01 |
| inclination | Vertical | drill fluid | Water and polymer mud. | drilled by | KMR |
| | | | | logged by | AW |
| | | | | checked by | CC |

| drilling information | | | | rock substance | | | | rock mass defects | | | | | | | | |
|----------------------|------------|-------|-----------------|----------------|-------|-------------|--|-------------------|----------|----|---|----|---------------------|--------------------|--|--------------------------------------|
| case-lift | fluid loss | water | notes | metres | | graphic log | substance description rock type: grain characteristics, colour, structure, minor components. | weathering | strength | | | | defect spacing (mm) | defect description | | |
| | | | | R.L. | depth | | | | EL | VL | L | SL | | VH | EH | 30 |
| H | | | | 18.85 | 0 | | No core recovered - reaming casing | | | | | | | | | |
| | | | | 18.11 | 1 | | CLAY, high plasticity, light grey, soft to firm. Occasional organic pockets. | | | | | | | | | |
| | | | | 17.60 | 2 | | CLAY, high plasticity, brown, stiff, with trace of subrounded fine gravel | | | | | | | | | |
| | | | No recovery | 15.55 | 3 | | CLAY, high plasticity, brown, soft to firm becoming very stiff to hard. | | | | | | | | | |
| | | | 3.30 | | | | | | | | | | | | | |
| | | | 3.45 | | | | | | | | | | | | | |
| | | | | 14.65 | 4 | | MUDSTONE, extremely low strength, brown with many coarse sand to fine gravel subangular to rounded fragments of limestone, quartz, sandstone and shale. 4.35 - 4.50m: grey very clayey silt. | | | | | | | | fissure, subvertical, planar, polished | |
| | | | | 12.70 | 6 | | BOULDER of distinctly weathered dolerite. | | | | | | | | | |
| | | | | 12.35 | 7 | | SANDSTONE, fine, extremely low strength, brown, very clayey, with many fine gravel sized fragments of limestone. | | | | | | | | | |
| | | | | 11.35 | 8 | | BOULDER, of distinctly weathered dolerite. | | | | | | | | | |
| | | | Core non intact | 10.35 | 9 | | SILTSTONE, brown, very low strength, with many angular to rounded fine to medium gravel sized fragments of dolerite, sandstone and limestone. | | | | | | | | | joint, dipping 60°, planar, polished |
| | | | 8.40 | | | | | | | | | | | | | |
| | | | 9.50 | | | | | | | | | | | | | |
| | | | | | 10 | | | | | | | | | | | |

ENGINEERING LOG - CORED BOREHOLE

borehole no. BH1-01
sheet 2 of 8

| project | | TAROONA INVESTIGATION | | location | | FLINDERS ESPLANADE, TAROONA | | | | | | | | | | | |
|----------------------|------------|-----------------------|-------|----------------|----------------|--|------------|-------------------|----|---|---|---|---------------------|--------------------|----|----|---|
| co-ordinates | | | | drill type | | hole commenced | | | | | | | | | | | |
| R.L. | | AS SHEET 1 | | drill method | | hole completed | | | | | | | | | | | |
| inclination | | | | drill fluid | | logged by | | | | | | | | | | | |
| | | | | | | checked by | | | | | | | | | | | |
| drilling information | | | | rock substance | | | | rock mass defects | | | | | | | | | |
| case-lift | fluid loss | water | notes | metres | graphic log | substance description rock type: grain characteristics, colour, structure, minor components. | weathering | strength | | | | | defect spacing (mm) | defect description | | | |
| | | | R.L. | depth | | | | EL | V1 | L | Σ | T | | VH | EH | 30 | 300 |
| H | | | | 10 | 10 | SILTSTONE (as Sheet 1) | SW | | | | | | | | | | joint dipping 50°, undulating, smooth, polished, striated, striations dip 40° |
| | | | | 11 | 11.10 - 11.30m | interbed of sandy CLAY, with trace of fine to medium gravel. | | | | | | | | | | | |
| | | | | 12 | 6.85 | BOULDER of distinctly weathered dolerite. | DW | | | | | | | | | | |
| | | | | 13 | 6.45 | CLAY, medium plasticity, brown, soft to firm with many angular to subangular fine to medium sized fragments of assorted rocks. | SW | | | | | | | | | | |
| | | | | 14 | 5.75 | SILTSTONE, brown, very low strength with some angular to subangular fine to medium gravel sized fragments of assorted rocks. | | | | | | | | | | | |
| | | | | 15 | 5.25 | BOULDER of distinctly weathered dolerite | DW | | | | | | | | | | |
| | | | | 16 | 4.95 | SILTSTONE, light brown, very low strength, clayey with some angular to subrounded fine to medium gravel of limestone and sandstone. | SW | | | | | | | | | | joint, dipping 70°, planar, polished, striated. Striations dip 70° |
| | | | | 17 | 3.65 | 14.98 - 15.00m: COBBLE of distinctly weathered dolerite. | | | | | | | | | | | joint, subvertical, planar, smooth |
| | | | | 18 | 2.75 | Reaming Casing - no core recovered. | | | | | | | | | | | |
| | | | | 19 | 2.75 | SILTSTONE, brown, very low strength, very gravelly (angular to subrounded, fine to coarse), silty. | | | | | | | | | | | |
| | | | | 20 | 1.05 | SILTSTONE, brown mottled reddish brown, locally streaked red, very low strength with trace of angular fine to medium gravel of assorted composition. | | | | | | | | | | | joint, dipping 70°, undulating, smooth, striated. Striations dip 70° |
| | | | | | | | | | | | | | | | | | joint, dipping 60°, planar, rough |
| | | | | | | | | | | | | | | | | | joint, dipping 50°, planar, smooth |

