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ISLAND SOIL TESTING

AUSTRALIAN GEOMECHANICS SOCIETY MEMBER

PROFESSIONAL ENGINEERS OF QUEENSLAND MEMBER

ENGINEERS AUSTRALIA Professional Engineers MEMBER

SITE CLASSIFICATION REPORT

MEAGAN SHEPPARD: 71 WOODLANDS CIRCUIT, RUSSELL ISLAND

AS2870:2011 RESIDENTIAL SLABS AND FOOTINGS

REPORT N0. G504151	
SAMPLE DATE	19 APRIL 2023
REPORT DATE	20 APRIL 2023
REAL PROPERTY DESCRIPTION	LOT 76 RP124435
LOCAL AUTHORITY	REDLAND CITY COUNCIL
SITE CLASSIFICATION AS2870-2011	Class "P" (WEAK SOILS & TREES) Underlying Class "S"

SUMMARY

Site investigations have determined that the site soil material at founding depth is SANDY LOAM. In accordance with *clause 2.2.1 (a) "Classification of Other Sites*, due to the presence of trees whether remaining, recently removed or likely to be removed AND inadequate bearing capacity as indicated in the bore logs at possible founding depth being an indication of the presence of loose sands and / or collapsing soils, the Site Classification is: Class "P" (underlying Class "S").

PARTICULAR OBSERVATIONS

The site characteristics are presented below:

Vegetation: Treed	Slope: Slopes to the southwestern boundary at about 6%.	
FOUNDATION DESIGN PARAMETERS & POTENTIAL IMPACT OF TREES		
Abnormal moisture conditions are evident or likely to be evident beyond those for normal sites with a higher probability of foundation movement. Abnormal moisture conditions existing prior to construction include removal of trees prior to construction and the presence of trees on the building site or adjacent site.	Sampling of site material indicates a Characteristic Surface Movement (Ys) range for Class "S" sites of: $0 < Ys \leq 20$. In accordance with *clause 2.3.2(iii*) the recommended *Characteristic Surface Movement* to be used in the foundation design is Ys= 17mm	Due to the "P" classification, a standard design to Section 3 of AS2870-2011 is not appropriate for this site. Special consideration of the impact of weak soils & trees as per Appendix H of AS2870-2011 on the design of the foundations is required by the RPEQ Structural Engineer. Refer to section TREES below.

A report by The Island Engineer (RPEQ11020) is attached to this report in regard to the implications of foundation design. Refer to Appendix A: Bore Log and site photos at Appendix C: Site Photos.

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SITE INVESTIGATION

SCOPE

Island Soil Testing has been commissioned to undertake a site investigation (soil test) for the proposed residential construction at the above site address. The purpose of the site investigation is to provide information on the existing subsurface conditions and determine the site classification in accordance with *AS2870 Residential Slabs and footings; Section 2: Site Classification* to inform subsequent footing and foundation design in accordance with the Standard.

APPLICABLE STANDARDS

Site Classification in accordance with AS2870-2011(The Standard):

For "Class P" sites the classification is in accordance with clause 2.1.3 of the standard. The Method of Site Classification is in accordance with *clause 2.2.1 (a) "Classification of Other Sites".* Class P sites may include sites where:

i) Sites with inadequate bearing strength shall be classified as Class P. Class P sites include soft or unstable foundations such as soft clay or silt or loose sands, landslip, mine subsidence, collapsing soils and soils subject to erosion, reactive sites subject to abnormal moisture conditions and sites that cannot be classified in accordance with Clause 2.1 .2.

ii) Abnormal moisture conditions are those that result in foundation moisture variations beyond those for normal sites. Buildings constructed on sites subject to abnormal moisture conditions have a higher probability of damage. Examples of abnormal moisture conditions existing prior to construction include the following:
(a) Removal of trees prior to construction,
(b) Presence of trees on the building site or adjacent site.
(c) Adequate site drainage
(d) Removal of an existing building or structure likely to have significantly modified the soil moisture conditions under the footprint of the footing system of the building.

