ANNEXURE 3

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Submission under Clause 4.6

prepared by

Cowman Stoddart Pty Ltd

SUBMISSION UNDER CLAUSE 4.6 OF SLEP 2014

SUBMISSION UNDER CLAUSE 4.6 OF SHOALHAVEN LEP 2014

PROPOSED MODIFICATION OF APPROVED PACKING PLANT IN EXCESS OF ELEVEN METRE MAXIMUM BUILDING HEIGHT LIMIT (Clause 4.3(2A) Shoalhaven LEP 2014)

LOT 2 DP 538289
BOLONG ROAD
and
LOT 16 DP 1121337
RAILWAY STREET
BOMADERRY

Prepared for

Shoalhaven Starches Pty Ltd

March 2016

Prepared by:

COWMAN STODDART PTY LTD

Town Planning, Agricultural & Environmental Consultants

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CONTENTS

1.0 INTRODUCTION 1

2.0 DESCRIPTION OF SITE AND SURROUNDS 3

3.0 THE PROPOSAL 6

3.1 JUSTIFICATION FOR PROPOSAL 7

4.0 CLAUSE 4.6 OF SHOALHAVEN LEP 2014 9

4.1 CLAUSE 4.6 AND ITS USE 10

5.0 THE DEVELOPMENT STANDARD TO BE VARIED 13

5.1 OBJECTIVES OF STANDARD 13

5.2 OBJECTIVES OF IN1 ZONE 13

6.0 DEPARTMENT OF PLANNING AND INFRASTRUCTURE GUIDELINES 15

7.0 ASSUMED CONCURRENCE 16

8.0 ASSESSMENT 17

8.1 COMPLIANCE WITH STANDARD UNREASONABLE OR UNNECESSARY 17

8.2 ENVIRONMENTAL PLANNING GROUNDS THAT JUSTIFY CONTRAVENTION OF STANDARD 18

8.3 IS THE PROPOSED DEVELOPMENT IN THE PUBLIC INTEREST? 20

8.4 CLAUSE 4.6(5) MATTERS FOR CONSIDERATION BY DIRECTOR-GENERAL 24

9.0 CONCLUSION 25

FIGURES

Figure 1 Site Locality Plan
(extract from Shoalhaven City Council)

Figure 2 Aerial Photograph of Shoalhaven Starches Factory Site

1.0 INTRODUCTION

In 2009 the Minister for Planning issued Project Approval for Shoalhaven Starches to enable the Company to increase its ethanol production capacity to meet the expected increase in demand for ethanol arising from the NSW Government's ethanol mandate by upgrading the existing ethanol plant, located at the Shoalhaven Starches Plant at Bomaderry.

Project Approval MP06_0228 was granted by the Minister for Planning on the 28th January 2009 for the Shoalhaven Starches Expansion Project (SSEP). One component of this approval was the establishment of a new packing plant, container loading area and rail spur line on the northern side of Bolong road.

This submission has been made in support of a Modification Application that seeks permission to undertake modifications to the packing plant approved under the Shoalhaven Starches Expansion Project.

This Modification Application proposes to increase the floor area from that which was originally approved as part of the SSEP. The modification application also seeks permission for the construction of five (5) silos required for the storage of dry products

The modified Packing Plant will comprise a floor area (excluding awnings) of 6200 m^2. This purpose designed and built factory building will have dimensions of approximately 108 metres by 60 metres and have a height of a maximum height of 13 metres above ground level.

Five new silos are proposed to be constructed under this modification application. Two of these silos will each have a diameter of 10 metres and a height of approximately 26.5 metres above ground level. Two silos will have a diameter of 6 metres each and will have a height of approximately 20.7 metres above ground level, while one silo will have an eventual height above ground level of 34.3 m.

The site is zoned IN1 General Industrial under the provisions of the Shoalhaven LEP (SLEP) 2014. There are no specific maximum building height provisions specified for the subject site on mapping supporting the LEP. Clause 4.3(2A) of the Shoalhaven LEP stipulates that if no height limit is specified then a maximum height of any building is to be eleven (11) metres.

The proposed structures will therefore exceed the 11 m building height limit set by Clause 4.3(2A) of SLEP 2014.

Clause 4.6 of Shoalhaven LEP 2014 deals with exceptions to development standards and provides that Council may consent to a development even though it contravenes a development standard. The provisions of Clause 4.6 require that a written request accompany a proposal that justifies the contravention of a development standard.

This submission has therefore been prepared pursuant to Clause 4.6 and provides justification that the proposal is appropriate and that strict compliance with the provisions of Clause 4.3(2A) are unreasonable and unnecessary under the specific circumstances associated with the application.

2.0 DESCRIPTION OF SITE AND SURROUNDS

This modification application concerns land which is situated on two (2) allotments of land:

- Lot 2 DP 538289 on Bolong Road Bomaderry which has an area of 1.556143 ha; and
- Lot 16 DP1121337 on Railway Street Bomaderry which has an area of 4.791ha,

The approved Packing Plant is to be located on the northern side of Bolong Road and has a total area of approximately 6.347 hectares (refer **Plate 1**).

Plate 1: View of Packing Plant site from Bolong Road.

The town of Bomaderry is located 0.5 km (approx.) to the west of the PP site, and the Nowra urban area is situated 2.0 km to the south west of the site.

There are a number of industrial land uses, which have developed on the strip of land between Bolong Road and the Shoalhaven River. Industrial activities include a metal fabrication factory, the Shoalhaven Starches site, Shoalhaven Dairy Co-op (formerly Australian Co-operative Foods Ltd – now owned by the Manildra Group) and the Shoalhaven Paper Mill (Australian Papers). The industrial area is serviced by a privately owned railway spur line that runs from just north of the Nowra-Bomaderry station via the starch plant and Dairy Co-op site to the Paper Mill.

Land to the south of the packing plant site contains a number of industrial land uses including automotive repairs, screen manufacture and supply. Bolong Bricks, Welding premises, Refrigeration and Air-conditioning business and a service station. The BOC Gas Facility site, Integral Energy Natural Gas Installation and Manildra Gas Station are located to the east of the packing plant site.

The industrial area is serviced by a privately owned railway spur line that runs from just north of the Nowra-Bomaderry station via the starch plant and Dairy Co-op site to the Paper Mill.

The state railway terminates at Bomaderry Railway Station with a separate, privately owned spur line to the Shoalhaven Starches factory site through the packing plant site. Shoalhaven City Council sewerage treatment works is situated between the railway station and the packing plant site

The Company also carries out irrigation activities on the Company's Environmental Farm located over 1000 hectares on the northern side of Bolong Road. This area is cleared grazing land and also contains spray irrigation lines and wet weather storage ponds). These wet weather storage ponds on the farm form part of the irrigation management system for the factory.

The subject proposal is to be situated entirely within the factory site located on the southern side of Bolong Road and the west of Abernethy's Creek on Lot 1 DP 838753, 160 Bolong Road, Bomaderry.

The land is zoned IN1 General Industrial pursuant to Shoalhaven Local Environmental Plan (SLEP) 2014. Mapping that supports the SLEP 2014 does not identify the subject site as having a specified building height limit. The provisions of Clause 4.3(2A) of the SLEP state that if no height limit is specified for a parcel of land then a maximum building height of eleven (11) metres applies.

Figure 1 is a site locality plan, whilst **Figure 2** is an aerial photo of the locality.

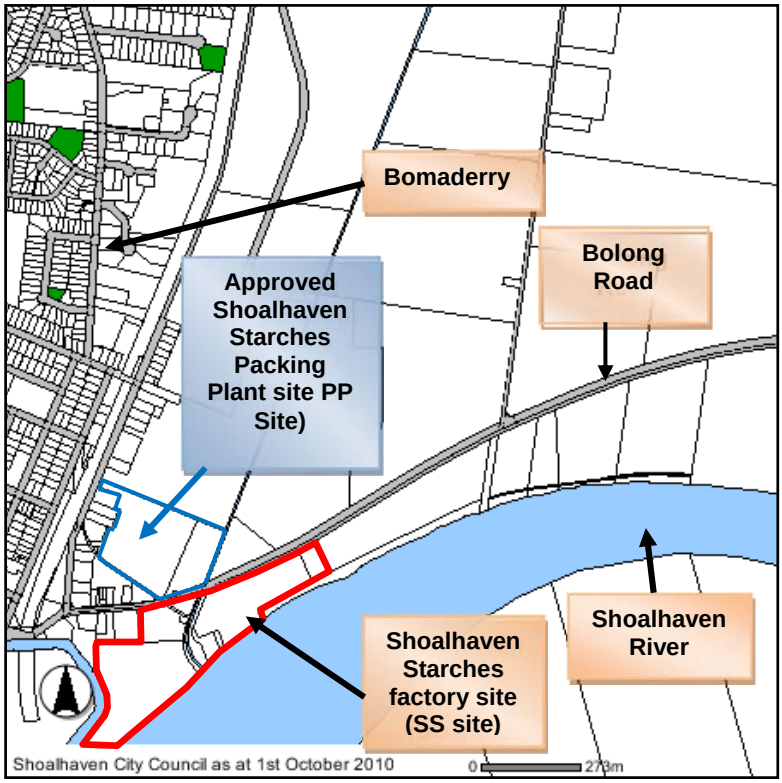


Figure 1: Site locality plan.

Figure 2: Aerial view of Packing Plant and Shoalhaven Starches factory site.

3.0 THE PROPOSAL

This submission made pursuant to Clause 4.6 of the SLEP 2014 supports a modification application that seeks approval from the NSW Department of Planning & Environment to undertake modifications to the Packing Plant approved under the Shoalhaven Starches Expansion Project (Project Approval MP06_0228) at the Packing Plant factory site at Bolong Road Bomaderry.

It is proposed to increase the floor area of the approved Packing Plant from that which was originally approved as part of the SSEP. It is also proposed to erect 5 silos adjacent to the Packing Plant to store product prior to packing. The Packing Plant will remain on the same parcels of land where it was originally approved.

Following further detailed engineering design it has become apparent that the footprint originally set aside for the proposed Packing Plant under the SSEP provided insufficient area for the plant, equipment and product storage requirements. As a result it is proposed to increase the floor area of the approved development. The approved Packing Plant under the SSEP comprised a floor area (excluding awnings) of 3050 m^2. The proposed modified Packing Plant will comprise a floor area (excluding awnings) of 6200 m^2 with dimensions of 108 m by 60 m. The modified packing plant will have a height above ground level of approximately 13 metres.

There will also be two main storage silos located to the east of the packing plant building with heights of approximately 26.5 metres above ground level, and adjacent to these two silos, three silos with a height of 20.7 m.. A further silo structure located above the packing plant building will eventually have a height of 34.3 m above ground level.

In addition to the above, it is proposed to construct a container / truck loading facility between the packing plant and the two silos. A new railway spur line is also proposed to be extended from the existing railway to service this container loading area. The containers are to be stored to the south of the packing plant building.

The dried starch will be pneumatically conveyed from the existing factory site on the south side of Bolong Road to the proposed new silos via an overhead bridge that will cross Bolong Road. This overhead bridge will also double as a pedestrian bridge to improve safety for pedestrians crossing between the existing factory site and the packing plant site. The bridge crossing was originally approved as part of the SSEP, however under this proposal the bridge has been relocated and re-aligned. A gantry structure will carry this pipework from the bridge to the packing plant. The gantry will have a height above ground level of 11.8 metres above ground level.

As summarised in **Table 1** below the modified Packing Plant will have a number of elements which have a height above the maximum height level permitted by Shoal haven Council:

Table 1

Height of Proposed Packing Plant under Approved SSEP and Proposed Modification

Component	***Maximum Height under SSEP Approval***	***Maximum Height under Modification Proposal***
Packing Plant factory	10 metres	13 metres
Metal tower structure servicing the approved silos within Packing Plant factory	30 metres	34.30 metres
Two silos sited immediately east of Packing Plant and associated gantries	Not part of original proposal	26.5 metres
Three silos sited east of the two new proposed silos	Not part of original proposal	20.7 metres
Service bridge extension	Original bridge crossing comprised height of 11.8 m. Proposal included gantry extension from bridge crossing to Packing Plant of height of 11.8 m.	11.8 metres

3.1 JUSTIFICATION FOR PROPOSAL

In 2009 the Minister for Planning issued Project Approval for Shoalhaven Starches to enable the Company to increase its ethanol production capacity to meet the expected increase in demand for ethanol arising from the NSW Government's ethanol mandate by upgrading the existing ethanol plant, located at the Shoalhaven Starches Plant at Bomaderry.

Project Approval MP06_0228 was granted by the Minister for Planning on the 28th January 2009 for the Shoalhaven Starches Expansion Project (SSEP).

The SSEP sought to increase ethanol production at the Bomaderry plant in a staged manner from 126 million litres per year to 300 million litres per year.

To accomplish the increase in ethanol production, this project required a series of plant upgrades and increase in throughput of raw materials, principally flour and grain.

Following the Minister's determination Shoalhaven Starches have been implementing and commissioning works in accordance with this approval. The commissioning of components of the approved development provided the Company with an opportunity to review and identify several operational, efficiency and process improvements

As mentioned above the increase in ethanol production envisaged by the SSEP Project Approval was in response to the NSW Government's 6% ethanol mandate. The reality

however is the amount of ethanol that is being blended with petrol within NSW has to date fallen well short of this objective, largely due to on-going exemptions from the mandated ethanol content being granted to the major oil companies.

As a result the demand for ethanol is not meeting expectations raised by the NSW Government's ethanol mandate. Shoalhaven Starches therefore must seek alternative markets for the products that would otherwise be directed into ethanol production. One such approach involves the diversion of liquid starch used in the ethanol production process to the production of dried starch.

The increase in dry product is a result of the diversion of liquid starch from ethanol to dry starch and will require additional storage area within the packing plant compared to that originally proposed with the SSEP.

Five new silos are proposed to be constructed under this modification application to provide the additional storage necessitated by the increase in dry product. Two of these silos will each have a diameter of 10 metres and a height of approximately 26.5 metres above ground level. Another two silos will have a diameter of 6 metres each and will have a height of approximately 20.7 metres above ground level. One silo will have an eventual height of 34.3 metres above ground level.

Furthermore following further detailed engineering design it has become apparent that the footprint originally set aside for the proposed Packing Plant under the SSEP provided insufficient area for the plant, equipment and product storage requirements.

The increase in footprint of the Packing Plant building has largely arisen as a result of further detailed engineering design in terms of the intended plant and machinery that will be sited within the building. A greater level of flexibility is being sought in terms of packaging with this modified proposal with a range of packing alternatives now being proposed ranging from 12.5 and 25 kg bags, bulk bag filling (1 tonne) to bulk containers for export markets. These different packaging alternatives will each necessitate different packing plant and equipment not originally envisaged with the SSEP. The footprint of these individual packing plants will be larger than that which was originally envisaged with the SSEP. As a result of the increase in size of the packing plant the maximum height of this building has increased from the 10 metres approved under the SSEP approval to 13 metres in the modification application.

Plan details of the proposed modification are included as Annexure 1 to the EA that this submission supports.

4.0 CLAUSE 4.6 OF SHOALHAVEN LEP 2014

Clause 4.6 of Shoalhaven LEP 2014 stipulates:

4.6 Exceptions to development standards

(1) The objectives of this clause are as follows:

(a) to provide an appropriate degree of flexibility in applying certain development standards to particular development,

(b) to achieve better outcomes for and from development by allowing flexibility in particular circumstances.

(2) Development consent may, subject to this clause, be granted for development even though the development would contravene a development standard imposed by this or any other environmental planning instrument. However, this clause does not apply to a development standard that is expressly excluded from the operation of this clause.

(3) Development consent must not be granted for development that contravenes a development standard unless the consent authority has considered a written request from the applicant that seeks to justify the contravention of the development standard by demonstrating:

(a) that compliance with the development standard is unreasonable or unnecessary in the circumstances of the case, and

(b) that there are sufficient environmental planning grounds to justify contravening the development standard.

(4) Development consent must not be granted for development that contravenes a development standard unless:

(a) the consent authority is satisfied that:

(i) the applicant's written request has adequately addressed the matters required to be demonstrated by subclause (3), and

(ii) the proposed development will be in the public interest because it is consistent with the objectives of the particular standard and the objectives for development within the zone in which the development is proposed to be carried out, and

(b) the concurrence of the Director-General has been obtained.

(5) In deciding whether to grant concurrence, the Director-General must consider:

(a) whether contravention of the development standard raises any matter of significance for State or regional environmental planning, and

(b) the public benefit of maintaining the development standard, and

(c) any other matters required to be taken into consideration by the Director-General before granting concurrence.

(6) Development consent must not be granted under this clause for a subdivision of land in Zone RU1 Primary Production, Zone RU2 Rural Landscape, Zone RU3 Forestry, Zone RU4 Primary Production Small Lots, Zone RU6

Transition, Zone R5 Large Lot Residential, Zone E2 Environmental Conservation, Zone E3 Environmental Management or Zone E4 Environmental Living if:

(a) the subdivision will result in 2 or more lots of less than the minimum area specified for such lots by a development standard, or

(b) the subdivision will result in at least one lot that is less than 90% of the minimum area specified for such a lot by a development standard.

Note. *When this Plan was made it did not include all of these zones.*

(7) After determining a development application made pursuant to this clause, the consent authority must keep a record of its assessment of the factors required to be addressed in the applicant's written request referred to in subclause (3).

(8) This clause does not allow development consent to be granted for development that would contravene any of the following:

(a) a development standard for complying development,

(b) a development standard that arises, under the regulations under the Act, in connection with a commitment set out in a BASIX certificate for a building to which State Environmental Planning Policy (Building Sustainability Index: BASIX) 2004 *applies or for the land on which such a building is situated,*

(c) clause 5.4,

(ca) clause 6.1 or 6.2

4.1 CLAUSE 4.6 AND ITS USE

Clause 4.6 of the SLEP 2014 sets out the general principle that a development standard may be varied where strict compliance can be shown to be unreasonable or unnecessary in the circumstances of the case; and that there are sufficient environmental planning grounds to justify contravening the development standard.

Before applying the discretionary power of Clause 4.6 the consent authority must be satisfied that the standard for which the departure is sought is a "development standard" and not a matter which would prohibit the proposal.

A development standard is defined within Section 4 of the EP&A Act.

"Development standard" means provisions of an environmental planning instrument in relation to the carrying out of development, being provisions by or under which requirements are specified or standards are fixed in respect of any aspect of that development, including, but without limiting the generality of the forgoing, requirements or standards in respect of -

(a) the area, shape or frontage of any land, the dimensions of any land, buildings or works, or the distance of any land, building or works, or the distance of any land, building or work from any specified point;

(b) the proportion or percentage of the area of a site which a building or work may occupy;

(c) the character, location, siting, bulk, scale, shape, size, height, density, design or external appearance of a building or work;

(d) the cubic content or floor space of a building;

(e) the intensity or density of the use of any land, building or work;

(f) the provision of public access, open space, landscaped space, tree planting or other treatment for the conservation, protection or enhancement of the environment;

(g) the provision of facilities for the standing, movement, parking, servicing manoeuvring, loading or unloading of vehicles;

(h) the volume, nature and type of traffic generated by the development;

(i) road patterns;

(j) drainage;

(k) the carrying out of earthworks;

(l) the effects of the development on patterns of wind, sunlight, daylight or shadows;

(m) the provision of services, facilities and amenities demanded by the development;

(n) the emission of pollution and means for its prevention or control or mitigation; and

(o) such other matters as may be prescribed.

