GABRIELS HEARNE FARRELL

ARCHITECTURAL ACOUSTICS

DAYTON PRIMARY SCHOOL - DD REPORT

23rd April 2021

For

CHRISTOU DESIGN GROUP

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CLAREMONT WA 6010

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GABRIELS HEARNE FARRELL PTY LTD ACN 608 956 734 ATF THE GHF UNIT TRUST

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Report Version	Author	Notes	Date
SD Report	Michael Ferguson		5th March 2021
DD Report	Michael Ferguson		23rd April 2021

Gabriels Hearne Farrell Pty Ltd is a Member Firm of the Association of Australasian Acoustical Consultants. The report author is a full member of the Australian Acoustical Society.

1. INTRODUCTION

This report considers a wide range of architectural acoustic and building envelope issues to be addressed during the design and documentation of the proposed Dayton Primary School. It is based on architectural Design Development stage drawings received from the architect on the 23rd April, 2021.

The report addresses the design requirements as set out in "Part 5.14 - Acoustics & Building Envelope" (Nov 2020) of the Department of Education Primary Schools Brief, including relevant BCA and GreenStar Education Tool issues.

In accordance with 5.14 of the PS Brief, the range of issues considered includes:

- Acoustic Isolation
- Reverberation Control
- Services Noise Control
- Rain Noise
- External Noise Intrusion
- Environmental Noise Emissions

2. ENVIRONMENTAL ACOUSTICS

2.1 Traffic Noise

The site is mostly located with typical suburban streets. Therefore we do not envisage any concerns regarding traffic noise intrusion.

2.2 Aircraft Noise

The proposed primary school location is located to the North of Perth Airport, however it can be seen in the below image that the proposed primary school location does not fall within the airport ANEF Contours:

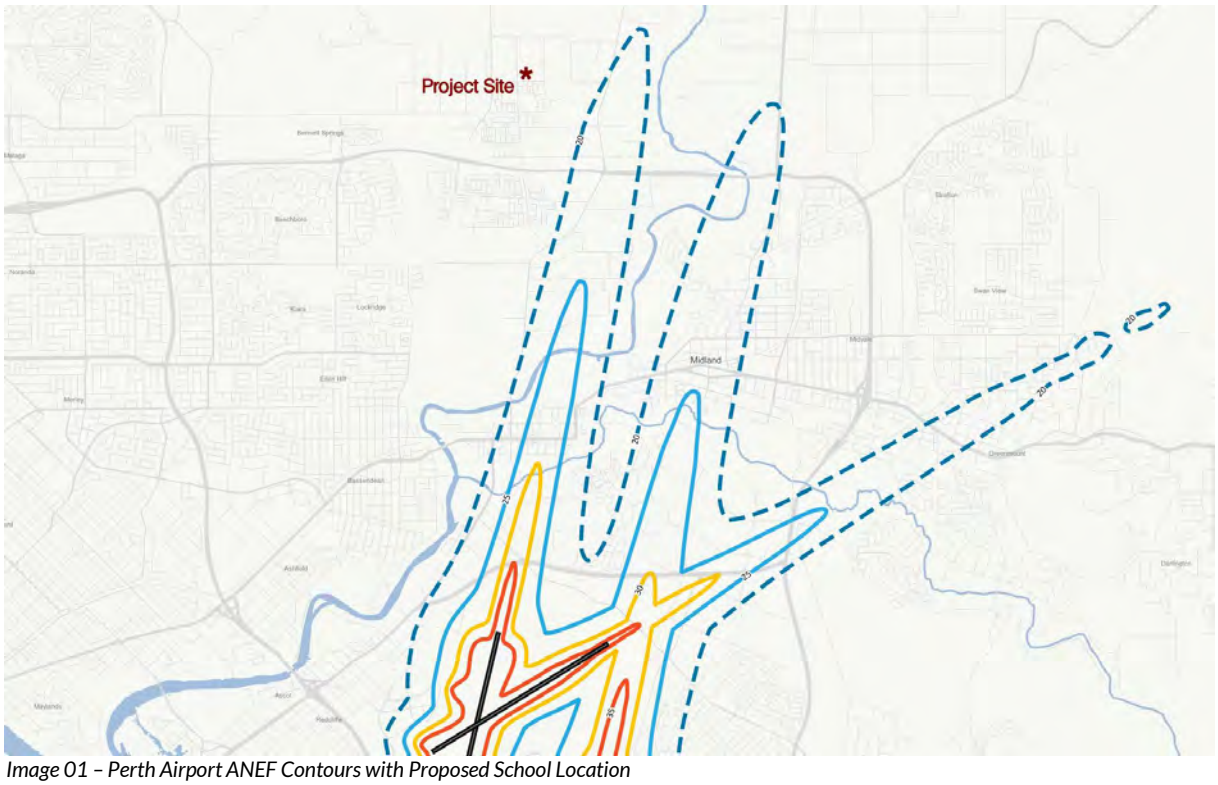

Image 01 – Perth Airport ANEF Contours with Proposed School Location

Based on this information it is our view that aircraft noise intrusion is unlikely to be a concern. With typical primary school constructions aircraft noise will still be audible, however this should be below the recommended levels set out in the relevant Australian Standards.

3. NOISE EMISSION TO NEIGHBOURS

Noise emission from one premises to another is governed by the Environmental Protection (Noise) Regulations, 1997. However, most activity noise emissions from schools are considered to be Community Noise and are technically exempt from compliance with the regulatory Assigned Noise Levels, as discussed below:

According to Regulation 16 and Schedule 2 (Item 4), the "exempt noise" applies to:

Noise emitted as a consequence of a recreational or educational activity from the premises occupied for educational purposes if the activity -

a) is conducted under the control of the occupier of the premises; and

b) does not include the use of mechanical equipment other than musical instruments

Therefore it is our belief that any school or educational activity occurring on this land is exempt from meeting the EPNR, provided they are not mechanical in nature, and are still under the control of the occupier. A summary of noise sources requiring consideration is set out below.

3.1 Dedicated Kindergarten / Pre-Primary Outdoor Play Areas

Although technically exempt from complying with the Environmental Protection (Noise) Regulations 1997, complaints from kindergarten and pre-primary outdoor play areas do occur. In these cases, the CEO of the local government can enforce compliance with the noise regulations even if technically outdoor play areas are exempt.

In relation to this project the risk of noise complaint from the kindergarten / pre-primary play areas is minimal given that Teaching Block 1 has been oriented appropriately, whereby the building itself is acting as a significant acoustic barrier between the play areas and the adjacent neighbours.

3.2 Covered Assembly / Music Block

The orientation of the Covered Assembly block is ideal, in that the covered assembly area is centrally located and not facing directly towards the nearby residences.

3.3 Mechanical Equipment

Standard Pattern Primary schools do not typically incorporate significant external mechanical equipment (e.g. large chillers, cooling towers or dust extractors etc.). If specific high noise equipment is proposed, a check of potential noise emissions will be conducted. This will be reviewed in liaison with the project mechanical consultants during the following stages of this project.

We note that the use of small condensing units to each Block do not typically pose a concern, due to the distance to neighbouring properties, and limitation of use to daytime hours. As above, a detailed review will be conducted once equipment selections are progressed during the following stages.

3.4 School sirens

The school sirens that are used to signal the beginning and ending of break times are deemed to be a 'mechanical device' as defined by the Environmental Protection (Noise) Regulations 1997 which means that technically the sirens are required to comply. However the reality is that school sirens will generally not comply with these noise regulations as their sole purpose is to be heard at distances.

Notwithstanding the above, things can be done to minimise the noise transmission to residences and therefore reduce the risk of complaint:

- Have more sirens/speakers spread around the school, rather than having one or two sirens in the centre of the school. Having more speakers will mean that the volume from each speaker can be significantly lower and therefore will reduce the overall noise emissions to neighbouring residences.
- Sirens should be localised to the specific play areas where possible.
- Selected sirens should have reduced annoying characteristics, and the length of time that the siren is played should be limited.
- Any sirens located near the boundary of the school should be directional in nature, facing back towards the school.

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3.5 Bore Water Filtration Plant

It has recently come to light the potential for noise emissions from bore water filtration plant to be problematic (if one is required). Generally the issue arises from the requirement for these units to be running during the most stringent overnight period.

Given the potential location to the North of the site, should this system be required then an additional acoustic enclosure may be required. The exact nature of this enclosure is unknown until the radiated noise levels are confirmed, however this typically cannot be confirmed until the unit is installed and measurements can be taken. At this stage we would recommend a provisional sum is allowed for the construction of a brick or fibre cement clad shed with some internal acoustic lining and the required ventilation preferably facing away from residences.

4. ARCHITECTURAL ACOUSTICS

4.1 Internal Walls

Section 5.14 of the PS Brief includes minimum acoustic ratings and / or speech privacy requirements for wall separating the various spaces. Of particular note is the fact that walls separating spaces with perforated or metal strip ceilings must be constructed full height to roof over, to control room-to-room sound flanking via the ceiling space. Where this is not practical, an alternative is to use proprietary Audibar barrier backed acoustic ceilings.

The attached marked up plans refer to Wall Types 1 to 4, depending on the required acoustic performance to meet the intent of the PS Brief. The Table below sets out acoustic performance and construction options for the various wall types.

Wall Type	Acoustic Performance	Lightweight Partition	Masonry / Concrete
Type W1 Blue	≥ R_w 42	1 layer 13mm plasterboard 76mm stud frame, 75mm insulation in cavity. 1 layer 13mm plasterboard	90mm masonry rendered both sides *OR* 110mm masonry (no render)
Type W2 Green	≥ R_w 46	2 layers 13mm plasterboard 76mm stud frame, 75mm insulation in cavity. 1 layer 13mm plasterboard	110mm masonry rendered both sides *OR* 150mm special performance brick (no render)
Type W3 Red	≥ R_w 50	2 layers 13mm plasterboard 76mm stud frame, 75mm insulation in cavity. 2 layers 13mm plasterboard	150mm special performance brick rendered both sides *OR* Cavity Masonry wall
Type W4 Yellow	Hydraulic / Discontinuous	1 layer of 13 mm Plasterboard with a minimum 20mm discontinuous gap to the adjacent wall 64mm stud frame, 75mm insulation in cavity All services to be mounted to hydraulic wall and separated from adjacent wall.	Cavity Masonry Wall No wall ties

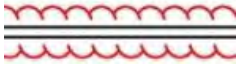
Table 01 – Acoustic Wall Types

Notes:

- It is essential that fibre insulation provided in stud-framed construction be specified to have density ≥10.8 kg/m^3. It is recommended that 75mm glasswool partition batts are used. If polyester insulation is desired, utilise *Tontine Nova 75* insulation.
- Direct stick plasterboard on masonry walls is not an acoustic equivalent to render. A significant reduction is acoustic rating is likely to result where this lining is applied.
- Stud sizing is based upon acoustics and estimated partition height limits. This must be confirmed by structural and we must be advised before any changes are made.

The minimum wall performance specified on the attached marked-up plans should provide an acceptable level of acoustic separation, provided the ambient noise level in each space complies with AS 2107:2016. If the actual ambient noise levels are too low (i.e. less than the *satisfactory* noise levels stipulated in AS 2107:2016), the specified performance for walls may not be adequate.

4.2 Full-Height Walls



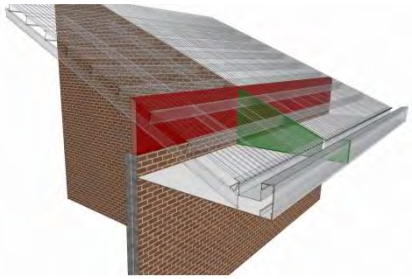
Many of the walls in this project need to be taken full-height right up to the underside of the roof sheeting above. This is required to control room-to-room noise transmission via the ceiling space.

Full height walls are compulsory around spaces that contain perforated ceilings, given that perforated ceilings do not act as a barrier to noise transmission. The required full height walls are clouded in red on the attached plans. It is critical that an air-tight seal is achieved where the walls meet the underside of the roof sheeting / floor slab above:

- For stud framed walls, the plasterboard sheeting must push up against the Anticon roof insulation. The plasterboard sheeting must be cut around the purlins, with the resultant gaps sealed with a non-setting flexible sealant (similar to how a fire wall would be detailed).
- For masonry walls, stud framed construction can be used between the top of the masonry wall and the underside of the roof insulation to create full height walls. The stud framed construction must be as per the table of 'Wall Types' above, correlating with the colours on the marked-up plans.

It is important that the portions of full height wall above ceiling level are not compromised by mechanical and electrical services. Some issues to consider include:

- Avoid having mechanical ductwork penetrating full height walls. Where this is unavoidable, ensure an air-tight flexible seal is achieved around the duct at the wall penetration. This is often achieved by inserting high density fibreglass insulation into the small gap around the mechanical duct, then installing steel angles in front of the gaps to cover the insulation. Further information can be provided, if required.
- Avoid having cable trays passing through full height walls. Where this is unavoidable, special detailing is required to ensure an air-tight seal is achieved at the penetration. If cable trays must pass through full height walls, the best location for the penetration is above the door to the room in the ceiling space. We can provide a schematic detail for this penetration, if required.
- Cable trays must not pass through walls rated at or above R_w 50. Where this is unavoidable the cable tray must stop before the wall with cables being bundled, passed through conduits and sealed through the wall penetration. Conduits must not be more than 50mm individually.



It is also critical that all perimeter open eaves are closed off with a full height wall detail. This can either be achieved via the perimeter wall continuing up to the underside of the roof sheeting above (red area in the adjacent image), or by continuing the separating partition walls out to the edge of the eave lining (green area in adjacent image).

The current documentation has a change from brickwork to light weight construction at a high level of the external walls. Due to this it is critical that this junction is sealed off appropriately. This can be done by either continuing the

internal lining of the external wall up to the roof line, or by cutting the internal lining at the top of the brickwork and sealing the full height wall to the outer lining. Should this second approach be taken then the full height wall must penetrate the lightweight external wall (internal lining) otherwise sound may flank down the cavity space of the external wall.

4.3 Operable Partitions

It must be recognised that operable partitions will not provide the same level of acoustic isolation as a permanent masonry or stud framed wall. Operable partitions provide flexibility of spaces, not 'sound proof' conditions.

4.3.1 *Classroom to Classroom*

In accordance with the PS Brief, operable partitions between Teaching Areas must be selected on the basis of at least R_w 45 design rating. Suppliers of operable walls must be a of a high quality with adequate seals to limit loss of acoustic performance over time with use e.g. Lotus, Hufcor, or similar equal approved.

4.3.2 *Library Block - Conference to Staff Room*

The operable wall between the Conference Room and Staff Room also needs to be specified with a minimum R_w 50 design rating, as per the latest PS Brief.

4.3.3 *Covered Assembly Block - Music Classroom to Covered Area*

The operable wall between Music and Covered Assembly should be R_w 52, as both spaces may accommodate noise generating activities. Even this is not considered soundproof, but represents a practical level of noise control for this planning arrangement.

4.3.4 *Noise Flanking*

Given that perforated acoustic ceilings will be used in the various teaching spaces, conference room, etc., an 'acoustic septum' is required between the top of the operable room and the underside of the roof sheeting. This is necessary such that flanking noise transmission is sufficiently controlled. The acoustic septum is to consist of the following construction:

- Green Rating - Wall Type W2
- Red Rating - Wall Type W3

These septum walls must be fully sealed around the structural beam and hanging track etc. below.

4.4 Internal Doors

Acoustically, doors form the weakest link in a wall system. It follows that special attention to the performance and detailing of doors is required.

Where a basic level of noise control is required, doors should be provided with full perimeter rubber acoustic seals (frame seals and drop seals such as Raven RP10 & RP38 or Raven RP126 & RP78). Acoustic seals will also be required for the meeting stile of double doors (e.g. Raven RP16 or RP71 seals). The door itself should be either 38mm solid core or 10.38mm laminated glass in a high quality metal frame.

Note – A 38mm solid core door with seals will achieve a transmission loss performance of around R_w 28 to 30. This is noticeably lower performance than the wall types detailed in Section 8.1. As such, speech privacy is not possible even though an acoustically sealed door. Door grilles negate the acoustic performance of doors and must not be used in solid core doors. If 'Return Air' is required, it should be via acoustic air-transfer ducts, not door grilles.

The locations where it is recommended that acoustically sealed solid core or glazed doors be implemented are indicated on the attached marked-up plans (doors coloured in solid red).

4.5 Internal Glazing

Glazed areas in acoustic rated partition walls typically result in a significant acoustic weakness. Where internal glazing is recommended to spaces requiring speech privacy, the glass area must be minimised, and the performance of the glazing should generally be as close as possible to that of the partition wall.

However, this typically requires acoustic double-glazed construction, since 6.38mm laminated glass in a solid frame only has a design rating of R_w 33 (whereas rendered single leaf 110mm masonry = R_w 47).

Acoustic double glazing typically has a large air-gap such as one layer of 10.38mm laminated glass, a minimum air space of 75mm and one layer of 6.38 laminated glass, in a solid frame. This construction should achieve approximately R_w 43 to 45 performance.

However, in our experience it is common for single glazing to be used in walls between spaces and corridors where speech privacy is not a high priority, particularly where the wall is already downgraded by the inclusion of a door (R_w 28 to 30). In the Administration building it is therefore likely to be adequate to use a single layer laminated glass from Manager Corp. Services to Reception, and Medical to Corridor. Provided high privacy is not required between Interview and Reception, then we assume single glass will also continue to be used here. If higher speech privacy levels are required in this area then our recommendation is to remove the secondary door to the reception area and install the double glazing as described above. This could alternatively be documented with one pane of 6.38mm laminated glass to one side of a suitable frame that can readily be upgrade to acoustic double glazing in the future by the addition of another layer of 10.38mm laminated glass.

One area for further detailed consideration is the window from Deputies to Medical Room. We would normally expect to see acoustic double glazing with > 70mm air gap in situations where speech privacy is important. If only single glazing is provided in this location then the Deputies will have to carefully manage voice levels when the Medical Room is occupied. This appears to be the status-quo in all recent Primary School projects, however steps could be taken to install a suitable frame that can be upgraded in the future as described above.

4.6 Ceilings

The attached acoustic marked-up plans (Appendix D) identifies the recommended ceilings for this project, based on the ceiling types below.

4.6.1 *Acoustically Absorbent Ceilings*

Acoustically absorbent ceilings are required for reverberation control in all multiple occupancy spaces and are annotated in blue on the attached marked-up floor plans. To be effective, at least 80% of the area over each room must be acoustically absorbent, allowing for some flush perimeter borders / bulkheads etc. if required. These ceilings must be specified to achieve a Noise Reduction Co-efficient of NRC 0.75 or better. For schools this is typically achieved by use of perforated metal strip ceilings to entire ceiling area, without closer strips. Examples of perforated metal strip systems include:

- Architectural Ceiling Systems — Ministrip (perforated)
Linear 5 (perforated)
- Acoustics Group — Paneline (perforated)
- Hunter Douglas — Luxalon 84B School Series (perforated)

Alternative acoustic ceilings may include:

- Perforated Coruline (ACS)
- High NRC Mineral Fibre Tile ceiling systems
- Perforated metal pan ceiling system
- Perforated plasterboard, such as Boral 12mm square pattern

If perforated plasterboard is to be used for selected feature areas, we strongly recommend it be specified as the Boral 12mm square pattern with a ≥ 16% open area. Unfortunately the standard CSR Gyprock Perforated Plasterboard with 6mm diameter perforations and no integral fabric backing has only 8.2% open area, and achieves noticeably reduced acoustic absorption performance (in the order of NRC < 0.5). Note also that perforated plasterboard must not be spray painted, as this is highly likely to obscure the perforations and insulation overlay, significantly degrading its acoustic performance. This must be included in the project specifications.

Provide at least 75mm batts or blanket insulation directly over all acoustically absorbent ceilings, for acoustic performance. We understand that a common form of ceiling insulation over metal strip is fibre building blanket. This insulation must be specified to achieve at least NRC 0.80. This may be achieved by various thickness building blankets, being dependant on the material (fibreglass vs. polyester) and the insulation density etc.

Black scrim facing to insulation or separate scrim layer directly over metal strip or other perforated ceilings is typically required for aesthetic purposes.

4.6.3 *Music Room Ceiling*

The ceiling to the Music Room with carpet floor should be configured as approximately 50% acoustically absorbent ceiling area, and 50% reflective area. The reflective area should be centred within the room dimensions, with the absorptive ceiling located around the perimeter. The perimeter of acoustic absorption is required for reverberation control, whilst the central plasterboard 'reflector' will provide useful acoustic feedback for musical activity.

Ideally, the central plasterboard ceiling shall not be parallel with the floor surface. It is recommended that the plasterboard ceiling is a minimum 7^{o} out-of-parallel with the floor surface. It is acceptable for the perimeter acoustically absorbent ceiling to be parallel with the floor.

In order to achieve compliance with the reverberation time criteria of AS 2107:2016, a minimum of $4.3m^2$ of acoustically absorbent panels are required on the walls. This can consist of 50mm Autex Quietspace Panels or an alternative product achieving a Noise Reduction Coefficient (NRC) of 0.85.

It is also acceptable to have four acoustic panels, each 800mm (wide) x 1370mm (high) in accordance with 'Furniture Detail FD.07 Music Room – Acoustic Panel'. Please note that there is an error on this detail where it should say that the perforated timber is greater than 18% perforations, rather than less than 10% perforations.

4.6.4 *Flush Plasterboard Ceilings*

Plasterboard ceilings should be 13mm and sealed to form an effective acoustic junction around the perimeter of the space. For acoustic purposes at least 75mm insulation must be provided over. Ideally light fittings should be surface mounted to avoid downgrading the acoustic barrier integrity of the plasterboard. This is because most flush plasterboard ceilings are required to act as a barrier to room-to-room flanking sound transmission via the roof spaces.

4.6.5 *Covered Assembly and External Activity Areas*

Under the roof sheeting of the Covered Assembly and the External Activity areas, it is recommended that nominal 80mm thick perforated Anticon is provided. We note that the November 2019 PSB has deleted the insulation from Teaching Block covered areas as well as TB1 covered play areas. However it is our strong recommendation that this insulation is maintained as it serves both thermal comfort and reverberation control purposes.

To meet WorkSafe requirements, we understand perforated Anticon is installed over a safety mesh. Unfortunately safety mesh with wire spaced at 200mm centres does not usually provide adequate protection against vandalism and ball sports impact etc. The Primary School Brief now specifically states the use of a poly-weave, perforated foil facing to be applied to the Anticon insulation, however to our knowledge the combination of both poly-weave and perforations does not exist on the market. It is our understanding that were the poly-weave fabric to be perforated then this would lose its strength benefit from the continuous fibres. Further to this we have been advised by the Department of Finance will be altering the primary school brief to state "heavy duty perforated foil facing". Tear resistance of this material may still be a concern (to be co-ordinated by the project Architect and client) however for acoustic purposes this must be a perforated Anticon product or similar.

Do **NOT** provide a flush plasterboard ceiling in the Covered Assembly area. This will result in an unacceptably high reverberation level. If a ceiling is to be incorporated, now that this is basically a fully enclosed space, the system must be selected on the basis of maximum practical acoustic absorption (no less than NRC 0.75).

NOTE – The separate 'Energy Efficiency' requirements may require higher levels of ceiling insulation than those outlined above. See separate Energy Efficiency report for clarification on this.

4.7 Rain Noise

4.7.1 *Rain Noise Dampening*

It is essential that a minimum of 80mm thick Anticon blanket insulation be installed (without spacers) to the underside of all metal deck roofing over habitable rooms. This is required for rain noise dampening. Alternative foil only radiant insulation products will **not** fulfil this role.

Provision of 80mm Anticon with insulated metal strip ceilings below is currently applied to all DET primary Schools. This does not prevent audible rain noise, but is considered adequate to reduce it to reasonable levels in general purpose learning environments.

Any rain water pipes that travel through the ceiling space above 'acoustic ceilings' should be wrapped in Pyrotek 4525 Acoustic Lagging, or equivalent.

4.7.2 *Roof Run-off*

All changes in roof level from high to low must be supplied with individual gutter systems and associated downpipes and spreaders, rather than allowing direct run-off. Without these, the 'waterfall effect' from roof run-off can generate noticeable noise intrusion.

4.8 Hydraulic Services

Structure-borne noise generated by water supply pipes, waste pipes, and hydraulic fittings can radiate noise into adjoining areas. The hydraulic fittings and lines must be carefully considered in terms of their impact on adjoining noise sensitive areas.

Where possible, hydraulic fittings such as cisterns and hand basins should not be mounted on walls that are common with adjacent noise sensitive spaces. Where this is not possible, the common wall will need to be discontinuous. In our experience the location of cisterns on 'noise sensitive walls' has generally been avoided, however we will advise on any recommended hydraulic walls during the following stages of this project.

4.9 Electrical Services

This section establishes general guidelines for within this project for the general installation of electrical equipment.

4.9.1 *Light Fittings in Acoustic Barrier Ceilings*

Where ceilings are designed to provide sound transmission loss performance, special care is required in the location of recessed light fittings. Recessed light fluorescent light fitting are required to be solid metal boxes designed to maintain the design sound reduction performance of the ceiling. Open recessed down lights are not permitted.

4.9.2 *Back to Back Power Points*

Standard electrical switch boxes must not be installed in a back-to-back arrangement within any of the acoustically rated walls (i.e. walls with an R_w rating greater than 40). If back-to-back switch boxes are unavoidable, then fire/acoustic rated switch boxes must be used, such as those manufactured by *Promat*, *Clipsal*, and *HPM*.

Standard electrical switchboxes can be used where they offset horizontally by a minimum of 300 mm as well as a vertical stud being located between the two boxes.

4.9.3 *Penetrations*

All electrical penetrations through walls are to be packed with fibreglass insulation fully sealed on both sides of the wall with acoustic sealant.

4.10 Mechanical Services

4.10.1 *Indoor Design Sound Levels*

The duct-borne noise from the mechanical services shall comply with the design sound levels for the following spaces, as established in Australian Standard AS/NZS 2107:2016 *"Acoustics - Recommended Design Sound Levels and Reverberation Times for Building Interiors"*. Relevant design values are summarised below:

	Recommended Ambient Design Sound Level Range	
Type of Space	*Lower*	*Upper*
Corridors, Lobbies & Foyers	40 dB(A)	50 dB(A)
Conference / Staff Room	40 dB(A)	45 dB(A)
Library	40 dB(A)	45 dB(A)
Office Areas	40 dB(A)	45 dB(A)
Primary Teaching Spaces / Activity Areas	35 dB(A)	45 dB(A)
Dental Therapy	40 dB(A)	45 dB(A)
Music Room	40 dB(A)	45 dB(A)
Toilets	< 55 dB(A)	

Table 02 – AS 2107-2016 Design Sound Levels

Design to control duct-borne Noise (Room Noise Levels) is responsibility of the Mechanical Services Design Consultant.

4.10.2 *Outside Air Fans*

Consideration must be given to any outside air fans located in the ceiling space, particularly above perforated ceiling systems as these will provide minimal acoustic separation. In our experience the fans should be located above adjacent non-teaching spaces that typically have flush plasterboard ceilings.

Where located above classroom ceilings these should be specified to have a radiated sound level of no more than 45 dB(A). A radiated sound pressure level of 48 dB(A) has also been accepted in the past provided these are appropriately wrapped in Soundlag 4525. Advice can be provided where these occur.

4.10.3 *Environmental Protection (Noise) Regulations 1997*

As per Section 2.3, the potential noise emissions from the mechanical services will be assessed during the following stages of the project in order to ensure compliance with the Environmental Protection (Noise) Regulations 1997.

If you have any queries regarding this information please call the undersigned on 9474 5966.

Regards,

Michael Ferguson
Associate Director *B.IntArch(Hons) M.A.A.S.*

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ATTACHMENTS

- APPENDIX A - Legend for Marked-up Floor Plans
- APPENDIX B - Acoustic Marked-up Floor Plans (x6)

APPENDIX A

LEGEND FOR ACOUSTIC MARK-UPS

Type W1 - ≥ R_w 42 Wall

Type W2 - ≥ R_w 46 Wall

Type W3 - ≥ R_w 50 Wall

Type W4 - R_w 55+ Wall - Hydraulic Discontinuous Construction

Full Height Wall, Sealed to the Underside of the Roof Sheeting / Floor Slab Above

Acoustically Absorbent Ceiling (minimum NRC 0.75) - e.g. perforated metal strip ceiling with 75mm fibreglass insulation over

80mm Perforated Foil Faced Fibreglass Insulation - Previously in brief with plastic coated chain link mesh under. Protection of foil now unknown

Flush Plasterboard Ceiling with 75mm Fibreglass Insulation Over

Solid Core Door with Full perimeter rubberised adjustable acoustic seals

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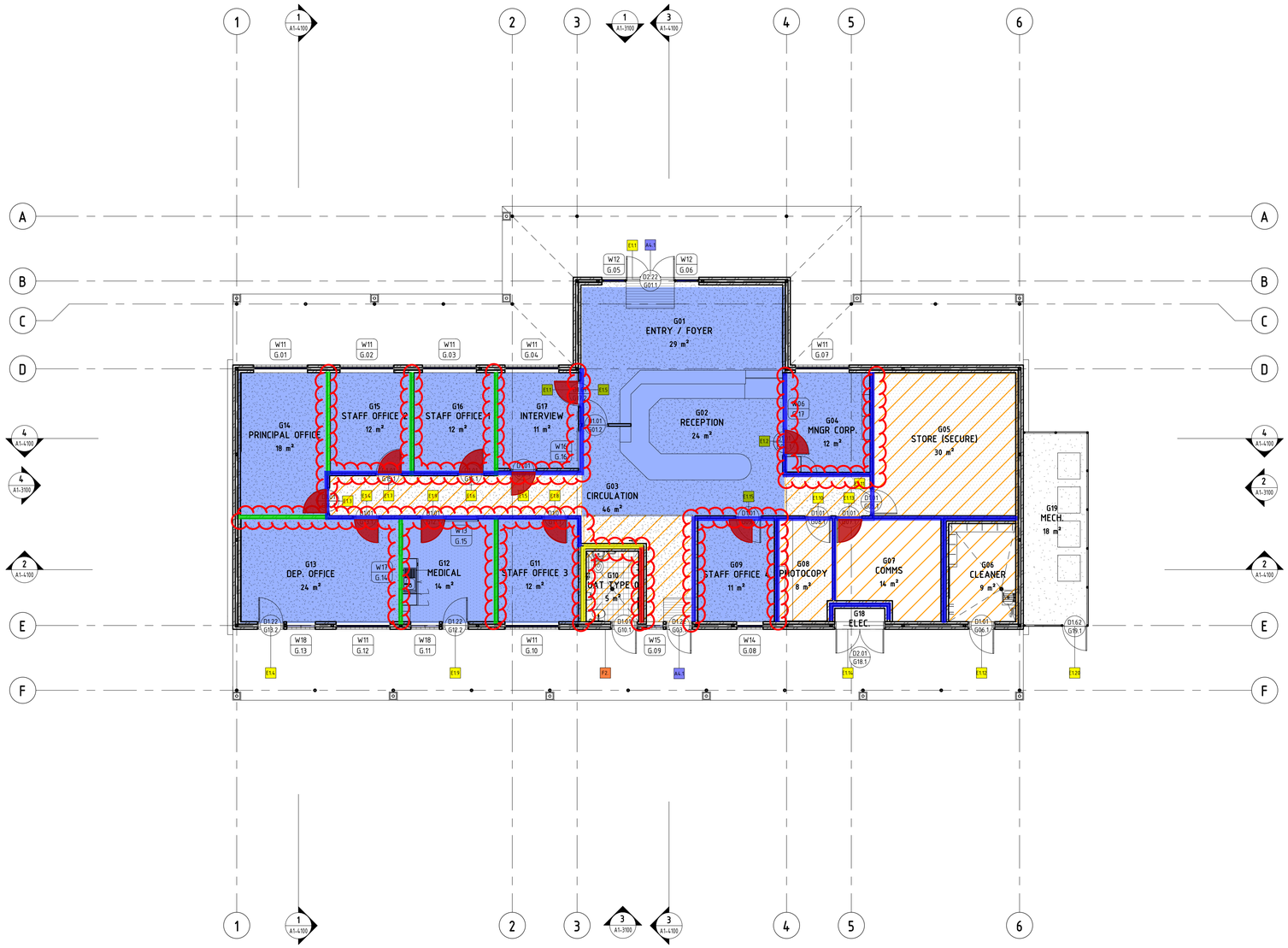
AR-5150 - WALL TYPE SCHEDULE		
CODE	DESCRIPTION	FRL
WT-401		
WT-404		
WT-405		
WT-601		



REV	DATE	DESCRIPTION	BY
D	21/04/2021	ISSUED FOR COORDINATION	
C	19/03/2021	ISSUED FOR APPROVAL	
B	26/02/2021	ISSUED FOR COORDINATION	
A	17/02/2021	ISSUED FOR COORDINATION	

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Buildings and Contracts

ARCHITECTURAL

DEPARTMENT OF FINANCE

DAYTON PRIMARY SCHOOL - ADMIN

LOT 557, 11 BLUNDELL STREET DAYTON & LOT 558 ON PLAN 3698

GA FLOOR PLANS

LEVEL GROUND

DRAWN CDG	DESIGNED CDG	REDUCTION 0 2.5M	
CHECKED CDG	PRINCIPAL		
APPROVED CDG			
SCALE 1 : 100 @ A1	DATE 21/04/2021	DRAWING No. A1-2101	REV. D
PROJECT No 20056	DF FILE No		

THIS IS A CADD DRAWING
DO NOT AMEND MANUALLY

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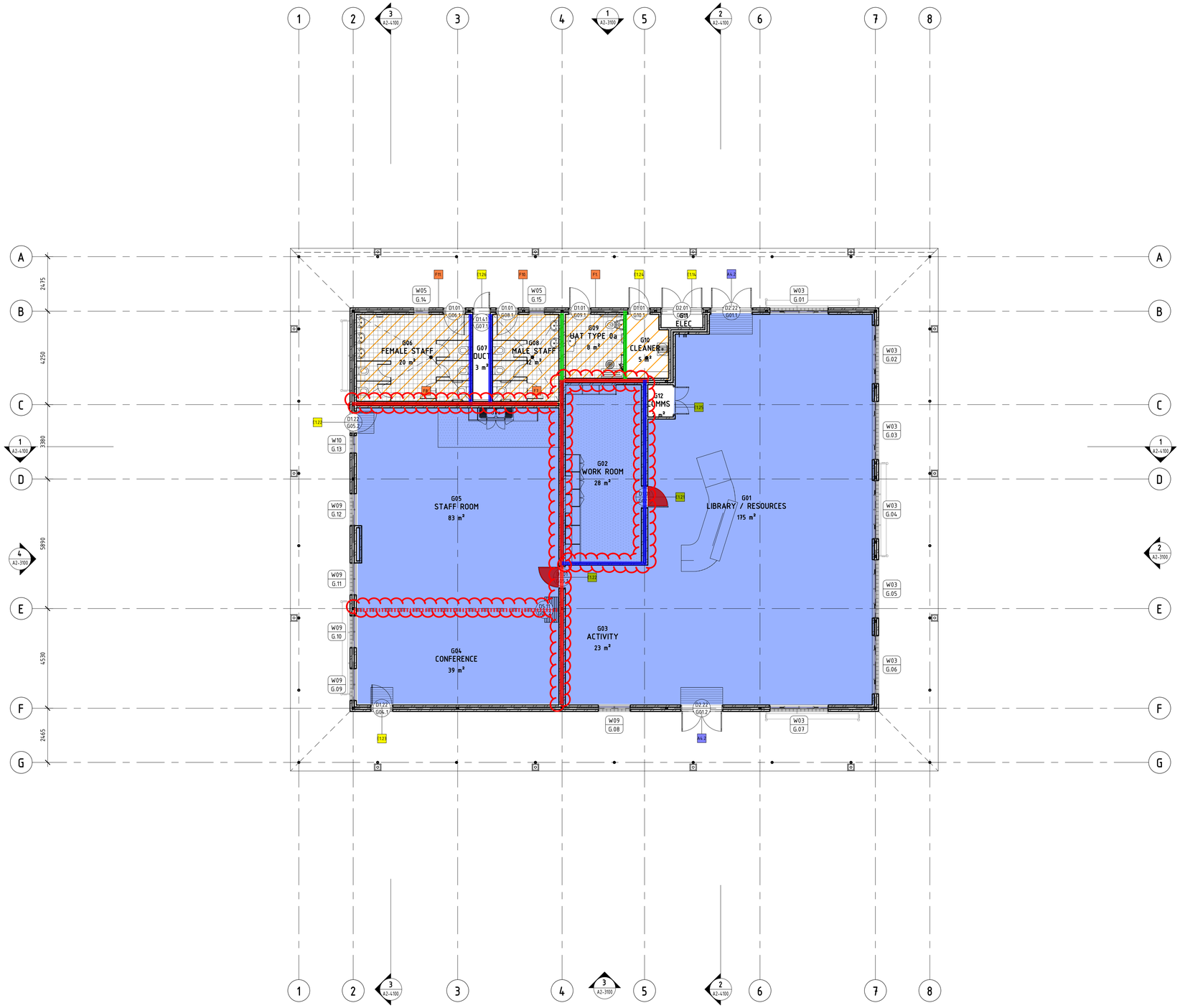

REV	DATE	DESCRIPTION	BY
D	21/04/2021	ISSUED FOR COORDINATION	
C	19/03/2021	ISSUED FOR APPROVAL	
B	26/02/2021	ISSUED FOR COORDINATION	
A	17/02/2021	ISSUED FOR COORDINATION	

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ARCHITECTURAL

DEPARTMENT OF FINANCE

DAYTON PRIMARY SCHOOL - STAFF & LIBRARY

LOT 557, 11 BLUNDELL STREET DAYTON & LOT 558 ON PLAN 3698

GA FLOOR PLANS

LEVEL GROUND

DRAWN CDG		DESIGNED CDG	REDUCTION 0 2.5M
CHECKED CDG		PRINCIPAL	
APPROVED CDG			
SCALE 1 : 100 @ A1		DATE 21/04/2021	DRAWING No. A2-2101 REV. D
PROJECT No 20056		DF FILE No	

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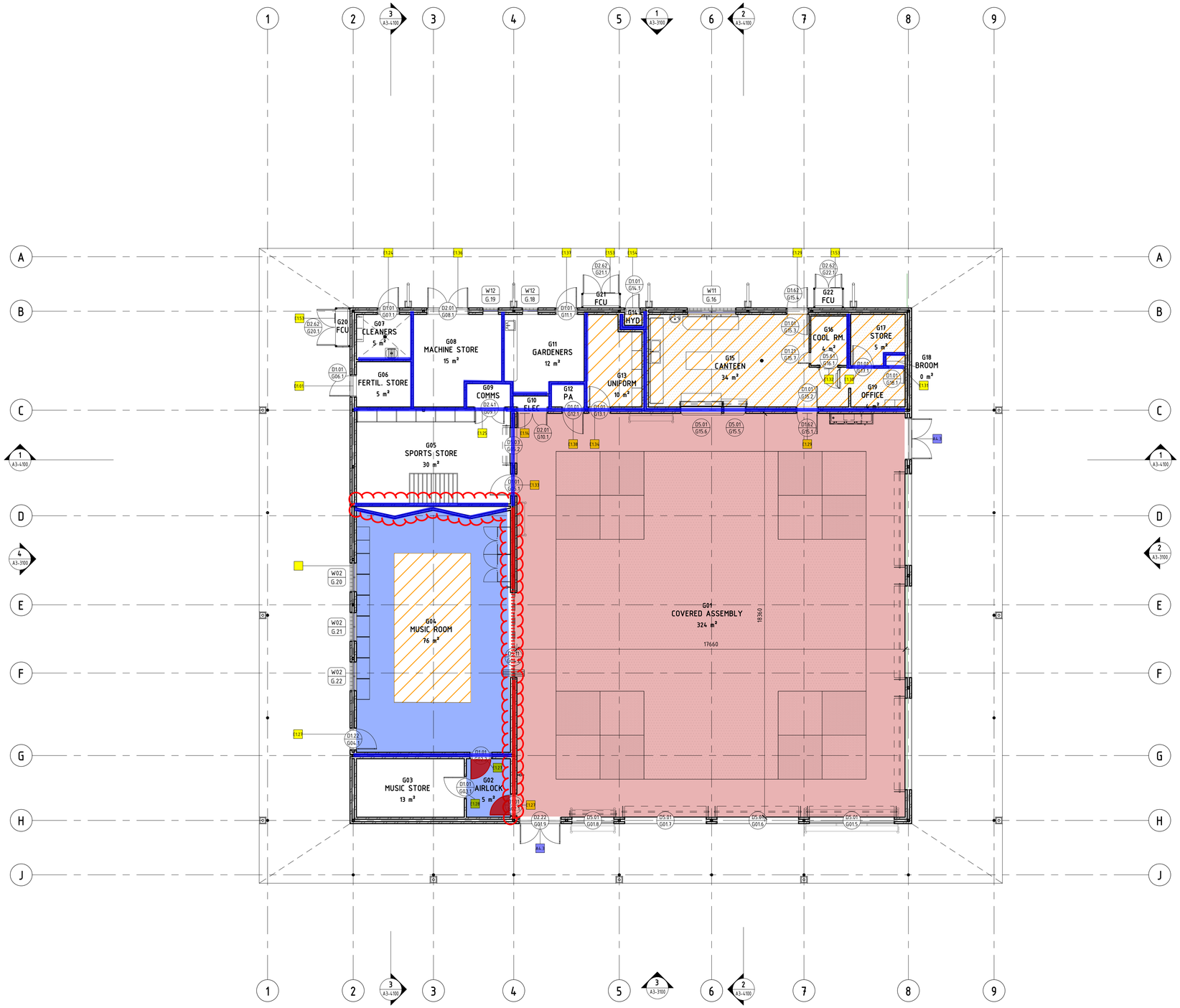

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DEPARTMENT OF FINANCE

DAYTON PRIMARY SCHOOL - CCA

LOT 557, 11 BLUNDELL STREET DAYTON & LOT 558 ON PLAN 3698

GA FLOOR PLANS

LEVEL GROUND

DRAWN CDG		DESIGNED CDG	REDUCTION 0 2.5M
CHECKED CDG		PRINCIPAL	
APPROVED CDG			
SCALE 1 : 100 @ A1		DATE 21/04/2021	DRAWING No. A3-2101 REV. D
PROJECT No 20056		DF FILE No	

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EXTENT OF WALL IN RED REQUIRED TO ACHIEVE FRL 90/90/90 DEPENDANT ON LOCATION OF FHR (2M EITHER SIDE)

G01 MECH. 11 m²
G02 KINDY 2 82 m²
G03 KITCHEN 3 9 m²
G04 STORE 3 21 m²
G05 UNISEX STUDENTS 3 12 m²
G06 AAT TYPE 0 6 m²
G07 KINDY 1 81 m²
G08 ELEC. 2 m²
G09 AC 2 m²
G10 AAT TYPE 2a 12 m² CONDITIONED SPACE AS PSB APPLICATION
G11 CLEANER 6 m²
G12 COLLEGIATE 34 m²
G13 STAFF OFFICE 12 m²
G14 EX. STORE 2 36 m²
G15 UNISEX STUDENTS 2 8 m²
G16 STORE 2 14 m²
G17 COMMS 1 m²
G18 KITCHEN 2 11 m²
G19 PRE-PRIMARY 3 81 m²
G20 PRE-PRIMARY 2 81 m²
G21 KITCHEN 1 19 m²
G22 STORE 1 21 m²
G23 UNISEX STAFF 6 m²
G24 UNISEX STUDENTS 1 19 m²
G25 PRE-PRIMARY 1 81 m²
G26 EX. STORE 39 m²

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DEPARTMENT OF FINANCE
DAYTON PRIMARY SCHOOL - TB1
LOT 557, 11 BLUNDELL STREET DAYTON & LOT 558 ON PLAN 3698
GA FLOOR PLANS
LEVEL GROUND

DRAWN CDG		DESIGNED CDG	REDUCTION 0 2.5M
CHECKED CDG		PRINCIPAL	
APPROVED CDG			
SCALE 1 : 100 @ A1		DATE 21/04/2021	DRAWING No. A4-2101 REV. D
PROJECT No 20056		DF FILE No	

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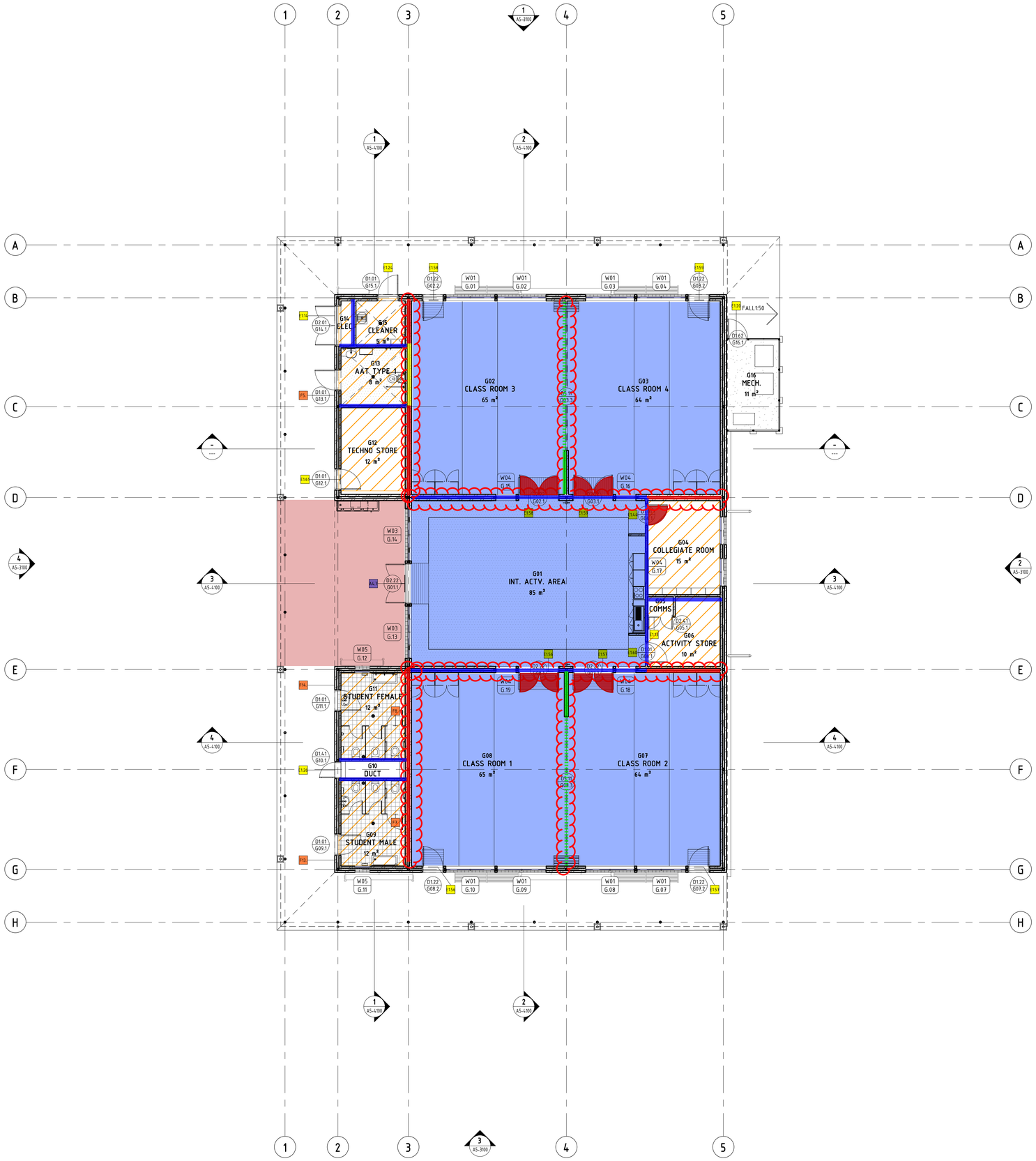

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DAYTON PRIMARY SCHOOL - TB234

LOT 557, 11 BLUNDELL STREET DAYTON & LOT 558 ON PLAN 3698

GA FLOOR PLANS

LEVEL GROUND

DRAWN CDG		DESIGNED CDG	REDUCTION 0 2.5M
CHECKED CDG		PRINCIPAL	
APPROVED CDG			
SCALE 1 : 100 @ A1		DATE 21/04/2021	DRAWING No. A5-2101 REV. D
PROJECT No 20056		DF FILE No	

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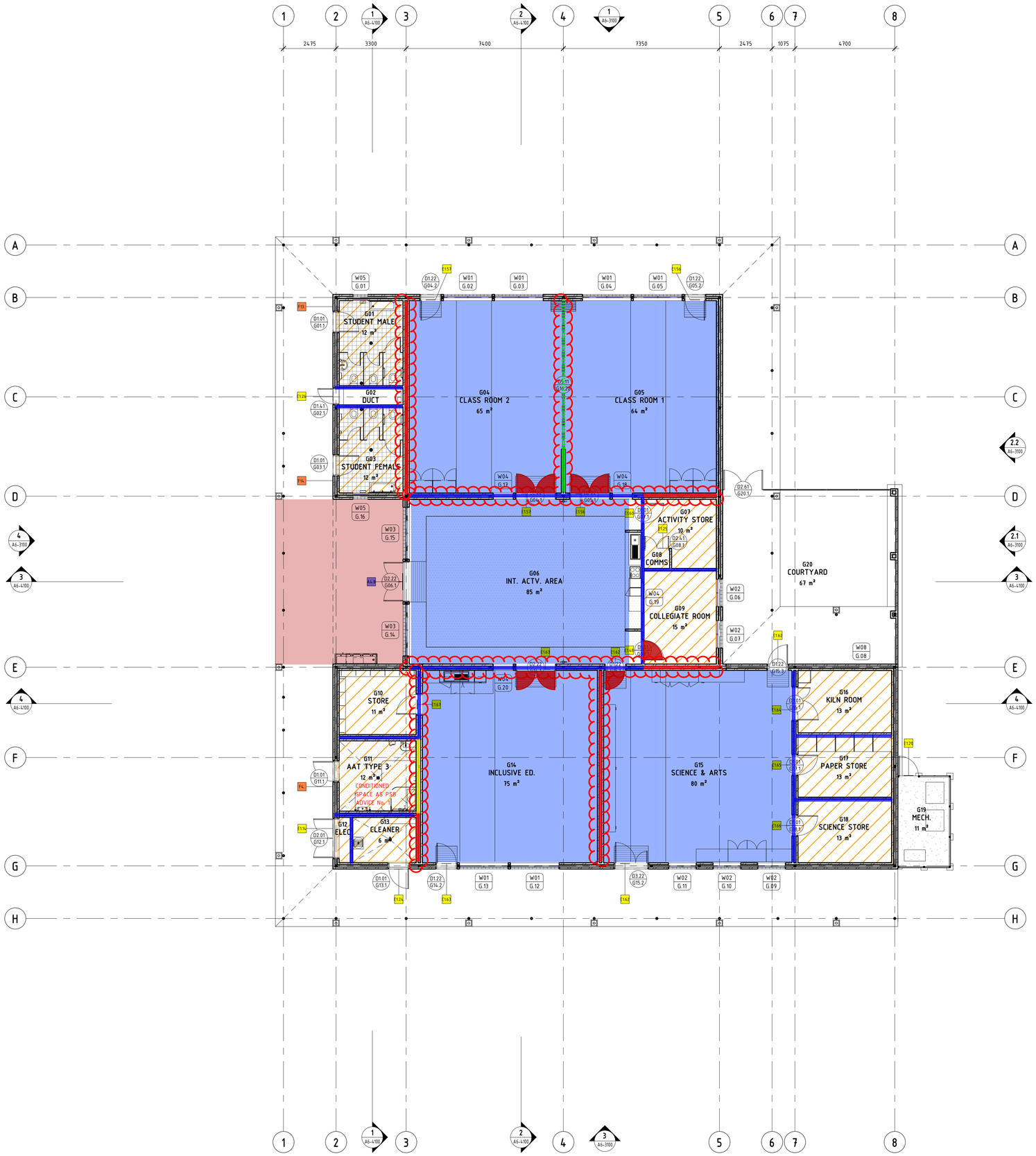

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DAYTON PRIMARY SCHOOL - TB5

LOT 557, 11 BLUNDELL STREET DAYTON & LOT 558 ON PLAN 3698

GA FLOOR PLANS

LEVEL GROUND

DRAWN CDG		DESIGNED CDG	REDUCTION 0 2.5M
CHECKED CDG		PRINCIPAL	
APPROVED CDG			
SCALE 1 : 100 @ A1		DATE 21/04/2021	DRAWING No. A6-2101 REV. D
PROJECT No 20056		DF FILE No	

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DAYTON (W SWAN EAST) PRIMARY SCHOOL - 2023			
SCHEDULE OF ACCOMMODATION - 540 students capacity - version 5			
~5.7 hectare site			April 21, 2021
FACILITY	**sqm**	**details**	**COMMENTS**
ADMINISTRATION:			
Foyer / Waiting	29		Security isolation required from rest of the building
Reception	23		
Manager Corp Services Office	12		Must be securable
Principal	18		
Deputies - 2 (shared room)	24		
Staff Offices 1 to 3	36	3x12	
Interview Room	11.4		
Staff Office 4	12		(previously the Duplication room)
Communications Room	15	min side 3m	Air conditioned
Medical Room	14		Vision from deputies office and passageway required
Secure Store	30		
Duplication Room	8		Mech ventilation required (previously archives store)
Cleaner's Bulk Store	10	min side 3m	External access required
Universal Access Toilet Type 0	5.5	2.7mx2.3m	Delete if staff toilets are in Admin block
USABLE FLOOR AREA (UFA)	247.9		
CIRCULATION etc 20%	50		Includes elec & comms cupboards (internal opening)
TOTAL AREA (FECA)	**297**		
TEACHING BLOCK 1:			
KINDERGARTEN			
Kindy Classrooms	160	2x80	
Kitchen No 3	19.5		Located between the two kindy classrooms
Internal Store No 3	19.5		Located between the two kindy classrooms
Student Toilets (4 WC - internal & unisex) + staff WC	26		Located between the two kindy classrooms - adjacent to external play area with external door
Teacher Preparation/Collegiate	36		
Staff Office	12		
Play area store	35		
Cleaner's Room	7	min side 2m	
Assisted Access Toilet Type 2a	13	with shower	
PRE PRIMARY			
Pre-Primary Classrooms	240	3x80	One pair and one single
Kitchen No 1	19.5		Located between two PP classrooms (rooms 1 & 2)
Internal Store No 1	19.5		Located between two PP classrooms (rooms 1 & 2)
Student Toilets Set 1 (4 WC - internal & unisex) + staff WC	26		Located between two PP classrooms (rooms 1 & 2)
Kitchen No 2	11		Located at the end of the third PP classroom (room 3)
Internal Store No 2	14		Located at the end of the third PP classroom (room 3)
Student Toilets Set 2 (2 WC - internal & unisex)	8		Located at the end of the third PP classroom (room 3) - adjacent to external play area
External Store	40		
USABLE FLOOR AREA (UFA)	706		
CIRCULATION etc 5%	35		Includes elec & comms cupboards (internal opening)
TOTAL AREA (FECA)	**741**		
Fenced Play Area	1200		with bicycle circuit - 1000 sqm min if site is constrained
Sand Pits (x4)		4200 x 4200 x 500 deep	
TEACHING BLOCK 2:			
General Classrooms	260	4x65	Arranged in pairs with operable wall between
Internal Activity Area	85		To be accessible to all four classrooms
Teacher Preparation/Collegiate	15		These two rooms are located internally adjacent to the Activity area
Activity Area Store	10		
Male Student Toilets (external)	12	2WC + U	These toilets are located together on the end of one wing of the building
Female Student Toilets (external	12	3 WC	
Assisted Access Toilet Type 1	8		These three rooms are located together on the end of the other wing of the building
Technology & Enterprise Store	12		

Cleaner's Room	4	min side 2m	the other wing of the building
USABLE FLOOR AREA (UFA)	418		
CIRCULATION etc 5%	21		Includes elec & comms cupboards (internal opening)
TOTAL AREA (FECA)	**439**		
TEACHING BLOCK 3:			
General Classrooms	260	4x65	Arranged in pairs with operable wall between
Internal Activity Area	85		To be accessible to all four classrooms
Teacher Preparation/Collegiate	15		These two rooms are located internally adjacent to the Activity area
Activity Area Store	10		
Male Student Toilets (external)	12	2WC + U	These toilets are located together on the end of one wing of the building
Female Student Toilets (external	12	3 WC	
Assisted Access Toilet Type 1	8		These three rooms are located together on the end of the other wing of the building
Technology & Enterprise Store	12		
Cleaner's Room	4	min side 2m	
USABLE FLOOR AREA (UFA)	418		
CIRCULATION etc 5%	21		Includes elec & comms cupboards (internal opening)
TOTAL AREA (FECA)	**439**		
TEACHING BLOCK 4:			
General Classrooms	260	4x65	Arranged in pairs with operable wall between
Internal Activity Area	85		To be accessible to all four classrooms
Teacher Preparation/Collegiate	15		These two rooms are located internally adjacent to the Activity area
Activity Area Store	10		
Male Student Toilets (external)	12	2WC + U	These toilets are located together on the end of one wing of the building
Female Student Toilets (external	12	3 WC	
Assisted Access Toilet Type 1	8		These three rooms are located together on the end of the other wing of the building
Technology & Enterprise Store	12		
Cleaner's Room	4	min side 2m	
USABLE FLOOR AREA (UFA)	418		
CIRCULATION etc 5%	21		Includes elec & comms cupboards (internal opening)
TOTAL AREA (FECA)	**439**		
TEACHING BLOCK 5:			
General Classrooms	130	2x65	To be adjacent with operable wall between
Inclusive Education Classroom	74		To be adjacent to the art room, but not connected
Multi-purpose Room (art/science	80		Internal and external door required
Kiln Room	13		All 3 to be located together with internal access to the Art / Craft room
Science Store & Paper Store	26	2x13	
Internal Activity Area	85		To be accessible to all four classrooms
Teacher Preparation/Collegiate	15		These two rooms are located internally adjacent to the Activity area
Activity Area Store	10		
Male Student Toilets (external)	12	2WC + U	These toilets are located together on the end of one wing of the building
Female Student Toilets (external	12	3 WC	
Assisted Access Toilet Type 3	12	4m x 3m	These three rooms are located together on the end of the other wing of the building with the IE storeroom having direct access to the IE classroom. Now 11m2 due to insulation required in bounding wall due to PSB change to conditioned space
Inclusive Education Storeroom	11		
Cleaner's Room	4	min side 2m	
USABLE FLOOR AREA (UFA)	484		
CIRCULATION etc 5%	24		Includes elec & comms cupboards (internal opening)
TOTAL AREA (FECA)	**508**		
LIBRARY / STAFF BLOCK:			
Library & Activity	200		
Workroom	30		
Staff Room	85		These two rooms may be located in the Administration Block
Conference Room	40		
Female Staff Toilets	20	5 WC	Staff and Universal Access toilets may be located in the Administration Block
Male Staff Toilets	12	2WC + U	
Universal Access Toilet Type 0a	8	with shower	
Cleaner's Room	5	min side 2m	Not required if staff common room is in admin block

USABLE FLOOR AREA (UFA)	400		
CIRCULATION etc 5%	20		Includes elec & comms cupboards (internal opening)
TOTAL AREA (FECA)	**420**		
COVERED ASSEMBLY BLOCK:			With low velocity ceiling fan
Covered Assembly Area	324	18mx18m	To be enclosed by roller doors or similar - wall oposite music room to have roller doors the full width of the wall
Music Room	75		To have operable wall to undercover area
Music store & Airlock	18		To be accessed off the music room airlock
Sports Store	30		To be accessible to undercover area
Canteen & Office	38		
Canteen Store & Broom cupbd	5		
Canteen Coolroom	4		
Gardener's Workshop	12		
Gardener's Fertilizer Store	5		
Gardener's Machine Store	15		
Uniform Store & Office	10		To be accessible to undercover area
PA Cupboard	2		Must not be on the same wall as the music room
Cleaner's Room	5	min side 2m	
Bin Enclosure		7m x 2.5m	To hold 2 bins 2330 x 1605
USABLE FLOOR AREA (UFA)	543		
CIRCULATION etc 2.5%	14		Includes elec & comms cupboards (internal opening)
TOTAL AREA (FECA)	**557**		
~~**DENTAL THERAPY**~~			Confirmed not required
~~Surgery~~		~~42~~	
~~Waiting area~~		~~14~~	
~~Staff area~~		~~8~~	
~~Office~~		~~13~~	
~~Mechanical / plant~~		~~5~~	
~~USABLE FLOOR AREA (UFA)~~		~~82~~	
~~CIRCULATION etc 5 %~~		~~4~~	
~~**TOTAL AREA (FECA)**~~		~~**86**~~	
OVERALL TOTAL UFA	3634.9		
OVERALL TOTAL FECA	***3840***		
OVERALL TOTAL UCA	***1920***		*(UCA/FECA = 50% max)*
OVERALL TOTAL GFA	**5760**		
OTHER FACILITIES:			
1 x junior football oval 118m x 84m (incl over-run) with goal posts - no adjacent POS			
1 x cricket pitch + 2 x cricket practice nets			
2 x basketball / netball courts (each 28m/30m x 15m) overlain at right angles with 2 x tennis courts			
(Dimensions of double courts with over-run is 41m x 37m) - oval & courts must have wheelchair access			
Parking - onsite (staff and visitors) - 54 bays + 2 universal access bay/s			
Street embayments - 14 bays / 100 students - provide as many as possible (minimum of 76 bays) - some should be located on-site for Pre-primary drop-off (~15 bays)			
~~Dental Therapy parking - 6 bays~~			
Bicycle parking (students) - 60 spaces			
EDUCARE:			
A 2500sqm portion of the site should be set aside for a possible Educare facility. Street access required			
FUTURE TRANSPORTABLES:			
Allow for the provision of x2 Kindy/Pre-Primary transportables and x10 general transportables in the future.			
This will increase the capacity of the school by 330 students (60 K-PP and 270 years 1-6) to give a final total capacity of 870. Additional parking will be required for staff (33 bays), K-PP drop-off (10 bays) and yr 1-6 drop-off (36 bays)			
FUTURE STAGE:			
Masterplan for a possible future 4 or 8-classroom (double-storey) block			

NOTE:			
Covered Assembly area is not included in UCA			
All verandahs around Classroom Blocks are to be 2.6m wide (to the gutter line)			
A verandah is required at the rear of the covered assembly block			
Verandah outside Kindy and Pre-Primary classrooms (facing the yard) is to be 3.6m wide			
All classroom external doors and verandahs must be INSIDE the secure lock-down zone			
All rooms are to be air-conditioned (NOT air-cooled) - gas heaters not required but ceiling fans are			
30 KW array of photovoltaic cells are to be installed			
New Library layout to be used			
KEY:			
UFA = Usable Floor Area			
FECA = Fully Enclosed Covered Area			
UCA = Unenclosed Covered Area			
GFA = Gross Floor Area			

February 15, 2021

Four Landscape Studio
11/34 Eighth Avenue
Maylands, WA, 6051

ATTENTION: Andrew Thomas

RE: Assessment of Trees at Dayton Primary School site

Dear Andrew,

Further to your request, the following is a brief summary of my assessment of the identified trees at the Dayton Primary School site.