ENGINEERING LOG - CORED BOREHOLE

borehole no. BH1-01
sheet 3 of 8

| project | | TAROONA INVESTIGATION | | location | | FLINDERS ESPLANADE, TAROONA | | | | | | | | | | |
|----------------------|------------|-----------------------|-------|----------------|-------------|--|------------|-------------------|----|----|---|---------------------|--------------------|----|----|--|
| co-ordinates | | | | drill type | | hole commenced | | | | | | | | | | |
| R.L. | | | | drill method | | hole completed | | | | | | | | | | |
| inclination | | | | AS SHEET 1 | | drilled by | | | | | | | | | | |
| | | | | drill fluid | | logged by | | | | | | | | | | |
| | | | | | | checked by | | | | | | | | | | |
| drilling information | | | | rock substance | | | | rock mass defects | | | | | | | | |
| case-lift | fluid loss | water | notes | metres | graphic log | substance description rock type: grain characteristics, colour, structure, minor components. | weathering | strength | | | | defect spacing (mm) | defect description | | | |
| | | | | R.L. | | | | depth | EL | VL | L | | SL | VH | EH | 30 |
| H | | | | | 20 | SILTSTONE (as sheet 2) 20.12 - 20.50m: very gravelly | | | | | | | | | | |
| | | | | -1.65 | 21 | CLAY, medium plasticity, reddish brown and greenish brown, very stiff to hard. | | | | | | | | | | fissure sets, dipping 50°, planar, polished |
| | | | | | 22 | | | | | | | | | | | |
| | | | | | 23 | | | | | | | | | | | |
| | | | | | 24 | 23.90 - 24.05m: BOULDER of distinctly weathered dolerite. | | | | | | | | | | |
| | | | | -5.20 | 25 | MUDSTONE, reddish brown, very low strength | | | | | | | | | | joint, dipping 60°, planar, smooth |
| | | | | | 26 | MUDSTONE, greenish brown, low strength, sandy. | | | | | | | | | | joint, dipping 70°, and subvertically planar, polished |
| | | | | -6.55 | 27 | CLAY, high plasticity, reddish brown, stiff, gravelly (angular to subrounded, fine to medium, limestone) | | | | | | | | | | |
| | | | | -7.05 | 28 | 26.75 - 26.90m: COBBLE of distinctly weathered sandstone. | | | | | | | | | | |
| | | | | -8.35 | 29 | MUDSTONE, reddish brown and greenish brown, extremely low strength, slightly sandy, (medium to coarse) | | | | | | | | | | joins dipping 30° and 50° planar, polished |
| | | | | | 30 | 27.60 - 27.80m: COBBLE of distinctly weathered sandstone. | | | | | | | | | | |
| | | | | -9.90 | 31 | MUDSTONE, greenish brown and greenish grey, very low strength, sandy (fine to medium). | | | | | | | | | | joins dipping 65°, planar, polished |
| | | | | | 32 | | | | | | | | | | | joins dipping 40°, planar, smooth |
| | | | | | 33 | | | | | | | | | | | joins dipping 65°, planar, smooth |

