MIXED USE DEVELOPMENT - JONSON ST, BYRON BAY

136420 LANDSCAPE REPORT [E] - 2017-08-23

[E]	2017-08-23	ZL	KE
[D]	2017-07-19	KE	KE
[C]	2017-07-18	ZL	KE
[B]	2017-06-28	ZL	KE
[A]	2017-05-25	ZL	KE
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LANDSCAPE CONTEXT

Located on the corner of Jonson and Browning Streets the site is positioned in the sort after fringe of Byron Bay's commercial hub. There are several large scale retail developments within walking distance of the development and a historic item identified in the Heritage Study and mentioned within the Byron Bay Master Plan which sits across from the development on Browning Street.

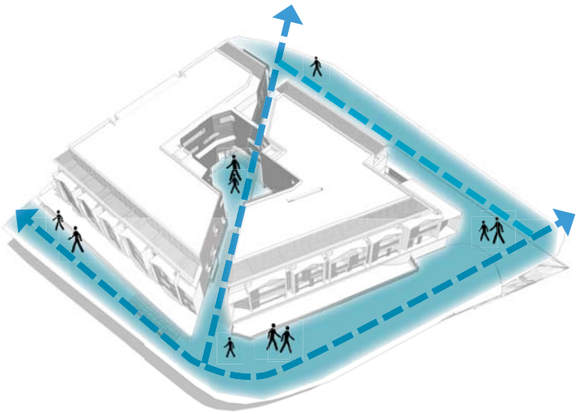
The site is well connected to the surrounding residential areas with a laneway to the east and major roads to its north and west.

The Byron Bay Master Plan has identified the Jonson/Browning intersection as a secondary arrival point to the town centre. Also identified in this location is a connection to the Byron Bay Bypass highlighting the need to create a focal point on this corner. The Master plan identifies a pedestrian and cycle link along the Bypass route that terminates with a cycle hire facility sited across Jonson road from the development site.

LANDSCAPE INTENT

The development will respond to the unique Byron Bay culture and local character. Natural forms and materials will integrate with the built, form connecting the precinct into its surrounding context. The landscape materiality, language and form will reflect the Byron Bay character, natural environment and the functional requirements of the individual sapces including the childcare precinct.

DESIGN DRIVERS



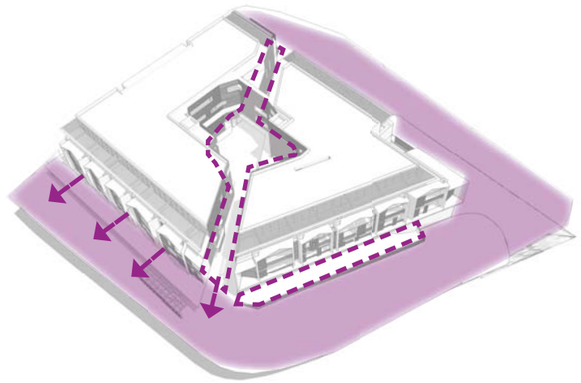
Connectivity

Focus will be highlighted through feature planting or materials to assist legibility. The public courtyard will foster interaction between all users strengthing the sense of community in the development.

The public landscape will reflect Byron Bay's vivid and welcoming community, ensuring the development becomes an intergrated part of the Byron Bay business district.

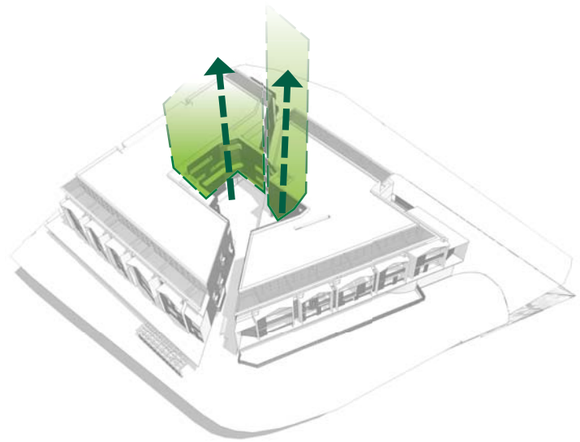
Verdant

The large open central courtyard is an internal garden space amongst the taller built form providing a green, soft and refreshing reprieve of the built form. Pockets of soft landscape are proposed on all building levels to ensure a consistent landscape character in all external spaces.



Interfaces

Establish meaningful engaging interfaces with the streetscape. Seamless interface with the steetscape. Define the edges between public and private spaces without compromising safety and security. Create recognisable break down of the space delineating the differing functions of the space.



Vertical Landscapes

The landscape will stretch vertically, extending vegetation up the building, providing the sense of a coastal rainforest within the central courtyard, grounding the building into the environment, and creating a secrete garden of lush green tranquillity.

SUSTAINABLE DESIGN DRIVERS

Transport

Promoting sustainable travel modes by incorporating cycle parking into the landscape and strengthening the proposed cycle network adjacent the site.

Strengthen pedestrian connections through the site by emphasizing the cross block link supporting walking.

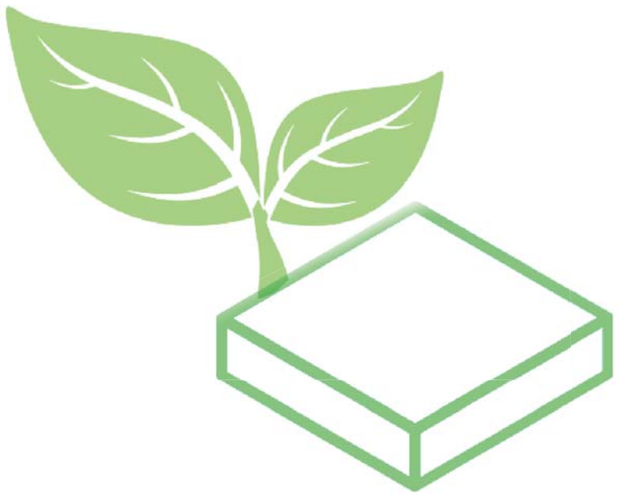
Introducing tree planting to the streetscape creating a green leafy streetscape aims to encourage walking throughout Byron Bay.

Green roofs and walls

Maximising the softscape by using wall and roof spaces for planting reducing glare, providing shade and increasing amenity .

Introduction of green roofs broadens the species diversity and increasing the habitat area within the development.

The addition of the green roof, walls and trellis creates a cooling effect and aids in insulating the building resulting in less energy required for air-conditioning and heating.



Materials and Planting

Where possib le, endemic materials will be sourced.

The paving is proposed to use locally sourced aggregates to reduce the carbon footprint on delivery of materials.

The use of site specific plant species to ensure successful establishment, long live growth and low maintenance.

Deep planting will be maximised where possible by utilising 'dead' space in the basement to achieve planter depth.

Tree planting will be undertaken where possible to achieve a greater number of new plantings than what was existing. This will provide a larger habitat, contribute to broadening the species diversity and increasing shade and cooling effects across the site.

Water

Utilising water wise, hardy, local native plants that are suited to the conditions to create a low maintenance landscape providing long-term amenity and environmental benefits.

Integrated water management which includes utilisation of rain water for irrigation and green roofs filtration systems.

GROUND PLAN 1:250

1. Feature paving
2. Planting beds at back of kerb, species to maintain vehicle site lines and views through to building.
3. Deep planting with feature tree
4. Trellis to boundary acoustic fence
5. Podium planter
6. Feature planting to boundary acoustic fence
7. Rainforest courtyard refer page 13 for details
8. Staff courtyard
9. Turf to verge
10. 0-3 year old outdoor playspace
11. 3-5 year old outdoor playspace refer page 14 for details
12. 4m wide pedestrian pavement. Wave pattern to council colour specifications
13. 2m wide pedestrian pavement. Wave pattern to council colour specifications
14. 2m wide pedestrian path
15. Hardstand for rubbish bin collection
16. Bike racks

Planting quantities

215m² total planting within boundary
71m² deep planting within boundary (15% of total site planting)
195m² Streetscape planting (deep planting)

Note these quantities may alter with detailed design.

LEVEL ONE PLAN 1:250

1. Private balconies
2. Podium planters with small feature trees
3. Green roof
4. Podium planter with feature tree
5. Podium planter

Planting quantities

178m² podium planting

Note these quantities may alter with detailed design.

LEVEL TWO PLAN 1:250

1 Private balconies

2 Podium planter

Planting quantities

6m² podium planting

Note these quantities may alter with detailed design.

LEVEL THREE PLAN 1:250

1 Private balconies

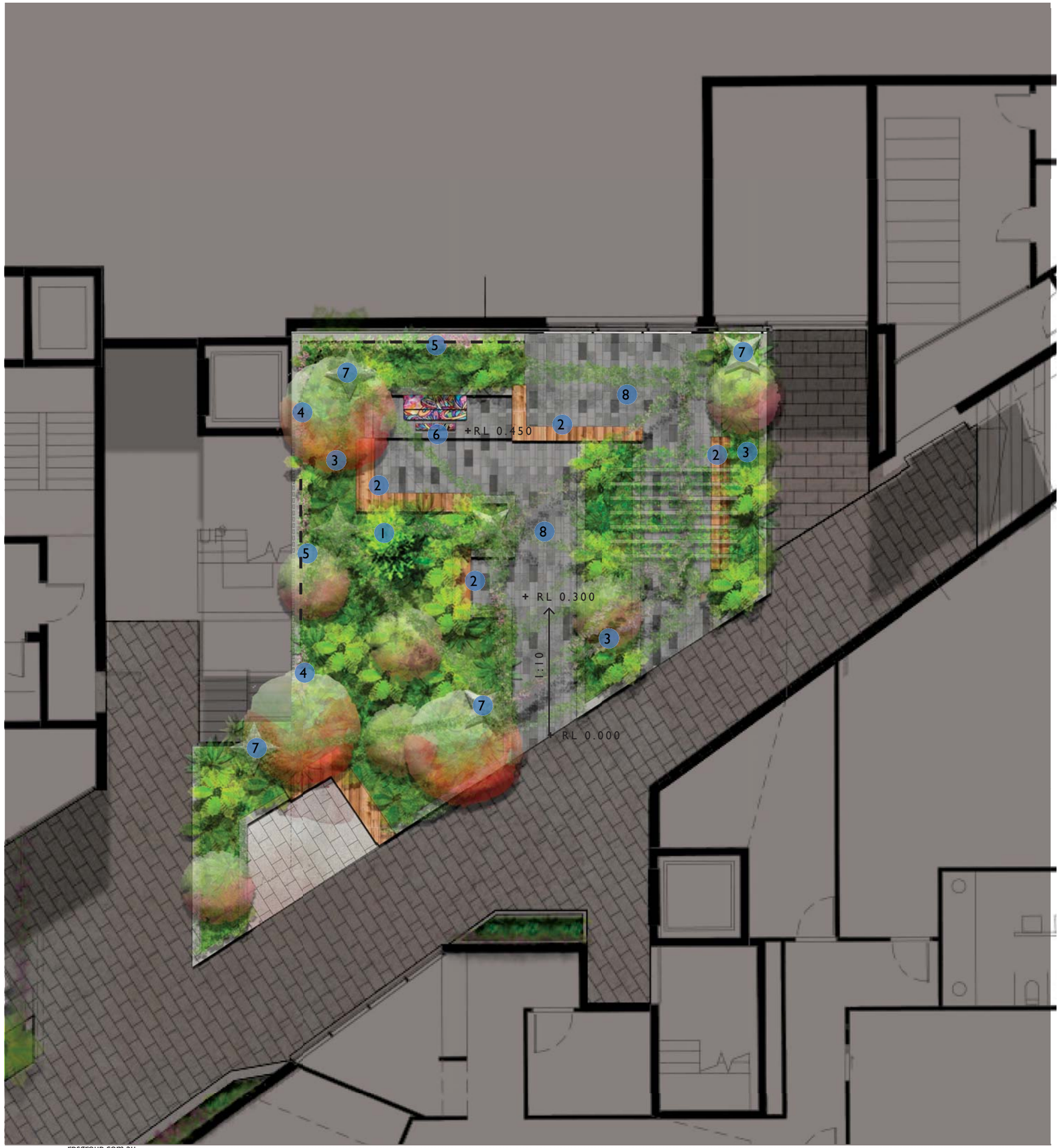
2 Podium planters

3 Podium planter with feature tree

Planting quantities

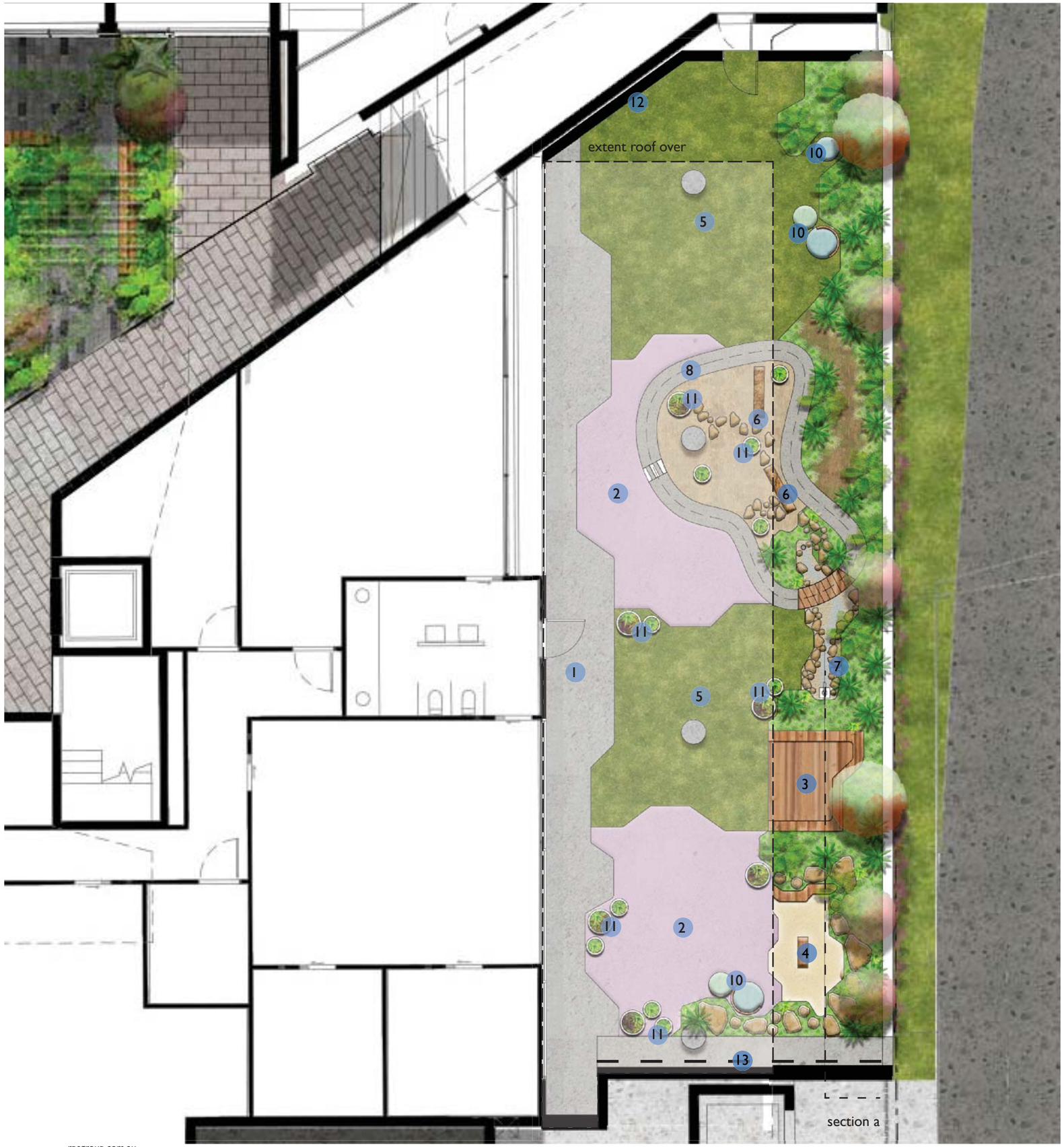
41m² podium planting (not including freestanding pots)

Note these quantities may alter with detailed design.



RAINFOREST COURTYARD 1:100

1. Feature trees
2. Timber seating
3. Podium planter
4. Vertical trellis with climbers
5. Green wall
6. Street panio - “Play me, I’m yours” project
7. Art structure with vertical greening system
8. Granite pavement



0-3YR PLAY PLAN 1:100

1. Concrete breakout space for tables and chairs
2. Softfall area for movable play equipment
3. Deck with seating edge
4. Sand pit
5. Artificial turf play space
6. Sensory garden with various mulch types, rocks and logs
7. Play creek with hand pump, feature rocks, flood gates and tippy buckets
8. Bike track
9. Bike parking
10. Egg seats and outdoor cushions
11. Large flower pots with chalkboard paint
12. Chalkboard wall with hanging pots
13. Green wall - mix of trellis system and cells

0-3YR PLAY

SECTION A 1:20

1. Green wall - mix of trellis system and cells
2. Planting - mix of species to provide various textures
3. Stepping stones
4. Sand pit
5. Tunnel
6. Seat
7. Outdoor bean bags
8. Hand pump
9. Play creek

3-5YR PLAY PLAN 1:100

1. Concrete breakout space for tables and chairs
2. Softfall area for movable play equipment
3. Deck with climbing net to raised platform
4. Raised deck with chalkboard balustrade (max 600mm off ground)
5. Sand pit
6. Artificial turf play space
7. Stepping stones and logs to play river
8. Play creek with reticulated hand pump, feature rocks, flood gates and tippy buckets
9. Bike track
10. Bike parking
11. Sensory garden with various mulch types, rocks and logs
12. Egg seats and outdoor cushions
13. Jungle reading room and outdoor library
14. Steppers to reading room
15. Chalkboard wall with hanging pots

3-5YR PLAY

SECTION B 1:20

1. Green wall - mix of trellis system and cells
2. Planting - mix of species to provide various textures
3. Stepping stones
4. Sand pit
5. Climbing wall
6. Raised deck (max 600mm from FFL)
7. Outdoor bean bags
8. Chalkboard wall
9. Bike track
10. Play creek

CHARACTER IMAGES

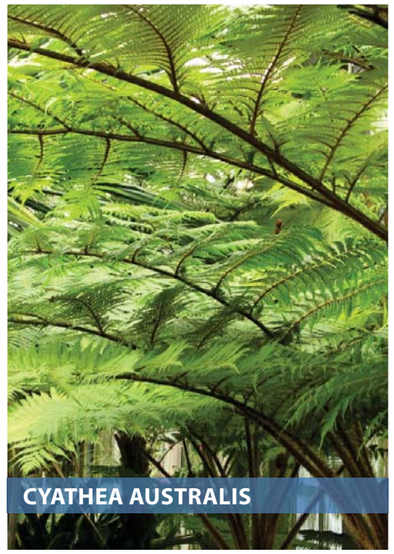
CHARACTER IMAGES

PLANTING PALETTE

ALLOXYLON FLAMMEUM

CALLITRIS COLUMELLARIS

CASUARINA LITTORALIS


CYATHEA AUSTRALIS

ELAEOCARPUS 'PRIMA DONNA'

FLINDERSIA SCHOTTIANA

HIBISCUS TILIACEUS

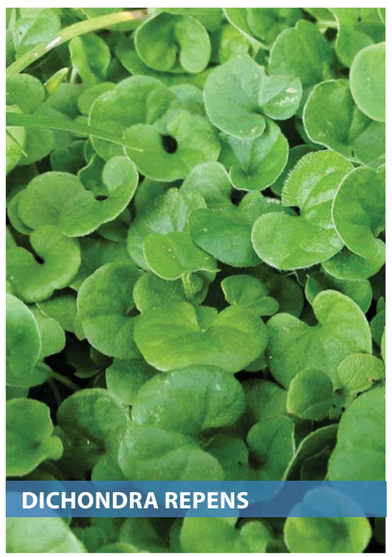
PODOCARPUS ELATUS

ASPLENIUM AUSTRALASICUM

AUSTROMYRTUS DULCIS

BLECHNUM INDICUM

CISSUS ANTARCTICA


DICHONDRA REPENS

FICINIA NODOSA

HARDENBERGIA VIOLACEA

HELMHOLTZIA GLABERRIMA

HOYA AUSTRALIS

LEPIDOZAMIA PEROFFSKYANA

PLANTING MATRIX

		A1	A2	A3	A4
Trees and Palms					
Alloxylon flammeum	Tree waratah	●		●	●
Callitris columellaris	Coastal cypress				
Casuarina littoralis	Black she-oak				
Cyathea cooperi	Tree Fern				●
Elaeocarpus 'Prima Donna'	Blueberry Ash		●	●	
Flindersia schottiana	Cudgerie				
Hibiscus tiliaceus	Coastal Hibiscus	●		●	●
Podocarpus elatus	Plum Pine		●		
Accents					
Asplenium australasicum	Bird's Nest Fern		●	●	●
Doryanthes excelsa	Gymea lily	●		●	
Helmholtzia glaberrima	Stream lily	●	●		
Lepidozamia peroffskyana	Native Cycad		●		●
Groundcovers					
Austromyrtus dulcis	Midgen berry	●		●	●
Blechnum indicum	Swamp water fern		●	●	●
Dichondra repens	Kidney weed		●	●	●
Ficinia nodosa	Knotted club rush				●
Poa labillardieri	Tussock grass	●	●	●	
Viola hederacea	Native violet		●	●	
Vertical Greening					
Asplenium australasicum	Bird's Nest Fern		●		
Cissus antartica	Kangaroo Vine		●	●	●
Hardenbergia violacea	Purple coral pea			●	
Hoya australis	Wax vine			●	●
Pandorea pandorana	Wonga wonga vine		●		
Platycerium bifurcatum	Elkhorn fern		●		
Platycerium superbum	Staghorn fern		●		

Note the above and pictured species are not an exhaustive list. Species may be added/removed with refinement of design

PLANTING PALETTE

PANDOREA PANDORANA

PLATYCERIUM BIFURCATUM

PLATYCERIUM SUPERBUM

POA LABILLARDIERI

VIOLA HEDERACEA

A1 - STREETSCAPE

A2 - RAINFOREST ROOM

A3 - CHILD CARE

A4 - PODIUM

LANDSCAPE REQUIREMENTS

DCP requires 1 street tree for each 8 metres of street frontage.

Planter minimums
Large Trees (16m)- 1625mmm deep (1300mm soil, 200mm drainage gravel, 100mm mulch, 25mm setdown from top of planter.)

Medium trees (8m)- 1325mm deep (1000mmm soil, 200mm drainage, 100mm mulch, 25mm setdown below top of planter.)

Small Trees (4m)-1125mm deep (800mm soil, 200mm drainage, 100mm mulch, 25mm setdown below top of planter.)

Shrubs- 825mm deep (500mm soil, 200mm drainage, 100mm mulch, 25mm setdown below planter)

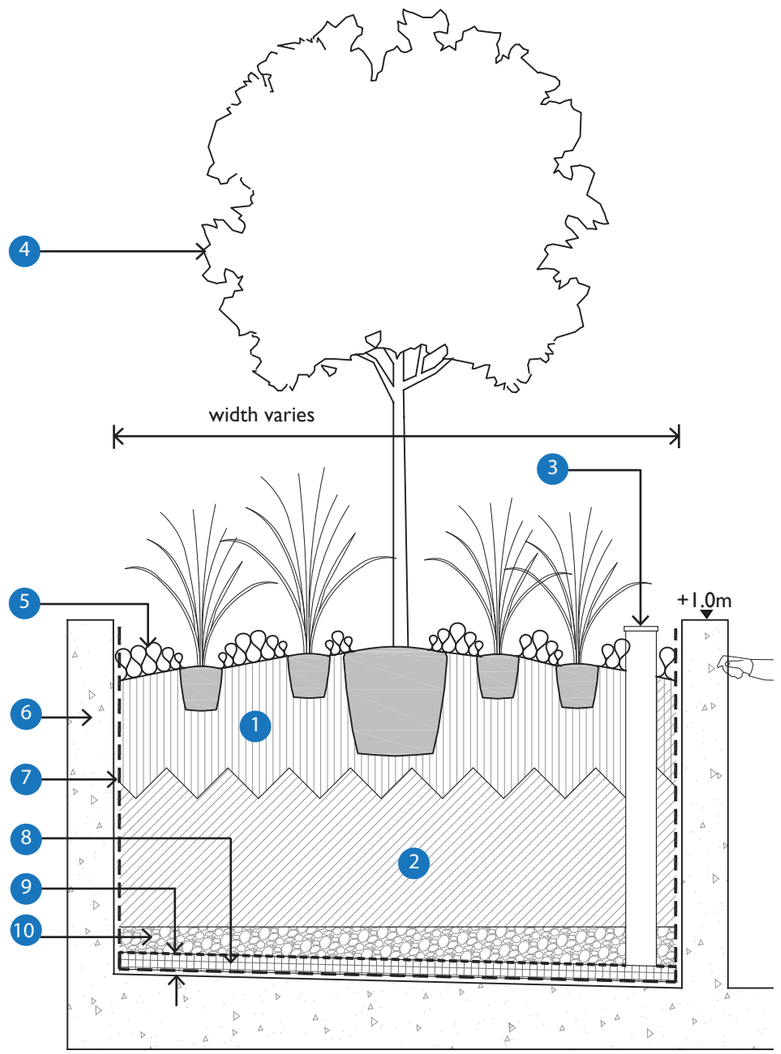
Groundcover/climbers- 775mm deep(450mm soil, 200mm drainage, 100mm mulch, 25mm setdown from planter.)

600mm wide soil profile plus planter structure width.

Provide irrigation to planter boxes.

APPENDIX A

PODIUM PLANTER 1:20



This detail has been produced to fulfil the dual purpose combined podium planter and balustrade, as well as provide an optimal growing medium for plants.

The proposed design will include the following:

1. Planting media mix type 1 to be in accordance with AS4419 with a volume sufficient to ensure the long term health and vigour of all plants. The planting media shall be: - max 500mm depth - mounded to max 1:4 grade

2. Planting media mix type 2 to be in accordance with AS4419.

3. Inspection opening - 100 dia PVC pipe with cap and installed at max 10m centres at 150mm from planter edge.

4. Planting as specified - refer plans and plant schedule.

5. Organic mulch composition as recommended by an AIH registered horticulturlist and to include organic materials that decompose over time and provide an organic substrate for soil biology.

6. Planter wall to future architect/engineer's detail.

7. Water proofing membrane to all planter surfaces in accordance with future structural engineers advice.

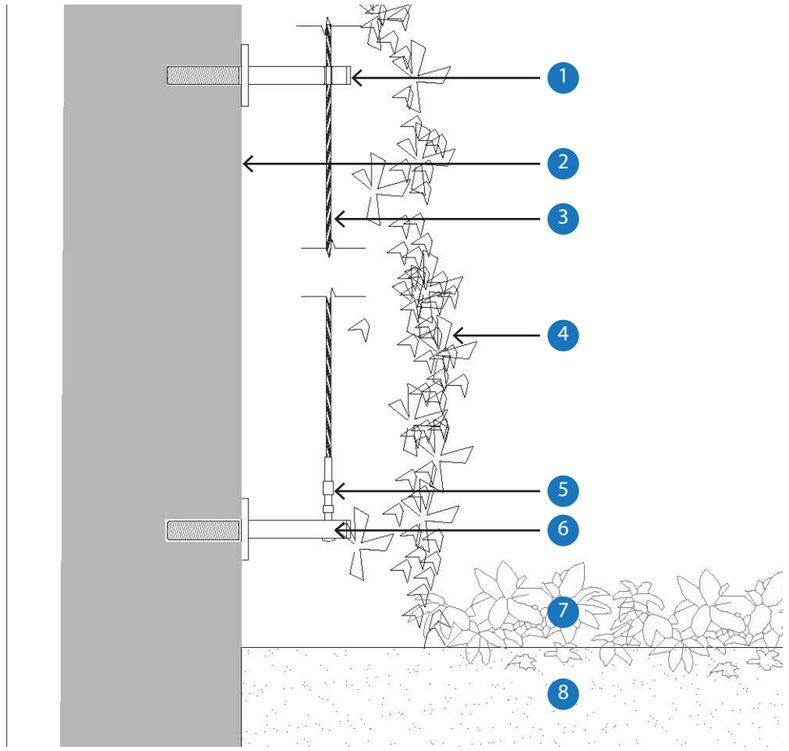
8. Atlantis or Elmich drainage cell or equivalent installed as per manufacturer's instructions.

9.Geotextile layer to future structural engineers detail between sand layer and drainage cell.

10. Min 100mm thick layer of washed course river sand.

APPENDIX B

TRELLIS DETAIL 1:5



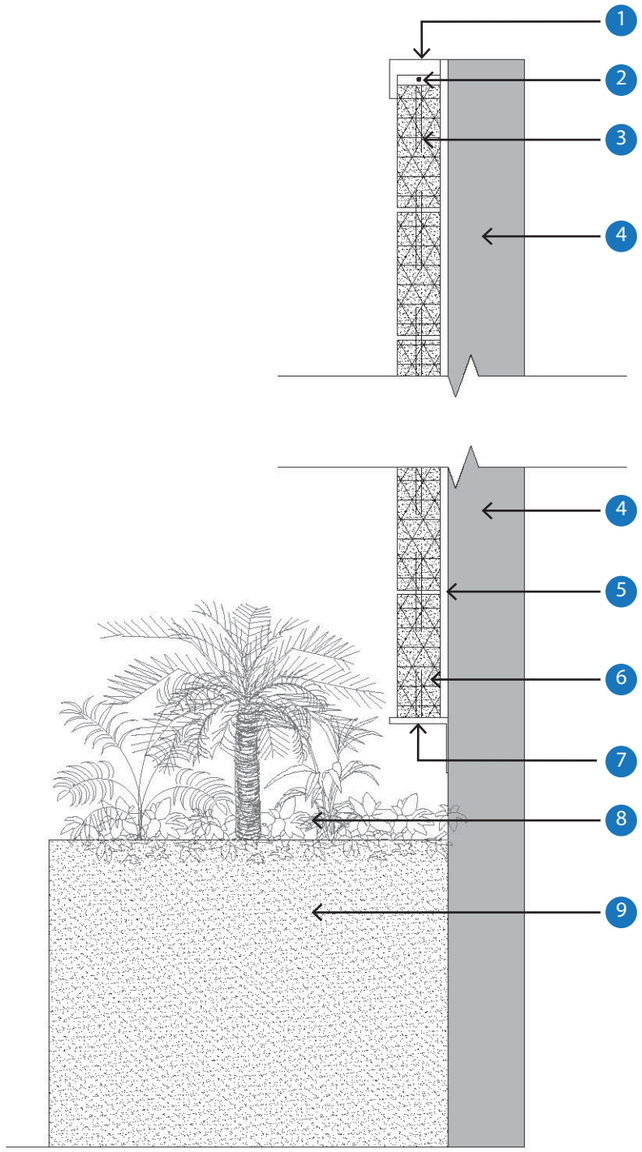
This detail is indicative only and is subject to further design development and co-ordination with a qualified contractor and installer.

The proposed design will include the following:

1. Spacer bar and ground plate, chemset into wall
2. Face of architectural wall
3. Cable trellis system
4. Climber species as specified
5. Termination system
6. Spacer bar and ground plate, chemset into wall
7. Podium planter species as specified
8. Podium planter refer Appendix A

APPENDIX C

GREEN WALL DETAIL 1:10



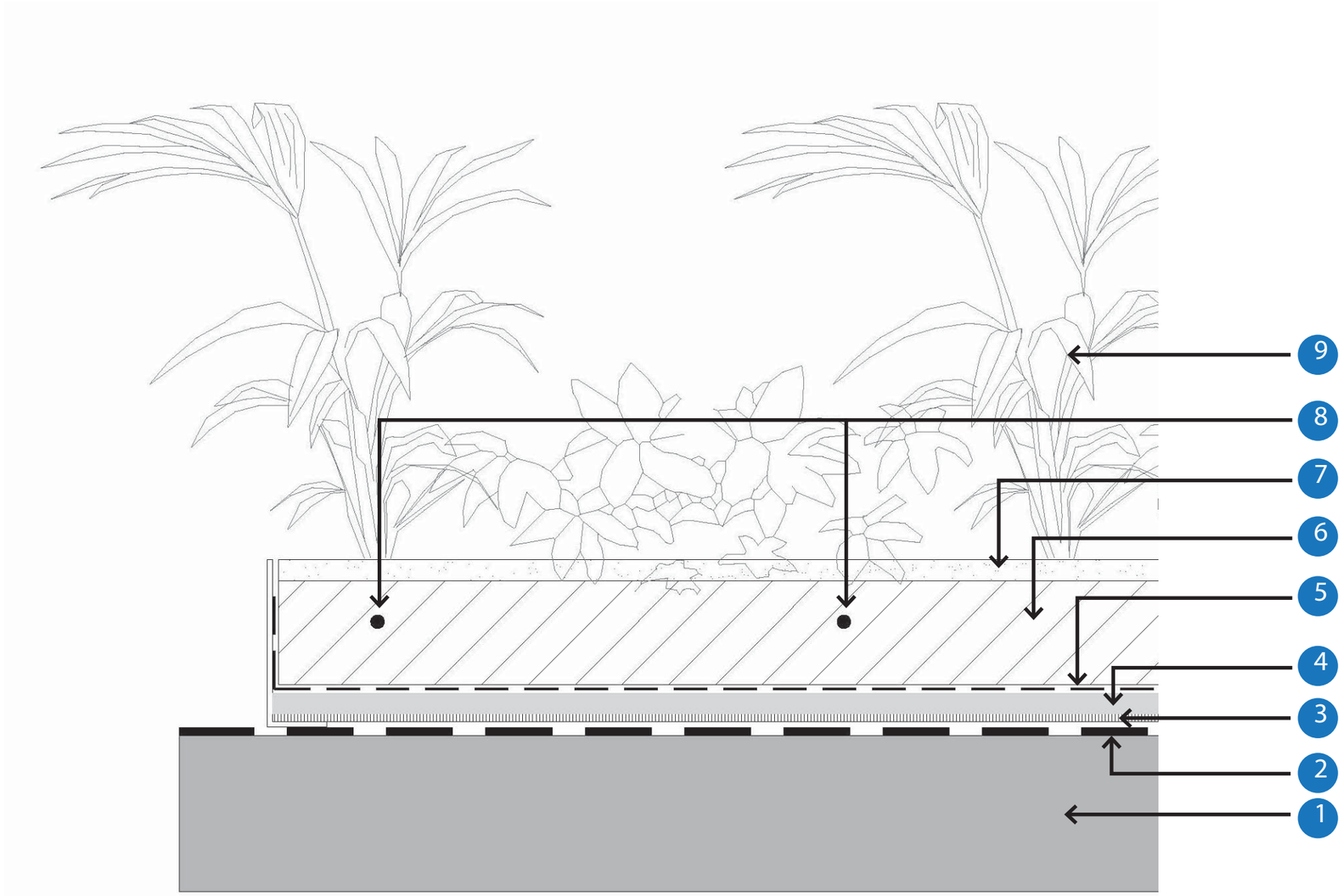
This detail is indicative only and is subject to further design development and co-ordination with a qualified green wall contractor.

The proposed design will include the following:

1. Capping
2. Irrigation drip line
3. Irrigation to back of system
4. Architectural wall
5. Support bracket fixed to architectural wall
6. Greenwall panel
7. Lower support bracket
8. Podium planting species as specified
9. Podium planter refer Appendix A

APPENDIX D

GREEN ROOF DETAIL 1:5



This detail is indicative only and is subject to further design development and co-ordination with a qualified green roof contractor.

The proposed design will include the following:

1. Roof to architect's detail

2. Waterproofing

3. Waterproofing protection

4. Drainage cell - 20mm depth

5. Geofabric

6. Growing medium - 100mm depth soil mix to be confirmed by green roof contractor

7. Gravel mulch - 20mm depth

8. Subsurface drip irrigation

9. Green roof planting as specified

ENV Solutions

Engineering the Future

ACID SULPHATE SOIL MANAGEMENT PLAN

Proposed Development

137 and 139 Jonson St & 3 Browning St, Byron Bay
(Lot 21 DP 247289, Lot 5 DP 758207, Lot 6 DP 758207)

For:

JGD Developments

June 2017

Environmental Engineering Solutions
ENV Solutions Pty Ltd ABN 46856079490
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Ballina NSW 2478
0421519354

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Figure 5 ASS Plan 26

Executive Summary

ENV Solutions Pty Ltd (ENV) has been commissioned by JGD Developments to prepare an Acid Sulphate Management Plan (ASSMP) for the proposed development located at 137 and 139 Jonson St & 3 Browning St, Byron Bay (Lot 21 DP 247289, Lot 5 DP 758207, Lot 6 DP 758207) (Figure 2). The proposed development includes an excavation down to approximately -2 m AHD for a double-storey underground car park.

The site is mapped as Class 3 and 5 Acid Sulphate Soils by the Byron Shire Council (Figure 5), which means that works below the ground surface and dewatering operations trigger the need for an ASSMP.

As part of preparing this ASSMP, soil samples were retrieved from the subject property to depths from the ground surface to 7.0 m. Actual Acid Sulfate Soils (AASS) and Potential Acid Sulphate Soils (PASS) were identified. Results from earlier investigations undertaken by Australian Soil and Concrete Testing (ASCT) in 2017 were also reviewed. Based on both investigations and in accordance with the Acid Sulfate Soil Assessment guidelines (ASSMAC (1998)), soil excavated from below ground level will require a maximum liming rate of 8.1 kg/tonne of fine agricultural lime to neutralise the Net Acidity found. Given these levels of treatment required, validation of neutralisation effectiveness will be required.

From the design information available from JGD Developments, it is understood that approximately 21,000 m^3 of soil may be disturbed and will require treatment during the construction process.

It is recommended that reuse of treated acid sulfate soils occurs on the source site wherever possible. For the proposal site, this is not possible, as the excavated soil will be surplus to the development. Liming treatment will be required if soils are benefically re-used off-site as fill materials, or if the soils are disposed to landfill in NSW. This ASSMP has been prepared to address these two managenent options. The soil may also be transported interstate to QLD without prior liming treatment. These options should be reviewed to asertain the most cost effective treatment / disposal method.

Movement of treated ASS to another site is is not permissable under the Virgin Excvated Natural Material (VENM) or Excavated Natural Material (ENM) beneficial reuse guidelines unless a specific exemption for benefical use is granted by the Environment Protection Authority (EPA). ENV is currently preparing an application for this exemption separately, to assist with the review of managenent options.

1 Introduction

Acid Sulphate Soil (ASS) is the common name given to soils containing iron sulphides. When exposed to oxygen through lowering of surrounding groundwater or excavation, air drawn into the soils can cause oxidation of the iron sulphides producing sulphuric acid.

ASS typically occur in low-lying coastal areas. Runoff from exposed ASS areas may find its way to stormwater, groundwater and eventually into natural aquatic environments. The acidic runoff may lower the pH of receiving waters, increase the concentration of metals and reduce the natural buffering capacity of the receiving waters.

There are two basic types of ASS: Actual Acid Sulphate Soils (AASS) and Potential Acid Sulphate Soils (PASS). AASS are soils that have already been oxidised. Hence AASS environments may be acidic, but have low potential for further acid generation. PASS are soils that have not yet been oxidized (i.e. they contain oxidisable sulphur). AASS and PASS can coexist.

In anaerobic conditions (such as below the watertable), PASS do not pose an environmental threat, however if conditions change (such as during dewatering, excavation or drought), the sulphides can oxidise and form sulphuric acid. Developments involving excavation or dewatering must establish the presence and extent of ASS down the soil profile, as works may intercept ASS horizons and pose risks to both human and ecological health.

1.1 Scope

This Acid Sulphate Soils Management Plan (ASSMP) has been prepared by ENV Solutions (ENV) for the proposed development located at 137 and 139 Johnson St & 3 Browning St, Byron Bay (Lot 21 DP 247289, Lot 5 DP 758207 and Lot 6 DP 758207) (Figure 2).

The ASSMP sets out the works and management procedures to be adopted during the construction of the proposed development (Figure 3).

Table 1:Laboratory results from ASCT soil investigations (EAL 2017)

Sample Number	Sample Location	Depth (m)	Texture	pH_{KCl}	Titratable Actual Acidity (TAA) (mole H^+/tonne)	ASSMAC AASS Action Criteria[1] (mole H^+/tonne)	Reduced Inorganic Sulfur (%S_{cr})	ASSMAC AASS Action Criteria[1] (%S_{cr})	Net Acidity (based on %S_{cr})	Acidic Soil Action Criteria[1] (mole H^+/tonne)	Acid Sulfate Potential	Liming Rate (kg $CaCO_3$/tonne DW^2)
1	**BH-1**	**0.0**	**Medium**	**4.83**	**33**	**18**	**0.006**	**>0.03**	**37**	**18**	**PASS**	**2.7**
2	**BH-1**	**1.0**	**“**	**4.36**	**52**	**18**	**<0.005**	**>0.03**	**52**	**18**	**PASS**	**3.9**
3	**BH-1**	**1.5**	**”**	**4.17**	**71**	**18**	**<0.005**	**>0.03**	**71**	**18**	**PASS**	**5.3**
4	**BH-2**	**0.0**	**“**	**4.18**	**103**	**18**	**0.008**	**>0.03**	**108**	**18**	**PASS**	**8.1**
5	**BH-2**	**1.0**	**“**	**4.82**	**20**	**18**	**0.028**	**>0.03**	**38**	**18**	**PASS**	**2.8**
6	BH-2	2.0	Coarse	5.00	14	18	<0.005	>0.03	14	18		1.0
7	**BH-2**	**2.5**	**”**	**5.04**	**15**	**18**	**0.006**	**>0.03**	**19**	**18**	**PASS**	**1.4**
8	**BH-2**	**3.5**	**“**	**5.10**	**14**	**18**	**0.006**	**>0.03**	**18**	**18**	**PASS**	**1.3**
9	BH-2	4.0	”	5.24	13	18	0.007	>0.03	17	18		1.3
10	**BH-3**	**0.5**	**Medium**	**4.02**	**86**	**18**	**<0.005**	**>0.03**	**86**	**18**	**PASS**	**6.4**

Table 2: Laboratory results from ENV soil investigations (EAL 2017)

Sample Number	Sample Location	Depth (m)	Texture	Initial pH_F water	pH_{FOX} peroxide	pH_F - pH_{FOX}	pH_{KCl}	Titratable Actual Acidity (TAA) (mole H^+/tonne)	ASSMAC AASS Action Criteria[1] (mole H^+/tonne)	Reduced Inorganic Sulfur (%S_{cr})	ASSMAC AASS Action Criteria[1] (%S_{cr})	Net Acidity (based on %S_{cr})	Acidic Soil Action Criteria[1] (mole H^+/tonne)	Acid Sulfate Potential	Liming Rate (kg $CaCO_3$/tonne DW^2)
1	BH-1	0.5	Medium	4.31	3.19	1.12								PASS	
2	**BH-1**	**1.0**	**Medium**	**4.82**	**3.63**	**1.19**	**4.26**	**42**	**18**	**0.012**	**>0.03**	**48**	**18**	**PASS**	**3.6**
3	**BH-1**	**1.5**	**Medium**	**4.78**	**3.63**	**1.15**	**4.18**	**48**	**18**	**0.015**	**>0.03**	**54**	**18**	**PASS**	**4.1**
4	BH-1	2.0	Medium	4.78	3.65	1.13								PASS	
5	BH-1	2.5	Medium	4.85	3.85	1								PASS	
6	BH-1	3.0	Medium	4.96	4.15	0.81									
7	BH-1	3.5	Medium	4.90	3.80	1.1								PASS	
8	**BH-1**	**4.0**	**Medium**	**4.96**	**3.82**	**1.14**	**4.44**	**35**	**18**	**0.010**	**>0.03**	**42**	**18**	**PASS**	**3.2**
9	BH-1	4.5	Medium	4.95	3.84	1.11								PASS	
10	BH-1	5.0	Medium	5.04	4.20	0.84									
11	BH-1	5.5	Medium	5.09	4.02	1.07								PASS	
12	BH-1	6.0	Medium	5.03	4.05	0.98									
13	BH-1	6.5	Medium	5.09	4.11	0.98									
14	BH-1	7.0	Medium	5.14	4.02	1.12								PASS	

[1]Action criteria taken from the ASSMAC guidelines and is based on more than 1000 tonnes of soil to be disturbed.
[2]DW – Dry Weight.

- Non-PASS if → pHf – pHfox < 1.0 and pHf > 4.0
- Non-AASS → pHf > 4.0
- **Possible PASS if → 5 < pHfox > 3, or pHf – pHfox > 1.0**
- PASS very likely if → pHfox < 3.0, or pHf – pHfox > 1.5
- AASS present if → pHf < 4.0

2 Existing Site Conditions

The site occupies an approximate area of 2800 m^2 which is currently three seperate residential dwellings. The proposed development is within the Byron Bay levee system so the surface runoff travels north-west, ultimately into the Belongil Creek. The site is situated at the edge of areas affected by the 1:100 year ARI flood event, however the site is not susceptible to flooding (see Figure 4).

Historically the site was used for gravel extraction purposes.

It is understood that the subsurface is non-uniform consisting of silty sands, silts , silty clays and gravels ranging between fine and coarse texture.