For normal sites as defined in clause *1.3.2 "Normal Sites"* Site classification is in accordance with *clause 2.2 Methods of Site Classification* based on characteristic surface movement in accordance with *Clause 2.2.3. Site classification based on characteristic surface movement.* As per *clause 2.3.2 Instability Index* the instability index (I_{pt}) is determined by Visual-tactile identification of the soil to determine the *Characteristic Surface Movement* in accordance with *clause 2.3.1.* Refer to the table below for Site Classification based on the Characteristic Surface Movement.

CLASSIFICATION BASED ON SITE REACTIVITY (Table 2.1 AS2780-2011)

SITE CLASSIFICATION SYMBOLS	DESIGN Y'S RANGE	GENERALISED DESCRIPTION (Guide only)
'A'	0 < Ys	Moist sand rock sites with little or no ground movement from moisture changes.
'S'	0 < Ys ≤ 20	Slightly reactive clay sites, which may experience only slight ground movement from moisture changes
'M'	20 < Ys ≤ 40	Moderately reactive clay or silt sites, which may experience moderate ground movement from moisture changes
'H1'	40 < Ys ≤ 60	Highly Reactive clay sites, which may experience high ground movement from moisture changes.

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'H2'	60 < Ys ≤ 75	Highly Reactive clay sites, which may experience very high ground movement from moisture changes
'E'	Ys > 75	Extremely reactive clay sites, which may experience extreme ground movement from moisture changes

Test Methods: AS1289 3.1.2 (liquid limit). 3.4.1 (linear shrinkage). 7.1.1. (shrink-swell)

The depth of investigation as per clause *2.4.3 Depth of Investigation* of the soil profile has been examined equal to 0.75 times the depth of design suction change (Hs), being 1.125m for the locality, but not less than 1.5 m unless rock is encountered. The depth of investigation is at least 1.5m.

The number of sampling boreholes is in accordance with clause 2.4.4 Minimum number of exploration positions, being a minimum of one borehole or pit per building site. In addition, Dynamic Cone Penetrometer (DCP) tests were undertaken in accordance with A*S1289.6.3.2 Methods of testing soils for engineering purposes Soil strength and consolidation tests - Determination of the penetration resistance of a soil - 9 kg dynamic cone penetrometer test* to provide bearing capacity. Discussion of adequate bearing strength is referenced in *clause 2.4.5 Bearing capacity*. Refer to Appendix B SITE SKETCH.

FIELD WORK

A sampling borehole at the likely / proposed building location was undertaken using a powered auger to a maximum depth of 2000mm. Dynamic Cone Penetrometer (DCP) tests (AS 1289.6.3.2) were also undertaken at the time of the site investigation. Where site is not accessible due to dense vegetation, non-trafficable surfaces or remote locations, a hand auger is used to 1.5m depth for soil sampling. DCP tests will be to at least 2m.

GROUNDWATER

Any groundwater identified at the time of the investigation is shown in the borelog at Appendix A: Bore Log (3rd left column "W" indicates groundwater.

Further reference is given to:

Foundation Maintenance and footing performance: a home owners guide" < https://www.publish.csiro.au/book/7076/ >
AS 2870-2011 Residential Slabs and Footings
AS 2870 – 2011 Commentary
AS 1726 – 2017 Geotechnical Site Investigations
AS 1289 -2003 Methods of Testing Soils for Engineering Purposes
HB 160-2006 Handbook - Soil Testing

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INVESTIGATION ASSESSMENT

Refer to Appendix B: SITE SKETCH and Appendix C: SITE PHOTOS.

FOOTINGS

Uniform performance of footings across the site is assisted by the founding of footings into similar competent strata.

ALLOWABLE BEARING CAPACITY

The bearing capacity of the soils encountered on this site is provided at Appendix A: Bore Log

FILL

No evidence of fill was found during the investigation. Note that buried trees are often found on the Southern Moreton Bay Islands on cleared land and a cautionary approach should be adopted.

