



BRINK HOLDINGS PTY. LTD. A.B.N. 75 050 212 710 Trading as:

BRINK & ASSOCIATES

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Geological Consultants*

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SYDNEY: 5/12 Tarlington Place, SMITHFIELD 2164 Phone: (02) 9609 3800 Fax: (02) 9604 6427 - P.O. Box 6871, WETHERILL PARK N.S.W. 2164

KENMICK GROUP PTY LTD

PROPOSED RESIDENTIAL DEVELOPMENT

CNR. DERBY AND CASTLEREAGH STREETS

PENRITH

GEOTECHNICAL INVESTIGATION REPORT

BRINK & ASSOCIATES
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S04114-A RE:RE

8th June 2004

Kenmick Group Pty Ltd
Unit 3 575 Great Western Highway
FAULCONBRIDGE NSW 2776

ATTENTION: Mr. Dahdah

Dear Sir,

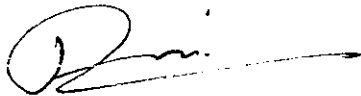
RE: Proposed Residential Development, Cnr. Derby and Castlereagh Streets, Penrith.

As requested, Brink & Associates visited the above site on the 25th May and 1st June 2004 in order to undertake a geotechnical investigation with the purpose of identifying the site's subsurface conditions and consequently providing recommendations and advice in relation to the design and construction of the proposed residential development.

This report presents the details and results of the investigation undertaken and provides information on the site's surface and subsurface conditions, the geotechnical features present and gives recommended parameters relevant for the project's structural design. Details on footing design and construction are also included.

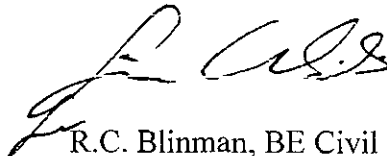
For and on behalf of

Brink & Associates



Ralph Erni B.Sc. Eng (Civil)
Senior Geotechnical Engineer

Reviewed by



R.C. Blinman, BE Civil (Hons) MIEAust CPEng NPER
Manager Engineering Services

S04114-A

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APPENDIX A - Field Investigation Results (14 Pages)

Drawing No. S04114-1 Site Plan

S04114-A



1.0 INTRODUCTION

As requested, Brink & Associates carried out a geotechnical investigation on the 25th May and 1st June 2004 of the combined land known as Lots 14, 15A, 15B, 16A and 16B of DP 1582 and DP 347812 in Penrith (“the site”). The purpose of this investigation was to provide detailed information on the surface and subsurface conditions of the site, to identify any constraints that need to be placed on the development from a geotechnical viewpoint and to provide recommendations and advice in relation to the design and construction of the proposed residential development.

We understand that the proposed development for the site is to comprise the demolition of all existing improvements and the subsequent construction of three residential apartment buildings of three to four storeys each, with the inclusion of a double-storey below-ground basement car park. Unreferenced plan and elevation drawings of the proposed development prepared by Adrian Winton Architects and a survey plan, referenced Sheet 1 of 1, prepared by T Grabara & Associates, both dated May 2003, were provided by Kenmick Group Pty Ltd for information purposes. Based on the provided design levels, we infer excavation of the land will be required to a depth of about 6.0m below current ground surface levels as part of the construction of the basement car park.

Specifically required from this investigation was detailed information on the site’s subsurface conditions to determine the founding stratum and to verify that this material is suitable as a foundation for the proposed development. Recommended design parameters in relation to the site’s geotechnical constraints and suitable footing and retaining wall alternatives were also to be provided. These items are discussed herein.

2.0 FIELD INVESTIGATION

The field investigation was conducted under the direction of one of our Senior Geotechnical Engineers from our Sydney office. In order to investigate the site and provide all necessary information for the design and construction of the development, the following field investigation was undertaken:

- A detailed inspection of the site’s surface and surrounds to identify existing site

features and to assess geotechnical/geological consistency with the adjoining land.

- Excavation by truck mounted drill rig of five boreholes (BH1 to BH5) to depths of between 7.2m and 10.4m below the existing surface levels at the locations shown on our Drawing No. S04114-1.
- Standard Penetration Tests (SPT's) at regular intervals throughout all boreholes in order to assess the in-situ strength of the soil profile below the site.
- Collection of several soil samples of the subsurface soils from the boreholes in order to provide potential laboratory test specimens for later testing.

The above investigation was undertaken in order to gain an understanding of the site's geotechnical conditions and to assess subsurface soil strengths. The field investigation results are presented in Appendix A.

3.0 SITE CONDITIONS

3.1 Location

The site is positioned within a predominantly residential area near the central reaches of Penrith, approximately 500m south of the Penrith Town Centre and 400m east of the Nepean Square Shopping Centre. Furthermore the site forms the north-western corner of the intersection between the kerbed and sealed Derby and Castlereagh Streets.

3.2 Topography

The site is located within and near the eastern extremity of the low-lying terrain that forms the Nepean River Valley. The land within the site and its surrounds is therefore generally flat and exhibits a gentle westward fall of typically between 1° and 3° and a crossfall of about 1° down towards the south.

3.3 Surface Details

The near square-shaped site, which covers an area of about 3600m², has a frontage of about 60m along Derby Street as well as Castlereagh Street. It encompasses five existing lots including Lots 14, 15A, 15B, 16A and 16B of DP 1582 and DP 347812.



At the time of our investigation, the two northern Lots (Lots 14 and 15A) were undeveloped aside from a concrete slab located within the north-eastern region of Lot 15A. Their surface was topped by a thick grass cover and contained a minor mound of building rubble and some compost heaps. Privets and some mature trees formed hedges along the south-western boundaries of Lots 14 and 15A as well as the north-western boundary of Lot 14. A large Wattle tree stump was encountered within the north-western corner of Lot 14.

Lot 15B contained within its eastern region a single-storey weatherboard and tile roof cottage that was surrounded to its east by a verandah and a lawn garden and the south by overgrown flowerbeds. Aside from a concrete slab located in the Lot's south-western corner, the remaining western region and northern driveway comprised lawn gardens.