2.1 Results of Acid Sulfate Soil Investigation

The results of two acid sulphate soil investigations conducted by Australian Soil and Concrete Testing (ASCT) and ENV in 2017 are summarised in Table 1 and Table2 below. A figure showing the approximate location of the ASCT investigations is provided in Attachment 1. The borehole (BH1/MW1) drilled by ENV was situated on the western portion of 139 Jonson Street (refer Figure 2).

The laboratory analysis for the investigation undertaken by ASCT shows that samples 1-5 and 10 have a TAA above the ASSMAC (1998) action criterion for >1,000 tonnes disturbed. Samples 1-5, 7, 8 and 10 also had net acidity results that exceed the ASSMAC (1998) action criterion of 18 mole H+/tonne for >1,000 tonnes disturbed.

The laboratory analysis for the investigation undertaken by ENV shows that samples 2, 3 and 8 have a TAA and net acidity above the ASSMAC (1998) action criterion for >1,000 tonnes disturbed. Field testing indicated that samples 1-5, 7-9, 11 and 14 also possibly contain PASS.

The laboratory results indicate that more than half of the samples analysed contain Potential Acid Sulfate Soils which if they are disturbed, may generate sulfuric acid and may present an environmental hazard. Management of these soils will be required if disturbed during civil or construction works proposed in the development.

The laboratory analysis has also determined a liming application rate (with a safety factor of 1.5) based on the results of laboratory testing. The recommended liming rate is up to 8.1 kg CaCo3 (lime)/t of soil which is based on the treatment of the ‘worst case’ potential acid sulfate soils detected in the two investigations.

3 Environmental Responsibilities and Roles

JGD Developments is responsible for ensuring that the principal contractor implements the management requirements of this ASSMP. This contractor will have responsibility for ensuring that all employees, subcontractors and persons involved with the proposed works are familiar with the requirements of the ASSMP.

Determining and implementing management for other environmental aspects associated with the works at the proposed development site, including but not limited to erosion and sediment control, and stormwater management, is the responsibility of JGD Developments and is to be addressed in the Environmental Management Plan prepared by the principal contractor. This ASSMP does not address environmental impact and mitigation measures associated with other environmental aspects of the project.

A copy of this ASSMP and the Environmental Management Plan must be kept by JGD Developments and a copy must also be kept by the principal contractor onsite and accessible to all site personnel at all times.

Successful implementation of this ASSMP relies upon support from and compliance by all involved parties. Such responsibilities are detailed below.

3.1 JGD Developments' Appointed Project Manager

- Review and monitor environmental performance at regular worksite meetings.
- Required to be notified of any major environmental incidents and review the management procedures in place to deal with such occurrences.
- Monitor non-compliance and review management procedures if problem persists.
- Ensure that appropriate and adequate resources are allocated to allow for effective implementation and maintenance of the ASSMP.

3.2 Principal Contractor's Site Supervisor/Foreman

- Facilitate the reporting of incidents that may impact on the surrounding environment.
- Manage remediation actions to correct incidents of environmental non-compliance.
- Ensure that all staff are aware of and understand their responsibilities under the ASSMP.
- Identify any environmental training requirements.

3.3 Principal Contractor's Environment Officer

- Provide guidance and advice to staff with regard to ASS management requirements.
- Monitor statutory requirements and ensure compliance.
- Where necessary, coordinate and/or assist in the response to environmental incidents.
- Maintain records of treatment, including verification testing of treated soils.
- Report all incidents with the potential to cause serious environmental harm to the JGD Developments' Project Manager and where necessary, to the EPA.
- Should the principal contractor wish, ENV Solutions can assist with this role.

4 Management of ASS

4.1 Relevant Objectives

The objectives that are relevant to ASS management include:

- to minimise the potential for inappropriate material handling through accurate identification of ASS;
- to manage ASS material so that the potential for environmental harm is minimised;
- to minimise lowering of the groundwater, due to dewatering, in areas containing PASS (note: this will not be possible for the proposed development);
- to minimise the potential for adverse environmental impact due to handling, storage and application of hazardous materials related to the treatment of ASS; and
- to ensure awareness of all personnel involved in the works at the proposed development of the requirements of this ASSMP and its objectives and management, particularly those aspects relevant to the individual.

4.2 Targets & Performance Indicators

The targets that are relevant to management of ASS include:

- ASS material has been identified;
- excavation and/or filling to occur only in those areas where disturbance is absolutely necessary;
- no residual sulfide acidity is present following full oxidation of disturbed ASS i.e. appropriate treatment of excavated ASS confirmed by collection and analysis of verification samples;
- confirmation that any containment measures (i.e. bunds) are intact and impermeable and that records be kept of effectiveness and augmentation of these facilities;
- during and after works, the physical parameters, including pH of groundwater, are not to significantly vary or fall below the values that exist onsite, prior to the works commencing;
- groundwater level is maintained above PASS during and after works, where possible;
- confirmation that collected groundwater and surface water meets relevant criteria and/or existing characteristics prior to discharge (to the receiving environment) – refer to the Dewatering Management Plan (DMP);
- confirmation that handling and storage of hazardous materials is undertaken in accordance with relevant legislation and that records are kept of said handling and storage; and
- all personnel involved in the works have undertaken appropriate training for their role in the project with regards to management of ASS.

4.3 Summary of Works

The main work activities identified that could potentially lead to disturbance of soils are:

- demolition works;
- excavation for the proposed underground car park;
- excavation for foundations, footings and piling spoil; and
- excavation for installation of underground services (e.g. sewer line, electrical services and stormwater drainage pipes).

In an effort to reduce the risk of exposure and subsequent oxidation of these materials, this ASSMP has been prepared to provide management guidelines and mitigation practices that are to be incorporated as a part of the proposed works. It has been assumed that the total disturbance of acid sulfate material will be approximately 21,000 m^3.

5 Dewatering/Groundwater Extraction

5.1 Dewatering

Dewatering should be avoided where possible to ensure that AASS and PASS within the site and on adjacent properties are not exposed to oxygen during the construction phase of this project. Exposure to oxygen, even for a short period of time, can result in the continued oxidisation of pyrite (FeS_2) through the exchange of electrons between Fe^{2+} and Fe^{3+}. This reaction, which can produce sulfuric acid (H_2SO_4), can continue in the absence of oxygen (re-saturated sediments) resulting in the same environmental impact as could be expected should the materials be exposed to the atmosphere.

Due to the depth of the excavation required for the proposed development, it is expected that dewatering will be necessary. Where dewatering is required, the area within which excavation is to be completed should be isolated using piling. The DMP has proposed that contiguous piles be constructed to facilitate dewatering. The zone within the isolated zone can then be dewatered as required with less impact expected on the surrounding materials. Shoring, such as sheet piling, may be required even if dewatering is not to occur, as the sediments to be excavated may have little strength and may be saturated.

5.2 Groundwater Extraction

Any groundwater that is extracted from the excavations should be treated in accordance with the requirements of the DMP.

6 Neutralisation Treatment of Excavated Sediment

6.1 Excavation

All material excavated during the subdivision is to be placed within the treatment area specified by the principal contractor. At the time of preparing this ASSMP, the total estimated volume of soil to be excavated was approximately 21,000 m^3. This section of the ASSMP discusses the options for neutralisation of the material excavated from the proposed development site.

It is anticipated that dewatering will be required during construction stages. The area to be dewatered should be isolated using shoring, such as contiguous piles, after appropriate geotechnical evaluation is undertaken. The zone within the piled area can then be dewatered with less impact expected on the surrounding materials and adjacent structures.

6.2 Treatment Area

Material should be moved to the treatment area within 24 hours of exposure. As part of earthworks, soil requiring neutralisation will be placed in maximum 200 m^3 (bulked volume) stockpiles on the treatment pad.

Prior to commencement of excavation, the treatment area must be appropriately constructed to intercept any material that may cause environmental harm to the surrounding environments (e.g. acid leachate collection systems and sediment traps around the treatment pad). Due to the limited size of the site and the need to excavate the majority of soils from within the site boundaries, consideration must be taken to the location and size of the treatment area. Multiple treatment areas may be required for different portions of the excavation to allow for onsite treatment and validation before removal.

6.2.1 Leachate Capture

The entire liming pad (treatment area) is to be constructed with a perimeter bund wall, no less than 400 mm high and no less than 500 mm wide. The bund wall should be constructed using fine-grained and non-dispersive material (clay) and should be compacted to be as impermeable as possible. The leachate collection point should be constructed as a sump that is of sufficient size to store a Q_{10} storm event (1:10 year ARI).

It may be more efficient and effective to have a sump of limited size that is fitted with a pump with a float trigger. Water would then be pumped from the smaller (concrete pit style) sump to a portable plastic water tank. This tank could then be emptied by a wastewater contractor or the water treated and released in accordance with the site Environmental Management Plan.

6.2.2 Leachate Treatment

Water and leachate collected in the sump should be monitored using a calibrated pH meter prior to the commencement of work, and following the completion of work, each day for 14-21 days. All pH measurements should be recorded.

Should water in the sump have a pH falling outside the ANZECC & ARMCANZ (2000) trigger value appropriate for the receiving watercourse, the water should be buffered using an accepted chemical neutralisation agent, (commonly superfine agricultural lime). Additional treatment may be required where other parameters such as turbidity (high iron “floc”) exceeded the trigger values.

Standard application rates for the treatment of water and leachate are presented in Table 3. The table indicates the amount of neutralising agent required to raise the pH of the water to neutral. For example, if the leachate has low salinity and a pH of 3.5, 16 kg of Aglime would be required to neutralise 1ML of water.

Table 3: Neutralisation rates for leachate

Water pH	H+ (mol/L)	H+ (mol/ML)	Aglime to Neutralise 1 ML	Hydrated Lime to Neutralise 1 ML	Sodium Bicarbonate to Neutralise 1 ML
			Kilograms Required		
0.5	0.316	316228	15824	11716	26574
1.0	0.1	100000	5004	3705	8403
1.5	0.032	31623	1582	1172	2657
2.0	0.01	10000	500	371	840
2.5	0.0032	3162	158	117	266
3.0	0.001	1000	50	37	84
3.5	0.00032	316	16	12	27
4.0	0.0001	100	5	4	8.4
4.5	0.000032	32	1.6	1.17	2.66
5.0	0.00001	10	0.5	0.37	0.84
5.5	0.0000032	3.2	0.16	0.12	0.27
6.0	0.000001	1.0	0.05	0.037	0.08
6.5	0.00000032	0.3	0.016	0.012	0.027

Source: State Planning Policy 2/02 Guideline: Acid Sulfate Soils, Department of Natural Resources and Mines, Brisbane, 2004.

Table 3 has been provided as a guide only. Depending on the chemistry of the water, additional neutralising agent may be required to obtain a pH of 7. Regular pH testing of the water should also be undertaken to monitor changes in pH during any dosing operations.

6.2.3 Liming Pad

Prior to the commencement of excavation, a liming pad (treatment area) should be constructed in an area that is not to be disturbed during the excavation and filling processes. If this is not possible, the treatment area may need to be relocated as excavation works progress. A graphical representation of a treatment pad is provided as Figure 1.

Basic Design

The liming pad should be constructed so the base of the pad is composed of compacted fine-grained material so as to produce as impermeable foundation as possible. Ideally, a clay liner, no less than 300 mm thick, should be placed on the base of the pad if the pad is to be used to treat the entire volume of excavated material. The base of the pad should slope gently (2 – 5%) so as to allow water/leachate to drain to a designated collection point. A leachate collection system, as described above, should be constructed.

Guard Layer

The base of the liming pad should be dusted with AgLime at a rate determined using the following equation:

Guard layer (kg/m^2) = 0.2 x thickness of layer to be treated (m) x average liming rate (kg/tonne).

For excavations at the proposed development, the guard-layer liming rate was calculated to be 0.486 kg/m^2 for a 0.30 m thick layer (based on the liming rate of 8.1 kg/ tonne).

The AgLime for the guard layer should be spread using a lime/fertilizer spreader (tractor-towed) to ensure the base of the pad is evenly covered, prior to the placement of the material requiring treatment.

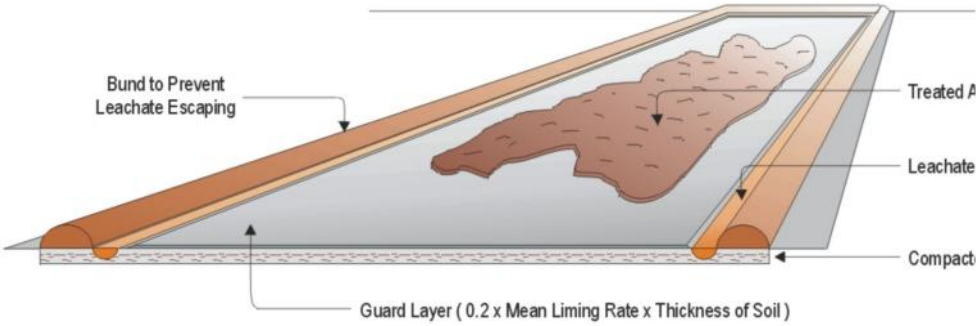


Figure 1:Treatment Pad Design

6.3 Application Rates for Neutralising Agent

Based on the laboratory analyses completed on samples from the two ASS investigations conducted to date (by ASCT and ENV), a nominal liming rate has been adopted for all material excavated. A safety factor of 1.5 has been applied to the liming rate to minimise the risk that any areas with excessive PASS or AASS will cause harm to the surrounding environment. **The liming rate for excavated material is:**

- **8.1 kg AgLime[1]/tonne of sediment.**

All material excavated should be treated using the specified liming rate. If a variation from the liming rate is proposed, further field investigations will be required. If sub-surface conditions vary significantly from those observed during the previous investigation, including any indications of contamination, excavations should stop and qualified personnel should be engaged to assess the site conditions, including laboratory testing to confirm the concentrations of any contaminants observed.

6.4 Mixing of Neutralising Agent

The materials to be treated should be placed on the liming pad in a layer no greater than 300 mm in thickness. Ideally, the soils/sediments should be allowed to partially dry prior to attempting to mix the neutralising agent. If the soils are too moist, the neutralising agent will not be evenly distributed throughout the soils and pockets of AgLime and untreated sediment will form within the stockpile. If this occurs, the soils will not self-neutralise when acidic leachate develops.

There are several ways to mix the neutralising agent into the materials to be treated, all of which have positive and negative aspects. Common mixing methods are described in Table 4.

Table 4: Mixing methods.

Method	Positive Factors	Negative Factors
Tractor-towed disc plough	◗ Allows thorough mixing of AgLime and constant turning of soil to ensure AgLime distribution is even. ◗ Works well on dry soils.	◗ Requires a tractor, which may have no other use on site. ◗ Can require relatively large areas to enable treatment, as tractor will require turning space.
Rubber tyred vehicles	◗ Able to utilise any idle machinery to drive over the AgLime/soil mixture to mix materials together.	◗ Often results in pockets of lime forming in the soils.

[1] AgLime is the most common neutralising agent. Other neutralising agents are available, however AgLime is considered to be the most cost-effective and user-friendly material.

Method	Positive Factors	Negative Factors
Excavator	◗ Can utilise idle excavators to mix AgLime with soils. ◗ Works well on moist/wet soils.	◗ Requires specialised (longer) teeth to allow soils to be ripped deeply, allowing lime to be mixed more thoroughly. ◗ Can result in the formation of lime pockets in the soils.
Grader	◗ Can utilise idle machinery on site. ◗ Allows some churning of soil/AgLime mix by inclining blade and using tines.	◗ Can result in pockets of lime developing. ◗ Can result in damage to low permeability liner beneath the liming pad.
Pug Mill	◗ Allows high lime dosage rates. ◗ Guaranteed thorough mixing of neutralising material and soil.	◗ Additional plant required at high mobilisation cost.

The most efficient and effective method of mixing neutralising agents, from those listed above, is the tractor-towed disc-plough. Provided the soils are dry to moist, the disc plough is ideal, however should water be present and the soils comprised of cohesive material (clays), the excavator is likely to be more efficient (however not as effective) in mixing the neutralising agent through the soils.

No less than three (3) passes will be required to mix the neutralising agent through the soil. The effectiveness of the mixing process is contingent on the methodology of mixing.

6.5 Short Term Exposure

Table 5: Indicative maximum periods for short-term stockpiling of untreated ASS

Type of Material		Duration of stockpiling		
Texture range	**Approx clay content (%)**	**Days**		**Hours**
Coarse texture Sands to loamy sands	≤ 5	Overnight	or	18 hours
Medium texture Sandy loams to light clays	5-40	2½ days	or	70 hours
Fine texture Medium to heavy clays and silty clays	≥ 40	2½ days	or	70 hours

Source: Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines, Department of Natural Resources and Mines, Brisbane, 2014.

Table 5 presents information regarding the short-term stockpiling of soils within the treatment area without liming for neutralisation.

The *in situ* walls of the excavation should also be dusted with lime to ensure any acid generated during the period of exposure can be neutralised (refer below).

6.6 *In-Situ* Treatment/Lime Dusting of Exposed Surfaces

If left untreated after excavation, the exposed ASS in the excavations may oxidise over time, causing an acidic environment. In addition, any acid produced during exposure may corrode concrete and other structures constructed within the excavations. It is therefore critically important to neutralise the exposed surfaces (base and walls) of the excavations, to minimise drying out and reduce the potential for ASS and/or PASS to produce acid leachate. Dusting of exposed surfaces should be carried out at a rate of not less than 1kg/m^2 of fine Aglime.

6.7 Waste Tracking

Waste tracking must be undertaken by the contractor and provided in a final report to JGD Developments, as per requirements outlined in Section 8.

7 Validation

7.1 Environmental Testing

The principal contractor will be responsible for ensuring that the validation sampling and analysis is conducted by a suitably qualified person, and in a manner that will demonstrate, with acceptable confidence, that sufficient AgLime has been mixed into the ASS, to provide an adequate buffer, such that the material meets the criteria set out in Table 6.

Validation sampling locations will be selected, as approved by the Site Supervisor/Foreman, such that a representative distribution for sample locations is achieved for the treated soil.

Validation sampling and analysis will be undertaken at a frequency that will demonstrate that satisfactory neutralisation has taken place. The frequency of soil validation sampling and analysis will be:

- 1 sample per 100 m^3 of remediated soil.

7.1.1 Sampling Technique

A suitably qualified Engineer/Scientist shall collect ten representative sub-samples to produce one (1) representative (composite) sample from each 100 m^3 stockpile, in accordance with the following requirements:

- approximately 250 g of soil must be collected from 10 representative locations, evenly distributed through the 100 m^3 stockpile; and
- where the soil is cohesive, the sample must be homogenised in a large stainless bowl, or equivalent, and a representative sample taken from the homogenised material.

7.1.2 Laboratory Analysis

SPOCAS testing (by third party NATA approved Laboratory) must be undertaken on all material that has been treated. Southern Cross University's Environmental Analysis Laboratory (EAL) can perform the required testing.

7.2 Validation Reporting

The principal contractor is responsible for ensuring that a suitably qualified Engineer/Scientist prepares two (2) copies of an ASS Neutralisation Certification Report ("ASSNCR") suitable for submission to Byron Shire Council and the EPA. The report will demonstrate that the excavated soil has been sufficiently neutralised and meets the criteria presented in Table 6.

The ASSNCR will include, but not be limited to, the following information:

- Summary table of analytical results for each soil stockpile and the results of validation analysis;
- Plan of earthworks stockpile locations, showing:
  - Sample identification numbers
  - Location of validation sampling.

By submitting the ASSNCR to the Superintendent for review, the contractor is deemed to be stating to the Superintendent that all information presented in the ASSNCR is true and accurate and that the remediation and validation of the ASS soils is of sufficient quality that the contractor is certifying that remediation, as defined under the contract, has been satisfactorily completed.

If the Superintendent considers that the ASSNCR does not provide sufficient evidence to demonstrate that satisfactory remediation has been achieved, or is of unsatisfactory quality, the Superintendent shall notify the contractor in writing, outlining the deficiencies in the ASSNCR and any corrective actions to be undertaken before approval by the Superintendent will be further considered. The contractor must immediately undertake such corrective action to the ASSNCR. The cost of such corrective action will be borne by the contractor.

7.3 Neutralisation Criteria

The criteria presented in Table 6 will be used to ensure that the excavated material has been sufficiently neutralised.

Table 6: Action limits for treatment of AASS and PASS

Soil Texture	Clay Content %	< 1000 Tonnes Disturbed		> 1000 Tonnes Disturbed	
		Sulfur Content %	Acid Trail mol/tonne	Sulfur Content %	Acid Trail mol/tonne
Coarse (sand & gravel)	< 5	0.03	18	0.03	18
Medium (sandy loam - light clay)	5 - 40	0.06	36		
Fine (medium to heavy clays, silty clays)	> 40	0.10	62		

Where the TPA (TSA), and SPOS results meet the action criteria presented in Table 6, the material will be considered to have been sufficiently neutralised.

Where the TPA (TSA), and SPOS results do not meet the action criteria presented in Table 6, additional neutralisation of the soil will be required.

8 Waste Traceability

All work under the Contract shall be subdivided into distinct work lots or work items. Work lots or work items shall be chosen by the Contractor, consistent with any specified requirements, but shall be subject to approval by the Superintendent.

Each work lot or work item shall be assigned a unique identification number, and the Contractor shall maintain a register of all allocated work lot or work item numbers. This register shall contain as a minimum, the following information:

- Brief description of the work lot or work item;
- Location reference (3 dimensional where applicable); and
- Lot or item status (ASS conforming or non-conforming).

The Contractor shall ensure that traceability is maintained throughout all documented records under this Contract. All test results, where applicable under this Contract, shall be positively identified with their respective work lot or work item number. The Contractor shall notify the Superintendent in writing 24 hours prior to commencing a new work lot or work item.

The Contractor will be responsible for implementing a traceability programme for neutralisation and off-site transport of the material. The documentation will contain, but not limited, to the following information:

- Truck registration
- Truck driver
- Date and time of departure from site
- Date and time of arrival at the disposal or beneficial re-use site
- Source of material (stockpile)
- Estimated volume of material transported.

Clear records of movements of excavated material to the treatment pads (source and destination), *in-situ* treatment details (AgLime volumes and application times) and disposal/reuse destinations are to be kept. Details of dewatering volumes, water quality, and disposal/reinjection destinations and volumes are to be kept (note; all requirements relating to dewatering are presented in the DMP). Table 7 provides an example of how the records could be tabulated.

Table 7: Example of a Record of Movement

Label	Date	Volume m^3	Location	Disposal Location A	Treatment Date	Volume of Aglime required	pH field testing	Testing Date	Result[1]	Disposal Location B	Disposal Location B
Vol A	5-6-06	150	Channel Ch 0-40	Treatment Pad	7-6-06	160 kg/tonne = 45,600 kg	pH_f = 6.5 pH_{fox} = 6.0	7-6-06	12-6-06 Acceptable (refer lab results)	12-6-04	Existing Drain Ch 0 to Ch 50, 3 m below surface level.
Vol B	6-6-06	330	Channel Ch 40-80	Treatment Pad	8-6-06	220 kg/tonne = 139,940 kg	pH_f = 5.5 pH_{fox} = 5.0	8-6-05	13-6-06 Failed	-	-
					14-6-06	120 kg/tonne = 45,240 kg	pH_f = 6.5 pH_{fox} = 6.0	14-6-06	19-6-06 Acceptable (refer lab results)	19-6-06	Existing Drain Ch 50 to Ch 120, 3 m below surface level.
Vol C	7-6-05	120	Table Drain	Lemura Quarry	NA	NA	NA	25-5-06	27-5-06 Sent to Lemura	NA	NA
Vol D	9-6-05	NA	Existing Drain Ch 20 - Ch 60	*In-situ* guard layer	9-6-06	80 kg/m^3 = 4,800 kg	NA	NA	NA	NA	NA

9 Off-Site Management of Treated Excavated Materials

All off-site management of ASS must be undertaken in accordance with the NSW EPA Waste Classification Guidelines Part 4: Acid Sulfate Soils, and other applicable EPA guidance documents.

It is not possible to beneficially re-use AASS or PASS as VENM or ENM off-site. This means that all treated excavated material will need to disposed of as waste to a nominated landfill, or beneficially re-used as fill material off-site under a specific exemption granted by EPA in accordance with the NSW Resource Recovery framework. Application for a specific exemption is being undertaken separately by ENV. If this application is approved by EPA, the treated excavated material will be transported to the approved receiving site and used as engineered fill. Movement of the treated excavated material to another site is not permissible unless the application for a specific exemption for beneficial reuse is granted by the EPA.

If the application is not approved, or it is considered more cost-effective to dispose of the material to landfill, it can be disposed to a suitably licensed landfill facility. Alternatively, off-site transport to a suitably licensed interstate facility may be possible without prior treatment, as described in this ASSMP.

These options should be reviewed to ascertain the most cost effective treatment and/or disposal method.

10 References

ANZECC and ARMCANZ (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

Ahern, C.R, Stone, Y, Blunden, B (1998) *Acid Sulfate Soils Assessment Guidelines*, Acid Sulfate Soils Management Advisory Committee, Wollongbar, NSW.

Ahern, C.R., Ahern, M.R., Powell, B., (QASSIT), October 1998, *Guidelines for Sampling and Analysis of Lowland Acid Sulfate Soils (ASS) in Queensland – Version 4.0*, Department of Natural Resources and Mines, Brisbane.

Dear, S.E., Moore, N.G., Dobos, S.K., Watling, K.M., Fahl, D., (QASSIT), September 2004, *Queensland Acid Sulfate Soil Technical Manual, Legislation and Policy Guide – Version 2.2,* Department of Natural Resources and Mines, Indooroopilly.

NSW EPA (2014). Waste Classification Guidelines - Part 4: Acid Sulfate Soils, NSW Environmental Protection Authority (EPA).

White, I. And Melville, M.D. (1993). *Treatment and Containment of Potential Acid Sulfate Soils- Formation, Distribution, Properties and Management of Potential Acid Sulfate Soils*. Consultants Report to the Roads and Traffic Authority.

11 Scope and Limits of Acid Sulfate Assessment

This report includes the results of an Acid Sulfate Assessment prepared for the purpose of this commission. The data and advice provided herein relate only to the project and structures described herein and must be reviewed by a competent engineer/scientist before being used for any other purpose. JGD Developments accepts no responsibility for other use of the data.

Where drill hole or test pit logs, laboratory tests, geophysical test and similar work have been performed and recorded by subcontractors or others the data is included and used in the form provided by others. The responsibility for the accuracy of such data remains with the issuing authority, not with JGD Developments.

The advice tendered in this report is based on information obtained from the assessment locations, tests points and sample points and is not warranted in respect to the conditions that may be encountered across the site at other than these locations. It is emphasised that the actual characteristics of the subsurface materials may vary significantly between adjacent test points and sample intervals and at locations other than where observations, explorations and investigations have been made. Subsurface conditions, including groundwater levels and contaminant concentrations can change in a limited time. This should be borne in mind when assessing the data.

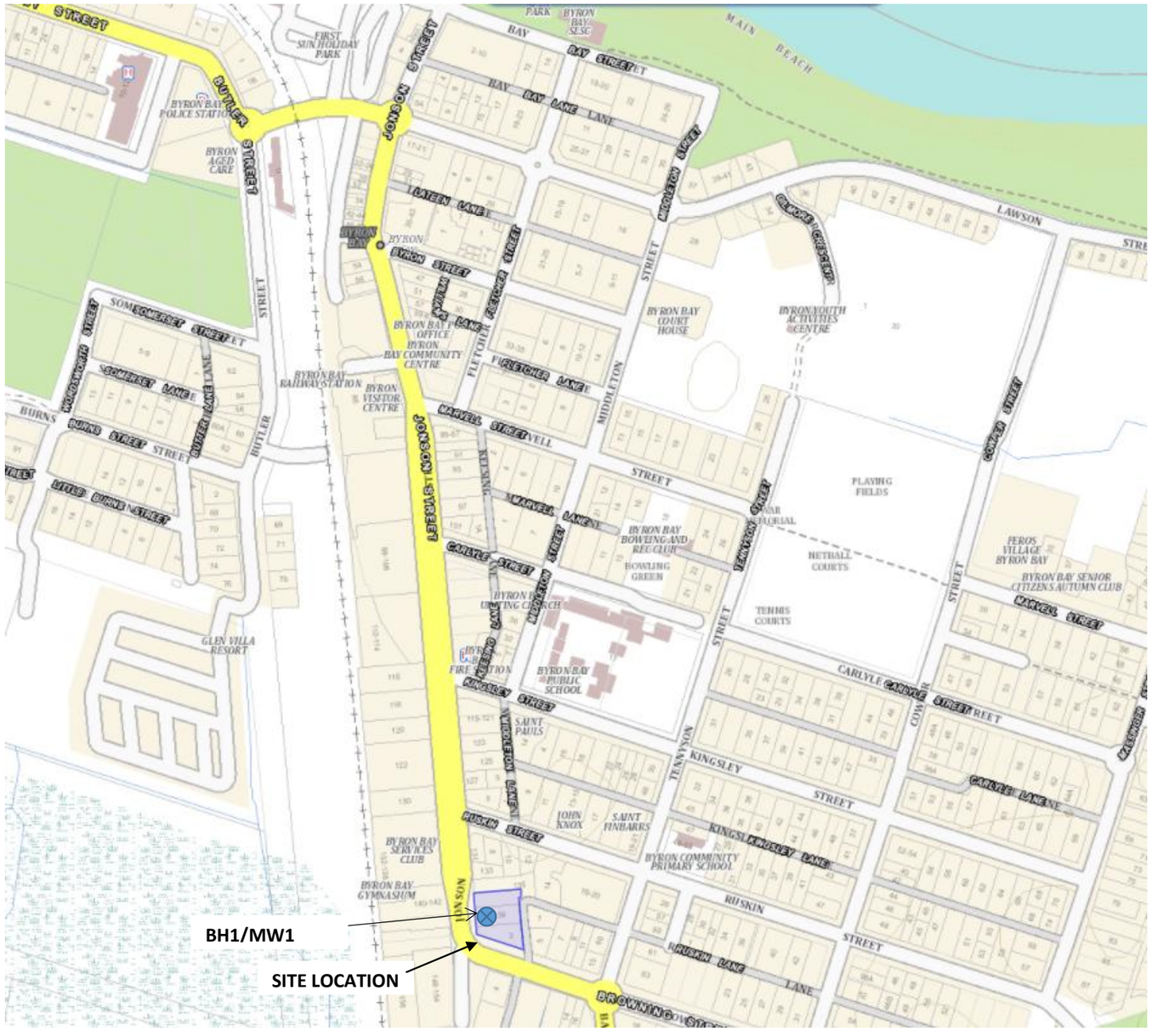
It should be noted that because of the inherent uncertainties in subsurface evaluations, changed or unanticipated subsurface conditions might occur that could affect total project cost and/or execution. JGD Developments does not accept responsibility of the consequences of significant variances in the conditions and the requirements for execution of the work.

During remediation or subsequent investigations the subsurface and surface earthworks and excavations should be examined by a suitably qualified and experienced Engineer/Scientist who shall judge whether the revealed conditions accord with both the assumptions in this report and/or the design of the remediation works. If they do not accord, the Engineer/Scientist shall modify the advice in this report and/or design of the works to accord with the circumstances that are revealed.

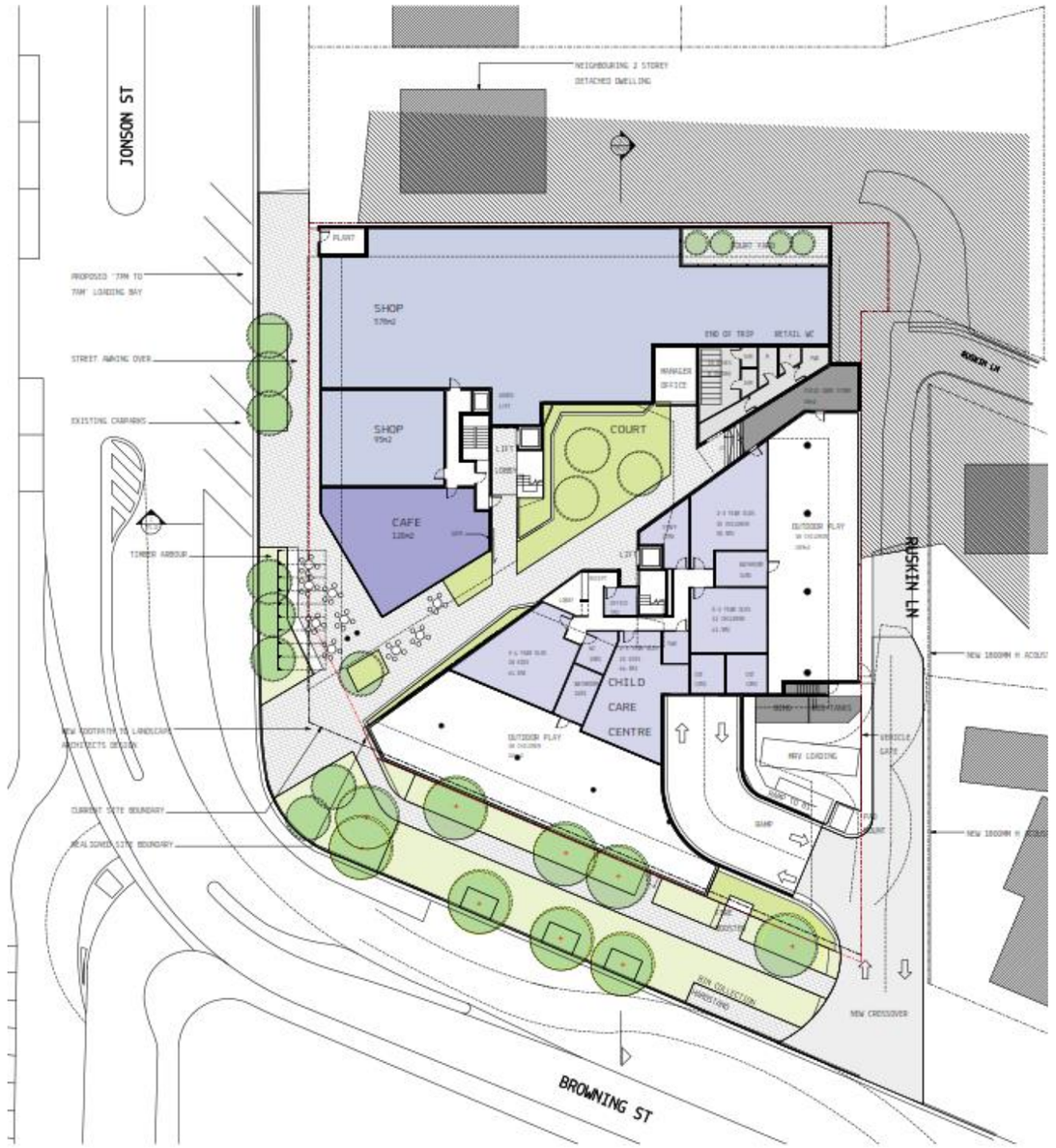
An understanding of the subsurface site conditions depends on the integration of many pieces of information, some regional, some site specific, some structure specific and some experience based. Hence this report should not be altered, amended or abbreviated, issued in part or issued incomplete in any way without prior checking and approval by JGD Developments. JGD Developments accepts no responsibility for any circumstances, which arise from the issue of the report, which has been modified in any way as outlined above.

12 Figures

Figure 2 **Site Location Plan**
Figure 3 **Site Plan**
Figure 4 **Flood Plan**
Figure 5 **ASS Plan**

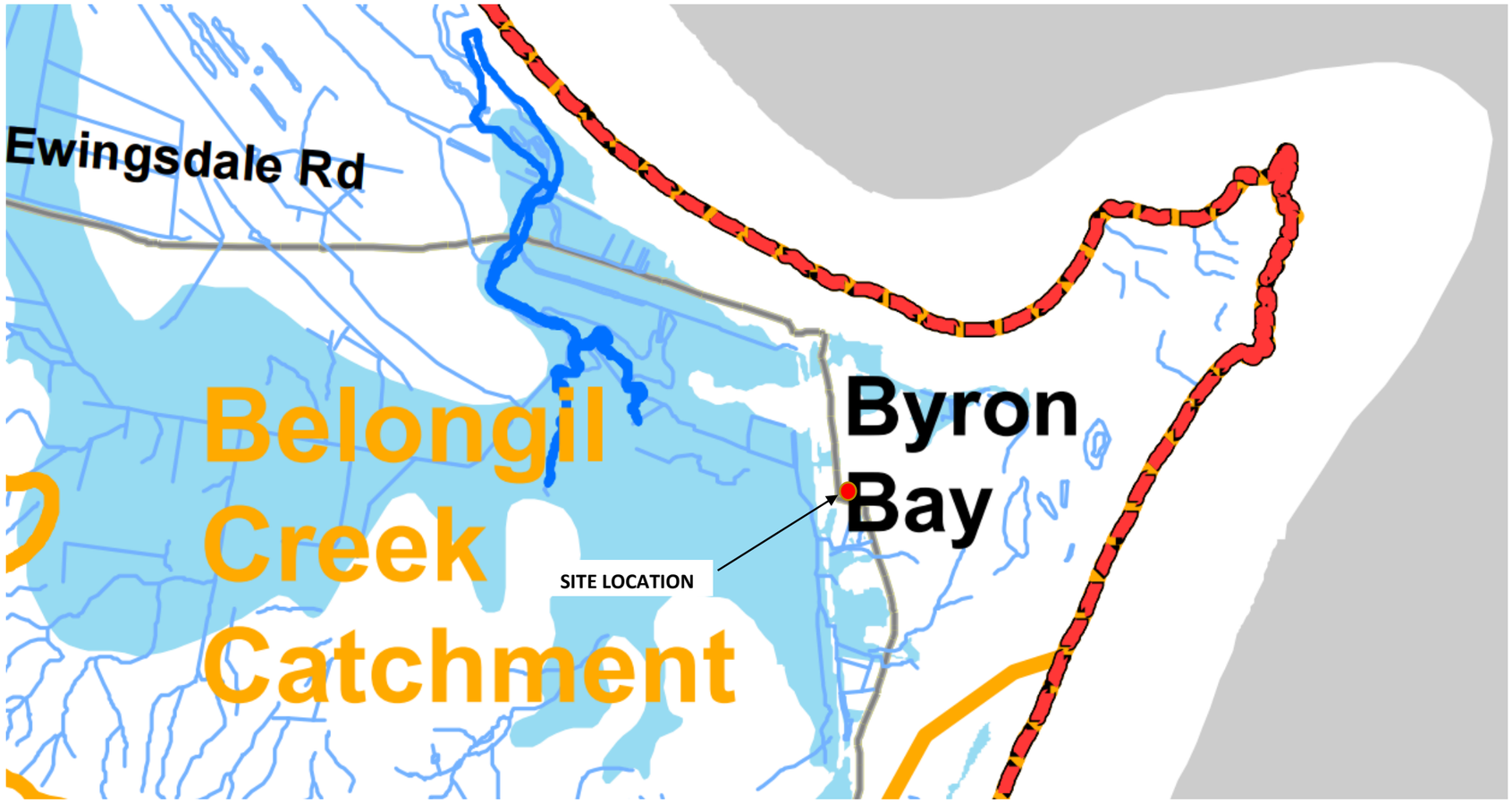


ENV Solutions Environmental Engineering Solutions	Ph: 0421 519 354 Email: james@envsolutions.com.au Mail: PO Box 248 Ballina, NSW 2478	**Figure 2 – Site Location**	Client: JGD Developments Pty Ltd Site: Jonson & Browning St, Byron Bay, NSW 2481	Not to scale. Illustration only. Background aerial imagery from Sixmaps (image dated 2012).
	Job No.: 16330 Project: Byron ASSMP		Date: 7/06/2017 By: Ollie Fick	

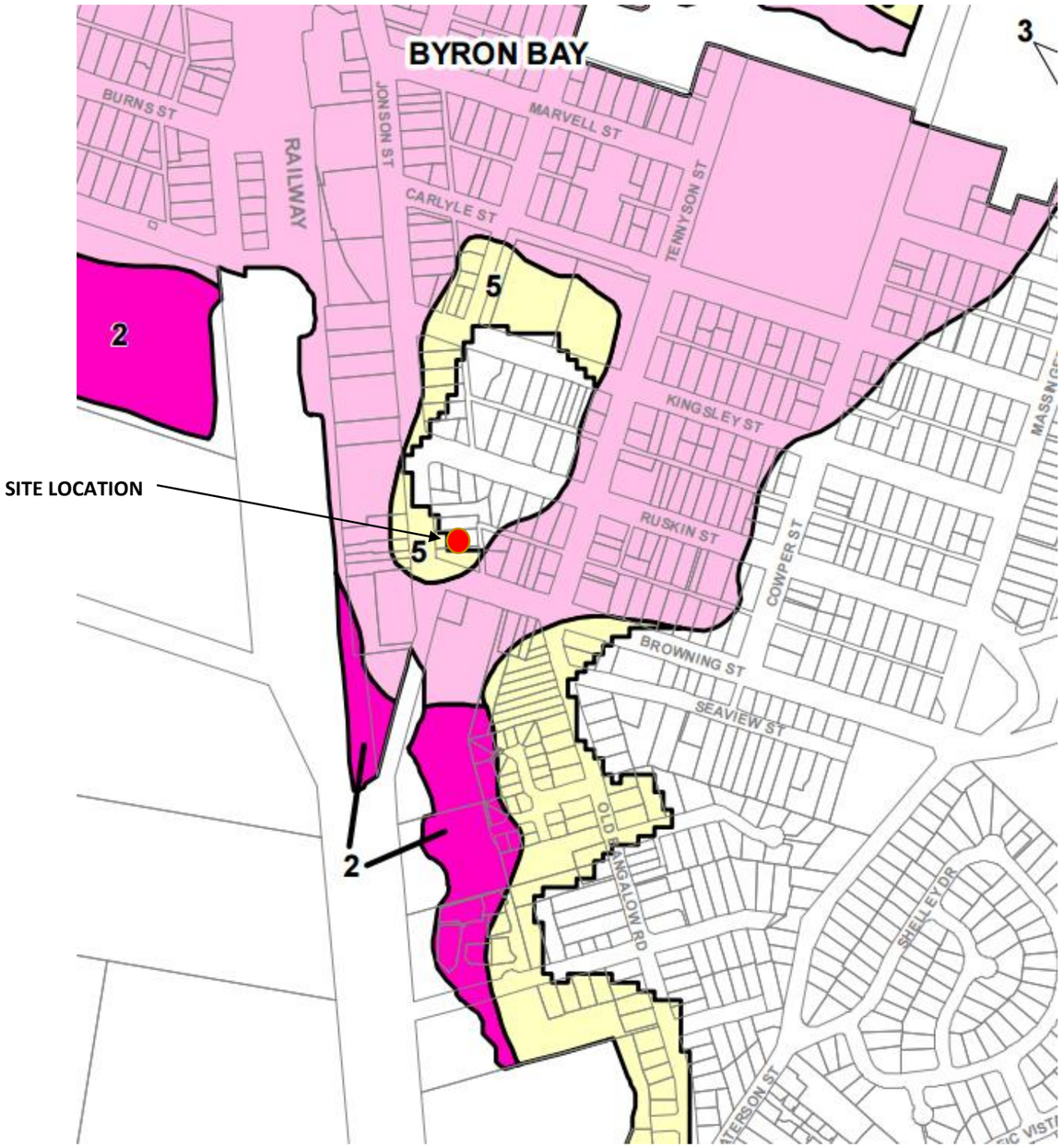


ENV Solutions Environmental Engineering Solutions	Ph: 0421 519 354 Email: james@envsolutions.com.au Mail: PO Box 248 Ballina, NSW 2478 Job No.: 16330 Project: Byron – ASSMP	**Figure 3 – Proposed Site Plan**	Client: JGD Developments Pty Ltd Site: Jonson & Browning St, Byron Bay, NSW 2481 Date: 7/06/2017 By: Ollie Fick	Not to scale. Illustration only. From: Myers Ellyett (image dated 2017).

1:100 ARI Flood Map



ENV Solutions Environmental Engineering Solutions	Ph: 0421 519 354 Email: james@envsolutions.com.au Mail: PO Box 248 Ballina, NSW 2478 Job No.: 16330 Project: Byron – ASSMP	**Figure 4 – Flood Management Map.**	Client: JGD Developments Pty Ltd Site: Jonson & Browning St, Byron Bay, NSW 2481 Date: 7/06/2017 By: Ollie Fick	Not to scale. Illustration only. Background aerial imagery from Byron Shire Council.



Acid Sulfate Soils

1	Class 1
2	Class 2
3	Class 3
4	Class 4
5	Class 5

ENV Solutions
Environmental Engineering Solutions

Ph: 0421 519 354
Email: james@envsolutions.com.au
Mail: PO Box 248 Ballina, NSW 2478

Job No.: 16330
Project: Byron – ASSMP

Figure 5 – Acid Sulphate Map.

Client: JGD Developments Pty Ltd
Site: Jonson & Browning St, Byron Bay, NSW 2481

Date: 7/06/2017
By: Ollie Fick

Not to scale. Illustration only.

Background aerial imagery from Byron Shire Council.

