SOIL TEST MELBOURNE

Mob: 0458 876 290
ABN: 55615412087
www.soiltestmelbourne.com.au
info@soiltestmelbourne.com.au

03653

29th March 2018

Mr Paul Yeriondais
paul@pcdgroup.com.au
141 Charles Street
Northcote VIC 3070

SITE INVESTIGATION AND CLASSIFICATION REPORT

No. 141 CHARLES STREET NORTHCOTE VICTORIA

This document is a classification report compiled in accordance with AS2870-2011 and shall be considered for design purposes only, of an extension. It is intended as a summary of the conditions observed for the site at the time of the investigation as deemed relevant for classification under AS2870-2011 and AS1726-1993. Soil Test Melbourne Engineering does not endorse any resulting footing design and can only verify the geotechnical site conditions if an inspection of all earthworks and footing excavations prior to pouring concrete is undertaken with reference to the final design documentation, and as per AS1726-1993.

This report complies with all specifications and requirements outlined in the Australian Standard AS 2870-2011 and Foundation & Footings Society (Vic.) (FFSV), Practice Notes 1 to 6, have been considered in the compilation of this classification report.

Further testing may be necessary especially where the building design is not finalised at the time of testing or where the design changes occur after testing is completed

This report is valid for a maximum period of twelve (12) months providing no changes are made to the site that may affect the recommendations. Changes to the site which may render this report invalid include, but are not limited to, changes to the design and/or construction methods proposed, planting of trees on the subject site or neighbouring properties, cut/fill to the site, abnormal weather conditions, failure of plumbing or drainage on or adjacent to the subject site, or change of ownership.

1. COMMISSION

Soil Test Melbourne Engineering (STME) was commissioned to determine the SITE CLASSIFICATION of the site for engineering design based on geological maps, aerial photography study and a site inspection.

2. SCOPE OF WORKS

The following information was received to assist STME in undertaking a site assessment:

- Drawings *Ref: as per email received on 26th March 2018*

STME has used its best endeavors to select the number and location of test sites based on the above information.

Four (4) test locations were logged on site using a Mechanical Push Tube at the approximate positions specified on the unscaled site sketch (Appendix C).

Two (2) Test locations were nominated by Paul Yerondais reference as per email received on 26th March 2018.

Pocket Penetrometer tests were conducted at positions indicated in the bore logs.

Drilling refusal does not allow for the determination of the vertical or horizontal extent of a hard layer or object. STME recommends further investigation to assess the continuity of rock if founding to rock is deemed advantageous.

Any classification report is based on a unique set of project specific factors and isolated test locations within the testing limitations instructed by the client. Conditions may vary across the site in areas that have not been tested.

Further investigations must be undertaken if the proposed works differ from what is described above. Final drawings must be made available to STME as soon as the design has been finalised for construction to allow for a report review.

3. TERRAIN & VEGETATION (Refer Site Plan)

The site is on the North side of the road.

The land is sloping North-East with an approximate fall of 1 to 14.

Drainage is considered Poor.

Vegetation on the subject site and neighbouring sites consists of trees as per the site plan attached.

Planting of trees shall be avoided near the foundation of a building or neighbouring building on reactive sites as they can cause damage due to drying of the clay at substantial distances. Most modern allotments with clayey soils are too small to safely grow large trees without special footings. Generally the larger the root system of the tree(s) the greater the drying effect. If in doubt seek the advice of an expert arborist and designing engineer.

4. WATER & DRAINAGE

No groundwater was encountered.

Subsurface drainage water is not considered to be groundwater.

Water may cause constructional problems during footing excavations and may also cause increased movement of the foundation. The excavations must be kept dry and dewatered well prior to pouring concrete.

Stormwater piping, even if temporary, must be connected by the time the roof is constructed.

Ongoing maintenance of the drainage and stormwater shall be effectively managed for the life of this building.

5. GEOLOGY

Regionally the site is within an area of Silurian (Sxm) Melbourne Formation consisting of marine mudstone, turbiditic sandstone and storm wave deposits.

6. SITE CLASSIFICATION

The following classification of the site is based on the minimum testing requirements outlined in AS2870-2011. This classification must be confirmed with a final inspection of the excavated footings to confirm founding material prior to pouring concrete. Please contact STME allowing satisfactory time to attend site and confirm the site classification during construction.