Having regard to the definition of *"development standard"*, particularly paragraph (c), it is considered that Clause 4.3 contains a development standard limiting the height of a building. Furthermore, Clause 4.3 is contained in Part 4 of the Shoalhaven LEP, which contains the primary development standards outlined in the LEP. This reinforces the contention that the provisions of Clause 4.3 are a development standard. Such a development standard is therefore open to a written request made pursuant to Clause 4.6.

A consent authority must also be satisfied of three matters (pursuant to the provisions of Clause 4.6) before it may agree with the written request and grant development consent to a development application for development that could, but for a development standard, be carried out with development consent.

First, the request is to be in writing (Clause 4.6(3)), demonstrate that the compliance with that development standard is unreasonable or unnecessary in the circumstances of the case (Clause 4.6(3)(a)) and that there are sufficient environmental planning grounds to justify contravening the development standard (Clause 4.6(3)(b)).

Secondly, the consent authority must also be satisfied that the proposed development will be in the public interest because it is consistent with the objectives of the particular standard and the objectives for development within the zone in which the development is proposed to be carried out (Clause 4.6(4)(a)(ii)).

Finally, the consent authority can only grant development consent for a development that contravenes a development standard if the concurrence of the Secretary (formerly Director General) of Planning and Infrastructure has been obtained (Clause 4.6(4)(b)).

The Secretary in deciding whether to grant concurrence must consider pursuant to Clause 4.6(5):

(a) whether contravention of the development standard raises any matter of significance for State or regional environmental planning, and

(b) the public benefit of maintaining the development standard, and

(c) any other matters required to be taken into consideration by the Director-General before granting concurrence.

As this matter does not concern the subdivision of land zoned *RU1 Primary Production, Zone RU2 Rural Landscape, Zone RU3 Forestry, Zone RU4 Primary Production Small Lots, Zone RU6 Transition, Zone R5 Large Lot Residential, Zone E2 Environmental Conservation, Zone E3 Environmental Management or Zone E4 Environmental Living* the provisions of Clause 4.6(6) are also not applicable to this proposal and are not further addressed in this written request.

This submission has been prepared having regard to the above relevant matters.

5.0 THE DEVELOPMENT STANDARD TO BE VARIED

This written request seeks to vary Clause 4.3(2A) of the SLEP 2014 as it applies to this modification application. Clause 4.3 of Shoalhaven LEP 2014 stipulates the following:

> ***4.3 Height of buildings***
>
> *(1) The objectives of this clause are as follows:*
>
> *(a) to ensure that buildings are compatible with the height, bulk and scale of the existing and desired future character of a locality,*
>
> *(b) to minimise visual impact, disruption of views, loss of privacy and loss of solar access to existing development,*
>
> *(c) to ensure that the height of buildings on or in the vicinity of a heritage item or within a heritage conservation area respect heritage significance.*
>
> *(2) The height of a building on any land is not to exceed the maximum height shown for the land on the Height of Buildings Map.*
>
> ***(2A) If the Height of Buildings Map does not show a maximum height for any land, the height of a building on the land is not to exceed 11 metres.***

Mapping supporting the SLEP 2014 does not identify a maximum building height that applies to this land. Under these circumstances, and having regard to Clause 4.3(2A) a maximum building height of 11 metres applies to the subject site.

As summarised in Table 1 in Section 3.0 of this submission, the modified packing plant proposal will include buildings and structures that will have a height above ground level that will exceed the 11 metre maximum building height limit. The development therefore does not comply with the provisions of Clause 4.3(2A) of Shoalhaven LEP 2014.

5.1 OBJECTIVES OF STANDARD

As outlined in Clause 4.3(1) above the objectives of Clause 4.3 are:

> *(a) to ensure that buildings are compatible with the height, bulk and scale of the existing and desired future character of a locality,*
>
> *(b) to minimise visual impact, disruption of views, loss of privacy and loss of solar access to existing development,*
>
> *(c) to ensure that the height of buildings on or in the vicinity of a heritage item or within a heritage conservation area respect heritage significance.*

5.2 OBJECTIVES OF IN1 ZONE

The objectives of the General Industrial IN1 zone that applies to the subject land are:

- *To provide a wide range of industrial and warehouse land uses.*

- *To encourage employment opportunities.*
- *To minimise any adverse effect of industry on other land uses.*
- *To support and protect industrial land for industrial uses.*
- *To allow a diversity of activities that do not significantly conflict with the operation of existing or proposed development.*
- *To enable other land uses that provide facilities or services to meet the day to day needs of workers in the area.*

6.0 DEPARTMENT OF PLANNING AND INFRASTRUCTURE GUIDELINES

The Department of Planning and Infrastructure has produced a document entitled "*Varying Development Standards – A Guide*" dated August 2011. This document updates the former Circular B1 which applied to *State Environmental Planning Policy No. 1 (SEPP No. 1) - Development Standards* to include the relevant matters applying.

The Guidelines build upon the matters outlined above and in Clause 4.6 itself, and also stipulates that the application should address the "five part test". In this regard, the Land and Environment Court (*Wehbe v Pittwater Council [2007] NSWLEC827 (21 December 2007)* has set out a "five part test" for consent authorities to consider when assessing a proposal that seeks to vary a development standard. The "five part test" is as follows:

1. *the objectives of the standard are achieved notwithstanding non-compliance with the standard;*

2. *the underlying objective or purpose of the standard is not relevant to the development and therefore compliance is unnecessary;*

3. *the underlying object of purpose would be defeated or thwarted if compliance was required and therefore compliance is unreasonable;*

4. *the development standard has been virtually abandoned or destroyed by the council's own actions in granting consents departing from the standard and hence compliance with the standard is unnecessary and unreasonable;*

5. *the compliance with development standard is unreasonable or inappropriate due to existing use of land and current environmental character of the particular parcel of land. That is, the particular parcel of land should not have been included in the zone.*

Relevant matters are addressed in Section 8.0 below.

7.0 ASSUMED CONCURRENCE

The Guidelines prepared by the Department deal with the concurrence requirements of proposals reliant upon an exception to development standards. Where a Standard Instrument LEP applies, as is the case with this proposal and the provisions of Shoalhaven LEP 2014, the Guidelines reference Planning Circular PS 08-003 issued in May 2008 and which advises that the concurrence can be assumed with respect to all environmental planning instruments that adopt Clause 4.6, or a similarly worded clause, providing for exception to development standards.

The concurrence of the Secretary of the Department of Planning and Infrastructure can therefore be assumed with respect to this proposal.

8.0 ASSESSMENT

This written request seeks to justify the departure to the provisions of Clause 4.3(2A) of the SLEP 2014 which imposes a maximum building height of eleven (11) metres. The proposal seeks to undertake modifications to the approved Packing Plant that formed part of the Shoalhaven Starches Expansion Project approval.

Clause 4.3(2A) imposes, in the absence of a site specific building height limit, a generic height limit of 11 metres.

Table 2 below summarises the components of the modified Packing Plant which have a height above the maximum height level permitted by Clause 4.3(2A):

Table 2

Height of Proposed Modified Packing Plant

Component	***Maximum Height under Modification Proposal***	***Extent of Departure to Clause 4.3(2a) SLEP 2014***
Packing Plant factory	13 metres	2 m
Metal tower structure servicing the approved silos within Packing Plant factory	34.30 metres	23.3 m
Two Silos sited immediately east of Packing Plant and associated gantries	26.5 metres	15.5 m
Three silos sited east of the two New proposed silos	20.7 metres	9.7 m
Service bridge extension	11.8 metres	0.8 m

This written request demonstrates that compliance with Clause 4.3(2A) of SLEP 2014 is unreasonable and unnecessary given the specific circumstances of this case; and that there are sufficient environmental planning grounds to justify contravention of the maximum height limit.

8.1 COMPLIANCE WITH STANDARD UNREASONABLE OR UNNECESSARY

It is our view that requiring compliance with the maximum building height limit of 11 metres as outlined in Clause 4.3(2A) of the SLEP 2014 under the specific circumstances of this case would be unreasonable and unnecessary under the specific circumstances of this case:

The 11 metres height limit imposed by Clause 4.3(2A) is a generic height limit that applies throughout all land with the Shoalhaven (unless a site specific height limit applies). The height limit applies irrespective of the zoning or development potential that may apply to land.

The subject site is zoned General Industrial IN1. The purpose of this zone is to permit a wide range of general industrial land uses and activities.

Importantly the subject site forms part of the Shoalhaven Starches factory complex. The existing factory complex includes a range of large scale industrial buildings and structures that range in height well in excess of 11 metres including:

- Interim Packing Plant – 34 metres;
- Boiler House Stack – 53.7 metres;
- No. 5 Starches Dryer (as approved) – 33 metres;
- Existing Flour Mill building has a height of 34.78 metres;
- The constructed No. 6 Dryer (Wet End) has a height of 34.78 metres.

Clearly the existing factory complex includes a number of large scale industrial buildings and structures that are already of a height that well exceeds the 11 metre height limit.

It should also be noted that the approved Packing Plant that forms part of the SSEP included a components of 30 metres which also exceeded the 11 metre height limit set by Clause 4.3(2A).

The Shoalhaven Starches factory complex is a larger scale industrial complex with buildings and structures that match the significance of the site. Structures are required to have a scale and height to reflect the industrial activities and processes that take place on the site.

The current modification proposal reflects the scale and height of development that already exists as part of the Shoalhaven Starches factory site.

The 11 metres building height imposed by Clause 4.3(2A) is a generic height limit that applies through-out the Shoalhaven and does not reflect the specific nature of development associated with the Shoalhaven Starches factory site.

Given these circumstances it is our view that requiring compliance with Clause 4.3(2A) under the specific circumstances of this case would be unreasonable and unnecessary.

8.2 ENVIRONMENTAL PLANNING GROUNDS THAT JUSTIFY CONTRAVENTION OF STANDARD

The written request is also required to demonstrate that there are sufficient environmental planning grounds to justify contravening the 11 metre building height restriction that applies under Clause 4.3(2A).

As outlined in Section 8.1 above the subject site forms part of the Shoalhaven Starches factory complex. The existing factory complex includes a range of large scale industrial buildings that range in height well in excess of 11 metres.

The approved Packing Plant also included a components of 30 metres which also exceeded the 11 metre height limit set by Clause 4.3(2A).

The Shoalhaven Starches factory complex is a large scale industrial complex with buildings and structures that match the significance of the site. Structures are required to have a scale and height to reflect the industrial activities and processes that take place on the site.

The current modification proposal reflects the scale and height of development that already exists as part of the Shoalhaven Starches factory site.

As also discussed in the EA for this Modification Application part of the original justification for the SSEP was the need to meet the expected increase in demand for arising from the NSW Government's ethanol mandate which sought to increase the blending of ethanol in to the total volume of petrol sold in NSW to a 6% ethanol content. The reality however is the amount of ethanol that is being blended with petrol within NSW has to date fallen well short of this objective, largely due to on-going exemptions from the mandated ethanol content being granted to the major oil companies.

As a result the demand for ethanol is not meeting expectations raised by the NSW Government's ethanol mandate.

Shoalhaven Starches therefore must seek alternative markets for the products that would otherwise be directed into ethanol production. One such approach involves the diversion of liquid starch used in the ethanol production process to the production of dried starch, resulting in an increase the production of dried starch.

Currently the existing factory operations produce 130 shipping containers of finished dried product per week. Following the SSEP it is anticipated that there will be an increased production of an additional 168 shipping containers of dried product per week resulting in a total of 298 shipping containers produced each week.

This increase in dried starch production will require additional warehouse storage within the packing plant.

In addition Shoalhaven Starches wish to provide a range of packaging options not previously considered as part of the SSEP including:

- 12.5 kg bags;

- 25 kg bags;
- Bulk bag (1 tonne) for containerisation; and
- Direct into containers for the export market.

As a result of the above, and following further engineering design and investigation as to the types of packaging equipment that will need to be located within the proposed packing plant building, Shoalhaven Starches have been required to review the size, height and siting of the Packing Plant on the site resulting in an increase in the size of this building to accommodate the plant and machinery that will need to be housed within the packing plant building.

As will be dealt with further in Section 8.3 below, the proposal is consistent with the objectives and is permissible within the IN1 zone that applies to the land.

As will also be dealt with further in Section 8.3 below despite non-compliance with 11 metre height restriction, the proposal is consistent with the stated objectives of Clause 4.3 as they relate to the building height requirements as outlined above in Section 8.3 of this written request.

The proposed development is representative of the prevailing character of the locality, ie. industrial development within an industrial zone and is of a height consistent with buildings already existent on the development.

Given the above circumstances it is my view that there are suitable environmental planning grounds for justifying contravention of the 11 metres building height limit under the specific circumstances of this case.

8.3 IS THE PROPOSED DEVELOPMENT IN THE PUBLIC INTEREST?

Preston CJ in *Wehbe v Pittwater Council [2007] NSWLEC827 (21 December 2007)* provides commentary with respect to establishing whether compliance with a development standard is unreasonable or unnecessary under the specific circumstances of a particular matter. Whilst this case related to the use of SEPP 1, given the similarities between the objects of SEPP No. 1 and Clause 4.6 the findings of Preston CJ does provide guidance with respect to the implementation of this clause.

According to Preston CJ one of the most commonly invoked ways to establish that compliance with the development standard is unreasonable or unnecessary is because the objectives of the development standard are achieved notwithstanding non-compliance with the standard. Such also serves to determine whether or not a proposal is consistent with the “public interest”.

The rationale is that development standards are not ends in themselves but means of achieving ends. The ends are environmental or planning objectives. Compliance with a development standard is fixed as the usual means by which the relevant environmental or planning objective is able to be achieved. However, if the proposed development proffers an alternative means of achieving the objective, strict compliance with the standard would be unnecessary (it is achieved anyway) and unreasonable (no purpose would be served).

As outlined in Section 6.0 above, the objectives underpinning the development standard – in this instance the maximum Building Height of 11 metres is a relevant consideration in determining whether strict compliance with that standard under the specific circumstances of the case would be unreasonable or unnecessary.

The objectives of the height of buildings standard are expressly stated in Clause 4.3 as follows:

> *(1) The objectives of this clause are as follows:*
>
> *(a) to ensure that buildings are compatible with the height, bulk and scale of the existing and desired future character of a locality,*
>
> *(b) to minimise visual impact, disruption of views, loss of privacy and loss of solar access to existing development,*
>
> *(c) to ensure that the height of buildings on or in the vicinity of a heritage item or within a heritage conservation area respect heritage significance.*

The above objectives in my view provide a clear understanding of the purposes underpinning the building height standard outlined in Clause 4.3(2A) and which applies to the subject site.

This written submission will demonstrate that this proposal will not prevent the above objectives from being achieved notwithstanding non-compliance with the eleven metre height restriction development standard in the specific circumstances of this case.

Having regard to the objectives of Clause 4.3, it is my view that the proposal is not inconsistent with these for the following reasons:

- The modified packing plant development will comprise components that will range in height from 11.8 metres (the gantry connection between the bridge crossing and the packing plant); 13 metres for the modified packing plant building; and silos ranging in height from 20.7 metres to 34.5 metres above ground level. As detailed in Section 8.1 above, the existing Shoalhaven Starches factory complex (which is located opposite the subject site) includes a range of large scale industrial buildings and structures which are either significantly higher than those works proposed by this

modification proposal; or are of a similar height and scale to those which are proposed. The modified proposal will therefore be compatible with the height. bulk and scale and character of existing development within the locality.

- As detailed in Section 8.6 of the EA that supports this modification application the modified proposal will not adversely impact the visual amenity of the locality.
- Given the siting of the modified packing plant within the subject land; and the nature of surrounding land uses which comprise either industrial lands uses to the west, and south; rural pasture under the ownership of the Manildra Group of Companies to the east; or Shoalhaven Council's Sewerage Treatment Plant to the north; the proposal will not result in disruption of views or adverse overshadowing of adjoining lands.
- The subject site is not located within the vicinity of an item of environmental heritage. The proposal will therefore not have any adverse impacts on any site or locality with identified heritage significance.

Given the above circumstances it is my view that the modified Packing Plant proposal will not be inconsistent with the prevailing character of this locality; or that which is envisaged given the planning provisions applying to the land; and will therefore be consistent with the objectives of Clause 4.3.

The subject site is zoned General Industrial IN1 under the SLEP 2014. The objectives of the IN1 zone as outlined in Section 5.2 of this submission are:

- *To provide a wide range of industrial and warehouse land uses.*
- *To encourage employment opportunities.*
- *To minimise any adverse effect of industry on other land uses.*
- *To support and protect industrial land for industrial uses.*
- *To allow a diversity of activities that do not significantly conflict with the operation of existing or proposed development.*
- *To enable other land uses that provide facilities or services to meet the day to day needs of workers in the area.*

It is my view that the modification proposal is also consistent with the above objectives of the IN1 zone:

The packing plant that is to be modified by this proposal forms part of the SSEP.

In a broader strategic context the Shoalhaven Starches factory is a key supplier of ingredients to many industries within NSW. The products created at the Shoalhaven Starches Plant at Bomaderry are essential ingredients for a wide range of industries within

NSW and Australia. These industries depend significantly upon products produced at the Shoalhaven Starches Plant, products that are not in many cases produced elsewhere. Were the Shoalhaven Starches plant to cease operations such a cessation would have significant adverse implications to other industries within the State and Australia as a whole. This was one of the reasons why the NSW Government in 1993 identified the Shoalhaven Starches Plant at Bomaderry as a *State Significant Site*.

Apart from the important role that the Shoalhaven Starches Plant plays in the NSW economy, the factory plays a particularly important role in the local Shoalhaven (and South Coast) economy. The Shoalhaven Starches factory site at Bomaderry directly employs 280 employees; with the SSEP creating an estimated additional 25 ongoing positions. It is also estimated that up to 150 jobs will be created for the estimated 12 month construction phase.

Such employment generation needs to be seen in a broader context with the loss of significant employers within the Shoalhaven including Gates Rubber at South Nowra, the closure of the Dairy Farmers Co-operative operations and the Australian Paper Mill (both operations situated along Bolong Road). Shoalhaven Starches is one of the few major employers within this region seeking to generate additional employment for the local economy.

The SSEP, which the modified packing plant forms a significant component, will ensure the on-going operations of the Shoalhaven Starches plant at Bomaderry in a commercially and environmentally sustainable manner. In doing so the SSEP will be integrated with an overall Odour Management Plan for the complex, that has and will continue to result in significant reduction in odours that emanate from the site. The SSEP also includes the implementation of a waste water treatment plant that will treat waste waters to a higher quality standard where over half of the waste water treated will be able to be re-used in the factory process on the site. The remainder will be able to be irrigated in a sustainable manner on the Company's Environmental Farm.

The proposed modified packing plant as demonstrated by the EA that supports the modification application, (and in particular by the expert assessments that support the EA) will not result in adverse impacts on the surrounding locality in terms of:

- Air quality (including odours)
- Noise
- Traffic
- Flooding
- Hazards

Given the above it is our view that the modification proposal will be consistent with the zone objectives that apply to the land.