14 Attachments

Attachment 1 ASCT Acid Sulfate Soils Investigation

Attachment 2 NSW Waste Classification Guidelines Part 4: ASS

ATTACHMENT 1

ASCT Acid Sulfate Soils Investigation

AUSTRALIAN SOIL AND CONCRETE TESTING

PO Box 5120
Ballina Mail Centre, Ballina NSW 2478
17 De-Havilland Crescent, Ballina NSW 2478

Telephone: (02) 6681 1516
Mob: 0402 876 868
A.B.N. 92 602 346 127

ASCT Doc. No. R60 Rev. 00 – 24/06/15

Acid Sulfate Soil Investigation

For

Proposed Residential Development

At

137-139 Jonson Street & 3 Browning Street,

Byron Bay NSW 2481

Prepared For

JGD Developments Pty Ltd

Reference Number: H17-0003-ASS

14th February 2017

NATA
ACCREDITED FOR TECHNICAL COMPETENCE

Engineering, Geotechnical & Environmental Consultant & Technical Service
Laboratory and Field Testing Services for Soil, Rock and Aggregate
Concrete Instrumentation for Civil Engineering Projects

14th February 2017

Reference No: H17-0003-ASS

JGD Developments Pty Ltd

Acid Sulfate Soil Report
For: Proposed Residential Development
At: 137-139 Jonson Street and 3 Browning Street, Byron Bay, NSW 2481.

Introduction
Australian Soil and Concrete Testing (ASCT) have undertaken an acid sulfate soil (ASS) investigation for a proposed residential development at 137-139 and 3 Browning Street Byron Bay, NSW. This report presents the results of the acid sulfate soil investigation.

The Investigation
Three boreholes were drilled in the proposed building envelope at the site on the 23rd January 2017, the location of the boreholes is displayed in figure 1. The boreholes were drilled to a depth of 1.4m, 2.0m and 4.0m, soil samples were collected from each 0.5m depth interval.

The soil at the site generally consists of silty sands/ silts/ silty clays natural and a summary of the subsurface soil conditions found at the site is displayed in table 1 below. The complete soil borehole logs are contained in the geotechnical report compiled by ASCT (ref: H17-0003 dated 11/2/17).

Table 1: Summary of subsurface soil conditions at the site.

Sample Location	Material Description	Depth (m)
Borehole 1	Silty Sand: Brown	0.0
"	Silt: White Brown	0.5
"	Silt: Red White	1.0
"	Silt: White Red	1.5
"	Silt: Red White	2.0
Borehole 2	Silty Clay: Brown	0.0
"	Sand: Pale Brown Grey	0.5
"	Sand: Pale Brown Grey	1.0
"	Sandy Silty Clay: Grey	1.5
"	Sand: Grey Brown	2.0
"	Sand: Grey Brown	2.5
"	Sand: Grey Brown	3.0
"	Sand: Grey Brown	3.5
"	Sand: Grey Brown	4.0
Borehole 3	Silty Gravelly Clay: Dark Brown	0.1

Field Testing
The soil samples were tested for field pH (pH_f) and field peroxide pH (pH_{fox}) in accordance with the Acid Sulfate Soil Management Advisory Committee (ASSMAC, 1998) test method codes 21Af and 21Bf respectively. The field test results are displayed in table 2 and they indicate the site may contain acid sulfate soil (ASS) or acidic soil.

Table 2: Field Testing Results

Sample Number	Sample Source	Sample Description	Sample Depth (m)	Field pH (pH_f)	Field Peroxide pH (pH_{fox})	($pH_f - pH_{fox}$)	Acid Sulfate* Indication
1	Borehole 1	Silty Sand: Brown	0.0	5.09	2.59	2.5	Very Likely
2	"	Silt: White Brown	0.5	4.77	3.60	1.17	Very Likely
3	"	Silt: Red White	1.0	4.74	3.86	0.88	Possible
4	"	Silt: White Red	1.5	4.82	4.16	0.66	Possible
5	"	Silt: Red White	2.0	4.63	3.91	0.72	Possible
6	Borehole 2	Silty Clay: Brown	0.0	4.87	2.27	2.6	Very likely
7	"	Sand: Pale Brown Grey	0.5	4.57	2.77	1.73	Very Likely
8	"	Sand: Pale Brown Grey	1.0	5.11	2.88	2.23	Very Likely
9	"	Sandy Silty Clay: Grey	1.5	4.80	3.72	1.08	Very Likely
10	"	Sand: Grey Brown	2.0	4.57	3.49	1.08	Very Likely
11	"	Sand: Grey Brown	2.5	4.67	3.53	1.14	Very Likely
12	"	Sand: Grey Brown	3.0	4.59	3.67	0.92	Possible
13	"	Sand: Grey Brown	3.5	4.69	3.58	1.11	Very Likely
14	"	Sand: Grey Brown	4.0	4.77	3.52	1.25	Very Likely
15	Borehole 3	Silty Gravelly Clay: Dark Brown	0.1	4.69	2.95	1.74	Very Likely

* Indications of potential acid sulfate soil (PASS) and actual acid sulfate soil (AASS) are based on the ASSMAC guidelines and are determined as follows:

- Non-PASS if → $pH_f - pH_{fox} < 1.0$ and $pH_f > 4.0$
- Non-AASS → $pH_f > 4.0$
- Possible PASS if → $5 < pH_{fox} > 3$, or $pH_f - pH_{fox} > 1.0$
- PASS very likely if → $pH_{fox} < 3.0$, or $pH_f - pH_{fox} > 1.5$
- AASS present if → $pH_f < 4.0$

The field peroxide test is only an indicative test that is used to guide the selection of laboratory test samples. Care must be taken when interpreting the reaction as organic matter and other constituents such as manganese oxide can also cause a reaction.

Laboratory Testing

On the basis of field testing the most reactive soil sample (sample 1) from 0.5m below the ground surface was submitted to the Environmental Analysis Laboratory (EAL, Lismore) for analysis of % chromium reducible sulfur ($\%S_{cr}$), titratable actual acidity (TAA), net acidity and liming rate. A summary of the laboratory results are displayed in table 3 and the complete results have been included in appendix A of this report. Furthermore, the chain of custody documentation for the laboratory testing has been included in Appendix B.

The laboratory results are based on the following:

- **Non-Actual Acid Sulfate Soils** (Non-AASS) – Laboratory testing indicates these soils have a TAA and reduced inorganic sulfur ($\%S_{crs}$) below the ASSMAC action criteria and are not considered to present an environmental hazard.
- **Non-Potential Acid Sulfate Soils** (Non-PASS) – Laboratory testing indicates these soils have reduced inorganic sulfur ($\%S_{cr}$) below the ASSMAC action criteria and are not considered to present an environmental hazard
- **Potential Acid Sulfate Soils** (PASS) – Laboratory testing indicates these soils have reduced inorganic sulfur ($\%S_{crs}$) above the ASSMAC action criteria they may generate sulfuric acid and may present an environmental hazard. Management of these soils will be required.
- **Actual Acid Sulfate Soils** (AASS) – Laboratory testing indicates that these soils have TAA and reduced inorganic sulfur ($\%S_{crs}$) above the ASSMAC action criteria. These soils may leach acid and will require management.
- **Acidic Soils** – Laboratory testing indicates that these soils have a net acidity (based on $\%S_{cr}$) above the ASSMAC action criteria, but they have reduced inorganic sulfur below the ASSMAC action criteria. These soils may present an environmental hazard and may require management.

Table 3: Summary of laboratory test results.

Sample Number	Sample Location	Depth (m)	Texture	Titratable Actual Acidity (TAA) (mole H^+/tonne)	ASSMAC AASS Action Criteria[1] (mole H^+/tonne)	Reduced Inorganic Sulfur (%S_{cr})	ASSMAC PASS Action Criteria[1] (%S_{cr})	Net Acidity (based on %S_{cr})	Acidic Soil Action Criteria[1] (mole H^+/tonne)	Acid Sulfate Potential	Liming Rate (kg $CaCO_3$/tonne DW[2])
1	BH-1	0.0	Medium	**33**	37	**0.006**	>0.06	**37**	37	Acidic Soils	2.7
2	"	1.0	"	**52**	37	**<0.005**	>0.06	**52**	37	Acidic Soils	3.9
3	"	1.5	"	**71**	37	**<0.005**	>0.06	**71**	37	Acidic Soils	5.3
4	BH-2	0.0	"	**103**	37	**0.008**	>0.06	**108**	37	Acidic Soils	8.1
5	"	1.0	"	**20**	37	**0.028**	>0.06	**38**	37	Acidic Soils	2.8
6	"	2.0	Coarse	**14**	19	**<0.005**	>0.03	**14**	19	Non-Actual	1.0
7	"	2.5	"	**15**	19	**0.006**	>0.03	**19**	19	Non-Actual	1.4
8	"	3.5	"	**14**	19	**0.006**	>0.03	**18**	19	Non-Actual	1.3
9	"	4.0	"	**13**	19	**0.007**	>0.03	**17**	19	Non-Actual	1.3
10	BH-3	0.5	Medium	**86**	37	**<0.005**	>0.06	**86**	37	Acidic Soils	6.4

[1] Action criteria taken from the ASSMAC guidelines and is based on less than1000 tonnes of soil to be disturbed and is also dependent on soil texture.
[2] DW – Dry Weight.

The laboratory analysis shows that samples 1-5 and 10 has a TAA and net acidity (mole H^+/tonne) where both results exceed the ASSMAC action criteria of 37 mole H^+/tonne for medium textured soil.

The laboratory analysis shows that samples 6-9 have a TAA and net acidity (mole H^+/tonne) where both results are below the ASSMAC action criteria of 19 mole H^+/tonne for Coarse textured soil.

The laboratory results indicate the samples (1-5 and 10) analysed contains mild actual acidity. This acidity may be the result of previously oxidised ASS soil or soluble aluminium and iron from other acid forming coastal processes. Soils with actual acidity are common in coastal areas of Northern NSW and based on the data available the soils investigated would be classed as “acidic” rather than “acid sulfate”.

The laboratory analysis has also determined a liming application rate (with a safety factor of 1.5) based on the results of testing. The recommended liming rate of between 2.7 and 8.1kg $CaCo_3$ (lime)/t of soil which is based on the treatment of the ‘worst case’ acidic soil detected in the investigation.

Also, the laboratory results indicate the samples (6 to 9) analysed contains Non-Actual Acid Sulfate soils and will not require treatment if disturbed or excavated.

Conclusion
Australian Soil and Concrete Testing have conducted an ASS investigation for a residential development at 137-139 Jonson Street and 3 Browning Street, Byron Bay NSW. Three boreholes were drilled across the site on 23rd January 2017 and soil samples were collected from the boreholes at 0.5m depth intervals. Each of the 0.5m depth intervals were field tested for acid sulfate (ASSMAC test method codes 21 Af and 21 Bf). The most reactive samples (sample 1,3,4,6,8,10,11,13,14 and 15) was subsequently tested in the laboratory (SPOCAS method 23 & S_{cr} Method 22B). The results of field and laboratory testing have shown the site contains mild acidic soil from the ground surface to approximately 2.0m below the ground surface. The acidic soil may present an environmental hazard and it will require treatment if it is to be disturbed or excavated for the proposed development. However, treatment of soils at the location of borehole two will not require treatment for soils disturbed 2.0m below the ground surface.

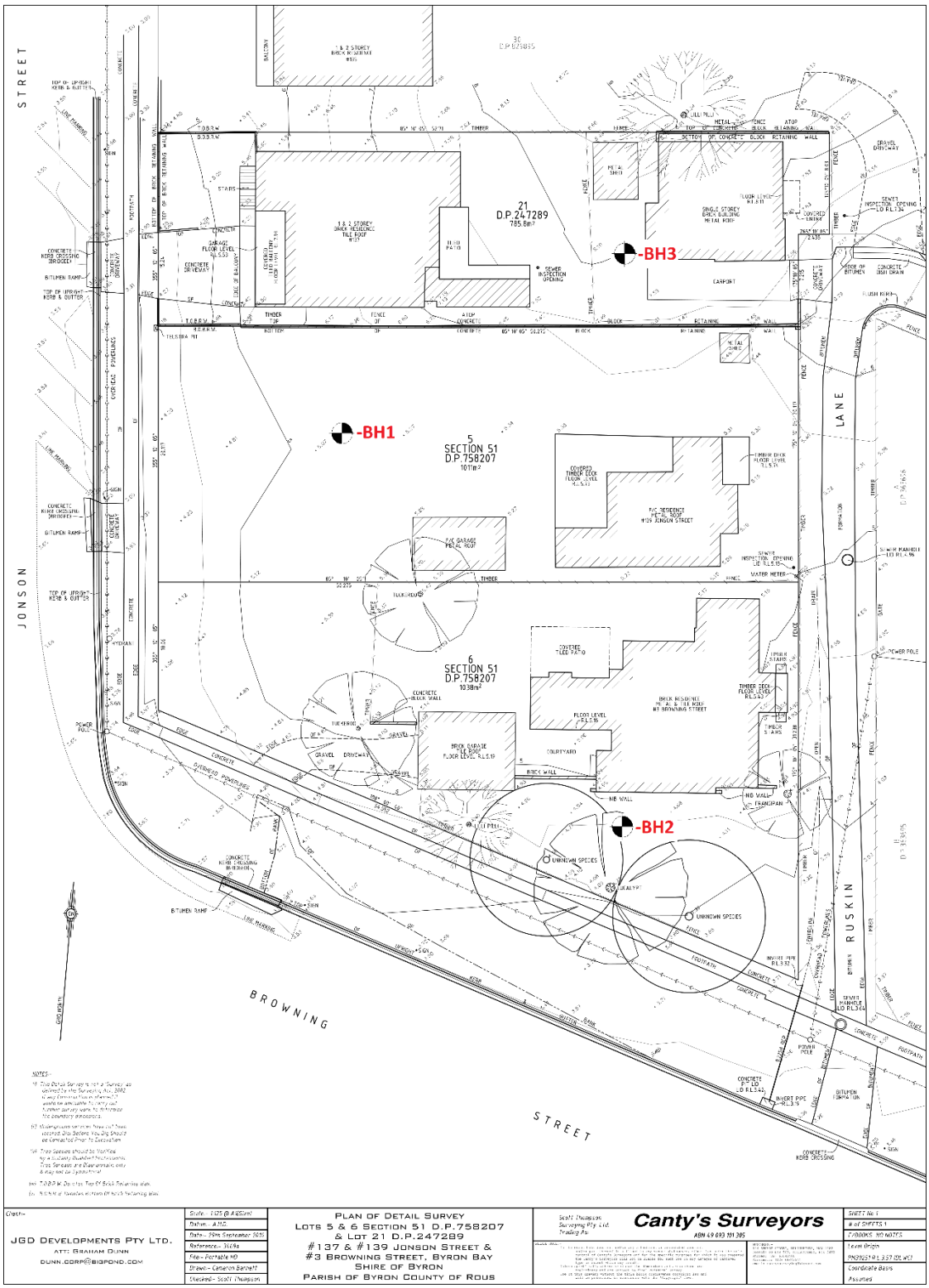
The laboratory testing also determined a lime application rate of up to 8.1 kg $CaCO_3$ (lime)/tonne of dry soil to neutralise the worst case acidic soil found at the site. **The lime neutralising agent shall be applied to the soil at the site at the calculated rate immediately upon excavation.**

Limitations
This report relies on information supplied by the client and the results of investigations conducted in accordance with accepted practices and standards. The report is intended to represent a reasonable interpretation of the appropriate legislation and the condition of the site at the time of the investigation. However, due to these elements being subject to change over time the report under no circumstances can be considered to represent the definitive state of the site at all times.

Finally, should you require any further assistance, please do not hesitate to contact our office.

Yours Faithfully,
Australian Soil and Concrete Testing

Darran Kennedy
Laboratory Manager



X – Borehole Sampling Location for ASS Investigation.

Figure 1: Plan of 137-139 Jonson Street and 3 Browning Street, Byron Bay showing the location of the acid sulfate soil sampling locations.

APPENDIX A – Results of Laboratory Soil Analysis

RESULTS OF ACID SULFATE SOIL ANALYSIS

10 samples supplied by Australian Soil and Concrete Testing on 30th January, 2017 - Lab. Job No. F6414
Analysis requested by Patrick Paynter. **Your Project: H17-0003 (G. Dunn)**

17 De Havilland Crescent, BALLINA NSW 2478

Required if pH_{KCL} <4.5

Sample Site	Depth (m)	EAL lab code	TEXTURE (note 7)	MOISTURE CONTENT (% moisture of total wet weight)	MOISTURE CONTENT (g moisture / g of oven dry soil)	TITRATABLE ACTUAL ACIDITY (TAA) pH_{KCl}	TITRATABLE ACTUAL ACIDITY (TAA) (To pH 6.5) (mole H^+/tonne)	REDUCED INORGANIC SULFUR (% chromium reducible S) (%Scr)	REDUCED INORGANIC SULFUR (% chromium reducible S) (mole H^+/tonne)	RETAINED ACIDITY (HCL extract) (as $\%S_{HCL}$ - $\%S_{KCl}$)	RETAINED ACIDITY S_{NAS} (mole H^+/tonne)	NET ACIDITY Chromium Suite mole H^+/tonne (based on %Scrs)	LIME CALCULATION Chromium Suite kg $CaCO_3$/tonne DW (includes 1.5 safety Factor when liming rate is $^+$ve)
Method Info.			**	**		*(ACTUAL ACIDITY-Method 23)*		*(POTENTIAL ACIDITY-Method 22B)*		*(RETAINED ACIDITY)*		** & note 5	** & note 4 and 6
BH1	0.0	F6414/1	Medium	17.3	0.21	4.83	33	0.006	4	..	..	37	2.7
BH1	1.0	F6414/2	Medium	14.7	0.17	4.36	52	<0.005	0	..	..	52	3.9
BH1	1.5	F6414/3	Medium	17.9	0.22	4.17	71	<0.005	0	..	..	71	5.3
BH2	0.0	F6414/4	Medium	28.5	0.40	4.18	103	0.008	5	..	..	108	8.1
BH2	1.0	F6414/5	Medium	6.8	0.07	4.82	20	0.028	17	..	..	38	2.8
BH2	2.0	F6414/6	Coarse	14.3	0.17	5.00	14	<0.005	0	..	..	14	1.0
BH2	2.5	F6414/7	Coarse	19.7	0.24	5.04	15	0.006	4	..	..	19	1.4
BH2	3.5	F6414/8	Coarse	19.7	0.25	5.10	14	0.006	4	..	..	18	1.3
BH2	4.0	F6414/9	Coarse	19.6	0.24	5.24	13	0.007	4	..	..	17	1.3
BH3	0.5	F6414/10	Medium	18.3	0.22	4.02	86	<0.005	0	..	..	86	6.4

NOTE:
1 - All analysis is Dry Weight (DW) - samples dried and ground immediately upon arrival (unless supplied dried and ground)
2 - Samples analysed by SPOCAS method 23 (ie Suspension Peroxide Oxidation Combined Acidity & sulfate) and 'Chromium Reducible Sulfur' technique (Scr - Method 22B)
3 - Methods from Ahern, CR, McElnea AE , Sullivan LA (2004). ***Acid Sulfate Soils Laboratory Methods Guidelines.*** QLD DNRME.
4 - Bulk Density is required for liming rate calculations per soil volume. Lab. Bulk Density is no longer applicable - field bulk density rings can be used and dried/ weighed in the laboratory.
5 - **ABA Equation: Net Acidity = Potential Sulfidic Acidity (ie. Scrs or Sox) + Actual Acidity + Retained Acidity - measured ANC/FF (with FF currently defaulted to 1.5)**
6 - The neutralising requirement, lime calculation, includes a 1.5 safety margin for acid neutralisation (an increased safety factor may be required in some cases)
7 - For Texture: coarse = sands to loamy sands; medium = sandy loams to light clays; fine = medium to heavy clays and silty clays
8 - .. denotes not requested or required. '0' is used for ANC and Snag calcs if TAA pH <6.5 or >4.5
9 - SCREENING, CRS, TAA and ANC are NATA accredited but other SPOCAS segments are currently not NATA accredited
10- Results at or below detection limits are replaced with '0' for calculation purposes.
11 - Projects that disturb >1000 tonnes of soil, the ≥0.03% S classification guideline would apply (refer to acid sulfate management guidelines).
12 - Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
13 ** denotes these test procedure or calculation are as yet not NATA accredited but quality control data is available

NATA
Accreditation No. 14960.
Accredited for compliance with ISO/IEC 17025.

(Classification of potential acid sulfate material if: coarse Scr≥0.03%S or 19mole H^+/t; medium Scr≥0.06%S or 37mole H^+/t; fine Scr≥0.1%S or 62mole H^+/t) - as per QUASSIT Guidelines

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked: .....
Graham Lancaster
Laboratory Manager

APPENDIX B – Chain of Custody Documentation

F6414 x 10 soil

AUSTRALIAN SOIL AND CONCRETE TESTING

ASCT Doc. No. A18 Rev. 05 - 11/1/16

Laboratory Test Program

ASCT Laboratory: BALLINA		Laboratory Acc#: 19647	
Client : G. DUNN		Project no : H17-0003	Project : 137 - 139 JONSON ST, BYRON
Location :		Requested By: ASCT	Test methods : AS PER METHOD
Sampled By : ASCT		Sample Type : SOIL	Date Sampled : 23.1.17

Lab Sample No	Sample Source	Sample Description	Depth of Sample (M)	AS-PACK 01
1	BH 1	SANDY SILT	0	
2	"	SILT	1.0	
3	"	"	1.5	
4	BH 2	SANDY SILT	0	
5	"	SAND	1.0	
6	"	"	2.0	
7	"	"	2.5	
8	"	"	3.5	
9	"	"	4.0	
10	BH 3	GRAVELLY CLAY	0.5	

Comments:

Signed: (Approved Signatory) Date: 30.1.17

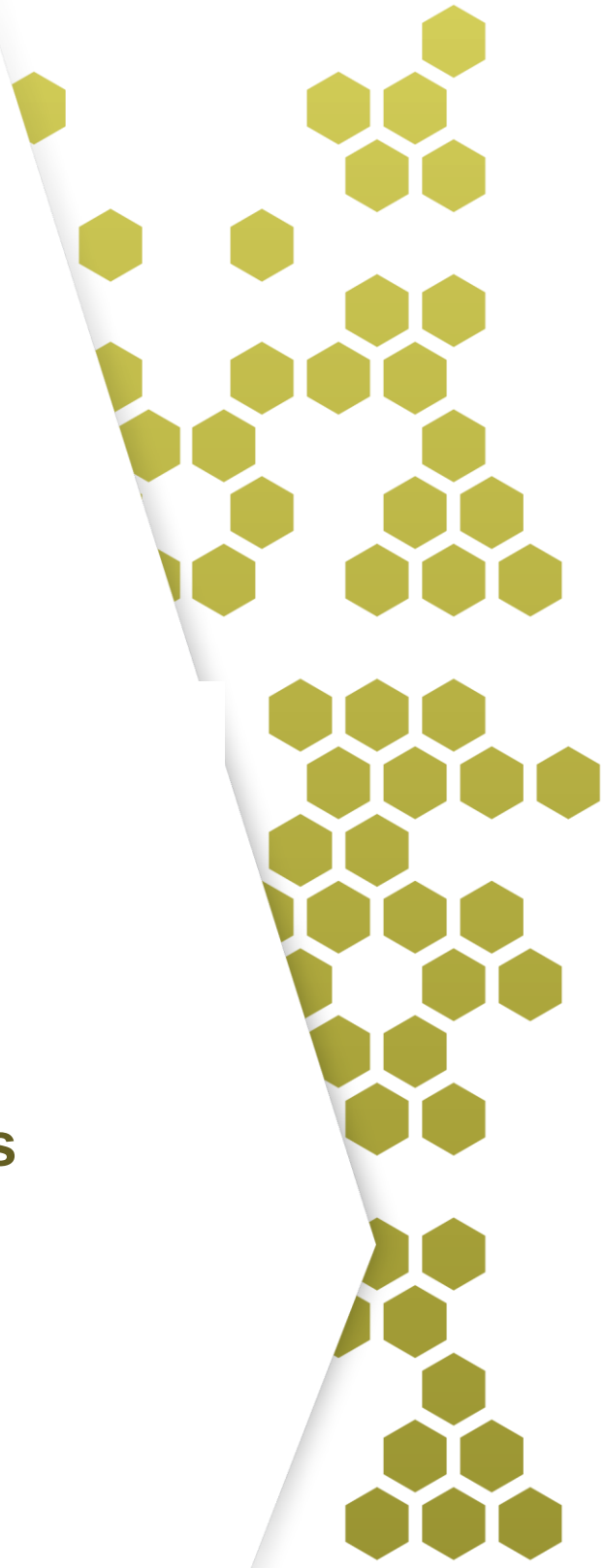
Signed: KSC (Receiving Authority) Date: 30/1/17

ATTACHMENT 2

NSW Waste Classification Guidelines Part 4: ASS

Waste classification guidelines

Part 4: Acid sulfate soils



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ISBN 978 1 74359 808 5
EPA 2014/0798

November 2014

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Disposal of potential acid sulfate soils *above* the water table 2
Actual acid sulfate soils **2**
Treatment of actual acid sulfate soils prior to disposal 2
Disposal of actual acid sulfate soils 3

Classifying wastes into groups that pose similar risks to the environment and human health facilitates their management and appropriate disposal. It is the responsibility of those who generate waste to classify that waste. To assist waste generators classify the wastes they produce, the EPA has developed the *Waste Classification Guidelines* ('the Guidelines') which are a step-by-step process for classifying waste.

Generators and waste facilities must carefully follow the procedures in these Guidelines to ensure they comply with applicable laws in classifying their waste and safeguard protection of the environment and human health.

The Guidelines are comprised of the following sections, of which this document is Part 4:

Overview of the Guidelines

Part 1: Classifying waste

Part 2: Immobilisation of waste

Part 3: Waste containing radioactive material

Part 4: Acid sulfate soils

All sections of the Guidelines are available for download from the EPA website at www.epa.nsw.gov.au/waste/classification.htm.

Introduction

Acid sulfate soils (ASS) are those naturally occurring sediments and soils which contain sulfides, mainly iron sulfide and iron disulfide or their precursors. Exposure of these sulfides in the soil to oxygen – often as a result of drainage or excavation – can produce sulfuric acid, which may have a significant impact on the environment. Leaching of sulfuric acid into waterways can cause serious water quality problems, resulting in fish kills and damage to infrastructure, such as floodgates and bridges.

ASS are most commonly found in NSW along the coast and they need to be managed appropriately to avoid major environmental damage.

The NSW *Acid Sulfate Soils Manual*[1] (the ASS Manual) provides 'best practice' guidance for planning, assessing and managing activities in areas prone to developing ASS. The manual is available from the NSW Department of Planning: phone 1300 305 695.

Using this part of the Guidelines

This part of the EPA Waste Classification Guidelines (the Guidelines) applies to acid sulfate soils which are unable to be managed on-site. In these cases, off-site disposal to landfill is often the most appropriate management option.

Waste generators need to assess the status of ASS at their point of generation, using the techniques outlined in the ASS Manual. The ASS Manual also provides guidance for on-site management, while this part of the Waste Classification Guidelines details disposal requirements for ASS that need to be transported and managed off-site.

This document has advice on dealing with both 'potential' ASS and 'actual' ASS. The two types are often found together in the same soil profile, with actual ASS generally overlying potential ASS horizons.

Potential acid sulfate soils

Potential ASS are soils that contain iron sulfides or sulfidic materials that have not been exposed to air and thus are not oxidised. The pH of these soils in their undisturbed state is 5.5 or more, making them neutral or slightly alkaline. If not managed appropriately, potential ASS pose a considerable environmental risk: disturbance and exposure to air may render them severely acidic.

Handling potential acid sulfate soils prior to disposal

Potential ASS must be kept wet at all times during excavation and subsequent handling, transport and storage, until they can be disposed of safely. They must be received at the proposed disposal point within 16 hours of being dug up.

[1] Stone Y, Ahem, CR and Blunden, B 1998. *Acid Sulphate Soils Manual 1998*. Acid Sulphate Soils Management Advisory Committee (ASSMAC), Wollongbar, NSW.

Disposal of potential acid sulfate soils *below* the water table

Potential ASS may be disposed of in water below the permanent water table, provided:

- this occurs before they have had a chance to oxidise, i.e. within 24 hours of excavation

and

- they meet the definition of 'virgin excavated natural material' (VENM) under the *Protection of the Environment Operations Act 1997*, even though they contain sulfidic ores or soils.

Landfills must be licensed by the EPA to dispose of potential ASS below the water table. EPA's Environment Line has details on facilities able to accept this waste: phone 131 555.

Potential ASS must be disposed of within 8 hours of their receipt at a landfill and kept wet at all times until their burial at least two metres below the lowest historical level of the water table at the disposal site.

Documentation must be provided to the occupier of the landfill for each truckload of potential ASS received, indicating that the soil's excavation, transport and handling have been in accordance with the ASS Manual, thus preventing the generation of acid.

The occupier of the disposal site must also test the pH of each load of soil received immediately prior to its placement under water using the test method(s) in the ASS Manual (Methods 21A and/or 21Af). These details, together with the pH of the soil recorded at the time of its extraction, must be retained by the occupier of the landfill site.

The disposal site's licence will outline what documentation needs to be kept and for how long.

Soil that has dried out, undergone any oxidation of its sulfidic minerals, or which has a pH of less than 5.5 must be treated by neutralisation and disposed of at a landfill that can lawfully accept it (see **Disposal of actual acid sulfate soils** below).

The pH of the water at the landfill into which the potential ASS is placed must not be less than 6.0 at any time. Landfill licence conditions require the occupiers of potential ASS disposal sites to regularly monitor the pH of ground and surface waters at their premises.

Disposal of potential acid sulfate soils *above* the water table

Where potential ASS cannot be classified as VENM or a suitable underwater disposal site at a landfill is not available, the soil must be treated in accordance with the neutralising techniques in the ASS Manual. After treatment the soil should be chemically assessed in accordance with Step 5 in Part 1 of the Waste Classification Guidelines, available at www.epa.nsw.gov.au/waste/classification.htm. This will determine whether any other contaminants are present in the material. When the classification has been established, the soil should be disposed of to a landfill that can lawfully accept that class of waste.

Actual acid sulfate soils

Actual ASS contain highly acidic soil horizons or layers resulting from the aeration of soil materials that are rich in sulfides, primarily iron sulfide. This oxidation produces more hydrogen ions than the sediment is able to neutralise, resulting in soils with a pH of 5.5 or less when measured in dry season conditions. These soils can usually be identified by the presence of pale yellow mottles and coatings of jarosite.

Treatment of actual acid sulfate soils prior to disposal

Actual ASS must be treated by the generator of the waste before they can be considered for disposal. Treatment should be in accordance with the neutralising techniques outlined in the ASS Manual.

Disposal of actual acid sulfate soils

Following neutralisation, the generator of the waste must chemically assess the soil in accordance with Step 5 of Part 1 of the Waste Classification Guidelines. This will determine whether there are any other contaminants that may affect how the waste is classified for disposal.

Once classified, the waste must be taken to a landfill licensed to accept that class of waste.

Prior arrangements should be made with the occupier of the landfill to ensure that it is licensed to accept the waste. The landfill should be informed that the actual ASS has been treated in accordance with the neutralising techniques outlined in the ASS Manual and that the waste has also been classified in accordance with Part 1 of the Waste Classification Guidelines.

Document Control:

Filename:	16330_Byron_ASSMP
Job No.:	16330
Author:	Ollie Fick
Client:	JDG Developments
File/Pathname:	C:\Users\ollie\Dropbox (ENV Solutions)\ENV Solutions Team Folder\01 Jobs\16330 - Byron ASS, ASSMP, DMP\16330_Byron_ASSMP.docx

Revision No:	Date:	Issued By	
		Name	Signed
1.0	13/06/2017	James Foster	
2.0	26/06/2017	Craig Helbig	
3.0	29/03/2017	Craig Helbig	

Scope of Engagement / Statement of Limitations

This report has been prepared by ENV Solutions Pty Ltd ABN 46856079490 at the request of JGD Developments for the purpose of supporting an acid sulphate soil management plan (ASSMP) for the site and is not to be used for any other purpose or by any other person or corporation.

This report has been prepared based on the information provided to us and from other information obtained as a result of enquiries made by us. ENV Solutions Pty Ltd accepts no responsibility for any loss or damage suffered howsoever arising to any person or corporation who may use or rely on this document for a purpose other than that described above.

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ENV Solutions Pty Ltd declares that it does not have, nor expects to have, a beneficial interest in the subject project.

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ENV has used a degree of care and skill ordinarily exercised in similar investigations by reputable members of the environmental industry in Australia at the date of this document. No other warranty, express or implied, is made or intended. Each section of this report must be read in conjunction with the whole of this report, including the appendices and attachments.

The conclusions presented in this report are based on a limited investigation of conditions with specific sampling locations chosen to be as representative as possible under the circumstances.

ENVs professional opinions contained in this report are subject to modification if additional information is obtained through further investigation, observation or validation testing and analysis during remedial activities. In some cases further testing and analysis may be required, which may result in a further report with different conclusions.

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Proposed Mixed Use Development
Browning Street, Byron Bay
(Lot 21 DP247289 and Lots 5 & 6 Section 51 DP758207)

ENVIRONMENTAL NOISE IMPACT REPORT

Prepared for

JGD Developments Pty Ltd

07 August 2018
crgref: 17083 report rev.3

1.0 INTRODUCTION

This report is in response to a request from JGD Developments Pty Ltd for an environmental noise impact assessment of proposed Mixed Use Development along Browning Street at Byron Bay. This report is further to our previous report dated 25 August 20107, and is required due to a minor alteration to the loading dock arrangements. It is noted that the changes did not impact upon our recommendations or conclusions. In undertaking the assessment, noise monitoring was conducted at the site and through modelling, predictions of road traffic noise were produced as well as onsite commercial activity noise impacting the noise sensitive receivers surrounding the site and within the development. Based upon the predicted noise impact levels, recommendations regarding acoustic treatment have been provided.

2.0 DESCRIPTION OF THE DEVELOPMENT

The parcel of land is described as part of Lot 21 DP247289 and Lots 5 & 6 Section 51 DP758207 and is currently occupied by detached dwellings. The site is bounded by Browning Street to the south and west, Ruskin Street to the east and a residential property to the north. The topography of the site and surrounding land generally rises from the south to the north. For site location refer to Appendix A. The proposal is to remove the existing dwellings and constructed the following:

- **Basement 1 and 2:** Car parking and lift lobby.
- **Ground Level:** Two shop tenancies, café tenancy, central courtyard, childcare centre with western & southern outdoor play spaces, basement ramp, driveway crossover at southeast corner to both Ruskin Lane & Browning Street and MRV loading and bin storage area.
- **Level 1:** Nine northern apartments, ten southern serviced apartments and central courtyard.
- **Level 2:** Nine northern apartments and ten southern serviced apartments.
- **Level 3:** Six northern apartments and six southern serviced apartments.

The childcare centre is likely to operate between 6:30am and 6pm Monday to Friday with café operating between 6:30am to 10pm and shop tenancies operating between 7am to 10pm. For Development Plans refer to Appendix B.

Proposed onsite commercial activity (i.e. childcare centre and commercial tenancies) noise impacts have the potential to impact upon proposed onsite apartments and offsite dwellings (i.e. building façades, outdoor play space and inside habitable / activity rooms) and has been assessed in accordance with the *"NSW Industrial Noise Policy"*.

The site is impacted by road traffic noise from Browning and Jonson Streets; hence the site has been assessed in accordance with the State Environmental Planning Policy (Infrastructure) 2007. The Infrastructure SEPP does not exclude residential development adjacent to busy roads; but instead provides "*recommended approaches"* to ensure an acceptable level of amenity can be achieved for future residents by prescribing internal noise criterion for habitable rooms. The Byron Bay Bypass is proposed to run along the existing Butler Street road corridor and continue south to connect with Jonson and Browning Streets (immediately adjacent the subject site). The proposed roundabout alignment at Jonson and Browning Streets is attached in Appendix A. The Bypass is likely to be constructed within a 10 year planning horizon and will ultimately take traffic off Jonson Street. The ultimate (10 year) traffic noise modelling predictions include the Bypass.

3.0 AMBIENT NOISE SURVEY

3.1 Instrumentation

The following equipment was used to record ambient noise conditions at the subject site location:

- Rion NC 73 Calibrator; and
- Rion NL-21 Environmental Noise Logger.

All instrumentation hold current calibration certificates from a certified NATA calibration laboratory.

3.2 Unattended Background Measurement Methodology and Results

A logger was located at the western end of the subject site. The microphone was within 1m of a solid wall, approximately 1.4m above ground level and approximately 42m from the nearest lane of Browning Street. For logger location refer to Figure 2 of Appendix A.

The logger was set to record noise statistics in 15 minute blocks continually between Tuesday 16/05/2017 and Tuesday 23/05/2017.

All measurements were conducted generally in accordance with Australian Standard AS 1055:1997 - *"Acoustics-Description and measurement of environmental noise*".

The operation of the sound level logging equipment was field calibrated before and after the measurement session with no significant drift from the reference signal recorded.

Daily weather observations were obtained from the Bureau of Meteorology's website at the Byron Bay weather station. Weather conditions during the noise monitoring period were generally fine (with the exception of 20mm of rain on Sunday 14/05), with a temperature range between 14 and 22ºC and a relative humidity range between 40 and 99%.

Table 1 presents the measured ambient noise levels at the unattended logger location. Graphical presentation of the measured noise levels is presented in the Appendix C.

Background Noise	**Measured L_{90} dB(A)**			
	Morning (6:30am to 7am)	**Daytime (7am to 6pm)**	**Evening (6pm to 10pm)**	**Night (10pm to 7am)**
Tuesday 16/05/17	-	-	45	-
Wednesday 17/05/17	48	43	41	41
Thursday 18/05/17	45	43	40	39
Friday 19/05/17	44	46	45	37
Saturday 20/05/17	45	42	41	44
Sunday 21/05/17	43	42	40	40
Monday 22/05/17	44	44	42	41
Tuesday 23/05/17	45	43	-	-
RBL L_{90}	**44**	**43**	**41**	**40**

Table 1: Measured ambient background noise levels at the background logger location.

It is noted that the morning period between 6:30am and 7am is likely to comprise higher levels of road traffic noise (compared to the other periods) associated with people driving to work.

3.3 Unattended Road Traffic Measurement Methodology and Results

A logger was located to the south of the subject site fronting Browning Street. The microphone was in a free-field location, approximately 1.2m above ground level and approximately 11m from the nearest lane of Browning Street. For logger location refer to Figure 2 of Appendix A.

The logger was set to record noise statistics in 15 minute blocks continually between Thursday 11/05/2017 and Thursday 18/05/2017.

All measurements were conducted generally in accordance with Australian Standard AS 1055:1997 - *"Acoustics-Description and measurement of environmental noise*".

The operation of the sound level logging equipment was field calibrated before and after the measurement session with no significant drift from the reference signal recorded.

Daily weather observations were obtained from the Bureau of Meteorology's website at the Byron Bay weather station. Weather conditions during the noise monitoring period were generally fine (with the exception of 20mm of rain on Sunday 14/05), with a temperature range between 14 and 22ºC and a relative humidity range between 40 and 99%.

Table 2 presents the measured ambient noise levels at the unattended logger location. Graphical presentation of the measured noise levels is presented in the Appendix C to this report.

Road Traffic Noise Descriptors	**Time Period**	**Measured Level dB(A)**		
		15/05	**17/05**	**Average**
$L_{10\ (18hr)}$	6am to Midnight	62	62	62
$L_{eq\ (24hr)}$	6am to 6am	59	59	59
$L_{eq\ (15hr)}$	7am to 10pm	60	60	60
$L_{eq\ (9hr)}$	10pm to 7am	54	54	54
$L_{eq\ (1hr)}$ Daytime	7am to 10pm	63	62	63
$L_{eq\ (1hr)}$ Night-time	10pm to 7am	61	61	61

Table 2: Measured ambient road traffic noise levels at the road noise logger location.

4.0 NOISE ASSESSMENT CRITERION

4.1 Onsite and Offsite Commercial Activity Noise Criterion

Noise associated with the commercial premises is regulated by the *"NSW Industrial Noise Policy"*.

The assessment procedure has the following components:

- Control of intrusive noise impacts – The limit criteria for this assessment is as follows:

  $L_{Aeq,\ 15\ min} \leq$ rating background level[1] + 5 dB; and

- Maintaining noise level amenity for residential premises. This is achieved by ensuring that the proposed development complies with the noise limit criteria set in Table 2.1 of the Policy. If we assume that the area is within a Urban Area (as defined in the Policy), the following limits apply:

Indicative Noise Amenity Area	Time of Day	Recommended L_{Aeq} Noise Level, dB(A) *(see Note 8 in Section 2.2.1)*	
(see Notes in Section 2.2.1)		Acceptable *(See Note 11)*	Recommended Maximum *(See Note 11)*
Urban	Day	60	65
	Evening	50	55
	Night	45	50

Table 3: Amenity Criterion Prescribed in the *"NSW Industrial Noise Policy"*.

By considering the above criteria and the Rating Background Levels presented in Table 1 of Section 3.2, we recommend the following noise limits for the proposed use:

- Daytime (7 am to 6 pm Mon-Sat; 8 am to 6 pm Sun): 48 (L_{90} 43 + 5) dB(A) L_{eq};
- Evening (6 pm to 10 pm): 46 (L_{90} 41 + 5) dB(A) L_{eq};
- Night (10pm to 7am): 45 (L_{90} 40 + 5) dB(A) L_{eq}.

Shoulder Period:

Café and Childcare: 6:30am to 7am: 49 (L_{90} 44 + 5) dB(A) L_{eq}.

For all assessment time periods the adopted noise criterion is within the "*Acceptable*" and *"Recommended Maximum"* L_{Aeq} noise levels presented in Table 3 above.

[1] The rating background level is the overall single figure background level representing each assessment period (day/evening/night over the whole monitoring period.

4.2 Road Traffic Noise Criterion

Road traffic noise criterion for new residential developments is specified in The State Environmental Planning Policy (Infrastructure) 2007 (Infrastructure SEPP). Of particular importance, the Infrastructure SEPP prescribes internal noise goals (based on World Health Organisation guidelines) for proposed noise sensitive developments. The Infrastructure SEPP recognises that judicious land use planning, architectural design, building orientation and good internal layout can achieve acceptable acoustic amenity near busy transport corridors.

While application of the Infrastructure SEPP requirements are mandatory only for proposed noise sensitive developments near highly trafficked roads (i.e. roads with annual average daily traffic volume (AADT) of more than 40,000 vehicles), the design advice offered in the SEPP may be useful when designing noise sensitive developments near other roads such as Browning Street / Bangalow Road.

The internal noise goals for dwellings specified in the Infrastructure SEPP are as follows:

For Clauses 87 (Rail) and 102 (Road):

- If the development is for the purpose of a building for residential use, the consent authority must be satisfied that appropriate measures will be taken to ensure that the following LA_{eq} levels are not exceeded:
  - in any bedroom in the building : 35dB(A) at any time 10pm–7am
  - anywhere else in the building (other than a garage, kitchen, bathroom or hallway): 40dB(A) at any time.

The New South Wales Department of Planning document *"Development near Rail Corridors and Busy Roads – Interim Guideline"* states the following in respect to childcare developments impacted by road traffic noise:

Table 3.1: Noise criteria

Residential Buildings			
Type of occupancy		Noise Level dBA	Applicable time period
Sleeping areas (bedroom)		35	Night 10 pm to 7 am
Other habitable rooms (excl. garages, kitchens, bathrooms & hallways)		40	At any time
Non–Residential Buildings			
Type of occupancy			Recommended Max Level dBA
Educational Institutions including child care centres			40
Places of Worship			40
Hospitals	- Wards		35
	- Other noise sensitive areas		45

Note: airborne noise is calculated as L_{eq} (9h) (night) and L_{eq} (15h)(day). Groundborne noise is calculated as L_{max} (slow) for 95% of rail pass-by events.

For the childcare outdoor play spaces we have adopted the external noise criterion of 60 dB(A) $_{Leq\ 1hr}$ (daytime) sourced from the superseded *"Environmental Criteria for Road Traffic Noise 1999"* which is applied to active recreation areas.

5.0 PREDICTED NOISE IMPACTS

5.1 Predicted Onsite Commercial Activity Noise Emissions

Noise source levels used in the assessment have been collected from similar previous investigations. Boisterous children noise source levels used in the assessment have been collected from the Australian Association of Acoustical Consultant' *"Guideline for Child Care Centre Acoustic Assessment"* dated September 2010. All noise levels have been corrected for impulsiveness or tonality as per Australian Standard AS 1055:1997 – *"Acoustics-Description and measurement of environmental noise*".

Measured L_{Aeq} levels have been converted to $L_{Aeq\ 15min}$ levels by estimating a worst case number of events / duration for which each activity occurs during any 15 minute period (refer to Appendix C for calculations). For children's outdoor play we have assumed that the activity will occur for a full 15 minute period.

Noise levels associated with mechanical plant are purely illustrative, and should be reviewed upon determination of types of plant. Additional acoustic assessment/s should be undertaken once plant selections are finalised, and testing conducted prior to Commencement of Use; and be conditioned within the Development Approval.

The following activities and associated noise source levels are typical of the proposed onsite commercial operations and have been assessed within this report:

Activity / Noise Source	Distance (m)	Measured L_{eq} Adjusted dB(A)
Fluctuating Noise Source		
Car door closures at basement	1m	80** (1.5 secs)
Car bypass at 5km/hr at ramp	1m	66 (7 secs)
Childcare 20 children playing normally	1m	73
Childcare 20 children playing boisterously	1m	82
People talking outside shops / café	1m	58
Alfresco dining at café	1m	78
Waste collection	1m	87**
Deliveries	1m	97**
Continuous Noise Source		
A/C units	1m	65
Toilet exhaust fans	1m	52

* Denotes + 5 dB(A) correction due to tonality as per AS1055 – 1997 ; ** Denotes + 5 dB(A) correction due to impulsiveness as per AS1055 – 1997

Table 4: Typical noise source levels associated with the proposed onsite commercial operations.