Should you have any queries regarding the findings of this report, or if I can be of any further assistance in the management of the identified trees, please do not hesitate to contact me.

Yours sincerely

JASON ROYAL
Dip. Arboriculture (UK)
Tech. Arbor A

Preliminary Assessment of identified Trees; Dayton Primary School site

Prepared For

Four Landscape Studio

Prepared By

ARBOR logic

Contents

1. Particulars to the Assessment

1.1 Terms Used

The following terms have been used in this report:

'Site' meaning the area that encompasses the proposed development

'Tree' meaning any tree shown on the Plan provided to be included in the assessment

'TPZ' meaning 'Tree Protection Zone'; the area where the majority of the Tree's root mass is considered likely to be found. Any works required in this zone are considered likely to have the potential to have an impact the Tree's future health.

'SRZ' meaning 'structural root zone; the area where the majority of the Tree's larger in-ground supportive root mass is considered likely to be found. Any works required in this zone are considered likely to have some potential to impact the Tree's future health and possibly its in-ground stability as well. **Important Note: the SRZ of a tree does not need to be considered unless works and encroachment occur within the tree's nominal TPZ.**

'AS 4970' meaning Australian Standards 4970; Protection of Trees on Development Sites

'AS 4373' meaning Australian Standards 4373; Pruning of Amenity Trees

1.2 Limitations and Particulars of this Assessment

The information and opinions provided in this document are based on the findings from the visual observations of the Trees on the Site during the inspections undertaken February 9 and 10, 2021.

All observations of all of the Trees were undertaken from ground level.

No exploratory excavations were undertaken as part of this particular assessment to verify the actual root spread of any given Tree.

As such the allocation of TPZ for each Tree has at this stage been based on AS 4970 guidelines, with some amendments being made for the physical size and canopy dimensions of the Tree, its condition, the known root zone morphology of its given species in the sort of soil profile considered to be typical to this area of Western Australia.

2. Scope of Works

- Undertake an inspection of the trees in the identified areas of the proposed Dayton Primary School site.
- Provide basic cursory information on each of the identified trees in terms of their species, approximate height, approximate canopy spread (metres diameter in both N-S and E-W dimensions), DBH (Diameter at breast height), DRF (Diameter at Root flare), Nominal TPZ (Tree Protection Zone radius), Nominal SRZ (Structural Root Zone radius), Health & structural condition, any comments deemed pertinent to the given tree and an opinion on the suitability for retention of the given tree in the context of a school site.
- Provide any broad-brush purposeful and practical recommendations for any design and construction implications that may apply for any trees identified as being able to be retained in the context of the proposed development so to ensure their preservation if undertaken remains successful.

3. Methodology of the Assessment

All of the Trees identified on the Plan provided were assessed in the course of this assessment from ground level (on all sides where the absence of any obstructions and/or access restrictions allowed) in accordance with 'visual tree assessment'[1] ("VTA") methods and principles.

The VTA method is based on the sciences of tree biology, physiology, tree structure, and tree bio-mechanics. It is a method widely used by arborists worldwide to identify visible signs on trees that indicate any health or potential structural issues that in turn could increase the risks associated with the given tree. There are many variables that require consideration as part of this process including the structure of the given tree, its health condition, known natural species traits, environmental factors such as direction of prevailing (and storm) winds and how they would affect the subject tree and the occurrence of potential Targets within its projected Fall Zone.

The overall health of each Tree was adjudged from an inspection of its leaf, overall percentage of leaf mass present in the canopy of the Tree, and the presence (or absence) of any pest or disease factor that could have an effect on its health.

The structural integrity of each Tree was determined from a visual inspection of its main stem, primary (and secondary) branch unions to determine the presence of any areas considered to be a structural 'defect' or 'imperfection' such as unions with included bark, swelling, or noticeable splitting at them. Symptoms of decay, growth patterns and defects are identified and assessed as to their potential to cause whole tree, part tree or branch failure, and where considered necessary further investigation by way of the use of sounding techniques was utilised to determine the presence and general extent of any areas of cavity or associated decay within a tree's main stem structure. Each Tree's root plate area was also inspected to identify any visible signs of root plate, movement, cracking or heave from which a determination of its in-ground stability can be ascertained. It is however important to note that there are limitations in verifying the in-ground stability of a tree based on a 'one-off' cursory visual observation; particularly if the inspection is undertaken during a period of 'fine' weather with little to no wind; as was the case over the period of this assessment.

The natural species traits of the given Tree was also considered as part of the assessment process; i.e. its typically anticipated natural life span for the Perth area, if it is a species known to be subject to issues associated with decay, termites (and how that would affect its structural integrity), or can be subject to the 'sudden branch drop' phenomenon, known to have large diameter surface root system, declared weed species etc.

The Trees were also assessed using the principles of SULE; "Safe-Useful-Life-Expectancy"[2].

SULE is a system that can be used to provide an indication of the length of time an individual tree can be retained with an acceptable level of risk based on the information available at the time of inspection.

It is a snapshot in time of the potential an individual tree has for survival in the eyes of the assessor based on the tree's current health and structural condition, and the known typical life span of specimens of its given species for the given area/situation.

There are many factors that can affect SULE of a tree, and as such, at best the SULE for any given tree can only be estimated within a 'range' of years, with the following ranges typically used; Long Term (>40 years), Medium Term (15-40 years), Short Term (5-15 years), and Limited (<5yrs).

1 Field Guide for Visual Tree Assessment (VTA); The Body Language of Trees, A Handbook for Failure Analysis; C Matteck, H Breloer

2 SULE: Its use and status into the new millennium; J Barrell; 2001

4. Summary of the Key Findings of the Assessment

4.1 No of Trees Identified

A total of 149 Trees were identified and included in this assessment.

4.2 Species Identified

20 different species of tree were identified on the Site including some local West Australian native, Australian native and 'exotic' introduced species of tree.

Flooded Gum (*Eucalyptus rudis*) were noted to be the most common species present; some of which may actually be a cross with the Northern River Red Gum (*Eucalyptus camaldulensis* subsp. '*Obtusa*').

Spotted Gum (*Corymbia maculata*), Ironbark (*Eucalyptus sideroxylon*), Lemon Scented Gum *(Corymbia citriodora*) and Rose Gum (*Eucalyptus grandis*) are also well represented, and collectively these five species represent over 70% of the Trees present on the Site.

Table 1; List of Species identified

Species	No of	Origin
Bangalay (*Eucalyptus botryoides*)	3	Aus. Native
Bracelet Honey Myrtle (*Melaleuca armillaris*)	4	Aus. Native
Flinders Range Wattle (*Acacia iteaphylla*)	1	Aus. Native
Flooded Gum (*Eucalyptus rudis*)	38	WA Native
Ironbark (*Eucalyptus sideroxylon*)	16	Aus. Native
Jarrah (*Eucalyptus marginata*)	1	WA Native
Lemon Scented Gum (*Corymbia citriodora*)	13	Aus. Native
Marri (*Corymbia calophylla*)	3	WA Native
Mulberry (*Morus nigra*)	1	Exotic
Northern River Red Gum (*Eucalyptus camaldulensis* subsp. '*Obtusa*')	2	Aus. Native
Olive (*Olea europaea*)	1	Exotic
Pencil Pine (*Cupressus sempervirens 'Stricta'*)	4	Exotic
River Yate (*Eucalyptus macrandra*)	1	WA Native
Rose Gum (*Eucalyptus grandis*)	12	Aus. Native
Silver Princess (*Eucalyptus caesia* subsp. *caesia*)	1	WA Native
South Australian Yellow Gum (*Eucalyptus leucoxylon*)	1	Aus. Native
Spotted Gum (*Corymbia maculata*)	36	Aus. Native
Swamp Mahogany (*Eucalyptus robusta*)	8	Aus. Native
Tuart (*Eucalyptus gomphocephala*)	1	WA Native
White Cedar (*Melia azedarach*)	2	Exotic

None of the tree species identified are considered to be (or are known to be classed as) an endangered species, or found on the Environment Protection and Biodiversity Conservation Act 1999. None of the tree species identified are known to have been declared a weed species[3].

Rose Gum, Northern River Red Gum and the species that looks to be a cross between the Northern River Red Gum and Flooded Gum are all considered to be higher risk species in terms of their propensity for branch failures than others. To a lesser extent Bangalay and Lemon Scented Gum are also considered to have an elevated potential for failure than others.

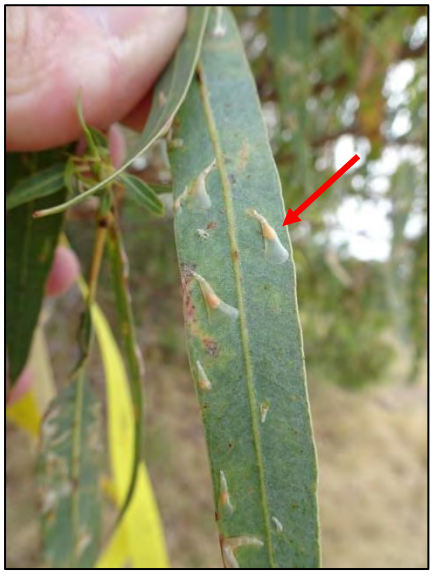
[3] Reference; Declared Plant Species in Western Australia (Department of Agriculture and Food, Western Australia 2008)

4. Summary of the Key Findings of the Assessment

4.3 Health Condition

The majority of the Trees showed to be in good health or better at this time.

Western Horned Lerp (*Creiis periculosa*); a Psyllid[4] insect species was noted on some of the Flooded Gum and River Red Gum; seen in the images below. However its presence at this time does not appear to be affecting their health at this time.



I could see no visible evidence of any other pest or disease pathogen that could have a major impact to the health of the Trees on this Site at the time of my inspection.

Whilst a number showed to have varying amounts of varying diameter sized deadwood in their canopy, it looks to have occurred as part of the natural growth processes of tree's rather than being caused by any pest or disease pathogen.

Three dead trees were identified along with two that look to be mostly dead and a further six that look to be in a poor health condition and look to have limited life span remaining so may not survive the development process.

[4] Psyllids are a sap sucking insect. The nymphs (immatures) form a cover called a "lerp"; a small white cap composed of solidified honeydew and wax. The yellow or brownish nymphs resemble a wingless aphid, and spend most of their time covered beneath a lerp feeding on the sap in the leaf, and in the process secreting substances that cause localised death of plant cells within the leaf. Severe infestations cause the entire leaf to die and subsequently fall off. As with many insect species they can have several life cycles in the one calendar year lower numbers typically occur during the winter.

Treatment measures for Psyllids/Lerp is generally not required as the 'host' trees generally are able to recover and grow new leaf mass to replace the damaged leaf. Maintaining soil moisture and undertaking other efforts to aid in their recovery (such as applications of liquid seaweed and other organic bio-stimulants) can be of benefit. Conversely, applications of in-organic fertilisers such as NPK can be counter-productive or even detrimental to the recovery of affected trees.

Applications of chemical insecticides although available can be varied in its effectiveness as often the Psyllid insect has left the host by the time the damage becomes noticed.

4. Summary of the Key Findings of the Assessment

4.4 Structural Condition

The majority of the Trees showed to have (what is considered to be) typical structural forms for specimens of their given species.

Whilst a number of the Trees showed to have what are considered to be 'structural defects' such as bi-furcated unions with signs of swelling and included bark (which are considered to potentially have an increased likelihood for failure than other forms of branch unions) for the most part any structural defect or imperfections were not considered to be of any major concern at this time.

Branch failures were observed to have occurred in 23 of the Trees on this Site including some notably large diameter sized parts. All looked to have occurred as a result of force loading (i.e. wind/storm damage) as opposed to any predisposition for branch failures although some of the species present are considered to have a higher propensity for branch failures than many others; particularly the Northern River Red Gum and Rose Gum.

There are also a number of Trees that have been previously topped (height reduced) along the Arthur Street and Cranleigh Street boundaries.

35 of the Trees were considered to have a 'questionable' or 'undesirable' structural form; mostly trees that have been previously (badly) topped. These Trees will have an increased potential for branch failure and subsequently will require increased levels of management and expenditure in the long term particularly when 'targets' (people/structures etc.) are introduced into their projected fall zone once the development around them has been completed. As such their retention within a school situation is often considered questionable as canopy works (pruning) will not necessarily be able to address the risks or reduce the potential for failure to occur.

24 Trees were considered to have a poor structural form due to splits and decay in their structure and (what looks to be a) high probability for failure. Retention of these Trees within a school situation would NOT be recommended as canopy works (pruning) will not necessarily be able to address the risks or reduce the potential for failure to occur.

4.5 SULE

With regards to their SULE, when consideration is given to the proposed use of the Site, most of the Trees look likely to have a comparatively short SULE remaining as many are considered to either be a comparatively high risk species, or have poor/questionable structural form.

Whilst this is not to say that their life span is comparatively short, managing trees of higher risk species and/or trees with poor/questionable structural form within urbanised areas with higher use and 'targets' can be problematic and often results in the removal of a tree; even if it remains in good health at that time.

Table 2; SULE Rating for the Trees

SULE	No of.
Long term (>40 yrs)	34
Medium term (15-40 yrs)	36
Short-term (5-15 yrs)	61
Limited (<5 yrs)	15
n/a. Dead tree	3

4. Summary of the Key Findings of the Assessment

4.6 Suitability for inclusion into an area of Development

Retention value of the various tree species and even individual tree specimens will always be open to some personal opinion.

In general trees displaying good health and deemed to have a good aesthetic quality will be generally considered to have a high retention value.

Conversely, dead or declining trees, or tree species known (or considered) to be problematic in terms of having a propensity for branch failures, or ones that could self-seed freely, or one that display low aesthetic traits would typically be considered to have a low retention value.

Whilst all of the Trees on this Site may have high environmental benefits, as part of ascertaining the suitability for inclusion into a development, other aspects of the tree must be considered; primarily its structural form and suitability for inclusion into an urbanised area with high volumes of potential targets (such as people, structures etc.), and its potential to cope with changes to its soil and surrounding environment that typically occur as part of a development process.

With this in mind, based on the findings of the assessment:

1. 15 Trees are considered to have a **high retention value**. Generally all larger older specimens in good health and structural form. Retention of as many of these Trees as possible is strongly encouraged to occur as part of the development of the Site as they will provide a valuable amenity to the area where they are situated and are species that are suited to the proposed situation.

2. 40 Trees were considered to be good specimens of their species and were considered to suitable for retention in the context of what is proposed.

   Retention of some however may be questionable if adjacent Trees are removed (due to impact of sudden exposure and the issues it can cause to trees), and some would be better retained as a group rather than individual trees.

   Retention of some of these Trees may however also be subject to aspects of detailed design relating to not only the civil stages of the development but also aspects of Lot development as well.

3. The retention of 88 Trees is however considered <u>questionable</u> in the context of what is proposed due to their species, current health and/or structural condition and risks that they look likely to represent to the 'targets' that will be introduced into their fall zone as a result of the proposed development.

4. 6 other Trees are considered to have a **very low** retention value and would <u>not</u> be considered suitable for retention as part of the development of the Site; namely the dead and near dead Trees.

The aerial overleaf provides an overview of the Site with the retention value of each Tree overlaid and colour coded for ease of reference.

4. Summary of Key Findings of the Assessment

Key

- High Retention Value Tree
- Suitable Tree
- Unsuitable Tree
- Very Low Retention Value (remove)

Client;	Four landscapes Studio
Site;	Dayton Primary School
Drawn by;	J Royal
Revision;	0
Date;	12/02/2020
Arial Source;	Nearmap.com
Scale;	1:1750

ARBOR logic
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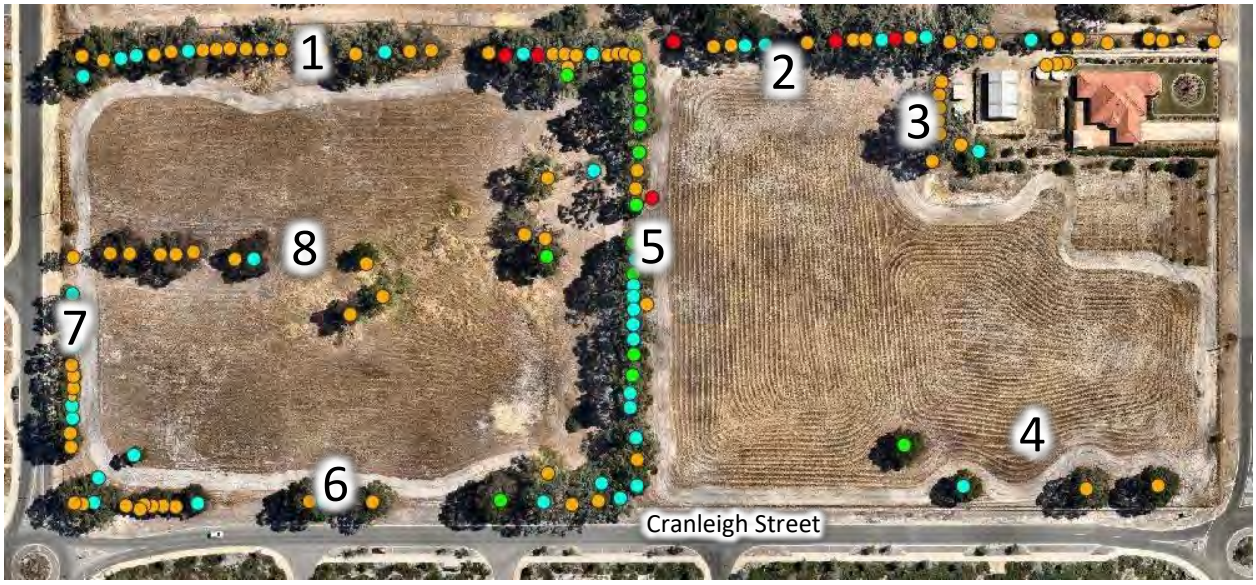
4. Summary of Key Findings of the Assessment

4.7 Visual Summary of Key Findings



Long row of trees along the northern boundary planted as a windbreak.

Mix of species including some Flooded Gum (most of which look to be a cross with Northern River Red Gum) as well as some Ironbark.

Most currently show good health and structural form although some of the larger Trees in this area show evidence of a history of branch failures having occurred.

The Rose Gum and Northern River Red Gum and to a lesser extent the Bangalay are all considered to be higher risk species in terms of their propensity for branch failure so whilst physically large and in good condition they are not necessarily suited to school situations due to the risks that they can represent.

Long row of trees along the northern boundary planted as a windbreak.

Mix of species including some Flooded Gum (most of which look to be a cross with Northern River Red Gum) as well as some Ironbark, Rose Gum, Bangalay and others.

Most currently show good health and structural form although some of the larger Trees in this area show evidence of a history of branch failures having occurred.

The Rose Gum and Northern River Red Gum and to a lesser extent the Bangalay are all considered to be higher risk species in terms of their propensity for branch failure so whilst physically large and in good condition they are not necessarily suited to school situations due to the risks that they can represent.

4. Summary of Key Findings of the Assessment

Short row of Trees; mostly Rose Gum.

Most currently show good health and structural form although some of the larger Trees in this area show evidence of a history of branch failures having occurred.

The Rose Gum are considered to be higher risk species in terms of their propensity for branch failure so whilst physically large and in good condition they are not necessarily suited to school situations due to the risks that they can represent.

Four individual trees; 2 Rose Gum, a Marri and a Jarrah.

All currently show good health and structural form although both Rose Gum show evidence of a history of branch failures having occurred.

The Rose Gum are considered to be higher risk species in terms of their propensity for branch failure so whilst physically large and in good condition they are not necessarily suited to school situations due to the risks that they can represent.

The Marri may be ok to retain depending on the landscape around it (due to potential issues with the 'honky-nuts')

Row of large mature trees including some Spotted Gum and Rose Gum.

Most currently show good health and structural form although some of the larger Rose Gum in this area show evidence of a history of branch failures having occurred.

The Rose Gum and to a lesser extent the Bangalay are all considered to be higher risk species in terms of their propensity for branch failure so whilst physically large and in good condition they are not necessarily suited to school situations due to the risks that they can represent.

Conversely Spotted Gum although a physically large species are considered to have a comparatively low propensity for branch failure.

4. Summary of Key Findings of the Assessment

Row of large mature trees along the southern boundary and Cranleigh Street.

Mix of species but predominantly Lemon Scented Gum along with a few Flooded Gum.

Most currently show good health and structural form although some have been previously topped at some stage in the past so their structure looks likely to cause issues longer term and reduce their suitability for retention in the context of what's proposed.

Row of mature trees along the western boundary and Arthur Street.

Predominantly Spotted Gum.

Most currently show good health although they all look to have been previously topped at some stage in the past so their structure looks likely to cause issues longer term and reduce their suitability for retention in the context of what's proposed depending on the proposed landscape around them and what 'targets' will be introduced into their fall zone area.

Row of mature trees through the middle of the Site.

Predominantly Ironbark.

Most currently show good health although they all look to have been previously topped at some stage in the past so their structure looks likely to cause issues longer term and reduce their suitability for retention in the context of what's proposed.

One very good large mature Spotted Gum at the eastern end of the row also noted and is considered to have a high retention value.

5. Table of the Key Findings of the Assessment

The following pages provide further information on the Trees identified during this assessment.

Explanation of Fields of Information in the Table

Tree ID. Provides an identification number for the identified Tree corresponding to its tree tag number on Site

Species Provides the botanical and most commonly used species name of the Tree.

Height Provides the height of the Tree (in metres) to the nearest metre.

DBH (Trunk Calliper) Provides the diameter of the Tree's main stem (trunk) in centimetres, and generally measured at 1.4 metres above ground level as per the industry standard. Should lower canopy formation start below 1.4 metres above ground level, the DBH is estimated at the point below the furcation of its main stem. In instances where the tree has multiple main stem structures, the DBH of all has been provided.

Estimated Canopy Spread Provides an estimated spread of the Tree's canopy; provided in metres diameter. Both north-south and east – west canopy dimensions have been provided.

Health Condition Provides a view of the Tree's health/vigour condition at the time of inspection based on a number of predetermined criteria.

Health Rating	Explanation
Excellent	Shows to have typical foliage condition and amount of foliage mass for a specimen of the species. May have a minor amount of deadwood, but no signs of any pest or disease factor that may affect its health.
Good	Shows to have typical foliage condition. Canopy foliage may be slightly chlorotic, or it may have a slightly higher percentage of deadwood than usual, or exhibit signs of being affected by environmental conditions. May have a minor pest or disease present that could start to affect its health.
Fair	Shows to have a relatively high percentage of deadwood than considered typical for a specimen of the given species and/or a low volume of live canopy leaf mass for a specimen of the given species. Apical sections of the canopy (may also be) dead. Signs of a pest or disease factor evident.
Poor	Canopy mass and foliage condition shows to be in a poor state for a specimen of the species. Has a high percentage of deadwood material in its canopy and a low volume of live canopy mass (typically <20%).
Dead	Shows to have either no live tissue within its structure, or at best has <5% live foliage mass remaining in its canopy.

5. Table of Information on the individual Trees identified during the Assessment

Structural Form Provides a view of the Tree's structural form at the time of inspection based on a number of predetermined criteria.

Structure Rating	Explanation
Good	Shows typical structural form for a specimen of the species. Branch unions show typical form at the point of attachment. May have a small number of minor structural defects; but are within the scope of tree surgery management to rectify. Shows to be root-stable.
Acceptable	Shows an acceptable form, but may have a number of structural defects present i.e. bi-furcation (but with no major swelling or movement), or areas of stem cavities, but structure remains within the scope of management at this stage; albeit with a higher risk/management requirement. Can include previously lopped trees that are known to have good points of attachment of any regrowth that occurs.
Questionable ('Undesirable' for juvenile/semi-mature trees)	Shows an undesirable structure for a specimen of the species. Structural condition likely to cause future issues in regards to the potential for branch or even complete tree failure to occur. Generally includes previously lopped trees, trees with large areas of cavity and/or associated decay that may be starting to affect its structural integrity, trees with bi-furcated unions with notable included bark and swelling that are considered to have an increased potential to fail.
Poor	Major structural defects evident. May have very large stem cavities, extensive termite damage, or noticeable movement in main stem, branch unions or root plate area.

Age Class Provides the age class of the given Tree.

SULE; Provides an indication of the safe-useful-life-expectancy remaining for the given Tree based on its current health and structural condition**.** This has been expressed as:

- Limited (<5yrs)
- Short Term (5-20 years),
- Medium Term (20-40 years)
- Long Term (>40 years)

Comment Provides any additional information (seen as relevant in the context of this report) to the Tree. Comments are (generally) self-explanatory. An explanation of arboricultural terms has been provided as an attachment to this document.

TPZ Meaning the Tree's protection zone; the area where the majority of the given Tree's root mass is considered likely to be found. **Any works required in this zone are considered likely to have some potential to impact the Tree.**

SRZ Meaning the Tree's 'structural root zone; the area where the majority of the Tree's larger in-ground supportive root mass is considered likely to be found. **Important Note: the SRZ of a tree does not need to be considered unless works and encroachment occur within the tree's nominal TPZ.**

Retention Value Provides an overall 'opinion' on the quality of the Tree and its suitability for retention as part of the development.

This opinion rating has been colour-coded for ease of reference.

High Suitable Questionable Very Low

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
1	Flooded Gum (Eucalyptus rudis)	17	77	84	0.84	9--10	14-15	Excellent	Good	Mature	Medium term (15-40 yrs)		Large mature specimen. Part of a group of trees in close proximity that effectively form the one canopy. Possibly cross with Northern River Red Gum. Basal sucker forms part of its canopy but can be removed if desired. Weight loading noted in parts of its canopy	9.2	3.1	**Suitable**
2	Flooded Gum (Eucalyptus rudis)	10	57	60	0.6	7--8	7--8	Excellent	Undesirable	Mature	Medium term (15-40 yrs)		Ok tree. Possibly cross with Northern River Red Gum. Effectively forms the one canopy with the adjacent Tree. Evidence of a history of branch failures	6.8	2.7	Low (unsuitable)
3	Flooded Gum (Eucalyptus rudis)	8	36, 32	46	0.46	4--5	11--12	Excellent	Poor	Mature	Short-term (5-15 yrs)		Previously topped tree. Small tree. Low spreading canopy form which may be a limiting factor to its retention. Probably wouldn't be missed from the landscape if removed	4.3	2.4	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
4	Flooded Gum (Eucalyptus rudis)	16	70	76	0.76	14-15	11--12	Excellent	Good	Mature	Medium term (15-40 yrs)		Large mature specimen. Possibly cross with Northern River Red Gum. Part of a group of trees in close proximity that effectively form the one canopy. Some moderate and larger diameter deadwood in canopy. Broken branch in canopy	8.4	2.9	**Suitable**
5	Flooded Gum (Eucalyptus rudis)	14	91	93	0.93	14-15	11--12	Good	Good	Mature	Medium term (15-40 yrs)		Large mature specimen. Possibly cross with Northern River Red Gum. Part of a group of trees in close proximity that effectively form the one canopy. Some moderate and larger diameter deadwood in canopy. Broken branch in canopy. Upper canopy slightly sparse but lower canopy still ok	10.9	3.2	**Suitable**
6	Ironbark (Eucalyptus sideroxylon)	9	52	58	0.58	3--4	3--4	Excellent	Poor	Mature	Short-term (5-15 yrs)		Badly topped tree and unions of regrowth look likely to cause issues longer term	6.2	2.6	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
7	Ironbark (Eucalyptus sideroxylon)	14	85	85	0.85	7--8	6--7	Excellent	Poor	Mature	Short-term (5-15 yrs)		Badly topped tree and unions of regrowth look likely to cause issues longer term	10.2	3.1	Low (unsuitable)
8	Flooded Gum (Eucalyptus rudis)	14	45	50	0.5	5--6	7--8	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Ok tree. Canopy is one-sided west due to proximity of the adjacent tree. Possibly cross with Northern River Red Gum	5.4	2.5	**Suitable**
9	Ironbark (Eucalyptus sideroxylon)	14	80	83	0.83	10--11	7--8	Excellent	Poor	Mature	Short-term (5-15 yrs)		Badly topped tree and unions of regrowth look likely to cause issues longer term	9.6	3.1	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
10	Ironbark (Eucalyptus sideroxylon)	14	82	86	0.86	10--11	7--8	Excellent	Poor	Mature	Short-term (5-15 yrs)		Badly topped tree and unions of regrowth look likely to cause issues longer term	9.8	3.1	Low (unsuitable)
11	Flooded Gum (Eucalyptus rudis)	14	52	58	0.58	10--11	7--8	Poor	Acceptable	Mature	Limited (<5 yrs)		Canopy indicates decline. Apical sections of its canopy are dead/declining. Possible lightning strike	6.2	2.6	Low (unsuitable)
12	Flooded Gum (Eucalyptus rudis)	18	74	80	0.8	5--6	5--6	Good	Poor	Mature	Limited (<5 yrs)		Large section of its canopy has snapped. Remainder ok but structure looks likely to cause issues longer term	8.9	3.0	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
13	Flooded Gum (Eucalyptus rudis)	18	86	86	0.86	11--12	8--9	Good	Poor	Mature	Limited (<5 yrs)		Badly topped tree	10.3	3.1	Low (unsuitable)
14	Flooded Gum (Eucalyptus rudis)	12	49	56	0.56	11--12	12--13	Poor	Acceptable	Mature	Limited (<5 yrs)		Apical sections of its canopy are dead/declining	5.9	2.6	Low (unsuitable)
15	Ironbark (Eucalyptus sideroxylon)	9	51	53	0.53	4--5	4--5	Excellent	Poor	Mature	Limited (<5 yrs)		Badly topped tree	6.1	2.5	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
16	Flooded Gum (Eucalyptus rudis)	17	56, 51, 40, 38, 34, 32	85	0.85	11--12	12--13	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Multi-stemmed from ground level and looks to be regrowth off/around an old stump/original tree. Evidence of a history of (various sized) branch failures (storm damage). Possibly cross with Northern River Red Gum	5.5	3.1	Low (unsuitable)
17	Flooded Gum (Eucalyptus rudis)	17	74	80	0.8	12--13	12--13	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Large mature specimen. Evidence of previous branch failure (small <100mm diameter). Widespread canopy form. Some moderate and larger diameter deadwood in canopy. Possibly cross with Northern River Red Gum	8.9	3.0	**Suitable**
18	Ironbark (Eucalyptus sideroxylon)	6	32	34	0.34	3--4	3--4	Excellent	Poor	Mature	Limited (<5 yrs)		Badly topped tree	3.8	2.1	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
19	Flooded Gum (Eucalyptus rudis)	12	61, 42, 36	93	0.93	12--13	16-17	Fair	Acceptable	Mature	Medium term (15-40 yrs)		Large mature specimen. Evidence of previous branch failure (small <100mm diameter). Some moderate and larger diameter deadwood in canopy. Possibly cross with Northern River Red Gum. Apical sections of its canopy are dead/declining. Low spreading canopy. Multi-stemmed from near ground level. Western-Horned Lerp noted on leaf; looks to be major impact to its health	7.3	3.2	Low (unsuitable)
20	Flooded Gum (Eucalyptus rudis)	6	42	45	0.45	4--5	4--5	Excellent	Poor	Early-mature	Short-term (5-15 yrs)		Badly topped tree. Possibly cross with Northern River Red Gum	5.0	2.4	Low (unsuitable)
21	Flooded Gum (Eucalyptus rudis)	6	57	60	0.6	4--5	4--5	Dead	Undesirable	Mature	Limited (<5 yrs)		Dead tree	6.8	2.7	Very Low (Remove)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
22	Ironbark (Eucalyptus sideroxylon)	18	73, 67	92	0.92	12--13	12--13	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Large mature specimen. Multi-stemmed from near ground level	8.8	3.2	**Suitable**
23	Flooded Gum (Eucalyptus rudis)	9	36	40	0.4	2--3	2--3	Near Dead	Poor	Mature	n/a. Dead tree		Mostly dead tree	4.3	2.3	Very Low (Remove)
24	Flooded Gum (Eucalyptus rudis)	9	46	48	0.48	5--6	7--8	Good	Questionable	Mature	Short-term (5-15 yrs)		Canopy is one-sided west due to proximity of the adjacent tree. Leaning. Looks to have been partially ring-barked	5.5	2.4	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
25	Flooded Gum (Eucalyptus rudis)	10	41	46	0.46	7--8	5--6	Good	Acceptable	Mature	Short-term (5-15 yrs)		Canopy is relatively one-sided north due to proximity of the adjacent tree. Looks to have been partially ring-barked	4.9	2.4	Low (unsuitable)
26	Flooded Gum (Eucalyptus rudis)	8	26	30	0.3	2--3	2--3	Poor	Acceptable	Mature	Limited (<5 yrs)		Canopy is relatively one-sided east due to proximity of the adjacent tree. Apical sections of its canopy are dead/declining	3.1	2.0	Low (unsuitable)
27	Lemon Scented Gum (Corymbia citriodora)	11	31	35	0.35	5--6	4--5	Excellent	Undesirable	Early-mature	Short-term (5-15 yrs)		Canopy is one-sided north due to proximity of the adjacent tree. Effectively forms the one canopy with the adjacent Tree. Probably wouldn't be missed from the landscape if removed	3.7	2.1	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
28	Flooded Gum (Eucalyptus rudis)	18	84	90	0.9	12--13	12--13	Excellent	Good	Mature	Long term (>40 yrs)		Large mature specimen. Good specimen. Some moderate and larger diameter deadwood in canopy	10.1	3.2	**High Retention Value**
29	Flooded Gum (Eucalyptus rudis)	18	60, 56	78	0.78	11--12	10--11	Excellent	Good	Mature	Long term (>40 yrs)		Large mature specimen. Some moderate and larger diameter deadwood in canopy. Main stem bi-furcates. Union looks to be Ok at this stage	7.2	3.0	**Suitable**
30	Flooded Gum (Eucalyptus rudis)	8	16 (multiple)	36	0.36	3--4	3--4	Poor	Undesirable	Early-mature	Limited (<5 yrs)		Apical sections of its canopy are dead/declining. Multi-stemmed from near ground level	1.9	2.2	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
31	Flooded Gum (Eucalyptus rudis)	8	16	20	0.2	1--2	1--2	Good	Acceptable	Early-mature	Medium term (15-40 yrs)		Ok tree	1.9	1.7	Low (unsuitable)
32	Ironbark (Eucalyptus sideroxylon)	14	61	70	0.7	8--9	7--8	Excellent	Poor	Mature	Short-term (5-15 yrs)		Large mature specimen. Section of its main stem looks to have failed. Canopy is one-sided west. Resulting structure looks likely to cause issues longer term	7.3	2.8	Low (unsuitable)
33	Flooded Gum (Eucalyptus rudis)	7	37	46	0.46	5--6	3--4	Excellent	Poor	Mature	Short-term (5-15 yrs)		Ok tree. Top of main leader has snapped (storm damage). Canopy is one-sided north. Resulting structure looks likely to cause issues longer term	4.4	2.4	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
34	Spotted Gum (Corymbia maculata)	23	46	54	0.54	6--7	6--7	Excellent	Good	Early-mature	Long term (>40 yrs)		Large mature tree. No issues or concerns visible at this time. Part of a group of trees in close proximity that effectively form the one canopy	5.5	2.6	**High Retention Value**
35	Spotted Gum (Corymbia maculata)	23	41	44	0.44	6--7	8--9	Excellent	Good	Early-mature	Long term (>40 yrs)		Large mature tree. No issues or concerns visible at this time. Part of a group of trees in close proximity that effectively form the one canopy. Co-dominant leader. Union looks to be ok	4.9	2.3	**High Retention Value**
36	Spotted Gum (Corymbia maculata)	21	61	68	0.68	11--12	14-15	Excellent	Good	Early-mature	Long term (>40 yrs)		Large mature tree. No issues or concerns visible at this time. Part of a group of trees in close proximity that effectively form the one canopy. Co-dominant leader. Union looks to be ok	7.3	2.8	**High Retention Value**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
37	Spotted Gum (Corymbia maculata)	27	65	69	0.69	11--12	13-14	Excellent	Good	Mature	Long term (>40 yrs)		Large mature tree. No issues or concerns visible at this time. Good aesthetic form/value. Effectively forms the one canopy with the adjacent Tree	7.8	2.8	**High Retention Value**
38	Spotted Gum (Corymbia maculata)	27	83	93	0.93	15-16	13-14	Excellent	Good	Mature	Long term (>40 yrs)		Large mature specimen. Good aesthetic form/value. Effectively forms the one canopy with the adjacent Tree. Evidence of a history of (various sized) branch failures (storm damage)	10.0	3.2	**High Retention Value**
39	Spotted Gum (Corymbia maculata)	11	44	46	0.46	9--10	9--10	Excellent	Good	Mature	Long term (>40 yrs)		Good specimen. No issues or concerns visible at this time	5.3	2.4	**High Retention Value**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
40	Spotted Gum (Corymbia maculata)	9	48	53	0.53	5--6	7--8	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Badly topped tree	5.8	2.5	Low (unsuitable)
41	Rose Gum (Eucalyptus grandis)	26	53	60	0.6	12--13	12--13	Excellent	Good	Mature	Short-term (5-15 yrs)		Large mature specimen. Species generally considered to be a higher risk species for the propensity for branch failures	6.4	2.7	Low (unsuitable)
42	Spotted Gum (Corymbia maculata)	11	41	44	0.44	7--8	7--8	Excellent	Good	Early-mature	Long term (>40 yrs)		Upper canopy is dead. Good specimen. No issues or concerns visible at this time. Good aesthetic form/value	4.9	2.3	**High Retention Value**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
43	Bangalay (Eucalyptus botryoides)	13	68	72	0.72	9--10	8--9	Dead	Questionable	Mature	n/a. Dead tree		Dead tree	8.2	2.9	Very Low (Remove)
44	Spotted Gum (Corymbia maculata)	16	47	50	0.5	8--9	8--9	Excellent	Good	Mature	Long term (>40 yrs)		Good specimen. No issues or concerns visible at this time. Part of a group of trees in close proximity that effectively form the one canopy	5.6	2.5	**High Retention Value**
45	Spotted Gum (Corymbia maculata)	16	34	38	0.38	5--6	6--7	Excellent	Good	Mature	Long term (>40 yrs)		Good specimen. No issues or concerns visible at this time. Part of a group of trees in close proximity that effectively form the one canopy	4.1	2.2	Suitable

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
46	Spotted Gum (Corymbia maculata)	21	77	82	0.82	8--9	8--9	Excellent	Good	Mature	Long term (>40 yrs)		Good specimen. No issues or concerns visible at this time. Part of a group of trees in close proximity that effectively form the one canopy. Main stem bi-furcates. Union looks to be Ok at this stage	9.2	3.0	**High Retention Value**
47	Swamp Mahogany (Eucalyptus robusta)	21	63	73	0.73	8--9	12--13	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Reasonably good specimen. Leggy canopy form. Canopy is one-sided due to proximity of the adjacent tree. Main stem bi-furcates. Union looks to be Ok at this stage	7.6	2.9	**Suitable**
48	Swamp Mahogany (Eucalyptus robusta)	15	45	56	0.56	6--7	8--9	Excellent	Good	Mature	Medium term (15-40 yrs)		Good specimen. No issues or concerns visible at this time. Part of a group of trees in close proximity that effectively form the one canopy	5.4	2.6	**Suitable**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
49	Spotted Gum (Corymbia maculata)	12	27	29	0.29	2--3	3--4	Excellent	Good	Early-mature	Long term (>40 yrs)		Good specimen. No issues or concerns visible at this time. Part of a group of trees in close proximity that effectively form the one canopy	3.2	2.0	**Suitable**
50	Swamp Mahogany (Eucalyptus robusta)	9	55	60	0.6	5--6	6--7	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Ok tree. Part of a group of trees in close proximity that effectively form the one canopy. Canopy is one sided north	6.6	2.7	Low (unsuitable)
51	Swamp Mahogany (Eucalyptus robusta)	17	47	53	0.53	5--6	7--8	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Reasonably good specimen. Part of a group of trees in close proximity that effectively form the one canopy	5.6	2.5	**Suitable**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
52	Spotted Gum (Corymbia maculata)	17	51	54	0.54	7--8	9--10	Excellent	Acceptable	Mature	Long term (>40 yrs)		Good specimen. Main stem bi-furcates. Union looks to be Ok at this stage. Part of a group of trees in close proximity that effectively form the one canopy	6.1	2.6	**Suitable**
53	Spotted Gum (Corymbia maculata)	17	51	56	0.56	8--9	9--10	Excellent	Good	Mature	Long term (>40 yrs)		Good specimen. Part of a group of trees in close proximity that effectively form the one canopy	6.1	2.6	**High Retention Value**
54	Spotted Gum (Corymbia maculata)	20	71	76	0.76	12--13	10--11	Excellent	Good	Mature	Long term (>40 yrs)		Large mature specimen. Good specimen. Good aesthetic form/value. Main stem bi-furcates. Union looks to be Ok at this stage. Part of a group of trees in close proximity that effectively form the one canopy	8.5	2.9	**High Retention Value**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
55	Marri (Corymbia calophylla)	8	28, 25	51	0.51	3--4	4--5	Excellent	Undesirable	Early-mature	Medium term (15-40 yrs)		Reasonably good specimen. Main stem bi-furcates. Included bark at the union. Union looks to be ok at this time but may cause future issues	3.4	2.5	**Suitable**
56	Marri (Corymbia calophylla)	8	30	33	0.33	3--4	4--5	Excellent	Good	Early-mature	Long term (>40 yrs)		Reasonably good specimen	3.6	2.1	**Suitable**
57	Swamp Mahogany (Eucalyptus robusta)	16	56	75	0.75	10--11	12--13	Excellent	Good	Early-mature	Long term (>40 yrs)		Large mature specimen. Low spreading canopy. Part of a group of trees in close proximity that effectively form the one canopy	6.7	2.9	**Suitable**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
58	Flooded Gum (Eucalyptus rudis)	14	58	63	0.63	8--9	12--13	Excellent	Undesirable	Mature	Medium term (15-40 yrs)		Ok tree. Canopy is one-sided north due to proximity of the adjacent tree. Structure ok but would question retention if the adjacent trees were removed	7.0	2.7	Low (unsuitable)
59	Spotted Gum (Corymbia maculata)	20	51	54	0.54	8--9	7--8	Excellent	Acceptable	Mature	Long term (>40 yrs)		Large mature specimen. Main stem bi-furcates. Swelling at the union. Union looks to be ok. Part of a group of trees in close proximity that effectively form the one canopy	6.1	2.6	**Suitable**
60	Flooded Gum (Eucalyptus rudis)	16	61, 54	80	0.8	17-18	12--13	Excellent	Acceptable	Mature	Long term (>40 yrs)		Large mature specimen. Main stem bi-furcates. Swelling at the union. Union looks to be ok. Part of a group of trees in close proximity that effectively form the one canopy. Possibly cross with Northern River Red Gum. Low spreading canopy. Western-Horned Lerp noted on leaf	7.3	3.0	**Suitable**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
61	Spotted Gum (Corymbia maculata)	18	54	57	0.57	6--7	6--7	Good	Acceptable	Mature	Medium term (15-40 yrs)		Large mature specimen. Main stem bi-furcates. Swelling at the union. Union looks to be ok. Part of a group of trees in close proximity that effectively form the one canopy. Apical sections of its canopy are dead/declining	6.5	2.6	**Suitable**
62	Spotted Gum (Corymbia maculata)	20	51, 49	89	0.89	16-17	9--10	Fair	Acceptable	Mature	Short-term (5-15 yrs)		Large mature specimen. Canopy is relatively sparse. Multi-stemmed from near ground level. Included bark at union. Looks to be ok at this time. Part of a group of trees in close proximity that effectively form the one canopy	6.1	3.2	Low (unsuitable)
63	Spotted Gum (Corymbia maculata)	21	43	52	0.52	8--9	7--8	Fair	Acceptable	Mature	Short-term (5-15 yrs)		Large mature specimen. Canopy slightly sparse. Remaining leaf still good condition. Leggy canopy form. Main stem bi-furcates. Union looks to be Ok at this stage. Some root plate mounding noted but looks to be remaining root stable at this time. Part of a group of trees in close proximity that effectively form the one canopy	5.2	2.5	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
64	Northern River Red Gum (Eucalyptus camaldulensis 'Obtusa')	19	62, 53, 46, 30	98	0.98	18-20	14-15	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Large mature specimen. Part of a group of trees in close proximity that effectively form the one canopy. Multi-stemmed from ground level and looks to be regrowth off/around an old stump/original tree. Species generally considered to be a higher risk species for the propensity for branch failures. Widespread canopy form	7.4	3.3	Low (unsuitable)
65	Spotted Gum (Corymbia maculata)	21	44	50	0.5	6--7	6--7	Good	Acceptable	Mature	Short-term (5-15 yrs)		Large mature specimen. Leggy canopy form. Main stem bi-furcates. Union looks to be Ok at this stage. Part of a group of trees in close proximity that effectively form the one canopy	5.3	2.5	**Suitable**
66	Spotted Gum (Corymbia maculata)	20	61	72	0.72	12--13	13-14	Excellent	Good	Mature	Long term (>40 yrs)		Large mature specimen. Main stem bi-furcates. Union looks to be Ok at this stage. Good aesthetic form/value	7.3	2.9	**High Retention Value**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
67	Lemon Scented Gum (Corymbia citriodora)	15	49, 44, 38	80	0.8	13-14	11--12	Excellent	Undesirable	Mature	Medium term (15-40 yrs)		Large mature specimen. Multi-stemmed from near ground level. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future. Widespread canopy form	5.9	3.0	Low (unsuitable)
68	Lemon Scented Gum (Corymbia citriodora)	18	61	69	0.69	13-14	10--11	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Large mature specimen. Evidence of previous branch failure (100-200mm diameter). Broken branch in canopy	7.3	2.8	**Suitable**
69	Lemon Scented Gum (Corymbia citriodora)	11	32, 26	47	0.47	7--8	5--6	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Previously topped tree. Canopy is one-sided west due to proximity of the adjacent tree. Effectively forms the one canopy with the adjacent Tree. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	3.8	2.4	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
70	Lemon Scented Gum (Corymbia citriodora)	14	33, 32, 20	56	0.56	7--8	7--8	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Reasonably good specimen. Multi-stemmed from ground level possibly more than one tree	4.0	2.6	**Suitable**
71	Lemon Scented Gum (Corymbia citriodora)	9	18 (multiple)	30	0.3	4--5	4--5	Excellent	Undesirable	Early-mature	Short-term (5-15 yrs)		Looks to be regrowth off/around an old stump/original tree. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	2.2	2.0	Low (unsuitable)
72	Lemon Scented Gum (Corymbia citriodora)	12	57	60	0.6	6--7	7--8	Excellent	Undesirable	Early-mature	Short-term (5-15 yrs)		Previously topped tree. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	6.8	2.7	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
73	Lemon Scented Gum (Corymbia citriodora)	11	20	22	0.22	3--4	3--4	Excellent	Good	Juvenile	Long term (>40 yrs)		Good specimen. No issues or concerns visible at this time	2.4	1.8	**Suitable**
74	Lemon Scented Gum (Corymbia citriodora)	12	40	44	0.44	4--5	2--3	Excellent	Poor	Early-mature	Short-term (5-15 yrs)		Badly topped tree. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	4.8	2.3	Low (unsuitable)
75	Lemon Scented Gum (Corymbia citriodora)	7	14	15	0.15	2--3	2--3	Excellent	Undesirable	Juvenile	Short-term (5-15 yrs)		Looks to be regrowth off/around an old stump/original tree. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	1.7	1.5	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
76	Lemon Scented Gum (Corymbia citriodora)	9	15	17	0.17	1--2	1--2	Excellent	Acceptable	Juvenile	Medium term (15-40 yrs)		Ok tree. Probably self sown. Grown up through the fence	1.8	1.6	Low (unsuitable)
77	Lemon Scented Gum (Corymbia citriodora)	7	38	42	0.42	3--4	4--5	Excellent	Poor	Early-mature	Limited (<5 yrs)		Badly topped tree. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	4.6	2.3	Low (unsuitable)
78	Lemon Scented Gum (Corymbia citriodora)	5	11, 8	15	0.15	1--2	1--2	Excellent	Acceptable	Juvenile	Medium term (15-40 yrs)		Ok tree. Probably self sown. Co-dominant leader from ground level	1.3	1.5	**Suitable**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
79	Flooded Gum (Eucalyptus rudis)	16	78	77	0.77	16-17	12--13	Excellent	Good	Mature	Long term (>40 yrs)		Large mature specimen. Widespread canopy form. Possibly cross with Northern River Red Gum	9.4	3.0	**Suitable**
80	Flooded Gum (Eucalyptus rudis)	16	46	50	0.5	10--11	7--8	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Large mature specimen. Possibly cross with Northern River Red Gum. Leggy canopy form. Effectively forms the one canopy with the adjacent Tree. Evidence of a history of branch failures. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	5.5	2.5	Low (unsuitable)
81	Flooded Gum (Eucalyptus rudis)	10	43	46	0.46	7--8	7--8	Excellent	Undesirable	Early-mature	Short-term (5-15 yrs)		Ok tree. Possibly cross with Northern River Red Gum. Canopy is one-sided west due to proximity of the adjacent tree	5.2	2.4	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
82	Spotted Gum (Corymbia maculata)	14	44	46	0.46	5--6	5--6	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Ok tree. Part of a group of trees in close proximity that effectively form the one canopy. Main stem bi-furcates. Included bark & swelling at the union. Union looks to be ok at this time but looks likely to cause issues longer term	5.3	2.4	Low (unsuitable)
83	Spotted Gum (Corymbia maculata)	14	35, 20, 16	48	0.48	5--6	5--6	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Ok tree. Part of a group of trees in close proximity that effectively form the one canopy. Multi-stemmed from ground level and looks to be regrowth off/around an old stump/original tree. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	4.2	2.4	Low (unsuitable)
84	Spotted Gum (Corymbia maculata)	16	48	53	0.53	5--6	5--6	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Large mature specimen. Part of a group of trees in close proximity that effectively form the one canopy. Previously topped. Regrowth unions look ok at this time	5.8	2.5	**Suitable**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
85	Spotted Gum (Corymbia maculata)	16	42	46	0.46	5--6	5--6	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Large mature specimen. Part of a group of trees in close proximity that effectively form the one canopy. Previously topped. Regrowth unions look ok at this time. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	5.0	2.4	**Suitable**
86	Spotted Gum (Corymbia maculata)	16	38	47	0.47	5--6	5--6	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Large mature specimen. Part of a group of trees in close proximity that effectively form the one canopy. Previously topped. Regrowth unions look ok at this time. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	4.6	2.4	**Suitable**
87	Spotted Gum (Corymbia maculata)	7	14	18	0.18	1--2	1--2	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Part of a group of trees in close proximity that effectively form the one canopy. Previously topped. Regrowth unions look ok at this time. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future. Small tree and probably wouldn't be missed from the landscape if removed.	1.7	1.6	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
88	Spotted Gum (Corymbia maculata)	16	51	56	0.56	7--8	7--8	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Large mature specimen. Part of a group of trees in close proximity that effectively form the one canopy. Previously topped. Regrowth unions look ok at this time. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	6.1	2.6	Low (unsuitable)
89	Spotted Gum (Corymbia maculata)	15	29, 24, 20	42	0.42	6--7	6--7	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Ok tree. Multi-stemmed from ground level. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future. Canopy is one sided due to pruning for line clearance	3.5	2.3	Low (unsuitable)
90	Spotted Gum (Corymbia maculata)	15	37	37	0.37	4--5	3--4	Excellent	Acceptable	Mature	Short-term (5-15 yrs)		Ok tree. Canopy is one sided due to pruning for line clearance. Leggy canopy form	4.4	2.2	**Suitable**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
91	Spotted Gum (Corymbia maculata)	13	44	46	0.46	6--7	3--4	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Ok tree. Canopy is one sided due to pruning for line clearance	5.3	2.4	**Suitable**
92	Spotted Gum (Corymbia maculata)	10	31	33	0.33	3--4	3--4	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Badly topped tree. Canopy is one sided due to pruning for line clearance. Area of decay. Possibly starting to impact its structural integrity	3.7	2.1	Low (unsuitable)
93	Spotted Gum (Corymbia maculata)	13	31	37	0.37	4--5	3--4	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Ok tree. Canopy is one sided due to pruning for line clearance. Leggy canopy form	3.7	2.2	**Suitable**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
94	Spotted Gum (Corymbia maculata)	11	31	36	0.36	4--5	3--4	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Canopy is one sided due to pruning for line clearance. Leggy canopy form. Badly topped tree. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	3.7	2.2	Low (unsuitable)
95	Ironbark (Eucalyptus sideroxylon)	8	36	38	0.38	2--3	1--2	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Badly topped tree. Canopy is one-sided west due to proximity of the adjacent tree. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	4.3	2.2	Low (unsuitable)
96	Ironbark (Eucalyptus sideroxylon)	11	92	96	0.96	12--13	12--13	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Large mature specimen. Good aesthetic form/value. Looks to have been previously topped. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	11.0	3.3	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
97	Ironbark (Eucalyptus sideroxylon)	15	74	80	0.8	7--8	7--8	Excellent	Poor	Mature	Short-term (5-15 yrs)		Badly topped tree. Union looks to be ok at this time but looks likely to cause issues longer term. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	8.9	3.0	Low (unsuitable)
98	Ironbark (Eucalyptus sideroxylon)	17	76	86	0.86	9--10	5--6	Excellent	Poor	Mature	Short-term (5-15 yrs)		Badly topped tree. Union looks to be ok at this time but looks likely to cause issues longer term. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	9.1	3.1	Low (unsuitable)
99	Ironbark (Eucalyptus sideroxylon)	15	88	94	0.94	13-14	8--9	Excellent	Poor	Mature	Short-term (5-15 yrs)		Badly topped tree. Union looks to be ok at this time but looks likely to cause issues longer term. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future. Evidence of a history of branch failures	10.6	3.2	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
100	Ironbark (Eucalyptus sideroxylon)	10	40	40	0.4	3--4	2--3	Excellent	Poor	Mature	Short-term (5-15 yrs)		Badly topped tree. Union looks to be ok at this time but looks likely to cause issues longer term. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future. Canopy is one-sided west	4.8	2.3	Low (unsuitable)
101	Ironbark (Eucalyptus sideroxylon)	12	96	96	0.96	12--13	9--10	Excellent	Undesirable	Mature	Short-term (5-15 yrs)		Large mature specimen. Good aesthetic form/value. Previously topped. Regrowth unions look ok at this time	11.5	3.3	**Suitable**
102	Ironbark (Eucalyptus sideroxylon)	12	88	89	0.89	9--10	9--10	Excellent	Poor	Mature	Short-term (5-15 yrs)		Large mature specimen. Section of its main stem looks to have failed. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	10.6	3.2	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
103	White Cedar (Melia azedarach)	9	36, multiple)	101	1.01	9--10	9--10	Good	Undesirable	Early-mature	Short-term (5-15 yrs)		Multi-stemmed from ground level possibly more than one tree. Canopy slightly sparse. Remaining leaf still good condition. Few dead tips	4.3	3.3	Low (unsuitable)
104	White Cedar (Melia azedarach)	9	33 (multiple)	68	0.68	7--8	7--8	Excellent	Undesirable	Early-mature	Short-term (5-15 yrs)		Multi-stemmed from ground level possibly more than one tree	4.0	2.8	Low (unsuitable)
105	Flooded Gum (Eucalyptus rudis)	11	56	80	0.8	14-15	14-15	Fair	Questionable	Mature	Short-term (5-15 yrs)		Large mature specimen. Few dead tips. Western-Horned Lerp noted on leaf; looks to be major impact to its health. Broken branch in canopy. Low spreading canopy. Minimal canopy may remain if canopy is raised	6.7	3.0	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
106	Flooded Gum (Eucalyptus rudis)	6	41	48	0.48	7--8	9--10	Fair	Undesirable	Mature	Short-term (5-15 yrs)		Canopy is one-sided north due to proximity of the adjacent tree. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future. Effectively forms the one canopy with the adjacent Tree. Few dead tips. Western-Horned Lerp noted on leaf; looks to be major impact to its health	4.9	2.4	Low (unsuitable)
107	Spotted Gum (Corymbia maculata)	16	59	63	0.63	10--11	10--11	Excellent	Good	Mature	Long term (>40 yrs)		Large mature specimen. Main stem bi-furcates. Union looks to be Ok at this stage. Good aesthetic form/value	7.1	2.7	**High Retention Value**
108	Northern River Red Gum (Eucalyptus camaldulensis 'Obtusa')	17	78, 42, 38, 30	106	1.06	15-16	15-16	Excellent	Poor	Mature	Limited (<5 yrs)		Large mature specimen. Evidence of a history of branch failures. Species generally considered to be a higher risk species for the propensity for branch failures	9.4	3.4	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
109	Flooded Gum (Eucalyptus rudis)	7	17, 14, 10	26	0.26	3--4	4--5	Excellent	Acceptable	Juvenile	Medium term (15-40 yrs)		Ok tree. Looks to be self-sown. Multi-stemmed from ground level possibly more than one tree	2.0	1.9	Suitable
110	Bracelet Honey Myrtle (Melaleuca armillaris)	5	26, 11, 11	30	0.3	3--4	4--5	Excellent	Poor	Mature	Limited (<5 yrs)		Signs to suggest root plate heave/partial failure has occurred	3.1	2.0	Very Low (Remove)
111	Swamp Mahogany (Eucalyptus robusta)	7	16	20	0.2	1--2	1--2	Poor	Poor	Early-mature	Limited (<5 yrs)		Apical sections of its canopy are dead/declining. Canopy is one-sided west due to proximity of the adjacent tree. Wouldn't be missed from the landscape if removed	1.9	1.7	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
112	Rose Gum (Eucalyptus grandis)	21	57	82	0.82	14-15	15-16	Excellent	Acceptable	Mature	Short-term (5-15 yrs)		Canopy is one-sided west due to proximity of the adjacent tree. Large mature specimen. Species generally considered to be a higher risk species for the propensity for branch failures. Evidence of a history of branch failures	6.8	3.0	Low (unsuitable)
113	Swamp Mahogany (Eucalyptus robusta)	17	54	72	0.72	9--10	5--6	Excellent	Good	Mature	Long term (>40 yrs)		Reasonably good specimen. No issues or concerns visible at this time	6.5	2.9	**Suitable**
114	Spotted Gum (Corymbia maculata)	19	44	50	0.5	9--10	6--7	Excellent	Good	Mature	Long term (>40 yrs)		Large mature specimen. Canopy slightly sparse. Remaining leaf still good condition. Leggy canopy form	5.3	2.5	**Suitable**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
115	Flooded Gum (Eucalyptus rudis)	4	20, 17, 12	36	0.36	4--5	4--5	Good	Good	Mature	Long term (>40 yrs)		Ok smaller tree. Canopy slightly sparse. Remaining leaf still good condition. Multi-stemmed from near ground level	2.4	2.2	Low (unsuitable)
116	Swamp Mahogany (Eucalyptus robusta)	11	45	50	0.5	2--3	4--5	Dead	Questionable	Mature	n/a. Dead tree		Dead tree	5.4	2.5	Very Low (Remove)
117	Rose Gum (Eucalyptus grandis)	24	107	110	1.1	14-15	13-14	Excellent	Good	Mature	Short-term (5-15 yrs)		Large mature specimen. Species generally considered to be a higher risk species for the propensity for branch failures. Area of decay. Possibly starting to impact its structural integrity. Evidence of a history of branch failures	12.8	3.4	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
118	Flooded Gum (Eucalyptus rudis)	11	34, 21	50	0.5	7--8	3--4	Good	Acceptable	Early-mature	Medium term (15-40 yrs)		Ok tree. Canopy is one-sided due to proximity of the adjacent tree. Possibly cross with Northern River Red Gum. Canopy slightly sparse. Remaining leaf still good condition. Few dead tips. Co-dominant leader	4.1	2.5	Low (unsuitable)
119	Flooded Gum (Eucalyptus rudis)	15	59	64	0.64	8--9	8--9	Good	Acceptable	Early-mature	Medium term (15-40 yrs)		Reasonably good specimen. Main stem bi-furcates. Union looks to be Ok at this stage	7.1	2.7	**Suitable**
120	Flooded Gum (Eucalyptus rudis)	6	20	25	0.25	1--2	1--2	Near Dead	Acceptable	Early-mature	Limited (<5 yrs)		Mostly dead tree	2.4	1.8	Very Low (Remove)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
121	Rose Gum (Eucalyptus grandis)	25	59	69	0.69	11--12	12--13	Excellent	Good	Mature	Short-term (5-15 yrs)		Large mature specimen. Species generally considered to be a higher risk species for the propensity for branch failures	7.1	2.8	Low (unsuitable)
122	Tuart (Eucalyptus gomphocephala)	19	85	88	0.88	13-14	11--12	Excellent	Good	Mature	Long term (>40 yrs)		Large mature specimen. Main stem bi-furcates. Union looks to be Ok at this stage	10.2	3.1	**Suitable**
123	Rose Gum (Eucalyptus grandis)	25	68	76	0.76	11--12	11--12	Excellent	Acceptable	Mature	Short-term (5-15 yrs)		Large mature specimen. Species generally considered to be a higher risk species for the propensity for branch failures. Broken branch in canopy. Evidence of a history of branch failures	8.2	2.9	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
124	Bangalay (Eucalyptus botryoides)	24	84	110	1.1	13-14	11--12	Excellent	Acceptable	Mature	Long term (>40 yrs)		Large mature specimen. Main stem bi-furcates. Union looks to be Ok at this stage. Evidence of a history of (various sized) branch failures (storm damage). Some moderate and larger diameter deadwood in canopy	10.1	3.4	Low (unsuitable)
125	Bangalay (Eucalyptus botryoides)	18	50	62	0.62	9--10	8--9	Excellent	Acceptable	Mature	Long term (>40 yrs)		Large mature specimen. Canopy is one sided north. Effectively forms the one canopy with the adjacent Tree. Minor amount of moderate diameter sized deadwood	6.0	2.7	Low (unsuitable)
126	River Yate (Eucalyptus macrandra)	8	56	56	0.56	6--7	11--12	Excellent	Acceptable	Mature	Medium term (15-40 yrs)		Ok specimen. Previously topped but not of any concerns at this time	6.7	2.6	**Suitable**

