J1601146 001 L Rev0 11 April 2017

Wave Park Group
Email: bmccarthy@waveparkgroup.com

Attention: Ben McCarthy

GEOTECHNICAL ASSESSMENT
URBNSURF SYDNEY
CNR HILL ROAD AND HOLKER BUSWAY, SYDNEY OLYMPIC PARK

Dear Ben,

1. INTRODUCTION

This letter presents Galt Geotechnics Pty Ltd's (Galt's) geotechnical assessment of the proposed Urbnsurf wave park at the corner of Hill Road and Holker Busway, Sydney Olympic Park (the "site").

This assessment has been based on:

1. Geotechnical investigation by WSP Parsons Brinkerhoff (WSP) (report reference 2270060A-GEO-REP-470A RevC dated 2 August 2016); and
2. Geophysical investigation by GBG Australia (GBG) (report reference GBGA2031_Draft dated 16 March 2017).
3. Various communications with you and Keller Ground Engineering (Keller).

Galt has not carried out any investigation to confirm the findings of the above studies.

2. SITE DESCRIPTION AND PROPOSED DEVELOPMENT

The site is located on an existing parking lot to the east of the intersection of Hill Road and Holker Busway in the Sydney Olympic Park. It is roughly rectangular in plan and covers some 32,000 m^2. Provided surface contours show that the existing surface falls from about RL 9 m AHD along the southeast boundary to about RL 4.5 m AHD along the northwest boundary.

Several drainage features are present in the area. Haslams Creek is located immediately south of the site and the Narawang Wetland is located directly to the north.

Fill was apparently placed on the site at various times from the 1950s to about 20 years ago.

The proposed development includes:

- An HDPE lined lagoon with retaining walls along the northwestern and northeastern boundaries;
- A central plinth (wave generator platform) extending through the middle of the lagoon from the northern corner;
- Various buildings along the "beach" on the southwestern edge of the lagoon (changerooms, shops, café, pro-shop, etc.)

The maximum water depth will be about 3.8 m at the northern corner and the floor of the lagoon slopes upwards to the beach.

Earthworks will be balanced cut-to-fill to form the required shape of the lagoon. The maximum depth of cut and fill is expected to be about 2 m.

The proposed layout is presented on Figure 1.

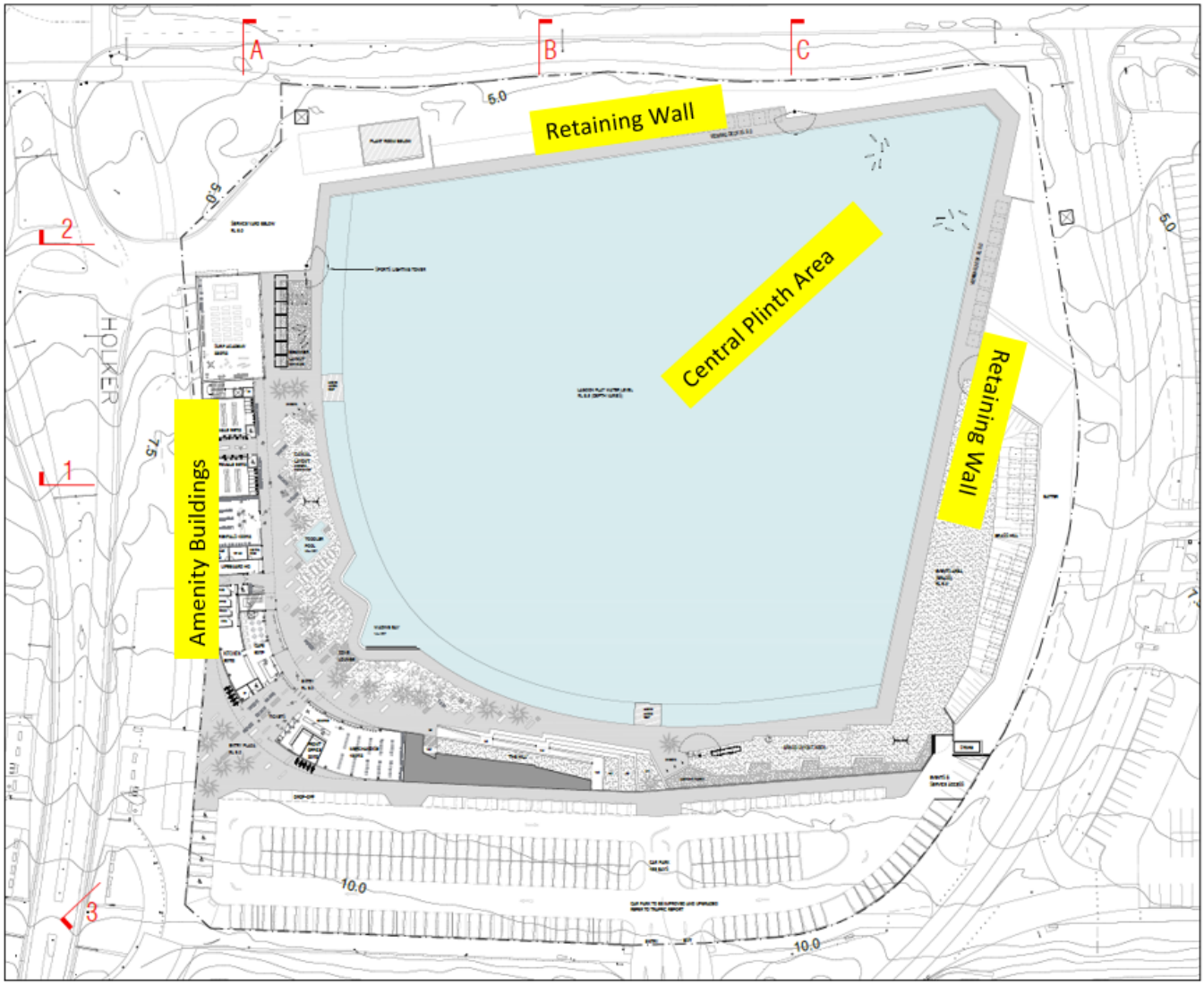


Figure 1: Site Layout

3. SCOPE OF SITE ASSESSMENT

The geotechnical and geophysical studies completed to date include:

- Drilling of seventeen boreholes to depths ranging from 3.0 m to 21.9 m (typically less than 10.5 m deep);
- Thirteen cone penetration tests (CPTs) to depths ranging from 0.1 m to 19.7 m (only three tests extended through the fill and into the underlying residual strata);
- Multi-channel Analysis of Surface Waves (MASW) along eight sections;
- Electrical Resistivity Imaging (ERI) along eight sections;
- Frequency Domain Electromagnetics (FDEM) over the entire site.

Extracts from the GBG report are presented in Attachment A.

4. SUBSURFACE AND GROUNDWATER CONDITIONS

The site is underlain by the following stratigraphy as noted by WSP and generally confirmed by the subsequent geophysical surveys:

Layer	Thickness (m)	Description
Uncontrolled Fill	5 – 9	Variable mixtures of GRAVEL, SAND and CLAY. Sand and gravel range from fine to coarse grained, and clay range from low to high plasticity. Fragments of bricks, concrete, timber, steel and plastic are present throughout this layer. The consistency is highly variable. Most of the CPTs and boreholes stopped in this layer due to refusal on an obstruction.
Estuarine Deposits	0 – 5	Silty CLAY, medium to high plasticity, dark brown and grey, trace fine sand and seashell fragments throughout. Typically firm. Not encountered at all test locations.
Alluvial Deposits	3 - 5	CLAY / Silty CLAY, medium to high plasticity, dark brown, with some fine grained gravel and seashell fragments throughout. Typically stiff.
Residual Soil	2 - 8	CLAY, medium to high plasticity, firm to very stiff.
Sandstone	Unknown	Highly weathered to fresh, fine to medium grained, medium to very high strength.

We note that the above stratigraphy is based on a limited number of boreholes and CPTs which extended through the full profile.

Groundwater was recorded in the various boreholes at depths ranging from 3.6 m to 7.3 m (about 1 – 2 m AHD).

5. DISCUSSION

5.1. SITE CLASSIFICATION

Due to the presence of uncontrolled fill, the site is classed as Class P in accordance with AS2870-2011.

Without suitable engineering, we estimate that settlements of up to about 250 mm may be expected below parts of the site where the applied load (due to fill and / or water) is greatest and where the underlying fill and soft estuarine soils are thickest.

5.2. PROPOSED GROUND IMPROVEMENT

The following has been proposed by Keller:

- Bulk earthworks (cut-to fill) to form the approximate shape of the lagoon floor.
- High Energy Impact Compaction over the entire site to provide a uniform, stiff, soil “raft” and a load transfer platform for the Rigid Inclusions (see below). The compaction is carried out using a multi-sided roller (3, 4 or 5 sided) towed by a tractor. Final shaping will be done following the compaction.
- Installation of Rigid Inclusions (RIs) which are essentially 350mm diameter, unreinforced concrete columns which extend through the estuarine layer and into the top of the stiff alluvium. These will be installed below the retaining walls, wave generator plinth and the buildings. According to Keller, these RIs are intended to reduce the total settlements by a factor of between 3 and 5.

We note the following regarding the possible settlements below the various structures and the lagoon floor:

- We understand that total settlements of the order of 20 mm to 70 mm may occur below the various structures, however, the compacted soil raft will act to reduce the differential settlements of the structures. We recommend that allowance is made for such settlements in the design such that the settlements do not affect the overall performance of the structures and / or remedial measures can be readily implemented.
- The central and southern part of the lagoon requires up to 2 m of cut, and the northern and retaining wall batters require up to 2 m of fill. The HDPE liner is sensitive to differential settlements which we estimate could be in the order of 200 mm with most of the settlement likely to occur in the west corner and north-west part of the lagoon. Most of the differential movement is expected to occur along the interface with the structures which will be supported by the RIs.

  Various options are being considered to address this issue, including:

  - Surcharge loading;
  - Provision of a reinforcing layer (e.g. geogrid) below the liner;
  - Provision of a secondary impermeable liner (e.g. geosynthetic clay liner) below the liner; and/or
  - Provide flexible joints or overlaps along the edges of the structures.

6. CLOSURE

We draw your attention to Attachment B of this letter, “Understanding your Report”. The information provided within is intended to inform you as to what your realistic expectations of this report should be. Guidance is also provided on how to minimize risks associated with groundworks for this project. This information is provided not to reduce the level of responsibility accepted by Galt, but to ensure that all parties who rely on this report are aware of the responsibilities each assumes in so doing.

We trust that the information provided satisfies your present requirements and meets with your approval. Should you have any queries please do not hesitate to contact this office.

Yours Faithfully,

GALT GEOTECHNICS PTY LTD

Rick Piovesan CPEng

Geotechnical Engineer

O:\Jobs\2016\J1601146 - Wave Park Advice Sydney Olympic Park\03 Correspondence\J1601146 001 L Rev0.docx

ATTACHMENT A

Extracts from GBG Report

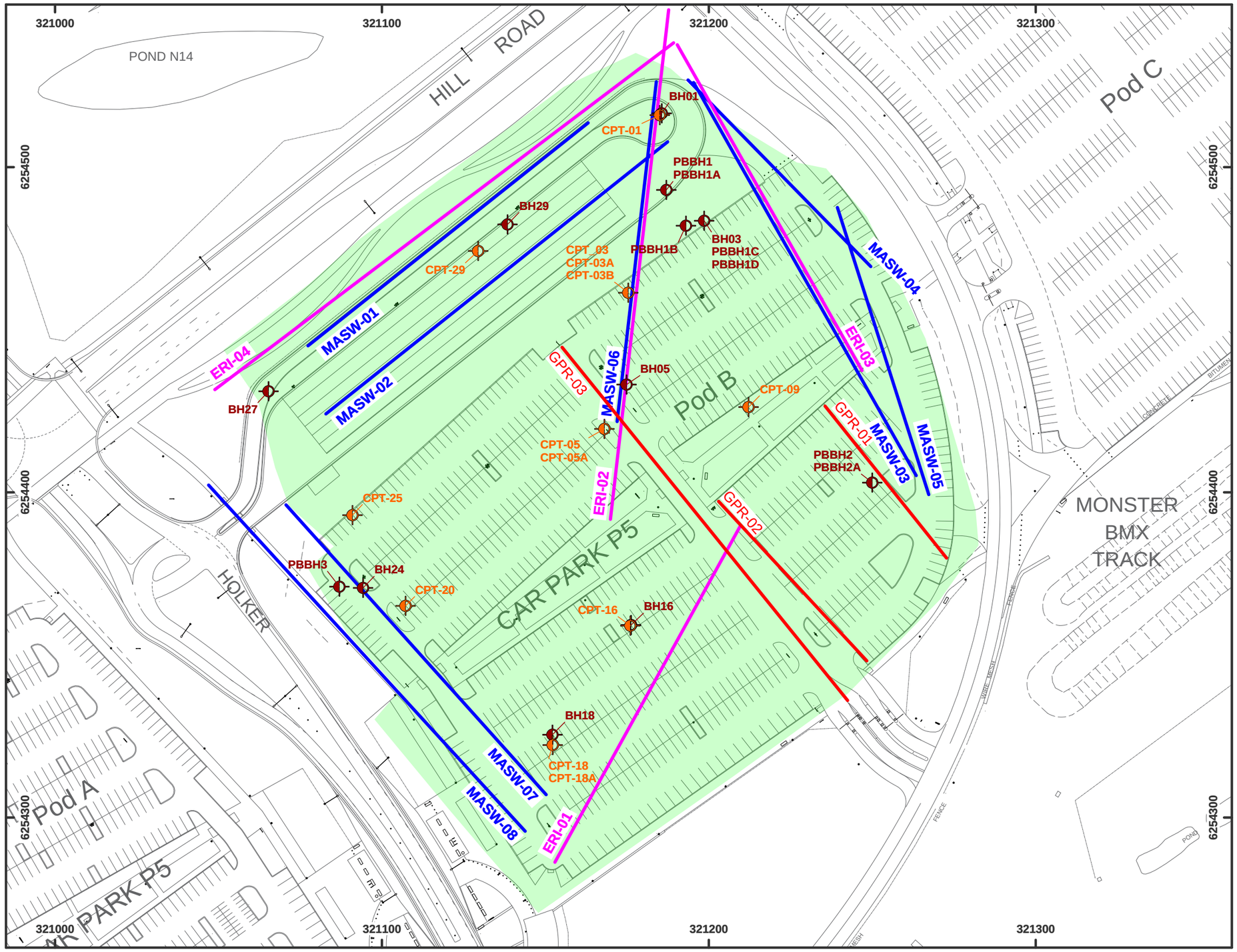
The GBG Group

GBGMAPS
Advanced Subsurface Investigations

GBG Australia

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

EXTENT OF GEOPHYSICAL DATA ACQUISITION



Legend

- Ground Penetrating Radar Transect transect (GBG, 2017)
- Multi-channel analysis of surface waves transect (GBG, 2017)
- Electrical resistivity imaging transect (GBG, 2017)
- Extent of frequency domain electromagnetic data acqusition (GBG, 2017)
- Borehole location (WSP Parsons Brinckerhoff, 2016)
- Cone penetrometer test location (WSP Parsons Brinckerhoff, 2016)

