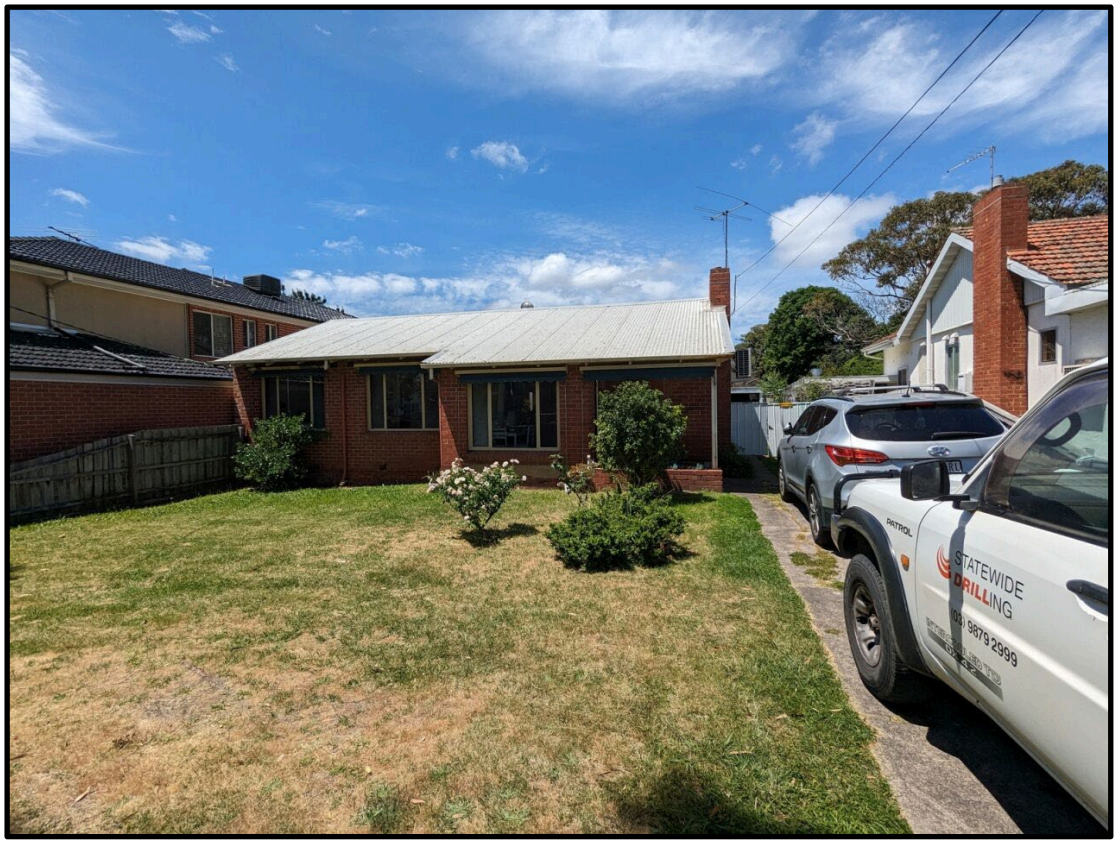
Statewide Geotechnical
Geotechnical Engineers

GEOTECHNICAL INVESTIGATION - RESIDENTIAL



32 KENDALL STREET
HAMPTON

PROJECT NO: 30164-1

Prepared for: DSL CONSULTING

22ND NOVEMBER, 2023

Statewide Geotechnical (Aust) Pty Ltd
17-20 Summer Lane, Ringwood 3134 - Phone: 03 9879 2999 Fax: 03 9879 6226
Email: geo@statewidedrilling.com.au ABN: 73 113 017 799 ACN: 113 017 799

1.0 INTRODUCTION

Statewide Geotechnical (Aust) Pty Ltd was engaged by DSL Consulting to conduct suitable field investigation in accordance with AS2870-2011 (Residential Slabs and Footings) for the purpose of assigning a site classification and providing site specific advice in relation to; earthworks, footings, construction and site maintenance requirements.

We understand that the proposed construction will comprise two new double storey, articulated brick veneer and clad frame dwellings.

2.0 SCOPE OF INVESTIGATION

Fieldwork was carried out by engineering staff from this firm on 15th November, 2023. Three boreholes were drilled with mechanical hand probe equipment and the subsurface profiles logged, sampled and appropriately strength/density tested. Borehole locations are shown in figure 1.

