Pells Sullivan Meynink
Engineering Consultants
Rock-Soil-Water

G3 56 Delhi Road
North Ryde NSW 2113
P: 61-2 9812 5000
F: 61-2 9812 5001
mailbox@psmconsult.com.au
www.psmconsult.com.au

Our Ref: PSM2043-003R
Date: 26 November 2012

Ionic Management Pty Ltd
Shop 1, 22 Gadigal Avenue
ZETLAND NSW 2017

ATTENTION: MATT BENTLEY
By email to: mbentley@imanage.net.au

Dear Sir,

RE: LOT 1, DP 859608 BURROWAY ROAD, HOMEBUSH BAY
GEOTECHNICAL INVESTIGATION

We are pleased to submit our geotechnical report for the proposed development at Lot 1, DP 859608 Burroway Road, Homebush Bay.

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

For and on behalf of
PELLS SULLIVAN MEYNINK

GARRY MOSTYN
Principal

Distribution: 1 copy Ionic Management Pty Ltd
Original held by PSM

Ionic Management Pty Ltd

LOT 1, DP 859608 BURROWAY ROAD, HOMEBUSH BAY
GEOTECHNICAL INVESTIGATION

Report PSM2043-003R **November, 2012**

CONTENTS

1. INTRODUCTION

This report presents the results of the geotechnical investigation performed by Pells Sullivan Meynink (PSM) at Lot 1, DP 859608 Burroway Road, Homebush Bay. The work was carried out in general accordance with PSM proposal dated 30 October 2012 (Ref. PSM2043-001L). An approval to proceed with the work was provided by Ionic Management in its e-mail dated 30 October 2012.

An environmental investigation has also been undertaken for the site by DLA Environmental under PSM coordination. The report is presented separately from this geotechnical report.

Prior to the work, PSM was supplied with the following documents.

1. Jeffrey and Katauskas (J&K) report – *"Preliminary Geotechnical investigation report for proposed development at Lot 1, DP 859608 Burroway Road, Homebush Bay, NSW"* dated 14 May 2010 (Ref. 23907ZArpt).
2. Environmental Investigation Services (EIS) report – *"Preliminary Environmental Site investigation for Proposed mixed use development at Wentworth Point Ferry Wharf Site, Burroway Road, Sydney Olympic Park, NSW"* dated 14 May 2010 (Ref. E23907K-rpt).
3. Lockley Land Title Solutions drawings *"Plan of Detail and Level over LOT 1 DP 859608 1 Burroway Road, Wentworth Point"* Sheet 1 and 2 dated 3 August 2012 (Ref. Proj. no. 23323 – Job. No. 35064DT).
4. Rice Daubney preliminary drawings SK 250 to SK 259 and SK 202 to SK 204 dated 26 October 2012.

2. BACKGROUND

Based on the documents, we understand the following regarding the site and the proposed development.

1. The site covers an area of approximately 10,430 m^2. The current ground surface elevation is between RL 2.0 m and 3.0 m AHD.
2. The site is bounded by Wentworth wharf at the north, Burroway Road at the south, and some industrial warehouses at the east and west.
3. The proposed residential and commercial development will comprise:
   (a) A ten storey building, i.e. approx. 30 m above the ground surface.
   (b) A basement carpark with base of carpark located at RL -0.2 m AHD.
4. The proposed foundation system is likely to be piles or raft slab.

5. The J&K report indicates that:

   (a) The site comprises up to 2.0 m thick of uncontrolled fill overlying alluvium overlying sandstone bedrock at approximate depth of 14.5 m below ground surface.

   (b) The ground water table is approximately 2.0 m below the ground surface.

6. A monitoring well was installed by J&K in 2010.

3. GEOTEHNICAL INVESTIGATION

The fieldwork was undertaken on 15 and 16 November 2012. It comprised drilling of two (2) boreholes to a maximum depth of 19.85 m. The boreholes were drilled using a 16 tonne truck mounted drill rig. Figure 1 presents the locations of these boreholes.

The boreholes were drilled using augering technique to a depth between 12.1 m and 13.9 m and then followed by NMLC coring technique in the bedrock unit. Standard penetration tests (SPT) were performed at 1.5 m intervals to a depth of 6.0 m.

The boreholes were drilled in the full time presence of a PSM Geotechnical Engineer who set out the test locations, prepared engineering logs and took photographs of the rock cores from each borehole. Engineering borehole logs together with the explanation sheets and core photos are presented in Appendix A.

The collar elevations of both PSM boreholes were inferred from the survey plan (Ref. 23323) to be at RL 2.5 m AHD.

PSM Geotechnical engineer also took one measurement of water level in the monitoring well installed in 2010.

4. SITE CONDITIONS

4.1. Geological setting

The 1:100,000 Sydney Geological map indicates that the site is underlain by man-made fill, dredged estuarine sand and mud, demolition rubble, industrial and household waste and silty to peaty quartz sand, silt and clay with common shell layers.

The published information was consistent with the subsurface conditions encountered in the field.

4.2. Surface condition

At the time of the investigation, the majority of the area comprised grassed surface. A portion of the site at the north comprised bitumen roadway and carpark.

4.3. Subsurface conditions

The subsurface condition encountered during the investigation was consistent with the findings in J&K investigation. The inferred geotechnical units encountered in the boreholes are presented in Table 1.