Based upon the location of the proposed onsite activities in relation to surrounding offsite noise sensitive properties (i.e. at the nearest building façades), we predict the following noise impact levels as presented in Table 5. The predicted levels assume that the recommended treatments detailed in Section 6 are incorporated into the development. For point source calculations refer to Appendix C.

It is noted that combined daytime (and morning 6:30am to 7am) impacts presented in Table 5 include all impacts with the exception of waste collection and deliveries. Given that delivery or waste collection activities would generally be infrequent occurrences they have not been included in combined impact predictions. Evening combined impacts do not include childcare activities. Night-time combined impacts do not include childcare activities and café alfresco dining. All time periods include car door closures and car movements, which shows compliance for a 6:30am start for the café and childcare, provided children activity prior to 7am is restricted to inside the childcare centre.

Noise source	Predicted Noise Impact, SPL $L_{eq\ 15min}$ dB(A)
R1: Two Storey Dwelling Due North	**Nearest Façade to Onsite Activity**
Car door closures at basement	22
Car bypass at 5km/hr at ramp	<20
Childcare 20 children playing normally OUTSIDE	30
Childcare 20 children playing normally INSIDE	<20
Childcare 20 children playing boisterously OUTSIDE	39
Childcare 20 children playing boisterously INSIDE	24
People talking outside shops / café	39
Alfresco dining at café	39
Deliveries	38
Waste collection	45
A/C units	37
Toilet exhaust fan	24
Daytime (and Morning) combined impacts	**45**
Evening combined impacts	**43**
Night-time combined impacts	**41**
R2: Single Storey Dwelling Due East	**Nearest Façade to Onsite Activity**
Car door closures at basement	<20
Car bypass at 5km/hr at ramp	31
Childcare 20 children playing normally OUTSIDE	38
Childcare 20 children playing normally INSIDE	28
Childcare 20 children playing boisterously OUTSIDE	47
Childcare 20 children playing boisterously INSIDE	37
People talking outside shops / café	<20
Alfresco dining at café	32
Deliveries	62
Waste collection	69
A/C units	31
Toilet exhaust fan	<20
Daytime (and Morning) combined impacts	**48**
Evening combined impacts	**37**
Night-time combined impacts	**34**
R3: Single Storey Guest Houses Due Southeast	**Nearest Façade to Onsite Activity**
Car door closures at basement	<20
Car bypass at 5km/hr at ramp	29
Childcare 20 children playing normally OUTSIDE	38
Childcare 20 children playing normally INSIDE	28
Childcare 20 children playing boisterously OUTSIDE	47
Childcare 20 children playing boisterously INSIDE	37
People talking outside shops / café	24
Alfresco dining at café	32
Deliveries	60
Waste collection	73
A/C units	31
Toilet exhaust fan	<20
Daytime (and Morning) combined impacts	**48**
Evening combined impacts	**36**
Night-time combined impacts	**34**
Proposed Onsite Apartments	**Nearest Façade to Onsite Activity**
Car door closures at basement	20
Car bypass at 5km/hr at ramp	43
Childcare 20 children playing normally OUTSIDE	57
Childcare 20 children playing normally INSIDE	41
Childcare 20 children playing boisterously OUTSIDE	66
Childcare 20 children playing boisterously INSIDE	50
People talking outside shops / café	43
Alfresco dining at café	65
Deliveries	76
Waste collection	83
A/C units	44
Toilet exhaust fan	31
Daytime (and Morning) combined impacts	**69 (R_w to achieve 40 dB(A) inside – 33)**
Evening combined impacts	**66 (R_w to achieve 40 dB(A) inside – 29)**
Night-time combined impacts	**48 (R_w to achieve 35 dB(A) inside – 17)**
Daytime (and Morning) Criterion	**48**
Evening Criterion	**46**
Night-time Criterion	**45**

Table 5: Predicted onsite commercial activity noise impacts at the surrounding noise sensitive uses.

5.2 Predicted Road Traffic Noise Impacts

5.2.3 Road Traffic Volumes

Traffic surveys and predicted AADT traffic volumes were provided by Planit Consulting for year 2017 and 2027 (year 2027 volumes assume a 2.5% annual growth rate) and are as follows:

Jonson Street

2017 Traffic Volume:	AADT 24 hour:	12,485 vehicles, 6.1% heavy vehicles
2027 Traffic Volume:	AADT 24 hour:	15,981 vehicles, 6.1% heavy vehicles

Browning Street

2017 Traffic Volume:	AADT 24 hour:	12,189 vehicles, 4.9% heavy vehicles
2027 Traffic Volume:	AADT 24 hour:	15,603 vehicles, 4.9% heavy vehicles

Ruskin Street

2017 Traffic Volume:	AADT 24 hour:	10 vehicles, 0% heavy vehicles
2027 Traffic Volume:	AADT 24 hour:	13 vehicles, 0% heavy vehicles

The proposed Byron Bay Bypass will *"redirect between 3,200 and 4,400 vehicles per day away from Jonson Street"* (GHD "Byron Bay Bypass – Traffic and Transport Assessment June 2015). Therefore, the adopted year 2027 predicted traffic volumes are as follows:

Jonson Street:	AADT 24 hour:	12,181 vehicles, 6.1% heavy vehicles
Browning Street:	AADT 24 hour:	15,603 vehicles, 4.9% heavy vehicles
Bypass:	AADT 24 hour:	3,800 vehicles, 4.9% heavy vehicles

5.2.3 Modelled Road Traffic Noise Levels – Existing Situation

Road traffic noise modelling was conducted using PEN3D, which is based upon the *"CoRTN"* (Control of Road Traffic Noise) method produced by the UK Department of Transport 1988. To verify the road traffic noise prediction model, the $L_{Aeq\ 18hr}$ traffic noise level was calculated and compared to the measured noise level. For PEN3D calculation results refer to the Appendix C.

The predicted free-field $L_{Aeq\ 18hr}$ existing noise level, approximately 11m from the nearest lane of the Browning Street / Bangalow Road is 63.4 dB(A). Compared with the measured $L_{Aeq\ 18hr}$ level of 61.7 dB(A), the model over predicting by 1.7 dB(A) and is within the allowable 2 dB(A) deviation from measured levels. We note that for model verification we have dropped the speed limit to 40 km/hr (median speed limit from traffic count data).

5.2.3 Modelled Road Traffic Noise Levels – 10 Year Planning Horizon

Based upon the year 2027 traffic volumes, the PEN3D model predicts the following traffic noise levels as presented in Table 6 over the page. The following parameters were used in the PEN3D model for the proposed development:

- 2.5 dB(A) correction for building façade predictions.
- 50 km/hr speed limit on Browning Street.
- Dense graded asphalt road surface for Browning Street / Bangalow Road (no corrected required).
- Development plans as presented in Appendix B.
- Building façade receiver height of 1.5m above finished floor levels.
- 3.5 dB(A) adjustment to the model to determine the $L_{Aeq\ 24hr}$ from the $L_{A10\ 18hr.}$
- $L_{Aeq\ 15hr}$ and $L_{Aeq\ 9hr}$ levels as per the measured adjustments from the $L_{Aeq\ 24hr}$ as detailed in Table 1.

Building Façades (Façade Corrected Levels)						
Floor Level	**Dwelling Number**	**Habitable Room**	**Façade**	**Predicted Year 2027 $L_{eq\ 24hr}$ dB(A)**	**Predicted Daytime $L_{eq\ 15hr}$ dB(A)**	**Predicted Night-time $L_{eq\ 9hr}$ dB(A)**
Level 1	1	Living Area	West	65	66	60
		Bedroom 1	West / Southeast	66	67	61
		Bedroom 2	Southeast	58	59	53
	2	Living Area	West	64	65	59
		Bedroom	West	64	65	59
	3	Living Area	West	64	65	59
		Bedroom	West	60	61	55
	4	Living Area	West	64	65	59
		Bedroom	West	60	61	55
	5	Living Area	West	64	65	59
		Bedroom 1	West / North	64	65	59
		Bedroom 2	North	55	56	50
	6	Living Area	North	48	49	43
		Bedroom 1	North	37	38	32
		Bedroom 2	North	46	47	41
	7	Living Area	North	40	41	35
		Bedroom 1	North	36	37	31
		Bedroom 2	North	45	46	40
	8	Living Area	East / North	40	41	35
		Bedroom 1	North	41	42	36
	9	Living Area	North	41	42	36
		Bedroom 1	North / East	42	43	37
		Bedroom 2	East / South	50	51	45
	10	Living Area	South	64	65	59
		Bedroom 1	South / East	64	65	59
		Bedroom 2	East	58	59	53
	11	Living Area	South	63	64	58
		Bedroom 1	South	62	63	57
		Bedroom 2	South	64	65	59
	12	Living Area	South	63	64	58
		Bedroom 1	South	63	64	58
		Bedroom 2	South	65	66	60
	13	Living Area	South	65	66	60
		Bedroom 1	South / Northwest	65	66	60
		Bedroom 2	Northwest	56	57	51
	14	North Room	East	46	47	41
		South Room	East	38	39	33
	15	North Room	East	41	42	36
		South Room	East	40	41	35
	16	North Room	East	40	41	35
		South Room	East / South	44	45	39

Table 6 (Cont.): Predicted road traffic noise impacts at the proposed apartments and childcare.

For PEN3D calculation results refer to the Appendix C.

Building Façades (Façade Corrected Levels)						
Floor Level	**Dwelling Number**	**Habitable Room**	**Façade**	**Predicted Year 2027 $L_{eq\ 24hr}$ dB(A)**	**Predicted Daytime $L_{eq\ 15hr}$ dB(A)**	**Predicted Night-time $L_{eq\ 9hr}$ dB(A)**
Level 2	1	Living Area	West	66	67	61
		Bedroom 1	West / Southeast	66	67	61
		Bedroom 2	Southeast	58	59	53
	2	Living Area	West	64	65	59
		Bedroom	West	65	66	60
	3	Living Area	West	65	66	60
		Bedroom	West	60	61	55
	4	Living Area	West	65	66	60
		Bedroom	West	60	61	55
	5	Living Area	West	64	65	59
		Bedroom 1	West / North	65	66	60
		Bedroom 2	North	58	59	53
	6	Living Area	North	50	51	45
		Bedroom 1	North	40	41	35
		Bedroom 2	North	49	50	44
	7	Living Area	North	43	44	38
		Bedroom 1	North	39	40	34
		Bedroom 2	North	47	48	42
	8	Living Area	East / North	43	44	38
		Bedroom 1	North	44	45	39
	9	Living Area	North	44	45	39
		Bedroom 1	North / East	45	46	40
		Bedroom 2	East / South	53	54	48
	10	Living Area	South	64	65	59
		Bedroom 1	South / East	65	66	60
		Bedroom 2	East	59	60	54
	11	Living Area	South	64	65	59
		Bedroom 1	South	63	64	58
		Bedroom 2	South	65	66	60
	12	Living Area	South	64	65	59
		Bedroom 1	South	64	65	59
		Bedroom 2	South	65	66	60
	13	Living Area	South	65	66	60
		Bedroom 1	South / Northwest	66	67	61
		Bedroom 2	Northwest	57	58	52
	14	North Room	East	51	52	46
		South Room	East	43	44	38
	15	North Room	East	46	47	41
		South Room	East	45	46	40
	16	North Room	East	45	46	40
		South Room	East / South	49	50	44

Table 6 (Cont.): Predicted road traffic noise impacts at the proposed apartments and childcare.

For PEN3D calculation results refer to the Appendix C.

Building Façades (Façade Corrected Levels)						
Floor Level	**Dwelling Number**	**Habitable Room**	**Façade**	**Predicted Year 2027 $L_{eq\ 24hr}$ dB(A)**	**Predicted Daytime $L_{eq\ 15hr}$ dB(A)**	**Predicted Night-time $L_{eq\ 9hr}$ dB(A)**
Level 3	1	Living Area	West	63	64	58
		Bedroom 1	West	64	65	59
		Bedroom 2	West / Southeast	64	65	59
		Bedroom 3	Southeast	57	58	52
	2	Living Area	West	64	65	59
		Bedroom 1	West	64	65	59
		Bedroom 2	West	64	65	59
	3	Living Area	West	64	65	59
		Bedroom 1	West	64	65	59
		Bedroom 2	West / North	64	65	59
		Bedroom 3	North	60	61	55
	4	Living Area	North	55	56	50
		Bedroom 1	North	46	47	41
		Bedroom 2	North	56	57	51
	5	Living Area	North	48	49	43
		Bedroom 1	North	45	46	40
		Bedroom 2	North	50	51	45
	6	Living Area	North	47	48	42
		Bedroom 1	North / East	47	48	42
		Bedroom 2	East	54	55	49
	7	Living Area	South	64	65	59
		Bedroom 1	South	64	65	59
		Bedroom 2	South / East	64	65	59
		Bedroom 3	East	56	57	51
	8	Living Area	South	64	65	59
		Bedroom 1	South	64	65	59
		Bedroom 2	South / Northwest	65	66	60
		Bedroom 3	Northwest	57	58	52
	9	North Room	East	54	55	49
		South Room	East	55	56	50
	10	North Rooms	East	55	56	50
		South Rooms	East / South	57	58	52

Building Façades (Façade Corrected Levels)						
Floor Level	**Receiver**	**Habitable Room**	**Façade**	**Predicted Year 2027 $L_{eq\ 24hr}$ dB(A)**	**Predicted Daytime $L_{eq\ 1hr}$ dB(A)**	**Predicted Night-time $L_{eq\ 1hr}$ dB(A)**
Ground	Childcare	Cot	East	36	40	N/A
		0-2 Activity Room	East	37	41	N/A
		2-3 Activity Room	East	42	46	N/A
		3-4 Activity Room	South	56	60	N/A
		4-5 Activity Room	South	56	60	N/A
Outdoor Play Spaces (Free-field Levels)						
Floor Level	**Receiver**	**Outdoor Area**	**Location**	**Predicted Year 2027 $L_{eq\ 24hr}$ dB(A)**	**Predicted Daytime $L_{eq\ 1hr}$ dB(A)**	**Predicted Night-time $L_{eq\ 1hr}$ dB(A)**
Ground	Childcare	0-2 Play Space	East	38	42	N/A
		2-3 Play Space	East	41	45	N/A
		3-4 Play Space	South	55	59	N/A
		4-5 Play Space	South	55	59	N/A

Table 6 (Cont.): Predicted road traffic noise impacts at the proposed apartments and childcare.

For PEN3D calculation results refer to the Appendix C.

6.0 RECOMMENDED ACOUSTIC TREATMENTS

6.1 Recommended Acoustic Treatments to Control Onsite Activity Noise

We recommend that the following acoustic treatments be incorporated into the development to mitigate onsite commercial activity noise:

- Construction of the acoustic barrier as detailed in Sketch No. 1 in Appendix A adjacent to the childcare play spaces.
- Absorptive ceilings should be constructed above children play space areas (i.e. underside of apartment floor levels / balconies) to achieve an NRC of 0.8.
- Hours of operation for the café tenancy be limited to between 6:30am to midnight.
- Hours of operation for the shop tenancies be limited to between 7am to midnight.
- Hours of operation for the childcare centre be limited to between 6.30am to 6pm.
- Children activity prior to 7am should be restricted to inside the childcare centre.
- Children at the outdoor play space of the childcare centre be limited to one classroom at any one time (less than 20 children).
- No elevated play equipment in the outdoor play areas.
- Waste collection and deliveries be limited to the daytime between 7am and 6pm.
- Driveway, ramps and car parking areas be finished with surface coatings which prevent tyre squeal (an uncoated rough concrete or bitumen surface is acceptable)
- Drainage grating over trafficable areas be well secured to prevent rattling.
- Onsite units (living areas and bedrooms) which are located above the childcare outdoor play spaces and entry (i.e. apartments U1.9 Bed2 - U16, U2.9 Bed2 - U2.16 and U3.6 B2 - U3.10) are to achieve a minimum glazing R_w rating of 33 (minimum 10.38mm laminate glass with acoustic grade frames and acoustic seals) to mitigate outdoor childcare activity.
- Onsite units which are located above the alfresco dining areas (i.e. southwestern apartments U1.1, U1.2, U1.3, U2.1, U2.2, U2.3, U3.1 and U3.2) are to achieve a minimum glazing R_w rating of 29 (minimum 6.38mm laminate glass with acoustic grade frames and acoustic seals) to mitigate outdoor dining activity noise.
- Onsite units are located above the childcare outdoor play spaces and / or alfresco dining areas require provision for air conditioning or sealed mechanical ventilation to allow occupants to close windows and doors to exclude childcare and dining activity noise. The installed plant should not reduce the acoustic performance of the building shell.

It is noted that the acoustic treatment requirements to mitigate road traffic noise may exceed the requirements for onsite activity noise. The highest R_w rating for glazing requirements should be incorporated into the building envelope.

6.2 Recommended Acoustic Treatments to Control Road Traffic Noise

We recommended construction of the 1.8m high acoustic barrier as detailed in Sketch No. 1 in Appendix A at the southern outdoor play space. Barriers are to be generally constructed above the finished ground or existing ground, whichever is higher and be free of gaps and holes. Typical acoustic barrier materials include 19mm lapped timber fence (40% overlap), 9mm FC sheet, masonry, or a combination of the above (a minimum surface mass of 11kg/m^2 is required).

To achieve the required indoor noise levels (refer to Section 4.2), we recommend the building shell treatment performances (R_w) as detailed in Table 7 to affected spaces. Spaces not requiring any treatment are excluded from Table 7.

Building shell treatment performances were determined by using the calculation methods detailed in Australian Standard AS3671 1989 *'Road Traffic Noise Intrusion – Building Siting and Construction'*. Calculations for building treatment performances are presented in Appendix C.

To achieve the indoor criteria in affected spaces, it is necessary to close windows and doors. The BCA requirements for supply of fresh air apply, which may warrant provision of a sealed mechanical ventilation to habitable rooms affected by road traffic noise (i.e. habitable rooms detailed in Table 7). A review by a mechanical engineer may reduce this requirement, based upon *"borrowed air"* from other indoor spaces.

Browning Street Mixed Use Space	Building Component	Rw
Unit 1.1		
Living / Dining / Kitchen Area	Glazing	**34**
	External Walls	**24**
Bedroom 1	Glazing	**35**
	External Walls	**36**
Bedroom 2	Glazing	**23**
	External Walls	**26**
Unit 1.2		
Living / Dining / Kitchen Area	Glazing	**30**
	External Walls	**23**
Bedroom 1	Glazing	**32**
	External Walls	**29**
Unit 1.3		
Living / Dining / Kitchen Area	Glazing	**31**
	External Walls	**30**
Bedroom 1	Glazing	**25**
	External Walls	**21**
Unit 1.4		
Living / Dining / Kitchen Area	Glazing	**31**
	External Walls	**30**
Bedroom 1	Glazing	**25**
	External Walls	**20**
Unit 1.5		
Living / Dining / Kitchen Area	Glazing	**31**
	External Walls	**23**
Bedroom 1	Glazing	**33**
	External Walls	**35**
Bedroom 2	Glazing	**17**
	External Walls	**24**
Unit 1.10		
Living / Dining / Kitchen Area	Glazing	**31**
	External Walls	**23**
Bedroom 1	Glazing	**33**
	External Walls	**34**
Bedroom 2	Glazing	**21**
	External Walls	**26**
Units 1.11 & 1.12		
Living / Dining / Kitchen Area	Glazing	**29**
	External Walls	**22**
Bedroom 1	Glazing	**29**
	External Walls	**22**
Bedroom 2	Glazing	**34**
	External Walls	**35**
Unit 1.13		
Living / Dining / Kitchen Area	Glazing	**32**
	External Walls	**24**
Bedroom 1	Glazing	**34**
	External Walls	**34**
Bedroom 2	Glazing	**18**
	External Walls	**25**

Table 7 (Cont.): Recommended building shell acoustical performance ratings (R_w) to mitigate road traffic noise from Browning Street.

Browning Street Mixed Use Space	Building Component	Rw
Unit 2.1		
Living / Dining / Kitchen Area	Glazing	**35**
	External Walls	**25**
Bedroom 1	Glazing	**35**
	External Walls	**36**
Bedroom 2	Glazing	**23**
	External Walls	**26**
Unit 2.2		
Living / Dining / Kitchen Area	Glazing	**30**
	External Walls	**23**
Bedroom 1	Glazing	**33**
	External Walls	**30**
Unit 2.3		
Living / Dining / Kitchen Area	Glazing	**32**
	External Walls	**31**
Bedroom 1	Glazing	**25**
	External Walls	**21**
Unit 2.4		
Living / Dining / Kitchen Area	Glazing	**32**
	External Walls	**31**
Bedroom 1	Glazing	**25**
	External Walls	**20**
Unit 2.5		
Living / Dining / Kitchen Area	Glazing	**31**
	External Walls	**23**
Bedroom 1	Glazing	**34**
	External Walls	**36**
Bedroom 2	Glazing	**20**
	External Walls	**27**
Unit 2.10		
Living / Dining / Kitchen Area	Glazing	**31**
	External Walls	**23**
Bedroom 1	Glazing	**34**
	External Walls	**35**
Bedroom 2	Glazing	**22**
	External Walls	**27**
Units 2.11 & 2.12		
Living / Dining / Kitchen Area	Glazing	**30**
	External Walls	**23**
Bedroom 1	Glazing	**30**
	External Walls	**23**
Bedroom 2	Glazing	**34**
	External Walls	**35**
Unit 2.13		
Living / Dining / Kitchen Area	Glazing	**32**
	External Walls	**24**
Bedroom 1	Glazing	**35**
	External Walls	**35**
Bedroom 2	Glazing	**22**
	External Walls	**25**
Unit 2.15		
South Room	Glazing	**22**
	External Walls	**19**
Unit 2.16		
North Room	Glazing	**22**
	External Walls	**19**
South Room	Glazing	**24**
	External Walls	**28**

Table 7 (Cont.): Recommended building shell acoustical performance ratings (R_w) to mitigate road traffic noise from Browning Street.

Browning Street Mixed Use Space	Building Component	Rw
Unit 3.1		
Living / Dining / Kitchen Area	Glazing	**33**
	External Walls	**30**
	Roof / Ceiling	**34**
Bedroom 1	Glazing	**33**
	External Walls	**26**
	Roof / Ceiling	**32**
Bedroom 2	Glazing	**32**
	External Walls	**36**
	Roof / Ceiling	**32**
Bedroom 3	Glazing	**23**
	External Walls	**28**
	Roof / Ceiling	**25**
Unit 3.2		
Living / Dining / Kitchen Area	Glazing	**33**
	External Walls	**25**
	Roof / Ceiling	**35**
Bedroom 1	Glazing	**28**
	External Walls	**23**
	Roof / Ceiling	**32**
Bedroom 2	Glazing	**35**
	External Walls	**26**
	Roof / Ceiling	**32**
Unit 3.3		
Living / Dining / Kitchen Area	Glazing	**33**
	External Walls	**25**
	Roof / Ceiling	**35**
Bedroom 1	Glazing	**34**
	External Walls	**27**
	Roof / Ceiling	**32**
Bedroom 2	Glazing	**34**
	External Walls	**36**
	Roof / Ceiling	**32**
Bedroom 3	Glazing	**24**
	External Walls	**32**
	Roof / Ceiling	**28**
Unit 3.4		
Living / Dining / Kitchen Area	Glazing	**24**
	External Walls	**16**
	Roof / Ceiling	**26**
Bedroom 2	Glazing	**27**
	External Walls	**28**
	Roof / Ceiling	**24**
Unit 3.7		
Living / Dining / Kitchen Area	Glazing	**35**
	External Walls	**26**
	Roof / Ceiling	**35**
Bedroom 1	Glazing	**33**
	External Walls	**27**
	Roof / Ceiling	**32**
Bedroom 2	Glazing	**35**
	External Walls	**37**
	Roof / Ceiling	**32**
Bedroom 3	External Walls	**26**
	Roof / Ceiling	**22**

Table 7 (Cont.): Recommended building shell acoustical performance ratings (R_w) to mitigate road traffic noise from Browning Street.

Browning Street Mixed Use Space	Building Component	Rw
Unit 3.8		
Living / Dining / Kitchen Area	Glazing	**35**
	External Walls	**26**
	Roof / Ceiling	**35**
Bedroom 1	Glazing	**33**
	External Walls	**26**
	Roof / Ceiling	**32**
Bedroom 2	Glazing	**35**
	External Walls	**38**
	Roof / Ceiling	**33**
Bedroom 3	Glazing	**22**
	External Walls	**26**
	Roof / Ceiling	**25**
Unit 3.9		
South Room	Glazing	**25**
	External Walls	**17**
	Roof / Ceiling	**26**
Unit 3.10		
North Room	Glazing	**25**
	External Walls	**17**
	Roof / Ceiling	**26**
South Room	Glazing	**28**
	External Walls	**27**
	Roof / Ceiling	**28**

Browning Street Mixed Use Space	Building Component	Rw
Childcare		
Activity Room 3-4 Year Olds	Glazing	**28**
	External Walls	**28**
Activity Room 4-5 Year Olds	Glazing	**27**
	External Walls	**12**

Table 7 (Cont.): Recommended building shell acoustical performance ratings (R_w) to mitigate road traffic noise from Browning Street.

7.0 DISCUSSION

7.1 Onsite Activity Noise

Based upon the assumed noise source levels and recommended acoustic treatments, predicted noise impacts from onsite activities are predicted to be at or below the relevant external noise criterion; with the exception of delivery and waste collection activities. Given that delivery and waste collection activities would generally be infrequent occurrences and of short duration such activities are unlikely to cause annoyance.

Noise from onsite childcare outdoor activity and vehicle movements at the ramp and crossover to Ruskin Lane are predicted to impact the nearest offsite residential receivers (i.e. east and southeast signal-storey dwellings) below the criteria due to the effect of the acoustical barrier designs.

We have also recommended no elevated play equipment in the outdoor play areas; and acoustically absorptive ceilings above children play space areas (i.e. underside of apartment floor levels / balconies) to minimise noise reflections inside the play spaces, and to ensure the effectiveness of the acoustical barriers.

As noted in Section 5.1, all time periods include car door closures and car movements, which shows compliance for a 6:30am start for the café and childcare, provided children activity prior to 7am is restricted to inside the childcare centre. Alfresco dining between 6:30am and 7am is more likely to be that of people talking at a table rather than full patronage.

We have recommended that the hours of operations for the onsite café and shop tenancies be up to midnight as the combined evening time operations (which include both alfresco dining and people talking outside shops / café) are predicted below the night-time external criterion. The midnight cessation will also minimise the potential for noise annoyance to onsite apartments.

With regards to onsite activity noise impacts at the proposed apartments, noise impacts can be controlled with acoustic building shell treatments (i.e. upgraded glazing) and provision for air-conditioning or sealed mechanical ventilation. **It is noted that the acoustic treatment requirements to mitigate road traffic noise may exceed the requirements for onsite activity noise. The highest R_w rating for glazing requirements should be incorporated into the building envelope.**

For outdoor recreation for the noise affected apartments (primarily being serviced apartments above the childcare centre), there is a central ground level court, which is accessible from the lifts / stairs. This court area is well screened from the childcare activity by the building envelope should patrons / residents seek a quieter noise amenity.

7.2 Road Traffic Noise

As noted in Section 2, the Byron Bay Bypass is proposed to run along the existing Butler Street road corridor and continue south to connect with Jonson and Browning Streets (immediately adjacent the subject site). The Bypass is likely to be constructed within a 10 year planning horizon and will ultimately take traffic off Jonson Street. The ultimate (10 year) traffic noise modelling predictions include the Bypass.

The development is predicted to be impacted by road traffic noise from the Bypass, Jonson Street and Browning Street; hence the site has been assessed in accordance with the State Environmental Planning Policy (Infrastructure) 2007 and Department of Planning document *"Development near Rail Corridors and Busy Roads – Interim Guideline"*.

To show that compliance with the internal criterion can be achieved, we have recommended building shell treatment performances (R_w) for habitable rooms.

To achieve the indoor criteria in affected spaces, it is necessary to close windows and doors. The BCA requirements for supply of fresh air apply, which may warrant provision of a sealed mechanical ventilation to habitable rooms affected by road traffic noise (i.e. habitable rooms detailed in Table 3). A review by a mechanical engineer may reduce this ventilation requirement, based upon *"borrowed air"* from other indoor spaces.

Predicted road traffic noise impacts are predicted to be at or below the adopted external noise creation of 60 dB(A) $L_{eq\ 1hr}$ at the proposed childcare centre outdoor play spaces due to the proposed building envelope and the recommended acoustic barrier screening.

8.0 CONCLUSIONS

This report is in response to a request from JGD Developments Pty Ltd for a revised environmental noise impact assessment of proposed Mixed Use Development along Browning Street at Byron Bay. Revisions are required due to minor alterations to the loading dock arrangement. It is confirmed that these changes have not impacted upon the recommendations or conclusions of the previous report.

Overall, the proposed development will generally be within acceptable levels of the adopted criterion, subject to the acoustic treatments recommended in Section 6 being integrated into the design, construction and operation of the development.

Report Reviewed By:

JAY CARTER BSc
Director

Report Compiled by:

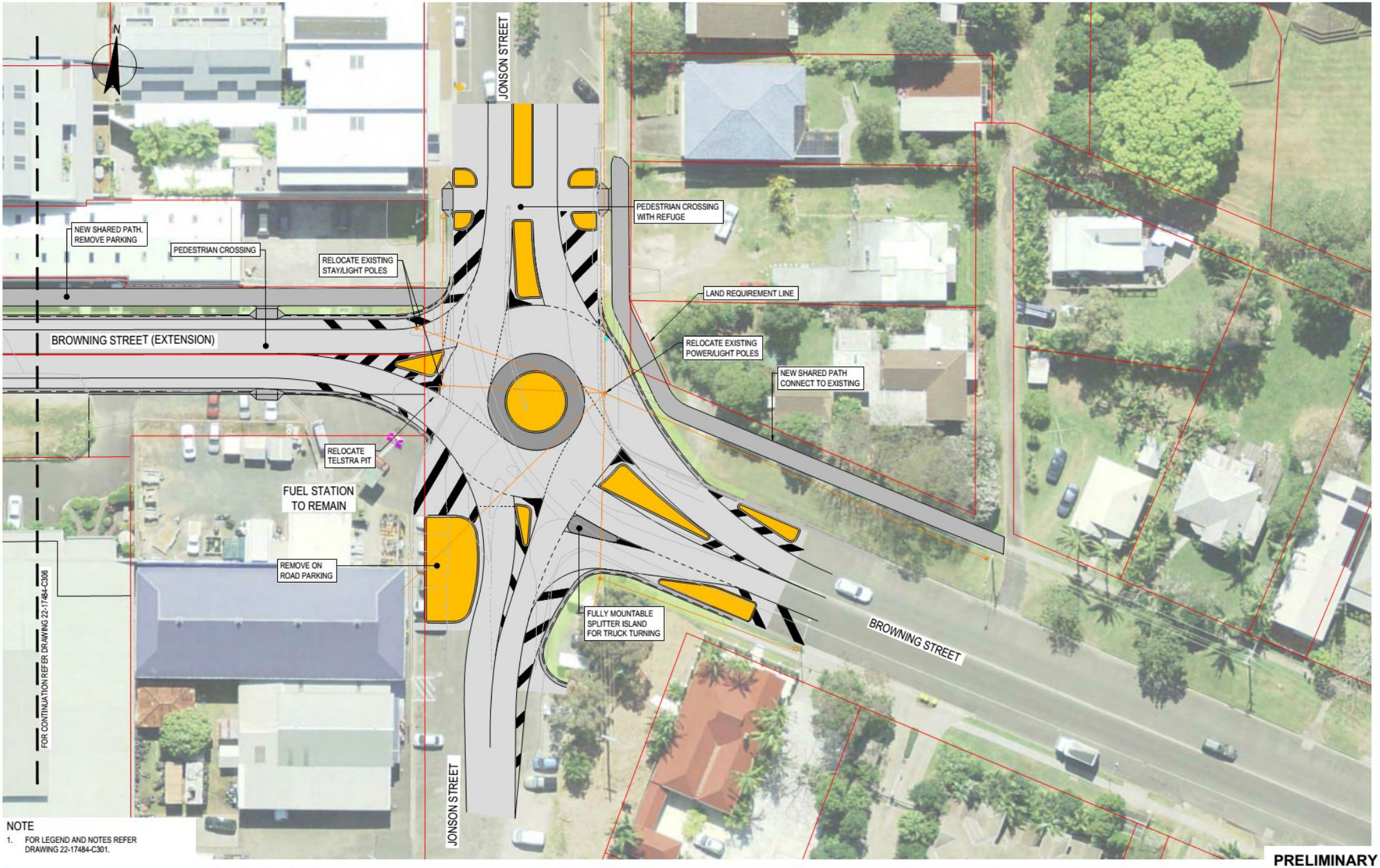
Matthew Lopez BEng
Consultant

APPENDIX A

Subject Site, Attachment, Monitoring Locations, Receiver Locations and Acoustic Barrier Sketch

Figure No. 1: Subject Site Location (NSW Six Maps).

Figure No. 2: Subject Site, Receiver Locations and Logger Locations (NSW Six Maps).



NOTE

1. FOR LEGEND AND NOTES REFER DRAWING 22-17484-C301.

PRELIMINARY

No	Revision	Drawn	Job Manager	Project Director	Date
E	REVISED CONCEPT LAYOUT	MM			11/05/15
D	REVISED CONCEPT LAYOUT	MM			08/05/15
C	REVISED CONCEPT LAYOUT	MM			11/03/15
B	REVISED CONCEPT LAYOUT	MM			06/03/15
A	ISSUE FOR DISCUSSION	BC			17/11/14

Note: * indicates signatures on original issue of drawing or last revision of drawing

0 2.5 5 7.5 10 12.5m
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Drafting Check | Design Check
Approved (Project Director)
Date
Scale AS SHOWN

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Client BYRON SHIRE COUNCIL
Project BYRON BAY BYPASS
Title CONCEPT LAYOUT
SHEET 7 OF 7

Original Size A1
Drawing No: 22-17484_C307
Rev: E

Plot Date: 11 May 2015 - 4:45 PM
Plotted by: Michael Mason
Cad File No: G:\22\17484\CADD\Drawings\22-17484_C307.dwg

Sketch No. 1: Service Station Layout and Recommended Acoustic Treatments (Not to Scale).

ACOUSTIC TREATMENT LEGEND

Recommended 1.8m high acoustic barrier to mitigate road traffic noise, to be constructed above the finished ground level at the outdoor play (of R.L. 3.9m) and be free of gaps and holes.

Recommended acoustic barrier with minimum top of barrier R.L. at 7.0m constructed at the top of the proposed retaining wall (i.e. estimated 1.5m high retaining wall with an average barrier height of around 1.5m) to mitigate play space noise emissions, and be free of gaps and holes.

Recommended 1.8m high acoustic barrier to mitigate onsite vehicle movements, to be constructed above the finished or existing ground level, whichever is higher and be free of gaps and holes.

The barriers could be constructed of a combination of materials. Refer to Sketch No. 2 for examples of an acoustic barrier with a combination of materials including glass / or Perspex to reduce to visual impact. Gates will also be required to be treated with acoustic materials and acoustic door jams.

Sketch No. 2: Acoustic Barrier Combination of Materials (Not to Scale).

The above barrier was constructed at the interface of an established residential area and a service station north of Brisbane. This barrier was constructed to a height of 3.4m above finished ground level. By incorporating a mix of materials, visual impacts were mitigated and deemed acceptable by the local council.

APPENDIX B

Development Plans

JONSON ST
BROWNING ST
RUSKIN LN
NEIGHBOURING 3 STOREY BUILDING
NEIGHBOURING 2 STOREY DETACHED DWELLING
30 DP 829895
A DP 363696
B DP 363695
NEIGHBOURING DETACHED DWELLING
NEIGHBOURING SHED
SOLID BLOCKWORK FENCE
REMOVABLE SCREEN
STREET AWNING OVER
PROPOSED LOADING BAY
PROPOSED PEDESTRIAN CROSSING
TIMBER RETAIL ARBOUR OVER
METAL PEDESTRIAN RAILS
PROPOSED ROUND-A-BOUT
CURRENT SITE BOUNDARY
REALIGNED SITE BOUNDARY
NEW FOOTPATH TO LANDSCAPE ARCHITECT'S DESIGN
GRASS BUFFER STRIP FOR WATER TREATMENT
OPEN ACCESS TO RAMP
NEW CROSSOVER
SHOP 510m2
SHOP 74m2
CAFE 120m2
END OF TRIP FACILITY
TANK ROOM
MANAGER OFFICE
RETAIL WC
COURT YARD
OPEN COURTYARD
LIFT LOBBY
CHILD CARE CENTRE
OUTDOOR PLAY
LOADING BAY
RAMP
FIRE BOOSTER
PAD MOUNT
RETAIL BIN STORE
GOODS LIFT
STAIR TO BASEMENT
FOLD-AWAY GATES
BIKE RACKS (10 BIKES)
BUILDING OVER
LIFT OVERRUN
PLANT
OFFICE
CHILD CARE STORE
BULK STORE
RESIDENTIAL BINS
VEHICLE GATE
EMERGENCY EXIT
FIRE HOSE REEL
SWITCH ROOM
SUBSTATION
BASEMENT
0-2 YEAR OLDS 12 CHILDREN
2-3 YEAR OLDS 15 CHILDREN
3-5 YEAR OLDS 20 KIDS 66.5M2
OUTDOOR PLAY 20 CHILDREN
OUTDOOR PLAY 20 CHILDREN
CDT
AHD 3.4
AHD 3.5
AHD 3.6
AHD 3.9
AHD 4.0
AHD 4.2
AHD 4.5
AHD 4.7
AHD 5.0
AHD 6.6
7000
4200
4300
1700
1500
1000
1200
1800
2000
6450
PRELIMINARY
KEY
CAFE
SHOP
CHILD CARE
SHOP TOP HOUSING
SERVICED APARTMENTS
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No Date Description By
5 06.08.2018 DA RFI JH
4 28.02.2018 DA RFI JH
3 08.01.2018 DA RFI JH
2 11.12.2017 DA RFI
1 15.08.2017 DEVELOPMENT APPLICATION JH
CLIENT
JGD DEVELOPMENTS
PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
107-109 JONSON ST & 3 BROWNING ST, BYRON BAY
DRAWING TITLE
GROUND LEVEL
SCALE: @ A1
1 : 200
PROJECT No:
170102
DATE:
2017
DWG No:
TP1.01
REV
5
DRAWN BY:
JH
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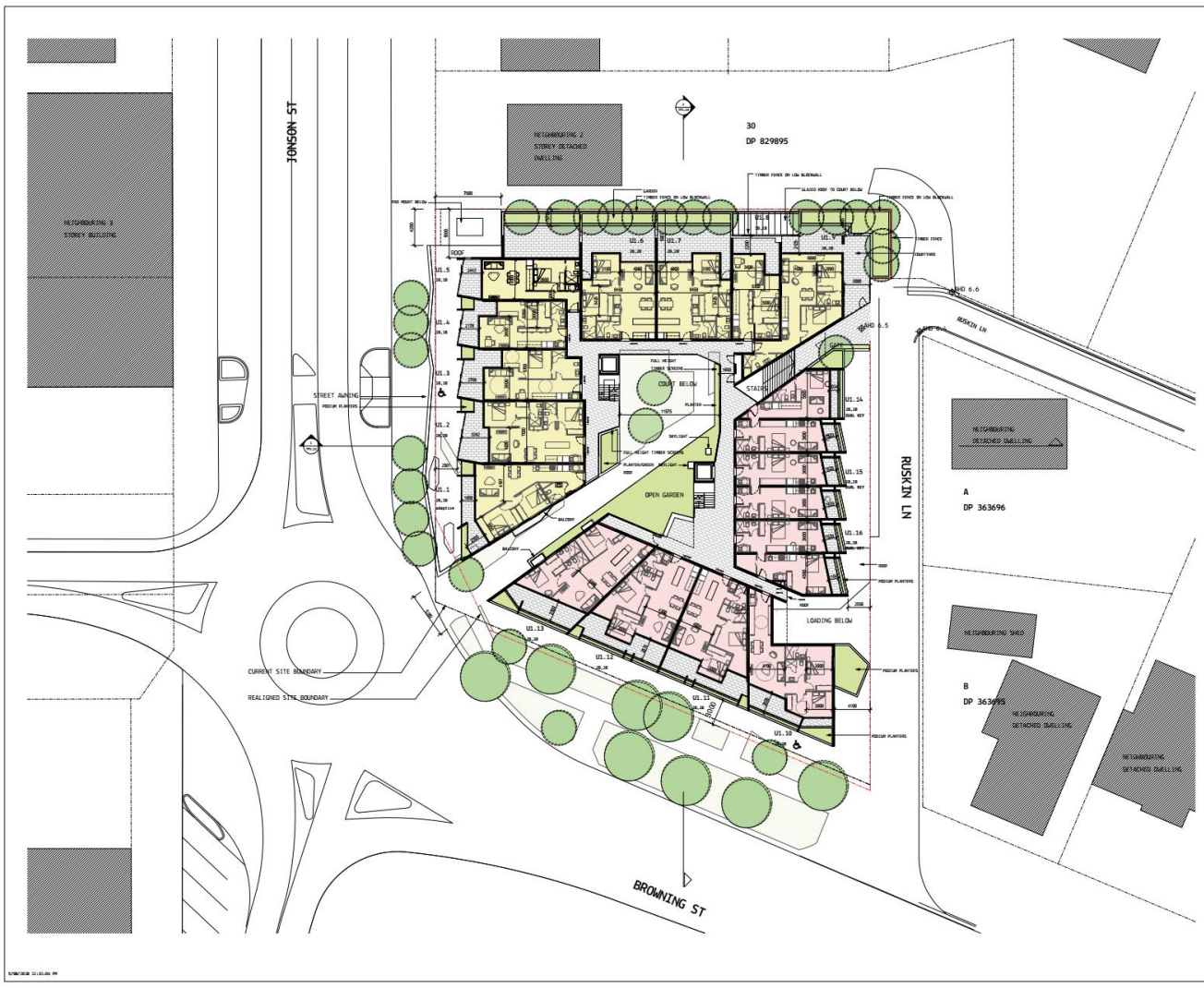
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BROWNING ST
RUSKIN LN
NEIGHBOURING 3 STOREY BUILDING
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A DP 363696
B DP 363695
NEIGHBOURING DETACHED DWELLING
NEIGHBOURING SHED
STREET AWNING
CURRENT SITE BOUNDARY
REALIGNED SITE BOUNDARY
COURT BELOW
OPEN GARDEN
LOADING BELOW
U1.1
U1.2
U1.3
U1.4
U1.5
U1.6
U1.7
U1.8
U1.9
U1.10
U1.11
U1.12
U1.13
U1.14
U1.15
U1.16
U1.1A
ROOF
BALCONY
PODIUM PLANTERS
SKYLIGHT
AHD 6.5
AHD 6.6
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CHILD CARE
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No Date Description By
5 06.08.2018 DA RFI JH
4 28.02.2018 DA RFI JH
3 08.01.2018 DA RFI JH
2 11.12.2017 DA RFI
1 15.08.2017 DEVELOPMENT APPLICATION JH
CLIENT
JGD DEVELOPMENTS
PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
107-109 JONSON ST & 3 BROWNING ST, BYRON BAY
DRAWING TITLE
LEVEL 1
SCALE: @ A1
1 : 200
PROJECT No:
170102
DATE:
2017
DWG No:
TP1.02
REV
5
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No	Date	Description	By
4	04.08.2018	DA RFI	JH
3	28.07.2018	DA RFI	JH
2	12.12.2017	DA RFI	
1	15.08.2017	DEVELOPMENT APPLICATION	JH

CLIENT
JGD DEVELOPMENTS

PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
107-109 JONSON ST & 3 BROWNING ST, BYRON BAY

DRAWING TITLE
LEVEL 2

SCALE: @ A1	PROJECT No:
1 : 200	170102
DATE: 2017	DWG No: TP1.03 REV 4
DRAWN BY:	

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KEY
- CAFE
- SHOP
- CHILD CARE
- SHOP TOP HOUSING
- SERVICED APARTMENTS

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PRELIMINARY

No	Date	Description	By
4	04.08.2018	DA RFI	JH
3	28.07.2018	DA RFI	JH
2	12.12.2017	DA RFI	
1	15.08.2017	DEVELOPMENT APPLICATION	JH

CLIENT
JGD DEVELOPMENTS

PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
107-109 JONSON ST & 3 BROWNING ST, BYRON BAY

DRAWING TITLE
LEVEL 3

SCALE: @ A1	PROJECT No:
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DATE: 2017	DWG No: TP1.04 REV 4
DRAWN BY:	