Lot 16A contained within its central to eastern reaches a single-storey cottage of brick wall and tile roof construction. Some visible cracks within the walls are indicative of possible previous moderate foundation movement. Surrounding the building to the east was a lawn garden and to the west a concrete driveway / car parking area. Flowerbeds were located to the south of the building and within the Lot's north-western and south-western corners. They contained predominantly bushes, some ground foliage and a number of young trees. The north-western flowerbed was surrounded and supported by a Kopper log retaining wall up to 0.5m in height as a result of the previously required filling within the site to obtain a level building platform and pavement.

Lot 16B comprised a single-storey cottage of rendered brick wall and tile roof construction, surrounded to the east and north by a concrete paved access road / car park area and to the south by a gravel topped garden. A brick wall formed the southern property boundary.

Owing to the location of the existing buildings within Lots 16A and 16B, the extensive concrete pavements and their limited accessibility, the investigation within these lots was limited to the flowerbed in the north-western corner of Lot 16A.

The properties to the north and west of the site contained two to three storey residential apartment buildings of brick wall and tiled roof construction. To the south and east of the site however, the properties contained generally single-storey residential houses of similar style and aged as those encountered within the subject site.

3.4 Subsurface Condition

The Geological map of the area (Penrith 1:100,000 Geological Series Sheet 9030) indicates the site to be located within the Nepean River Basin, which is affiliated with a large number of smaller creeks and associated flood plains. This site in particular is shown to be underlain by the Cranebrook Formation formed during the Quaternary period of the Cainozoic Era, consisting of Fluvial Gravels, Silts, Sands and / or Clays. This formation typically overlies the Bringelly Shale Formation of the Wianamatta Group. Based on the Geological map, the transition between the above formations is located about 200m south-east of the subject site.

Subsurface conditions encountered within the boreholes are detailed on the attached Engineering Logs presented in Appendix A. These logs confirm the presence of the above anticipated Cranebrook Formation and may be described in summary as follows:

TOPSOIL FILL: SILT to a depth of about 0.3m in BH4 only, low plasticity, dark brown, dry to moist and poorly compacted, overlying,

FILL: Silty Sandy GRAVELS containing crushed Concrete, Shale pieces and roadbase gravels to a depth of about 0.8m in BH4 only, light grey, dry and moderately to well compacted

or

TOPSOIL: SILT to depths of between about 0.4m (BH1, BH2) and 0.7m (BH5), low plasticity, dark brown to brown, generally dry to moist and soft to firm, overlying,



FLUVIAL DEPOSITS: CLAY, Silty CLAY and Silty Sandy CLAY containing Ironstone fragments to depths of between about 6.5m (BH2) and 9.0m (BH1), medium to high plasticity, brown / dark brown grading to light grey, yellow-brown and red-brown, generally dry to moist and stiff to very stiff, overlying,

Clayey SAND to depths of between about 7.3m (BH2) and 10.2m (BH1), fine to medium grained, brown to yellow-brown and light grey, moist and medium dense to dense, overlying,

GRAVELS / Sandy GRAVELS to depths of between about 7.2m (BH4) and 10.4m (BH1), moist to wet, dense.

Bedrock was not encountered within the borehole excavations. The very dense Gravels encountered at the base of all boreholes induced refusal of the TC-bit.

Although groundwater was not encountered within the borehole investigations, the Gravels within BH1 and BH2 were encountered in a wet condition indicating that some ground water seepage flows are present.

4.0 DISCUSSIONS AND RECOMMENDATIONS

4.1 General

Based on the topography, our inspection of the site and the subsurface conditions encountered in our investigation and as discussed above, we believe filling within the site to have been limited to localised areas requiring level building / pavement platforms. Included in these fill areas is the raised and retained flowerbed located within the north-western corner of Lot 16A. BH4, which was excavated within this flowerbed, encountered topsoil fills consisted of low plasticity dark brown SILT to a depth of about 0.3m below ground surface level. This topsoil fill was found to be in a dry to moist condition and poorly compacted. Underlying these topsoil fills were Silty Sandy GRAVEL fills containing crushed Concrete, Shale pieces and roadbase to a depth of

about 0.8m below ground surface level. They and were light grey in colour, dry and moderately to well compacted. Other more minor and localised surface filling was identified within the site in the form of some building rubble within Lot 15A and compost heaps within Lot 14. We advise that all the topsoil fill and fill material is unsuitable as a foundation material. It must be excavated from within the development area and stockpiled for removal from site or re-use in landscaping (where applicable).

The remaining undeveloped areas were found to be covered by a layer of topsoil consisting of low plasticity dark brown to brown SILT to a depth of between about 0.4m (BH1, BH2) and 0.7m (BH5) below ground surface level. This topsoil was found to be in a dry to moist and soft to firm condition and is considered unsuitable for use as a founding stratum.

Fluvial deposits were encountered underlying the topsoils, topsoil fills and fills to depths of between about 7.2m (BH4) and 10.4m (BH1) below ground surface levels, comprising the following individual profiles:

- CLAY, Silty CLAY and Silty Sandy CLAY of medium to high plasticity was encountered to depths of between about 6.5m (BH2) and 9.0m (BH1) below ground surface levels containing varying amounts of Ironstone fragments throughout the profile. The brown / dark brown grading to light grey, yellow-brown and red-brown Clay was found to be generally in a dry to moist and stiff to very stiff condition. This soil will provide a suitable foundation but may be of limited bearing capacity when considering footings for a three to four storey building. For foundations within this soil profile, the design bearing capacity values in Table No.1 in Section 4.2 of this report may be adopted.
- Underlying these Clays was fine to medium grained Clayey SAND to depths of between about 7.3m (BH2) and 10.2m (BH1) below ground surface levels. This brown to yellow-brown and light grey material was found to be in a moist and medium dense to dense condition. This soil will provide a suitable foundation but may be of limited bearing capacity when considering footings for a three to four storey building. For foundations within this soil profile, the design bearing capacity

values in Table No.1 in Section 4.2 of this report may be adopted.