3.0 SITE DESCRIPTION

3.1 Building / Site Details

The site is a rectangular shaped residential property, bounded to the front (west) by Kendall Street and to remaining sides by developed residential allotments. The site surface gradient was measured using a hand-held clinometer and ranged from 0-3º sloping towards the north-east. An existing single storey brick dwelling and a garage are centrally located onsite and will be demolished.

A 12-15m high tree is located on the front nature strip and a 6-7m high tree is located at the rear of the property. Trees can be assumed to exert a drying effect over a radius 0.75X the **mature height** of the tree and 1.0X for a group or row of trees. For this site these trees will potentially cause drying of foundation zone soils through the eastern and western portions of the proposed construction envelope.

It is important that the designer satisfy themselves as to the mature heights of these trees, and any trees which may remain and hence the extent of potential drying related influence on the proposed construction envelope.

Key site details are summarised on attached figure 1.

3.2 Climatic Region

This site is classified as being within the Class 2 'Wet Temperate' Climatic Region.

4.0 GEOLOGY

4.1 Regional

The site is identified on the Geological Survey of Victoria RINGWOOD Sheet (1:63,360) as being located within the Province of Pliocene 'Brighton Group' Sands and associated soil profiles.

4.2 Borehole Profile

Three boreholes were drilled on this site during our investigation. Logs of the specific boreholes are attached to this report. An overview of the site subsurface profile follows:

- FILL material extending from surface to 0.3-0.5m, underlain by
- Natural Silty SAND, light grey / grey / red / brown, medium dense, extending to 0.7m, underlain by
- Sandy CLAY, orange / brown / grey / red, medium plasticity, very stiff to hard, extending to 1.5m+.

4.3 Soil Moisture / Groundwater

The fill material and natural soil profile is described as moist.

During wet months or following significant rainfall events, development of "perched" groundwater may occur, resulting in localized wetting or saturation of fill materials or natural sand soils which overlie the clay interface.

5.0 SITE CLASSIFICATION

This site is classified as **Class P** in accordance with AS2870 – 2011:

Clause 1.3.3c: Abnormal Soil Moisture Conditions likely – Growth of trees too close to footing.

Clause 1.3.3a: Abnormal Soil Moisture Conditions likely – Removal of existing dwelling or structures is likely to expose areas having significantly modified soil moisture regime.

While the site is classified as CLASS P for reasons outlined above, the extent of the site which may be potentially affected by Abnormal Soil Moisture Conditions related to existing trees is described as the eastern and western portions of the proposed construction envelope.

For areas of the site not affected by Abnormal Soil Moisture Conditions, standard design per a **Class M classification** may be appropriate.

Any SITE CUTTING or FILL PLACEMENT has the potential to alter areas of the site which may be affected by abnormal soil moisture conditions. It may also alter appropriate footing types.

Where CUT or FILL works occur, this office must be supplied with accurate details to ensure that the SITE CLASSIFICATION and FOOTING ADVICE remain appropriate.

6.0 SITE PREPARATION

Ensure existing footings and related structures are removed sufficiently so as not to interfere with new footings.

Tree stumps should be removed at the same time that trees are felled and stump excavations immediately backfilled with competent fill materials (i.e. granular materials or low-medium plasticity clays), placed in lifts of 200mm maximum with each lift being well compacted.

'Abnormal' soil moisture conditions are likely to occur through areas from which buildings, paving or trees have been recently removed. Such abnormal conditions will diminish with time, particularly during winter months when frequent rainfall is experienced. Allow the maximum possible time to elapse between removal of buildings, pavements or trees and the commencement of new construction. Should this period be less than 3 months this office should be contacted for site specific advice.

In conjunction with any excavation to achieve required grade levels the site shall be prepared in accordance with Section 6 of AS2870 – 2011 (Residential Slabs & Footings). Particular attention should be given to the stripping of all vegetation and topsoil containing root zone material. In addition, any areas of soft, loose or wet material which will not respond to compactive measures should be selectively excavated to achieve a firm working base.

In the absence of any underpinning of adjoining structures, construction excavations should be designed so that the cut (from top to bottom) is not intersected by an inverted plane extending outwards (and downwards) from the base of adjoining footings at an angle of 30^{o} through non cohesive soil and 45^{o} through cohesive soil.