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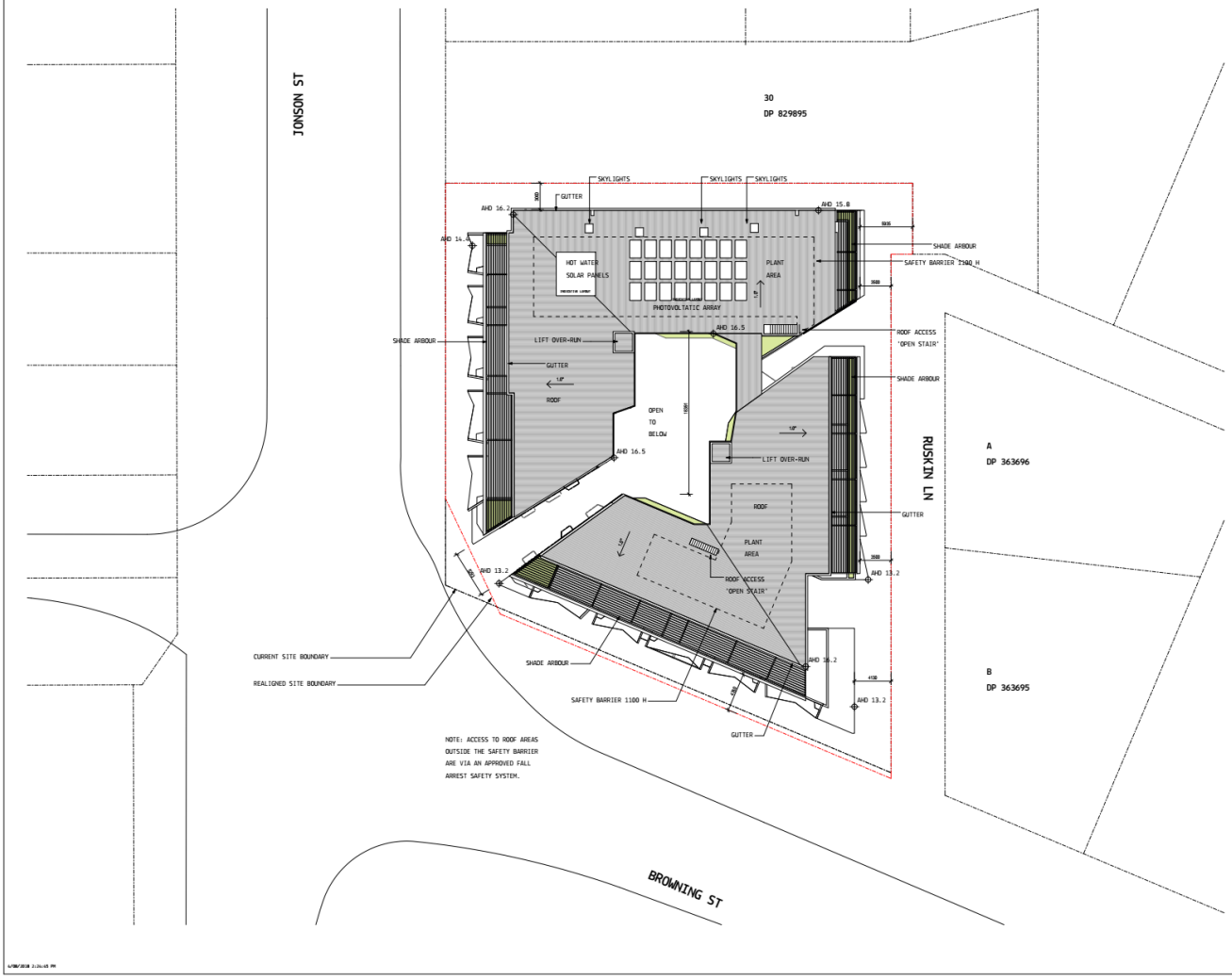

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PRELIMINARY

No	Date	Description	By
4	04.06.2018	DA RFI	JH
3	28.02.2018	DA RFI	JH
2	12.12.2017	DA RFI	
1	15.06.2017	DEVELOPMENT APPLICATION	JH

CLIENT
JGD DEVELOPMENTS

PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
107-129 JONSON ST & 2 BROWNING ST, BYRON BAY

DRAWING TITLE
ROOF PLAN

SCALE: @ A1
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PROJECT No.
170102
DATE:
2017
DRAWN BY:
MS
DWG No:
TP1.05
REV
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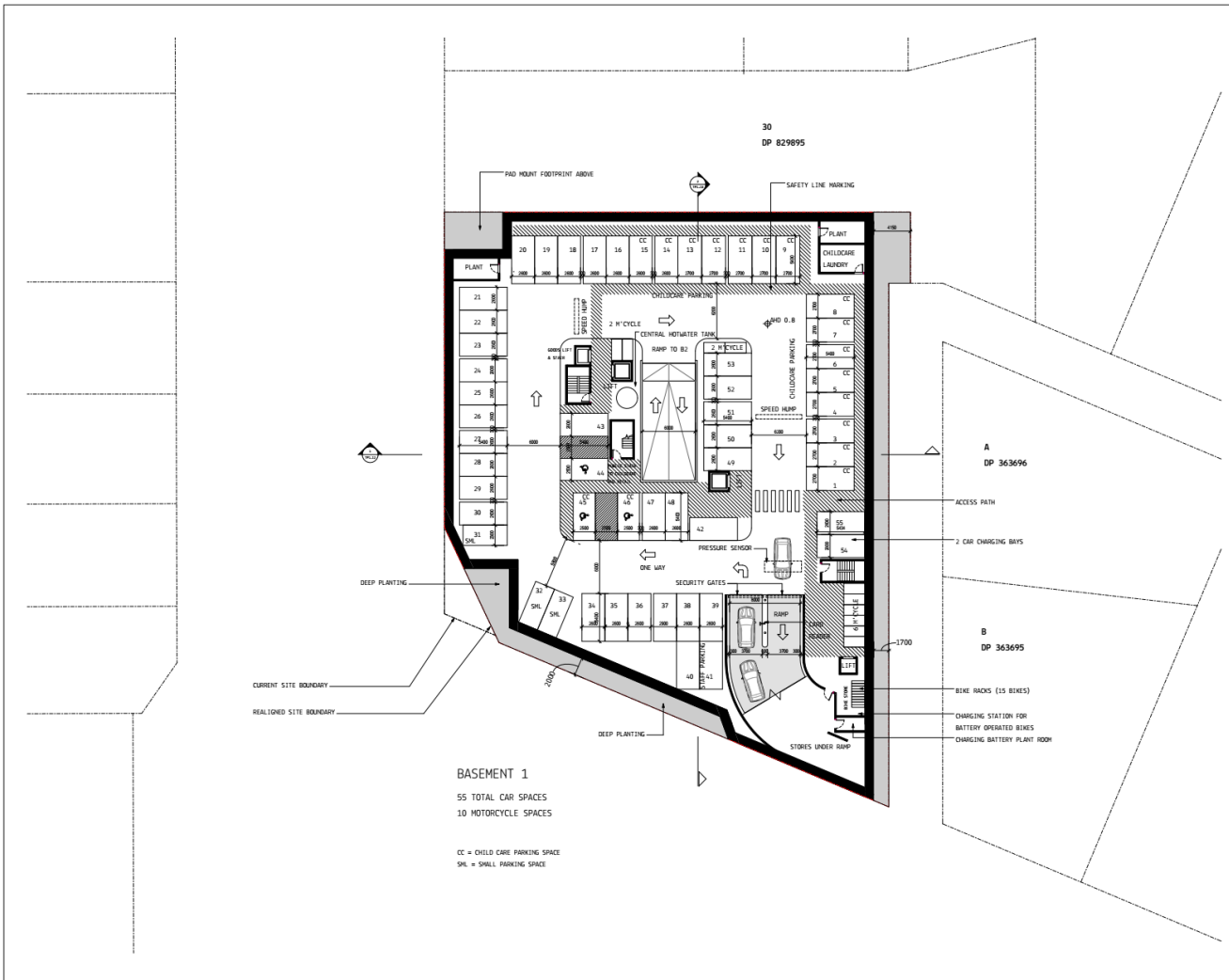

BASEMENT 1

55 TOTAL CAR SPACES

10 MOTORCYCLE SPACES

CC = CHILD CARE PARKING SPACE
SML = SMALL PARKING SPACE

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No	Date	Description	By
4	04.06.2018	DA RFI	JH
3	28.02.2018	DA RFI	JH
2	12.12.2017	DA RFI	
1	15.06.2017	DEVELOPMENT APPLICATION	JH

CLIENT
JGD DEVELOPMENTS

PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
107-129 JONSON ST & 2 BROWNING ST, BYRON BAY

DRAWING TITLE
BASEMENT 1

SCALE: @ A1
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170102
DATE:
2017
DRAWN BY:
MS
DWG No:
TP1.06
REV
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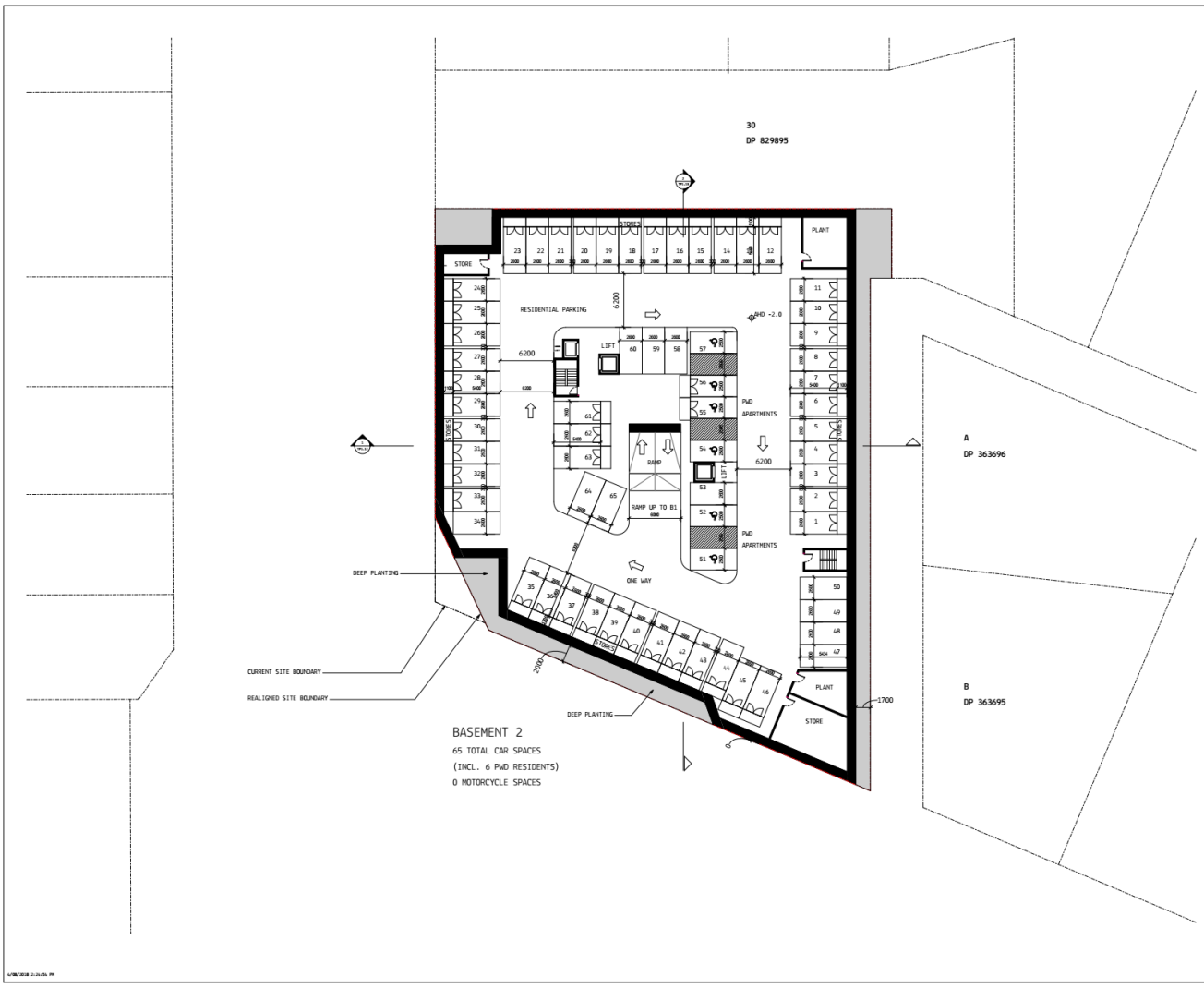
MYERS ELLYETT



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PRELIMINARY

No	Date	Description	By
4	04.08.2018	DA RFI	JH
3	28.02.2018	DA RFI	JH
2	12.12.2017	DA RFI	
1	15.08.2017	DEVELOPMENT APPLICATION	JH

CLIENT
JGD DEVELOPMENTS

PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
107-109 JONSON ST & 3 BROKING ST, BYRON BAY

DRAWING TITLE
BASEMENT 2

SCALE: @ A1
1 : 200
PROJECT No:
170102
DATE:
DRAWN BY:
CHK:
DWG No:
TP1.07
REV
4

MYERS ELLYETT

4/08/2018 2:24:54 PM

MATERIAL LEGEND

CODE:	DESCRIPTION:	COLOUR:
AP:01	RENDER TYPE 1	WHITE
AF:01	ACOUSTIC TIMBER FENCE	WHITE
AWN:01	STREET AWNING	WHITE TINTED CONCRETE
BAL:01	METAL BALUSTRADE	WHITE POWDERCOAT
GL:01	FULL HEIGHT APARTMENT GLAZING SYSTEMS	TINTED DOUBLE GLAZING, CHARCOAL FRAMES
GL:02	FULL HEIGHT SHOP FRONT GLAZING	TINTED GLAZING, CHARCOAL FRAMES
GL:03	OPAQUE GLASS	FROSTED GLAZING, CHARCOAL FRAMES
RF:01	ARBOUR SHADE ROOF	WHITE POWDERCOAT
RF:02	METAL ROOF	PROFILED ZINCALUME
SC:01	TIMBER VINE SCREEN	SEALED HARDWOOD TIMBER
SC:02	SLIDING SHADE SHUTTERS	SEALED TIMBER, METAL FRAMES
SC:03	METAL PLANT SCREEN	CHARCOAL POWDERCOAT
SC:04	FULL HEIGHT PRIVACY SCREENS SLIDING	SEALED HARDWOOD TIMBER
SN:01	RETAIL/SHOP SIGNAGE BAND	CHARCOAL BACKING BAND
TR:01	TIMBER RETAIL ARBOUR	SEALED HARDWOOD TIMBER
TR:02	TIMBER FENCE	PAINTED WHITE
TR:03	HARDWOOD TIMBER LINING	SEALED HARDWOOD TIMBER
TL:01	CERAMIC TILE WALL	GREEN TONES

PROPOSED WEST ELEVATION
SCALE 1 : 100

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No	Date	Description	By
3	28.02.2018	DA RFI	JH
2	12.12.2017	DA RFI	
1	15.08.2017	DEVELOPMENT APPLICATION	JH

CLIENT
JGD DEVELOPMENTS

PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
107-109 JONSON ST & 3 BROKING ST, BYRON BAY

DRAWING TITLE
ELEVATION - WEST

SCALE: @ A1
1 : 100
PROJECT No:
170102
DATE:
DRAWN BY:
CHK:
DWG No:
TP1.08
REV
3

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28/02/2018 9:37:08 PM

MATERIAL LEGEND

CODE:	DESCRIPTION:	COLOUR:
AP:01	RENDER TYPE 1	WHITE
AF:01	ACOUSTIC TIMBER FENCE	WHITE
AWN:01	STREET AWNING	WHITE TINTED CONCRETE
BAL:01	METAL BALUSTRADE	WHITE POWDERCOAT
GL:01	FULL HEIGHT APARTMENT GLAZING SYSTEMS	TINTED DOUBLE GLAZING, CHARCOAL FRAMES
GL:02	FULL HEIGHT SHOP FRONT GLAZING	TINTED GLAZING, CHARCOAL FRAMES
GL:03	OPAQUE GLASS	FROSTED GLAZING, CHARCOAL FRAMES
RF:01	ARBOUR SHADE ROOF	WHITE POWDERCOAT
RF:02	METAL ROOF	PROFILED ZINCALUME
SC:01	TIMBER VINE SCREEN	SEALED HARDWOOD TIMBER
SC:02	SLIDING SHADE SHUTTERS	SEALED TIMBER, METAL FRAMES
SC:03	METAL PLANT SCREEN	CHARCOAL POWDERCOAT
SC:04	FULL HEIGHT PRIVACY SCREENS SLIDING	SEALED HARDWOOD TIMBER
SN:01	RETAIL/SHOP SIGNAGE BAND	CHARCOAL BACKING BAND
TR:01	TIMBER RETAIL ARBOUR	SEALED HARDWOOD TIMBER
TR:02	TIMBER FENCE	PAINTED WHITE
TR:03	HARDWOOD TIMBER LINING	SEALED HARDWOOD TIMBER
TL:01	CERAMIC TILE WALL	GREEN TONES

1 PROPOSED EAST ELEVATION
Scale 1 : 100

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No	Date	Description	By
4	04.08.2018	DA RFI	JH
3	28.02.2018	DA RFI	JH
2	11.12.2017	DA RFI	
1	25.08.2017	DEVELOPMENT APPLICATION	JH

CLIENT
JGD DEVELOPMENTS

PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
107-109 JONSON ST & 3 BROUNING ST, BYRON BAY

DRAWING TITLE
ELEVATION - EAST

SCALE: @ A1
1 : 100
PROJECT No:
170102
DATE:
2017
DRAWN BY:
DWG No:
TP1.09
REV
4

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www.myersellyett.com.au

5/08/2018 12:01:01 PM

MATERIAL LEGEND

CODE:	DESCRIPTION:	COLOUR:
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AF:01	ACOUSTIC TIMBER FENCE	WHITE
AWN:01	STREET AWNING	WHITE TINTED CONCRETE
BAL:01	METAL BALUSTRADE	WHITE POWDERCOAT
GL:01	FULL HEIGHT APARTMENT GLAZING SYSTEMS	TINTED DOUBLE GLAZING, CHARCOAL FRAMES
GL:02	FULL HEIGHT SHOP FRONT GLAZING	TINTED GLAZING, CHARCOAL FRAMES
GL:03	OPAQUE GLASS	FROSTED GLAZING, CHARCOAL FRAMES
RF:01	ARBOUR SHADE ROOF	WHITE POWDERCOAT
RF:02	METAL ROOF	PROFILED ZINCALUME
SC:01	TIMBER VINE SCREEN	SEALED HARDWOOD TIMBER
SC:02	SLIDING SHADE SHUTTERS	SEALED TIMBER, METAL FRAMES
SC:03	METAL PLANT SCREEN	CHARCOAL POWDERCOAT
SC:04	FULL HEIGHT PRIVACY SCREENS SLIDING	SEALED HARDWOOD TIMBER
SN:01	RETAIL/SHOP SIGNAGE BAND	CHARCOAL BACKING BAND
TR:01	TIMBER RETAIL ARBOUR	SEALED HARDWOOD TIMBER
TR:02	TIMBER FENCE	PAINTED WHITE
TR:03	HARDWOOD TIMBER LINING	SEALED HARDWOOD TIMBER
TL:01	CERAMIC TILE WALL	GREEN TONES

1 PROPOSED SOUTH ELEVATION
Scale 1 : 100

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No	Date	Description	By
5	04.08.2018	DA RFI	JH
4	28.02.2018	DA RFI	JH
3	30.01.2018	DA RFI	JH
2	11.12.2017	DA RFI	
1	25.08.2017	DEVELOPMENT APPLICATION	JH

CLIENT
JGD DEVELOPMENTS

PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
107-109 JONSON ST & 3 BROUNING ST, BYRON BAY

DRAWING TITLE
ELEVATION - SOUTH

SCALE: @ A1
1 : 100
PROJECT No:
170102
DATE:
2017
DRAWN BY:
DWG No:
TP1.10
REV
5

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6/08/2018 2:25:18 PM

MATERIAL LEGEND

CODE:	DESCRIPTION:	COLOUR:
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AF:01	ACOUSTIC TIMBER FENCE	WHITE
AWN:01	STREET AWNING	WHITE TINTED CONCRETE
BAL:01	METAL BALUSTRADE	WHITE POWDERCOAT
GL:01	FULL HEIGHT APARTMENT GLAZING SYSTEMS	TINTED DOUBLE GLAZING, CHARCOAL FRAMES
GL:02	FULL HEIGHT SHOP FRONT GLAZING	TINTED GLAZING, CHARCOAL FRAMES
GL:03	OPAQUE GLASS	FROSTED GLAZING, CHARCOAL FRAMES
RF:01	ARBOUR SHADE ROOF	WHITE POWDERCOAT
RF:02	METAL ROOF	PROFILED ZINCALUME
SC:01	TIMBER VINE SCREEN	SEALED HARDWOOD TIMBER
SC:02	SLIDING SHADE SHUTTERS	SEALED TIMBER, METAL FRAMES
SC:03	METAL PLANT SCREEN	CHARCOAL POWDERCOAT
SC:04	FULL HEIGHT PRIVACY SCREENS SLIDING	SEALED HARDWOOD TIMBER
SN:01	RETAIL/SHOP SIGNAGE BAND	CHARCOAL BACKING BAND
TR:01	TIMBER RETAIL ARBOUR	SEALED HARDWOOD TIMBER
TR:02	TIMBER FENCE	PAINTED WHITE
TR:03	HARDWOOD TIMBER LINING	SEALED HARDWOOD TIMBER
TL:01	CERAMIC TILE WALL	GREEN TONES

PROPOSED NORTH ELEVATION

28/02/2018 9:37:16 PM

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PRELIMINARY

No	Date	Description	By
3	28.02.2018	DA RFI	JH
2	12.12.2017	DA RFI	JH
1	15.08.2017	DEVELOPMENT APPLICATION	JH

CLIENT
JGD DEVELOPMENTS

PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
137-139 JONSON ST & 3 BROKKING ST, BYRON BAY

DRAWING TITLE
ELEVATION - NORTH

SCALE: @ A1	PROJECT No:
1 : 100	170102
DATE: 02/2018	DWG No: TP1.11
DRAWN BY: AL	REV: 3

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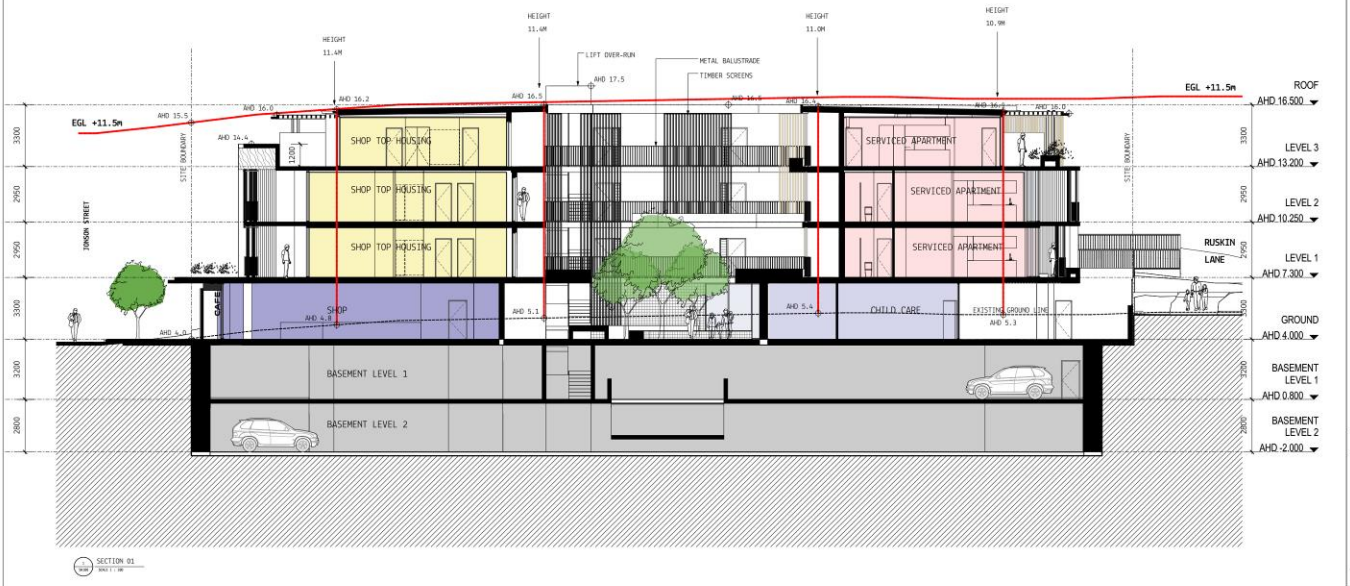

SECTION 01

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No	Date	Description	By
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2	12.12.2017	DA RFI	JH
1	15.08.2017	DEVELOPMENT APPLICATION	JH

CLIENT
JGD DEVELOPMENTS

PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
137-139 JONSON ST & 3 BROKKING ST, BYRON BAY

DRAWING TITLE
SECTION 01

SCALE: @ A1	PROJECT No:
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DRAWN BY: AL/MAD	REV: 3

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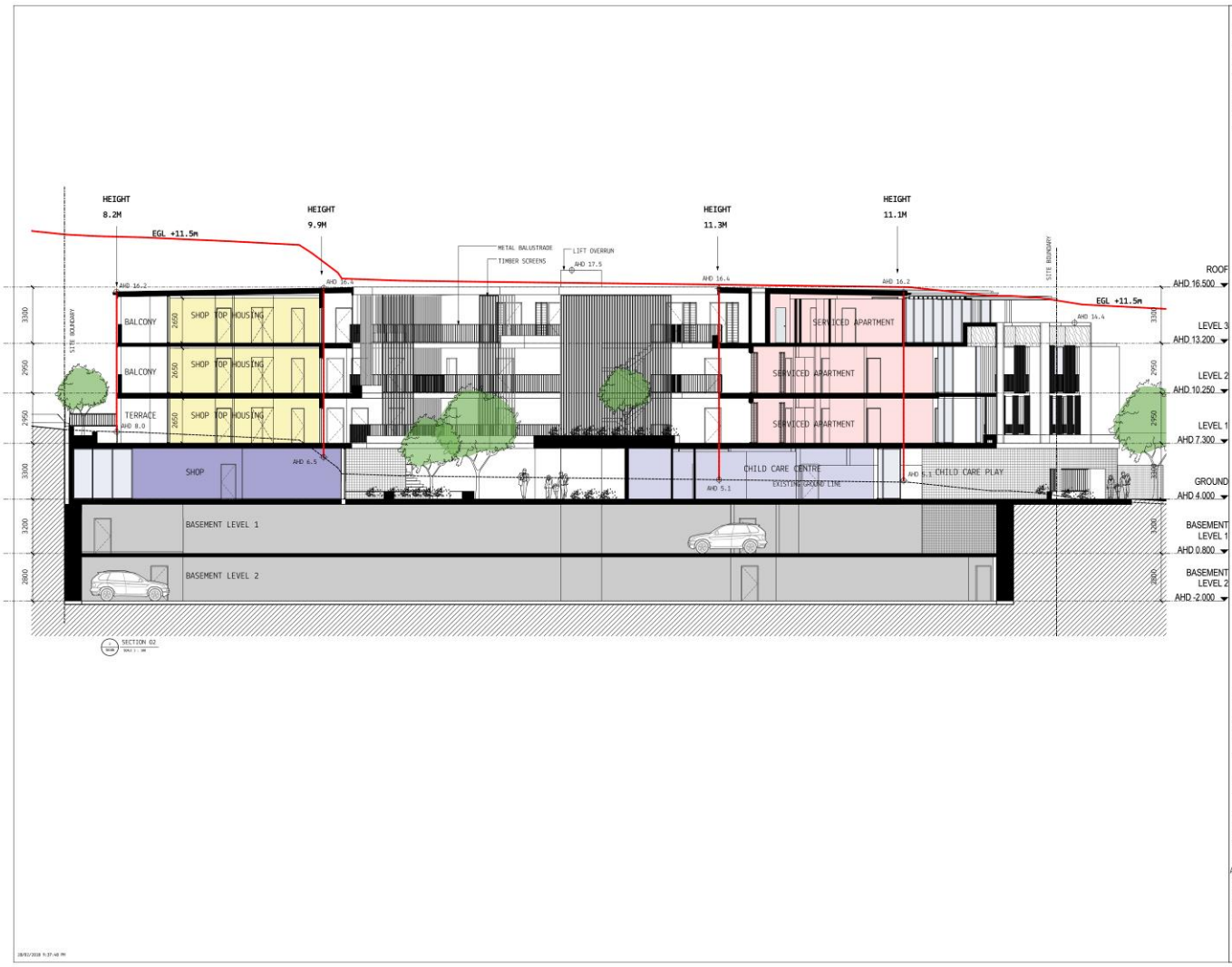

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KEY
- CAFE
- SHOP
- CHILD CARE
- SHOP TOP HOUSING
- SERVICED APARTMENTS

PRELIMINARY

No	Date	Description	By
3	28.02.2018	DA RFI	JH
2	12.12.2017	DA RFI	
1	15.06.2017	DEVELOPMENT APPLICATION	JH

CLIENT
JGD DEVELOPMENTS

PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT
127-139 JONSON ST & 2 BROUGHTON ST, BYRON BAY

DRAWING TITLE
SECTION 02

SCALE: @ A1	PROJECT No:
As indicated	170102
DATE: 02/03/18	DWG No: TP1.13 | REV: 3
DRAWN BY: Author	

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JONSON ST - ELEVATION

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PRELIMINARY

CLIENT
JGD DEVELOPMENTS

PROJECT TITLE
JONSON STREET MIXED USED DEVELOPMENT

DRAWING TITLE
3D PERSPECTIVE

SCALE: @ A1	PROJECT No:
	170102
DATE:	DWG No: TP5.02 | REV: 2
DRAWN BY:	

MYERS ELLYETT

JONSON & BROWNING ST - VIEW THROUGH PEDESTRIAN ENTRY

PRELIMINARY

JGD DEVELOPMENTS

JONSON STREET MIXED USED DEVELOPMENT

3D PERSPECTIVE

170102

TP5.03 | 2

MYERS ELLYETT

BROWNING STREET - ELEVATION

PRELIMINARY

JGD DEVELOPMENTS

JONSON STREET MIXED USED DEVELOPMENT

3D PERSPECTIVE

170102

TP5.04 | 2

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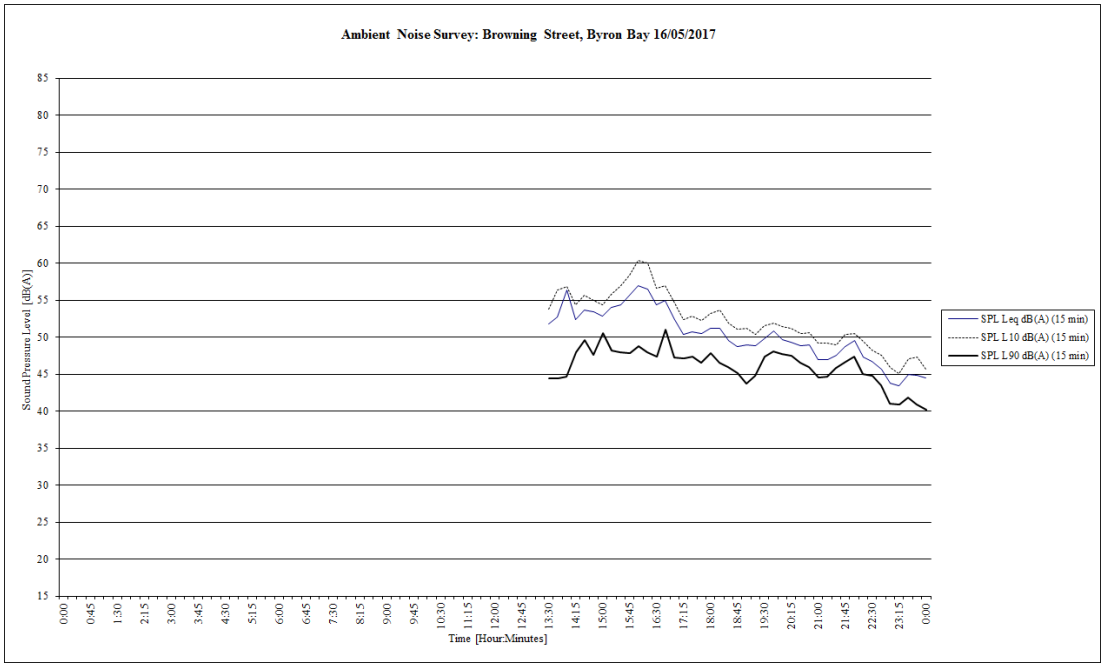
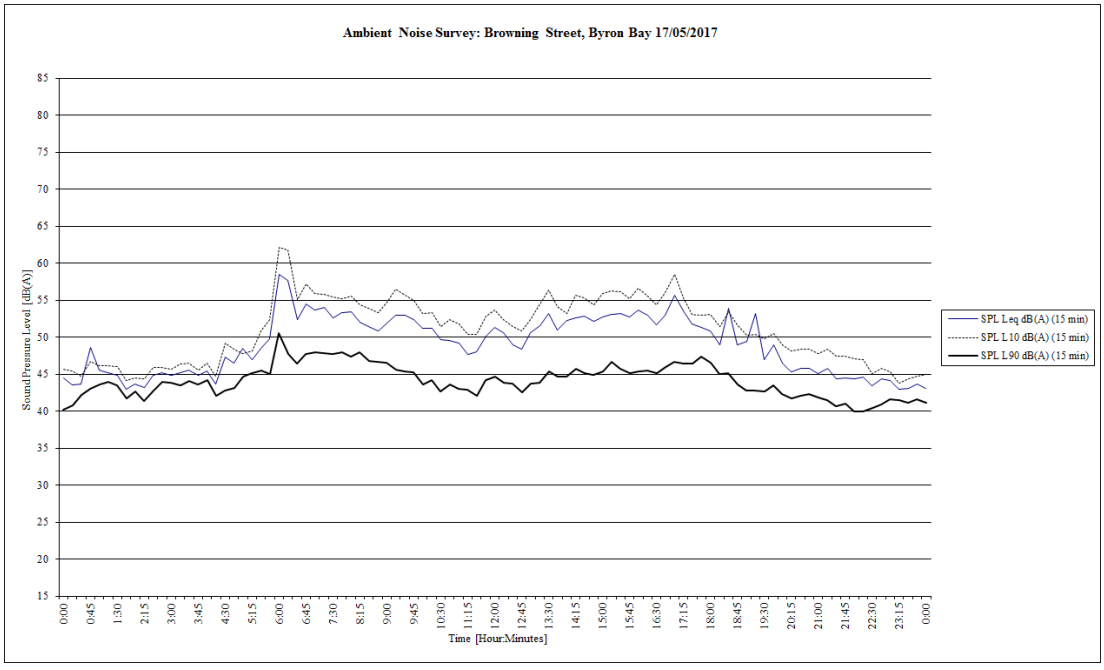
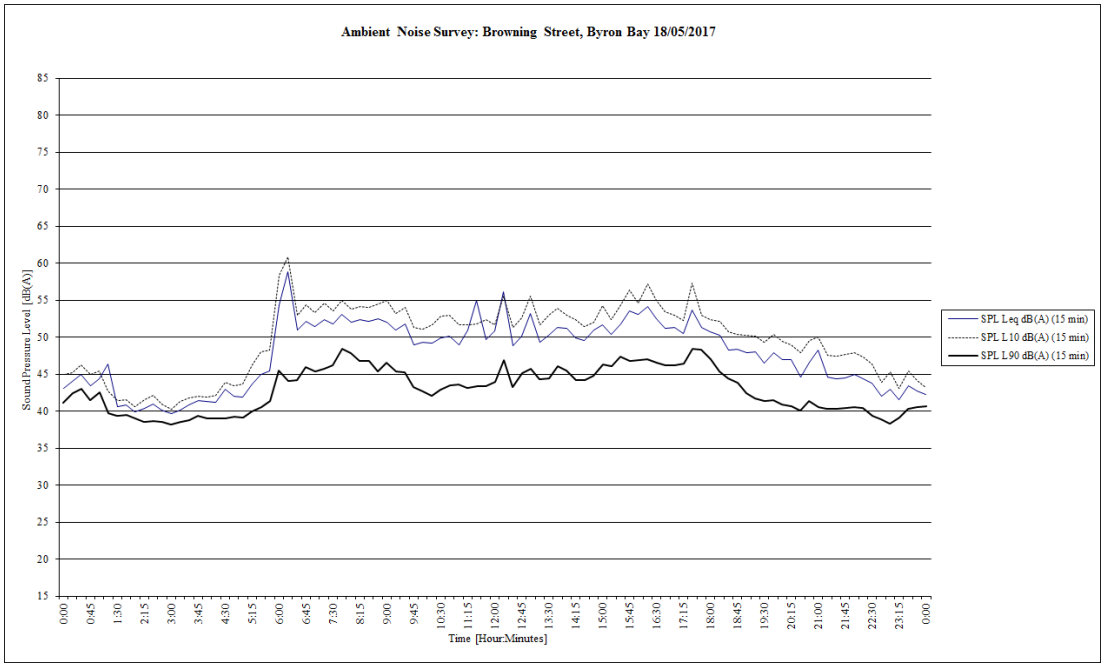
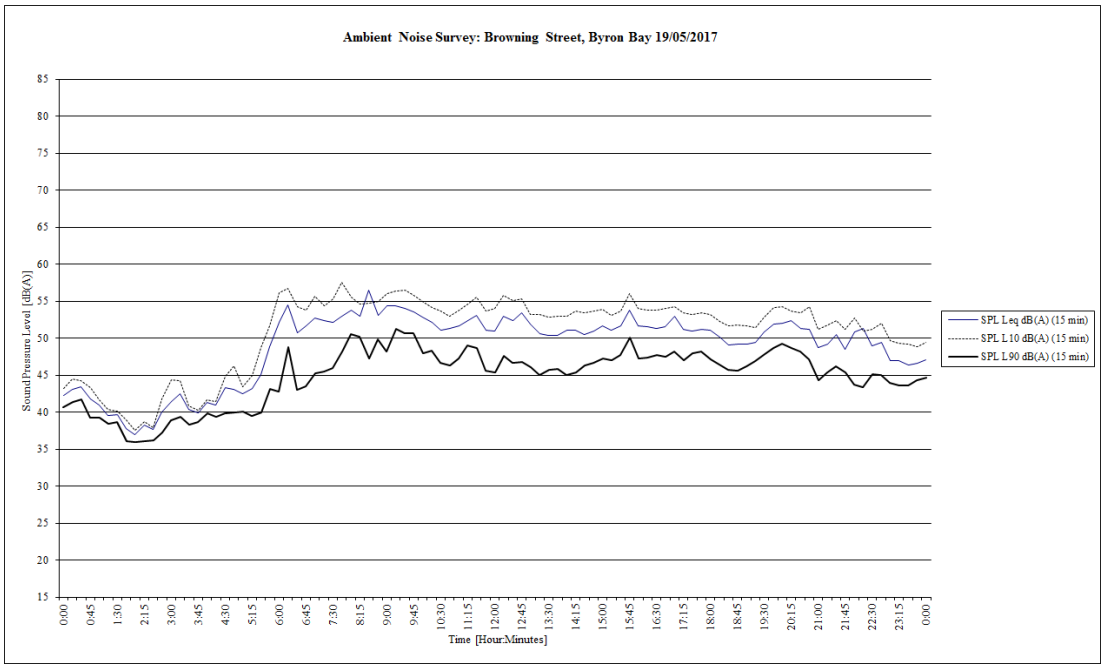
APPENDIX C

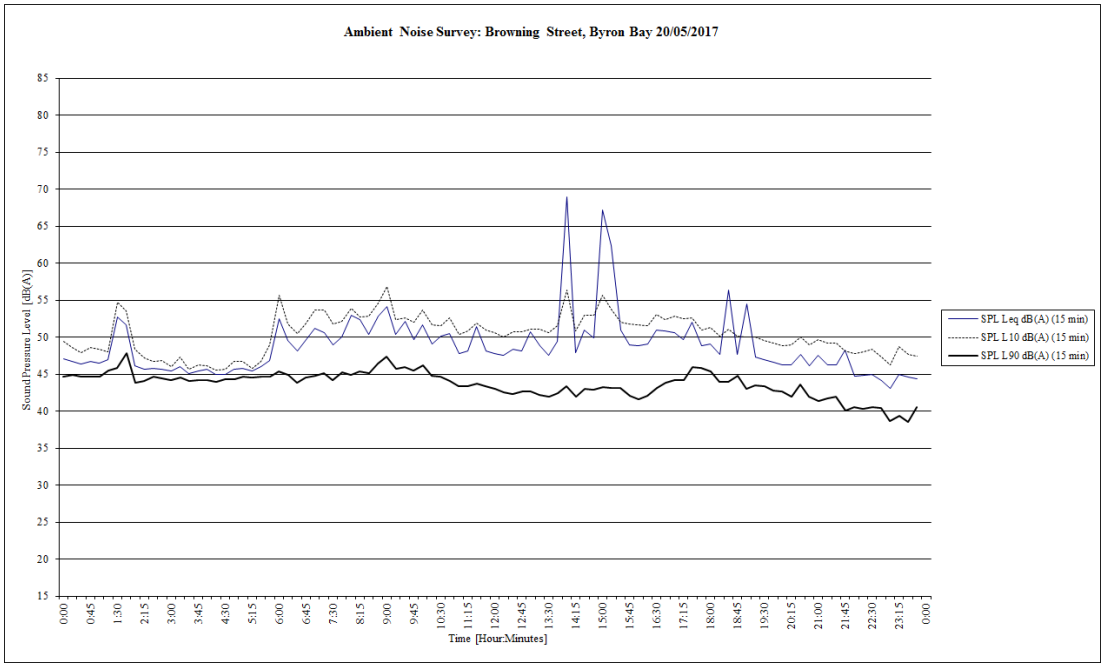
Measurement Results and Model Calculations / Predictions

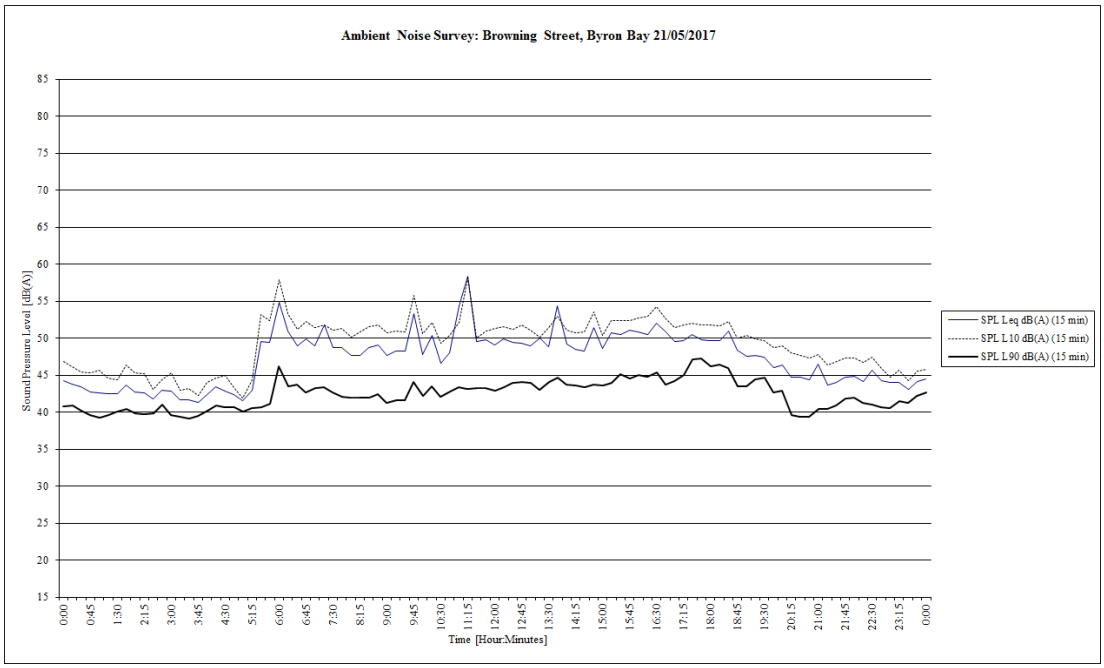

Ambient Noise Survey: Browning Street, Byron Bay 16/05/2017
Sound Pressure Level [dB(A)]
Time [Hour:Minutes]
SPL Leq dB(A) (15 min)
SPL L10 dB(A) (15 min)
SPL L90 dB(A) (15 min)

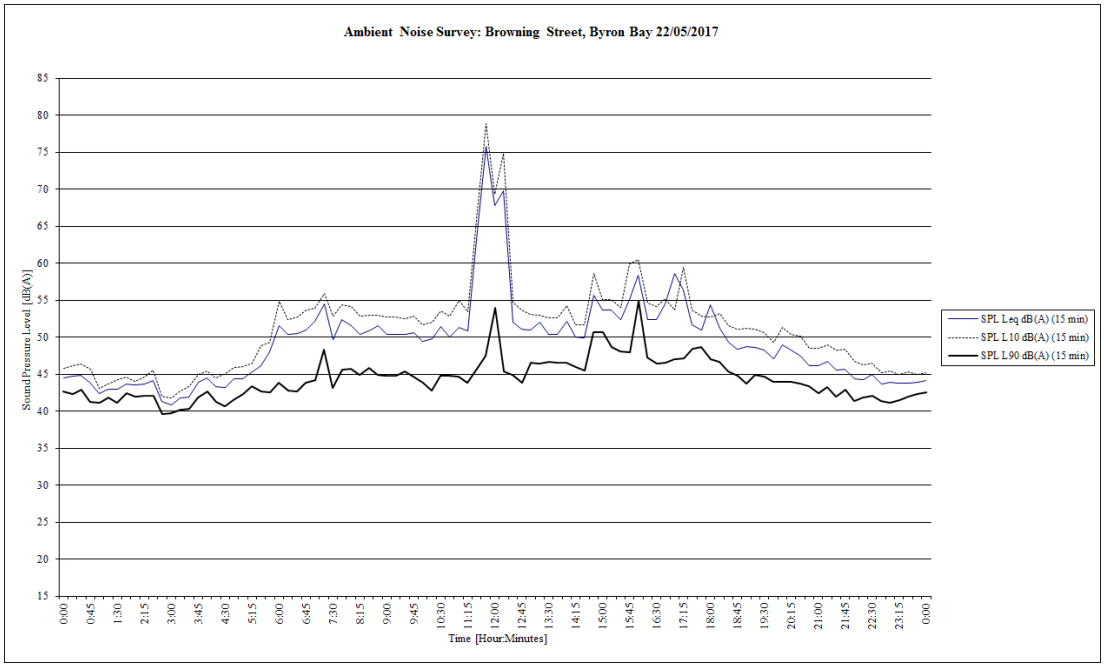

Ambient Noise Survey: Browning Street, Byron Bay 17/05/2017
Sound Pressure Level [dB(A)]
Time [Hour:Minutes]
SPL Leq dB(A) (15 min)
SPL L10 dB(A) (15 min)
SPL L90 dB(A) (15 min)

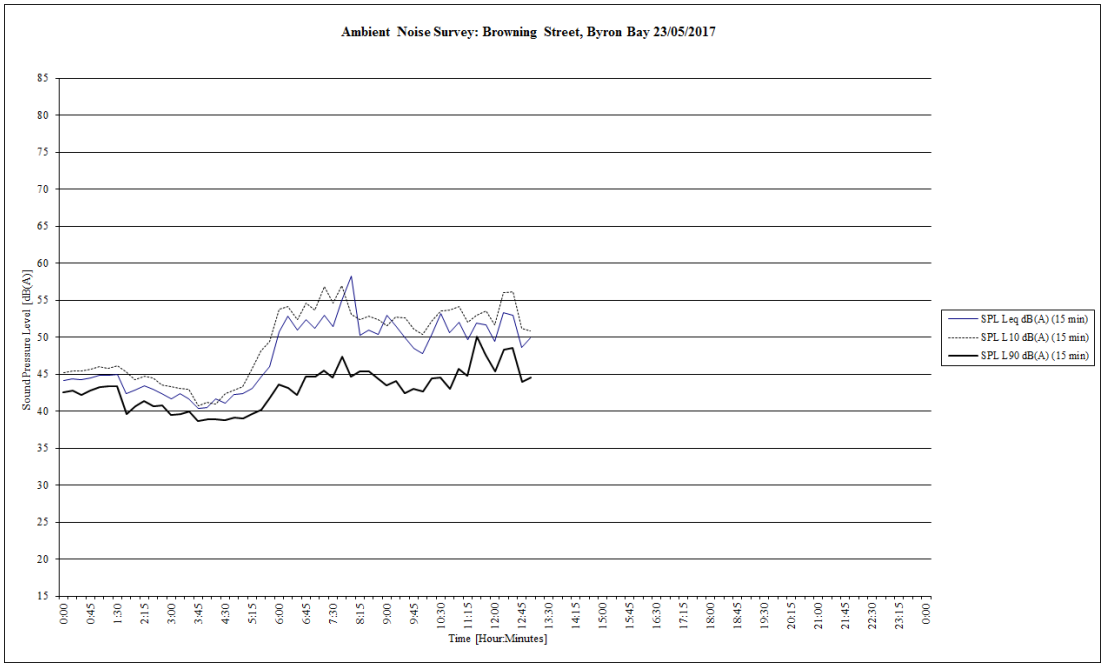

Ambient Noise Survey: Browning Street, Byron Bay 18/05/2017
Sound Pressure Level [dB(A)]
Time [Hour:Minutes]
SPL Leq dB(A) (15 min)
SPL L10 dB(A) (15 min)
SPL L90 dB(A) (15 min)


Ambient Noise Survey: Browning Street, Byron Bay 19/05/2017
Sound Pressure Level [dB(A)]
Time [Hour:Minutes]
SPL Leq dB(A) (15 min)
SPL L10 dB(A) (15 min)
SPL L90 dB(A) (15 min)


Ambient Noise Survey: Browning Street, Byron Bay 20/05/2017
Sound Pressure Level [dB(A)]
Time [Hour:Minutes]
SPL Leq dB(A) (15 min)
SPL L10 dB(A) (15 min)
SPL L90 dB(A) (15 min)


Ambient Noise Survey: Browning Street, Byron Bay 21/05/2017
Sound Pressure Level [dB(A)]
Time [Hour:Minutes]
SPL Leq dB(A) (15 min)
SPL L10 dB(A) (15 min)
SPL L90 dB(A) (15 min)


Ambient Noise Survey: Browning Street, Byron Bay 22/05/2017
Sound Pressure Level [dB(A)]
Time [Hour:Minutes]
SPL Leq dB(A) (15 min)
SPL L10 dB(A) (15 min)
SPL L90 dB(A) (15 min)


Ambient Noise Survey: Browning Street, Byron Bay 23/05/2017
Sound Pressure Level [dB(A)]
Time [Hour:Minutes]
SPL Leq dB(A) (15 min)
SPL L10 dB(A) (15 min)
SPL L90 dB(A) (15 min)

POINT CALCULATIONS
Pen3D2000 V 1.10.0
Project Code:17083a
Project Description:Noise assessment of Browning Street Mixed Use
File:G:\Users\Matty\CRGNAS\2017\17083 Mixed Use Browning St Byron\17083a_existing.PEN

Friday 28 Jul, 2017 at 9:26:51
CoRTN Calculations
All road segments included. Segmentation angle: 1degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	L10(18hour) (dB(A))
monitor	560026.8	6830554.9	1.2	63.4 free-field

File:G:\Users\Matty\CRGNAS\2017\17083 Mixed Use Browning St Byron\17083a_ultimate.PEN
File Description:Data file covering ultimate

Friday 25 Aug, 2017 at 14:47:28
CoRTN Calculations
All road segments included. Segmentation angle: 1degrees. Road elevations apply.