0 20 40 60 80 100

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

NOTES

Map Projection GDA 94, MGA Zone 50
Survey DRG. NO. 007-P-P0090 Rev A Sydney Olympic Park
Drawing to be used in conjunction with Report GBGA2031

N

Date	7 March 2017	Paper Size	A3
Scale	1:1250	Drawn	AHWS
Drawing	GBGA2031-01	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia
G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS
Advanced Subsurface Investigations
GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

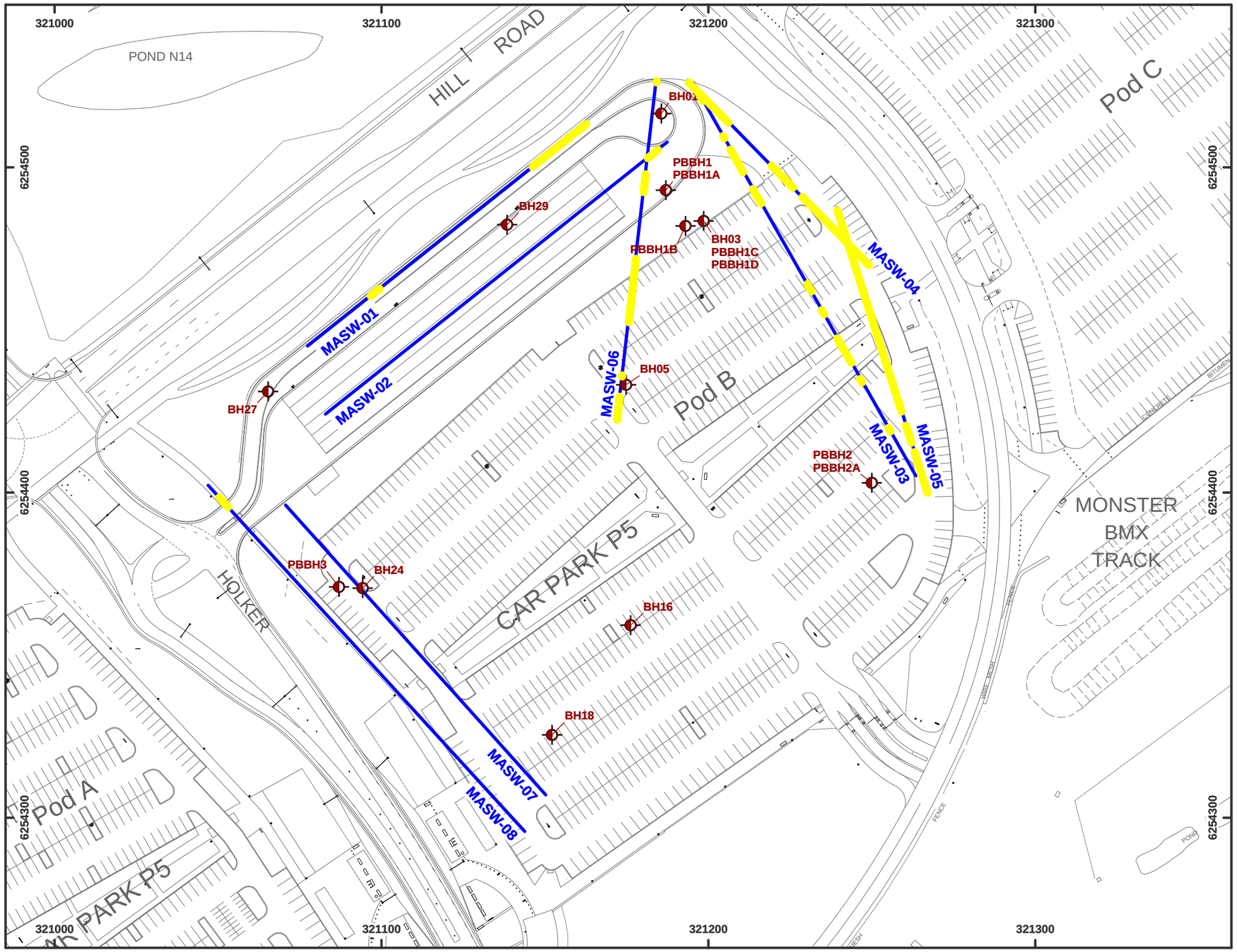
The GBG Group

GBGMAPS
Advanced Subsurface Investigations

GBG Australia

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

AREAS WITH VERY LOW S-WAVE VELOCITY < 150 M/S



Legend

- Multi-channel analysis of surface waves transect (GBG, 2017)
- Soft areas within estuarine material with very low S-wave velocity < 150 m/s
- Borehole location (WSP Parsons Brinckerhoff, 2016)
- Cone penetrometer test location (WSP Parsons Brinckerhoff, 2016)

0 20 40 60 80 100

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

NOTES

Map Projection GDA 94, MGA Zone 50
Survey DRG. NO. 007-P-P0090 Rev A Sydney Olympic Park
Drawing to be used in conjunction with Report GBGA2031

N

Date	7 March 2017	Paper Size	A3
Scale	1:1250	Drawn	AHWS
Drawing	GBGA2031-02	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia
G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS
Advanced Subsurface Investigations
GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

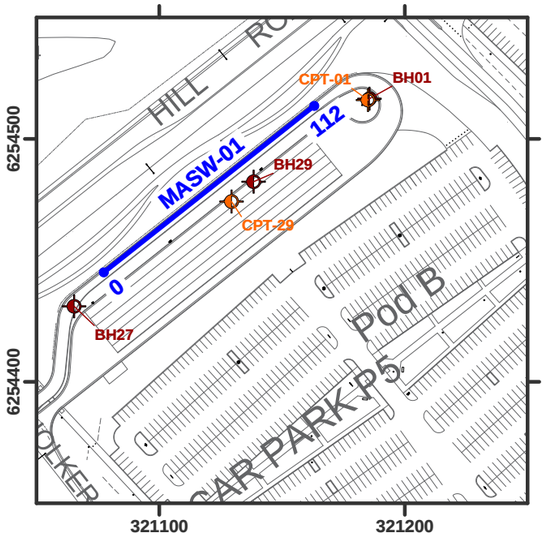
The GBG Group

GBGMAPS Advanced Subsurface Investigations

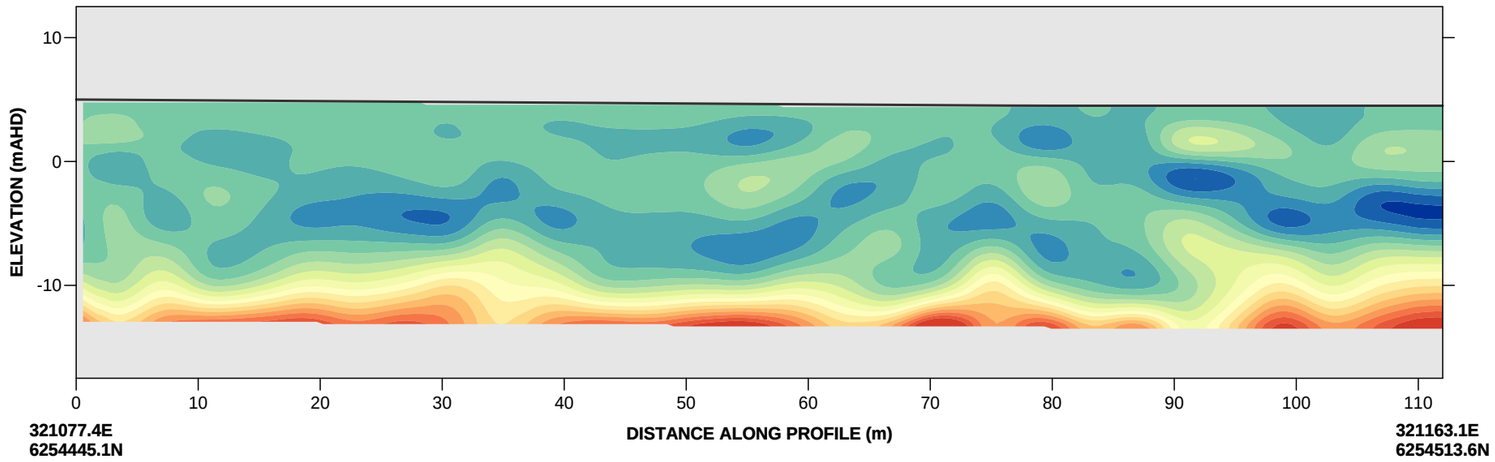
GBG Australia

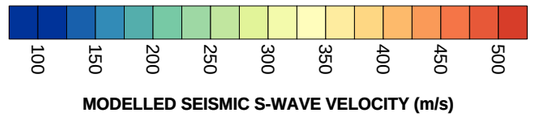
ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW)

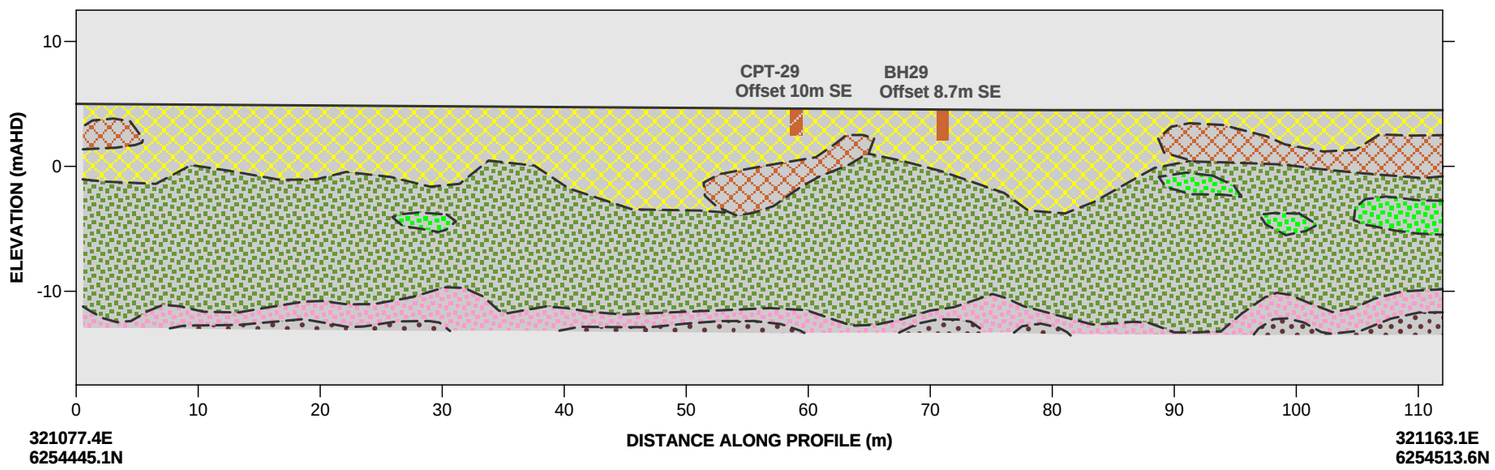


TRANSECT 1 - S-WAVE VELOCITY SECTION





TRANSECT 1 - INTERPRETED SECTION



Geophysical Interpretation*

- Mixed FILL material. Moderate S-wave velocity (225m/s < Vs < 350m/s).
- Mixed FILL material with reduced stiffness/compaction. Low S-wave velocity (Vs < 225m/s).
- ESTUARINE material. Interpreted increasing stiffness with depth. Low to moderate S-wave velocity (150m/s < Vs < 350m/s)
- ESTUARINE material with reduced stiffness. Very low S-wave velocity (Vs < 150m/s)
- Possible RESIDUAL SOIL. Moderate to high S-wave velocity (350m/s < Vs < 450m/s).
- Possible SANDSTONE. Weathered, low to moderate strength. High S-wave velocity (Vs > 450m/s).

* Refer to GBG report GBGA2031 for details.