- GRAVELS / Sandy GRAVELS were encountered at the base of all borehole excavations. The depth to top of gravels, and analogously the thickness of the Clay and Sand profiles, increased from 7.2m (BH4) below ground surface levels within the western site regions to 10.4m (BH1) within the central to eastern regions. The dense and moist or wet Gravels induced refusal of the TC-bit and are therefore will provide the most suitable foundation for the proposed development. Design bearing capacity values are provided in Table No.1 in Section 4.2 of this report.

Rock was not encountered within our borehole excavations nor were rock outcrops identified within the subject site or it's immediate surrounds.

The groundwater table was not encountered within any of the borehole excavations. However, other investigations undertaken by Brink & Associates in previous years within the surrounding area have identified groundwater tables at depths of up to about 7.5m below ground surface levels, which are similar to the subject property's ground surface levels. We therefore anticipate the dry conditions experienced in Penrith over the last year may have caused a reduction in the groundwater table and induced the dry conditions encountered within the boreholes.

In addition, we anticipate the upper regions of the encountered fluvial deposits to be relatively impermeable to surface water ingress and subsurface seepage flows owing to their high Silt and Clay content (visually assessed as greater than 70% in volume). Seepage flows are therefore considered limited to the more sandy profile near the base of the soil and the gravelly profiles, which are considered more permeable owing to a lower Silt and Clay content. The encountered wet gravels within the BH1 and BH2 excavations support the inferred seepage conditions. On inspection of the boreholes approximately 3 hours subsequent to their completion, no build up of water was identified. This substantiates the fact that the wet conditions are the result of current slow seepage flows rather than saturated groundwater levels.



Based on the encountered conditions and the design levels, we anticipate that the seepage flows will not adversely affect the proposed development. However, we do anticipate that the seepage flows through or groundwater levels within the sandy and gravelly profiles are likely to increase during and after more substantial rainfall periods. These flows / water table may be constrained vertically by the impermeable Clays overhead, thereby generating a confined / charged aquifer within the sandy and gravelly profiles. These conditions are considered to have an adverse effect on the installation of deep footing systems.

4.2 Footings

From our observations, our borehole investigation results and the anticipated 6.0m deep excavation of the land for the basement car park, it is evident that the Gravels (estimated bearing capacity of 500kPa), which were encountered from depths of between 1.2m and 4.2m beneath the estimated building footprints, will provide a suitable foundation for deep footings. At this level the gravels will provide a foundation, which will experience only minor settlement and ground movements. We consider that piers founding on the Gravels will provide the most suitable footing system for the proposed building due to the depth of this stratum. This will involve removal of the overlying fluvial soils to a design level of approximately 6.0m below ground surface levels and construction of concrete piers to the depth of the Gravels. The piers are to be additionally socketed into the Gravels. The socket depth and pier dimensions depend on the load requirements and are to be based on the design bearing capacity values provided below in Table No.1. The high cost of such footings is however to be considered and weighed up against alternative footings such as pad footings. Should foundation on different materials be considered, design bearing capacity values are provided below in Table No.1.

The footings should be designed and constructed in accordance with the recommendations and advice contained in AS/NZS 2870-1996 "Residential Slabs and Footings". In addition, the development must be carried out in accordance with sound engineering principles and the following recommendations and advice:

- For the purpose of the footing design for the proposed development, the site is

4.3 Earthworks

Earthworks for the preparation of building pads will necessitate excavation to depths of approximately 6m for the basement car park. These earthworks must be performed as follows:

1. Excavate and remove all building rubble, compost and existing vegetation from within the development area and stockpile for removal from site or re-use for landscaping (compost only).
2. Excavate the existing topsoils / topsoil fills from within the footprint of the footings and stockpile these for either re-use for landscaping or removal from site.
3. Excavate the existing fill from the development footprint and stockpile these for **either re-use within the development as ‘controlled fill’ as detailed below or removal from site.**
4. Excavate the subsurface fluvial soils in the building areas to the design level of the building pads. Stockpile these materials for re-use within the development or removal from site. These soils are suitable for re-use within the development as ‘controlled fill’ as detailed below.
5. Proof roll the exposed surfaces of the building pads. A heavy (10 tonne) vibratory roller is required. This is required to assess the ability of the prepared surfaces to act both as a foundation platform for pad footings and also as a subgrade in the location of the basement carpark level.

4.4 Excavations and Retaining Walls

We understand that the construction of the basement will require excavation of up to about 6.0m to reach the bulk excavation level. Based on the results of our investigation, this excavation will intersect some topsoil fill, fill and topsoil but predominantly fluvial Silty Clay and Clay. These materials may be readily excavated using a conventional excavator.

Based on design levels and landslip possibilities within the fluvial deposits, some form of temporary retaining structure will be required. In the location of the basement level car park, these would be up to approximately 6.0m high. Sheet piled walls could be installed,

which could either be braced by soil nailing or extended to deeper depths to act as cantilevered supports. Alternatively, contiguous reinforced concrete piles could be installed as temporary support with the possibility of incorporating these into the permanent support design. Soldier pile retaining walls may be used to temporarily support shallow soil exposures, particularly where adjacent supported areas will be subjected to minor live loads only. All retaining structures must be appropriately engineered. An angle of shearing resistance of 26° and a K_0 value of 0.56 are to be adopted for the Silty Clays and Clays while a shearing resistance of 30° and a K_0 value of 0.50 are to be adopted for the Clayey Sands. Although we anticipate the excavation not to be affected by ground water, we do consider subsurface drainage will be required at the base of and behind all retaining walls, particularly if part of the permanent structure in order to reduce water pressures within the retained materials.

An alternative to constructing retaining walls is to batter / grade the excavation faces of the soil to a maximum temporary stable slope of 1V:1H (45°). The formation of battered slopes would however increase excavation extents. Due to the close vicinity of the surrounding buildings there may not be sufficient room to provide permanent batters adjacent to the site's boundaries particularly the north and east boundaries. A combination of batters and retaining structures may also be possible.