Given the modification proposal is consistent with the objectives of Clause 4.3; and is not inconsistent with the IN1 zone objectives that apply to the land; it is our view that the modification proposal will be in the public interest.

8.4 CLAUSE 4.6(5) MATTERS FOR CONSIDERATION BY DIRECTOR-GENERAL

As outlined the concurrence of the Director-General is to be assumed in this case.

- As identified in the original EA for the SSEP the overall proposal is consistent with state and regional planning provisions that apply to the site.
- As outlined in Section 8.3 of this submission it is our view that the proposal is in the public interest.

9.0 CONCLUSION

Under these circumstances it is my view that this objection made pursuant to Clause 4.6 is well founded and strict compliance with Clause 4.3(2A) of Shoalhaven LEP 2014 would be unreasonable under the specific circumstances of this case as:

- The objectives that underpin the development standard outlined in Clause 4.3 of Shoalhaven LEP are achieved notwithstanding non-compliance with the development standard.
- The proposal is consistent with the objectives of the IN1 zone that applies to the land.
- The proposed development is representative of the prevailing character of the locality, ie. industrial development within an industrial zone.
- The modified Packing Plant will not be dissimilar to existing structures already located within the immediate vicinity of the site in the existing Shoalhaven Starches complex and will conform to the visual character of the locality
- The underlying purpose of the proposed modifications would be defeated if compliance was required as restricted height would limit the ability to accommodate the type of plant and infrastructure associated with this proposal. Such would have an adverse impact on the ongoing operations on the site.

Although well considered, the 11 metre height restriction for the broader Shoalhaven encapsulated within Clause 4.3 should not be rigidly enforced as a development standard in all cases.

This submission demonstrates that the variation to the development standard sought by this proposal is consistent with the objectives of the state, regional and local planning provisions for this site. It is my opinion that strict compliance with this development standard under the specific circumstances of this case would be unreasonable and unnecessary.

For these reasons, this submission pursuant to Clause 4.6 requests that the Department exercise the discretionary power and support this proposal and the development application.

Stephen Richardson.

Stephen Richardson
TOWN PLANNER CPP MPIA

ANNEXURE 4

ANNEXURE 4

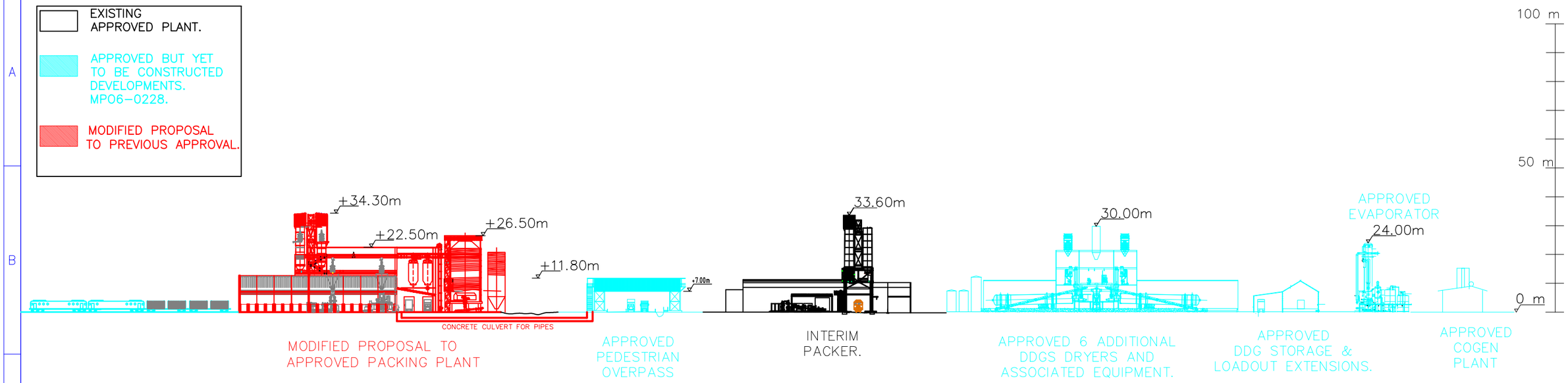
Plans Showing Modifications

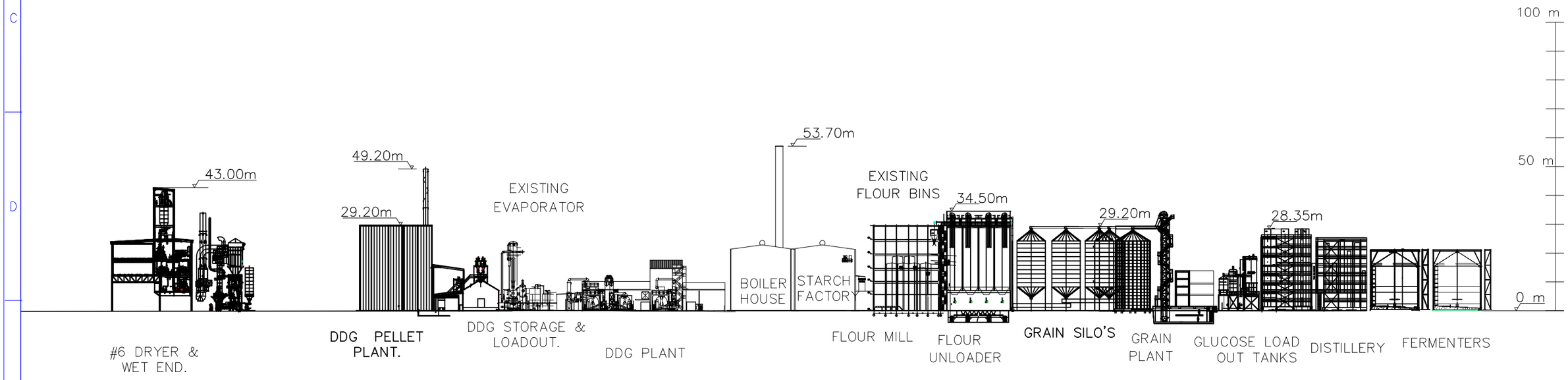
to Packing Plant

EXISTING
APPROVED PLANT.

APPROVED BUT YET
TO BE CONSTRUCTED
DEVELOPMENTS.
MP06-0228.

MODIFIED PROPOSAL
TO PREVIOUS APPROVAL.





TYPICAL ELEVATIONS OF STRUCTURES ON SHOALHAVEN STARCHES SITE.

0 50 m 100 m

SCALE 1:700

ISS	DATE	ZONE	CHANGE AMENDMENTS	BY	CKD
K	1-03-16	B3	Gantry replaced with culvert.	Paul C.	S.R../ J.S
J	30-10-15	ALL	Proposed packaging plant amended.	Paul C.	S.R../ J.S
I	9-02-15	D2	Colour amended.	Paul C.	S.R../ J.S
H	2-02-15	D1	Dryer #6 added.	Paul C.	S.R../ J.S
G	30-01-15	ALL	Notes amended,council applications added.	Paul C.	S.R../ J.S
F	28-01-15	ALL	Original proposal removed.	Paul C.	S.R../ J.S
E	27-01-15	ALL	Approved and proposed separated.	Paul C.	S.R../ J.S
D	14-01-15	D2	Pellet plant silos added.	Paul C.	S.R../ J.S
C	05-11-14	ALL	Pellet plant stack added.	Paul C.	m.m./ j.s.
B	24-01-14	ALL	Proposed now approved,new pellet plant added.	Paul C.	B.H.
A	10-04-08	ALL	Pedestrian bridge added.Scale was 1:650	Paul C.	B.H.
I	22-10-07	ALL	Draft.	Paul C.	Greg M.

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GEM OF THE WEST

MANILDRA GROUP
100% AUSTRALIAN

DRAWN	P.J.C.	TOLERANCES	
TRACED	----	LINEAR	±.2
CHECKED		ANGULAR	±.5
APPROVED		FINISH	NA
DRG PRACTICE	AS1100	MATERIAL	NA

MANILDRA GROUP.NOWRA.

TITLE: SITE DRAWING ELEVATIONS.

SIZE A1 | SCALES 1:700 | SHT

MR-5653

DRG No MN88-001-K

EXISTING – BLACK.

APPROVED MODIFIED PROPOSAL–RED

APPROVED & YET TO BE CONSTRUCTED–BLUE.

60M SETBACK

SOUTH COAST RAILWAY

RAILWAY STREET

RAILWAY STREET

APPROVED EXIT.

OPEN DRAIN

EASEMENT TO DRAIN WATER

CONTAMINATED AREA.

APPROVED WEIGHBRIDGE

CAR PARK. (30 Spaces).

115M SETBACK

88M SETBACK

PROPOSED SILOS.

APPROVED CONTAINER STORAGE AREA.

APPROVED RAIL LINE AND ROADWAY.

MANILDRA LAND

PROPOSED WEIGHBRIDGE

PROPOSED NEW RAIL LINE.

APPROVED LOCATION FOR PACKER & WAREHOUSE.

Min. 18M SETBACK

RE–VEGETATION ALONG DRAIN BANK.

PRIVATE

DP 433118

SERVICE STATION

DP 435054

DP 358577 Pt A

DP 381054

B DP 371388

DP 331547 Pt A

DP 541075 RAILWAY

1069758 DP 141

OPEN PADDOCKS

APPROVED ENTRY.

APPROVED SERVICES BRIDGE.

RELOCATED APPROVED SERVICES BRIDGE.

PROPOSED CULVERT.

BOLONG ROAD

LOT 200 DP1062668

CLEARY BROS CONCRETE BATCHING PLANT

143.75M SETBACK

DRYER #5. SEPARATE MODIFICATION APPLICATION

BOLONG ROAD

DP 1069758

MANILDRA LAND OPEN PADDOCK

MANILDRA

PROPOSED EXTENSION OF EXISTING GANTRY.

COMPLEX

DP 601330

DP 385145

Shoalhaven River

CAR PARK ENTRY VIA APPROVED ENTRY.

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DRAWN PC	DATE 20–08–15	SITE	MANILDRA–SHOALHAVEN STARCHES PTY LTD.
DESIGNED. PC	DATE	JOB TITLE	PROPOSED MODIFICATION APPLICATION
CHKD GN	DATE	DWG TITLE	FOR PACKING FACILITY. OVER ALL SITE PLAN & APPROVED.
APPD A.T.	DATE 20–08–15	SCALE	1:2500
		PROJECT No.	5767
		DWG No.	MN262–001
		SHT SI:E	A3
		SHEET	
		OF	
		REV.	P07

EXISTING – BLACK.
APPROVED MODIFIED PROPOSAL–RED
APPROVED & YET TO BE CONSTRUCTED–BLUE.

CAR PARK EXIT VIA APPROVED INTERNAL ROAD.

SOUTH COAST RAILWAY

RAILWAY STREET

OPEN DRAIN

60M

42.2M

195.6M

CONTAMINATED AREA.

4M X 3.7M

16 DP 1121337

APPROVED AND MODIFIED INTERNAL ROAD.

CAR PARK. (30 Spaces at 45°).

115M SETBACK

105M SETBACK

79.64M SETBACK

BOUNDARY

APPROVED LOCATION FOR PACKER & WAREHOUSE.

APPROVED RAIL LINE AND ROADWAY.

18M

PROPOSED NEW RAIL LINE.

PROPOSED WEIGHBRIDGE

RE–VEGETATION ALONG DRAIN BANK.

R161.2M

4.8M X

4.4M X 4.4M

4.2M X

APPROVED CONTAINER STORAGE AREA.

4.7M X

62M

75M SETBACK

13M

CO2 GAS INSTALLATION (APPROX LAYOUT)

METAL TANK PROPOSED

METAL TANK

PUMP HOUSE

GAS FACILITY MANILDRA GAS STATION

MANILDRA LAND BOC GAS FACILITY

APPROVED PIPE & PEDESTRIAN BRIDGE

BOLONG ROAD

LOT 200 DP1062668

CAR PARK ENTRY VIA APPROVED ENTRY.

CONCRETE CULVERT FOR PIPES

LOT BOUNDARY

Alternative

RELOCATED APPROVED SERVICES BRIDGE.

22M

SERVICE STATION

DP 234054

DP 358577 PT A

DP 381054 PT B

DP 331547 PT 1

RAILWAY DP 541075

PT LOT 62 DP1078788

LOT B DP401549

CARPARK

ACCESS

MANILDRA GROUP
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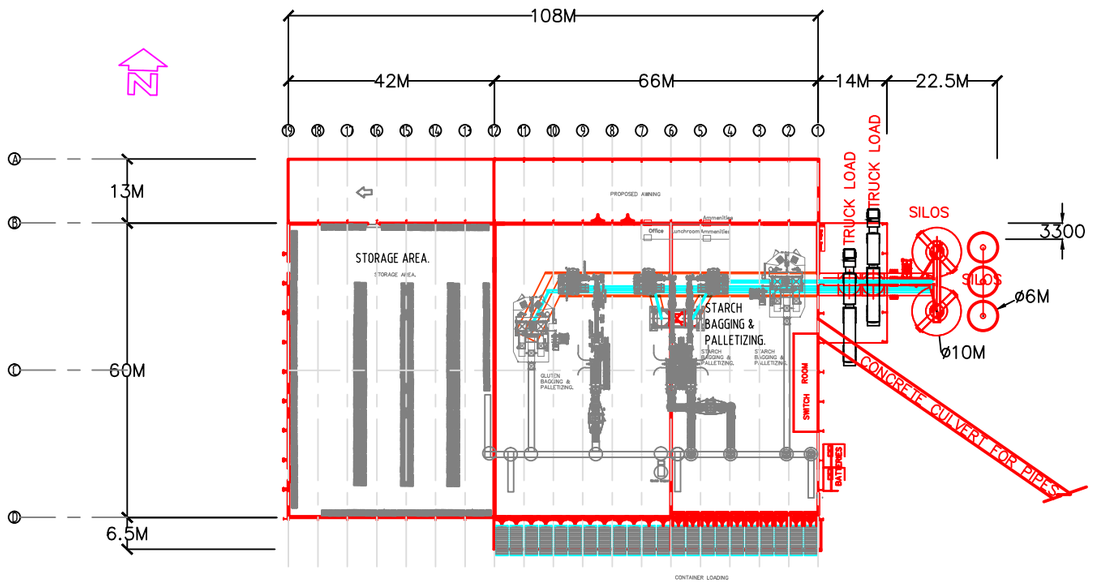
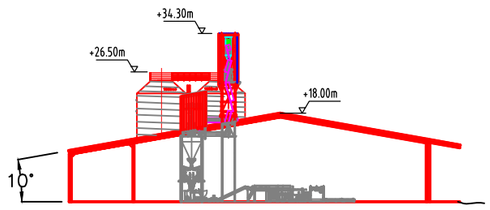
DRAWN PC	DATE 20–08–15	SITE	MANILDRA–SHOALHAVEN STARCHES PTY LTD.
DESIGNED PC	DATE	JOB TITLE	PROPOSED MODIFICATION APPLICATION
CHKD GM	DATE	DWG TITLE	FOR PACKING FACILITY. PACKER DETAIL & APPROVED PLAN VIEW.
APPD A.T.	DATE 20–08–15	SCALE	1:1500
		PROJECT No.	5845
		DWG No.	MN262–002
		SHT SIZE	A3
		SHEET	OF
		REV.	P11

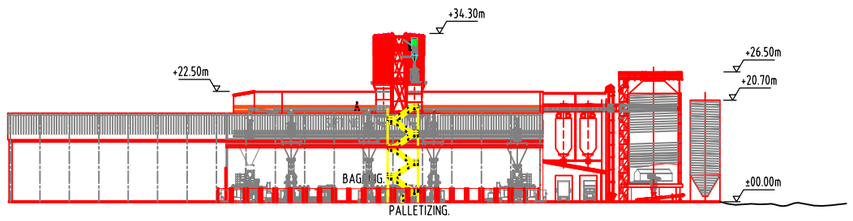
546 x 891



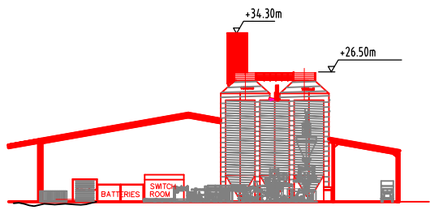
PLAN VIEW



WESTERN ELEVATION



SOUTHERN ELEVATION



EASTERN ELEVATION

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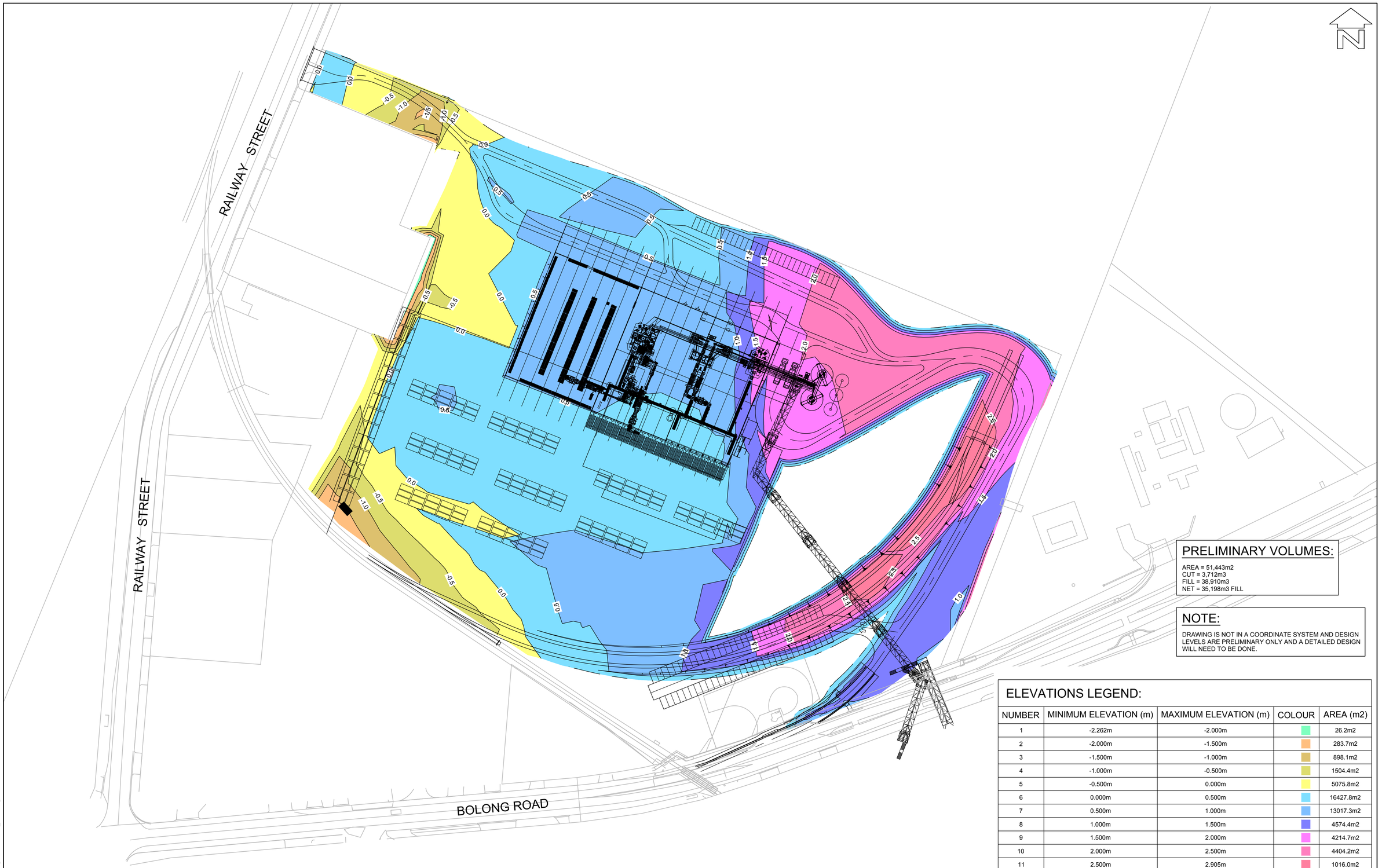
DRAWN PC	DATE 20-08-15	SITE	MANILDRA–SHOALHAVEN STARCHES PTY LTD.
DESIGNED PC	DATE	JOB TITLE	PROPOSED MODIFICATION APPLICATION
CHKD GM	DATE	DWG TITLE	PACKING FACILITY. BUILDING DETAIL.
APPD A.T.	DATE 20-08-15	SCALE 1:1250	PROJECT No. 5767
		DWG No.	MN262-004

SHT SIZE A3 | SHEET | OF | REV. P05



PRELIMINARY VOLUMES:

AREA = 51,443m2
CUT = 3,712m3
FILL = 38,910m3
NET = 35,198m3 FILL

NOTE:

DRAWING IS NOT IN A COORDINATE SYSTEM AND DESIGN LEVELS ARE PRELIMINARY ONLY AND A DETAILED DESIGN WILL NEED TO BE DONE.