Borehole and CPT Lithological Description**

- FILL: Mixtures of GRAVEL, SAND and CLAY of highly variable consistency. Fragments of bricks, concrete, timber, steel and plastic encountered.
- ESTUARINE: Silty CLAY / CLAY. Medium to high plasticity.
- RESIDUAL SOIL: CLAY. Medium to high plasticity, interpreted firm to very stiff consistency
- ROCK: Sandstone. Highly weathered to fresh, fine to medium grained, medium to very hard rock strength

Sections with diagonal cross hatch are inferred from CPT response

** Refer to WSP Parsons Brinckerhoff report 2270060A-GEO-REP-470A for details

0 10 20 30 40

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

Date	7 March 2017	Paper Size	A3
Scale	1:500	Drawn	AHWS
Drawing	GBGA2031-03	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia
G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS Advanced Subsurface Investigations
GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

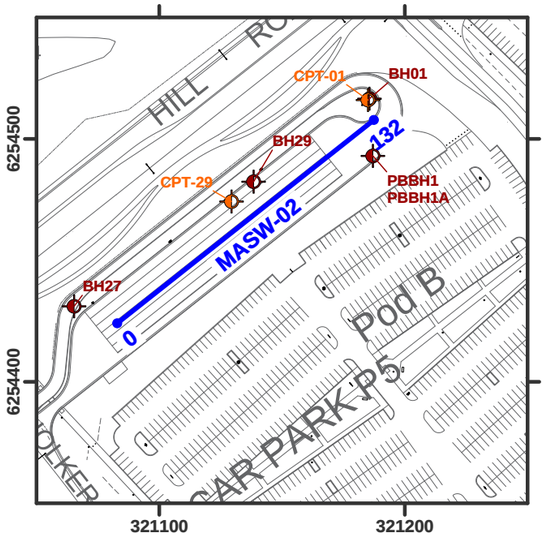
The GBG Group

GBGMAPS Advanced Subsurface Investigations

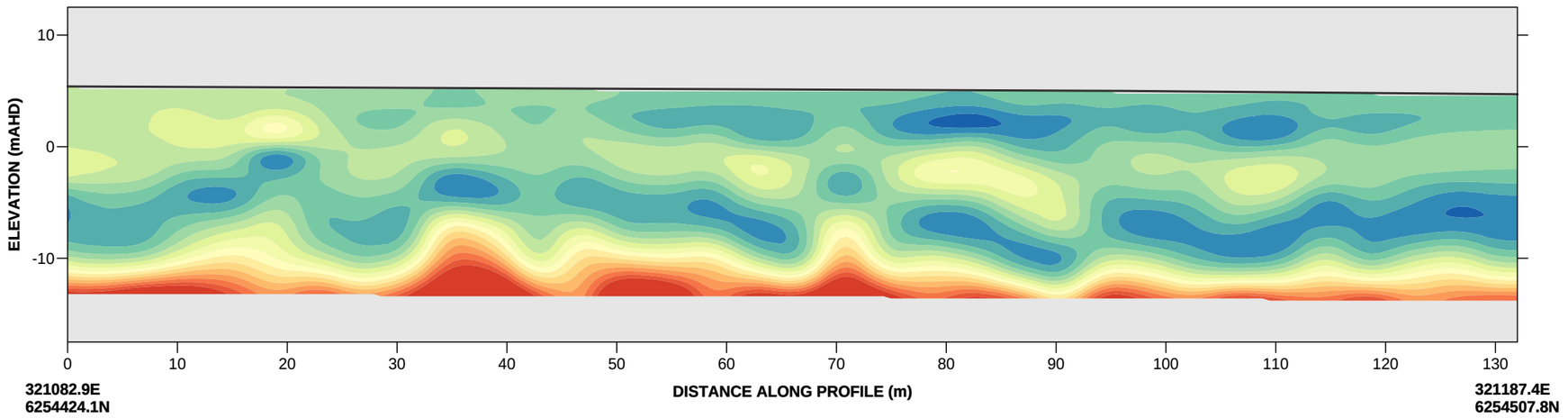
GBG Australia

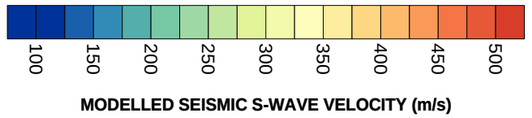
ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW)

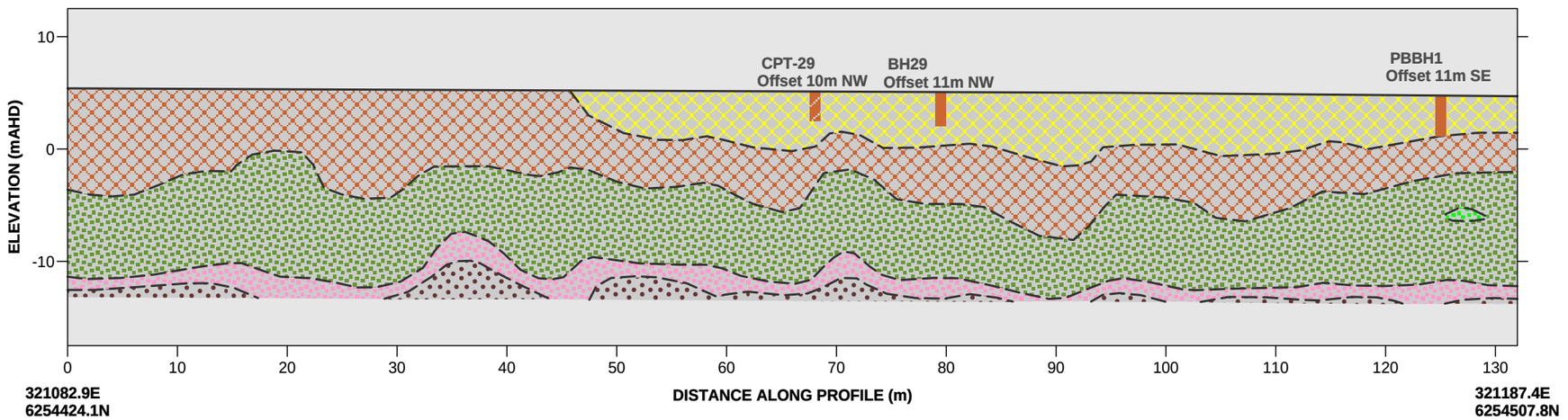


TRANSECT 2 - S-WAVE VELOCITY SECTION





TRANSECT 2 - INTERPRETED SECTION



Geophysical Interpretation*

- Mixed FILL material. Moderate S-wave velocity (225m/s < Vs < 350m/s).
- Mixed FILL material with reduced stiffness/compaction. Low S-wave velocity (Vs < 225m/s).
- ESTUARINE material. Interpreted increasing stiffness with depth. Low to moderate S-wave velocity (150m/s < Vs < 350m/s)
- ESTUARINE material with reduced stiffness. Very low S-wave velocity (Vs < 150m/s)
- Possible RESIDUAL SOIL. Moderate to high S-wave velocity (350m/s < Vs < 450m/s).
- Possible SANDSTONE. Weathered, low to moderate strength. High S-wave velocity (Vs > 450m/s).

* Refer to GBG report GBGA2031 for details.

Borehole and CPT Lithological Description**

- FILL: Mixtures of GRAVEL, SAND and CLAY of highly variable consistency. Fragments of bricks, concrete, timber, steel and plastic encountered.
- ESTUARINE: Silty CLAY / CLAY. Medium to high plasticity.
- RESIDUAL SOIL: CLAY. Medium to high plasticity, interpreted firm to very stiff consistency
- ROCK: Sandstone. Highly weathered to fresh, fine to medium grained, medium to very hard rock strength

Sections with diagonal cross hatch are inferred from CPT response

** Refer to WSP Parsons Brinckerhoff report 2270060A-GEO-REP-470A for details

0 10 20 30 40

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

Date	7 March 2017	Paper Size	A3
Scale	1:500	Drawn	AHWS
Drawing	GBGA2031-04	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia

G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS Advanced Subsurface Investigations

GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

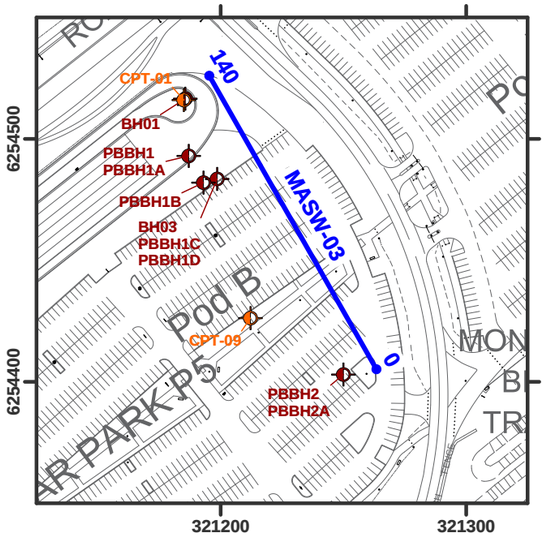
The GBG Group

GBGMAPS Advanced Subsurface Investigations

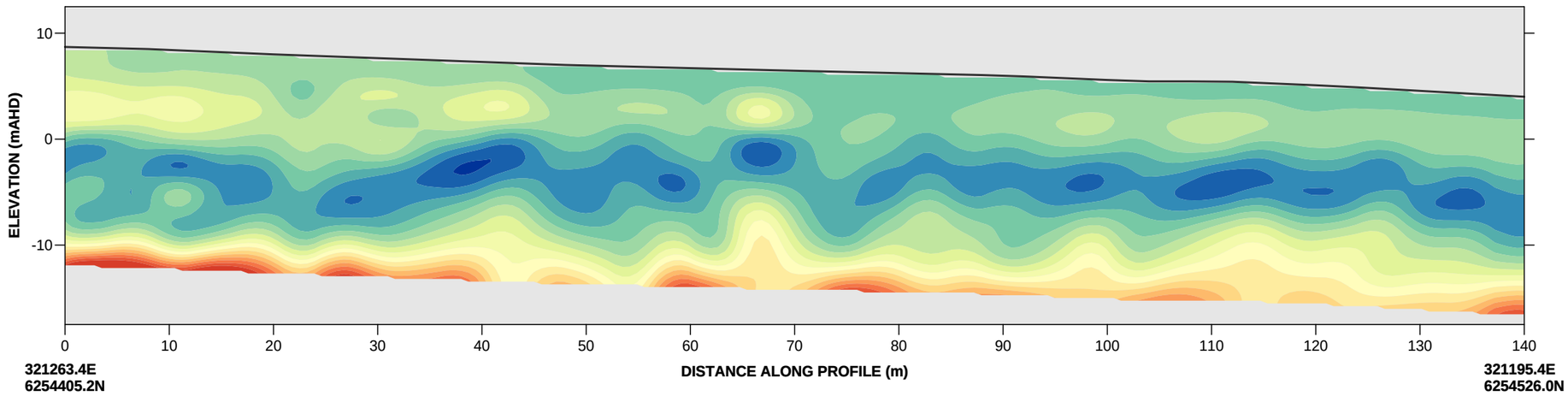
GBG Australia

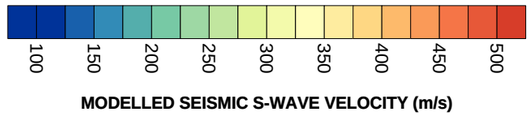
ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW)



TRANSECT 3 - S-WAVE VELOCITY SECTION



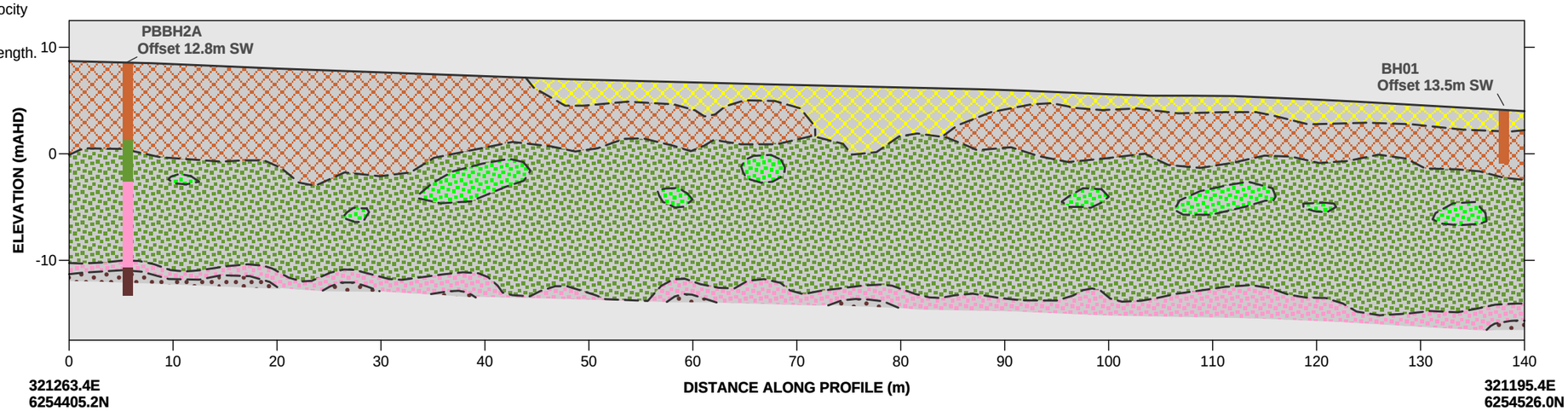


Geophysical Interpretation*

- Mixed FILL material. Moderate S-wave velocity (225m/s < Vs < 350m/s).
- Mixed FILL material with reduced stiffness/compaction. Low S-wave velocity (Vs < 225m/s).
- ESTUARINE material. Interpreted increasing stiffness with depth. Low to moderate S-wave velocity (150m/s < Vs < 350m/s)
- ESTUARINE material with reduced stiffness. Very low S-wave velocity (Vs < 150m/s)
- Possible RESIDUAL SOIL. Moderate to high S-wave velocity (350m/s < Vs < 450m/s).
- Possible SANDSTONE. Weathered, low to moderate strength. High S-wave velocity (Vs > 450m/s).