TABLE 1
INFERRED GEOTECHNICAL UNITS

INFERRED UNIT	DEPTH TO THE TOP OF THE UNIT (m)	DESCRIPTION
FILL	0.0	Sandy CLAY to CLAY; clay is high plasticity, brown, with firm to very stiff consistency, sand is fine grained with some gravel.
ALLUVIUM	1.0 – 3.0	Clayey SAND to CLAY; sand is coarse grained, brown to grey, clay is high plasticity, very soft consistency.
CLASS IV SANDSTONE*	11.8 – 13.85	SANDSTONE; moderately weathered, very low to medium strength, coarse grained, sub-horizontal bedded, with localised defect spacing less than 200 mm.
CLASS III SANDSTONE*	12.5 - 16.0	SANDSTONE; moderately weathered, medium strength, coarse grained, sub-horizontal bedded, with localised defect spacing greater than 200 mm.

Note: * = sandstone classification as per Pells et al 1998.

The summary of the boreholes are presented in Table 2 below.

TABLE 2
BOREHOLE SUMMARY

INFERRED UNIT	DEPTH TO THE TOP OF THE UNIT (m)		
	PSM BH1	PSM BH2	J&K – BH2[1]
FILL	0.0	0.0	0.0
ALLUVIUM	1.2	2.6	1.2
CLASS IV SANDSTONE	13.9	11.8	14.4[2]
CLASS III SANDSTONE	16.0	12.1	NA
END OF HOLE	19.9	18.1	15.4

Note: (1) Information was obtained from J&K report (2010). The borehole was drilled with augering technique.
(2) Rock strength was assessed from TC bit resistance

4.4. Groundwater

During the fieldwork on 15 November 2012, the groundwater level in the monitoring well was recorded to be at RL 0.8 AHD, i.e. approximately 2 m below the ground surface.

Previous measurement taken by J&K from the same well between 9 April 2010 and 22 April 2010 (Ref. J&K report) showed that the water level was between RL 1.0 and RL 1.1 m AHD. The measurements were made every 15 minutes using a data logger and suggested that there was little effect from tidal variations on the height of groundwater at the site.

5. DISCUSSION AND RECOMMENDATIONS

5.1. Excavation conditions

Excavation in FILL and ALLUVIUM units will be required for the proposed single basement level, i.e. basement elevation at RL -0.2 m. This should be achievable using conventional earth moving equipment. We note that trafficability will be a significant issue in these materials.

The groundwater level is at least one metre above the proposed basement level. It will need to be drawn down temporarily to allow construction for the basement.

Excavation in SANDSTONE UNITS might be required when piling is proposed. This should be achievable using conventional piling rigs. It is our experience that excavatability is heavily dependent on both the operator and the plant used. The piling contractor should satisfy itself with regard to excavatability and ability to meet the design requirements.

5.2. Foundation

The following section provides advice and parameters that may be used when designing the foundations.

5.2.1. Raft slab

We note that the ALLUVIUM unit comprises very soft clay to clayey sand with SPT blow counts of between 0 and 4 at 3 to 6 m below the ground surface. On this basis, it is our opinion that raft slab foundation system is not a feasible solution for the proposed development.

5.2.2. Piles

Piles should be designed in accordance with the requirements in AS 2159 (2009), *Piling - Design and Installation*. The parameters provided in Table 4 may assist in the design of piles.

Subject to the confirmation of the design foundation loads, we envisage that piles will be founded within the CLASS IV SANDSTONE unit or better. With regards to pile design we recommend that:

- A geotechnical strength reduction factor, Φ_g = 0.60 (AS2159 Cl. 4.3.2) be adopted for a high redundancy system for an assessed average risk rating (ARR) of 3.0. This should be reviewed to suit the specific design and construction methods proposed by the structural designers,
- It may be possible to increase the pile reduction factors, if the details of the proposed pile installation procedures indicate a high level of quality control with regards to concrete placement, base cleanliness and etc.

For settlement of bored piles founded in rock, note the following:

- Where the pile is sized using the allowable bearing capacity in Table 4 (i.e. assuming all the serviceability load is carried by the base), the settlement would be expected to be less than 1% of the pile diameter, and
- Where the design intends to utilise the resistance of the pile shaft, methods are available to predict settlements. Pells (1999) provides guidance on these methods.

Pile inspections to confirm the foundation conditions will be required. The inspection should be performed by a suitably qualified Geotechnical Engineer during pile installation. Details of the inspection regime should be finalised once loading and construction details are finalised by the designer.

The designer should allow for the effects of negative friction where it might occur.

TABLE 4
ENGINEERING PARAMETERS OF INFERRED GEOTECHNICAL UNITS

INFERRED UNIT	ALLOWABLE BEARING PRESSURE UNDER VETICAL CENTRIC LOADING (kPa)	ULTIMATE SHAFT ADHESION (kPa)	ELASTIC PARAMETERS	
			YOUNG MODULUS (MPa)	POISSON'S RATIO
FILL / ALLUVIUM	NA	NA	NA	NA
CLASS IV SANDSTONE	1000	250	100	0.25
CLASS III SANDSTONE	3500	800	350	0.25

6. GENERAL

If at any time, the conditions are found to vary from those described in this report, further advice should be sought.