Receptor	X Posn (m)	Y Posn (m)	Height (m)	L10(18hour) (dB(A))
U1.1L	559940.6	6830635	5	68.9
U1.1B1	559941.9	6830630.1	5	69.4
U1.1 B2	559948.3	6830632.5	5	61.2
U1.2L	559941.7	6830640.6	5	67.4
U1.2B1	559940.9	6830643.8	5	67.9
U1.3L	559940.7	6830647.4	5	67.8
U1.3B1	559942.3	6830650.4	5	63
U1.4L	559939.7	6830653.4	5	67.8
U1.4B1	559941.5	6830655.9	5	63.1
U1.5L	559940.3	6830658.8	5	67.3
U1.5B1	559939.4	6830662.5	5	67.5
U1.5B2	559948.2	6830665.2	5	58.6
U1.6L	559957.7	6830663.1	5	51.1
U1.6B1	559951.8	6830662	5	40.9
U1.6B2	559954	6830663.8	5	49.6
U1.7L	559962	6830663.4	5	43.1
U1.7B1	559967.7	6830663.3	5	39.7
U1.7B2	559964.9	6830664.7	5	48
U1.8L	559970.2	6830665	5	43.7
U1.8B1	559973	6830664.7	5	44.7
U1.9L	559976	6830665.7	5	44
U1.9B1	559979.7	6830665.8	5	45.3
U1.9B2	559982.1	6830658	5	53.4
U1.10L	559976.4	6830614.2	5	67
U1.10B1	559979.8	6830611.9	5	67.4
U1.10B2	559984.1	6830618.3	5	61.3
U1.11L	559966.4	6830617.8	5	66.6
U1.11B1	559972.7	6830615.9	5	65.9
U1.11B2	559969.5	6830615.3	5	67.6
U1.12L	559962.6	6830618.9	5	66.8
U1.12B1	559956.4	6830621.2	5	66.8
U1.12B2	559958.7	6830618.9	5	68.1
U1.13L	559952.7	6830622.1	5	68.2
U1.13B1	559948.4	6830623.6	5	68.8
U1.13B2	559953.4	6830631.3	5	59.4
U1.14 N	559981.2	6830649.1	5	49.5
U1.14 S	559981	6830644.1	5	41.8
U1.15 N	559981.3	6830640.4	5	44.5
U1.15S	559981.6	6830636.4	5	43.6
U1.16 N	559981.8	6830632.6	5	43
U1.16 S	559982.6	6830628.5	5	47.2
U1.1B1	559941.9	6830630.1	8	69.5
U1.1L	559940.6	6830635	8	69.1
U1.1B1	559941.9	6830630.1	8	69.5
U2.1 B2	559948.3	6830632.5	8	61.9
U1.2L	559941.7	6830640.6	8	67.8
U1.2B1	559940.9	6830643.8	8	68.4
U1.3L	559940.7	6830647.4	8	68.3
U1.3B1	559942.3	6830650.4	8	63.7
U1.4L	559939.7	6830653.4	8	68.4
U1.4B1	559941.5	6830655.9	8	63.8
U1.5L	559940.3	6830658.8	8	67.9
U1.5B1	559939.4	6830662.5	8	68.1

U1.5B2	559948.2	6830665.2	8	61.4
U1.6L	559957.7	6830663.1	8	53.5
U1.6B1	559951.8	6830662	8	43.9
U1.6B2	559954	6830663.8	8	52.8
U1.7L	559962	6830663.4	8	46.5
U1.7B1	559967.7	6830663.3	8	42.7
U1.7B2	559964.9	6830664.7	8	50.5
U1.8L	559970.2	6830665	8	46.4
U1.8B1	559973	6830664.7	8	47.3
U1.9L	559976	6830665.7	8	47.1
U1.9B1	559979.7	6830665.8	8	48.3
U1.9B2	559982.1	6830658	8	56.2
U1.10L	559976.4	6830614.2	8	67.8
U1.10B1	559979.8	6830611.9	8	68.2
U1.10B2	559984.1	6830618.3	8	62.5
U1.11L	559966.4	6830617.8	8	67.4
U1.11B1	559972.7	6830615.9	8	66.7
U1.11B2	559969.5	6830615.3	8	68.3
U1.12L	559962.6	6830618.9	8	67.6
U1.12B1	559956.4	6830621.2	8	67.4
U1.12B2	559958.7	6830618.9	8	68.7
U1.13L	559952.7	6830622.1	8	68.7
U1.13B1	559948.4	6830623.6	8	69.1
U1.13B2	559953.4	6830631.3	8	60.2
U1.14 N	559981.2	6830649.1	8	54.7
U1.14 S	559981	6830644.1	8	46.7
U1.15 N	559981.3	6830640.4	8	49
U1.15S	559981.6	6830636.4	8	48.2
U1.16 N	559981.8	6830632.6	8	48
U1.16 S	559982.6	6830628.5	8	52.8
U3.1L	559943.4	6830638.6	11	66.7
U3.1B1	559943.1	6830642.9	11	67.4
U3.1B2	559943.8	6830633	11	67.1
U3.1B3	559950.6	6830634.2	11	60.6
U3.2L	559942.6	6830649.2	11	67.5
U3.2B1	559942.4	6830652.8	11	67.5
U3.2B2	559943	6830645.4	11	67.5
U3.3L	559941.9	6830659	11	67.4
U3.3B1	559942.2	6830654.9	11	67.5
U3.3B2	559941.7	6830662.3	11	67.4
U3.3B3	559948.2	6830665.2	11	63.3
U3.4L	559957.7	6830663.1	11	58
U3.4B1	559951.8	6830662	11	49.5
U3.4B2	559954	6830663.8	11	59.3
U3.5L	559962	6830663.4	11	51.1
U3.5B1	559967.7	6830663.3	11	48.2
U3.5B2	559964.9	6830664.7	11	53.6
U3.6 L	559971.6	6830664.5	11	50.4
U3.6 b1	559976.2	6830664.9	11	50.6
U3.6 b2	559979.1	6830657.1	11	57.1
U3.7L	559969.7	6830618.4	11	67.6
U3.7B1	559964.5	6830620.2	11	67.4
U3.7B2	559976.3	6830616.2	11	67.4
U3.7B3	559978.3	6830622.1	11	59.5
U3.8L	559956.6	6830622.8	11	67.7
U3.8B1	559961.5	6830621.1	11	67.3
U3.8B2	559950.9	6830624.7	11	68
U3.8B3	559953.4	6830631.3	11	60.8
U3.9 N	559979.1	6830645.8	11	57.8
U3.9 S	559979.5	6830639.7	11	58.3
U3.10 N	559979.9	6830634.5	11	58.8
U3.10 S	559980.4	6830629.1	11	60.2

CC COT	559979.1	6830629.6	1.5	39.7
CC 0-2 ACT	559978.7	6830634.5	1.5	40.4
CC 2-3 ACT	559977.9	6830644.7	1.5	45.9
CC 3-4 ACT	559954.8	6830625.4	1.5	59.9
CC 4-5 ACT	559966.2	6830621.4	1.5	59.6

					Free-field
0-2 PLAY	559982.6	6830634.8	1.5	44.2	41.7
2-3 PLAY	559981.7	6830645	1.5	47.3	44.8
3-4 PLAY	559952.6	6830622.2	1.5	61.1	58.6
4-5 PLAY	559965.1	6830618	1.5	60.7	58.2

Proposed	Browning Street Mixed Use										
Job no.	17083a										
Rw Calculations to AS3671											
Road Traffic Noise	**Building**	**Impact**	**Criteria**	**TNR**	**Element Area**	**Floor Area**	**Height**	**RT60**	**C**	**TNA**	**Rw**
Space	**Component**	**dB(A)**	**dB(A)**	**dB(A)**	**(m2)**	**(m2)**	**(m)**	**(s)**			
Unit 1.1											
Living / Dining / Kitchen Area	Glazing	66.0	40	26.0	17.55	37.35	2.70	0.70	2	27.65	**34**
Living / Dining / Kitchen Area	External Walls	66.0	40	26.0	1.95	37.35	2.70	0.70	2	18.11	**24**
Bedroom 1	Glazing	61.0	35	26.0	10.26	11.31	2.70	0.50	2	29.04	**35**
Bedroom 1	External Walls	61.0	35	26.0	13.74	11.31	2.70	0.50	2	30.31	**36**
Bedroom 2	Glazing	53.0	35	18.0	2.97	8.70	2.70	0.50	2	16.80	**23**
Bedroom 2	External Walls	53.0	35	18.0	6.03	8.70	2.70	0.50	2	19.88	**26**
Unit 1.2											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	10.26	41.89	2.70	0.70	2	23.82	**30**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	2.34	41.89	2.70	0.70	2	17.40	**23**
Bedroom 1	Glazing	59.0	35	24.0	7.56	11.20	2.70	0.50	2	25.76	**32**
Bedroom 1	External Walls	59.0	35	24.0	3.84	11.20	2.70	0.50	2	22.82	**29**
Unit 1.3											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	9.45	29.98	2.70	0.70	2	24.92	**31**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	8.55	29.98	2.70	0.70	2	24.48	**30**
Bedroom 1	Glazing	55.0	35	20.0	5.13	15.13	2.70	0.50	2	18.77	**25**
Bedroom 1	External Walls	55.0	35	20.0	1.47	10.71	2.70	0.50	2	14.84	**21**
Unit 1.4											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	9.45	30.88	2.70	0.70	2	24.79	**31**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	8.55	30.88	2.70	0.70	2	24.35	**30**
Bedroom 1	Glazing	55.0	35	20.0	4.05	12.54	2.70	0.50	2	18.56	**25**
Bedroom 1	External Walls	55.0	35	20.0	1.35	12.54	2.70	0.50	2	13.79	**20**
Unit 1.5											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	10.53	36.14	2.70	0.70	2	24.57	**31**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	1.77	36.14	2.70	0.70	2	16.83	**23**
Bedroom 1	Glazing	59.0	35	24.0	9.45	10.96	2.70	0.50	2	26.82	**33**
Bedroom 1	External Walls	59.0	35	24.0	14.55	10.96	2.70	0.50	2	28.70	**35**
Bedroom 2	Glazing	50.0	35	15.0	1.62	9.66	2.70	0.50	2	10.71	**17**
Bedroom 2	External Walls	50.0	35	15.0	8.88	9.66	2.70	0.50	2	18.10	**24**
Unit 1.10											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	11.88	36.20	2.70	0.70	2	25.09	**31**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	1.92	36.20	2.70	0.70	2	17.18	**23**
Bedroom 1	Glazing	59.0	35	24.0	14.04	15.86	2.70	0.50	2	26.94	**33**
Bedroom 1	External Walls	59.0	35	24.0	18.96	15.86	2.70	0.50	2	28.24	**34**
Bedroom 2	Glazing	53.0	35	18.0	3.51	15.88	2.70	0.50	2	14.91	**21**
Bedroom 2	External Walls	53.0	35	18.0	11.49	15.88	2.70	0.50	2	20.06	**26**
Units 1.11 & 1.12											
Living / Dining / Kitchen Area	Glazing	64.0	40	24.0	10.80	39.20	2.70	0.70	2	23.33	**29**
Living / Dining / Kitchen Area	External Walls	64.0	40	24.0	1.80	39.20	2.70	0.70	2	15.55	**22**
Bedroom 1	Glazing	58.0	35	23.0	6.75	14.50	2.70	0.50	2	23.15	**29**
Bedroom 1	External Walls	58.0	35	23.0	1.35	14.50	2.70	0.50	2	16.16	**22**
Bedroom 2	Glazing	60.0	35	25.0	8.10	8.61	2.70	0.50	2	28.20	**34**
Bedroom 2	External Walls	60.0	35	25.0	9.90	8.61	2.70	0.50	2	29.07	**35**
Unit 1.13											
Living / Dining / Kitchen Area	Glazing	66.0	40	26.0	12.15	41.04	2.70	0.70	2	25.64	**32**
Living / Dining / Kitchen Area	External Walls	66.0	40	26.0	1.95	41.04	2.70	0.70	2	17.70	**24**
Bedroom 1	Glazing	60.0	35	25.0	14.09	14.60	2.70	0.50	2	28.31	**34**
Bedroom 1	External Walls	60.0	35	25.0	14.41	14.60	2.70	0.50	2	28.41	**34**
Bedroom 2	Glazing	51.0	35	16.0	1.62	9.55	2.70	0.50	2	11.76	**18**
Bedroom 2	External Walls	51.0	35	16.0	7.98	9.55	2.70	0.50	2	18.69	**25**

Unit 2.1											
Living / Dining / Kitchen Area	Glazing	67.0	40	27.0	17.55	37.35	2.70	0.70	2	28.65	**35**
Living / Dining / Kitchen Area	External Walls	67.0	40	27.0	1.95	37.35	2.70	0.70	2	19.11	**25**
Bedroom 1	Glazing	61.0	35	26.0	10.26	11.31	2.70	0.50	2	29.04	**35**
Bedroom 1	External Walls	61.0	35	26.0	13.74	11.31	2.70	0.50	2	30.31	**36**
Bedroom 2	Glazing	53.0	35	18.0	2.97	8.70	2.70	0.50	2	16.80	**23**
Bedroom 2	External Walls	53.0	35	18.0	6.03	8.70	2.70	0.50	2	19.88	**26**
Unit 2.2											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	10.26	41.89	2.70	0.70	2	23.82	**30**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	2.34	41.89	2.70	0.70	2	17.40	**23**
Bedroom 1	Glazing	60.0	35	25.0	7.56	11.20	2.70	0.50	2	26.76	**33**
Bedroom 1	External Walls	60.0	35	25.0	3.84	11.20	2.70	0.50	2	23.82	**30**
Unit 2.3											
Living / Dining / Kitchen Area	Glazing	66.0	40	26.0	9.45	29.98	2.70	0.70	2	25.92	**32**
Living / Dining / Kitchen Area	External Walls	66.0	40	26.0	8.55	29.98	2.70	0.70	2	25.48	**31**
Bedroom 1	Glazing	55.0	35	20.0	5.13	15.13	2.70	0.50	2	18.77	**25**
Bedroom 1	External Walls	55.0	35	20.0	1.47	10.71	2.70	0.50	2	14.84	**21**
Unit 2.4											
Living / Dining / Kitchen Area	Glazing	66.0	40	26.0	9.45	30.88	2.70	0.70	2	25.79	**32**
Living / Dining / Kitchen Area	External Walls	66.0	40	26.0	8.55	30.88	2.70	0.70	2	25.35	**31**
Bedroom 1	Glazing	55.0	35	20.0	4.05	12.54	2.70	0.50	2	18.56	**25**
Bedroom 1	External Walls	55.0	35	20.0	1.35	12.54	2.70	0.50	2	13.79	**20**
Unit 2.5											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	10.53	36.14	2.70	0.70	2	24.57	**31**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	1.77	36.14	2.70	0.70	2	16.83	**23**
Bedroom 1	Glazing	60.0	35	25.0	9.45	10.96	2.70	0.50	2	27.82	**34**
Bedroom 1	External Walls	60.0	35	25.0	14.55	10.96	2.70	0.50	2	29.70	**36**
Bedroom 2	Glazing	53.0	35	18.0	1.62	9.66	2.70	0.50	2	13.71	**20**
Bedroom 2	External Walls	53.0	35	18.0	8.88	9.66	2.70	0.50	2	21.10	**27**
Unit 2.10											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	11.88	36.20	2.70	0.70	2	25.09	**31**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	1.92	36.20	2.70	0.70	2	17.18	**23**
Bedroom 1	Glazing	60.0	35	25.0	14.04	15.86	2.70	0.50	2	27.94	**34**
Bedroom 1	External Walls	60.0	35	25.0	18.96	15.86	2.70	0.50	2	29.24	**35**
Bedroom 2	Glazing	54.0	35	19.0	3.51	15.88	2.70	0.50	2	15.91	**22**
Bedroom 2	External Walls	54.0	35	19.0	11.49	15.88	2.70	0.50	2	21.06	**27**
Units 2.11 & 2.12											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	10.80	39.20	2.70	0.70	2	24.33	**30**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	1.80	39.20	2.70	0.70	2	16.55	**23**
Bedroom 1	Glazing	59.0	35	24.0	6.75	14.50	2.70	0.50	2	24.15	**30**
Bedroom 1	External Walls	59.0	35	24.0	1.35	14.50	2.70	0.50	2	17.16	**23**
Bedroom 2	Glazing	60.0	35	25.0	8.10	8.61	2.70	0.50	2	28.20	**34**
Bedroom 2	External Walls	60.0	35	25.0	9.90	8.61	2.70	0.50	2	29.07	**35**
Unit 2.13											
Living / Dining / Kitchen Area	Glazing	66.0	40	26.0	12.15	41.04	2.70	0.70	2	25.64	**32**
Living / Dining / Kitchen Area	External Walls	66.0	40	26.0	1.95	41.04	2.70	0.70	2	17.70	**24**
Bedroom 1	Glazing	61.0	35	26.0	14.58	14.60	2.70	0.50	2	29.46	**35**
Bedroom 1	External Walls	61.0	35	26.0	13.92	14.60	2.70	0.50	2	29.26	**35**
Bedroom 2	Glazing	52.0	35	17.0	3.24	9.55	2.70	0.50	2	15.77	**22**
Bedroom 2	External Walls	52.0	35	17.0	6.36	9.55	2.70	0.50	2	18.70	**25**
Unit 2.15											
South Room	Glazing	57.0	40	17.0	6.75	24.69	2.70	0.70	2	16.30	**22**
South Room	External Walls	57.0	40	17.0	2.85	24.69	2.70	0.70	2	12.55	**19**
Unit 2.16											
North Room	Glazing	57.0	40	17.0	6.75	24.69	2.70	0.70	2	16.30	**22**
North Room	External Walls	57.0	40	17.0	2.85	24.69	2.70	0.70	2	12.55	**19**
South Room	Glazing	58.0	40	18.0	8.64	25.18	2.70	0.70	2	18.28	**24**
South Room	External Walls	58.0	40	18.0	18.36	25.18	2.70	0.70	2	21.56	**28**

Unit 3.1											
Living / Dining / Kitchen Area	Glazing	64.0	40	24.0	17.55	36.73	2.70	0.70	3	27.48	**33**
Living / Dining / Kitchen Area	External Walls	64.0	40	24.0	7.95	36.73	2.70	0.70	3	24.04	**30**
Living / Dining / Kitchen Area	Roof / Ceiling	61.0	40	21.0	36.73	36.73	2.70	0.70	3	27.69	**34**
Bedroom 1	Glazing	59.0	35	24.0	8.10	12.40	2.70	0.50	3	27.38	**33**
Bedroom 1	External Walls	59.0	35	24.0	1.50	12.40	2.70	0.50	3	20.06	**26**
Bedroom 1	Roof / Ceiling	56.0	35	21.0	12.40	12.40	2.70	0.50	3	26.23	**32**
Bedroom 2	Glazing	59.0	35	24.0	5.13	9.94	2.70	0.50	3	26.36	**32**
Bedroom 2	External Walls	59.0	35	24.0	12.87	9.94	2.70	0.50	3	30.35	**36**
Bedroom 2	Roof / Ceiling	56.0	35	21.0	9.94	9.94	2.70	0.50	3	26.23	**32**
Bedroom 3	Glazing	52.0	35	17.0	3.24	10.20	2.70	0.50	3	17.25	**23**
Bedroom 3	External Walls	52.0	35	17.0	8.76	10.20	2.70	0.50	3	21.57	**28**
Bedroom 3	Roof / Ceiling	49.0	35	14.0	10.20	10.20	2.70	0.50	3	19.23	**25**
Unit 3.2											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	12.15	32.64	2.70	0.70	3	27.40	**33**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	1.95	32.64	2.70	0.70	3	19.45	**25**
Living / Dining / Kitchen Area	Roof / Ceiling	62.0	40	22.0	32.64	32.64	2.70	0.70	3	28.69	**35**
Bedroom 1	Glazing	59.0	35	24.0	3.24	15.60	2.70	0.50	3	22.40	**28**
Bedroom 1	External Walls	59.0	35	24.0	0.96	15.60	2.70	0.50	3	17.12	**23**
Bedroom 1	Roof / Ceiling	56.0	35	21.0	15.60	15.60	2.70	0.50	3	26.23	**32**
Bedroom 2	Glazing	59.0	35	24.0	9.45	9.30	2.70	0.50	3	29.30	**35**
Bedroom 2	External Walls	59.0	35	24.0	1.05	9.30	2.70	0.50	3	19.76	**26**
Bedroom 2	Roof / Ceiling	56.0	35	21.0	9.30	9.30	2.70	0.50	3	26.23	**32**
Unit 3.3											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	10.80	34.80	2.70	0.70	3	26.61	**33**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	1.80	34.80	2.70	0.70	3	18.83	**25**
Living / Dining / Kitchen Area	Roof / Ceiling	62.0	40	22.0	34.80	34.80	2.70	0.70	3	28.69	**35**
Bedroom 1	Glazing	59.0	35	24.0	8.10	11.25	2.70	0.50	3	27.80	**34**
Bedroom 1	External Walls	59.0	35	24.0	1.80	11.25	2.70	0.50	3	21.27	**27**
Bedroom 1	Roof / Ceiling	56.0	35	21.0	11.25	11.25	2.70	0.50	3	26.23	**32**
Bedroom 2	Glazing	59.0	35	24.0	7.56	10.23	2.70	0.50	3	27.92	**34**
Bedroom 2	External Walls	59.0	35	24.0	13.44	10.23	2.70	0.50	3	30.41	**36**
Bedroom 2	Roof / Ceiling	56.0	35	21.0	10.23	10.23	2.70	0.50	3	26.23	**32**
Bedroom 3	Glazing	55.0	35	20.0	1.62	8.76	2.70	0.50	3	17.90	**24**
Bedroom 3	External Walls	55.0	35	20.0	10.38	8.76	2.70	0.50	3	25.97	**32**
Bedroom 3	Roof / Ceiling	52.0	35	17.0	8.76	8.76	2.70	0.50	3	22.23	**28**
Unit 3.4											
Living / Dining / Kitchen Area	Glazing	56.0	40	16.0	10.80	34.80	2.70	0.70	3	17.61	**24**
Living / Dining / Kitchen Area	External Walls	56.0	40	16.0	1.80	34.80	2.70	0.70	3	9.83	**16**
Living / Dining / Kitchen Area	Roof / Ceiling	53.0	40	13.0	34.80	34.80	2.70	0.70	3	19.69	**26**
Bedroom 2	Glazing	51.0	35	16.0	8.10	9.54	2.70	0.50	3	20.52	**27**
Bedroom 2	External Walls	51.0	35	16.0	10.50	9.54	2.70	0.50	3	21.65	**28**
Bedroom 2	Roof / Ceiling	48.0	35	13.0	9.54	9.54	2.70	0.50	3	18.23	**24**
Unit 3.7											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	22.95	44.55	2.70	0.70	3	28.81	**35**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	3.15	44.55	2.70	0.70	3	20.18	**26**
Living / Dining / Kitchen Area	Roof / Ceiling	62.0	40	22.0	44.55	44.55	2.70	0.70	3	28.69	**35**
Bedroom 1	Glazing	59.0	35	24.0	8.37	13.53	2.70	0.50	3	27.14	**33**
Bedroom 1	External Walls	59.0	35	24.0	1.83	13.53	2.70	0.50	3	20.54	**27**
Bedroom 1	Roof / Ceiling	56.0	35	21.0	13.53	13.53	2.70	0.50	3	26.23	**32**
Bedroom 2	Glazing	59.0	35	24.0	11.34	11.31	2.70	0.50	3	29.24	**35**
Bedroom 2	External Walls	59.0	35	24.0	15.66	11.31	2.70	0.50	3	30.64	**37**
Bedroom 2	Roof / Ceiling	56.0	35	21.0	11.31	11.31	2.70	0.50	3	26.23	**32**
Bedroom 3	External Walls	51.0	35	16.0	10.50	9.57	2.70	0.50	2	19.87	**26**
Bedroom 3	Roof / Ceiling	48.0	35	13.0	9.57	9.57	2.70	0.50	2	16.47	**22**

Unit 3.8											
Living / Dining / Kitchen Area	Glazing	65.0	40	25.0	21.60	42.93	2.70	0.70	3	28.71	**35**
Living / Dining / Kitchen Area	External Walls	65.0	40	25.0	3.00	42.93	2.70	0.70	3	20.13	**26**
Living / Dining / Kitchen Area	Roof / Ceiling	62.0	40	22.0	42.93	42.93	2.70	0.70	3	28.69	**35**
Bedroom 1	Glazing	59.0	35	24.0	8.37	13.93	2.70	0.50	3	27.02	**33**
Bedroom 1	External Walls	59.0	35	24.0	1.53	13.93	2.70	0.50	3	19.64	**26**
Bedroom 1	Roof / Ceiling	56.0	35	21.0	13.93	13.93	2.70	0.50	3	26.23	**32**
Bedroom 2	Glazing	60.0	35	25.0	10.00	13.20	2.70	0.50	3	29.02	**35**
Bedroom 2	External Walls	60.0	35	25.0	20.00	13.20	2.70	0.50	3	32.03	**38**
Bedroom 2	Roof / Ceiling	57.0	35	22.0	13.20	13.20	2.70	0.50	3	27.23	**33**
Bedroom 3	Glazing	52.0	35	17.0	2.43	10.92	2.70	0.50	3	15.70	**22**
Bedroom 3	External Walls	52.0	35	17.0	7.17	10.92	2.70	0.50	3	20.40	**26**
Bedroom 3	Roof / Ceiling	49.0	35	14.0	10.92	10.92	2.70	0.50	3	19.23	**25**
Unit 3.9											
South Room	Glazing	56.0	40	16.0	12.42	30.27	2.70	0.70	3	18.82	**25**
South Room	External Walls	56.0	40	16.0	1.98	30.27	2.70	0.70	3	10.85	**17**
South Room	Roof / Ceiling	53.0	40	13.0	30.27	30.27	2.70	0.70	3	19.69	**26**
Unit 3.10											
North Room	Glazing	56.0	40	16.0	12.42	30.27	2.70	0.70	3	18.82	**25**
North Room	External Walls	56.0	40	16.0	1.98	30.27	2.70	0.70	3	10.85	**17**
North Room	Roof / Ceiling	53.0	40	13.0	30.27	30.27	2.70	0.70	3	19.69	**26**
South Room	Glazing	58.0	40	18.0	13.23	27.17	2.70	0.70	3	21.56	**28**
South Room	External Walls	58.0	40	18.0	10.77	27.17	2.70	0.70	3	20.67	**27**
South Room	Roof / Ceiling	55.0	40	15.0	27.17	27.17	2.70	0.70	3	21.69	**28**

Proposed	Browning Street Mixed Use										
Job no.	17083a										
Rw Calculations to AS3671											
Road Traffic Noise	**Building**	**Impact**	**Criteria**	**TNR**	**Element Area**	**Floor Area**	**Height**	**RT60**	**C**	**TNA**	**Rw**
Space	**Component**	**dB(A)**	**dB(A)**	**dB(A)**	**(m2)**	**(m2)**	**(m)**	**(s)**			
Childcare											
Activity Room 3-4 Year Olds	Glazing	60.0	40	20.0	32.00	61.50	3.20	0.80	2	21.93	**28**
Activity Room 3-4 Year Olds	External Walls	60.0	40	20.0	35.20	61.50	3.20	0.80	2	22.35	**28**
Activity Room 4-5 Year Olds	Glazing	60.0	40	20.0	27.84	66.50	3.20	0.80	2	20.99	**27**
Activity Room 4-5 Year Olds	External Walls	60.0	40	20.0	0.96	66.50	3.20	0.80	2	6.37	**12**

Leq ONSITE COMMERCIAL ACTIVITIES IMPACTING:						
R1: Two Storey Dwelling Due North				**R2: Single Storey Dwelling Due East**		
Car door closures at basement	80	dB(A) @ 1m	#	Car door closures at basement	80	dB(A) @ 1m
Single event duration	1.5	seconds		Single event duration	1.5	seconds
Number of events in 15 minutes	20	events		Number of events in 15 minutes	20	events
Worst case duration in 15 minutes	0.5	minutes		Worst case duration in 15 minutes	0.5	minutes
15 minute Leq	65.2	dB(A) @ 1m		15 minute Leq	65.2	dB(A) @ 1m
Distance to receiver	6	m		Distance to receiver	10	m
Basement screening	-30	dB(A)		Basement screening	-30	dB(A)
Distance attenuation	-15.6	dB(A)		Distance attenuation	-20.0	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	22	dB(A)	#	Impact at Façade	18	dB(A)
Car bypass @ 5km/hr at basement ramp	66	dB(A) @ 1m	#	Car bypass @ 5km/hr at basement ramp	66	dB(A) @ 1m
Single event duration	7	seconds		Single event duration	7	seconds
Number of events in 15 minutes	20	events		Number of events in 15 minutes	20	events
Worst case duration in 15 minutes	2.333	minutes		Worst case duration in 15 minutes	2.333	minutes
15 minute Leq	57.9	dB(A) @ 1m		15 minute Leq	57.9	dB(A) @ 1m
Distance to receiver	50	m		Distance to receiver	29	m
Building screening	-15	dB(A)		Barrier Screening	0	dB(A)
Distance attenuation	-34.0	dB(A)		Distance attenuation	-29.2	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	11	dB(A)	#	Impact at Façade	31	dB(A)
Children playing normally outside	73	dB(A) @ 1m	#	Children playing normally outside	73	dB(A) @ 1m
Single event duration	900	seconds		Single event duration	900	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	15	minutes		Worst case duration in 15 minutes	15	minutes
15 minute Leq	73.0	dB(A) @ 1m		15 minute Leq	73.0	dB(A) @ 1m
Distance to receiver	35	m		Distance to receiver	13	m
Building screening	-15	dB(A)		Barrier Screening	-15	dB(A)
Distance attenuation	-30.9	dB(A)		Distance attenuation	-22.3	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	30	dB(A)	#	Impact at Façade	38	dB(A)
Children playing normally inside	73	dB(A) @ 1m	#	Children playing normally inside	73	dB(A) @ 1m
Single event duration	900	seconds		Single event duration	900	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	15	minutes		Worst case duration in 15 minutes	15	minutes
15 minute Leq	73.0	dB(A) @ 1m		15 minute Leq	73.0	dB(A) @ 1m
Distance to receiver	35	m		Distance to receiver	20	m
Inside to outside att. + building screening	-30	dB(A)		Inside to outside att. + barrier	-21	dB(A)
Distance attenuation	-30.9	dB(A)		Distance attenuation	-26.0	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	15	dB(A)	#	Impact at Façade	28	dB(A)
Children playing boisterously outside	82	dB(A) @ 1m	#	Children playing boisterously outside	82	dB(A) @ 1m
Single event duration	900	seconds		Single event duration	900	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	15	minutes		Worst case duration in 15 minutes	15	minutes
15 minute Leq	82.0	dB(A) @ 1m		15 minute Leq	82.0	dB(A) @ 1m
Distance to receiver	35	m		Distance to receiver	13	m
Building screening	-15	dB(A)		Barrier Screening	-15	dB(A)
Distance attenuation	-30.9	dB(A)		Distance attenuation	-22.3	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	39	dB(A)	#	Impact at Façade	47	dB(A)
Children playing inside boisterously	82	dB(A) @ 1m	#	Children playing inside boisterously	82	dB(A) @ 1m
Single event duration	900	seconds		Single event duration	900	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	15	minutes		Worst case duration in 15 minutes	15	minutes
15 minute Leq	82.0	dB(A) @ 1m		15 minute Leq	82.0	dB(A) @ 1m
Distance to receiver	35	m		Distance to receiver	20	m
Inside to outside att. + building screening	-30	dB(A)		Inside to outside att. + barrier	-21	dB(A)
Distance attenuation	-30.9	dB(A)		Distance attenuation	-26.0	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	24	dB(A)	#	Impact at Façade	37	dB(A)

Leq ONSITE COMMERCIAL ACTIVITIES IMPACTING:						
R1: Two Storey Dwelling Due North				**R2: Single Storey Dwelling Due East**		
People talking outside shops / café	58	dB(A) @ 1m	#	People talking outside shops / café	58	dB(A) @ 1m
Single event duration	900	seconds		Single event duration	900	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	15	minutes		Worst case duration in 15 minutes	15	minutes
15 minute Leq	58.0	dB(A) @ 1m		15 minute Leq	58.0	dB(A) @ 1m
Distance to receiver	12	m		Distance to receiver	45	m
Barrier Screening	0	dB(A)		Building screening	-15	dB(A)
Distance attenuation	-21.6	dB(A)		Distance attenuation	-33.1	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	39	dB(A)	#	Impact at Façade	12	dB(A)
Alfresco Dining	78	dB(A) @ 1m	#	Alfresco Dining	78	dB(A) @ 1m
Single event duration	900	seconds		Single event duration	900	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	15	minutes		Worst case duration in 15 minutes	15	minutes
15 minute Leq	78.0	dB(A) @ 1m		15 minute Leq	78.0	dB(A) @ 1m
Distance to receiver	30	m		Distance to receiver	45	m
Building screening	-12	dB(A)		Building screening	-15	dB(A)
Distance attenuation	-29.5	dB(A)		Distance attenuation	-33.1	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	39	dB(A)	#	Impact at Façade	32	dB(A)
Deliveries	87	dB(A) @ 1m	#	Deliveries	87	dB(A) @ 1m
Single event duration	600	seconds		Single event duration	600	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	10	minutes		Worst case duration in 15 minutes	10	minutes
15 minute Leq	85.2	dB(A) @ 1m		15 minute Leq	85.2	dB(A) @ 1m
Distance to receiver	55	m		Distance to receiver	20	m
Building screening	-15	dB(A)		Barrier Screening	0	dB(A)
Distance attenuation	-34.8	dB(A)		Distance attenuation	-26.0	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	38	dB(A)	#	Impact at Façade	62	dB(A)
Waste collection	97	dB(A) @ 1m	#	Waste collection	97	dB(A) @ 1m
Single event duration	300	seconds		Single event duration	300	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	5	minutes		Worst case duration in 15 minutes	5	minutes
15 minute Leq	92.2	dB(A) @ 1m		15 minute Leq	92.2	dB(A) @ 1m
Distance to receiver	55	m		Distance to receiver	20	m
Building screening	-15	dB(A)		Barrier Screening	0	dB(A)
Distance attenuation	-34.8	dB(A)		Distance attenuation	-26.0	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	45	dB(A)	#	Impact at Façade	69	dB(A)
Rooftop A/C plant x2	65	dB(A) @ 1m	#	Rooftop A/C plant x2	65	dB(A) @ 1m
Single event duration	600	seconds		Single event duration	600	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	10	minutes		Worst case duration in 15 minutes	10	minutes
15 minute Leq	63.2	dB(A) @ 1m		15 minute Leq	63.2	dB(A) @ 1m
Distance to receiver	12	m		Distance to receiver	17	m
Rooftop screening	-7	dB(A)		Rooftop screening	-10	dB(A)
Distance attenuation	-21.6	dB(A)		Distance attenuation	-24.6	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	37	dB(A)	#	Impact at Façade	31	dB(A)
Rooftop toilet exhaust	52	dB(A) @ 1m	#	Rooftop toilet exhaust	52	dB(A) @ 1m
Single event duration	600	seconds		Single event duration	600	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	10	minutes		Worst case duration in 15 minutes	10	minutes
15 minute Leq	50.2	dB(A) @ 1m		15 minute Leq	50.2	dB(A) @ 1m
Distance to receiver	12	m		Distance to receiver	17	m
Rooftop screening	-7	dB(A)		Rooftop screening	-10	dB(A)
Distance attenuation	-21.6	dB(A)		Distance attenuation	-24.6	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	24	dB(A)	#	Impact at Façade	18	dB(A)
Combined daytime	45	dB(A)		Combined daytime	48	dB(A)
Combined evening	43	dB(A)		Combined evening	37	dB(A)
Combined night-time	41	dB(A)		Combined night-time	34	dB(A)

Leq ONSITE COMMERCIAL ACTIVITIES IMPACTING:						
R3: Single Storey Guest Houses Due Southeast				**Proposed Onsite Apartments**		
Car door closures at basement	80	dB(A) @ 1m	#	Car door closures at basement	80	dB(A) @ 1m
Single event duration	1.5	seconds		Single event duration	1.5	seconds
Number of events in 15 minutes	20	events		Number of events in 15 minutes	20	events
Worst case duration in 15 minutes	0.5	minutes		Worst case duration in 15 minutes	0.5	minutes
15 minute Leq	65.2	dB(A) @ 1m		15 minute Leq	65.2	dB(A) @ 1m
Distance to receiver	10	m		Distance to receiver	7.5	m
Basement screening	-30	dB(A)		Basement screening	-30	dB(A)
Distance attenuation	-20.0	dB(A)		Distance attenuation	-17.5	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	18	dB(A)	#	Impact at Façade	20	dB(A)
Car bypass @ 5km/hr at basement ramp	66	dB(A) @ 1m	#	Car bypass @ 5km/hr at basement ramp	66	dB(A) @ 1m
Single event duration	7	seconds		Single event duration	7	seconds
Number of events in 15 minutes	20	events		Number of events in 15 minutes	20	events
Worst case duration in 15 minutes	2.333	minutes		Worst case duration in 15 minutes	2.333	minutes
15 minute Leq	57.9	dB(A) @ 1m		15 minute Leq	57.9	dB(A) @ 1m
Distance to receiver	14	m		Distance to receiver	4	m
Barrier Screening	-8	dB(A)		Balcony directivity	-5	dB(A)
Distance attenuation	-22.9	dB(A)		Distance attenuation	-12.0	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	29	dB(A)	#	Impact at Façade	43	dB(A)
Children playing normally outside	73	dB(A) @ 1m	#	Children playing normally outside	73	dB(A) @ 1m
Single event duration	900	seconds		Single event duration	900	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	15	minutes		Worst case duration in 15 minutes	15	minutes
15 minute Leq	73.0	dB(A) @ 1m		15 minute Leq	73.0	dB(A) @ 1m
Distance to receiver	13	m		Distance to receiver	4.5	m
Barrier Screening	-15	dB(A)		Balcony directivity	-5	dB(A)
Distance attenuation	-22.3	dB(A)		Distance attenuation	-13.1	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	38	dB(A)	#	Impact at Façade	57	dB(A)
Children playing normally inside	73	dB(A) @ 1m	#	Children playing normally inside	73	dB(A) @ 1m
Single event duration	900	seconds		Single event duration	900	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	15	minutes		Worst case duration in 15 minutes	15	minutes
15 minute Leq	73.0	dB(A) @ 1m		15 minute Leq	73.0	dB(A) @ 1m
Distance to receiver	20	m		Distance to receiver	4.5	m
Inside to outside att. + barrier	-21	dB(A)		Inside to outside att. + directivity	-21	dB(A)
Distance attenuation	-26.0	dB(A)		Distance attenuation	-13.1	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	28	dB(A)	#	Impact at Façade	41	dB(A)
Children playing boisterously outside	82	dB(A) @ 1m	#	Children playing boisterously outside	82	dB(A) @ 1m
Single event duration	900	seconds		Single event duration	900	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	15	minutes		Worst case duration in 15 minutes	15	minutes
15 minute Leq	82.0	dB(A) @ 1m		15 minute Leq	82.0	dB(A) @ 1m
Distance to receiver	13	m		Distance to receiver	4.5	m
Barrier Screening	-15	dB(A)		Balcony directivity	-5	dB(A)
Distance attenuation	-22.3	dB(A)		Distance attenuation	-13.1	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	47	dB(A)	#	Impact at Façade	66	dB(A)
Children playing inside boisterously	82	dB(A) @ 1m	#	Children playing inside boisterously	82	dB(A) @ 1m
Single event duration	900	seconds		Single event duration	900	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	15	minutes		Worst case duration in 15 minutes	15	minutes
15 minute Leq	82.0	dB(A) @ 1m		15 minute Leq	82.0	dB(A) @ 1m
Distance to receiver	20	m		Distance to receiver	4.5	m
Inside to outside att. + barrier	-21	dB(A)		Inside to outside att. + directivity	-21	dB(A)
Distance attenuation	-26.0	dB(A)		Distance attenuation	-13.1	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	37	dB(A)	#	Impact at Façade	50	dB(A)

Leq ONSITE COMMERCIAL ACTIVITIES IMPACTING:						
R3: Single Storey Guest Houses Due Southeast				**Proposed Onsite Apartments**		
People talking outside shops / café	58	dB(A) @ 1m	#	People talking outside shops / café	58	dB(A) @ 1m
Single event duration	900	seconds		Single event duration	900	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	15	minutes		Worst case duration in 15 minutes	15	minutes
15 minute Leq	58.0	dB(A) @ 1m		15 minute Leq	58.0	dB(A) @ 1m
Distance to receiver	65	m		Distance to receiver	4	m
Building screening	0	dB(A)		Balcony directivity	-5	dB(A)
Distance attenuation	-36.3	dB(A)		Distance attenuation	-12.0	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	24	dB(A)	#	Impact at Façade	43	dB(A)
Alfresco Dining	78	dB(A) @ 1m	#	Alfresco Dining	78	dB(A) @ 1m
Single event duration	900	seconds		Single event duration	900	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	15	minutes		Worst case duration in 15 minutes	15	minutes
15 minute Leq	78.0	dB(A) @ 1m		15 minute Leq	78.0	dB(A) @ 1m
Distance to receiver	50	m		Distance to receiver	4	m
Building screening	-15	dB(A)		Balcony directivity	-3	dB(A)
Distance attenuation	-34.0	dB(A)		Distance attenuation	-12.0	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	32	dB(A)	#	Impact at Façade	65	dB(A)
Deliveries	87	dB(A) @ 1m	#	Deliveries	87	dB(A) @ 1m
Single event duration	600	seconds		Single event duration	600	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	10	minutes		Worst case duration in 15 minutes	10	minutes
15 minute Leq	85.2	dB(A) @ 1m		15 minute Leq	85.2	dB(A) @ 1m
Distance to receiver	12	m		Distance to receiver	4	m
Barrier Screening	-6	dB(A)		Onsite building screening	0	dB(A)
Distance attenuation	-21.6	dB(A)		Distance attenuation	-12.0	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	60	dB(A)	#	Impact at Façade	76	dB(A)
Waste collection	97	dB(A) @ 1m	#	Waste collection	97	dB(A) @ 1m
Single event duration	300	seconds		Single event duration	300	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	5	minutes		Worst case duration in 15 minutes	5	minutes
15 minute Leq	92.2	dB(A) @ 1m		15 minute Leq	92.2	dB(A) @ 1m
Distance to receiver	12	m		Distance to receiver	4	m
Barrier Screening	0	dB(A)		Onsite building screening	0	dB(A)
Distance attenuation	-21.6	dB(A)		Distance attenuation	-12.0	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	73	dB(A)	#	Impact at Façade	83	dB(A)
Rooftop A/C plant x2	65	dB(A) @ 1m	#	Rooftop A/C plant x2	65	dB(A) @ 1m
Single event duration	600	seconds		Single event duration	600	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	10	minutes		Worst case duration in 15 minutes	10	minutes
15 minute Leq	63.2	dB(A) @ 1m		15 minute Leq	63.2	dB(A) @ 1m
Distance to receiver	17	m		Distance to receiver	5	m
Rooftop screening	-10	dB(A)		Rooftop screening + directivity	-8	dB(A)
Distance attenuation	-24.6	dB(A)		Distance attenuation	-14.0	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	31	dB(A)	#	Impact at Façade	44	dB(A)
Rooftop toilet exhaust	52	dB(A) @ 1m	#	Rooftop toilet exhaust	52	dB(A) @ 1m
Single event duration	600	seconds		Single event duration	600	seconds
Number of events in 15 minutes	1	events		Number of events in 15 minutes	1	events
Worst case duration in 15 minutes	10	minutes		Worst case duration in 15 minutes	10	minutes
15 minute Leq	50.2	dB(A) @ 1m		15 minute Leq	50.2	dB(A) @ 1m
Distance to receiver	17	m		Distance to receiver	5	m
Rooftop screening	-10	dB(A)		Rooftop screening + directivity	-8	dB(A)
Distance attenuation	-24.6	dB(A)		Distance attenuation	-14.0	dB(A)
Façade reflection	2.5	dB(A)		Façade reflection	2.5	dB(A)
Impact at Façade	18	dB(A)	#	Impact at Façade	31	dB(A)
Combined daytime	48	dB(A)		Combined daytime	69	dB(A)
Combined evening	36	dB(A)		Combined evening	66	dB(A)
Combined night-time	34	dB(A)		Combined night-time	48	dB(A)
				Day Rw to achieve 40 dB(A) inside	33	
				Evening Rw to achieve 40 dB(A) inside	29	
				Night-tiem Rw to achieve 35 dB(A) inside	17	

ENV Solutions

Engineering the Future

DEWATERING MANAGEMENT PLAN

JGD Developments Pty Ltd

137 and 139 Jonson Street;
3 Browning Street
Byron Bay, NSW

June 2017

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1 Introduction & Scope of Works

This Dewatering Management Plan (DMP) has been prepared by ENV Solutions Pty Ltd (ENV) at the request of JGD Developments Pty Ltd (JGD) for proposed construction activities that will impact the water table at 137-139 Jonson Street, and 3 Browning Street, Byron Bay. A location plan is presented in Figure 1, Attachment 1. The Lot boundaries comprising the subject area are presented on Figure 2, Attachment 1.