Based on the soil profile the typical surface movement for the area has been assessed to be extremely variable. In accordance with AS 2870-2011, the site is classified as a **CLASS P, PROBLEM SITE.**

The P classification in this otherwise **Moderately Reactive (M)** clay site which may experience **moderate** ground movement from moisture changes has been made as a result of;

- The site may be subject to moisture changes due to site conditions more severe than normal site conditions due to:
  - Removal of trees prior to construction.
  - Presence of trees on the building site or adjacent site.
  - Unusual moisture conditions caused by [drains, channels, ponds, swimming pools, effluent disposal area or tanks] which are to be maintained or removed from the site.
  - Failure to provide adequate site drainage.
  - Failure to detail or construct drainage in accordance with AS2870-2011.

Abnormal moisture conditions are likely to result in exaggerated soil movement as the site adjusts to a new moisture regime. These adverse conditions can cause a number of problems, such as foundation instability, cracking plaster and brickwork, and poorly fitting openings.

The newly cleared site, if left fallow, would take at least 3 seasonal cycles to achieve a new soil moisture equilibrium. Where construction is applied to a site with abnormal moisture conditions, soil moisture equilibrium can take much longer.

The site classification must be reconsidered if any site cut exceeds 0.5m or if the site is filled to more than 0.4 m depth. Adverse site conditions undetected by the agreed testing program may also impact on the site classification, founding depth, bearing capacity and footing system nominated.

STME recommends further geotechnical testing may be requested by a structural engineer to provide parameters necessary for a suitable footing design at this site. In accordance with AS2870:2011 testing is required to a minimum depth 1.5m below the design depth of a deep footing system. As the necessity for additional deep testing will depend on the design to be adopted please contact STME as soon as the preliminary footing design is complete.

7. FOOTING DESIGN GUIDELINES

The design of a footing system at this site shall be by engineering principles in accordance with section 4, AS2870-2011. Design by engineering principles shall be undertaken by a suitably qualified Engineer.

All guidelines within AS2870-2011 shall be followed in the construction of footings.

All footings must be founded to a material and depth of equivalent characteristic surface movement.

The following parameters may be adopted for a design founded within the Silty Clay (CI) to a maximum depth of 1.8 metres. All footings must be founded to a material and depth of equivalent characteristic surface movement.

Depth (mm)	**Bearing Capacity (Kpa)**
0 – 500	N/A
500 - 1800	200

Table 1 - Bearing Capacities

For stiffened raft design an allowable bearing pressure of up to 50kPa may be adopted for a slab and stiffening beams founded on the stripped surface to Silty Clay (CI). This bearing pressure must not be applied to fill or disturbed material.

Design of a stiffened raft must consider the reactivity of the underlying clay. We strongly recommend against founding a stiffened raft directly to the stripped surface.

On this site Slab, Strip or Stump footing may be used. For a Stiffened Raft Slab STME recommend that edge and internal beams are to be found to a depth of 600mm and on the natural Silty Clay (CI), and as per the specifications of the AS 2870-2011, or as per the design of a suitably qualified structural engineer.

For a structural design with Strip Footings, STME recommends that Strip footings be founded 700mm deep and into the natural Silty Clay (CI), and following the specification of the AS 2870-2011, or as per the design of a suitably qualified structural engineer.

For a structural design with Stump Footings, STME recommends that Stump Footings be founded 800mm deep and into the natural Silty Clay (CI), and following the specification of the AS 2870-2011, or as per the design of a suitably qualified structural engineer.

Where trees have been removed, the entire trunk and tree roots must be removed and replaced with compacted soil, to avoid differential settlement of the footing. Soil must be compacted as per AS 3798-2007, before footings can be placed in the area of removed trees and tree roots. Alternatively, piled footings can be used to beyond the influence of the removed trees, at least 1.8m deep.

STME recommends the use of tree root barriers to protect from invasive tree roots on the neighbouring properties. Tree root barriers are to be at least 1.8m deep.

A deep footings system may be required as specified by the design. Further testing must be undertaken to verify founding material and allowable bearing capacity for deep footing design to greater than 1.5m.

Relatively shallow rock has been identified at the site. If it is desired to found to rock further testing will be required to prove continuity of rock at the site.

If the guidelines outlined in HEDRA, How to Protect Your House are not adhered to, some changes to the design may be required and STME must be notified.

If the proposed construction is in a reactive area and you wish to grow, retain or remove trees near buildings, the builder shall be advised of this prior to signing the building contract so that the engineer can design for these conditions.

In accordance with the requirements of AS2870-2011, all footing excavations must be inspected by a suitably qualified engineer to verify founding depth, founding material and allowable bearing pressure. Please contact STME to arrange for further inspection allowing sufficient time for the inspection prior to pouring any concrete.