For and on behalf of
PELLS SULLIVAN MEYNINK

GARRY MOSTYN
Principal

REFERENCES

1. Pells, P.J.N., Mostyn, G., and Walker, B.F., "Foundations on Sandstone and Shale in the Sydney Region", Australian Geomechanics Journal, Dec. 1998.
2. Pells, P.J.N., "State of Practice for the Design of Socketed Piles in Rock", Proceedings 8th Australia New Zealand Conference on Geomechanics, Hobart, 1999.
3. AS 2159 (2009) Piling - Design and Installation

LEGEND

- PSM boreholes drilled on 15/11/2012 - 16/11/2012
- DLA Environmental boreholes drilled on 15/11/2012
- Jeffery and Katouskas and EIS boreholes

0 5 10 20 30 40 50 m

Pells Sullivan Meynink

Ionic Management Pty Ltd
Lot 1, DP 859608 Burroway Road
Homebush Bay, NSW

GEOTECHNICAL INVESTIGATION
BOREHOLE LOCATION PLAN

PSM2043-003R	Figure 1

APPENDIX A

BOREHOLE LOGS

EXPLANATION SHEET
BOREHOLE LOG

GENERAL

Method

Non-Cored Borehole
Auger
Hand Auger
Diamond Rotary
Percussion
Other

Coring Size

Cored Borehole	Nominal Core Diameter (mm)
NMLC	51.9
BQ	36.5
BQ3	33.5
NQ	47.6
NQ3	45.1
HQ	63.5
HQ3	61.1
PQ	85
PQ3	83.1
Diatube	Variable
Other	-

Testing

Symbol	Description
UCS	Uniaxial Compressive Strength
TXL	Triaxial Test
BT	Brazilian Test
DT	Direct Tensile
SD	Slake Durability
Packer	Rock Mass Permeability

Samples

Symbol	Description
U50	50 mm undisturbed tube sample
D	Disturbed sample
Bs	Bulk sample

Water

Symbol	Description
	Water level
	Water inflow
	Complete water loss
	Partial water loss

SOIL DESCRIPTIONS

Unified Soil Classification System (USCS)

Major Divisions			Symbol	Typical Names
Coarse-Grained Soils More than 50% coarser than 0.075mm	Gravels (more than 50% coarser than 2mm)	Clean Gravels	GW	Well-graded gravels and gravel-sand mixtures, little or no fines.
			GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.
		Gravels With Fines	GM	Silty gravels, gravel-sand-silt mixtures.
			GC	Clayey gravels. gravel-sand-clay mixtures.
	Sands (more than 50% of coarse fraction finer than 2mm)	Clean Sands	SW	Well-graded sands and gravelly sands, little or no fines.
			SP	Poorly graded sands and gravelly sands, little or no fines.
		Sand With Fines	SM	Silty sands, sand-silt mixture.
			SC	Clayey sands, sand-clay mixtures.
Fine-Grained Soils 50% or more finer than 0.075mm	Silts and Clays Liquid limit 50% or less		ML	Inorganic silts, very fine sands, rock flour silty or clayey fine sands.
			CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
			OL	Organic silts and silty clays of low plasticity.
	Silts and Clays Liquid limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.
			CH	Inorganic clays of high plasticity, fat clays.
			OH	Organic clays of medium to high plasticity.
Highly Organic Soils			PT	Peat etc.

Moisture Condition

Term	Symbol
Dry	D
Moist	M
Wet	W
Wet at Plastic Limit	WP
Wet at Liquid Limit	WL

Strength

COHESIVE SOILS are described in terms of undrained shear strength, colour and structure with comments on minor constituents or apparent special features. Undrained shear strength is measured by hand penetrometer or determined by laboratory testing or estimated from experience. Classification in terms of undrained shear strength is as follows:

Term	Symbol	Description for Field Estimation	Shear Strength (kPa)	UCS (kPa)
Very Soft	VS	Easily penetrated several centimetres by fist.	<12	<25
Soft	S	Easily penetrated several centimetres by thumb. Can be moulded by light finger pressure.	12-25	25-50
Firm	F	Can be penetrated by thumb with moderate effort. Can be moulded by strong finger pressure.	25-50	50-100
Stiff	ST	Readily indented by thumb.	50-100	100-200
Very Stiff	VST	Readily indented by thumbnail.	100-200	200-400
Hard	H	Indented with difficulty by thumbnail	>200	>400

NON-COHESIVE SOILS are described in terms of density, colour, with comments on minor constituents or special features. Density (density index) is generally based on standard penetration testing (AS1289 Method 6.3.1), or other forms of penetration testing. Terms used in describing density are set out below:

Term	Symbol	Density Index	SPT N Values
Very Loose	VL	<15%	<5
Loose	L	15-35 %	5-10
Medium Dense	MD	35-65 %	10-30
Dense	D	65-85 %	30-50
Very Dense	VD	>85 %	>50

ROCK DESCRIPTIONS

Weathering

Term	Symbol	Description
Fresh	FR	Rock substance unaffected by weathering.
Slightly Weathered	SW	Rock substance affected by weathering to the extent that partial staining or partial discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable; strength properties are essentially those of the fresh rock substance.
Moderately Weathered	MW	Rock substance affected by weathering to the extent staining extends throughout whole of the rock substance and the original colour of the fresh rock is no longer recognisable.
Highly Weathered	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and signs of chemical or physical decomposition of individual minerals are usually evident. Porosity and strength may be increased or decreased when compared to the fresh rock substance, usually as a result of the leaching or deposition of iron. The colour and strength of the original fresh rock substance is no longer recognisable.
Extremely Weathered	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties, i.e. it can be remoulded and can be classified according to the Unified Soil Classification System, but the texture of the original rock is still evident.