All exposed land surfaces must be paved or vegetated immediately after completion of construction in order to limit risks associated with soil erosion. Storm water flows, surface run off and collected subsurface seepage flows must be piped and discharged into Council's system or to an appropriate and Council approved discharge point down slope of the property. These flows must be prevented from entering the building site and in particular the founding stratum.



Please do not hesitate to contact the undersigned if you have any queries.

For and on behalf of

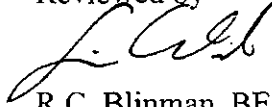
Brink & Associates



Ralph Erni B.Sc. Eng (Civil)

Senior Geotechnical Engineer

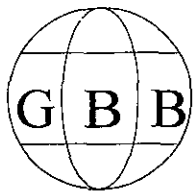
Reviewed by



R.C. Blinman, BE Civil (Hons) MIEAust CPEng NPER

Manager Engineering Services





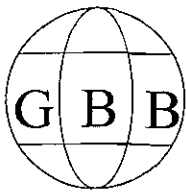
Job No:	S04114-A
Hole No:	BH1
Sheet	1 of 3

ENGINEERING BOREHOLE LOG

Client:	Kenmick Group Pty. Ltd.	Test Location:	Ref Dwg No. S04114-1
Project:	Proposed Residential Development	Test Method:	Truck Mounted Drill Rig
Project Location:	Cnr. Derby & Castlereagh Streets Penrith	Coordinates:	-
		Logged by:	RE
		Surface Level:	Existing
		Date:	25/5/04

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
N | L				ML	SILT, low plasticity, brown	D	S F	TOPSOIL	
		0.5		CL	Silty CLAY, medium to low plasticity, brown with red-brown, containing many Ironstone gravels		St/ VSt	FLUVIAL	0.5
		1.0		CH	.....grading to..... CLAY, high plasticity, yellow-brown with light grey from about 1.3m depth	D/M			1.0
	SPT 7,20,18 N=38	1.5		CH					1.5
		2.0							2.0
		2.5							2.5
	SPT 6,11,15 N=26	3.0			some red-brown from about 2.8m				3.0
		3.5							3.5
Continued on Sheet 2 of 3									

Explanatory Notes:			
Consistency	Density Index	Samples	Moisture
VS Very Soft	VL Very Loose	B Bulk Sample	D Dry
S Soft	L Loose	D Disturbed Sample	M Moist
F Firm	MD Medium Dense	U50 Undisturbed Sample (50mm diam.)	W Wet
St Stiff	D Dense	N S.P.T. Value	Wp Plastic Limit
VSt Very Stiff	VD Very Dense		Wl Liquid Limit
H Hard			



BRINK & Associates

Geotechnical, Geological, Environmental Consultants

Job No:	S04114-A
Hole No:	BH1
Sheet	2 of 3

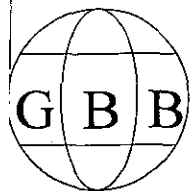
ENGINEERING BOREHOLE LOG

Client:	Kenmick Group Pty. Ltd.	Test Location:	Ref Dwg No. S04114-1
Project:	Proposed Residential Development	Test Method:	Truck Mounted Drill Rig
Project Location:	Cnr. Derby & Castlereagh Streets Penrith	Coordinates:	-
		Logged by:	RE
		Surface Level:	Existing
		Date:	25/5/04

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)						
					Continued from Sheet 1 of 3										
N I L		4.0		CH	CLAY, high plasticity, yellow-brown with light grey and some red-brown, containing some Ironstone gravels	D/M	VS/ St	FLUVIAL	4.0						
	SPT 7,11,14 N=25	4.5							4.5						
		5.0							5.0						
		5.5							5.5						
	SPT 7,10,14 N=24	6.0							6.0						
		6.5							6.5						
		7.0							7.0						
												becoming Silty CLAY with some SAND, medium plasticity, fine to medium grained Sand, yellow-brown and light grey with some red-brown		VSt	
										CL					
												Continued on Sheet 3 of 3			

Explanatory Notes:

<u>Consistency</u>	<u>Density Index</u>	<u>Samples</u>	<u>Moisture</u>
VS Very Soft	VL Very Loose	B Bulk Sample	D Dry
S Soft	L Loose	D Disturbed Sample	M Moist
F Firm	MD Medium Dense	U50 Undisturbed Sample (50mm diam.)	W Wet
St Stiff	D Dense	N S.P.T. Value	Wp Plastic Limit
VSt Very Stiff	VD Very Dense		Wl Liquid Limit
H Hard			



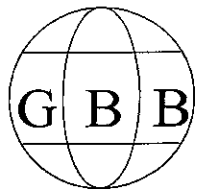
Job No:	S04114-A
Hole No:	BH1
Sheet	3 of 3

ENGINEERING BOREHOLE LOG

Client:		Kenmick Group Pty. Ltd.			Test Location: Ref Dwg No. S04114-1				
Project:		Proposed Residential Development			Test Method: Truck Mounted Drill Rig				
Project Location:		Cnr. Derby & Castlereagh Streets Penrith			Coordinates: -	Logged by: RE			
					Surface Level: Existing	Date: 25/5/04			
Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					Continued from Sheet 2 of 3				
N I L	SPT 7,13,13 N=26	7.5		CL	Silty CLAY with some SAND, medium plasticity, fine to medium grained Sand, yellow-brown and light grey with some red-brown	D/M	VSt	FLUVIAL Ironstone seam between 7.3m & 7.4m 20mm thick Sandstone seam at 7.4m	7.5
		8.0							8.0
		8.5							8.5
		9.0							9.0
		9.5							9.5
		10.0		SW	Clayey SAND, medium grained, brown & light grey	M	MD/D	10.0	
		10.5		GW	Gravels, Quartz	W	D	10.5	
		10.5			BH1 terminated at 10.4m depth (TC bit Refusal)			10.5	

Explanatory Notes:

