



EARTHSCAPE HORTICULTURAL SERVICES

Arboricultural, Horticultural and Landscape Consultants

ABN 36 082 126 027

13th April 2018

Jane Fielding
Senior Associate, Planning
architectus
Level 18, MLC Centre, 19 Martin Place
SYDNEY NSW 2000

Dear Jane,

**Addendum 2 to Arboricultural Impact Assessment Report
Art Gallery of NSW Expansion Project – Sydney Modern [SSD 14_6471]
Consistency with the objectives of the *Royal Botanic Gardens and Domain Trust Act 1980*.**

I refer to the above matter and your request to provide arboricultural advice on the consistency of the proposed development with the objectives of the *Royal Botanic Gardens and Domain Trust Act 1980*, particularly in relation to the proposed removal and replacement of trees. I also refer to my previous Arboricultural Impact Assessment Report prepared in relation to the abovementioned development (Version 9) dated 3rd November 2017.

There are 220 trees in the vicinity of the proposed development, including 38 trees of High Retention Value, 128 trees of Moderate Retention Value and 54 trees of Low or Very Low Retention Value. The methodology for ascertaining Retention Values is outlined in Section 6 of the abovementioned report. Some of these trees are located within land owned by NSW Roads and Maritime Services (RMS) [over the Eastern Distributor 'land bridge'], some are located within land managed by the City of Sydney Council [medians and verges in Lincoln Crescent] and the remainder are located within land managed by the Royal Botanic Gardens and Domain Trust (RBGDT).

The proposed development will necessitate the removal of 124 trees. This includes six trees of High Retention Value (all within RBGDT land), 79 trees of Moderate Retention Value (56 within RBGDT land) and 39 trees of Low and Very Low Retention Value (33 within RBGDT land). In addition, four trees of High Retention Value (T742, T1228, T1363 & T2436) and five trees of Moderate Retention Value (T1227, T4578, T4579, T4580 & T4581) [all within RBGDT land] are proposed to be relocated (transplanted) elsewhere within the site to accommodate the proposed works. The remaining 87 trees are proposed to be retained in situ and protected as part of the proposed development. In order to compensate for loss of amenity resulting from the removal of trees to accommodate the proposed development, 273 new trees are proposed to be planted within the site as part of the landscape works.

The greater majority of the trees to be removed are locally-indigenous and non-local native species that were planted in association with the 'land bridge' over the Eastern Distributor tunnel in c.1999. As such, whilst there are a relative large number of trees being removed,

most of them are relatively young specimens. These trees form part of the overall landscape of this part of the Domain, but they have not been specifically planted as part of the botanical collection at the Royal Botanic Gardens, nor are they managed in the same way. The area also has a distinctly different visual character to that of the Domain and the Botanic Gardens, which have a more 'parkland' appearance and are clearly maintained as a botanical collection. These trees are proposed to be replaced with a significantly greater number of trees, of species that were typical of the original vegetation community formerly occupying the Governor's Domain. As such, the new planting has potentially more botanical interest than the present vegetation proposed to be removed, once it is established.

Aside from the relatively young native trees that are proposed to be removed to accommodate the development, there are a small number of other trees proposed to be either removed or transplanted that are more typical of plantings of the Victorian Era or Interwar period. These include a variety of Fig species and palm species. These trees have been planted in different time periods. Some are considered to have heritage significance and others, whilst of similar species and character, have been planted more recently and have no special heritage significance. Of the trees to be removed (in comparison to those to be transplanted) only one tree (being T1119, a Port Jackson Fig) is considered to be an early planting (c. 1860-1880), which has heritage significance. However, diagnostic testing has indicated that this tree has a substantial defect (large cavity) in the lower trunk and root crown area, that renders it potentially hazardous. As such, this tree is considered a potential safety risk and would ultimately need to be removed anyway for safety reasons.

Of the trees to be transplanted, only T2436 (a Mediterranean Fan Palm), T1363 (Silver Date Palm) and T742 (a Canary Island Palm) are early plantings considered to have some heritage significance and could be considered to form part of the botanical collection of the Botanic Gardens. These are probably Federation period plantings. T1363 does not appear to have been planted in its current location originally, as it is not visible in this location in the 1943 aerial photograph of Sydney (SIX Maps). This tree appears to have been transplanted to its current location after this time. The remainder of the trees that are proposed to be transplanted, which include T1227 and T1228 (a Moreton Bay Fig) and T4481, T4580, T4579 & T4578 (Cabbage Tree Palms), are relatively recent plantings (probably c. 1980-1990) with no heritage significance. The transplanting of these species is considered horticulturally feasible with a relatively low risk of fatality. All of these trees can be successfully transplanted to new areas surrounding the development, subject to verifying the logistical feasibility of relocation to the proposed planting locations.

As such, in my opinion, the proposed development is consistent with the objectives of the *Royal Botanic Gardens and Domain Trust Act 1980*, in that there will be little impact on the existing botanical collection, the heritage values of the landscape or the public enjoyment of open space areas. The new landscape development surrounding the expansion will maintain and enhance the Trust lands, by improving public domain facilities and providing better accessibility for the enjoyment of the general public. The extent of replacement planting proposed will compensate for loss of amenity resulting from the removal of trees to accommodate the proposed development within the next 10 to 15 years as it establishes and grows to maturity. It should be noted that the majority of the trees to be removed were planted c.1999 (and are therefore less than 20 years old). The new planting will be more in keeping with the original floristics of the area, prior to European settlement, which is not well represented anywhere else on Trust lands.