* Refer to GBG report GBGA2031 for details.

TRANSECT 3 - INTERPRETED SECTION



Borehole and CPT Lithological Description**

- FILL: Mixtures of GRAVEL, SAND and CLAY of highly variable consistency. Fragments of bricks, concrete, timber, steel and plastic encountered.
- ESTUARINE: Silty CLAY / CLAY. Medium to high plasticity.
- RESIDUAL SOIL: CLAY. Medium to high plasticity, interpreted firm to very stiff consistency
- ROCK: Sandstone. Highly weathered to fresh, fine to medium grained, medium to very hard rock strength

Sections with diagonal cross hatch are inferred from CPT response

** Refer to WSP Parsons Brinckerhoff report 2270060A-GEO-REP-470A for details

0 10 20 30 40

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

Date	7 March 2017	Paper Size	A3
Scale	1:500	Drawn	AHWS
Drawing	GBGA2031-05	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia

G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS Advanced Subsurface Investigations

GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

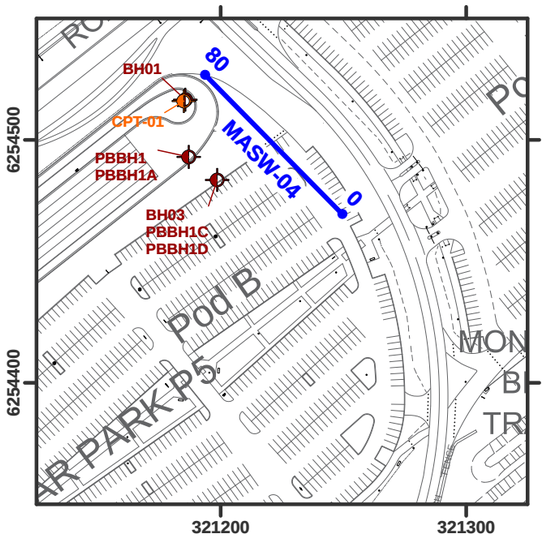
The GBG Group

GBGMAPS Advanced Subsurface Investigations

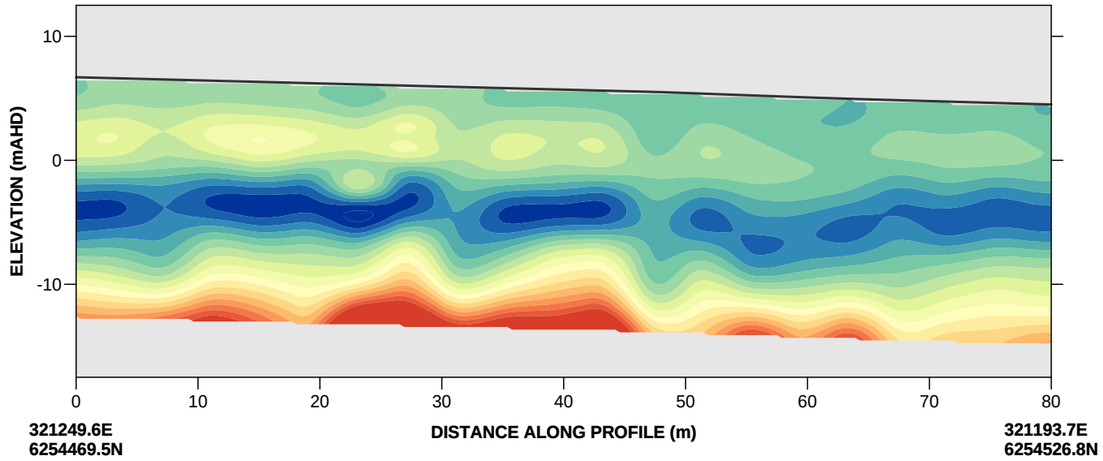
GBG Australia

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

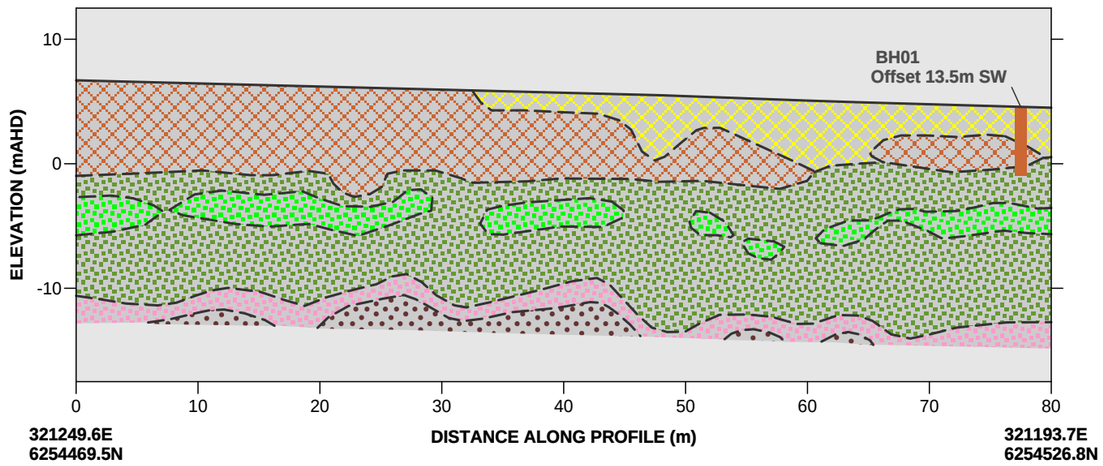
MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW)



TRANSECT 4 - S-WAVE VELOCITY SECTION



TRANSECT 4 - INTERPRETED SECTION



Geophysical Interpretation*

- Mixed FILL material. Moderate S-wave velocity (225m/s < Vs < 350m/s).
- Mixed FILL material with reduced stiffness/compaction. Low S-wave velocity (Vs < 225m/s).
- ESTUARINE material. Interpreted increasing stiffness with depth. Low to moderate S-wave velocity (150m/s < Vs < 350m/s)
- ESTUARINE material with reduced stiffness. Very low S-wave velocity (Vs < 150m/s)
- Possible RESIDUAL SOIL. Moderate to high S-wave velocity (350m/s < Vs < 450m/s).
- Possible SANDSTONE. Weathered, low to moderate strength. High S-wave velocity (Vs > 450m/s).

* Refer to GBG report GBGA2031 for details.

Borehole and CPT Lithological Description**

- FILL: Mixtures of GRAVEL, SAND and CLAY of highly variable consistency. Fragments of bricks, concrete, timber, steel and plastic encountered.
- ESTUARINE: Silty CLAY / CLAY. Medium to high plasticity.
- RESIDUAL SOIL: CLAY. Medium to high plasticity, interpreted firm to very stiff consistency
- ROCK: Sandstone. Highly weathered to fresh, fine to medium grained, medium to very hard rock strength

Sections with diagonal cross hatch are inferred from CPT response

** Refer to WSP Parsons Brinckerhoff report 2270060A-GEO-REP-470A for details

0 10 20 30 40

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

Date	7 March 2017	Paper Size	A3
Scale	1:500	Drawn	AHWS
Drawing	GBGA2031-06	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia

G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS Advanced Subsurface Investigations

GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

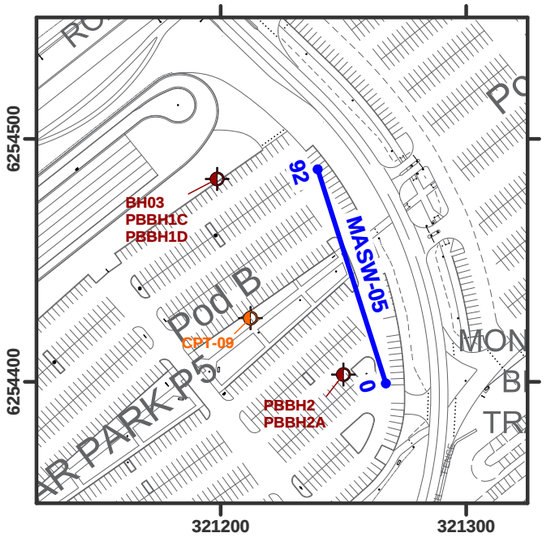
The GBG Group

GBGMAPS Advanced Subsurface Investigations

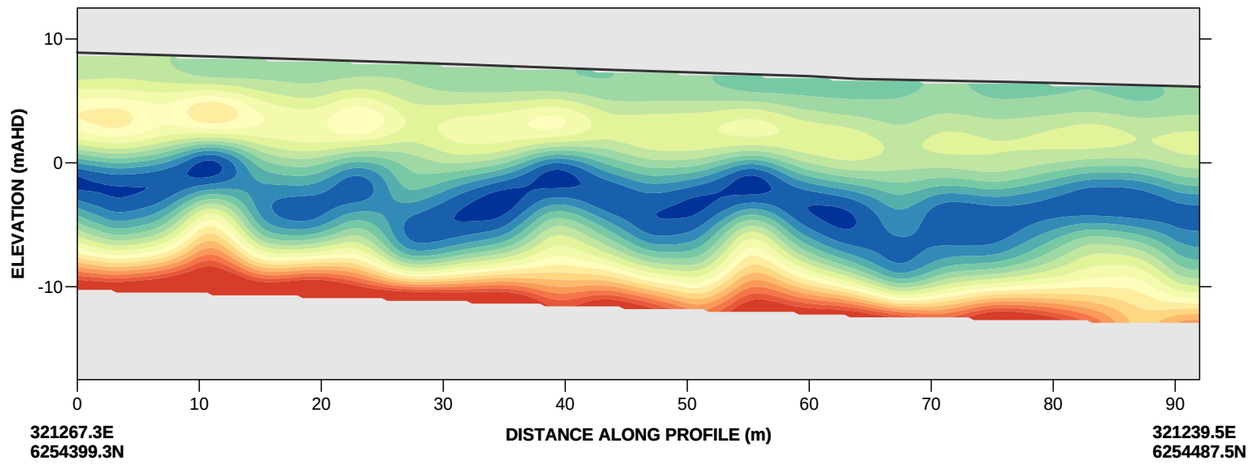
GBG Australia

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

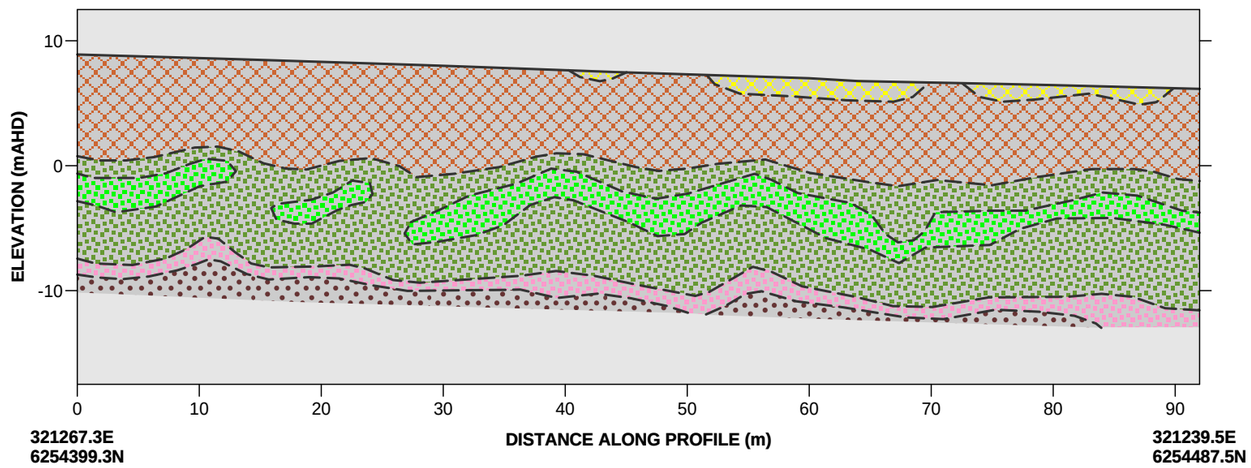
MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW)



TRANSECT 5 - S-WAVE VELOCITY SECTION



TRANSECT 5 - INTERPRETED SECTION



Geophysical Interpretation*

- Mixed FILL material. Moderate S-wave velocity (225m/s < Vs < 350m/s).
- Mixed FILL material with reduced stiffness/compaction. Low S-wave velocity (Vs < 225m/s).
- ESTUARINE material. Interpreted increasing stiffness with depth. Low to moderate S-wave velocity (150m/s < Vs < 350m/s)
- ESTUARINE material with reduced stiffness. Very low S-wave velocity (Vs < 150m/s)
- Possible RESIDUAL SOIL. Moderate to high S-wave velocity (350m/s < Vs < 450m/s).
- Possible SANDSTONE. Weathered, low to moderate strength. High S-wave velocity (Vs > 450m/s).

* Refer to GBG report GBGA2031 for details.