Strength

Term	Symbol	Description for Field Estimation	UCS (MPa)
Extremely Low	R0	Thumbnail easily scratches; gentle blow with geological pick leaves deep impression.	0.7-1.5
Very Low	R1	Can be peeled by a pocket knife. Crumbles under firm blows with geological pick.	1.5-3.0
Low	R2	Can be peeled by a pocket knife with difficulty; shallow indentation made by firm blow of geological pick.	3.0-10
Medium	R3	Cannot be scraped or peeled with a pocket knife; specimen can be fractured with single firm blow of hammer end of geological pick.	10-25
High	R4	Specimen requires more than one blow with hammer end of geological pick to fracture.	25-80
Very High	R5	Specimen requires many blows of hammer end of geological pick to fracture.	>80

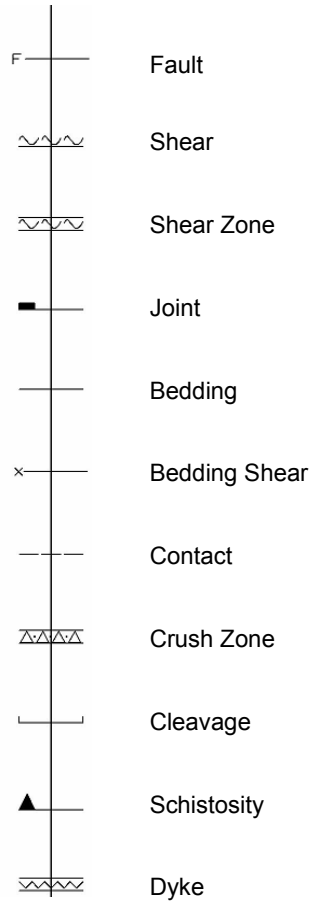
Defect Description

Order of description: type, inclination, shape, roughness, infill type, infill thickness, number

Defect Type

Symbol	Description
CL	Clay Seam
FL	Fault - fracture along which displacement is recognisable.
SR	Shear - a fracture along which movement has taken place but no displacement is recognisable. Evidence for movement may be slickensides, polishing and/or clay gouge.
SH	Sheared Zone - zone of multiple closely spaced fracture planes with roughly parallel planar boundaries usually forming blocks of lenticular or wedge shaped intact material. Fractures are typically smooth, polished or slickensided; and curved.
BG	Bedding parting - arrangement in layers of mineral grains or crystals parallel to surface of deposition along which a continuous observable parting occurs.
BSH	Bedding plane shear - a shear formed along a bedding plane
JN	Joint - a single fracture across which rock has little or no tensile strength and is not obviously related to rock fabric.
CN	Contact - surface between two lithologies.
SC	Schistosity - plane formed by the preferred orientation of the constituent minerals in a parallel arrangement in a coarse grained rock which has undergone regional metamorphism (schist).
CV	Cleavage - plane of mechanical fracture in a rock normally sufficiently closely spaced to form parallel-sided slices.
FO	Foliation
CZ	Crushed Zone - zone with roughly parallel, planar boundaries (commonly slickensided) containing disoriented usually angular rock fragments of variable size often in a soil matrix.
VN	Vein - fracture in which a tabular or sheet-like body of minerals have been intruded.
DK	Dyke - Igneous intrusion - often weathered and altered to a clay like substance.
DZ	Decomposed Zone - zone of any shape but commonly with parallel planar boundaries containing moderately to gradational boundaries into fresher rock.
FZ	Fractured Zone - a zone of closely spaced defects (mainly joints, bedding, cleavage and/or schistosity) comprised of core lengths in the order of 50 mm or less.

Standard Defect Symbols



Roughness Colour Code (for summary log)

Ro1
Ro2
Ro3
Ro4
Ro4

Shape

Term	Symbol	Description
Planar	PL	Forms a continuous plane without variation in orientation.
Curved	CU	Has a gradual change in orientation.
Undulating	UN	Has a wavy surface shape.
Stepped	ST	Has one or more well defined steps
Irregular	IR	Many changes of orientation.

Roughness

Term	Symbol	Description
Slickensided or polished	Ro1	Very smooth, reflects light.
Smooth	Ro2	Roughness not detected with finger.
Defined ridges	Ro3	Sandpaper feel (fine to medium sandpaper).
Small steps	Ro4	Sandpaper feel (medium to coarse sandpaper).
Very rough	Ro5	Very well defined ridges and/or steps.