If you require any further information regarding the above matter, please do not hesitate to contact me on 9456 4787 or 0402 947 296.

Yours sincerely,

A handwritten signature in black ink, appearing to read 'Andrew Morton', enclosed within a large, loopy oval stroke.

Andrew Morton

Dip. (Arboriculture) [AQF5]

B.App.Sci (Horticulture),

A.Dip.App.Sci. (Landscape)

Member of the Arboriculture Australia

Member of the International Society of Arboriculture (ISA)

PICUS SONIC TOMOGRAPH REPORT



Subject tree. *Ficus macrophylla*

25th July 2017

Australian Tree Consultants Pty Ltd.



AUSTRALIAN TREE CONSULTANTS Pty Ltd
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25th July 2017

To: Ms Ann Deng
McGregor Coxall
P.O. Box 1083
Manly NSW 1655

Re – Arborist Inspection - Picus Sonic Tomograph Testing

I refer to your request to undertake Picus Sonic Tomograph testing on a tree located at the grounds of NSW Art Gallery. Australian Tree Consultants Pty Ltd undertook the site inspection and Picus testing on the 18th July 2017.

The Picus test was undertaken on a *Ficus macrophylla* (Moreton Bay Fig) identified as requiring further investigation to determine the structural condition of the tree at the site of a large lower trunk cavity.

Based on the findings from this Picus test the structural integrity at the base of the tree has been compromised by extensive decay and the tree should be only considered for retention if the area can be isolated from the public.

If you require any further information in relation to this report, please contact us on 1300 737 674 or 0418 474 796.

Yours sincerely

Hugh Taylor

Director Australian Tree Consultants
Member Arboriculture Australia
BA (L) Major in Wilderness Management/Outdoor Education
Diploma Horticulture – Arboriculture (Level 5)
Arborist/ Tree Surgeon/ Horticulturist
Certificate IV Occupational Health & Safety
QTRA No 2650
NPWS Wildlife license and Wires volunteer
CASA RPAS Pilot and Operator

FACTS & KEY TO ANALYSING PICUS REPORTS

The following points will assist you with visual interpretation of the test results against the subject tree.

- ❖ Sensor one is usually located to the northern side of the tree.
- ❖ The test height is always measured at sensor one.
- ❖ The red line in the photograph of the tree demonstrates the approximate height in which the test was conducted.
- ❖ In some test results other measurements may be mentioned. These will be explained within the text of the report.
- ❖ In most cases the active fungus and decayed wood (blue, pink and white areas in the test results) will not be visible to human eye within the cross section (at the test location) of the tree. This may alter dependent on the species of fungus.
- ❖ In most cases the altering wood (wood being chemically and structurally changed by the fungus - green area) will not be visible to human eye within the cross section (at the test location) of the tree. This may alter dependent on the species of fungus.
- ❖ The **PICUS Sonic Tomograph (Series 3)** is very accurate with the colour coding produced. At times, the image produced may vary to what will be visually observed in the cross section of the tree when the test area is exposed. It is important that only trained professionals make comments and recommendations regarding any test results.
- ❖ Every endeavour is made to identify the species of active fungi present in the test results. However, without scientific laboratory tests accurate visual identification is not always possible.
- ❖ If used GNSS Co-ordinates are recorded in Map Grid of Australia Zone 56.
- ❖ Australian Tree Consultants have attended the Master Picus Accreditation. ATC has completed over 5000 Picus tests and has been using the Picus Sonic Tomograph since 2005.

DIAGNOSTIC ICONS

Diagnostic icons may be used within the Picus tomogram.

	Open Cavity		Foreign material (steel concrete etc)
	Crack		Decay
	Co-dominant stem		Bracket fungus
	Bark inclusion		Moisture emerging (water sap etc)
	Bark abnormalities		Mechanical damage
	Callus strong growing wood		Tension load
	Damaged root		Compression load
	North Direction		Prevailing wind direction

INTRODUCTION / METHODOLOGY:

McGregor Coxall on behalf of their client has commissioned Australian Tree Consultants Pty Ltd to undertake Picus Sonic Tomograph testing on a *Ficus macrophylla* (Moreton Bay Fig) tree which is located in the grounds of NSW Art Gallery.

Australian Tree Consultants Pty Ltd undertook the site inspection and Picus test on 18th July 2017. A Visual Structural Tree Assessment (VSTA) was undertaken on the *Ficus macrophylla* to determine the most probable area of concern. The Picus test on this tree was undertaken at 300 mm above ground level at the site of the large cavity at the base of the tree.



Photo 1. Main cavity at base of the tree which was the main area of concern.