ELEVATIONS LEGEND:

NUMBER	MINIMUM ELEVATION (m)	MAXIMUM ELEVATION (m)	COLOUR	AREA (m2)
1	-2.262m	-2.000m		26.2m2
2	-2.000m	-1.500m		283.7m2
3	-1.500m	-1.000m		898.1m2
4	-1.000m	-0.500m		1504.4m2
5	-0.500m	0.000m		5075.8m2
6	0.000m	0.500m		16427.8m2
7	0.500m	1.000m		13017.3m2
8	1.000m	1.500m		4574.4m2
9	1.500m	2.000m		4214.7m2
10	2.000m	2.500m		4404.2m2
11	2.500m	2.905m		1016.0m2

BEWARE!

THE CONTRACTOR IS TO VERIFY THE LOCATION OF ALL EXISTING SERVICES PRIOR TO COMMENCEMENT OF CONSTRUCTION AND SHALL BE RESPONSIBLE, AT THE CONTRACTOR'S EXPENSE, FOR ANY REPAIRS TO DAMAGE CAUSED DURING CONSTRUCTION.

DIAL BEFORE YOU DIG www.1100.com.au

LAYOUT PLAN

SCALE 1:800

0 10 20 30 40 50

SCALE:- 1:800

LIABILITY LIMITED BY A SCHEME APPROVED UNDER PROFESSIONAL STANDARDS LEGISLATION

COVER OF EXCELLENCE

RATIO:	DATUM:						
1:800 (AT A1 ORIGINAL)	AUSTRALIAN HEIGHT DATUM	SURVEY	APS	REV	DESCRIPTION	BY	DATE
	ORIGIN: SSM RL	DESIGN	CJG	=			
		DRAWN	CJG				
		CHECK'D	MP				
	DATE OF PLAN: DECEMBER 2015						

allen price & scarratts
land and development consultants
Head Office: 75 Plunkett Street, Nowra NSW 2541
Kiama Branch: 5/125 Terralong Street, Kiama NSW 2533
phone:(02) 4421 6544 fax:(02) 4422 1821
consultants@allenprice.com.au www.allenprice.com.au

PROPOSED MODIFICATION APPLICATION FOR PACKING FACILITY, MANILDRA - SHOALHAVEN STARCHES PTY LTD

PRELIMINARY BULK EARTHWORKS SHADING LAYOUT PLAN FOR THE MANILDRA GROUP

DRAWING STATUS: PRELIMINARY
NOT TO BE USED FOR CONSTRUCTION PURPOSES

DRAWING NUMBER: 25003-200_S01 SHEET 1 OF 1 REVISION P4

M:\Projects\25000\25000s\25003\25003-200\Drawings\25003-200_S01.dwg

ANNEXURE 5

ANNEXURE 5

Preliminary Hazard Analysis

prepared by

Pinnacle Risk Management Pty Ltd

Pinnacle
Risk Management Pty Ltd

PRELIMINARY HAZARD ANALYSIS, STARCH PACKING PLANT, SHOALHAVEN STARCHES, BOMADERRY, NSW

Prepared by: Dean Shewring

23 November 2015

Pinnacle Risk Management Pty Limited
ABN 83 098 666 703

PO Box 5024 Elanora Heights
NSW Australia 2101
Telephone: (02) 9913 7284
Facsimile: (02) 9913 7930

Preliminary Hazard Analysis, Shoalhaven Starches, Starch Packing Plant

Disclaimer

This report was prepared by Pinnacle Risk Management Pty Limited (Pinnacle Risk Management) as an account of work for Shoalhaven Starches. The material in it reflects Pinnacle Risk Management's best judgement in the light of the information available to it at the time of preparation. However, as Pinnacle Risk Management cannot control the conditions under which this report may be used, Pinnacle Risk Management will not be responsible for damages of any nature resulting from use of or reliance upon this report. Pinnacle Risk Management's responsibility for advice given is subject to the terms of engagement with Shoalhaven Starches.

Rev	Date	Description	Reviewed By
A	9/9/15	Draft for Comment	Shoalhaven Starches
B	11/11/15	Vent Calculations Included	Shoalhaven Starches
C	23/11/15	Final Revision	Shoalhaven Starches

CONTENTS

EXECUTIVE SUMMARY I
GLOSSARY II
1 INTRODUCTION 1
1.1 Background 1
1.2 Objectives 1
1.3 Scope 2
1.4 Methodology 2
2 SITE DESCRIPTION 3
3 PROCESS DESCRIPTION 6
4 HAZARD IDENTIFICATION 8
4.1 Process Materials 8
4.2 Potential Hazardous Incidents Review 9
5 RISK ANALYSIS 14
5.1 Dust Explosions 16
5.2 Building Explosions 19
5.3 Dust Explosion Safeguarding 19
5.3.1 Dust Free Process 20
5.3.2 Dust Control 20
5.3.3 Control of Ignition Sources 20
5.3.4 Inerting 20
5.3.5 Explosion Containment 21
5.3.6 Explosion Isolation 21
5.3.7 Explosion Suppression 21
5.3.8 Explosion Venting 21
5.3.9 Equipment Separation 21
5.4 Aircraft Impact and Other External Events 22
5.5 Cumulative Risk 23
5.6 Societal Risk 23
5.7 Risk to the Biophysical Environment 23
6 CONCLUSION AND RECOMMENDATIONS 24
7 REFERENCES 25

LIST OF FIGURES

Figure 1 - Site Locality Plan..... 4
Figure 2 – Site Layout 5

LIST OF TABLES

Table 1 – Hazard Identification Word Diagram 10
Table 2 - Risk Criteria, New Plants..... 15
Table 3 – Grain Dust Explosions in the USA..... 16
Table 4 – Source Locations of Dust Explosions in Germany (1965-1985). 16
Table 5 – Overpressures from Dust Explosions..... 18
Table 6 – Effects of Explosion Overpressures 18

EXECUTIVE SUMMARY

The Shoalhaven Starches factory located on Bolong Road, Bomaderry, produces a range of products for the food, beverage, confectionary, paper and motor transport industries including starch, gluten, glucose and ethanol.

A new starch and gluten packing plant and warehouse is proposed to be installed. The new facility includes:

- Starch or gluten from the existing site is to be transferred via blowlines to new silos;
- The dried starch or gluten is to be packaged into 1 te bulk bags, 25 kg bags or loaded onto trucks;
- The bags are to be stored in a warehouse; and
- The bulk bags can also be loaded into containers for delivery to the market by rail.

As part of the project requirements, a Preliminary Hazard Analysis (PHA) is required. This report details the results from the analysis.

The risks associated with the proposed new starch and gluten packing plant at the Shoalhaven Starches Bomaderry site have been assessed and compared against the NSW Department of Planning and Environment risk criteria.

In summary:

- The potential hazardous events associated with the new equipment and building are primarily dust explosions. Given the location of the new equipment then no significant adverse off-site impacts to residential areas or similar are expected. Correspondingly, all risk criteria in HIPAP 4 are expected to be satisfied for this proposal;
- The risk of propagation to neighbouring equipment is low given the proposed facility location and generous separation distances; and
- Societal risk, environmental risk and transport risk are all considered to be broadly acceptable.

The following recommendations are made from this review:

1. The existing safety management systems, e.g. maintenance procedures, operating procedures, training and emergency response plans, will need to be updated to reflect the proposed changes; and
2. All explosion vents should be positioned to avoid impact to personnel and sensitive equipment.

GLOSSARY

AS	Australian Standard
ATEX	Explosive Atmospheres (European Directive)
CIP	Clean-in-Place
DoPE	NSW Department of Planning and Environment
DP	Differential Pressure
HAZOP	Hazard and Operability Study
HIPAP	Hazardous Industry Planning Advisory Paper
LEL	Lower Explosion Limit
NFPA	National Fire Protection Association (USA)
PHA	Preliminary Hazard Analysis
QRA	Quantitative Risk Assessment
SEPP	State Environmental Planning Policy
TNO	Dutch Based Research Organisation
TWA	Time Weighted Average

REPORT

1 INTRODUCTION

1.1 BACKGROUND

From Ref 1, Shoalhaven Starches is a member of the Manildra Group of companies. The Manildra Group is a wholly Australian owned business and the largest processor of wheat in Australia. It manufactures a wide range of wheat based products for food and industrial markets both locally and internationally.

The Shoalhaven Starches factory located on Bolong Road, Bomaderry, produces a range of products for the food, beverage, confectionary, paper and motor transport industries including starch, gluten, glucose and ethanol.

A new starch and gluten packing plant and warehouse is proposed to be installed. The new facility includes:

- Starch or gluten from the existing site is to be transferred via blowlines to new silos;
- The dried starch or gluten is to be packaged into 1 te bulk bags, 25 kg bags or loaded onto trucks;
- The bags are to be stored in a warehouse; and
- The bulk bags can also be loaded into containers for delivery to the market by rail.

As part of the project requirements, a Preliminary Hazard Analysis (PHA) is required. Shoalhaven Starches requested that Pinnacle Risk Management prepare the PHA for the new packing plant. This PHA has been prepared in accordance with the guidelines published by the Department of Planning and Environment (DoPE) Hazardous Industry Planning Advisory Paper (HIPAP) No 6 (Ref 2).

1.2 OBJECTIVES

The main aims of this PHA study are to:

- Identify the credible, potential hazardous events associated with the new packing plant;
- Evaluate the level of risk associated with the identified potential hazardous events to surrounding land users and compare the calculated risk levels with the risk criteria published by the DoPE in HIPAP No 4 (Ref 3);
- Review the adequacy of the proposed safeguards to prevent and mitigate the potential hazardous events; and
- Where necessary, submit recommendations to Shoalhaven Starches to ensure that the new packing plant is operated and maintained at acceptable levels of safety and effective safety management systems are used.

1.3 SCOPE

This PHA assesses the credible, potential hazardous events and corresponding risks associated with the Shoalhaven Starches proposed new packing plant with the potential for off-site impacts only. Transport of the starch and gluten is not included as it is not a Dangerous Good and it is currently transported by road and rail from the site.

1.4 METHODOLOGY

In accordance with the approach recommended by the DoPE in HIPAP 6 (Ref 2) the underlying methodology of the PHA is risk-based, that is, the risk of a particular potentially hazardous event is assessed as the outcome of its consequences and likelihood.

The PHA has been conducted as follows:

- Initially, the new packing plant and its location were reviewed to identify credible, potential hazardous events, their causes and consequences. Proposed safeguards were also included in this review;
- As the potential hazardous events are located at a significant distance from other sensitive land users, the consequences of each potential hazardous event were estimated to determine if there is any possible unacceptable off-site impacts;
- Included in the analysis is the risk of propagation between the proposed equipment and the adjacent processes; and
- If adverse off-site impacts could occur, assess the risk levels to check if they are within the criteria in HIPAP 4 (Ref 3).

2 SITE DESCRIPTION

From Ref 1, the Shoalhaven Starches factory site is situated on various allotments of land on Bolong Road, Bomaderry, within the City of Shoalhaven (see Figure 1). The factory site, which is located on the south side of Bolong Road on the northern bank of the Shoalhaven River, has an area of approximately 12.5 hectares.

The town of Bomaderry is located approximately 0.5 km to the west of the factory site and the Nowra urban area is situated 2.0 km to the south west of the site. The "Riverview Road" area of the Nowra Township is situated approximately 600 metres immediately opposite the factory site across the Shoalhaven River.

The village of Terara is situated approximately 1.5 kilometres to the south east of the site, across the Shoalhaven River. Pig Island is situated between the factory site and the village of Terara and is currently used for dairy cattle grazing.

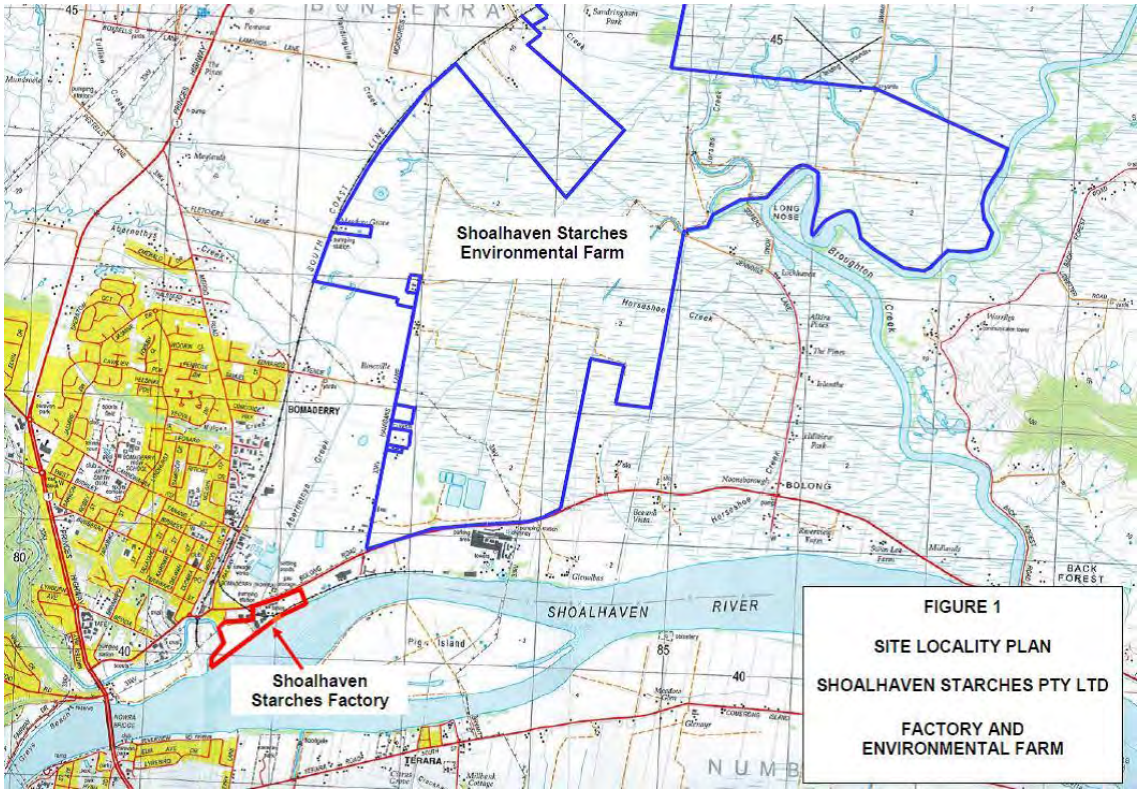
There are a number of industrial land uses, which have developed on the strip of land between Bolong Road and the Shoalhaven River. Industrial activities include a metal fabrication factory, the Shoalhaven Starches site, Shoalhaven Dairy Co-op (formerly Australian Co-operative Foods Ltd – now owned by the Manildra Group) and the former Shoalhaven Paper Mill (Australian Papers). The industrial area is serviced by a privately owned railway spur line that runs from just north of the Nowra-Bomaderry station via the starch plant and the former Dairy Co-op site to the Paper Mill.

The Company also has an Environmental Farm located over 1,000 hectares on the northern side of Bolong Road. This area is cleared grazing land and contains spray irrigation lines and wet weather storage ponds (total capacity 925 Mega litres). There are at present six wet weather storage ponds on the farm that form part of the waste water management system for the factory. A seventh pond approved in 2002 was converted into the biological section of the new wastewater treatment plant.

The Environmental Farm covers a broad area of the northern floodplain of the Shoalhaven River, stretching from Bolong Road in the south towards Jaspers Brush in the north. Apart from its use as the Environmental Farm, this broad floodplain area is mainly used for grazing (cattle). The area comprises mainly large rural properties with isolated dwellings although there is a clustering of rural residential development along Jennings Lane (approximately 1 kilometre from the site), Back Forest Road (approximately 500 metres to 1.2 kilometres to the west) and Jaspers Brush Road (approximately 1.2 kilometres to the north).

It is proposed to construct the packing plant on Manildra owned land immediately to the north of the existing factory, i.e. on the northern side of Bolong Road. This area is surrounded by the existing carbon dioxide plant to the east and general industry / commercial facilities in all other directions. The nearest residential and shopping areas are approximately 200 m to the west of the site.

Figure 1 - Site Locality Plan



Source: Ref 1.