ENGINEERING LOG - CORED BOREHOLE

borehole no. BH1-01
sheet 4 of 8

| project | | TAROONA INVESTIGATION | | location | | FLINDERS ESPLANADE, TAROONA | | | | | | | | | | |
|----------------------|------------|-----------------------|-------|-----------------|--------|-----------------------------|---|--|------------|----------|----|---|----|--|---|----|
| co-ordinates | | drill type | | drill method | | hole commenced | | | | | | | | | | |
| R.L. | | AS SHEET 1 | | | | hole completed | | | | | | | | | | |
| inclination | | drill fluid | | | | drilled by | | | | | | | | | | |
| | | | | | | logged by | | | | | | | | | | |
| | | | | | | checked by | | | | | | | | | | |
| drilling information | | | | rock substance | | | | rock mass defects | | | | | | | | |
| case-lift | fluid loss | water | notes | | metres | graphic log | substance description | rock type: grain characteristics, colour, structure, minor components. | weathering | strength | | | | defect spacing (mm) | defect description | |
| | | | R.L. | depth | | | | | | EL | VL | L | SL | | VH | EH |
| H | | | | | | 30 | MUDSTONE (as sheet 3) | | | | | | | | | |
| | | | | | | 31 | | | | | | | | | | |
| | | | | | | -12.55 | BOULDER of slightly weathered dolerite, grey and white, high strength. | | | | | | | | | |
| | | | | | | -13.05 | MUDSTONE, red and green mottled, very low strength with trace of coarse sand. | | | | | | | | joint, dipping 65°, stepped, rough | |
| | | | | | | -13.90 | Recovered as SILT, light grey and greenish brown, very stiff, very clayey. | | | | | | | | joint, dipping 60°, planar, polished | |
| | | | | Core non intact | | 33 | | | | | | | | | | |
| | | | | | | -15.15 | Recovered as SILT, light grey, very stiff, very clayey. | | | | | | | | | |
| | | | | | | -15.55 | CLAY, high plasticity, dark green, very silty, with traces of gravel (angular to rounded, fine to medium). | | | | | | | | very closely spaced, randomly oriented fissures | |
| | | | | | | 35 | | | | | | | | joint, dipping 60°, planar, smooth | | |
| | | | | | | -16.74 | MUDSTONE, greenish brown, extremely low strength, very silty, sandy (fine to coarse), slightly gravelly, (subangular to subrounded, fine to medium) | | | | | | | | | |
| | | | | | | 36 | | | | | | | | | | |
| | | | | | | 37 | | | | | | | | | | |
| | | | | | | 38 | | | | | | | | | | |
| | | | | | | 39 | | | | | | | | joint, dipping 40°, planar, smooth, striated. Striations dip 20° | | |
| | | | | | | -20.35 | MUDSTONE (as sheet 5) | | | | | | | | | |
| | | | | | | 40 | | | | | | | | | | |