7.0 FOOTING DESIGN RECOMMENDATIONS

7.1 On Grade Slab

For areas of ROLLED FILL, (per AS2870-2011) and/or successfully proof rolled site fill, having total depths of less than 400mm, construction of a CLASS M slab is appropriate. Slab EDGE and Load Bearing INTERNAL beams must penetrate through fill material and natural silty sand and be founded at least 100mm into the underlying natural sandy clay.

Non structurally loaded internal stiffening beams must penetrate through fill materials and can be founded into any natural, competent soils including silt, sand or clay.

Maximum allowable bearing pressures beneath slab beams are: 100kPa (edge and internally loaded) and 70kPa (internal stiffening).

All relevant construction notes to Fig.3.1, AS2870-2011 apply.

Where total depths of ROLLED and UNCONTROLLED FILL material as per C6.4.2 AS2870-2011 (including existing fill material) beneath any portion of the slab panel base exceed 400mm, then through such areas panels must be designed as self-supporting.

7.2 Strip / Pad / Stump Footings

Footings proportioned in accordance with a CLASS M site classification must penetrate through any fill material and natural silty sand and be founded at least 200mm into the underlying sandy clay.

Minimum founding depths should not be reduced to less than 600mm.

Maximum allowable bearing pressure beneath footings must not exceed 150kPa.

All relevant construction notes to Fig. 3.6, AS2870 2011 apply.

7.3 Areas Affected By 'Abnormal' Soil Moisture Conditions

For areas of the site affected by Abnormal Soil Moisture Conditions resulting from the existing trees, slab edge beams and strip footings should be deepened to adopt a minimum founding depth of 1.5m below finished surface level. This additional deepening will reduce the potential for root related drying of the foundation zone clays to affect the integrity of the footing. Beyond the zone(s) of tree influence, footings can be progressively shallowed to conform to founding depths specified earlier in this section.

7.4 General

It is essential that all foundation excavations be based in natural soil which is neither soft nor saturated. Should such conditions be encountered, then additional deepening to achieve a firm excavation base is required.

Where edge beams/footings are located adjacent to a backfilled service trench, we advise that, unless continuous rock is intersected at shallower depths, such footings should be deepened such that they are founded at or below the level of a plane of inclination (45º) extending outwards from the base of the trench.

8.0 CONSTRUCTION ADVICE

Founding depths recommended in Sections 7.2 and 7.3 are designed to minimize foundation movement experience by the proposed super structure. Minor foundation movement cannot be ruled out; particularly should any factors cause significant alterations to the soil moisture content within the foundation zone clays. Should the risk of such movement be unacceptable to the property owner, this office should be contacted immediately in relation to alternate engineer designed suspended footing systems which will negate potential footing movement.

Provide full height control joints in masonry walls above or close to junctions between different types of footing systems, footings founded at significantly different depths or footings founded on significantly different materials (i.e., clay and rock).

Brickwork control joints and/or features which articulate the brickwork such as timber panelling or full height windows should be incorporated at regular intervals. Full height articulation joints should be provided within 4.5m of corners, and a nominal 6.0m thereafter. Should a rendered finish be applied to new brickwork or clad frame walls, it is important that control joints are similarly integrated into the render finish.

9.0 SITE MAINTENANCE

The attached Appendix (Site Maintenance Requirements) forms an integral part of this report and should be read carefully. In addition the following maintenance issues are emphasised;

Surface spoon drains and cut-off drains should be installed upslope of the building envelope to intercept and channel both run-off and shallow groundwater seepage away from site cuts and foundations. Cut-off drains should penetrate 50mm below the upper clay interface.

Ensure that the ground level is contoured to provide adequate drainage away from foundations.