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
127	Olive (Olea europaea)	6	8 multiple)	60	0.6	3--4	3--4	Excellent	Acceptable	Semi-mature	Long term (>40 yrs)		Ok tree. Multi-stemmed from ground level and looks to be regrowth off/around an old stump/original tree	1.0	2.7	Low (unsuitable)
128	South Australian Yellow Gum (Eucalyptus leucoxylon)	7.5	39	46	0.46	6--7	6--7	Excellent	Poor	Mature	Short-term (5-15 yrs)		Previously topped. Regrowth unions could cause future issues	4.7	2.4	Low (unsuitable)
129	Silver Princess (Eucalyptus caesia ssp. caesia)	7.5	14, 12, 10, 8	36	0.36	4--5	5--6	Poor	Acceptable	Mature	Limited (<5 yrs)		Canopy condition suggests possibly limited life remaining. Canopy is sparse. Multi-stemmed from ground level	1.7	2.2	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
130	Flinders Range Wattle (Acacia iteaphylla)	5	15	18	0.18	3--4	4--5	Excellent	Good	Early-mature	Short-term (5-15 yrs)		Reasonably good specimen. No issues or concerns visible at this time. Typically a short-lived species	1.8	1.6	Low (unsuitable)
131	Bracelet Honey Myrtle (Melaleuca armillaris)	4.5	18 multiple)	35	0.35	3--4	6--7	Good	Acceptable	Mature	Short-term (5-15 yrs)		Ok tree. Multi-stemmed from ground level possibly more than one tree	2.2	2.1	Low (unsuitable)
132	Bracelet Honey Myrtle (Melaleuca armillaris)	4.5	27	36	0.36	3--4	3--4	Good	Undesirable	Mature	Short-term (5-15 yrs)		Ok specimen. Previously topped but not of any concerns at this time	3.2	2.2	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
133	Bracelet Honey Myrtle (Melaleuca armillaris)	4.5	25	34	0.34	2--3	2--3	Good	Acceptable	Mature	Short-term (5-15 yrs)		Ok tree. Canopy is one-sided south	3.0	2.1	Low (unsuitable)
134	Pencil Pine (Cupressus sempervirens 'Stricta')	6	12	15	0.15	1--2	1--2	Excellent	Good	Mature	Medium term (15-40 yrs)		Ok tree. Part of a row of four	1.4	1.5	Low (unsuitable)
135	Pencil Pine (Cupressus sempervirens 'Stricta')	6	12	15	0.15	1--2	1--2	Excellent	Good	Mature	Medium term (15-40 yrs)		Ok tree. Part of a row of four	1.4	1.5	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
136	Pencil Pine (Cupressus sempervirens 'Stricta')	6	12	15	0.15	1--2	1--2	Excellent	Good	Mature	Medium term (15-40 yrs)		Ok tree. Part of a row of four	1.4	1.5	Low (unsuitable)
137	Pencil Pine (Cupressus sempervirens 'Stricta')	7	12	15	0.15	1--2	1--2	Excellent	Good	Mature	Medium term (15-40 yrs)		Ok tree. Part of a row of four	1.4	1.5	Low (unsuitable)
138	Rose Gum (Eucalyptus grandis)	7	10	12	0.12	1--2	1--2	Fair	Acceptable	Semi-mature	Short-term (5-15 yrs)		Canopy is relatively sparse. Leggy canopy form. Species generally considered to be a higher risk species for the propensity for branch failures	1.2	1.4	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
139	Rose Gum (Eucalyptus grandis)	11	27	30	0.3	4--5	5--6	Excellent	Acceptable	Semi-mature	Short-term (5-15 yrs)		Ok tree. Leggy canopy form. Species generally considered to be a higher risk species for the propensity for branch failures	3.2	2.0	Low (unsuitable)
140	Rose Gum (Eucalyptus grandis)	19	38	44	0.44	7--8	7--8	Excellent	Undesirable	Early-mature	Short-term (5-15 yrs)		Ok tree. Leggy canopy form. Species generally considered to be a higher risk species for the propensity for branch failures	4.6	2.3	Low (unsuitable)
141	Flooded Gum (Eucalyptus rudis)	19	47	49	0.49	7--8	7--8	Excellent	Undesirable	Early-mature	Short-term (5-15 yrs)		Ok tree. Leggy canopy form. Canopy is one-sided north due to proximity of the adjacent tree. Swoop in main stem	5.6	2.5	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
142	Rose Gum (Eucalyptus grandis)	25	85	90	0.9	14-15	14-15	Excellent	Good	Mature	Short-term (5-15 yrs)		Large mature specimen. Species generally considered to be a higher risk species for the propensity for branch failures. Some moderate and larger diameter deadwood in canopy	10.2	3.2	Low (unsuitable)
143	Flooded Gum (Eucalyptus rudis)	15	38	46	0.46	5--6	7--8	Excellent	Undesirable	Early-mature	Short-term (5-15 yrs)		Canopy is one-sided due to proximity of the adjacent tree. Grown on a lean but not considered an issue at this time. Structure looks to be ok at this time but equally looks likely to cause issues in foreseeable future	4.6	2.4	Low (unsuitable)
144	Rose Gum (Eucalyptus grandis)	9	24	26	0.26	3--4	4--5	Fair	Acceptable	Early-mature	Short-term (5-15 yrs)		Canopy is slightly sparse & suggests decline. Few dead tips. Canopy is one sided north. Species generally considered to be a higher risk species for the propensity for branch failures	2.9	1.9	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
145	Mulberry (Morus nigra)	7	52	56	0.56	9--10	9--10	Excellent	Good	Mature	Long term (>40 yrs)		Good specimen. No issues or concerns visible at this time. Low spreading canopy	6.2	2.6	**Suitable**
146	Rose Gum (Eucalyptus grandis)	16	72	83	0.83	10--11	12--13	Excellent	Acceptable	Mature	Short-term (5-15 yrs)		Large mature specimen. Main stem bi-furcates. Union looks to be Ok at this stage. Union looks to be ok at this time but may cause future issues. Species generally considered to be a higher risk species for the propensity for branch failures	8.6	3.1	Low (unsuitable)
147	Rose Gum (Eucalyptus grandis)	18	60	64	0.64	12--13	15-16	Good	Acceptable	Mature	Short-term (5-15 yrs)		Large mature specimen. Species generally considered to be a higher risk species for the propensity for branch failures. Canopy slightly sparse. Remaining leaf still good condition	7.2	2.7	Low (unsuitable)

Tree Number	Species	Approx. Height (metres)	DBH (cm)	Approx. DRF (cm)	DRF (m)	Canopy Spread (metres diameter)		Health	Structure	Age Class	SULE	Image	Comments	Nominal TPZ (metres radius)	Nominal SRZ (metres radius)	Opinion
						N-S	E-W									
148	Marri (Corymbia calophylla)	11	45	52	0.52	9--10	11--12	Good	Good	Mature	Long term (>40 yrs)		Good specimen. Good aesthetic form/value. Canopy slightly sparse. Remaining leaf still good condition	5.4	2.5	**Suitable**
149	Jarrah (Eucalyptus marginata)	11	56, 50	110	1.1	12--13	12--13	Excellent	Good	Mature	Long term (>40 yrs)		Good specimen. Good aesthetic form/value. Multi-stemmed from ground level and looks to be regrowth off/around an old stump/original tree	6.7	3.4	**High Retention Value**

6. Further Considerations; Development Design and Construction

6.1 Protection of Trees as part of Development

It is difficult to provide any further specific comments for each Tree as to the potential of the impact from the development of this Site at this stage, as much of the impact caused will be very much dependent on the detailed design aspects of any proposed development.

The retention of the existing current ground level and soil profile and limiting excavations within a Tree's designated TPZ will however be of paramount and key importance in the success of the retention of any Tree.

Effective tree protection must also begin with good design and specifications, so that protection during the construction/landscape stages of a development will be achievable and practicably possible.

As an initial recommendation:

1. The Trees considered to have a very low retention value are recommended to be removed as part of the development process. Removal of any tree directly adjacent to a Tree to be retained must be undertaken in a manner that does not cause any damage to any of the above or below ground parts of the Tree being retained. Some of these Trees will need to be removed using sectional dismantling methods.

2. Retention of the Trees considered to be unsuitable is highly questionable in the context of what is proposed and they too would be suggested to be removed as part of the development process. Whilst some of these Trees are large mature trees that are in good health their structural condition and/or their typical species traits are considered likely to represent a high risk to the Site once development has been completed that may not be able to be managed or mitigated through canopy works without either extensive resources (expense) or the extent of canopy pruning undertaking resulting in the retention of the Tree being questionable anyway (i.e. the Tree is topped).

   Retention of a few of these Trees may however be viable in areas where there will be no or few 'targets' introduced into their fall zone.

3. **Retention of the Trees considered to have a high retention value is strongly recommended as they are considered to be good mature specimens of their given species that are currently in good health and structural form and highly suitable for the proposed situation.**

4. Retention of the other suitable Trees identified during this survey would also be encouraged.

5. The nominal TPZ of each Tree is strongly recommended to be overlaid onto all drawings and designs of the proposed development where the Tree is proposed to be retained.

   Where encroachments into a designated TPZ are found to be required, further discussion with an experienced independent arboricultural consultant is an important part of the tree protection process.

   This is not to say that some encroachment and development activity would not be permitted to be undertaken within a TPZ area as part of a development process. However any encroachment required/proposed will require further input and discussion with the arboricultural consultant as part of any detailed design process to determine what the potential impact on the given Tree will be, and what design modifications or measures may need to be implemented to mitigate any potential negative impact on the given Tree.

7. Further Considerations; Development Design and Construction

If considered necessary, some exploratory excavation works may also be required to verify actual root spread and determine what impact could occur.

Aspects such as resulting levels, delineation of any underground service pipework, drainage, sewerage etc. can all have (potentially) a major impact on a tree's root zone, and in turn its future health and potential lifespan.

During the detailed design process further arboricultural input will likely be required to discuss:

- Current existing ground levels and proposed resulting levels of the various areas of the Site. Note: As previously mentioned, retaining and maintaining current existing ground levels within the designated TPZ of any tree is of paramount importance to the success of tree retention.
- Delineation of any underground services pipework including drainage, sewerage, water, gas, electricity, telecommunications and the like; specifically should they pass through any designated TPZ.
- Location of any drainage near to the Trees and their TPZ.
- Any further site remediation requirements within TPZ areas as part of the Site clearing process.

Once development design has been furthered, tree protection method statements are recommended to be drafted for use during the construction stages of the development and include specific details of any:

- Protection measures for each Tree's TPZ area,
- Specifications for any works designed to occur within a TPZ area during the construction process,
- Canopy pruning works,
- Watering requirements,
- Monitoring requirements during construction

Including a degree of further arboricultural input is considered key to the success of the retention of any of the Tree's during the proposed development, and effective protection of trees during a development process must being with good design and construction specifications so that physical impact to any Tree's root zone during the construction stages will be limited.

7.2 Physical Protection of Trees during Development

Physical protection measures in accordance with AS 4970 will also be required for any Tree selected for retention; details of any measures to be implemented will be very much dependent on the final detailed design.

It will be of critical importance that the appropriate protection measures are set up and maintained from the outset.

Implementing tree protection measures after damage has occurred from works is often of little to no value other than affording some protection from further damages occurring.

7. Further Considerations; Development Design and Construction

7.3 Canopy Works

Minor amounts of canopy work may be required on a number of the Trees as part of the development process.

To some degree, the extent of canopy works on each Tree is however very much dependent on the eventual landscape around the Tree and what potential targets (people, structures etc.) may eventually be within the given Tree's projected fall zone.

At this stage canopy works are likely to be restricted to the removal of any larger diameter deadwood (i.e. any dead branches 50mm or greater in diameter) and/or the raising of canopy's where necessary to provide clearances for future footpaths, structures and/or roads.

All canopy works are recommended to be undertaken by suitably qualified and experienced tree surgeons, who possess a minimum qualification of AQF certificate 3 arboriculture or recognised equivalent qualification.

All canopy pruning works must also comply with Australian Standards 4373; Pruning of Amenity Trees.

Attachments to the Report

Attachment 1; Location Guide with Retention Value overlaid

Attachment 2; Glossary of arboricultural terms

Attachment 3; Company Information & Disclaimer

Attachment 1; Location Guide with Retention Value overlaid

Key

- High Retention Value Tree
- Suitable Tree
- Unsuitable Tree
- Very Low Retention Value (remove)

Client;	Four landscapes Studio
Site;	Dayton Primary School
Drawn by;	J Royal
Revision;	0
Date;	12/02/2020
Arial Source;	Nearmap.com
Scale;	1:1750

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Attachment 2; Glossary of Commonly Used Arboricultural Terms

Absorbing Root Smaller root structures that are utilised in the uptake of water and essential elements and soil minerals from the surrounding soil profile.

Bark All tissue outside the vascular cambium. Bark can be divided into 'inner bark' (active phloem) and 'outer bark' (aging and dead phloem).

Basal Lower trunk area of the tree.

Branch Part of the tree which supports its leaves flowers and fruit organs.

Can be further classified into:

Primary Branch Structures; meaning the larger first order branches that arise off the main stem or trunk of the tree.

Secondary Branch Structures; meaning smaller diameter sized branches that arise off the Primary Branch Structures.

Branch Collar Bark tissue that forms around the base of a branch where it meets its 'parent source' be it the main stem/trunk of the tree or primary branch structure. Formed as the bark layers of both sections of the plant meet and by their expansion as part of their natural growth processes and radial expansion.

Branch Bark Ridge Bark tissue that forms at the union of a branch where it meets its 'parent source' be it the main stem/trunk of the tree or another branch structure. Formed as the bark layers of both sections of the plant meet and by their expansion as part of their natural growth processes.

Canopy The part of the crown of a tree composed of the branch and leaf mass.

Cavity An open wound, characterized by the presence of decay and resulting in a hollow. (Matheny & Clarke, 1994).

Co-dominant stem A primary branch structure of about the same size as the trunk, arising from the trunk and competing to become the main dominant leading stem/trunk.

Compaction Compaction of soils causes roots to die due to lack of oxygen and water.

Compartmentalization Dynamic tree defence process involving protection features that resist the spread of pathogens.

Decay Degeneration and delignification of plant tissue, including wood, by pathogens and/or micro organisms.

Decline Decline is a general loss of vitality over the entire tree either caused by a systemic disease or by a series of events that disrupt the essential plant processes.

Epicormic shoots Shoots produced by dormant buds within the bark or stems of a tree as a result of stress, lopping or increased light factors. Epicormic shoots usually have a weaker form of branch attachment.

Furcation A point where two (or more) trunk or branch structures arise from the same point of union and subsequently compete for the same physical space at the point of attachment.

Glossary of Commonly Used Arboricultural Terms

Hollows Hollows from when wood-digesting microorganisms digest wood within the boundaries set by the reaction zone or the barrier zone.

Included bark Inwardly formed bark or bark found in between the union of a co-dominant or 'furcated' branch/trunk. Typically (although not always) this leads to an area of decay forming at the point of union leading to an increased risk of failure.

Kino A dark red to brown resin-like substance produced by the trees in the genera *Eucalyptus* and *Corymbia*. Kino forms when living cells are injured and infected.

Live Crown Ratio The volume of canopy of the tree relative to its overall height.

Lopping Random cutting of branches or a tree's trunk between a union or not at a proper pruning point or in accordance with Australian Standards Guidelines.

Main Stem Structure The main stem section of the tree. Also commonly referred to as the trunk of a tree.

Mycorrhiza A symbiotic non pathogenic (or weakly pathogenic) relationship between fungi and the non-woody absorbing roots of plants. Note: Research has shown that certain mycorrhiza can aid a tree with mineral absorption, especially phosphorus.

Micro-organisms An organism of microscopic size.

Pathogen Any agent that causes disease or adversely affects the health of the plant. Can include insect, fungal, viral and bacterial agents.

Photosynthesis A process where a combination of water, sunlight and carbon dioxide are utilised by the plant for the production of simple sugars.

Scaffolding Limbs/Branch Structures The parts of the tree that provide support to the smaller secondary branch structures. Can also be sometimes referred to as the primary branch structures, or stems.

Supportive Root Structures An organ of a tree that serves to maintain the mechanical support and in-ground stability of the plant.

Stem The parts of the tree that provide support to the smaller secondary branch structures. Can also be sometimes referred to as the primary branch structures, or 'scaffolding' limbs/branch structures.

Tree Long lived woody perennial plant greater than (or potentially greater than) 3m in height with one or relatively few stems.

Trunk The main stem section of the tree. Also commonly referred to as a stem or main stem.

Wound An opening that is created when the bark is cut, removed or injured.

Attachment; Company Information and Disclaimer

Company Name:	ARBOR logic
A.C.N.:	107 194 061
A.B.N.:	66 566 369 687

Insurance Details:

General Liability;	Woodina	$20 million
Professional Indemnity;	Woodina	$5 million
Personal Protection;	Zurich	

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MEMBER ISA J. Royal; 172723

QTRA Registered User Lisc. No. 1743

Disclaimer

This Report has been provided in good faith and based upon the material information provided by the Client to Arbor logic, and/or based on the visual inspection of the tree(s) at the time this advice was prepared.

The contents of this Report should be read in full, and at no time shall any part of the Report be referred to unless taken in full context with the remainder of the document.

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- The provision of misleading or incorrect information by the Client or any other party to Arbor logic upon which this advice was prepared.
- This advice being used by the Client or any other party in circumstances or situations other than the specific subject of this advice.
- Failure by the Client to follow this advice.
- The action(s) or inaction(s) of the Client or any other party that gives rise to the loss of, or damage to, the tree(s) that are the subject of this advice.

It is also important to take into consideration that all trees are living organisms and as such there are many variables that can affect their health and structural properties that remain beyond the scope of reasonable management practices or the advice provided in this Report based on the visual inspection of the tree(s).

As such a degree of risk will still remain with any given tree(s) despite the adoption of any best management practices or recommendations made in this Report.

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To :	Stantec	**Date :**	4 May 2021
Attention :	Darren Pesich	**Our Ref :**	J7050a
Email :	*Darren.pesich@stantec.com*	**Pages :**	14
cc :	Bronwyn Clements (Bronwyn.clements@stantec.com)		

DAYTON PRIMARY SCHOOL – SITE WATER MANAGEMENT PLAN

1. INTRODUCTION

The proposed Dayton Primary School is located on Cranleigh St between Arthur St and Blundell St. The total area is 5.66 ha, of which 4.63 ha is proposed for the school site (Figure 1).

The school site formed the entirety of catchment CR3 within the West Swan East LWMS (JDA, 2014), with a single basin proposed to manage runoff from the catchment.

The proposed design removes the single stormwater basin, and stormwater is to be managed through swales, underground storage and a small basin, prior to discharge to the Cranleigh St swale system.

2. LWMS CONSTRAINTS

The West Swan East LWMS (JDA, 2014) was approved in 2014. It details water management within the West Swan East area. The proposed school site is within the Cranleigh Street Catchment which ultimately discharges to the Malvern Street Drain to the east.

The proposed school site is catchment CR3 (see Figure 2). This catchment discharges southward to a series of swales immediately south of Cranleigh St. Currently there is no connection from the eastern most extent of the swales at Blundell St, through to the Malvern St Drain and the swales currently act as infiltration swales.

Discharge from the catchment to the Cranleigh St swales is constrained, with flows rates based on pro rata areas. The LWMS documents that the outflow from the CR3 conceptual basin is 0.03 m^3/s for the 5 year ARI (~20% AEP) event and 0.04 m^3/s for the 100 year ARI (1% AEP) event.

As the revised school site covers an area of 4.63 ha compared to the total area of 7.3 ha, on a pro rata basis, the 20% and 1% AEP flows permissible from the school site are 0.019 m^3/s (19 L/s) and 0.025 m^3/s (25 L/s) respectively.

The LWMS also documents groundwater AAMGL contours and areas that are suitable for soakwells and where subsoil drainage is recommended. The Study Area is within the area for soakwell drainage and the western half of the area is within the subsoil drainage area.

3. ENVIRONMENT

RAINFALL

Annual rainfall recorded at the Bureau of Meteorology (BoM) Midland gauging station (station no. 009025, 1914 to 2019) is shown in Figure 3. The long term average annual rainfall at the station is 789 mm. The average rainfall has decreased in recent years, with a 30 year (1990-2019) average of 730 mm, and a 10 year (2010-2019) average of 655 mm. A similar reduction in rainfall has been seen throughout South West WA.

GEOTECHNICAL ASSESSMENT

A detailed geotechnical assessment has been completed by Douglas Partners in March 2021. Test pits were installed across the Study Area (Figure 4).

The investigation found that the site was generally comprised of sand (overlain by thin topsoil), with cemented (coffee rock) layers found in the western section of the site. Clayey soils from the Guildford Formation were observed at lower depths in three test pits in the south western section of the site.

The clayey soils will form an impediment to vertical flow of water through infiltration. The more cemented layers of coffee rock will also restrict vertical flow of water, depending upon the degree of cementation.

Groundwater was observed in a number of test pits (see section below), though a number of these were based on observed seepage from the test pit walls. These seepages were generally within coffee rock or clayey sand layers. It should be noted that the estimated surface levels in Table 1 of the Douglas Partners (2021) report differ from those estimated by JDA from the Brown McAllister January 2021 surveyed levels for the test pit locations, and hence it is considered (by JDA) that the estimated groundwater levels in Table 2 of the Douglas Partners (2021) report are incorrect. Estimated JDA groundwater levels are presented in Table 1 below.

Infiltration testing was performed as part of the investigation, with falling head method carried out at TP6 and TP17, at depths below natural surface of 1.8 m and 1.2 m respectively. Soil samples were also collected, and particle size distribution testing performed, and the results used to estimate permeability using Hazen's formula (it should be noted that this method tends to overestimate permeability). The falling head method gave permeabilities of 1 m/d and 8 m/d for TP6 and TP17 respectively. The Hazen's formula method gave permeabilities of 19 m/d and >25 m/d for TP6 and TP17 respectively. Douglas Partners (2021) suggested using a permeability of 0.8 m/d for preliminary design permeability to allow for possible variations in soil fines content and densification of the sand during site construction.

GROUNDWATER

The AAMGL from the LWMS for the School site is shown in Figure 4. This AAMGL was estimated using data collected in 2005 and 2006. One monitoring bore (AS9) was located at the north west corner of the site, with a second (AS8) located at the south east corner (Figure 4). In addition, one of the long term DWER monitoring bores (MM48) was located in the south east corner of the site. Estimated AAMGL values at the test pit sites are given in Table 1.

The observed groundwater levels during the geotechnical investigation (15 & 16 February 2021) are presented in Table 1. These groundwater levels will be close to the summer minimum levels.

TABLE 1: GROUNDWATER LEVELS FROM GEOTECHNICAL INVESTIGATION (DOUGLAS PARTNERS (2021)

Test Pit	Approx. Surface Elevation [1] (mAHD)	Groundwater Depth, 15 & 16 Feb 2021 (m)	Groundwater Level, 15 & 16 Feb 2021 (mAHD)	Estimated AAMGL from LWMS (mAHD)
TP1	19.8	2.05	17.75	19.0
TP2	19.75	2.00	17.75	18.75
TP3	19.35	2.40	16.95	18.7
TP4	19.55	2.40 [2]	17.15	18.75
TP5	20.45	2.80	17.65	16.65
TP6	19.45	2.10 [2]	17.35	18.5
TP8	19.35	1.95 [2]	17.40	18.2
TP9	19.15	1.75 [2]	17.40	18.45
TP12	19.65	1.90 [2]	17.75	18.6

Notes: 1. Elevation data estimated from Brown McAllister survey Jan 2021 (note levels in Geotech report are wrong)
2. Level estimated from observed groundwater seepage during geotechnical investigation.

Groundwater levels observed in the test pits in February 2021 are 0.8 to 1.7 m lower than the estimated AAMGL – this is as expected for a summer groundwater level measurement.

The AAMGL contours are used in the assessment of the proposed surface water management system for the school, as described below.

4. PROPOSED DESIGN

The proposed school layout is shown in Figure 5, with school buildings in the west and oval in the east. Rather than managing rainfall runoff using a single basin (as shown in the LWMS – Figure 2), it is proposed to use a combination of distributed underground storage / infiltration and swales to provide attenuation prior to discharge from the site.

5. STORMWATER MANAGEMENT

Management of runoff within the school site will be managed through attenuation via interconnected underground storages and swales prior to discharge to the drainage swales on the south side of Cranleigh St. As calculated in Section 2, the discharge criteria are a maximum flow rate of 0.025 m^3/s for the 1% AEP event and 0.019 m^3/s for the 20% AEP event.

PROPOSED MANAGEMENT

A catchment plan for the site is shown in Figure 6, with building roof runoff discharging to adjacent storages. Courtyard areas will also drain to local storages. Landscaped areas will have some infiltration within the areas, with overflow to storages. The oval is to be graded such that any runoff will drain from north east to south west, where a swale is to be located.

The proposed water management is shown in Figure 7.

The proposed underground storage units are 800 mm square and 350 mm high and arranged in a grid. Five of these arrays are located within the carparks, and three located within courtyard areas. A ninth is proposed for the eastern section within the future Educare Centre. The carpark arrays also have surface storage within the carpark areas for the 1% AEP event.

The drainage arrays will have a minimum 500 mm separation to the AAMGL. Pipe outlet inverts from all 9 arrays will be 50 mm above the array inverts to facilitate infiltration within the arrays.

The tree corridor along the northern boundary (north of school buildings) will be maintained at existing natural surface elevation, which will be lower than the filled school site immediately south. This area will therefore provide storage for stormwater runoff from the local area and the area north of the oval. A pipe connection to Drainage Array 8 will provide an outlet for any water in the swale which does not infiltrate.

The central tree corridor will have a shallow swale graded to the south. This will capture runoff from the oval and eastern areas. A minor swale will be located along the southern boundary of the oval to capture upstream flow (Figure 6). A pipe connection to Drainage Array 5 will provide an outlet for any water in the swale which does not infiltrate.

All drainage arrays and swales will be connected by a pipe system, with a single pipe connection at the south western corner providing an outlet to the Cranleigh St drainage swales. This pipe connection will be sized to provide the appropriate attenuation of flow rates.

An earthworks and drainage plan by Stantec is attached as Appendix A.

HYDRAULIC MODELLING

The proposed stormwater management system has been modelled by JDA using XP-Storm based on the methodology in Australian Rainfall and Runoff (IEAust, 1987). The rainfall temporal pattern was assumed to be spatially uniform across the catchment. Storms modelled range from 30 minutes to 72 hours duration.

Australian Rainfall and Runoff (ARR) 1987 (IEAust, 1987) was used in the stormwater modelling for this report rather than the recently released Australian Rainfall and Runoff 2019 (Ball et al., 2019), for consistency with the LWMS (JDA, 2014) and other UWMP's for the adjoining developments.

The adopted rainfall runoff loss model for the site is presented in Table 2.

TABLE 2: RUNOFF LOSS MODEL

Loss Model	Carpark	Roof Areas	Courtyards & Play	Turf and Landscaping
Initial Loss (mm)	1.5	0	2	10
Proportional Loss (%)	15	20	40	85

Infiltration within the drainage arrays and swales was included, at the rate of 0.8 m/d recommended by Douglas Partners (2021). Infiltration will be a combination of vertical and horizontal flows.

Pipe connections within the school site were modelled as 300 mm diameter pipes.

The central tree corridor swale was modelled with a 1 m base width and 1:6 side slopes. The minor swale along the southern boundary of the oval was modelled with a 0.1 m base width and 1:6 side slopes.

The details of the nine drainage arrays are shown in Table 3 below.

TABLE 3: UNDERGROUND DRAINAGE ARRAY DETAILS

Drainage Array	Array Invert (mAHD)	Outlet Invert (mAHD)	Array Plan Area (m^2)	Array Volume (m^3)
1	19.35	19.40	43.52	14.76
2	19.20	19.25	25.60	8.68
3	19.02	19.07	25.60	8.68
4	19.19	19.24	145.92	49.48
5	19.25	19.30	238.08	80.72
6	18.93	18.98	391.04	132.59
7	19.80	19.85	116.48	39.49
8	19.18	19.23	614.40	208.32
9	19.38	19.43	102.40	34.72

The proposed system was simulated in XP-Storm iteratively with varying pipe / orifice plate sizing (for the link connecting to the Cranleigh St swale) until the discharge rates matched the peak flow criteria.

An orifice diameter of 100 mm was required to attenuate flow to required rates for the 20% and 1% AEP events. This will be required to be installed at the final junction pit prior to the Cranleigh St crossing.

In the 20% AEP event, all runoff is contained within the drainage arrays (with no surcharging), with minor water depths within the swales (< 50 mm depth) to the west and south of the oval. The 30 minute duration event is critical, with a peak flow rate of 0.018 m^3/s at the discharge location.

In the 1% AEP event there is some surface storage above the arrays within the carparks, however there is no surcharging of the drainage arrays within the courtyard areas. Figure 8 shows the 1% AEP event plan.

In the northern tree corridor swale, in the 1% AEP event there will be up to 600 mm ponding depth, however this will drain within 4 hours of storm cessation. In the 20% AEP event the flood depth is less than 50 mm.

Flow depth in the swales south and west of the oval is less than 100 mm for the 1% AEP event.

In summary, the key elements of the proposed drainage system are as follows:

- Underground drainage arrays, carparks and swales within the tree corridors provide flood storage for the 20% and 1% AEP events.
- Underground drainage arrays will have a minimum 500 mm separation between invert and AAMGL.
- A 300 mm pipe system will connect the arrays and swales to the outlet connection location. The outlet will require a 100 mm diameter orifice plate to attenuate flow to required rates.
- All runoff is contained within the arrays and swales in the 20% AEP event, with peak flow from the site restricted to 0.018 m^3/s, within the LWMS criteria.
- All runoff is contained with the arrays, carparks and swales in the 1% AEP event, with peak outflow from the site restricted to 0.025 m^3/s, within the LWMS criteria.

6. REFERENCES

Douglas Partners (2021) *Report on Geotechnical Investigation – Proposed Dayton Primary School, 11 Blundell St, Dayton*, prepared for Stantec Australia Pty Ltd, Project 201389.00, March 2021.

JDA (2014) *West Swan East: Local Water Management Strategy*, prepared for St Leonards Estate Pty Ltd, JDA ref: J5132l, July 2014.

Please contact Alex Rogers or Jim Davies of this office with any queries.

Regards,

JDA CONSULTANT HYDROLOGISTS

FIGURES

Figure 1: Location Plan

Figure 2: Catchment Plan from LWMS (JDA, 2014)

Figure 3: Annual Rainfall at Midland BoM Station

Figure 4: Geotech and AAMGL Contours

Figure 5: Proposed School Layout

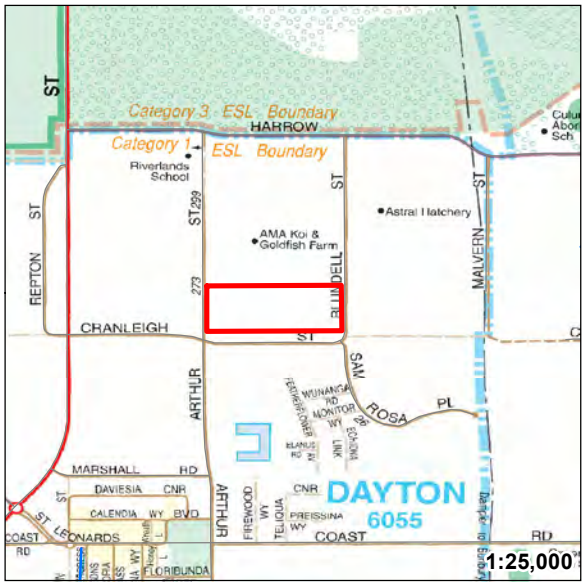
Figure 6: School Catchment Plan

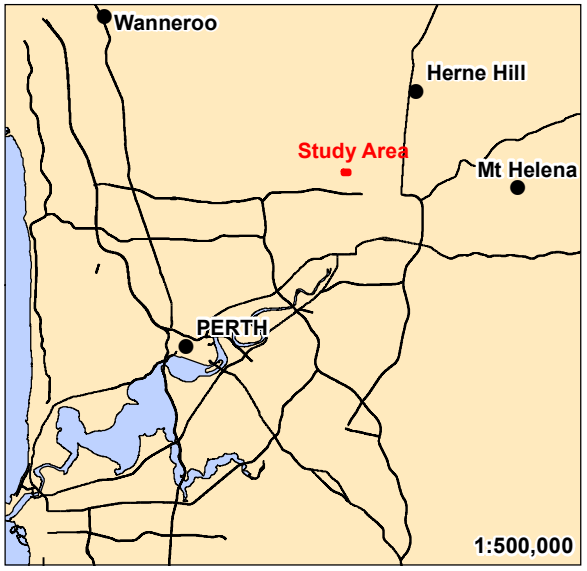
Figure 7: School Water Management

Figure 8: 1% AEP Event Plan

APPENDICES

Appendix A: Stantec Earthworks and Drainage Plan





Data Source: Nearmap Digital Imagery (27 February 2021); StreetMap (2012)

Coordinate System: GDA 94, Zone 50

JDA

Job No. J7050
Scale: 1:3,000 @A4

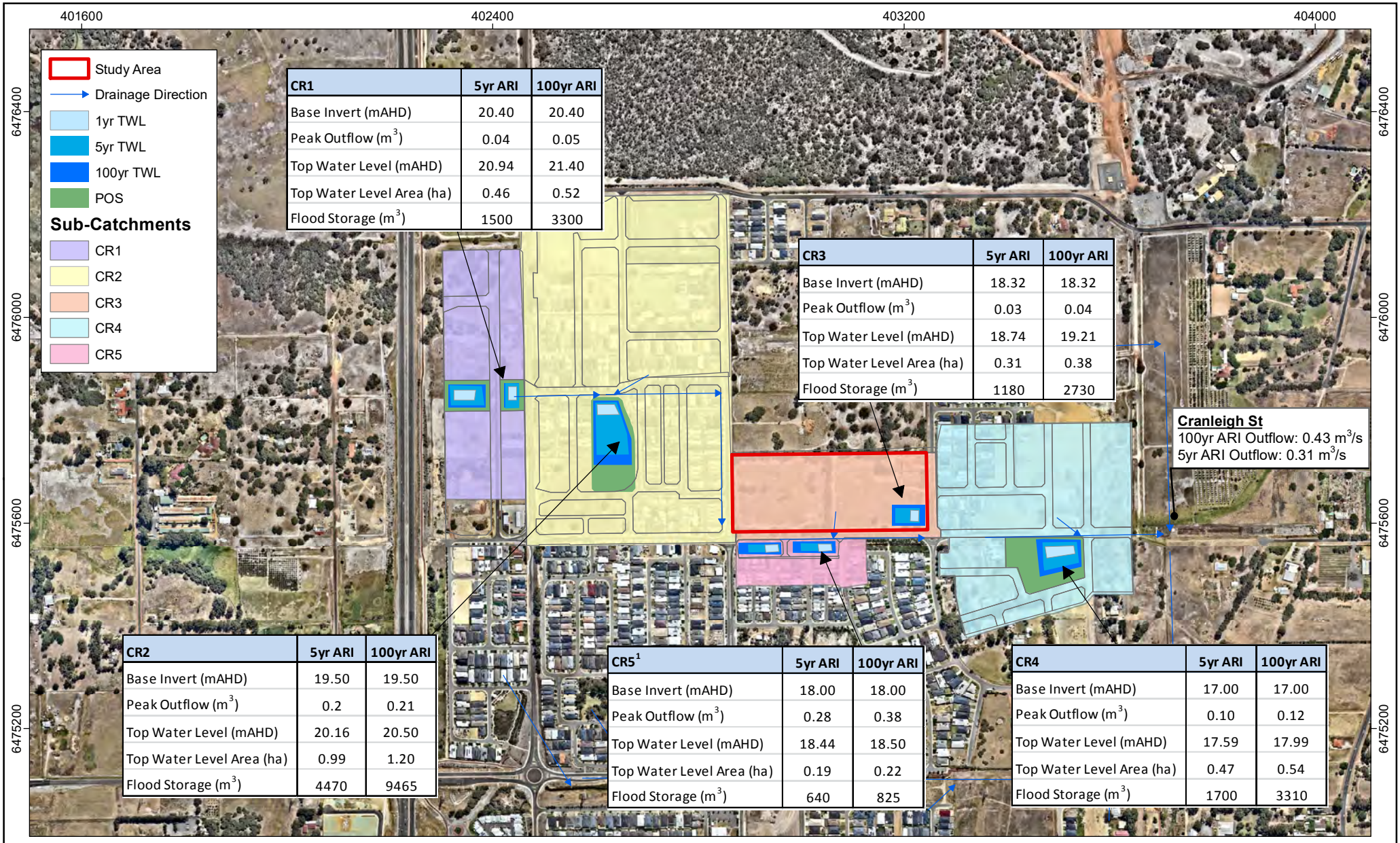
0 50 100 150 200 Metres

N

Stantec

Dayton Primary School: Site Water Management Plan

Figure 1: Location Plan



CR1	5yr ARI	100yr ARI
Base Invert (mAHD)	20.40	20.40
Peak Outflow (m^3)	0.04	0.05
Top Water Level (mAHD)	20.94	21.40
Top Water Level Area (ha)	0.46	0.52
Flood Storage (m^3)	1500	3300

CR3	5yr ARI	100yr ARI
Base Invert (mAHD)	18.32	18.32
Peak Outflow (m^3)	0.03	0.04
Top Water Level (mAHD)	18.74	19.21
Top Water Level Area (ha)	0.31	0.38
Flood Storage (m^3)	1180	2730

CR2	5yr ARI	100yr ARI
Base Invert (mAHD)	19.50	19.50
Peak Outflow (m^3)	0.2	0.21
Top Water Level (mAHD)	20.16	20.50
Top Water Level Area (ha)	0.99	1.20
Flood Storage (m^3)	4470	9465

CR5[1]	5yr ARI	100yr ARI
Base Invert (mAHD)	18.00	18.00
Peak Outflow (m^3)	0.28	0.38
Top Water Level (mAHD)	18.44	18.50
Top Water Level Area (ha)	0.19	0.22
Flood Storage (m^3)	640	825

CR4	5yr ARI	100yr ARI
Base Invert (mAHD)	17.00	17.00
Peak Outflow (m^3)	0.10	0.12
Top Water Level (mAHD)	17.59	17.99
Top Water Level Area (ha)	0.47	0.54
Flood Storage (m^3)	1700	3310

Data Source: JDA (2014)

Coordinate System: GDA 94, Zone 50

Job No. J7050
Scale: 1:10,000 @A4

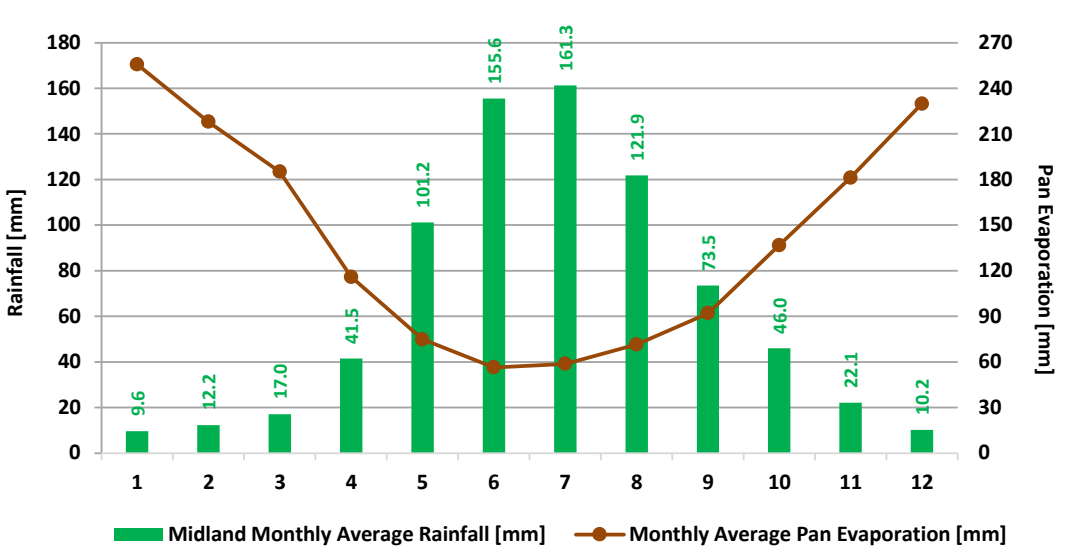
0 100 200 300 400 Metres

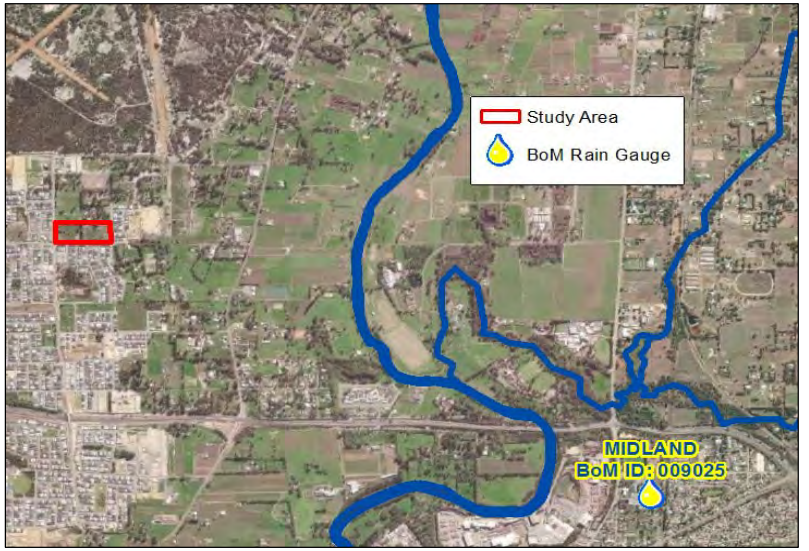
N

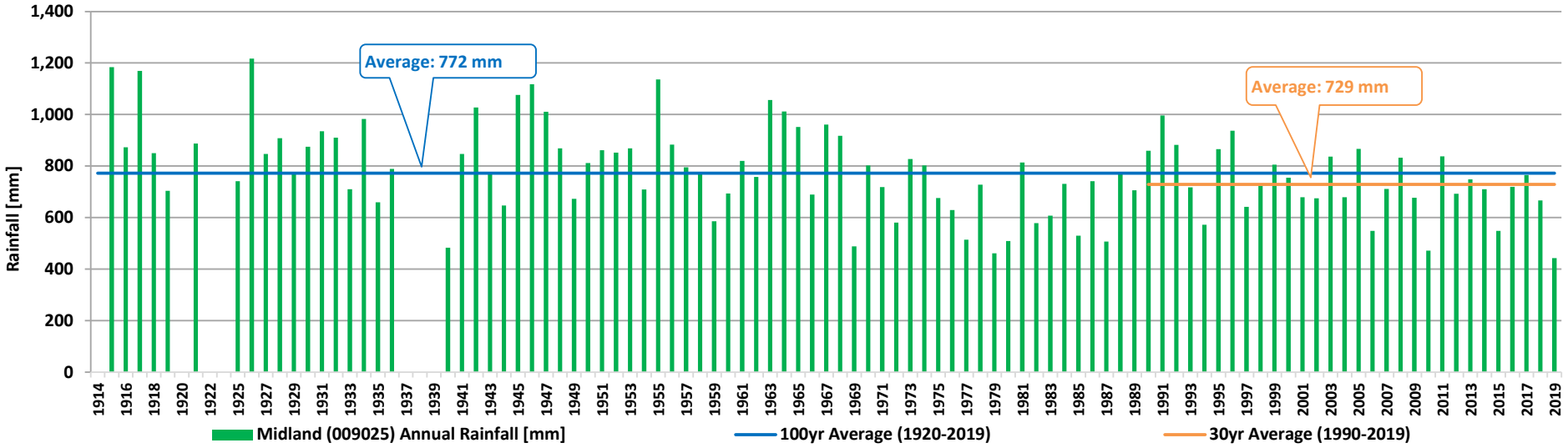
Stantec

Dayton Primary School: Site Water Management Plan

Figure 2: Catchment Plan from LWMS (JDA, 2014)







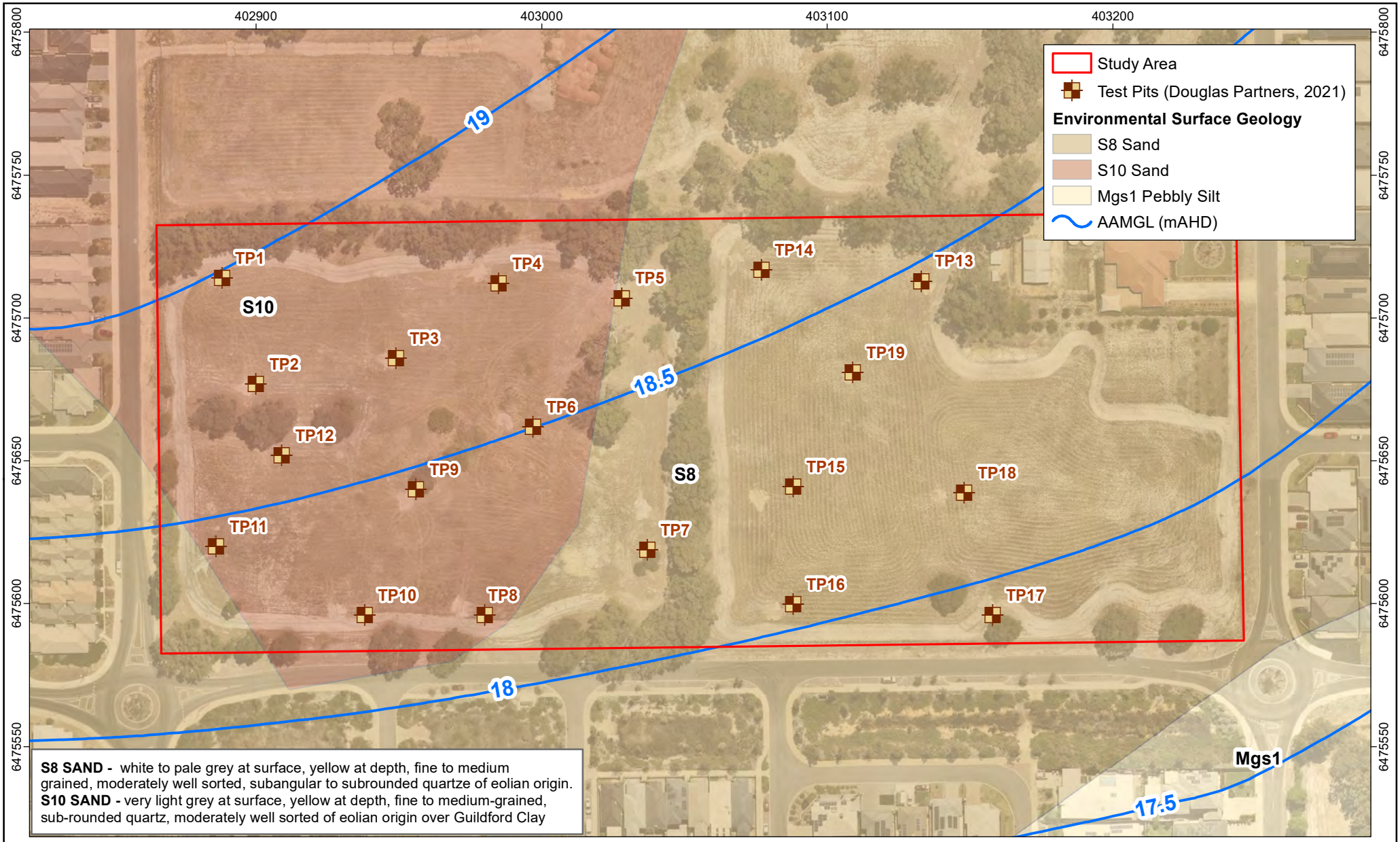
Data Source: BoM (2020) Climate Data Online; Luke (1998) *Evaporation Data for Western Australia*

Job No. J7050

Stantec

Dayton Primary School: Site Water Management Plan

Figure 3: Annual Rainfall at Midland BoM Station



Data Source: Douglas Partners (2021); JDA (2014); Gozzard (1986).

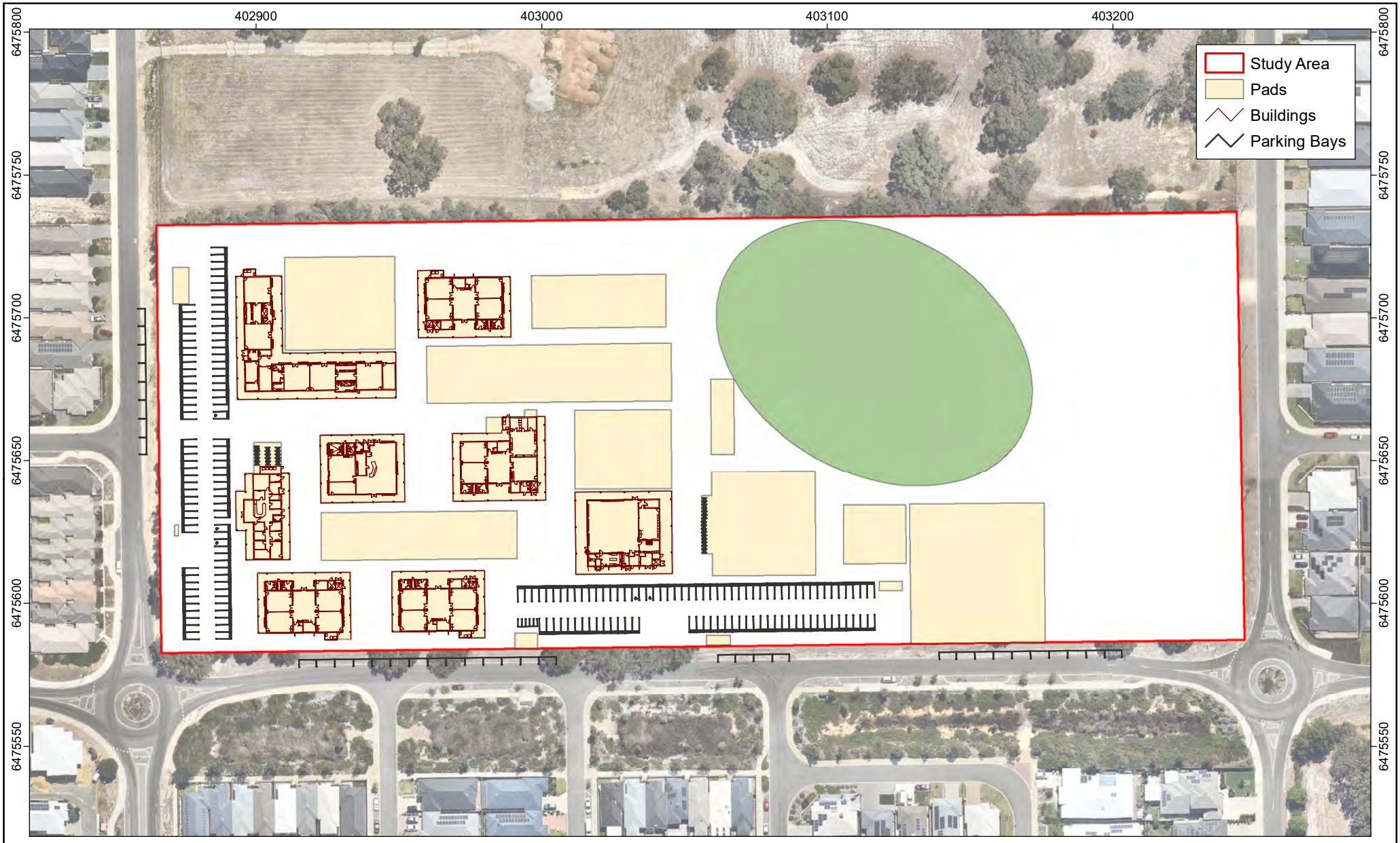
Coordinate System: GDA 94, Zone 50

JDA

Job No. J7050
Scale:1:1,800 @A4
0 20 40 60 80
Metres

N

Stantec
Dayton Primary School: Site Water Management Plan
Figure 4: Geotech and AAMGL Contours



Data Source: Stantec (2021).