ENGINEERING LOG - CORED BOREHOLE

borehole no. BH1-01
sheet 5 of 8

| project | | TAROONA INVESTIGATION | | location | | FLINDERS ESPLANADE, TAROONA | | | | | | | | | | | |
|----------------------|------------|-----------------------|-----------------|----------------|--------|-----------------------------|--|-------------------|----------|----|----|----|----|---------------------|--------------------|----|--|
| co-ordinates | | | | drill type | | hole commenced | | | | | | | | | | | |
| R.L. | | | | drill method | | hole completed | | | | | | | | | | | |
| inclination | | | | AS SHEET 1 | | drilled by | | | | | | | | | | | |
| | | | | drill fluid | | logged by | | | | | | | | | | | |
| | | | | | | checked by | | | | | | | | | | | |
| drilling information | | | | rock substance | | | | rock mass defects | | | | | | | | | |
| case-lift | fluid loss | water | notes | metres | | graphic log | substance description rock type: grain characteristics, colour, structure, minor components. | weathering | strength | | | | | defect spacing (mm) | defect description | | |
| | | | | R.L. | depth | | | | EL | VL | UL | SL | VH | | EH | 30 | 300 |
| H | | | | | | | MUDSTONE, green becoming reddish brown, extremely low strength, very gravelly (rounded to subangular, fine to medium), very silty. | SW | | | | | | | | | joint, dip 65°, planar, polished |
| | | | | | 41 | | | | | | | | | | | | joins, randomly orientated, polished |
| | | | | | -22.25 | | BOULDER of distinctly weathered dolerite. | DW | | | | | | | | | |
| | | | | | -22.95 | | Recovered as CLAY, high plasticity, green and dark red mottled, very stiff, with trace of gravel (angular to rounded, fine to coarse). | SW | | | | | | | | | fissures, dip 80°, undulating, polished |
| | | | | | 42 | | | | | | | | | | | | fissure, dip 25°, planar, polished, striated, striations dip 25° |
| | | | core non intact | | 43 | | | | | | | | | | | | abundant randomly oriented polished surfaces |
| | | | core non intact | | 44 | | | | | | | | | | | | abundant randomly oriented polished surfaces |
| | | | core non intact | | 45 | | | | | | | | | | | | abundant randomly oriented polished surfaces |
| | | | core non intact | | -26.75 | | MUDSTONE, green, extremely low strength. | | | | | | | | | | |
| | | | core non intact | | -27.15 | | CLAY, high plasticity, mottled green and dark red, very stiff, with trace of gravel (angular to rounded, fine to coarse). | | | | | | | | | | abundant randomly oriented polished surfaces |
| | | | core non intact | | 47 | | | | | | | | | | | | abundant randomly oriented polished surfaces |
| | | | core non intact | | 48 | | | | | | | | | | | | fissure, dip 80°, planar, polished |
| | | | core non intact | | -29.25 | | CLAY, high plasticity, dark green, very stiff very becoming slightly gravelly (angular to rounded, fine to coarse) below 48.30m. | | | | | | | | | | abundant randomly oriented polished surfaces |
| | | | core non intact | | 49 | | | | | | | | | | | | |
| | | | | | 50 | | | | | | | | | | | | fissure, dip 70°, planar, polished |

ENGINEERING LOG - CORED BOREHOLE

borehole no. BH1-01
sheet 6 of 8

| project | | TAROONA INVESTIGATION | | location | | FLINDERS ESPLANADE, TAROONA | | | | | | | | | | | | | | | | | | | | | | | | |
|----------------------|------------|-----------------------|---|----------------|--------|-----------------------------|--|-------------------|----------|----|----|----|----|---------------------|--|-----|------|--|-------------|---------|--|--|--|--|--|--|--|--|--|--|
| co-ordinates | | | | drill type | | hole commenced | | | | | | | | | | | | | | | | | | | | | | | | |
| R.L. | | | | drill method | | hole completed | | | | | | | | | | | | | | | | | | | | | | | | |
| inclination | | | | AS SHEET 1 | | drilled by | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | drill fluid | | logged by | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | checked by | | | | | | | | | | | | | | | | | | | | | | | | |
| drilling information | | | | rock substance | | | | rock mass defects | | | | | | | | | | | | | | | | | | | | | | |
| case-lift | fluid loss | water | notes | metres | | graphic log | substance description rock type: grain characteristics, colour, structure, minor components. | weathering | strength | | | | | defect spacing (mm) | defect description thickness, type, inclination, planarity, roughness, coating. | | | | | | | | | | | | | | | |
| | | | | R.L. | depth | | | | EL | VL | SL | EH | EH | | 30 | 300 | 1000 | 3000 | significant | general | | | | | | | | | | |
| H | | | core non intact | -32.15 | 50 | | CLAY, high plasticity, dark green, hard, slightly sandy (coarse) becoming gravelly (subangular to rounded, fine to medium) below 52.80m. | | | | | | | | | | | <ul style="list-style-type: none"> abundant, randomly orientated smooth surfaces abundant, randomly orientated smooth surfaces fissures, dip 60°, 80° and subhorizontal, planar and curved, polished fissures, dip 60° - 70°, planar and curved, smooth and polished fissures, dip 40° - 50°, and 70° - 80°, planar, smooth fissures, dip 70°, planar, smooth and polished | | | | | | | | | | | | |
| | | | | | 51 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | 52 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | 53 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | -34.65 | 54 | BOULDER of sandstone, fine to medium, grey, slightly weathered. | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | -35.65 | 55 | MUDSTONE, dark green, extremely low strength, with trace of coarse sand. Becoming gravelly (subangular to subrounded, fine to medium, limestone) below 55.00m. | | | | | | | | | | | | | | | | | | | | | | | |
| | | | core non intact | | 56 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | core non intact | | 57 | | Reaming casing - no core recovered | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Below 57.40m swelling of clays into hole noticeable | | -38.05 | 58 | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | Possible development of artesian conditions below 58m | | -38.55 | 59 | Recovered as CLAY, high plasticity, dark green, soft to firm, slightly gravelly (angular to subrounded, fine to medium). | | | | | | | | | | | | | | | | | | | | | | | |
| | | | core non intact | | 60 | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | core non intact | | | | | | | | | | | | | | | | | | | | | | | | | | | |