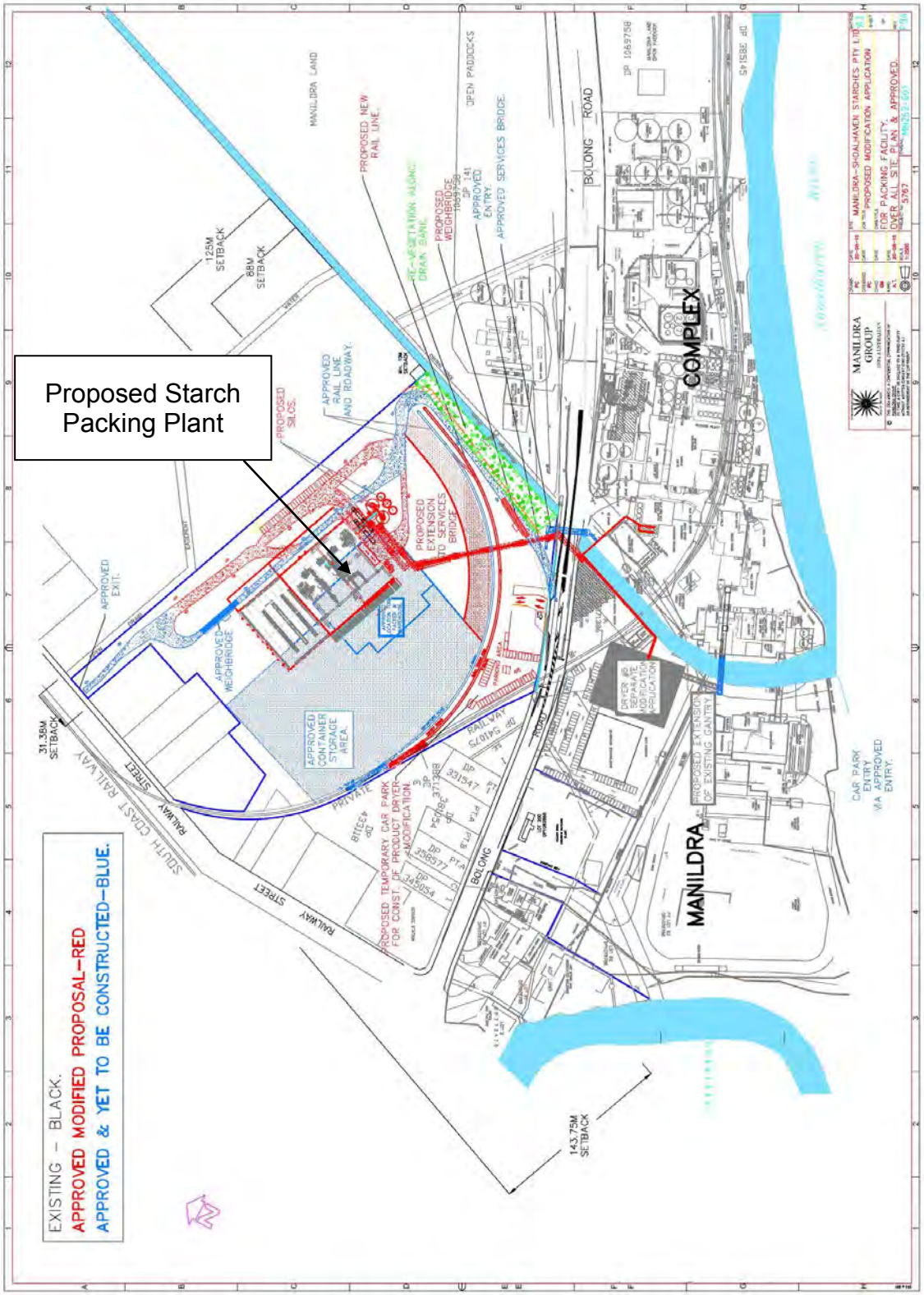
Security of the site is achieved by a number of means. This includes site personnel and security patrols by an external security company (this includes weekends and night patrols). The site operates 7 days per week (24 hours per day). Also, the site is fully fenced and non-operating gates are locked. Security cameras are installed for staff to view visitors and site activities. These security measures are to be replicated to the packing plant.

There are approximately 120 people on site during Monday to Fridays 8 am to 5 pm and 30 people on site at other times.

The main natural hazard for the site is flooding. No other significant external events are considered high risk for this site.

A layout drawing showing the proposed location of the new packing plant is shown in Figure 2.

Figure 2 – Site Layout



3 PROCESS DESCRIPTION

It is proposed to build a new packing plant and its associated container loading facilities on an undeveloped property owned by the Manildra Group of Companies on the northern side of Bolong Road. The property comprises two allotments: Lot 5 DP 825808 and Lot 2 DP 538289.

The new facility will include:

- Transfer blowlines (x5) from the existing site on the southern side of Bolong Road;
- A new pipe bridge over Bolong Road;
- The packing plant facilities for filling bags and trucks;
- A warehouse for bag storage; and
- A rail extension for loading containers onto trains (250 m long).

The proposal will seek to erect a purpose designed and built factory building with dimensions of approximately 108 metres by 60 metres, and having a height of approximately 22.5 metres above ground level. There will also be two main storage silos (1,000 te each) located to the east of the packing plant building with heights of approximately 26.5 metres above ground level and 10 m diameter.

In addition to the above, it is proposed to construct a container / truck loading facility between the packing plant and the two silos. A new railway spur line is also proposed to be extended from the existing railway to service this container loading area. The containers are to be stored to the south of the packing plant building.

The dried starch will be pneumatically conveyed from the existing site to the proposed new silos via an overhead bridge to cross Bolong Road. This overhead bridge will also double as a pedestrian bridge to improve safety for pedestrians crossing between the existing factory site and the packing plant site. The silos will feed the proposed new packing plant and container loading facility.

Gluten is to be transported directly to three storage silos from the existing network and then fed to the bag filling bin.

The ground product starch has the following representative assay:

< 75 micron = 35 to 40%

< 150 micron = 10 to 15%

< 250 micron = 8 to 12%

< 355 micron = 5 to 6%

The packaged product will be filled into 1 te or 25 kg bags at dedicated bag filling stations. The 1 te bag filling stations will be designed for approximately 40 te per hour filling rate.

The new packing plant will be built to avoid dust emissions as product will not be blown into bags but rather mechanically packed. Furthermore, sealing and

weighing operations will be completed simultaneously resulting in a reduction in leakages.

The packing building has been designed to meet good practice for food safety and housekeeping / cleanliness. The steel work is on the outside of the wall panels to prevent ledges for product to settle on (i.e. reducing the risk of dust explosions).

The bags are to be stored in a new warehouse (concrete and steel construction).

Starch and gluten can be delivered to the market via road or rail, e.g. using bulk trucks or bags in containers or on trucks. At this point on the rail system the train is moving at walking pace, i.e. process safety incidents involving the train are unlikely.

The packing plant is designed for 450 to 480 te per day of product.

All equipment in contact with the product is to be constructed from 304L or equivalent stainless steel.

All equipment handling potentially explosive dust is to be designed to ATEX and/or NFPA standards. This will include rotary valves for seals, explosion vents, equipment earthing and hazardous area zoning with the electrics and instruments to suit the requirements.

4 HAZARD IDENTIFICATION

4.1 PROCESS MATERIALS

Starch:

Starch or amylum is a carbohydrate consisting of a large number of glucose units joined together. The chemical formula for starch is $(C_6H_{10}O_5)n$. It is not defined as a hazardous material or a Dangerous Good.

Starch is produced by most green plants as an energy store. It is the most common carbohydrate in human diets and is contained in large amounts in such staple foods as potatoes, wheat, corn, rice, and cassava.

Papermaking is the largest non-food application for starches globally. In a typical sheet of copy paper, the starch content may be as high as 8%.

Starch is a fine, white, odourless powder. The respiratory TWA is 5 mg/m^3. It is insoluble in water. Starch is not defined as a combustible solid (it will not support combustion) but may form explosive mixtures with air. It is a potentially explosive dust when critical parameters exist, e.g. particle size less than 500 micron and moisture content less than 30% (Ref 4).

Potential ignition sources include (Ref 5):

- Smouldering, self-heating or burning dust;
- Open flames, e.g. welding, hot work, cutting and matches;
- Hot surfaces, e.g. hot bearings, dryers, incandescent materials and heaters;
- Lightning;
- Heat from mechanical impact or friction; and
- Electrical discharges and arcs.

K_{st} is a measure of a dust's explosibility classification and is a measure of the maximum rate of pressure rise, i.e. the higher the K_{st} value, the greater the explosive energy. For starch, the K_{st} value is 199 bar.m/s. These are deemed potentially weak explosions although it is noted that previous incidents involving starch dust explosions have led to fatalities (Refs 4 and 5).

Starch is non-toxic to people and has a low environmental impact potential. It is mildly irritating to eyes and lungs.

Gluten:

Gluten is a protein composite found in wheat and related grains, including barley and rye. Gluten gives elasticity to dough, helping it rise and keep its shape, and often gives the final product a chewy texture (Ref 6).

Gluten is the composite of two storage proteins, gliadin and a glutenin, and is conjoined with starch in the endosperm of various grass-related grains, e.g. wheat. Worldwide, gluten is a source of protein, both in foods prepared directly from sources containing it, and as an additive to foods otherwise low in protein.

Gluten is a fine, pale yellow powder. It is insoluble in cold water. Gluten is ignitable above 460 C and may form explosive mixtures with air. It is a potentially explosive dust when critical parameters exist, e.g. particle size less than 500 micron. For gluten, the K_{st} value is 100 bar.m/s. As for starch, these are deemed potentially weak explosions. The lower explosion limit is 60 g/m^3 and the bulk density is 0.4 to 0.5 g/cm^3.

Gluten is slightly hazardous in case of inhalation, skin or eye contact and ingestion.

From the above review, there are no Dangerous Goods associated with the new packing plant. From the State Environmental Planning Policy (SEPP) No.33 (Ref 7), as dust explosions are possible with the product starch and gluten then a PHA is required.

4.2 POTENTIAL HAZARDOUS INCIDENTS REVIEW

In accordance with the requirements of *Guidelines for Hazard Analysis*, (Ref 2), it is necessary to identify hazardous events associated with the facility's operations. As recommended in HIPAP 6, the PHA focuses on "atypical and abnormal events and conditions. It is not intended to apply to continuous or normal operating emissions to air or water".

In keeping with the principles of risk assessments, credible, hazardous events with the potential for off-site effects have been identified. That is, "slips, trips and falls" type events are not included nor are non-credible situations such as an aircraft crash occurring at the same time as an earthquake.

The identified credible, significant incidents with the potential for off-site impacts for the proposed facility are summarised in the Hazard Identification Word Diagram following (Table 1). These potential events are based known incidents and dust process safety (Refs 4 and 5) and were derived via a Hazardous Event Identification workshop conducted at the Manildra site. Only the potential hazardous events that could cause significant consequences are shown in Table 1.

This diagram presents the causes and consequences of the events, together with major preventative and protective features that are included as part of the design.

Table 1 – Hazard Identification Word Diagram

Event ID No.	Hazardous Event	Causes	Possible Consequences	Proposed Prevention and Mitigation Control Measures
1.	Dust explosions within the new equipment, e.g. the rotary seal valves and silos	Ignition of combustible dust, e.g. due to smouldering, open flames, hot surfaces, lightning, heat from mechanical impact or friction, and electrical discharges and arcs	Damage to the processing equipment and injury to personnel. Potential propagation to the combustible material processed and stored at the facility. Products of combustion emitted with the potential to impact people and the environment. The explosion can also travel throughout equipment with the potential for pressure piling and hence more significant explosive energy. Projectiles are possible with the risk of injury to people and damage to equipment	All equipment containing dust is to be designed to ATEX standards including explosion vents and airlocks to separate transfer systems. Housekeeping to keep the area dust-free. The equipment is to be rated for hazardous zones including electrics and instruments are to be suitably rated and all equipment is to be bonded and earthed. Permit to work system requiring adequate cleaning and control of ignition sources. Condition monitoring of equipment and preventative maintenance to limit the probability of hot surfaces from friction occurring. High level detection on the silos. Use of fire hoses to extinguish smouldering fires. As the minimum ignition temperature for starch is approximately 380 C and higher and gluten is 460 C, maintenance of equipment and possibly detection by operators may prevent hot surfaces initiating a dust explosion

Event ID No.	Hazardous Event	Causes	Possible Consequences	Proposed Prevention and Mitigation Control Measures
2.	Explosion in a dust collector	Propagation of fire event from elsewhere in the process, e.g. burning embers drawn into the dust collector	Explosion with the potential for injury and equipment damage	Inducted draft which keeps the concentration below the LEL (lower explosive limit). All filters are to be pulsed with air for cleaning. All filters are to be checked routinely by maintenance for high differential pressure (DP). If issues arise then the socks are changed
3.	Blockage of the blowline to the silos	Material buildup, blower failure, baghouse failure on the silo	Material build up with potential for heating and hence fire and explosion	Process tripped on loss of a blower and other essential drives. Pressure monitoring on the blowline
4.	Release of product from the transfer blowline	Erosion, explosion vent opening, gasket failure, impact from a vehicle	Loss of containment of product to atmosphere potential for environmental impact and possible ignition. If the release is over or near Bolong Road then there is the potential to affect traffic, e.g. causing an accident	Schedule 40 stainless steel pipe for extra thickness, long radius elbows used to minimise the risk of erosion, minimum joints to be installed, pipe bridge height to comply with road authority requirements, impact protection for the pipe bridge supports including being located away from Bolong Road
5.	Overfilling a silo	Failure of the level instrument monitoring the product level within the silos	The product level can overflow the silo via the aspiration system. This can lead to explosions	Independent high level trip on the silos to stop the filling system, the area is to be rated for hazardous zones including electrics and instruments are to be suitably rated and all equipment is to be bonded and earthed

Event ID No.	Hazardous Event	Causes	Possible Consequences	Proposed Prevention and Mitigation Control Measures
6.	Dust explosion within the warehouse / bagging area	Loss of containment of dust within the building, e.g. dust emissions from bags and the filling machine	Dust explosion within the building, loss of life, equipment damage, production downtime, potential for both a primary and secondary explosion	Aspirated system, instruments and electrics to hazardous zones, housekeeping. Equipment is to be designed for containment. The open building doors will provide explosion venting to minimise the developed overpressures. No purlins on the inside of the building where dust can accumulate. The bags are mechanically filed (air blowing is not to be used)
7.	Static charge on the truck during loading	Free-falling product	Potential source of ignition for explosive / combustible dust	All loading equipment will be bonded to earth
8.	Overfilling a container or truck	Failure of the loading systems	Loss of containment of the starch. Most credible consequence is environmental impact	Area is paved with liquid effluent to flow to the existing environmental farm. Batching systems to include overfill prevention
9.	Release of product	Failed sock in a dust collector	Product release and environmental impact	Visual detection of an emission and response, reporting from outside sources, LEL levels not reached, i.e. not considered to be an ignition risk. Maintenance of the socks to check the integrity

Event ID No.	Hazardous Event	Causes	Possible Consequences	Proposed Prevention and Mitigation Control Measures
10.	Fire in warehouse	Arson, faulty electrics, hot work	Damage to warehouse and loss of product and contaminated fire water	For starch, this is a low risk given the starch is not deemed to be a solid capable of supporting combustion. The product is to be stored within 1 te and 25 kg bags on wooden pallets. The warehouse is to be a concrete and steel construction. Therefore, the fire load is very low and any fires occurring will be of limited radiant heat consequence. Fire protection to comply with Australian Standards as appropriate. Contaminated fire water flows to the farm. Permit to work system. The new facility is to be located within the a new boundary fence and hence only authorised personnel have access. Security patrols, the area is to have adequate lighting
11.	Flooding	Natural event involving significant rain fall	Potential for off-site environmental impact from material being swept away in the flood	The structural characteristics of the new facility will be certified by an engineer as capable of withstanding flooding and will not become unsafe during floods or as a result of moving debris that would potentially threaten the safety of people or the integrity of the structures

5 RISK ANALYSIS

The assessment of risks to both the public as well as to operating personnel around the new packing plant requires the application of the basic steps outlined in Section 1. As per HIPAP 6 (Ref 2), the chosen analysis technique should be commensurate with the nature of the risks involved. Risk analysis could be qualitative, semi-quantitative or quantitative.

The typical risk analysis methodology attempts to take account of all credible hazardous situations that may arise from the operation of processing plants etc.

Having identified all credible, significant incidents, risk analysis requires the following general approach for individual incidents:

Risk = Likelihood x Consequence

The risks from all individual potential events are then summated to get cumulative risk.

For QRA and hazard analysis, the consequences of an incident are calculated using standard correlations and probit-type methods which assess the effect of fire radiation, explosion overpressure and toxicity to an individual, depending on the type of hazard.

In this PHA, however, the approach adopted to assess the risk of the identified hazardous events is scenario based risk assessment. The reasons for this approach are:

1. The distance from the new equipment to residential and other sensitive land users is large and hence it is unlikely that any significant consequential impacts, e.g. due to radiant heat from fires, from the facility will have any significant contribution to off-site risk;

2. The new equipment is to be protected from explosions using explosion vents and hence these will limit the impact distance; and

3. There are a limited number of process safety events and therefore cumulative and societal risk is not significant. The main events of interest are dust explosions. Therefore, these are analysed in the remaining sections of this report.

The risk criteria applying to developments in NSW are summarised in Table 2 on the following page (from Ref 3).

Table 2 - Risk Criteria, New Plants

Description	Risk Criteria
Fatality risk to sensitive uses, including hospitals, schools, aged care	0.5×10^{-6} per year
Fatality risk to residential and hotels	1×10^{-6} per year
Fatality risk to commercial areas, including offices, retail centres, warehouses	5×10^{-6} per year
Fatality risk to sporting complexes and active open spaces	10×10^{-6} per year
Fatality risk to be contained within the boundary of an industrial site	50×10^{-6} per year
Injury risk – incident heat flux radiation at residential areas should not exceed 4.7 kW/m^2 at frequencies of more than 50 chances in a million per year or incident explosion overpressure at residential areas should not exceed 7 kPa at frequencies of more than 50 chances in a million per year	50×10^{-6} per year
Toxic exposure - Toxic concentrations in residential areas which would be seriously injurious to sensitive members of the community following a relatively short period of exposure	10×10^{-6} per year
Toxic exposure - Toxic concentrations in residential areas which should cause irritation to eyes or throat, coughing or other acute physiological responses in sensitive members of the community	50×10^{-6} per year
Propagation due to Fire and Explosion – exceed radiant heat levels of 23 kW/m^2 or explosion overpressures of 14 kPa in adjacent industrial facilities	50×10^{-6} per year

As discussed above, the consequences of the potential hazardous events are initially analysed to determine if any events have the potential to contribute to the above-listed criteria and hence worthy of further analysis.

5.1 DUST EXPLOSIONS

A summary of historical dust explosions is given in Ref 5. Two of the reported studies detail dust explosions in Germany from 1965 to 1985 and in the USA from 1900 to 1988. The following tables show some of the analysis results. It is noted that analysts suggest that not all dust explosions are reported. One analyst (Ref 5) reports that only 15% of the actual dust explosions that occur are reported, i.e. many more may have occurred.

Table 3 – Grain Dust Explosions in the USA

Loss Category	1900 - 1956		1957 - 1975		1979 - 1988	
	Total	Per Year	Total	Per Year	Total	Per Year
Number of Explosions	490	8.6	192	10.1	202	20.2
Fatalities	381	6.8	68	3.6	54	5.4
Injuries	991	17.4	346	18.2	267	26.7
Estimated Damage to Facility ($US millions), not inflated	70	1.3	55	2.9	169	16.9

Table 4 – Source Locations of Dust Explosions in Germany (1965-1985)

Type of Plant Item	Percentage of Total Dust Explosions in the Food and Feed Industry
Silos and Bunkers	22.9
Dust Collecting Systems	9.5
Milling and Crushing Plants	18.1
Conveying Systems	26.7
Dryers	7.6
Furnaces	2.0
Mixing Plants	2.0
Grinding and Polishing Plants	0
Sieves and Classifiers	2.8
Unknown and Others	8.4
Total	100.0

That is, dust explosions are credible events and can cause significant impacts.

From Ref 8, the damage radius of a dust explosion is usually limited to the building (or equipment item) in which it occurs and to a very short range outside. This is supported by the historical incidents involving dust explosions where the majority of fatalities involve on-site personnel.