Consistency	Density Index	Samples	Moisture
VS Very Soft	VL Very Loose	B Bulk Sample	D Dry
S Soft	L Loose	D Disturbed Sample	M Moist
F Firm	MD Medium Dense	U50 Undisturbed Sample (50mm diam.)	W Wet
St Stiff	D Dense	N S.P.T. Value	Wp Plastic Limit
VSt Very Stiff	VD Very Dense		Wl Liquid Limit
H Hard			



Job No:	S04114-A
Hole No:	BH2
Sheet	1 of 3

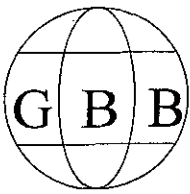
ENGINEERING BOREHOLE LOG

Client:	Kenmick Group Pty. Ltd.	Test Location:	Ref Dwg No. S04114-1
Project:	Proposed Residential Development	Test Method:	Truck Mounted Drill Rig
Project Location:	Cnr. Derby & Castlereagh Streets Penrith	Coordinates:	-
		Logged by:	RE
		Surface Level:	Existing
		Date:	25/5/04

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
				ML	SILT, low plasticity, brown	D	S F	TOPSOIL	
		0.5		CL	Silty CLAY, medium to low plasticity, brown with red-brown, containing many Ironstone gravels	D/M	St/ VSt	FLUVIAL	0.5
		1.0							1.0
		1.5		CH	.....grading to..... CLAY, high plasticity, yellow-brown & light grey from about 1.5m depth				1.5
		2.0							2.0
		2.5							2.5
		3.0							3.0
		3.5							3.5
Continued on Sheet 2 of 3									

Explanatory Notes:

<u>Consistency</u>	<u>Density Index</u>	<u>Samples</u>	<u>Moisture</u>
VS Very Soft	VL Very Loose	B Bulk Sample	D Dry
S Soft	L Loose	D Disturbed Sample	M Moist
F Firm	MD Medium Dense	U50 Undisturbed Sample (50mm diam.)	W Wet
St Stiff	D Dense	N S.P.T. Value	Wp Plastic Limit
VSt Very Stiff	VD Very Dense		Wl Liquid Limit
H Hard			



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Job No:	S04114-A
Hole No:	BH2
Sheet	2 of 3

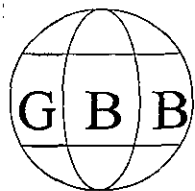
ENGINEERING BOREHOLE LOG

Client:	Kenmick Group Pty. Ltd.	Test Location:	Ref Dwg No. S04114-1
Project:	Proposed Residential Development	Test Method:	Truck Mounted Drill Rig
Project Location:	Cnr. Derby & Castlereagh Streets Penrith	Coordinates:	-
		Logged by:	RE
		Surface Level:	Existing
		Date:	25/5/04

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					Continued from Sheet 1 of 3				
		4.0		CH	CLAY, high plasticity, yellow-brown & light grey	D/M	St/ VSt	FLUVIAL	4.0
		4.5			some red-brown from about 4.2m depth, containing Ironstone gravels				4.5
		5.0							5.0
		5.5		CL	Silty CLAY, medium plasticity, yellow-brown & light grey				5.5
	SPT 7,11,14 N=25	6.0			becoming Silty Sandy CLAY from about 5.8m depth				6.0
		6.5		SP	Clayey SAND, fine to medium grained, yellow-brown		MD/ D		6.5
		7.0							7.0
					Continued on Sheet 3 of 3				

Explanatory Notes:

Consistency	Density Index	Samples	Moisture
VS Very Soft	VL Very Loose	B Bulk Sample	D Dry
S Soft	L Loose	D Disturbed Sample	M Moist
F Firm	MD Medium Dense	U50 Undisturbed Sample (50mm diam.)	W Wet
St Stiff	D Dense	N S.P.T. Value	Wp Plastic Limit
VSt Very Stiff	VD Very Dense		Wl Liquid Limit
H Hard			



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Job No:	S04114-A
Hole No:	BH2
Sheet	3 of 3

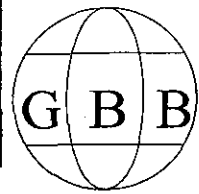
ENGINEERING BOREHOLE LOG

Client:	Kenmick Group Pty. Ltd.	Test Location: Ref Dwg No. S04114-1
Project:	Proposed Residential Development	Test Method: Truck Mounted Drill Rig
Project Location:	Cnr. Derby & Castlereagh Streets Penrith	Coordinates: - Logged by: RE
		Surface Level: Existing Date: 25/5/04

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					Continued from Sheet 2 of 3				
				SP	Clayey SAND, fine to medium grained, yellow-brown	M/D	MD/ D	FLUVIAL	
				-	Gravels, Quartz	W	D		
		7.5			BH2 terminated at 7.4m depth (V-bit Refusal)				7.5
		8.0							8.0
		8.5							8.5
		9.0							9.0
		9.5							9.5
		10.0							10.0
		10.5							10.5

Explanatory Notes:

<u>Consistency</u>	<u>Density Index</u>	<u>Samples</u>	<u>Moisture</u>
VS Very Soft	VL Very Loose	B Bulk Sample	D Dry
S Soft	L Loose	D Disturbed Sample	M Moist
F Firm	MD Medium Dense	U50 Undisturbed Sample (50mm diam.)	W Wet
St Stiff	D Dense	N S.P.T. Value	Wp Plastic Limit
VSt Very Stiff	VD Very Dense		Wl Liquid Limit
H Hard			



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Job No:	S04114-A
Hole No:	BH3
Sheet	1 of 3

ENGINEERING BOREHOLE LOG

Client:	Kenmick Group Pty. Ltd.	Test Location:	Ref Dwg No. S04114-1
Project:	Proposed Residential Development	Test Method:	Truck Mounted Drill Rig
Project Location:	Cnr. Derby & Castlereagh Streets Penrith	Coordinates:	-
		Logged by:	RE
		Surface Level:	Existing
		Date:	25/5/04

