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By email
Dinesh.Poudyal@caltex.com.au

9 April 2020

Dinesh Poudyal
Program Lead Divestments
Caltex Australia Petroleum Pty Ltd
2 Market Street
Sydney NSW 2000

Dear Dinesh

**Geotechnical and Structural Desktop Assessment
Proposed Excavations for Remediation of the Caltex Service Station
488-492 Old South Head Rd Rose Bay, NSW**

1. INTRODUCTION

At the request of Caltex Australia Petroleum Pty Ltd, WSP Australia Pty Ltd (WSP) has undertaken a geotechnical and structural desktop assessment for proposed excavations planned for remediation at the Caltex service station located at 488-492 Old South Head Road, Rose Bay, Sydney to enable the sale of the site for residential development. The work was based on our proposal PP122229-GEO-LTR-20058 and accepted by Poudyal Dinesh.

Woollahra Municipal Council have requested that if excavations are greater than 2 m deep and/or are proposed within 1.5 m of a site boundary, that a geotechnical and structural report is required demonstrating that the works will not have any adverse effects on the neighbouring properties.

This report provides information on the geotechnical site conditions and provides an indication of the geotechnical and structural risks posed to the neighbouring properties given the proposed excavations planned at the site.

2. SITE CONDITIONS

2.1 SITE DESCRIPTION

Based on available information, the site is situated within relatively flat terrain at an elevation of approximately RL12m AHD. The area slopes gently towards Rose Bay, which is approximately 700 m to the west.

The site is bordered by the following infrastructure:

- Old South Head Road— 2 lane road extending north and south of the eastern side of the site. The presence of utilities needs to be confirmed.

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- Albemarle Avenue– 2 lane road extending to the northwest on the southern side of the site. The presence of utilities needs to be confirmed.
- Three storey Commercial / residential development to the north. It is assumed the property had an underground car park which is accessed from the north-east end of that property off Old South Head Road.
- Single storey residential property to the west – with a detached 2-car carport adjacent to the service station boundary. An approximately 1.8-2 m high brick wall appears to be located near the boundary.

Current infrastructure at the site includes:

- Single storey masonry convenience store with office and amenities is located along the northern boundary of the property, which abuts the commercial property to the north.
- Canopy and 3 fuel dispenser islands which are located centrally and south of the shop.
- Three underground petroleum storage tanks were positioned north of the canopy.
- Surface and subsurface drainage which is connected to the street drainage system (ERM, 2020).

2.2 SITE HISTORY

Based on information in the Remedial Action Plan (ERM, 2020) provided by Caltex), the site history is summarised below;

- Caltex purchased the site 1961. Prior occupation and site use is unknown.
- The site was redeveloped by Caltex after 1999 to its current service station arrangement. This included ‘knock-down / rebuild’ and replacement of underground petroleum storage systems (UPSS) in 2000. In addition, upgrades to the sales building occurred in 2008.

It is understood that the site will be remediated for a proposed residential development.

2.3 SITE GEOLOGY

Based on the 1:100,000 Sydney Geological Series Sheet 9130 (1983), the site is underlain by medium to fine grained ‘marine’ sands with podsoils (soils with leaching of minerals) associated with transgressive dunes (formed from dunes that have moved). The depth to rock is not known but can be highly variable in these environments.

Soil landscape mapping indicates that the site is within the Tuggerah Soil Landscape comprising acid sandy soils which were described as having high permeability and poor drainage due to very high water tables.

2.4 SUBSURFACE CONDITIONS

Several contamination and geotechnical subsurface investigations have been previously undertaken at the site since 1998, as listed below:

- Limited Environmental Site Assessment and Geotechnical Investigation of the Caltex Service Station – for proposed re-development of the site, Environmental and Earth Sciences Pty Ltd. 1998. Four geotechnical boreholes with SPT testing were undertaken to 5.5m depth.
- Soil and Groundwater Assessment Caltex Service Station Rose Bay – for proposed re-development of the site, Environmental Resources Management Pty Ltd, 1999. Three environmental boreholes were drilled to 6m depth with piezometers installed.

- Phase 2 Environmental Site Assessment – Final Report, URS, 2007.
Three environmental boreholes were drilled to 8m depth with piezometers installed.
- Caltex UPPS Groundwater monitoring Event – for assessment of potential impacts from the underground petroleum storage systems, URS, 2010.
- Groundwater Sampling and Testing data from April 2016, AECOM, 2016.
- Remediation Action Plan, Caltex Rose Bay, Environmental Resources Management Pty Ltd. 2020.

