TREE WISE MEN®
AUSTRALIA PTY LTD

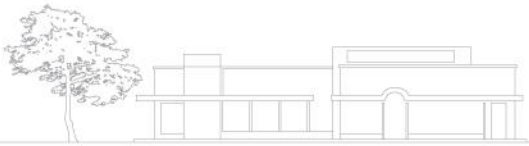
Arboricultural Impact Assessment
For
Block 5 Remediation Development Application
At
Block 5, Barangaroo
Hickson Road
Millers Point

Prepared for:

Lend Lease (Millers Point) Pty Ltd
Level 4, 30 The Bond
30 Hickson Road
MILLERS POINT NSW 2000

Ref: 2095AIABlock5RemRev

June 2014



ARBORICULTURAL CONSULTANCY
ACN 002 982 247 ABN 15 002 982 247
84 Fuller Street, Collaroy Plateau NSW 2097
Phone +61 2 9981 5219 Fax +61 2 9971 0881
treewise@treewisemen.com.au
www.treewisemen.com.au

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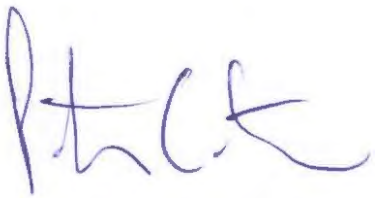

Peter Castor
Director

BSc (For.)
Member: AA, IACA, PIA, LGTRA, MAE (UK)
30 June 2014

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ATTACHMENTS

1. EXECUTIVE SUMMARY

1.1 GENERAL

1.1.1 This Arboricultural Impact Assessment (AIA) assesses the likely tree impacts from remediation works proposed in a Development Application for Remediation at Block 5 Barangaroo South, Hickson Road, Millers Point.

1.2 TREE IMPACTS

1.2.1 The ten (10) trees assessed within and adjacent to the Block 5 Remediation Area are indicated on the Tree Protection Plan (Sheet 1 of 2 at Attachment B) and in the Tree Schedule (Attachment A). There are only three (3) trees located within Block 5 Remediation Area. Tree protection recommendations are provided in relation to the crown overhang from the seven (7) trees located within Hickson Road adjoining Block 5. Trees 55-59 located within Block 5 but outside the Remediation Area are to be assessed under a separate DA.

1.2.2 Based upon assessment of the existing vigour and condition of the trees and the construction works detailed in the supplied *Barangaroo Remediation and Landforming Development Application Block 5 – Staging Plans Stage 1, Issue D, dated 13.5.14,* prepared by ARUP, Trees 60, 61 and 62 will need to be removed.

Trees 60, 61 and 62 are low quality (©Retention Value C) Beach Hibiscus, *Hibiscus tiliaceus* located within Block 5 which need to be removed to allow for the Block 5 Remediation works.

1.2.3 The seven (7) trees in Hickson Road adjoining Block 5 are Trees 13 – 19. They are all Hill's Figs, *Ficus microcarpa var. Hillii*.

Tree protection/tree management measures are detailed in Section 4 below. If the tree protection measures are implemented, there should be no significant impact on the existing vigour and condition of the retained trees.

Crown pruning will be required to varying extent to the Hickson Road trees adjoining.

2. BACKGROUND

2.1 INTRODUCTION

2.1.1 This Arboricultural Impact Assessment (AIA) was prepared for Lend Lease (Millers Point) Pty Ltd (Lend Lease) in relation to a Development Application for the Remediation project within Block 5 of the EPA Declaration Area No. 21122 in Barangaroo and some adjoining land, Barangaroo, Millers Point. The Development Application is to be submitted to the Minister for Planning pursuant to Part 4 of the EP&A Act 1979.

2.1.2 The Declaration No. 21122 area has been found to contain groundwater contaminated with TPH, PAHs and BTEX at concentrations significantly exceeding the relevant trigger values for the protection of human and aquatic ecosystems in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (Aecom, July 2013). The existing trees are likely to have roots in contact with this groundwater.

2.1.3 This AIA assesses the tree impacts of Ex-Situ remediation at Block 5 and associated stormwater diversion.

2.1.4 Refer to **3.2** for a list of reference documents and plans.

2.1.5 The purpose of this AIA is to describe the existing characteristics of the trees in the vicinity of and the likely impacts of the Block 5 Remediation works on those trees located in Block 5.

2.1.6 This AIA will form part of the Environmental Assessment required under the Director General's Requirements dated 20 May, 2013.

2.1.7 Australian Standard *AS4970-2009 Protection of trees on development sites* has been used as a guiding document in the preparation of this report.

2.1.8 The aims and objectives of the City of Sydney Development Control Plan 2012 (DCP) tree management have been acknowledged as all trees assessed are protected under this DCP[2].

2.2 THE SUBJECT SITE

2.2.1 The Development Application works area comprises that portion of Block 5, as indicated on *Remediation and Land Forming Development Application Locality/Context Plan* Drawing No. BB2_PA1_A003 Rev. B prepared by Lend Lease.

2.2.2 The Development Application works area encompasses part of the EPA Declaration Area No. 21122, the area of proposed stormwater diversion and an area of adjacent land to be used for staging and the undertaking of proposed works, for Block 5 Remediation.

[2] City of Sydney Development Control Plan 2012 (DCP) tree management controls applies to all lands within the Local Government Area of the City of Sydney. It applies to a tree, with a height equal to or exceeding five (5) metres, for a single trunk species, a trunk circumference of 300mm at a height of one (1) metre above ground level or for multi-trunked species, a trunk circumference exceeding 100mm at a height of one (1) metre above ground level.

2.2.3 Hickson Road adjoining to the east is lined with Hills Figs, *Ficus microcarpa var. Hillii* of varying size, age, vigour and condition. The Hickson Road trees will be assessed under a separate DA where relevant. Block 4 adjoins to the south. Other site development works are to be undertaken to the west.

2.2.4 Refer to the Detail Survey by Rygate and Company Pty Ltd (Ref: 74479, Rev. J 23.02.11) for further detail of the existing site features.

2.2.5 Refer to the geotechnical drawings (*Figures*) contained in the *Specialist Desktop Geotechnical Report*, May, 2014, prepared by Coffey for further detail of the existing below ground features of the site.