Infill Type

Symbol	Description
KL	Clean
CA	Calcite
CB	Carbonaceous
CHL	Chlorite
FE	Iron oxide
QZ	Quartz
MG	Manganese
SU	Sulphides
SE	Sericite
RF	Rock fragments
G	Gravel
S	Sand
Z	Silt
CL	Clay

Infill Thickness

Where infilling is present, the thickness of infill is recorded using the following convention:

ST Iron oxide staining of less than 1 mm
VN Veneer coating of less than 1 mm

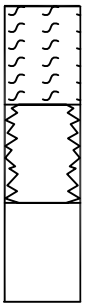
If the infilling is greater than 1 mm, the actual thickness of infill is recorded in millimeters.

If infill is not present, a dash (-) is recorded

Number

Number of defects with similar characteristics.

Miscellaneous

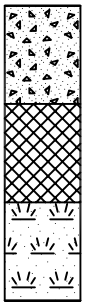


CATACLASTIC – FAULT GOUGE: soft puggy, possibly foliated fault infill

CAVITY: cavity – as indicated by driller

NO_CORE: No Core

Man-Made

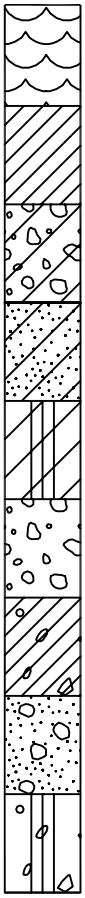


MAN–MADE – CONCRETE/ASPHALT: man–made surface paving

MAN–MADE – FILL: Fill (made ground)

MAN–MADE TOPSOIL: Topsoil

Soil



SOIL – ALLUVIUM: reworked material deposited by water in the past

SOIL – CLAY: Clay

SOIL – CLAYEY GRAVEL: Clayey Gravel

SOIL – CLAYEY SAND: Clayey Sand

SOIL – CLAYEY SILT: Clayey Silt

SOIL – GRAVEL: Gravel

SOIL – GRAVELLY CLAY: Gravelly Clay

SOIL – GRAVELLY SAND: Gravelly Sand

SOIL – GRAVELLY SILT: Gravelly Silt

SOIL – SAND: Sand

SOIL – SANDY CLAY: Sandy Clay

SOIL – SANDY GRAVEL: Sandy Gravel

SOIL – SANDY SILT: Sandy Silt

SOIL – SHELLS: unconsolidated marine material

SOIL – SILT: Silt

SOIL – SILTY CLAY: Silty Clay

SOIL – SILTY SAND: Silty Sand

SOIL – SILTY GRAVEL: Silty Gravel

PSM

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Geotechnical Logging

LITHOLOGY GRAPHIC SYMBOLS
SOIL, MAN-MADE & MISCELLANEOUS

Igneous

IGNEOUS – ANDESITE: mid range mafic to felsic igneous fine grained rock (moderate in quartz and in colour)

IGNEOUS – BASALT (MAFIC): mafic igneous fine grained rock (dark in colour)

IGNEOUS – DIORITE: mid range felsic to mafic igneous coarse grained rock (moderate quartz)

IGNEOUS – DOLERITE: dolerite

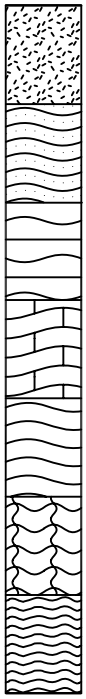
IGNEOUS – GABBRO (MAFIC): mafic igneous coarse grained rock (low quartz, dark in colour)

IGNEOUS – GRANITE (FELSIC): felsic igneous coarse grained rock (light in colour)

IGNEOUS – RHYOLITE (FELSIC): felsic igneous fine grained rock (light in colour)

IGNEOUS – TUFF/IGNIMBRITE: extremely fine grained air fall volcanic

Metamorphic



METAMORPHIC – AMPHIBOLITE: non-foliated metamorphic rock formed by regional metamorphism of mafic igneous rocks

METAMORPHIC – GNEISS: a foliated high grade metamorphic rock

METAMORPHIC – HORNFELS: contact metamorphic rock

METAMORPHIC – MARBLE: metamorphosed limestone

METAMORPHIC – SCHIST: a foliated high grade metamorphic rock

METAMORPHIC – SKARN: contact metamorphosed carbonate body

METAMORPHIC – SLATE/PHYLLITE: low grade regionally metamorphosed rock

Sedimentary

SEDIMENTARY – BRECCIA: consolidated clastic rock made up of angular clasts

SEDIMENTARY – CALCRETE/SILCRETE: Calcrete or silcrete

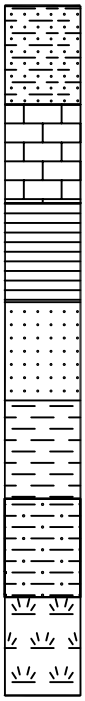
SEDIMENTARY – CHERT: chert/quartz

SEDIMENTARY – COAL: Coal

SEDIMENTARY – CONGLOMERATE: consolidated rounded clastic material

SEDIMENTARY – DOLOMITE: Dolomite

SEDIMENTARY – IRONSTONE: hard iron enriched layer



SEDIMENTARY – LAMINITE: interbedded sandstone and siltstone

SEDIMENTARY – LIMESTONE: Limestone

SEDIMENTARY – MUDSTONE: Mudstone

SEDIMENTARY – SANDSTONE: Sandstone

SEDIMENTARY – SHALE: Shale

SEDIMENTARY – SILTSTONE: Siltstone

SEDIMENTARY – SWAMP/PEAT: Peat (Swamp Symbol)