Borehole and CPT Lithological Description**

- FILL: Mixtures of GRAVEL, SAND and CLAY of highly variable consistency. Fragments of bricks, concrete, timber, steel and plastic encountered.
- ESTUARINE: Silty CLAY / CLAY. Medium to high plasticity.
- RESIDUAL SOIL: CLAY. Medium to high plasticity, interpreted firm to very stiff consistency
- ROCK: Sandstone. Highly weathered to fresh, fine to medium grained, medium to very hard rock strength

Sections with diagonal cross hatch are inferred from CPT response

** Refer to WSP Parsons Brinckerhoff report 2270060A-GEO-REP-470A for details

0 10 20 30 40

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

Date	7 March 2017	Paper Size	A3
Scale	1:500	Drawn	AHWS
Drawing	GBGA2031-07	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia

G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS Advanced Subsurface Investigations

GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

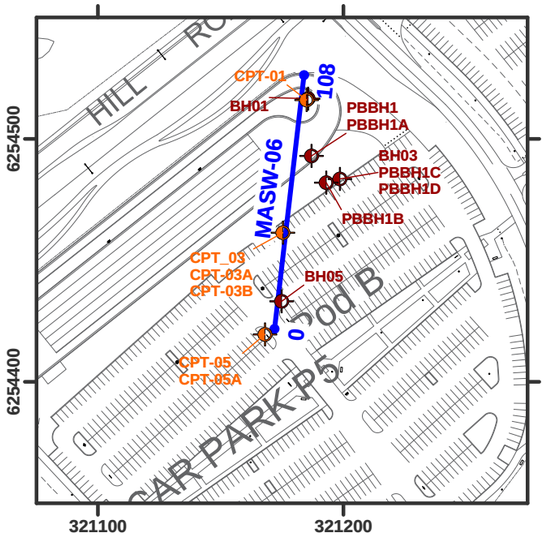
The GBG Group

GBGMAPS Advanced Subsurface Investigations

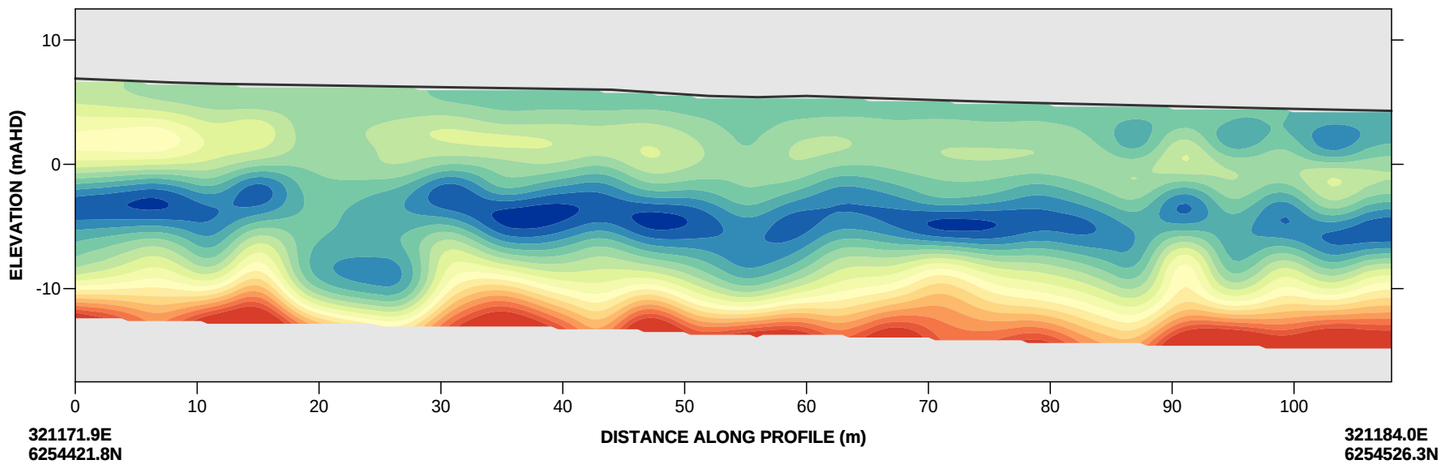
GBG Australia

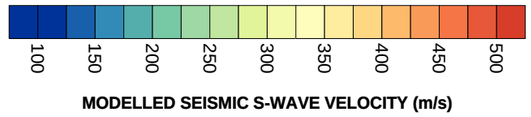
ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW)

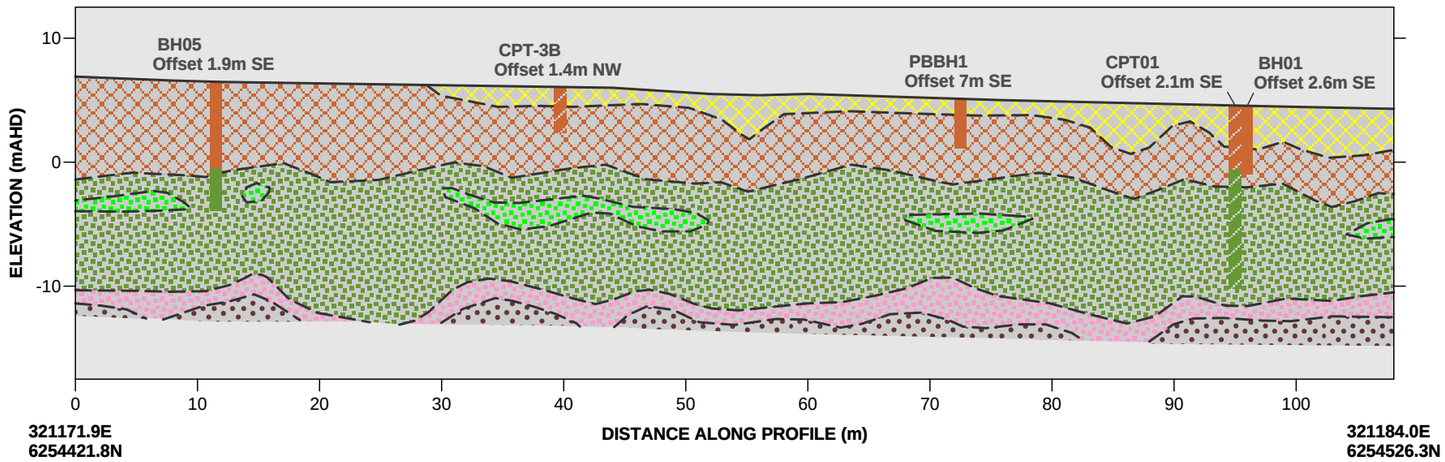


TRANSECT 6 - S-WAVE VELOCITY SECTION





TRANSECT 6 - INTERPRETED SECTION



Geophysical Interpretation*

- Mixed FILL material. Moderate S-wave velocity (225m/s < Vs < 350m/s).
- Mixed FILL material with reduced stiffness/compaction. Low S-wave velocity (Vs < 225m/s).
- ESTUARINE material. Interpreted increasing stiffness with depth. Low to moderate S-wave velocity (150m/s < Vs < 350m/s)
- ESTUARINE material with reduced stiffness. Very low S-wave velocity (Vs < 150m/s)
- Possible RESIDUAL SOIL. Moderate to high S-wave velocity (350m/s < Vs < 450m/s).
- Possible SANDSTONE. Weathered, low to moderate strength. High S-wave velocity (Vs > 450m/s).

* Refer to GBG report GBGA2031 for details.

Borehole and CPT Lithological Description**

- FILL: Mixtures of GRAVEL, SAND and CLAY of highly variable consistency. Fragments of bricks, concrete, timber, steel and plastic encountered.
- ESTUARINE: Silty CLAY / CLAY. Medium to high plasticity.
- RESIDUAL SOIL: CLAY. Medium to high plasticity, interpreted firm to very stiff consistency
- ROCK: Sandstone. Highly weathered to fresh, fine to medium grained, medium to very hard rock strength

Sections with diagonal cross hatch are inferred from CPT response

** Refer to WSP Parsons Brinckerhoff report 2270060A-GEO-REP-470A for details

0 10 20 30 40

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

Date	7 March 2017	Paper Size	A3
Scale	1:500	Drawn	AHWS
Drawing	GBGA2031-08	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia

G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS Advanced Subsurface Investigations

GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

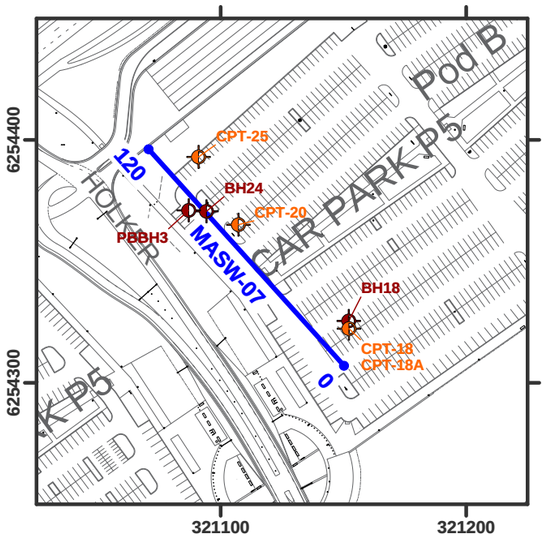
The GBG Group

GBGMAPS Advanced Subsurface Investigations

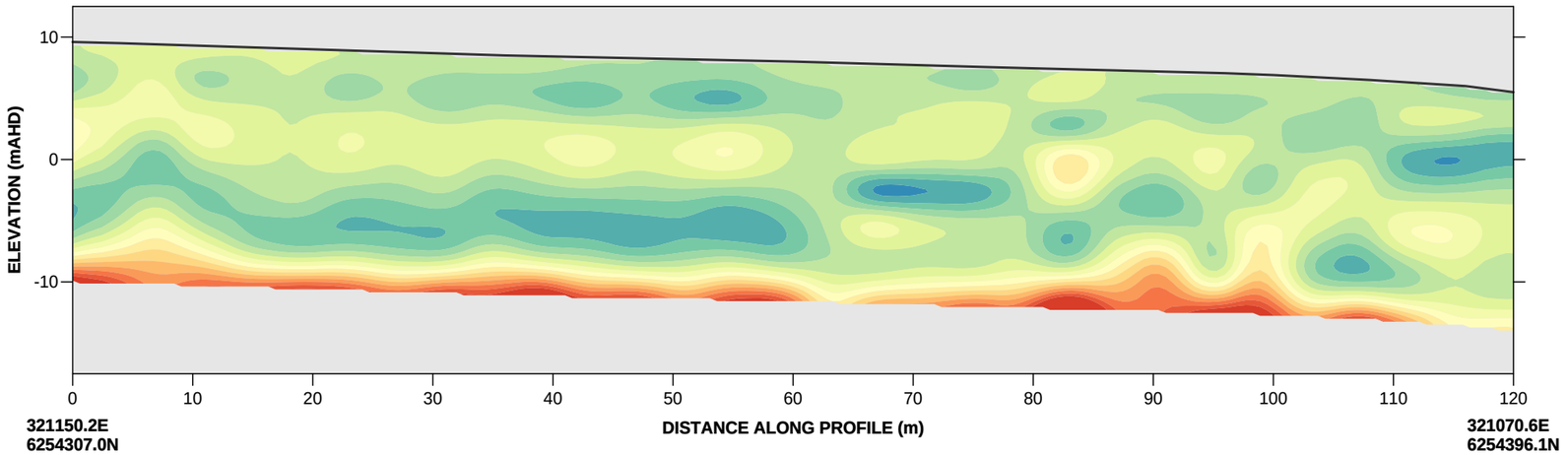
GBG Australia

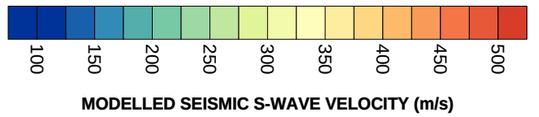
ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW)

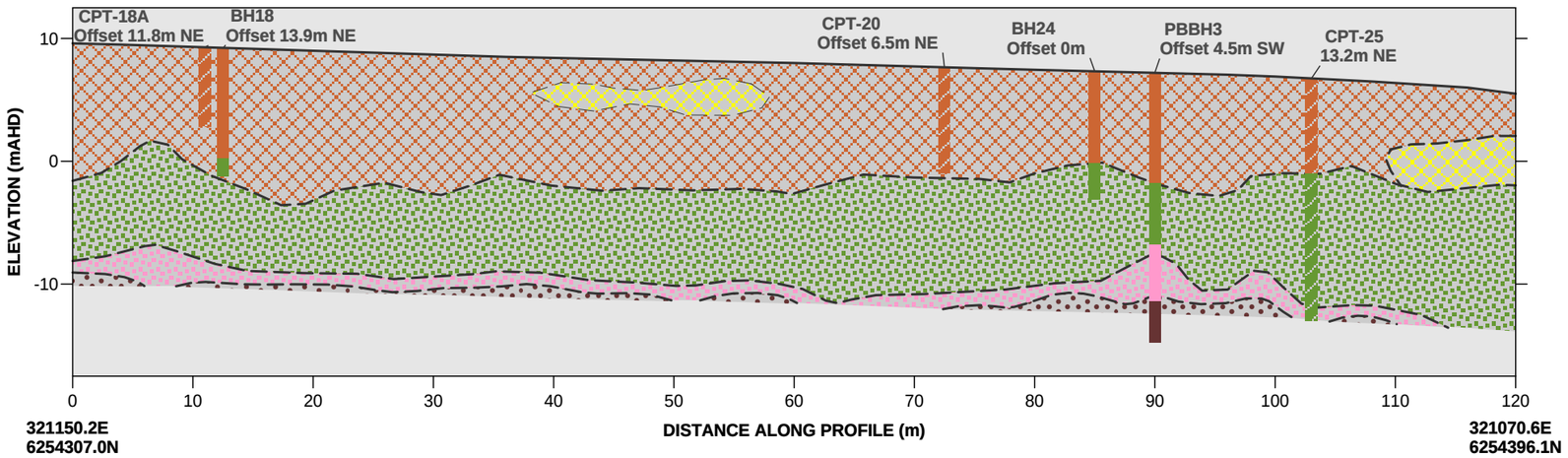


TRANSECT 7 - S-WAVE VELOCITY SECTION





TRANSECT 7 - INTERPRETED SECTION



Geophysical Interpretation*

- Mixed FILL material. Moderate S-wave velocity (225m/s < Vs < 350m/s).
- Mixed FILL material with reduced stiffness/compaction. Low S-wave velocity (Vs < 225m/s).
- ESTUARINE material. Interpreted increasing stiffness with depth. Low to moderate S-wave velocity (150m/s < Vs < 350m/s)
- ESTUARINE material with reduced stiffness. Very low S-wave velocity (Vs < 150m/s)
- Possible RESIDUAL SOIL. Moderate to high S-wave velocity (350m/s < Vs < 450m/s).
- Possible SANDSTONE. Weathered, low to moderate strength. High S-wave velocity (Vs > 450m/s).