Proposed development at the site includes a four level building with childcare centre and retail businesses on the ground floor, and three levels of apartments above. The development also includes a double-storey underground car park (down to approximately -2 m AHD). A cross-sectional plan showing the proposed car park area and overlying construction is provided in Attachment 1. Excavation and dewatering is required for construction of the underground car park.

Sub-surface soil and groundwater investigations were undertaken by ENV on 26 May 2017. A groundwater monitoring well was installed as part of the investigation so that groundwater level and quality could be assessed. Additional Acid Sulfate Soil (ASS) sampling was also undertaken at this time to support preparation of the Acid Sulfate Soil Management Plan (ASSMP). Information from the field investigation and other borehole investigations conducted at the site by Australian Soil and Concrete Testing (ASCT; refer Section 3) has been used to prepare this DMP. The ASSMP has been developed by ENV and is provided separately:

- Acid Sulphate Soil Management Plan; 137 and 139 Jonson Street & 3 Browning Street, Byron Bay (Lot 21 DP 247289, Lot 5 DP 758207, Lot 6 DP 758207), dated June 2017.

The investigation encountered groundwater at between approximately 5.5 and 6.0 metres below existing ground level (m bgl), or approximately -0.5 to -1.0 m AHD, at the site. The base of the proposed excavation will be -2 m AHD. The excavation may therefore intercept the shallow groundwater table by between 0.5 and 1.0 m. However, the static groundwater level (SWL) in the monitoring well installed at the site was approximately 2.7 m bgl immediately following its installation, indicating that the shallow aquifer beneath the subject site is semi-confined/confined (e.g. groundwater may be present in fractures within weathered parent rock).

Groundwater analytical results from the monitoring well installed at the site were compared with published Australian criteria for freshwater ecosystems, to evaluate whether current groundwater conditions beneath the subject site meet the criteria, and to develop discharge criteria for treated water removed from the site during dewatering. The results from beneath the subject site were also compared with results for a sample collected from the proposed discharge (receiving) environment to assist in development of the discharge criteria.

Groundwater quality beneath the subject site is summarised as follows:

- The pH of 5.31 is outside of (less than) the range of pH presented in the published Guideline values for freshwater lakes in south-east Australia (6.5 – 8.0 pH units).

- Nutrient concentrations (phosphorus, nitrogen and oxidised forms of nitrogen (nitrate and nitrite)) are higher than the published Guideline values for freshwater lakes in south-east Australia (various).
- All metal concentrations are less than or equal to the published Guideline values. It is noted that no criteria exist for several metals (aluminium, chromium and iron), owing to the lack of suitable data to derive criteria within the Guidelines.

The primary objective of the DMP is to ensure that the proposed dewatering operations do not impact on the quality of the receiving environment.

The treatment train will therefore contain:

- pH correction
- Aeration to increase DO to aid precipitation of metals
- Flocculation assisted precipitation of sediment (and metals, if required)
- Off gas treatment for odour – only if required.

The treatment train has been proposed to effectively remove all contaminants of concern, reducing the risks of potential hazards on the receiving environment. The management of the dewatering process, including all testing regimes, are included in this DMP.

Online monitoring and logging of pH and turbidity will be undertaken continuously. A multi-parameter water quality analyser will be used for calibration.

Initially, treated groundwater will be returned to the excavation area and recycled until the discharge meets the required standards. At this stage, samples of the treated water will be collected and analysed prior to release.

2 Site Information and Development Details

2.1 Site Condition

The three lots which comprise 'the site' are 137 and 139 Jonson Street, and 3 Browning Street. The site is located within the town centre of Byron Bay, and has a total area of approximately 2,800 m^2. The site slopes up from Jonson Street (western boundary), and then levels off toward the rear.

There are existing residential dwellings on each of the three lots comprising the site. These will be demolished in preparation for the proposed development (refer below).

A site locality plan is provided as Figure 1, Attachment 1. A plan showing the layout of the three lots comprising the site is presented as Figure 2, Attachment 1.

2.2 Proposed Development

Excavation is required to facilitate the proposed construction of a double storey underground car park. The remainder of the development will comprise a four level building with a childcare centre and retail businesses on the ground floor, and residential apartments on the overlying three levels.

The excavation is proposed to be to a depth of -2 m AHD, and will therefore intercept the water table and require dewatering.

This DMP provides a framework to ensure that the proposed dewatering operations have negligible impact on the quality of the receiving environment.

2.3 Dewatering Management Plan

The objectives of this DMP are to:

- identify the sub-surface geology along with depth and type of groundwater to be encountered;
- provide a framework for dewatering operations;
- provide a treatment and disposal strategy for dewatered groundwater;
- provide a monitoring program with action criteria for pollutants of concern;
- provide an action plan in case of exceedance of the action criteria;
- review and ameliorate other potential environmental impacts from the operation; and
- provide a responsible party for monitoring and reporting.

3 Subsurface Conditions

3.1 Soil Profiles

ENV drilled one investigative bore to a depth of 7.0 m bgl at the subject site (front (west) portion of 139 Jonson Street) on 26 May 2017 to assess soil and groundwater conditions. Australian Soil and Concrete Testing (ASCT) has also drilled several boreholes across the property to a maximum depth of 6.0 m bgl for geotechnical and ASS purposes.

Sub-surface geological profiles reported from these investigations were variable, potentially representing filling with variable natural soil types following historical quarrying in the area. The borehole log from the ENV investigation is presented in Table 1 below. Subsurface conditions reported by ASCT included descriptions predominantly of sand, silt and gravelly clay profiles. Borehole logs from the ASCT investigations are provided in Attachment 2.

Table 1: Borehole Log – BH1/MW1; 139 Jonson Street (ENV, 2017)

Depth (mm)	Description
0 – 700	Gravelly SAND: pale red to brown, fine to medium grained sand, sub-angular gravels to 10 mm, dry. Trace of silt/clay.
700 – 1500	Gravelly Sandy CLAY: pale red to brown, low plasticity fines, fine sub-angular gravels to 5 mm, fine to medium sand, dry.
1500 – 7000	As above, mottled white/pale red. White mottling decreasing with depth, plasticity of fines increasing with depth. Wet at approximately 5.8 m bgl, end of borehole at 7.0 m bgl.

3.2 Acid Sulfate Soils (ASS)

According to Byron Shire Council online interactive mapping (accessed 16/05/2017), the site is largely unclassified with respect to ASS, although some known Class 3 and Class 5 soils intersect small portions of the property.

For each class of land, the maps identify the type of works likely to present an environmental risk if undertaken in the particular class of land. If these types of works are proposed, further investigation is required to determine if ASS are actually present and whether they are present in such concentrations as to pose a risk to the environment. If the titratable actual acidity (TAA) concentrations meet or exceed the "action criteria" in Table 4.4 of the New South Wales Acid Sulfate Manual (1998), an acid sulfate soils management plan (ASSMP) must be prepared and development consent must be obtained from Council.

Limited ASS investigations were undertaken at the site by ASCT in January 2017. Additional ASS sampling was conducted by ENV on 26 May 2017. These investigations show that ASS is present at the subject site, with TAA concentrations greater than the action criteria provided in the ASSMAC (1998). ENV was engaged to prepare an ASSMP from these investigations, which has been provided separately.

3.3 Groundwater

MW1 was installed by ENV to a depth of 6.7 m bgl (partial borehole collapse following drilling) and constructed using a 3 m length of machine slotted polyvinyl chloride (PVC) casing, fitted to a 3.7 m length of blank (unslotted) PVC casing. The borehole annulus was constructed using clean, washed sand from the base to a depth of 1.6 m bgl, followed by a bentonite plug to the ground surface. A flush-mounted steel gatic cover was then concreted into the surrounding ground surface.

The SWL was measured within MW1 following its construction on 26 May 2017, prior to sampling. The SWL was measured to be 2.66 m below the top of the PVC well casing (approximate ground level). Since groundwater was not encountered until a depth of between approximately 5.5 and 6.0 m bgl during drilling, the shallow aquifer beneath the subject site is indicated to be semi-confined/confined. Boreholes drilled by ASCT to a maximum depth of 6.0 m bgl did not intersect groundwater.

Following measurement of the SWL in MW1, the well was purged until dry (19 L) and physico-chemical parameters measured *ex situ* using a calibrated water quality meter. The results of the physico-chemical measurements are presented in Table 2 below. These are the final measurements recorded after completing purging.

Table 2: Physico-Chemical Groundwater Data – MW1

Well	SWL	Electrical Conductivity (EC)	Temperature	Oxidation /Reduction Potential (ORP)	Dissolved Oxygen (DO)
	m bgl	ms/cm	°C	mV	mg/L
MW1	2.66	0.267	23.6	227	2.79

The measurements show that the groundwater is neutral to slightly basic, and fresh. Visual observations made of the extracted groundwater indicated that it was also highly turbid (but with no odour). As only one well was installed, no hydraulic gradient could be determined beneath the site. The general gradient of shallow groundwater in the area may be in the vicinity of north to east (towards the coast), however low-lying areas also exist to the west of the site.

The well was allowed to recover prior to sampling. Samples were collected in laboratory-supplied containers using a dedicated disposable bailer, and sent to the analytical laboratory with accompanying chain of custody (COC) documentation. The samples were analysed for a broad screen of chemicals and physical parameters (refer to Attachment 3).

The groundwater results are summarised in Table 3 below. A comparison of the results was made with criteria presented in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000), published by the Australian and New Zealand Environment Conservation Council (ANZECC) and Agriculture and Resource Management Council of Australia and New Zealand (ARMCANZ). This comparison as made as an initial evaluation of the groundwater quality beneath the site with respect to its ultimate discharge location.

Table 3: Groundwater Analytical Results (26 May 2017)

Reference	MW1	ANZECC/ARMCANZ (2000) Guidelines – 95% protection level - freshwater
Groundwater Level (mbTOC)	2.66	
Date Sampled	26/05/2017	
Type Of Sample	Water (mg/L)	
pH	5.31 (pH units)	6.5-8.0 (SE Aust freshwater lakes)*
Total phosphorus	0.54	0.01 (SE Aust freshwater lakes)*
Total nitrogen	0.67	0.35 (SE Aust freshwater lakes)*
Nitrate	0.572	0.01 (SE Aust freshwater lakes)*
Nitrite	0.035	0.01 (SE Aust freshwater lakes)*
Ammonia	0.038	0.9
Silver	<0.001 (total); <0.001 (dissolved)	0.00005
Aluminium	2.984 (total); 0.043 (dissolved)	ID
Arsenic	0.001 (total); <0.001 (dissolved)	0.024
Cadmium	<0.001 (total and dissolved)	0.0002
Chromium	0.002 (total); <0.001 (dissolved)	ID
Copper	0.010 (total); 0.001 (dissolved)	0.0014
Iron	0.474 (total); 0.017 (dissolved)	ID
Manganese	0.052 (total); 0.024 (dissolved)	1.9
Nickel	0.001 (total and dissolved)	0.011
Lead	0.032 (total); <0.001 (dissolved)	0.0034
Selenium	0.001 (total and dissolved)	0.011
Zinc	0.023 (total); 0.008 (dissolved)	0.008
Mercury	<0.01 (total); <0.005 (dissolved)	0.0006

ID – insufficient data to derive criterion

*No data available for wetlands in south-eastern Australia. Data for freshwater lakes and reservoirs have been adopted for pH and nutrients.

The results of the comparison indicated the following with respect to existing groundwater quality beneath the subject site:

- The pH of 5.31 is outside of (less than) the range of pH presented in the ANZECC/ARMCANZ (2000) Guidelines for freshwater lakes in south-east Australia (6.5 – 8.0 pH units).
- Nutrient concentrations (phosphorus, nitrogen and oxidised forms of nitrogen (nitrate and nitrite)) are higher than the ANZECC/ARMCANZ (2000) criteria for freshwater lakes in south-east Australia (various).
- All metal concentrations are less than or equal to the ANZECC/ARMCANZ (2000) criteria (various). It is noted that no criteria exist for several metals (aluminium, chromium and iron), owing to the lack of suitable data to derive criteria.

4 Potential Environmental Impacts

4.1 Receiving Environment

The proposed dewatering operation will discharge treated water into an existing stormwater pit located approximately 40 m south-east of the site, as shown in Figure 3, Attachment 1. This pit enters the Council stormwater system, which flows beneath Browning Street and then in a southerly direction via a concrete culvert toward a low lying area comprising filtration reed beds and then wetlands (refer to Figure 3).

A surface water sample ('Discharge') was collected from near the beginning of the concrete culvert, where it joins to the below ground stormwater network, on 6 June 2017. The purpose of collecting the sample was to evaluate the existing conditions within the receiving environment. The sample location is indicated on Figure 3 (Attachment 1). Physico-chemical parameters were also measured at this time using a calibrated water quality meter. The sample was sent in a chilled esky with accompanying chain of custody (COC) documentation to EAL laboratory in Lismore, NSW, which is accredited by the National Association of Testing Authorities (NATA) for the required analyses. The physico-chemical measurements and groundwater analytical results are provided in Table 4 and Table 5, respectively. Laboratory certificates are provided in Attachment 3.

The laboratory results were compared with the criteria presented in the ANZECC/ARMCANZ (2000) Guidelines. A fresh water level of protection (% of species protected) of 95% was conservatively adopted for comparison with the laboratory results. This level of protection is generally adopted for a slightly to moderately disturbed ecosystem, which is considered to be representative of the receiving environment south of Browning Street into which the dewatered water will ultimately discharge.

Table 4: Physico-chemical Water Quality Parameters – Receiving Site

Site	pH	Conductivity	Turbidity	TDS	Salinity	ORP	DO
	(pH units)	(mS/cm)	(NTU)	(g/L)	(ppt)	(mV)	(mg/L)
'Discharge'	7.20	0.297	31.5	0.193	0.1	110	5.98

Table 5: Laboratory Analytical Results – Receiving Site

Reference	'Discharge'	ANZECC/ARMCANZ (2000) Guidelines – 95% protection level - freshwater
Date Sampled	06/06/2017	
Type Of Sample	Water (mg/L)	
pH	6.67	6.5-8.0 (SE Aust freshwater lakes)*
Total phosphorus	0.06	0.01 (SE Aust freshwater lakes)*
Total nitrogen	0.80	0.35 (SE Aust freshwater lakes)*
Nitrate	0.261	0.01 (SE Aust freshwater lakes)*
Nitrite	0.014	0.01 (SE Aust freshwater lakes)*
Ammonia	0.237	0.9
Silver	<0.001 (total and dissolved)	0.00005
Aluminium	0.177 (total); 0.043 (dissolved)	ID
Arsenic	0.002 (total); 0.001 (dissolved)	0.024
Cadmium	<0.001 (total and dissolved)	0.0002
Chromium	0.001 (total and dissolved)	ID
Copper	0.003 (total); 0.004 (dissolved)	0.0014
Iron	1.154 (total); 0.476 (dissolved)	ID
Manganese	0.139 (total); 0.141 (dissolved)	1.9
Nickel	0.002 (total and dissolved)	0.011
Lead	0.001 (total); 0.002 (dissolved)	0.0034
Selenium	0.001 (total and dissolved)	0.011
Zinc	0.096 (total); 0.056 (dissolved)	0.008
Mercury	<0.010 (total and dissolved)	0.0006

Comparison of the receiving environment results with the ANZECC/ARMCANZ (2000) criteria for freshwater ecosystems indicates that current water quality entering the reed filtration beds and wetlands of the receiving environment exceeds one or more of these criteria. The exceeding analytes include nutrients (total phosphorus, total nitrogen, nitrate and nitrite) and metals (copper and zinc). Overall, the water currently entering the proposed receiving environment is of a lesser quality than groundwater beneath the subject site which will be dewatered and discharged to the receiving environment (refer to Table 3).

Notwithstanding the above information, discharge criteria have been developed for the release of water from the subject site. Discussion of the discharge criteria is presented in Section 4.2 below.

4.2 Discharge Criteria

Discharge criteria have been derived in consideration of the results of the sampling conducted from the receiving environment, and the criteria presented in the ANZECC/ARMCANZ (2000) Guidelines.

The discharge criteria are presented in Table 6. Groundwater sampling and monitoring requirements to ensure compliance with these criteria, both on site and at the proposed discharge location, are presented in Section 6.

Table 6: Discharge Criteria

Indicators	Criteria
Turbidity	<25 NTU
pH	6.5-8.0 pH units
Dissolved Oxygen	90th percentile greater than 90% saturation, or 6 mg/L
Total Suspended Solids	6 mg/L
Litter	No visible litter washed from the site
Total phosphorus[1]	0.06 mg/L
Total nitrogen[1]	0.80 mg/L
Nitrate[1]	0.26 mg/L
Nitrite[1]	0.014 mg/L
Ammonia[1]	0.237 mg/L
Silver	<0.001 mg/L[2]
Aluminium (at pH>6.5)	0.055 mg/L
Arsenic	0.024 mg/L
Cadmium	0.0002 mg/L[2]
Chromium[1]	0.001 mg/L
Copper	0.0014 mg/L
Iron[1]	0.476 mg/L
Manganese	1.9 mg/L
Nickel	0.011 mg/L
Lead	0.0034 mg/L
Selenium	0.011 mg/L
Zinc	0.008 mg/L
Mercury	0.0006[2] mg/L

1. **Discharge criteria are those measured at the receiving site ('background concentrations' - refer Table 5).**
2. **Discharge criterion is the typical laboratory detection limit for that metal in fresh water (ANZECC/ARMCANZ (2000) criterion is less than the typical detection limit).**

5 Dewatering Management Plan

5.1 Regulatory Framework

The *Water Management Act 2000* (the 'WMA Act') defines an aquifer interference activity as an activity involving any of the following:

- the penetration of an aquifer,
- the interference with water in an aquifer,
- the obstruction of the flow of water in an aquifer,
- the taking of water from an aquifer in the course of carrying out mining, or any other activity prescribed by the regulations,
- the disposal of water taken from an aquifer as referred to in the above item.

Aquifer interference approvals are referred to in section 91(3) of the WMA Act.

While the provisions of an aquifer interference activity have not yet commenced under the WMA Act, an Aquifer Interference Policy (AIP) has been developed to guide proponents and to establish what other approvals under the WMA Act, or licences under the *Water Act 1912*, are required for certain activities.

According to information provided by WaterNSW, an interim position for the regulation of minor temporary infrastructure/construction dewatering has been established for activities such as building basement construction that take water for a period of up to 12 months (which is consistent with the proposed redevelopment). This position does not apply to the ongoing take of water beyond 12 months.

Where the take of water is less than 3 ML over a 12 month period, no Water Access Licence (WAL) or other approval is required. If the take is greater than 3 ML over a period of up to 12 months, a licence under Part 5 of the *Water Act 1912* is required, and certain information is required in order to assess the application. This information includes the following:

Mandatory Requirements

- A copy of a valid consent for the project (where already granted).
- A report documenting the predicted total volume of groundwater to be extracted at the property – the method of calculation and assumptions used to derive the volume are to be clearly documented.
- A report detailing the predicted duration of dewatering at the property.
- A copy of the written authorisation for the disposal of the extracted groundwater.

Secondary Requirements

The following information is required for confirmation of the predicted impacts of the aquifer interference activity.

- A report describing the groundwater levels beneath the property, including at least three repeat measurements from at least three monitoring bores.
- A report detailing the maximum depth of excavation to be undertaken and the commensurate required lowering of groundwater levels beneath the property.
- A report identifying the ambient quality of groundwater beneath the property and the treatment to be applied to pumped water prior to disposal – at a minimum, treatment must be undertaken to remove contaminants, manage pH and eliminate turbidity.
- A report detailing monitoring, measurement and reporting arrangements in relation to volumes extracted, groundwater levels and quality, as well as treatment.

For the take of water for a period greater than 12 months, a WAL and a water supply work approval under section 90 of the WMA Act is required.

Information relating directly to these requirements is provided in the following sub-sections.

5.2 Dewatering Process and Duration

Contiguous piling, comprising steel reinforced concrete columns designed to intersect and tie into bedrock, will be used to prevent excessive infiltration of groundwater into the excavation. The piles will extend along the property boundaries. The intrusive investigations undertaken at the site to date, which have extended to a maximum depth of 7 m below existing ground level, have not intersected bedrock (refer to Section 3). Based on this information, the piles will need to extend to a depth of at least 7 m below the existing ground level. The use of this design will prevent vibration associated with the installation of sheet piles, which may have adverse structural effects on adjacent buildings.

Based on the nature of the excavation and surrounding residential properties, a sump with associated pump is considered the most practical method for dewatering inside the piled area. This method of dewatering (from inside the piling only) will allow the removal of groundwater inside the excavation without significant potential for settlement of the adjacent structures. However, dewatering spears may also be used to achieve the same outcome.

All water collected from the sump/spears will require treatment prior to release into the local stormwater system. Treatment will be conducted in accordance with the process described in Section 5.4. Performance

(discharge) criteria which must be met prior to release of the treated water to the stormwater system are provided in Section 4.2.

Dewatering will be required while soil is excavated from inside the contiguous piling, treated with lime and transported off-site, and for the duration of construction of the double-storey car park. A total period of 3 to 6 months is anticipated for these works. Total water extraction volumes from the dewatering process have been calculated on this basis (refer Section 5.3).

5.3 Volume of Water

It is estimated that the excavation and construction program will take between 3 and 6 months to complete. On this basis, the anticipated total volume of water to be collected, treated and discharged to stormwater can be calculated as follows:

- The total area of soil within the piled area (approximately equivalent to the total site area) = 2,800 m^2.
- The total volume of soil to be removed from inside the piled area = 2,800 m^2 * average of approximately 7.5 m deep excavation = 20,900 m^3.
- Assuming an average moisture content of 30% (allowing for drier conditions in the vadose zone between the ground surface and the water table; and saturated conditions between 5.5 and 6.0 m below grade), the total volume of water contained within the soil to be excavated = 0.3 * 20,900 m^3 = **6,270 m^3**.
- The total rainfall contribution (infiltration) to the piled area = 1.73 m (average annual rainfall for Byron Bay) * 2,800 m^2 * 0.5 (6 months dewatering duration) = **2,380 m^3**.
- Assuming a negligible groundwater inflow rate from beneath the piles (which will be founded on bedrock), the total amount of water to be removed from inside the piled area over a 6 month duration is **8.65 ML.**

On this basis, a licence under Part 5 of the *Water Act 1912* would be required for the dewatering program. The mandatory and secondary information required to support an application for this licence (refer to the requirements listed in Section 5.1) is provided in this Plan.

5.4 Groundwater Treatment Process

Dewatered groundwater will require treatment to remove sediment, and increase pH and DO (in order to allow precipitation of metals, if required), prior to discharge to stormwater.

The pollutants of potential concern are listed in Table 7. Each treatment operation is discussed in the sub-sections that follow. A process flow diagram

(PFD) representing the modules of the treatment plant is presented as Figure 4, Attachment 1.

Table 7: Discharge Pollutants of Potential Concern

Potential Pollutant	Source	Treatment
TSS / Turbidity	Suspended sediment	Gravity separation / flocculation
Low Dissolved Oxygen	Precipitation of Metals	Aeration
pH	ASS/naturally low pH in groundwater	pH correction
Metals	Present in groundwater (although at concentrations < discharge criteria). More soluble at low pH.	pH correction, precipitation (if required)
Nutrients	Naturally present in groundwater	Dilution and assimilation

5.4.1 pH Correction, Metal Precipitation

Metals become more soluble at low pH, therefore by raising the pH within the treatment system, they will precipitate out. Although metals concentrations in groundwater beneath the subject site were less than the proposed discharge criteria, the pH control set point will be 8.0 pH units during treatment, with a discharge range of between 6.5 and 8.0 pH units adhered to at all times. This will assist in the precipitation of metals if regular discharge monitoring indicates that metals concentrations exceed the discharge criteria.

If required, pH correction will be undertaken by the addition of Caustic Soda (NaOH) to the treatment cycle. Caustic dosing will be PLC controlled and MSDS for Caustic Soda is presented in Attachment 4.

5.4.2 Flocculation Assisted Gravity Separation

Gravity separation uses the higher density of suspended particles (such as silts and clay) in the water to settle to the bottom of a tank or hopper. This can be assisted by flocculants (such as gypsum) which remove the weak secondary bonds between these colloids and water, allowing particles to join together (coagulate) and therefore settle quicker. Flocculation efficiency can also be increased by the use of parallel plate separators.

Flocculation will be undertaken by dosing liquid gypsum into the primary discharge line of the primary settling chamber. Flocculation dosing will be PLC controlled based on online turbidity monitoring. An MSDS for Liquid Gypsum is presented in Attachment 4.

Sediment collected within the flocculation tank will be discharged back into the pit, or removed from the site using a vacuum truck and disposed of by a licensed waste contractor. Any disposal of waste will be noted in the site log book.

5.4.3 Aeration

DO levels of groundwater are often much lower than surface water. In addition, precipitation of some metal oxides (such as iron) can also consume oxygen. Compressed air will be introduced into the primary settling tank to assist with aeration of the water.

5.4.4 Activated Carbon Odour Scrubber

No odours are expected during the dewatering program. However, an activated carbon odour control unit will be available, should it require incorporation into the treatment plant. The unit would tie into the initial mixing and aeration tank. This unit would provide treatment for hydrogen sulfide odours (if present). The unit is included in the PFD presented as Figure 4 (Attachment 1).

5.4.5 Nutrient Dilution and Assimilation

Nutrients are naturally present in groundwater. It is noted that the nutrient concentrations measured within the proposed receiving environment are generally higher than those measured in groundwater beneath the subject site, and the criteria presented in the ANZECC/ARMCANZ (2000) Guidelines.

There are no practical and effective options for reduction of nutrients in a site-based treatment system. Therefore, reductions in nutrient concentration will rely upon dilution and natural aquatic processes within the receiving environment. The location and flushing characteristics of the receiving environment should mitigate any possible impacts of nutrient loading.

6 Water Quantity/Quality Management

Water quality monitoring will be required for the duration of the dewatering process. This monitoring is described in the following sub-sections.

6.1 Online Monitoring

The water treatment plant has online monitoring and logging of turbidity, pH and reagent levels (flocculants and caustic soda). Logging will occur continuously (24 hours per day for the duration of the dewatering program).

6.2 Water Sampling Methodology

The water sampling methodology and frequencies are presented in the sub-sections below. A daily water quality monitoring record sheet has been prepared and is provided in Attachment 5. This is designed to collect and report all relevant water quality information.

6.2.1 Routine Water Quality Analysis

A calibrated multi-parameter water quality data logger (HORIBA U-52) will be used to monitor treated groundwater discharge (on site) every day that discharges are occurring. The monitoring will include the following:

- Temperature (°C)
- pH
- Oxidation/reduction potential (ORP; mV)
- Electrical conductivity (EC; mS/cm)
- Turbidity (NTU)
- Dissolved oxygen (DO; mg/L)
- Total dissolved solids (TDS; g/L)
- Salinity (ppt).

This monitoring will also be conducted once per week at the receiving site (undertaken concurrently with the sampling for laboratory analysis – refer Section 6.2.3).

6.2.2 Physical Inspection – Visual/Odour

A visual inspection of the treatment system will be undertaken every 24 hours whilst dewatering is occurring. This inspection will identify any:

- iron staining (red precipitation) within the treatment system or downstream drains;

- flocculent and reagent levels;
- monitoring and emptying sludge build up as required; and
- monitoring and recording of nuisance odours emanating from the works.

6.2.3 Sampling and Laboratory Analysis

Water samples will be collected from the discharge outlet of the treatment system and from the receiving environment, and sent to a laboratory which is accredited by the National Association of Testing Authorities (NATA) for testing of all analytes included in Table 5.

Testing will occur at the following times:

- upon commissioning of the treatment system; and
- once per week until the cessation of dewatering.

6.2.4 Metering

A discharge water meter will be installed to measure the total volume of water discharged during the program. The meter reading will be recorded daily in the site log book.

6.3 Non Compliance

An action plan for non-compliances with the performance criteria is presented in Table 8.

In the event of a non-compliance, all discharges from the treatment system will immediately cease. Water can be recycled within the treatment system or discharged back to the excavation to prevent discharge of water off-site that does not meet the performance criteria.

6.4 Reporting

A dewatering report will be prepared following completion of the dewatering program. The report will summarise the results of monitoring undertaken during the program, total metered discharge flows and any non-compliances and corrective actions taken.

Table 8: Action Plan for Non-Compliances

ACTION – Hydrocarbon:

No hydrocarbons are expected to be encountered during the dewatering program, based on the initial groundwater quality results. However, if a visual sheen or hydrocarbon is detected during daily checks, the plant will be shut down or put into recycle. If necessary, booms will be deployed and the hydrocarbon source addressed.

ACTION – pH:

If water quality outside the discharge criteria is reported (pH<6.5 or >8.0), additional caustic soda or acid will be added to the system automatically via the PLC. If continued pH compliance cannot be met, dewatering will be suspended until pH control can be maintained.

ACTION – DO:

If DO measurements are less than the required criterion of 6.0 mg/L, additional steps to increase the oxygen content of the water will be taken. These could include:

1. Pumped discharges directed to increase splashing and improve oxygen uptake; and/or
2. Additional recirculation of water and/or increased air sparging; and/or
3. Additional means of increasing oxygenation be investigated (such as mechanical aerators, stepped discharge weirs, etc).

These activities and hourly monitoring will be undertaken until a stable DO of greater than 6.0mg/L is achieved at the outlet.

ACTION – Turbidity:

If turbidity measurements >25 NTU are detected at the outlet, the following steps will be taken to ensure the turbidity is managed effectively:

1. Slow the pumping flow rate from the sump to the treatment plant and allow better settlement within the settling tank. When the turbidity is <25 NTU, pumping and/or discharge can recommence.
2. If the turbidity is continuously >25 NTU and settlement is slow, additional or alternate flocculants will be dosed into the settlement tank. Once flocculation has occurred and water quality reaches <25 NTU, dewatering can recommence.

Action – Dissolved Metals:

If metals concentrations are greater than the discharge criteria, additional pH control may be required to assist precipitation of metals.

Action – Odour:

No odours are expected during the dewatering program. However, should odours be noted, an odour scrubber module will be added to the treatment train (refer to PFD – Figure 4, Attachment 1).

6.5 Record Keeping

A site log book will be maintained and be made available to a Council Officer or other relevant regulatory authority upon request. The following, as a minimum, will be recorded in the log book:

- Any discharge outside the performance criteria and the corrective actions taken to prevent recurrence.
- A flow meter will record all discharges from the site and these will also be recorded daily in the site log book.
- Daily pump operation and any potential issues seen or rectified.

6.6 Complaints

Any complaints will be noted in the site log book and corrective actions taken (where appropriate and practicable) to prevent recurrence.

6.7 Contingency Equipment and Disposal Options

The following information is provided regarding contingency equipment and treated discharge disposal:

- Contingency reagents such as flocculent, lime and activated carbon should be procured prior to commencing dewatering.
- Contingency pumps and power sources are recommended during critical dewatering stages.
- Given the volume of water required to be treated on site, there are no alternative disposal options (other than the proposed discharge to stormwater).
- Should water quality not meet the performance criteria for discharge, additional treatment units/modules/techniques may be required.

7 Environmental Management During Dewatering

Aside from the environmental controls described in Section 6, environmental aspects including noise, odour, air pollution and ground settlement will be controlled using one or more of the management options presented in Table 9.

Table 9: Environmental Management during Dewatering Program

Item	Management Options
Noise	▪ Select pumps for dewatering with noise suppression or electric power. ▪ Minimise pumping hours (where possible). ▪ Site pumps with regard to potential noise impacts on neighbours. ▪ Identify possible noise receptors (such as nearby houses) and explain to them the requirement for, and duration of, dewatering. ▪ Handle any complaints professionally and courteously, and record them in the site log book.
Air Pollution	▪ Ensure pumps and mobile equipment are well maintained. ▪ Ensure dust is minimised from workings.
Odour	▪ If odours are encountered, add odour scrubber to the treatment train. ▪ Ensure odour scrubber is in good working condition. ▪ Monitor odour generation during dewatering activities and note in site log book any odour generation. ▪ Minimise odour generation by reducing splashing via locating discharging pipe outlets underwater. ▪ Identify possible odour receptors (such as nearby houses) and explain requirement for, and duration of, dewatering. ▪ Handle any complaints professionally and courteously, and record them in the site log book.
Ground Settlement	▪ Dewatering in unconsolidated soils such as loose sands and soft sediments has the ability to induce settlement, possibly compromising the integrity of surrounding structures. ▪ A piling and dewatering methodology has been selected to minimise potential settlement effects. This includes contiguous piling to bedrock and removal of groundwater from inside the piled area only. ▪ Notwithstanding the above, it would be prudent to identify assets adjacent to the piled area which may be affected by ground settlement. ▪ If required, conduct pre- and post-dilapidation surveys on surrounding structures. ▪ Expert geotechnical design and documentation shall be required of the piling and bracing methodology. This assessment should also include settlement.
H_2S	▪ H_2S (typically described as 'rotten egg gas') can form from the oxidation of sulfides within an excavation. H_2S is an asphyxiant and can be deadly if inhaled. Gas monitoring for H_2S is recommended should even small amounts be noted or measured on site. H_2S is heavier than air, and can concentrate in depressions and or excavations. ▪ H_2S is not expected to be encountered, based on the initial testing results. However, if H_2S gas is liberated during dewatering and/or excavation activities, gas testing of all excavations will be regularly undertaken.

8 Dewatering Management – Responsible Parties

Responsible parties and their roles for the dewatering program are summarised in Table 10.

Table 10: Responsible Parties and Associated Roles

Role	Name	Company	Responsibility
Site Manager	TBA	TBA	▪ Reviewing DMP ▪ Approving discharge
Site Piling	TBA	TBA	▪ Installing piles
Dewatering Technical Specialist	James Foster	ENV Solutions	▪ Dewatering Technical specialist role ▪ Specifying treatment system ▪ Preparing this DMP ▪ Lab analysis and reporting ▪ Troubleshooting ▪ Overseeing the dewatering process ▪ Monitoring requirements as presented in this DMP
Geotechnical Specialist	TBA	TBA	▪ Technical specialist role ▪ Design and specification of piling and bracing system ▪ Dilapidation survey of surrounding buildings and assets ▪ Settlement calculations ▪ Ongoing inspection and monitoring of construction
Local Regulatory Authority	TBA	Byron Shire Council (Engineering Department)	▪ Reviewing DMP (as part of DA approval process) ▪ Reviewing lab results

9 Conclusion

The design and management of dewatering is important to maintain the quality of water discharged to the receiving environment, and to minimise potentially adverse effects on assets close to the dewatering area. Dewatering associated with the proposed construction program at the subject site will be effectively managed by the procedures and monitoring detailed in this Plan.

It is important that this Plan is read and understood prior to undertaking dewatering on site so that all requirements of this Plan can be met.

10 Attachments

Attachment 1	Figures 1, 2, 3 and 4
Attachment 2	Borehole Logs (ASCT, 2017)
Attachment 3	Laboratory Certificates
Attachment 4	Material Safety Data Sheets
Attachment 5	Daily Check Sheet (Water Quality)

ATTACHMENT 1

FIGURES 1, 2, 3 and 4

Not To Scale

ENV SOLUTIONS PTY LTD

Project: **Byron DMP**
Job No: **14330**
Date: **06/06/2017**
By: **CAH**
Figure 1: Site Location

Not To Scale	**ENV SOLUTIONS PTY LTD**	Project: **Byron DMP** Job No: **14330** Date: **06/06/2017** By: **CAH** **Figure 2: Site Layout**

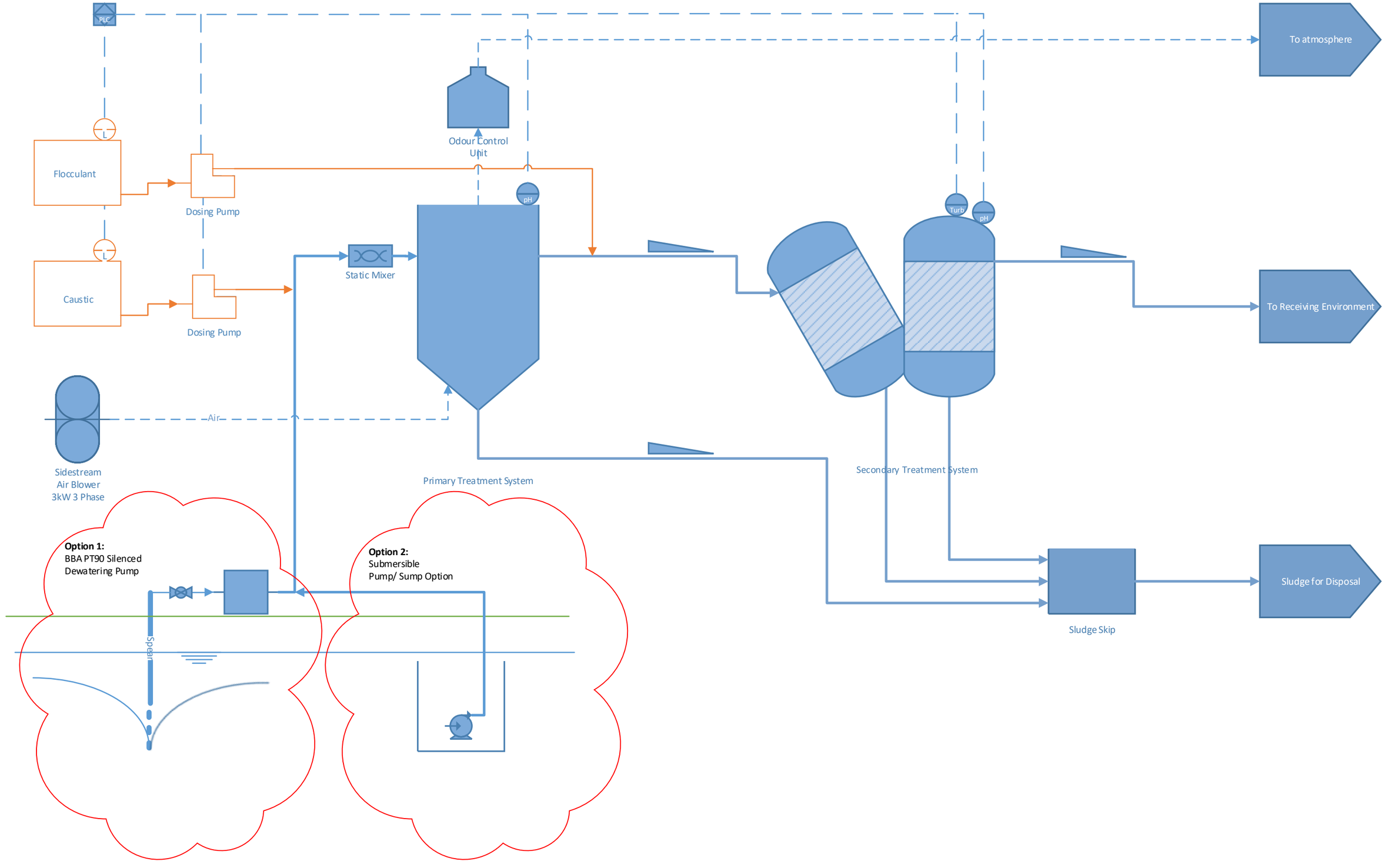
Stormwater Side Entry Pit (SEP)
Below ground stormwater piping
Open culvert draining to wetlands
Reed filtration beds and wetlands

Not to scale

ENV SOLUTIONS PTY LTD

Project: **Byron DMP**
Job No: **14330**
Date: **08/06/2017**
By: **CAH**

Figure 3: Discharge Location



REV	DESCRIPTION	DATE	DRAWN	DESIGN	CHECK	APP.
A	ISSUED FOR INFORMATION	14/06/17	RM	JKF	JKF	JKF

Client: JGD Developments Pty Ltd.