2.3 THE SUBJECT TREES

2.3.1 The general findings and data collected for each of the subject trees within 10 metres of the proposed works are contained in Tree Schedule (Attachment A). Refer to the Tree Protection Plan (Attachment B) for location of and Tree Protection Zones for the assessed trees.

2.3.2 All assessed trees are protected under the City of Sydney Tree Preservation Order (TPO).

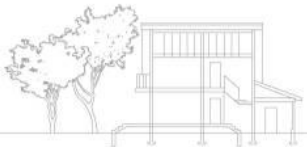
2.3.3 The Tree Protection Zones (nominal) for all existing trees are indicated as coloured circles on the Tree Protection Plans. The actual spread of roots is likely to be restricted by existing structures such as kerb and gutters, carriageway and walling at the boundary of Block 5 and Hickson Road. Large surface roots exist adjacent to the back-of-kerb and the walling at the Block 5 boundary for many of the mature Hills Figs, *Ficus microcarpa var. Hillii*. These existing restrictions to root spread will need to be considered during the works and acknowledged by the Project Arborist when making specific impact assessments.

2.4 THE PROPOSAL - EX-SITU REMEDIATION

2.4.1 Soil remediation works under the Development Application involve the Ex-Situ, bulk earthwork removal of contaminated soils with associated impacts on trees on or adjacent to the site.

2.4.2 The works include diversion and augmentation of existing stormwater drainage infrastructure within the subject site and adjoining Hickson Road, involving decommissioning existing pipes and construction of a new pipe network. Any works undertaken within the Tree Protection Zones of the existing trees will be monitored by the Project Arborist. Refer to Section 4 below for tree protection requirements.

2.4.3 The Ex-Situ works involve the removal of contaminated soil using conventional bulk earthworks techniques. There will be damage to the root systems of the existing trees within the footprint of the bulk earthworks thus necessitating the removal of Trees 61, 62 and 63. The existing concrete retaining wall at the Hickson Road boundary is likely to have restricted root growth onto the site. No TPZ excavation is proposed for the Hickson Road trees, except if required for temporary stormwater diversion.



2.4.4 The Stage 1 piling works within the dripline of Trees 13-19 may necessitate crown pruning to allow for piling machinery. Where possible, pruning is to be minimised by using a small (short) piling rig and tying back branches wherever possible. Approved pruning is to be monitored by the Project Arborist (refer to **4.3.18 Crown Pruning** for further detail).

2.4.5 The works to be undertaken within the Tree Protection Zones of the retained, Hickson Road trees will be monitored by the Project Arborist. Refer to Sections 4 and 5 below for tree protection requirements.

3. METHODOLOGY

3.1 DATA COLLECTION

3.1.1 Tree related data for this AIA was collected on 1 October, 18 November and 3 December, 2010, 3 February and 6 May, 2011 and 7 August and 3 October, 2012. The inspections were ground level, visual tree assessments (VTA)[3]. No aerial (climbing) inspections, woody tissue testing or tree root mapping were undertaken as part of these assessments. The inspection of 3.02.2011 was to identify locations for the test excavations by AECOM to determine root growth adjacent to the existing Hickson Road pavement. The inspection of 6.05.2011 was to determine the extent of crown and root pruning required for the MP10_0087 works.

3.1.2 Attachment B provides definition of terms used in this Report. Tree heights were estimated. Trunk diameter at breast height (DBH) was measured at 1.4 metres above ground level and rounded to the nearest 0.1 metre. Structural Root Zones (SRZ) and Tree Protection Zones (TPZ) were also rounded to the nearest 0.5 metre. The TPZs shown on the Tree Protection Plans are indicative only and do not account for likely root spread constrictions by existing structures such as concrete retaining walls, kerb and gutters and carriageway sub-base.

3.1.3 All tree offsets mentioned in this Report are to centre of trunk unless otherwise stated.

3.2 DOCUMENTS AND PLANS REFERENCED

3.2.1 The following documents have been reviewed in the preparation of this AIA:

- *Barangaroo Remediation and Landforming Development Application Block 5 –* 226463-CCT-SKT-1101 - 1004 dated 1 May, 2014 prepared by ARUP.
- *Remediation and Land Forming Development Application –Block 5 Remediation BB2_PA1_A000, Rev B – A007, Rev B.*, prepared by Lend Lease
- *AS4970-2009 Protection of trees on development sites*.
- Detail Survey, 74479-1, 18.10.10 prepared by Rygate & Company Surveyors.

3.3 AUSTRALIAN STANDARD *AS4970-2009*

3.3.1 The Australian Standard *AS 4970–2009 Protection of trees on development sites* has been used as a guiding document in the preparation of this AIA. The terminology and impact assessment methodology have been adopted from this document. This AIA complies with *2.3.5 Arboricultural Impact Assessment* of AS4970-2009.

3.3.2 Tree Protection Zone (TPZ) and Structural Root Zone (SRZ) are as per *Section 3* of *AS4970-2009* and are defined in the Definition of Terms attached to the Tree Schedules.

[3] VTA – Visual Tree Assessment, undertaken by tree professionals, is a recognised (International Society of Arboriculture, Journal of Arboriculture, Vol. 22 No. 6, Nov. 1996) systematic method of identifying tree characteristics and hazard potential. VTA is also an assessment method described by Claus Mattheck in *The Body Language of Trees – A handbook for failure analysis*. The Stationary Office, London (1994)

3.3.3 "Construction" for the purpose of this AIA means excavation (greater than 100mm), compacted fill or machine trenching[4]. "Excavation" includes cut batters, boxing–out for the various pavement types and trenching for conduits.

3.3.4 All trees with construction within TPZ offsets will be monitored by the Project Arborist. The tree protection recommendations detailed at Sections 4 and 5 are to be implemented.

3.3.5 Refer to Section 4 of this report for tree management recommendations.

[4] "Construction" is equivalent to "works" as defined at 1.4.9 of AS4970-2009.

4. TREE MANAGEMENT PLAN

4.1 REMEDIATION

4.1.1 The remediation works are as outlined in the abovementioned drawings (**3.2.1**). The remediation methodology is detailed in the AECOM Remedial Action Plan (RAP) July, 2013. The Tree Schedule (Attachment A) and Tree Protection Plan (Attachment B) identify which trees need to be removed and outline the key tree protection measures for retained trees. The **Tree Management Requirements** below qualify these key protection measures.