* Refer to GBG report GBGA2031 for details.

Borehole and CPT Lithological Description**

- FILL: Mixtures of GRAVEL, SAND and CLAY of highly variable consistency. Fragments of bricks, concrete, timber, steel and plastic encountered.
- ESTUARINE: Silty CLAY / CLAY. Medium to high plasticity.
- RESIDUAL SOIL: CLAY. Medium to high plasticity, interpreted firm to very stiff consistency
- ROCK: Sandstone. Highly weathered to fresh, fine to medium grained, medium to very hard rock strength

Sections with diagonal cross hatch are inferred from CPT response

** Refer to WSP Parsons Brinckerhoff report 2270060A-GEO-REP-470A for details

0 10 20 30 40

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

Date	7 March 2017	Paper Size	A3
Scale	1:500	Drawn	AHWS
Drawing	GBGA2031-09	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia

G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS Advanced Subsurface Investigations

GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

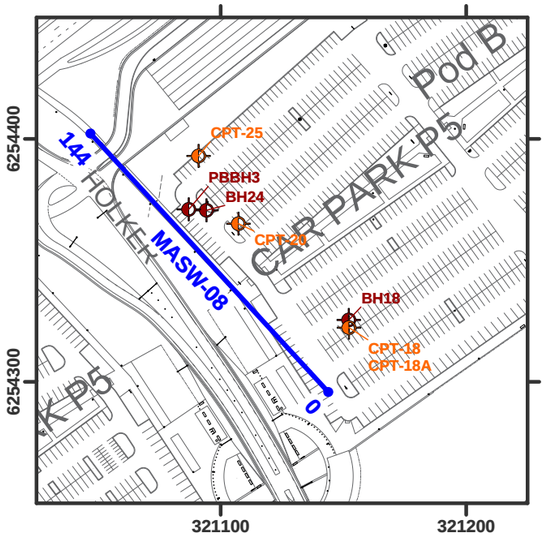
The GBG Group

GBGMAPS Advanced Subsurface Investigations

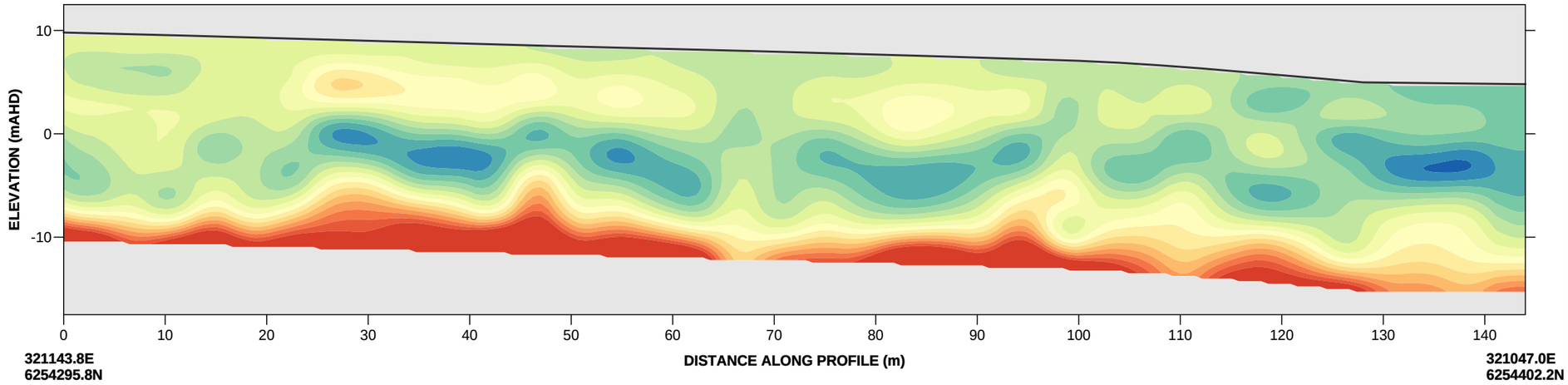
GBG Australia

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

MULTI-CHANNEL ANALYSIS OF SURFACE WAVES (MASW)



TRANSECT 8 - S-WAVE VELOCITY SECTION

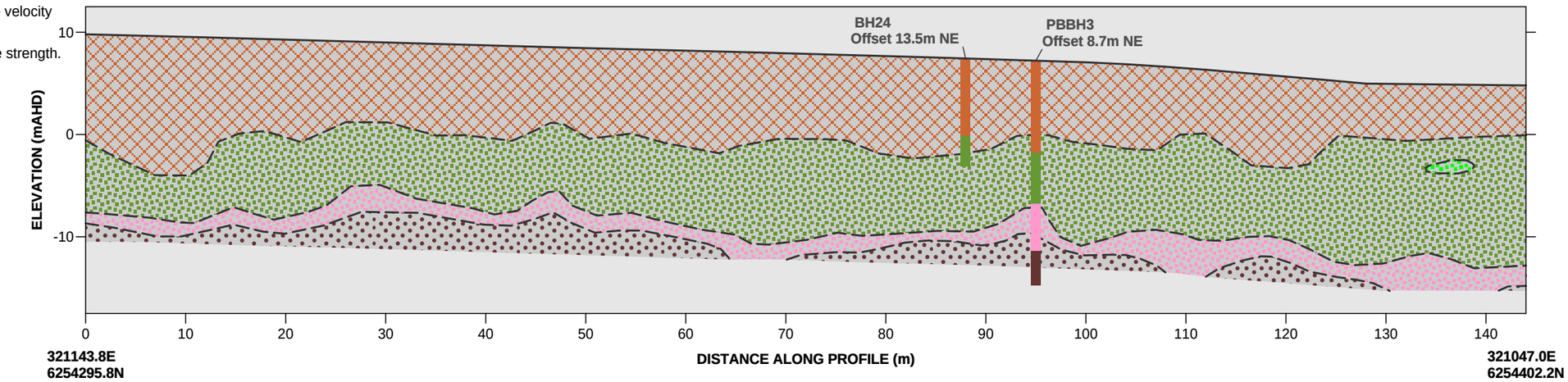


Geophysical Interpretation*

- Mixed FILL material. Moderate S-wave velocity (225m/s < Vs < 350m/s).
- Mixed FILL material with reduced stiffness/compaction. Low S-wave velocity (Vs < 225m/s).
- ESTUARINE material. Interpreted increasing stiffness with depth. Low to moderate S-wave velocity (150m/s < Vs < 350m/s)
- ESTUARINE material with reduced stiffness. Very low S-wave velocity (Vs < 150m/s)
- Possible RESIDUAL SOIL. Moderate to high S-wave velocity (350m/s < Vs < 450m/s).
- Possible SANDSTONE. Weathered, low to moderate strength. High S-wave velocity (Vs > 450m/s).

* Refer to GBG report GBGA2031 for details.

TRANSECT 8 - INTERPRETED SECTION



Borehole and CPT Lithological Description**

- FILL: Mixtures of GRAVEL, SAND and CLAY of highly variable consistency. Fragments of bricks, concrete, timber, steel and plastic encountered.
- ESTUARINE: Silty CLAY / CLAY. Medium to high plasticity.
- RESIDUAL SOIL: CLAY. Medium to high plasticity, interpreted firm to very stiff consistency
- ROCK: Sandstone. Highly weathered to fresh, fine to medium grained, medium to very hard rock strength

Sections with diagonal cross hatch are inferred from CPT response

** Refer to WSP Parsons Brinckerhoff report 2270060A-GEO-REP-470A for details

0 10 20 30 40

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

Date	7 March 2017	Paper Size	A3
Scale	1:500	Drawn	AHWS
Drawing	GBGA2031-10	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia

G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS Advanced Subsurface Investigations

GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

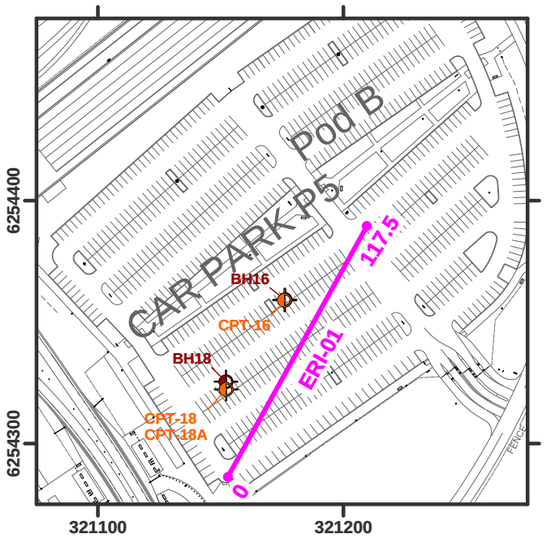
The GBG Group

GBGMAPS Advanced Subsurface Investigations

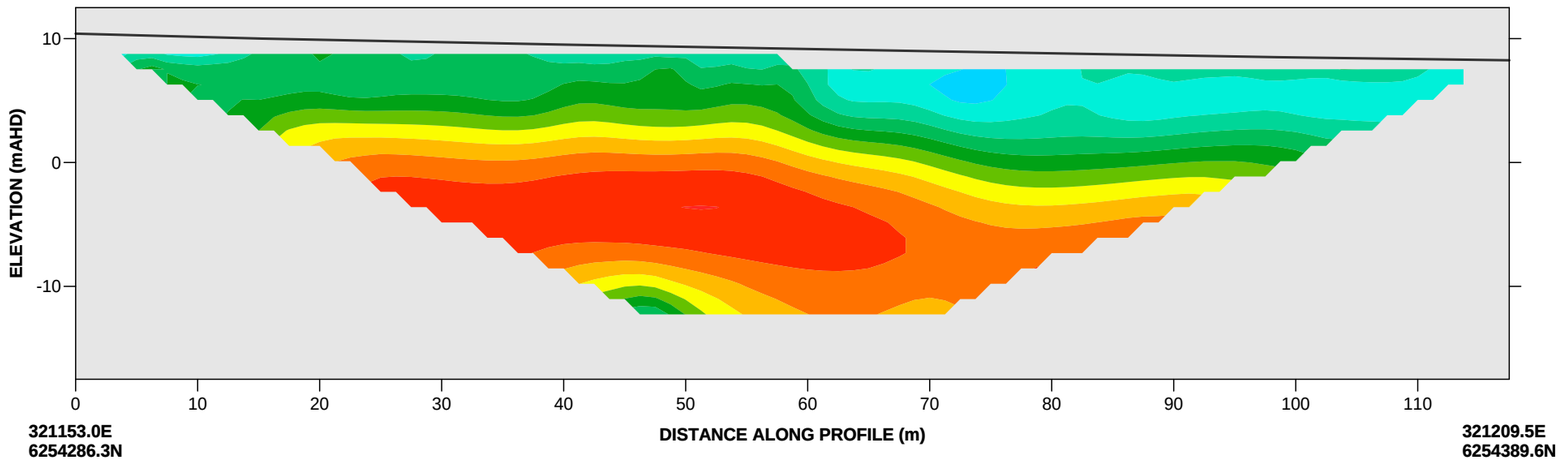
GBG Australia

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

ELECTRICAL RESISTIVITY IMAGING (ERI)



TRANSECT 1 - ELECTRICAL RESISTIVITY SECTION

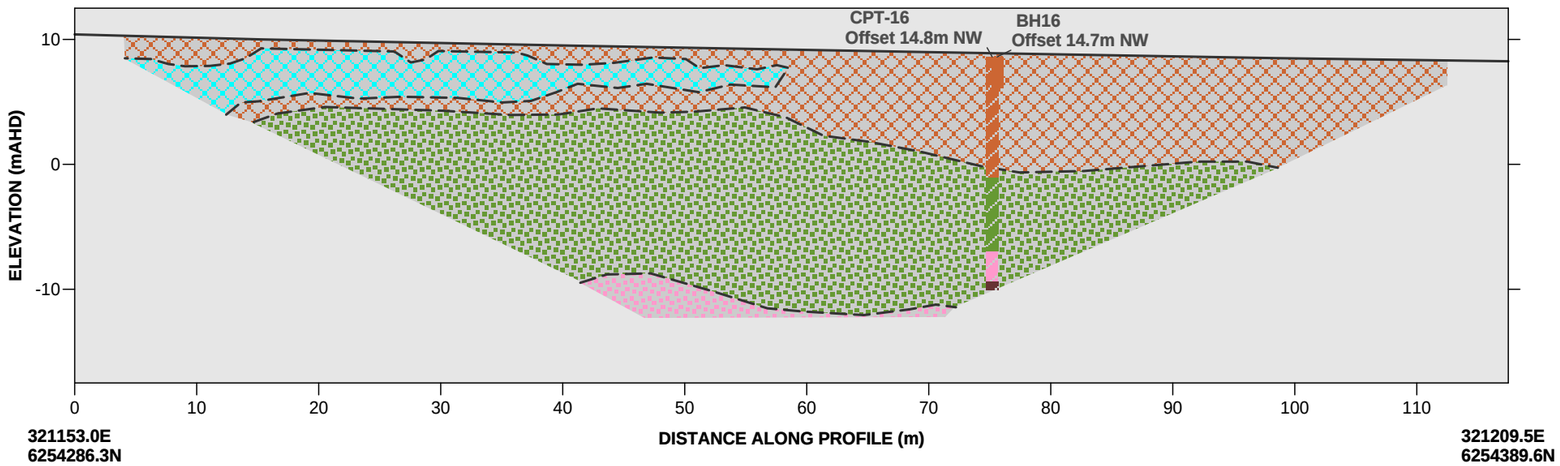


Geophysical Interpretation*

- Mixed FILL material. Moderate electrical resistivity (15Ωm < ρ < 160Ωm).
- Possible extent of capping over containment cell. Slightly decreased resistivity response within mixed FILL material.
- Mixed FILL material with increased porosity and potential large inclusions. High electrical resistivity (ρ >160Ωm).
- ESTUARINE material. Saturated and electrically conductive. Low to moderate electrical resistivity (2.5Ωm < ρ < 16Ωm).
- Possible RESIDUAL SOIL. Low to moderate electrical resistivity (2.5Ωm < ρ < 6.5Ωm).
- Possible SANDSTONE. Weathered. Moderate electrical resistivity (ρ > 6.5Ωm).