ENV Solutions Pty Ltd
PO BOX 248
Ballina NSW 2478
admin@envsolutions.com.au

Project:

Dewatering System Overview

Drawing Title:

Process Flow Diagram

Size: **A3** Job No: **ENV** Drawing No: **0001** Revision: **A**

ATTACHMENT 2

BOREHOLE LOGS (ASCT, 2017)

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

PO Box 5120 Ballina Mail Centre, NSW 2478
17 De-Havilland Crescent, Ballina
Telephone: (02) 6686 8567
Fax: (02) 6686 8396
A.B.N: 92 602 346 127

BOREHOLE LOG SHEET - 1

Client:	Graham Dunn	**ASCT Ref No:**	H17-0003
Project:	137-139 Jonson & Browning Street, Byron Bay	**Client Ref No:**	NA
Borehole Position:	See Site Sketch	**Drilling Method:**	Power Auger
Surface Elevation:	Exisiting Surface Level	**Drill Bit:**	100mm Ø TC

Depth (m)	Graphic Symbol	Group Symbol	Soil Description (AS 1726)	Consistency / Relative Density	DCP Blows/300mm	Test Sample
					Cone Tip	
0.0		**SM**	**SILTY SAND, NATURAL:** some organics, brown, low	Very Dense		Disturbed
0.1			plastic, low dry strength, fine grain size, moist.		29	
0.2						
0.3		**ML**	**SILT STONE, NATURAL:** white brown/red, low plastic, low	Extremely low		
0.4			dry strength, fine grain size, moist.	Strength	42	
0.5						Disturbed
0.6						
0.7					34	
0.8						
0.9				Very Low		
1.0				Strength	67	Disturbed
1.1						
1.2						
1.3					Stopped	
1.4						
1.5						Disturbed
1.6						
1.7						
1.8						
1.9						
2.0						Disturbed
2.1			END DRILLING @ 2.2m: TARGET DEPTH REACHED			
2.2						
2.3						
2.4						
2.5						
2.6						
2.7						
2.8						
2.9						
3.0						
3.1						
3.2						
3.3						
3.4						
3.5						
3.6						
3.7						
3.8						
3.9						
4.0						
4.1						
4.2						
4.3						
4.4						
4.5						
4.6						
4.7						
4.8						
4.9						
5.0						

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

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17 De-Havilland Crescent, Ballina
Telephone: (02) 6686 8567
Fax: (02) 6686 8396
A.B.N: 92 602 346 127

BOREHOLE LOG SHEET - 2

Client:	Graham Dunn	**ASCT Ref No:**	H17-0003
Project:	137-139 Jonson & Browning Street, Byron Bay	**Client Ref No:**	NA
Borehole Position:	See Site Sketch	**Drilling Method:**	Power Auger
Surface Elevation:	Exisiting Surface Level	**Drill Bit:**	100mm Ø TC

Depth (m)	Graphic Symbol	Group Symbol	Soil Description (AS 1726)	Consistency / Relative Density	DCP Blows/300mm *Cone Tip*	Test Sample
0.0		CI	**SILT CLAY, NATURAL:** some sand, brown, medium to high plastic, medium to high dry strength, fine grain size, moist.	Firm to Stiff	6	Disturbed
0.1						
0.2						
0.3					10	
0.4						
0.5						Disturbed
0.6					29	
0.7						
0.8		SM	**SAND, NATURAL:** some silt, pale brown grey, low plastic,	Very Dense		
0.9					44	
1.0						Disturbed
1.1						
1.2		SC	**CLAYEY SAND, NATURAL:** grey medium plastic, medium dry strength, fine grain size, moist.	Medium Dense	16	
1.3						
1.4						
1.5					12	Disturbed
1.6						
1.7						
1.8		SP	**SAND, NATURAL:** grey brown, non plastic, no dry strength, fine grain size, moist.	Medium Dense	14	
1.9						
2.0						Disturbed
2.1					12	
2.2						
2.3						
2.4					16	Disturbed
2.5						
2.6				Dense		
2.7					23	
2.8						
2.9						
3.0		SP	**SAND, NATURAL:** grey brown, non plastic, no dry strength, fine grain size, saturated.	Very Dense		Disturbed
3.1					39	
3.2						
3.3						
3.4					46	
3.5						Disturbed
3.6						
3.7					Stopped	
3.8						
3.9						
4.0						Disturbed
4.1						
4.2		SM	**SILTY SAND NATURAL: (Indurated Sand)** dark brown, non-plastic, dry strength, fine grain size, wet.			
4.4						
4.6						
5.0		CH	**SILTY CLAY NATURAL: (Marine Soil)** grey, high plastic high dry strength, some shell fragments, very moist.			
5.2						
5.4						
5.6						
5.8						
6.0			End of Drilling. Target Depth Reached.			

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

PO Box 5120 Ballina Mail Centre, NSW 2478
17 De-Havilland Crescent, Ballina
Telephone: (02) 6686 8567
Fax: (02) 6686 8396
A.B.N: 92 602 346 127

BOREHOLE LOG SHEET - 3

Client:	Graham Dunn	**ASCT Ref No:**	H17-0003
Project:	137-139 Jonson & Browning Street, Byron Bay	**Client Ref No:**	NA
Borehole Position:	See Site Sketch	**Drilling Method:**	Power Auger
Surface Elevation:	Exisiting Surface Level	**Drill Bit:**	100mm Ø TC

Depth (m)	Graphic Symbol	Group Symbol	Soil Description (AS 1726)	Consistency / Relative Density	DCP Blows/300mm *Cone Tip*	Test Sample
0.0		CI	**GRAVELLY SILTY CLAY, NATURAL:** some sand, orange brown, medium plastic, medium dry strength, fine to coarse gravels, moist.	Firm		Disturbed
0.1					7	
0.2						
0.3						
0.4					6	
0.5						Disturbed
0.6						
0.7					8	
0.8						
0.9						
1.0				Stiff	9	Disturbed
1.1						
1.2						
1.3					11	
1.4			END DRILLING: HAND AUGER REFUSAL @ 1.4m			Disturbed
1.5			Possible Siltstone.			
1.6					39/200mm	
1.7						
1.8						
1.9					Stopped	
2.0						
2.1						
2.2						
2.3						
2.4						
2.5						
2.6						
2.7						
2.8						
2.9						
3.0						
3.1						
3.2						
3.3						
3.4						
3.5						
3.6						
3.7						
3.8						
3.9						
4.0						
4.1						
4.2						
4.3						
4.4						
4.5						
4.6						
4.7						
4.8						
4.9						
5.0						

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A.S.C.T.

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17 De-Havilland Crescent, Ballina
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Fax: (02) 6686 8396
A.B.N: 92 602 346 127

BOREHOLE LOG SHEET - 4

Client:	Graham Dunn	**ASCT Ref No:**	H17-0003
Project:	137-139 Jonson & Browning Street, Byron Bay	**Client Ref No:**	NA
Borehole Position:	See Site Sketch	**Drilling Method:**	Power Auger
Surface Elevation:	Exisiting Surface Level	**Drill Bit:**	100mm Ø TC

Depth (m)	Graphic Symbol	Group Symbol	Soil Description (AS 1726)	Consistency / Relative Density	DCP Blows/300mm *Cone Tip*	Test Sample
0.0		CI	**GRAVELLY SILTY CLAY, NATURAL:** some sand, orange brown, medium plastic, medium dry strength, fine to coarse gravels, moist.	Soft	4	
0.1						
0.2						
0.3					24	
0.4						
0.5				Hard		
0.6					67	
0.7			END DRILLING: HAND AUGER REFUSAL @ 0.7m			
0.8			Possible Siltstone.			
0.9						
1.0					Stopped	
1.1						
1.2						
1.3						
1.4						
1.5						
1.6						
1.7						
1.8						
1.9						
2.0						
2.1						
2.2						
2.3						
2.4						
2.5						
2.6						
2.7						
2.8						
2.9						
3.0						
3.1						
3.2						
3.3						
3.4						
3.5						
3.6						
3.7						
3.8						
3.9						
4.0						
4.1						
4.2						
4.3						
4.4						
4.5						
4.6						
4.7						
4.8						
4.9						
5.0						

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

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17 De-Havilland Crescent, Ballina
Telephone: (02) 6686 8567
Fax: (02) 6686 8396
A.B.N: 92 602 346 127

BOREHOLE LOG SHEET - 5

Client:	Graham Dunn	**ASCT Ref No:**	H17-0003
Project:	137-139 Jonson & Browning Street, Byron Bay	**Client Ref No:**	NA
Borehole Position:	See Site Sketch	**Drilling Method:**	Power Auger
Surface Elevation:	Exisiting Surface Level	**Drill Bit:**	100mm Ø TC

Depth (m)	Graphic Symbol	Group Symbol	Soil Description (AS 1726)	Consistency / Relative Density	DCP Blows/300mm *Cone Tip*	Test Sample
0.0		CI	**SANDY SILTY CLAY: NATURAL:** brown, medium plastic, medium dry strength, fine grain size, moist.	Stiff	8	
0.1						
0.2						
0.3						
0.4		CI	**GRAVELLY SILTY CLAY, NATURAL:** some sand, orange brown, medium plastic, medium dry strength, fine gravels, moist.	Very Stiff to Hard	15	
0.5						
0.6						
0.7			END DRILLING: HAND AUGER REFUSAL @ 0.7m		51	
0.8			Possible Siltstone.			
0.9						
1.0					Stopped	
1.1						
1.2						
1.3						
1.4						
1.5						
1.6						
1.7						
1.8						
1.9						
2.0						
2.1						
2.2						
2.3						
2.4						
2.5						
2.6						
2.7						
2.8						
2.9						
3.0						
3.1						
3.2						
3.3						
3.4						
3.5						
3.6						
3.7						
3.8						
3.9						
4.0						
4.1						
4.2						
4.3						
4.4						
4.5						
4.6						
4.7						
4.8						
4.9						
5.0						

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

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Telephone: (02) 6686 8567
Fax: (02) 6686 8396
A.B.N: 92 602 346 127

BOREHOLE LOG SHEET - 6

Client:	Graham Dunn	**ASCT Ref No:**	H17-0003
Project:	137-139 Jonson & Browning Street, Byron Bay	**Client Ref No:**	NA
Borehole Position:	See Site Sketch	**Drilling Method:**	Power Auger
Surface Elevation:	Exisiting Surface Level	**Drill Bit:**	100mm Ø TC

Depth (m)	Graphic Symbol	Group Symbol	Soil Description (AS 1726)	Consistency / Relative Density	DCP Blows/300mm *Cone Tip*	Test Sample
0.0		SM	**SILTY SAND, NATURAL:** some organics, brown, low plastic, low dry strength, fine grain size, moist.	Very Dense	28	
0.1						
0.2						
0.3		ML	**SILTSTONE, NATURAL:** red white, low plastic, low dry strength, fine grain size, moist.	Extremely low Strength	31	
0.4						
0.5						
0.6					26	
0.7						
0.8						
0.9					41	
1.0						
1.1						
1.2					Stopped	
1.3						
1.4						
1.5						
1.6						
1.7						
1.8						
1.9						
2.0						
2.1			END DRILLING @ 2.2m: TARGET DEPTH REACHED			
2.2						
2.3						
2.4						
2.5						
2.6						
2.7						
2.8						
2.9						
3.0						
3.1						
3.2						
3.3						
3.4						
3.5						
3.6						
3.7						
3.8						
3.9						
4.0						
4.1						
4.2						
4.3						
4.4						
4.5						
4.6						
4.7						
4.8						
4.9						
5.0						

AUSTRALIAN SOIL AND CONCRETE TESTING
A.S.C.T.

PO Box 5120 Ballina Mail Centre, NSW 2478
17 De-Havilland Crescent, Ballina
Telephone: (02) 6686 8567
Fax: (02) 6686 8396
A.B.N: 92 602 346 127

BOREHOLE LOG SHEET - 7

Client:	Graham Dunn	**ASCT Ref No:**	H17-0003
Project:	137-139 Jonson & Browning Street, Byron Bay	**Client Ref No:**	NA
Borehole Position:	See Site Sketch	**Drilling Method:**	Power Auger
Surface Elevation:	Exisiting Surface Level	**Drill Bit:**	100mm Ø TC

Depth (m)	Graphic Symbol	Group Symbol	Soil Description (AS 1726)	Consistency / Relative Density	DCP Blows/300mm *Cone Tip*	Test Sample
0.0		SM	**SILTY SAND, NATURAL:** some organics, brown, low plastic, low dry strength, fine grain size, moist.	Very Dense	24	
0.1						
0.2						
0.3		ML	**SILTSTONE, NATURAL:** red white, low plastic, low dry strength, fine grain size, moist.	Extremely low Strength	35	
0.4						
0.5						
0.6					29	
0.7						
0.8						
0.9				Very Low Strength	55	
1.0						
1.1						
1.2					Stopped	
1.3						
1.4						
1.5						
1.6						
1.7						
1.8						
1.9						
2.0						
2.1			END DRILLING @ 2.2m: TARGET DEPTH REACHED			
2.2						
2.3						
2.4						
2.5						
2.6						
2.7						
2.8						
2.9						
3.0						
3.1						
3.2						
3.3						
3.4						
3.5						
3.6						
3.7						
3.8						
3.9						
4.0						
4.1						
4.2						
4.3						
4.4						
4.5						
4.6						
4.7						
4.8						
4.9						
5.0						

ATTACHMENT 3

LABORATORY CERTIFICATES

CHAIN OF CUSTODY

eal Environmental Analysis Laboratory

PO Box 157 (Military Road)
LISMORE NSW 2480
P| 02 6620 3678 F| 02 6620 3957
eal@scu.edu.au, www.scu.edu.au/eal

Submitting Client Details

Quote Id: –
Job Ref: 16330
Company Name: ENV Solutions Pty Ltd
Contact Person: ~~James Foster~~ Craig Helbig
Phone:
Mobile: 0421519354 0405 364 626
Fax: craig
Email: ~~james~~@envsolutions.com.au
Postal Address: 21 Clark St, Ballina NSW

Billing Client Details

F9804 x1

ABN: 600788814
Company Name: ENV Solutions Pty Ltd
Contact Person: James Foster water
Phone:
Mobile: 0421519354
Fax:
Email: james@envsolutions.com.au
Postal Address: 1/17 Grandview Street
East Ballina NSW 2478

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Payment Method:
☐ Purchase Order
☐ Cheque
☑ Invoice (prior approval required)
☐ Credit Card Mastercard / Visa No: _____/_____/_____/_____

Exp. Date: Name on Card: CVV: by phone

		Date	Signed
Relinquished By:	Craig Helbig	29/5/17	
Preservation: None / (Ice) / Ice bricks / Acidified / Filtered / Other:			FROZEN Soil Sampl
Received By:		29.5.17	
Condition on receipt: Ambient / (Cool) / Frozen / Other:			

Comments: * Please analyse the 3 x samples with the highest reported pH change (pHf - pHfox) for Chromium suite analysis (complete) — AS-PACK-008

Marketing Survey – where did you find us?
☐ Word of mouth ☐ Magazine ☐ Google search ☑ Other

Sample Analysis Request

Price List Code (e.g. SW-PACK-06)

Lab Sample No.	Sample ID	Sample Depth (m)	Sampling Date	Your Client	Crop ID	Sample Type (e.g. water, leaf, soil)	AS-PACK-10									
	BH1 – 0.5m	0.5	26/5/17	16330	—	Soil	✓									
	BH1 – 1.0m	1.0	↓	↓	↓	↓	✓									
	BH1 – 1.5m	1.5					✓									
	BH1 – 2.0m	2.0					✓									
	BH1 – 2.5m	2.5					✓									

CHAIN OF CUSTODY

Comments:

Marketing Survey – where did you find us?
☐ Word of mouth ☐ Magazine ☐ Google search ☐ Other

Sample Analysis Request

Price List Code (e.g. SW-PACK-06)

Lab Sample No.	Sample ID	Sample Depth (m)	Sampling Date	Your Client	Crop ID	Sample Type (e.g. water, leaf, soil)	AS-PACK-07	Environmental Monitoring 2	SW-PACK-07								
	BHL-3.0m	3.0	26/5	16330	—	Soil	✓										
	BHL-3.5m	3.5					✓										
	BHL-4.0m	4.0					✓										
	BHL-4.5m	4.5					✓										
	BHL-5.0m	5.0					✓										
	BHL-5.5m	5.5					✓										
	BHL-6.0m	6.0					✓										
	BHL-6.5m	6.5					✓										
	BHL-7.0m	7.0					✓										
(1)	MW1	—				Water		✓									

Sample Receipt Notification (SRN)

Project:	**EAL/F9804**
Customer:	Env Solutions Pty Ltd
Contact:	Craig Helbig
Client Job ID:	16330
No. of Samples	1 x water
Date Received:	29 MAY 2017
Comments:	Standard Request

Southern Cross University
PO Box 157 Lismore NSW 2480

T: (02) 6620 3678
F: (02) 6620 3957
E: eal@scu.edu.au
W: scu.edu.au/eal
ABN: 41 995 651 524

Biller: **Env Solutions Pty Ltd** - Accounts Payable - Phone Not Provided

		Test Request	
		SW-PACK-017	Environmental Monitoring - 2
Sample Text ID	**Client Sample ID**		
F9804/001	MW1		1
Total			1

Sample Receipt Notification (SRN) for EAL/F9804

Test Descriptions

Test List Item	Item Description
SW-PACK-017	**Environmental Monitoring - 2** pH, EC, TDS (by calc.), TSS, Bicarbonate Alkalinity Total Nutrients (TN, TP) Dissolved Nutrient (NO3, NO2, PO4, NH4) Metals (Cu, Pb, Cd, Zn, As, Se, Fe, Mn, Ag, Cr, Ni, Al, Hg) Salts (Na, K, Ca, Mg, Cl, SO4), SAR, Water Hardness (by calc.)

RESULTS OF WATER ANALYSIS (Page 1 of 1)

1 sample supplied by Env Solutions Pty Ltd on the 29th May, 2017 - Lab. Job No. F9804

Analysis requested by Craig Helbig - **Your Project: 16330**

(PO Box 248 BALLINA NSW 2478)

PARAMETER	METHODS REFERENCE	Sample 1 MW1
	Job No.	*F9804/1*
pH	APHA 4500-H^+-B	5.31
CONDUCTIVITY (EC) (dS/m)	APHA 2510-B	0.26
TOTAL DISSOLVED SALTS (mg/L)	calculation using EC x 680	173
TOTAL SUSPENDED SOLIDS (mg/L)	GFC equiv. filter - APHA 2540-D	8,875
BICARBONATE (ALKALINITY) (mg/L $CaCO_3$ equivalent)	** Total Alkalinity - APHA 2320	6
WATER HARDNESS (mg/L $CaCO_3$ equivalent)	** using Ca&Mg calculation	31
TOTAL PHOSPHORUS (mg/L P)	APHA 4500 P-H	0.54
ORTHOPHOSPHATE (mg/L P)	APHA 4500 P-G	0.01
TOTAL NITROGEN (mg/L N)	APHA 4500 N-C	0.67
TOTAL KJELDAHL NITROGEN (mg/L N)	CALCULATION: TN - NOx	0.07
NITRATE (mg/L N)	APHA 4500 NO_3^--F	0.572
NITRITE (mg/L N)	APHA 4500 $NO3^-$-I	0.035
AMMONIA (mg/L N)	APHA 4500 NH_3-H	0.038
SODIUM (mg/L)	APHA 3125 ICPMS*note 1&2	36.5
POTASSIUM (mg/L)	APHA 3125 ICPMS*note 1&2	2.1
CALCIUM (mg/L)	APHA 3125 ICPMS*note 1&2	5.6
MAGNESIUM (mg/L)	APHA 3125 ICPMS*note 1&2	4.2
SODIUM ABSORPTION RATIO	BY CALCULATION	2.9
CHLORIDE (mg/L)	** APHA 4500-Cl^-	38
SULFATE (mg/L SO_4^{2-})	APHA 3125 ICPMS*note 1&2	33
CHLORIDE/ SULFATE RATIO	Calculation	1.2
SILVER (mg/L)	APHA 3125 ICPMS*note 1&2	<0.001
ALUMINIUM (mg/L)	APHA 3125 ICPMS*note 1&2	2.984
ARSENIC (mg/L)	APHA 3125 ICPMS*note 1&2	0.001
CADMIUM (mg/L)	APHA 3125 ICPMS*note 1&2	<0.001
CHROMIUM (mg/L)	APHA 3125 ICPMS*note 1&2	0.002
COPPER (mg/L)	APHA 3125 ICPMS*note 1&2	0.010
IRON (mg/L)	APHA 3125 ICPMS*note 1&2	0.474
MANGANESE (mg/L)	APHA 3125 ICPMS*note 1&2	0.052
NICKEL (mg/L)	APHA 3125 ICPMS*note 1&2	0.001
LEAD (mg/L)	APHA 3125 ICPMS*note 1&2	0.032
SELENIUM (mg/L)	APHA 3125 ICPMS*note 1&2	0.001
ZINC (mg/L)	APHA 3125 ICPMS*note 1&2	0.023
MERCURY (mg/L)	APHA 3125 ICPMS*note 1&2	<0.010
SILVER (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	<0.001
ALUMINIUM (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.034
ARSENIC (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	<0.001
CADMIUM (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	<0.001
CHROMIUM (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	<0.001
COPPER (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.001
IRON (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.017
MANGANESE (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.024
NICKEL (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.001
LEAD (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	<0.001
SELENIUM (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.001
ZINC (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.008
MERCURY (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	<0.0005

Notes:

1. Total available (acid soluble/ extractable) metals - samples acidified with nitric acid to <2pH.
2. Metals/ salts analysed by ICP-MS (Inductively Coupled Plasma - Mass Spectrometry) or ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry)
3. 1 mg/L (milligram per litre) = 1 ppm (part per million) = 1000 µg/L (micrograms per litre)= 1000 ppb (part per billion)
4. For conductivity - 1 dS/m = 1 mS/cm = 1000 µS/cm
5. In Pesticide Analysis Screening, no other pesticides occurred above reportable levels in the attached list
6. For Bacteria - cfu= colony forming unit
5. Analysis performed according to APHA, 2012, "Standard Methods for the Examination of Water & Wastewater", 22nd Edition, except where stated otherwise.
8. Analysis conducted between sample arrival date and Report provision date
9. ** denotes these test procedures are as yet not NATA accredited but quality control data is available
10. .. Denotes not requested

NATA
WORLD RECOGNISED ACCREDITATION
Accreditation No. 14960.
Accredited for compliance with ISO/IEC 17025.

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked: .....
Graham Lancaster
Laboratory Manager

CHAIN OF CUSTODY

Environmental Analysis Laboratory
Division of Research, Southern Cross University

PO Box 157 (Military Road)
LISMORE NSW 2480
P| 02 6620 3678 F| 02 6620 3957
eal@scu.edu.au, www.scu.edu.au/eal

Submitting Client Details

Quote Id: —
Job Ref: 16330
Company Name: ENV Solutions Pty Ltd
Contact Person: ~~James Foster~~ Craig Helbig
Phone:
Mobile: ~~0421519354~~ 0405 364 626
Fax: craig
Email: ~~james~~@envsolutions.com.au
Postal Address: 21 Clark St, Ballina, NSW

Billing Client Details

GOOS3
ABN: 600788814
Company Name: ENV Solutions Pty Ltd x1
Contact Person: James Foster
Phone: water
Mobile: 0421519354
Fax:
Email: james@envsolutions.com.au
Postal Address: 1/17 Grandview Street
East Ballina NSW 2478

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☐ Cheque
☑ Invoice (prior approval required)
☐ Credit Card Mastercard / Visa No: _____/_____/_____/_____

Exp. Date: Name on Card: CVV: by phone

Relinquished By:	Craig Helbig	6/6/17	
Preservation: None / Ice / Ice bricks / Acidified / Filtered / Other:			
Received By:		7.6.17	
Condition on receipt: Ambient / Cool / Frozen / Other:			

Comments:

URGENT

Marketing Survey – where did you find us?
☐ Word of mouth ☐ Magazine ☐ Google search ☐ Other

Sample Analysis Request

Price List Code (e.g. SW-PACK-06)

Environment Monitoring ✓ 2

SW-PACK-017
SW-PACK-040

Lab Sample No.	Sample ID	Sample Depth	Sampling Date	Your Client	Crop ID	Sample Type (e.g. water, leaf, soil)	
1.	Discharge	—	6/6/17	JGD	—	Water	* Please apply 24 hr turn-around time to analysis *

Sample Receipt Notification (SRN)

Project:	**EAL/G0083**
Customer:	Env Solutions Pty Ltd
Contact:	Craig Helbig
Client Job ID:	16330
No. of Samples	1 x water
Date Received:	07 JUN 2017
Comments:	Urgent 24hr TAT due Thursday 8th June

Southern Cross University
PO Box 157 Lismore NSW 2480

T: (02) 6620 3678
F: (02) 6620 3957
E: eal@scu.edu.au
W: scu.edu.au/eal
ABN: 41 995 651 524

Biller: **Env Solutions Pty Ltd** - Accounts Payable - Phone Not Provided

Test Request

Sample Text ID	Client Sample ID	Environmental Monitoring - 2 (SW-PACK-017)	Basic Metals Scan - Dissolved (SW-PACK-040)
G0083/001	Discharge 6/06/17	1	1
Total		1	1

Sample Receipt Notification (SRN) for EAL/G0083

Test Descriptions

Test List Item	Item Description
SW-PACK-017	**Environmental Monitoring - 2** pH, EC, TDS (by calc.), TSS, Bicarbonate Alkalinity Total Nutrients (TN, TP) Dissolved Nutrient (NO3, NO2, PO4, NH4) Metals (Cu, Pb, Cd, Zn, As, Se, Fe, Mn, Ag, Cr, Ni, Al, Hg) Salts (Na, K, Ca, Mg, Cl, SO4), SAR, Water Hardness (by calc.)
SW-PACK-040	**Basic Metals Scan - Dissolved** Metals (Cu, Pb, Cd, Zn, As, Se, Fe, Mn, Ag, Cr, Ni, Al, Hg)

RESULTS OF WATER ANALYSIS

1 sample supplied by Env Solutions Pty Ltd on the 7th June, 2017 - Lab. Job No. G0083
Analysis requested by Craig Helbig. **Your Project: 16330**
(PO Box 248 BALLINA NSW 2478).

PARAMETER	METHODS REFERENCE	Sample 1 Discharge 6/06/17
	Job No.	*G0083/1*
pH	APHA 4500-H^+-B	6.67
CONDUCTIVITY (EC) (dS/m)	APHA 2510-B	0.321
TOTAL DISSOLVED SALTS (mg/L)	** calculation using EC x 680	218
TOTAL SUSPENDED SOLIDS (mg/L)	GFC equiv. filter - APHA 2540-D	7
BICARBONATE (ALKALINITY) (mg/L $CaCO_3$ equivalent)	** Total Alkalinity - APHA 2320	50
CARBONATE (mg/L $CaCO_3$ equivalent)	** Residual Alkalinity - APHA 2320	0
WATER HARDNESS (mg/L $CaCO_3$ equivalent)	** using Ca&Mg calculation	91
TOTAL PHOSPHORUS (mg/L P)	APHA 4500 P-H	0.06
PHOSPHATE (mg/L P)	APHA 4500 P-G	0.009
TOTAL NITROGEN (mg/L N)	APHA 4500 N-C	0.80
TOTAL KJELDAHL NITROGEN (mg/L N)	CALCULATION: TN - NOx	0.53
NITRATE (mg/L N)	APHA 4500 NO_3^--F	0.261
NITRITE (mg/L N)	APHA 4500 NO_2^--I	0.014
AMMONIA (mg/L N)	APHA 4500 NH_3-H	0.237
SODIUM (mg/L)	APHA 3125 ICPMS*note 1&2	29
POTASSIUM (mg/L)	APHA 3125 ICPMS*note 1&2	4
CALCIUM (mg/L)	APHA 3125 ICPMS*note 1&2	28
MAGNESIUM (mg/L)	APHA 3125 ICPMS*note 1&2	5
SODIUM ABSORPTION RATIO (SAR)	** BY CALCULATION	1.3
CHLORIDE (mg/L)	APHA 3125 ICPMS*note 2 or ** APHA 4500-Cl^-	40
SULFATE (mg/L SO_4^{2-})	APHA 3125 ICPMS*note 2	45
CHLORIDE/ SULFATE RATIO	** Calculation	0.9
SILVER (mg/L)	Total - APHA 3125 ICPMS*note 1&2	<0.001
ALUMINIUM (mg/L)	Total - APHA 3125 ICPMS*note 1&2	0.177
ARSENIC (mg/L)	Total - APHA 3125 ICPMS*note 1&2	0.002
CADMIUM (mg/L)	Total - APHA 3125 ICPMS*note 1&2	<0.001
CHROMIUM (mg/L)	Total - APHA 3125 ICPMS*note 1&2	0.001
COPPER (mg/L)	Total - APHA 3125 ICPMS*note 1&2	0.003
IRON (mg/L)	Total - APHA 3125 ICPMS*note 1&2	1.154
MANGANESE (mg/L)	Total - APHA 3125 ICPMS*note 1&2	0.139
NICKEL (mg/L)	Total - APHA 3125 ICPMS*note 1&2	0.002
LEAD (mg/L)	Total - APHA 3125 ICPMS*note 1&2	0.001
SELENIUM (mg/L)	Total - APHA 3125 ICPMS*note 1&2	0.001
ZINC (mg/L)	Total - APHA 3125 ICPMS*note 1&2	0.096
MERCURY (mg/L)	Total - APHA 3125 ICPMS*note 1&2	<0.010
SILVER (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	<0.001
ALUMINIUM (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.043
ARSENIC (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.001
CADMIUM (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	<0.001
CHROMIUM (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.001
COPPER (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.004
IRON (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.476
MANGANESE (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.141
NICKEL (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.002
LEAD (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.002
SELENIUM (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.001
ZINC (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	0.056
MERCURY (mg/L)	Dissolved - APHA 3125 ICPMS*note 1&2	<0.010

Notes:

1. Total available (acid soluble/ extractable) metals - samples acidified with nitric acid to <2pH.
1. Dissolved metals - samples filtered through 0.45μm cellulose acetate and then acidified with nitric acid prior to analysis
2. Metals/ salts analysed by ICP-MS (Inductively Coupled Plasma - Mass Spectrometry) or ICP-OES (Inductively Coupled Plasma - Optical Emission Spectrometry)
3. 1 mg/L (milligram per litre) = 1 ppm (part per million) = 1000 μg/L (micrograms per litre)= 1000 ppb (part per billion)
4. For conductivity - 1 dS/m = 1 mS/cm = 1000 μS/cm
5. Analysis performed according to APHA, 2012, "Standard Methods for the Examination of Water & Wastewater", 22nd Edition, except where stated otherwise.
6. Analysis conducted between sample arrival date and Report provision date
7. ** denotes these test procedure or calculation are as yet not NATA accredited but quality control data is available
8. .. **Denotes not requested**

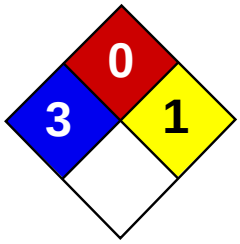
NATA
Accreditation No. 14960.
Accredited for compliance with ISO/IEC 17025.

checked: .....
Graham Lancaster
Laboratory Manager

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

ATTACHMENT 4

MATERIAL SAFETY DATA SHEETS



Material Safety Data Sheet
Sodium hydroxide MSDS

Section 1: Chemical Product and Company Identification

Product Name: Sodium hydroxide

Catalog Codes: SLS3298, SLS1081, SLS2503, SLS3925, SLS1705

CAS#: 1310-73-2

RTECS: WB4900000

TSCA: TSCA 8(b) inventory: Sodium hydroxide

CI#: Not available.

Synonym: Caustic Soda

Chemical Name: Sodium Hydroxide

Chemical Formula: NaOH

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Sodium hydroxide	1310-73-2	100

Toxicological Data on Ingredients: Sodium hydroxide LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, of inhalation. The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to mucous membranes, upper respiratory tract, skin, eyes. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: metals

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available. Slightly explosive in presence of heat.

Fire Fighting Media and Instructions: Not available

Special Remarks on Fire Hazards:
sodium hydroxide + zinc metal dust causes ignition of the latter. Under proper conditions of temperature, pressure and state of division, it can ignite or react violently with acetaldehyde, ally alcohol, allyl chloride, benzene-1,4-diol, chlorine trifluoride, 1,2 dichlorethylene, nitroethane, nitromethane, nitroparaffins, nitropropane, cinnamaldehyde, 2,2-dichloro-3,3-dimethylbutane. Sodium hydroxide in contact with water may generate enough heat to ignite adjacent combustible materials. Phosphorous boiled with NaOH yields mixed phosphines which may ignite spontanously in air. sodium hydroxide and cinnamaldehyde + heat may cause ignition. Reaction with certain metals releases flammable and explosive hydrogen gas.

Special Remarks on Explosion Hazards:
Sodium hydroxide reacts to form explosive products with ammonia + silver nitrate. Benzene extract of allyl benzenesulfonate prepared from allyl alcohol, and benzene sulfonyl chloride in presence of aquesous sodium hydroxide, under vacuum distillation, residue darkened and exploded. Sodium Hydroxde + impure tetrahydrofuran, which can contain peroxides, can

cause serious explosions. Dry mixtures of sodium hydroxide and sodium tetrahydroborate liberate hydrogen explosively at 230-270 deg. C. Sodium Hydroxide reacts with sodium salt of trichlorophenol + methyl alcohol + trichlorobenzene + heat to cause an explosion.

Section 6: Accidental Release Measures

Small Spill:
Use appropriate tools to put the spilled solid in a convenient waste disposal container. If necessary: Neutralize the residue with a dilute solution of acetic acid.

Large Spill:
Corrosive solid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of acetic acid. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep container dry. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If you feel unwell, seek medical attention and show the label when possible. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, metals, acids, alkalis, moisture.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Hygroscopic. Deliquescent.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:
Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
STEL: 2 (mg/m3) from ACGIH (TLV) [United States] TWA: 2 CEIL: 2 (mg/m3) from OSHA (PEL) [United States] CEIL: 2 (mg/m3) from NIOSHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Deliquescent solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 40 g/mole

Color: White.

pH (1% soln/water): 13.5 [Basic.]

Boiling Point: 1388°C (2530.4°F)

Melting Point: 323°C (613.4°F)

Critical Temperature: Not available.

Specific Gravity: 2.13 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water.

Solubility: Easily soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, moisture, moist air

Incompatibility with various substances:
Highly reactive with metals. Reactive with oxidizing agents, reducing agents, acids, alkalis, moisture.

Corrosivity: Not available.

Special Remarks on Reactivity:
Hygroscopic. Much heat is evolved when solid material is dissolved in water. Therefore cold water and caution must be used for this process. Sodium hydroxide solution and octanol + diborane during a work-up of a reaction mixture of oxime and diborane in tetrahyrofuran is very exothermic, a mild explosion being noted on one occassion. Reactive with water, acids (mineral, non-oxidizing, e.g. hydrochloric, hydrofluoric acid, muriatic acid, phosphoric), acids (mineral, oxidizing e.g. chromic acid, hypochlorous acid, nitric acid, sulfuric acid), acids (organic e.g. acetic acid, benzoic acid, formic acid, methanoic acid, oxalic acid), aldehydes (e.g. acetaldehyde, acrolein, chloral hydrate, foraldehyde), carbamates (e.g. carbanolate, carbofuran), esters (e.g. butyl acetate, ethyl acetate, propyl formate), halogenated organics (dibromoethane, hexachlorobenzene, methyl chloride, trichloroethylene), isocyanates (e.g. methyl isocyanate), ketones (acetone, acetophenone, MEK, MIBK), acid chlorides, strong bases, strong oxidizing agents, strong reducing agents, flammable liquids, powdered metals and metals (i.e aluminum, tin, zinc, hafnium, raney nickel), metals (alkali and alkaline e.g. cesium, potassium, sodium), metal compounds (toxic e.g. berylium, lead acetate, nickel carbonyl, tetraethyl lead), mitrides (e.g. potassium nitride, sodium nitride), nitriles (e.g. acetonitrile, methyl cyanide), nitro compounds (organic e.g. nitrobenzene, nitromethane), acetic anhydride, chlorohydrin, chlorosulfonic acid, ethylene cyanohydrin, glyoxal, hydrosulfuric acid, oleum, propiolactone, acylonitrile, phorosous pentoxide, chloroethanol, chloroform-methanol, tetrahydroborate, cyanogen azide, 1,2,4,5 tetrachlorobenzene, cinnamaldehyde. Reacts with formaldehyde hydroxide to yield formic acid, and hydrogen.

Special Remarks on Corrosivity: Very caustic to aluminum and other metals in presence of moisture.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans:
MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. May cause damage to the following organs: mucous membranes, upper respiratory tract, skin, eyes.

Other Toxic Effects on Humans:
Extremely hazardous in case of inhalation (lung corrosive). Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (corrosive), of ingestion, .

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Dose: LDL [Rabbit] - Route: Oral; Dose: 500 mg/kg

Special Remarks on Chronic Effects on Humans: May affect genetic material. Investigation as a mutagen (cytogenetic analysis)

Special Remarks on other Toxic Effects on Humans:

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:
Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Sodium hydroxide, solid UNNA: 1823 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Illinois toxic substances disclosure to employee act: Sodium hydroxide Illinois chemical safety act: Sodium hydroxide New York release reporting list: Sodium hydroxide Rhode Island RTK hazardous substances: Sodium hydroxide Pennsylvania RTK: Sodium hydroxide Minnesota: Sodium hydroxide Massachusetts RTK: Sodium hydroxide New Jersey: Sodium hydroxide Louisiana spill reporting: Sodium hydroxide California Director's List of Hazardous Substances: Sodium hydroxide TSCA 8(b) inventory: Sodium hydroxide CERCLA: Hazardous substances.: Sodium hydroxide: 1000 lbs. (453.6 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS E: Corrosive solid.

DSCL (EEC):
R35- Causes severe burns. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S37/39- Wear suitable gloves and eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 2

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/09/2005 06:32 PM

Last Updated: 05/21/2013 12:00 PM

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Organic Farming Systems

(Sustainable Ventures Pty Ltd ACN 076 001 100)

Tel: 08 9384 3789
Fax: 08 9384 3379
Email: admin@organicfarming.com.au
Address: PO Box 419, Cottesloe WA 6911
Warehouse: 3 Rawlinson St, O'Connor WA 6163

Material Safety Data Sheet

==========

1. Identification

==========

Product Name: **OFS Liquid Gypsum**
UN Number: None allocated
Hazchem Code: None allocated
Dangerous Goods Class: None allocated
Poisons Schedule: Not scheduled

Use
Product is used as a liquid fertilizer.
Method of Application: Applied via spray equipment or irrigation.

Physical Description
Appearance: Black viscous liquid. Slight pungent odor.
Vapour Pressure Not available
pH 6.8 - 7
Specific Gravity: 1.61
Flashpoint: Not applicable
Solubility in Water: Fully miscible
Other Properties: Avoid mixing with strong acids and alkalis.

Ingredients
Chemical Entity: Gypsum, Fulvic acid
CAS Number: Non allocated

==========

2. Health Hazard Information

==========

Health Effects
No adverse health effects expected if the product is handled in accordance with this MSDS and the product label. Symptoms that may arise if the product is mishandled are:

Acute	Swallowed	Small quantities are not harmful. Non-toxic but may cause vomiting. If swallowed wash mouth out. Give water to drink. Monitor condition and seek medical advice if adverse symptoms become apparent.
	Eye:	May cause irritation, slight burning sensation or inflammation if the material concentrate comes in contact with eyes. Flush from eyes with clean water. Seek medical advice if inflammation persists.

	Skin:	Presents no danger through contact with skin although may cause irritation and slight burning sensation to open cuts or abrasions. Wash or rinse exposed skin/open wound with clean water and remove contaminated clothing if irritation is a problem.
	Inhalation:	Will not cause harm if inadvertently inhaled in mist or vapour form during spray application. May cause irritation – seek medical attention if problems persist.
Advice to Doctor:		Treat symptomatically.

3. Precautions for Use

Exposure Standards:	No value assigned for this specific material by the National Occupational Health and Safety Commission.
Engineering Controls:	Use in a ventilated area.
Personal Protection	Good industrial hygiene practices should be observed. Face shields recommended during handling of product. Overalls and gloves recommended when handling liquid concentrate.
Flammability	Non-Flammable

4. Safe Handling Information

Storage and Transport:	Store out of sunlight. Suitable for all general storage areas
Spills and Disposal:	Avoid accidents, clean up immediately. Contain using sand or soil – prevent run off into drains and waterways. Soak up spillage and recover/recycle if possible.
Disposal	Dispose of as industrial waste in accordance with local city, district or regional Council Waste Management Authority.
Fire Explosion Hazard:	Non-combustible material. Extinguishing media governed by other materials present.

5. Contact Point

Organic Farming Systems - Steven David (Manager) 08 9384 3789

Disclaimer
The data and recommendations presented herein are based upon research of others and are believed to be accurate. However, no warranty is expressed or implied regarding this data or the results to be obtained from use thereof. Organic Farming Systems assumes no responsibility for the injury to customers or third party proximity caused by the material if reasonable safety procedures are not adhered to as stipulated in this data sheet.

ATTACHMENT 5

DAILY CHECK SHEET (WATER QUALITY)

Byron DMP - DAILY CHECKLIST: Dewatering Management Plan

Inspector

Date

Time

Discharge Volume (to date):

Physico-Chemical Logger Results

Start Time		End Time		On Site **(Daily)**	Receiving Environment **(once per week)**
Temperature (°C)					
pH					
Oxidation Reduction Potential (ORP; mV)					
Electrical Conductivity (EC; mS/cm)					
Turbidity (NTU)					
Dissolved Oxygen (DO; mg/L)					
Total Dissolved Solids (TDS; g/L)					
Salinity (ppt)					

Physical Inspection - Visual / Odour

	Level	OK?
Hydrocarbon sheen and/or odour within the treatment system?		
Iron staining within treatment system or downstream drains?		
Flocculent Level		
Gypsum on Hand (kg)		
Lime on Hand (kg)		
Sludge Level		
Odours Present		

Laboratory Analysis

Lab Sample Taken? Yes ☐ No ☐ US and DS ☐

COC Number _____

Send To Lab _____ Time _____

Complaints Yes ☐ No ☐

Details _____

Notes: _____

_____

The water quality is Compliant ☐ Non Compliant ☐

Signature: _____

11 General Notes

General

Environmental reports present the results of investigations carried out for a specific project and usually for a specific phase of the project (e.g. preliminary design). The report is based on specific criteria, such as the nature of the project, underground utilities or scope of service limitations imposed by the Client. The report may not be relevant for other phases of the project (e.g. construction), after some time or where project details and clients change.

Soil and Rock Description

Soil and rock descriptions are based on AS1726-1993 using visual and tactile assessment, except at discrete locations where field and/or laboratory tests have been carried out. Refer to the terms and symbols sheet for definitions.

Groundwater

The water levels indicated are taken at the time of measurement and depending on material permeability, may not reflect the actual groundwater level at those specified locations. Also, groundwater levels can vary with time due to seasonal or tidal fluctuation, construction activities and other external factors.

Interpretation of Results

The discussion and recommendations in the accompanying report are based on extrapolation/interpolation from data obtained at discrete locations and other external sources and guidelines. The actual interface between the materials may be far more gradual or abrupt than indicated. Also, actual conditions in areas not sampled may differ from those predicted.

The report is based on significant background details that only the authors can be aware off, and therefore implementation of the recommendations by others may lead to misinterpretation and complications. Therefore, this company should be consulted to explain the reports implications to other involved parties.

Reporting relies on interpretation of often limited factual information, based on judgement and opinion, which has a level of uncertainty and ambiguity attached to it, and is far less exact than other design disciplines. This should be considered by users of the report when assessing the implications of the recommendations.

Change in Conditions

Subsurface conditions can change with time and can vary between test locations. Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations can also affect subsurface conditions.

12 Document Control:

Filename:	16330_Byron DMP
Job No.:	16330
Author:	Craig Helbig
Client:	JGD Developments Pty Ltd
File/Pathname:	C:\Users\admin\Dropbox (ENV Solutions)\ENV Solutions Team Folder\01 Jobs\16330 - Byron ASS, ASSMP, DMP

Revision No:	Date:	Issued By	
		Name	Signed
1.0	16/06/17	C Helbig	
2.0	22/06/17	J Foster	
3.0	29/06/17	C Helbig	

Scope of Engagement:

This report has been prepared by ENV Solutions PTY LTD (ENV) ABN 46856079490 at the request of JGD Developments Pty Ltd for the purpose of providing a Dewatering Management Plan for the subject site described in this Plan, and is not to be used for any other purpose or by any other person or corporation.

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