TREES

As described in Appendix H of AS2870-2011, the presence of trees will affect the Characteristic Surface Movement (Y_s) that is used in the foundation design. For the design of a stiffened raft system at this site, the tree-induced differential ground beam mound height (ym) trees, is equal to (0. 7ys + yt). The foundation design will need to determine the ym based on the location of the trees in regard to the proposed building and the adjacent height of trees or group of trees. The table below is typical for the Southern Moreton Bay Islands and shows the effect of trees based on the distance to the foundation for various tree heights.

Design y_m (mm) differential ground movement Appendix H AS2870-2011									
Single Tree Height (m)	Class S			Class M			Class H1		
	Distance to Footing (m)			Distance to Footing (m			Distance to Footing (m		
	2	4	6	2	4	6	2	4	6
	Typical Design Differential Y_m (mm)								
6	40	24	7	54	38	21	68	52	35
10	47	37	27	61	51	41	75	65	55
14	50	43	36	64	57	50	78	71	64
18	51	46	40	65	60	54	79	74	68

Trees removed prior to construction will provide an initially extreme soil moisture condition, outside the scope of AS 2870-2011. As moisture is slowly regained beneath the new construction, swelling movements may be exacerbated in the vicinity of the removed trees, which, depending on the locations of the trees, could impact adversely on the performance of the foundations.

DRAINAGE

The site showed reasonable drainage conditions

During construction and throughout the life of the structure good drainage is required to avoid abnormal moisture conditions within the soil profile adversely affecting the performance of the foundations. Overland and gutter overflow is to be diverted away from foundations. The area surrounding the structure (min 1.0m) is to be graded away from the foundation at a minimum slope

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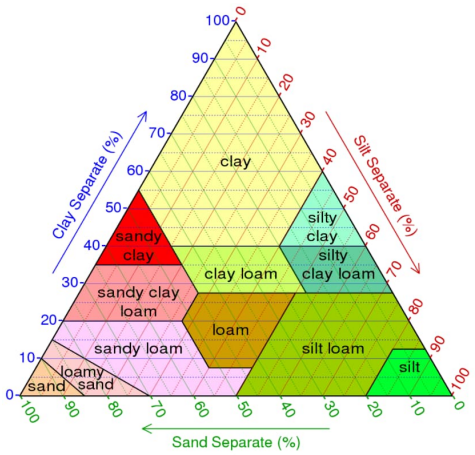
1:20. All drainage is to be maintained in good working order (no leaks). Regular inspections and maintenance are essential.

SOIL TYPES

Loam is soil composed mostly of sand, silt, and a smaller amount of clay being by weight, about 40–40–20% concentration of sand–silt–clay, respectively. These proportions can vary to a degree, and result in different types of loam soils: sandy loam, silty loam, clay loam, sandy clay loam, silty clay loam, and loam. Refer to the textural classification triangle (right). Loam soils generally contain more nutrients, moisture, and humus than sandy soils, have better drainage and infiltration of water and air than silt and clay-rich soils. The different types of loam soils each have slightly different characteristics, with some draining liquids more efficiently than others.



SITE CLASSIFICATION

After assessing the test results at Appendix D and after considerations of the requirements of *AS2870-2011 Residential Slabs and Footings* in regard to Site Classification in-particular clauses 2.1.3 and 2.4.5 this site has the site soil characteristics to indicate Class “P” type soil properties. The site can therefore be generally described as Class “P” Problematic for engineering design purposes.