Coordinate System: GDA 94, Zone 50

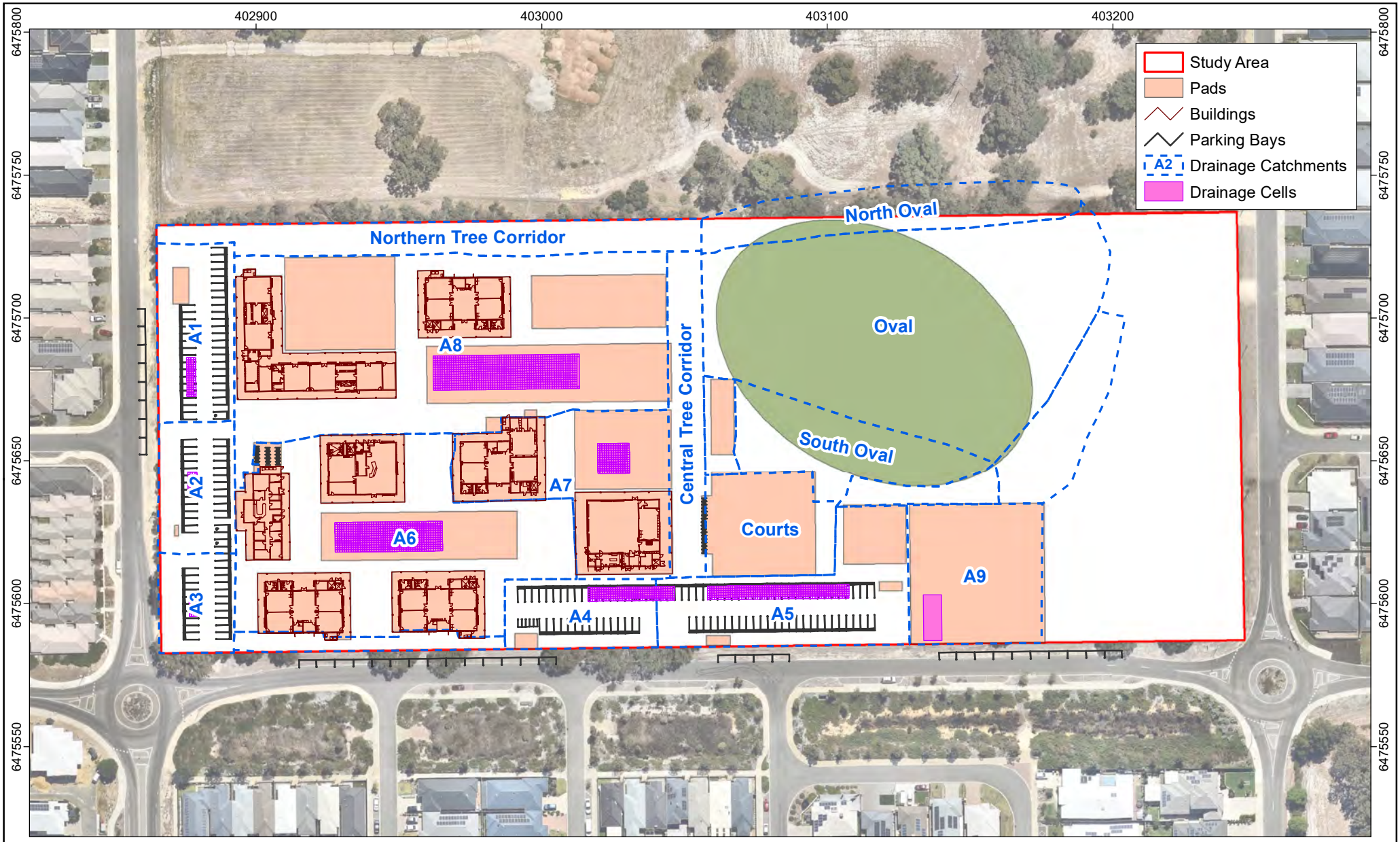
JDA

Job No. J7050
Scale:1:1,800 @A4

0 20 40 60 80
Metres

N

Stantec
Dayton Primary School: Site Water Management Plan
Figure 5: School Layout



Data Source: Stantec (2021).

Coordinate System: GDA 94, Zone 50

JDA

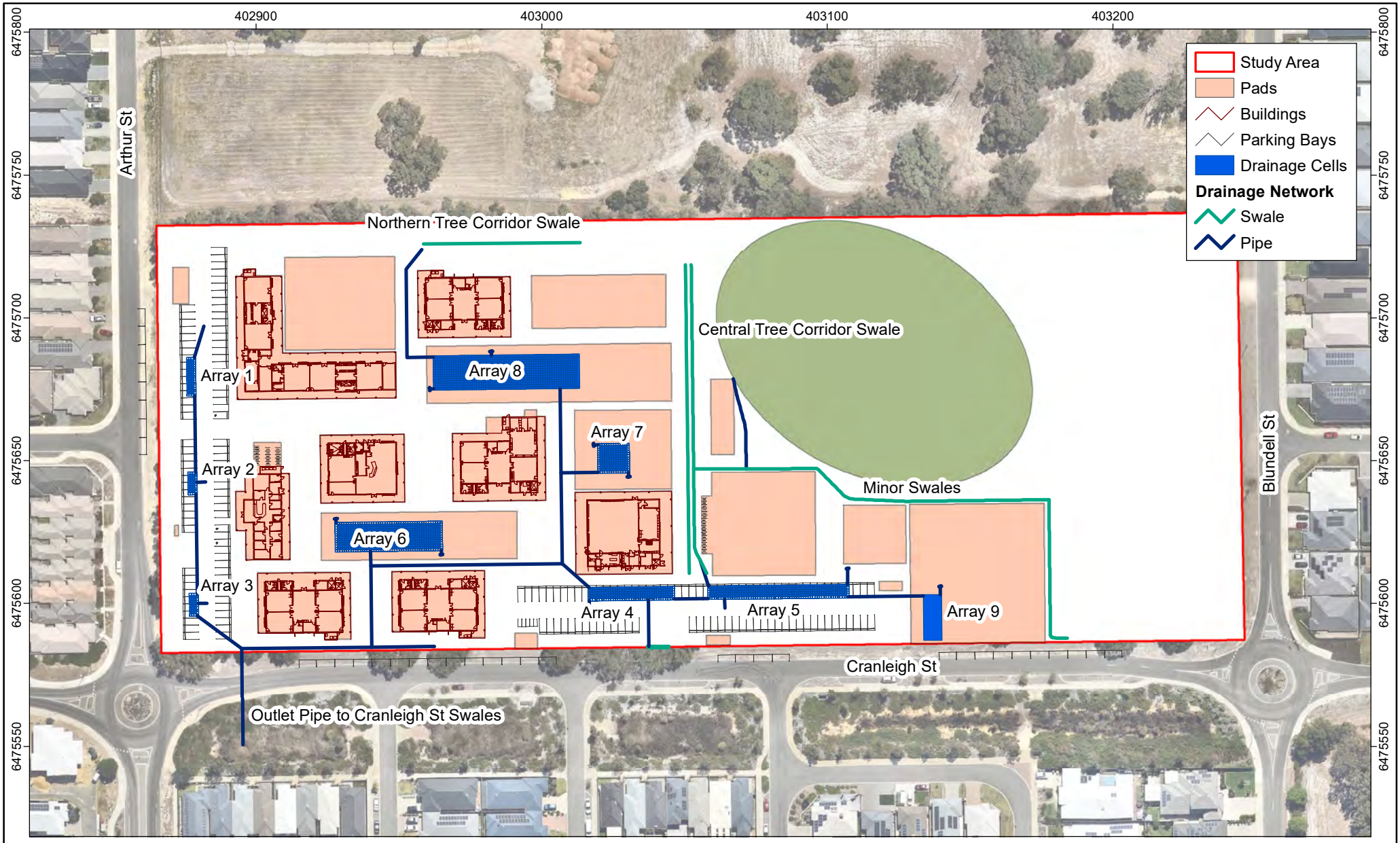
Job No. J7050
Scale:1:1,800 @A4

0 20 40 60 80 Metres

N

Stantec
Dayton Primary School: Site Water Management Plan

Figure 6: School Catchment Plan



Data Source: Stantec (2021).

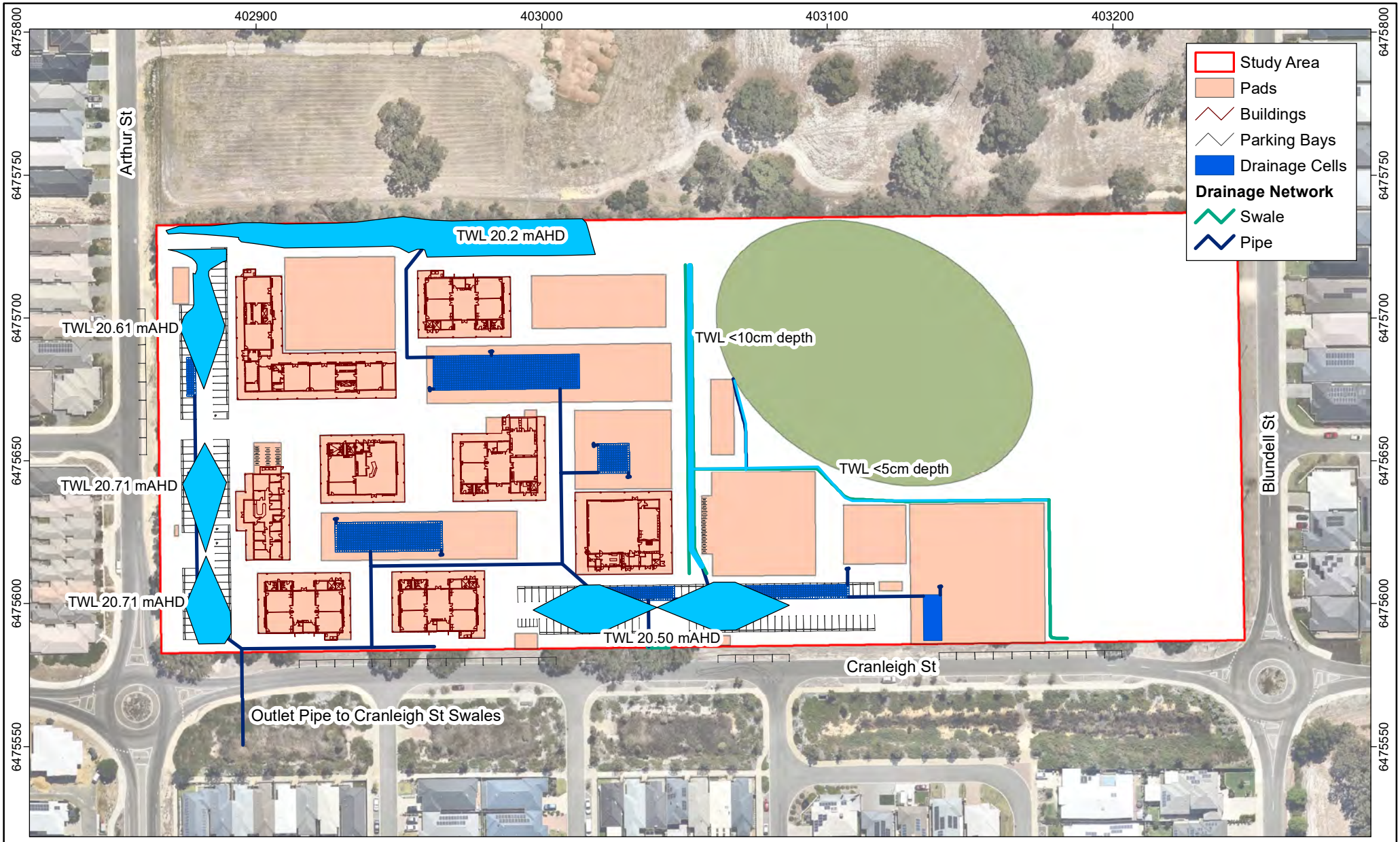
Coordinate System: GDA 94, Zone 50

Job No. J7050
Scale:1:1,800 @A4

0 20 40 60 80 Metres

N

Stantec
Dayton Primary School: Site Water Management Plan
Figure 7: School Water Management



Data Source: Stantec (2021).

Coordinate System: GDA 94, Zone 50

JDA

Job No. J7050
Scale: 1:1,800 @A4

0 20 40 60 80 Metres

N

Stantec
Dayton Primary School: Site Water Management Plan
Figure 8: 1% AEP Event Plan

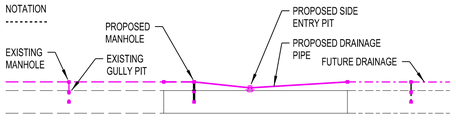
DATE PLOTTED: 28/04/2021 7:07:22 PM

LEGEND

- EXTENT OF BOUNDARY
- 10.0 DESIGN CONTOURS
- 10.0 EXISTING CONTOURS
- EXISTING ROAD
- PROPOSED ROAD
- PROPOSED FOOTPATH
- PROPOSED RETAINING WALL
- PROPOSED HEADWALL
- SD PROPOSED DRAINAGE PIPE AND PIT
- PROPOSED STRIP DRAIN
- PROPOSED SWALE (INDICATIVE, SUBJECT TO SITE WATER MANAGEMENT PLAN REPORT)
- EXISTING DRAINAGE PIPE AND PIT
- INSPECTFLEX CELLS (BOTTOM LAYER ONLY) PROPOSED GRAF ECOBLOC MAXX (OR EQUIVALENT) DRAINAGE CELL ARRAYS AS APPROVED BY THE CIVIL ENGINEER (INDICATIVE, SUBJECT TO SITE WATER MANAGEMENT PLAN REPORT)
- GRAF VARIO 800 FLEX SHAFT SYSTEM WITH TRAFFICABLE MAXI CAST IRON TELESCOPIC DOME SHAFT COVER (OR EQUIVALENT), SET FLUSH WITH FSL
- FUTURE DRAINAGE CELL ARRAY
- PROPOSED CONNECTION POINT TO HYDRAULIC SYSTEM REFER TO HYDRAULIC DRAWINGS FOR INFORMATION

- W EXISTING WATER
- S EXISTING SEWER
- P EXISTING SEWER
- 18.7 AAMGL LINE
- EXISTING TREE TO RETAIN
- × 20.79 PROPOSED SPOT LEVEL

NOTATION



- B1 BUBBLE UP PIT
- R1 RAISED GULLY PIT
- SPT GROSS POLLUTANT TRAP
- DS1 DOUBLE SIDE ENTRY PIT
- S1 SIDE ENTRY PIT
- C1 COMBINATION PIT
- M1 ACCESS CHAMBER
- G1 GULLY PIT
- ØXXX PROPOSED GULLY DIAMETER
- G1 PIT NUMBER / DESCRIPTOR
- XX.XX PROPOSED DEPTH TO INVERT

300/4' PIPE DIA. & CLASS
240 PIPE GRADE
18.65 — 18.97 INVERT LEVEL
38.5 LENGTH

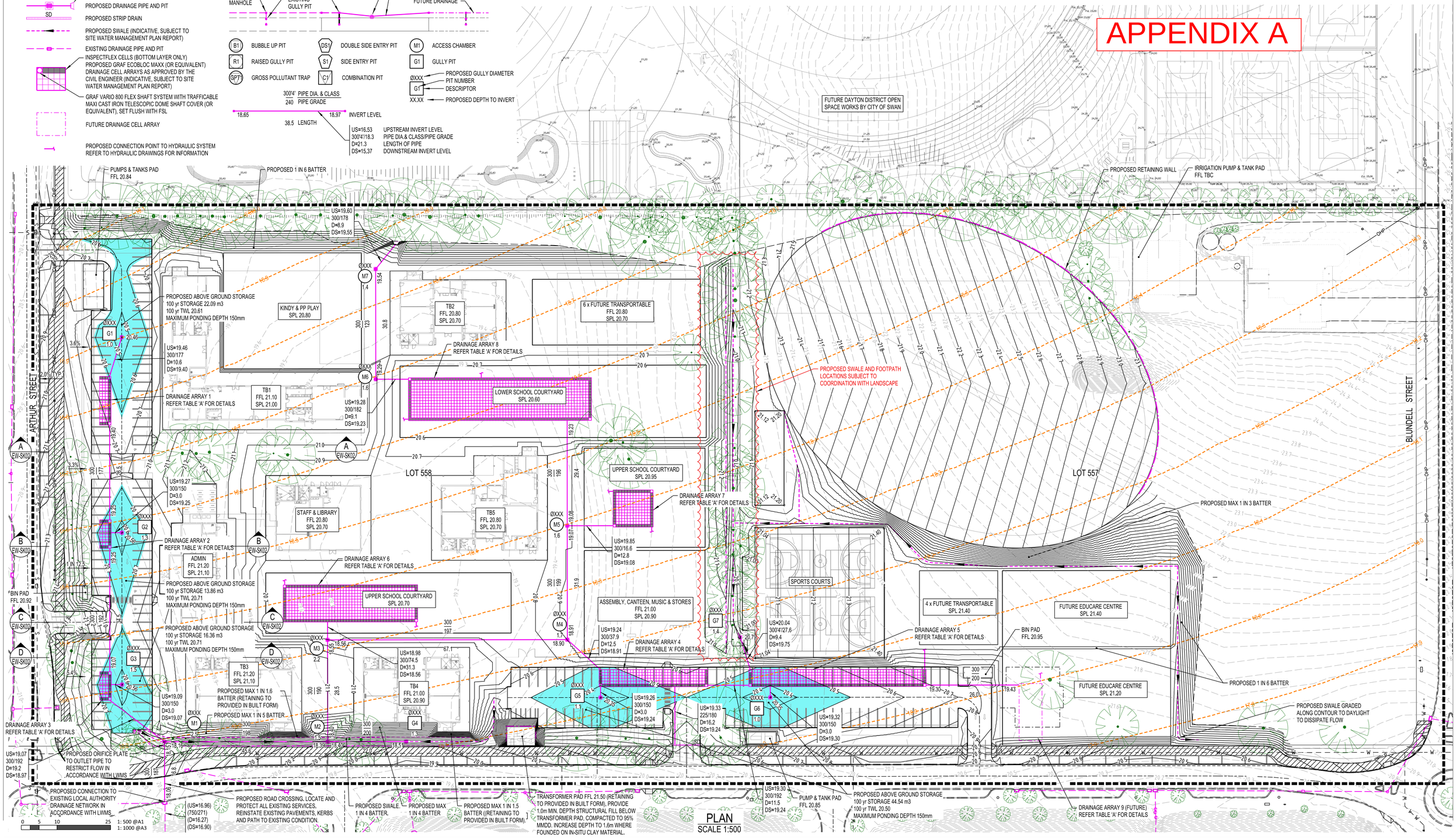
US=16.53 UPSTREAM INVERT LEVEL
300/4'/18.3 PIPE DIA & CLASS/PIPE GRADE
D=21.3 LENGTH OF PIPE
DS=15.37 DOWNSTREAM INVERT LEVEL

TABLE A

1 in 100 YEAR STORM EVENT - EXTERNAL TO BUILDING IMPERVIOUS AREAS + BUILDING ROOF AREAS STORMWATER DISCHARGE + HARD LANDSCAPED AREAS

	DRAINAGE ARRAY 1	DRAINAGE ARRAY 2	DRAINAGE ARRAY 3	DRAINAGE ARRAY 4	DRAINAGE ARRAY 5	DRAINAGE ARRAY 6	DRAINAGE ARRAY 7	DRAINAGE ARRAY 8	DRAINAGE ARRAY 9 (FUTURE)
REQUIRED VOLUME	13.46m³	6.08m³	6.08m³	47.95m³	78.23m³	127.19m³	35.98m³	197.83m³	33.20m³
STORAGE VOLUME PROVIDED	14.76m³	8.68m³	8.68m³	49.48m³	80.72m³	132.59m³	39.49m³	208.32m³	34.72m³
NUMBER OF MODULES	68 (4 ROWS x 17 LINES x 1 LAYER)	40 (4 ROWS x 10 LINES x 1 LAYER)	40 (4 ROWS x 10 LINES x 1 LAYER)	228 (6 ROWS x 38 LINES x 1 LAYER)	372 (6 ROWS x 62 LINES x 1 LAYER)	611 (13 ROWS x 47 LINES x 1 LAYER)	182 (13 ROWS x 14 LINES x 1 LAYER)	960 (15 ROWS x 64 LINES x 1 LAYER)	160 (8 ROWS x 20 LINES x 1 LAYER)
BASE AREA	43.52m²	25.60m²	25.60m²	145.92m²	238.08m²	391.04m²	116.48m²	614.40m²	102.40m²
BASE RL	19.35	19.20	19.02	19.19	19.25	18.93	19.80	19.18	TBC
TOP RL	19.70	19.55	19.37	19.54	19.60	19.28	20.15	19.53	TBC

APPENDIX A



PLAN
SCALE 1:500

REV	DESCRIPTION	DRAWN	APP'D	DATE
B	ISSUED FOR HYDROLOGY REVIEW	LUL	BC	28/04/2021
A	PRELIMINARY ISSUE	LUL	BC	16/04/2021

CHRISTOU
ARCHITECT/CLIENT

DAYTON PRIMARY SCHOOL
EARTHWORKS AND DRAINAGE PLAN SKETCH
PROJECT/TITLE

Stantec

PRELIMINARY
NOT FOR CONSTRUCTION
CIVIL

WAPC	COORDS	DATUM	SCALE @ A1	PROJECT No	DRAWING No	REV
-	PCG94	mAHD	1:500	301250182	CI-109-EW-SK03	B

CAD FILE: P:\301250182\Project Documentation\Civil\Drawings & Designs\ Sketch Drainage.dgn

MATTHEW LE MEUR

From: Fisher, Daniel <Daniel.Fisher@finance.wa.gov.au>
Sent: Tuesday, 20 April 2021 11:36 AM
To: MATTHEW LE MEUR
Subject: FW: High importance-Dayton amalgamation

Hi Matthew

Please see below regarding amalgamation.

Please advise if you require more detail

Thanks

Daniel Fisher
Senior Project Officer
Department of Finance
Optima Centre, 16 Parkland Road, Osborne Park WA 6017
m: 0403 984 657 |e: daniel.fisher@finance.wa.gov.au | WA.gov.au

Government of Western Australia
Department of Finance

Acknowledgement of Country The Government of Western Australia acknowledges the traditional custodians of Western Australia and their continuing connection to the land, waters and community. We pay our respects to all members of Aboriginal communities and their cultures; and to Elders both past and present.

From: BINESH Saviz [Capital Works and Maintenance] <saviz.binesh@education.wa.edu.au>
Sent: Monday, 19 April 2021 3:01 PM
To: Fisher, Daniel <Daniel.Fisher@finance.wa.gov.au>
Subject: FW: High importance-Dayton amalgamation

Hi Daniel,

Please see below re current status of amalgamation process. Does it help? I can send you Certificate of title tomorrow.

Regards,

Saviz Binesh
Senior Project Officer
Capital Works and Maintenance

Department of Education
a: 151 Royal Street, East Perth WA 6004
t: (08) 9264 4373 m: 0436 847 664
w: education.wa.edu.au e: saviz.binesh@education.wa.edu.au

We're working for Western Australia.

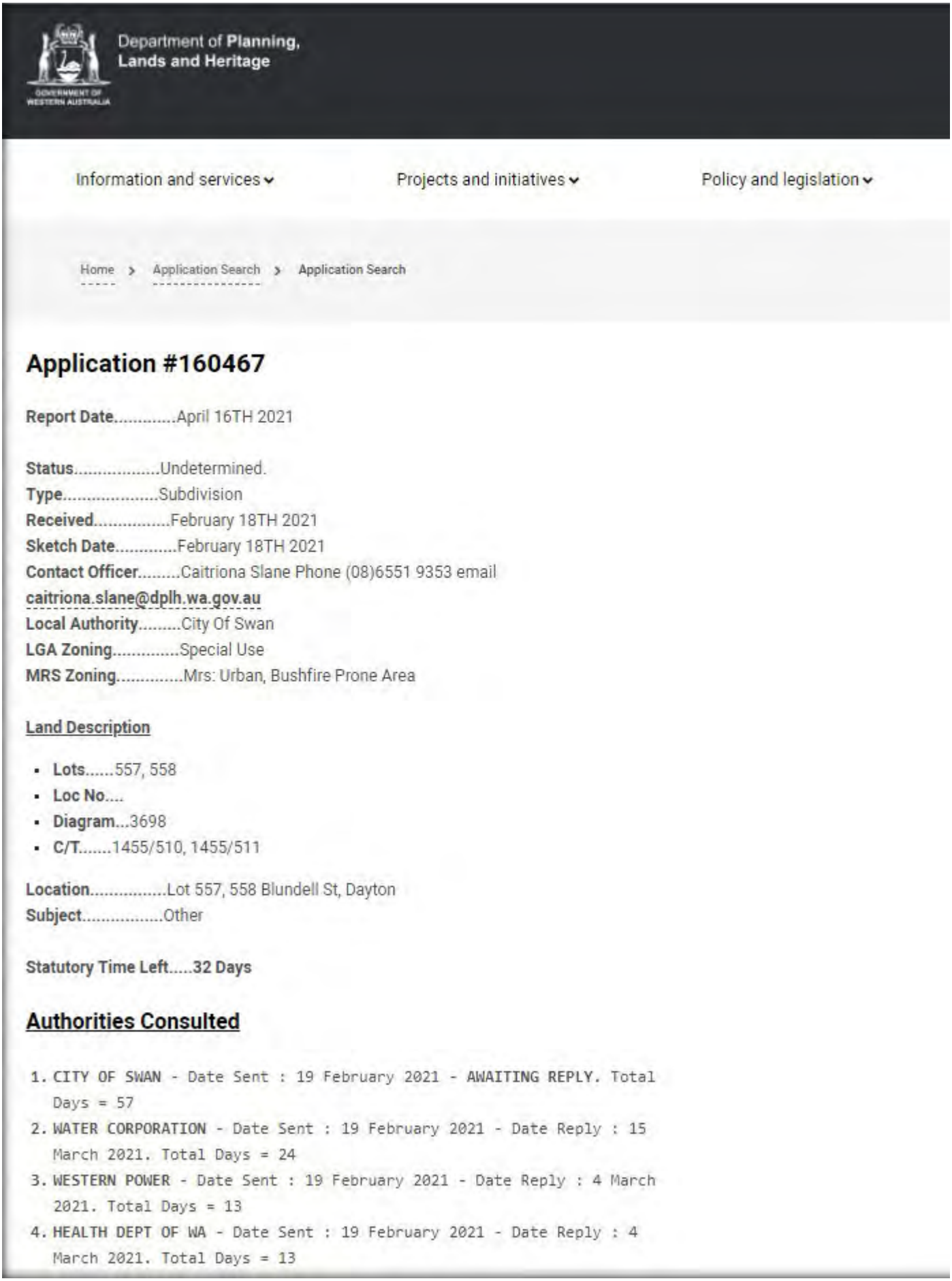
From: MACKAY Christopher [Asset Planning and Services] <christopher.mackay@education.wa.edu.au>
Sent: Monday, 19 April 2021 2:57 PM
To: BINESH Saviz [Capital Works and Maintenance] <saviz.binesh@education.wa.edu.au>
Cc: BARRETT Michael [Asset Planning and Services] <michael.barrett2@education.wa.edu.au>
Subject: RE: High importance-Dayton amalgamation

Hi Saviz

I'm not certain as to what you require. Perhaps the following is sufficient:

Current status of both lots under DoE ownership

- The two lots are undergoing freehold amalgamation. Keith Piper, Consulting Surveyor, engaged to facilitate.
- The application to amalgamate has been referred by the WAPC to the LGA and various authorities for comment and recommendation (for current status refer below)
- The WAPC will then consider a report on the application taking into account any region scheme and/or local planning scheme, relevant WAPC policies, comments from referral agencies, physical attributes or conditions of the site and other relevant matters. Thereafter, the WAPC may approve an application with or without conditions.
- The survey will also concurrently draft and submit the compiled Deposited Plan to Landgate for approval and
  finalisation.



Department of Planning, Lands and Heritage

Information and services | Projects and initiatives | Policy and legislation

Home > Application Search > Application Search

Application #160467

Report Date.....April 16TH 2021

Status.....Undetermined.
Type.....Subdivision
Received.....February 18TH 2021
Sketch Date.....February 18TH 2021
Contact Officer.....Caitriona Slane Phone (08)6551 9353 email caitriona.slane@dplh.wa.gov.au
Local Authority.....City Of Swan
LGA Zoning.....Special Use
MRS Zoning.....Mrs: Urban, Bushfire Prone Area

Land Description

- **Lots**.....557, 558
- **Loc No**....
- **Diagram**...3698
- **C/T**.....1455/510, 1455/511

Location.....Lot 557, 558 Blundell St, Dayton
Subject.....Other

Statutory Time Left.....**32 Days**

Authorities Consulted

1. CITY OF SWAN - Date Sent : 19 February 2021 - AWAITING REPLY. Total Days = 57
2. WATER CORPORATION - Date Sent : 19 February 2021 - Date Reply : 15 March 2021. Total Days = 24
3. WESTERN POWER - Date Sent : 19 February 2021 - Date Reply : 4 March 2021. Total Days = 13
4. HEALTH DEPT OF WA - Date Sent : 19 February 2021 - Date Reply : 4 March 2021. Total Days = 13

Regards

Christopher Mackay

Senior Land Consultant
Asset Planning and Services

Department of Education
a: 151 Royal Street, East Perth WA 6004
t: 9264 4420
w: education.wa.edu.au e: christopher.mackay@education.wa.edu.au

We're working for Western Australia.

From: BINESH Saviz [Capital Works and Maintenance] <saviz.binesh@education.wa.edu.au>
Sent: Monday, 19 April 2021 2:31 PM
To: MACKAY Christopher [Asset Planning and Services] <christopher.mackay@education.wa.edu.au>
Cc: BARRETT Michael [Asset Planning and Services] <michael.barrett2@education.wa.edu.au>
Subject: High importance-Dayton amalgamation
Importance: High

Hi Chris,

We are preparing the DA application package for Dayton PS. We need to include Lot amalgamation and updated certificate of titles **or** DoE letter confirming current status of both lots under DoE ownership. Note forms will need to reflect which option occurs when DA is submitted. Currently we are listing both Lots 557 & 558 in the application. Can you please provide the documents or letter at your earliest convenience?

Regards,

Saviz Binesh
Senior Project Officer
Capital Works and Maintenance

Department of Education
a: 151 Royal Street, East Perth WA 6004
t: (08) 9264 4373 m: 0436 847 664
w: education.wa.edu.au e: saviz.binesh@education.wa.edu.au

We're working for Western Australia.

Our Ref: DA-400/2021
Officer: Lyn Leong
Phone: 08 9267 9267
Email: Lyn.Leong@swan.wa.gov.au
Fax: 9267 9444

city of swan
2 Midland Square, Midland
PO Box 196, Midland WA 6936
T: (08) 9267 9267
F: (08) 9267 9444
www.swan.wa.gov.au

09 June 2021

Department of Finance - Statutory Planning and Asset Policy
c/o GHD
999 Hay Street
Perth WA 6000

By Email: primaryschools@ghd.com

Dear Xavier

TO CONSTRUCTION OF A NEW 540 STUDENT PRIMARY SCHOOL IN DAYTON - LOT 558 ARTHUR STREET DAYTON AND LOT 557 NO.11 BLUNDELL STREET DAYTON

The City of Swan supports the public primary school development at Lot 557 (No.11) Blundell Street and Lot 558 Arthur Street Dayton subject to the following conditions:

1. A site management plan must be submitted and approved by the City prior to any works commencing on the site. The site management plan is to address the following concerns: noise from carrying out work and from the construction site and trucks; hours of operation; light; dust; protection of existing roads, paths, services; site security; drainage; vibration management; fill; excavation and traffic management that relates to any works to take place on the site. Once approved, the site management plan must be implemented in its entirety.

2. All vehicle access onto the site, including any widening and modifications shall be to the specification and the satisfaction of the City of Swan.

3. A minimum of 212 parking bays with 5 accessible bays to be provided on and around the school site (inclusive of the proposed on-street bays around the subject lot). All car parking and associated vehicle access areas are to be constructed in accordance with relevant Australian Standards prior to the occupation of the proposed development. Disabled bays to comply with Australian Standard 2890.6:2009. The car parking bays are to be clearly sign-posted and designated with appropriate line marking in accordance with Australian Standards.

4. No on-street bays around the subject lot is permitted to be used as kiss and drop off bays for the exclusive use of the school.

5. All car parking areas and associated vehicle access areas shall be constructed, sealed, drained and marked, prior to the occupation of the proposed development and thereafter, maintained.

6. Car parking and associated vehicle access areas shall be available for vehicles, and shall not be used for the purpose of storage or obstructed during school hours.

7. A minimum of 60 bicycle parking bays shall be provided on site for standard pattern 540 student primary school capacity, along with appropriate end-of-trip facilities for school staff. Additional parking facility will be necessary when the planned future transportable classrooms are added.

8. All proposed crossovers and works within the road reserve shall be to the specification and the satisfaction of the City of Swan.

9. The proposed development has to be designed to connect with existing roads abutting the subject land so that the access point connects seamlessly.

10. The development shall be connected to the reticulated sewerage system of the Water Corporation before commencement of any use.

11. The landowner, applicant or developer is to ascertain the location and depth of any services that may interfere this development. Any adjustment to the services must be approved by relevant service authorities.

12. Any damage or removal of a City of Swan asset within the road reserve or the adjoining public open space (roads, signage, verge etc.) shall be made good at the cost of the applicant to the specification and the satisfaction of the City of Swan.

13. All stormwater produced is to be disposed of to the satisfaction of the City Swan.

14. Landscaping as specified in the approved landscape plans within the subject lot must be implemented prior to the occupation or use of the development, and maintained thereafter, to the satisfaction of the City. Any species that fails to establish within the first three growing seasons following implementation must be replaced in consultation with the City.

15. Prior to occupation of the development, a signage plan indicating the location and design of any proposed signage (including traffic directional signage) shall be prepared to the satisfaction of the City of Swan.

16. All piped and wired services, plant, equipment and storage areas shall be screened from public view, and in the case of roof mounted plant, screened or located so as to minimise visual impact.

17. All site works shall be contained on the proposed development site and not encroach onto any adjoining road reserve or public open space without prior approval.

18. Soil on the site must be stabilised at all times to prevent erosion and dust blowing, and appropriate measures must be implemented by the landowner within the time and in the manner directed by the City in the event that sand or dust is blown or drifts from the lot.

19. Prior to occupation of the proposed development, any bulk bin area is to be screened.

Advice Notes

a) This approval does not include the works within the adjoining road reserves, as indicated on the approved plans. Separate approval is required from the City of Swan for all works within the road reserve. This includes the new vehicle crossovers for which separate approval is required under the Local Government (Uniform Local Provisions) Regulations 1996.

b) Noise from works associated with the development must not exceed the levels within the Environmental Protection (Noise) Regulations 1997.

c) All external lighting shall comply with requirements of AS 4282 - Control of Obtrusive Effects of Outdoor Lighting.

d) You are advised that it is the responsibility of the applicant to obtain any other necessary approvals, consents and licenses that may be required under any other law and to commence and carry out development in accordance with all relevant laws.

e) Take notice that it is the responsibility of the applicant to advise the landowner(s) and/or builder(s) of the need to satisfy the requirements of the conditions of the planning approval for the subject lot, prior to or on lodgement of Building Applications. The City will not issue a Building Permit until all the conditions of planning approval and any other requirements pertaining to this planning approval have been met (including payment of fees and charges).

f) This approval is not an authority to ignore any constraint to development on the land, which may exist through contract or on title, such as an easement or restrictive covenant. It is the responsibility of the applicant and not the City to investigate any such constraints before commencing development. This approval will not necessarily have regard to any such constraint to development, regardless of whether or not it has been drawn to the City's attention.

g) All development must comply with the provisions of the Health Regulations, National Construction Code, Public Building Regulations and all other relevant Acts, Regulations and Local Laws. This includes the provision of access and facilities for people with disabilities in accordance with the National Construction Code.

h) Development may be carried out only in accordance with the terms of the application as approved herein and any approved plan.

If you would like to discuss this further, please contact Lyn Leong on 08 9267 9289.

Yours faithfully,

Philip Russell
Manager - Statutory Planning
STATUTORY PLANNING

Our Ref: D20850
Your Ref: 80214-844

Xavier Byrne
GHD
primaryschools@ghd.com

Dear Mr Byrne

RE: VULNERABLE LAND USE - LOT 557 (11) BLUNDELL STREET, DAYTON – DAYTON PRIMARY SCHOOL

I refer to your email dated 11 May 2021 regarding the submission of a Bushfire Management Plan (BMP) (Version 1.1), prepared by Bushfire Prone Planning and dated 2 March 2021, for the above development application. The BMP is accompanied by a report from the proponent titled "Dayton Primary School" dated 5 May 2021 for the above development application (DA).

This advice relates only to *State Planning Policy 3.7: Planning in Bushfire Prone Areas* (SPP 3.7) and the *Guidelines for Planning in Bushfire Prone Areas* (Guidelines). It is the responsibility of the proponent to ensure the proposal complies with relevant planning policies and building regulations where necessary. This advice does not exempt the applicant/proponent from obtaining approvals that apply to the proposal including planning, building, health or any other approvals required by a relevant authority under written laws.

Assessment

1. Policy Measure 6.5 a) (ii) Preparation of a BAL contour map

Issue	Assessment	Action
Vegetation classification	Vegetation Plot 3 on the adjoining lot to the north (Lot 600 Arthur Street, Dayton) cannot be substantiated as and Class B Woodland with the limited information and photographic evidence available and the potential for revegetation has not been considered. The BMP should detail specifically how the Class B Woodland classification was derived as opposed to Class A Forest. If unsubstantiated, the vegetation classification should be revised to consider the vegetation at maturity as per AS3959, or the resultant BAL ratings may be inaccurate.	Modification to the BMP is required. The decision maker to be satisfied with the vegetation classification.

2. **Policy Measure 6.5 c) Compliance with the Bushfire Protection Criteria**

Element	Assessment	Action
Location, and Siting & Design	**A1.1 & A2.1 – not demonstrated** The BAL ratings cannot be validated for the reason(s) outlined in the above table.	Modification of the BMP required. The decision maker to be satisfied that Elements 1 and 2 can be achieved.

3. **Policy Measure 6.6.1 Vulnerable land uses**

Issue	Assessment	Action
Bushfire Emergency Evacuation Plan (BEEP)	The referral has not included a *'Bushfire Emergency Evacuation Plan'* for the purposes of addressing the policy requirements. Consideration should be given to the Guidelines Section 5.5.2 'Developing a Bushfire Emergency Evacuation Plan'. This contains detail regarding what should be included in a BEEP and will ensure the appropriate content is detailed when finalising the BEEP to the satisfaction of the City.	Comment only.

The development application and the BMP have adequately identified issues arising from the bushfire risk assessment and considered how compliance with the bushfire protection criteria can be achieved. However, modifications to the BMP are necessary to ensure it accurately identifies the bushfire risk and necessary mitigation measures. As these modifications will not affect the development design, these modifications can be undertaken without further referral to DFES.

The required modifications are listed in the table(s) above.

If you require further information, please contact Richard Trinh, Senior Land Use Planning Officer on telephone number 9395 9709.

Yours sincerely

Ron de Blank
DIRECTOR LAND USE PLANNING

21 June 2021

CC: Xavier.Byrne@ghd.com

Level 1 159-161 James Street Guildford WA 6055
PO Box 388 Guildford WA 6935
P: 6477 1144

Our Ref: 201091

24 June 2021

Matthew Le Meur
Christou Design Group

Dear Matthew

Re: Response to DFES comments – Letter dated 21 June 2021 - Reference D20850

I refer to the DFES Comments letter dated 21 June 2021. Bushfire Prone Planning's responses are set out below.

If you wish to discuss the contents of this review further, please do not hesitate to contact myself at this office.

Yours sincerely

Kathy Nastov
Director
Bushfire Prone Planning

Issue	Assessment	DFES Action	BPP comment
Vegetation Classification	Vegetation Plot 3 on the adjoining lot to the north (Lot 600 Arthur Street, Dayton) cannot be substantiated as and Class B Woodland with the limited information and photographic evidence available and the potential for revegetation has not been considered. The BMP should detail specifically how the Class B Woodland classification was derived as opposed to Class A Forest. If unsubstantiated, the vegetation classification should be revised to consider the vegetation at maturity as per AS3959, or the resultant BAL ratings may be inaccurate.	Modification to the BMP is required.	Vegetation has been classified or excluded in accordance with AS3959-2018 in conjunction with the Guidelines for Planning in Bushfire Prone Areas and the State Planning Policy 3.7 Planning in Bushfire Prone Areas. The BMP clearly states how the classification of Area 3 has been determined. It provides detailed descriptions and has been substantiated by a site assessment and supported by georeferenced photographs that also include dates and times taken. Area 3 on the adjoining lot to the north is not located within a Bush Forever Site nor have other Environmental Sensitivities been identified. In addition, there is no evidence to indicate revegetation through plantings or natural native vegetation re-establishment within Area 3 on the adjoining lot to the north. **Action:** No further action.
Policy Measure 6.5 c) Compliance with the Bushfire Protection Criteria			
Element	**Assessment**	**DFES Action**	**BPP comment**
Location, Siting & Design	**A1.1 & A2.1 – not demonstrated.** The BAL ratings cannot be validated for the reason(s) outlined in the above table.	Modification of the BMP required. The decision maker to be satisfied that Elements 1 and 2 can be achieved.	BAL ratings are validated as outlined in the above table.
3. Policy Measure 6.6.1 Vulnerable land uses			
Issue	**Assessment**	**DFES Action**	**BPP comment**
Bushfire Emergency Evacuation Plan (EEP)	The referral has not included a 'Bushfire Emergency Evacuation Plan' for the purposes of addressing the policy requirements. Consideration should be given to the Guidelines Section 5.5.2 'Developing a Bushfire Emergency Evacuation Plan'. This contains detail regarding what should be included in a BEEP and will ensure the appropriate content is detailed when finalising the BEEP to the satisfaction of the City.	Comment Only	The BMP makes reference to the requirement of a BEEP for proposed occupants. It is a requirement that prior to operation of the school and the first bushfire season that the school prepares or has prepared a Stand-Alone Bushfire Plan (Bushfire Emergency Plan).

LOTS 108, 1304, 8003 AND PORTION OF ROAD RESERVE, ROCKINGHAM BEACH ROAD, EAST ROCKINGHAM
LIQUID UREA AMMONIUM NITRATE FERTILISER AND SOLID FERTILISER STORAGE AND BLENDING FACILITY

Form 1 – Responsible Authority Report
(Regulation 12)

DAP Name:	Metro Outer Joint Development Assessment Panel	
Local Government Area:	City of Rockingham	
Applicant:	Planning Solutions Pty Ltd	
Owners:	1. Western Australian Land Authority trading as DevelopmentWA 2. Co-operative Bulk Handling Pty Ltd 3. Main Roads Western Australia 4. Water Corporation	
Value of Development:	☒ Mandatory (Regulation 5) ☐ Opt In (Regulation 6)	
Responsible Authority:	City of Rockingham	
Authorising Officer:	Bob Jeans, Director Planning & Development Services	
LG Reference:	DD020.2020.290.001	
DAP File No:	DAP/20/01878	
Application Received Date:	9 October 2020	
Report Due Date:	23 June 2021	
Application Statutory Process Timeframe:	90 (plus additional 163 with applicant consent)	
Attachment(s):	Attachment 1 - Development Application Plans Attachment 2 - Revised Development Application Submission Attachment 3 - Schedule of Public Submissions Attachment 4 - External Agency Responses Attachment 5 - Kwinana Industrial Area Map Attachment 6 - City of Rockingham recommendations to Western Australian Planning Commission	
Is the Responsible Authority Recommendation the same as the Officer Recommendation?	☒ Yes ☐ N/A	Complete Responsible Authority Recommendation section
	☐ No	Complete Responsible Authority and Officer Recommendation sections

Responsible Authority Recommendation

That the Metro Outer Joint Development Assessment Panel (MOJDAP) resolves to **Approve** DAP Application reference DAP/20/01878 and accompanying plans:

- Overall Facility Piping, DRG No. 0001, Rev C;
- Site Plan, DRG No. 0002, Rev H;
- Storage Warehouse Site Elevations, DRG No. 004, Rev D;
- Storage Warehouse Elevations, DRG No. 0013, Rev D;

- Storage Warehouse Plan, DRG No. 0009; Rev D;
- Storage Warehouse Plan Part A, DRG No. 0010; Rev C;
- Storage Warehouse Plan Part B, DRG No. 0011; Rev D;
- Storage Warehouse Sections, DRG No. 0014; Rev C;
- Maintenance Store Plan, Elevations and Sections, DRG No. 0012, Rev A;
- Administration Building Elevations, DRG No. 0007, Rev B;
- Site Plan Administration, DRG No. 0005, Rev B;
- Floor Plan Administration, DRG No. 0006, Rev B;
- Drainage Design, DRG No. 0002, Rev B;
- Landscaping Plan, DRG No. 0003, Rev G;
- Turning Movements, DRG No. 0001_E; Rev F; and
- Fence Section, Rev A;

in accordance with Clause 68 of Schedule 2 (Deemed Provisions) of the Planning and Development (Local Planning Schemes) Regulations 2015, and the provisions of Clause 68(2)(b) of the City of Rockingham Town Planning Scheme No. 2, subject to the following conditions:

Conditions

1. This decision constitutes development approval only and is valid for a period of four years from the date of approval **(this is inclusive of the additional two years available under 'Clause 78H Notice of Exemption from planning requirements during State of Emergency' issued by the Minister for Planning on 8 April 2020)**. If the subject development is not substantially commenced within the specified period, the approval shall lapse and be of no further effect.

2. Development is to be removed, modified or protected at the lessees/landowners cost when the most landward part of the Horizontal Shoreline Datum is within 17 metres of the proposed development to the satisfaction of the City of Rockingham, on advice from Western Australian Planning Commission.

3. Prior to commencement of development, detailed civil engineering construction plans for the auxiliary left turn treatment within the Rockingham Beach Road road reserve shall be submitted by a suitably qualified person to the City of Rockingham and Main Roads WA for approval. These works must be constructed, in accordance with the approved plans, prior to the occupation of the development.

4. Prior to commencement of development, an updated Stormwater Management Plan must be submitted showing how stormwater will be contained on-site and those plans must be submitted to the City of Rockingham for its approval. All stormwater generated by the development must be managed in accordance with Planning Policy 3.4.3 - Urban Water Management to the satisfaction of the City of Rockingham. The approved plans must be implemented and all works must be maintained for the duration of the development.

5. Stormwater discharge (if any) shall not exceed pre-development discharge to the Rockingham Beach Road reserve.

6. Prior to commencement of development, an updated Fauna Relocation Plan for the native fauna species within the site is to be prepared, approved and implemented to the satisfaction of the City of Rockingham, to ensure the protection and management of the site's environmental assets.

7. Prior to commencement of development, a Dust Management Plan for the development must be prepared and approved by the City of Rockingham and all measures identified in the plan shall be implemented to the satisfaction of the City of Rockingham for duration of the development.

8. Prior to commencement of development, an Asbestos Management Plan shall be developed and implemented to address the potential risks to site workers to the satisfaction of the City of Rockingham and Department of Water and Environmental Regulations.

9. Prior to commencement of development, a revised Landscaping Plan must be prepared and must include the following:

   (i) The location, number and type of existing and proposed trees (including any shade trees), swales and shrubs, indicating calculations for the landscaping area;

   (ii) Any lawns to be established;

   (iii) Those areas to be reticulated or irrigated for plant establishment;

   (iv) All plants to be native; and

   (v) The swale south of the administrating building is to include a combination of mulch and plantings or alternatively is to be grassed.

   The landscaping, paving and reticulation must be completed prior to the occupation of the development, and the approved Landscaping Plan must be maintained at all times to the satisfaction of the City of Rockingham for the duration of the development.

10. Prior to occupation of development, as this land is not connected to the reticulated sewerage infrastructure, development on Lot 108 must adhere to the Government Sewage Policy 2019 including the requirement for a secondary treatment system with nutrient removal as well as setbacks required to the satisfaction of the City of Rockingham and Department of Water and Environmental Regulation.

11. Prior to occupation of the development, the Asset Protection Zone on Lot 108, as depicted in the Bushfire Management Plan prepared by Linfire Consultancy, dated 31 July 2020 must be implemented in accordance with the WAPC Guidelines for Planning in Bushfire Prone Areas. The Asset Protection Zone must be maintained for duration of the development.

12. No earthworks shall encroach to the Rockingham Beach road reserve.

13. Earthworks over the site associated with the development must be stabilised to prevent sand or dust blowing off the site, and appropriate measures shall be implemented within the time and in the manner directed by the City of Rockingham in the event that sand or dust is blown from the site.

14. All vegetation outside the approved development area on Lot 108 must be retained, unless otherwise required for bushfire mitigation pursuant to the Offsite Vegetation Management Zone which is identified within the Linfire Consultancy Report, dated 31 July 2020 for duration of the development.

15. Grass tree plants (XANTHORRHOEACEAE family) must be retained (unless specifically identified for removal on the approved Landscaping Plan) and, during the construction period, measures for their retention must be taken in accordance with Australian Standard AS 4970—2009, Protection of trees on development sites. Arrangements must be made to the satisfaction of the City for all grass tree plants requiring removal to be relocated, prior to applying for a Building Permit.

16. In accordance with City of Rockingham *Planning Policy 3.3.14 - Bicycle parking and End of Trip Facilities*, 3 long-term bicycle parking spaces must be provided for the development. The bicycle parking spaces must be designed in accordance with AS2890.3— 1993, Parking facilities, Part 3: Bicycle parking facilities and must be approved by the City of Rockingham prior to applying for a Building Permit and constructed prior to occupancy of the development.

17. The Carpark must:

    (i) provide 11 car parking spaces;

    (ii) be designed in accordance with Australian/New Zealand Standard AS/NZS 2890.1:2004, Parking facilities, Part 1: Off-street car parking unless otherwise specified by this approval prior to commencement of development;

    (iii) minimum one (1) car parking space dedicated to people with disabilities designed in accordance with Australian/New Zealand Standard AS/NZS 2890.6:2009, Parking facilities, Part 6: Off-street parking for people with disabilities, linked to the main entrance of the development by a continuous accessible path of travel designed in accordance with Australian Standard AS 1428.1—2009, Design for access and mobility, Part 1: General Requirements for access—New building work;

    (iv) Be constructed, sealed, kerbed, drained and marked prior to the development being occupied and maintained thereafter;

    (v) Have lighting installed, prior to the occupation of development; and

    (vi) Confine all illumination to the land in accordance with the requirements of Australian Standard AS 4282-1997, Control of the obtrusive effects of outdoor lighting, at all times.

18. Materials, sea containers, goods or bins must not be stored within the carpark at any time.

19. No waste collection is permitted from the Rockingham Beach Road reserve.

Advice Notes

1. Prior to construction of the below ground liquid fertiliser pipeline, a Deed of Agreement regarding the pipeline crossing the Rockingham Beach Road reserve shall be entered into and executed between CBH Group and Main Roads Western Australia. The Deed shall be prepared by and be at the cost of the lessee/landowner.

2. The proponent is advised of the requirement under the Environmental Protection Act 1986 to obtain a clearing permit for the clearing of native vegetation from the Department of Water and Environmental Regulation.

3. The proponent is advised that this approval is not a building permit, which constitutes a separate legislative requirement. Prior to any building work commencing on site, a building permit may need to be obtained.

4. The proponent is to ensure Health (Asbestos) Regulations 1992 and National Code of Practice for the Safe Removal of Asbestos practices and procedures are in place and followed during the removal of any asbestos containing material.

5. Any spills on-site exceeding in-ground containment, are to be reported to the City of Rockingham and Department of Water and Environmental Regulations.

6. Main Roads Western Australia is the responsible authority for the Rockingham Beach Road reserve adjacent to the CBH Kwinana Grain Terminal. Main Roads has provided the applicant with authority to lodge a development application for a below ground liquid fertiliser pipeline crossing the Rockingham Beach Road reserve. This is subject to a deed between CBH Group and Main Roads in relation to the pipeline being executed prior to construction of the pipeline and this requirement for a deed being a condition of development application approval.

7. Given the works proximity to a water pipe asset within the Rockingham Beach Road and reserve Lot 8003, a damage risk assessment and working near assets approval shall be obtained prior to construction from Water Corporation.

8. All works in the road reserve, including construction of a crossover and other streetscape works and works to the road carriageway must be to the satisfaction of the City of Rockingham and Main Roads WA; the applicant should liaise with the City of Rockingham's Land Infrastructure and Development Services and Main Roads WA in this regard.

   The applicant is required to submit an Application form to undertake works within the road reserve prior to undertaking any works within the road reserve. Application forms and supporting information about the procedure can be found on the Main Roads website > Technical & Commercial > Working on Roads.

9. With respect to the Landscape Plan and Stormwater Management Plan, the applicant is to liaise with the City’s Land Development and Infrastructure Services in this regard.

10. With respect to the Dust Management Plan, the applicant is to prepare a Plan in accordance with the Environmental Protection Authority Dust Management Plan Guidelines.

11. In relation to Condition 2, the applicant is advised that the Horizontal Shoreline Datum means the active limit of the shoreline under storm activity, as defined in State Planning Policy 2.6 - State Coastal Planning Policy (2013). The applicant is advised that the 17 metre distance between the Horizontal Shoreline Datum and the proposed development is the S1 value for this location which is obtained from the Coastal Hazard Risk Management and Adaptation Plan prepared for the City of Rockingham. S1 is the allowance for absorbing the current risk of storm erosion, as defined in State Planning Policy 2.6 - Coastal Planning.

12. In relation to Condition 6, the following additional detail is required in the Fauna Relocation Plan to outline the methods that will be implemented for the proposed cage-trapping program:

    - A list of all required fauna relocation licenses that are to be obtained from the Department of Biodiversity, Conservation and Attractions. Copies of these licenses are required to be sent to the City prior to any trapping commencing onsite; and

    - A detailed trapping methodology with the Southern Brown Bandicoot being the primary target species. The methodology must be in accordance with the relevant Department of Biodiversity, Conservation and Attractions guidance.

    The applicant is advised to liaise with the City of Rockingham Sustainability and Environment Department in this regard.

13. In relation to Condition 8, the Asbestos Management Plan should be prepared in accordance with the Code of Practice for the Management and Control of Asbestos in Workplaces [NOHSC:2008 (2005)] (National Occupational Health and Safety Commission, April 2005.

14. In relation to Condition 10, an application will need to be made to the City of Rockingham Health Services for installation of the secondary treatment system and the evaporation pond as required by Health (Treatment of Sewerage and Disposal of Effluent and Liquid Waste) Regulations 1974.

Details: outline of development application

Region Scheme	Metropolitan Region Scheme
Region Scheme - Zone/Reserve	Lots 108 & 8003: Special Industrial zone Lots 1304 & Portion of Road Reserve: Industrial zone
Local Planning Scheme	Town Planning Scheme No.2
Local Planning Scheme - Zone/Reserve	Lots 108, 1304 & 8003: General Industry zone Portion of Road Reserve: Local Roads reserve
Structure Plan/Precinct Plan	N/A
Structure Plan/Precinct Plan - Land Use Designation	N/A
Use Class and permissibility:	Industry General: Licensed = 'A'
Lot Size:	Lot 108: 22.4622ha (portion of) Lot 1304: 20.9729ha Lot 8003: 0.1095ha Portion of Road Reserve: 0.6658ha
Existing Land Use:	Lot 108: Fuel Depot Lot 1304: Industry General: Licensed Lot 8003: Vacant Land
State Heritage Register	No
Local Heritage	☐ N/A ☒ Heritage List ☐ Heritage Area
Design Review	☒ N/A

	☐ Local Design Review Panel ☐ State Design Review Panel ☐ Other
Bushfire Prone Area	Yes
Swan River Trust Area	No

Background:

Lot 108 (being the main portion of the Development Area) is predominantly vacant shrubland. Further beyond on Lot 108 ongoing construction of the Puma Fuel Depot facility continues, which overlaps the municipal boundary of the City of Rockingham and the City of Kwinana. The Puma Fuel Depot development was approved by the MOJDAP (former Metro South-West JDAP) in October 2014.

Lot 1304 is developed with the CBH Kwinana Grain Terminal. The terminal has been operational for over 40 years.

Lot 8003 is developed with underground water supply infrastructure and otherwise remains vacant.

The subject land is low-lying, generally flat land.

The Development Area also comprises of Lots 1585 and 4552, which do not form part of this Joint Development Assessment Panel (JDAP) application. For clarity, the overall Development Area is identified below, in Figures 1 and 2, and is further explained below in the Proposal section of this report.

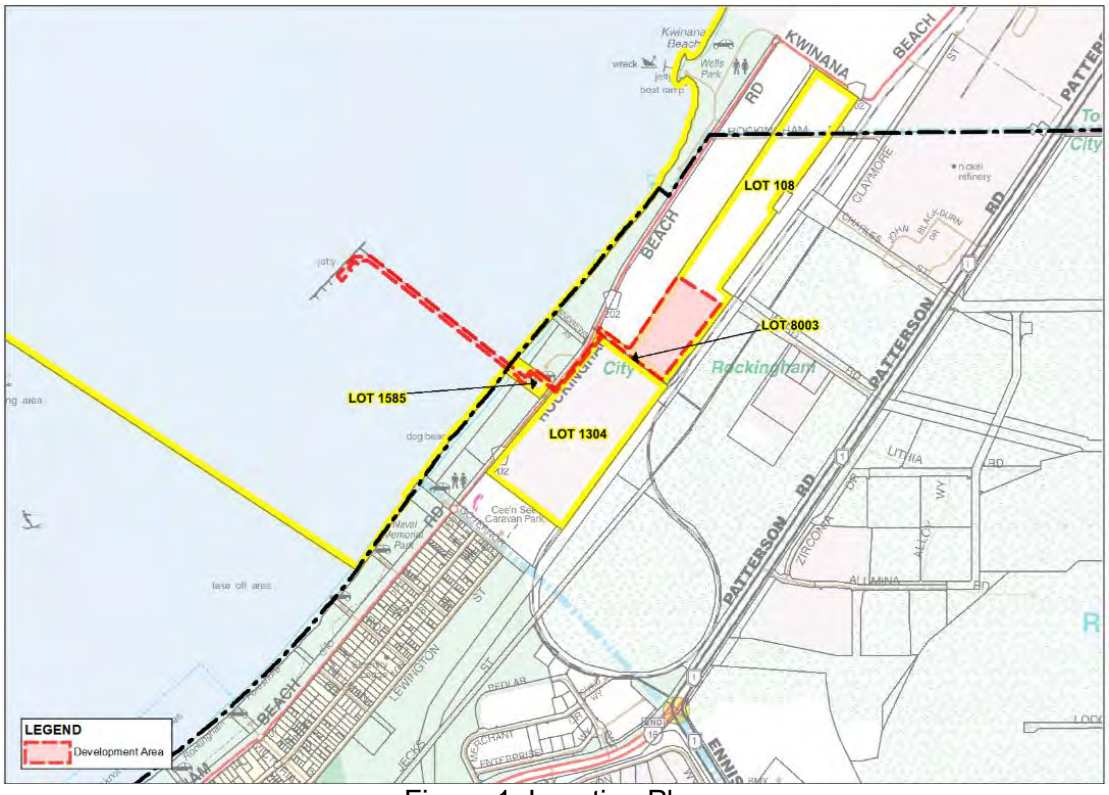


Figure 1. Location Plan

Figure 2. Aerial Photograph

In a broader context, the Development Area is situated within an industrial/port related precinct bounded by Rockingham Beach Road/Kwinana Beach Road to the north, Cockburn coastline to the northwest and Patterson Road further to the east.

There are residential areas to the southwest of the development area (North Rockingham).

History

The Kwinana Industrial Area (KIA) is the primary location of heavy industry in Western Australia. KIA consists of a highly diverse range of industries from smaller service industries, such as fabrication and construction facilities, through to very large heavy process industries, such as alumina, nickel and oil refineries. The subject lot is located within the Rockingham Industrial Zone (RIZ), which is a sub-precinct of the KIA.

Improvement Plan 14 (IP14), initiated under the provisions of the Metropolitan Region Scheme (MRS) in 1988, was created to facilitate the planning, development and use of land for industrial purposes within the KIA. The Kwinana Regional Strategy (1988) identified that the majority of underutilised land in the region (approximately 1,150ha) was located in the East Rockingham locality. The East Rockingham Industrial Park IP14 Structure Plan was subsequently adopted by the Western Australian Planning Commission (WAPC) to coordinate the utilisation of industrial land in East Rockingham.

The subject land falls within Precinct One - Port Related Industry of the East Rockingham Industrial Park IP14 (Attachment 5).

Proposal:

On 9 October 2020, the City received two JDAP applications for the Co-corporative Bulk Handling (CBH) Fertiliser Expansion Project (Development Area), comprising of:

1. Liquid Urea Ammonium Nitrate (UAN) Fertiliser and Solid Fertiliser Storage and Blending Facility located on and under Lots 108, 1304, 8003 and portion of Road Reserve, Rockingham Beach Road in East Rockingham; and

2. CBH Grain Jetty Fertiliser Expansion Project - Construction of an UAN pipeline and UAN cargo receival equipment and associated infrastructure located under Lot 4552 on Deposited Plan 220690 and under Lot 1585 on Deposited Plan 191087 in East Rockingham.