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
N - L		0.5		ML	SILT, low plasticity, brown	D	S F	TOPSOIL	0.5
		1.0		CL	Silty CLAY, medium to low plasticity, brown to red-brown, containing many Ironstone gravels	D/M	St VSt	FLUVIAL	1.0
		1.5		CH	CLAY, high plasticity, yellow-brown with light grey from about 1.3m depth				1.5
		2.0							2.0
		2.5							2.5
		3.0							3.0
		3.5							3.5

Continued on Sheet 2 of 3

Explanatory Notes:

<u>Consistency</u>	<u>Density Index</u>	<u>Samples</u>	<u>Moisture</u>
VS Very Soft	VL Very Loose	B Bulk Sample	D Dry
S Soft	L Loose	D Disturbed Sample	M Moist
F Firm	MD Medium Dense	U50 Undisturbed Sample (50mm diam.)	W Wet
St Stiff	D Dense	N S.P.T. Value	Wp Plastic Limit
VSt Very Stiff	VD Very Dense		Wl Liquid Limit
H Hard			



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Job No:	S04114-A
Hole No:	BH3
Sheet	2 of 3

ENGINEERING BOREHOLE LOG

Client:	Kenmick Group Pty. Ltd.	Test Location:	Ref Dwg No. S04114-1
Project:	Proposed Residential Development	Test Method:	Truck Mounted Drill Rig
Project Location:	Cnr. Derby & Castlereagh Streets Penrith	Coordinates:	-
		Logged by:	RE
		Surface Level:	Existing
		Date:	25/5/04

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					Continued from Sheet 1 of 3				
		4.0		CH	CLAY, high plasticity, yellow-brown with light grey	M/D	VS/ St	FLUVIAL	4.0
		4.5							4.5
	SPT 5,7,9 N=16	5.0			with some red-brown from about 4.6m depth				5.0
		5.5			becoming				5.5
		6.0		CL	Silty Sandy CLAY, medium to low plasticity, light grey & yellow-brown with some red-brown				6.0
		6.5							6.5
		7.0							7.0
					Continued on Sheet 3 of 3				

Explanatory Notes:			
<u>Consistency</u>	<u>Density Index</u>	<u>Samples</u>	<u>Moisture</u>
VS Very Soft	VL Very Loose	B Bulk Sample	D Dry
S Soft	L Loose	D Disturbed Sample	M Moist
F Firm	MD Medium Dense	U50 Undisturbed Sample (50mm diam.)	W Wet
St Stiff	D Dense	N S.P.T. Value	Wp Plastic Limit
VS St Very Stiff	VD Very Dense		Wl Liquid Limit
H Hard			

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Job No:	S04114-A
Hole No:	BH3
Sheet	3 of 3

ENGINEERING BOREHOLE LOG

Client: Kenmick Group Pty. Ltd.				Test Location: Ref Dwg No. S04114-1					
Project: Proposed Residential Development				Test Method: Truck Mounted Drill Rig					
Project Location: Cnr. Derby & Castlereagh Streets Penrith				Coordinates: -		Logged by: RE			
				Surface Level: Existing		Date: 25/5/04			
Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					Continued from Sheet 2 of 3				
		7.5		CL	Silty Sandy CLAY, medium to low plasticity, light grey & yellow-brown with some red-brown	D/M	St/ VSt	FLUVIAL	7.5
		8.0							8.0
		8.5							8.5
		9.0		CL and SP	Sandy CLAY/Clayey SAND, light brown/ yellow-brown, fine grained Sand, medium plasticity Clay		VSt and D		9.0
		9.5							9.5
				SW	Clayey SAND, grey	M	D		
		10.0			BH3 terminated at 9.9m depth (Refusal on Gravels)				10.0
		10.5							10.5

Explanatory Notes:

<u>Consistency</u>	<u>Density Index</u>	<u>Samples</u>	<u>Moisture</u>
VS Very Soft	VL Very Loose	B Bulk Sample	D Dry
S Soft	L Loose	D Disturbed Sample	M Moist
F Firm	MD Medium Dense	U50 Undisturbed Sample (50mm diam.)	W Wet
St Stiff	D Dense	N S.P.T. Value	Wp Plastic Limit
VSt Very Stiff	VD Very Dense		Wl Liquid Limit
H Hard			



Job No:	S04114-A
Hole No:	BH4
Sheet	1 of 2

ENGINEERING BOREHOLE LOG

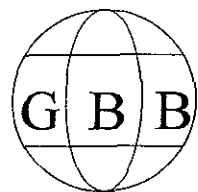
Client:		Kenmick Group Pty. Ltd.			Test Location: Ref Dwg No. S04114-1	
Project:		Proposed Residential Development			Test Method: Truck Mounted Drill Rig	
Project Location:		Cnr. Derby & Castlereagh Streets Penrith			Coordinates: -	Logged by: RE
					Surface Level: Existing	Date: 1/6/04

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
				ML	SILT, low plasticity, dark brown	D/M	-	TOPSOIL FILL (poorly compacted)	
		0.5		GP	Silty Sandy GRAVELS, with crushed Concrete, shale pieces and roadbase, light grey	D		FILL (moderately to well compacted)	0.5
		1.0		ML	SILT, low plasticity, brown, containing Ironstone gravels	D/M	F	FLUVIAL (possibly fill)	1.0
	SPT 5,9,10 N=19	1.5		CL	Silty CLAY, medium plasticity, yellow-brown/ brown with some red-brown, containing Ironstone gravels....grading to....		St/ VSt	FLUVIAL	1.5
		2.0		CH	CLAY, medium to high plasticity, red-brown with some light grey/grey and yellow-brown				2.0
	SPT 3,8,14 N=22	2.5							2.5
		3.0							3.0
		3.5		CL	....grading to.... Silty CLAY, medium plasticity, light grey and yellow-brown with some red-brown				3.5