Signed

RAYMOND J SAUNDERS RPEQ11020

Digitally signed by RAYMOND J SAUNDERS RPEQ11020
DN: cn=RAYMOND J SAUNDERS RPEQ 11020, c=AU, ou=FOUR PRIVET DRIVE TRUST, email=raysaunders.pacific@gmail.com
Reason: I am approving this document
Date: 2023.04.21 14:14:35 +10'00'

Raymond J Saunders

RPEQ 11020 (Civil & Struct) MIEAust CPEng NER APEC Engineer IntPE(Aus) Member Australian Geomechanics Society

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GENERAL INFORMATION

CLASSIFICATION "P" PROBLEMATIC (Clauses 2.1.3; 2.4.5 AS2780-2011)

2.1.3 Classification of other sites

Sites with inadequate bearing strength or where ground movement may be significantly affected by factors other than reactive soil movements due to normal moisture conditions shall be classified as Class P. Class P sites include soft or unstable foundations such as soft clay or silt or loose sands, landslip, mine subsidence, collapsing soils and soils subject to erosion, reactive sites subject to abnormal moisture conditions and sites that cannot be classified in accordance with Clause 2.1.2.

A site shall be classified as Class P if—

(a) the bearing strength is less than that specified in Clause 2.4.5;

2.4.5 Bearing capacity

Determination of adequate bearing strength shall be considered as follows:

(a) The design bearing capacity at foundation level shall be not less than 100 kPa for strip and pad footings and under the edge footing of footing slabs used without tie bars between the edge footing and slab.

(b) The design bearing capacity at foundation level shall be not less than 50 kPa under all beams and slab panels and support thickenings for slab construction.

Determination of bearing capacity shall consider the weakest state of the foundation under normal site conditions. Local knowledge shall be used where available.

NOTE: Inadequate bearing capacity is not common, except for some sites with loose sand, collapsing soils or swampy deep silt deposits.

APPENDIX A: References: AS2870-2011; cl 2.4.4 (a), AS 1289.6.3.2

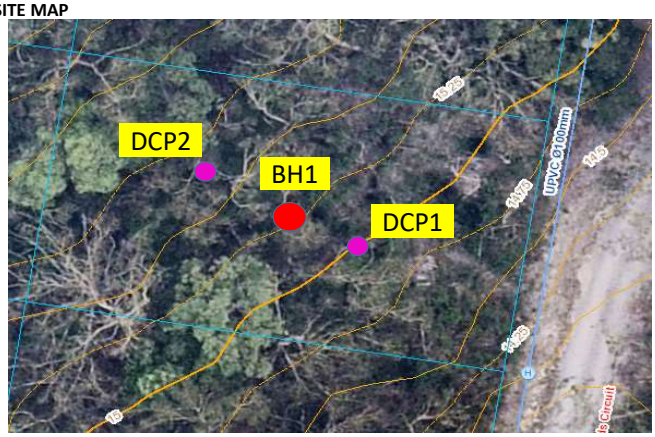
ISLAND SOIL TESTING

JOB NO	**504151**
LOCATION	**71 WOODLANDS CCT**
	RUSSELL ISLAND
TEST DATE	**19 April 2023**

SURFACE ELEVATION ***(source: red-e-map)***

BH1	15.25	m AHD
DCP 1	15.00	m AHD
DCP 2	15.65	m AHD

SITE MAP



BOREHOLE BH-1 (PIT)

RL (m AHD)	DEPTH (m)	WATER (W)	GEO UNIT (N-natural F-fill)	GRAPHIC	CLASSIFICATION SYMBOL	SOIL MATERIAL DESCRIPTION	Moisture Cond.	Cons. Strgth
15.2	0.1		N			SANDY LOAM		S
15.1	0.2					Yellow Grey		
15.0	0.3				ML	SANDY LOAM	Sl. MOIST (w≈<PL)	St
14.9	0.4					Dense		
14.8	0.5				ML	SANDY LOAM		S
14.7	0.6					Yellow Grey	DRY (w<PL)	
14.6	0.7					Dense		S
14.5	0.8							F
14.4	0.9							S
14.3	1.0				ML	LOAM	Sl. MOIST (w≈<PL)	
14.2	1.1					Yellow Brown		S
14.1	1.2					Med Dense		
14.0	1.3							F
13.9	1.4							St
13.8	1.5				MH	CLAY LOAM	Sl. MOIST (w≈<PL)	H
13.7	1.6					Red Yellow Brown		
13.6	1.7					Med. Dense		H
13.5	1.8					Red Yellow Brown		
13.4	1.9				MH	CLAY LOAM	Sl. MOIST (w≈<PL)	H
13.3	2.0					Dense		
					END			