CBH proposes to develop a liquid UAN fertiliser and solid fertiliser storage and blending facility on Lot 108. The proposed overall development also includes the construction of a pipeline between the CBH Jetty at the Kwinana Grain Terminal and the proposed liquid UAN fertiliser storage facility on Lot 108.

The liquid UAN fertiliser storage facility will have a capacity of 48,000 tonnes, and the solid fertiliser storage facility will have a capacity of 80,000 tonnes. The fertiliser is imported to the storage facility on shipping carriers and transferred to the proposed facility via:

(a) a liquid UAN pipeline from the Kwinana Grain Terminal; and

(b) solid fertiliser transferred by semi-trailers from the Kwinana Bulk Jetty.

Both liquid UAN fertiliser and solid fertiliser are stored at the facility pending distribution to customers via road.

The facility may operate 7 days a week, 24 hours a day, however, the operations at the facility are seasonal and these operating hours would only be required during the annual peak period, which typically runs for approximately 7 weeks. Outside of this peak period, the facility is expected to primarily operate 5 days a week with a 12 hour day (6am to 6pm).

The development is expected to generate approximately 98 vehicle trips during the peak hour period (in and out) and a daily approximate trip generation total of 788 (in and out).

The liquid UAN fertiliser is used to provide plants with nitrogen and is primarily used for bloom growth, whilst, the solid fertiliser will be blended on-site to provide for a variety of fertiliser compounds for various agricultural uses. The development provides for a range of fertilisers to balance soil nutrients and contribute to the long-term viability of farmland.

A summary of the development is tabled below.

Extent of Development Seeking Approval Under TPS2	
Solid fertiliser storage warehouse	A 240m long and 85m wide warehouse, with a wall height of 14m and a ridge height of 19.1m. There are 12m high, 24m wide openings on the northeast and southwest sides to permit truck and machinery egress.
UAN storage tanks	Three 16,000m^3 capacity above ground storage tanks (30m diameter and 20m high) for the storage of liquid UAN fertiliser. The tanks are contained within a bunded area to contain any spills.
UAN Pipeline	One 254mm diameter pipeline between the CBH Kwinana Grain Terminal Jetty and the UAN storage tanks. The

	pipeline will be located underground between the Jetty and the UAN storage facility.
Administration building	A 444m^2 single-storey office designed to accommodate up to 10 staff.
Vehicle access	Access road and crossover to Rockingham Beach Road to allow access by RAV-4 and semi-trailer vehicles. All vehicle access will travel to and from the north in the direction of Kwinana Beach Road.
Car parking	11 on-site car parking spaces are provided west of the Administration building.
Diesel storage tank	A 20,000 litre diesel storage tank at the northeast end of the warehouse building. The tank will be a proprietary item including self-contained bund and bowser.
Maintenance shed	Located adjacent to the diesel storage tank.
Weighbridges	Installed to weigh tanks being loaded with blended fertiliser product.
Landscaping	The perimeter of the fertiliser storage facility is proposed to be landscaped.
Evaporation Pond	85m x 40m pond with a total volume of 3,000m^3.
Swale	Designed to manage clean site runoff.
Fencing and Gates	Security fencing around the perimeter of fertiliser storage facility. A security gate and two emergency access gates will be provided on the southwest and southeast side of the facility.
Extent of Development Seeking Approval Under MRS	
UAN Pipeline	One, 254mm diameter pipeline constructed to Australian Standard 4041 – Pressure Piping (AS 4041) supported on the CBH Grain Jetty, the piping materials will change specification to heavy wall HDPE at the transition from the Jetty to the land crossing, after crossing the shoreline the pipeline then continues underground to the onsite UAN storage tanks.
UAN Cargo Unloading Hose	One, 203.2mm diameter UAN cargo unloading hose retained on a retractable reel, located mid-way on the east side of the CBH Grain Terminal Jetty berth, connected to the 254mm diameter discharge pipeline.

Supporting documentation

The following reports accompanied the two JDAP applications:

- Planning Report;
- Environmental Assessment Report and Environmental Management Plan;
- Acoustic Report;
- Bushfire Management Plan and Bushfire Risk Management Plan;
- Transport Impact Assessment; and
- Water Management Strategy.

Development Application Process

The proposed CBH Fertiliser Expansion Project is located on land which is zoned General Industry under the City's Town Planning Scheme No.2 (TPS2), and in part reserved for Local Roads under the TPS2. The proposed CBH Grain Jetty Fertiliser Expansion is also located on land which is reserved for Waterways under the Metropolitan Region Scheme (MRS), and for Parks and Recreation under the MRS.

Accordingly two separate approvals are required as follows:

1. Development Approval under the City's TPS2 for the portion of the application which is within the General Industry zone and Local Roads via this DAP application; and

2. Approval to Commence Development under the MRS for the portion of the application which is reserved for Waterways and Parks and Recreation under the Metropolitan Region Scheme via the Western Australian Planning Commission DAP application.

While the MOJDAP is the determining authority for both Development Applications, this Responsible Authority Report (RAR) relates only to the CBH Fertiliser Expansion Project (Extent of Development Seeking Approval Under TPS2), being the development northeast of and under Rockingham Beach Road. This RAR assesses the proposal with regard to the City's TPS2.

The pipeline and related infrastructure which is proposed on the southwest of Rockingham Beach Road, including Jetty infrastructure is subject to a separate Development Application under the MRS. Officers representing the WAPC (via Department of Planning, Lands and Heritage), have prepared a concurrent RAR for the CBH Grain Jetty Fertiliser Expansion Project (Extent of Development Seeking Approval Under MRS) and the City has provided its recommendations to the WAPC for consideration of the proposal (Attachment 6).

Figure 3. Extent of Development Seeing Approval under TPS2

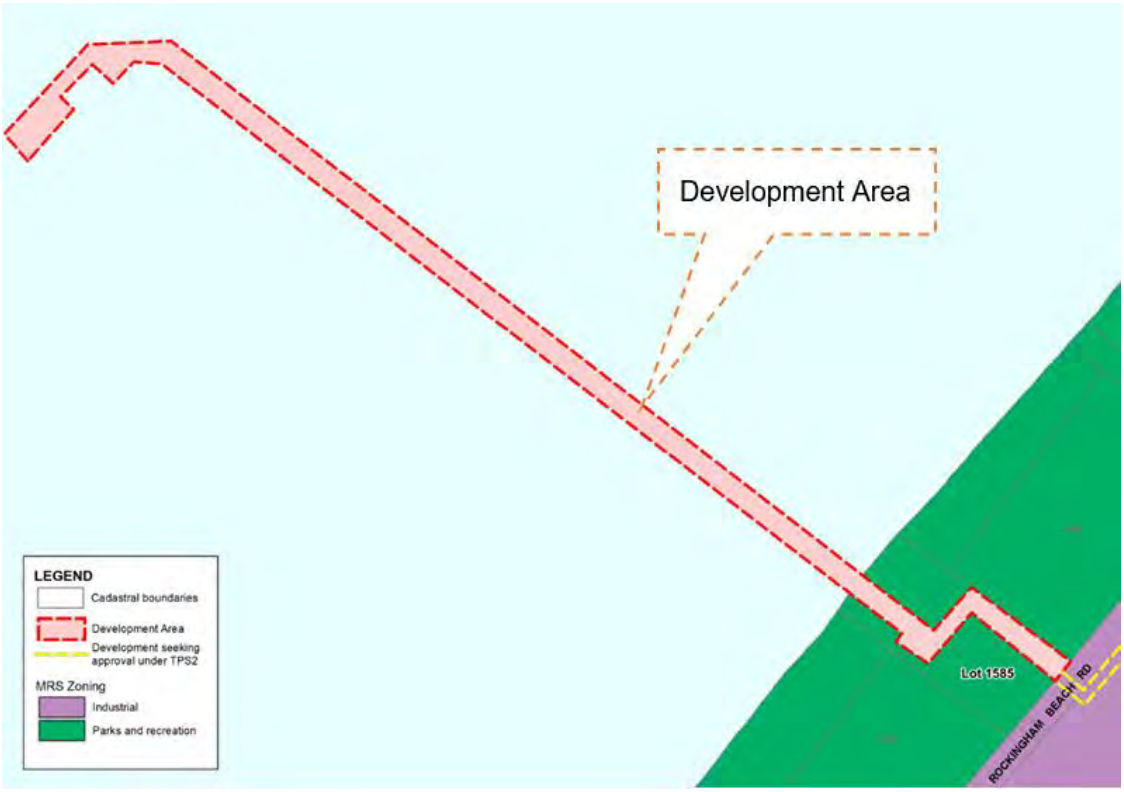


Figure 4. Extent of Development Seeing Approval under MRS

Environmental Approval

On 21 January 2021, the City was informed that pursuant to the Environmental Protection Act 1986 (EPA Act), the Environmental Protection Authority (EPA) decided to assess the proposed facility for the blending, transfer and storage of liquid UAN and solid fertiliser. In this regard the EPA had requested more information from the applicant to determine the impact to marine environmental quality and to consider it in the context of the Cockburn Sound Environmental Policy area.

On 20 May 2021, EPA concluded that the proposal is environmentally acceptable, and may be implemented subject to conditions. In this regard, the subject JDAP application represents the next step of Approval process for the development, and reflects the proposal recommended for Approval to the Minister for Environment by the EPA.

Legislation and Policy:

Legislation

- Planning and Development Act 2005
- Metropolitan Region Scheme
- Planning and Development (Local Planning Schemes) Regulations 2015 (the Regulations)
- City of Rockingham Town Planning Scheme No.2
- Environmental Protection Act 1986

State Government Policies

- State Planning Policy 2.6 – Coastal Planning
- State Planning Policy 3.7 – Planning in Bushfire Prone Areas
- State Planning Policy 4.1 – State Industrial Buffer
- Environmental Protection Authority – Separation Distance between Industrial and Sensitive Land Uses No.3 (Guidance Statement)
- Government Sewerage Policy 2019
- Development Control Policy 4.2 – Planning for Hazards and Safety
- Guidelines for Planning in Bushfire Prone Areas

Local Policies

- Planning Policy 3.3.8 – East Rockingham Development Guidelines (draft)
- Planning Policy 3.3.14 – Bicycle Parking and End-of-Trip Facilities
- Planning Policy 3.3.21 – Heritage Conservation and Development
- Planning Policy 7.3 – Cockburn Sound Catchment

Other

- Coastal Hazard Risk Management and Adoption Planning

Consultation:

Public Consultation

The proposed land use is not permitted unless the Local Government has exercised its discretion following advertising. Both Development Applications were advertised for public comment over a period of 36 days, commencing on 27 October 2020 and concluding on 2 December 2020. This consultation period includes the one week extension period, as a result of a City letter being sent out on 2 November 2020, clarifying the description of the proposed development.

The applications were subsequently further advertised to the occupants of the Cee and See Caravan Park site for an additional period of 21 days, commencing on 16 December 2020 and concluding on 5 January 2021. The Caravan Park operator and occupants were omitted from the original consultation period. The nature of the development warranted comments from nearby owners and occupiers prior to MOJDAP making its decision.

Advertising was carried out in the following manner:

- Owners and occupiers within 1.1km of Lot 108 were notified in writing of the proposed development;
- A sign advertising the proposed development was erected on site;
- A copy of the consultation letter was displayed on a public notice board at the Cee and See Caravan Park site;
- A notice appeared in the public notices section of the Sound Telegraph on the 28 October 2020 and 11 November 2020; and
- Copies of technical documents and plans of the proposal were made available for public inspection at the City's Administration Offices and placed on the City's website.

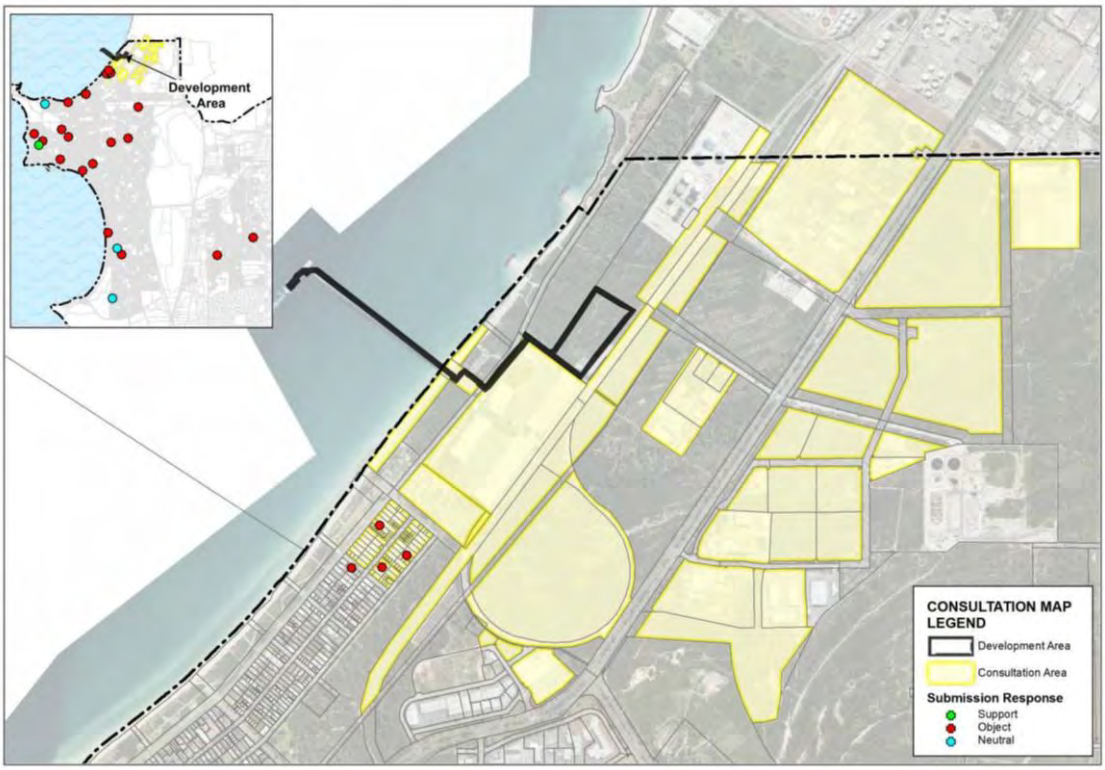


Figure 5. Consultation Plan

At the close of the public consultation period a total of 33 submissions were received, which included 29 objections, three (3) neutral letters and one (1) letter of support.

The locations from where the submissions originated are shown on the Consultation Plan above. All submissions are contained in the Schedule of Public Submissions (Attachment 3).

Issue Raised	**Officer comments**
<u>Amenity and Land Use</u> Concerns development encroaches on the surrounding ambience for people living in close proximity.	The proposed development is an industrial type land use in the RIZ. The immediate locality is characterised by a mix of general, heavy industrial and port related land uses, with surrounding vacant land to the north-east and south-east also zoned for industrial development. The amenity aspects of this proposal have been discussed below, where it is concluded the development will have minimal impact on the amenity of the area and will not create or exacerbate any amenity issues for people living in close proximity.
Concerns regarding storage of explosive substances – Ammonium Nitrate.	The Department of Mines, Industry Regulation and Safety (DMIRS) response is that the proposed development will not import or store Ammonium Nitrate or any other materials in quantities classified as

	Dangerous Goods under the Dangerous Goods Safety Act 2004 and Regulations. DMIRS response is provided below in the Referrals/consultation with Government/Service Agencies section of this RAR.
<u>Risk and Safety</u> Some submitters questioned who can confirm the proposal does not present a risk to lives.	The determination of risk guidelines for hazardous development are matters within the domain of the EPA under the EPA Act 1986 and the DMIRS under the Dangerous Goods Safety Act 2004 and Regulations. DMIRS considered risk in terms of explosive gas atmosphere and hazardous zones and have confirmed that all the products and quantities intended to be stored on-site are not classified as Dangerous Goods. The applicant has also demonstrated through the EPA process that impacts (marine environmental quality, Inland Waters for impacts on Cockburn Sound) associated with the proposed development can be managed to an acceptable standard.
<u>Impact on Cockburn Sound – water quality</u> A concern that the spilt grain from the existing Jetty is impacting the quality of water in Cockburn Sound.	Whilst the submission is not relevant to the proposed development, it is worth noting that as part of EPA's decision to assess the proposal, more information was requested from the proponent to determine the impact to marine environmental quality and to consider it in the context of the Cockburn Sound Environmental Policy area. By virtue of the EPA recommending approval to the Minister for Environment, it can be considered that the marine environmental impacts of the development are acceptable.
<u>Environmental Reporting</u> A concern that the supporting environmental report is thin, apologetic to zoning and highly qualified in its limitations, and likely reflects in the interest of CBH rather than the residents of the locality.	The City's Sustainability and Environment Services has reviewed the applicant's submitted Environmental Assessment Report and Environmental Management Plan and is satisfied that development is unlikely to have an adverse environmental impact on the Development Area or surrounding land, subject to the following measures being undertaken: • The applicant addressing City's Coastal Hazard Risk

	Management and Adoption Plan (CHRMAP); • A revised Fauna Management Plan being provided and approved by the City of Rockingham prior to commencement of development, outlining the methods that will be implemented for the proposed cage-trapping program; and • All vegetation outside of the approved Development Area being retained. With respect to the CHRMAP matter, this is discussed in detail in the Planning Assessment section of this RAR where it is concluded the proposed development has not adequately addressed the threat of coastal erosion. Notwithstanding the above comment, condition/s requiring compliance with the abovementioned matters have been recommended in the event that the development is approved by MOJDAP. Again, by virtue of the EPA recommending approval to the Minister for Environment, it can be considered that the submitted Environmental Assessment Report and Environmental Management Plan is acceptable.
<u>Traffic</u> A concern regarding increased truck movement along Rockingham Beach Road.	The additional traffic from the north generated as a result of this development will operate along Rockingham Beach Road, which is in the process of being handed over from the City of Rockingham to Main Roads Western Australia and the City of Kwinana road network. These Government Agencies did not object to the increased traffic movements, and this is discussed below in Referrals/consultation with Government/Service Agencies section of this RAR. The City reviewed the traffic modelling for the proposal and considers that the existing surrounding road network has the capacity to accommodate the increase in traffic generated by the proposed development, subject to the

	construction of a 70m long auxiliary left-turn off Rockingham Beach Road. The auxiliary lane is necessary due to the high performance of RAV-4 network and semi-trailers which are required to access the facility. No trucks or heavy vehicles associated with the proposal will travel along Rockingham Beach Road from the south, past residential areas to the southwest.
Not in the long-term interest of local community The proposal is not in the long-term interest of Rockingham as a place where people want to live.	The development application complies with City's TPS2 and applicable planning policies, and is considered to be compatible with the General Industry zone and is unlikely to have any adverse impacts on the amenity of the Rockingham residents.

Referrals/consultation with Government/Service Agencies

The following government departments and service agencies were consulted:

- Alinta Energy;
- City of Kwinana;
- Cockburn Sound Management Council;
- Dampier-Bunbury Pipeline;
- Department of Biodiversity, Conservation and Attractions;
- Department of Fire and Emergency Services;
- Department of Mines, Industry Regulation and Safety;
- Department of Planning, Lands and Heritage;
- Department of Water and Environmental Regulation;
- DevelopmentWA;
- Fremantle Ports Authority;
- Main Roads Western Australia;
- Telstra; and
- Water Corporation.

The comments received are as follows:

1. City of Kwinana (CoK)
The fertiliser facility is located adjacent to Kwinana Beach Road, which is under the control of Main Roads WA. It is presumed the application has been referred to MRWA for comment. The City's Health team has requested than written notification be provided via email in the event any marine spillages result from the operations of the proposed development.
City's Comment: Main Roads Western Australia responses is provided below. CoK comment pertaining to any spillage is noted.
2. Cockburn Sound Management Council (CSMC)

Under its Terms of Reference, CSMS is an advisory council to the Minister for Environment and as such, does not have a role in providing advice to decision-making authorities on development proposals in Cockburn Sounds. CSMC provides advice and recommendations to the Minister on the environmental management of Cockburn Sound to ensure the protection and maintenance of water quality and associated environmental values for the Cockburn Sound marine area.

City's Comment:
Noted.

3. Dampier-Bunbury Pipeline (DBP)

DBP as owners and operators of the Dampier-Bunbury Natural Gas Pipeline have no objection to the proposed facility as indicated on the plans supplied.

City's Comment:
Noted.

4. Department of Biodiversity, Conservation and Attractions (DBCA)

Any proposed clearing of native vegetation associated with the development should be undertaken in accordance with the Environmental Protection Act 1986 (EP Act) and Environmental Protection (Clearing of Native Vegetation) Regulations 2004, and discussed with the DWER.

City's Comment:
Based on the information provided the proposal may be exempt for the requirement for a clearing permit under Schedule 6, Clause 2 of the EP Act. This exemption is dependent upon whether it is determined that the development constitutes a derived proposal from the RIZ (Ministerial Statement 863) which was previously referred and assessed under Part IV of the EP Act. If the exemption is applicable, any clearing must be in accordance with the implementation agreement or decision. In any instance, the applicant will be required to liaise with Department of Water and Environmental Regulation in this regard.

5. Department of Fire and Emergency Services (DFES)

BMP Methodology
The Bushfire Management Plan (BMP) has not been prepared in accordance with Appendix 3 of the Guidelines. Notwithstanding that the CBH Grain Jetty is predominantly not in a bushfire prone area the BMP must assess the subject land in its entirety that includes the CBH Grain Jetty and the pipeline.
Management Agreement On-site (APZ)
DFES acknowledges that the BMP recommends that the Development Approval incorporates a condition requiring a Maintenance Agreement between the proponent and the owner of Lot 108. The condition requires an Agreement to be prepared and implemented in relation to maintenance of off-site vegetation management zone within an undeveloped portion of Lot 108 in perpetuity, or until such a time the bushfire hazard is permanently removed and the lot is developed to a non-vegetated/low threat state. DFES notes that Clause 4.6.2 of the Guidelines states: *"As the BMP is a document that should apply for the life of the development, the decision-maker should require modifications to the document in the event that there are discrepancies, prior to endorsement and/or approval of the planning application being granted. Conditional approval should not be granted prior to the BMP being prepared and endorsed."* Technical evidence and verification should be included in the BMP to qualify the vegetation exclusion can be achieved and that it is enforceable in perpetuity. An endorsed copy of the agreement or written undertaking by the Lot 108 landowner would address this requirement.

Recommendation
The development design has not demonstrated compliance to Element 1: Location and Element 2: Siting and Design.
The BMP has not assessed the CBH Grain Jetty and Pipeline.

City Comments:
BMP Methodology

The pipeline and related infrastructure which is proposed to the south-west of Rockingham Beach Road, including Jetty infrastructure is subject to a separate Development Application under the MRS. Advice from Department of Planning, Lands and Heritage officers is that the response provided by the applicant adequately addresses the concern raised by DFES.

Management Agreement On-site (APZ)
As advised by the applicant's bushfire consultant, in the response to this matter (within Attachment 2), the City is satisfied that an enforceable mechanism would be in place between the lessee and owner to permit an off-site vegetation management zone on Lot 108 (outside of the Development Area), should MOJDAP resolve to approve the proposed development.

Recommendation
The development application and the BMP have adequately identified issues arising from the bushfire risk assessment and considered how compliance with the bushfire protection criteria can be achieved. The City does not consider that modifications to the BMP are required.

The City and Department of Planning, Lands and Heritage is satisfied that the development in its entirety complies with SPP3.7, specifically Element 1: Location and Element 2: Siting and Design which is discussed in detail in the Planning Assessment section of this RAR.

6. Department of Mines, Industry Regulation and Safety (DMIRS)

Based on the provided information, the products which are UN3082 are stored in Intermediate Bulk Containers (IBC) and are not classified at Dangerous Goods under SP01. The remainder of the bulk products are not classified as Dangerous Goods. As a result this site would not be considered as requiring a Dangerous Goods Storage Licence.

As a result of our assessment that the site will not require a Dangerous Goods Storage Licence, it is therefore not tested for distance/buffers under Dangerous Goods legislation or relevant Australian Standards.

City's Comment:
Noted. The application was referred to DMIRS for comment to clarify if the development requires a Dangerous Goods Licence and registration of the proposed pipelines.

7. Department of Planning, Lands and Heritage (DPLH)

The Department has no objection to the proposal.

City's Comment:
Noted.

8. Department of Water and Environmental Regulations (DWER)

DWER has reviewed the application and wishes to advise it has no objections to the proposal. General advice is provided in relation to Industry Regulation, Native Vegetation Regulation and Contamination.

City's Comments:

DWER makes comment that no decision on this proposal should be made until the EPA's process is complete. Upon resolution of the EPA's process for determination at the time, DWER in its submission includes various advice notes relating to Industry Regulation, Native Vegetation Regulation and Contamination.

In relation to Contamination, DWER notes that part of Lot 108 is classified as potentially contaminated and continues to be managed under the Contaminated Sites Act 2003. DWER acknowledges that the extent of the proposed Development

Area is outside the portions of Lot 108 where contaminated sites memorials are placed. Given the risks associated with the potential disturbance of remnant buried asbestos-containing material, DWER recommends an Asbestos Management Plan. The City agrees with the need for an Asbestos Management Plan, however, as a recommended condition of Development Approval. The applicant has been provided with a copy of the DWER submission.
9. DevelopmentWA
DevelopmentWA does not have any comments on the proposal.
City's Comment: Noted.
10. Fremantle Ports Authority (FPA)
FPA has reviewed the proposal and have no comment.
City's Comment: Noted.
11. Main Roads Western Australia (MRWA)
MRWA has reviewed the application and wishes to advise it has no objection to the proposal subject to conditions relating to a Deed of Agreement, earthworks encroachment into the road reserve, stormwater discharge and waste collection pick up point.
City's Comment: Noted. The recommended conditions and footnotes form part of the Officer recommendation for conditional Development Approval. The Deed of Agreement has been recommended as an advice note to the applicant since this matter would require agreement between CBH Group and MRWA, not the City.
12. Water Corporation (WC)
The WC has no objection to the proposed development. It is noted that the WC has an existing potable water pipe asset within Rockingham Beach Road and Lot 8003. Given the works proximity to the WC asset, in line with the corporations Working Near Assets Technical Guidelines, a damage risk assessment and working near assets approval shall be obtained prior to construction.
City's Comment: Noted. An advice note per WC comment has been recommended in the event development is approved.

Design Review Panel Advice

Not relevant

Swan Valley Planning

Not relevant

Planning Assessment:

The proposal has been assessed against all the relevant legislative requirements of the Scheme, State and Local Planning Policies, as outlined in the Legislation and Policy section of this RAR. The following matters have been identified as key considerations for the determination of this application:

- Bushfire
- Industrial Buffer
- Hazards and Safety

- Coastal Hazard Risk Management and Adoption Planning
- Cockburn Sound Catchment
- Development Standards
- Bicycle Parking and Car Parking

Bushfire

As the land is designated as a bushfire prone area and is classified as a 'high risk' land use, the applicant submitted a BMP, Risk Management Plan (RMP) and Bushfire Emergency Plan (BEP) in support of the application, as per the requirements of SPP3.7.

The proposal was referred to DFES which advised development does not comply with Elements 1 and 2 of the Guidelines for Planning in Bushfire Prone Areas because the BMP excluded the Jetty and associated infrastructure from the BMP assessment and technical evidence was not included in the BMP to qualify that vegetation exclusion can be achieved and that it is enforceable in perpetuity. The matter raised pertaining to Element 1 relates to the extent of Seaward Development Application while matter raised pertaining to Element 2 relates to the extent of the Landside Development Application.

The City liaised with DPLH officers and determined that the submitted BMP adequately addresses the concerns raised by DFES. This was previously detailed in the Referrals/consultation with Government/Service Agencies section of this RAR.

The BMP has been assessed and is considered acceptable.

Guidelines for Planning in Bushfire Prone Areas (GfPBPA)

The DPLH's GfPBPA provide supporting information to assist in the interpretation of the objectives and policy measures outlined in SPP3.7. The following is an assessment against the relevant requirements of the GfPBPA.

Provision	**Proposal**	**Compliance**
Element 1 – Location	The development in its entirety complies with the relevant Acceptable Solution for this Element, as the applicant has demonstrated through a BAL assessment and implementation of an Asset Protection Zone (APZ) that the maximum BAL level that buildings will be required to be constructed to will be BAL-19 of Australian Standard 3959 - Construction of Buildings in Bushfire Prone Areas (AS3959).	Yes
Element 2 – Siting and Development	The development complies with the relevant Acceptable Solution for this Element, as the buildings on the lot will be provided with an APZ (of the required dimension with off-site vegetation management zone).	Yes
Element 3 – Vehicular Access	The development includes two access routes which complies with the requirement of Acceptable Solution A3.1. Unless, however, there is a bushfire emergency, all truck movements as a result of this development are to	Yes

	travel north-east along Rockingham Beach Road as per MRWA requirements. The development also complies with the requirement of Acceptable Solution A3.4 (Battle-axe Lots) and Acceptable Solution A3.5 (Private Driveways).	
Element 4 – Water	The proposed development will be connected to reticulated water supply via surrounding development in accordance with WC requirements.	Yes

Industrial Buffer

The EPA Guidance Statement provides advice to proponents, responsible authorities, stakeholders and the public, on the minimum requirements for environmental management which the EPA would expect to be met when the Authority considers a development proposal.

For the purpose of the Guidance Statement, "industrial land use" is used in a general way to encompass a range of industrial, commercial and rural activities, associated with off-site emissions that may affect adversely the amenity of sensitive land uses. A table of land uses is provided in the Guidance Statement, however, it is recognised that the list is not definitive.

The generic separation distances are based on the consideration of typical emissions that may affect the amenity of nearby sensitive land uses. These include gaseous and particulate emissions, noise, dust and odour. The EPA recommends a 300-500m distance buffer to all chemical blending or mixing (where chemicals or chemical products are blended, mixed or packaged) industries from sensitive land uses. It should be noted that the buffer recommended by the Guidance Statement is not an absolute separation distance, but instead are default distances providing general guidance in the absence of site-specific technical studies.

The nearest sensitive land use – Cee n See Caravan Park is setback approximately 647m from the proposed storage facility on Lot 108 where fertilisers are proposed to be blended and packaged. The development meets the generic separation requirements and is compliant with the EPA Guideline Statement.

The proposal is considered to be compatible with existing industrial land uses in the area, which has been strategically designated for port related industry type land uses.

Hazards and Safety

The overseas catastrophe in Beirut, Lebanon has heightened public awareness of the hazards associated with land use activities such as storing of ammonium nitrate, which is reflected in the large number of submissions received objecting the development.

The determination of risk guidelines for hazardous development are matters within the domain of the EPA under the EPA Act 1986 and the DMIRS under the Dangerous Goods Safety Act 2004 and Regulations. DMIRS has confirmed that all the products and quantities intended to be stored are not classified as Dangerous Goods. It was also clarified that the proposed 20,000L diesel storage tank east of the storage warehouse does not require licencing either as it is under the 100KL threshold. As part of its assessment, EPA has determined that development is of a low risk.

Further, DFES hazardous materials unit did not raise any concerns pertaining to the location of the proposed development.

Development Control Policy 4.2 – Planning for Hazards and Safety supports the location of hazardous industries within industrial areas, separated from residential areas. As the development is located within the established RIZ and is separated from sensitive land uses, the proposal is considered to be consistent with the applicable policy objectives.

Coastal Hazard Risk Management and Adoption Planning (CHRMAP)

In September 2019, Council endorsed a CHRMAP, in accordance with State Planning Policy 2.6 - Coastal Planning. The CHRMAP is a strategic planning document that informs the community and decision makers about potential costal hazards (such as erosion and inundation), the risk and necessary actions. The CHRMAP outlines key directions for coastal adoption over a 100-year planning timeframe, while also prioritising management responses over the next 10 years.

An assessment of erosion vulnerability shows that the proposed development is within the coastal erosion hazard lines as modelled in the City's CHRMAP.

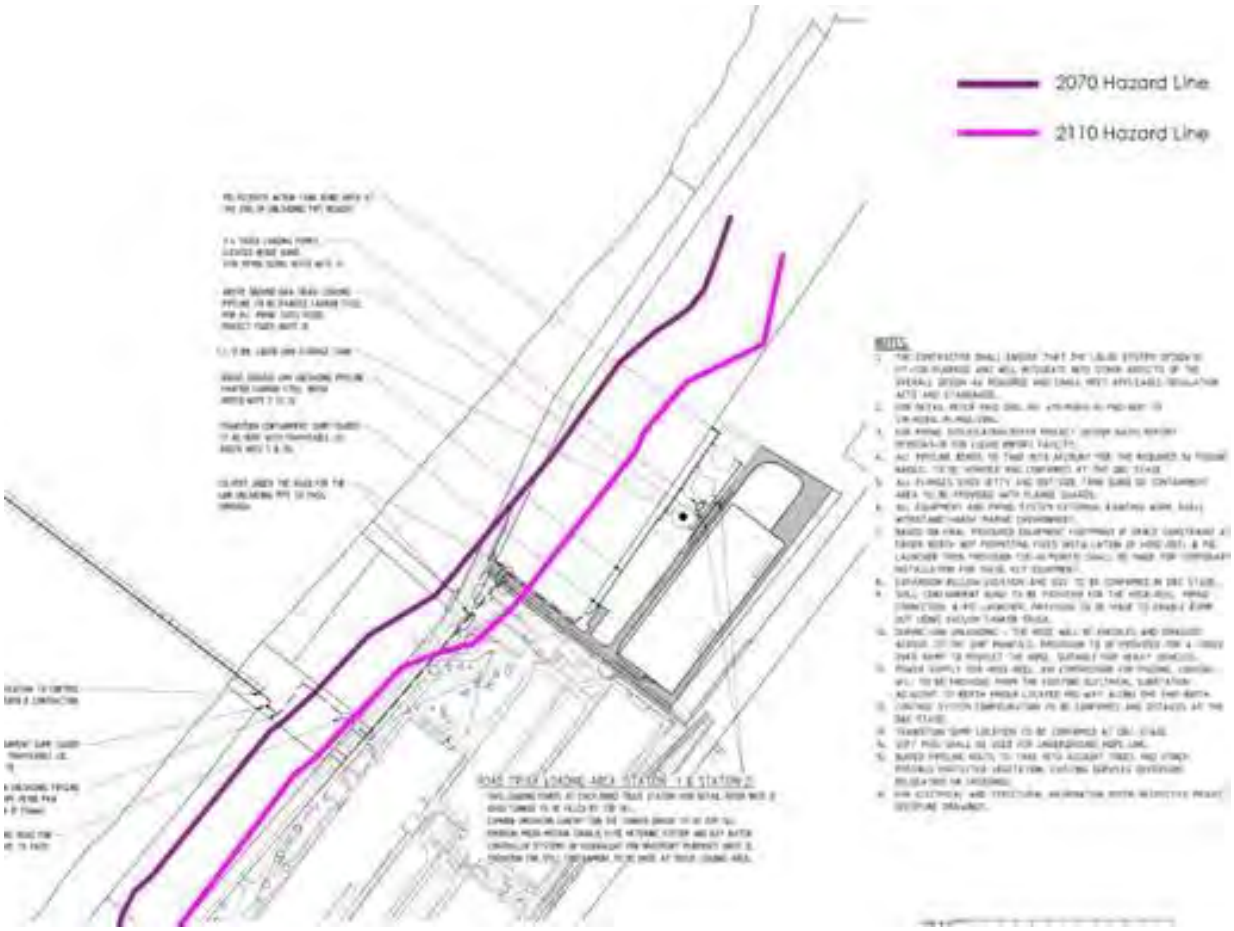


Figure 6. Coastal Erosion Overlay

The proposed overall development has not appropriately addressed the threat of coastal erosion as identified by the City's CHRMAP. It is noted that pipeline is to be built on existing infrastructure, however, the works will only increase the value of the assets at risk. The new pipeline and vehicle access-way onto Rockingham Beach Road are also proposed as part of the development seeking approval under TPS2 (refer to Figures 1-4). The extent of the overall proposed development extends beyond the areas of existing approved infrastructure, and as such, the Development Approval process is an appropriate mechanism to ensure that the risk of future coastal hazards is suitably addressed prior to these development commencing.

To address this risk, it is recommended that a condition requires the proponent to implement measures to protect or remove pipeline and road infrastructure once the most landward part of the Horizontal Shoreline Datum (HSD) is within the S1 storm erosion allowance of 17 metres of the most seaward part of the proposed development. This has been agreed at Officer level with the DPLH staff.

The CHRMAP has acknowledged the strategic economic importance of CBH Kwinana Grain Terminal to the State and this infrastructure has been identified as a priority for long-term protection, subject to this protection being funded by the CBH Group or the State Government. As the CHRMAP was endorsed by Council, it is the City's position that any future protection of this infrastructure will not be funded by the City.

Cockburn Sound Catchment (Nutrients, Sewerage and Drainage)

The liquid UAN fertiliser and solid fertiliser is to be stored in enclosed, sealed storage facilities that will prevent the leaching of nutrients to the environment and will be handled and stored in compliance with the licensing requirements specified by DWER. A liquid UAN Spill Response Procedure and Diesel Spill Response Plan have been prepared to account for any spillage of liquid UAN fertiliser. The proposed development is not considered to be a nutrient intensive land use and will not result in nutrient loading.

There are no reticulated sewerage networks in the area. As reticulated sewerage service is not available on Lot 108, a secondary treatment system with nutrient retention will be required for wastewater produced from staff facilities. The storage of potentially contaminated stormwater from bunded areas will be directed into a waste stabilisation (evaporation) pond. An application will need to be made to the City of Rockingham's Health Services for installation of the secondary treatment system and the evaporation pond as required by Health (Treatment of Sewerage and Disposal of Effluent and Liquid Waste) Regulations 1974.

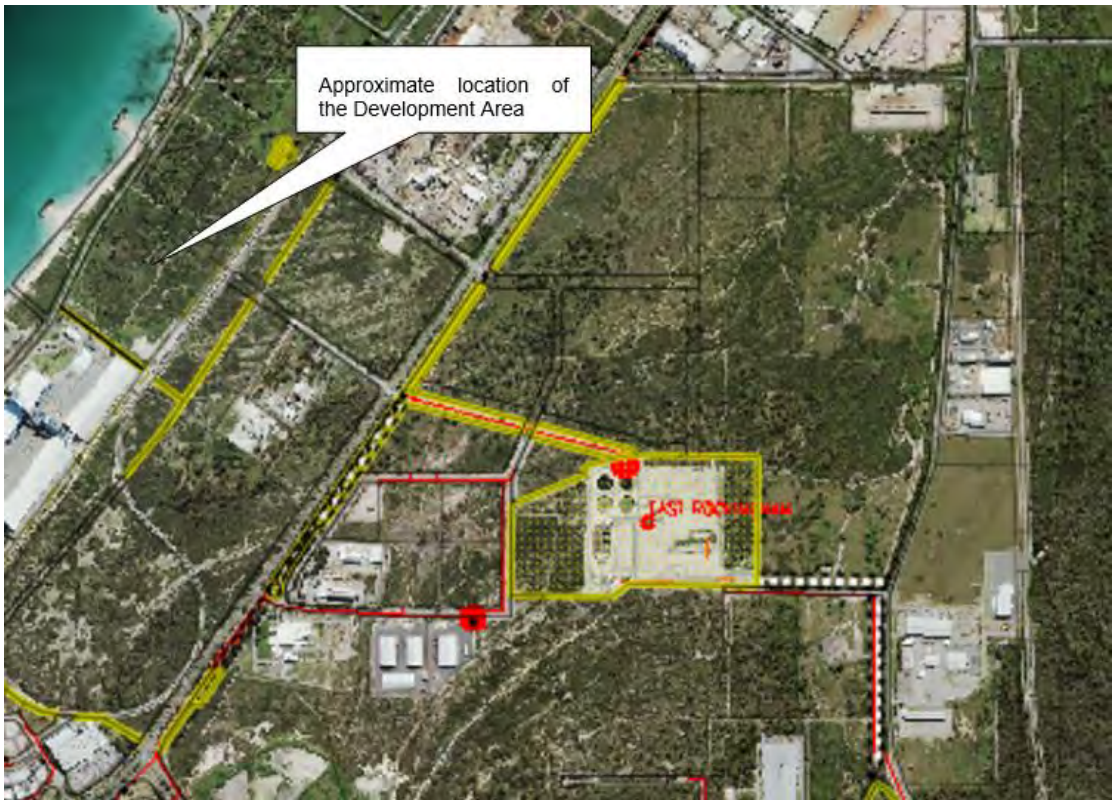


Figure 7. Existing Sewer Network (red line shows the location of any sewerage)

Given that engineering plans and cross-sections have not been provided at the development application stage (generally provided at the detailed design stage), it is difficult to determine how the proposed drainage infrastructure will integrate with all other elements of the development. The applicant submitted Water Management Strategy does address the initial concerns raised pertaining to urban water and consequently the City is satisfied that management of drainage and groundwater can be resolved at the detailed design stage.

General Development Provisions

Provision	Requirement	Proposal	Compliance
TPS2 - Clause 4.10.4 (Façade)	The facades of all buildings visible from the primary road or open space area shall be of masonry construction or any other material approved by the Local Government in respect of the ground floor level, provided that if concrete panels are used, such panels must have an exposed aggregate or textured finished. The second floor level or its equivalent may be constructed of any other material in accordance with the Building Code of Australia and to the satisfaction of Local Government.	The proposed development on Lot 108 does not have a direct frontage to its primary road, however, it does adjoin a Parks and Recreation reserve to the west. The storage warehouse, administration building and three liquid storage tanks visible from the reserve are proposed to be constructed of materials generally expected within an industrial setting (e.g. concrete, fibre cement sheeting and colorbond). A proposed 10m wide landscaping strip along the western side boundary will further assist soften visual impact from the public realm.	Yes
TPS2 - Clause 4.10.4 (Fencing)	No fence visible from a road or open space reserve shall be constructed of materials/colours which in the opinion of Local Government are unsightly or detract from the amenity of the locality, or be used for signage where the approval of the Local Government has not been granted. Any industrial (eg. chain wire) fencing forward of the street building	The proposed fencing shall be constructed from black PVC coated galvanised mesh material at a height of 2.1m along the northern, eastern and western side boundaries of the site. The proposed fencing material is considered acceptable as it will not be visible from Rockingham Beach Road.	Yes

	setback line shall be landscaped to the satisfaction of the Local Government.		
TPS2 - Clause 4.10.4 (Setback Area)	No use of the area between the street alignment and the prescribed building setback line shall be permitted other than for landscaping, or for pedestrian and vehicular circulation and parking, except that not more than 20% of the setback area may be used for trade display purposes, to be approved at the discretion of the Local Government.	Area between the street alignment and prescribed building setback will only be used for pedestrian and vehicular circulation.	Yes
Clause 4.10.9 (Landscaping)	Landscaping shall be provided on all street frontages for a distance of not less than 10 metres from each property boundary. At the discretion of Local Government, additional landscaping may be required on the remainder of the site.	Development on Lot 108 does not have a direct street frontage. A 10m wide landscaping strip has been provided along the western side boundary and a partial 3m wide landscaping strip has been provided along the northern side boundary of the development site. A revised Landscape Plan was also subsequently submitted as requested by the City showing a landscape treatment along the northeaster side of the access road. The City does not consider that any further landscaping is necessary to support the proposed development on Lot 108, however, notes that the plan does not provide any details on the proposed drainage swales. Because of this the Landscape Plan is not consistent with the Water Management Strategy which is evident in the vegetation that is proposed along the northern side boundary (e.g vegetation not typical for regular inundation –	Yes, subject to condition of Development Approval

		Banskia Trees are not typically positioned in drainage swales).	

Bicycle Parking

Land use	**Minimum Short-Term Parking**	**Minimum Long-Term Parking**
Office (350m^2 NLA)	0.05 spaces per 100m^2 NLA	0.45 spaces per 100m^2 NLA
Industry (<1000m^2 NLA)	N/A	0.1 spaces per 100m^2 NLA
Note: All rounding of bicycle parking rates is to be calculated by rounding up to the nearest whole number.		

The proposed development requires the provision of 2.8 (3) long-term bicycle parking spaces. The proposed development provides two U-rails along the eastern side of the administration building capable of parking four bicycles.

In its submission, the applicant states that "*due to the frequency of heavy vehicles accessing the site and the limited access points, along with the intended 24 / 7 operational nature of development, site access may be required to be restricted to vehicles only."* Whilst the above comments are acknowledged, cycling may be attractive to employees of the proposed development and two U-rails are considered appropriate as on-site traffic safety measures can be adopted by the operator to ensure safe cyclist passage. A condition of Development Approval requiring the provision of minimum 3 bicycle parking spaces is recommended.

Car Parking

The development proposes 11 car parking bays which includes one accessible bay.

The applicant has stated that the facility has an intended workforce of six, with a maximum capacity for 10 staff to manage and coordinate the facility operations. It is understood that all car parking and vehicular access will be at the facility on Lot 108 with no new parking or vehicle access proposed at the Jetty. Entry to the facility will also be restricted to authorised vehicles via a security gate adjacent to the administration building along the access road into the site. Given there are adequate bays to accommodate the intended workforce and visitor access being restricted, the parking requirements of TPS2 are considered to be compliant with the relevant criteria.

Conclusion:

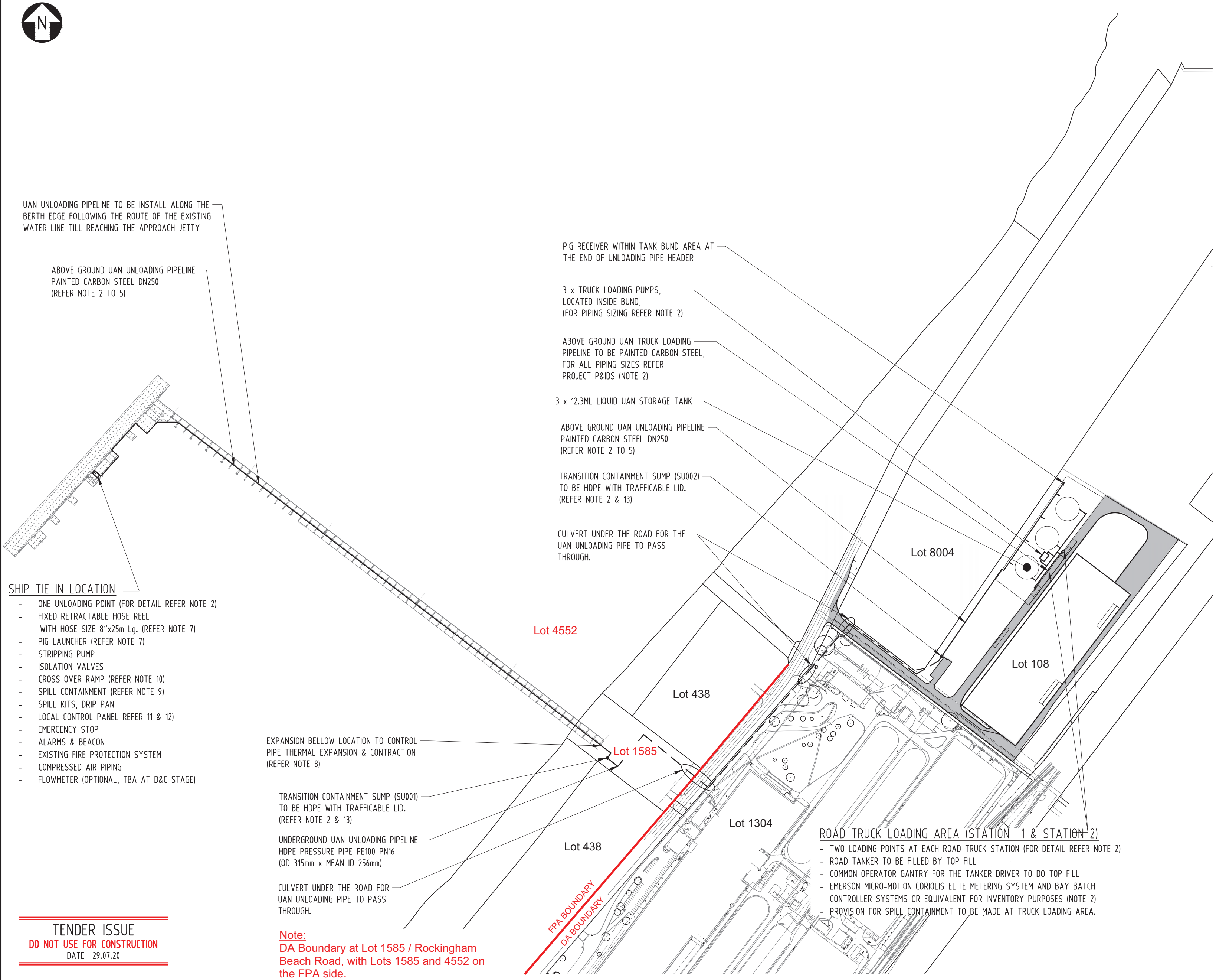
The proposed development is an industrial land use. The context of the surrounding locality is for a mix of general, heavy industrial and port related industry land uses, with surrounding vacant land to the north-east and south-east also zoned for industrial purposes. The proposed development is considered compatible with the existing surrounding context of the locality.

The proposed development is compliant with TPS2, Policy requirements and represents effective use of currently vacant industrial land within the RIZ.

Granting Development Approval consents to the proposed land use and location of buildings. Should an approval be granted, the applicant is still subject to further approvals (Building Permits and DWER licences) that must be obtained prior to development commencing.

It should be noted that the MOJDAP will not be able to make its decision on the proposed development until the Minister for Environment decision is made under section 45(8) of the EPA Act 1986, which involves the issue of the Ministerial Statement. The EPA assessment has drawn to a conclusion and it is expected that the Ministerial Statement will be released shortly after.

It is recommended that the application be conditionally approved.



NOTES:

1. THE CONTRACTOR SHALL ENSURE THAT THE LIQUID SYSTEM DESIGN IS FIT-FOR-PURPOSE AND WILL INTEGRATE INTO OTHER ASPECTS OF THE OVERALL DESIGN AS REQUIRED AND SHALL MEET APPLICABLE REGULATION, ACTS AND STANDARDS.
2. FOR DETAIL REFER P&ID DRG. NO. 419-M2814-PI-PND-0001 TO 419-M2814-PI-PND-0004.
3. FOR PIPING SPECIFICATION REFER PROJECT DESIGN BASIS REPORT PE190349-10 FOR LIQUID IMPORT FACILITY.
4. ALL PIPELINE BENDS TO TAKE INTO ACCOUNT FOR THE REQUIRED 5d PIGGING RADIUS. TO BE VERIFIED AND CONFIRMED AT THE D&C STAGE
5. ALL FLANGES OVER JETTY AND OUT SIDE TANK BUND OR CONTAINMENT AREA TO BE PROVIDED WITH FLANGE GUARDS.
6. ALL EQUIPMENT AND PIPING SYSTEM EXTERNAL PAINTING WORK SHALL WITHSTAND HARSH MARINE ENVIRONMENT.
7. BASED ON FINAL PROCURED EQUIPMENT FOOTPRINT IF SPACE CONSTRAINT AT FINGER BERTH NOT PERMITTING FIXED INSTALLATION OF HOSE-REEL & PIG LAUNCHER THEN PROVISION (TIE-IN POINTS) SHALL BE MADE FOR TEMPORARY INSTALLATION FOR THESE KEY EQUIPMENT.
8. EXPANSION BELLOW LOCATION AND SIZE TO BE CONFIRMED IN D&C STAGE.
9. SPILL CONTAINMENT BUND TO BE PROVIDED FOR THE HOSE-REEL, PIPING CONNECTION, & PIG LAUNCHER. PROVISION TO BE MADE TO ENABLE PUMP OUT USING VACUUM TANKER TRUCK.
10. DURING UAN UNLOADING - THE HOSE WILL BE UNCOILED AND DRAGGED ACROSS TO THE SHIP MANIFOLD. PROVISION TO BE PROVIDED FOR A CROSS OVER RAMP TO PROTECT THE HOSE, SUITABLE FOR HEAVY VEHICLES.
11. POWER SUPPLY FOR HOSE-REEL, AIR COMPRESSOR FOR PIGGING, LIGHTING etc., TO BE PROVIDED FROM THE EXISTING ELECTRICAL SUBSTATION ADJACENT TO BERTH FINGER LOCATED MID-WAY ALONG THE SHIP BIRTH.
12. CONTROL SYSTEM CONFIGURATION TO BE CONFIRMED AND DETAILED AT THE D&C STAGE.
13. TRANSITION SUMP LOCATION TO BE CONFIRMED AT D&C STAGE.
14. SOFT PIGS SHALL BE USED FOR UNDERGROUND HDPE LINE.
15. BURIED PIPELINE ROUTE TO TAKE INTO ACCOUNT TREES AND OTHER POSSIBLE PROTECTED VEGETATION, EXISTING SERVICES (DIVERSION, RELOCATION OR CROSSING).
16. FOR ELECTRICAL AND STRUCTURAL INFORMATION REFER RESPECTIVE PROJECT DISCIPLINE DRAWINGS,

1:2500 @ A1
1:5000 @ A3
0 40 80 120 160 200 240 m

CBH GROUP
ABN 29 256 604 947

ÂCOR CONSULTANTS (WA) Pty Ltd
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JOB. No. PE190349

REF DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
X_PE190349_ARCH	ARCHITECTURAL	C	29.07.20	TENDER ISSUE	US	BM	BM
X_PE190349_JETTY SURVEY	EXISTING JETTY SURVEY	B	29.06.20	TENDER ISSUE	US	BM	BM
X_PE190349_FACILITY SURVEY	EXISTING FACILITY SURVEY	A	29.05.20	TENDER ISSUE	US	BM	BM

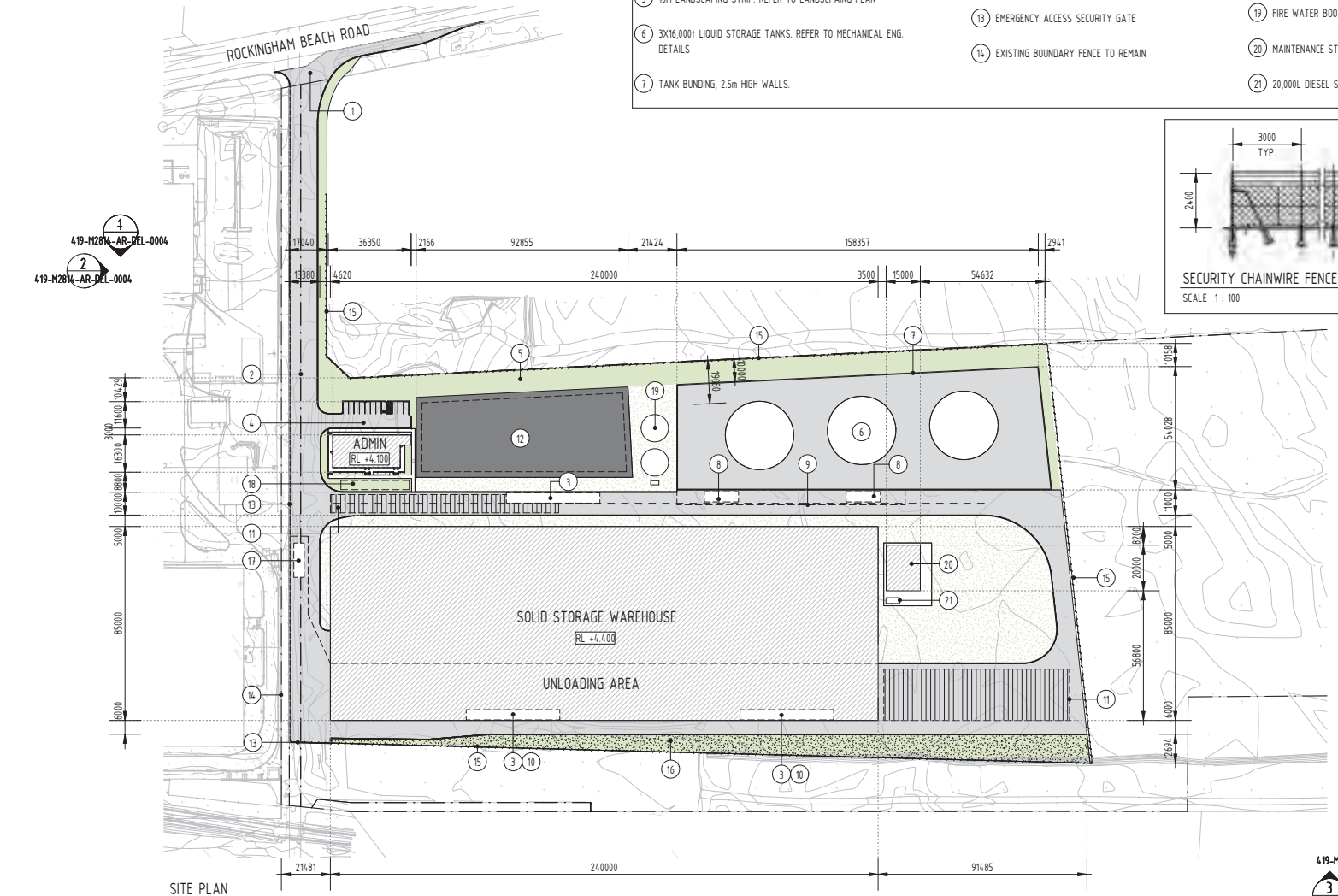
SCALE: AS SHOWN	DRAWN: NS	27.03.20
SHEET: A1	CHECKED: BM	01.04.20
PROJECT: M2814	DESIGNED: US	01.04.20
CONTRACT No	DESIGN APPR: BM	01.04.20
	PROJECT APPR: PR	

TITLE
KWINANA FERTILISER IMPORT FACILITY
FERTILISER FACILITY CONCEPT STAGE DESIGN
OVERALL FACILITY PIPING
GENERAL ARRANGEMENT

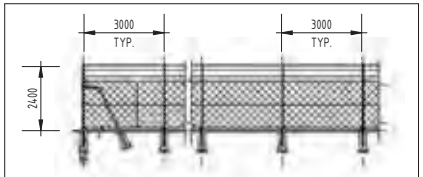
DRG No 491-M2814-PI-DGA-0001 | SHEET 1 OF 1 | REV. C

NOTES

1. CROSSOVER TO LOCAL AUTHORITY REQUIREMENTS REFER TO CIVIL ENG. DETAILS
2. 7M WIDE AUTOMATED SWING GATES
3. AUTOMATED WEIGHBRIDGE
4. FOR CARPARK REFER TO LOCALISED SITE PLAN
5. 10M LANDSCAPING STRIP. REFER TO LANDSCPAING PLAN
6. 3X16,000t LIQUID STORAGE TANKS. REFER TO MECHANICAL ENG. DETAILS
7. TANK BUNDING, 2.5m HIGH WALLS.
8. UAN LOADING POINT
9. AWNING TO UAN LOADING AREA
10. COVERED LOADING AREA - SOLIDS
11. UNDERGROUND STORMWATER INFILTRATION SYSTEM
12. EVAPORATION POND, SIZE TO BE CONFIRMED
13. EMERGENCY ACCESS SECURITY GATE
14. EXISTING BOUNDARY FENCE TO REMAIN
15. PROPOSED SECURITY CHAINWIRE FENCE TO BOUNDARY 2.1M HIGH
16. STORMWATER SWALE WITH LANDSCAPING. REFER TO CIVIL ENGINEERS DETAILS
17. WHEEL WASH. 15M LONG
18. SEPTIC SYSTEM AREA
19. FIRE WATER BOOSTER PUMPS & BUFFER TANKS
20. MAINTENANCE STORE
21. 20,000L DIESEL STORAGE TANK



SITE PLAN
SCALE 1 : 1000



SECURITY CHAINWIRE FENCE DETAIL
SCALE 1 : 100

LEGEND

- BITUMEN PAVEMENT. REFER TO CIVIL ENGINEERS DETAILS
- CONCRETE FOOTPATHS. REFER TO ENGINEERS DETAILS
- LANDSCAPED AREA. REFER TO LANDSCAPING PLAN FOR DETAILS
- STORMWATER SWALE. REFER TO CIVIL ENGINEERS DETAILS
- CADASTRAL BOUNDARY LINE
- PROPOSED FENCING. REFER TO NOTES
- PROPOSED FENCING. REFER TO NOTES

AREAS

ADMINISTRATION BUILDING	444 m²
SOLID STORAGE WAREHOUSE	20400 m²
EVAPORATION POND	3507 m²
UAN LIQUID STORAGE	8061 m²
TOTAL	32412 m²

PARKING SCHEDULE

DISABLED BAY		
2/2400mm x 5400m	SHARED BAY W/ BOLLARD TO COMPLY W/ AS2890.6	1
STANDARD BAY		
2400mm x 5400mm		10
TOTAL		11

PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE - 04.08.20

1:100 @ A1 / 1:200 @ A3 — 0 1 2 3 4 5 6 7 8 9 10 m
1:1000 @ A1 / 1:2000 @ A3 — 0 10 20 30 40 50 60 70 80 90 100 m

CBH GROUP

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JOB. No.