* Refer to GBG report GBGA2031 for details.

TRANSECT 1 - INTERPRETED SECTION



Borehole and CPT Lithological Description**

- FILL: Mixtures of GRAVEL, SAND and CLAY of highly variable consistency. Fragments of bricks, concrete, timber, steel and plastic encountered.
- ESTUARINE: Silty CLAY / CLAY. Medium to high plasticity.
- RESIDUAL SOIL: CLAY. Medium to high plasticity, interpreted firm to very stiff consistency
- ROCK: Sandstone. Highly weathered to fresh, fine to medium grained, medium to very hard rock strength

Sections with diagonal cross hatch are inferred from CPT response

** Refer to WSP Parsons Brinckerhoff report 2270060A-GEO-REP-470A for details

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

Date	7 March 2017	Paper Size	A3
Scale	1:500	Drawn	AHWS
Drawing	GBGA2031-11	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia

G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS Advanced Subsurface Investigations

GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

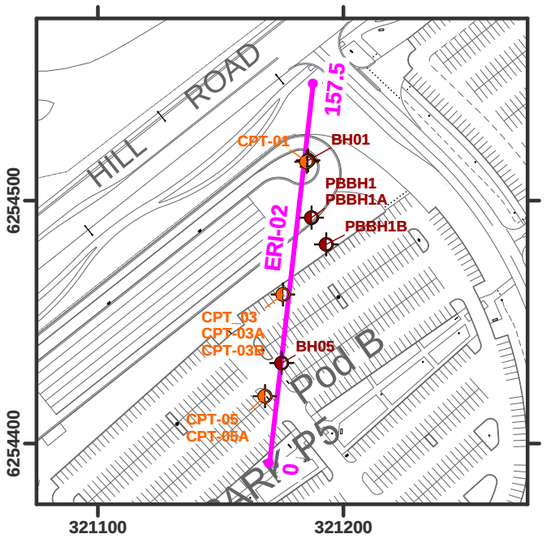
The GBG Group

GBGMAPS Advanced Subsurface Investigations

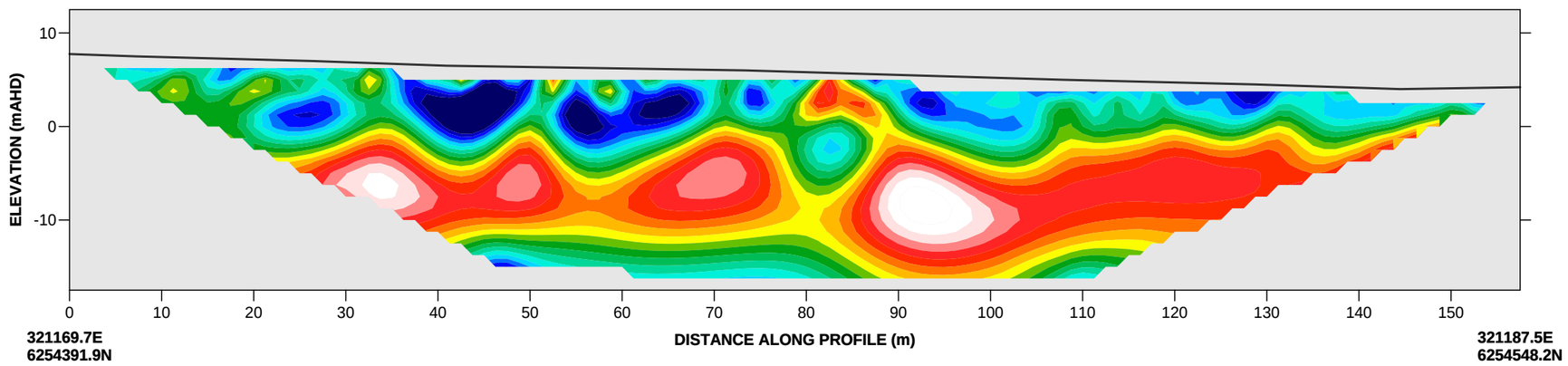
GBG Australia

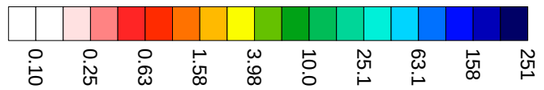
ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

ELECTRICAL RESISTIVITY IMAGING (ERI)



TRANSECT 2 - ELECTRICAL RESISTIVITY SECTION



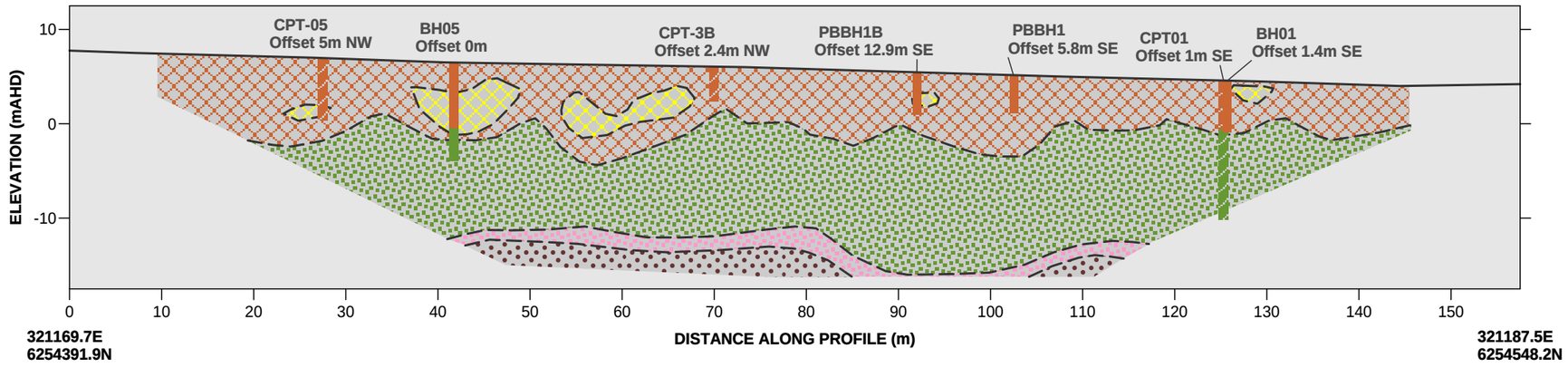


Geophysical Interpretation*

- Mixed FILL material. Moderate electrical resistivity (15Ωm < ρ < 160Ωm).
- Mixed FILL material with increased porosity and potential large inclusions. High electrical resistivity (ρ >160Ωm).
- ESTUARINE material. Saturated and electrically conductive. Low to moderate electrical resistivity (2.5Ωm < ρ < 16Ωm).
- Possible RESIDUAL SOIL. Low to moderate electrical resistivity (2.5Ωm < ρ < 6.5Ωm).
- Possible SANDSTONE. Weathered. Moderate electrical resistivity (ρ > 6.5Ωm).

* Refer to GBG report GBGA2031 for details.

TRANSECT 2 - INTERPRETED SECTION



Borehole and CPT Lithological Description**

- FILL: Mixtures of GRAVEL, SAND and CLAY of highly variable consistency. Fragments of bricks, concrete, timber, steel and plastic encountered.
- ESTUARINE: Silty CLAY / CLAY. Medium to high plasticity.
- RESIDUAL SOIL: CLAY. Medium to high plasticity, interpreted firm to very stiff consistency
- ROCK: Sandstone. Highly weathered to fresh, fine to medium grained, medium to very hard rock strength

Sections with diagonal cross hatch are inferred from CPT response

** Refer to WSP Parsons Brinckerhoff report 2270060A-GEO-REP-470A for details

0 10 20 30 40

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

Date	7 March 2017	Paper Size	A3
Scale	1:600	Drawn	AHWS
Drawing	GBGA2031-12	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia

G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS Advanced Subsurface Investigations

GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

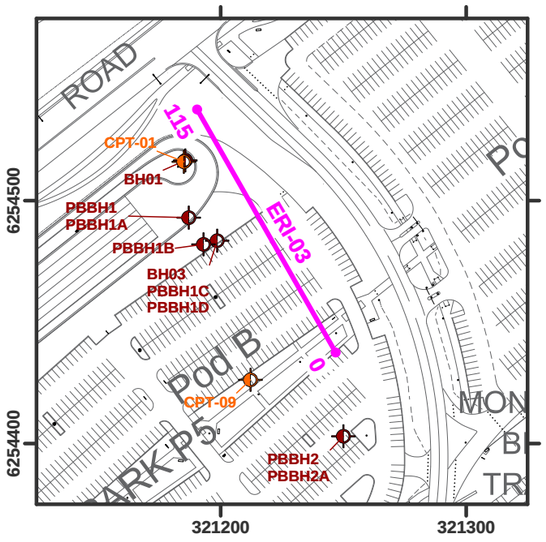
The GBG Group

GBGMAPS Advanced Subsurface Investigations

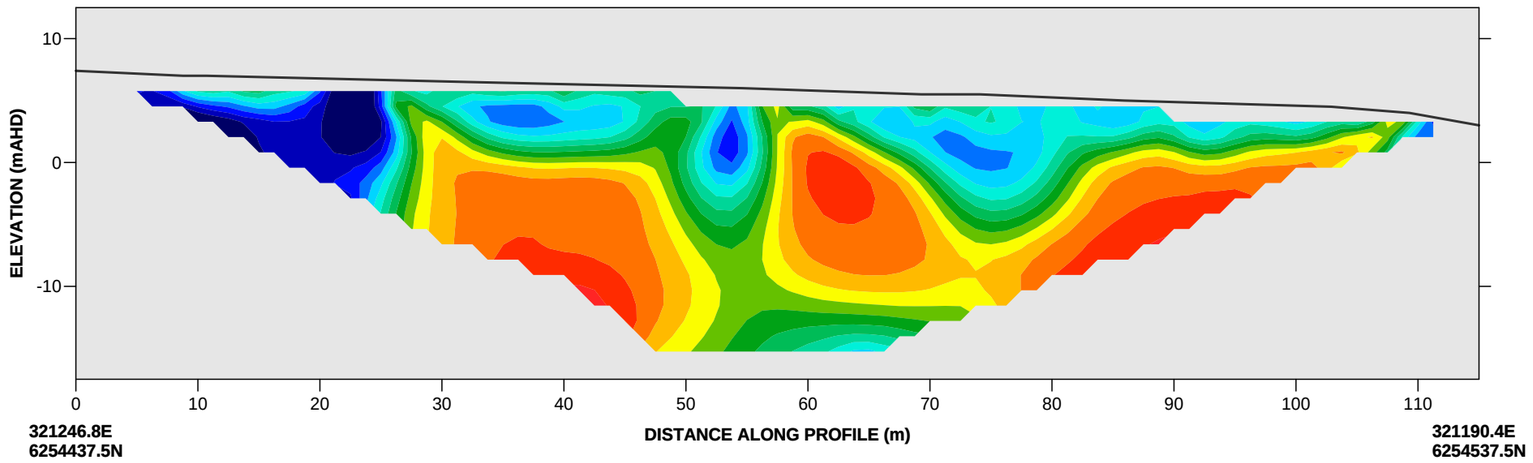
GBG Australia

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

ELECTRICAL RESISTIVITY IMAGING (ERI)