Tree Risk Assessment – Decay in trees

Previously, many tree technicians when determining the point of failure of trees with decay / cavities have relied on research conducted by Mattheck and Breloer (1994). They applied a t/R ratio (t radial thickness of sound wood to R the radius of the stem) to determine a threshold point of failure. They found that trees usually failed when the ratio fell below that threshold ($t/R < 0.3$), but rarely failed when the t/R was greater than 30% ($t/R > 0.3$).

However, numerous limitations with the one-third rule have been identified (Bond 2006 Gruber 2007 and Schwarze 2008) such as the need to include an evaluation of other factors that contribute to failure e.g. wind load, exposure, crown architecture, decay type, species, maturity etc. The following important implications for the t/R requirement can be made:

- Gruber (2007) concludes that the 'one-third' rule is neither scientifically valid nor practicable and therefore should not be used for tree hazard assessment.
- A low t/R ratio does not necessarily imply high risk. Some trees can tolerate extremely large amounts of internal decay without necessarily incurring adverse effects on their stability.

By combining our diagnostic techniques (Picus Sonic Tomograph), Visual Structural Tree Assessment, sounding out the tree, the location of the decay – cavity and our arboricultural knowledge we are then able to make recommendations for either the retention of the tree or remedial works that may include the removal of part or the whole removal of the tree.

ATC is one of the first companies in Australia to use the new **Picus Sonic Tomograph Series 3** unit to investigate cross sectional tomograph of the extent of decay in the tree by using sonic waves. The instrument measures the time of flight of the sonic signals that have been generated by an electronic hammer. By using accurate tree geometry information the software calculates the apparent sonic velocities and draws a "velocity" or "E-module" map of the tree. The velocity of sound in wood depends on the modulus of elasticity (MOE) and the density of the wood itself and therefore indicating the general condition of the tree (health and structure). Full resolution tomograms can be recorded with as few as 12 sonic sensors and up to 60 sonic sensors.

The Picus Sonic Tomograph detects differences in the ability of the wood to transmit sound waves. Although it can accurately identify the amount of damage in the tree at the testing location, it cannot specifically determine if the reason is due to decay, hollowness, cracks etc. If the tree is felled it is highly likely that the image and the cross section will not look exactly the same.

Inspection carried out by
Test Height
Tree Circumference
Botanical Name
Common Name
Tree Location
GNSS Location

Hugh Taylor Master Picus Accredited, Dip Arboriculture Level 5
300 mm above ground level at sensor one
4320 mm at test height
Ficus macrophylla
Moreton Bay Fig
Art Gallery NSW
33.867098°South - 151.218568°East

The Picus© Sonic Tomograph (Series 3) test shows (lower right insert) that this *Ficus macrophylla* tree has extensive active fungus, decay and altering wood within the test location.

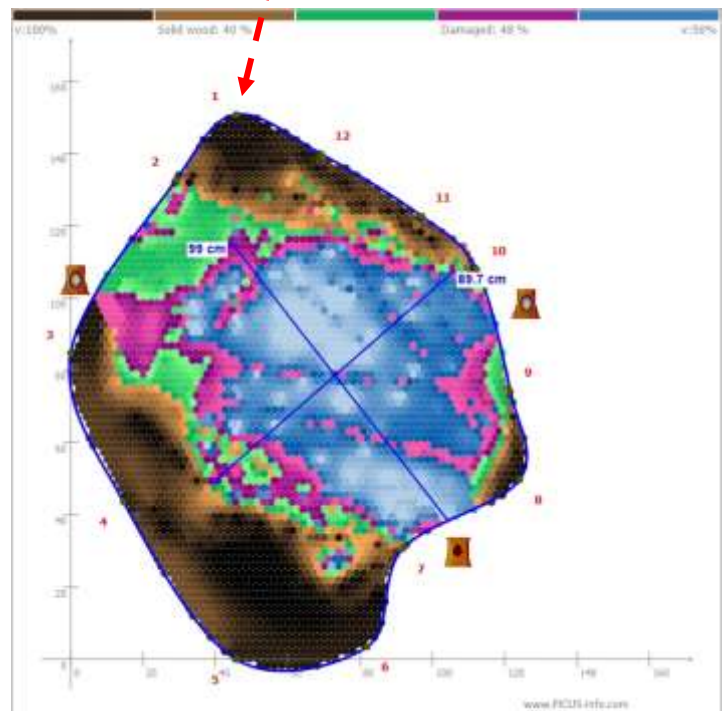
The test results indicate 40% of the test area is sound wood (brown areas), 12% consists of altering wood i.e. wood being altered by the fungus (green area) and 48% active fungus and decay (pink and blue areas).

The fungal activity and decay appears to have initially entered the trunk through past lower trunk damage. The active fungal pathogen, decay and altering wood have breached the outer trunk between sensors 2 – 3, 7 – 8 and 9 – 10.

The active fungal pathogen is progressing through the remaining sound wood at a moderate rate, as shown by the amount of altering wood, (green colouration).

The fungal activity measured 99 cm in a north-south direction and 89.7 cm in an east-west direction. The decayed section has trisected the tree from sensors 2 – 3, 7 – 8 and 9 – 10.

New incremental wood growth was recorded at sensors 1, 3 – 6, 8 and 11 – 12.