4.2 TREE IMPACTS

4.2.1 **Tree Removal:** Trees 60, 61 and 62 Beach Hibiscus, *Hibiscus tiliaceus* will need to be removed being located within the bulk earthwork footprint.

4.2.2 **Tree Retention:** The following adjoining (overhanging) Hickson Road trees will be retained and protected: Trees 13-19. Tree protection requirements for these trees are outlined at **4.3** below.

4.2.3 **Tree Pruning:** Crown pruning of the adjoining Hickson Road trees will be required to a varying extent to allow for the piling works associated with the perimeter walling of the remediation works. Refer to **4.3.18** for detail. None of the Hickson Road trees will be significantly impacted (vigour or condition) by this crown pruning.

4.3 TREE MANAGEMENT REQUIREMENTS

4.3.1 **Project Arborist:** An Arborist (the Project Arborist) experienced in tree protection on construction sites should be engaged prior to the commencement of demolition or Site establishment works. The Project Arborist will monitor and report regularly to the site Supervisor on the condition and protection of the retained trees. The Project Arborist is to monitor the piling works, demolition of the existing concrete retaining wall at the Hickson Road boundary, machinery trenching for stormwater diversions and crown pruning of the Hickson Road trees.

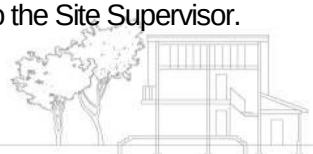
Refer to the Tree Schedule (Attachment A) for TPZ radii.

The schedule of works for the development must acknowledge the role of the Project Arborist and the need to protect the retained trees. Sufficient notice must be given to the Project Arborist where his/her attendance is required. Should the proposed design change from that reviewed, additional arboricultural assessment will be required.

We recommend that the Proponent offer a tree protection commitment along the following lines:

> *"An appropriately qualified Arborist (the Project Arborist) will be engaged to identify any required tree protection measures required for the proposed scope of works and to monitor the site establishment works."*

4.3.2 **Certification:** The Project Arborist should certify tree protection measures at key stages of the construction. Certification should coincide with the four (4) Stages of the ARUP Staging Plans. Copies of the Certification should be sent to the Site Supervisor.



4.3.3 **Early Works/Site Preparation:** Co-ordination with contractors for works is required. The Project Arborist needs to be informed of all potentially damaging processes with sufficient prior notice to allow of assessment and comment on the particular works likely to impact trees.

4.3.4 **Tree Removal:** The Project Arborist is to direct the approved tree removal works and liaise with the contracting Arborist. Tree removal approval is required under the City of Sydney Tree Preservation Order. Tree removal is to comply with WorkCover NSW Code of Practice for the Amenity Tree Industry 1998. Tree removal works are to be undertaken by qualified contracting Arborist with minimum arboricultural qualification of AQF Level 3 (Certificate).

4.3.5 **Ex-situ Methodology:** For the area of Block 5 within the Declaration No. 21122 soils will be excavated and then treated/disposed/re-used, where appropriate. A perimeter retaining wall is indicated on the eastern boundary of Block 5 where it adjoins the road reserve of Hickson Road. There is an existing substantial concrete wall approximately 500mm – 800mm deep, defining the boundary which is likely to have restricted root spread onto Block 5. The extent to which root spread has been confined by this existing wall is as indicated on the Tree Protection Plan.

4.3.6 If the existing concrete retaining wall at the eastern boundary of Block 5 is to be demolished care it to be taken to protect roots from Trees 13-19. Roots are expected immediately adjacent to this existing retaining wall. As indicated on Section 1-1 (BB2_PA1_A005, B) the depth of the "perimeter retention system" is relatively shallow (<2m deep).

The piling of the perimeter retaining wall will coincide with the crown spread of Hickson Road trees (Trees 13-19). The piling machine should be designed such that pruning of overhead crown is minimised. However crown pruning will be required to varying extent to the adjoining Hickson Road trees. The Project Arborist is to liaise with the piling contractor to minimise crown pruning (see **4.3.17** for further pruning detail).

4.3.7 **Tree Protection Zone (TPZ):** The TPZ is the area requiring tree protection and monitoring. All works within the TPZs are to be monitored. The TPZ of each of the Hickson Road trees (Trees 13-19) is indicated on the Tree Protection Plan (Attachment B). The crown projection (dripline) is included in the TPZ. The indicative circular TPZs on the TPP have been amended to reflect the root confinement by existing road pavement or other substantial retaining walls. Crown protection measures are still required.

4.3.8 **Structural Root Zone (SRZ):** The SRZ is the area around the base of a tree required for the tree's stability in the ground. Refer to the Tree Schedule (Attachment A) for SRZ radii. The SRZ radii of Trees 13-19 will not be impacted by the perimeter retention system.

4.3.9 **Tree Protection Fencing:** Where works are to be undertaken in the Hickson Road reserve, as much as possible of the TPZ area should be fenced to prohibit potentially damaging construction activities. Tree Protection Fencing is to be installed as indicated on the Tree Protection Plan. Fencing is to comply with Figure 03 of the Tree Protection Plan (Sheet 2 of 2). Site security fencing or hoarding can be used as tree protection fencing. Signs (see **4.3.11** below) will be required.

4.3.10 **Trunk, Branch and Ground Protection:** Where works are required within TPZ offsets and fencing cannot be installed, trunk, branch and ground protection may need to be installed. If required, such protection measures are to comply with Figure 04 of the Tree Protection Plan (Sheet 2 of 2) or as directed by the Project Arborist.

4.3.11 **Signs:** Where works are to be undertaken in the Hickson Road reserve, signs are to be placed prominently at regular intervals on the tree protection fencing and site security fencing stating: *Tree Protection Fencing.*

4.3.12 **Hoarding or Scaffolding:** If scaffolding is required, it is to comply with Figure 05 of the Tree Protection Plan (Sheet 2 of 2). If hoarding is required it is to comply with the City of Sydney Hoarding policy: *Policy for the Design of Construction Hoardings*. Crown pruning is to be minimised wherever possible as part of hoarding erection. No crown pruning is to be undertaken without approval from the Project Arborist.