8. WIND RATING

At the time of our site visit an investigation of this site and the surrounding terrain was conducted to determine the Wind Classification Design Speed. The maximum design gust wind speed for this site is **28** m/s based on wind speed calculations (Vh) for use in ultimate limit state design only calculated in accordance with the limitations as in AS4055 Section 1.2.

The Wind Rating for this site has been assessed as **N1**.

9. SPACING OF CONSTRUCTION JOINTS

TABLE 4.2

SPACING OF CONTRACTION JOINTS FOR UNREINFORCED MASONRY WALLS

Masonry wall construction and surface finish	Maximum joint spacing m
External masonry that is face-finished, rendered and/or painted	7.0
Internal masonry that is face-finished or sheeted	6.0
Internal masonry that is rendered and/or painted	5.0
External masonry with openings more than 900 mm in height	5.0

Table 4.2 from the Australian Standard for Masonry Structures 3700-2011

10. PLUMBING

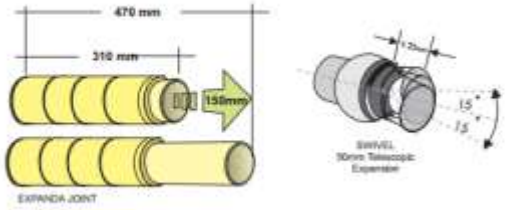
Footings shall be engineer designed and design work shall consider articulation and flexible plumbing joints to allow for ground movement. We advise that the following parameters must be followed in the plumbing design so as to protect the footings:

Table SP 01 - SOIL CLASSIFICATION, DIFFERENTIAL MOVEMENT, GRADE, ANGLE, JOINTS LOCATION & DRAWING No'S. CHART.

AS2870-2011 SOIL CLASSIFICATION	ON SITE SOIL CONDITIONS	DIFFERENTIAL MOVEMENT	SEWER & Stormwater GRADE	SWIVEL * (50mm Expansion)	SWIVEL/COMBO * (100mm Expansion)	EXPANDA JOINTS *	CREEP SLOPE SITES	DRAWING NUMBER
A	Most Sand & Rock sites	0 - 10mm	1:60 Minimum	Not necessary	Not necessary	Not necessary	These are termed P sites and are referred to in Drawing SP 105	N/a
S	Slightly reactive Soils	10 - 20mm						N/a
M	Moderatively reactive soils	20 - 40mm						SP 100 & SP 101
H1	Highly reactive soils	40 - 60mm	1:40 Minimum	As per AS3500.5 using 2 units outside and an Expansion Joint at every riser Not applicable to suspended sub-floors	As necessary using either or both Bend or Straight units ....unless suspended from slab	At Junctions within 1 mtr of internal building footprint and every 6 mtrs. As per Differential Movement See AS2032-2006 Clause 6.4.2.2-4 for suspension requirements		SP 102
H2	Very highly reactive soils	60 - 75mm						SP 102A
E	Extremely reactive soils	75 + mm						SP 102A
P	Soils affected by Abnormal moisture and conditions	From.. 20 + mm	As per Differential Movement					SP 105A

NOTE: Engineer or local Authority details take precedence over this chart

To be read in conjunction with Storm Plastics drawings shown.



GRADE RATIO	FALL IN 10 mtrs	ANGLE	GRADE %
1:100	100 mm	.57	1.0
1:80	125 mm	.71	1.25
1:60	167 mm	.95	1.65
1:50	200 mm	1.14	2.0
1:40	250 mm	1.43	2.5

* Unless specified otherwise, these joints are to be set at 50% of total telescopic movement.

Table SP 01 *taken from the Storm Plastics web site www.stormplastics.com.au*

All soils are affected by water. - Clay soils in particular react physically. They swell and shrink (expand and contract), with changes in moisture content. - Maintaining absolute stability of the moisture in the soil around a building, be it a house or a shed, is rarely achievable but much can be done to control it and minimise its effects. Adopting a "risk management" philosophy in such circumstances could well prevent litigation at a later date. STME recommends following the Storm Plastics Technical Drawings for plumbing fittings which can be found at:

stormplastics.com.au/tech_info_&_drawings.html#technical

11. SITE PREPARATION GUIDELINES

All works must comply with AS 2870-2011.

Standard deemed-to-comply designs shall be in accordance with AS2870-2011 Clauses 3.2 to 3.6. These designs shall not apply to Class E or Class P sites or other instances listed in clause 3.1.1, AS2870-2011.

Where filling is required, the placement of suitable material shall be conducted in accordance with the guidelines outlined in AS3798.

The builder/engineer must be aware of the requirements for aggressive soils so that an appropriate treatment can be installed in accordance with section 5.5 of AS2870-2011. STME is not aware of any such soils in the area of the subject site. However, we recommend further testing of soils and/or groundwater to which masonry and/or concrete surfaces are to be exposed. Please contact STME to arrange for testing to be undertaken.