TRANSECT 3 - ELECTRICAL RESISTIVITY SECTION

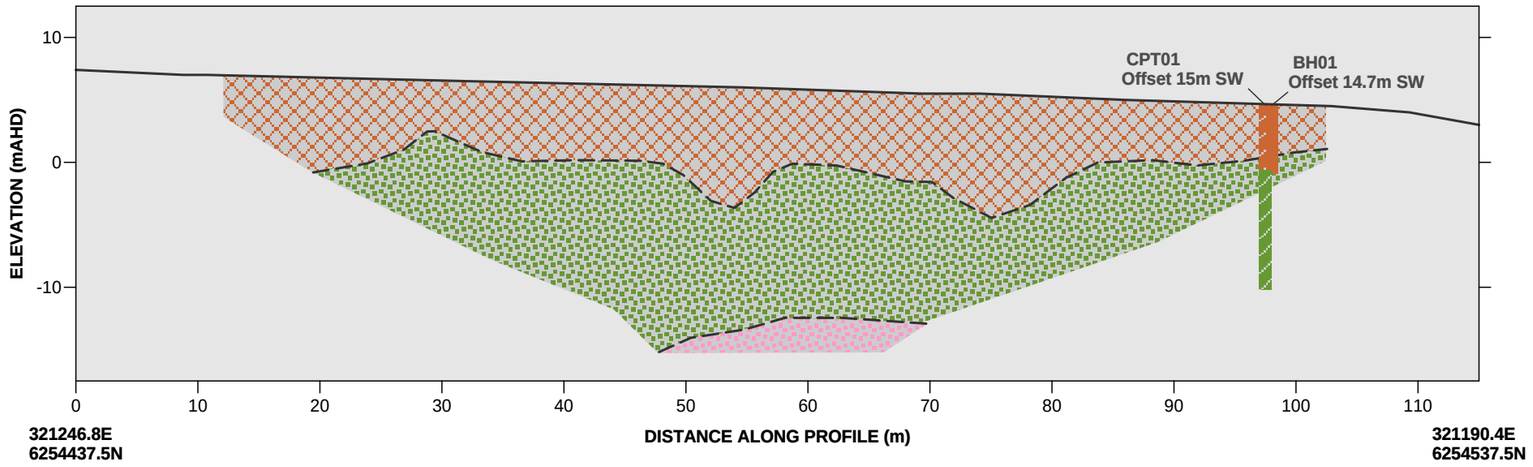


Geophysical Interpretation*

- Mixed FILL material. Moderate electrical resistivity (15Ωm < ρ < 160Ωm).
- Mixed FILL material with increased porosity and potential large inclusions. High electrical resistivity (ρ >160Ωm).
- ESTUARINE material. Saturated and electrically conductive. Low to moderate electrical resistivity (2.5Ωm < ρ < 16Ωm).
- Possible RESIDUAL SOIL. Low to moderate electrical resistivity (2.5Ωm < ρ < 6.5Ωm).
- Possible SANDSTONE. Weathered. Moderate electrical resistivity (ρ > 6.5Ωm).

* Refer to GBG report GBGA2031 for details.

TRANSECT 3 - INTERPRETED SECTION



Borehole and CPT Lithological Description**

- FILL: Mixtures of GRAVEL, SAND and CLAY of highly variable consistency. Fragments of bricks, concrete, timber, steel and plastic encountered.
- ESTUARINE: Silty CLAY / CLAY. Medium to high plasticity.
- RESIDUAL SOIL: CLAY. Medium to high plasticity, interpreted firm to very stiff consistency
- ROCK: Sandstone. Highly weathered to fresh, fine to medium grained, medium to very hard rock strength

Sections with diagonal cross hatch are inferred from CPT response

** Refer to WSP Parsons Brinckerhoff report 2270060A-GEO-REP-470A for details

0 10 20 30 40

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

Date	7 March 2017	Paper Size	A3
Scale	1:500	Drawn	AHWS
Drawing	GBGA2031-13	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia

G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS Advanced Subsurface Investigations

GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

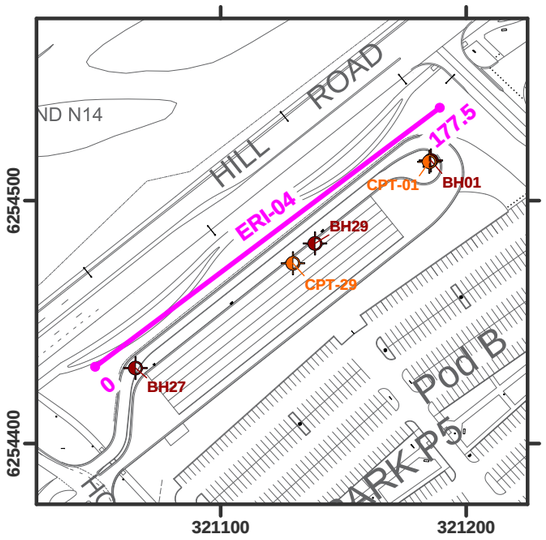
The GBG Group

GBGMAPS Advanced Subsurface Investigations

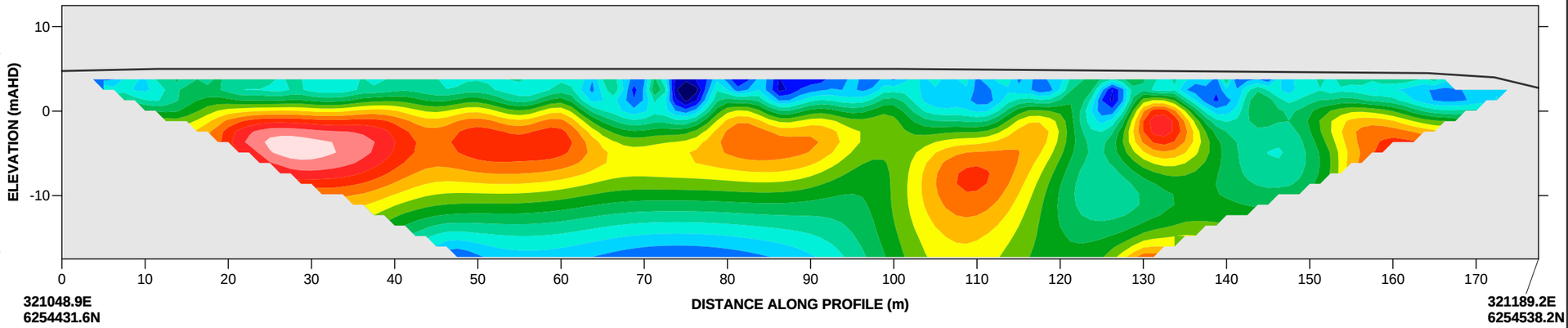
GBG Australia

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES - URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK SYDNEY NSW

ELECTRICAL RESISTIVITY IMAGING (ERI)



TRANSECT 4 - ELECTRICAL RESISTIVITY SECTION

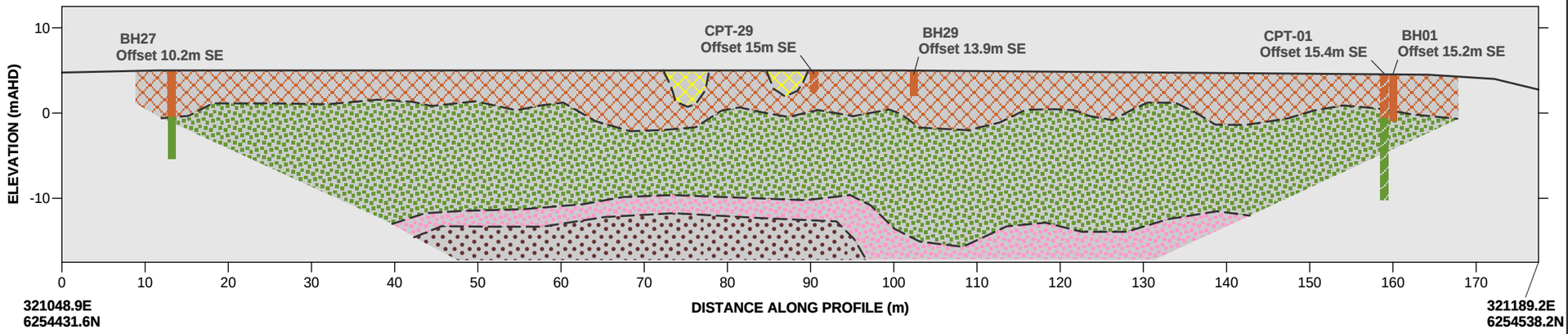


Geophysical Interpretation*

- Mixed FILL material. Moderate electrical resistivity (15Ωm < ρ < 160Ωm).
- Mixed FILL material with increased porosity and potential large inclusions. High electrical resistivity (ρ >160Ωm).
- ESTUARINE material. Saturated and electrically conductive. Low to moderate electrical resistivity (2.5Ωm < ρ < 16Ωm).
- Possible RESIDUAL SOIL. Low to moderate electrical resistivity (2.5Ωm < ρ < 6.5Ωm).
- Possible SANDSTONE. Weathered. Moderate electrical resistivity (ρ > 6.5Ωm).

* Refer to GBG report GBGA2031 for details.

TRANSECT 4 - INTERPRETED SECTION



Borehole and CPT Lithological Description**

- FILL: Mixtures of GRAVEL, SAND and CLAY of highly variable consistency. Fragments of bricks, concrete, timber, steel and plastic encountered.
- ESTUARINE: Silty CLAY / CLAY. Medium to high plasticity.
- RESIDUAL SOIL: CLAY. Medium to high plasticity, interpreted firm to very stiff consistency
- ROCK: Sandstone. Highly weathered to fresh, fine to medium grained, medium to very hard rock strength

Sections with diagonal cross hatch are inferred from CPT response

** Refer to WSP Parsons Brinckerhoff report 2270060A-GEO-REP-470A for details

0 10 20 30 40

Metres - For true to scale reproduction of this drawing, plot to A3 with the Page Scaling set to none.

Date	7 March 2017	Paper Size	A3
Scale	1:600	Drawn	AHWS
Drawing	GBGA2031-14	Revision	A

WAVE PARK GROUP

ASSESSMENT OF BEDROCK AND SUBSURFACE PROPERTIES URBAN WAVE PARK SITE, SYDNEY OLYMPIC PARK, SYDNEY NSW.

GBG Australia

G B Geotechnics (Australia) Pty Ltd
18 Fennell Street , North Parramatta NSW 2151
Telephone: (08) 9890 2122
Email: info@gbgoz.com.au

GBGMAPS Advanced Subsurface Investigations

GBGMaps Pty Ltd
Level 1, 2 Sabre Crescent, Jandakot WA 6164
Telephone: (08) 6436 1599
Email: info@gbgmaps.com.au

ATTACHMENT B

Understanding Your Report

UNDERSTANDING YOUR REPORT

GALT FORM PMP11 Rev2

1. EXPECTATIONS OF THE REPORT

This document has been prepared to clarify what is and is not provided in your report. It is intended to inform you of what your realistic expectations of this report should be and how to manage your risks associated with the conditions on site.

Geotechnical engineering and environmental science are less exact than other engineering and scientific disciplines. We include this information to help you understand where our responsibilities begin and end. You should read and understand this information. Please contact us if you do not understand the report or this explanation. We have extensive experience in a wide variety of projects and we can help you to manage your risk.

2. THIS REPORT RELATES TO PROJECT-SPECIFIC CONDITIONS

This report was developed for a unique set of project-specific conditions to meet the needs of the nominated client. It took into account the following:

- the project objectives as we understood them and as described in this report;
- the specific site mentioned in this report; and
- the current and proposed development at the site.

It should not be used for any purpose other than that indicated in the report. You should not rely on this report if any of the following conditions apply:

- the report was not written for you;
- the report was not written for the site specific to your development;
- the report was not written for your project (including a development at the correct site but other than that listed in the report); or
- the report was written before significant changes occurred at the site (such as a development or a change in ground conditions).

You should always inform us of changes in the proposed project (including minor changes) and request an assessment of their impact.

Where we are not informed of developments relevant to your report, we cannot be held responsible or liable for problems that may arise as a consequence.

Where design is to be carried out by others using information provided by us, we recommend that we be involved in the design process by being engaged for consultation with other members of the project team. Furthermore, we recommend that we be able to review work produced by other members of the project team that relies on information provided in our report.

3. SOIL LOGS

Our reports often include logs of intrusive and non-intrusive investigation techniques. These logs are based on our interpretation of field data and laboratory results. The logs should only be read in conjunction with the report they were issued with and should not be re-drawn for inclusion in other documents not prepared by us.

4. THIRD PARTY RELIANCE

We have prepared this report for use by the client. This report must be regarded as confidential to the client and the client's professional advisors. We do not accept any responsibility for contents of this document from any party other than the nominated client. We take no responsibility for any damages suffered by a third party because of any decisions or actions they may make based on this report. Any reliance or decisions made by a third party based on this report are the responsibility of the third party and not of us.

5. CHANGE IN SUBSURFACE CONDITIONS

The recommendations in this report are based on the ground conditions that existed at the time when the study was undertaken. Changes in ground conditions can occur in numerous ways including anthropogenic events (such as construction or contaminating activities on or adjacent to the site) or natural events (such as floods, groundwater fluctuations or earthquakes). We should be consulted prior to use of this report so that we can comment on its reliability. It is important to note that where ground conditions have changed, additional sampling, testing or analysis may be required to fully assess the changed conditions.

6. SUBSURFACE CONDITIONS DURING CONSTRUCTION

Practical constraints mean that we cannot know every minute detail about the subsurface conditions at a particular site. We use professional judgement to form an opinion about the subsurface conditions at the site. Some variation to our evaluated conditions is likely and significant variation is possible. Accordingly, our report should not be considered as final as it is developed from professional judgement and opinion.

The most effective means of dealing with unanticipated ground conditions is to engage us for construction support. We can only finalise our recommendations by observing actual subsurface conditions encountered during construction. We cannot accept liability for a report's recommendations if we cannot observe construction.

7. ENVIRONMENTAL AND GEOTECHNICAL ISSUES

Unless specifically mentioned otherwise in our report, environmental considerations are not addressed in geotechnical reports. Similarly, geotechnical issues are not addressed in environmental reports. The investigation techniques used for geotechnical investigations can differ from those used for environmental investigations. It is the client's responsibility to satisfy themselves that geotechnical and environmental considerations have been taken into account for the site.

O:\Administration\Standard Forms and Documents\PMP11-Rev2 Understanding your Report.docx