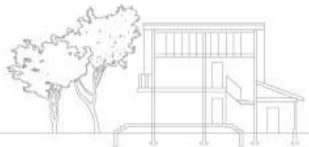
4.3.13 **Prohibited Activities Within Tree Protection Zone (TPZ):** The following potentially damaging activities are to be prohibited within the TPZ offsets unless particular rootzone protection recommendations are provided by the Project Arborist: stockpiling, storage or preparation of materials, parking of machinery, machinery trenching. The Hickson Road trees (T13-19) are located adjacent to the Block 5 Remediation Works. Pedestrian and vehicular movements are to be maintained during the works.

4.3.14 **Trenching for Services Within Tree Protection Zone (TPZ):** Wherever possible machinery trenching is to be avoided within TPZ offsets. Where this is not possible, hand excavation or trenchless, direction boring is to be used. Specific assessment of actual TPZ root loss should be sought from the Project Arborist. If trenching is required within TPZ it is to be undertaken by hand with no roots greater than 30mm diameter cut. Conduits are to be feed under or over roots wherever possible. All cut roots are to be logged and recorded by the Project Arborist. Cut roots are to be covered with moist hessian or equivalent biodegradable matting to buffer drying and potential chemical contact. Trenches are to be left open for as short a period as possible.

Where the extent of root pruning is unknown due to existing pavement cover, assessment, treatment and reporting will be undertaken during the works by the Project Arborist.

4.3.15 **Trenching Within Structural Root Zone (SRZ):** No trenching or drilling is currently proposed within the SRZ of any existing trees. Tree stability can be compromised if trenching and root cutting are undertaken within the SRZ. If trenching is required within a SRZ, it is to be undertaken by hand, with specific instructions from Project Arborist. No roots greater than 30mm diameter are to be cut. All cut roots are to be logged and recorded by the Project Arborist for assessment of impact on tree stability. Cut roots are to be covered with moist hessian or equivalent biodegradable matting if potentially damaging substances are to be used within the trench. Trenches are to be left open for as short a period as possible.

4.3.16 **Existing Pavement:** Retain existing road and footpath pavements intact wherever possible within TPZ offsets to protect underlying roots from construction activity. If existing pavement needs to be demolished within TPZ offsets and roots are observed beneath, these roots are to be covered immediately with topsoil, wood mulch or steel plating depending upon construction proposed.



4.3.17 Traffic Diversion: All traffic diversion devices are to be installed with adequate rootzone protection as per Fig. 04 of the Tree Protection Plan (Attachment B). If the existing footpath, kerb and guttering or road pavement need to be demolished refer to **4.3.16** for tree protection measures.

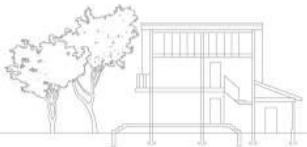
4.3.18 Crown Pruning: There is to be no crown pruning on any tree without approval from the Project Arborist. All approved crown pruning is to comply with *AS4373–2007 Pruning of amenity trees.*

All pruning works are to be undertaken by qualified contracting Arborist with minimum arboricultural qualification of AQF Level 3 (Certificate) with monitoring from the Project Arborist.

Hoarding erection may require minor crown pruning on Trees 13-19. Limbs are to be retained and wrapped (as per Fig. 04 of the Tree Protection Plan) wherever possible.

The perimeter retaining wall at the eastern boundary of Block 5 is likely to be piled within the crown spread of Trees 13- 19 as notated on the Stage 1 plan. Crown pruning will be required to a varying extent. The piling machine should be designed such that pruning of overhead crown is minimised.

The Project Arborist is to liaise with the piling contractor to ensure crown pruning is minimised.



Attachment A: Tree Schedule Block 5

Tree Schedule - Barangaroo Remediation (Block 5)

TREE No.	COMMON NAME/ GENUS SPECIES	DBH (m)	HEIGHT (m)	CANOPY RADIUS (m)	AGE CLASS	VIGOUR	CONDITION	SRZ RADIUS (m)	TPZ RADIUS (m)	SULE	©SIG RATING	©RETENTION INDEX	RECOMMENDATION	COMMENTS
13	Hills Fig, *Ficus microcarpa var. Hillii*	0.6	12	7	M	G	F	2.7	7.2	M	2	A	R+	*Retain. Hickson Road verge tree. 1st Order bark inclusion on both NE and SW sides. Major bark wounds on NE side at 1m. Major pavement uplift. Roots confined by adjacent structures.*
14	Hills Fig, *Ficus microcarpa var. Hillii*	0.5	11	6	M	G	F	2.5	6.0	M	2	A	R+	*Retain. Hickson Road verge tree. 1st Order bark inclusion on both SE and SW sides. Optus Pit 5m to S. Stormwater inlet pit 4m to SE. Root run at back of kerb, 5m to N. Major pavement uplift. See original. Roots confined by adjacent structures.*
15	Hills Fig, *Ficus microcarpa var. Hillii*	0.5	12	6	M	G	F	2.5	6.0	M	2	A	R+	*Retain. Hickson Road verge tree. Branch failure E side at 2m. Bark wounding SE side. Lamp pole 4m to S. Moderate pavement uplift. Roots confined by adjacent structures.*
16	Hills Fig, *Ficus microcarpa var. Hillii*	0.5	13	7	M	G	F	2.5	6.0	M	2	A	R+	*Retain. Hickson Road verge tree. 1st Order bark inclusion on SE side. Bike parking adjacent to W side. Moderate pavement uplift. Roots confined by adjacent structures.*
17	Hills Fig, *Ficus microcarpa var. Hillii*	0.5	16	N12, S5, E6, W10	M	G	F	2.5	6.0	M	2	A	R+	*Retain. Hickson Road verge tree. Root run at back of kerb, 6m to N. Broken limbs N and S. Sewer Pump Station building adjacent to NW. Major pavement uplift. Roots confined by adjacent structures.*
18	Hills Fig, *Ficus microcarpa var. Hillii*	0.7	16	N5, S5, E10, W10	M	G	F	2.8	8.4	M	2	A	R+	*Retain. Hickson Road verge tree. Root run at back of curb, 7m to N. Major pavement uplift. See original. Roots confined by adjacent structures.*
19	Hills Fig, *Ficus microcarpa var. Hillii*	0.7	16	N6, S6, E12, W12	M	G	F	2.8	8.4	M	2	A	R+	*Retain. Hickson Road verge tree. Trunk wound, SE side at 2m. . Major pavement uplift. Roots confined by adjacent structures.*
60	Beach Hibiscus, *Hibiscus tiliaceus*	0.3	5	3	SM	F	P	2.0	3.6	S	4	C	Rm	*Low quality tree located within Block 5. Remove to facilitate remediation works. Within Declaration Area No. 21122.*
61	Beach Hibiscus, *Hibiscus tiliaceus*	0.2, 0.2	5	3	SM	F	P	2.0	3.5	S	4	C	Rm	*Low quality tree located withinBlock 5. Remove to facilitate remediation works. Within Declaration Area No. 21122.*