CONCLUSIONS:

The Picus test was undertaken at 300 mm above ground level at the location of the lower trunk cavity site. The Picus Tomograph test showed that there is a moderate amount of altering wood 12% surrounding an extensive amount of fungal activity and decay 48% with only 40% of sound wood remaining at the site of the test location.

The active fungal pathogen is progressing through the sound wood at a moderate rate, as shown by the amount of altering wood (green colouration) and has breached the outer trunk between sensors 2 – 3, 7 – 8 and 9 – 10. The active decayed section has trisected the tree.

Moderate levels of new incremental wood growth were recorded at sensors 1, 3 – 6, 8 and 11 – 12.

At the time of testing the Picus test results show that the structural integrity of the lower trunk has been compromised by the active fungal pathogen.

RECOMMENDATIONS:

- Based on the results of the Picus test combined with Visual Tree Assessment as well as a WHS/OH&S assessment and usage of the site at the time of testing the tree was considered to be structurally compromised at the test location and should be considered for removal.
- If the tree is to be retained then it would require the fall area of the tree to be barricaded off from public access. Native grasses could be grown under the tree as they will not require regular mowing. Signage could state that the tree is being left and no access to the area is permitted.
- The management of the tree should be based on this Picus report as well as any other recent and, or, current Arboricultural reports or Visual Tree Assessments.

Note: Only trained Picus professionals should make comments and recommendations regarding any testing results such as analyzing testing results against cross sections of felled trees. The Picus Sonic Tomograph detects differences in the ability of the wood to transmit sound waves. Although it can accurately identify the amount of damage in the tree at the testing location, it cannot specifically determine if the reason is due to decay, hollowness, cracks etc. If the tree is felled it is highly likely that the image and the cross section will not look exactly the same. Also, in most cases the altering wood (wood being chemically and structurally changed by the fungus - green area) will not be visible to human eye within the cross section (at the test location) of the tree. This may alter dependent on the species of fungus.

If you require any further information in relation to this report, please contact us on 1300 737 674 or 0418 474796.



Hugh Taylor

Director - Australian Tree Consultants

Member Arboriculture Australia

BA (L) Major in Wilderness Management/Outdoor Education

Diploma Horticulture – Arboriculture (Level 5)

Arborist / Tree Surgeon / Horticulturist

Certificate IV Occupational Health & Safety

QTRA No 2650

NPWS Wildlife license and Wires volunteer

CASA RPAS Pilot and Operator

LIMITATION OF LIABILITY

Australian Tree Consultants Pty Ltd and their employees are tree specialists who use their qualifications, education, knowledge, training, diagnostic tools and experience to examine trees, recommend measures to enhance the beauty and health of trees, and attempt to reduce the risk of living near trees. Clients may choose to accept or disregard the recommendations of this assessment and report.

Australian Tree Consultants Pty Ltd and its employees cannot detect every condition that could possibly lead to the structural failure of a tree. Trees are living organisms that sometimes fail in ways the arboriculture industry does not fully understand. Conditions are often hidden within trees and below ground. Unless otherwise stated, observations have been visually assessed from ground level. Australian Tree Consultants Pty Ltd cannot guarantee that a tree will be healthy or safe under all circumstances, or for a specified period of time. Likewise, remedial treatments cannot be guaranteed.

Treatment, pruning and removal of trees may involve considerations beyond the scope of Australian Tree Consultants Pty Ltd services, such as property boundaries and ownership, disputes between neighbours, sight lines, landlord-tenant matters, and related incidents. Australian Tree Consultants Pty Ltd cannot take such issues into account unless complete and accurate information is given prior or at the time of the site inspection. Likewise Australian Tree Consultants Pty Ltd cannot accept responsibility for the authorisation or non-authorisation of any recommended treatment or remedial measures undertaken.

In the event that Australian Tree Consultants Pty Ltd recommends retesting or inspection of trees at stated intervals or installs any cable/s, bracing systems and support systems, Australian Tree Consultants Pty Ltd must inspect the system installed at intervals not greater than 12 months unless otherwise specified in written reports. It is the client's responsibility to make arrangements with Australian Tree Consultants Pty Ltd to conduct the re- inspection.

Trees can be managed, but they cannot be controlled. To live or work near a tree involves a degree of risk. The only way to eliminate all risks associated with a tree is to eliminate the tree.

All written reports must be read in their entirety, at no time shall part of the written assessment be referred to unless taken in full context of the whole written report.

If this written report is to be used in a court of law or any legal situation Australian Tree Consultants Pty Ltd must be advised in writing prior to the written assessment being presented in any form to any other party.