The majority of dust explosion incidents detailed in Ref 5 resulted in no fatalities. For the incidents where fatalities occurred, these were to on-site

personnel. Ref 5 quotes statistics from the USA where, on average, dust explosions result in approximately 5 deaths per year. Historically, about one in six fatalities occur in the food and grain industry. Again, the greater risk for fatality or injury for dust explosions is to on-site personnel as claimed in Ref 8.

To support the above findings, see the following calculations for maximum explosive overpressures and flame length from a dust explosion in one of the 1,000 te silos, i.e. the largest process vessel associated with the packing plant.

The maximum explosion overpressures at a distance D (m) from a vent or point of release is given by (Ref 5):

$$P_{blast} = (P_{max} \times C1 \times C2) / D$$

Where:

P_{blast} is the overpressure (or peak blast pressure) at a distance D from the vent, kPag

P_{max} is the pressure within the vessel when the vent opens or the rupture pressure of the vessel (if no vent installed), kPag

C1 = 10^((-0.26/A) + 0.49)

A = vent area, m^2

C2 = 1 m

D = distance away from the vent, m

The rupture pressure of weak structures such as grain handling equipment is typically less than 90 kPag (Ref 5). This reference quotes one experiment where a 500 m^3 silo ruptured at 60 kPag with a hole size of 50 m^2.

If a dust explosion were to occur in the 1,000 te silos with an explosion vent designed to rupture at 0.1 kPag (with an estimated reduced pressure within the silo of 0.7 barg) and a combined vent size of 13.56 m^2 then the overpressures at various distances away from the silo are estimated as shown in Table 5.

Table 5 – Overpressures from Dust Explosions

Distance, m	Overpressure, kPag
	1,000 te Silo
5	41
10	21
20	10
30	7
40	5
50	4
60	3

The effects of explosion overpressures are summarised in the following table (Ref 3).

Table 6 – Effects of Explosion Overpressures

OVERPRESSURE, kPa	PHYSICAL EFFECT
3.5	90% glass breakage No fatality, very low probability of injury
7	Damage to internal partitions & Joinery 10% probability of injury, no fatality
14	Houses uninhabitable and badly cracked
21	Reinforced structures distort, storage tanks fail 20% chance of fatality to person in building
35	Houses uninhabitable, rail wagons & plant items overturned. Threshold of eardrum damage, 50% chance of fatality for a person in a building, 15% in the open
70	Complete demolition of houses Threshold of lung damage, 100% chance of fatality for a person in a building or in the open

Given the estimated impact distances in Table 5 and the distances to the nearest boundary to the silos (at least 45 m) then no significant off-site impacts are expected from explosion overpressures.

To estimate the possible maximum horizontal flame length from a vented dust explosion, the following equation is used (Ref 9):

$$\text{Flame Length} = 10 \times V^{1/3} \text{ (m)}$$

Where:

V is the volume of the vessel, m^3

However, no flame length has ever been measured greater than 30 m (even for large volumes) so this should be taken as the upper limit (Ref 10). Other studies in Ref 10 also show that effects of thermal radiation from the fireball is limited to close to the fireball's surface given the short duration. For the 1.000 te silos, the estimated flame length using the above methodology is 30 m.

Typically, the flames from a ruptured or vented vessel travel horizontally and vertically. For the new explosion vents, the flame will travel horizontally given the proposed orientation. For a 30 m flame length, the flames are therefore unlikely to impact people off-site as the silos are at least 45 m from the site's closest boundary.

Hence, given the above consequence assessment, adverse impact from the vented dust explosions is unlikely for off-site personnel and therefore the risk of fatality, injury or property damage is expected to comply with risk criteria in Table 2.

5.2 BUILDING EXPLOSIONS

It is possible that dust explosions could occur in the new bagging area or in the warehouse, e.g. deposited dust is not removed due to failure of the housekeeping program.

Doors, if open, as well as failure of the metal sheeting will limit the impact from confined explosions in buildings. This is supported by historical evidence (Ref 8) where the damage radius of dust explosions is usually limited to the building (or equipment item) in which it occurs and to a very short range outside. Correspondingly, significant adverse impact to people off-site is not expected, in particular, given the large distances to residential areas. The nearest site boundary to the building is approximately 35 m away whilst the nearest residential and shopping areas are over 200 m away.

The packing building has been designed to meet good practice for food safety and housekeeping / cleanliness. The steel work is on the outside of the wall panels to prevent ledges for product to settle on (i.e. reducing the risk of dust explosions).

The controls such as housekeeping, hazardous zoning and permits to work are discussed in more detail in Section 5.3 but these are imperative measures to lower the risk of dust explosions within the new building. As this hazard exists now on-site then the existing safety management systems for prevention of confined dust explosions within buildings need to be implemented to the new building.

5.3 DUST EXPLOSION SAFEGUARDING

For equipment processing a potentially explosive dust, it is generally not possible to always ensure the concentration of the dust is below the lower explosive limit. Rather, safeguarding is required to prevent and/or control the potential explosions as discussed below.

There are no mandatory standards or regulations that dictate the design criteria and features for equipment where dust explosions can occur. However, the main means for safeguarding against dust explosions are as follows.

A discussion of the proposed safeguards for the new equipment is included at the end of this Section.

5.3.1 Dust Free Process

Inherently safer options include operating with the materials being wet rather than dry, i.e. preventing dust formation. Not all processes are suited to this option though, e.g. wheat grains, as self-heating can occur and degradation of the grain can occur.

5.3.2 Dust Control

Measures to control dust and avoiding the explosive range include:

- Avoid large volumes as much as possible, e.g. to avoid equipment items running empty;
- Avoid dust formation by limiting the free-fall;
- Remove the dust at the point of production rather than convey it along ducts where it can accumulate;
- Buildings which contain plant handling flammable dusts should be designed to minimise the accumulation of dust deposits and to facilitate cleaning; and
- Regular housekeeping to avoid dust build-up.

5.3.3 Control of Ignition Sources

Measures used to control ignition sources which could give rise to dust explosions include:

- Avoid direct fired equipment;
- Bonding and earthing for static dissipation;
- Permits to work, training and auditing;
- Regular housekeeping to avoid dusts overheating, e.g. on hot surfaces;
- Hazardous area determination with compliant electrics and instruments;
- Preventative maintenance on equipment to minimise the probability of fault conditions;
- Use appropriate electrical equipment and wiring methods;
- Control smoking, open flames, and sparks;
- Avoid the possibility of a thermite reaction, e.g. aluminium reacting with iron oxide;
- Use separator devices to remove foreign materials capable of igniting combustibles from process materials; and
- Separate heated surfaces and heating systems from dusts.

5.3.4 Inerting

The suspension of a flammable dust in air may be rendered non-explosive by the addition of an inert gas. The main gases used for inerting of dust handling

equipment are nitrogen, carbon dioxide, flue gas and inert gas from a generator, e.g. argon or helium.

Inerting by adding an inert dust is another means to prevent dust explosions. This is mainly done in mining, e.g. coal dust is mixed with ground stone to render the coal dust non-explosive.

5.3.5 Explosion Containment

One option for dealing with a dust explosion is total containment, i.e. design the equipment to withstand the maximum generated pressure. For dust explosions, the maximum generated pressures are quoted as 7 to 12 barg for atmospheric processes or up to 12 times the initial pressure in the equipment item. Hence, if the equipment has a design pressure equal to or exceeding these values then the explosion will be contained with no flames being emitted. Grinding mills are an example of such equipment items which may be made strong enough to withstand a dust explosion.

5.3.6 Explosion Isolation

The two basic methods for explosion isolation are:

- Automatic isolation, e.g. a pressure sensor will send a signal to a fast closing valve to shut and isolation the equipment item or pipe; and
- Material chokes such as rotary valves, screw conveyors with baffle plates and/or part of the helix removed to prevent the conveyor emptying on no feed flow, and self-actuating float valves.

5.3.7 Explosion Suppression

Typically an increase in operating pressure is detected (e.g. pressure rises to 5 kPag) which then results in a suppressant being injected into the equipment item to suppress the flame. By suppressing the flame early, the pressure rise is limited. Suppressants include dry powder and water.

5.3.8 Explosion Venting

Explosion venting is an effective and economic way to provide protection against dust explosions, however, it is only suitable if there is a safe discharge for the material being vented. For equipment within a building, ducting the vent to outside should be done provided it is short, e.g. less than 10 m (detonations can occur in pipes of 10 to 30 m in length).

5.3.9 Equipment Separation

It is possible that an explosion from one equipment item or building could propagate to another. This could be via secondary explosions due to dust lifting and forming a cloud or from projectiles embedding into thin-walled equipment and hence being a point of ignition due to heat. If layout considerations permit, adequately separately higher risk process items or buildings is an inherently safe option.

In practice (Ref 5), the assessment of dust explosion hazards is bound to be subjective because the problem is too complex for quantitative analytical methods to yield an indisputable answer. Therefore, the acceptable safeguards for any given design will vary from company to company. Ref 5 quotes work by Pinkwasser and Haberli who suggest most of the dust explosion hazards in the grain, feed and flour industry can be eliminated by soft means such as training, motivation, improving the organisation, good housekeeping and proper maintenance. All of these safeguards are in-place at Shoalhaven Starches.

When these are combined with the additional measures proposed for the new equipment and building then further risk reduction is achieved. These additional measures include all equipment handling potentially explosive dust is to be designed to ATEX standards including rotary valves for seals, explosion vents, equipment bonding and earthing, minimisation of horizontal surfaces in the buildings where dust can collect, screw feeders to contain plugs to prevent flame propagation, generous separation distances between the building, silos and site boundaries, mechanically filling bags (not pneumatic) and hazardous area zoning with the electrics and instruments to suit the requirements. Therefore, no further analysis of building dust explosions is warranted.

5.4 AIRCRAFT IMPACT AND OTHER EXTERNAL EVENTS

Previous risk assessments (e.g. Ref 11) have shown that the likelihood of an aircraft crash is acceptably low within Australia. Typical frequencies associated with aircraft crashes are:

- Scheduled aircraft $1x10^{-8}$/year; and
- Unscheduled aircraft $4x10^{-7}$/year.

The likelihood of this type of event is acceptably low for a site of this size and location.

Other external events that may lead to propagation of incidents on any site include:

Subsidence	Landslide
Burst Dam	Vermin/insect infestation
Storm and high winds	Forest fire
Storm surge	Rising water courses
Earthquake	Storm water runoff
Breach of security	Lightning
Tidal waves	

These events were reviewed and none of them were found to pose any significant risk to the new facility given the proposed safeguards. Flooding can occur at this site, however, any potential propagation events are unlikely to be significant given that the new equipment and building are being designed for the expected flood conditions.

5.5 CUMULATIVE RISK

As shown in this PHA, the proposed changes to the Shoalhaven Starches site will have negligible impact on the cumulative risk results for the local area as the significant consequential effects such as explosion overpressures are local to the equipment and there are generous separation distances from the building and equipment to the site's boundary.

Therefore it is reasonable to conclude that the development does not make a significant contribution to the existing cumulative risk in the area.

5.6 SOCIETAL RISK

The abovementioned criteria in Table 2 for individual risk do not necessarily reflect the overall risk associated with any proposal. In some cases for instance, where the 1 pmpy contour approaches closely to residential areas or sensitive land uses, the potential may exist for multiple fatalities as the result of a single accident. One attempt to make comparative assessments of such cases involves the calculation of societal risk.

Societal risk results are usually presented as F-N curves, which show the frequency of events (F) resulting in N or more fatalities. To determine societal risk, it is necessary to quantify the population within each zone of risk surrounding a facility. By combining the results for different risk levels, a societal risk curve can be produced.

In this study of the new equipment and building, the risk of fatality does not extend significantly from the sources and is therefore well away from the residential areas. The concept of societal risk applying to residential population is therefore not applicable for the new equipment.

5.7 RISK TO THE BIOPHYSICAL ENVIRONMENT

The main concern for risk to the biophysical environment is generally with effects on whole systems or populations.

As the new equipment is being designed to be above the expected flood levels then significant environmental impact is not expected. Importantly, any spilt material will be contained in the area or via the environmental farm.

Whereas any adverse effect on the environment is obviously undesirable, the results of this study show that the risk of losses of containment impacting the environment is broadly acceptable.

From the analysis in this report, no incident scenarios were identified where the risk of whole systems or populations being affected by a release to the atmosphere, waterways or soil is intolerable.

6 CONCLUSION AND RECOMMENDATIONS

The risks associated with the proposed new packing plant at the Shoalhaven Starches Bomaderry site have been assessed and compared against the DoPE risk criteria.

In summary:

- The potential hazardous events associated with the new equipment and building are primarily dust explosions. Given the location of the new equipment then no significant adverse off-site impacts to residential areas or similar are expected. Correspondingly, all risk criteria in HIPAP 4 are expected to be satisfied for this proposal;
- The risk of propagation to neighbouring equipment is low given the proposed facility location and generous separation distances; and
- Societal risk, environmental risk and transport risk are all considered to be broadly acceptable.

The following recommendations are made from this review:

1. The existing safety management systems, e.g. maintenance procedures, operating procedures, training and emergency response plans, will need to be updated to reflect the proposed changes; and
2. All explosion vents should be positioned to avoid impact to personnel and sensitive equipment.

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ANNEXURE 6

Noise Impact Assessment

prepared by

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ANNEXURE 6

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Environmental Noise Impact Assessment

Proposed Modification to Packing Plant & Container Storage Area
Shoalhaven Starches, Bolong Road, Bomaderry, NSW

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TABLE OF CONTENTS

1.0 EXECUTIVE SUMMARY 5
2.0 CONSULTING BRIEF 7
3.0 SITE AND DEVELOPMENT DESCRIPTION 8
3.1 Site Description 8
3.2 Development Description 8
4.0 ACOUSTICAL CRITERIA 10
4.1 Department of Planning and Environment 10
4.1.1 Existing Project Approval 10
4.1.2 Department's Requirement for Modification Assessment 10
4.2 Environment Protection Licence 883 11
4.3 Shoalhaven Starches Noise Management Plan 11
4.4 EPA Construction Noise Guideline 11
4.5 Project Specific Noise Criteria 14
5.0 PACKING PLANT AND CONTAINER AREA OPERATIONAL NOISE EMISSION 15
5.1 Packing Plant Noise Levels 15
5.2 Container Storage Area 15
5.3 Predicted Noise Levels 16
6.0 CONSTRUCTION NOISE EMISSION 17
7.0 NOISE CONTROL RECOMMENDATIONS 18
7.1 Project Approved Recommendations 18
7.2 Construction of the Packing Plant Building 18
7.3 Additional Mechanical Plant and Equipment 19
7.4 Container Area Noise Barriers 19
7.5 Construction Noise 20
8.0 NOISE IMPACT STATEMENT 21

TABLE OF TABLES

Table 1 Rating Background Levels 12

Table 2 L_{eq} Noise Management Levels from Construction Activities 13

Table 3 L_{10} Sound Power Levels – Packing Plant 15

Table 4 L_{10} Sound Power Levels – Container Loading and Storage 16

Table 5 Predicted Noise Levels at Receptor Locations – Packing plant and Container Storage Area 16

Table 6 Construction Equipment – L_{eq} Sound Power Levels 17

Table 7 Predicted Noise Levels at Receptor Locations – Construction Phase 17

1.0 EXECUTIVE SUMMARY

Shoalhaven Starches Pty Ltd is part of the Manildra Group of companies and their existing Bomaderry complex produces a range of products including starch, gluten, glucose, ethanol and stock feed.

Their existing facility is located on the southern side of Bolong Road, Bomaderry, NSW, on the northern side of the Shoalhaven River. The surrounding area is a mix of commercial, industrial and residential premises. The nearest residences are located in the township of Bomaderry to the north-west and across the Shoalhaven River in Nowra to the south and Terara to the south-east.

Shoalhaven Starches also owns industrial land on the opposite side of Bolong Road, identified as Lot 16 DP 1121337 and Lot 2 DP 538289 Bolong Road and Railway Street, Bomaderry.

In 2009 Shoalhaven Starches received Project Approval from the Minister for Planning for the Shoalhaven Starches Expansion Project (SSEP), reference 06_0228. This project included the establishment of a new packing plant and container storage area on this land on the northern side of Bolong Road.

Shoalhaven Starches now propose to modify the approved packing plant and container storage area on this site as previously approved under the SSEP.

The development will comprise an additional rail spur line, an increase in the floor area of the packing plant building and its slight relocation, as shown in the attached Appendix A. The location of the container storage area will remain unchanged.

The packing plant building will contain predominantly automated packing lines, which will be fed by external silos. Product will be 'blown' into the silos from the mills within the existing complex via blow lines spanning Bolong Road.

Packaged product will then either be loaded into shipping containers for dispatch via train or loaded into trucks via silos at the south eastern end of the packing plant.

Forklifts will be used to load and unload trains as well move containers around the storage area.

This report has been prepared in response to requirements issued by the NSW Department of Planning and Environment, which requires an assessment of the proposed modification in accordance with the NSW Industrial Noise Policy and Interim Construction Noise Guideline, including a description of the proposed mitigation measures. Also required, is a review of the modification against the existing EPL conditions and any noise reduction programs.

Shoalhaven Starches operates under Environment Protection Licence Number 883 which sets noise limits for the overall operation of the complex. Noise goals have been designed for the proposal so as to ensure existing noise levels are not increased by the introduction of the new plant and equipment.

The noise goals for any new plant are a minimum 10 dB below the EPL noise limits and range between 28 dBA and 32 dBA depending upon the residential receptor location.

These goals are also in accordance with Shoalhaven Starches Noise Management Plan originally prepared on 31 October 2009 and revised 7 September 2010 under the Project Approval conditions for the SSEP.

Noise modelling has been undertaken using measured noise levels from existing indicative plant and equipment and similar processes at the existing complex.

Noise control recommendations approved as part of the Project Approval will be sufficient for the proposed modification with the exception of a required increase to the height of the barrier to the north and west of the container storage area, as outlined in Section 7 of this report.

Providing all recommendations are satisfactorily implemented the level of noise emitted by the proposal will comply with the Shoalhaven Starches Environment Protection Licence noise limits and Shoalhaven Starches' Noise Management Plan.

The construction works will consist of preliminary earthworks, construction of the rail spur, potential piling work, pouring of the concrete slabs and the erection and fit-out of the packing plant.

Calculations show that the level of noise emission from the construction phase will be within noise management levels set by the NSW EPA's *Interim Construction Noise Guideline* at all receptor locations for the majority of the construction phase. There is potential for piling to exceed the noise management levels at the closest receptors by up to approximately 4 dB. This is not considered to be a significant exceedence however, it is recommended that a construction noise and vibration management plan be commissioned detailing best practices to minimise the noise impact from piling, if required. The plan should include the recommendation to conduct piling during the day time hours only as recommended in the Project Approval.

2.0 CONSULTING BRIEF

Day Design Pty Ltd was engaged by Shoalhaven Starches Pty Ltd to assess the potential environmental noise impact of proposed modifications to the approved packing plant and container storage area to be located on the northern side of Bolong Road opposite the existing complex in Bomaderry, NSW.

This commission involves the following:

Scope of Work:

- Inspect the site and environs
- Prepare a site plan identifying the proposal and nearby noise sensitive locations
- Establish acceptable noise level criteria and design goals
- Quantify noise emission from the proposal
- Calculate the level of noise emission, taking into account building envelope transmission, distance loss, screen walls, etc
- Consider noise emission from the construction phase of the development
- Provide recommendations for noise control if necessary
- Prepare an Environmental Noise Impact Assessment Report.