TREE No.	COMMON NAME/ GENUS SPECIES	DBH (m)	HEIGHT (m)	CANOPY RADIUS (m)	AGE CLASS	VIGOUR	CONDITION	SRZ RADIUS (m)	TPZ RADIUS (m)	SULE	©SIG RATING	©RETENTION INDEX	RECOMMENDATION	COMMENTS
62	Beach Hibiscus, *Hibiscus tiliaceus*	0.1, 0.1 0.1	6	3	SM	F	P	1.6	2.0	S	4	C	Rm	*Low quality tree located within Block 5. Remove to facilitate remediation works. Within Declaration Area No. 21122.*
10														

©SIG. RATING	NO. OF TREES
1	0
2	7
3	0
4	3

©RETENTION INDEX	NO. OF TREES
A	7
B	0
C	3
D	0

RECOMMENDATION	NO. OF TREES
R	0
R+	7
T	0
Rm	3

COMMON NAME/GENUS SPECIES CULTIVAR – Common names can vary with selected texts. Where species is unknown, "*sp*." indicated after genus. Where cultivar is unknown "*cv*" indicated after species. The number in brackets e.g. (x9) after the species indicates the number of trees in this tree group.

DBH – Diameter at Breast Height. Tree trunk diameter measured at breast height (1.4 metres above ground level). Fabric diameter tape is used which assumes a circular cross section. Multiple measurements indicate multiple trunks. More than three trunks are indicated as "multi". Where DBH measurement cannot be taken at 1.4m the height at which it has been taken is indicated in the Comments column.

CANOPY SPREAD RADIUS – Average canopy radius (widest + narrowest ÷ 2). Circular canopy depictions on Tree Plan/Survey are indicative only. Where canopy spread was significantly skewed, all four cardinal point measurements were recorded.

AGE CLASS – Immature (IM), Semi-mature (SM), Mature (M), Over-mature (OM). Assessment of the tree's current Age. A **Mature (M)** tree has reached a near stable size (biomass) above and below ground. Trees can have a Mature age class for >90% of life span. **Over-mature (OM)** trees show symptoms of irreversible decline and decreasing biomass.

VIGOUR – Good (G), Fair (F) or Poor (P). The general appearance of the canopy/foliage of the tree at the time of inspection. Vigour can vary with the season and rainfall frequency. A tree can have Good vigour but be hazardous due to Poor condition. A tree in Good vigour has the ability to sustain its life processes. Vigour is synonymous with health.

CONDITION – Good (G), Fair (F) or Poor (P). The general form and structure of the trunk/s and branching. Trunk lean, trunk/branch structural defects, canopy skewness or other hazard features are considered.

SRZ RADIUS – Structural Root Zone. The area around a tree required for tree stability. Earthworks should be prohibited within the SRZ. The area is calculated from the formula and graph at Figure 1 of AS4970-2009. The SRZ graph has been adapted from the work of Claus Mattheck (1994). DBH has been used instead of stem diameter above root buttress in the calculation of SRZ. 0.1m has been added to SRZ to allow for minor increases in stem diameter.

TPZ RADIUS – Tree Protection Zone. Radial offset (m) of twelve times (12X) trunk DBH measured from centre of trunk (for trees less than 0.3 metre DBH minimum TPZ is 2.0 metres). To satisfactorily retain the tree construction activity (both soil cut and fill) must be restricted within this offset. TPZ offsets are rounded to the nearest 0.1 metre. Existing constraints to root spread can vary TPZ. Generally an area equivalent to the TPZ should be available to the tree post development. Encroachment occupying up to 10% of the TPZ area is acceptable without detailed rootzone assessment. Encroachments greater than 10% require specific arboricultural assessment.

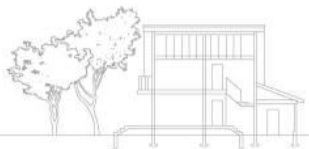
SULE – Safe Useful Life Expectancy. A systematic pre-development tree assessment procedure developed by Jeremy Barrell, Hampshire, England. The SULE method used in this assessment has been adapted for simplified use within the field. It gives a length of time that the Arborist feels a particular tree can be retained with an acceptable level of risk based on the information available at the time of the inspection. SULE ratings are **Long** (retainable for 40 years or more with an acceptable level of risk), **Medium** (retainable for 16-39 years), **Short** (retainable for 5-15 years) and **Removal** (tree requiring immediate removal due to imminent hazard or absolute unsuitability).

©SIG. RATING – ©Significance Rating Scale (see notes over)

©RETENTION INDEX (see notes over)

RECOMMENDATIONS – Retain ***(R)*** – Trees with no TPZ encroachments proposed; ***Retain Plus (R+)*** – Trees with variable but acceptable TPZ encroachments; ***Transplant*** **(T)** – Trees proposed to be transplanted or ***Remove (Rm)*** – Trees proposed to be removal to allow for the proposed works.

COMMENTS – Comments relating to notable tree features, the location, surrounding site features at the time of inspection and where applicable the reason for removal.



©SIG. RATING – ©Significance Rating Scale. A site specific qualitative evaluation of a tree relative to the existing landuse developed by Tree Wise Men® Australia Pty Ltd. Takes into consideration the impact of the tree on the surrounding landscape, streetscape and bushland. Rarity, habitat value, historical/cultural value and structural form of the tree are considered in this rating system. It is possible for a tree to have a Short SULE and a ©Significance Rating of 1. Likewise it is possible for a tree to be given a Long SULE and a ©Significance Rating of 4 (e.g. weed species). The ©Significance Ratings used in this Report are as outlined in Table 1.