ENGINEERING LOG - CORED BOREHOLE

borehole no. BH1-01
sheet 7 of 8

| project | | TAROONA INVESTIGATION | | location | | FLINDERS ESPLANADE, TAROONA | | | | | |
|----------------------|------------|-----------------------|-----------------|----------------|-------------|---|------------|-------------------|---------------------|--------------------|--|
| co-ordinates | | drill type | | drill method | | hole commenced | | | | | |
| R.L. | | AS SHEET 1 | | | | hole completed | | | | | |
| inclination | | drill fluid | | | | drilled by | | | | | |
| | | | | | | logged by | | | | | |
| | | | | | | checked by | | | | | |
| drilling information | | | | rock substance | | | | rock mass defects | | | |
| case-lift | fluid loss | water | notes | metres | graphic log | substance description rock type: grain characteristics, colour, structure, minor components. | weathering | strength | defect spacing (mm) | defect description | |
| | | | | R.L. | | | | | | depth | |
| N | | | | | 60 | CLAY (as sheet 6) | FR | | | | |
| | | | | | -41.85 | COBBLE of slightly weathered dolerite | SW | | | | |
| | | | | | -41.95 | Recovered as CLAY, high plasticity, dark green, soft to firm, slightly gravelly (angular to subrounded, fine to medium). | FR | | | | occasional polished surfaces |
| | | | core non intact | | 62 | | | | | | |
| | | | | | -44.10 | BOULDER of distinctly weathered dolerite | DW | | | | |
| | | | | | -44.55 | GRAVEL (angular, medium to coarse, limestone) | | | | | |
| | | | | | -44.65 | | | | | | |
| | | | core non intact | | -44.90 | BOULDER of grey distinctly weathered limestone | FR | | | | occasional randomly orientated polished surfaces |
| | | | | | 64 | CLAY (as 57.40 - 60.70) with trace of gravel (angular to subrounded, fine to medium, limestone) | | | | | occasional polished surfaces |
| | | | | | -45.55 | 64.00 - 64.15m COBBLE of limestone | | | | | |
| | | | | | 65 | MUDSTONE, dark green, extremely low strength, slightly gravelly (angular, fine, limestone) | | | | | |
| | | | core non intact | | -47.15 | Recovered as MUDSTONE, dark brown, extremely low strength, slightly gravelly (angular to subrounded, fine to medium, limestone) | | | | | |
| | | | | | 67 | | | | | | |
| | | | | | -48.60 | NO CORE RECOVERED | | | | | |
| | | | | | 68 | | | | | | |
| | | | | | -49.30 | Hole terminated at 68.15m | | | | | |
| | | | | | 69 | | | | | | |
| | | | | | 70 | | | | | | |