For and on behalf of
Statewide Geotechnical (Aust) Pty Ltd

Matthew Cotter B.Sc (Geo),
Engineering Geologist
(Author)

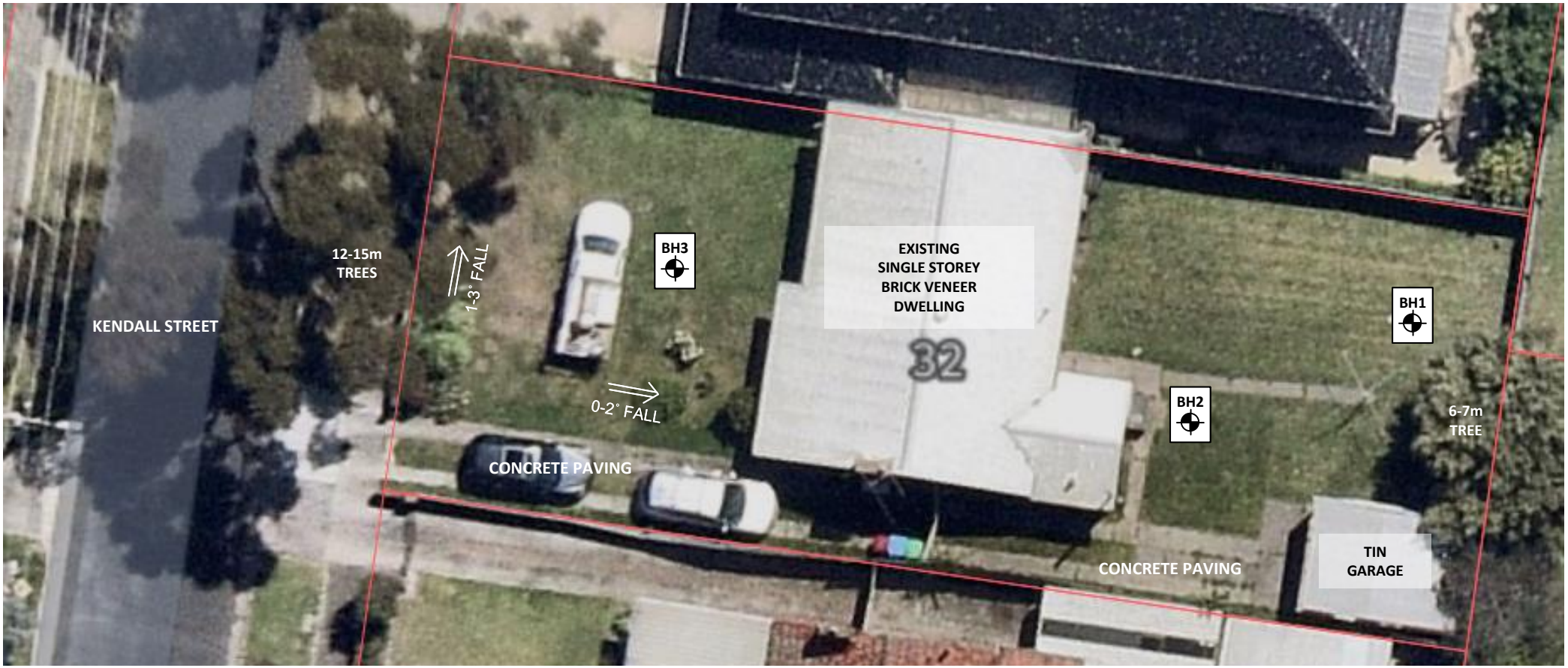
David Alkemade B.Eng (Geo), MSc
Engineering Manager
(Reviewed by)

Statewide Geotechnical
Geotechnical Engineers

CLIENT: DSL CONSULTING

PROJECT No: 30164

FIGURE 1 SITE PLAN



AERIAL IMAGE FROM WWW.NEARMAP.COM.AU DATED: 29/10/2023

PROJECT ADDRESS: 32 KENDALL STREET, HAMPTON

SCALE: NOT TO SCALE

KEY Borehole Probe

N

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Borehole No.
BH1
Page 1 of 1

Engineering Log - Borehole

Project No.: 30164

Client:	DSL CONSULTING	Commenced:	15/11/2023
Project Name:	NEW DWELLING	Completed:	15/11/2023
Project Location:	32 KENDALL STREET, HAMPTON	Logged By:	CL
Hole Position:	SEE ATTACHED FIGURE	Checked By:	DW

Drill Model and Mounting:	HAND PROBE	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	90 mm	Bearing:		Datum:	AHD	Operator:	CL