Based on the available previous site investigation reports, ground conditions at the site are anticipated to consist of:

- Concrete pavement across the site, which was up to approximately 150mm thick, underlain by.
- Fill material, which generally consisted of sand, fine to medium grained, very loose to loose sand, with sandstone fragments, bitumen, and tile pieces. The depth of fill was generally 1m, except for deeper fill encountered to depths of 2.2m and 2.7m in two boreholes drilled in the southern corner of the site adjacent to New South Head Road and Albemarle Ave (EES 1998). The fill was underlain by.
- Alluvial sand to approximately 4 – 5 m depth; some silty sand, very loose to medium dense, moist to wet, underlain by.
- Alluvial clayey sand to a depth of at least 8 m; loose to medium dense, moist to wet.
- The depth of the alluvium and top of rock at the site are not known.

2.5 GROUNDWATER

Groundwater monitoring at 3 piezometers on the site has been undertaken intermittently since 2011. Recorded groundwater levels fluctuated between 4.0 m and 5.6 m below top of casing (pavement level), with an average depth of 4.8 m. Levels have decreased since approximately 2016, with the last recorded depth of approximately 5.5 m in 2019.

It is noted that groundwater levels are likely to be seasonal and vary with precipitation, and no readings have been made since recent rainfall events.

3. PROPOSED EXCAVATIONS

The Remediation Action Plan (RAP) (ERM, 2020) states that all the service station infrastructure is to be removed, including excavation of underground service tanks and fuel lines, backfill sands, building and canopy foundations, and all existing pavements. Removal of contaminated soils beyond those structures is also required.

The RAP does not provide excavation depths or extent of remediation, other than indicating the approximate locations of buried infrastructure and stating that it is unlikely that groundwater will be encountered during tank removal given the recorded groundwater depths.

Demolition of the existing canopy and shop would include removal of the foundations and slabs. The extent of the foundations is unknown. If deep piled footings are present for the canopy or shop, they may also require removal as per the RAP.

4. COMMENTS AND RECOMMENDATIONS

4.1 POTENTIAL RISKS TO ADJACENT INFRASTRUCTURE

Based on the proposed remediations, potential risks include;

- Undermining or settlement of footings or infrastructure where excavations are within their zone of influence. Key infrastructure includes:
 - Underground services and roads along the site boundaries, particularly within the road reserves (including RMS assets).
 - The commercial / residential building to north and the underground basement.
 - Dwelling on west side
 - The brick wall along the western boundary (unless it is to be removed and replaced).
- The risk of undermining would be increased where excavations are extended or deepened to remove contaminated soils or additional buried infrastructure.
- Temporary excavation or shoring collapse
- Groundwater issues if groundwater is encountered within the excavations. Risks include:
 - Temporary excavation or shoring collapse.
 - Dewatering induced settlement of nearby structures if the groundwater level is lowered.
 - Groundwater inflows within the high permeability sands which cannot be controlled using conventional sump and pump dewatering methods.

4.2 RECOMMENDATIONS

Key recommendations based on the available information are provided below, including recommended HOLD points which are to be approved by a suitably qualified Geotechnical Engineer or Engineering Geologist prior to work proceeding.,

- The contractor shall develop an excavation and earthwork methodology with current groundwater levels measured, and excavation backfill methodology and specification requirements for review (HOLD POINT). Excavations within the soils at the site should be achievable using conventional earthmoving equipment such as a hydraulic excavator with bucket.
- Temporary excavations can be excavated provided they are:
 - Inspected by an experienced Geotechnical Engineer or Engineering Geologist (HOLD POINT)
 - Graded with side slopes no steeper than 3H:1V (horizontal to vertical), have a minimum 1 m offset from the top of the excavation to adjacent underground services, footings, and pavements, subject to confirmation by analyses (HOLD point)
 - A maximum of 4 m depth.
 - Excavations greater than 2 m depth or within 1.5 m of neighbouring properties shall be inspected by an experienced Geotechnical Engineer or Engineering Geologist (HOLD POINT).
 - Do not extend below the groundwater level (HOLD POINT) if groundwater or seepage is encountered).
 - Do not extend within a zone of influence of 3H:1V beneath the footings of adjacent infrastructure.