Pells Sullivan Meynink

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Geotechnical Logging

LITHOLOGY GRAPHIC SYMBOLS
IGNEOUS, METMORPHIC & SEDIMENTARY

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Borehole No: **BH01**

Sheet: 1 of 3

Job No: PSM2043

Borehole Log

Client:	Ionic Management Pty Ltd	**Date commenced:**	15/11/2012
Principal:		**Date completed:**	15/11/2012
Project:	LOT 1, DP 859608 BURROWAY ROAD	**Logged by:**	CF
Site location:	Homebush Bay, NSW	**Checked by:**	AS

Drilling contractor:	Macquarie Drilling	**R.L. surface:**	2.5 m	**Vertical datum:**	AHD (m)
Equipment type:	HYDRAPOWER SCOUT VI Rig	**Easting:**	322163	**Horizontal datum:**	MGA56
		Northing:	6255841	**Inclination / azimuth:**	90 / -

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
Hand dug			2.0				FILL: Sandy CLAY; low plasticity, dark brown		F	Topsoil and bark garden bed
							FILL: CLAY; high plasticity, brown, with some gravel, 5 mm to 80 mm, angular		VST	
	D			1.0			becomes black and red	M		
	SPT 16, 11, 7 N=18		1.0				SAND; coarse grained, yellow brown, with a trace of shells		MD	Alluvium
	D	▼		2.0			CLAY; high plasticity, dark grey, with inerbedded Clayey SAND, coarse, dark brown/grey			
125 mm Auger		Water table observed at 2.1m within hole	0.0							Interbedded layers observed to be 100 mm from SPT push tube
	SPT 1, 2, 1 N=3									
	D			3.0					VS	
			-1.0					W		
	SPT 1, 0, 1 N=1			4.0						
			-2.0							

File Name: PSM2043_AUGERED BOREHOLE LOGS.GPJ Print Date: 26/11/12

Refer to Explanation Sheets Attached for Classification Systems

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Borehole Log

Borehole No: **BH01**

Sheet: 2 of 3

Job No: PSM2043

Client:	Ionic Management Pty Ltd	**Date commenced:**	15/11/2012
Principal:		**Date completed:**	15/11/2012
Project:	LOT 1, DP 859608 BURROWAY ROAD	**Logged by:**	CF
Site location:	Homebush Bay, NSW	**Checked by:**	AS

Drilling contractor:	Macquarie Drilling	**R.L. surface:**	2.5 m	**Vertical datum:**	AHD (m)
Equipment type:	HYDRAPOWER SCOUT VI Rig	**Easting:**	322163	**Horizontal datum:**	MGA56
		Northing:	6255841	**Inclination / azimuth:**	90 / -

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
125 mm Auger	SPT 0, 0, 0 N=0		-3.0	6.0						
			-4.0	7.0				W	VS	
			-5.0	8.0			CLAY, high plasticity, light grey, with a trace of fine grained sand			
			-6.0	9.0					S	
			-7.0							

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Refer to Explanation Sheets Attached for Classification Systems

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Borehole Log

Borehole No: **BH01**
Sheet: 3 of 3
Job No: PSM2043

Client:	Ionic Management Pty Ltd	**Date commenced:**	15/11/2012
Principal:		**Date completed:**	15/11/2012
Project:	LOT 1, DP 859608 BURROWAY ROAD	**Logged by:**	CF
Site location:	Homebush Bay, NSW	**Checked by:**	AS

Drilling contractor:	Macquarie Drilling	**R.L. surface:**	2.5 m	**Vertical datum:**	AHD (m)
Equipment type:	HYDRAPOWER SCOUT VI Rig	**Easting:**	322163	**Horizontal datum:**	MGA56
		Northing:	6255841	**Inclination / azimuth:**	90 / -

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
125 mm Auger			-8.0	11.0				W	S	
			-9.0	12.0						
			-10.0	13.0						
Wash bored NMLC			-11.0						ST	Drilling observed to be more difficult at 13.2 m depth, hole cased and continued using NMLC sized washboring until 13.85 m
				14.0			Continued on core log			
			-12.0							

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Refer to Explanation Sheets Attached for Classification Systems

Pells Sullivan Meynink

Engineering Consultants
Rock-Soil-Water

Borehole No: **BH01**

Sheet: 1 of 2

Job No: PSM2043

Cored Borehole Log

Client:	Ionic Management Pty Ltd	**Date commenced:**	15/11/2012
Principal:		**Date completed:**	15/11/2012
Project:	LOT 1, DP 859608 BURROWAY ROAD	**Logged by:**	CF
Site location:	Homebush Bay, NSW	**Checked by:**	AS

Drilling contractor:	Macquarie Drilling	**R.L. surface:**	2.5 m	**Vertical datum:**	AHD (m)
Equipment type:	HYDRAPOWER SCOUT VI rig	**Easting:**	322163 m	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	6255841 m	**Inclination / azimuth:**	90 /