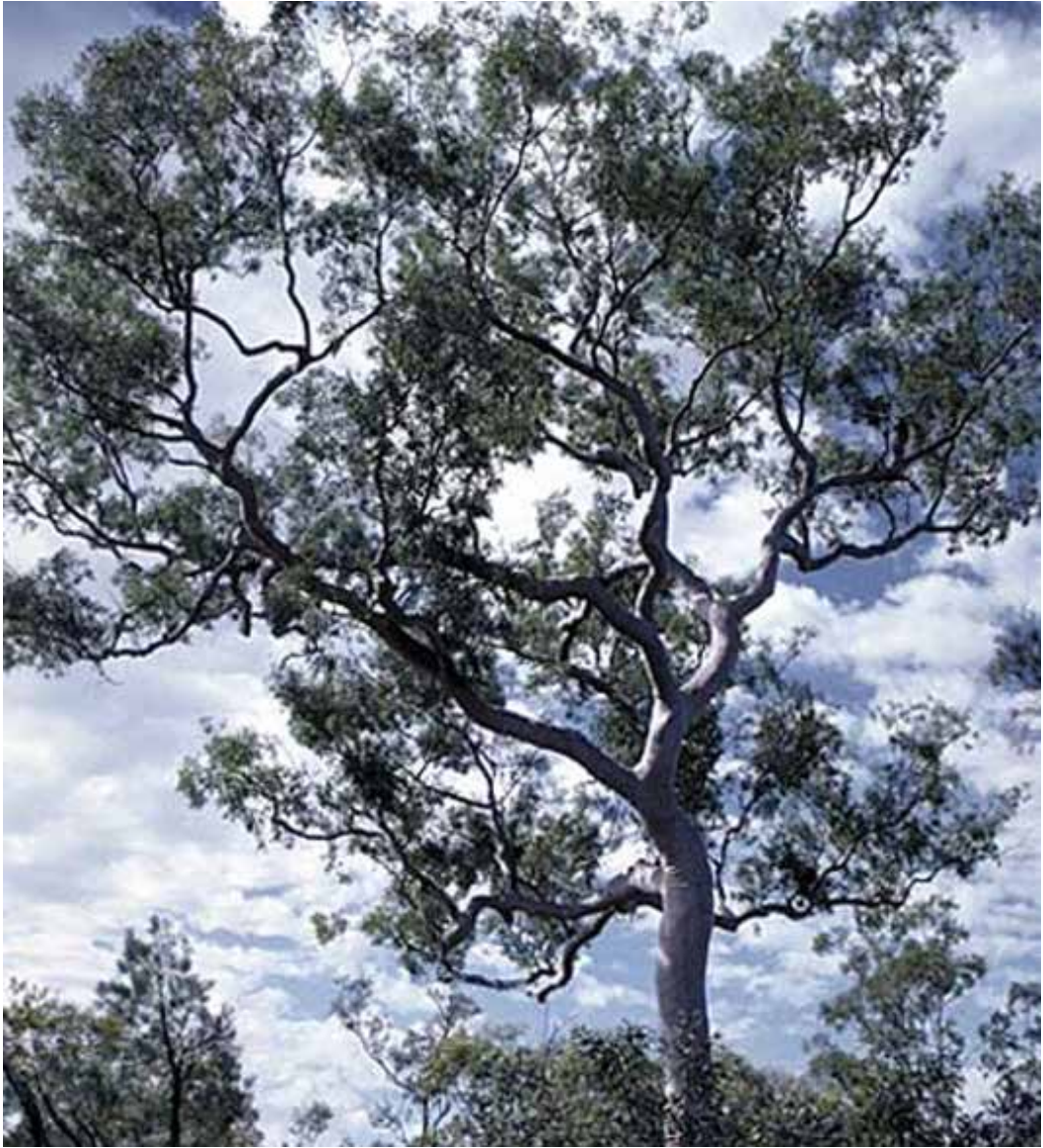
Acacia conveyi



Acacia decurrens



Acacia longissima



Angophora costata



Banksia integrifolia



Banksia serrata



Cassinia aculeata



Eucalyptus botryoides



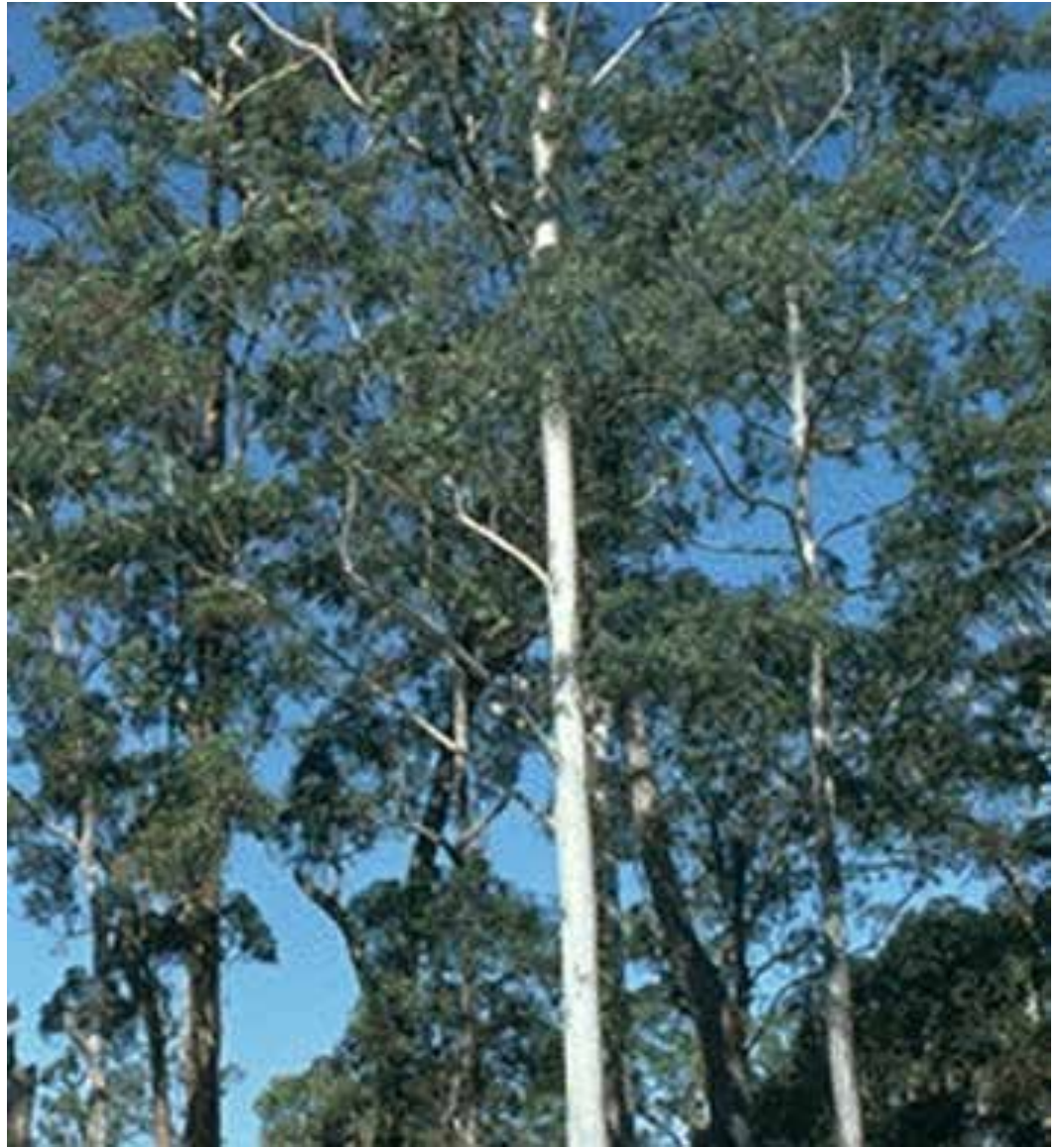
Eucalyptus globoidea