3.0 SITE AND DEVELOPMENT DESCRIPTION

3.1 Site Description

The Shoalhaven Starches complex is located on the southern side of Bolong Road across the Shoalhaven River from Nowra.

The proposed modified packing plant and container storage area will be located on the northern side of Bolong Road, opposite the existing complex. Specifically Lot 16 DP 1121337 and Lot 2 DP 538289 Bolong Road and Railway Street, Bomaderry.

The surrounding area is a mix of commercial, industrial and residential premises.

The nearest residential locations to the proposal are as follows:-

- Location 1 – Nobblers Lane, Terara approximately 1750 metres to the south east
- Location 2 – Riverview Road, Nowra approximately 1160 metres to the south west;
- Location 3 – Meroo Street, Bomaderry approximately 310 metres to the north west;
- Location 4 – Coomea Street, Bomaderry approximately 420 metres to the north west;

Locations are listed in keeping with the order shown in the Environment Protection Licence (see Section 4.1 of this report) and are based on the closest noise producing area on the site to the residential area. All noise producing plant and equipment will be at varying distances from the respective receptors and these varying distances are used in calculations in Section 5.3 of this report.

Shoalhaven Starches, the proposed site, surrounding area and receptor locations are shown in Figure 1.

3.2 Development Description

In 2009 Shoalhaven Starches received Project Approval from the Minister for Planning for the Shoalhaven Starches Expansion Project (SSEP). This project, amongst other components, included the establishment of a new packing plant and container storage area on the northern side of Bolong Road.

It is now proposed to modify the approved packing plant by increasing the floor area and slightly relocating it on the site as well as providing an additional rail spur line to service the new plant, as shown in the attached Appendix A.

The modified packing plant building will contain predominantly automated packing lines, which will be fed by external silos. Product will be 'blown' into the silos from the mills within the existing complex via blow lines spanning Bolong Road.

The silos will then feed raw materials into the automated packing plant for bulk bag and paper bag packing. The automated process will fill bags, heat seal and stack pallets using a

robot stacker / palletiser. Pallets will then be wrapped in shrink wrap with a stretch wrapping machine ready for loading into containers.

Containers will then be loaded on to the train along the new rail spur line using forklifts.

The train will also arrive with containers for unloading and this will be done using forklifts and containers stored within the storage area as indicated in Appendix A.

Figure 1. Location Plan – Shoalhaven Starches, Bomaderry *(source: Google Maps Imagery © 2014).*

4.0 ACOUSTICAL CRITERIA

This section presents the noise guidelines applicable to this proposal and establishes the project specific noise criteria.

4.1 Department of Planning and Environment

4.1.1 Existing Project Approval

Project Approval for Application No. 06_0228, provided by the Minister for Planning, dated January 2009, Schedule 2, Condition 2, 'Terms of Approval' states:-

"The proponent shall carry out the project generally in accordance with the:

a) EA and associated site plans (see Appendix 2);

b) Statement of commitments; and

c) Conditions of this approval."

The original Project Approval incorporates noise mitigation measures recommended in the *'Acoustical Assessment, Proposed Ethanol Upgrade, Shoalhaven Starches'* – prepared by The Acoustic Group Pty Ltd, ref 38.3849.R52:ZJM,dated 26 June 2008. This document forms part of the EA and statement of commitments and it is implicit that the noise control recommendations within this document are required to be implemented as part of the Project Approval. These are addressed in Section 7 of this report.

Schedule 3, Conditions 11 to 14 inclusive of the Project Approval, also refer to noise emission and are summarised as follows:-

Condition 11 relates to restricted hours of construction activities. Condition 12 reiterates the noise limits contained with Environment Protection Licence 883. Condition 13 requires that all feasible and reasonable noise mitigation measures must be implemented during the construction phase of the project. Condition 14 required the preparation of a noise management plan (see Section 4.3 below).

4.1.2 Department's Requirement for Modification Assessment

In response to a request for information relating to noise emission from the proposed modification to the approved packing plant and container storage area, the Department of Planning and Environment, states:-

"Noise - An assessment in accordance with the EPA's Industrial Noise Policy and Interim Construction Noise Guideline, including a description of the proposed mitigation measures. A review of the modification against the existing EPL conditions and any noise reduction programs."

4.2 Environment Protection Licence 883

Shoalhaven Starches operates under Environment Protection Licence 883 issued by the NSW Environment Protection Authority.

Section L5 'Noise Limits' of the licence states:-

"L5.1 the $L_{A10\ (15min)}$ sound pressure level contribution generated from the premises must not exceed the following levels when measured at or near the boundary of any residential premises:

a) 38 dBA at locations in Terara on the south side of the Shoalhaven River;

b) 38 dBA at locations in Nowra on the south side of the Shoalhaven River;

c) 42 dBA at locations in Meroo Street, Bomaderry;

d) 40 dBA at other locations in Bomaderry."

These noise limits apply to the overall operation of the Shoalhaven Starches complex.

4.3 Shoalhaven Starches Noise Management Plan

Previous approval for the Shoalhaven Starches Expansion Project, required the preparation of a Noise Management Plan to address and manage noise emission from the expansion project.

The Shoalhaven Starches Noise Management Plan originally prepared 31 October 2009 and revised 7 September 2010 addresses, among other things, acoustic criteria relating to the Shoalhaven Starches complex and any new developments. Section 3 of the plan lists noise limits from the Environmental Protection Licence as shown in Section 4.1 above and states:-

"Compliance testing conducted on a regular basis on behalf of the Mill [Shoalhaven Starches complex] *has found noise emission from the premises satisfies the EPA criteria as a result of works on the Shoalhaven Starches site. In order to ensure that there is no increase in noise emission from the subject premises, with respect to the noise criteria nominated by the EPA in License Condition 6.3* [now 5.1]*, the design goal for such additional plant should be at least 10 dB below the criteria nominated by the EPA."*

4.4 EPA Construction Noise Guideline

The NSW EPA published the *Interim Construction Noise Guideline* in July 2009. While some noise from construction sites is inevitable, the aim of the Guideline is to protect the majority of residences and other sensitive land uses from noise pollution most of the time.

The Guideline presents two ways of assessing construction noise impacts; the quantitative method and the qualitative method.

The quantitative method is generally suited to longer term construction projects and involves predicting noise levels from the construction phase and comparing them with noise management levels given in the guideline.

The qualitative method for assessing construction noise is a simplified way to identify the cause of potential noise impacts and may be used for short-term works, such as repair and maintenance projects of short duration.

In this instance the entire construction phase may take several months although significant noise producing aspects, such as piling, if required, will last a total of approximately two weeks. Consideration is given to the potential for noise impact from construction activities on residential receptors in Section 6 of this report.

Table 2 in Section 4 of the Guideline sets out noise management levels at affected residences and how they are to be applied during normal construction hours. The noise management level is derived from the rating background level (RBL) plus 10 dB in accordance with the Guideline. This level is considered to be the 'noise affected level' which represents the point above which there may be some community reaction to noise.

Day Design has carried out numerous noise surveys in Nowra, Bomaderry and Terara and has found daytime background noise levels range between 33 and 40 dBA depending on the location, as shown in Table 1 below.

Table 1 Rating Background Levels

Noise Measurement Location	Time Period	Rating Background Level
135 Terara Road, Terara March 2012	Day (7 am to 6 pm)	**33 dBA**
250 Bolong Road, Bomaderry March 2014	Day (7 am to 6 pm)	**38 dBA**
Shoalhaven Village Caravan Park, Nowra - March 2012	Day (7 am to 6 pm)	**40 dBA**

For the purpose of determining the potential for community reaction to noise emission from construction activities, previously measured background noise levels in the vicinity of each receptor location have been used to determine the noise management levels as shown in Table 2 below.

Table 2 L_{eq} Noise Management Levels from Construction Activities

Receptor Location	Noise Management Level	How to Apply
Location 1 (Terara) Location 2 (Nowra) Locations 3 & 4 (Bomaderry)	**43 dBA** (33 + 10) **50 dBA** (40 + 10) **48 dBA** (38 + 10)	The noise affected level represents the point above which there may be some community reaction to noise. ▪ Where the predicted or measured $L_{Aeq\ (15\ min)}$ noise level is greater than the noise affected level, the proponent should apply all feasible and reasonable* work practices to meet the noise affected level. ▪ The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB(A)	The highly noise affected level represents the point above which there may be strong community reaction to noise. ▪ Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: 1. times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences) 2. if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

* Section 6, "work practices" of The *Interim Construction Noise Guideline*, states:- *"there are no prescribed noise controls for construction works. Instead, all feasible and reasonable work practices should be implemented to minimise noise impacts.*

This approach gives construction site managers and construction workers the greatest flexibility to manage noise".

Definitions of the terms feasible and reasonable are given in Section 1.4 of the Guideline.

The 'highly noise affected' level of 75 dBA represents the point above which there may be strong community reaction to noise. This level is provided in the Guideline and is not based on the RBL.

4.5 Project Specific Noise Criteria

When all the above factors are considered, we find that the most stringent noise criteria for the proposed modified packing plant and container storage area are as follows:-

Operational Phase (Environment Protection Licence noise limits less 10 dB) -

- *28 dBA ($L_{10,\ 15\ minute}$) at locations in Terara on the south side of the Shoalhaven River;*
- *28 dBA ($L_{10,\ 15\ minute}$) at locations in Nowra on the south side of the Shoalhaven River;*
- *32 dBA ($L_{10,\ 15\ minute}$) at locations in Meroo Street, Bomaderry;*
- *30 dBA ($L_{10,\ 15\ minute}$) at other locations in Bomaderry.*

Construction Phase Noise Management Levels

- *43 dBA ($L_{eq,\ 15\ minute}$) at locations in Terara;*
- *48 dBA ($L_{eq,\ 15\ minute}$) at locations in Bomaderry; and*
- *50 dBA ($L_{eq,\ 15\ minute}$) at locations in Nowra.*

The residential criteria apply at the most-affected point on or within the residential property boundary or, if that is more than 30 metres from the residence, at the most-affected point within 30 metres of the residence. For upper floors, the noise is assessed outside the nearest window.

5.0 PACKING PLANT AND CONTAINER AREA OPERATIONAL NOISE EMISSION

5.1 Packing Plant Noise Levels

The main sources of noise associated with the operation of the packing plant will be the plant and equipment located within the building and any external silo motors.

Day Design Pty Ltd has conducted several noise surveys at Shoalhaven Starches' complex including noise measurements within and around the existing interim packing plant.

Noise measurements were taken in terms of L_{10} sound pressure levels and have been used to calculate the L_{10} octave band, and overall 'A' frequency weighted sound power levels, in decibels re: 1 pW, shown in Table 3 below.

Table 3 L_{10} Sound Power Levels – Packing Plant

Mechanical Plant	dBA	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
Enclosed Hand Packer Blower	**94**	86	81	87	82	91	89	84	75
Packer Head	**90**	86	77	82	79	82	85	84	83
Heat Sealer	**91**	83	88	89	83	84	82	81	88
Robot / Palletiser	**90**	87	88	87	85	86	83	80	79
Silo Motor	**78**	85	73	74	77	74	70	64	53
Vacuum Cleaner	**99**	74	75	83	86	93	95	92	88
Forklift (Crown CD25S)	**94**	98	89	83	83	93	85	73	68
Truck Movement	**101**	104	104	98	97	96	95	90	92

5.2 Container Storage Area

The container area will be located to the south eastern side of the packing plant as shown in the attached Appendix A. The location and siting of the container storage area will remain largely unchanged from that originally approved under the 2009 Project Approval. Containers will be unloaded and loaded onto the train along the new rail spur line and moved around the area using a 32 ton forklift. Day Design has carried out noise measurements at the existing Shoalhaven Starches complex of 32 ton forklifts loading and unloading containers from a freight train and moving containers around the area.

Table 4 below provides a schedule of the octave band and overall 'A' frequency weighted sound power levels of noise sources associated with the container area.

Table 4 L_{10} Sound Power Levels – Container Loading and Storage

Mechanical Plant	dBA	Sound Power Levels (dB) at Octave Band Centre Frequencies (Hz)							
		63	125	250	500	1k	2k	4k	8k
Freight Train Shunting	**99**	110	104	100	97	92	90	87	80
Hyster Forklift Loading / Unloading or Moving Containers	**100**	104	109	98	96	94	93	86	80

5.3 Predicted Noise Levels

Knowing the sound power level of a noise source (see Tables 3 and 4 above), the sound pressure level (as measured with a sound level meter) can be calculated at a remote location using suitable formulae to account for building envelope transmission, distance losses, etc.

Table 5 below shows the predicted noise level at each of the receptor locations from the ongoing operation of the proposal.

Table 5 Predicted Noise Levels at Receptor Locations – Packing plant and Container Storage Area

Description	Predicted Noise Level $L_{10,\ 15\ minute}$ (dBA) at Receptor Location			
	Location 1	Location 2	Location 3	Location 4
Packing Plant	21	23	29	27
Container Area	25	21	30	28
Combined	**26**	**26**	**32**	**30**
Acceptable Noise Limit ($L_{10,\ 15\ minute}$)	28	28	32	30
Complies	**Yes**	**Yes**	**Yes**	**Yes**

The above calculations and predictions consider distance loss to each receptor and the following:-

- Packing plant includes truck movements and allowable sound level for external plant outlined in Section 7;
- Container area considers cumulative impact of two forklifts moving containers and not the cumulative impact of the locomotive shunting as outlined in Section 7.1;
- Packing plant building is constructed as outlined in Section 7.2;
- Sound barrier screens are erected around the container area as outlined in Section 7.4.

6.0 CONSTRUCTION NOISE EMISSION

The construction process will involve preliminary earthworks, pouring of concrete slabs, erection and fit-out of the packing plant building and silos.

It is likely that piling will be required to establish the footing of the new structures.

Table 6 below shows a schedule of sound power levels for typical construction equipment likely to be used at the site.

Table 6 Construction Equipment – L_{eq} Sound Power Levels

Description	L_{eq} Sound Power Level (dBA)
Piling Rig	118
Mobile Crane (Diesel)	110
Excavator – 30 T	110
Concrete Truck / Pump	105
Grinder	105
Power Saw	101

Table 7 below shows the predicted level of noise emission from construction activities at each of the receptor locations.

Table 7 Predicted Noise Levels at Receptor Locations – Construction Phase

Description	Predicted Noise Level $L_{eq,\ 15\ minute}$ (dBA) at Receptor Location			
	Location 1	Location 2	Location 3	Location 4
Construction Activity*	37 – 43	41 – 47	45 – 52	42 – 49
Acceptable Noise Limit ($L_{eq,\ 15\ minute}$)	43	50	48	48
Complies	✓	✓	**No up to + 4 dB during piling**	**No up to + 1 dB during piling**

* The range provided is with and without piling activity.

7.0 NOISE CONTROL RECOMMENDATIONS

7.1 Project Approved Recommendations

The original Project Approval incorporates noise mitigation measures recommended in *'Acoustical Assessment, Proposed Ethanol Upgrade, Shoalhaven Starches'* – prepared by The Acoustic Group Pty Ltd, ref 38.3849.R52:ZJM,dated 26 June 2008.

Recommendations made in the above-mentioned report included the following:-

- *"Walls, roof/ceiling of the packing plant is to be constructed of material having an Rw of not less than 35 dBA;*
- *The forklift (new item) that is used for the loading and stacking of containers is to have a maximum sound pressure level of 80 dBA at 1 metre;*
- *The northern end of the container loading area is to have solid masonry walls not less than 8.5 metres in height and the western and eastern end of the container loading area is to have solid masonry walls not less than 8 metres in height;*
- *We have been instructed that there will be no train movements on the spur line that forms part of the container loading area between the night time period of 10 pm to 7 am;*
- *As part of the management plan for the container loading area during the night time period (10 pm to 7 am) the forklift trucks will only stack two containers high at locations within 10 metres of the wall and only one container high above the ground floor locations more than 10 metres from the wall. No loading of the train in the proposed container loading area will take place during the night time period."*

Following an assessment of the proposed modification, minor amendments to the approved noise control measures are required as detailed below.

7.2 Construction of the Packing Plant Building

The following recommendations with regard to building construction are in keeping with the Project Approval and provide additional detail.

Walls

The external walls of the packing plant building should have a minimum weighted sound reduction index (R_w) 33.

Roof / Ceiling

The roof and ceiling of the building should have a minimum weighted sound reduction index (R_w) 33.

Openings and Container Loading Area

Acoustically untreated openings in the building should not exceed a total of 36 m^2 and be located in the south eastern façade, or south eastern end of the north western or south western facades only (see Appendix B).

Roller door openings in the south western façade of the building should remain closed when containers are not being loaded in this location.

External Doors

All external doors should be of minimum 44 mm thick, solid core timber construction in well-sealed frames.

7.3 Additional Mechanical Plant and Equipment

At the time of writing this report it is not known what, if any significant noise producing mechanical plant or equipment may be located externally to the packing plant building.

Noise predictions in Table 5 assume there are five (5) silo motors each with a maximum sound power level (L_w) of 78 dBA, which will be acceptable without additional noise controls.

A final assessment should be carried out prior to the issue of a Construction Certificate once details of any external plant, if any, are known. Any items of externally located plant which exceed the allowable sound power level of 78 dBA may require additional acoustical treatment.

We are confident that the level of noise emission from the proposal will, or can be controlled to, meet the acceptable noise limits at all receptor locations.

7.4 Container Area Noise Barriers

The forklifts intended to be used will operate a sound pressure level that will exceed that envisaged by the original Project Approval. Two Hyster forklifts, as detailed in Table 4 of this report, will be used in the container storage area to unload the train and move containers.

We therefore recommend erecting sound barrier screens along the north western, north eastern and south western boundaries of the container area as shown in the attached Appendix C and as follows:-

- Along the entire length of the north western boundary of the area and returning along the north eastern boundary to meet the packing plant building to a minimum height of 10 metres above the finished ground level of the container storage area; and
- Along the south western boundary of the site on the south western side of the site and to the south west of the rail spur line to a minimum height of 7.8 metres above the finished ground level of the container storage area;

- The south western barrier should overlap by a minimum 2 metres where it separates to accommodate the rail spur (see Appendix C);
- Sound barriers may be constructed from, for example, masonry, shipping containers, 9 mm fibre cement sheet on both sides of 92 mm steel posts, a proprietary modular wall system with a minimum weighted sound reduction index (R_w) 20;
- Barriers should be constructed without holes or gaps other than a maximum 50 mm at the base;
- All sound barriers should remain in place at all times;
- The locomotive should not be used to shunt rail cars whilst being loaded or unloaded;
- All other recommendations forming the Project Approval, not superseded in this report should be implemented and maintained (as detailed in Section 7.1);

7.5 Construction Noise

The Project Approval prescribes allowable operation hours for construction activities in Clause 11 and Clause 13 states:-

"During construction, the Proponent shall prepare and implement all reasonable and feasible measures to minimise the construction noise impacts of the project."

It can be seen from Table 7 that the construction noise management levels are likely to be met at each receptor location during general construction activity, with the exception of piling. During piling (if required) there is potential for the noise management levels to be exceeded at receptors 3 and 4, by up to 4 dB, on some occasions. This is not considered a signifant exceedence during day time hours for short and sporadic duration.