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
		13	10.5								
			11.0								
		14	11.5								
			12.0								
		15	12.5								
			13.0								
		16	13.5		Continued from non-cored borehole log						
	Water table at 2.1 m depth		14.0		SANDSTONE; Pale red yellow and grey, banded, coarse grained, sub horiztonal bedding	MW			82		BG, 11°, PL, Ro3, KL
		17	14.5								BG, 12°, PL, Ro3, KL BG, 12°, PL, Ro3, KL BG, 14°, PL, Ro3, KL BG, 9°, PL, Ro3, CL, 10 - 50mm BG, 11°, PL, Ro3, CL, 10 - 50mm

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Engineering Consultants
Rock-Soil-Water

Borehole No: **BH01**

Sheet: 2 of 2

Job No: PSM2043

Cored Borehole Log

Client:	Ionic Management Pty Ltd	**Date commenced:**	15/11/2012
Principal:		**Date completed:**	15/11/2012
Project:	LOT 1, DP 859608 BURROWAY ROAD	**Logged by:**	CF
Site location:	Homebush Bay, NSW	**Checked by:**	AS

Drilling contractor:	Macquarie Drilling	**R.L. surface:**	2.5 m	**Vertical datum:**	AHD (m)
Equipment type:	HYDRAPOWER SCOUT VI rig	**Easting:**	322163 m	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	6255841 m	**Inclination / azimuth:**	90 /

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
	Water table at 2.1 m depth	18	15.5		SANDSTONE; Pale red yellow and grey, banded, coarse grained, sub horizontal bedding	MW			82		BG, 12°, PL, Ro3, KL BG, 12°, UN, Ro3, CL, 1 - 5mm BG, 12°, UN, Ro3, KL BG, 13°, ST, Ro3, KL BG, 12°, PL, Ro3, KL BG, 6°, IR, Ro3, CL, 10 - 50mm BG, 3°, PL, Ro3, KL BG, 0°, IR, Ro3, CL, 10 - 50mm
			16.0		Becomes light grey						BG, 20°, UN, Ro3, KL BG, 9°, UN, Ro3, KL
		19	16.5								
			17.0								BG, 14°, UN, Ro3, KL
		20	17.5		Red banding from 17.5 m to 18 m	SW			100		BG, 6°, PL, Ro3, KL
			18.0		Becomes yellow brown						BG, 16°, PL, Ro3, KL
		21	18.5								BG, 8°, PL, Ro3, KL
			19.0								BG, 12°, CU, Ro3, KL
		22	19.5								BG, 13°, CU, Ro3, KL
					End of Hole at 19.85m.						

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Ionic Management Pty Ltd	
LOT 1, DP 859608 Burroway Road	
Homebush Bay, NSW	
GEOTECHNICAL INVESTIGATION	
CORE PHOTOGRAPHS	
PSM2043-003R	**BH01 Photos**

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Rock-Soil-Water

Borehole Log

Borehole No: **BH02**
Sheet: 1 of 3
Job No: PSM2043

Client:	Ionic Management Pty Ltd	**Date commenced:**	16/11/2012
Principal:		**Date completed:**	16/11/2012
Project:	LOT 1, DP 859608 BURROWAY ROAD	**Logged by:**	CF
Site location:	Homebush Bay, NSW	**Checked by:**	AS

Drilling contractor:	Macquarie Drilling	**R.L. surface:**	2.5 m	**Vertical datum:**	AHD (m)
Equipment type:	HYDRAPOWER SCOUT VI Rig	**Easting:**	322181	**Horizontal datum:**	MGA56
		Northing:	6255775	**Inclination / azimuth:**	90 / -

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
125 mm Auger	SPT 7, 8, 6 N=14	Water table obsreved at 2 m within hole	2.0	0.0			FILL: Sandy CLAY, low plasticity, dark brown	M	F	Topsoil with rootlets
							FILL: Gravelly CLAY with some Sand, high plasticity, red-brown, gravels 20 to 30 mm in size, angular		VST	
			1.0	1.0			FILL: CLAY, high plasticity, red-brown		ST	
	SPT 1, 2, 2 N=4		0.0	2.0			CLAY; high plasticity, dark grey, with inerbedded Clayey SAND, coarse, dark brown/grey	W	VS	Alluvium
	SPT 1, 0, 1 N=1		-1.0	3.0						
			-2.0	4.0						

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Refer to Explanation Sheets Attached for Classification Systems

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Rock-Soil-Water

Borehole No: **BH02**

Sheet: 2 of 3

Job No: PSM2043

Borehole Log

Client:	Ionic Management Pty Ltd	**Date commenced:**	16/11/2012
Principal:		**Date completed:**	16/11/2012
Project:	LOT 1, DP 859608 BURROWAY ROAD	**Logged by:**	CF
Site location:	Homebush Bay, NSW	**Checked by:**	AS

Drilling contractor:	Macquarie Drilling	**R.L. surface:**	2.5 m	**Vertical datum:**	AHD (m)
Equipment type:	HYDRAPOWER SCOUT VI Rig	**Easting:**	322181	**Horizontal datum:**	MGA56
		Northing:	6255775	**Inclination / azimuth:**	90 / -

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
125 mm Auger	SPT 1, 0, 1 N=1		-3.0	6.0					VS	
			-4.0	7.0						
			-5.0				CLAY, high plasticity, light grey, with a trace of fine grained sand	W		
			-6.0	8.0					S	
			-7.0	9.0						