Continued on Sheet 2 of 2

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	VL	Very Loose	B	Bulk Sample	D	Dry
S	Soft	L	Loose	D	Disturbed Sample	M	Moist
F	Firm	MD	Medium Dense	U50	Undisturbed Sample (50mm diam.)	W	Wet
St	Stiff	D	Dense	N	S.P.T. Value	Wp	Plastic Limit
VSt	Very Stiff	VD	Very Dense			WI	Liquid Limit
H	Hard						



Job No:	S04114-A
Hole No:	BH4
Sheet	2 of 2

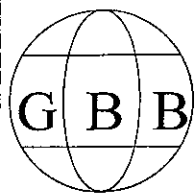
ENGINEERING BOREHOLE LOG

Client:	Kenmick Group Pty. Ltd.	Test Location:	Ref Dwg No. S04114-1
Project:	Proposed Residential Development	Test Method:	Truck Mounted Drill Rig
Project Location:	Cnr. Derby & Castlereagh Streets Penrith	Coordinates:	-
		Logged by:	RE
		Surface Level:	Existing
		Date:	1/6/04

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Ref. Density	Additional Comments	Depth (m)
					Continued from Sheet 1 of 2				
NIL		4.0		CL	Silty CLAY, medium plasticity, light grey and yellow-brown with some red-brown	D/M	S/ VSt	FLUVIAL	4.0
	SPT 6,8,10 N=18	4.5							4.5
		5.0							5.0
		5.5							5.5
	SPT 8,9,11 N=20	6.0			...grading to.... Silty Sandy CLAY, low plasticity, yellow-brown with some light grey				6.0
		6.5							6.5
		7.0		GP	Sandy GRAVELS, quartz, coarse grained Sands	M	D		7.0
BH4 terminated at 7.2m depth. (TC-bit Refusal in Gravels)									

Explanatory Notes:

<u>Consistency</u>	<u>Density Index</u>	<u>Samples</u>	<u>Moisture</u>
VS Very Soft	VL Very Loose	B Bulk Sample	D Dry
S Soft	L Loose	D Disturbed Sample	M Moist
F Firm	MD Medium Dense	U50 Undisturbed Sample (50mm diam.)	W Wet
St Stiff	D Dense	N S.P.T. Value	Wp Plastic Limit
VSt Very Stiff	VD Very Dense		WI Liquid Limit
H Hard			



Job No:	S04114-A
Hole No:	BH5
Sheet	1 of 3

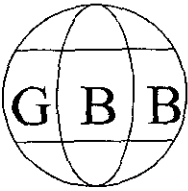
ENGINEERING BOREHOLE LOG

Client:	Kenmick Group Pty. Ltd.	Test Location:	Ref Dwg No. S04114-1
Project:	Proposed Residential Development	Test Method:	Truck Mounted Drill Rig
Project Location:	Cnr. Derby & Castlereagh Streets Penrith	Coordinates:	-
		Surface Level:	Existing
		Logged by:	RE
		Date:	1/6/04

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
N I L		0.5		ML	SILT, low plasticity, dark brown, containing root fibres, ironstone gravels	M	S to F	TOPSOIL	0.5
		1.0		CL	Silty CLAY, low to medium plasticity, dark brown to brown, containing Ironstone gravels		St	FLUVIAL	1.0
		1.5		CH	....grading to.... CLAY, medium to high plasticity, red-brown with yellow-brown and light grey	D/M	St/ VSt		1.5
		2.0		CL	....grading to....				2.0
		2.5		CL	Silty CLAY, medium plasticity, light grey/grey and yellow-brown with some red-brown				2.5
	SPT 7,9,12 N=21	3.0							3.0
		3.5							3.5
Continued on Sheet 2 of 3									

Explanatory Notes:

Consistency	Density Index	Samples	Moisture
VS Very Soft	VL Very Loose	B Bulk Sample	D Dry
S Soft	L Loose	D Disturbed Sample	M Moist
F Firm	MD Medium Dense	U50 Undisturbed Sample (50mm diam.)	W Wet
St Stiff	D Dense	N S.P.T. Value	Wp Plastic Limit
VSt Very Stiff	VD Very Dense		WL Liquid Limit
H Hard			



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Job No:	S04114-A
Hole No:	BH5
Sheet	2 of 3

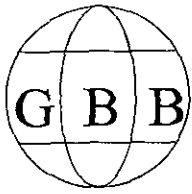
ENGINEERING BOREHOLE LOG

Client:	Kenmick Group Pty. Ltd.	Test Location:	Ref Dwg No. S04114-1
Project:	Proposed Residential Development	Test Method:	Truck Mounted Drill Rig
Project Location:	Cnr. Derby & Castlereagh Streets Penrith	Coordinates:	-
		Logged by:	RE
		Surface Level:	Existing
		Date:	1/6/04

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					Continued from Sheet 1 of 3				
		4.0	|||||	CL	Silty CLAY, medium plasticity, light grey/grey	D/M	S/ VSt	FLUVIAL	4.0
		4.5	|||||						4.5
		5.0	|||||						5.0
		5.5	|||||		....grading to....				5.5
	SPT 7,8,9 N=17	6.0	|||||	CH	CLAY, medium to high plasticity, light grey and yellow-brown with some red-brown	M			6.0
		6.5	|||||						6.5
		7.0	|||||	CL	Silty Sandy CLAY, low plasticity, yellow-brown with light grey and red-brown				7.0
					Continued on Sheet 3 of 3				

Explanatory Notes:

Consistency		Density Index		Samples		Moisture	
VS	Very Soft	VL	Very Loose	B	Bulk Sample	D	Dry
S	Soft	L	Loose	D	Disturbed Sample	M	Moist
F	Firm	MD	Medium Dense	U50	Undisturbed Sample (50mm diam.)	W	Wet
St	Stiff	D	Dense	N	S.P.T. Value	Wp	Plastic Limit
VSt	Very Stiff	VD	Very Dense			Wl	Liquid Limit
H	Hard						