DCP-1

DEPTH (m)	DCP (blows/100mm)	Kpa	BEARING CAPACITY DESCRIPTION
0.1	1	60	SOFT
0.2	2	90	
0.3	4	340	STIFF
0.4	4	340	
0.5	2	90	SOFT
0.6	2	90	
0.7	2	90	SOFT
0.8	3	150	FIRM
0.9	2	90	SOFT
1.0	2	90	
1.1	1	60	SOFT
1.2	2	90	
1.3	3	150	FIRM
1.4	4	340	STIFF
1.5	7	600	HARD
1.6	7	600	
1.7	8	730	HARD
1.8	7	600	
1.9	7	600	HARD
2.0	8	730	
			END

DCP-2

DEPTH (m)	DCP (blows/100mm)	Kpa	BEARING CAPACITY DESCRIPTION
0.1	1	60	SOFT
0.2	2	90	
0.3	2	90	SOFT
0.4	2	90	
0.5	2	90	SOFT
0.6	3	150	FIRM
0.7	4	340	STIFF
0.8	4	340	
0.9	4	340	STIFF
1.0	2	90	SOFT
1.1	2	90	
1.2	4	340	STIFF
1.3	5	430	VERY STIFF
1.4	6	430	
1.5	6	430	VERY STIFF
1.6	6	430	
1.7	7	600	HARD
1.8	8	730	
1.9	7	600	HARD
2.0	8	730	
			END

0.6m SAMPLE	SAMPLE 0.9m DEPTH	SAMPLE 1.5m DEPTH
		

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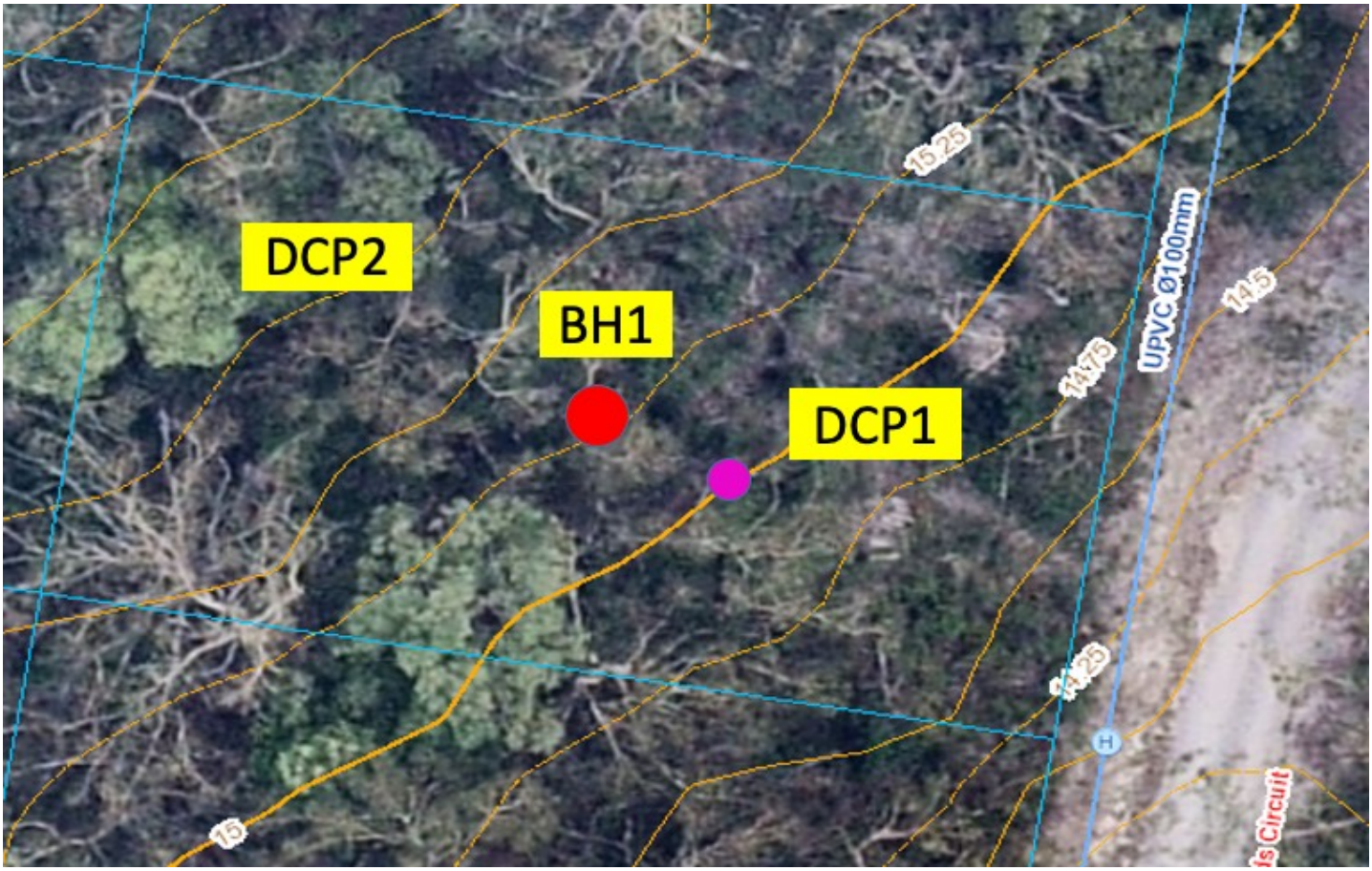
APPENDIX B