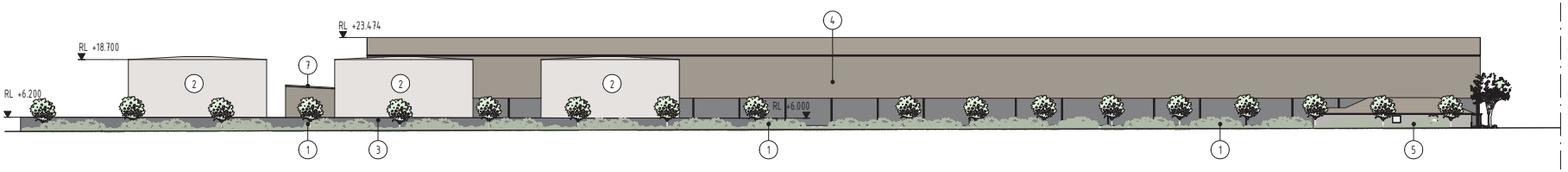
REF DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
		H	08.12.20	UPDATED LANDSCAPING AS PER CLIENT COMMENTS	JM		
		G	02.12.20	UPDATED LANDSCAPING AS PER CLIENT COMMENTS	JM		
		F	04.08.20	ISSUED FOR INFORMATION	NM		
		E	29.07.20	ISSUED FOR INFORMATION	NM		
		D	27.07.20	ISSUED FOR INFORMATION	NM		
		C	26.06.20	ISSUED FOR INFORMATION	NM		

SCALE	As indicated
SHEET	A1
PROJECT	
CONTRACT No.	

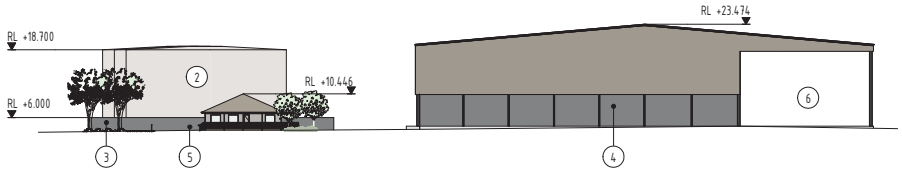
DRAWN	N.MCDONALD	02.06.20
CHECKED	J.MARTIN	25.06.20
DESIGNED	N.MCDONALD	02.06.20
DESIGN APPR		
PROJECT APPR		

TITLE
KWINANA TERMINAL
FERTILISER STORAGE FACILITY
SCHEMATIC DESIGN
SITE PLAN

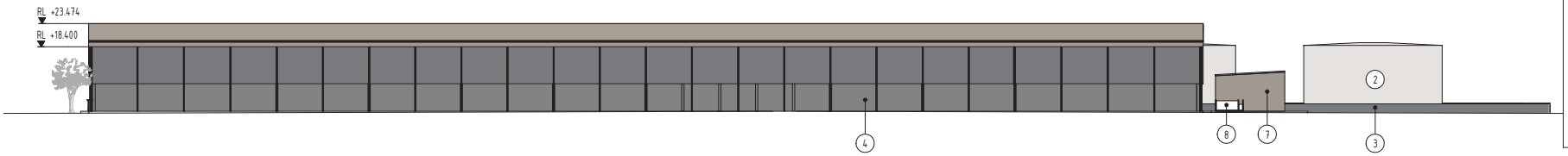
DRG No. 419-M2814-AR-DLP-0002 | SHEET 2 OF 15 | REV H



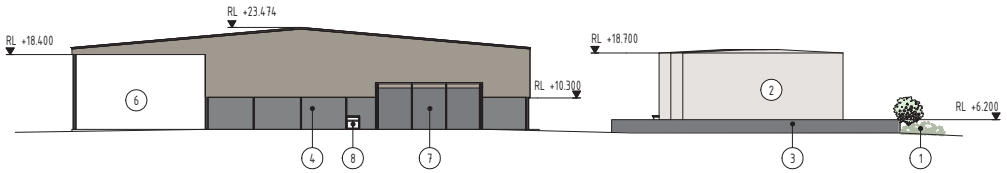
WEST (STREET) ELEVATION 1
SCALE 1 : 500 419-M2814-AR-DGA-0006



SOUTH ELEVATION 2
SCALE 1 : 500 419-M2814-AR-DGA-0006



EAST ELEVATION 3
SCALE 1 : 500 419-M2814-AR-DGA-0006



NORTH ELEVATION 4
SCALE 1 : 500 419-M2814-AR-DGA-0006

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS RELATING TO THIS PROJECT & SPECIFICATIONS

ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE BUILDING CODE OF AUSTRALIA

ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS AND REGULATIONS OF ALL LOCAL AUTHORITIES

INSTALLATION OF ALL BUILDING MATERIALS, TO BE INSTALLED IN ACCORDANCE TO MANUFACTURERS RECOMMENDATIONS.

NOTES.

1. 10M LANDSCAPING STRIP. REFER TO LANDSCPAING PLAN
2. 3x??† LIQUID STORAGE TANKS. REFER TO MECHANICAL ENG. DETAILS
3. TANK BUNDING, 2.5m HIGH WALLS.
4. SOLID STORAGE WAREHOUSE
5. ADMINISTRATION BUILDING
6. COVERED LOADING AREA - SOLIDS
7. MAINTENANCE STORE
8. 20,000L DIESEL STORAGE TANK

PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE – 04.08.20

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

ACOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
JOB. No.

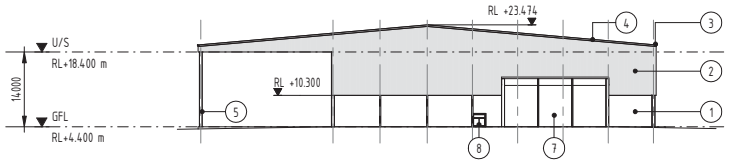
REF DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
		D	04.08.20	ISSUED FOR INFORMATION	NM		
		C	27.07.20	ISSUED FOR INFORMATION	NM		
		B	26.06.20	ISSUED FOR INFORMATION	NM		
		A	02.06.20	ISSUED FOR INFORMATION	NM		

SCALE 1 : 500
SHEET A1
PROJECT
CONTRACT No.

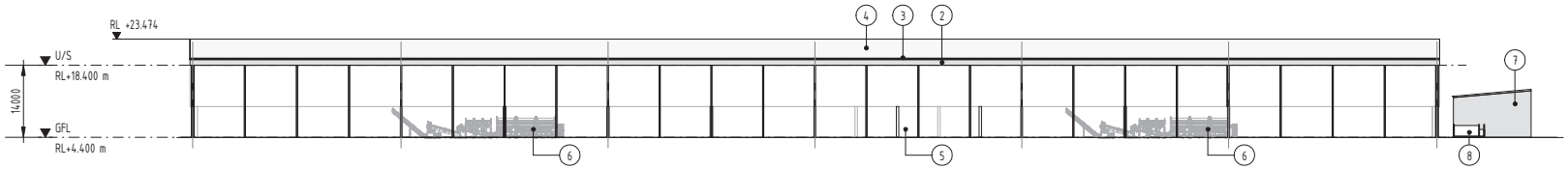
DRAWN	N.MCDONALD	02.06.20
CHECKED	J.MARTIN	25.06.20
DESIGNED	N.MCDONALD	02.06.20
DESIGN APPR		
PROJECT APPR		

TITLE
KWINANA TERMINAL
FERTISLISER STORAGE FACILITY
SCHEMATIC DESIGN
SITE ELEVATIONS

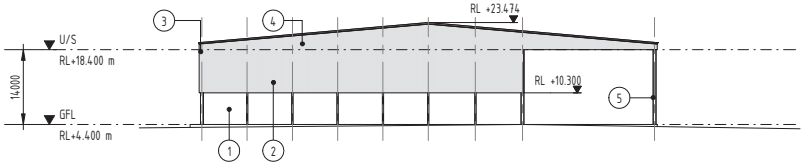
DRG No. 419-M2814-AR-DEL-0004
SHEET 4 OF 15
REV D



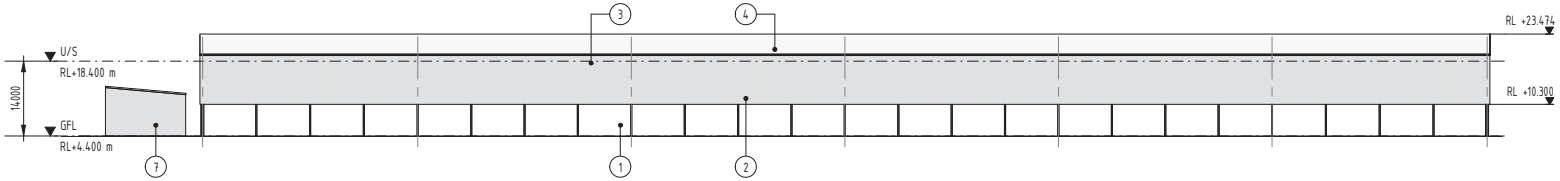
NORTH ELEVATION (1)
SCALE 1 : 500
419-M2814-AR-DGA-0009



EAST ELEVATION (2)
SCALE 1 : 500
419-M2814-AR-DGA-0009



SOUTH ELEVATION (3)
SCALE 1 : 500
419-M2814-AR-DGA-0009



WEST ELEVATION (4)
SCALE 1 : 500
419-M2814-AR-DGA-0009

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

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INSTALLATION OF ALL BUILDING MATERIALS, TO BE INSTALLED IN ACCORDANCE TO MANUFACTURERS RECOMMENDATIONS.

ELEVATION NOTES

1. CONCRETE WALL 6M HIGH TO ENGINEERS DETAILS. COLOUR AS PER FINSHES SCHEDULE
2. COLORBOND SHEETING LAID VERTICALLY. COLOUR AS PER FINSHES SCHEDULE
3. COLORBOND GUTTER AND FASCIA TO MATCH ROOF COLOUR
4. COLORBOND ROOF SHEETING LAID @ 5 DEGREE PITCH. COLOUR AS PER FINISHES SCHEDULE
5. STEEL COLUMN TO ENGINEERS DETAILS. COLOUR AS PER FINISHES SCHEDULE
6. BLENDING MACHINE
7. MAINTENANCE STORE
8. 20,000L DIESEL STORAGE TANK

PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE – 04.08.20

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

ÂCOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
Atwell Arcade, Level 1, Suite 101
3 Cantonment Street
Fremantle WA 6160
PH: +61 8 9339 3700
JOB. No.

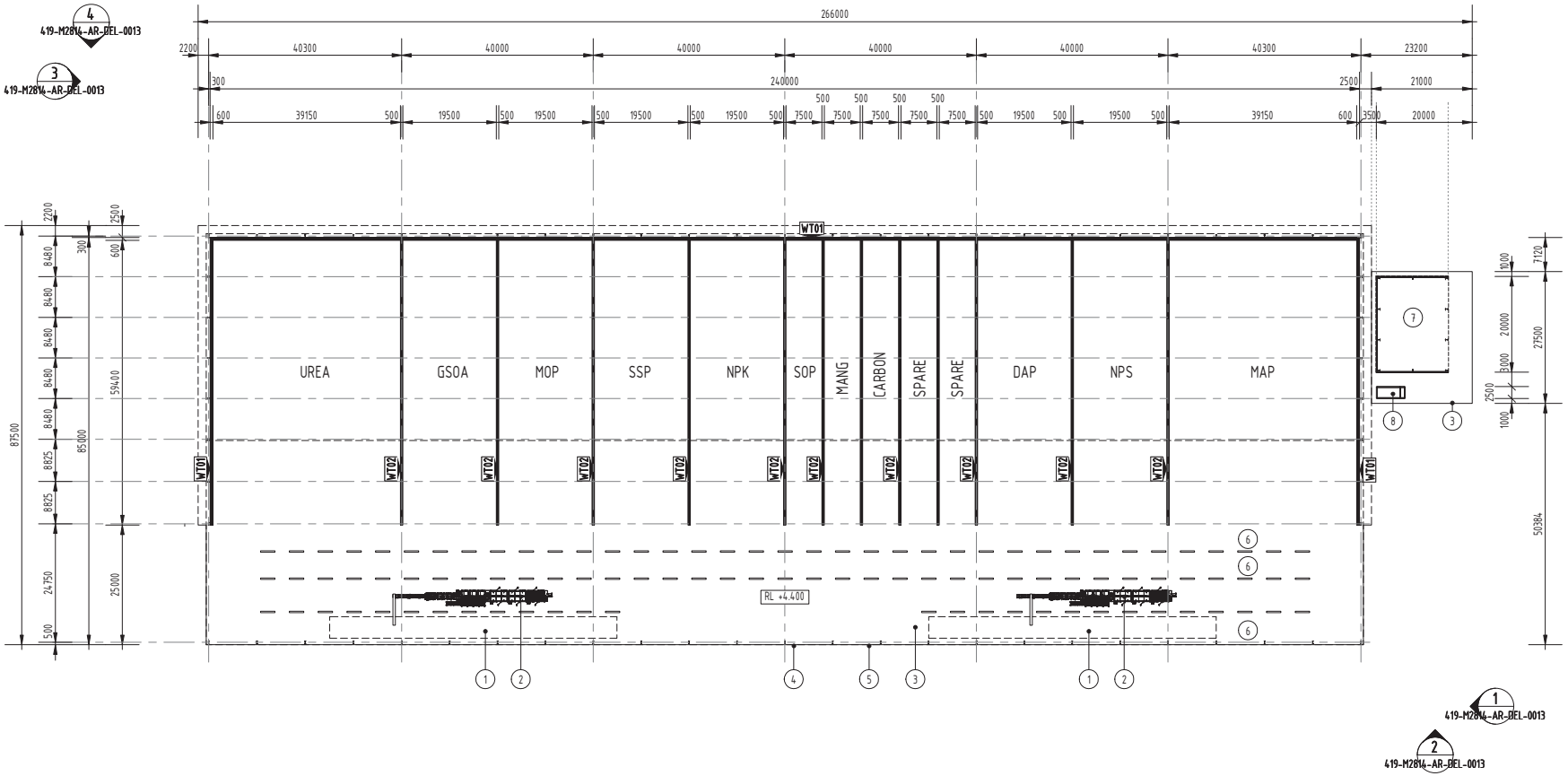
REF DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
		D	04.08.20	ISSUED FOR INFORMATION	NM		
		C	24.07.20	ISSUED FOR INFORMATION	NM		
		B	26.06.20	ISSUED FOR INFORMATION	NM		
		A	02.06.20	ISSUED FOR INFORMATION	NM		

SCALE 1 : 500
SHEET A1
PROJECT
CONTRACT No.

DRAWN	N.MCDONALD	24.07.20
CHECKED	J.MARTIN	24.07.20
DESIGNED	N.MCDONALD	24.07.20
DESIGN APPR		
PROJECT APPR		

TITLE
KWINANA TERMINAL
FERTILISER STORAGE FACILITY
SOLIDS STORAGE WAREHOUSE
ELEVATIONS

DRG No. 419-M2814-AR-DEL-0013
SHEET 12 OF 15
REV D



GENERAL ARRANGEMENT PLAN

SCALE 1 : 500

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS RELATING TO THIS PROJECT & SPECIFICATIONS

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LEGEND

WTX	WALL TYPE TAG
RL XX.XXX	PROPOSED FLOOR LEVEL

WALL TYPES

ID	DESCRIPTION
WT01	-600MM THK CONCRETE WALL -TO STRUCTURAL ENGINEERS DETAILS -6M HIGH
WT02	-500MM THK CONCRETE WALL -TO STRUCTURAL ENGINEERS DETAILS -6M HIGH
WT03	-COLORBOND SHEETING LAID VERT. -STEEL GIRTS TO STRUCTURAL ENGINEERS DETAILS

NOTES

1. AUTOMATED WEIGHBRIDGE INSTALLED AT GROUND LEVEL
2. BLENDING EQUIPMENT
3. CONCRETE SLAB TO ENGINEERS DETAILS
4. EXTENT OF ROOF DASHED OVER
5. STEEL COLUMNS TO ENGINEERS DETAILS
6. ONE WAY DRIVE THRU LANE
7. MATENANCE STORE
8. 20,000L DIESEL STORAGE TANK

PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE – 04.08.20

1:500 @ A1
1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

ACOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
Atwell Arcade, Level 1, Suite 101
3 Cantonment Street
Fremantle WA 6160
PH: +61 8 9339 3700
JOB. No.

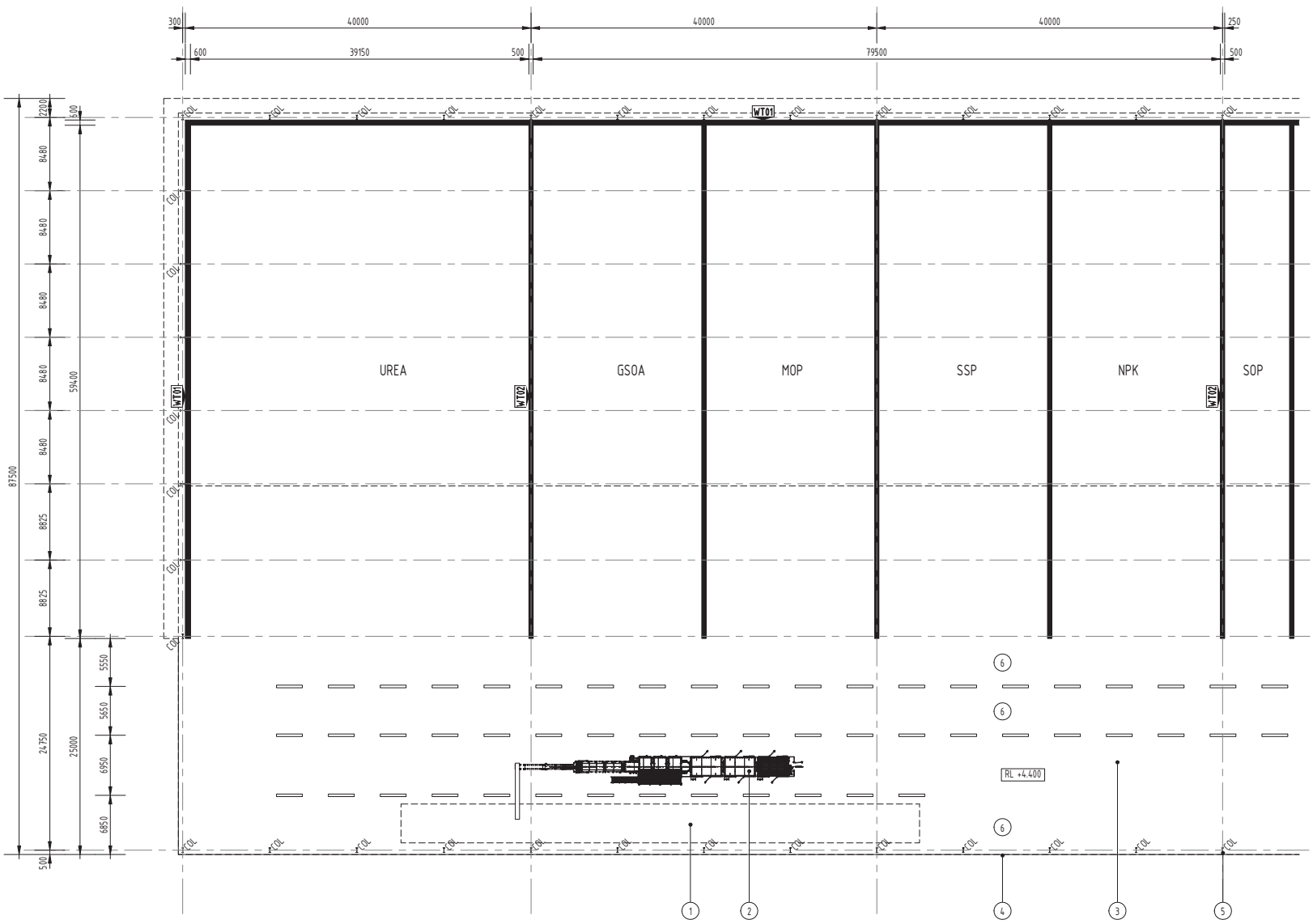
REF DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
		D	04.08.20	ISSUED FOR INFORMATION	NM		
		C	24.07.20	ISSUED FOR INFORMATION	NM		
		B	26.06.20	ISSUED FOR INFORMATION	NM		
		A	02.06.20	ISSUED FOR INFORMATION	NM		

SCALE 1 : 500
SHEET A1
PROJECT
CONTRACT No.

DRAWN	N.MCDONALD	24.07.20
CHECKED	J.MARTIN	24.07.20
DESIGNED	N.MCDONALD	24.07.20
DESIGN APPR		
PROJECT APPR		

TITLE
KWINANA TERMINAL
FERTISLISER STORAGE FACILITY
SOLIDS STORAGE WAREHOUSE
GENERAL ARRANGMENT PLAN

DRG No. 419-M2814-AR-DGA-0009
SHEET 9 OF 15
REV D



FLOOR PLAN - PART A

SCALE 1 : 250

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS RELATING TO THIS PROJECT & SPECIFICATIONS

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INSTALLATION OF ALL BUILDING MATERIALS, TO BE INSTALLED IN ACCORDANCE TO MANUFACTURERS RECOMMENDATIONS.

LEGEND

WTX	WALL TYPE TAG
RL XX.XXX	PROPOSED FLOOR LEVEL

WALL TYPES

ID	DESCRIPTION
WT01	-600MM THK CONCRETE WALL -TO STRUCTURAL ENGINEERS DETAILS -6M HIGH
WT02	-500MM THK CONCRETE WALL -TO STRUCTURAL ENGINEERS DETAILS -6M HIGH
WT03	-COLORBOND SHEETING LAID VERT. -STEEL GIRTS TO STRUCTURAL ENGINEERS DETAILS

NOTES

1. AUTOMATED WEIGHBRIDGE INSTALLED AT GROUND LEVEL
2. BLENDING EQUIPMENT
3. CONCRETE SLAB TO ENGINEERS DETAILS
4. EXTENT OF ROOF DASHED OVER
5. STEEL COLUMNS TO ENGINEERS DETAILS
6. ONE WAY DRIVE THRU LANE

PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE - 26.06.20

1:250 @ A1
1:500 @ A3
0 4 8 12 16 20 24 m

CBH GROUP

ÂCOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
Atwell Arcade, Level 1, Suite 101
3 Cantonment Street
Fremantle WA 6160
PH: +61 8 9336 2100
JOB. No.

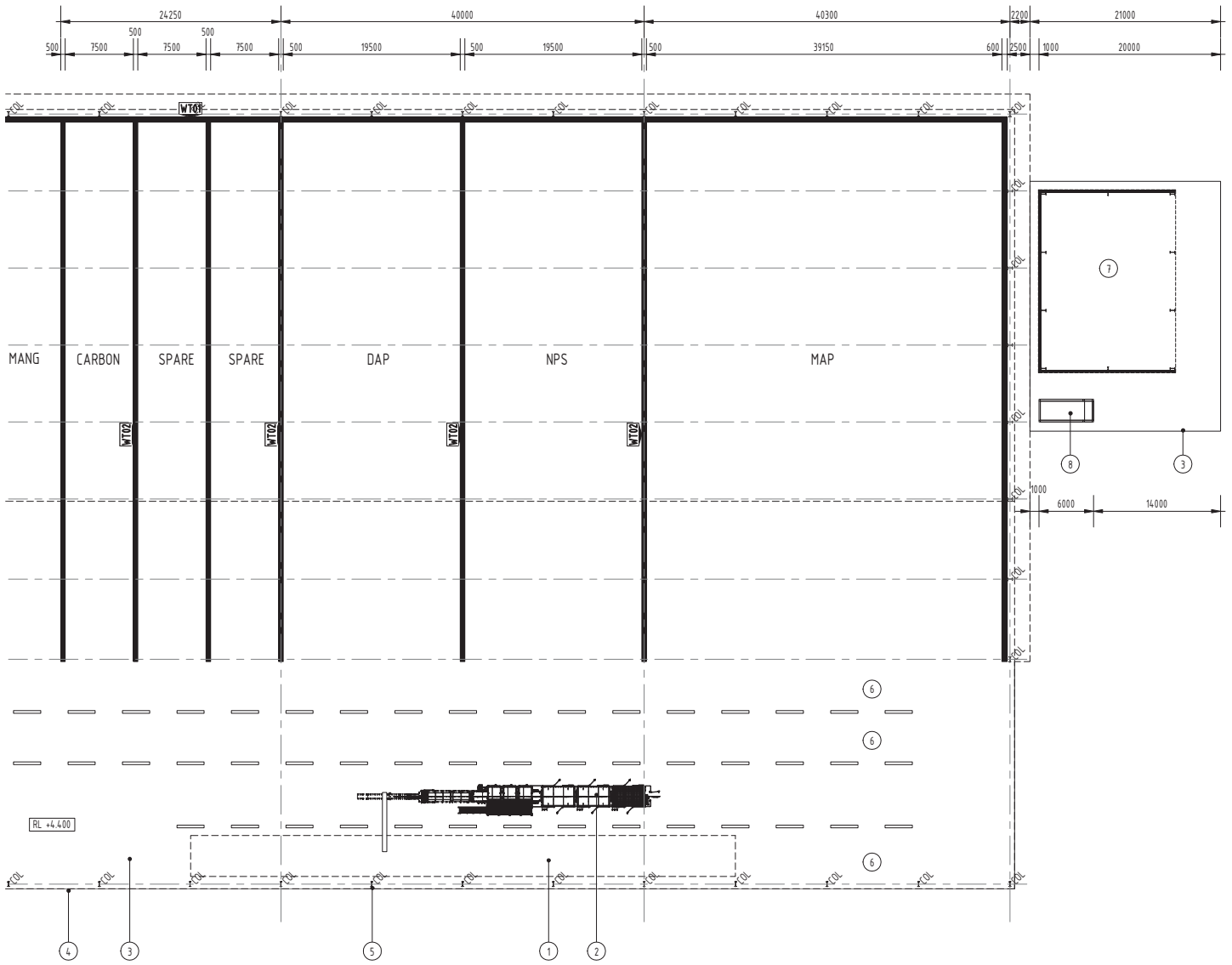
REF DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
		C	24.07.20	ISSUED FOR INFORMATION	NM		
		B	26.06.20	ISSUED FOR INFORMATION	NM		
		A	02.06.20	ISSUED FOR INFORMATION	NM		

SCALE 1 : 250
SHEET A1
PROJECT
CONTRACT No.

DRAWN	N.MCDONALD	24.07.20
CHECKED	J.MARTIN	24.07.20
DESIGNED	N.MCDONALD	24.07.20
DESIGN APPR		
PROJECT APPR		

TITLE
KWINANA TERMINAL
FERTILISER STORAGE FACILITY
SOLIDS STORAGE WAREHOUSE
FLOOR PLAN - PART A

DRG No. 419-M2814-AR-DGA-0010
SHEET 10 OF 14
REV. C



FLOOR PLAN - PART B

SCALE 1 : 250

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS RELATING TO THIS PROJECT & SPECIFICATIONS

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INSTALLATION OF ALL BUILDING MATERIALS, TO BE INSTALLED IN ACCORDANCE TO MANUFACTURERS RECOMMENDATIONS.

LEGEND

WTX	WALL TYPE TAG
RL XX.XXX	PROPOSED FLOOR LEVEL

WALL TYPES

ID	DESCRIPTION
WT01	-600MM THK CONCRETE WALL -TO STRUCTURAL ENGINEERS DETAILS -6M HIGH
WT02	-500MM THK CONCRETE WALL -TO STRUCTURAL ENGINEERS DETAILS -6M HIGH
WT03	-COLORBOND SHEETING LAID VERT. -STEEL GIRTS TO STRUCTURAL ENGINEERS DETAILS

NOTES

1. AUTOMATED WEIGHBRIDGE INSTALLED AT GROUND LEVEL
2. BLENDING EQUIPMENT
3. CONCRETE SLAB TO ENGINEERS DETAILS
4. EXTENT OF ROOF DASHED OVER
5. STEEL COLUMNS TO ENGINEERS DETAILS
6. ONE WAY DRIVE THRU LANE
7. MATENANCE STORE
8. 20,000L DIESEL STORAGE TANK

PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE - 04.08.20

1:250 @ A1
1:500 @ A3
0 4 8 12 16 20 24 m

ACOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
Atwell Arcade, Level 1, Suite 101
3 Cantonment Street
Fremantle WA 6160
PH: +61 8 9339 3700
JOB. No.

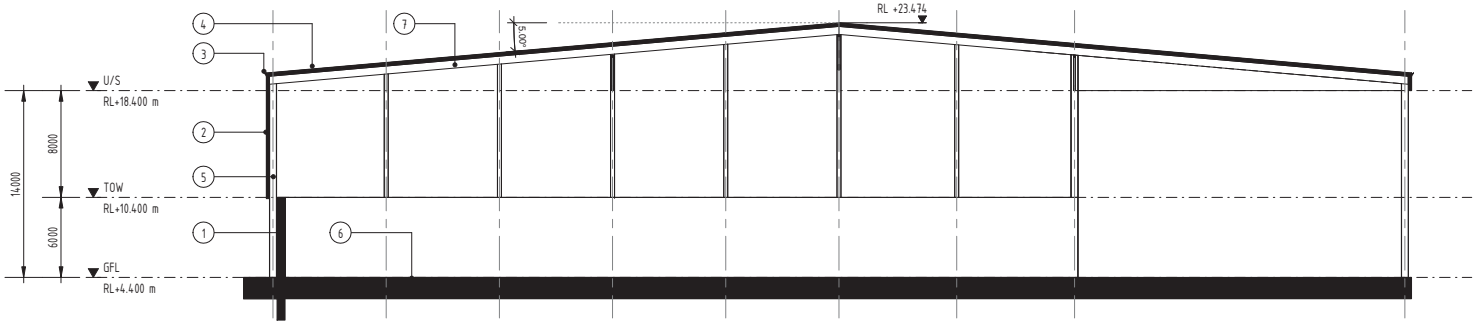
REF DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
		D	04.08.20	ISSUED FOR INFORMATION	NM		
		C	24.07.20	ISSUED FOR INFORMATION	NM		
		B	26.06.20	ISSUED FOR INFORMATION	NM		
		A	02.06.20	ISSUED FOR INFORMATION	NM		

SCALE 1 : 250
SHEET A1
PROJECT
CONTRACT No.

DRAWN	N.MCDONALD	24.07.20
CHECKED	J.MARTIN	24.07.20
DESIGNED	N.MCDONALD	24.07.20
DESIGN APPR		
PROJECT APPR		

TITLE
KWINANA TERMINAL
FERTILISER STORAGE FACILITY
SOLIDS STORAGE WAREHOUSE
FLOOR PLAN - PART B

DRG No. 419-M2814-AR-DGA-0011
SHEET 11 OF 15
REV D



SECTION A

SCALE 1 : 200

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

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INSTALLATION OF ALL BUILDING MATERIALS, TO BE INSTALLED IN ACCORDANCE TO MANUFACTURERS RECOMMENDATIONS.

SECTION NOTES

1. CONCRETE WALL 6M HIGH TO ENGINEERS DETAILS. COLOUR AS PER FINSHES SCHEDULE
2. COLORBOND SHEETING LAID VERTICALLY. COLOUR AS PER FINSHES SCHEDULE
3. COLORBOND GUTTER AND FASCIA TO MATCH ROOF COLOUR
4. COLORBOND ROOF SHEETING LAID @ 5 DEGREE PITCH. COLOUR AS PER FINISHES SCHEDULE
5. STEEL COLUMN TO ENGINEERS DETAILS. COLOUR AS PER FINISHES SCHEDULE
6. CONCRETE SLAB TO STRUCTURAL ENGINEERS DETAILS
7. STEEL ROOF STRUCTURE TO ENGINEERS DETAILS

PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE – 26.06.20

1:200 @ A1
1:400 @ A3
0 5000 10000 15000 20000 mm

CBH GROUP

ÂCOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
Atwell Arcade, Level 1, Suite 101
3 Cantonment Street
Fremantle WA 6160
PH: +61 8 9336 3700
JOB. No.

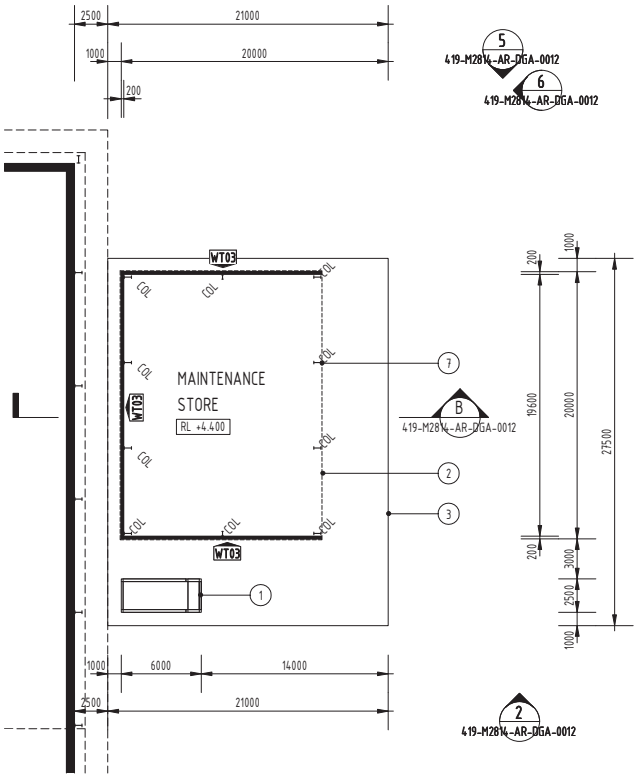
REF DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
		C	24.07.20	ISSUED FOR INFORMATION	NM		
		B	26.06.20	ISSUED FOR INFORMATION	NM		
		A	02.06.20	ISSUED FOR INFORMATION	NM		

SCALE 1 : 200
SHEET A1
PROJECT
CONTRACT No.

DRAWN	N.MCDONALD	24.07.20
CHECKED	J.MARTIN	24.07.20
DESIGNED	N.MCDONALD	24.07.20
DESIGN APPR		
PROJECT APPR		

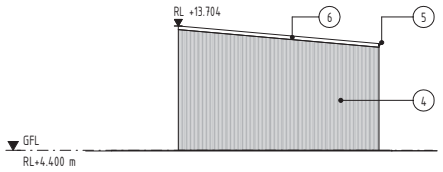
TITLE
KWINANA TERMINAL
FERTISLISER STORAGE FACILITY
SOLIDS STORAGE WAREHOUSE
SECTIONS

DRG No. 419-M2814-AR-DSE-0014
SHEET 13 OF 14
REV. C



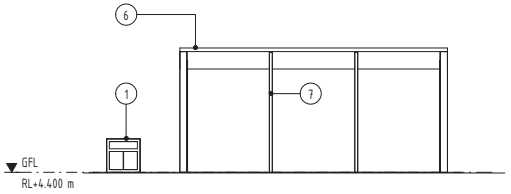
MAINTENANCE STORE PLAN

SCALE 1 : 200



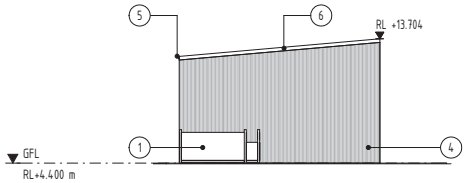
NORTH WEST ELEVATION 5

SCALE 1 : 200 419-M2814-AR-DGA-0012



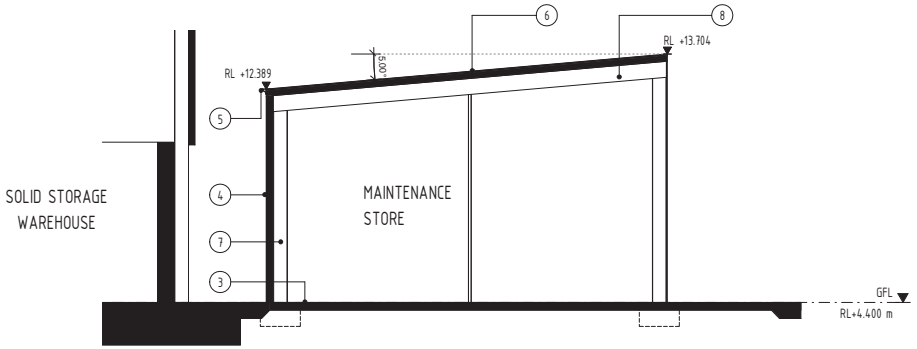
NORTH EAST ELEVATION 6

SCALE 1 : 200 419-M2814-AR-DGA-0012



SOUTH EAST ELEVATION 2

SCALE 1 : 200 419-M2814-AR-DGA-0012



SECTION B

SCALE 1 : 100 B 419-M2814-AR-DGA-0012

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

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LEGEND

WTX	WALL TYPE TAG
RL XX.XXX	PROPOSED FLOOR LEVEL

WALL TYPES.

ID	DESCRIPTION
WT03	-COLORBOND SHEETING LAID VERT. -STEEL GIRTS TO STRUCTURAL ENGINEERS DETAILS

MAINTENANCE STORE NOTES

1. 20,000L DIESEL STORAGE TANK
2. EXTENT OF ROOF OVER
3. CONCRETE SLAB TO STRUCT. ENG. DETAILS
4. COLORBOND SHEETING LAID VERTICALLY. COLOUR AS PER FINSHES SCHEDULE
5. COLORBOND GUTTER AND FASCIA TO MATCH ROOF COLOUR
6. COLORBOND ROOF SHEETING LAID @ 5 DEGREE PITCH. COLOUR AS PER FINISHES SCHEDULE
7. STEEL COLUMN TO ENGINEERS DETAILS. COLOUR AS PER FINISHES SCHEDULE
8. STEEL ROOF STRUCTURE TO ENGINEERS DETAILS

PRELIMINARY ISSUE

DO NOT USE FOR CONSTRUCTION

DATE – 04.08.20

1:100 @ A1 / 1:200 @ A3 0 1 2 3 4 5 6 7 8 9 10 m

1:200 @ A1 / 1:400 @ A3 0 5000 10000 15000 20000 mm

ACOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
Alsatt Arcade, Level 1, Suite 101
3 Cantonment Street
Fremantle WA 6160
PH: +61 8 9339 3700
JOB. No.

REF DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
		A	04.08.20	ISSUED FOR INFORMATION	NM		

SCALE: A1

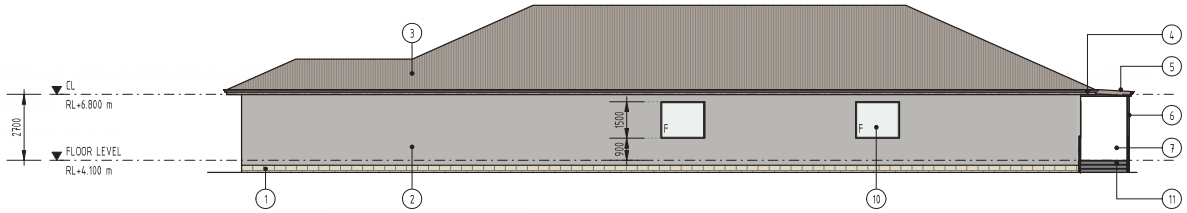
PROJECT:

CONTRACT No.:

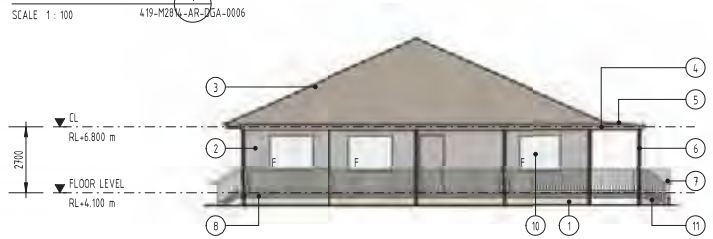
DRAWN	N.MCDONALD	04.08.20
CHECKED	J.MARTIN	04.08.20
DESIGNED	N.MCDONALD	04.08.20
DESIGN APPR		
PROJECT APPR		

TITLE: KWINANA TERMINAL
FERTILISER STORAGE FACILITY
SOLIDS STORAGE WAREHOUSE
MAINTENANCE STORE PLAN, ELEVATIONS & SECTION

DRG No. 419-M2814-AR-DGA-0012 | SHEET 12 OF 15 | REV. A

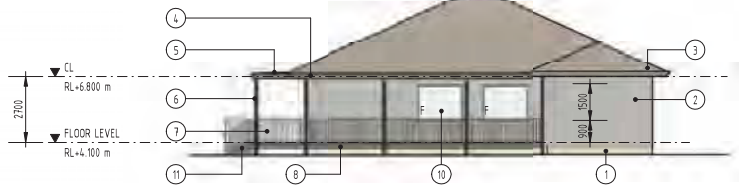


ELEVATION 1
SCALE 1 : 100
419-M2814-AR-DGA-0006



ELEVATION 2
SCALE 1 : 100
419-M2814-AR-DGA-0006

ELEVATION 3
SCALE 1 : 100
419-M2814-AR-DGA-0006



ELEVATION 4
SCALE 1 : 100
419-M2814-AR-DGA-0006

CADDSGROUP
ARCHITECTURAL DRAFTING

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS RELATING TO THIS PROJECT & SPECIFICATIONS

ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE BUILDING CODE OF AUSTRALIA

ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS AND REGULATIONS OF ALL LOCAL AUTHORITIES

INSTALLATION OF ALL BUILDING MATERIALS, TO BE INSTALLED IN ACCORDANCE TO MANUFACTURERS RECOMMENDATIONS.

NOTES

1. RETAINING WALL TO STRUCTURAL ENGINEERS DETAILS.
2. FIBRE CEMENT SHEETING.
   PAINTED COLOUR AS PER FINISHES SCHEDULE.
3. COLORBOND TRIMDEK ROOF SHEETING LAID @ 24 PITCH.
   COLOUR AS PER FINISHES SCHEDULE.
4. COLORBOND GUTTER AND FASCIA TO MATCH ROOF COLOUR.
5. COLORBOND TRIMDEK ROOF SHEETING LAID @ 3 PITCH.
   COLOUR AS PER FINISHES SCHEDULE.
6. STEEL COLUMNS AS PER STRUCTURAL ENGINEERS DETAILS.
   COLOUR AS PER FINISHES SCHEDULE.
7. 1M HIGH POWDERCAOTED ALUMINUM BALUSTRADING.
   COLOUR AS PER FINISHES SCHEDULE
8. FRAMED VERANDAH AREA AS PER STRUCTURAL ENGINEERS DETAILS.
9. RAMP TO COMPLY WITH AS1428.1. MAX GRADIENT OF 1:14
10. POWDERCOATED ALUMINIUM WINDOW & DOOR FRAMES.
    COLOUR AS PER FINISHES SCHEDULE.
11. STAIRS AND RELATED HANDRAILING TO COMPLY WITH THE NCC PART D

CBHGROUP

ACOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS

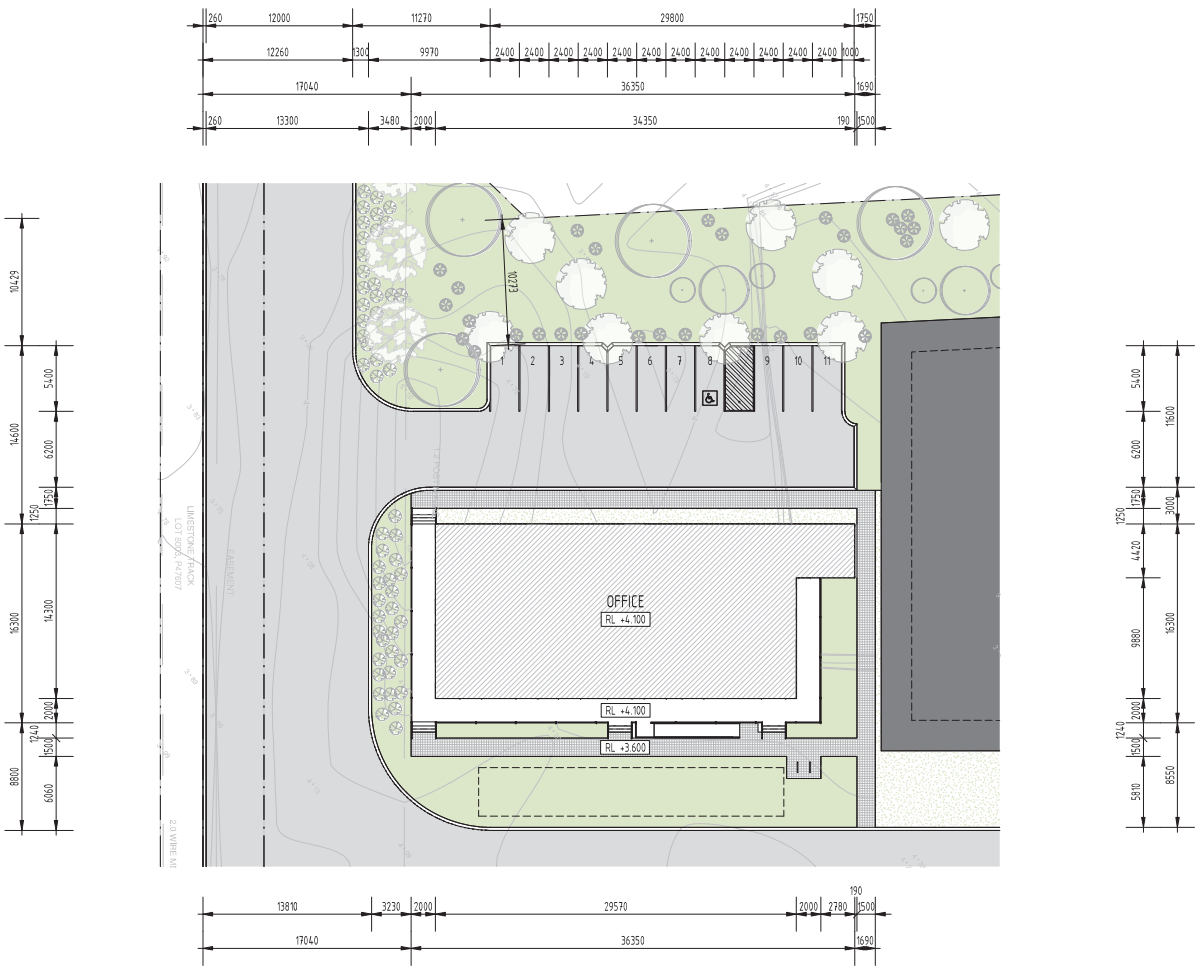
REF DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
		B	26.06.20	ISSUED FOR INFORMATION	NM		
		A	02.06.20	ISSUED FOR INFORMATION	NM		

SCALE 1 : 100
SHEET A1
PROJECT
CONTRACT No.

DRAWN	N.MCDONALD	02.06.20
CHECKED	J.MARTIN	25.06.20
DESIGNED	N.MCDONALD	02.06.20
DESIGN APPR		
PROJECT APPR		

TITLE
KWINANA TERMINAL
FERTILISER STORAGE FACILITY
ADMINISTRATION BUILDING
ELEVATIONS

DRG No. 419-M2814-AR-DEL-0007
SHEET 7 OF 14
REV B



OFFICE SITE PLAN

SCALE 1 : 200

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

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INSTALLATION OF ALL BUILDING MATERIALS, TO BE INSTALLED IN ACCORDANCE TO MANUFACTURERS RECOMMENDATIONS.

LEGEND

- BITUMEN PAVEMENT. REFER TO CIVIL ENGINEERS DETAILS
- CONCRETE FOOTPATHS. REFER TO ENGINEERS DETAILS
- LANDSCAPED AREA. REFER TO LANDSCAPING PLAN FOR DETAILS
- STORMWATER SWALE. REFER TO CIVIL ENGINEERS DETAILS
- CADASTRAL BOUNDARY LINE
- PROPOSED BOUNDARY LINE
- PROPOSED FENCING. REFER TO NOTES

AREAS

ADMINISTRATION BUILDING	444 m^2
SOLID STORAGE WAREHOUSE	20400 m^2
EVAPORATION POND	3507 m^2
UAN LIQUID STORAGE	8061 m^2
TOTAL	32412 m^2

PARKING SCHEDULE

DISABLED BAY		
2/2400mm x 5400m	SHARED BAY W/ BOLLARD TO COMPLY W/ AS2890.6	1
STANDARD BAY		
2400mm x 5400mm		10
TOTAL		11

PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE - 26.06.20

1:200 @ A1
1:400 @ A3
0 5000 10000 15000 20000 mm

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ACOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS

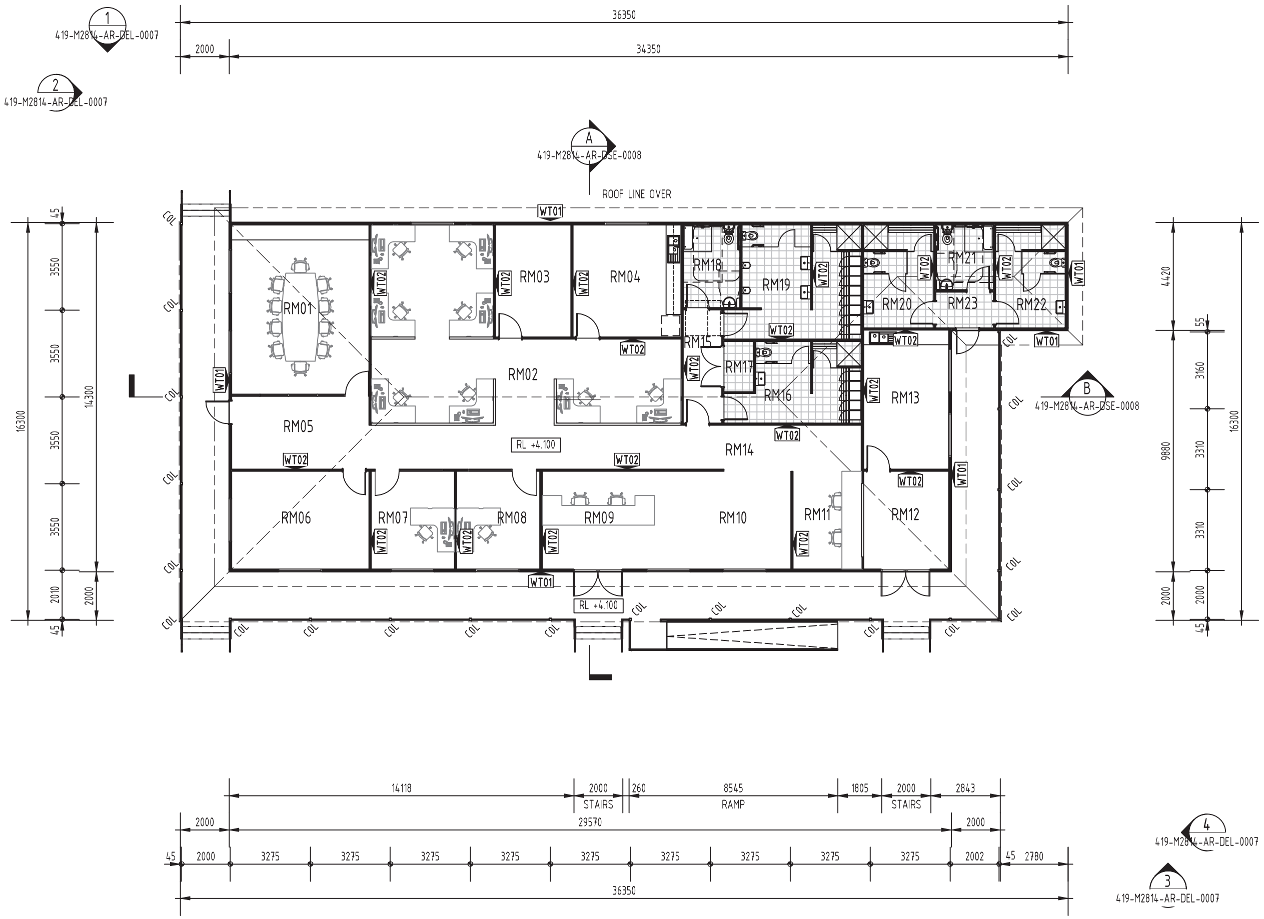
REF	DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
			B	26.06.20	ISSUED FOR INFORMATION	NM		
			A	02.06.20	ISSUED FOR INFORMATION	NM		

SCALE: As indicated
SHEET: A1
PROJECT:
CONTRACT No.:

DRAWN	N.MCDONALD	02.06.20
CHECKED	J.MARTIN	25.06.20
DESIGNED	N.MCDONALD	02.06.20
DESIGN APPR		
PROJECT APPR		

TITLE: KWINANA TERMINAL
FERTILISER STORAGE FACILITY
SCHEMATIC DESIGN
SITE PLAN - ADMINISTRATION AREA

DRG No.: 419-M2814-AR-DLP-0005
SHEET: 5 OF 14
REV: B



OFFICE FLOOR PLAN
SCALE 1 : 100

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

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LEGEND

WTX	WALL TYPE TAG
RL XX.XXX	PROPOSED FLOOR LEVEL

ROOM SCHEDULE

ID	ROOM NAME	FLOOR FINISH	AREA
RM01	MEETING ROOM	CARPET	39 m²
RM02	SHARED OFFICE	CARPET	90 m²
RM03	COMMS ROOM	VINYL	14 m²
RM04	CRIB ROOM	VINYL	20 m²
RM05	SHAREED OFFICE/PRINTER AREA	CARPET	17 m²
RM06	LABORATORY/STORE ROOM	VINYL	23 m²
RM07	OFFICE	CARPET	14 m²
RM08	OFFICE	CARPET	14 m²
RM09	RECEPTION	CARPET	23 m²
RM10	WAITING AREA	CARPET	18 m²
RM11	DRIVERS DISPATCH COORDINATION WINDOW	VINYL	11 m²
RM12	DRIVERS WAITING AREA	VINYL	14 m²
RM13	DRIVERS CRIB ROOM	VINYL	20 m²
RM14	HALLWAY	CARPET	14 m²
RM15	HALLWAY	CARPET	7 m²
RM16	FEMALE TOILET	TILE	16 m²
RM17	CLEANERS STORE	TILE	2 m²
RM18	UNISEX UA TOILET	TILE	8 m²
RM19	MALE TOILET	TILE	23 m²
RM20	DRIVERS FEMALE TOILET & SHOWER	TILE	12 m²
RM21	DRIVERS UNISEX UA TOILET & SHOWER	TILE	6 m²
RM22	DRIVERS MALE TOILET & SHOWER	TILE	12 m²
RM23	AIRLOCK	TILE	3 m²

PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE - 26.06.20

1:100 @ A1
1:200 @ A3
0 1 2 3 4 5 6 7 8 9 10 m

DO NOT SCALE FROM THIS DRAWING

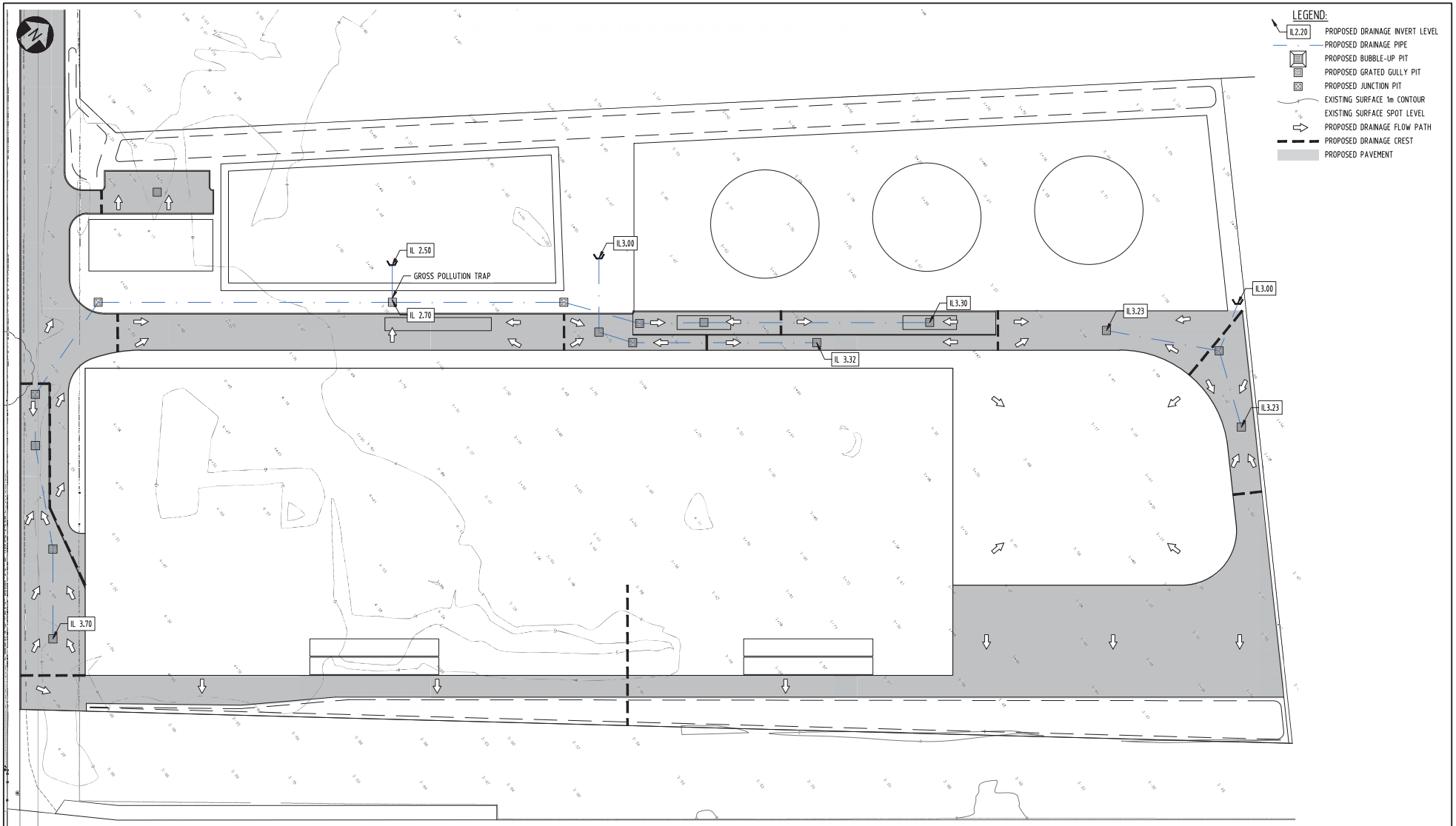
ACOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
JOB. No.