Job No:	S04114-A
Hole No:	BH5
Sheet	3 of 3

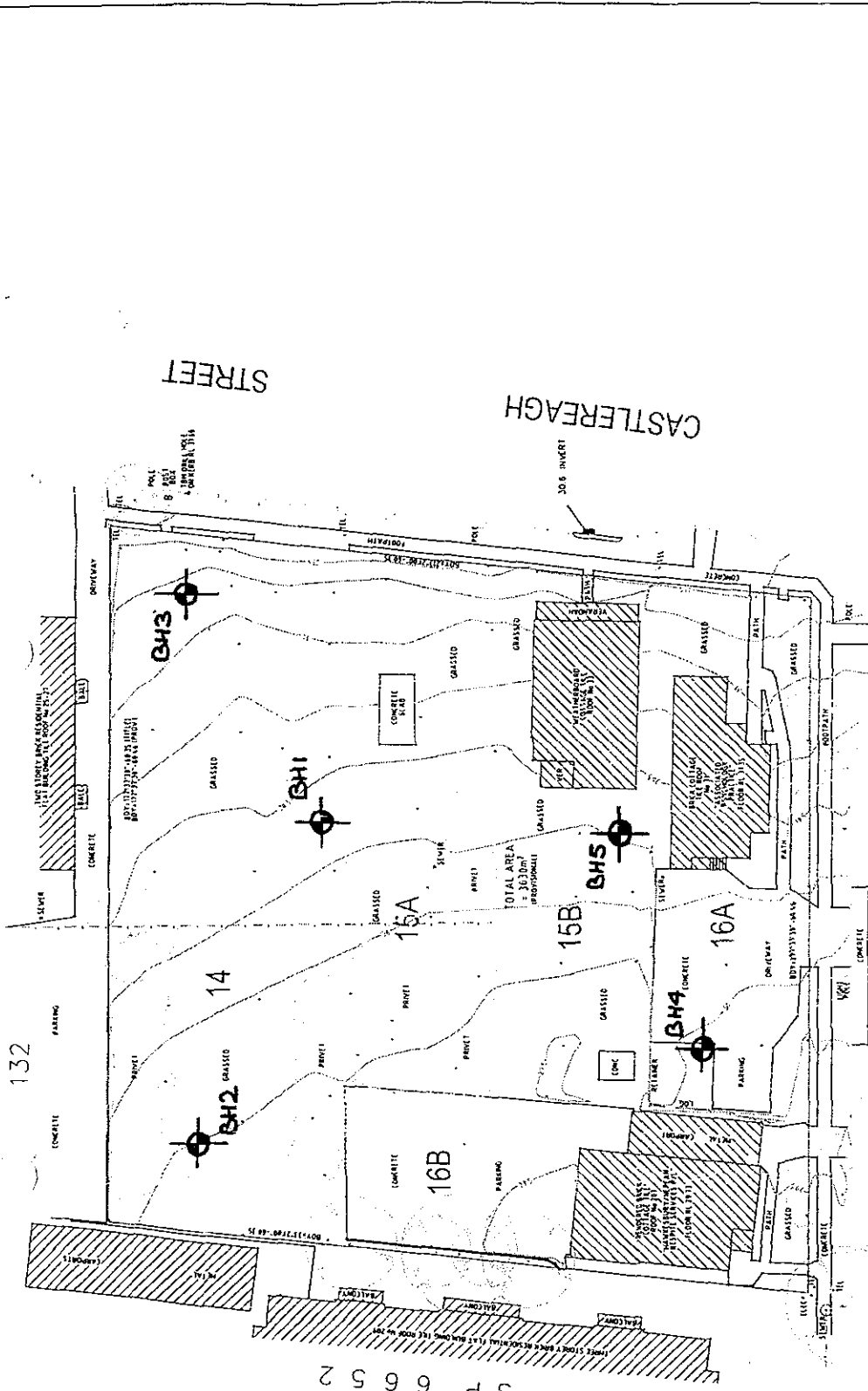
ENGINEERING BOREHOLE LOG

Client:	Kenmick Group Pty. Ltd.	Test Location:	Ref Dwg No. S04114-1
Project:	Proposed Residential Development	Test Method:	Truck Mounted Drill Rig
Project Location:	Cnr. Derby & Castlereagh Streets Penrith	Coordinates:	-
		Logged by:	RE
		Surface Level:	Existing
		Date:	1/6/04

Groundwater	Samples/ Field Tests	Depth (m)	Graphic Log	Unified Classification	Description	Moisture Condition	Consistency/ Rel. Density	Additional Comments	Depth (m)
					Continued from Sheet 2 of 3				
N		7.5	CL	CL	Silty Sandy CLAY, low plasticity, yellow-brown with light grey and red-brown	M	St/ VSt	FLUVIAL	7.5
		8.0							8.0
		8.5							8.5
		9.0	SW	SW	Clayey SAND, fine grained, yellow-brown to light grey		MD/ D		9.0
		9.5							9.5
		10.0			Sandy GRAVELS		D		10.0
					BH5 terminated at 10.0m depth. (TC-bit Refusal in Gravels)				
		10.5							10.5

Explanatory Notes:

<u>Consistency</u>	<u>Density Index</u>	<u>Samples</u>	<u>Moisture</u>
VS Very Soft	VL Very Loose	B Bulk Sample	D Dry
S Soft	L Loose	D Disturbed Sample	M Moist
F Firm	MD Medium Dense	U50 Undisturbed Sample (50mm diam.)	W Wet
St Stiff	D Dense	N S.P.T. Value	Wp Plastic Limit
VSt Very Stiff	VD Very Dense		Wl Liquid Limit
H Hard			



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SP 6652

CASTLEREAGH STREET

DERBY STREET

KENMICK GROUP PTY LTD
PROPOSED RESIDENTIAL DEVELOPMENT
CNR. DERBY STREET AND
CASTLEREAGH STREET


PENRITH
 SITE PLAN



SCALE:
 ~1:570


DRAWING NO:
 S04114-1

BRINK & ASSOCIATES
 Geotechnical, Geological, Environmental
 Consulting Engineers and Scientists



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 WETHERILL PARK NSW 2164
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LEGEND

 Approximate Test Location