Table 1: ©Significance Rating Characteristics

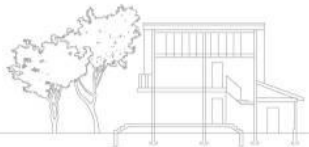
Rating	Significance	Characteristics (some or all)
©Sig. Rating 1	**Exceptional**	▪ Major contribution to site amenity ▪ Remnant specimen ▪ Heritage Listed ▪ Listed on Significant Tree Register ▪ Threatened Species ▪ Good vigour and condition ▪ Cultural significance ▪ Possible habitat for threatened fauna ▪ Excellent, well formed specimen ▪ Rare or unusual species ▪ Large above ground biomass ▪ Unique within the site and surrounds
©Sig. Rating 2	**High**	▪ Considerable contribution to site amenity ▪ Remnant specimen ▪ Good vigour and condition ▪ Threatened Species ▪ Cultural significance ▪ Possible habitat tree for threatened fauna ▪ Well formed specimen ▪ Rare or unusual species ▪ Large or moderate above ground biomass ▪ Other specimens with similar characteristics within the site and surrounds
©Sig. Rating 3	**Moderate**	▪ Minor contribution to site amenity ▪ Remnant or planted ▪ Fair or Poor vigour and condition ▪ Potential for growth ▪ Well formed or asymmetrical form ▪ Other specimens with similar characteristics within the site and surrounds
©Sig. Rating 4	**Low**	▪ Small/poor specimen ▪ Poor vigour and condition ▪ Inappropriate for the location ▪ Minor contribution to landscape amenity ▪ Easily replaced ▪ Weed species or TPO Exempt ▪ Hazardous ▪ Previously ©Sig. Rating 5 tree

©RETENTION INDEX. A site specific assessment of an individual tree's retention value developed by Tree Wise Men® Australia Pty Ltd. Incorporating SULE and ©Significance Rating each tree is allocated a retention value of A, B, C or D. The ©Retention Index values can be described as follows:

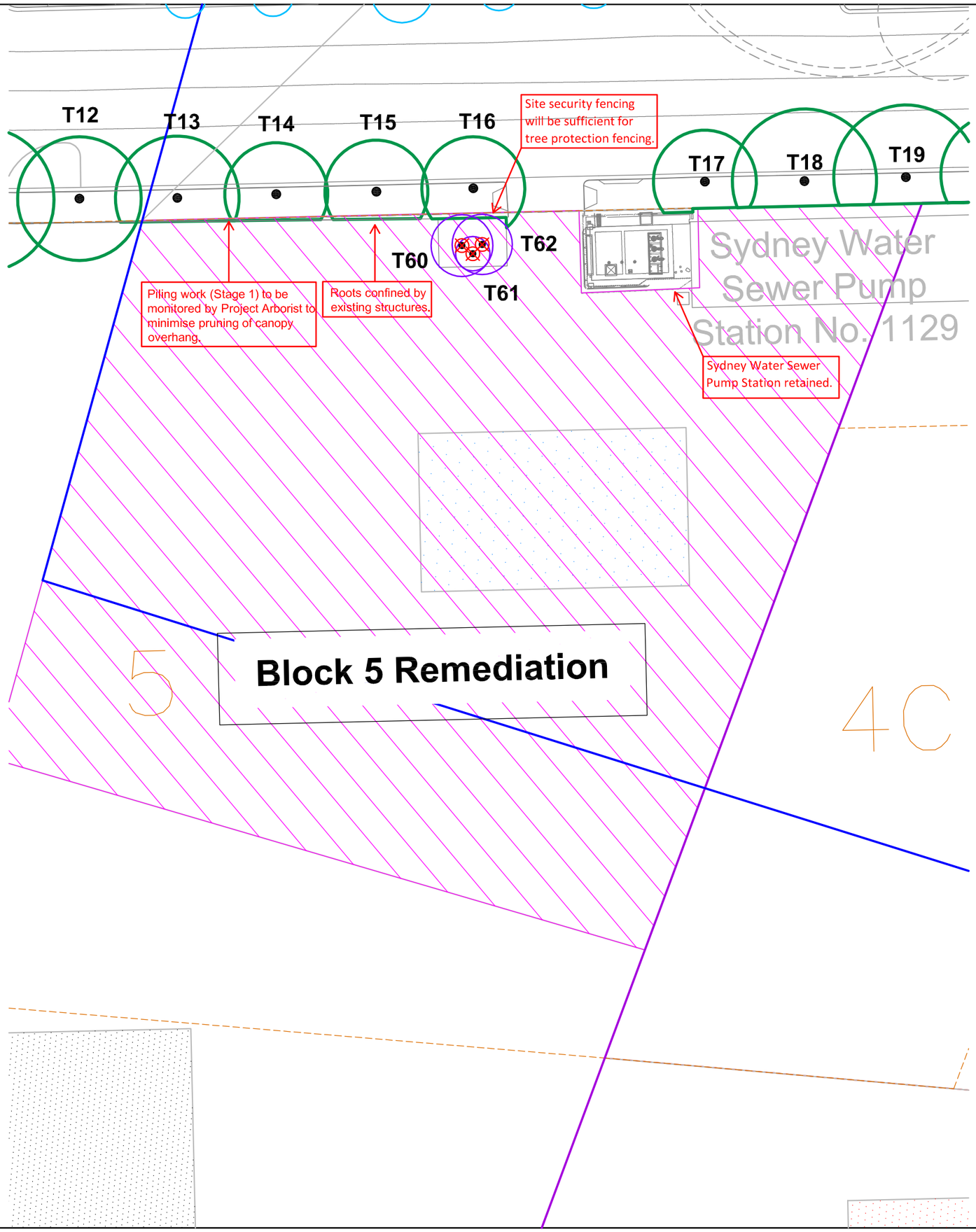
©Retention Value A	**Should be retained**	▪ Major redesign may be required (e.g. movement of building footprint, re-alignment of roadway).
©Retention Value B	**Could be retained**	▪ Minor redesign may be required (e.g. level changes, pavement detail).
©Retention Value C	**Could be removed**	▪ Should not constrain proposed development.
©Retention Value D	**Should be removed or permanently fenced off (irrespective of development layout.)**	▪ Imminently dangerous. ▪ In an irreversible state of decline.