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Refer to Explanation Sheets Attached for Classification Systems

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Rock-Soil-Water

Borehole Log

Borehole No: **BH02**

Sheet: 3 of 3

Job No: PSM2043

Client:	Ionic Management Pty Ltd	**Date commenced:**	16/11/2012
Principal:		**Date completed:**	16/11/2012
Project:	LOT 1, DP 859608 BURROWAY ROAD	**Logged by:**	CF
Site location:	Homebush Bay, NSW	**Checked by:**	AS

Drilling contractor:	Macquarie Drilling	**R.L. surface:**	2.5 m	**Vertical datum:**	AHD (m)
Equipment type:	HYDRAPOWER SCOUT VI Rig	**Easting:**	322181	**Horizontal datum:**	MGA56
		Northing:	6255775	**Inclination / azimuth:**	90 / -

Method	Samples	Water	R.L. (m)	Depth (m)	Graphic Log	USCS Symbol	Material (SOIL TYPE; plasticity or particle characteristics, colour, secondary and minor components / ROCK TYPE; weathering, particle characteristics, colour, secondary and minor components)	Moisture Condition	Estimated Strength	Structure and Additional Observations
125 mm Auger			-8.0	11.0			Some gravel up to 60 mm occurs for 300 mm	W	S ST F	
			-9.0							
				12.0			SANDSTONE, extremely weathered, coarse, white/grey		R0	300 mm of sandstone observed on auger when removed from the ground
			-10.0				Continued to core log			
				13.0						
			-11.0							
				14.0						
			-12.0							

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Rock-Soil-Water

Borehole No: **BH02**

Sheet: 1 of 2

Job No: PSM2043

Cored Borehole Log

Client:	Ionic Management Pty Ltd	**Date commenced:**	16/11/2012
Principal:		**Date completed:**	16/11/2012
Project:	LOT 1, DP 859608 BURROWAY ROAD	**Logged by:**	CF
Site location:	Homebush Bay, NSW	**Checked by:**	AS

Drilling contractor:	Macquarie Drilling	**R.L. surface:**	2.5 m	**Vertical datum:**	AHD (m)
Equipment type:	HYDRAPOWER SCOUT VI rig	**Easting:**	322181 m	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	6255775 m	**Inclination / azimuth:**	90 /

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
		13	10.5								
			11.0								
		14	11.5								
			12.0		Continued from non-cored borehole log						
	Water table at 2.0 m depth	15	12.5		SANDSTONE; light brown grey and yellow, banded, corse grained, sub horizontal bedding	HW			100		BG, 25°, PL, Ro3, CL, 5 - 10mm
			13.0								BG, 22°, PL, Ro3, KL
		16	13.5								BG, 16°, UN, Ro3, KL
			14.0			SW					BG, 17°, PL, Ro3, KL
		17	14.5								BG, 0°, PL, Ro2, CL, 5 - 10mm

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Engineering Consultants
Rock-Soil-Water

Borehole No: **BH02**

Sheet: 2 of 2

Job No: PSM2043

Cored Borehole Log

Client:	Ionic Management Pty Ltd	**Date commenced:**	16/11/2012
Principal:		**Date completed:**	16/11/2012
Project:	LOT 1, DP 859608 BURROWAY ROAD	**Logged by:**	CF
Site location:	Homebush Bay, NSW	**Checked by:**	AS

Drilling contractor:	Macquarie Drilling	**R.L. surface:**	2.5 m	**Vertical datum:**	AHD (m)
Equipment type:	HYDRAPOWER SCOUT VI rig	**Easting:**	322181 m	**Horizontal datum:**	MGA56
Coring size / method:	NMLC	**Northing:**	6255775 m	**Inclination / azimuth:**	90 /

Testing	Water	RL (m)	Depth (m)	Graphic Log	Material Description ROCK TYPE; particle characteristics, colour, structure, secondary and minor components	Weathering	Estimated Strength S0 S1 S2 S3 S4 S5 R0 R1 R2 R3 R4 R5	Point Load Index Is (50) (MPa)	RQD (%)	Defect Spacing (mm) 10 30 100 300 1000	Defect Description / Comments Type, Inclination, Shape, Roughness, Infill Type, Infill Thickness, Number
	Water table at 2.0 m depth	18	15.5		SANDSTONE; light brown grey and yellow, banded, corse grained, sub horizontal bedding	SW			100		BG, 7°, PL, Ro2, CL, 10 - 50mm BG, 13°, PL, Ro2, CL, 5 - 10mm
			16.0								BG, 0°, UN, Ro2, CL, 1 - 5mm
		19	16.5						95		BG, 12°, PL, Ro2, CL, 1 - 5mm
			17.0								
		20	17.5								BG, 12°, PL, Ro3, CL, 1 - 5mm
			18.0								
					End of Hole at 18.1m.						
		21	18.5								
			19.0								
		22	19.5								

File Name: PSM2043 CORED BOREHOLE LOGS REV1.GPJ Print date: 26/11/12

Ionic Management Pty Ltd
LOT 1, DP 859608 Burroway Road
Homebush Bay, NSW
GEOTECHNICAL INVESTIGATION
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