SAMPLING SITE SKETCH



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APPENDIX C

SITE PHOTOS

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ENGINEERS AUSTRALIA Professional Engineers MEMBER

IMPORTANT

NOTE: Under the QBSA subsidence policy the engineer confirms the "Site Classification" nominated in this report and confirm that:

(i) the engineer or their representative has visited the site;

(ii) the site investigation for soil testing has been undertaken by a Registered Professional Engineer in Qld (RPEQ) or a soil tester licensed under the Act;

(iii) exploration positions or bore holes conducted by the site investigator have been undertaken in the proposed footprint of the building or where no proposed footprint has been provided in such locations to be able to suitable for foundation design purposes and below final platform level in accordance with current edition of Australian Standard AS2870:2011 Residential Slabs & Footings.

(iv) soil samples have been taken for the purposes of laboratory testing in accordance with Australian Standard AS2870: Residential Slabs & Footings.

(v) for clay sites the laboratory test and soil test report included ISS and YS values (obtained by shrink and swell tests) in accordance with Australian Standard AS2870:2011 Residential Slabs & Footings.

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(b) have not verified the accuracy or reliability of this information (other than as expressly stated in this Report);

(c) have not made any independent investigations or enquiries in respect of those matters of which it has no actual knowledge at the time of giving this Report to the Client; and

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(a) is based on information gathered from a field investigation.

(b) cannot predict the ground conditions encountered at any untested location because the ground conditions surrounding a test sampling location (or between any two test sampling locations) may be different from the test samples we have obtained.

(c) is not an environmental, contamination or hazardous materials assessment.

(d) may be invalid, incomplete or inaccurate (including errors in the scope of work, investigation methodology, observations, opinions and advice) where the information provided to Island Soil Testing was invalid, incomplete or inaccurate.

(e) is limited to observations of those parts of the site that were accessible at the time of the field investigation and is not based on observations about areas of the site which were inaccessible to the investigation equipment (including slopes, heavily vegetated areas or service corridors); and

(f) is not a comprehensive representation of the actual site conditions and may only show a reasonable interpretation of conditions encountered at discrete test locations along with general site observations.

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