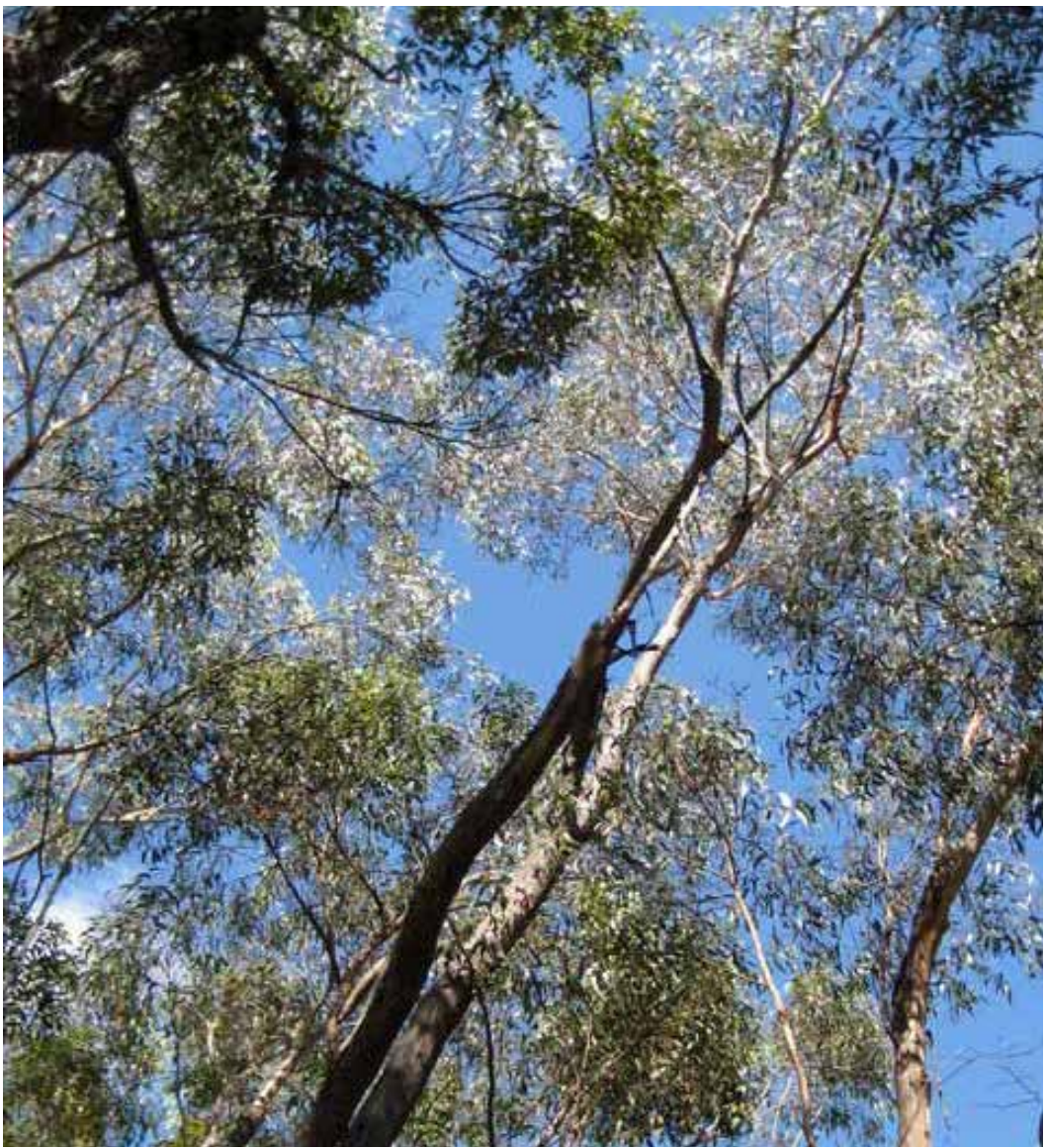
Eucalyptus haemastoma



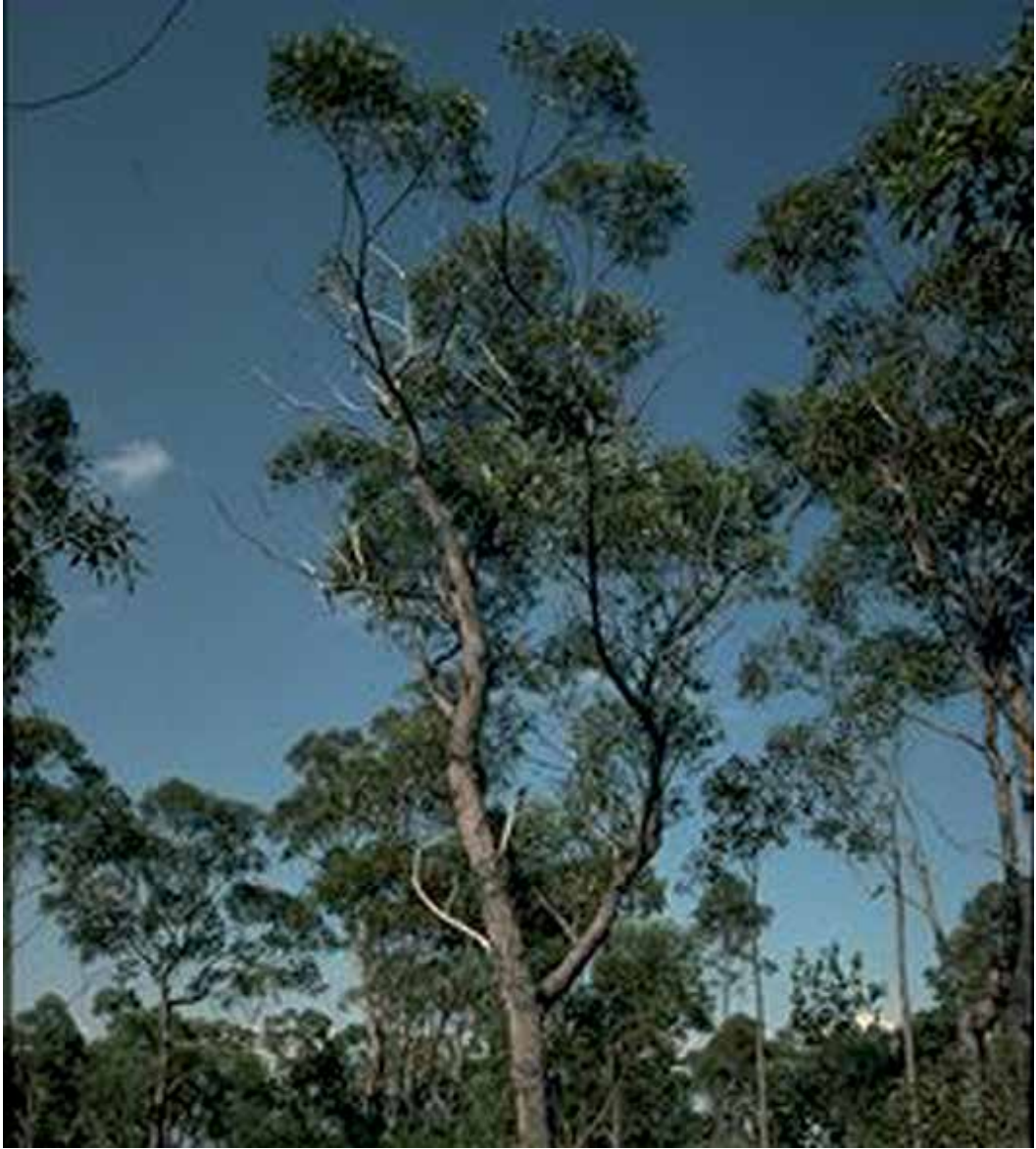
Eucalyptus pilularis



Eucalyptus saligna



Eucalyptus sieberi



Eucalyptus sparsifolia



Eucalyptus tereticornis



Melaleuca quinquenervia



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Client
Art Gallery NSW

Project No. 048558
**AGNSW Expansion: Sydney Modern
Project**
Address
Art Gallery Rd, Sydney NSW, 2000
Phase
SSDA

Key Plan

Scale & Orientation
NTS @ A3

All dimensions are in millimetres unless otherwise
stated. Check against the drawing.

Revision Log

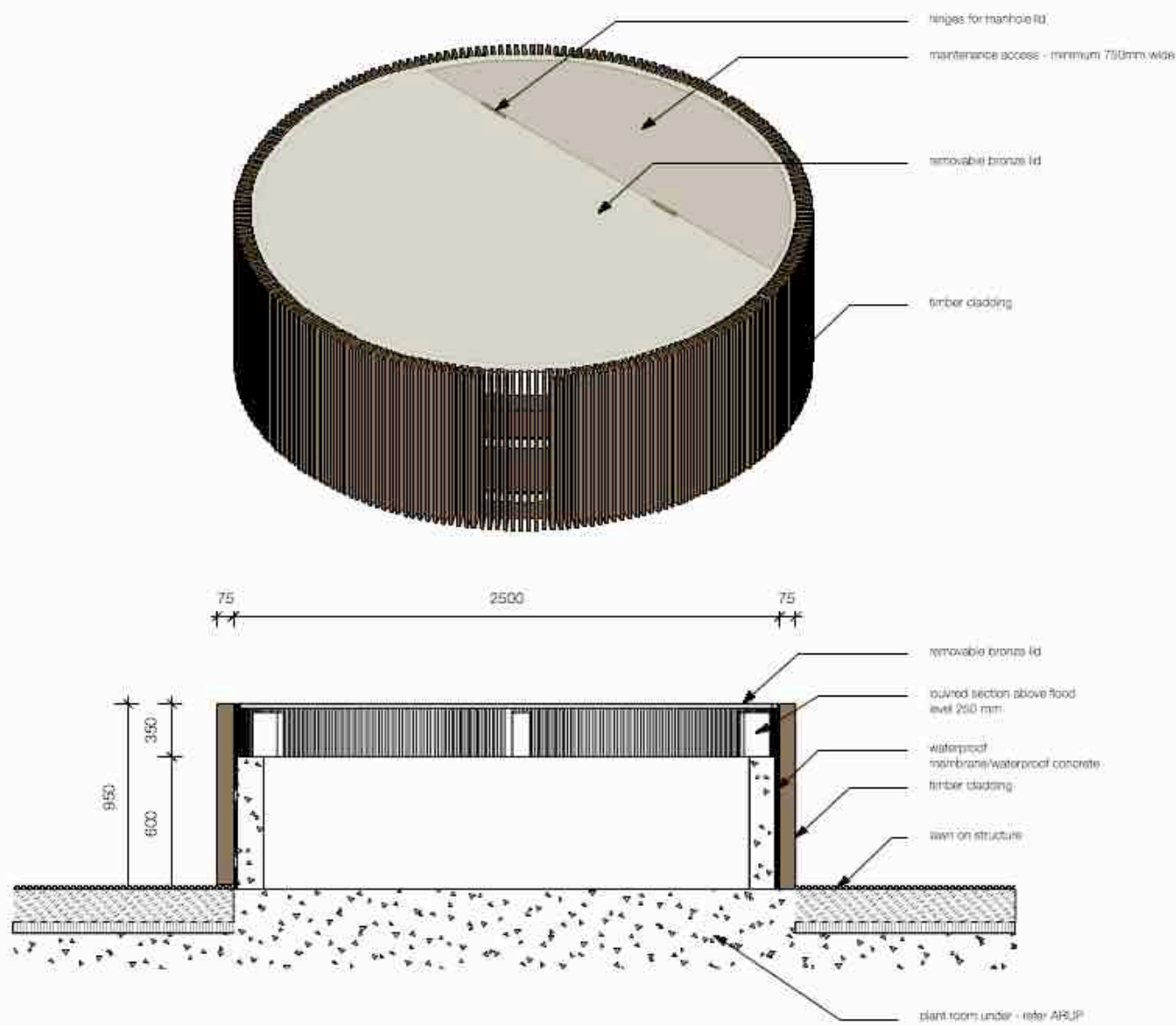
Rev	Reason/Description
1	Revised by SSA/SSDA
2	Revised by SSA/SSDA

By/Checked	Date
AC	2/1/18
AC	2/1/18

Sheet Title
Sea water exchange upper room
- Render

Sheet No.
LD_SK-90-21

Rev
B



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Client
Art Gallery NSW

Project No. 048558
**AGNSW Expansion: Sydney Modern
Project**
Address
Art Gallery Rd, Sydney NSW, 2000
Phase
SSDA

Key Plan

Scale & Orientation
1: 20 @ A3

All dimensions are in millimetres unless otherwise
indicated. Dimensions are to the centreline.

Revision Log

Rev	Revision Description
C	For SSDA Submission
B	For SSDA Submission
A	For SSDA Submission

By/Checked	Date
AD	10/11/18
AC	10/11/18
AC	10/11/18

Sheet Title
**Sea water exchange upper room
- ISO/Section**

Sheet No.
LD_SK-90-22

Rev
C