Drilling Information							Soil Description					Observations
Method	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
HP			PP 0.80 m =300 kPa PP 1.00 m =400 kPa PP 1.20 m =450 kPa			0.2 0.4 0.6 0.8 1.0 1.2 1.4 1.6 1.8		FILL	Admixed sand, silt, gravel, roots & root fibres, grey, dark grey, light grey 0.40m	M	MD		
								SM	Silty SAND, light grey, grey, (fine grained) 0.70m	M	MD		
								CL	Sandy CLAY, orange, grey, red, brown, medium plasticity, sand content increasing 1.50m	M	VSt H	× × ×	
									Hole Terminated at 1.50 m Target depth				

Method
AD - Auger Drilling
HA - Hand Auger
HP - Hand Probe
RR - Rock Roller
WB - Washbore
NDD - Non Destructive Digging

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very Soft
S - Soft
F - Firm
VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Support
C - Casing

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Plastic Limit
< PL
= PL
< PL

Statewide Geotechnical
Geotechnical Engineers

Borehole No.
BH2
Page 1 of 1

Engineering Log - Borehole

Project No.: 30164

Client:	DSL CONSULTING	Commenced:	15/11/2023
Project Name:	NEW DWELLING	Completed:	15/11/2023
Project Location:	32 KENDALL STREET, HAMPTON	Logged By:	CL
Hole Position:	SEE ATTACHED FIGURE	Checked By:	DW

Drill Model and Mounting:	HAND PROBE	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	90 mm	Bearing:		Datum:	AHD	Operator:	CL

Drilling Information							Soil Description					Observations
Method	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density / Pocket Penetrometer UCS (kPa)	Structure and Additional Observations
HP			PP 0.80 m =300 kPa			0.2		FILL	Admixed sand, silt, gravel, roots & root fibres, grey, dark grey, light grey	M	MD	
						0.4			0.50m			
						0.6		SM	Silty SAND, light grey, grey, (fine grained)	M	MD	
						0.8			0.70m			
						1.0		CL	Sandy CLAY, orange, grey, red, brown, medium plasticity, sand content increasing	M	VSt — — ×	
			PP 1.20 m =400 kPa			1.2					H ×	
						1.4			1.50m			
						1.6			Hole Terminated at 1.50 m Target depth			
						1.8						

Method
AD - Auger Drilling
HA - Hand Auger
HP - Hand Probe
RR - Rock Roller
WB - Washbore
NDD - Non Destructive Digging

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
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D - Disturbed Sample
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Moisture Condition
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Consistency/Relative Density
VS - Very Soft
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VSt - Very Stiff
H - Hard
Fr - Friable
VL - Very Loose
L - Loose
MD - Medium Dense
D - Dense
VD - Very Dense

Support
C - Casing

Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Plastic Limit
< PL
= PL
< PL

Statewide Geotechnical
Geotechnical Engineers

Borehole No.
BH3
Page 1 of 1

Engineering Log - Borehole

Project No.: 30164

Client:	DSL CONSULTING	Commenced:	15/11/2023
Project Name:	NEW DWELLING	Completed:	15/11/2023
Project Location:	32 KENDALL STREET, HAMPTON	Logged By:	CL
Hole Position:	SEE ATTACHED FIGURE	Checked By:	DW

Drill Model and Mounting:	HAND PROBE	Inclination:	-90°	RL Surface:	No survey		
Hole Diameter:	90 mm	Bearing:		Datum:	AHD	Operator:	CL

Drilling Information							Soil Description					Observations
Method	Support	Water	Samples Tests Remarks	Recovery	RL (m)	Depth (m)	Graphic Log	Group Symbol	Material Description Fraction, Colour, Structure, Bedding, Plasticity, Sensitivity, Additional	Moisture Condition	Consistency Relative Density	Pocket Penetrometer UCS (kPa) 100 200 300 400 500	Structure and Additional Observations
HP						0.2		FILL	Admixed sand, silt, gravel, roots & root fibres, grey, dark grey, light grey	M	MD		
						0.4		SM	0.30m Silty SAND, light grey, grey, (fine grained)	M	MD		
						0.6			With ferruginous gravel at 0.6m, red, brown				
			PP 0.80 m =300 kPa			0.8		CL	0.70m Sandy CLAY, orange, grey, red, brown, medium plasticity, sand content increasing		VSt	×	
			PP 1.10 m =400 kPa			1.0				M		×	
			PP 1.40 m =400 kPa			1.2					H	×	
						1.4			1.50m Hole Terminated at 1.50 m Target depth				
						1.6							
						1.8							