REF DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
		B	26.06.20	ISSUED FOR INFORMATION	NM		
		A	02.06.20	ISSUED FOR INFORMATION	NM		

SCALE 1 : 100	DRAWN N.MCDONALD	02.06.20
SHEET A1	CHECKED J.MARTIN	25.06.20
PROJECT	DESIGNED N.MCDONALD	02.06.20
	DESIGN APPR	
CONTRACT No.	PROJECT APPR	

TITLE
KWINANA TERMINAL
FERTILISER STORAGE FACILITY
ADMINISTRATION BUILDING
FLOOR PLAN

DRG No. 419-M2814-AR-DGA-0006 | SHEET 6 OF 14 | REV B



PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE 03.07.20

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1:1000 @ A3
0 5 10 15 20 25 30 35 40 45 50 m

CBH GROUP
ABN 29 256 604 947

ACOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
Level Ground, Level 1, Suite 10
3 Cantonment Street
Fremantle WA 6160
Ph +61 8 9336 3366
JOB. No. PE190349

REF DRAWING No.	REFERENCE DRAWING TITLE
X_PE190349_ARCH	ARCHITECTURAL
X_PE190349_JETTY SURVEY	EXISTING JETTY SURVEY
X_PE190349_FACILITY SURVEY	EXISTING FACILITY SURVEY

REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
B	03.07.20	ISSUED FOR INFORMATION	NS	BM	
A	22.05.20	ISSUED FOR INFORMATION	NS	BM	

SCALE: AS SHOWN
SHEET: A1
PROJECT: M2814
CONTRACT No:
DRAWN
CHECKED
DESIGNED
DESIGN APPR
PROJECT APPR

TITLE: KWINANA FERTILISER IMPORT FACILITY
FERTILISER FACILITY CONCEPT STAGE DESIGN
PROPOSED DRAINAGE DESIGN

DRG No: 419-M2814-CV-DDR-0002
SHEET: 1 OF 1
REV: B

NOTE:
LANDSCAPING TO COMPLY WITH LOCAL SHIRE REQUIREMENTS. SPECIES SELECTION AND LAYOUT IS INDICATIVE. LANDSCAPER TO DETRERMINE APROPRIATE SPECIES AND ARRANGEMENT.

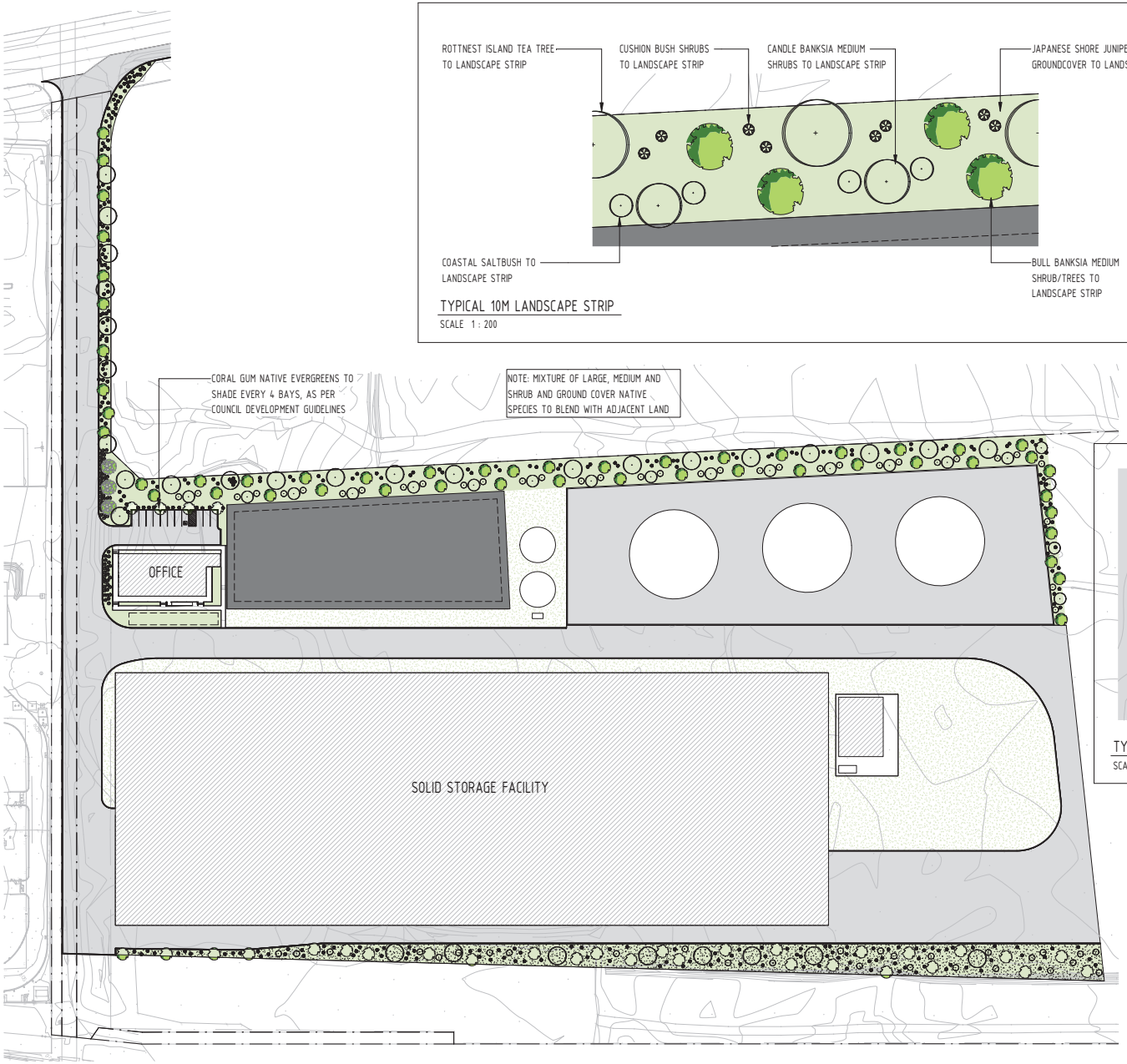
LEGEND

- CANDLE BANKSIA
- COASTAL SALT BUSH
- COASTAL WATTLE
- TUART EUCALUPTUS GOMPHOCEPHALA
- SNAKE VINE
- ROTTNEST ISLAND TEA TREE
- TAR BUSH
- CORAL GUM
- BULL BANKSIA
- MULCHED AREA (75MM COVER)
- RAINBOW STONE (30MM COVER)

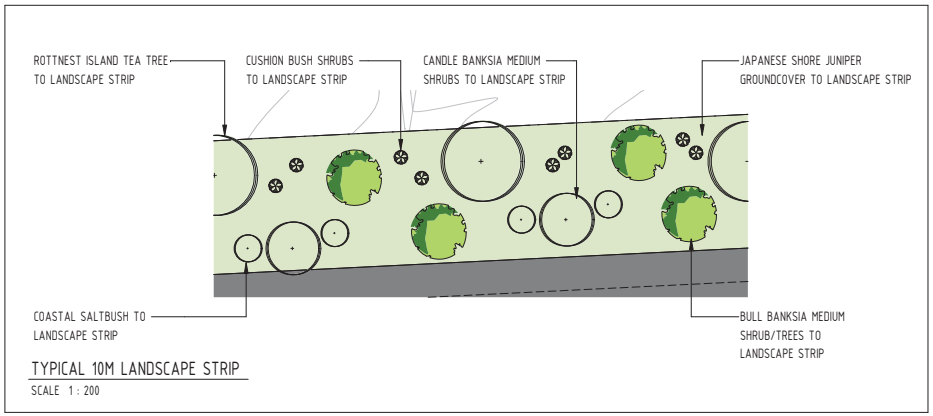
NOTE

ANY EXISTING XANTHORROHOEA PREISSII - GRASS TREES ARE TO BE RETAINED AND PROTECTED IN THEIR CURRENT LOCATIONS AS FAR AS PRACTICABLE. ANY GRASS TREES WHICH WILL BE IMPACTED BY THE PROPOSED DEVELOPMENT LAYOUT SHOULD BE UTILISED AND RELOCATED TO BE SITUATED WITHIN THE PROPOSED LANDSCAPE AREAS.

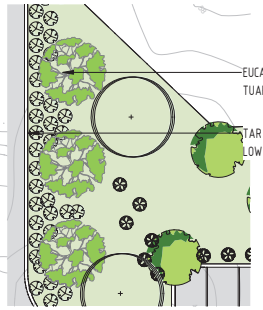
ALL INFILTRATION SWALES TO HAVE BIOFILTRATION VEGETATION AND AN AMENDED SOIL TREATMENT PROFILE TO SUIT THE DESIGN



LANDSCAPING PLAN
SCALE 1 : 750



TYPICAL 10M LANDSCAPE STRIP
SCALE 1 : 200



TYPICAL LANDSCAPE TO ENTRANCE
SCALE 1 : 200

CADDS GROUP
ARCHITECTURAL DRAFTING

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

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PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE - 04.08.20

1:200 @ A1 / 1:400 @ A3 — 0 5000 10000 15000 20000 mm
1:750 @ A1 / 1:1500 @ A3 — 0 10 20 30 40 50 60 70 m

CBH GROUP

ÂCOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
Atwell Arcade, Level 1, Suite 101
3 Cantonment Street
Fremantle WA 6160
PH: +61 8 9336 3700
JOB. No.

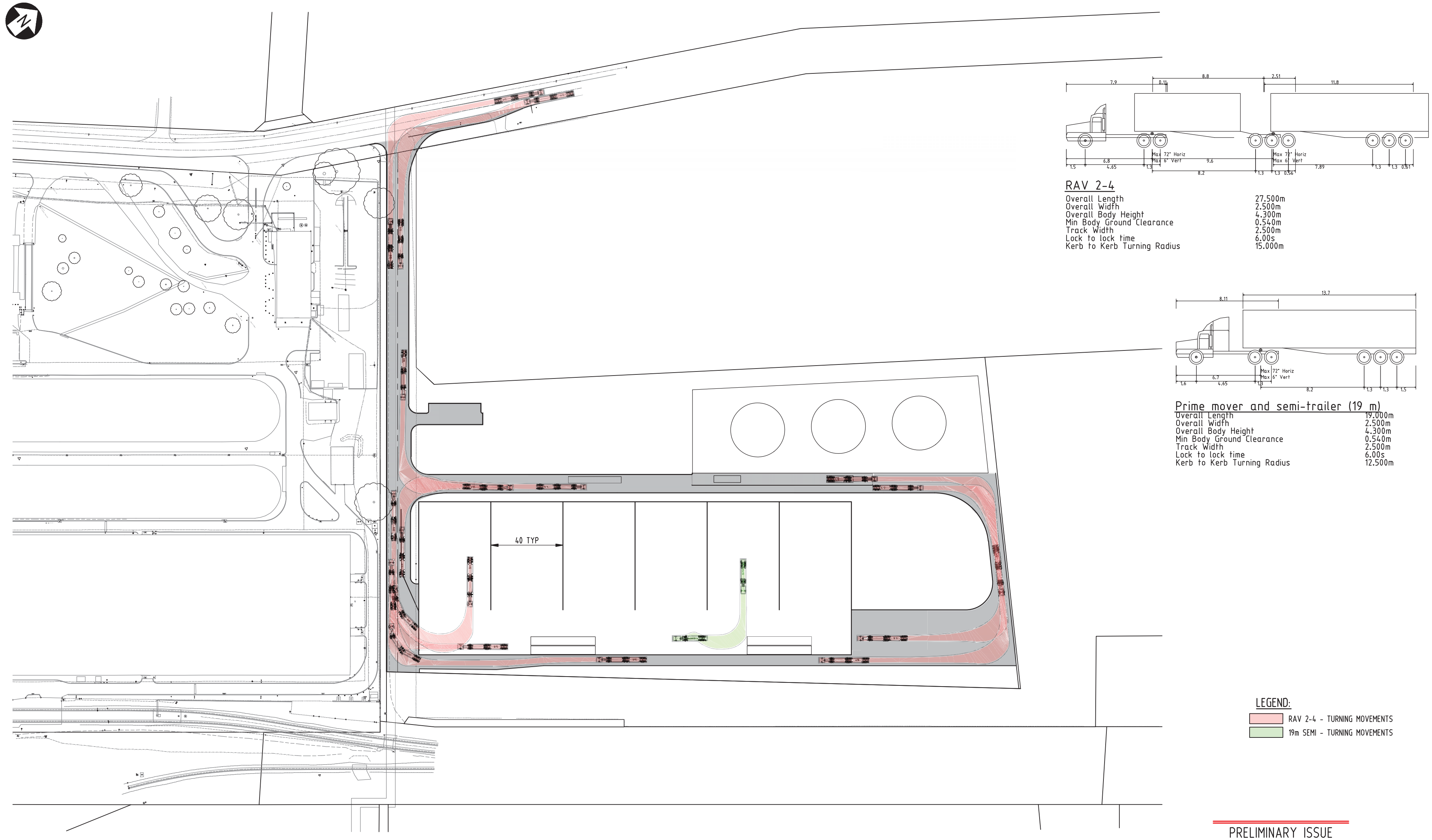
REF DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
		G	08.12.20	UPDATED LANDSCAPING AS PER CLIENT COMMENTS	JM		
		F	02.12.20	UPDATED LANDSCAPING AS PER CLIENT COMMENTS	JM		
		E	04.08.20	ISSUED FOR INFORMATION	NM		
		D	27.07.20	ISSUED FOR INFORMATION	NM		
		C	26.06.20	ISSUED FOR INFORMATION	NM		

SCALE: As indicated
SHEET: A1
PROJECT:
CONTRACT No.:

DRAWN	N.MCDONALD	02.06.20
CHECKED	J.MARTIN	25.06.20
DESIGNED	N.MCDONALD	02.06.20
DESIGN APPR		
PROJECT APPR		

TITLE:
KWINANA TERMINAL
FERTILISER STORAGE FACILITY
SCHEMATIC DESIGN
LANDSCAPING PLAN

DRG No.: 419-M2814-AR-DGA-0003
SHEET: 3 OF 15
REV: G



PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE 03.07.20

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1:2000 @ A3
0 10 20 30 40 50 60 70 80 90 100 m

CBH GROUP
ABN 29 256 604 947

ACOR CONSULTANTS (WA) Pty Ltd
ENGINEERS
MANAGERS
INFRASTRUCTURE
PLANNERS
Atwell Arcade, Level 1, Suite 101
3 Cantonment Street
Fremantle WA 6160
PH +61 8 9336 3156

JOB. No. PE190349

REF DRAWING No.	REFERENCE DRAWING TITLE
X_PE190349_ARCH	ARCHITECTURAL
X_PE190349_JETTY SURVEY	EXISTING JETTY SURVEY
X_PE190349_FACILITY SURVEY	EXISTING FACILITY SURVEY

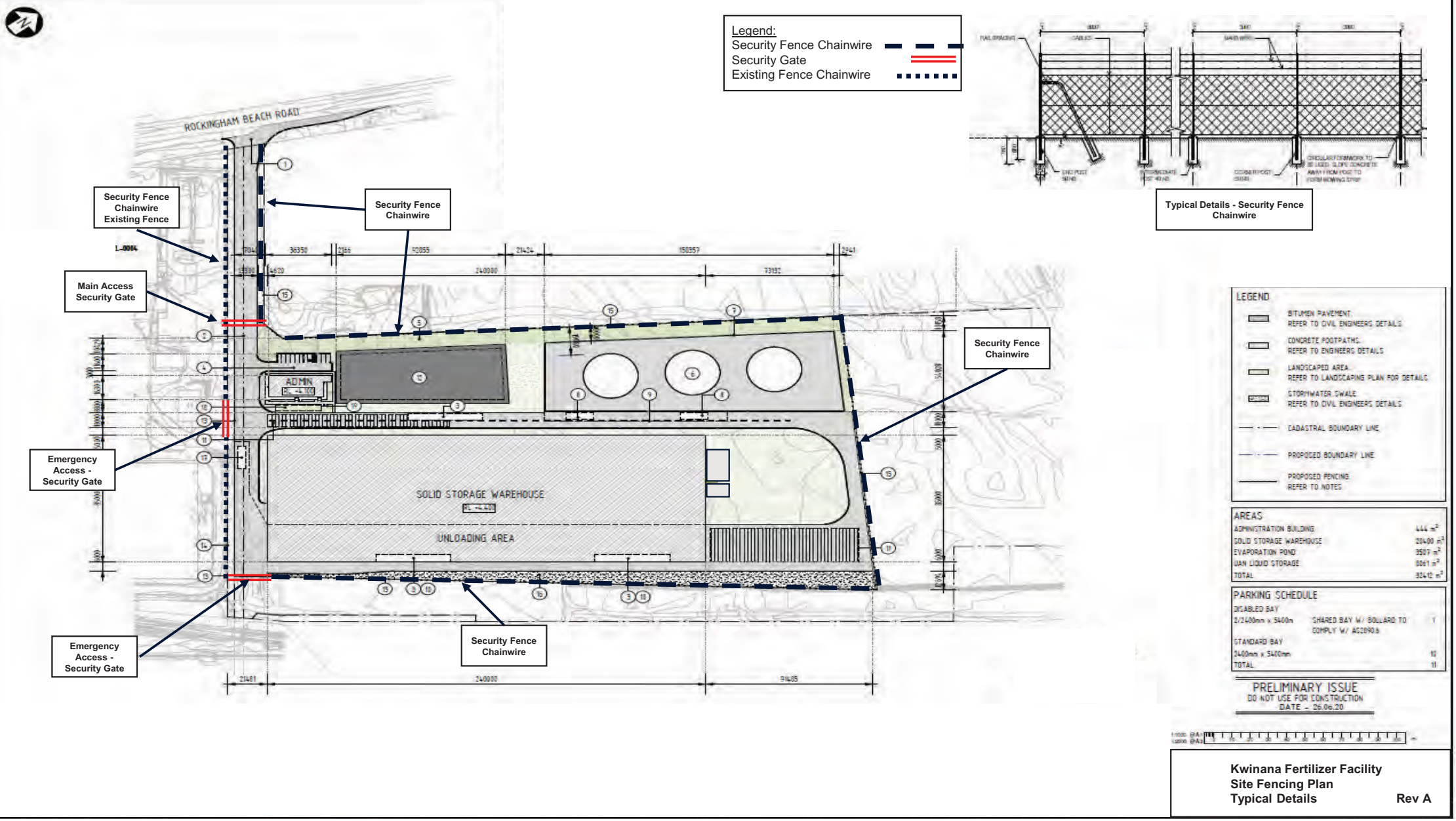
REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
F	03.07.20	ISSUED FOR INFORMATION	NS	BM	
E	12.06.20	RE-ISSUED FOR DISCUSSION	NS	BM	
D	11.05.20	ISSUED FOR DISCUSSION	NS	BM	
C	17.04.20	RE-ISSUED FOR DISCUSSION	NS	BM	
B	09.04.20	PRELIMINARY ISSUE	NS	BM	
A	08.04.20	ISSUED FOR DISCUSSION	NS	BM	

SCALE: AS SHOWN
SHEET: A1
PROJECT: M2814
CONTRACT No

DRAWN	NS	20.03.20
CHECKED	BM	20.03.20
DESIGNED	NS	20.03.20
DESIGN APPR		
PROJECT APPR		

TITLE
KWINANA FERTILISER IMPORT FACILITY
FERTILISER FACILITY CONCEPT STAGE DESIGN
OVERALL SITE
TURNING MOVEMENTS

DRG No: 419-M2814-CV-SKT-0001_E
SHEET: 1 OF 1
REV.: F


Legend:
Security Fence Chainwire
Security Gate
Existing Fence Chainwire
ROCKINGHAM BEACH ROAD
Security Fence Chainwire Existing Fence
Security Fence Chainwire
Main Access Security Gate
Security Fence Chainwire
Emergency Access - Security Gate
Emergency Access - Security Gate
Security Fence Chainwire
ADMIN
SOLID STORAGE WAREHOUSE
UNLOADING AREA
Typical Details - Security Fence Chainwire
LEGEND
BITUMEN PAVEMENT. REFER TO CIVIL ENGINEERS DETAILS
CONCRETE FOOTPATHS. REFER TO ENGINEERS DETAILS
LANDSCAPED AREA. REFER TO LANDSCAPING PLAN FOR DETAILS
STORMWATER SWALE REFER TO CIVIL ENGINEERS DETAILS
CADASTRAL BOUNDARY LINE
PROPOSED BOUNDARY LINE
PROPOSED FENCING REFER TO NOTES
AREAS
ADMINISTRATION BUILDING 444 m²
SOLID STORAGE WAREHOUSE 2040.00 m²
EVAPORATION POND 3507 m²
UAN LIQUID STORAGE 8061 m²
TOTAL 3241.2 m²
PARKING SCHEDULE
DISABLED BAY
2/2400mm x 5400m SHARED BAY W/ BOLLARD TO COMPLY W/ AS2890.6 1
STANDARD BAY
2400mm x 5400mm 10
TOTAL 11
PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE - 26.06.20
Kwinana Fertilizer Facility
Site Fencing Plan
Typical Details
Rev A

PLANNING SOLUTIONS
URBAN & REGIONAL PLANNING
PS

Level 1, 251 St Georges Tce, Perth WA
(08) 9227 7970
GPO Box 2709
Cloisters Square PO 6850

admin@planningsolutions.com.au
www.planningsolutions.com.au
ACN 143 573 184 ABN 23 143 573 184
Planning Solutions (Aust) Pty Ltd

CoR Ref: 20.2020.290.1
PS Ref: 6555

8 December 2020

Greg Delahunty, Senior Projects Officer
City of Rockingham
Via email: customer@rockingham.wa.gov.au; greg.delahunty@rockingham.wa.gov.au

Dear Greg,

LOTS 108, 1304, 8003, AND ROCKINGHAM BEACH ROAD, EAST ROCKINGHAM
UAN FERTILISTER AND SOLID FERTILISER STORAGE FACILITY AND UAN DISCHARGE PIPELINE
RESPONSE TO CITY COMMENTS

We refer to the development application for the above, and the City's letter dated 24 November 2020 seeking further information from the application, and providing a preliminary schedule of submissions.

We are pleased to provide the following response. Refer Table 1 for a response to the City of Rockingham comments and Table 2 for a response to points raised by submitters.

Table 1 – Response to City of Rockingham comments

City comment	Applicant response
Planning	
1. Landscaping is to be provided for the length of the driveway access leg (see Figure 1 below) and is to include a 3 tier composition, to include ground cover, middle section and upper storey in accordance with draft Planning Policy 3.3.8 – East Rockingham Industrial Guidelines. The western side of the access leg should be prioritised. Amended landscape plans are required.	There is no landscaping on the southwestern side of the access road as the road directly abuts the lot boundary. The adjoining limestone track is under the care and control of Water Corporation. Refer enclosed amended landscaping plan showing a landscape treatment along the northeastern side of the access road.
Health	
1. Revised Acoustic Report to address Noise from operations and equipment located on the jetty structure (for example the pig launcher) and activities such as pipe cleaning.	This comment relates to the waterside development application. Refer enclosed technical note from Herring Storer Acoustics, addressing noise from jetty operations. It confirms there will be no discernible increase in noise from pumping activities, and that noise from compressed air for pipe-cleaning will comply with the assigned noise levels.
2. Operations on Lot 108 may generate odour and dust nuisance. Information in regards to control of these potential nuisances should be addressed via a suitable dust and odour management plan if these are not captured under required DWER licensing requirements.	This is acknowledged in section 3.7 of the Environmental Management Plan. Dust and odour were considered and addressed as part of the Department of Environment and Water Regulation (DWER) Part V Works Approval application and any required controls will be detailed in licensing agreements.

City comment	Applicant response
Engineering	
1. It is unclearing from drawing 419-M2814-CV-DDR-002 how stormwater generated from the kerbed slip lane and northern section of the access road catchment will be managed. The use of additional grated gully pits in the northern section of the access road is recommended.	The Water Management Strategy included with the development application proposes a 'roadside swale within verge' for infiltration of stormwater from the access road. This can be addressed at the detained design phase. Drainage from roadworks in the Rockingham Beach Road will be addressed and designed to City of Rockingham and Main Roads Western Australia (MRWA) specifications through the crossover permit process.
2. Sight lines are impacted by existing fencing in the western corner of Lot 8004. As Lot 8004 does not form part of this application, access needs to be adjusted to facilitate vehicle turning movement and future fence installation.	The existing fence at the western corner of Lot 8004 (conservation reserve managed by City of Rockingham) is a low post-and-wire fence which is visually permeable which will not obstruct sightlines of vehicles exiting the access road. Refer the following Streetview image. 
Traffic	
1. There is an existing limestone track located between the proposed internal road and the existing chainwire fence to the south of the site. Please confirm that there is a separation between the two areas (eg. kerbing). It should be noted that the existing fence is incorrectly shown in the site plan (i.e. it should be located to the south of the existing limestone track instead of to the north). Plan should be amended accordingly.	For ease of reference, the following figure depicts the limestone track on Lot 8003, and the location of the existing fence adjoining the CBH grain terminal.  The existing fence location is correctly referenced on the development plans. The fencing strategy is depicted on the Site Fencing Plan included with the development application. It is proposed to utilise the existing security fence along the northeast boundary of Lot 1304 (grain terminal) to secure the southwestern edge of the proposed facility. This prevents landlocking the narrow (3.56m-wide) Water Corporation site with fencing on both sides (CBH will provide Water Corporation unfettered access to Lot 8003), and avoids unnecessary duplication of the existing fence.

City comment	Applicant response
2. Consider increasing the length of the proposed auxiliary left-turn treatment at the proposed access of RBR from 70m to 100m. Austroads' Guide to Road Design Part 4A (Unsignalised and Signalised Intersections) recommends a desirable minimum length of deceleration of 100m for a design speed of 80km/hr and comfortable deceleration rate of 2.5m/s². It is noted that if a maximum deceleration rate of 3.5m/s² is adopted then an absolute minimum length of deceleration of 70m is required.	The detailed design of the deceleration lane on Rockingham Beach Road will be subject to consideration and assessment by City of Rockingham and MRWA as part of the crossover approval process (i.e. it is separate to this development application).
Urban Water	
1. Water Management Strategy Assessment updated to include below:	Refer enclosed the amended Water Management Strategy, addressing the City's comments as follows:
• *The City's requirement is 0.5m separation to MGL from swale/basin invert and not 0.3;*	• Section 5.2 of Water Management Strategy has been revised to state a clearance of 0.5m will be achieved between the base of the drainage swales to the maximum groundwater level (MGL).
• *Confirm if the infiltration swales will include biofiltration vegetation and an amended soil profile;*	• Drainage swales will be planted to the satisfaction of the City of Rockingham and soil profile amended. Refer sections 4.1.1, 4.1.3, and 4.3.1 of the Water Management Strategy.
• *Include a discussion on major events management and major event contingency actions for the evaporation pond;*	• Section 4.1.5 of the Water Management Strategy has been revised to include further details about the management of major events for the evaporation pond and commitments to truck water offsite if required to maintain a minimum freeboard of 0.3m. The evaporation pond is sized to retain the 1:20 year event while maintaining a 0.3m freeboard. The evaporation pond is 1.2m deep when including the freeboard. The water balance indicates the pond has the capacity to retain the 1% annual exceedance probability (AEP) event if required, however there will be no freeboard. A 0.3m freeboard will be maintained at all times by trucking water off site to a liquid waste receival facility to ensure sufficient capacity is available to retain a 1% AEP event. It should be noted that the water balance contained in the Water Management Strategy has assumed that the truck washdown will produce 300m³ of wastewater a month. This assumes 15m³/day wash-down and 20 working days per month, which is a conservative estimate as deliveries will not occur every working day.
• *Include a discussion on contingency actions and risks associated with groundwater rise due to climate change. Refer to City's Coastal Hazard and Risk Mapping report;*	• It is generally accepted that sea level rise will cause groundwater levels adjacent to the coast to also increase. This can have a number of impacts including: o seawater intrusion (migration inland of the freshwater/saline water interface); o increased salinity in groundwater dependent ecosystems (such as Lake Richmond); o impacts on drainage infrastructure; and o contamination of production bores.

City comment	Applicant response
	A macro-scale estimate of the potential rise in groundwater due to sea level rise to 2110 was completed and mapped. This was undertaken using DWER's maximum groundwater level contours. The projected sea level rise of 0.9m was then added to the groundwater levels to provide an estimate of groundwater elevations in 2110. The DWER groundwater mapping (Figure 5) indicates the MGL at the site is 1.5m AHD. Following the City's Coastal Hazard and Risk Mapping approach, the expected MGL may increase to 2.4m AHD (1.5m +0.9m) in 2110 due to an increase in sea level. Currently a conservative MGL of 1.95m AHD has been used to design the drainage infrastructure and all drainage infrastructure will achieve a minimum clearance of 0.5m to the MGL of 1.95m AHD. This results in the invert of all drainage infrastructure being above the predicted 2110 MGL which accounts for sea level rise, however the 0.5m clearance will no longer be achieved. The above details have been included in Section 4.2 of the Water Management Strategy.
• *Include peak storm durations, emptying times, storage volumes and areas for all events; and*	• Section 4.1.2 of the Water Management Strategy has been updated to include this information.
• *Include soakwell locations on Figure 7.*	• Figure 7 has been revised to show soakwell locations.
Landscaping	
1. Updated landscape plans to provide additional detail on the proposed drainage swales and evaporation pond noted within the submitted Water Management Strategy. (see Figure 1 below)  *Figure 1*	Refer enclosed landscaping plan providing additional detail for the drainage swales. The evaporation pond is plastic-lined and will not be landscaped.
2. Plant species recommendations: • *As the site is located adjacent to a Reserve, it is recommended that the proposed Ficus rubiginiosa – Port Jackson Fig is substituted for an equal number of Eucaluptus gomphocephala – Tuart; and* • *The existing Xanthorrohoea preissii – Grass Trees are retain and protected in their current locations as far as practicable. Any Grass Trees which will be impacted by the proposed development layout should be utilised and relocated to be situated within the proposed landscape areas.*	Refer enclosed amended landscape plan with an updated species list and a note on retaining and protecting grass trees where possible and practical to do so.

City comment	Applicant response
3. The proposed stormwater swale along the eastern boundary of the site has been noted to be installed as 30mm of Rainbow Stone. It is recommended that stormwater planting is also included within the swale.	Noted. Refer to the enclosed amended landscaping slowing planting in the swale along the southeast edge of the site.
Environment	
1. There appear to be larger Tuarts on-site that could potentially be retained within the landscape buffer along the western boundary. It would be desirable for the applicant to arrange for a Tree Survey to be conducted to determine if any significant Tuart trees can be retained within the landscape buffer.	The Rockingham Industrial Zone (RIZ) Strategic Environmental Assessment described only six tuarts with hollows identified in the RIZ (PGV 2014), with none of those on the development site. A site reconnaissance for flora and vegetation, which included a targeted tree survey was undertaken by 360 Environmental in November 2020 and confirmed that there were two tuarts in the northern corner of the development site and although they were of sufficient size (>500 mm diameter at breast height), they did not contain hollows or any sign of black cockatoo presence. The site has been assessed and approved for clearing at both State and Federal level. The tuarts are in areas which conflict with the concrete bund wall for the UAN tanks and drainage swales in the setback area. Given disturbances relating to construction of swales and concrete pads and given tuarts are susceptible to works in their root zones, the ongoing health of the tuarts could not be guaranteed if they were retained. Tuarts will be planted in the landscaped areas in accordance with the City's previous comment regarding species choice.
2. The application states that a Baseline Environmental Assessment (BEA) was conducted in 2020 by 360 Environmental. The assessment concluded that the site in general is not considered contaminated and concentration of identified contaminants of potential concern (COPCs) are low. This report has not been submitted to the City as part of the Development Application. This report should be submitted to the City for review.	Please refer enclosed a copy of the BEA. The BEA concluded that there is no contaminant plume beneath the site, and although surface soils exhibited elevated nitrogen, top stripping for development would result in compliant levels in underlying soils.
3. The application concludes that the proposed pipeline development has a low inundation vulnerability up to 2110 and therefore is considered at low risk to coastal processes for the near future, does not cause impacts on the coastline and is consistent with the objectives of SPP 2.6 State Planning Policy 2.6 – Coastal Planning Policy. Despite this, the application has not addressed all coastal processes listed in SPP2.6 and has only taken into account inundation and not coastal erosion. *An internal assessment of erosion vulnerability shows that the proposed development is within the coastal erosion hazard lines as modelled in the City's Coastal Hazard Risk Management and Adaptation Plan (CHRMAP). The modelled erosion hazard lines are shown in Figure 2 below. It is noted that pipeline is to be built on existing infrastructure, however, the works will only increase the value of the assets at risk. The CHRMAP has acknowledged the strategic economic importance of CBH Kwinana Grain Terminal to the State and this infrastructure has been identified as a priority area for long-term protection, subject to this protection being funded by CBH*	This comment relates to the waterside development application. It is acknowledged that the location where the pipeline crosses the foreshore zone is between the 2030 and 2070 Hazard Lines (for a 100 year ARI). The City's position on protection against coastal measures is noted, and is consistent with CBH's own understanding. It is noted, however, that the addition of the pipeline will not measurably impact the value of the infrastructure current asset. Given the planning approval process cannot be used to apply new conditions to existing approved infrastructure, funding arrangements for protection works will necessarily be negotiated with parties outside of this particular planning approval process.

City comment	Applicant response
Group or the State Government. As such, the following information is requested: - *The applicant must address the modelled coastal erosion risk to the proposed development in accordance with SPP 2.6 State Planning Policy 2.6 – Coastal Planning Policy, noting that although the City has identified the strategic importance of the CBH Kwinana Grain Terminal, it was determined that the protection of the site should be funded by CBH and the State. As the CHRMAP was endorsed by Council, it is the City's position that any future protection of this infrastructure will not be funded by the City.*  *Figure 2*	

Table 2 – response to public submissions

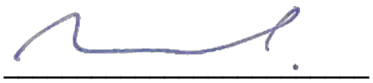
Public submission	Applicant's response
<u>Storage of ammonium nitrate</u> Several submitters commented the development proposed storage of an explosive substance (ammonium nitrate) which has a risk of uncontrolled explosions (such as in Beirut).	The proposed development will <u>not</u> import or store ammonium nitrate or any other explosive material. We understand the City of Rockingham unintentionally described the proposal as storing ammonium nitrate in correspondence, and a correction was issued once the mistake was identified. The proposed development will import, store and distribute UAN, which is a liquid solution of urea and ammonium nitrate at concentrations which are not explosive. The UAN product is currently imported and manufactured, stored and distributed to Wester Australian farmers from Kwinana and Kwinana Bulk Jetty and in Fremantle at Rouse Head and has been for many years. The Department of Mines, Industry Regulation and Safety has confirmed UAN is not a dangerous good. UAN has been manufactured in Kwinana for a number of decades, and in 2020 two UAN import facilities were approved at Kwinana Beach by the Metro South West Joint Development Assessment Panel and the Metro Outer Joint Development Assessment Panels.
<u>Compatibility of the development with its setting.</u> One submitter commented the development poses aesthetic challenges and encroaches on the surrounding ambiance for people living in the northern part of Rockingham.	The proposed development is of an industrial nature similar to facilities in the area, including the adjoining grain terminal, fuel storage facility to the north, and BHP nickel refinery to the east.
<u>Not in the interests of residents</u> One submitter commented the proposal is not in the long-term interests of Rockingham as a place where people want to live and enjoy retirement.	One of the specific objectives of at clause 1.6.2(f) of the City of Rockingham Town Planning Scheme No.2 is:

Public submission	Applicant's response
	to most effectively utilise resources and facilitate employment opportunities whilst enhancing the amenity of residents and having regard to the preservation of the natural environment; The proposed development is consistent with this objective as it provides employment opportunities and investment in local community. Further, the technical studies submitted with the application demonstrate the amenity of residential areas will be preserved with no adverse impact by way of noise, risk, traffic, or the like.
Risk and safety Some submitters have asked who will confirm the proposal doesn't present a risk to people.	The environmental impact assessment is being reviewed by the EPA (Part IV EP Act) and DWER (Part V EP Act) who are the appropriate agencies to assess the risk and provide a determination on the suitability of the proposal. There are no materials classed dangerous goods under the Australian Dangerous Goods (ADG) code, International Maritime Dangerous Goods (IMDG) Code IATA Dangerous Good and all material safety data sheets were provided to the City as part of the assessment process. It should be noted that the dry fertiliser facility is being relocated from existing facilities in Kwinana and no new dry fertilisers are being introduced to the precinct.
Buffer Once submitter commented there was once a buffer area separating industry and residential areas, and the buffer should be preserved.	There is no separation buffer in the applicable planning framework. The East Rockingham area has been identified for industry since at least 1994 when the structure plan for Improvement Area 14 was updated.
Cumulative impact of industry One submitter commented there are enough dangerous chemical plants in the area and another one will add to the already-high pollution levels.	No off-site impacts have been identified for the proposed development.
Environmental assessment reporting One submitter claims the environmental impact study by 360 Environmental is very thin, apologetic to zoning, highly qualified in its limitations, and likely reflects to the larger extent the business interests of CBH rather than the residents and ratepayers of East Rockingham. Another submitter requested an independent environmental assessment.	There is no evidence in support of the submitter's claims. The environmental reporting is subject to assessment and review through the DWER works approval process. The application has also been self-referred to the Environmental Protection Authority for a determination on whether an environmental review is required.
Cockburn Sound water quality One submitter commented spilt grain from the existing jetty is impacting the quality of the water in Cockburn Sound.	This comment relates to existing development and is not relevant to the current application. Nonetheless, we note the water quality of Cockburn Sound is improving, as detailed in the latest State of Cockburn Sound report; this is primarily a result of effort by industry and government to improve controls and recovery efforts. As a result of the improved water quality, the seagrass communities are also improving with the latest mapping (2017) showing significant increase in density and overall coverage area (CSMC 2018). The general operations related to the proposal have minimal possibility of causing any environmental impact to Cockburn Sound, with stringent operational controls for loading and pumping of UAN and emergency response procedures in the unlikely event of a spill.

We trust this information suitably responds to the matters raised and the City can now proceed to present a favourable recommendation to the Metro Outer Joint Development Assessment Panel.

Should you have any queries or require further clarification in regard to the above matter please do not hesitate to contact the writer.

Yours sincerely



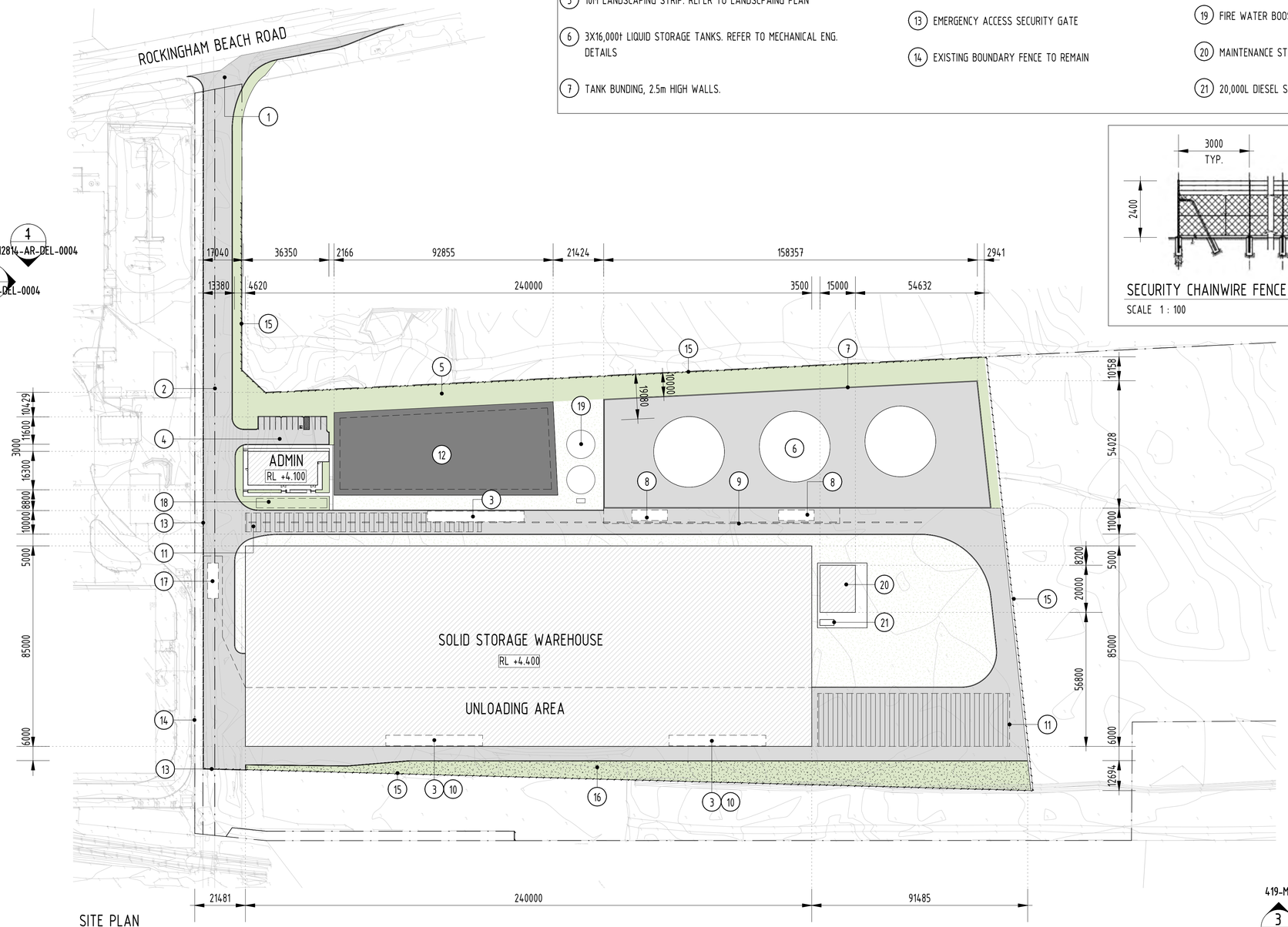
ROSS UNDERWOOD
ASSOCIATE

Encl. Technical note from Herring Storer Acoustics
Baseline Environmental Assessment
Updated Water Management Strategy
Amended landscaping plan

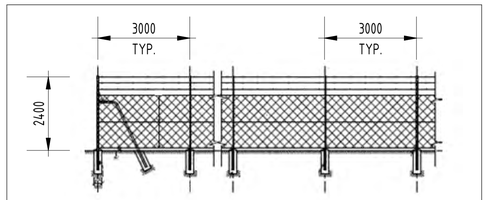
201208 6555 letter to City.docx

NOTES

1. CROSSOVER TO LOCAL AUTHORITY REQUIREMENTS REFER TO CIVIL ENG. DETAILS
2. 7M WIDE AUTOMATED SWING GATES
3. AUTOMATED WEIGHBRIDGE
4. FOR CARPARK REFER TO LOCALISED SITE PLAN
5. 10M LANDSCAPING STRIP. REFER TO LANDSCPAING PLAN
6. 3X16,000t LIQUID STORAGE TANKS. REFER TO MECHANICAL ENG. DETAILS
7. TANK BUNDING, 2.5m HIGH WALLS.
8. UAN LOADING POINT
9. AWNING TO UAN LOADING AREA
10. COVERED LOADING AREA - SOLIDS
11. UNDERGROUND STORMWATER INFILTRATION SYSTEM
12. EVAPORATION POND, SIZE TO BE CONFIRMED
13. EMERGENCY ACCESS SECURITY GATE
14. EXISTING BOUNDARY FENCE TO REMAIN
15. PROPOSED SECURITY CHAINWIRE FENCE TO BOUNDARY 2.1M HIGH
16. STORMWATER SWALE WITH LANDSCAPING. REFER TO CIVIL ENGINEERS DETAILS
17. WHEEL WASH. 15M LONG
18. SEPTIC SYSTEM AREA
19. FIRE WATER BOOSTER PUMPS & BUFFER TANKS
20. MAINTENANCE STORE
21. 20,000L DIESEL STORAGE TANK



SITE PLAN
SCALE 1 : 1000



SECURITY CHAINWIRE FENCE DETAIL
SCALE 1 : 100

4 / 419-M2814-AR-DEL-0004
2 / 419-M2814-AR-DEL-0004
4 / 419-M2814-AR-DEL-0004
3 / 419-M2814-AR-DEL-0004

CADDSGROUP ARCHITECTURAL DRAFTING

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

ALL DRAWINGS SHALL BE READ IN CONJUNCTION WITH ALL OTHER DRAWINGS RELATING TO THIS PROJECT & SPECIFICATIONS

ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE BUILDING CODE OF AUSTRALIA

ALL WORK SHALL BE CARRIED OUT IN ACCORDANCE WITH THE REQUIREMENTS AND REGULATIONS OF ALL LOCAL AUTHORITIES

INSTALLATION OF ALL BUILDING MATERIALS, TO BE INSTALLED IN ACCORDANCE TO MANUFACTURERS RECOMMENDATIONS.

LEGEND

- BITUMEN PAVEMENT. REFER TO CIVIL ENGINEERS DETAILS
- CONCRETE FOOTPATHS. REFER TO ENGINEERS DETAILS
- LANDSCAPED AREA. REFER TO LANDSCAPING PLAN FOR DETAILS
- STORMWATER SWALE. REFER TO CIVIL ENGINEERS DETAILS
- CADASTRAL BOUNDARY LINE
- PROPOSED FENCING. REFER TO NOTES
- PROPOSED FENCING. REFER TO NOTES

AREAS

ADMINISTRATION BUILDING	444 m^2
SOLID STORAGE WAREHOUSE	20400 m^2
EVAPORATION POND	3507 m^2
UAN LIQUID STORAGE	8061 m^2
TOTAL	32412 m^2

PARKING SCHEDULE

DISABLED BAY		
2/2400mm x 5400m	SHARED BAY W/ BOLLARD TO COMPLY W/ AS2890.6	1
STANDARD BAY		
2400mm x 5400mm		10
TOTAL		11

PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE - 04.08.20

1:100 @ A1 / 1:200 @ A3: 0 1 2 3 4 5 6 7 8 9 10 m
1:1000 @ A1 / 1:2000 @ A3: 0 10 20 30 40 50 60 70 80 90 100 m

CBH GROUP

ÄCOR CONSULTANTS (WA) Pty Ltd
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MANAGERS
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JOB. No.

REF	DRAWING No.	REFERENCE DRAWING TITLE	REV	DATE	REVISION DESCRIPTION	BY	CHK'D	APP'D
			H	08.12.20	UPDATED LANDSCAPING AS PER CLIENT COMMENTS	JM		
			G	02.12.20	UPDATED LANDSCAPING AS PER CLIENT COMMENTS	JM		
			F	04.08.20	ISSUED FOR INFORMATION	NM		
			E	29.07.20	ISSUED FOR INFORMATION	NM		
			D	27.07.20	ISSUED FOR INFORMATION	NM		
			C	26.06.20	ISSUED FOR INFORMATION	NM		

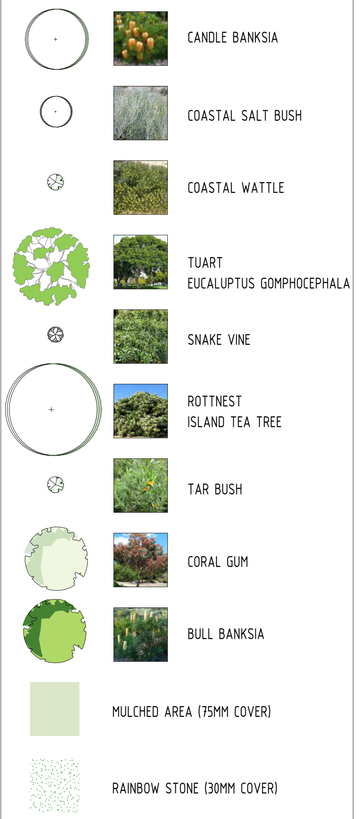
SCALE	As indicated	DRAWN	N.MCDONALD 02.06.20
SHEET	A1	CHECKED	J.MARTIN 25.06.20
PROJECT		DESIGNED	N.MCDONALD 02.06.20
		DESIGN APPR	
CONTRACT No.		PROJECT APPR	

TITLE
KWINANA TERMINAL
FERTISLISER STORAGE FACILITY
SCHEMATIC DESIGN
SITE PLAN

ORG No. 419-M2814-AR-DLP-0002 | SHEET 2 OF 15 | REV. H

NOTE:
LANDSCAPING TO COMPLY WITH LOCAL SHIRE REQUIREMENTS. SPECIES SELECTION AND LAYOUT IS INDICATIVE. LANDSCAPER TO DETRERMINE APROPRIATE SPECIES AND ARRANGEMENT.

LEGEND

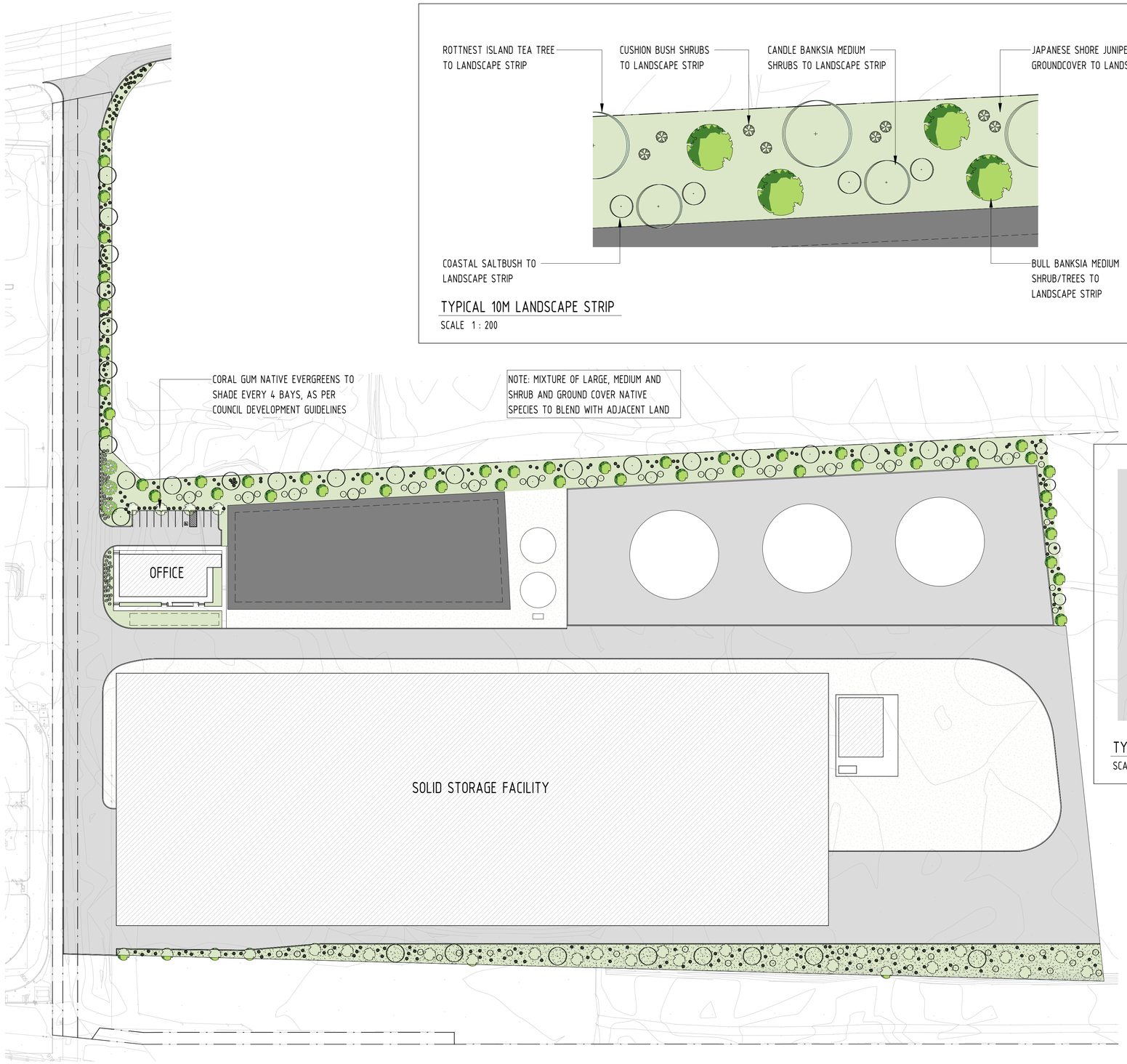


NOTE

ANY EXISTING XANTHORROHOEA PREISSII - GRASS TREES ARE TO BE RETAINED AND PROTECTED IN THEIR CURRENT LOCATIONS AS FAR AS PRACTICABLE. ANY GRASS TREES WHICH WILL BE IMPACTED BY THE PROPOSED DEVELOPMENT LAYOUT SHOULD BE UTILISED AND RELOCATED TO BE SITUATED WITHIN THE PROPOSED LANDSCAPE AREAS.

ALL INFILTRATION SWALES TO HAVE BIOFILTRATION VEGETATION AND AN AMENDED SOIL TREATMENT PROFILE TO SUIT THE DESIGN

TYPICAL 10M LANDSCAPE STRIP
SCALE 1 : 200



LANDSCAPING PLAN
SCALE 1 : 750

TYPICAL LANDSCAPE TO ENTRANCE
SCALE 1 : 200

CADDSGROUP ARCHITECTURAL DRAFTING

USE FIGURED DIMENSIONS ONLY DO NOT SCALE FROM DRAWINGS

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PRELIMINARY ISSUE
DO NOT USE FOR CONSTRUCTION
DATE - 04.08.20

1:200 @ A1
1:400 @ A3
0 5000 10000 15000 20000 mm

1:750 @ A1
1:1500 @ A3
0 10 20 30 40 50 60 70 m

CBH GROUP

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JOB. No.

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		C	26.06.20	ISSUED FOR INFORMATION	NM		

SCALE: As indicated
SHEET: A1
PROJECT:
CONTRACT No.:

DRAWN	N.MCDONALD	02.06.20
CHECKED	J.MARTIN	25.06.20
DESIGNED	N.MCDONALD	02.06.20
DESIGN APPR		
PROJECT APPR		

TITLE:
KWINANA TERMINAL
FERTISLISER STORAGE FACILITY
SCHEMATIC DESIGN
LANDSCAPING PLAN

ORG No.: 419-M2814-AR-DGA-0003
SHEET: 3 OF 15
REV.: G

Linfire Consultancy
ABN: 577 930 47299

Linfire ref: 2020022834360Env-LT-001_DRAFT

8 December 2020

CBH KWINANA – FERTILISER STORAGE FACILITY
RESPONSE TO DFES COMMENTS

The tables below provides a response to the written comments received from the Department of Fire and Emergency Services (DFES) in Table 1, relating to the Bushfire Management Plan (Revision 3 dated 31 July 2020), prepared to support proposed fertiliser storage development in the City of Rockingham.

Table 1: Response to DFES Comments

Issue	Comment	Applicant response
Policy Measure 6.5 a) (ii) Preparation of BAL contour map		
BMP Methodology – CBH Grain Jetty and Pipeline	The BMP has not been prepared in accordance with Appendix 3 of the Guidelines. Notwithstanding that the CBH Grain Jetty is predominantly not in a bushfire prone area the BMP must assess the subject land in its entirety that includes the CBH Grain Jetty and the pipeline. DFES notes that Section 4.4.2 (page 15) of the Development Application Report 'CBH Grain Jetty' has selectively justified exemption from SPP 3.7. Section 5 of Planning Bulletin 111/2016 does not apply to proposals that *result in an intensification of development (or land use), results in an increase in the number of residents or employees, or results in an increase in bushfire threat.* **Action: Modification to BMP required**	Linfire note that the Grain Jetty and associated pipeline (offshore works) is subject to a separate development application, and as such is not subject to this BMP. Notwithstanding, as outlined in the DA report for the CBH Grain Jetty, and in accordance with the criteria outlined in Planning Bulletin 111/2016, these offshore works are considered exempt from responding to SPP 3.7. The proposed offshore works consists of the following: • A pipeline and associated infrastructure on the existing CBH Grain Terminal jetty to enable liquid fertiliser ship offloading and pumping to storage tanks • Secondary containment infrastructure for the hose reel and coupling on the jetty. In accordance with Planning Bulletin 111/2016, proposal is considered exempt from SPP3.7 where is does not: • *result in an intensification of development (or land use),* • *result in an increase in the number of residents or employees,* • *involve the occupation of employees on site for any considerable amount of time; or* • *or results in an increase in bushfire threat.*

Issue	Comment	Applicant response
Policy Measure 6.5 a) (ii) Preparation of BAL contour map		
BMP Methodology – CBH Grain Jetty and Pipeline		In response to the above criteria, Linfire note the following: • There is no intensification of land use associated with the offshore DA, with development primarily focussed on infrastructure (pipeline and hoses) to enable the offloading of the liquid fertiliser to the onshore storage tanks. There are no habitable buildings associated with this DA • There is no proposed increase in the number of employees required over the current occupation, given the size of the jetty and wharf remains unchanged • The pipeline is largely outside of a bushfire prone area, but where it is within, it is mostly below-ground. The ships are also located well outside the designated bushfire prone area • The liquid fertiliser is urea ammonium nitrate (UAN), which is not flammable or considered to present an explosion risk nor any specific firefighting challenge. It can decompose upon heating and can form products including ammonia, oxides or nitrogen, cyanuric acid, cyanic acid, biuret, carbon dioxide. • The pipeline is completely purged of any UAN, following each unload. This is achieved using a “Pig” which is launched into the pipe to push any remaining UAN from the pipeline into the storage tanks. Assuming there is no unloading of fertiliser during a bushfire, which is considered highly unlikely, there would be no UAN within the pipe during any bushfire event along the foreshore. On this basis, there is considered to be no increase in bushfire threat posed by this development. Based on the above, the CBH Grain Jetty DA is not considered to represent an intensification of land use or occupants, nor pose an increase in bushfire threat, and as such, is considered exempt from responding to SPP 3.7.

Issue	Comment	Applicant response
Policy Measure 6.5 a) (ii) Preparation of BAL contour map		
Management Agreement – Off-site Asset Protection Zone	Compliance with the Bushfire Protection Criteria relies upon the ability to enter into a 'Maintenance Agreement' to maintain vegetation outside the subject site in accordance with Schedule 1: Standards for Asset Protection Zones contained in the Guidelines. DFES acknowledges that the BMP recommends that the Development Approval incorporates a condition requiring a Maintenance Agreement between the proponent and the owner of Lot 108. The condition requires an Agreement to be prepared and implemented in relation to maintenance of the off-site vegetation management zone within an undeveloped portion of Lot 108 in perpetuity, or until such a time that the bushfire hazard is permanently removed and the lot is developed to a non-vegetated/ low threat state. DFES notes that Clause 4.6.2 of the Guidelines states: As the BMP is a document that should apply for the life of the development, the decision-maker should require modifications to the document in the event that there are discrepancies, prior to endorsement and/or approval of the planning application being granted. Conditional approval should not be granted prior to the BMP being prepared and endorsed. Technical evidence and verification should be included in the BMP to qualify the vegetation exclusion can be achieved and that it is enforceable in perpetuity. An endorsed copy of the proposed Maintenance Agreement or written undertaking by the Lot 108 landowner would address this requirement. **Action: Modification to BMP required**	The project area is being leased from the current landowner of Lot 108 (DevelopmentWA), who have indicated via email that they addressed a similar issue with the Puma development to the north-east, by including a licence clause for the off-site management zone outside the lease area. This approach allows for the partial or total termination of the licence clause, should future development of the off-site management zone permanently remove the bushfire threat (with non-vegetated elements or low threat vegetation). Given that DevelopmentWA is the landowner of both the project area and the off-site management zone nominated in the BMP, it is considered there is little risk involved with this arrangement, with it considered more formalising that the landowner understand their obligation to enable ongoing management of this land by CBH for the life of the facility, or until vegetation is permanently removed.

Issue	Comment	Applicant response
Policy Measure 6.5 c) Compliance with the Bushfire Protection Criteria		
Location, and Siting & Design	**A1.1 & 2.1 - insufficient information** The BAL ratings cannot be validated, as technical evidence and verification has not been included in the BMP to qualify the vegetation exclusion within Lot 108 can be achieved and that it is enforceable in perpetuity, as per the above table. **Action: Modification to BMP required**	As outlined in the BMP, following implementation of the onsite APZ and the off-site management zone (the validity of which is addressed above), the vegetation classifications and BAL contours are to remain as documented within the BMP. On this basis, all proposed development can be compliantly located in an area of BAL-29 or lower, and a compliant APZ within the project area, supplemented by the off-site management zone. Compliance with A1.1 and A2.1 has been satisfactorily demonstrated.

Yours sincerely,

LINDEN WEARS
Bushfire Consultant/Fire Engineer
BSc, GradDip (Fire Safety Eng.), GradDip (Bushfire Protection)

EMAIL TRANSMITTAL

REF:	25717-7-20107
TO:	360 Environmental
ATTENTION:	Alysia Woodward
EMAIL:	AlysiaWoodward@360environmental.com.au
FROM:	Paul Drew
DATE:	23 November 2020
SUBJECT:	**KWINANA BULK FACILITY – ACOUSTIC QUERY RESPONSE**

Alysia,

As requested, we have reviewed the acoustic issues raised by the City of Rockingham with respect to the proposal, and in particular the potential noise emissions from the systems associated with pumping of liquids from the jetty.

We understand the City of Rockingham have identified that noise emissions from the proposed jetty operations (pumping of bulk liquid from jetty to holding tanks on shore) has not been specifically addressed in the acoustic assessment. Potential noise sources may include pumps and pigging (pipe cleaning) operations. The acoustic assessment report would have been more complete if these matters had been documented in detail.

We have made further enquiries and have been advised that in accordance with our original understanding, bulk liquids are to be pumped by the ships pumps. The ships pumps are specific to each ship, but we understand are electric drive pumps located within the ships hold. As such, there will not be a significant noise emission during the bulk liquids transfer process. The velocities within the proposed 250mm pipeline are understood to be relatively low, so flow noise is not expected to be noticeable.

We further note that approximately 3 - 4 ships per year is the expected frequency of bulk liquid unloading. Such unloading may occur during the night period. As there will be no discernible increase in noise from the pumping operations at the nearest noise sensitive receptors, no adverse acoustic impact is expected.

With respect to cleaning the 250mm pipeline, we understand this may occur after each ship has completed liquid transfer by use of a pig. The pig is moved by the pressure of compressed air, the compressor being located on the ocean end of the jetty. At pressures of up to 85 psi, there may also be some venting of compressed air at the discharge end (at the bulk tanks). The movement of the pig itself is not expected to generate significant noise.

The sound power levels of a typical air compressor (electric driven) and high pressure air venting have been modelled. This cleaning activity will usually occur during the day period, where the 'assigned level' at noise sensitive receptors is at least 45 dB(A).

Rochdale Holdings Pty Ltd A.B.N. 85 009 049 067 trading as:
HERRING STORER ACOUSTICS
P.O. Box 219, Como, W.A. 6952
(08) 9367 6200
hsa@hsacoustics.com.au

The respective sound power levels modelled were:

Air Compressor	93 dB(A)
Compressed Air Venting	110 dB(A)

The predicted noise contours, cumulative with the full operation of the proposed CBH Fertilizer facility are attached, plot 110. The predicted noise emissions at the nearest noise sensitive receptors is only slightly increased from the night scenario. The predicted noise emissions comply with the 'night-time' assigned levels at the nearest noise sensitive receptors, however the work will usually be carried out during the day when the 'assigned level' is higher.

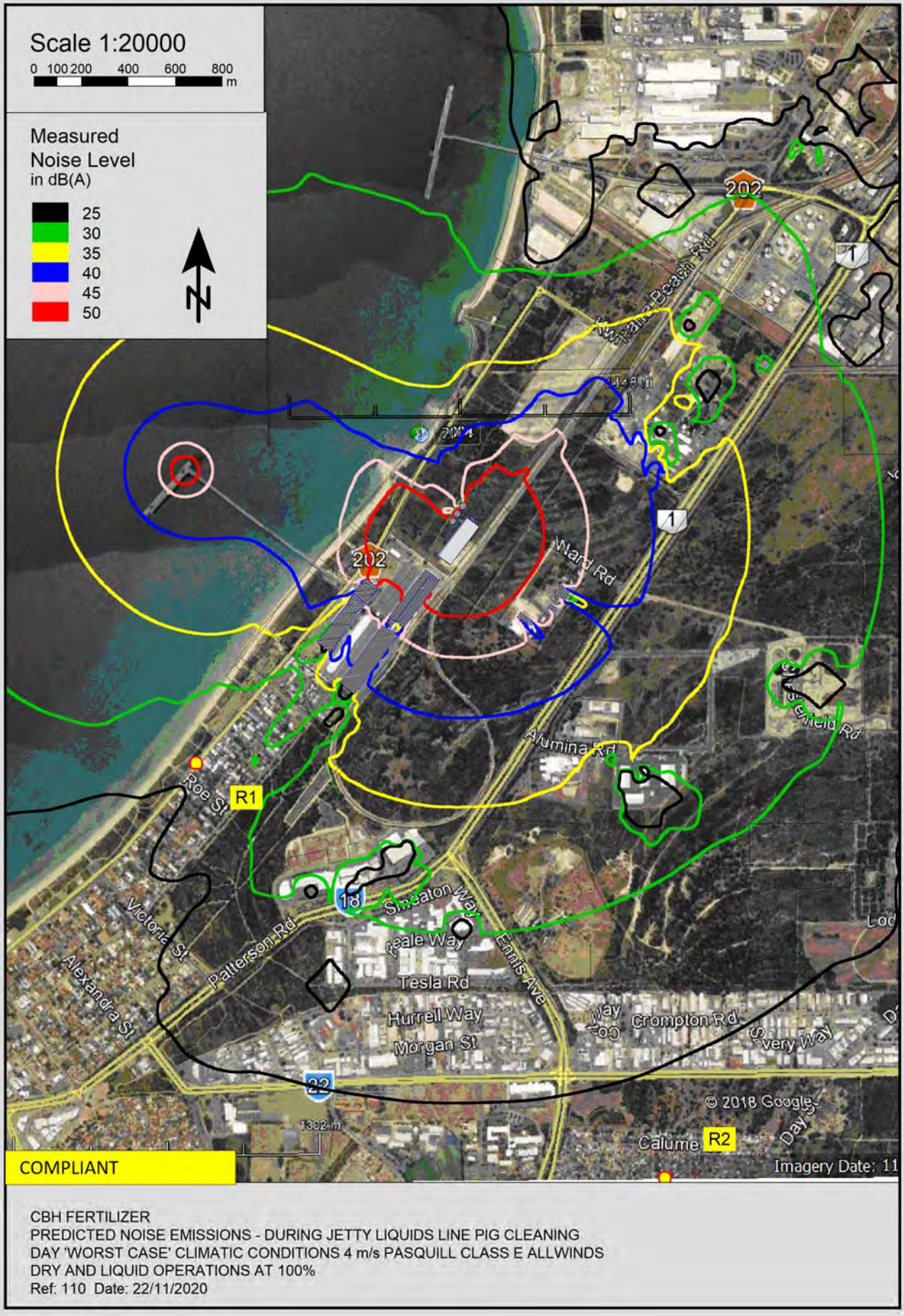
The potential noise emissions from activities associated with bulk liquids unloading from the jetty have been assessed. The predicted noise emissions are found not to be significant at the receptors.

Should you have any further queries, please do not hesitate to contact this office.

Yours faithfully,
for **HERRING STORER ACOUSTICS**

Paul Drew
DIRECTOR

Att.



CBH FERTILIZER
PREDICTED NOISE EMISSIONS - DURING JETTY LIQUIDS LINE PIG CLEANING
DAY 'WORST CASE' CLIMATIC CONDITIONS 4 m/s PASQUILL CLASS E ALLWINDS
DRY AND LIQUID OPERATIONS AT 100%
Ref: 110 Date: 22/11/2020

360 environmental

Kwinana Fertiliser Expansion Project

Water Management Strategy

Prepared for

Co-operative Bulk Handling Limited (CBH Ltd)

December 2020

people planet professional

Document Reference	Revision	Prepared by	Reviewed by	Admin Review	Submitted to Client	
					Copies	Date
3850AA_Rev0	Internal Draft	LZ	KL		-	-
3850AA_Rev1	Client Draft	LZ	KL	SH	1x electronic	24/06/2020
3850AA_Rev2	Client Final	KL		NL	1 x electronic	08/07/2020
3850AA_Rev3	Final	KAC		NL	1 x electronic	15/07/2020
3850AA_Rev4	Respond to comments	NC/KL	KL	LI	1 x electronic	04/12/2020

Disclaimer

Executive Summary

Co-operative Bulk Handling Limited (CBH Ltd) commissioned 360 Environmental Pty Ltd to prepare a Water Management Strategy (WMS) to support a Development Application for the Kwinana Fertiliser Expansion Project located at 108 on Deposited Plan 400167 the whole of the land in certificate of Title Volume 2953 Folio 177.

CBH Ltd propose to consolidate and expand its Kwinana fertiliser storage facilities at the site. And will involve the transfer of liquid urea ammonium nitrate (UAN) from ships at the existing CBH grain terminal to onshore storage tanks via a pipeline. Dry fertiliser will also be trucked to and from the Kwinana Bulk Jetty (KBJ) and stored within a large warehouse. Access to the site will be via a public access road with an entry / exit point on the western boundary of the site.

The WMS details how all forms of water will be managed onsite including wastewater, stormwater, groundwater, and the water conservation measures which will be implemented to conserve scheme water. Table 1 provides an overview of the site environmental characteristics and water management strategies that will be implemented on site to enable the development to achieve sustainable integrated water management.

Table 1: Key WMS Elements

Site Overview	Description
Site Details Section 1.0	The development is located at 49 Port Rd, Kwinana Beach (Lot 108 on Plan 400167), in the City of Rockingham. The site is 6.05 ha and is covered by scrub.
Planning Background Section 1.1	The current facility is zoned Industrial according to the Metropolitan Region Scheme (MRS) and the expansion area is zoned Special Industrial (Department of Planning, 2019). According to the City of Rockingham Town Planning Scheme No. 2 (TPS 2), the existing and expansion area is zoned General Industry (City of Rockingham, 2019). The existing zoning supports the proposed development, and a rezoning application is not required. The site is located in the Rockingham Industry Zone (RIZ). This WMS has been prepared to support the Development Application (DA) for the site.
Proposed Development Section 1.2	CBH propose to consolidate and expand its Kwinana fertiliser storage facilities at the site to include two main components: • Onshore • Offshore (existing jetty / pipeline). Liquid urea ammonium nitrate (UAN) will be transferred from ships at the CBH Grain Terminal to onshore storage tanks via a pipeline. Dry fertiliser will be trucked to and from site and stored within a storage shed. To facilitate the import and storage of liquid UAN, a pipeline will be constructed in-situ and attached to the existing jetty. A coupling and hose reel will be secured to the existing jetty within a bunded area to capture and manage stormwater. The pipeline will run underground from the shoreline crossing to the UAN tank storage location. To facilitate the import and storage of liquid UAN, 3 x 30 m diameter x 20 m high UAN storage tanks surrounded by a 2.5 m high concrete bund wall will be construction. To facilitate the import and storage of dry fertiliser, a 240 m long x 85 m wide fertiliser storage warehouse with storage bays will be constructed.
Topography Section 2.3	The site is flat and low lying with topography generally sloping from southwest to northeast across the site. The highest elevation of approximately 4 AHD occurs in the south west of the site and the lowest elevation of approximately 3m AHD occurs in the north east.

Site Overview	Description
Soil Type Section 2.4.2	A Geotechnical Investigation concluded that the site is comprised of sand to a depth of 12m and inferred as sandy soil to the depth of 21m below the ground.
Surface Water and Existing Drainage Section 2.7	There are no surface water features, including open drains or waterways located at the site. Due to the sites soil profile minor and major rainfall events infiltrate at source. No existing road drainage network is found along Rockingham Beach Road.
Groundwater Aquifers Section 2.6.1	The site lies within the Wellard and Cockburn Confined sub-areas of the Cockburn Groundwater Area. The groundwater aquifers located at the site include the Perth – Rockingham Sand (Wellard), Perth – Superficial (Wellard) and Perth-Leederville (Cockburn Confined).
Groundwater Levels Section 2.9.2	The Perth Groundwater Map indicates that the maximum groundwater level (MGL) onsite is approximately between 1 and 2 m AHD. Groundwater monitoring has been completed on site in March 2020. The maximum recorded groundwater level was 0.76 m AHD. DWER long-term bore recorded a historical maximum groundwater level of approximately 2 m AHD. The MGL onsite has been conservatively estimated as approximately 1.95 m AHD.
Groundwater Quality Section 2.9.3	The groundwater monitoring results from March 2020 indicate the groundwater quality generally has very low concentration of tested parameters. Except for one well having exceeding ammonia concentration, all the sampled wells had nutrients, heavy metal, and hydrocarbons levels lower than the Cockburn Sound Environmental Quality Criteria (EQC) for Moderate Protection Area.
Water Supply and Wastewater Disposal Section 3.1	The site will be serviced by the Water Corporation for potable water supply. Wastewater from the administration building will be treated onsite with a DoH-approved Secondary Treatment System (STS). Treated wastewater will be disposed via land application behind the administration building. Ample space is available for surface irrigation or use of leach drains to infiltrate the treated wastewater.
Water Efficiency and Conservation Section 3.3	Water efficient fixtures and fittings will be used within the site and waterwise landscaping principles will be followed. Irrigation of the vegetated buffer will occur for a 2-year period to establish the vegetation.
Stormwater Management Strategy Section 4.1	Proposed stormwater management for the site includes. • Uncontaminated stormwater runoff will be separated from potentially contaminated runoff • Collect and contain all potentially contaminated runoff using a lined evaporation pond. Contained water will be dissipated via evaporation during low order rainfall events. Water from the evaporation pond will need to be trucked offsite to maintain a 0.3m freeboard at all times. • Collect and infiltrate the uncontaminated runoff from the first 15 mm of rainfall using underground cells, drainage swales and soakwells • Collect and infiltrate the uncontaminated runoff in events greater than the first 15 mm up to 1% AEP event in underground cells, infiltration swales and soakwells.
Groundwater Management Strategy Section 4.2	The estimated finish floor level is 4 m AHD which will provide a clearance of 2.05 m to the estimated MGL of 1.95 m AHD. A sub soil drainage network is not required. Groundwater quality will be maintained by infiltrating the clean runoff from the first 15 mm through infiltration bio swales and soakwells. Contaminated runoff will be collected in the lined evaporation pond. Fertiliser (both liquid and dry) is to be stored in enclosed, sealed storage facilities which will prevent the leaching of nutrients to the environment.
Monitoring and Maintenance Section 5.0	Maintenance and monitoring commitments to be followed during and post construction have been provided. Ongoing monitoring requirements at the site will be in accordance with any future Part V licensing requirements.

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1 Introduction

1.1 Background

Co-operative Bulk Handling Limited (CBH Ltd) commissioned 360 Environmental Pty Ltd to prepare a Water Management Strategy (WMS) to support a Development Application for the Kwinana Fertiliser Expansion Project at 108 on Deposited Plan 400167 the whole of the land in certificate of Title Volume 2953 Folio 177 (the site, Figure 1) in the City of Rockingham (the City).

Lot 108 is approximately 22.46 ha, however the development area for the proposed facility is 6.5 ha and will be located in the south-eastern portion of Lot 108.

The WMS details how all forms of water will be managed onsite including wastewater, stormwater, groundwater, and the water conservation measures which will be implemented to conserve scheme water.

1.2 Planning Background

The current facility is zoned Industrial according to the Metropolitan Region Scheme (MRS) and the expansion area is zoned Special Industrial (Department of Planning, 2019). According to the City of Rockingham Town Planning Scheme No. 2 (TPS 2), the existing and expansion area is zoned General Industry (City of Rockingham, 2019). The existing zoning supports the proposed development, and a rezoning application is not required.

The site is located within the Rockingham Industry Zone (RIZ), development of the site has been assessed and approved (with conditions) under EPBC Act (EPBC 2010 / 5337) and EP Act (SEA-Report Number 1390). A Water Management Strategy (Hyd2o, 2013) is available for the RIZ.

To facilitate development within the site under the *Planning and Development Act 2005*, a Development Application (DA) is required. To support the DA, this Water Management Strategy has been prepared and can be read in conjunction with the DA application and supporting documentation:

- Environmental Assessment Report (EAR)
- Construction Environmental Management Plan (CEMP)
- Acoustic Assessment
- Bushfire Hazard and Management Plan
- Asbestos Removal Plan (from the outcomes of the Baseline Environmental Assessment)
- Site and Soil Evaluation (SSE).

This WMS has been prepared to comply with the Better Urban Water Management guidelines (WAPC 2008).

1.3 Proposed Development

Over the last four years Co-operative Bulk Handling Limited (CBH Ltd) has successfully grown its fertiliser business in WA and this expansion has resulted in the leasing of several different storage facilities within Kwinana.

CBH propose to consolidate and expand its Kwinana fertiliser storage facilities at the site to include two main components:

- Onshore (majority of the site within the RIZ)
- Offshore (existing jetty / new pipeline).

Liquid urea ammonium nitrate (UAN) will be transferred from ships at the CBH Grain Jetty to the onshore storage tanks via a pipeline. Dry fertiliser will be trucked to and from site and stored within a storage shed. Access to the site will be via public access road (Rockingham Beach Road) with an entry / exit point on the western boundary of the site.

To facilitate the import and storage of liquid UAN, a pipeline will be constructed in-situ and attached to the existing jetty. A coupling and hose reel will be secured to the existing jetty within a bunded area to capture and manage stormwater. The pipeline will run underground from the shoreline crossing to the UAN tank storage location.

To facilitate the import and storage of liquid UAN, 3 x 30 m diameter x 20 m high UAN storage tanks surrounded by a 2.5 m high concrete bund wall will be construction.

To facilitate the import and storage of dry fertiliser, a 240 m long x 85 m wide fertiliser storage warehouse with storage bays will be constructed.

Additional supporting infrastructure will be constructed, including: an evaporation pond, swale, access roads, hardstand area, administration offices, car park and weighbridges.

The proposed development plan is provided on Figure 2.

1.4 Guiding Documents

This WMS has been prepared in accordance with the following guidelines, policy documents and previous site investigations:

- State Planning Policy 2.9 Water Resources (WAPC, 2006)
- Stormwater Management Manual for Western Australia (DoW, 2007)
- Better Urban Water Management (WAPC, 2008)
- WQPN 52 – Stormwater Management at Industrial Sites (DoW, 2010)
- Rockingham Industry Zone Water Management Strategy (Hyd2o, 2013)
- State Environmental (Cockburn Sound) Policy 2015 (EPA, 2015)
- Environmental Quality Criteria reference document for Cockburn Sound (EPA, 2017)
- Geotechnical Study – Proposed CBH Fertiliser Facility Part Lot 108 Rockingham Beach Road (Galt, 2020)
- Baseline Environmental Assessment – Portion 49 Port Road, Kwinana Beach Western Australia (360 Environmental, 2020).

2 Existing Environment

2.1 Landuse

The Site is a greenfield site which has generally remained undeveloped. A section of the south-eastern corner of the site has been used by Watco for use as a blue metal storage, laydown, and train maintenance area from the early 2010s.

The Indian Ocean is approximately 250m north west of the site, where the existing CBH grain terminal and associated infrastructure including the offloading jetty is located.

2.2 Topography

The site is flat and low lying with topography generally sloping from southwest to northeast across the site. The highest elevation of approximately 4m AHD occurs in the south west of the site and the lowest elevation of approximately 3m AHD occurs in the north east (Figure 3).

2.3 Geology and Soils

2.3.1 Regional Geology

The regional soil types are mapped on Figure 4 indicates the site is located on the Quindalup South System (211Qu), described as 'Coastal dunes of the Swan Coastal Plain, with calcareous deep sands and yellow sand' (DPRID, 2020).

2.3.2 Geotechnical Investigation

A Geotechnical Investigation (Galt, 2020) has been completed (Appendix A). The investigation focused on the proposed development area. Four (4) test pits (TP01 to TP04) excavated to a depth of 2.0 m and eighteen (18) cone penetration tests (CPT01 to CPT18) to depths ranging from 4.2 m to 25.5 m were undertaken. The investigation concluded that the typical subsurface profile can be described as follows:

- FILL / TOPSOIL: Organic SAND – fine to medium grained, sub-angular to sub-rounded, grey to brown, trace fines, trace roots and root fibres, dry, loose, present from ground surface and extending to depths ranging from 0.2 m to 0.6 m; overlaying
- FILL: SAND / SAND (SP) – fine to medium grained, sub-angular to sub-rounded, typically pale yellow to white, typically trace fines, trace weakly cemented gravel, cobble and boulder sized limestone fragments, dry, typical medium dense with isolated loose to medium dense zones, extending to depths of about 1.5 m
- SAND (SP): fine to coarse grained, sub-angular to sub-rounded, becoming yellow to pale brown, trace shell fragments, moist becoming wet, medium dense to dense, extending to depths ranging from 3.0 m to 4.5 m; overlying
- SAND (SP-SM): fine to medium grained, sub-angular to sub-rounded, grey to dark grey, with non-plastic fines, trace shell fragments, wet, medium dense to dense, wet extending to a depth of 12.45 m; overlying
- Inferred SAND: medium dense to dense to a depth of 21.5 m with isolated loose to medium dense lenses / zones, extending to a depth of 21 m; overlying

- Inferred Silty SAND to Clayey SILT: very loose to soft, extending to the maximum investigated depth of 25.5 m; overlying
- Inferred LIMESTONE.

The Geotechnical Investigation report notes that soil descriptions below 12.45 m are inferred from CPT data only and no samples of rock were recovered (CPT only). Further details of the soil types and stratigraphy at each test location can be referred in the geotechnical report (Appendix A).

2.3.3 Infiltration Testing

The Geotechnical Investigation (Galt, 2020) included four (4) in-situ infiltration tests (IT01 to IT04) using the inverse auger hole method. The infiltration testing results are outlined in Table 2.

Table 2: Infiltration Testing Results

Test Location	Depth (m)	Minimum Unsaturated Permeability m / day		
		Test 1	Test 2	Test 3
IT01	0.80	5.4 (average)	1.4 (average)	1.0 (average)
IT02	0.92	7.7	3.8	3.5
IT03	0.82	8.6	5.4	-
IT04	0.90	3.2	2.0	-

The geotechnical report has recommended that an average minimum permeability design value of no more than 2 m / day for soakwells if installed within the in-situ sand. This design values assumes that soakwells are located at least 0.5 m above the maximum groundwater level.

An infiltration rate of 2 m / day has been used for the stormwater modelling for the proposed infiltration structures used to infiltrate the uncontaminated stormwater runoff (Section 4.1.2).

2.4 Acid Sulphate Soils

The Department of Water and Environmental Regulation's (DWER) Acid Sulfate Soil (ASS) risk mapping indicates that the site (onshore) has no known risk of ASS occurring within >3 m below natural surface ground level (DWER 2020a). No further ASS investigations are required.

2.5 Contaminated Sites

A search of the Department of Water and Environmental Regulation's (DWER) Contaminated Sites database indicates the site does not contain any registered contaminated sites.

An operational nickel refinery located to the northeast of the site that has been previously investigated and classed as 'Contaminated – Remediation Required' and a source site. This refinery has been classified due to concentrations of ammonia, sulfate, cobalt, and nickel which have impacted groundwater beneath properties located downgradient from the refinery.

A Baseline Environmental Assessment (BEA) was completed for the Site (360 Environmental, 2020), in order to investigate the current contamination status of soils and groundwater at the site prior to development and provide a preliminary assessment of the sites suitability for the proposed development.

The BEA has concluded that the site in general is not considered contaminated and background concentration of identified contaminants of potential concern (COPCs) are low.

2.6 Groundwater

2.6.1 Groundwater Resource

The Water Register database (DWER, 2020b) indicates the site lies within the Wellard and Cockburn Confined subareas of the Cockburn Groundwater Area. The groundwater aquifers located at the site include the Perth – Rockingham Sand (Wellard), Perth – Superficial (Wellard) and Perth - Leederville (Cockburn Confined).

An Aquifer Allocation Report was obtained from DWER in May 2020 which indicates that the Superficial Swan, Leederville and Yarragadee North are all over allocated with no remaining groundwater available for allocation, as described in Table 3 below.

Table 3: Aquifer Resource

Resource	Allocation Limit (kL)	Allocated and Committed Volume (kL)	Remaining Volume (kL)	% Allocated and Committed
Superficial Swan (Wellard subarea)	5,380,000	7,214,761	-1,834,761	134.10
Rockingham Sand (Wellard subarea)	0	0	0	0
Yarragadee North (Cockburn Confined)	5,150,000	5,155,689	-5,689	100.11
Leederville (Cockburn Confined)	1,350,000	1,500,000	-150,000	111.11

A groundwater licence for irrigation of public open space or for onsite processing is not required.

2.6.2 Groundwater Levels

2.6.2.1 Regional Groundwater Contours

The Perth Groundwater Map (DWER, 2020d) indicates that the maximum groundwater level (MGL) onsite is approximately between 1 and 2 m AHD (Figure 5), which would make sense given the sites proximity to the coast.

A search of the Water Information Reporting Database (DWER, 2020e) was undertaken and one DWER groundwater monitoring bore (ref: 61410035) were identified within approximately 900 m northeast to the site to have recent groundwater level information. The bore recorded groundwater levels since 1983 and the latest record was in March 2020. The groundwater level records are obtained from the database and plotted in Plate 1.

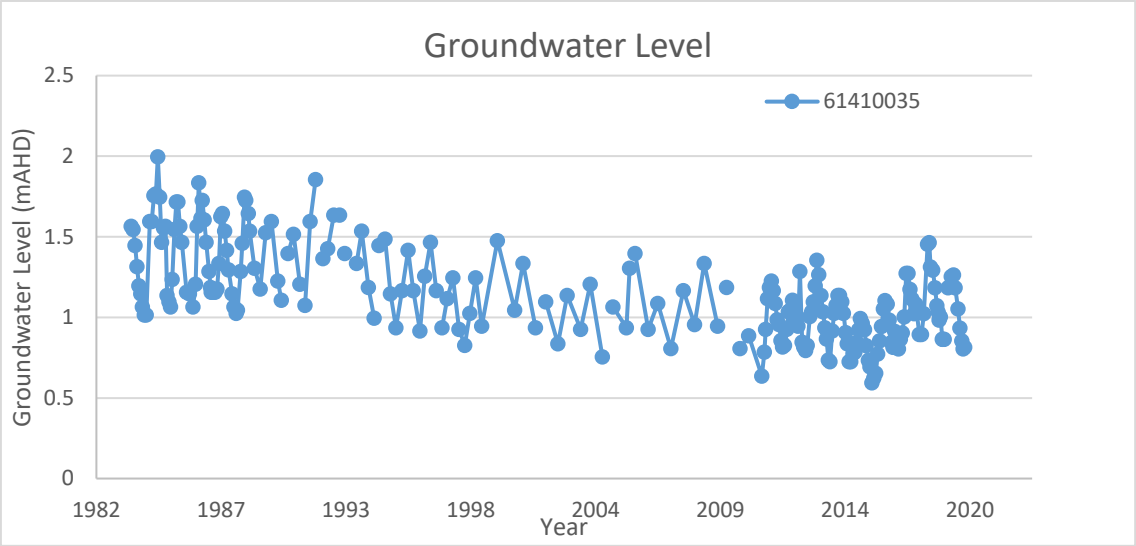

Plate 1: DWER Site Groundwater Levels

There is a generally decreasing trend in groundwater levels recorded in this bore.

2.6.2.2 Onsite Groundwater Levels

Seven (7) groundwater monitoring wells were installed onsite from 28 February to 6 March 2020 (Figure 5) as part of the BEA. Six (6) of the groundwater monitoring wells were sampled on 12 March 2020. MW05 was not sampled as the location was on the central southeast site boundary and MW01, MW02 and MW07 provided coverage of that boundary.

The highest groundwater level recorded in March is 0.76 m AHD (MW06). The minimum separation from existing surface to groundwater level is also recorded in MW06 as 2.41 m. The DWER bore 61410035 recorded a ground level of 0.804 m AHD on 6th March and 0.814 m AHD on 31st March. The site's recorded groundwater level is slightly lower (approximately 0.05 m) than the DWER bore levels. The historical MGL recorded in the DWER bore is 1.996 m AHD. For a conservative estimation, the MGL onsite is calculated as 1.946 m AHD (approximately 1.95 m AHD).

Several factors were considered that may affect the groundwater levels onsite:

- Groundwater abstraction on neighbouring sites
- Unsealed surfaces onsite which promotes faster rainfall infiltration and groundwater recharge
- Tidal influences on groundwater elevations given the proximity of the site to Cockburn Sound.

2.6.3 Groundwater Quality

The site is located next to the Moderate Ecological Protection Area of Cockburn Sound, defined by the State Environmental (Cockburn Sound) Policy 2015 (EPA, 2015). The Environmental Quality Criteria reference document for Cockburn Sound (EPA, 2017) provide the guideline values for the Moderate Protection Area.

Six (6) of the onsite groundwater monitoring wells (MW01-MW04, MW06-MW07) were sampled on 12 March 2020. The Groundwater quality monitoring results from this event are summarised as follows:

- Nutrients

  The site was reported to have generally low levels of nutrients. With the exception of ammonia in MW07, all the reported concentrations of nutrients were below the ANZECC and ARMCANZ (2018) Marine Water guideline values. Nutrients in all the sampled bores were reported below the Cockburn Sound Environmental Quality Criteria (EQC) – Moderate Protection levels (EPA, 2017).

  MW07 is located approximately 500 m from the Cockburn Sound. Nickel West is located directly upgradient of MW07 and may be the source of the ammonia, as the refinery has been reported to the DWER as having an ammonia plume in groundwater (360 Environmental, 2020). Historical site use is considered unlikely to have resulted in ammonia impacts to groundwater.

- Heavy Metals

  All the concentrations of dissolved metals were reported below ANZECC Marine Water guideline values and Cockburn Sound EQC Moderate Protection levels. The low levels of heavy metals indicate that metal contamination from nearby industrial facilities are not significant.

- Hydrocarbons

  All the concentrations of hydrocarbons were reported below ANZECC Marine Water guideline values and Cockburn Sound EQC Moderate Protection levels.

2.7 Surface Water and Existing Drainage

There are no surface water features, including open drains located at the site. Due to the site's sandy soil type and decent permeability, rainfall events are likely to infiltrate at source and limited runoff is expected to leave the site.

2.8 Wetlands

The Department of Biodiversity Conservation and Attractions (DBCA, 2020) wetland mapping indicates there are no wetlands onsite. Four Resource Enhancement wetlands (UFI: 6227, 6316, 6317 and 6318) are located 1 km south of the site. The wetlands are on the southern side of an access road east to the site and it is considered the development of the site will not impact the wetlands.

2.9 Coastal Flood Level

The Coastal Vulnerability Study, Erosion and Inundation Hazard Assessment (Cockburn Sound Coastal Alliance, Version 2, dated 16/10/2019) provides the results of various inundation scenarios based on different annual exceedance probability (AEP) and sea level rise (SLR)s scenarios associated with climate change. Table 4 below provides a summary.

Table 4: Coastal Inundation Scenarios and Levels

Scenario	Present day	+0.5 m SLR	+0.9 m SLR	+1.5 m SLR
1-year ARI (63% AEP)	1.00 m AHD	1.50 m AHD	1.90 m AHD	2.50 m AHD
10-year ARI (10% AEP)	1.16 m AHD	1.66 m AHD	2.06 m AHD	2.66 m AHD
100-year ARI (1% AEP)	1.34 m AHD	1.84 m AHD	2.24 m AHD	2.84 m AHD
500-year ARI (0.2% AEP)	1.48 m AHD	1.98 m AHD	2.38 m AHD	2.98 m AHD

The WA Government has adopted a 0.9 m SLR over a 100-year planning timeframe for coastal development (DPLH, 2018).

The inundation level for the 1% AEP, +0.9m SLR scenario is 2.24 m AHD. The lowest finished floor level is proposed to be 4.0 m AHD, which is 1.76 m above the 1% AEP inundation level accounting for the effects of climate change and sea level rise.

The Site is not prone to flooding from coastal inundation now or in the future (100 years).

3 Water Sustainability

3.1 Water Supply and Wastewater Disposal

The Water Corporation will provide potable water for the site via connection to existing water mains, located south of the site.

The Site is in a Sewerage Sensitive Area. The Government Sewerage Policy requires a Secondary Treatment System (STS) (previously known as Aerobic Treatment Unit (ATU) to be used as they produce treated effluent of secondary standard. To comply with the Government Sewerage Policy, the ATU must treat the wastewater to ensure the effluent discharge quality meets the following criteria

- 20 mg / L of Biochemical Oxygen Demand (BOD)
- 30 mg / L of Total Suspended Solids (TSS)
- 10 cfu / 100 mL of Escherichia (E) coli.

In addition, the levels of nitrogen and phosphorous must be reduced to:

- < 10 mg / L Nitrogen
- < 1 mg / L Phosphorous.

Although the Department of Health website provides an extensive list of approved secondary treatment systems that are certified to Australia Standard AS 1546.3. The only secondary treatment system that has been able to demonstrate that it provides the required water quality treatment are the systems produced by Aquarius Wastewater Systems Pty Ltd.

With the release of the Government Sewerage Policy (DPLH, 2019), there is likely to be additional systems available on the market by the time construction is due to commence, which will enable a more competitive tender process

In line with the Government Sewerage Policy (DPLH, 2019), a Site and Soil Evaluation (SSE) (360 Environmental, 2020b) has been prepared to detail how the site will manage wastewater generated from bathrooms, toilets, and kitchens.

The proposed wastewater treatment system and land application area have been determined based on the following assumptions:

- Eight permanent staff and a daily hydraulic load of 70 L / person / day
- Eight temporary staff (including truck drivers and contractors) and a daily hydraulic load of 30 L / person / day as temporary staff are unlikely to use shower facilities.

The daily hydraulic load for the proposed workforce is calculated as 800 L / day. The SSE proposed a DoH approved Aquarius O-3 STS, which will provide 1800 L / day treatment capacity. This is considered sufficient for the site. Further details are provided in the SSE (360 Environmental 2020b).

The Aquarius ATU systems treat the wastewater to a standard which is able to be irrigated to garden areas / turf through surface or sub surface irrigation systems, or disposed into leach drains, soak wells or aquasafe drains.

The required land application area is calculated by:

Land application area (m^2) = Hydraulic load (L / day) x Soil conversion factor

The Geotechnical Investigation concluded the site has a sandy soil profile, the sand conversion factor for Secondary Treatment is 0.2. Therefore, the land application (surface irrigation) area required for the site is calculated as 160 m^2.

The irrigation area will be required to achieve a clearance to groundwater of 1.5 m.

If at the detailed design phase, space is a constraint, the treated wastewater can be disposed via flatbed leach drains which require a significantly smaller area to infiltrate the treated wastewater.

For secondary treated effluent, the following calculation is used to determine the length of leach drains required.

Land application area for leach drains (m2):

= Hydraulic loading (L / day) ÷ 50 ÷ Infiltrative Area (IA)
(IA of Atlantis Corporation flatbed leach drains = 2.6 m2 / m)
= 800 ÷ 50 ÷ 2.65
= 6.0 m2

The flatbeach leach drains will also need to achieve a clearance to maximum groundwater of 1.5m. Given the office and administration building is to be located on the higher part of the site with a topography of approximately 4 m, achieving this clearance to groundwater is achievable.

3.2 Water for Irrigation

Given the limited area of landscaping, the proposed landscaped buffer and garden areas around the administration building will be irrigated with scheme water. The 3000 m^2 landscaped buffer will be irrigated for a two-year period to establish the vegetation only.

The preliminary landscaping plan is provided in Appendix B.

3.3 Water Efficiency and Conservation

3.3.1 Buildings

To achieve water efficiency targets, it is envisaged that all the buildings onsite will be built consistent with the current Building Codes Australia energy and water efficiency standards.

3.3.2 Landscaped Areas

The following will be implemented to improve water efficiency within landscaped areas:

- Selection of drought tolerant, native plant species
- Mulching to improve moisture and nutrient retention
- Controlled water application rates to suit the water requirement of plant, climate, and rainfall patterns
- The use of a water efficient sprinkler system.

4 Water Management Strategy

4.1 Stormwater Management

4.1.1 Background

The stormwater management strategy focuses on managing clean stormwater and stormwater potentially containing nutrients (contaminated stormwater) separately.

Stormwater runoff from internal roads where trucks deliver the liquid fertiliser (approximately 600 m^2) and the truck wash-down area (approximately 1000 m^2) will be directed to an evaporation pond. Stormwater runoff collected from other internal roads, roofs and carpark areas will be managed separately.

The fertiliser (both liquid and dry) is to be stored in enclosed, sealed storage facilities which will prevent the leaching of nutrients to the environment and will be handled and stored in compliance with the Part V licensing requirements, as specified by DWER.

The general intent of the stormwater management strategy is to:

- Uncontaminated stormwater runoff will be separated from potentially contaminated runoff
- Collect and contain all the potentially contaminated runoff using lined evaporation ponds
- Collect and infiltrate the uncontaminated runoff from the first 15 mm event using underground cells, planted infiltration swales with amended soils and soakwells
- Collect and infiltrate the uncontaminated runoff in events greater than the first 15 mm up to 1% AEP event in underground cells, infiltration swales and soakwells.

4.1.2 Hydrological and Infiltration Modelling

A hydrological model using XPStorm has been developed to assess the site's stormwater storage areas.

The liquid fertiliser storage tank area is approximately 8,020 m^2 and will include a concrete wall around the perimeter. This area is excluded from the sizing of the evaporation pond and open swales because the surface runoff within this area will be contained within itself until it is pumped out only when suitable. Therefore, the runoff from this area does not affect the pond and swales sizing.

The potentially contaminated area (approximately 1,600 m^2) is not included in the hydrological modelling, as the area will be discharged to the evaporation pond. The site areas that generate uncontaminated runoff have been broken into sub catchments shown in Table 5 and Figure 6.

Table 5: Hydrological Model Parameters

Catchment	Impervious Area (m^2)	Pervious Area (m^2)	Initial Loss (mm)	Continuing Loss (mm / hr)
Access Road	1,400	800	Impervious: 0 Pervious: 30	Impervious: 0 Pervious: 2.9
Western Catchment	4,700 (road and carpark) 462 (office building)	7,200	Impervious: 0 Office Building: 15 Pervious: 30	Impervious: 0 Pervious: 2.9

Catchment	Impervious Area (m^2)	Pervious Area (m^2)	Initial Loss (mm)	Continuing Loss (mm / hr)
Northern Catchment	0	6,100	Impervious: 0 Pervious: 30	Impervious: 0 Pervious: 2.9
Eastern Catchment	4,800	2,600	Impervious: 0 Pervious: 30	Impervious: 0 Pervious: 2.9
Northern Half Roof	10,214	0	Impervious: 0	Impervious: 0
Southern Half Roof	10,177	0	Impervious: 0	Impervious: 0

The initial and continuing loss values for the pervious area are based on the ARR Datahub in this area. The initial and continuing loss for impervious areas is estimated as zero for conservative estimation. The administration building is assumed to have a 15 mm initial loss to represent the use of soakwells.

The Northern Catchment is currently proposed to be an unpaved, pervious area. The area north of the fertiliser warehouse is reserved for future warehouse expansion and the associated drainage storage.

Runoff hydrographs for the catchments are generated in XPstorm for storm events with different durations (from 30 minutes to 24 hours). The hydrographs are then used as input in the infiltration modelling to determine the size of the required drainage swales and underground infiltration cells.

The infiltration modelling has been completed using PONDS. PONDS is able to consider the presence of shallow groundwater and the reduced infiltration within drainage infrastructure. Table 6 outlines the model parameters.

Table 6: PONDS Infiltration Model Parameters

Parameter	Value
Base of Aquifer Elevation (m AHD)	-25
Water Table Elevation (m AHD)	2.0
Saturated Hydraulic Conductivity (m / day)	2.0
Fillable Porosity (%)	30

Proposed infiltration structures and areas for each catchment are summarized in Table 7, along with critical event inundation statistics.

Table 7: Infiltration Structures, Areas and Critical Event Inundation Statistics

Catchment	Infiltration Structures / Areas	Modelled Dimensions	Critical Event Storm	Depth in storage (m)	Total Storage Volume (m^3)	Total Storage Area (m^2)	Time to Empty (hrs)
Access Road	Roadside swale within verge	Base: 1.6 m x 120 m Top: 4.0 m x 120 m Depth: 0.2 m Batter Slope: 1 in 6	1% AEP 3 hr	0.19	63	474	4
			10% AEP 1 hr	0.09	23	324	3
Western Catchment	Western open swale	Base: 2.5 m x 300 m Top: 9.7 m x 307 m Depth: 0.6 m Batter Slope: 1 in 6	1% AEP 3 hr	0.23	269	1593	4
			10% AEP 1 hr	0.09	82	1078	3

Catchment	Infiltration Structures / Areas	Modelled Dimensions	Critical Event Storm	Depth in storage (m)	Total Storage Volume (m^3)	Total Storage Area (m^2)	Time to Empty (hrs)
Northern Catchment	Informal infiltration area	Base: 20 m x 25 m Top: 24 m x 29 m Depth: 0.2 m Batter Slope: 1 in 10	1% AEP 6 hr	0.15	86	644	7
			10% AEP 18 hr	0*	0*	0*	0*
Eastern Catchment	Eastern open swale	Base: 2.4 m x 290 m Top: 7.2 m x 295 m Depth: 0.4 m Batter Slope: 1 in 6	1% AEP 3 hr	0.18	182	1332	4
			10% AEP 1 hr	0.09	77	1012	3
Northern Warehouse Roof	Underground infiltration cells	Base: 20 m x 50 m Top: 20 m x 50 m Depth: 0.5 m	1% AEP 3 hr	0.43	430	1000	10
			10% AEP 1 hr	0.21	210	1000	4
Southern Warehouse Roof	Underground infiltration cells	Base: 6 m x 100 m Top: 6 m x 100 m Depth: 1.0 m	1% AEP 6 hr	0.88	528	600	12
			10% AEP 3 hr	0.48	288	600	5

* Infiltration was modelled to exceed inflow so no ponding within storage

All the infiltration structures and areas are modelled with an invert level of 3.0 m AHD (1m separation from the estimated MGL). A sensitivity check has been done by modelling an invert level of 3.2 m AHD (1.2 m separation from the estimated MGL) and there was no difference in the model results.

4.1.3 First 15 mm

Stormwater runoff from the first 15 mm of rainfall will be retained and infiltrated onsite as follows:

- Runoff from the potentially contaminated areas will be conveyed into the lined evaporation pond for retention and evaporation. These areas will be earthworked and bunded so that no runoff will enter adjacent clean road areas.
- Runoff from the administration office building will be retained and infiltrated in soakwells.
- Warehouse roof runoff will be collected by downpipes and discharged into the underground infiltration cells. Runoff will be fully contained and infiltrated in the cells.
- Runoff from the access road from Rockingham Beach Road is captured by a roadside swale. The swale will provide infiltration and water quality treatment.
- Runoff from the rest of the road areas enter two infiltration swales (one located southeast of the warehouse and one located within the landscaped buffer). Runoff will be treated and infiltrated within the swales.
- Infiltration swales will be planted and contain amended soils.
- Runoff from the pervious area north to the warehouse will flow north and captured by an informal, bioretention area / sump within the unpaved, pervious land at north.

Table 8 shows the required volume for the first 15 mm and the provided volumes in various structures.

Table 8: 15 mm Event Required Volumes

Catchment	15 mm Required Volume (m^3)	Volume provided by Structures / Areas (m^3)
Access Road	21	67.2
Western Catchment	78 (including 7 m^3 for office building)	1,118
Northern Catchment	0*	119.6
Eastern Catchment	72	564
Northern Warehouse Roof	153	500
Southern Warehouse Roof	153	600

(*Northern Catchment is 100% pervious area and there is no runoff generated in the first 15 mm rainfall. Therefore, no retention volume is required.)

Figure 7 shows an indicative event plan for the first 15 mm.

4.1.4 10% and 1% AEP Event

Stormwater runoff from rainfall event up to 10% AEP and up to 1% AEP will be retained and infiltrated onsite as follows:

- Runoff from the potentially contaminated areas will be conveyed into the lined evaporation pond for retention and evaporation. Pipes and inlets connected to the areas will be sized for 1% AEP event. These areas will be earth worked and bunded to be self-contained, so that no runoff will enter adjacent clean road areas.
- Runoff from the administration office building will overflow into the western open swale after the soakwells are full.
- Warehouse roof runoff will be collected by downpipes and discharged into the underground infiltration cells. Runoff will be fully contained and infiltrated in the cells.
- Runoff from the access road from Rockingham Beach Road is captured by a roadside swale along the road. The swale is sized sufficiently for 1% AEP event.
- Runoff from the rest of the road areas enter two infiltration swales (one located east of the warehouse and one located within the western pervious area). Runoff will be treated and infiltrated within the swales.
- Runoff from the pervious area north to the warehouse will flow north and infiltrate within the informal bioretention area / sump.

PONDS model has been used to validate the sufficiency of the proposed infiltration structures and areas. Model results for 1% AEP are presented in Table 9.

Table 9: PONDS Infiltration Model Results

Catchment	Infiltration Structures / Areas	Modelled Dimensions	Max Water Level (m)
Access Road	Roadside swale within verge	Base: 1.6 m x 120 m Top: 4.0 m x 120 m Depth: 0.2 m Batter Slope: 1 in 6	1%AEP: 0.20 m 10%AEP: 0.10 m
Western Catchment	Western open swale	Base: 2.5 m x 300 m Top: 9.7 m x 307 m Depth: 0.6 m Batter Slope: 1 in 6	1%AEP: 0.23 m 10%AEP: 0.10 m
Northern Catchment	Informal infiltration area	Base: 20 m x 25 m Top: 24 m x 29 m Depth: 0.2 m Batter Slope: 1 in 10	1%AEP: 0.15 m 10%AEP: no inundation
Eastern Catchment	Eastern open swale	Base: 2.4 m x 290 m Top: 7.2 m x 295 m Depth: 0.4 m Batter Slope: 1 in 6	1%AEP: 0.20m 10%AEP: 0.10 m
Northern Half Roof	Underground infiltration cells	Base: 20 m x 50 m Top: 20 m x 50 m Depth: 0.5 m	1%AEP: 0.43 m 10%AEP: 0.22 m
Southern Half Roof	Underground infiltration cells	Base: 6 m x 100 m Top: 6 m x 100 m Depth: 1.0 m	1%AEP: 0.88 m 10%AEP: 0.48 m

The model results showed that the proposed structures are sufficient for managing the uncontaminated runoff in up to 1% AEP events, with the consideration of shallow groundwater. Figure 8 provides the event plans for the 10% and 1% AEP event.

The two open swales are modelled having spare storage capacity in 1% AEP. A portion of roof runoff from the warehouse can potentially be discharged into the two larger drainage swales to reduce the number of underground infiltration cells. The details will be confirmed at the detailed design stage once the final site layout is available.

The unpaved, pervious area north of the warehouse has sufficient area to manage its own runoff in up to the 1% AEP event. This area is currently proposed to be an unpaved area for potential warehouse expansion and associated drainage if needed in the future.

4.1.5 Evaporation Pond and Water Balance

The proposed evaporation pond is designed to collect the stormwater runoff from the potentially contaminated road areas and water from the wheel / truck wash-down. The proposed dimensions of the evaporation pond are summarized in Table 10.

Table 10: Evaporation Pond

Pond Design	Dimension
Bottom Area (m^2)	3167
Top Area (m^2)	3500
Depth (m)	0.9
Designed Capacity (m^3)	3000

The pond has been designed to cater for a 5% AEP (1 in 20 year ARI) 24 hour event, plus the capacity to store rainfall resulting from a 90th percentile wet season after the allowance for evaporation water loss, and a 300 mm freeboard.

A water balance has been completed to assess the capacity. The following data and assumptions have been used in the water balance:

- Rainfall and pan evaporation data are sourced from Garden Island HSF weather station (BoM, 2020). The pan evaporation data is downloaded from SILO Australia climate data website (SILO, 2020)
- The year 2013 rainfall and evaporation data has been used, as it is identified as the 90th percentile wet year between 2010 to 2019
- A pan factor of 0.85 has been applied to estimate evaporation
- The potentially contaminated roads area is approximately 1,600 m^2

The water balance has been included in Appendix C.

The water balance has showed that the proposed evaporation pond has sufficient capacity to cater for a 5% AEP 24-hour event while maintaining a 300 mm freeboard in a 90th percentile wet year. Water from the pond may need to be trucked off site during the wettest month (Aug / Sept) to maintain the required freeboard and storage capacity.

The water balance has also shown that the pond has the capacity to also retain the 1% AEP event, however there will be no freeboard and water will need to be trucked offsite to ensure the 0.3m freeboard is maintained at all times.

This commitment is likely to be enforced through the part V licence where DWER typically include conditions in the licence stating the pond cannot over top and the evaporation pond is to prove a 0.3m freeboard at all times.

CBH is aware that water may need to be trucked off site to a liquid waste receival facility on occasions, depending on the amount of washdown water generated on site and monthly rainfall patterns.

4.2 Groundwater Management

The onsite groundwater monitoring data in March 2020 indicates the maximum groundwater level recorded near the site is approximately 0.76 m AHD. The MGL onsite has been conservatively estimated as 1.95 m AHD based on DWER long-term monitoring data (Section 2.6.2.2). The estimated finished floor level for the fertiliser warehouse is approximately 4.0 m AHD. The minimum separation between the estimated MGL and the finish level is 2 m. This separation is considered suitable for built form. Sub soil drainage will not be required. The base of the drainage swales will exceed the City of Rockingham's requirement to provide a clearance of 0.5m to the MGL.

In relation to groundwater rise due to climate change, it is generally accepted that sea level rise will cause groundwater levels adjacent to the coast to also increase. This can have a number of impacts including:

- Seawater intrusion (migration inland of the freshwater/saline water interface)
- Increased salinity in groundwater dependent ecosystems (such as Lake Richmond)
- Impacts on drainage infrastructure
- Contamination of production bores.

The City's Coastal Hazard and Risk Mapping report included an assessment of the of the potential rise in groundwater due to sea level rise to 2110. This was undertaken using the Department of Water and Environmental Regulation's (DWER) maximum groundwater level contours. The projected sea level rise of 0.9 m was then added to the groundwater levels to provide an estimate of groundwater elevations in 2110.

The DWER groundwater mapping (Figure 5) indicates the MGL at the site is 1.5 m AHD. Following the City's Coastal Hazard and Risk Mapping approach, the expected MGL may increase to 2.4 m AHD (1.5 m +0.9 m) in 2110 due to an increase in sea level. Currently a conservative MGL of 1.95 m AHD has been used to design the drainage infrastructure and all drainage infrastructure will achieve a minimum clearance of 0.5 m to the MGL of 1.95 m AHD. This results in the invert of all drainage infrastructure being above the predicted 2110 MGL which accounts for sea level rise; however, the 0.5 m clearance will no longer be achieved.

4.3 Nutrient Management and Protection of the Receiving Environment

The receiving environment for stormwater is the Superficial groundwater aquifer. A combination of structural and non-structural controls will be applied in the stormwater management system to ensure treated stormwater is able to infiltrate and / or enter the ground at rates and quality that is similar to current conditions.

4.3.1 Structural Controls

Structural controls are structures that are implemented to treat stormwater runoff from uncontaminated surfaces or prevent the runoff from the potentially contaminated surface infiltrating into the soil and groundwater. For this site, the structural controls include:

- Infiltration swales to treat the first flush from the clean road areas and warehouse roof
- Infiltration swales will be planted and contain amended soils to facilitate water quality treatment
- Soakwells located at the office building area to infiltrate the first flush at source from roof areas
- Evaporation pond to collect, retain and evaporate all runoff from potentially contaminated road areas and the wheel / truck washdown bay
- All fertiliser is to be stored in sealed and contained storage areas which will prevent the leaching of nutrients to the environment.

4.3.2 Non-Structural Controls

Non-structural controls are proposed to complement the structural controls and provide a complete treatment train for the stormwater through the site. These controls are not fixed, permanent infrastructures and offer a relatively inexpensive and flexible approach (DoW, 2007). The controls are also proposed in line with the WQPN 52 Stormwater Management at Industrial Sites (DoW 2010). Non-structural controls for this site may include:

- Efficient water usage for truck wash down to minimise the wash-down runoff
- Sweeping to remove pollutants and sediments from roads and paths to prevent mobilisation during frequent rainfall events
- Management measures during construction to prevent erosion and dust
- Maintenance of stormwater infrastructure (swales and soakwells) before wet seasons to sustain performance
- Inspection and clearance of the evaporation pond during dry seasons to ensure the integrity of the pond liner and maintain the pond capacity
- Employee and contractor education about the environmental and water protection.

5 Monitoring and Maintenance

5.1 Post Development Monitoring

Post development monitoring is proposed to be implemented to ensure the functionality of the stormwater management structures throughout the site, and the maintenance of groundwater quality for the protection of Cockburn Sound. The final post development monitoring schedule will be confirmed in the Part V Operating Licence, the below provides an example of possible monitoring requirements.

The site is located within the Moderate Ecological Protection Area (EPA, 2015). Groundwater monitoring is proposed to ensure that the development will not have adverse impact on the groundwater quality or Cockburn Sound.

To allow the assessment of the water quality parameters, it is proposed that post development groundwater quality will be compared to the Environmental Quality Guidelines values the Moderate Protection Areas, outlined in the EQC reference document for Cockburn Sound (EPA, 2017). The EQC reference document states that '*the 95th percentile of the sample concentration from a single site or a designed area (either from one sampling run or all samples over an agreed period of time) should not exceed the environmental quality guideline value*'.

Pre-development groundwater monitoring results show that, except for the Ammonia concentration in MW07, all the tested parameters were below the IMT for Moderate Protection Areas. It is expected that if MW07 will be used as a post-development monitoring bore, the Ammonia concentration may be higher than the IMT.

The post development groundwater monitoring is proposed to include monitoring of groundwater levels and quality at four locations (MW01, MW03, MW04 and MW05). The four bores provide good coverage of the site from upgradient to downgradient locations. Table 11 details the proposed monitoring program.

Table 11: Post Development Monitoring

Monitoring Type	Parameter	Environmental Quality Guideline - Moderate Protection Areas
Groundwater Level	Static water level (m AHD)	NA
Groundwater Quality (in-situ)	Temperature (°C)	NA
	Dissolved Oxygen (mg / L)	NA
	pH (pH unit)	NA
	Oxygen Reduction Potential (mV)	NA
Groundwater Quality (lab)	Nutrients (mg / L)	
	Total Kjeldahl Nitrogen as N	NA
	Total Nitrogen as N	NA
	Nitrate as N	NA

Monitoring Type	Parameter	Environmental Quality Guideline - Moderate Protection Areas
	Nitrite as N	NA
	NOx as N	NA
	Ammonia as N	1.2#
	Total Phosphorus	NA
	Heavy Metals – Dissolved (mg / L)	
	Cadmium	0.014*
	Chromium	0.02*
	Cobalt	0.014
	Copper	0.003*
	Lead	0.0066*
	Mercury	0.0007*
	Nickel	0.2^
	Zinc	0.023^
	BTEXN (mg / L)	
	Benzene	0.9*
	Toluene	NA
	Ethylbenzene	NA
	meta-para-Xylene	NA
	ortho-Xylene	NA
	Xylene	NA

*Value may not protect key test species from chronic toxicity (see ANZECC and ARMCANZ 2000)

^Trigger value may not protect key test species from acute and chronic toxicity (see ANZECC and ARMCANZ 2000)

A proposed monitoring schedule and contingency measures are outlined in Table 12 and Table 13.

Table 12: Monitoring Schedule

Monitoring Type	Location	Method	Frequency, Responsibility	Parameter
Groundwater Level	MW01, MW03, MW04 and MW05 (if demolished, new bores to be installed)	Electrical depth probe	Quarterly by CBH	Water level (mAHD)

Monitoring Type	Location	Method	Frequency, Responsibility	Parameter
Groundwater Quality	MW01, MW03, MW04 and MW05 (if demolished, new bores to be installed)	Pumped bore sample	Quarterly by CBH	Refer to Table 11

Table 13: Monitoring Contingency Measures

Monitoring Type	Criteria for Assessment	Criteria Assessment Frequency	Contingency Options
Groundwater Quality	The 95th percentile of the sample concentration from a single site or a designed area (all samples over 12 months) should not exceed the environmental quality guideline value	Annual review of water quality targets	1. Identify and remove any point sources. 2. Review operational and maintenance (e.g. fertilising, cleaning) practices.

5.2 Maintenance

Operation and maintenance of the stormwater management system will be the responsibility of the client. Following measures will be undertaken to ensure the system functions correctly:

- Removal of debris to prevent blockages
- Sweeping to reduce particulate (and potential fertiliser) build up on road surfaces
- Inspection and maintenance of the infiltration swales, soak wells and the evaporation pond
- Site management will be in accordance with the Part V licence.

5.3 Contingency Plan

Due the site usage and proximity to Cockburn Sound, following contingency measures are proposed to minimise the risk of any potential commination and reduce the damage to environment:

- Site staff and contractors should be made aware best practices to minimise contaminant loss to stormwater management system (for example, efficient water use for truck wash down to minimise contaminated wash-down runoff)
- Site operators and designated staff should be trained to supervise the response to fertiliser spill incidents and, if necessary, liaise with emergency response personnel and authority
- If a fertiliser spill does escape into the infiltration swales, the DWER's pollution response section should be informed immediately. Effective remedial actions will be taken to limit any harmful effects downstream
- Water level in the evaporation pond should be inspected after significant rainfalls, and weekly inspected during wet seasons (typically between May to September)
- Trucking water offsite should be arranged immediately if the water level in the evaporation pond is observed higher than critical level.

6 Limitations

This report is produced strictly in accordance with the scope of services set out in the contract or otherwise agreed in accordance with the contract. 360 Environmental makes no representations or warranties in relation to the nature and quality of soil and water other than the visual observation and analytical data in this report.

In the preparation of this report, 360 Environmental has relied upon documents, information, data, and analyses ("client's information") provided by the client and other individuals and entities. In most cases where client's information has been relied upon, such reliance has been indicated in this report. Unless expressly set out in this report, 360 Environmental has not verified that the client's information is accurate, exhaustive or current and the validity and accuracy of any aspect of the report including, or based upon, any part of the client's information is contingent upon the accuracy, exhaustiveness and currency of the client's information. 360 Environmental shall not be liable to the client or any other person in connection with any invalid or inaccurate aspect of this report where that invalidity or inaccuracy arose because the client's information was not accurate, exhaustive and current or arose because of any information or condition that was concealed, withheld, misrepresented, or otherwise not fully disclosed or available to 360 Environmental.

Aspects of this report, including the opinions, conclusions, and recommendations it contains, are based on the results of the investigation, sampling and testing set out in the contract and otherwise in accordance with normal practices and standards. The investigation, sampling and testing are designed to produce results that represent a reasonable interpretation of the general conditions of the site that is the subject of this report. However, due to the characteristics of the site, including natural variations in site conditions, the results of the investigation, sampling and testing may not accurately represent the actual state of the whole site at all points.

It is important to recognise that site conditions, including the extent and concentration of contaminants, can change with time. This is particularly relevant if this report, including the data, opinions, conclusions, and recommendations it contains, are to be used a considerable time after it was prepared. In these circumstances, further investigation of the site may be necessary.

7 References

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