- Excavations greater than 2 m depth shall remain open for a minimal period to reduce risk of instability or washouts (ideally less than 3 days). Excavation batters should be protected from water run on with appropriate drainage measures and erosion protection.
- Where the above conditions cannot be met due to site constraints (such as boundaries) or the extent of remediation is extended, a properly engineered and constructed temporary excavation support system required (HOLD POINT).
- Underpinning of adjacent key infrastructure may be needed based on the extent of the work. Further investigation should be carried out prior to demolition and geotechnical and structural advice should be sought. (HOLD POINT).
- All works shall also comply with relevant RMS requirements pertaining to New South Head Road.
- Dilapidation surveys of neighbouring properties and infrastructure are recommended before and after demolition of the infrastructure and prior to excavation taking place (HOLD POINT).
- In addition, excavation and vibration monitoring are suggested to help reduce potential claims.

4.3 ADDITIONAL ASSESSMENT

Where shoring systems are required, additional geotechnical and structural assessment will be required for design. This may involve additional geotechnical investigation depending on the depth of shoring and proximity to adjacent infrastructure. Monitoring of the excavation and adjacent features is recommended.

5. LIMITATIONS

It should be noted further investigation should be carried out prior to demolition to determine the potential impacts due to demolition works and this assessment does not consider future structures and their impact on adjacent sites.

The recommendations provided in this report are based on historical site investigation reports and data by others. No site inspection has been carried out for this desktop assessment. Surface or subsurface conditions may have changed since the previous reports.

This report should be read in conjunction with the attached limitations statement. Further geotechnical advice should be sought if site conditions are different to those stated in this report. Environmental issues are beyond the scope of this document.

REFERENCES

- EES (1998), Limited Environmental Site Assessment and Geotechnical Investigation of the Caltex Service Station – for proposed re-development of the site, 488 Old South Head Road, Rose Bay, NSW. Environmental and Earth Sciences Pty Ltd. 10 July 1998. Reference; report No. 19870
- ERM (1999), Soil and Groundwater Assessment Caltex Service Station Rose Bay – for proposed re-development of the site, 488 Old South Head Road, Rose Bay, NSW. Environmental Resources Management Pty Ltd. 01 October 1999. Reference: 99474rp1.doc
- URS (2007), Phase 2 Environmental Site Assessment – Final Report, 488 Old South Head Road, Rose Bay, NSW. 15 November 2007. Reference: 43217594
- URS (2010), Caltex UPPS Groundwater monitoring Event – for assessment of potential impacts from the underground petroleum storage systems, 488 Old South Head Road, Rose Bay, NSW. 09 April 2010. Reference: 43218075



- AECOM (2016), Groundwater Sampling and Testing data from April 2016, Caltex Rose Bay, 488 Old South Head Road, Rose Bay, NSW. AECOM Pty Ltd. 04 April 2016
- ERM (2020), Remediation Action Plan, Caltex Rose Bay, 488 Old South Head Road, Rose Bay, NSW. Environmental Resources Management Pty Ltd. 10 March 2020. Reference: Project no. 0512642
- eSPADE, NSW Government (1983), Sydney Geological series sheet 9130tg – Tuggerah Soil Landscape, Rose Bay, NSW. NSW Government, Office of Environment & Heritage. 1983

Yours sincerely

A handwritten signature in blue ink, appearing to read 'A. Farquharson'.

Andrew Farquharson
Senior Geotechnical Engineer

A handwritten signature in blue ink, appearing to read 'R. Hansen'.

Roslyn Hansen
Senior Structural Engineer

Encl: Limitations Statement



Legal Limitations of Geotechnical Site Investigation

Scope of services

This geotechnical site assessment report (the report) has been prepared in accordance with the scope of services set out in the contract, or as otherwise agreed, between the client and WSP (scope of services). In some circumstances the scope of services may have been limited by a range of factors such as time, budget, access and/or site disturbance constraints.

Reliance on data

In preparing the report, WSP has relied upon data, surveys, analyses, designs, plans and other information provided by the client and other individuals and organisations, most of which are referred to in the report (the data). Except as otherwise stated in the report, WSP has not verified the accuracy or completeness of the data. To the extent that the statements, opinions, facts, information, conclusions and/or recommendations in the report (conclusions) are based in whole or part on the data, those conclusions are contingent upon the accuracy and completeness of the data. WSP will not be liable in relation to incorrect conclusions should any data, information or condition be incorrect or have been concealed, withheld, misrepresented or otherwise not fully disclosed to WSP.