Appendix 2
Core photographs



1.70 - 6.40 m



6.40 - 10.90 m



10.90 - (14.70) m



(14.70) – (20.05) m



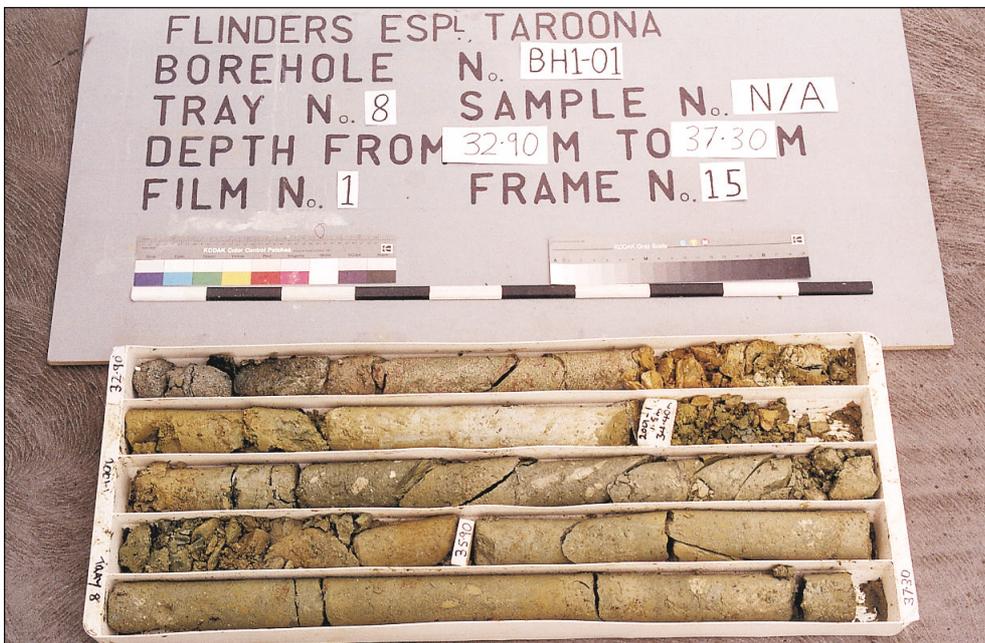
(20.05) – (24.55) m



(24.55) – (29.20) m



(29.20) – 32.90 m



32.90 – 37.30 m



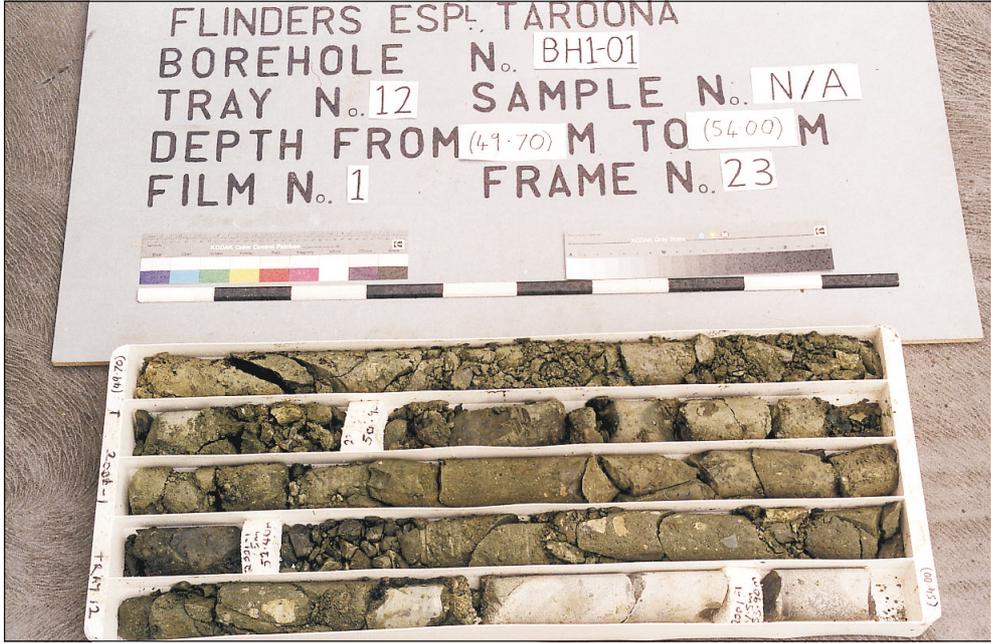
37.30 – (41.45) m



(41.45) - (45.60) m



(45.60) - (49.70) m



(49.70) - (54.00) m



(54.00) - 56.90 m



56.90 - 64.45 m



64.45 - 68.15 m