Method
AD - Auger Drilling
HA - Hand Auger
HP - Hand Probe
RR - Rock Roller
WB - Washbore
NDD - Non Destructive Digging

Penetration
No resistance ranging to refusal

Water
Level (Date)
Inflow
Partial Loss
Complete Loss

Samples and Tests
U - Undisturbed Sample
D - Disturbed Sample
SPT - Standard Penetration Test

Moisture Condition
D - Dry
M - Moist
W - Wet

Consistency/Relative Density
VS - Very Soft
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Support
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Graphic Log/Core Loss
Core recovered (hatching indicates material)
Core loss

Classification Symbols and Soil Descriptions
Based on Unified Soil Classification System

Plastic Limit
< PL
= PL
< PL

REPORT ADDENDUM

To be read in conjunction with attached report

LIMITATIONS OF REPORT

The subsurface conditions and related site preparation and footing advice outlined in this report is based on assumptions that test results obtained from borings or pits are representative of the overall subsurface conditions. It is the responsibility of the owner/builder to confirm that the locations of our test site has broadly covered the site area for the final proposed construction.

In the event that site/footing excavations reveal soil conditions which differ from those described in this report then Statewide Geotechnical (Aust) Pty Ltd should be contacted immediately and excavations stopped immediately. We take no responsibility for site/footings excavations deepened beyond our recommended founding depth without prior approval from this firm.

The recommendations in this report are also based on the following:-

a) Information about the site and its history, proposed site treatment and building type conveyed to us by the client or their agent.
b) Professional judgments and opinions using the most recent information in soil testing practice that is available to us.
c) The location of our test sites and the information gained from this and other investigations.

Should the client or their agent neglect to supply us with correct relevant information, including information about previous buildings, trees or past activities on the site, or should changes be made to the building type, size and/or position, our report may be made irrelevant or inappropriate. In such cases, we will not accept any liability for the consequences and we reserve the right to levy an additional charge if more testing or a change to the report is necessary.

Unless otherwise stated in our commission, all dimensions and measurements in relation to borehole positions and depths of soil strata, as well as slope directions and magnitudes are approximates only and must not be relied upon for accurate building cost calculations. Plans do not represent accurate title details. Locations of site features including trees, services, existing/adjoining buildings etc are approximates only.

All contractors must be well briefed as to the requirements and specifications in this report. To minimize the likelihood of misinterpretation, this report must not be reproduced unless in full and contractors given ready access to the complete report.

This report is based on the assumptions that conditions revealed through selective sampling are indicative of the actual conditions throughout the site, i.e. correlation between boreholes. Variations between boreholes may exist due to previous land use or natural geologic processes. Additional deepening of the foundations, deeper than the minimum specified founding depths in this report may be required. The actual subsurface conditions can be discerned only during earthworks when the subsurface profile can be directly observed.

CONSTRUCTION & SITE MAINTENANCE

Conventional footings are designed to accommodate normal reactivity induced seasonal surface movements, but require that a good foundation maintenance program be implemented. A good foundation maintenance program should be aimed at keeping foundation zone soils at a low and constant moisture content. To this end we recommend that the notes contained in AS2870-2011 Appendix B and the CSIRO Information Sheet BTF 18 (references 1 and 4) be implemented, and that particular attention be given to the points discussed below.

To ensure the satisfactory long term performance of footings, it is absolutely imperative that:

- No water shall be allowed to pond or pool at the base of the foundation excavations.
- The storm water be connected as soon as the roof is sealed. This will normally require the installation of a temporary system 'above ground' until permanent drainage is connected and operational, and
- The ground surface and pavements adjacent to the building be graded away from the building as per the drainage requirements C5.2.AS2870 Supp-2011.

Articulation

Articulation of masonry walls should be provided as per details contained in reference (3) above. Spacing between articulation joints should not exceed a maximum of 6.0m, and should be provided at/or between:

- Any new walls abutting the existing walls.
- Footings founding at significantly different founding depths, or founding material, and
- Points of high stress, i.e. above door and window openings, changes in storey height, or above large spanning lintels.