12. SITE MOISTURE

Water can cause constructional problems during footing excavations. Footing excavations shall be kept free of water and loose debris/foreign materials shall be cleared prior to pouring concrete.

Sites shall be maintained at essentially stable moisture conditions and extremes of wetting and drying prevented.

The site should be graded or drained so that water cannot pond against or near the building. The ground immediately adjacent to the building should be graded to a uniform fall of 50 mm minimum away from the building over the first metre. The subfloor space for buildings with suspended floors should be graded or drained to prevent ponding where this may affect the performance of the footing system. The site drainage recommendations should be maintained for the economic life of the building. A swale drain shall be constructed prior to any other works to divert stormwater runoff around the site. Where filling is placed adjacent to the building, the filling shall be compacted and graded to ensure drainage of water away from the building.

The development of the gardens must not interfere with the drainage requirements or the subfloor ventilation and weephole drainage systems. Garden beds adjacent to the building should be avoided. Care should be taken to avoid overwatering of gardens close to the building footings.

Planting of trees should be avoided near the foundation of a building or neighbouring building on reactive sites as they can cause damage due to drying of the clay at substantial distances.

Where rows or groups of trees are involved, the distance from the building should be increased. Removal of trees from the site can also cause similar problems. Alternatively, the footing system may be designed for the effect of trees.

Gardens adjacent to walls shall be avoided for further information on measures for protecting the building and foundations refer to the following document is attached:

- How To Protect Your House, Housing Engineering Design and Research Association (HEDRA)

Other documents containing useful information on protecting the building include:

- Foundations and Footing Society Victoria (FFSV) Practice Note 7
- AS287-2011, Section B2.3, SAI Global
- C.S.I.R.O. Building Technology File (BTF 18) 2011, CSIRO Publishing

Repair of leaks in plumbing, including stormwater and sewerage drainage, shall be undertaken promptly. All top soil containing grass roots shall be removed from the area on which the footing is to rest.

13. EXCAVATIONS

Any vertical or near-vertical permanent excavation within 2m of the building and deeper than 0.6 m in material other than stable rock shall be adequately retained or battered. The effects of excavations on drainage or foundation drying shall be considered.

Temporary excavations in the area of the footing shall be carried out only where adequate support for the footing system is maintained. Examples of such temporary excavation include levelling of the building platform and trenching for services. Where it is expected that future excavation in the area of the footing system may be required for maintenance of underground services, provision shall be made for continued support of the footings, for example by provision of piers to beneath the expected excavation level.

NOTE: Excavations should not extend below a line drawn 30° to the horizontal for sand, or 45° to the horizontal for clay, from the bottom edge of the edge beam, strip footing or pier without prior assessment in accordance with engineering principles.

14. GARDEN CONTAMINATION

If the garden area is to be used for growing vegetables or fruit STME recommends testing for heavy metals. This can be done through Macquarie University Vegesafe program:

https://research.science.mq.edu.au/vegesafe/

Or contact STME for broad spectrum contamination testing.

15. IMPORTANT INFORMATION ABOUT CLASSIFICATION REPORTS

Classification reports are based on a unique set of project specific issues. This report should not be used:

- When the nature of structure detailed at the commission stage varies;
- When the size of the structure alters;
- When the structure positioning changes;
- When there is a change in ownership;
- For un-tested areas.

STME cannot accept responsibility for developments which have been changed or conceived after the site investigation without further consultation.

Most geotechnical “findings” are estimates based on the opinion of experienced professionals. Even when optimum testing is undertaken subsurface conditions may differ from those inferred by the report. No matter how qualified a person is and no matter how comprehensive an exploration program is, neither can reveal what is hidden by earth, rock and time. Subsurface changes may be more gradual or abrupt than a report may indicate and for this reason we recommend that you retain Soil Test Melbourne Geotechnical Engineering ’s services throughout the construction stage.

Subsurface conditions can change over time and construction decisions should not be based on affected reports. Consultation with STME about effects of time on site conditions is advised to enable educated decisions about undertaking additional testing.

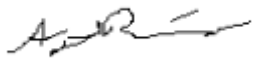
Costly misinterpretations can occur when other professionals interpret classification reports and for this reason STME should be retained to work with other suitably qualified consultants to ensure adequacy of their plans and specifications.

Reports and logs must never be read independently. In order to minimise delays, disputes and unanticipated costs other professionals and contractors should be given ready access to the complete classification report.

Important standard clauses appear throughout this report. They must be read carefully and in context with the site tested. STME will gladly assist with any questions you may have.