©Retention Index		**©Significance Rating**			
		1	**2**	**3**	**4**
SULE Rating	**Long (40+ years)**	**A**		**B**	**C**
	Medium (15-40 years)				
	Short (5-15 years)	**B**			
	Remove (< 5 years)	**D**			

Note: This ©Retention Index was developed for general residential, commercial and industrial developments. The applicability of the system to Block 5 Remediation works is limited and should be used as a guide to tree quality only.



Attachment B: Tree Protection Plan Block 5 (*2 Sheets)*

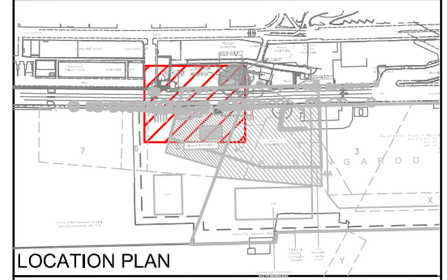


TREE WISE MEN®
AUSTRALIA PTY LTD

ARBORICULTURAL CONSULTANCY
84 Fuller Street, Collaroy Plateau NSW 2097
Phone +61 2 9981 5219 Fax +61 2 9971 0881
treewise@treewisemen.com.au
www.treewisemen.com.au

LEGEND

Tree number with trunk as plotted on Site Survey:	T16 ●
Tree number with trunk not plotted on Site Survey (approximate location shown):	T12 ○
©Retention Value A TPZ:	
©Retention Value B TPZ:	
©Retention Value C TPZ:	
Trees requiring removal to facilitate Block 5 works:	
Indicative Block 5 area:	



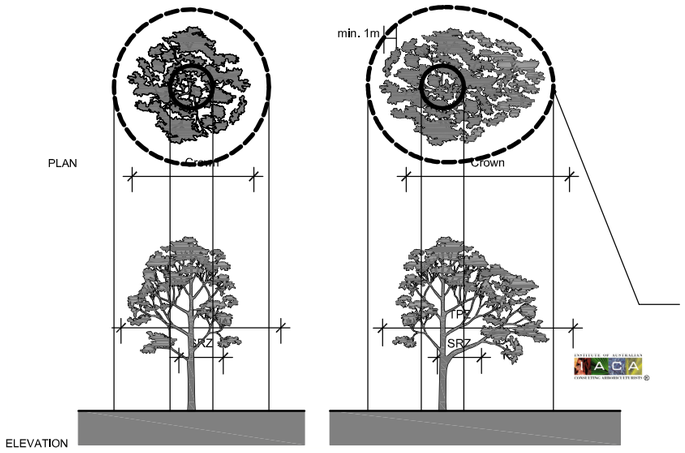
LOCATION PLAN

TITLE:	**©TREE PROTECTION PLAN - BLOCK 5**
CLIENT:	LEND LEASE (MILLERS POINT) PTY LTD
PROJECT:	REMEDIATION AND LANDFORMING WORKS SSD 5897-2013 BLOCK 5 BARANGAROO
DRAWING NO:	2095TPPBlock5 Sheet 1 of 2
DRAWN BY:	JB
BASED ON:	226463-CCT-SKT-1101, Rev D Dated 13/5/2014
DATE:	15/05/2014
REV:	REV DATE:
SCALE:	1:500@A3

0 5 10 25 meters

N

Based on IACA Members licence of AS4970-2009



TPZ = Tree Protection Zone
Referred to as radius in metres and calculated using the formula:

$TPZ = 12 \times DBH$

where:
DBH = Diameter at Breast Height (measured 1.4 m above ground level)
0.42

SRZ = Structural Root Zone
Referred to as radius in metres and calculated using the formula:

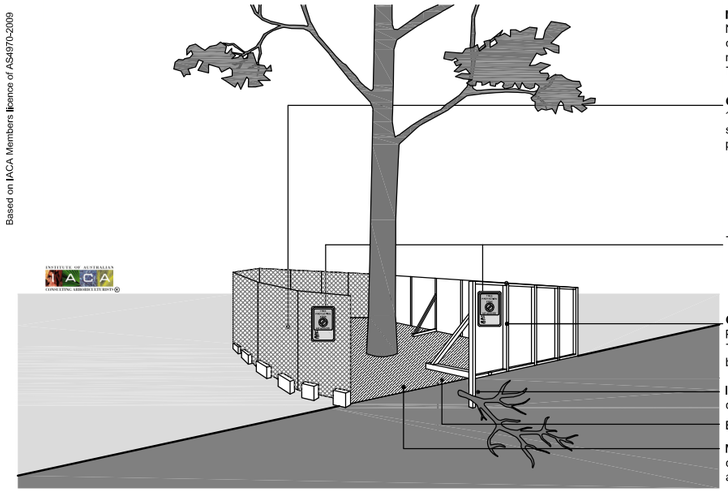
$R_{SRZ} = (D \times 50) \quad \times 0.64$

where:
R_{SRZ} = Radius of Structural Root Zone
D = Stem Diameter (measured directly above root buttress in metres)

TPZ adjusted to include crown protection. Adjusted TPZ should be a minimum of 1m outside the perimeter of the crown.

02 Indicative Tree Protection Zone (TPZ) — Scale 1:500 @ A4

Based on IACA Members licence of AS4970-2009



Note:
No excavation, construction activity, grade changes, surface treatment or storage of materials of any kind is permitted within the TPZ.

Option 1 - Fencing
1.8m high chain wire mesh panels with shade cloth attached (if required), held in place with concrete feet.

Tree Protection Zone (TPZ) sign

Option 2 - Fencing
Plywood or wooden panel paling fence. This type of fencing material also prevents building materials or soil entering the TPZ.

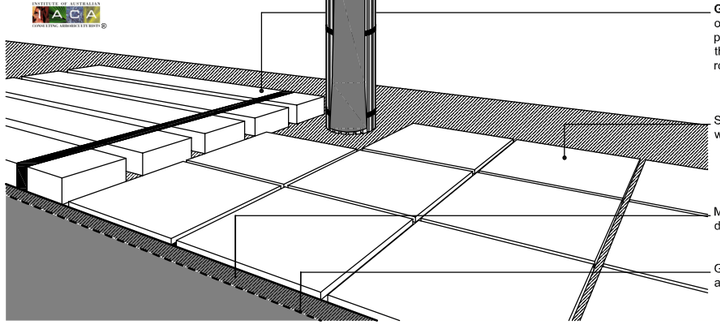
Installation of supports should avoid damaging roots.