Service Trenches/Easements

The presence of service trenches and easements is a common cause of unsatisfactory performance of foundations through either direct undermining or through the introduction of undesirable levels of soil moisture. For this reason we recommend:

- Where footings are located in close proximity or adjacent to a backfilled service trench or easements, the footings must be deepened and founded at a depth at or below the level of plane of inclination of 45^{o} above horizontal extending outwards from the base of the trench or filling (as illustrated by figure C6.1 AS2870 Suppl-2011). This includes service trenches which may be present on adjacent sites or on site prior to the current development (such as abandoned storm water and sewer trenches); and

- A minimum offset of 2.0m from the building should be adopted for all service trenches and/or easements.
- Where the minimum 2.0m offset is not possible, the maximum available offset should be adopted, and the footing should be deepened at least one footing width below the level of plane of inclination of 45^{o} above horizontal extending outwards from the closest deepest corner of the service trench. This is intended to minimize the risk of unacceptable soil moisture changes facilitated by the proximity of the service trenches. There will be instances where this office can reduce this depth upon discussions and written approval.
- All service trenches should be sloped away from the building as per AS2870-2011 section 6.6(d).
- Backfill material should ideally comprise weakmix concrete, mortar or (preferably) cement stabilized soil, or clean adequately tamped/compacted clay placed marginally wet of optimum. Permeable or granular material such as sand, gravel, ¼ minus, or building rubble, should not be used to backfill service trenches in proximity to building foundations.

Where footings/edge beams are to be additionally deepened, we recommend blinding concrete should first be poured in the base of the excavation upon which the footing/edge beam can be constructed.

Significant additional deepening (greater than nominal depth of 1.50m) may necessitate the footing/edge beam to be suspended to an engineer design. The design should be conducted with the intention that should the clay soils shrink, the footing/edge beam should then be supported on the mass pad/pier footing. In this way the structural stiffness of the footing can remain the same throughout the design, i.e. maintain a uniform slab edge beam thickness or strip footing depth. These footings must be founded as per the rest of the development. Recommendations for bored piers/mass excavated pad footings may be obtained from this office if required.

Site drainage

The site should be graded or drained to prevent water from ponding against or near the building. Monitoring of surface drainage paths should be ongoing. In any areas where ponding or pooling of water does occur, the surface should be regraded to direct water away from the building or to storm water discharge points.

Garden restrictions

Garden beds should not compromise site drainage or be located directly adjacent to the building and should not be over-watered where they are near the building foundations.

Maintenance of plumbing, services and storm water system

All services and plumbing must be well maintained and periodically checked for leaks. Guttering must be kept clean at all times and down pipes discharge all roof water into the storm water system (or rainwater tank).

Trees

Trees/shrubs can induce ‘drying’ of foundation zone soils, resulting in shrinkage and consequent foundation movement and cracking. Conversely, trees/shrubs can also block or crack service pipes, resulting in leaking and wetting of foundation zone soils, with similar undesirable consequences.

Trees should therefore be prohibited a minimum distance equal to the mature height of the tree from structures for sites of high reactivity. There generally has to be a compromise between the presence of trees and foundation movement and associated cracking.

Tree roots are attracted to moist ground conditions. If a relatively low and constant ground moisture condition can be maintained in the vicinity of the foundations, tree roots, which may cause volumetric changes in the foundation zone soils and/or cracking in later dry periods, will be attracted to other areas.

Foundation performance

It should be noted that the conventional foundations specified in AS2870-2011 may still experience some minor (non-structural) foundation movement and cracking, even where good foundation maintenance practices are undertaken, depending on environmental factors and local conditions (refer to AS2870-2011 Section 1.3.1 and Table C1 and C2 Appendix C). This reflects the necessity of achieving a balance between cost, safety and serviceability.

Alternatives to conventional foundations can be ‘tailored’ to suit the desired level of performance of the foundation system. Should minor foundation movements be intolerable or on-going maintenance be undesirable, the foundation may be engineered accordingly. This will be a matter for the proponent to decide based on the required level of serviceability and desired performance criteria, and cost. Further advice with regard to an alternative foundation design may be obtained from this office, if required.

This report is valid for a period of 2 years from date of testing. Should construction works commence after this time frame, then this office should be contacted for further advice and a report update. Note that this update will require a site inspection and possible additional fieldwork.

References:

AS2870-2011. “Residential slabs and footings – Construction”

AS2570 Suppl-2011

. “Residential slabs and footings – Construction – Commentary”

“The Cement and Concrete Association of Australia” Technical note TN61

“Foundation Maintenance and Footing Performance: A Homeowners Guide”, CSIRO Information Sheet BTF 18.