Should any queries arise, or should conditions differ from those described in this report upon footing excavations, please contact the undersigned prior to continuing any works.

Yours faithfully



Alex Rodriguez

GEOTECHNICAL ENGINEER

VBA Registration Number EC-43125

Appendix A	-	Borelogs (4)
Appendix B	-	Unified Soil Classification (1)
Appendix C	-	Site Sketch (1)

SOIL TEST MELBOURNE
Geotechnical engineering

PROJECT NO.: 03653
DATE: 29/03/2018
HOLE LOCATION: *Per Sketch*

HOLE NO.: 1
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (1kg per 1cm^2)	EXISTING FOOTING (mm)	DEPTH (mm)
	FILL *Grey, clay silt, dry, dense*						
400	*Containing gravel*						
500	***SILTY CLAY (CI)*** *Yellow/brown, moist, very stiff, Intermediate Plasticity*				*2.8*		
800					*4.8*		
1100		*GNO*			*6.0*		
1800	***END OF BOREHOLE***				*4.8*		

ABBREVIATIONS PER APPENDIX

SOIL TEST MELBOURNE
Geotechnical engineering

PROJECT NO.: 03653
DATE: 29/03/2018
HOLE LOCATION: *Per Sketch*

HOLE NO.: 2
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (1kg per 1cm^2)	EXISTING FOOTING (mm)	DEPTH (mm)
	FILL *Sandy silt, dry, gravel*	*GNO*					
400	***END OF BOREHOLE - UTP***						

ABBREVIATIONS PER APPENDIX

SOIL TEST MELBOURNE
Geotechnical engineering

PROJECT NO.: 03653
DATE: 29/03/2018
HOLE LOCATION: *Per Sketch*

HOLE NO.: 3
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (1kg per 1cm^2)	EXISTING FOOTING (mm)	DEPTH (mm)
	FILL *Sandy silt, dry, gravel*	*GNO*					
500	***END OF BOREHOLE - UTP***						

ABBREVIATIONS PER APPENDIX

SOIL TEST MELBOURNE
Geotechnical engineering

PROJECT NO.: 03653
DATE: 29/03/2018
HOLE LOCATION: *Per Sketch*

HOLE NO.: 4
METHOD: Mechanical Push Tube
WEATHER CONDITIONS: Fine

DEPTH (mm)	SOIL & ROCK DESCRIPTION	GROUND WATER	TREE ROOTS	SHEAR VANE READING	POCKET PENETROMETER (1kg per $1cm^2$)	EXISTING FOOTING (mm)	DEPTH (mm)
	FILL *Grey, clay silt, dry, dense*						
400	***SILTY CLAY (CI)*** *Yellow/brown, moist, very stiff, Intermediate Plasticity*	*GNO*					
1700	***END OF BOREHOLE***						

ABBREVIATIONS PER APPENDIX

COARSE GRAINED SOILS

(GW) Well graded gravels and gravel-sand mixtures, little or no fines.
(GP) Poorly graded gravels and gravel-sand mixtures, little or no fines.
(GM) Silty gravels, gravel-sand-silt mixtures.
(GC) Clayey gravels, gravel-sand-clay mixtures.
(SW) Well graded sands and gravelly sands, little or no fines.
(SP) Poorly graded sands and gravelly sands, little or no fines.
(SM) Silty sand, sand-silt mixtures.
(SC) Clayey sands, sand-clay mixtures.

FINE - GRAINED SOILS

(ML) Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.
(CL) Inorganic clays of low to low plasticity, gravelly clays, sandy clays, silty clays, lean clays.
(CI) Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.
(OL) Organic silts and organic silty clays of low plasticity.
(MH) Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.
(CH) Inorganic clays of high plasticity, fat clays.
(CH+) Inorganic clays of very high plasticity, fat clays.
(OH) Organic clays of medium to high plasticity.
(Pt) Peat, muck and other organic soils.

WEATHERING OF ROCK

Xw Extremely weathered rock
Hw Highly Weathered Rock
Dw Distinctly weathered rock
Sw Slightly weathered rock
Fr Fresh rock

GNO Groundwater not observed
GW Groundwater

UTP Unable to penetrate
DS Disturbed sample

GEOLOGICAL SYMBOL

Symbols used are taken from geological maps published by the Geological Survey of Victoria.

SITE SKETCH

SKETCH ONLY :- Not To Scale

TEST LOCATION (Approx)

FENCED BOUNDARY

UNFENCED BOUNDARY

Y:X SLOPE

m TREE

Appendix |C

JOB NUMBER: 03653

DATE: 29/03/2018