Geotechnical investigation

Geotechnical engineering is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. Geotechnical engineering reports are prepared to meet the specific needs of individuals. A report prepared for a consulting civil engineer may not be adequate for a construction contractor or even some other consulting civil engineer. This report was prepared expressly for the client and expressly for purposes indicated by the client or his representative. Use by any other persons for any purpose, or by the client for a different purpose, might result in problems. The client should not use this report for other than its intended purpose without seeking additional geotechnical advice.

This geotechnical report is based on project-specific factors

This geotechnical engineering report is based on a subsurface investigation which was designed for project-specific factors, including the nature of any development, its size and configuration, the location of any development on the site and its orientation, and the location of access roads and parking areas. Unless further geotechnical advice is obtained this geotechnical engineering report cannot be used:

- when the nature of any proposed development is changed
- when the size, configuration location or orientation of any proposed development is modified.

This geotechnical engineering report cannot be applied to an adjacent site.

The limitations of site investigation

In making an assessment of a site from a limited number of boreholes or test pits there is the possibility that variations may occur between test locations. Site exploration identifies specific subsurface conditions only at those points from which samples have been taken. The risk that variations will not be detected can be reduced by increasing the frequency of test locations; however this often does not result in any overall cost savings for the project. The investigation program undertaken is a professional estimate of the scope of investigation required to provide a general profile of the subsurface conditions. The data derived from the site investigation program and subsequent laboratory testing are extrapolated across the site to form an inferred geological model and an engineering opinion is rendered about overall subsurface conditions and their likely behaviour with regard to the proposed development. Despite investigation the actual conditions at the site might differ from those inferred to exist, since no subsurface exploration program, no matter how comprehensive, can reveal all subsurface details and anomalies.

The borehole logs are the subjective interpretation of subsurface conditions at a particular location, made by trained personnel. The interpretation may be limited by the method of investigation, and can not always be definitive. For example, inspection of an excavation or test pit allows a greater area of the subsurface profile to be inspected than borehole investigation, however, such methods are limited by depth and site disturbance restrictions. In borehole investigation, the actual interface between materials may be more gradual or abrupt than a report indicates.

Subsurface conditions are time dependent

Subsurface conditions may be modified by changing natural forces or man-made influences. A geotechnical engineering report is based on conditions which existed at the time of subsurface exploration.

Construction operations at or adjacent to the site, and natural events such as floods, or groundwater fluctuations, may also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. The geotechnical engineer should be kept apprised of any such events, and should be consulted to determine if additional tests are necessary.

Avoid misinterpretation

A geotechnical engineer should be retained to work with other appropriate design professionals explaining relevant geotechnical findings and in reviewing the adequacy of their plans and specifications relative to geotechnical issues.

Bore/profile logs should not be separated from the engineering report

Final bore/profile logs are developed by geotechnical engineers based upon their interpretation of field logs and laboratory evaluation of field samples. Customarily, only the final bore/profile logs are included in geotechnical engineering reports. These logs should not under any circumstances be redrawn for inclusion in architectural or other design drawings. To minimise the likelihood of bore/profile log misinterpretation, contractors should be given access to the complete geotechnical engineering report prepared or authorised for their use. Providing the best available information to contractors helps prevent costly construction problems. For further information on this matter reference should be made to 'Guidelines for the Provision of Geotechnical Information in Construction Contracts' published by the Institution of Engineers Australia, National Headquarters, Canberra 1987.

Geotechnical involvement during construction

During construction, excavation is frequently undertaken which exposes the actual subsurface conditions. For this reason geotechnical consultants should be retained through the construction stage, to identify variations if they are exposed and to conduct additional tests which may be required and to deal quickly with geotechnical problems if they arise.



Legal Limitations of Geotechnical Site Investigation

Report for benefit of client

The report has been prepared for the benefit of the client and no other party. WSP assumes no responsibility and will not be liable to any other person or organisation for or in relation to any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report (including without limitation matters arising from any negligent act or omission of WSP or for any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy or completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

Other limitations

WSP will not be liable to update or revise the report to take into account any events or emergent circumstances or facts occurring or becoming apparent after the date of the report.