Bracing is permissible within the TPZ.

Maximum 100mm and minimum 50mm depth mulch or aggregate layer installed across surface of TPZ.

03 Tree Protection Fencing — Not to Scale

Based on IACA Members licence of AS4970-2009



Branch Protection - use boards and padding to prevent damage to bark on branch. Boards are to be strapped, not screwed or nailed to the branch.

Trunk Protection - use boards and padding to prevent damage to bark (minimum 2m). Boards are to be strapped, not screwed or nailed to the trunk.

Ground Protection - use device strapped over mulch or aggregate layer. Ground protection device should be of a suitable thickness to prevent soil compaction and root damage.

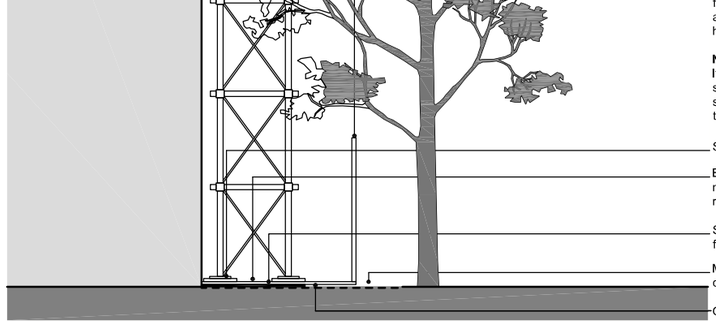
Steel plates (or approved equivalent) with or without mulch or aggregate layer below.

Maximum 100mm and minimum 50mm depth mulch or aggregate layer.

Geotextile fabric underneath mulch or aggregate layer.

04 Examples of Branch, Trunk and Ground Protection — Not to Scale

Based on IACA Members licence of AS4970-2009



Branches may require pruning to erect scaffolding. Pruning may be subject to local regulations. Flexible branches should be tied back in preference to pruning.

Minimum 1.8m high hoarding. Temporary fencing may be incorporated into scaffolding as either containment screening or as hoarding.

Note:
If excavation is required for installation of support post for fencing, the Project Arborist should assess any pruning of roots greater than 20mm diameter.

Scaffold planks

Boards or plywood to be installed over mulch or aggregate layer for any areas requiring access within the TPZ.

Soleplate over geotextile. No excavation for soleplate within TPZ.

Maximum 100mm and minimum 50mm depth mulch or aggregate layer within TPZ.

Geotextile fabric

05 Indicative Scaffolding within a Tree Protection Zone (TPZ) — Not to Scale

IMPORTANT TREE MANAGEMENT NOTES FOR ALL RETAINED TREES ADJACENT BLOCK 5

1. Tree impact assessment has been considered in relation to ***AS4970-2009 Protection of trees on development sites***.

2. This ***Tree Protection Plan*** is equivalent to the Development Submission plan identified in Table 1, ***AS4970-2009***.

3. This ***Tree Protection Plan*** should be incorporated into the site Construction Management Plan and stage all construction documentation.

4. Tree impact assessment includes likely impacts from development including: building platforms, driveways/accessways, services/infrastructure installation and cut/fill batters.

5. The extent of TPZ shown on this plan does not reflect any confinement of roots by existing structures, buildings, walls, topography, etc except along the site boundary. Roots confined by existing retaining wall at Hickson Road/Block 5 boundary have been indicated.

6. A ***Project Arborist*** with minimum AQF Level 5 qualifications is to be engaged to monitor and report regularly on works adjacent to trees.

7. ***Tree Protection Fencing*** as indicated, should be installed prior to demolition of existing structures or other site preparation works. Tree Protection Fencing should comprise of chainlink wire or wire mesh panels as per Figure 03 of the TPP. The following activities are to be prohibited within tree protection fencing: topsoil stripping, excavation, placement of soil fill, stockpiling of any materials, placement of site sheds/offices, parking of heavy machinery, placement of machinery haul roads.

8. If ***scaffolding*** is required within TPZ, install as shown in Figure 05 of the TPP.

9. Services installation should be supervised by the ***Project Arborist***. No roots greater than 50mm diameter are to be cut or damaged. Services should be routed beyond TPZ wherever possible.

10. ***Trunk battening*** and ***ground protection*** to be installed to trees where works are required within Tree Protection Fencing. Battening to comply with Figure 04 of the TPP.

12. All ***tree pruning*** is to comply with ***AS4373-2007, Pruning of Amenity Trees***. All approved tree removal is to comply with WorkCover Code of Practice for the Amenity Tree Industry.

13. ***Mulch*** is to be spread to a depth of 100mm within the TPZs. Where TPZs are greater than 5 metres of where native seedling regeneration would be prohibited, seek advice from the Project Arborist and Ecologist.

14. ***Over-excavation*** or battering towards trees is to be avoided unless indicated on approved earthworks or services drawings.

16. ***Temporary irrigation***, hand watering or water cart may be required during drought periods. The Project Arborist is to monitor soil moisture levels and advise on delivery volumes and frequency.

17. Temporary ***haul roads*** may be required to be installed where heavy machinery movements are proposed within TPZs of trees to minimize compaction. Woodchip mulch should be used as a minimum. Recycled concrete or other aggregate placed over a geofabric may be required for heavy use areas.

TREE WISE MEN®
AUSTRALIA PTY LTD

ARBORICULTURAL CONSULTANCY
84 Fuller Street, Collaroy Plateau NSW 2097
Phone +61 2 9981 5219 Fax +61 2 9971 0881
treewise@treewisemen.com.au
www.treewisemen.com.au

TITLE:	**©TREE PROTECTION PLAN - BLOCK 5**
CLIENT:	LEND LEASE (MILLERS POINT) PTY LTD
PROJECT:	REMEDIATION AND LANDFORMING WORKS SSD 5897-2013 BLOCK 5 BARANGAROO
DRAWING NO:	2095TPPBlock5 Sheet 2 of 2
DRAWN BY:	JB
BASED ON:	IACA Licence of *AS4970-2009 Protection of trees on development sites*
DATE:	15/05/2014
REV:	REV DATE: