LEGEND

- TILED / PAVED
- CONCRETE
- GARDEN BED
- GLASS
- WATER (POOL)
- METAL
- TO BE REMOVED
- BOUNDARY
- STRUCTURAL ROOT ZONE

Proposed frameless glass balustrade on spigots to replace existing

Proposed extension of existing tiled verandah to align with retaining wall below (to be extended approx. 600mm)

Pink dashed line depictsstructural root zone for Jacaranda. Proposed pool pier locations to be adjusted to avoid any roots found during excavation for piers.

Dashed red line depicts tile body proposed to be cut back

Frameless glass balustrade, to meet pool safety controls as per AS1926.1/2012

Frameless glass pool gate, to meet pool safety controls as per AS1926.1/2012

Existing tiled surface to remain

Proposed replacement of exsiting balustrade with framess glass on spigots, to meet pool safety controls as per AS1926.1/2012

Frameless glass pool gate, to meet pool safety controls as per AS1926.1/2012

Sandstone flagging surface to replace existing flagging surface. Substrate to engineers details

Frameless glass pool gate, to meet pool safety controls as per AS1926.1/2012

Existing vegetation to remain

Existing steps to remain

Frameless glass pool gate

Soil levels around base of Jacaranda tree to be retained

Proposed balance tank for over-flow from pool on piers (0.6M x 6.8M x 0.4M). Total volume 1.9m3

Existing stone wall to be retained and protected throughout proposed works

Proposed open aluminium pool fence, to meet pool safety controls as per AS1926.1/2012

Proposed Elaeocarpus reticulatus hedge to screen underside of pool

Proposed swimming pool, 3M x 7M, Maximum depth 1.7M (total volume 29.4m3). To engineers details.

Note: Combined Swimming pool, spa and balance tank volume = 39.5m3

Proposed 3.6M x 1.9M Spa with seat Av. 1.2M deep. Total volume 8.2m3

Proposed sandstone flagging on suspended bondek slab. Pool equipment to be located under raised slab at ground level

Existing Frangipani to be transplanted and relocated to corner of upper garden bed

Proposed landing to align with corner line of existing building

Proposed glass pool fence on spigots, to meet pool safety controls as per AS1926.1/2012

Existing vegetation to remain

POOL 3M x 7M
MAX. DEPTH
1.7M

SPA
3.6M x 1.9M

SANDSTONE FLAGGING

STEEP BANK DOWN TO CREEK

RIDGE RL=21.23

GUTTER RL=19.34

1ST FLOOR VERANDAH RL=19.56

Ext+16.45 RL=16.63

Ext+13.19

Ext+13.84

Ext+12.69

Ext+15.31

Ext+16.49

Ext+16.44

Ext+16.48

Ext+16.42

Ext+15.35

Ext+15.27

Ext+15.22

RI+15.22

TOW+11.68

TOW+14.14

Ext+11.95

TOW+11.65

2225

4950

2225

92.48

209°

20'

40"

0 600 1600 2600 3600 4600 5600 mm

NORTHERN BEACHES COUNCIL

THIS PLAN IS TO BE READ IN CONJUNCTION WITH

Endorsement Date: 23/06/2017

DA0081/2017

PLANT SCHEDULE				
ID	Qty	Botanical Name	Common Name	Scheduled Size
Er	20	Elaeocarpus reticulatus	Blueberry Ash	500mm

SECRET GARDENS
LANDSCAPE DESIGN, CONSTRUCTION & MAINTENANCE
17 AYLESBURY STREET, BOTANY NSW 2019
PHONE 9314 5333 FAX 9314 5322

NOTES
THIS DRAWING IS FOR DESIGN GUIDANCE ONLY. FINAL DETAILS MUST MEET SITE CONDITIONS, RELEVANT AUTHORITIES AND APPLICABLE BUILDING STANDARDS. VERIFY ALL DIMENSIONS ON SITE AND WITH DETAILED SITE SURVEY PRIOR TO OFF SITE FABRICATIONS.
PLEASE NOTE THAT THE PLANT GRAPHICS ARE INDICATIVE SIZES ONLY AND NOT AN ACCURATE REPRESENTATION AT TIME OF PURCHASE

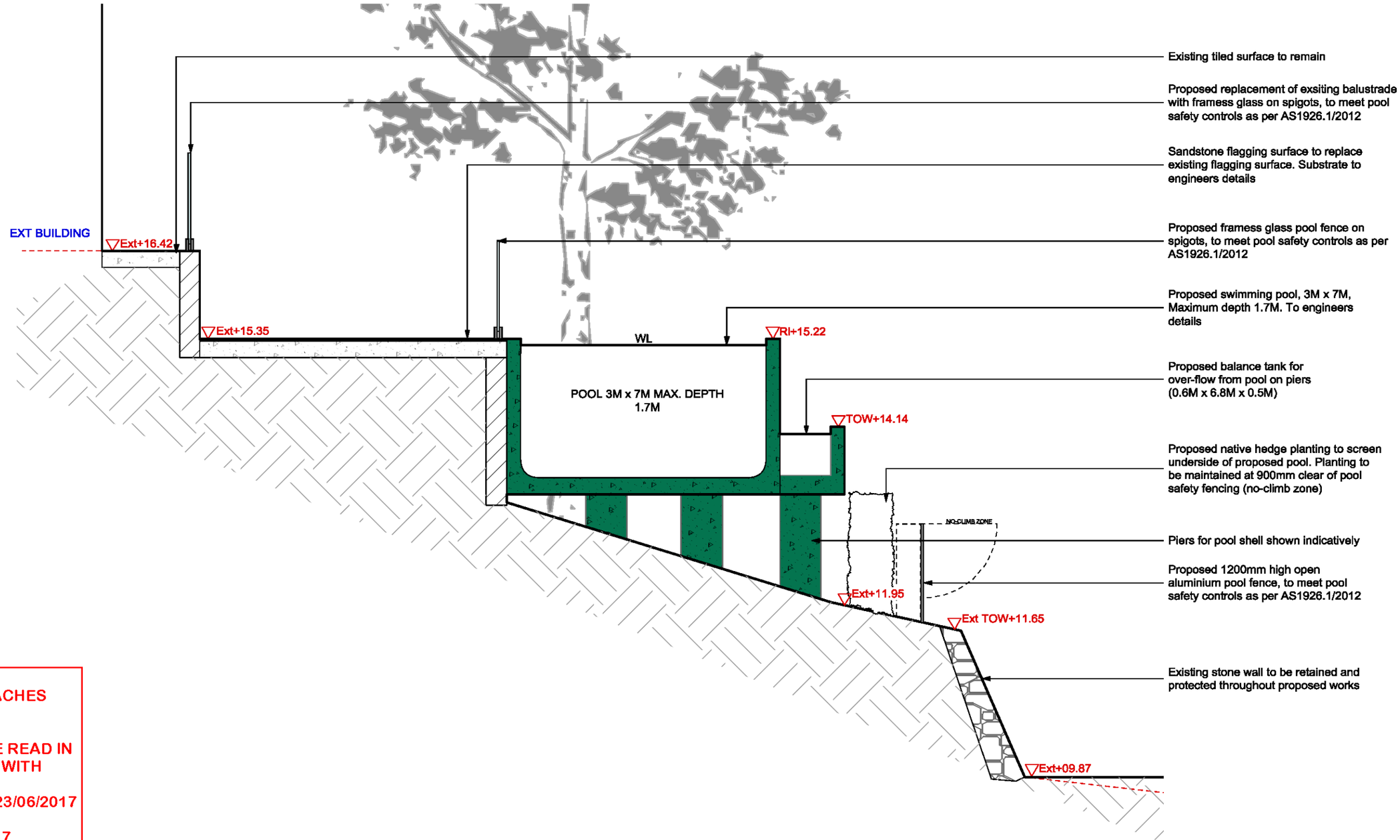
PROJECT
2A Beatty Street, Balgowlah Heights
NSW 2093

DRAWN	SCALE	DATE	DWG NO	REV
HTS	1:100 A3	28.04.17	DA-02	A

TITLE
LANDSCAPE PLAN

LEGEND

- TILED / PAVED
- CONCRETE
- GARDEN BED
- GLASS
- WATER (POOL)
- METAL
- TO BE REMOVED
- BOUNDARY



NORTHERN BEACHES COUNCIL

THIS PLAN IS TO BE READ IN CONJUNCTION WITH

Endorsement Date: 23/06/2017

DA0081/2017

0 300 800 1300 1800 2300 2800 mm

SECRET GARDENS

LANDSCAPE DESIGN, CONSTRUCTION & MAINTENANCE
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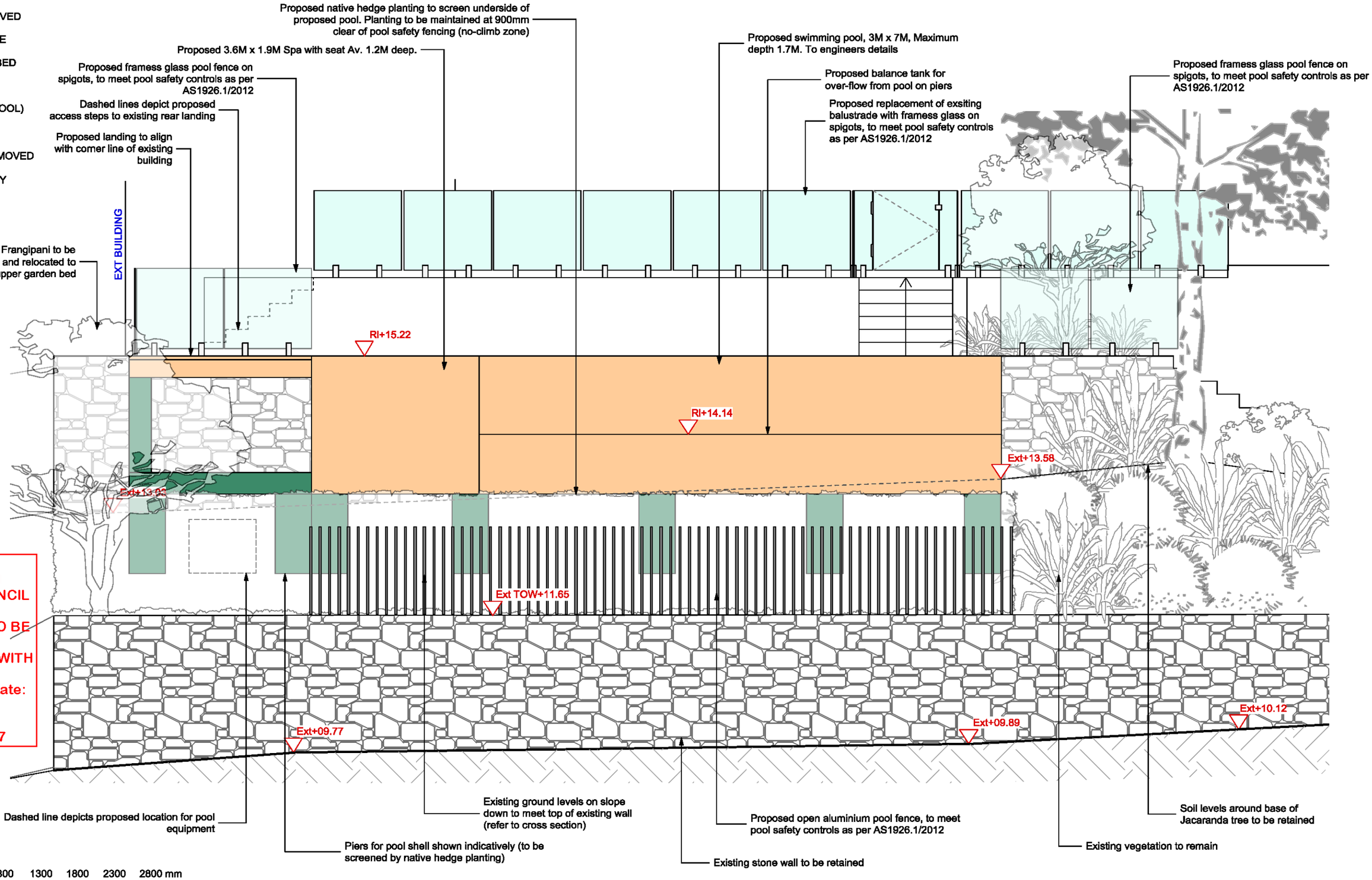
PROJECT
2A Beatty Street, Balgowlah Heights
NSW 2093

DRAWN	SCALE	DATE	DWG NO	REV
HTS	1:50 [A3]	28.04.17	DA-04	A

TITLE
PROPOSED POOL CROSS SECTION

LEGEND

- TILED / PAVED
- CONCRETE
- GARDEN BED
- GLASS
- WATER (POOL)
- METAL
- TO BE REMOVED
- BOUNDARY



NORTHERN BEACHES COUNCIL

THIS PLAN IS TO BE READ IN CONJUNCTION WITH

Endorsement Date: 23/06/2017

DA0081/2017

SECRET GARDENS

LANDSCAPE DESIGN, CONSTRUCTION & MAINTENANCE
17 AYLESBURY STREET, BOTANY NSW 2019
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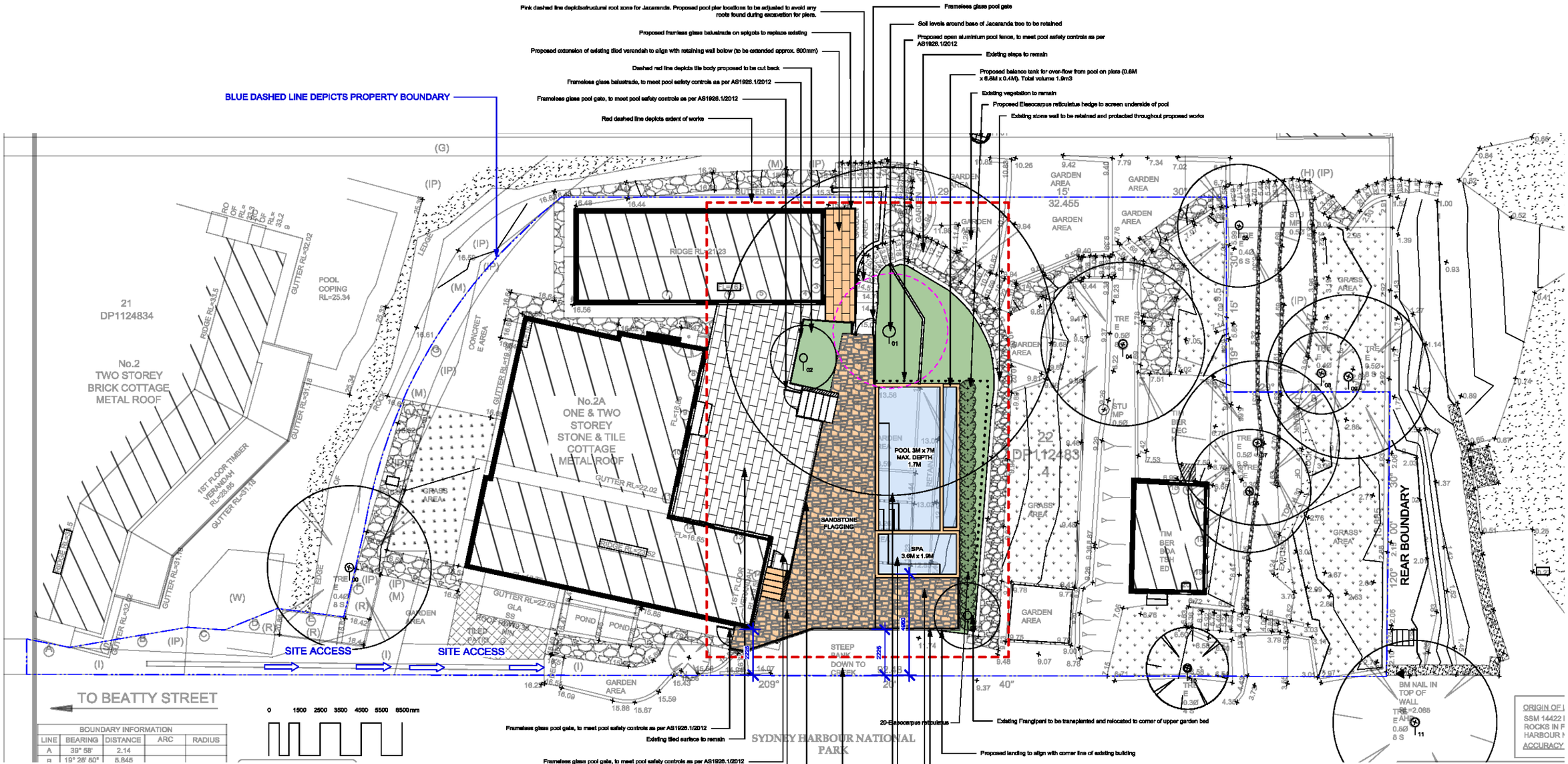
PROJECT
2A Beatty Street, Balgowlah Heights NSW 2093

DRAWN	SCALE	DATE	DWG NO	REV
HTS	1:50 [A2]	28.04.17	DA-05	A

TITLE
PROPOSED POOL ELEVATION



BOUNDARY INFORMATION				
LINE	BEARING	DISTANCE	ARC	RADIUS
A	39° 58'	2.14		
B	119° 28' 50"	5.845		

0 1500 2500 3500 4500 5500 6500mm

NORTHERN BEACHES COUNCIL

THIS PLAN IS TO BE READ IN CONJUNCTION WITH

Endorsement Date: 23/06/2017

DA0081/2017

SECRET GARDENS
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PROJECT
2A Beatty Street, Balgowlah Heights
NSW 2093

DRAWN	SCALE	DATE
HTS	1:200 A3	01.06.17

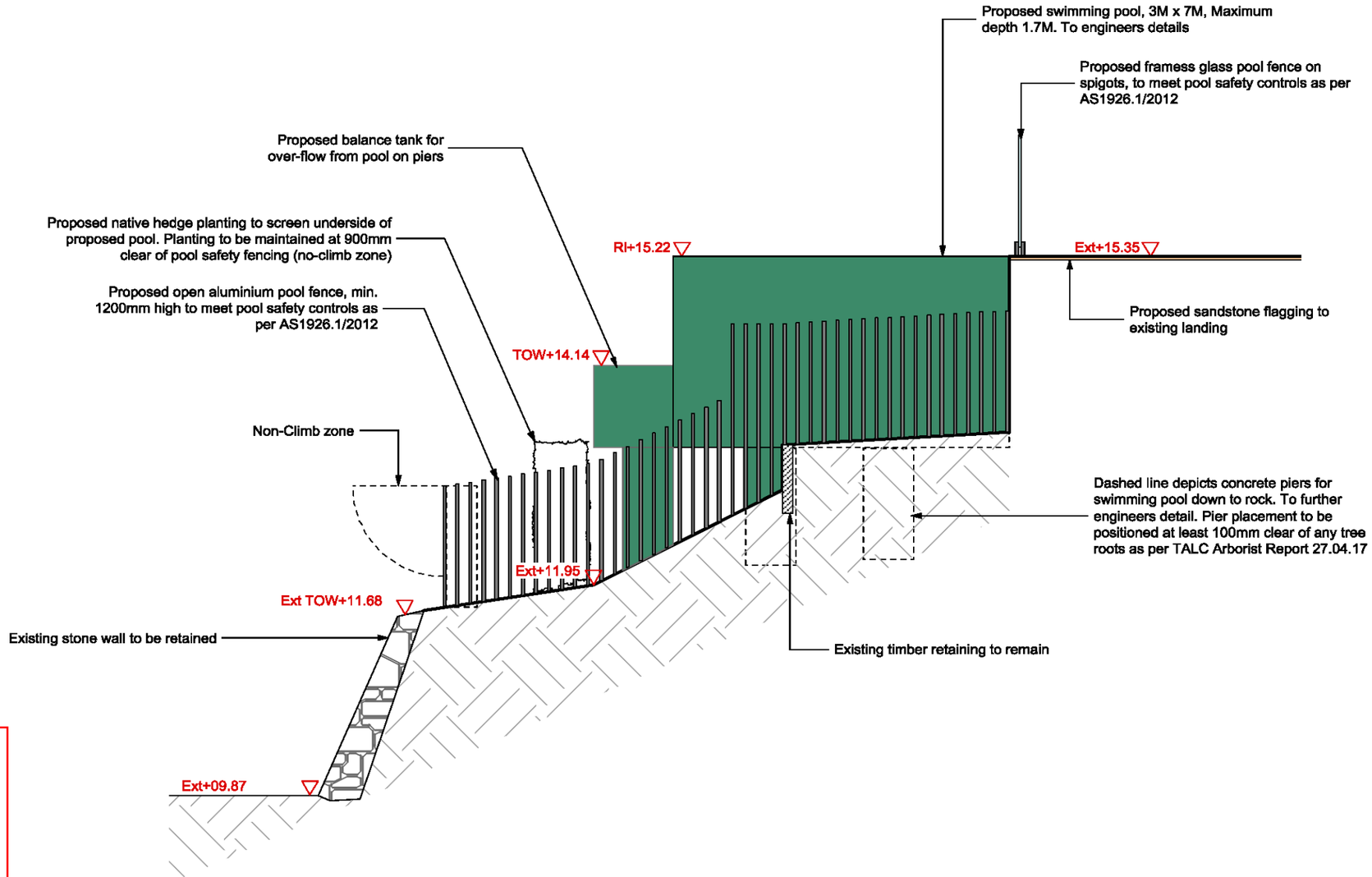
TITLE
SITE PLAN

DWG NO
DA-07

REV
B

LEGEND

- TILED / PAVED
- CONCRETE
- GARDEN BED
- GLASS
- WATER (POOL)
- METAL
- TO BE REMOVED
- BOUNDARY



NORTHERN BEACHES COUNCIL

THIS PLAN IS TO BE READ IN CONJUNCTION WITH

Endorsement Date: 23/06/2017

DA0081/2017

REQUIRED ADDITIONAL INFORMATION - NORTH WEST FACING POOL PROFILE ELEVATION

SECRET GARDENS

LANDSCAPE DESIGN, CONSTRUCTION & MAINTENANCE
17 AYLESBURY STREET, BOTANY NSW 2019
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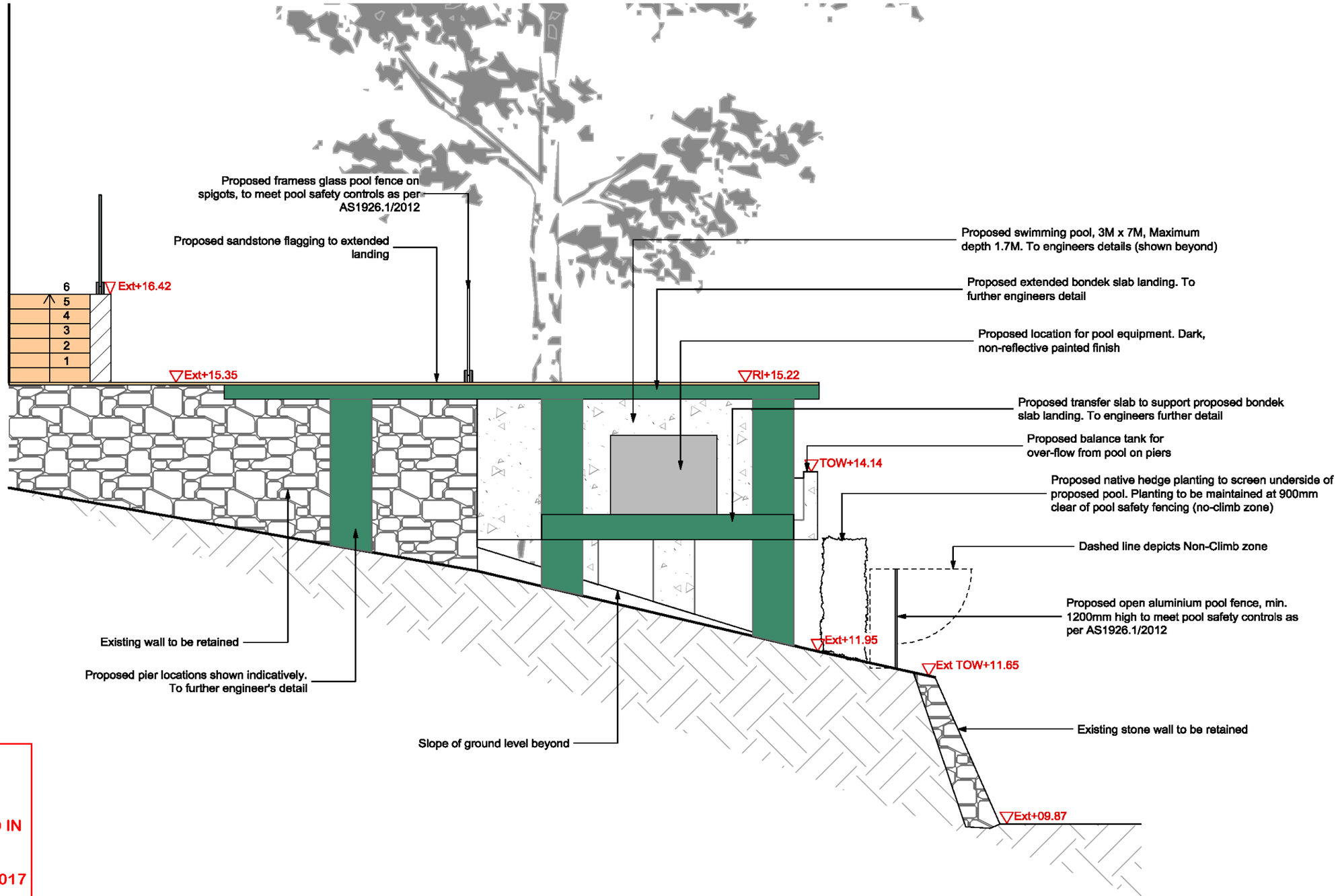
PROJECT
2A Beatty Street, Balgowlah Heights
NSW 2093

DRAWN	SCALE	DATE	DWG NO	REV
HTS	1:50 [A3]	14.06.17	DA-08	C

TITLE
PROPOSED POOL ELEVATION

LEGEND

- TILED / PAVED
- CONCRETE
- GARDEN BED
- GLASS
- WATER (POOL)
- METAL
- TO BE REMOVED
- BOUNDARY



NORTHERN BEACHES COUNCIL

THIS PLAN IS TO BE READ IN CONJUNCTION WITH

Endorsement Date: 23/06/2017

DA0081/2017

REQUIRED ADDITIONAL INFORMATION - SOUTH EAST FACING POOL PROFILE ELEVATION

SECRET GARDENS

LANDSCAPE DESIGN, CONSTRUCTION & MAINTENANCE
17 AYLESBURY STREET, BOTANY NSW 2019
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PROJECT
2A Beatty Street, Balgowlah Heights
NSW 2093

DRAWN	SCALE	DATE	DWG NO	REV
HTS	1:50 [A3]	14.06.17	DA-09	C

TITLE
PROPOSED POOL ELEVATION

STATEMENT OF ENVIRONMENTAL EFFECTS

PROPOSED ALTERATIONS TO

2A BEATTY STREET BALGOWLAH HEIGHTS

Prepared by
Ark Design Studio

Submitted to
NORTHERN BEACHES COUNCIL - MANLY
April 2017

Ark Design Studio
PO Box 2298 Clovelly West NSW 2031
Ph 02.9399 9772 Fax 02.9399 9773
admin@arkdesign.com.au

AL

1. INTRODUCTION

This report constitutes a Statement of Environmental Effects and accompanies a Development Application for proposed alterations at 2a Beatty Street Balgowlah Heights.

The purpose of this report is to:

- Describe the proposal and the locality in which it is situated;
- Discuss the potential environmental effects of the proposal;
- Draw conclusions as to whether those impacts are significant; and,
- Make a recommendation to Council as to whether the Development Application should be supported.

Ark Design Studio has prepared this report for the applicants of this proposal.
This report should be read in conjunction with the following information:

- Architectural, Site & Landscape Plans (*prepared by Secret Gardens of Sydney*)
- Survey Diagram (*prepared by Survplan*)
- Bushfire Assessment Report (*prepared by Sydney Bushfire Consultants*)
- Geotechnical Report (*prepared by AW Geotechnical*)
- Arborist Report (*prepared by Tree And Landscape Consultants*)

2. LOCALITY & PLANNING

The property is located within the boundaries of the area covered by the Manly Local Environmental Plan (LEP) 2013 and Manly Development Control Plan (DCP) 2013.

The proposed development has been assessed based on the characteristics of the site and locality, existing planning controls, in accordance with the Environmental Planning and Assessment Regulation 2000, and the requirements under the Environmental Planning and Assessment Act 1979.

3. EXISTING SITE ANALYSIS

3.1 SITE LOCATION

The subject site is located at 2a Beatty Street Balgowlah Heights and is on the northeast side of the street.

3.2 SITE DESCRIPTION

3.2.1 Site Characteristics

The total site area is 1292.4 m^2 and is identified as Lot 22 in Deposited Plan 1124834.

3.2.2 Contamination

Given the long residential use of the property, it is unlikely that the conditions of the site have been contaminated.

3.2.3 Site works – Building

Site building works consist of a one and two storey freestanding stone and tile residential cottage, and a detached timber boat shed at the rear of the property.

3.2.4 Existing vegetation
The site's existing open spaces consist of extensive grassed areas, deep soil planting and garden beds, some mature trees, stone retaining walls and paths.

3.2.5 Access & parking
The subject property is entered via a pedestrian concrete path along the southeast side boundary, accessed from the southeast (cul-de-sac) end of Beatty Street.

3.2.6 Utility Services
Services, including water, electricity, sewer and stormwater, are currently connected to the subject site.

3.2.7 Views & vistas
The subject site and adjoining properties have views of the North Harbour foreshore and Reef Bay to the northeast. There are no views directly from the adjoining public domain at the southeast end of Beatty Street.

4. PROPOSED DEVELOPMENT
4.1 ARCHITECTURAL DESIGN
- New swimming pool, tiling and pool fence to the existing rear private open space

4.2 LANDSCAPING
The proposed works will improve access and amenities to the existing private open space and landscaped area to the north-eastern rear of the property. *Refer 5.6*

4.3 ACCESS AND CIRCULATION
Beatty Street is a two-way street catering to predominantly local vehicle traffic.
The proposed development will not alter the current level of access and traffic to the street or immediate area.

4.4 WATER MANAGEMENT AND SEDIMENT CONTROL
There is no proposed increase to the current volume of stormwater entering the existing gravity-fed stormwater drainage system.

During construction, stormwater will be filtered before it enters the council stormwater system / street through the installation of sediment control measures placed on the site's boundary and any floor grates.

4.5 WASTE MANAGEMENT
During construction, rubble and off-cut waste will be disposed of into a suitable skip, located on site. The skip will not impede / interfere with the traffic flow.

All waste material from the demolition and construction stages of the development will be disposed of by an approved contractor and delivered to a waste and recycling facility. Where possible, material will be recycled and used in the construction of the proposed development, or used as fill.

The current on-going waste removal and recycling services will not be affected by the proposed development.

4.6 NOISE, SAFETY, SECURITY AND CRIME PREVENTION

During construction of the works, attempts will be made to provide against undue nuisance to adjoining properties from dust and noise.
The works will be constructed in accordance with the Occupation Health and Safety Act 2000, the Regulation 2001 and relevant Codes of Practice.

Surveillance and security:

i) Due the property's location, the existing dwelling is not subjected to casual observation from pedestrians and passers-by
ii) There is no casual street surveillance from the existing dwelling or property

5. ASSESSMENT UNDER THE DEVELOPMENT CONTROL AND ENVIRONMENTAL PLANNING ACT 1979

The proposal is to undertake alterations to the subject site and existing dwelling.
The proposed development represents an orderly and economic use of the land and as such the proposal is consistent with the relevant objects of the Act.

5.1 STATE ENVIRONMENTAL PLANNING POLICY NO. 55 REMEDIATION OF LAND

This SEPP provides a state-wide practice for the remediation of contaminated land. Under clause 7 (1) (a) of State Environmental Planning Policy No. 55 – Remediation of Land, consideration has to be given as to whether the land is contaminated.

INITIAL SITE EVALUATION

No testing for land contamination has been conducted on the subject site as part of this development proposal. *All information provided has been sourced from council's property records and local history library.*

Present use of subject site:	Residential
Date present use commenced:	Unknown
Previous use of subject site:	Unknown
Adjoining site(s):	2 & 4 Beatty Street
Present use(s):	Residential
Date present use commenced:	Unknown
Previous use:	Unknown

The site appears to have been in residential use since its original subdivision and there is no evidence of any potentially contaminating uses occurring. It can be concluded beyond reasonable doubt that there is no likelihood of contamination on this site. No further consideration is therefore required under clause 7 (1) (b) and (c) of SEPP 55.

5.2 MANLY LOCAL ENVIRONMENT PLAN 2013

The particular aims of this Plan are as follows:
(a) in relation to all land in Manly:

(i) to promote a high standard of urban design that responds to the existing or desired future character of areas, and
(ii) to foster economic, environmental and social welfare so that Manly continues to develop as an accessible, sustainable, prosperous, and safe place to live, work or visit, and
(iii) to ensure full and efficient use of existing social and physical infrastructure and the future provision of services and facilities to meet any increase in demand, and
(iv) to ensure all development appropriately responds to environmental constraints and does not adversely affect the character, amenity or heritage of Manly or its existing permanent residential population,
(b) in relation to residential development:
(i) to provide and maintain a diverse range of housing opportunities and choices that encourages affordable housing to cater for an ageing population, changing demographics and all socio-economic groups, and
(ii) to ensure high quality landscaped areas in the residential environment, and
(iii) to encourage higher density residential development to be located close to major transport nodes, services and employment opportunities, and
(iv) to maintain active retail, business and other non-residential uses at street level while allowing for shop top housing in centres and offices at upper floors in local centres,
(c) in relation to business and the economy:.
(i) to encourage, provide and consolidate business opportunities for a range of uses in appropriate locations that support local employment, community services and economic growth in business centres, and
(ii) to recognise that tourism is a major industry and employer in Manly and to encourage its growth and continuing viability while protecting the needs of the local community,
(d) in relation to transport, infrastructure and amenities:
(i) to reduce private car dependency, increase the viability of various public transport modes, minimise conflict between pedestrians and vehicular movement systems and encourage walking and cycling while concentrating intensive land uses and trip generating activities in locations most accessible to public transport and centres, and
(ii) to provide for a range of recreational and community service opportunities to meet the needs of residents and visitors to Manly and promote the efficient and equitable provisions of public services, infrastructure and amenities,
(e) in relation to heritage—to identify, protect, sustain, manage and conserve all heritage, including archaeological relics, sites and resources, places of Aboriginal heritage significance, heritage items (and their curtilages), heritage conservation areas and the cultural (natural and built) environmental heritage of Manly,
(f) in relation to the natural environment:
(i) to conserve and enhance terrestrial, aquatic and riparian habitats, biodiversity, wildlife habitat corridors, remnant indigenous vegetation, geo-diversity and natural watercourses, and
(ii) to promote energy conservation, water cycle management (incorporating water conservation, water reuse, catchment management, stormwater pollution control and flood risk management) and water sensitive urban design, and
(iii) to protect, enhance and manage environmentally sensitive land with special aesthetic, ecological, scientific, cultural or conservation values for the benefit of present and future generations, and

(iv) to protect existing landforms and natural drainage systems and minimise the risk to the community in areas subject to environmental hazards, particularly flooding, bush fires, acid sulphate soils, sea level rise, tsunami and landslip, and
(v) to provide a framework that facilitates and encourages measures to assist the adaptation of the local environment to mitigate the impacts of climate change, and
(vi) to give priority to retaining bushland for its own intrinsic value and as a recreational, educational and scientific resource,
(g) in relation to Manly's unique harbour, coastal lagoon and ocean beach setting:
(i) to preserve and enhance the amenity of public places and areas visible from navigable water around Manly, and
(ii) to retain open space, make more foreshore land available for public access and protect, restore and enhance riparian land along watercourses and foreshore bushland

The proposed development has considered the aforementioned aims and complies with the relevant objectives.

5.2.1 PART 2 PERMITTED OR PROHIBITED DEVELOPMENT

Land Use Zone

The proposed development site is located within an **E3 Environmental Management Zone**.

Objectives of the zone are as follows:

- To protect, manage and restore areas with special ecological, scientific, cultural or aesthetic values.
- To provide for a limited range of development that does not have an adverse effect on those values.
- To protect tree canopies and provide for low impact residential uses that does not dominate the natural scenic qualities of the foreshore.
- To ensure that development does not negatively impact on nearby foreshores, significant geological features and bushland, including loss of natural vegetation.
- To encourage revegetation and rehabilitation of the immediate foreshore, where appropriate, and minimise the impact of hard surfaces and associated pollutants in stormwater runoff on the ecological characteristics of the locality, including water quality.
- To ensure that the height and bulk of any proposed buildings or structures have regard to existing vegetation, topography and surrounding land uses.

The residential use and proposed development is permissible with consent and is consistent with the objectives of the zone.

5.2.2 PART 4 PRINCIPAL DEVELOPMENT STANDARDS

Minimum Subdivision Lot Size

Not applicable.

Height of Buildings

Maximum Building Height **8.5 metres**

The height of the existing building will not be increased or altered.

Floor Space Ratio

Maximum Permissible Floor Space Ratio (FSR)	**0.40:1**
Site Area	1292.4 m^2
Maximum Permissible Gross Floor Area	516.96 m^2

The proposed development will not increase or alter the current level of floor area.

5.2.3 PART 5 MISCELLANEOUS PROVISIONS

Development within the Coastal Zone

The subject site is not located within a Coastal Zone area.

Preservation of Trees and Vegetation

The proposed development will not remove or adversely impact on species or kinds of trees or other vegetation that are prescribed for the purposes of this clause by a development control plan made by the Council.

Heritage Conservation

The property is not listed as an *Item of Heritage Significance*.
The site is not located within a *Heritage Conservation Area*.

An Item of Heritage Significance, **I34** '*The eastern facing stone façade of the original cottage*', is located at the rear of the subject site. The proposed development is setback well away from this heritage item and will therefore have no adverse or visual impact.

There are no other items of heritage significance within direct vicinity of the site.

5.2.4 PART 6 ADDITIONAL LOCAL PROVISIONS

Acid Sulphate Soils

The subject site is not located within an Acid Sulphate Soil Area.

Earthworks

The proposed pool development -
(a) will not cause disruption of, or have a detrimental effect on, drainage patterns and soil stability in the locality of the development,
(b) will not have an adverse effect or create restrictions on the likely future use or redevelopment of the land,
(c) will ensure the quality of the fill and/or the soil to be excavated,
(d) will not have an adverse effect on the existing and likely amenity of adjoining properties,
(e) will ensure the quality of the source of any fill material and the suitability of the destination of any excavated material,
(f) will ensure that there is no likelihood of disturbing relics,
(g) is not located near, or has the potential for adverse impacts on, any waterway, drinking water catchment or environmentally sensitive area,
(h) will take appropriate measures to avoid, minimise or mitigate the impacts of the development.

Flood Planning
The subject site is not identified as being located within a *Flood Planning Area*, nor at or below the *Flood Planning Level*.

Stormwater Management
The proposed development will retain the existing gravity-fed stormwater drainage system and is designed to maximise the use of water permeable surfaces on the land.

The development avoids any significant adverse impacts of stormwater runoff on adjoining properties, native bushland and receiving waters, and if that impact cannot be reasonably avoided, will minimise and mitigate the impact.

Terrestrial Biodiversity
The subject site is identified as 'Terrestrial Biodiversity' on the Terrestrial Biodiversity Map, Sheet CL2_004.

The proposed development is designed, sited and will be managed to avoid any significant adverse environmental impact.
The proposed development will not have -

i) any adverse impact on the condition, ecological value and significance of the fauna and flora on the land, and
ii) any adverse impact on the importance of the vegetation on the land to the habitat and survival of native fauna, and
iii) any potential to fragment, disturb or diminish the biodiversity structure, function and composition of the land, and
iv) any adverse impact on the habitat elements providing connectivity on the land, and will have
v) appropriate measures in place to avoid, minimise or mitigate the impacts of the development.

Riparian Land and Watercourses
The subject site is not identified as 'Riparian' or 'Watercourse' land.

Wetlands
The subject site is not identified as 'Wetland' land.

Landslide Risk
The subject site is identified as 'Landslide Risk Area G1' land, (refer DCP Schedule 1 Map C – Potential Geotechnical Landslip Hazard Areas).
Refer to submitted Geotechnical Report.

Foreshore Scenic Protection Area
The subject site is identified as being located within the 'Foreshore Scenic Protection' area on the Foreshore Scenic Protection Map, Sheet FSP_004.
The proposed pool development will not breach the 'Foreshore Building Line' (refer Foreshore Building Line Map, Sheet FBL_004), and will not create adverse impacts that are of a detriment to the visual amenity of the harbour or coastal foreshore, including

overshadowing of the foreshore and any loss of views from a public place to the foreshore.

Active Street Frontages
Not applicable.

5.3 MANLY DEVELOPMENT CONTROL PLAN 2013
GENERAL CONTROLS
5.3.1 STREETSCAPES
Streetscape (Residential)
Not applicable. The proposed development is located at the rear of the site and cannot be viewed from the street, and will have no impact on the local streetscape character.
Front Fences and Gates
Not applicable.
Roofs and Dormer Windows
Not applicable.
Garages, Carports and Hardstand Areas
Not applicable.
Garbage Areas
Not applicable.

5.3.2 HERITAGE CONSIDERATION
The property is not listed as an *Item of Heritage Significance*.
The site is not located within *Heritage Conservation Area*.

An Item of Heritage Significance, **I34** '*The eastern facing stone façade of the original cottage*', is located at the rear of the subject site. This item will be retained.
The proposed development is setback well away from this heritage item and will therefore have no adverse or visual impact.

There are no other items of heritage significance within direct vicinity of the site.

5.3.3 LANDSCAPING
The proposed development is designed in accordance with the objectives, landscape character and design guidelines for low density areas, outlined in the DCP.
Refer to submitted Landscape Plan.

5.3.4 AMENITY (Views, Overshadowing, Visual and Acoustic Privacy)
Due to its location and design, the proposed pool development will not alter or have an adverse impact on the current level of views, solar access, or visual and acoustic privacy, to the subject site or adjoining residential properties.

5.3.5 ACCESSIBILITY
Not applicable. The proposed development will have no impact on the current level of access to and from the subject site.

5.3.6 STORMWATER MANAGEMENT
The proposed development will not alter the existing on-site water management and drainage system.

5.3.7 WASTE MANAGEMENT
The proposed development will not alter or impact on the existing on-site waste bin area and facilities. *Refer Item 4.5.*

5.3.8 MECHANICAL PLANT EQUIPMENT
The proposed pool filtration system and equipment is setback well away from adjoining properties and enclosed within a suitable enclosure. *Refer Item 5.4.9.*

5.3.8 SAFETY AND SECURITY
The current level of neighbourhood security will be maintained. *Refer Item 4.6.*

5.4 MANLY DEVELOPMENT CONTROL PLAN 2013
RESIDENTIAL DEVELOPMENT CONTROLS
5.4.1 DWELLING DENSITY AND SUBDIVISION
Residential Density
Density Area D9 – 1 unit / 1150 m^2 of Site Area
(*Refer DCP Map A – Residential Density Areas*)
Not applicable.

Residential Land Subdivision
Not applicable.

5.4.2 HEIGHT OF BUILDINGS
The height of the existing building will not be increased or altered. *Refer Item 5.2.2.*
Wall Height
Maximum Permissible Wall Height **6.5 metres**
Not applicable.

Number of Storeys
Not applicable.

Roof Height
Not applicable.

5.4.3 FLOOR SPACE RATIO
Not applicable. *Refer Item 5.2.2.*

5.4.4 SETBACKS
Front
Not applicable.

Side Streets and Secondary Street Frontages
Not applicable.

Rear
The proposed development will not alter the existing building to rear boundary setback.

Foreshore Building Line
The proposed pool development will not breach the 'Foreshore Building Line' (refer Foreshore Building Line Map, Sheet FBL_004). *Refer Item 5.2.4.*

Setback for Development Adjacent to LEP Zones RE1, RE2, E1 and E2
Minimum Common Boundary Setback **6 metres**
The property adjoins an ***E1*** *Natural Parks and Nature Reserves* zoned land, along the southeast side boundary.
Although the proposed pool development breaches this setback control, the design has endeavoured to comply with the objectives of the DCP with the use of landscaped vegetation, materials and finishes sympathetic to the adjoining natural environment.

5.4.5 OPEN SPACE AND LANDSCAPING
Residential Open Space
Open Space Area OS4 (*Refer DCP Map B – Residential Density Areas*)

Minimum Total Open Space	60% of site area
Minimum Landscaped Area	40% of Total Open Space

Site Area	1292.4 m^2
Existing Total Open Space	856 m^2 (66.23%)
Existing Landscape Area	484 m^2 (56.54%)
Proposed Total Open Space	**856 m^2 (66.23%)**
Proposed Landscape Area	**430 m^2 (50.23%)**

Private Open Space
Minimum Principal Private Open Space **18 m^2**
The proposed development will not alter the existing rear private open space area.
The existing area complies with the DCP numeric control.

5.4.6 PARKING, VEHICULAR ACCESS AND LOADING
Not applicable.

5.4.7 FIRST FLOOR AND ROOF ADDITIONS
Not applicable.

5.4.8 DEVELOPMENT ON SLOPING SITES
Not applicable. The proposed pool development will not alter the existing buildings on site and respects the existing topography.

5.4.9 SWIMMING POOLS
Height Above Ground
The existing rear private open space is terraced at various levels to the rear boundary.
The proposed new pool adjoins an existing stone paved area (at RL15.27), with the finished pool coping level at RL15.22 and the balance tank level at RL 14.14.

Location and Setbacks
The proposed pool development is located at the rear of the site and dwelling. The pool cannot be viewed from the adjoining public domain (streetscape) and will not detract from the amenity or character of the local neighbourhood.

The proposed pool development is setback from the southeast side boundary **4.95 metres** to the spa's water line (edge). The adjoining stone paved area and concourse is setback **2.225 metres** from the southeast side boundary, in line with the existing dwelling.

Total Open Space
The proposed pool and concourse area is not more than 30% (256.8m^2) of the proposed *Total Open Space* area.

Other Matters
The proposed new pool, spa and balance tank has a total volume of **39.8 m^3**.
The pool will be connected to the existing sewer system on site.
The pool filtration system will be enclosed and acoustically controlled to limit noise to the appropriate standard.
The pool will be fitted with a retractable 'pool blanket' or similar device.

5.4.10 FENCING
Not applicable.

6. CONCLUSION

The aim of this statement of environmental effects has been to:

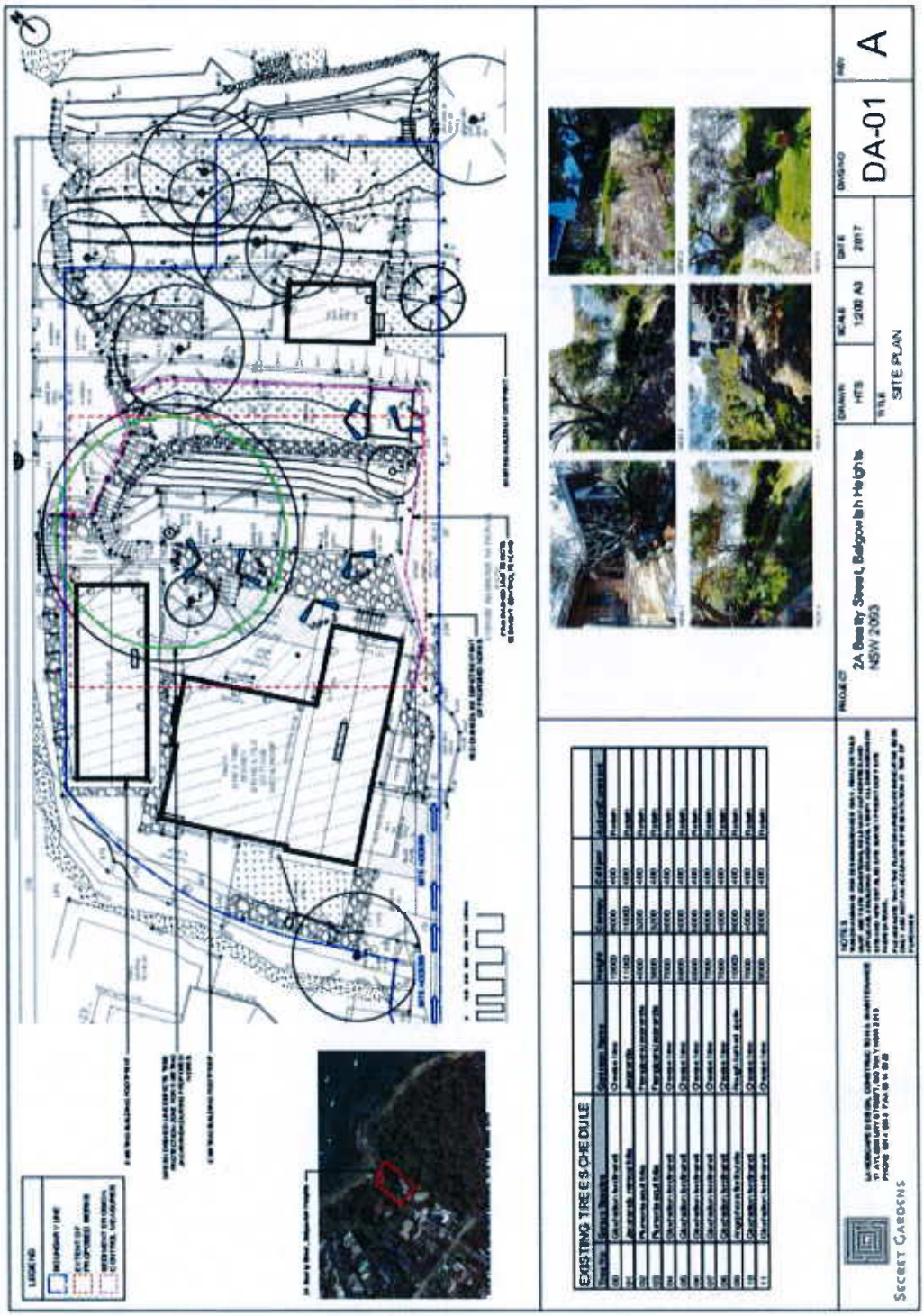
- Describe the proposal
- To illustrate the proposal's compliance with relevant statutory considerations; and,
- To provide an assessment of the likely environmental effects of the proposal.

The proposed development will improve access and amenity to the rear of the subject property. The design, materials and finishes respect the natural character of the site, and will not create adverse impacts on adjoining properties or the public domain.

Having regard to the analysis and assessment within this Statement of Environmental Effects, it is recommended that the Northern Beaches Council – Manly support the development application for the proposed alterations to this property.

ANNEXURE A

SITE PLAN

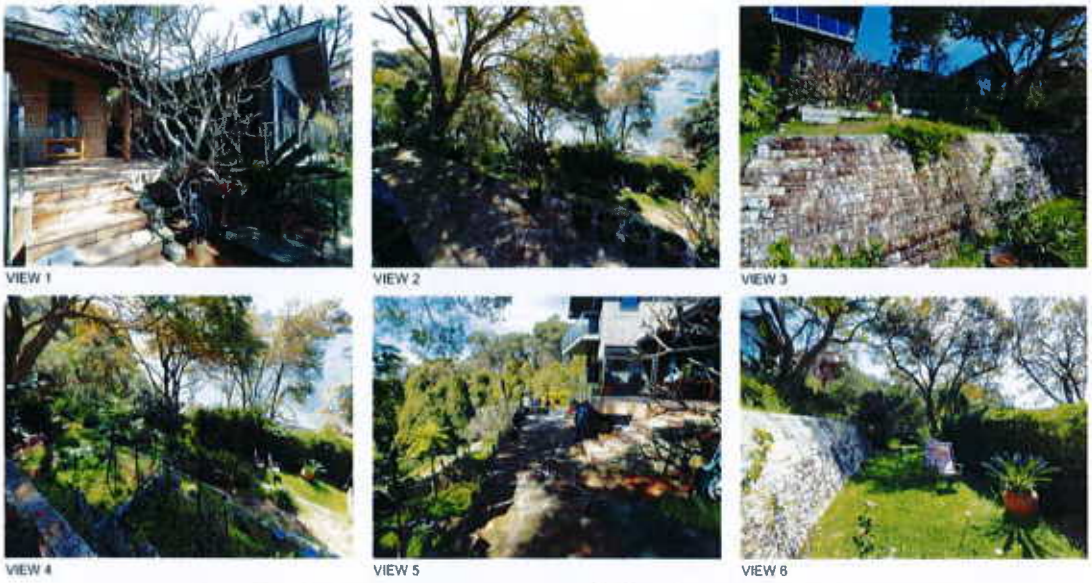

LEGEND
EXISTING TREES SCHEDULE
2A Beatty Street, Balgowlah Heights
NSW 2093
SITE PLAN
DA-01
A
SECRET GARDENS

ANNEXURE B

PHOTOGRAPHS OF EXISTING PROPERTY

Rear Private Open Space (Looking Northeast)

Rear Private Open Space & Dwelling Elevation (Looking Southwest)
Note sandstone wall in foreground to be retained.



View Lines of Rear Private Open Space (Refer to submitted Site Plan Dwg No DA-01)

Arboricultural Assessment Report

TALC
TREE AND LANDSCAPE CONSULTANTS

Prepared 27th April 2017

Site Location

2A Beatty Street
Balgowlah Heights NSW 2093

Client

Murray & Maureen Coleman

DISCLAIMER

The author and Tree & Landscape Consultants take no responsibility for actions taken and their consequences, contrary to those expert and professional instructions given as recommendations pertaining to safety by way of exercising our responsibility to our client and the public as our duty of care commitment, to mitigate or prevent hazards from arising, from a failure moment in full or part, from a structurally deficient or unsound tree or a tree likely to be rendered thus by its retention and subsequent modification/s to its growing environment either above or below ground contrary to our advice.

Peter Richards
Tree & Landscape Consultants

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Appendices

TREE & LANDSCAPE CONSULTANTS

Site Analysis, Arboricultural Assessments

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27th April 2017

Murray & Maureen Coleman
C/o Secret Gardens
Level 2, 17 Aylesbury Street
Botany NSW 2019

Our reference: 4220

Arboricultural Assessment Report:
2A Beatty Street
Balgowlah Heights NSW 2093

1. INTRODUCTION

This report has been prepared by Tree & Landscape Consultants for Murray & Maureen Coleman. The site was inspected by the author and the subject tree and its general growing environment evaluated on the 29th March 2017 for preparation of this report. The site is to be subject to a Development Application and this report and any works recommended, that require approval from the consenting authority is provided to form part of that development application and its consent conditions where appropriate.

This report assesses 1 tree the location of which is indicated in Appendix G and details its current health & condition and determines from the assessment, recommendations for its retention or removal.

2.0 AIMS & OBJECTIVES

Aims

Detail the condition of the tree/s on the site or on adjoining sites where such tree/s may be affected by the proposed works, by assessment of individual specimens or stands, and indicate remedial works or protection measures for their retention in a safe and healthy condition, or a condition not less than that at the time of initial inspection for this report, or in a reduced but sustainable condition due to the impact of the development but ameliorated through tree protection measures able to be applied, and will consider the location and condition of the tree/s in relation to the proposed building works, or recommend removal and replacement where appropriate.

Provide as an outcome of the assessment, the following: a description of the tree/s, observations made, discussion of the effects the location of the proposed building works may have on the trees, and make recommendations required for remedial or other works to the trees, if and where appropriate.

Determine from the assessment a description of the works or measures required to ameliorate the impact upon the tree/s to be retained, by the proposed building works or future impacts the tree/s may have upon the new building works if and where appropriate, or the benefits of removal and replacement if appropriate for the medium to long term safety and amenity of the site.

Objectives

Assess the condition of the subject tree.

Determine impact of development on the subject tree.

Provide recommendations for removal or management of the subject tree.

3. METHODOLOGY

3.1 The method of assessment of tree/s is applied from the ongoing knowledge and development of the author and considers but is not confined to:

- Tree health and subsequent stability, both long and short term
- Sustainable Retention Index Value (S.R.I.V.)© IACA 2009)
- Amenity values
- Significance

3.2 This assessment is undertaken using a standard tree assessment criteria for each tree based on the values above and is implemented as a result of at least one comprehensive and detailed site inspection.

3.3 In this report the dimensions of the tree recorded by the author for the trunk *diameter at breast height* (DBH) measurement is calculated at 1.4m above ground from the base of the tree. Where a tree is trunkless or branches at or near ground such as a mallee formed tree, an average diameter is determined by recording the radial extent of the stem mass at its narrowest and widest dimensions, adding the two dimensions together and dividing them by 2 to record an average.

3.4 Crown spreads are expressed as length by breadth measurements to accurately record their dimensions. Where appropriate, *crown spread orientation* is described along the length of the crown spread e.g. North/South, or as *radial* if the crown is distributed at an approximately even radius from the trunk e.g. 6x6m.

3.5 The Australian Standard AS 4970-2009 "Protection of trees on development sites, where applicable is applied to trees to be retained in this report as a point of reference and guide for the recommended minimum clearances from the centre of tree trunks to development works and is applied as a generalised benchmark and the distances may be increased or decreased by the author as a result of other factors providing mitigating circumstances or constraints as indicated by but not restricted to the following:

- *Tolerance of individual species to disturbance,*
- *Geology e.g. physical barriers in soil, floaters, bedrock to surface*
- *Topography e.g. slope, drainage,*
- *Soil e.g. depth, drainage, fertility, structure,*
- *Microclimate e.g. due to landform, exposure to dominant wind,*
- *Engineering e.g. techniques to ameliorate impact on trees such as structural soil, lateral boring,*
- *Construction e.g. techniques to ameliorate impact on trees such as pier and beam, bridge footings, suspended slabs*
- *Arboriculture e.g. exploration trenches to map location of roots,*
- *Physical limitations - existing modifications to the environment and any impact to tree/s by development e.g. property boundaries, road reserves, previous impact by excavation in other directions, soil level changes by cutting or filling, existing landscaping works within close proximity, modified drainage patterns.*

4. TREE ASSESSMENT

Table 1 Tree Assessment

Tree No.	Genus & Species Common Name	Age Y = Young M = Mature O = Overmature	Condition G = Good F= Fair P= Poor D = Dead	Pest & Diseases	Branch Bark Included	Canopy Orientation Sy = Symmetrical N,S,E,W = North South East West	Trunk Diameter (1.4m above ground in mm)	Height (m)	Spread (m)	Tree Vigour L = Low G= Good A= Abnormal	Trunk Lean X = Straight or Slightly Leaning A = Acutescent M = Moderate	SRIV (Age, Vigour, Condition Index Rating)
1	**Jacaranda mimosifolia** Jacaranda	M	F	No	No	Sy	600	17	12x12	G	A	MGVF9
	Comments: Deciduous exotic species appearing free of insect predation or disease.											

Table 2 Setbacks for tree protection zone

A	B	C	D	E	F	G	H
Tree No.	**Trunk Diameter** (1.4m above root buttress in mm)	**Trunk Diameter** (above root buttress)	**Tree Vigour** L = Low G= Good A= Abnormal	**Age of Tree** Y = Young M = Mature O = Over-Mature (Senescent)	**Calculated Structural Root Zone (SRZ)** (radius in meters)	**Distance of Tree Protection Zone (TPZ)** (radius in meters)	**Recommended Distance of Tree Protection Fence/Zone** (radius in meters)
1	600	620	G	M	2.8	7.2	6.48

5. Discussion

The tree assessed is fair in condition exhibiting good vigour entering the ground cleanly with minimal soil heaving occurring.

It is proposed to construct a pool which is located outside of the trees *Structural Root Zone* (SRZ) but is within the trees *Tree Protection Zone* (TPZ). To minimise impacts upon the tree the proposed pool is to be elevated and set on piers so as to avoid the need for excessive excavation and potential root severance.

It is considered that tree 1 can be adequately retained with the design in its current format if subject to the following recommendations for its protection.

6. RECOMMENDATIONS

a. That tree 1 be retained and protected in accordance with recommendation "B", prior to commencement of any site works.

b. Protection for tree 1 to avoid accidental damage during the proposed works, is to be achieved by wrapping 2 layers of hessian or carpet underfelt around the trunk and branches for a minimum of 2 metres or as lower branches permit, then wire or rope secures 75x50x2000 mm hardwood battens together around the trunk and branches for the duration of site works **(SEE appendix G detail).**

c. Any excavation works required for the pool and piers within a 7.2 metres radius from tree 1 is to be undertaken by hand to depths of 800mm and any roots encountered 40mm or less are to be cut cleanly with final cuts to undamaged woody tissue. This will prevent tearing damage to the roots from excavation equipment which can extend beyond the point of excavation back towards the tree. Below this mechanical means can be utilised. Any roots 40mm or greater should be retained and alternate pier location selected.

d. Any excavation works required for the new plantings within a 7.2 metres radius from tree 1 is to be undertaken by hand as opposed to use of mechanical means.

e. That crown cleaning be undertaken upon tree 1 to be retained prior to commencement of any site works to remove any dead or diseased wood. All pruning works are to be undertaken in accordance with AS 4373- 2007- Pruning of Amenity Trees.

f. If excessive site movement is required within a 7.2 metre radius from tree 1 temporary ground protection is to be established to prevent root damage and soil compaction and is to include a permeable membrane such as geotextile fabric beneath a layer of mulch or crushed rock below rumble boards where appropriate. These measures may be applied to root zones beyond the TPZ if required **(SEE appendix G detail).**

Peter Richards
Tree & Landscape Consultants

Appendix A
Matrix - Sustainable Retention Index Value (S.R.I.V.)©

Developed by IACA – Institute of Australian Consulting Arboriculturists www.iaca.org.au (2009)

To be used with the values defined in the Glossary.
An Index value as indicated where ten (10) is the highest value.

Age Class	Vigour Class and Condition Class					
	Good Vigour & Good Condition (GVG)	Good Vigour & Fair Condition (GVF)	Good Vigour & Poor Condition (GVP)	Low Vigour & Good Condition (LVG)	Low Vigour & Fair Condition (LVF)	Low Vigour & Poor Condition (LVP)
	Able to be retained if sufficient space available above and below ground for future growth. No remedial work or improvement to growing environment required. May be subject to high vigour. Retention potential - Medium – Long Term.	Able to be retained if sufficient space available above and below ground for future growth. Remedial work may be required or improvement to growing environment may assist. Retention potential - Medium Term. Potential for longer with remediation or favourable environmental conditions.	Able to be retained if sufficient space available above and below ground for future growth. Remedial work unlikely to assist condition, improvement to growing environment may assist. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.	May be able to be retained if sufficient space available above and below ground for future growth. No remedial work required, but improvement to growing environment may assist vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.	May be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment may assist condition and vigour. Retention potential - Short Term. Potential for longer with remediation or favourable environmental conditions.	Unlikely to be able to be retained if sufficient space available above and below ground for future growth. Remedial work or improvement to growing environment unlikely to assist condition or vigour. Retention potential - Likely to be removed immediately or retained for Short Term. Potential for longer with remediation or favourable environmental conditions.
Young (Y)	**Index Value 9** Retention potential - Long Term. Likely to provide minimal contribution to local amenity if height <5m. High potential for future growth and adaptability. Retain, move or replace.	**Index Value 8** Retention potential - Short – Medium Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Medium-high potential for future growth and adaptability. Retain, move or replace.	**Index Value 5** Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Low-medium potential for future growth and adaptability. Retain, move or replace.	**Index Value 4** Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Medium potential for future growth and adaptability. Retain, move or replace.	**Index Value 3** Retention potential - Short Term. Potential for longer with improved growing conditions. Likely to provide minimal contribution to local amenity if height <5m. Low-medium potential for future growth and adaptability. Retain, move or replace.	**Index Value 1** Retention potential - Likely to be removed immediately or retained for Short Term. Likely to provide minimal contribution to local amenity if height <5m. Low potential for future growth and adaptability.
Mature (M)	**Index Value 10** Retention potential - Medium - Long Term.	**Index Value 9** Retention potential - Medium Term. Potential for longer with improved growing conditions.	**Index Value 6** Retention potential - Short Term. Potential for longer with improved growing conditions.	**Index Value 5** Retention potential - Short Term. Potential for longer with improved growing conditions.	**Index Value 4** Retention potential - Short Term. Potential for longer with improved growing conditions.	**Index Value 2** Retention potential - Likely to be removed immediately or retained for Short Term.

Appendix B

Definitions & Terminology

From

Dictionary for Managing Trees in Urban Environments

Institute of Australian Consulting Arboriculturists (IACA) 2009.

Condition of trees

Condition A tree's *crown form* and growth habit, as modified by its *environment* (aspect, suppression by other trees, soils), the *stability* and *viability* of the *root plate*, trunk and structural branches (first (1st) and possibly second (2nd) order branches), including structural defects such as wounds, cavities or hollows, *crooked* trunk or weak trunk/branch junctions and the effects of predation by pests and diseases. These may not be directly connected with *vigour* and it is possible for a tree to be of *normal vigour* but in *poor condition*. Condition can be categorized as *Good Condition*, *Fair Condition*, *Poor Condition* and *Dead*.

Good Condition Tree is of good habit, with *crown form* not severely restricted for space and light, physically free from the adverse effects of *predation* by pests and diseases, obvious instability or structural weaknesses, fungal, bacterial or insect infestation and is expected to continue to live in much the same condition as at the time of inspection provided conditions around it for its basic survival do not alter greatly. This may be independent from, or contributed to by vigour.

Fair Condition Tree is of good habit or *misshapen*, a form not severely restricted for space and light, has some physical indication of *decline* due to the early effects of *predation* by pests and diseases, fungal, bacterial, or insect infestation, or has suffered physical injury to itself that may be contributing to instability or structural weaknesses, or is faltering due to the modification of the *environment* essential for its basic survival. Such a tree may recover with remedial works where appropriate, or without intervention may stabilise or improve over time, or in response to the implementation of beneficial changes to its local environment. This may be independent from, or contributed to by vigour.

Poor Condition Tree is of good habit or *misshapen*, a form that may be severely restricted for space and light, exhibits symptoms of advanced and *irreversible decline* such as fungal, or bacterial infestation, major die-back in the branch and *foliage crown*, *structural deterioration* from insect damage e.g. termite infestation, or storm damage or lightning strike, ring barking from borer activity in the trunk, root damage or instability of the tree, or damage from physical wounding impacts or abrasion, or from altered local environmental conditions and has been unable to adapt to such changes and may decline further to death regardless of remedial works or other modifications to the local *environment* that would normally be sufficient to provide for its basic survival if in *good* to *fair* condition. Deterioration physically, often characterised by a gradual and continuous reduction in vigour but may be independent of a change in vigour, but characterised by a proportionate increase in susceptibility to, and *predation* by pests and diseases against which the tree cannot be sustained. Such conditions may also be evident in trees of advanced senescence due to normal phenological processes, without modifications to the growing environment or physical damage having been inflicted upon the tree. This may be independent from, or contributed to by vigour.

Dead Tree is no longer capable of performing any of the following processes or is exhibiting any of the following symptoms;

Processes

Photosynthesis via its foliage crown (as indicated by the presence of moist, green or other coloured leaves);

Osmosis (the ability of the root system to take up water);

Turgidity (the ability of the plant to sustain moisture pressure in its cells);

Epicormic shoots or *epicormic strands* in Eucalypts (the production of new shoots as a response to stress, generated from latent or adventitious buds or from a *lignotuber*);

Symptoms

Permanent leaf loss;

Permanent wilting (the loss of turgidity which is marked by desiccation of stems leaves and roots);

Abscission of the *epidermis* (bark desiccates and peels off to the beginning of the sapwood).

Removed No longer present, or tree not able to be located or having been cut down and retained on a site, or having been taken away from a site prior to site inspection.

Description of Tree Dimensions

Height The distance measured vertically between the horizontal plane at the lowest point at the base of a tree, which is immediately above ground, and the horizontal plane immediately above the uppermost point of a tree.

Spread The furthest expanse of the crown when measured horizontally from one side of the tree to the other, generally through the centre of the trunk. Where the crown is not circular a measurement should be an average of the narrowest and widest diameters and this is dependent upon crown form and to a lesser extent its symmetry.

Crown Cover Percent of the homogenous distribution of foliage across the entire crown based upon that expected for a specimen of that species in good condition and of normal vigour, depending on form in situ, e.g. this may be influenced by crown die-back, proximity to other trees or structures, moisture stress, or overshadowing.

Vigour

Vigour Ability of a tree to sustain its life processes. This is independent of the *condition* of a tree but may impact upon it. Vigour can appear to alter rapidly with change of seasons (seasonality) e.g. *dormant*, deciduous or semi-deciduous trees. Vigour can be categorized as *Normal Vigour, High Vigour, Low Vigour* and *Dormant Tree Vigour*.

Normal Vigour Ability of a tree to maintain and sustain its life processes. This may be evident by the typical growth of leaves, crown cover and crown density, branches, roots and trunk and resistance to predation. This is independent of the condition of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.

High Vigour *Accelerated growth* of a tree due to incidental or deliberate artificial changes to its growing *environment* that are seemingly beneficial, but may result in *premature aging* or failure if the favourable conditions cease, or promote *prolonged senescence* if the favourable conditions remain, e.g. water from a leaking pipe; water and nutrients from a leaking or disrupted sewer pipe; nutrients from animal waste, a tree growing next to a chicken coop, or a stock feed lot, or a regularly used stockyard; a tree subject to a stringent watering and fertilising program; or some trees may achieve an extended lifespan from continuous *pollarding* practices over the life of the tree.

Low Vigour Reduced ability of a tree to sustain its life processes. This may be evident by the atypical growth of leaves, reduced crown cover and reduced crown density, branches, roots and trunk, and a deterioration of their functions with reduced resistance to predation. This is independent of the condition of a tree but may impact upon it, and especially the ability of a tree to sustain itself against predation.

Dormant Tree Vigour Determined by existing turgidity in lowest order branches in the outer extremity of the crown, with good bud set and formation, and where the last extension growth is distinct from those most recently preceding it, evident by bud scale scars. Normal vigour during dormancy is achieved when such growth is evident on a majority of branches throughout the crown.
Poor Vigour See low vigour
Good Vigour See Normal Vigour

Age of Trees

Age of Trees Most trees have a stable biomass for the major proportion of their life. The estimation of the age of a tree is based on the knowledge of the expected lifespan of the taxa in situ divided into three distinct stages of measurable biomass, when the exact age of the tree from its date of cultivation or planting is unknown. These increments are Young, Mature and Overmature.
Young Tree aged less than 20% of life expectancy.
Mature Tree aged 20-80% of life expectancy.
Over-mature Tree aged greater than 80% of life expectancy tending to senescent with or without reduced vigour, and declining gradually or rapidly but irreversibly to death.
Sapling A young tree, early in its development with small dimensions.
Senescent Advanced old age, over-mature.

General Terms

Significant Important, weighty or more than ordinary.
Significant Tree A tree considered important, weighty or more than ordinary. Example: due to prominence of location, or in situ, or contribution as a component of the overall landscape for *amenity* or aesthetic qualities, or *curtilage* to structures, or importance due to uniqueness of taxa for species, subspecies, variety, form, or as an historical or cultural planting, or for age, or substantial dimensions, or habit, or as remnant vegetation, or habitat potential, or a rare or threatened species, or uncommon in cultivation, or of aboriginal cultural importance, or is a commemorative planting.
Substantial A tree with large dimensions or proportions in relation to its place in the landscape.
Excurrent Tree where the crown is comprised of one (1) dominant first order structural branch which is usually an extension of the trunk, erect, straight and continuous, tapering gradually, with the main *axis* clear from base to apex, e.g. *Araucaria heterophylla* - Norfolk Island Pine. Note: some tree species of *typical* excurrent habit may be altered to deliquescent by physical damage of the *apical meristem*, or from top lopping, or from the propagation of inferior quality stock. However, *formative pruning* may be able to correct a *crown* to excurrent if undertaken when a tree is *young*.
Sustainable Retention Index Value (SRIV) A visual method of rating the viability of urban trees for development sites and management, based on general tree and landscape assessment criteria. SRIV© is for the professional manager of urban trees to consider the tree in situ with an assumed knowledge of the taxa and its growing environment and is based on the physical attributes of the tree and its response to its environment considering its age class, vigour class, condition class and its sustainable retention with regard to the safety of people or damage to property and the ability to retain the tree with remedial work or beneficial modifications to its growing environment or removal and replacement. (IACA 2005)
Crown Spread Orientation Direction of the *axis* of *crown spread* which can be categorized as *Orientation Radial* and *Orientation Non-radial*.
Diameter at Breast Height (DBH) Measurement of trunk width calculated at a given distance above ground from the base of the tree often measured at 1.4 m. The trunk of a tree is usually not a circle when viewed in cross section, due to the presence of *reaction wood* or *adaptive wood*, therefore an average diameter is determined with a *diameter tape* or by recording the trunk along its narrowest and widest axes, adding the two dimensions together and dividing them by 2 to record an average and allowing the orientation of the longest axis of the trunk to also be recorded. Where a tree is growing on a lean the distance along the top of the trunk is measured to 1.4m and the diameter then recorded from that point perpendicular to the edge of the trunk. Where a *leaning* trunk is *crooked* a vertical distance of 1.4m is measured from the ground. Where a tree branches from a trunk that is less than 1.4m above ground, the trunk diameter is recorded perpendicular to the length of the *trunk* from the point immediately below the base of the flange of the *branch collar* extending the furthest down the trunk, and the distance of this point above ground recorded as *trunk* length. Where a tree is located on sloping ground the DBH should be measured at half way along the side of the tree to average out the angle of slope. Where a tree is *acaulescent* or *trunkless* branching at or near ground an average diameter is determined by recording the radial extent of the trunk at or near ground and noting where the measurement was recorded e.g. at ground.
Structural Root Zone (SRZ) The minimal area around the base of a tree, generally circular, required for its *stability* in the ground. The section of *root plate* within this area and subsequent soil cohesion necessary to hold the tree upright against *wind throw*, therefore the entire depth of the *root zone* must be included.

Appendix C
Extract from Australian Standard AS 4970-2009
"Protection of trees on development sites
"Calculating the Structural Root Zone"

STANDARDS AUSTRALIA

Amendment No. 1
to
AS 4970—2009
Protection of trees on development sites

CORRECTION

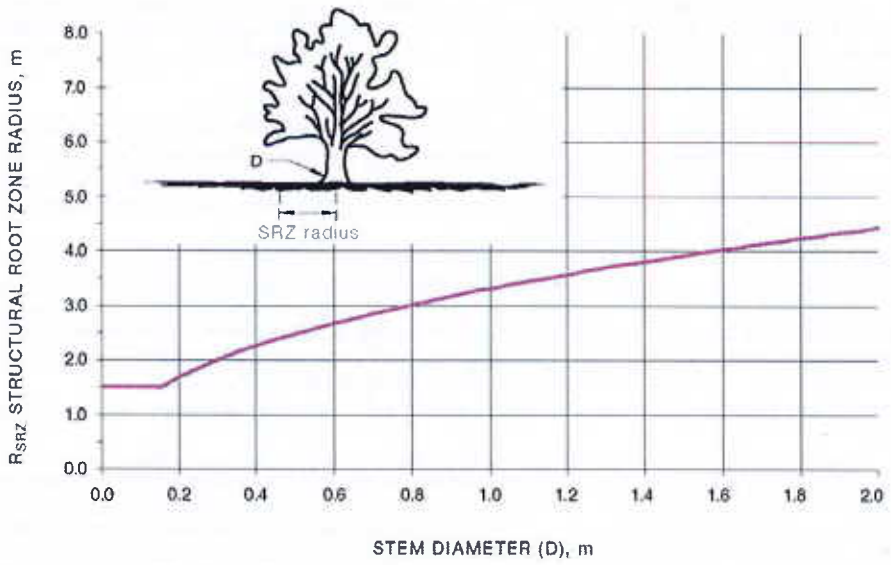
The 2009 edition of AS 4970 is amended as follows; the amendment should be inserted in the appropriate place.

SUMMARY: This Amendment applies to Figure 1.

Published on 26 March 2010.

Page 13, Figure 1

Delete Figure 1and *insert* the following figure:



The curve can be expressed by the following formula:
$R_{SRZ} = (D \times 50)^{0.42} \times 0.64$

NOTES:

1 R_{SRZ} is the calculated structural root zone radius (SRZ radius)
2 D is the stem diameter measured immediately above root buttress.
3 The R_{SRZ} for trees less than 0.15 m diameter is 1.5 m.
4 The R_{SRZ} formula and graph do not apply to palms, other monocots, cycads and tree ferns.
5 This does not apply to trees with an asymmetrical root plate.

FIGURE 1 STRUCTURAL ROOT ZONE CALCULATION

Appendix D
TREE PROTECTION GUIDELINES

1.1 GENERAL NOTES

1.1.1 The application of measures for the protection of trees on development sites is determined by the species characteristics, and the existing physical constraints of the growing environment on site both above and below ground.

1.1.2 This report considers where applicable, Australian Standard AS 4970-2009 "Protection of trees on development sites." as a guide for the management of trees on development sites.

1.1.3 This report applies the ***Tree Protection Zone - Standard Procedure*** as developed and continually improved by the Consultant Arboriculturist for the effective protection of trees on development sites over time. (See Appendix E) Additional or alternative conditions are applied where it is deemed appropriate by the author for the protection of trees. Such additional or alternative conditions may be founded upon professional judgement based on:

- the experience of the Consulting Arboriculturist
- scientific research
- new technology
- industry best practice
- consideration of the individual tree species and its relative tolerance to development impacts
- the individual or cumulative factors present or proposed to impact upon the growing environment essential for the trees' survival

1.2 PRECAUTIONS TO PROTECT TREES

1.2.1 *Demolition of landscape structures*

The demolition of walls, driveways, paths etc. near trees to be retained should be undertaken manually using hand tools. Use of light machinery can occur by utilising the driveway or a paved area as a stable platform to prevent soil compaction. The volume of space previously occupied by the driveway or paved area must be replaced with local top soil from the site or otherwise a loamy sand, to replace the mass on the root plate which may be critical to the ballast and centre of mass for the stability of the tree. If the tree becomes unstable immediately contact the Consultant Arboriculturist.

1.2.2 *Demolition of existing buildings*

The demolition of the buildings should be undertaken with access restricted to the driveway and the building platform for each of the existing buildings, or to areas of the land where no trees are growing within 6m of any tree to be retained. Where access or space for a safe working environment is restricted, or where the area of the 6m set back must be compromised, a 100mm layer of Eucalyptus wood mulch must be laid over the area of encroachment. Where vehicular access is required across the mulch layer further root protection should be provided by laying a temporary pathway over the mulch. The temporary pathway should be constructed of a grated steel material capable of supporting the vehicles used during demolition e.g. similar to ramps used to load vehicles onto the backs of trucks. Trunks of trees are to be protected from vehicular damage as per appendix E section 4 of this report.

1.2.3 *Removal of trees near to trees to be retained*

Removal of a tree within 6m of a tree to be retained should be undertaken only by cutting down such a tree without damaging the trees to be retained, and by grinding out its stump. Where possible the structural roots of 20mm diameter or greater of the tree to be cut down should not be removed, to minimise soil disturbance and to reduce the impact on the roots

of any tree to be retained nearby. Where structural roots are to be removed this should be undertaken manually by the use of non-motorized hand tools after the stump has been ground out when such roots are often easier to locate from the site of the stump from which they have been severed.

1.2.4 *Structural Soil to accommodate compacted subgrade and root growth*

To further protect woody roots with a diameter of 40mm or greater outside the area of the tree protection zone (see table 2), structural soil as a fill material or a subgrade should be used where appropriate and as detailed in the report recommendations. Structural soil addresses the issue of how to increase soil rooting volume whilst maintaining structural support for pavement. Structural soil maximises rock to rock contact utilising durable rock. Pore spaces are on average 8mm in size of which approximately 60% is taken up by the filler soil - the horticultural component, depending on the product utilised. The product is used for new tree planting in pavements, courtyards, carparks and kerbsides,planter boxes and raising levels around existing trees providing increased available soil volume to trees in pavements, structural properties for pavement support, increased root depth and high permeability for both air and water.

1.2.5 *Root location and protection where structures are to be positioned near a retained tree*

A: If walls, driveways or other structures are to be constructed near a protected tree or within a tree protection zone (see table 2 column G), careful excavation is to be undertaken manually by using hand tools or light machinery to determine the location of structural woody roots with a diameter of 40mm or greater, without damaging them. These roots are to be protected from physical damage by utilising pier & beam type footings to reduce excessive disturbance of existing soil profile supporting tree roots. Placement of piers are to be positioned so as to clear any structural root by at least 100mm to allow for future radial expansion of the tree root within the soil profile. Any roots 40mm or less may be clean cut with final cuts to undamaged woody tissue.

B: Where structural woody roots outside of the Tree Protection Zone or as otherwise indicated are to be pruned they are to be excavated manually first by using hand tools to adequately expose the root. Once located those roots to be severed are to be cut cleanly with a final cut to undamaged woody tissue. This will prevent tearing damage to the roots from excavation equipment which can extend beyond the point of excavation back towards the tree. Severed roots are to be treated with a root growth hormone stimulant.

1.2.6 *Location of Services*

If a utility service is to be located within the area of the dripline of a protected tree or within the Tree Protection Zone, the Australian Standard AS 4970-2009 "Protection of trees on development sites provides the following:

"4.5.5. If underground services must be routed within the TPZ , they should be installed by directional drilling or in manually excavated trenches. The direction drilling bore should be at least 600mm deep. The project arborist should assess the likely impacts of boring and bore pits on retained trees. For manual excavation of trenches the project arborist should advise on roots to be retained and should monitor the works. Manual excavation may include the use of pneumatic and hydraulic tools.

1.2.7 *Precautions in respect of temporary work*

For Precautions in respect of temporary work, Australian Standard AS 4970-2009 "Protection of trees on development sites." provides the following:
4.5.6 Scaffolding
Where scaffolding is required it should be erected outside the TPZ. Where it is essential for scaffolding to be erected within the TPZ, branch removal should be minimized. This can be achieved by designing scaffolding to avoid branches or tying back branches. Where

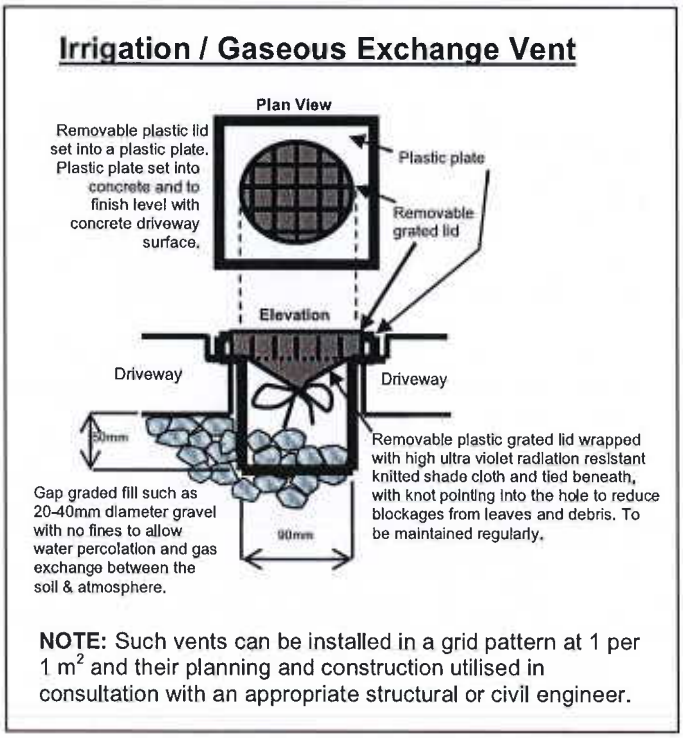
pruning is unavoidable it must be specified by the project arborist in accordance with AS 4373.NOTE: Pruning works may require approval by determining authority. Ground below the scaffolding should be protected by boarding (e.g. scaffold board or plywood sheeting) as shown in Figure 5. Where access is required, a board walk or other surface material should be installed to minimize soil compaction. Boarding should be placed over a layer of mulch and impervious sheeting to prevent soil contamination. The boarding should be left in place until the scaffolding is removed. NOTE: Excavation required for the insertion of support posts for tree protection fencing should not involve the severance of any roots greater than 20 mm in diameter, without the prior approval of the project arborist.

"4.5.3 Ground protection

If temporary access for machinery is required within the TPZ ground protection measures will be required. The purpose of ground protection is to prevent root damage and soil compaction within the TPZ. Measures may include a permeable membrane such as geotextile fabric beneath a layer of mulch or crushed rock below rumble boards. These measures may be applied to root zones beyond the TPZ."

1.2.9 *Water / Gaseous Exchange Vents*

Watering / Gaseous exchange vents are to be installed in the area of the driveway that passes within the dripline of the tree or the prescribed Tree Protection Zone area and the number and location are to be determined by a Consultant Arboriculturist and the driveway design approved by a Certified Engineer. Exposed edges of the path are to be concealed with the finished level beside the path equivalent to the top of the path by minimal filling with a sandy soil and turf, or mulch, or a garden bed with minimal cultivation, or other landscape treatments as appropriate.



1.2.10 *Pruning/Removal Guidelines*

- Any pruning recommended in this report is to be to the Australian Standard® AS4373 'Pruning of amenity trees', and conducted in accordance with the NSW Work Cover Authority Code of Practice for the Amenity Tree Industry, 1998

- All pruning or removal works are to be in accordance with the appropriate Tree Management Policy where applicable, or Tree Management Order (TMO), or Tree Preservation Order (TPO), or applicable consent conditions.
- Tree maintenance work is specialised and in order to be undertaken safely and to ensure the works carried out are not detrimental to the survival of the tree or surrounding vegetation, all works should be undertaken by a qualified Arboriculturist with appropriate competencies recognised within the Australian Qualification Framework, with a minimum of 5 years of continual experience within the industry of operational amenity arboriculture, and covered by appropriate and current types of insurance to undertake such works.
- Any pruning near electricity wires should be undertaken in accordance with relative Electrical Safety Rules and be performed by persons individually authorised by Energy Australia

Appendix E

TREE PROTECTION ZONE STANDARD PROCEDURE

1. Each tree to be retained is to have its dripline fenced off, except where otherwise indicated, to create a Tree Protection Zone, and this may include one enclosure to protect a single or multiple tree/s, or multiple enclosures separated over the site. The area contained is the Tree Protection Zone, and is to exclude any activity, except where otherwise stated. The Tree Protection Zone is to exclude: modification of existing soil levels, storage of materials, site sheds and machinery; preparation of building materials e.g. concrete, or chemical treatments; the movement of pedestrian or vehicular traffic; or the temporary or permanent location of services, or the works required for their installation, e.g. trenches, holes or canals. The above list is not meant to be exhaustive, and is intended as a guide to the types of activities that are excluded from within the Tree Protection Zone, except where otherwise stated.

2. The Protective fencing where required may delineate the ***TPZ*** and should be located as determined by the project arborist in accordance with AS4970 *Protection of trees on development sites*, Section 4, 4.3. *"Fencing should be erected before any machinery or materials are brought onto the site and before the commencement of works including demolition. Once erected, protective fencing must not be removed or altered without approval by the project arborist. The TPZ must be secured to restrict access. AS4687 Temporary fencing and hoardings specifies applicable fencing requirements. Shade cloth or similar should be attached to reduce the transport of dust, other particulate matter and liquids into the protected area. Fence posts and supports should have a diameter greater than 20 mm and be located clear of roots. Existing perimeter fencing and other structures may be suitable as part of the protective fencing."*

3. Tree Protection signage is to be attached to each ***Tree Protection Zone*** and displayed from within the development site in accordance with AS4970 2009 *Protection of trees on development sites*, Section 4.4 and lettering to comply with AS1319.

4 Where a tree is to be retained and a ***Tree Protection Zone*** cannot be adequately established due to restricted access e.g. tree located along side an access way, the trunk and branches in the lower crown will be protected by wrapping 2 layers of hessian or carpet underfelt around the trunk and branches for a minimum of 2 m or as lower branches permit, then wire or rope secures 75x50x2000 mm hardwood battens together around the trunk (do not nail or screw to the trunk or branches). The number of battens to be used is as required to encircle the trunk and the planks are to extend to the base of the tree (AS4970 2009 *Protection of trees on development sites*, Figure 4 .

5. If a tree is growing down slope from an excavation, a silt fence located along the contours of the site in the area immediately above the ***Tree Protection Zone*** fencing may need to be installed and regularly maintained to prevent burial and asphyxiation of the roots of the tree. To allow for the maintenance of both fences, the silt fence must be constructed separately to the tree protection fence and the 2 fences must be constructed independently of each other and standalone. To reduce competition with the tree the area within the ***Tree Protection Zone*** is to be kept free of weeds. These are best removed by the application of foliar herbicide with Glyphosate as the active constituent. This is the preferred method rather than removal by cultivation of the soil within the dripline, to minimise root disturbance to the tree. The removal of woody weeds such as Privet should use the cut and paint method of herbicide application. Weeds to be controlled within the ***Tree Protection Zone***, for the duration of the project.

6. The area of the ***Tree Protection Zone*** to be mulched to a depth of 100 millimetres

with organic material being 75% leaf litter and 25% wood, and this being composted material preferably from the same genus and species of tree as that to where the mulch is to be applied, i.e. species specific mulch. The depth of mulch and type as indicated, to be maintained for the duration of the project.

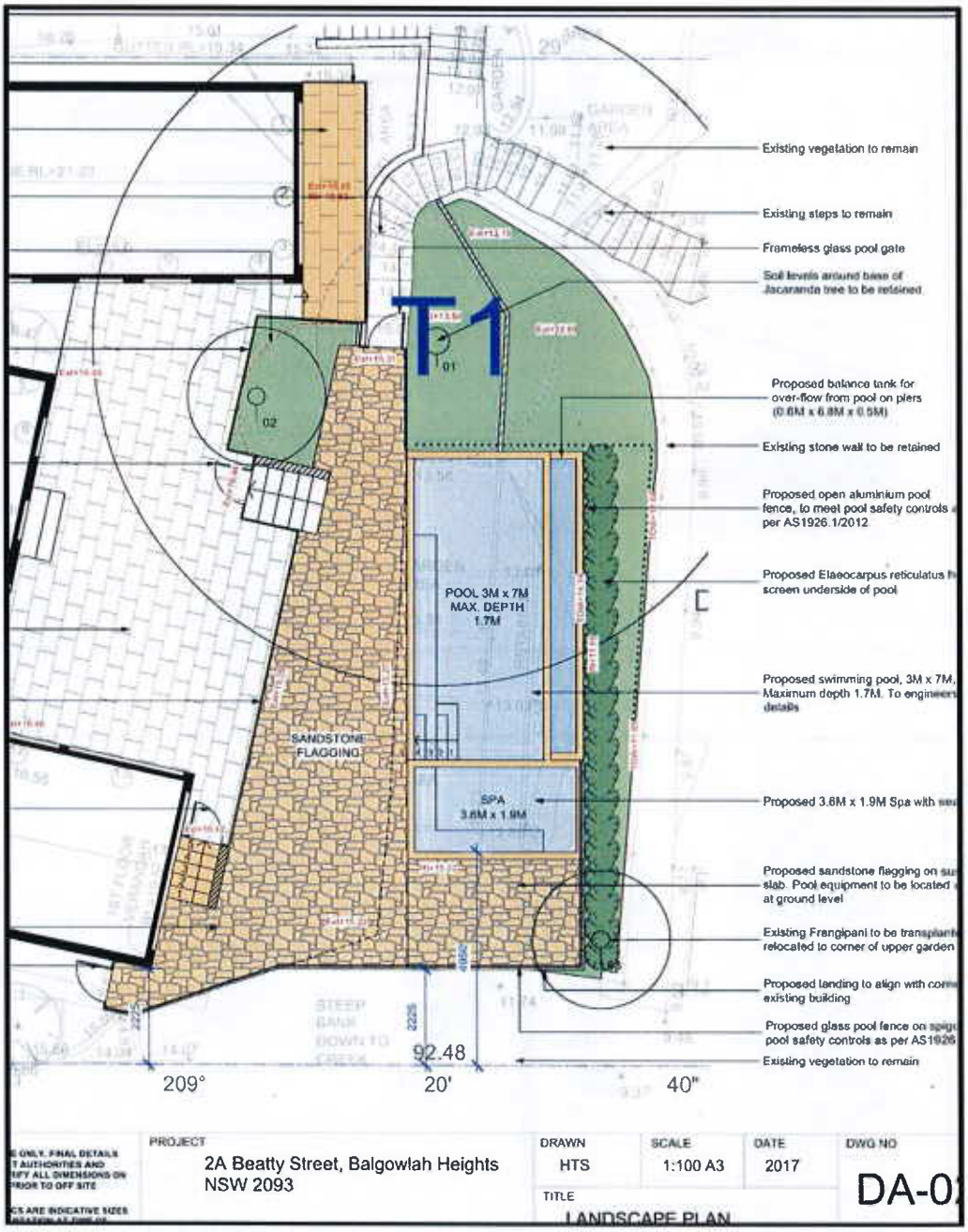
7. No services either temporary or permanent are to be located within the ***Tree Protection Zone***. If services are to be located within the ***Tree Protection Zone***, special details will need to be provided by a qualified Consulting Arboriculturist for the protection of the tree regarding the location of the service/s.

8. A tree will not be fertilised during its protection within the ***Tree Protection Zone***, as this may hasten its decline if it were to decline. If a tree is to be fertilised this should be in consultation with a qualified Consulting Arboriculturist.

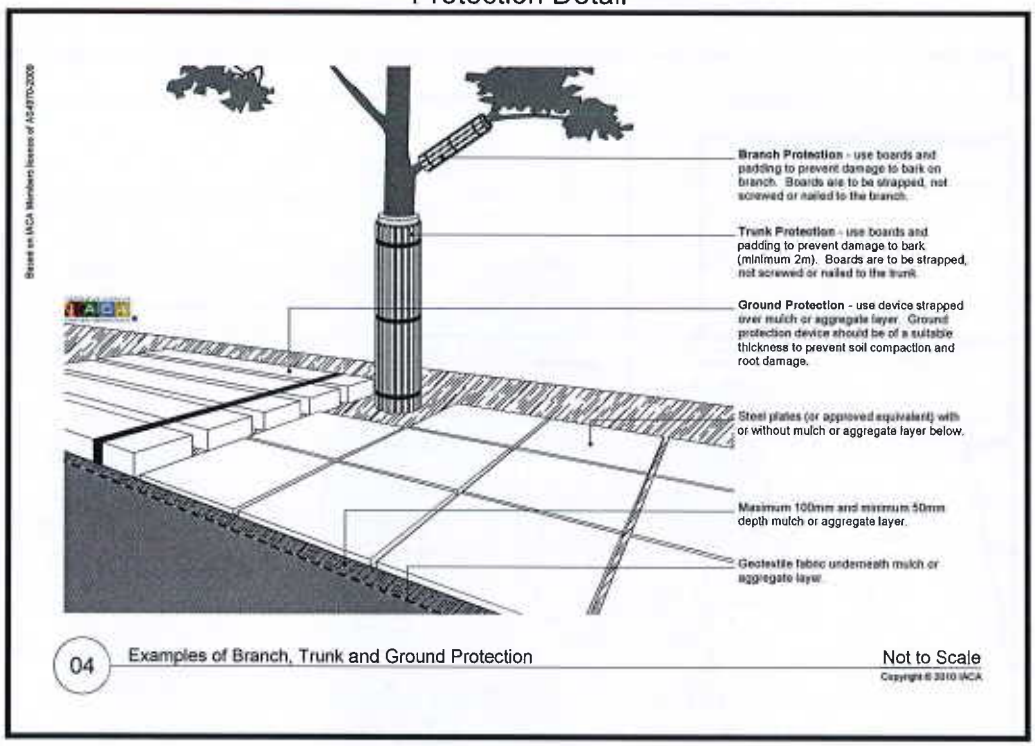
9. In the event of prolonged dry periods, or where a tree has been transplanted, or where excavation nearby, especially up slope, leads to drying out of soil profiles closest to the tree/s, the tree/s is to be deep root watered thoroughly at least twice a week. The need for such watering is determined readily by observing the dryness of the soil surface within the dripline of the tree by scraping back some mulch. Mulch to be reinstated afterwards. In the event of disrupted ground or surface water flows to the tree due to excavation, filling or construction, an irrigation system may be required to be installed within the ***Tree Protection Zone***. If an irrigation system is to be installed, consideration must be given to volume, frequency, and drainage of water delivered, and this should be in consultation with a qualified Consulting Arboriculturist.

Appendix F

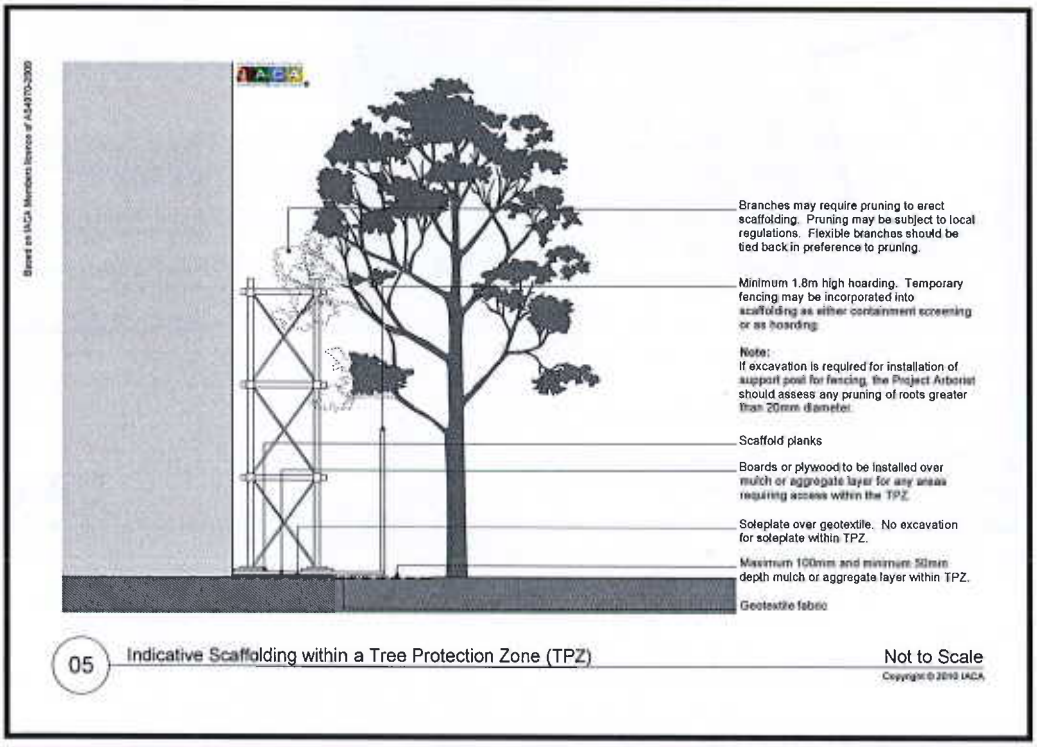
Landscape Plan Section/Tree Location



Appendix G
Protection Detail



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



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

Appendix H
References

REFERENCES

1. IACA (2009), Sustainable Retention Index Value, Institute of Australian Consulting Arboriculturists, www.iaca.org.au .

2. Australian Standard® AS 4373 – 2007 Pruning of amenity Trees.

3. Draper BD and Richards PA 2009, *Dictionary for Managing Trees in Urban Environments*, Institute of Australian Consulting Arboriculturists (IACA), CSIRO Publishing, Collingwood, Victoria, Australia.

4. Work Cover NSW 2007, *Code of Practice Tree Work*, New South Wales Government, Australia.

Proposed Residential Building Development
Bushfire Assessment & Compliance Report
Lot 22 DP 1124834
2A Beatty Street
Balgowlah Heights NSW 2093

26 April 2017

Author:	Scott Jarvis BPAD-Level 3 Certified Practitioner BPD-PA-18593 FPAA Member No. 18593	BPAD Bushfire Planning & Design Accredited Practitioner Level 3
Reviewed by:		

Executive Summary – Achievable (Recommended) AS3959 Level of Compliance

Construction Standard	Building Elevation / Section
Flame Zone	All Elevations ('Alterations & Additions' only)
BAL 40	
BAL 29	
BAL 19	
BAL 12.5	
Standard BCA Provisions	

Table of Contents

General Introduction

The following report outlines an assessment for the statutory compliance of the proposed residential building development to occur within 2A Beatty Street, Balgowlah Heights NSW 2093 – Lot 22 DP 1124834 (herewith 'the subject property'), and at least 140m beyond (herewith 'the study area'). Appendix 1 / Map 1 denote the subject property and study area.

Australian Standard 3959:2009 (Construction of buildings in bushfire prone areas) and the *Building Code of Australia, 2016* (BCA) are the primary building compliance documents considered for this assessment. AS3959:2009 being the Deemed to Satisfy (DTS) provision or acceptable construction standard.

Methodology for this site assessment for bushfire attack is based on *NSW Planning for Bushfire Protection Guidelines, 2006* (PBP) and specifically, *Addendum: Appendix 3, 2010.*

Terrain (slope) considered by this assessment is based on the Department of Lands Online Six Viewer contours and a site inspection (27/3/2017) of the subject property.

Vegetation extent within the subject area has been derived from available online Council vegetation mapping, aerial photo interpretation (API) and a site inspection 27/3/2017) conducted prior to finalising this report.

The extent and location of the proposed 'alterations and additions' to the existing residential building, are based on DA drawings by Secret Gardens, Botany (Drawing Nos. DA01 – DA06, Revision A, Dated 2017).

Photographic evidence (dated 27/3/2017) of the subject property and surrounds is appended to this report (Appendix 2 – Site Photos).

1.0 Property Details

Applicants Name: Murray & Maureen Coleman (herewith, 'the proponent')

Council: Northern Beaches Council (Manly LGA)

Council Reference: N/A

Lot: 22 **DP:** 1124834 **Area:** 1290m^2 (approximately)

Address/Location: 2A Beatty Street, Balgowlah Heights NSW 2093.

Zoning: E3 – Environmental Management (Manly LEP 2013)

Bushfire Prone Land: YES

Aspect: The site currently has a North Easterly aspect.

The subject property is mapped as being bushfire prone as currently shown by the Manly Council LGA Bushfire Prone Land Map (s146 EP&A Act). The site is located within the '100m Vegetation Buffer Zone' and is constrained by 'Category 1 & 2 Bushfire Vegetation'. In this regard, any new building development should conform to the specifications and requirements of the document *'Planning for Bushfire Protection'*, produced by the NSW Rural Fire Service, that are relevant to the development; as otherwise required under section *79BA of the Environmental Planning & Assessment Act (NSW).*

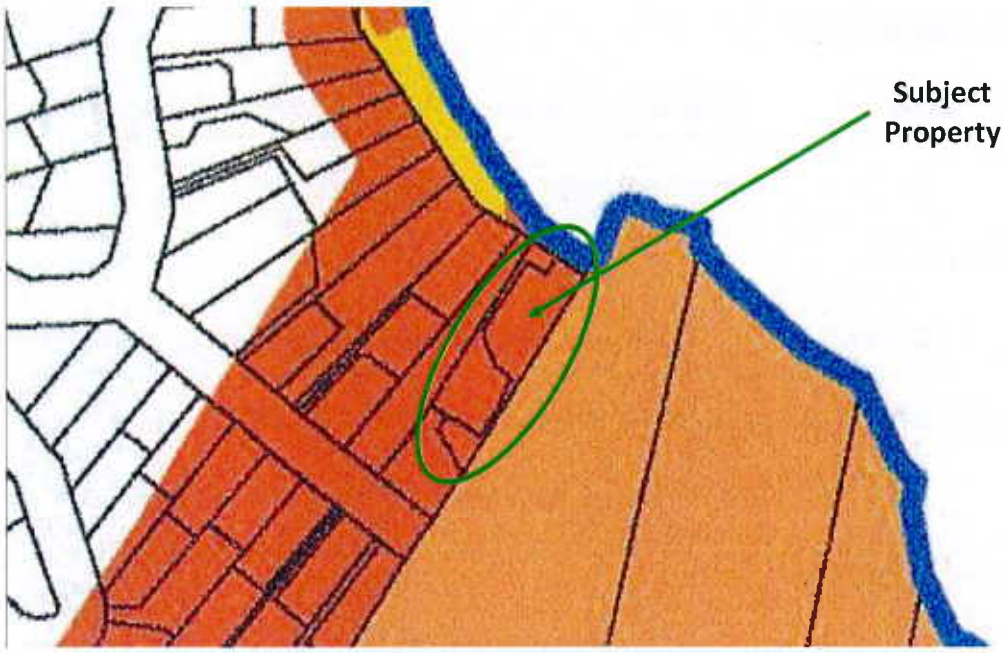
Other Known Constraints:

The subject site, and all surrounding areas, are also mapped as being within the Manly LGA 'Biodiversity Map' and 'Scenic Protection Map'.

However, it is **not** a recommendation of this assessment to remove or alter any significant vegetation within this area, as part of the bushfire protection measures.

A desktop assessment of the publicly available council mapping and planning enquiry system has found no other constraints to be considered in regard to development upon the subject property.

No other known significant environmental features have been noted, recorded or advised of as part of this assessment.



Extract Manly LGA Bushfire Prone Land Map

2.0 Type of Proposal

☐ New Building	☑ **Urban**	☐ Dual Occupancy
☐ Rural Residential	☑ **Alterations/Additions**	☐ Isolated Rural

Proposal Description

The proposed building development is to construct minor 'alterations and additions' to an existing residential building/dwelling structure (Class 1 (a) – as defined by BCA). This includes the installation of an in-ground pool, various landscaping works. No works are proposed to the existing residence.

The extent and location of the proposed 'alterations and additions' to the existing residential building, are based on DA drawings by Secret Gardens, Botany (Drawing Nos. DA01 – DA06, Revision A, Dated 2017).

The approximate location/site of the proposed building (herewith 'the subject development') is as denoted in Appendix 1 – Map 2.

3.0 Bushfire Attack

3.1 Vegetation (bushfire hazard) within 100m of the proposed building

The vegetation within the study area is mapped as 'Bushfire Prone Vegetation Category 1 & Category 2' on Council Bushfire Prone Land Maps.

The primary vegetation constraining the development is located within the Sydney Harbour National Park, directly adjacent to the Eastern boundary of the subject site. All vegetation within this area is considered to be 'Coastal Sandstone Gully Forest'.

Based on a determination of vegetation formation using the Keith 2004 Identification Key, the primary vegetation (East) having the potential to affect the subject development, based on a site visit, is most representative of 'Dry Sclerophyll Forest (Open Forest)'.

In terms of Addendum: Appendix 3 (PBP 2010) Section A.3.5 requires a conversion of vegetation types used in this assessment from Keith 2004 to Specht (AUSLIG 1990). Table A.3.5.1 converts 'Dry Sclerophyll Forest (Open Forest)' to 'Forest'.

The secondary vegetation constraining the development is located within the small public reserve, adjacent to Jilling Cove and Forty Baskets Beach, North West of the of the subject site. The vegetation within this area is considered to be a small remnant of 'Coastal Sandstone Gully Forest', and will be assessed as equivalent to 'Rainforest', as per PBP 2006 Section A.2.3.

PBP 2006 states, *'for the purposes of assessment, the following are not considered a hazard or as a predominant vegetation class/formation and can be included within an asset protection zone;*

- *non-vegetated areas including roads, footpaths, cycle ways, waterways, buildings, rocky outcrops and the like; and*
- *Reduced vegetation including maintained lawns, golf course fairways, playgrounds or sports fields, vineyards, orchards, cultivated ornamental gardens and commercial nurseries.*

The proposed development is located within a well established residential subdivision. Adjoining residential allotments to the South & West, generally contain cleared & managed land.

The approximate / estimated extent of these managed lands is clearly denoted in Appendix 1 – Map 2.

3.2 Distance/Separation between building line and bushfire hazard

Considering the location of the proposed development and the extent of the mapped bushfire vegetation within the subject allotment, and on adjoining lands, the achievable separation distance has been assessed as:

Direction	Distance
East	2m to Pool Landing Element

3.3 Effective slope that will influence bushfire behaviour

The effective slope within approximately 100m of the subject development site, which would influence bushfire behaviour, has been assessed as predominately;

Direction	Effective Slope
East	>5 – 10 Degrees Downslope
North West	>0 – 5 Degrees Downslope

3.4 Fire Danger Index (FDI) for Local Government Area (LGA)

☑ 100 ☐ 80 ☐ 50

Manly Council – Greater Sydney Region (Table A2.3 PBP, 2006)

3.5 Determination of Bushfire Attack Level (AS 3959:2009)

Direction	Vegetation	Slope	Minimum Distance	BAL Exposure Level
East	Forest	>5 – 10 Degrees Downslope	2m	BAL - FZ
North West	Remnant Forest	>0 – 5 Degrees Downslope	>30m	BAL – 12.5

4.0 Construction Standards (AS 3959-2009 – BCA DTS)

4.1 AS 3959:2009 Construction for Bushfire Attack Level

Building Elements	Vegetation	Slope	Minimum Distance	Construction Standard
Pool Landing Element	Forest	>5 – 10 Degrees Downslope	2m	BAL - FZ

PBP states: *'Where more than one façade is exposed to a hazard, then the façade with the highest construction requirement is used to determine the appropriate level of construction. All other facades may be reduced by one level of construction unless that façade is also subject to the same bush fire attack level'.*

Considering the subject developments location and the calculated extent of the APZ area recommended by this report, the subject development is **not** capable of complying with AS3959:2009 (in NSW) – in relation to the pool deck element only.

5.0 Water Supplies

5.1 Reticulated Water Supply

☑Yes ☐ No ☐ Proposed

The subject development/building is currently connected to a reticulated water supply which services the residential area within Beatty Street.

Apart from the above, the proponent has not provided any specific advice (at the time of this assessment) regarding the reticulated water infrastructure and mains size, supply pressure or guarantee of delivery.

Considering the building site denoted by this report (and corresponding access / driveways), the subject building would be >90m from the nearest and reasonably available fire hydrant connection point (approximately 120m) as denoted in attached Map 1.

PBP acceptable solutions for a reticulated water supply area (relevant to the subject development) states that:

- *fire hydrant spacing, sizing and pressures comply with AS 2419.1 – 2005. Where this cannot be met, the RFS will require a test report of the water pressures anticipated by the relevant water supply authority, once development has been completed. In such cases, the location, number and sizing of hydrants shall be determined using fire engineering principles.*
- *hydrants are not located within any road carriageway.*
- *all above ground water and gas service pipes external to the building are metal, including and up to any taps.*

Considering any potential risk associated with a failing or inadequate water supply as a result of higher water demand during a significant bushfire event, or the excessive travel distances, this report recommends that the residential building development should incorporate a supplementary static water supply for firefighting purposes.

In this respect, PBP water supply requirements (acceptable solutions) for fire fighting (*Table 4.2 – Dedicated water supply requirements for various non reticulated subdivision developments)* include;

- **10 000 L/lot for large Residential Lots**

Firefighting water supply recommendations are as listed section 9.3 (Bushfire Safety & Compliance Recommendations).

5.2 Distance to hydrant from subject proposed development

The distance from the furthest part of the proposed development to a reticulated hydrant is approximately **>120m**.

5.3 Existing or planned water supply provided for fire fighting purposes

☑ **Yes** ☐ No ☐ Proposed

As stated, the travel distance associated with this development is >120m, and as such, is not able to comply with the 'acceptable solutions' for reticulated water supplies.

However, it is also a recommendation of this assessment that the development will maintain a static water supply that will be readily available for firefighting purposes. The development incorporates the installation of an in-ground concrete pool, which would be readily available for firefighting operations, in need.

6.0 Gas Supplies

Reticulated Gas: ☑ **Yes** ☐ No

Bottled Gas: ☐ Yes ☑ **No**

7.0 Electricity Supplies

The subject development site is currently serviced by an above ground electrical supply grid which services the residential subdivision within Beatty Street.

The connection to the subject site is redirected underground, from a point on the Southern boundary. It is not proposed to alter this arrangement as part of this application.

8.0 Vehicle Access/Egress (Property Access)

Vehicular access to the subject property will continue to be by way of a short sealed all weather driveway, directly off Beatty Street, via an access easement/arrangement through/under the adjacent property (4 Beatty Street).

Physical entry to the subject residence is then a further 30m North of the carpark/garage, via timber stairs and an inclinator. Pedestrian access is also available directly from Beatty Street, along the Eastern boundary, via a path, the steps and/or inclinator, over a distance of approximately 70m.

Beatty Street is part of the public road system. It is a sealed all weather road approximately 9m in width within a road reserve of approximately 20m. It has a speed limit of 50 kph.

Beatty Street terminates at the subject site, and provides for a hardstand/sealed manoeuvring area (20m in length x 12m in width)

PBP acceptable solutions for property roads (for this specific development location) states that;

'No specific access requirements apply in an urban area where a 70m unobstructed path can be demonstrated between the most distant external part of the proposed dwelling and the nearest part of the public access road (where the road speed limit is not greater than 70kph) that supports the operational use of emergency firefighting vehicles (i.e. a hydrant or water supply)'.

The public road system servicing the proposed development is able to provide reasonably safe operational access for emergency services and egress for evacuating residents (i.e. egress to the West only) away from the bushfire hazard.

Direct pedestrian access to the site itself, is less than ideal, being away from the public road system, however, this is an existing site constraint, which is not made any worse than the existing approved arrangements, by this development proposal.

9.0 Bushfire Safety/Compliance Recommendations

9.1 Defendable Space / Asset Protection Zone (APZ) Recommendations

Recommendation 1.

As denoted in Appendix 1 – Map 2, the area within the site identified as **'Modified Inner Protection Area (MIPA)'** is to be managed/maintained as an APZ area for the life of the development.

The above recommendation should ensure that no easily combustible material, structures, available forest fuel/bushfire vegetation or other items be installed, stored or allowed to re-accumulate and become contiguous within the area. The MIPA extent should not support or carry a running bushfire towards the subject development site and associated infrastructure.

Landscaping to the site is to comply with the principles of 'Appendix 5' of 'Planning for Bushfire Protection 2006'. In this regard, the following landscaping principles are to be incorporated into the development:

- Suitable impervious areas being provided immediately surrounding the building such as courtyards, paths and driveways;
- Grassed areas/mown lawns or ground cover plantings being provided in close proximity to the building;

- Restrict planting in the immediate vicinity of the building which may over time and if not properly maintained come into contact with the building;
- Maximum tree cover should be less than 30%, and maximum shrub cover less than 20%;
- Planting should not provide a continuous canopy to the building (i.e. trees or shrubs should be isolated or located in small clusters);
- When considering landscape species consideration needs to be given to estimated size of plant at maturity;
- Avoid species with rough fibrous bark, or which retain/shed bark in long strips or retain dead materials within their canopies;
- Use smooth bark species of tree species which generally do not carry a fire up the bark into the crown;
- Avoid planting of deciduous species that may increase fuel at surface/ground level (i.e. leaf litter);
- Avoid climbing species to walls and pergolas;
- Locate combustible materials such as woodchip/mulch, flammable fuel stores away from the building; and
- Use low flammability vegetation species.

9.2 Construction Standard Recommendations

Construction standards have been determined from the following sections of the planning legislation and based on the relevant bushfire assessment as discussed above.

AS 3959-2009 Section 3 Construction General
(See Recommendation 2)

AS 3959-2009 Section 9 Construction for Bushfire Attack Level Flame Zone (BAL FZ)
(See Recommendation 3)

Planning for Bushfire Protection Addendum – Appendix 3 (2010)
Section A 3.7. 'Additional Construction Requirements' - NSW State Variation
(See Recommendation 4)

Recommendation 2.

Where any part of a garage, carport, veranda or similar roofed structure is attached to, or shares a common roof space with, or is within 10m of, a building required to comply with the standard (AS 3959-2009), the entire structure shall comply with the construction requirements of the standard (as per Recommendation 3), as applicable to the subject building. Alternatively, the structure may be separated from the subject building by a wall complying with Section 3.2.1 a) or b) of the standard (i.e. fire rated construction as specified).

Recommendation 3.

Predicated upon the maintenance of the APZ area as per Recommendation No. 1 of this report, it is recommended the proposed residence incorporate, as a minimum, the following levels of construction as per *AS 3959 – 2009 Construction of Buildings in Bushfire Prone Areas;*

All Landing Elements

Construction for Bushfire Attack Level Flame Zone (BAL FZ) – Section 9 (AS3959-2009)

Retaining Walls & Sundry Landscaping Elements

Non-combustible (as per PBP 2006 – S4.3.6 f)

Recommendation 4.

General

- No brushwood fencing shall be used
- All new fencing shall be 'non-combustible'

9.3 Water Supply Recommendations

Recommendation 5.

- Reticulated supply in urban subdivision with hydrant spacing, sizing and pressures to comply with AS 2419.1 – 2005. (As per Acceptable Solutions, PBP 2006, Section 4.1.3). This is reasonably assumed.
- Any above ground and external water pipes (including taps) incorporated as part of the subject building development and potentially exposed to radiant heat from any adjacent bush fire hazard are to be of metal design and manufacture.
- Minimum static water supply of **10 000L** (proposed pool will suffice).

9.4 Gas Supply Recommendations

Recommendation 6.

- Any new gas connection is installed and maintained in accordance with AS1596 and the requirements of relevant authorities.
- Metal piping should be used.
- Polymer sheathed flexible gas supply lines adjacent to the building are not used.

9.5 Electricity Supply Recommendations

Recommendation 7.

As the electricity supply is located underground there are no additional electricity supply conditions required for PBP compliance, (above and beyond standard Council and Energy Supplier conditions).

9.6 Vehicle Access/Egress Recommendations

Recommendation 8.

The proposed building development currently incorporates an all-weather driveway area for vehicle access and parking within the subject property. The access road / driveway will continue to provide direct access from Beatty Street.

No additional vehicle access requirements are recommended.

10.0 Compliance or non-compliance with PBP Specific Objectives for infill. (As per PBP 2006 Section 4.3.2)

Specific Objective	Comment
Ensure that the bushfire risk to adjoining land is not increased.	The subdivision is pre-existing. The construction of 'additions and alterations' to this building will not increase the bushfire risk to adjoining land. Subsequent bushfire fuel management from within the subject property will effectively reduce the risk to both the subject property and adjoining premises.
Provide a minimum defendable space.	A complying APZ (defendable space) has been recommended. This space consists of an area maintained as an IPA.

Provide better bushfire protection, on a redevelopment site, than the existing situation. This should not result in new works being exposed to greater risk than an existing building.	The site is located within an existing subdivision. Recommendations, relating to the 'alterations & additions', include strict building construction standards. The additions will not be exposed to any greater risk than the existing approved building.
Ensure that the footprint of the proposed building does not extend towards the hazard beyond existing building lines on neighbouring land.	The additions to the building are contained within the approved building envelope. They **do not** extend towards the hazard beyond the existing approved building lines and development envelopes on neighbouring land.
Not result in an increased bushfire management and maintenance responsibility on adjoining land owners unless they have agreed to the development	The development has not increased bushfire management and maintenance on adjoining land owners. For the purpose of this application, the management and maintenance responsibilities on adjoining land owners have not increased beyond existing legislative requirements.
Ensure building design and construction; enhance the chances of occupant and building survival.	The recommendations (above) relating to the design and construction of the 'alterations and additions', include a range of 'bushfire protection measures' will enhance the chances of occupant and building survival.

11.0 Compliance or non-compliance with PBP performance criteria and intent for bushfire safety protection measures for infill development.

Performance Criteria	Comment
APZ A defendable space is provided on site. An APZ is provided and maintained for the life of the development.	**Can Comply** – Recommendation No. 1 A defendable space will be provided within the site boundaries with the site being maintained as an MIPA. This is complimented by some 'cleared and managed lands' on adjoining residential properties.
Siting and Design Buildings are sited and designed to minimise the risk of bushfire attack.	**Can Comply** – Recommendation Nos. 1 – 4 The proposed development will be located within the approved building envelope and is based on the existing approved building siting. Predicated upon the proposed building standards and recommended APZ areas stated by this report, the risk of bushfire attack should be minimised upon the subject development/building.

Construction Standards Demonstrated that the proposed building can withstand bushfire attack in the form of wind, smoke, embers, radiant heat and flame contact.	**Can Comply** – Recommendation Nos. 2 – 4 Predicated upon the recommended APZ areas and siting requirements, non-combustible construction materials can achieve the performance requirements of the planning legislation.
Access Safe, operational access is provided (and maintained) for emergency service personnel in suppressing a bushfire while residents are seeking to relocate, in advance of a bushfire (satisfying the intent and performance criteria for access roads in sections 4.1.3 and 4.2.7).	**Can Comply** - Recommendation No. 8 Access/Egress is provided from Beatty Street. The access arrangements are sufficient for operational fire fighting and emergency egress.
Water and Utility Services Adequate water and electricity services are provided for fire fighting operations. Gas and electricity services are located so as not to contribute to the risk of fire to a building.	**Can Comply** – Recommendation Nos. 5 & 7 **Can Comply** – Recommendation Nos. 6 & 7
Landscaping Designed and managed to minimise flame contact and radiant heat to buildings, and the potential for wind driven embers to cause ignitions.	**Can Comply** – Recommendation No. 1

12.0 Statement assessing the environmental impact of any proposed bushfire protection measures.

Bushfire Protection Measure	Likely Environmental Impact	Comment
APZ (Rec. No. 1)	Minor	The recommended APZ within the subject property requires ongoing maintenance to achieve compliance.
Construction Standard (Rec. Nos. 2 - 4)	Insignificant	New additions are to be constructed within approved / current building envelope.

Water Supply for fire fighting (Rec. No. 5)	Insignificant	A reticulated water supply currently services the existing development. In addition, a supplementary supply is recommended.
Utility service protection (Rec. Nos. 5 - 7)	Insignificant	Water supply is currently located underground. Existing electrical supply and gas will be utilised, without altering existing arrangements.
Vehicle Access (Rec. No. 8)	Insignificant	Direct access to public road system is by way of short existing driveway, only ongoing maintenance is required.

13.0 Conclusion/Summary

Based on the above assessment and the 8 recommendations to protect persons and property from danger that may arise from a bushfire, the Consent Authority should determine that this development proposal can comply with *Planning for Bushfire Protection, 2006* as required under *section 79BA of the Environmental Planning and Assessment Act 1979.*

As a considered opinion, the recommended mitigation measures and construction requirements as stated in this report would reasonably address the aims and objectives of PBP 2006, consistent within the relative and current bushfire risk to the subject development site.

The recommended mitigation measures include the establishment of an Asset Protection Zone, maintained as an MIPA (Recommendation No.1) and the use of some 'non-combustible' construction materials.

As infill development, the residence will **not** be able to fully comply with the Acceptable Solutions provided within PBP, but, as a considered opinion, can still meet the Specific Objectives for Infill development.

In this regard, the subject development can reasonably facilitate PBP objectives in as far as;

- Affording occupants of any building adequate protection from exposure to bushfire;
- Providing for a defendable space to be located around buildings;
- Providing appropriate separation between a hazard and buildings which, in combination with other measures, prevent direct flame contact and/or material ignition;

- Ensuring that safe operational access and egress for emergency service personnel and residents is available;
- Providing for ongoing management and maintenance of bushfire protection measures, including fuel loads in the APZ; and
- Ensuring that utility services are adequate to meet the needs of fire fighters (and others assisting in bush fire fighting).

Should any of the above information require clarification or further discussion, please contact the author.

Scott Jarvis

Graduate Diploma Design for Bushfire Prone Areas
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Diploma of Public Safety (Fire Fighting Management) (Dip PSFM)
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(Note: Scott Jarvis is a recognised/ suitably qualified consultant pursuant to Rural Fire Service of NSW requirements - Fast Fact 5/10 Version 3 Dated 7 March 2011 & Development Control Practice Note 1/10 Version 2 Dated 4 February 2011)

References/Further Reading

Australian Standard 3959-2009, Construction of buildings in bushfire prone areas – Standards Australia.

Building Code of Australia (2016) – Australian Building Codes Board, Canprint.

Environmental Planning and Assessment Act (1979) – NSW Government Printer.

- Section 79BA Consultation and Development Consent Certain Bushfire Prone Land
- Section 146 Bushfire Prone Land

Rural Fires Act (1997) – NSW Government Printer

Landscape and building design for bushfire areas (2003) – Ramsay G C & Rudolf L, CSIRO Publishing, Collingwood Victoria.

Ocean shores to desert dunes: the native vegetation of NSW and the ACT (2004) – Keith D, NSW Dept of Environment and Conservation, Hurstville NSW.

Planning for Bushfire Protection. A guide for councils, planners, fire authorities and developers (2006) – NSW Rural Fire Service.

Addendum: Appendix 3 - Planning for Bushfire Protection. A guide for councils, planners, fire authorities and developers (2010) – NSW Rural Fire Service.

Standards for Asset Protection Zones – NSW Rural Fire Service

Appendix 1

Map 1 – Overview

Map 2 – Study Area / Subject Lot / Slopes / APZ extent

Existing development (approximate)

Recommended Inner Protection Area (MIPA)

Subject Property Lot 22 DP 1124834

Hydrants

Study Area

Slope Direction

Proposed 'Alterations & Additions'

Appendix 2 – Site Photo (27/3/2017)

Existing development site, looking N

Existing driveway / vehicle access

Beatty Street, looking E

Beatty Street, looking W

Inclinator & Stair Access, looking N

Pathway along Eastern boundary

Electrical supply along Beatty Street

Existing gas supply point

Front yard, development area, looking W

Degraded forest vegetation, within National Park, looking NE

Typical Dry Forest vegetation within National Park, looking E

Typical Dry Forest vegetation within National Park, looking SE

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GEOTECHNICAL ASSESSMENT REPORT FOR PROPOSED POOL AT 2A BEATTY STREET, BALGOWLAH HEIGHTS

1. INTRODUCTION.

1.1 This Geotechnical Assessment Report has been prepared to accompany an application for Development Approval with Northern Beaches Council - Manly.

1.2 The methods used in this Assessment are based on those described in *Landslide Risk Management March 2007*, published by the Australian Geo-mechanics Society.

1.3 The experience of Jack Hodgson Consultants spans some 40 years in Pittwater/Warringah and the Greater Sydney area.

2. PROPOSED DEVELOPMENT.

2.1 Construct new pool and paved patio along north-eastern side of residence.

2.2 Details of the proposed development are shown on a series of architectural drawings prepared by Secret Gardens, Dwg No: DA-01 to DA-05, Revision A, dated 28th April, 2017.

3. DESCRIPTION OF SITE & SURROUNDING AREA.

3.1 The site was inspected on 16th June, 2017.

3.2 This large irregular shaped property is located on the low side of the road and has a north-easterly aspect. From the road frontage, the slope of the land drops across the property at maximum average angles of some 20 degrees. The block is situated at the toe of a moderate slope that rises from the waterfront at Middle Harbour to the crest of the ridge near Jellicoe Street.

3.3 Vehicular access to the block is via a shared concrete driveway that terminates in a hardstand. Pedestrian access to the residence is via a set of stairs and inclinator that extends down the south-eastern boundary (Photo 1). A paved pathway and patio area extend along the south-western side of the residence (Photo 2). The cut for the patio area can be seen through competent Hawkesbury sandstone and has been spray concreted in some locations (Photo 3). An outbuilding is located near the north-

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AC

western side of the residence (Photo 4). A paved patio that shows signs of some cracking and movement extends along the north-eastern side of the residence (Photo 5). A stone stairway descends from the northern side of the residence down to the north-eastern boundary of the property. The slope that falls below the stone patio area is supported be a series of stack rock retaining walls that appeared to be stable at the time of our inspection (Photo 6). A small lawn area is located below the stack rock retaining wall. Below the lawn area the slope falls to the north-eastern boundary and is terraced and supported by several stack rock retaining walls (Photo 7). A small boatshed and deck is located midway down the slope and toward the south-eastern boundary (Photo 8). Outcropping Hawkesbury sandstone can be seen exposed below the north-eastern boundary of the residence (Photo 9).

3.4 The existing two storey masonry residence is in good condition for its age. No evidence of significant cracking or movement was identified at the time of our inspection.

4. GEOLOGY OF THE SITE.

4.1 The Sydney geological series sheet, at a scale of 1:100,000 indicates the site is underlain by Hawkesbury Sandstones of the Wianamatta group, which can be seen outcropping across the site. These sandstones are of Middle Triassic age and were probably laid down in braided streams. The sand grains are mainly quartz with some sand grade claystone fragments. There are lenticular deposits of mudstones and laminates which are thought to have been deposited in abandoned channels of the main streams. The sandstones generally have widely spaced sub vertical joints with some current bedding. The joint directions are approximately north/south and east/west. The beds vary in thickness from 0.5 to in excess of 5 metres.

4.2 The slope materials are colluvial at the surface and residual at depth. They consist of sandy loams over sandy clays that merge into the weathered zone of the underlying rocks at depths expected to be in the range of shallow to ~1.5 metres or deeper where filling has be carried out.

5. SUBSURFACE INVESTIGATION.

Due to the presence of abundant outcropping Hawkesbury Sandstone bedrock across the block and the known geology of the area, no subsurface investigation was deemed necessary.

6. DRAINAGE OF THE SITE.

6.1 ON THE SITE.

The site is naturally well drained with water moving downslope along the rock and soil interface of the profile.

6.2 SURROUNDING AREA.

Overland stormwater flow entering the site from the adjoining properties was not evident. Normal stormwater overflow could enter the site from above during intense or extended rainfall.

7. GEOTECHNICAL HAZARDS.

7.1 ABOVE THE SITE.

No geotechnical hazards likely to affect the subject property were observed above the property.

7.2 ON THE SITE.

By reference to Northern Beaches Councils geotechnical hazard mapping the site is identified as a G2 geotechnical hazard zone in relation to the steep flanking slopes and sandstone escarpments. The slope of the land surface that falls across the property is considered a potential hazard (**HAZARD ONE**).

7.3 BELOW THE SITE.

No geotechnical hazards likely to adversely affect the subject property were observed below the site.

7.4 BESIDE THE SITE.

The properties beside the site are at similar elevations and have similar geomorphology to the subject property. The house and grounds of the properties beside the site were in good condition as observed from the subject property and street. No geotechnical hazards likely to adversely affect the subject property were observed beside the site.

8. RISK ASSESSMENT.

8.1 ABOVE THE SITE.

As no geotechnical hazards likely to adversely impact upon the subject site were observed above the site, no risk analysis is required.

8.2 ON THE SITE.

8.2.1 HAZARD ONE Qualitative Risk Assessment on Property

The slope of the land surface drops from the road frontage at average angles of approximately 20 degrees toward the north-east. Exposed sandstone escarpments and supporting sandstone block and stack rock walls are considered stable in their current condition. No evidence of significant slope instability was identified at the time of our inspection. The likelihood of the slope failing and impacting on the house is assessed as 'Unlikely' (10^{-4}). The consequences to property of such a failure are assessed as 'Low' (5%). The risk to property is 'Low' (5×10^{-6}).

8.2.2 HAZARD ONE Quantitative Risk Assessment on Life

For loss of life risk can be calculated as follows:
$\mathbf{R_{(Loll)} = P_{(H)} \times P_{(SH)} \times P_{(TS)} \times V_{(DT)}}$ (See Appendix for full explanation of terms)

8.2.2.1 Annual Probability
No evidence of significant slope instability was identified at the time of inspection.
$\mathbf{P_{(H)}} = 0.0001$/annum

8.2.2.2 Probability of Spatial Impact
The existing cottage is situated toward the toe of steep slope.
$\mathbf{P_{(SH)}} = 0.1$

8.2.2.3 Possibility of the Location Being Occupied During Failure
The average household is taken to be occupied by 4 people. It is estimated that 1 person is in the house for 20 hours a day, 7 days a week. It is estimated 3 people are in the house 12 hours a day, 5 days a week.
For the person most at risk:

$$\frac{20}{24} x \frac{7}{7} = 0.83$$

$\mathbf{P_{(TS)}} = 0.83$

8.2.2.4 Probability of Loss of Life on Impact of Failure

Based on the volume of land sliding and its likely velocity when it fails, it is estimated that the vulnerability of a person to being killed in the house when a landslide occurs is 0.01

$V_{(DT)} = 0.01$

8.2.2.5 Risk Estimation

$R_{(LoI)} = 0.0001 \times 0.1 \times 0.83 \times 0.01$

$= 0.000000083$

$R_{(LoI)} = 8.3 \times 10^{-8}$/annum **NOTE:** This level of risk is **'ACCEPTABLE'** provided the recommendations provided in **Section 10** are followed.

8.3 BELOW THE SITE.

As no geotechnical hazards likely to adversely impact upon the subject site were observed below the site, no risk analysis is required.

8.4 BESIDE THE SITE.

As no geotechnical hazards likely to adversely impact upon the subject site were observed beside the site, no risk analysis is required.

9. SUITABILITY OF DEVELOPMENT FOR SITE.

9.1 GENERAL COMMENTS.

The proposed development is considered suitable for the site.

9.2 GEOTECHNICAL COMMENTS.

No geotechnical hazards will be created by the completion of the proposed development in accordance with the requirements of this Report and good engineering and building practice.

9.3 CONCLUSIONS.

The site and the proposed development can achieve the Acceptable Risk Management criteria as published by the Australian Geo-mechanics Society in March 2007, provided the recommendations given in **Section 10** are undertaken.

10. RISK MANAGEMENT.

10.1. TYPE OF STRUCTURE.

The proposed structures are considered suitable for the site.

10.2. EXCAVATIONS.

With the exception of those required for pad levels or footings, no significant excavations are required for the proposed works.

10.3. FILLS.

10.3.1 If minor filling is required all fills are to be placed in layers not more than 250 mm thick and compacted to not less than 95% of Standard Optimum Dry Density at plus or minus 2% of Standard Optimum Moisture Content.

10.3.2 The fill batters are to be not steeper than 1 vertical to 1.7 horizontal or they are to be supported by properly designed and constructed retaining walls.

10.4. FOUNDATION MATERIALS AND FOOTINGS.

It is recommended that all footings be supported on and socketed into the underlying sandstone bedrock. The design allowable bearing pressures are 1.0 MPa for spread footings or shallow piers. All footings are to be founded on material of equal consistency to prevent differential settlement.

10.5. STORM WATER DRAINAGE.

Storm water generated from any new works is to be piped to the existing stormwater system for the block through any on-site detention that may be required by the regulating authorities.

10.6. SUBSURFACE DRAINAGE.

Any retaining walls are to be backfilled with non-cohesive free draining material and slotted pipe to provide a drainage layer immediately behind the wall. The free draining material is to be separated from the ground materials by geotextile fabric.

10.7. INSPECTIONS.

The foundation materials of all footing excavations are to be inspected and approved before concrete is placed.

11. GEOTECHNICAL CONDITIONS FOR ISSUE OF CONSTRUCTION CERTIFICATE.

It is recommended that the following geotechnical conditions be applied to Development Approval:-

The work to be completed is to be carried out in accordance with the Risk Management Report MS 31177 dated 19th June, 2017.

The Geotechnical Engineer is to inspect and approve the foundation materials of all footing excavations before concrete is placed.

12. GEOTECHNICAL CONDITIONS FOR ISSUE OF OCCUPATION CERTIFICATE.

The Geotechnical Engineer is to certify the following geotechnical aspects of the development:-

The work to be completed was carried out in accordance with the Geotechnical Assessment Report MS 31177 dated 19th June, 2017.

The Geotechnical Engineer has inspected and approved the foundation materials of all footing excavations before concrete was placed.

13. RISK ANALYSIS SUMMARY.

HAZARDS	Hazard One
TYPE	By reference to Northern Beaches Councils geotechnical hazard mapping the site is identified as a G2 geotechnical hazard zone in relation to the steep flanking slopes and sandstone escarpments. The slope of the land surface that falls across the property is considered a potential hazard.
LIKELIHOOD	'Unlikely' (10^{-4})
CONSEQUENCES TO PROPERTY	'Minor' (5%)
RISK TO PROPERTY	'Low'(5×10^{-6})
RISK TO LIFE	8.3×10^{-8}/annum
COMMENTS	This level of risk is **'ACCEPTABLE'** provided the conditions in **Section 10** are followed.

JACK HODGSON CONSULTANTS PTY. LIMITED.

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Civil/Geotechnical Engineer

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Photo 1

Photo 2

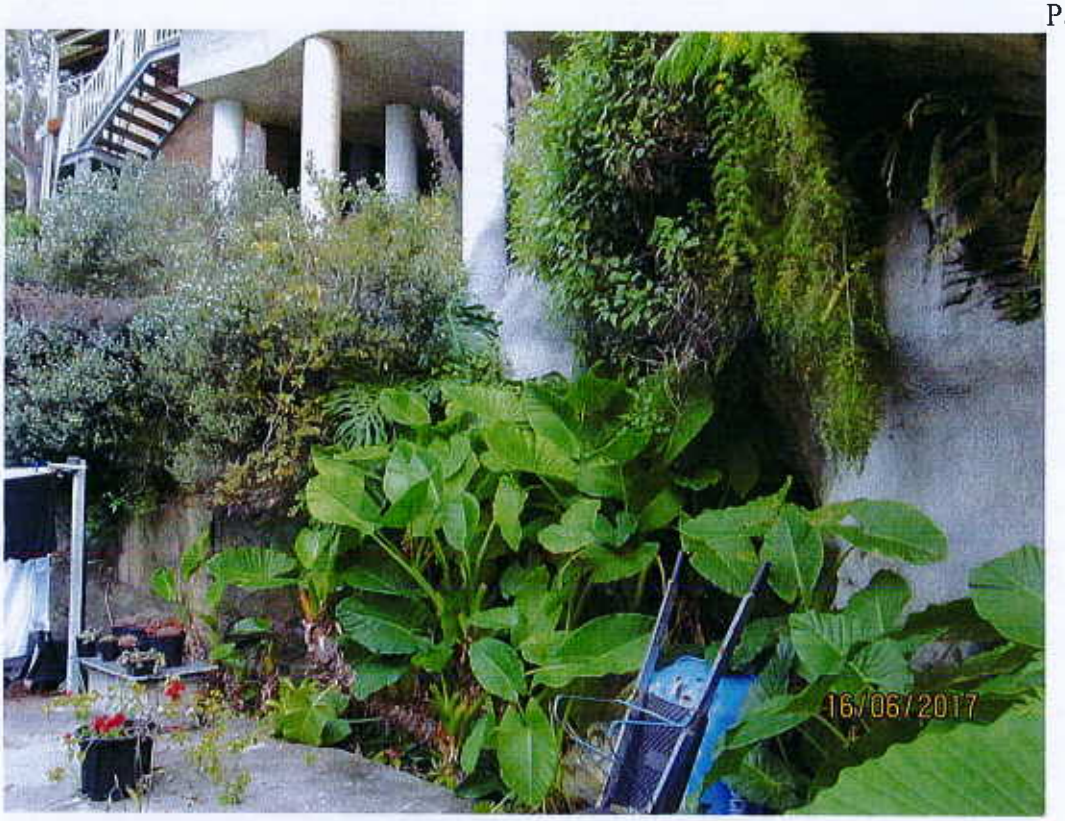


Photo 3

Photo 4

Photo 5

Photo 6

Photo 7

Photo 8

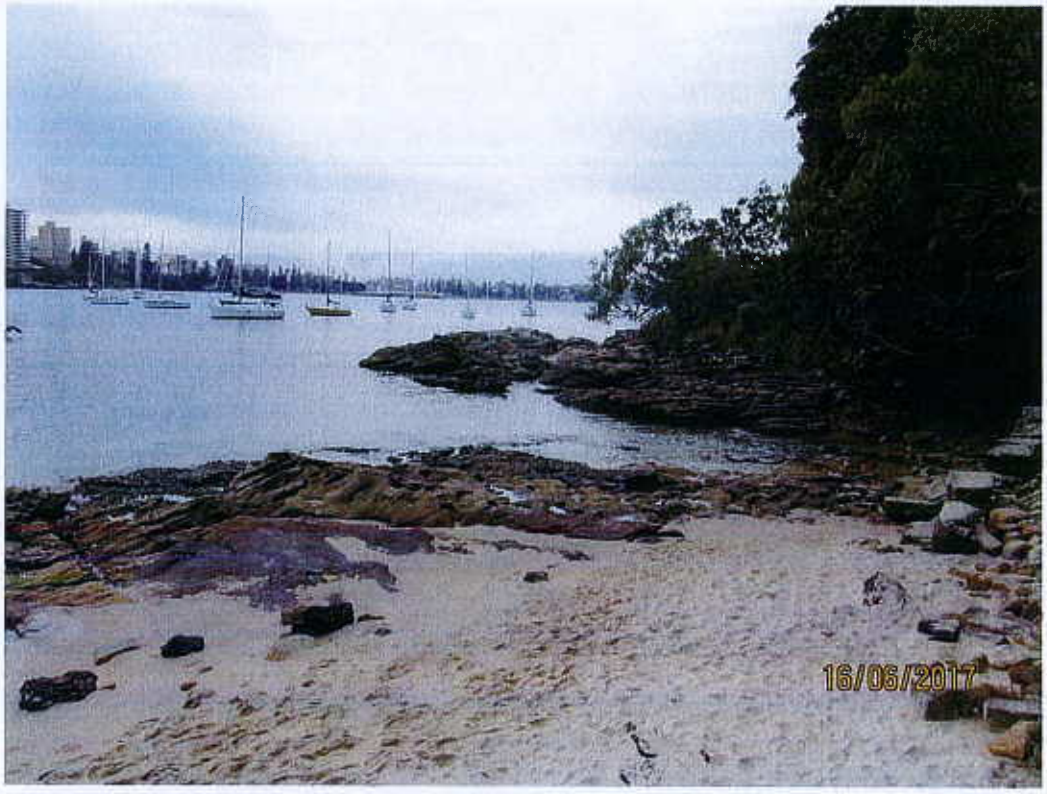
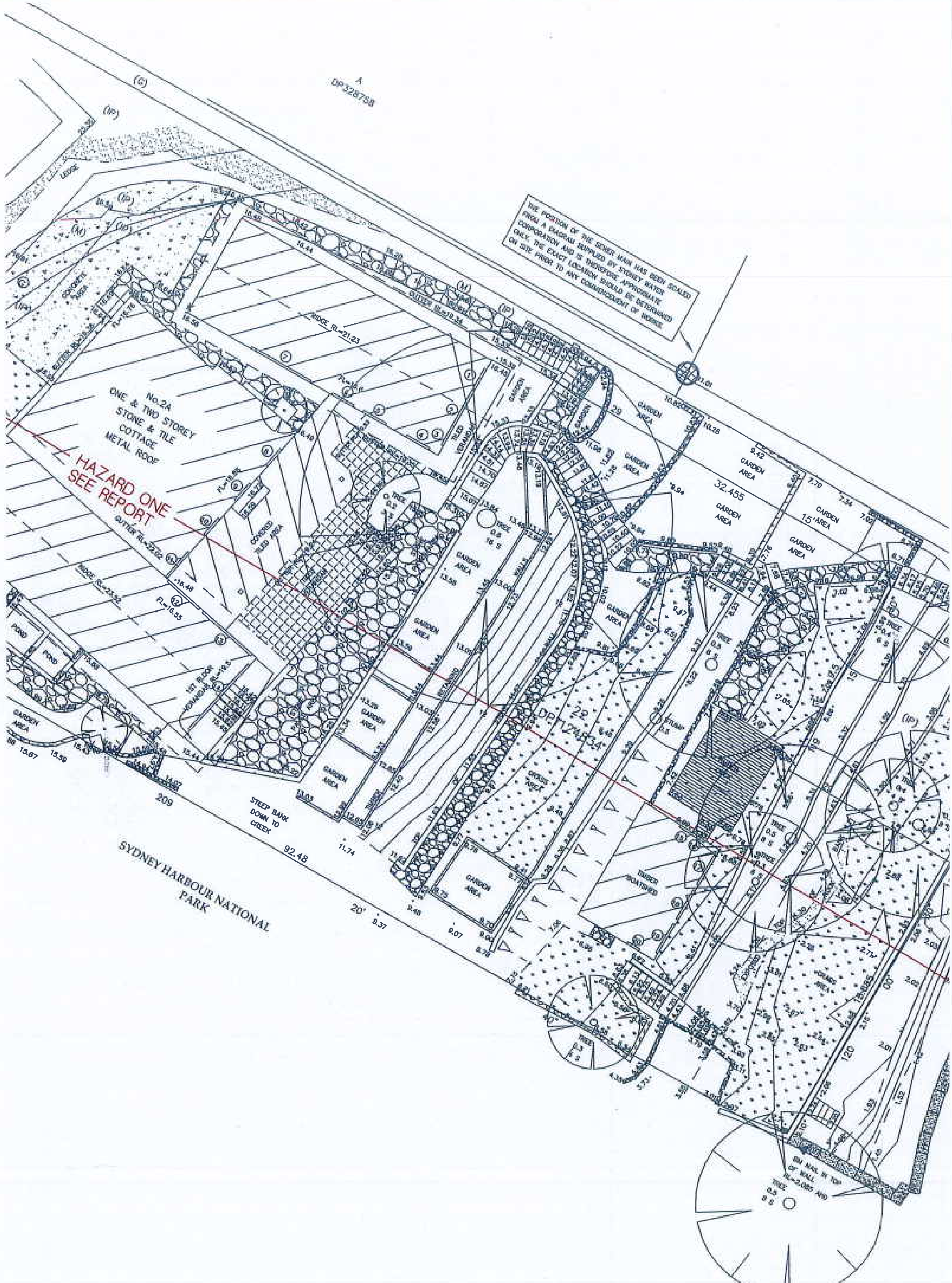
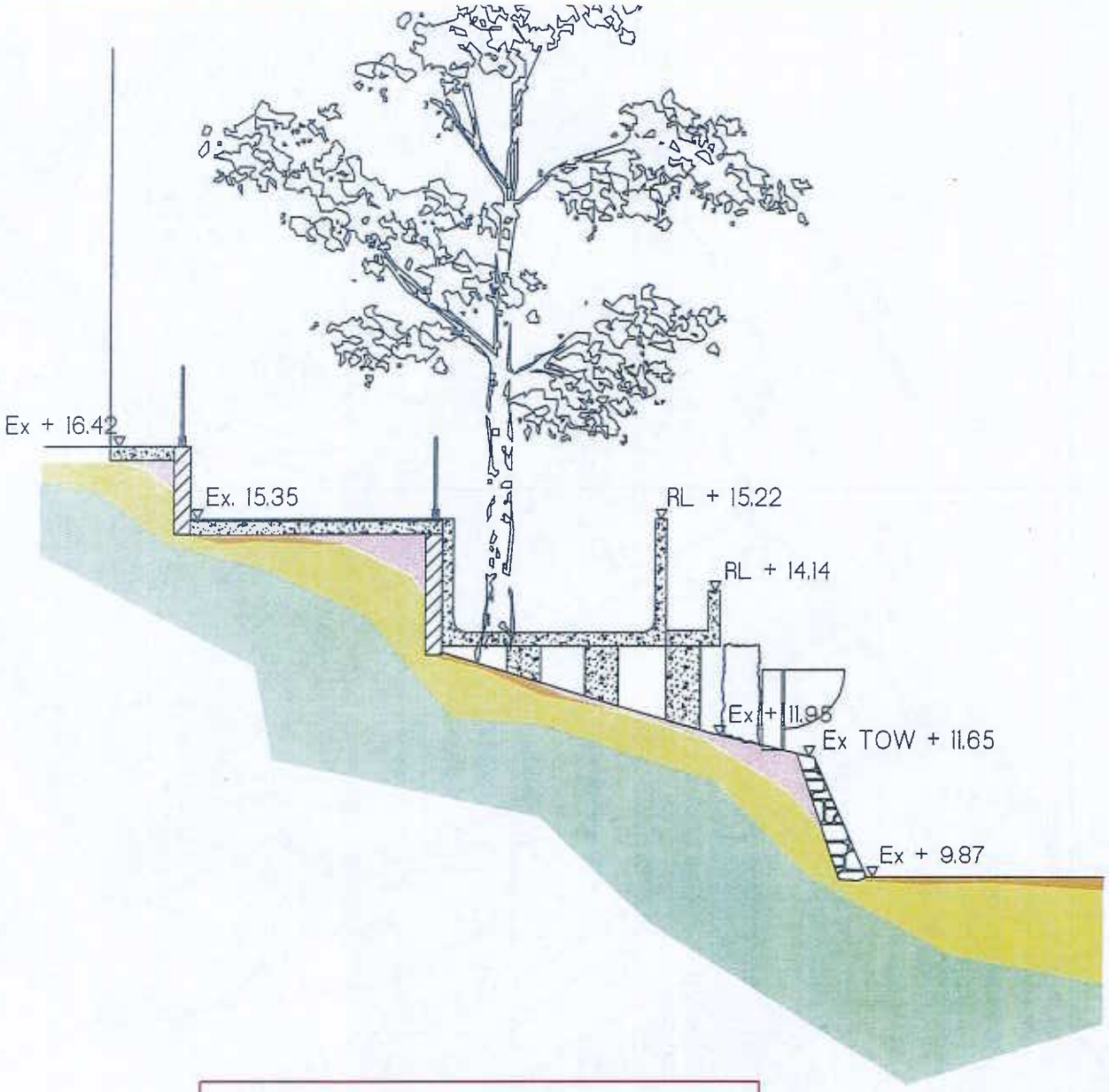


Photo 9



A
DP328758
THE POSITION OF THE SEWER MAIN HAS BEEN SCALED FROM A DIAGRAM SUPPLIED BY SYDNEY WATER CORPORATION AND IS THEREFORE APPROXIMATE ONLY. THE EXACT LOCATION SHOULD BE DETERMINED ON SITE PRIOR TO ANY COMMENCEMENT OF WORKS.
No.2A
ONE & TWO STOREY
STONE & TILE
COTTAGE
METAL ROOF
HAZARD ONE
SEE REPORT
32.455
92.48
209
SYDNEY HARBOUR NATIONAL
PARK
STEEP BANK
DOWN TO
CREEK
GARDEN AREA
22
DP124834
29
120



NOTE
INTERPRETED SUB SURFACE SECTION ONLY.
ACTUAL GROUND CONDITIONS MAY VARY.

7 RISK ESTIMATION

7.1 QUANTITATIVE RISK ESTIMATION

Quantitative risk estimation involves integration of the frequency analysis and the consequences.
For property, the risk can be calculated from:
$R_{(Prop)} = P_{(H)} \times P_{(S:H)} \times P_{(T:S)} \times V_{(Prop:S)} \times E$ (1)

Where
$R_{(Prop)}$ is the risk (annual loss of property value).

$P_{(H)}$ is the annual probability of the landslide.

$P_{(S:H)}$ is the probability of spatial impact by the landslide on the property, taking into account the travel distance and travel direction.

$P_{(T:S)}$ is the temporal spatial probability. For houses and other buildings $P_{(T:S)}$= 1.0. For Vehicles and other moving elements at risk1.0< $P_{(T:S)}$>0.

$V_{(Prop:S)}$ is the vulnerability of the property to the spatial impact (proportion of property value lost).

E is the element at risk (e.g. the value or net present value of the property).
For loss of life, the individual risk can be calculated from:

$R_{(LoL)} = P_{(H)} \times P_{(S:H)} \times P_{(T:S)} \times V_{(D:T)}$ (2)
Where

$R_{(LoL)}$ is the risk (annual probability of loss of life (death) of an individual).

$P_{(H)}$ is the annual probability of the landslide.

$P_{(S:H)}$ is the probability of spatial impact of the landslide impacting a building (location) taking into account the travel distance and travel direction given the event.

$P_{(T:S)}$ is the temporal spatial probability (e.g. of the building or location being occupied by the individual) given the spatial impact and allowing for the possibility of evacuation given there is warning of the landslide occurrence.

$V_{(D:T)}$ is the vulnerability of the individual (probability of loss of life of the individual given the impact).
A full risk analysis involves consideration of all landslide hazards for the site (e.g. large, deep seated landsliding, smaller slides, boulder falls, debris flows) and all the elements at risk.

For comparison with tolerable risk criteria, the individual risk from all the landslide hazards affecting the person most at risk, or the property, should be summed.

The assessment must clearly state whether it pertains to 'as existing' conditions or following implementation of recommended risk mitigation measures, thereby giving the 'residual risk'.