However, a construction noise management plan should be provided in accordance with NSW EPA's *Interim Construction Noise Guideline* and to satisfy Condition 13 of the Project Approval.

8.0 NOISE IMPACT STATEMENT

An assessment of the potential noise impact from the proposed construction and operation of a new packing plant and container storage area on Bolong Road, Bomaderry, NSW has been undertaken.

Calculations show that the level of noise emission from the operation of the facility will be within the noise design goals derived from Environment Protection Licence 883 noise limits at each receptor location. This is providing noise control recommendations made in Section 7 of this report are implemented and adhered to.

Matthew Harwood, MAAS
Senior Acoustical Consultant

for and on behalf of Day Design Pty Ltd

AAAC MEMBERSHIP

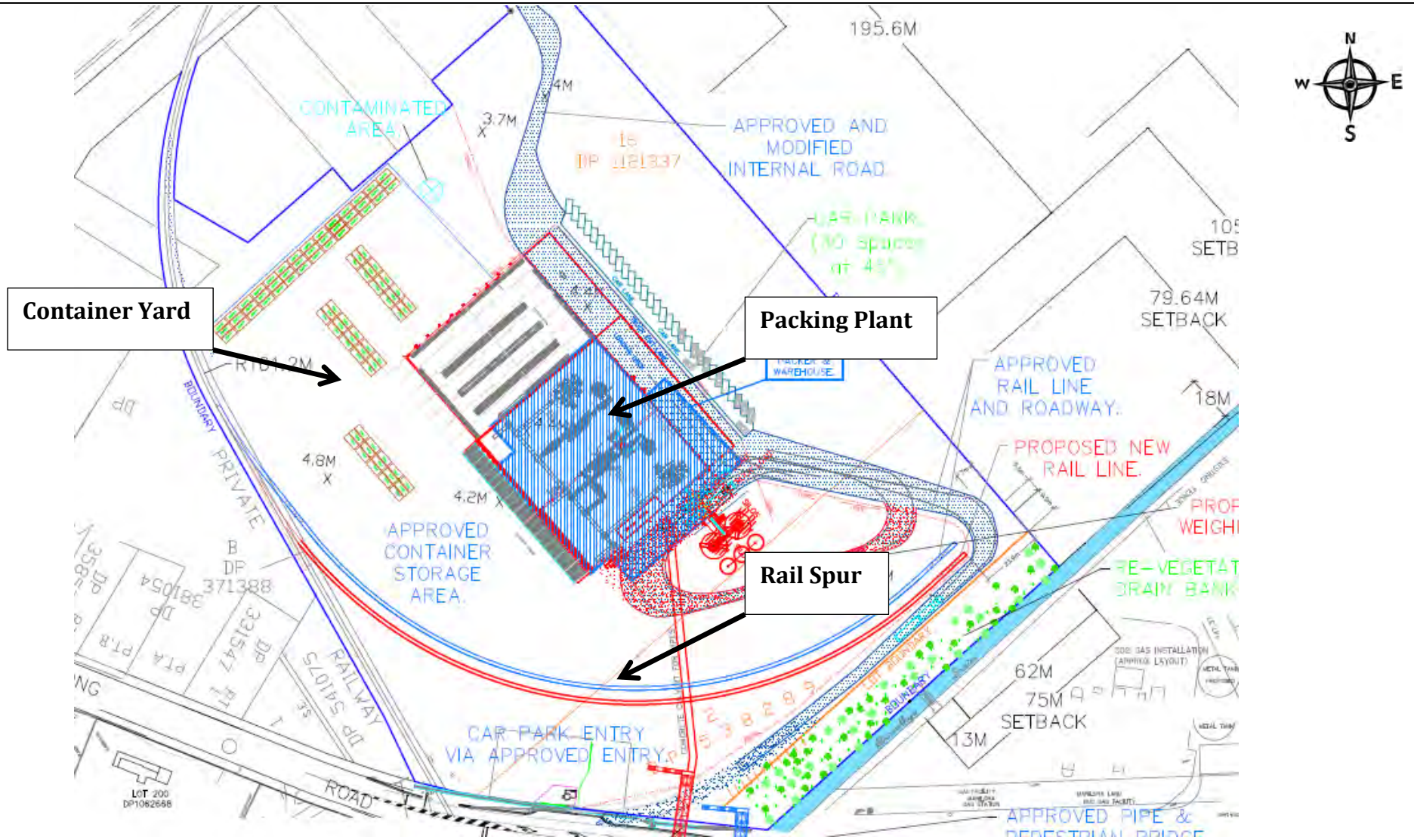
Day Design Pty Ltd is a member company of the Association of Australian Acoustical Consultants, and the work herein reported has been performed in accordance with the terms of membership.

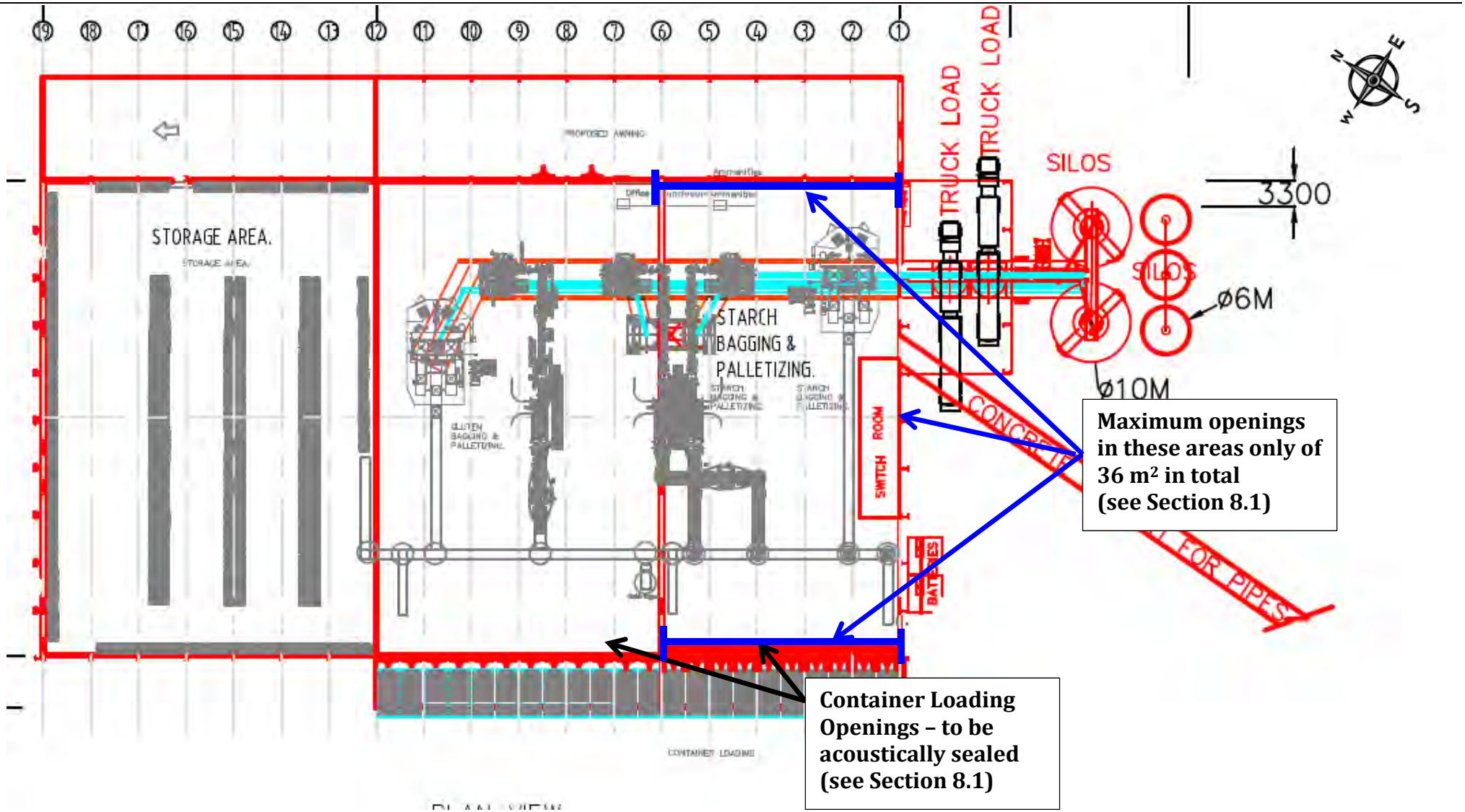
Attachments:

Appendix A – Proposed Site Layout

Appendix B – Packing Plant Floor Plan

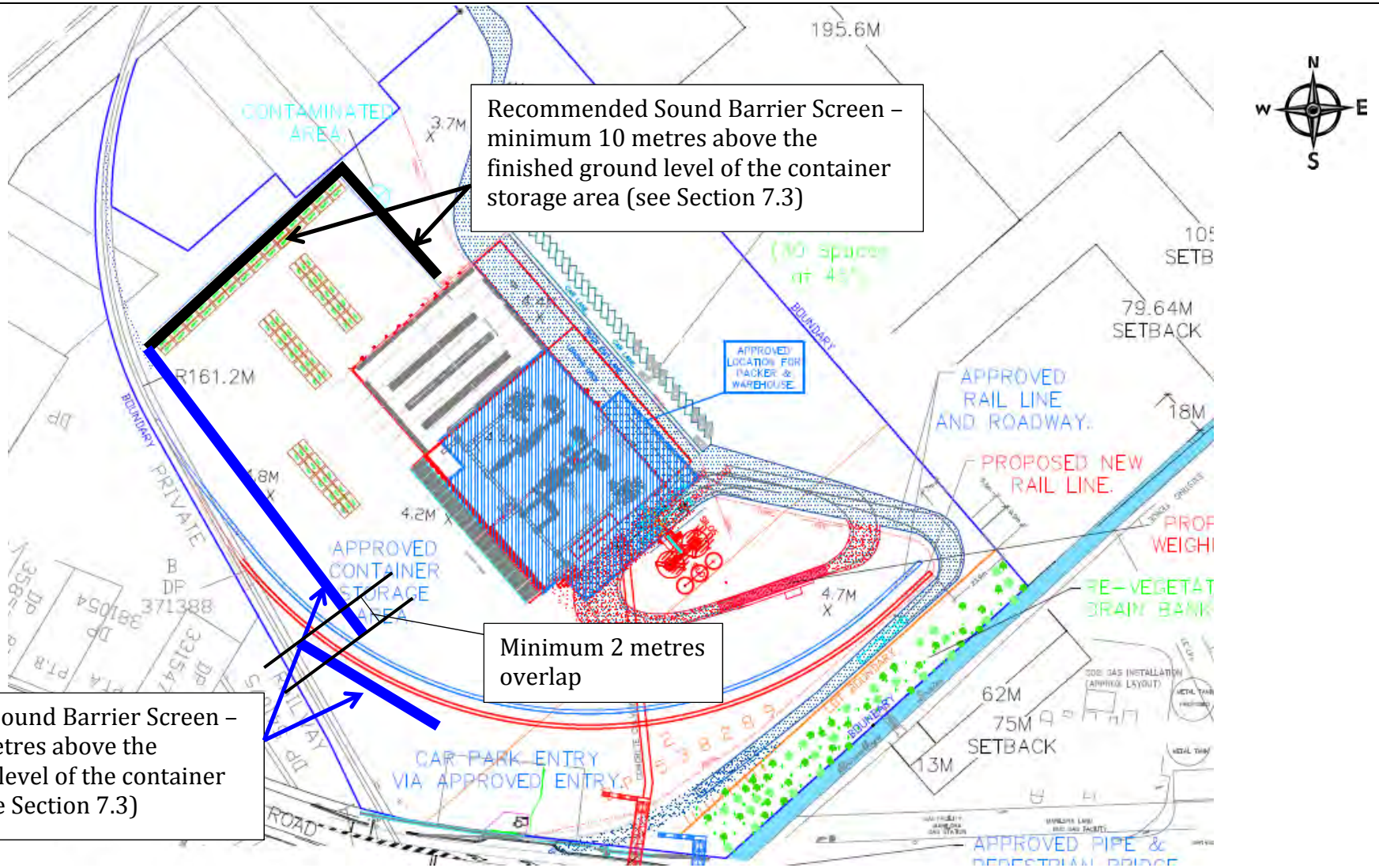
Appendix C – Container Storage Area Sound Barrier Recommendations


Container Yard
Packing Plant
Rail Spur
195.6M
CONTAMINATED AREA
APPROVED AND MODIFIED INTERNAL ROAD
APPROVED CONTAINER STORAGE AREA
APPROVED RAIL LINE AND ROADWAY.
PROPOSED NEW RAIL LINE.
79.64M SETBACK
18M
62M
75M SETBACK
13M
CAR PARK ENTRY VIA APPROVED ENTRY
APPROVED PIPE &
PRIVATE
B DP 371388
RAILWAY
ROAD
LOT 200 DP1062688
N
E
S
W


STORAGE AREA.
STARCH BAGGING & PALLETIZING.
GLUTEN BAGGING & PALLETIZING.
SWITCH ROOM
TRUCK LOAD
TRUCK LOAD
SILOS
3300
SILOS
ø6M
ø10M
CONCRETE
FOR PIPES
CONTAINER LOADING
Maximum openings in these areas only of 36 m² in total (see Section 8.1)
Container Loading Openings – to be acoustically sealed (see Section 8.1)

Proposed Container Storage Area – Bolong Rd, Bomaderry
Recommended Sound Barrier Screening (not to scale)

5843-1
Appendix C



ANNEXURE 7

Air Quality Impact Assessment

prepared by

Stephen Environmental Management Australia

ANNEXURE 7

Stephenson

Environmental Management Australia

AIR QUALITY IMPACT ASSESSMENT

PROPOSED MODIFICATIONS TO APPROVED PACKING PLANT

SHOALHAVEN STARCHES

BOLONG ROAD, BOMADERRY

PROJECT NO.: 5591/S23968A/15

DATE OF ISSUE: 21 DECEMBER 2015

PREPARED FOR COWMAN STODDART ON BEHALF OF THE MANILDRA GROUP

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AIR QUALITY IMPACT ASSESSMENT

PROPOSED MODIFICATIONS TO APPROVED PACKING PLANT

SHOALHAVEN STARCHES

BOLONG ROAD, BOMADERRY

PROJECT NO.: **5591/S23968A/15**

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PREPARED FOR COWMAN STODDART ON BEHALF OF THE MANILDRA GROUP

P W STEPHENSON

A NAGHIZADEH

TABLE OF CONTENTS

1 INTRODUCTION 1
2 THE SITE 2
3 PROPOSED PACKING PLANT MODIFICATION OPERATIONS 6
4 CONSTRUCTION DUST IMPACTS 7
5 EMISSION MONITORING AT EXISTING PACKING PLANT 8
6 IMPACT ASSESSMENT CRITERIA 9
6.1 ODOUR IMPACT ASSESSMENT CRITERIA 9
6.1.1 ADJUSTMENT FOR PEAK-TO-MEAN RATIOS 10
6.2 TOTAL SUSPENDED PARTICULATE MATTER IMPACT ASSESSMENT CRITERIA 11
7 DISPERSION MODELLING INPUT DATA 12
7.1 TERRAIN INPUT DATA 12
7.2 METEOROLOGICAL INPUT DATA 12
7.3 BUILDING INPUT DATA 12
7.4 RECEPTORS OF INTEREST 13
7.5 EMISSION INPUT DATA 13
8 IMPACT ASSESSMENT PREDICTIONS 18
9 CONCLUSIONS 21
APPENDIX A – PACKING PLANT EMISSION SURVEY 2015 I
APPENDIX B – ODOUR EMISSION INVENTORY 2008 I
APPENDIX C – TSP EMISSION INVENTORY 2008 I

TABLE OF TABLES

TABLE 5-1 AVERAGE EMISSION RESULTS EXISTING PACKING PLANT NOVEMBER 2015 8
TABLE 6-1 IMPACT ASSESSMENT CRITERIA FOR COMPLEX ODOROUS AIR POLLUTANTS 9
TABLE 6-2 PEAK-TO-MEAN FACTORS 10
TABLE 6-3 IMPACT ASSESSMENT CRITERIA FOR TOTAL SUSPENDED PARTICULATE MATTER 11
TABLE 7-1 PACKING PLANT EMISSION INPUT DATA 13
TABLE 7-2 PHYSICAL STACK DATA – PROPOSED MODIFIED PACKING PLANT 14
TABLE 8-1 PROPOSED MODIFIED PACKING PLANT PREDICTED ODOUR GLC 18
TABLE 8-2 PROPOSED MODIFIED PACKING PLANT PREDICTED TSP GLC 18

TABLE OF FIGURES

FIGURE 2-1 SHOALHAVEN STARCHES LOCATION 2
FIGURE 2-2 PACKING PLANT OVERALL SITE PLAN 3
FIGURE 2-3 SHOALHAVEN STARCHES, BOMADERRY - ELEVATION 4
FIGURE 2-4 SHOALHAVEN STARCHES, PACKING PLANT DETAIL 5
FIGURE 7-1 ANNUAL WIND ROSE- JANUARY 1ST –DECEMBER 31ST 2013 15
FIGURE 7-2 BUILDING INPUT DATA 16
FIGURE 7-3 RECEPTORS OF INTEREST LOCATIONS 17
FIGURE 8-1 PREDICTED ODOUR CONCENTRATIONS, PROPOSED MODIFIED PACKING PLANT 19
FIGURE 8-2 PREDICTED TSP CONCENTRATIONS, PROPOSED MODIFIED PACKING PLANT 20

1 INTRODUCTION

Stephenson Environmental Management Australia (SEMA) was engaged by Cowman Stoddart Pty Ltd on behalf of the Manildra Group to undertake an Air Quality Impact Assessment (AQIA) for proposed modifications to be made to the approved packing plant at Bolong Road, Bomaderry, New South Wales (NSW).

This assessment has been prepared in response to the requirements issued by the NSW Department of Planning and Environment (DoPE), which included:

"…Air Quality and Odour

> *An assessment in accordance with the EPA's Approved Methods for the Modelling and Assessment of Air Pollutants in NSW, including a comparison with measured impacts (odour audits) and approved impacts."*

Modelling has been undertaken in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales (AMMAAP).* The AERMOD computer based dispersion model was used to determine the ground level impacts of odour and TSP.

Odour and TSP emission measurements conducted by Stephenson Environmental Management Australia at the existing packing plant in November 2015 have been used as emission input data for the predictive dispersion modelling.

The Manildra Group provided proposed operational data, discharge stack and equipment design information.

2 THE SITE

The Manildra Group Shoalhaven Starches site is approximately 13 hectares, located between Bolong Road and the Shoalhaven River, approximately 0.6 km south east of the Bomaderry Post Office and 80 kilometres (km) south of Wollongong.

Figure 2-1 displays the location of the modelling domain and Figure 2-2 shows plans of the proposed packing plant modifications on the Shoalhaven Starches site. Figure 2-3 illustrates elevations of the proposed modifications.

FIGURE 2-1 SHOALHAVEN STARCHES LOCATION

FIGURE 2-2 PACKING PLANT OVERALL SITE PLAN

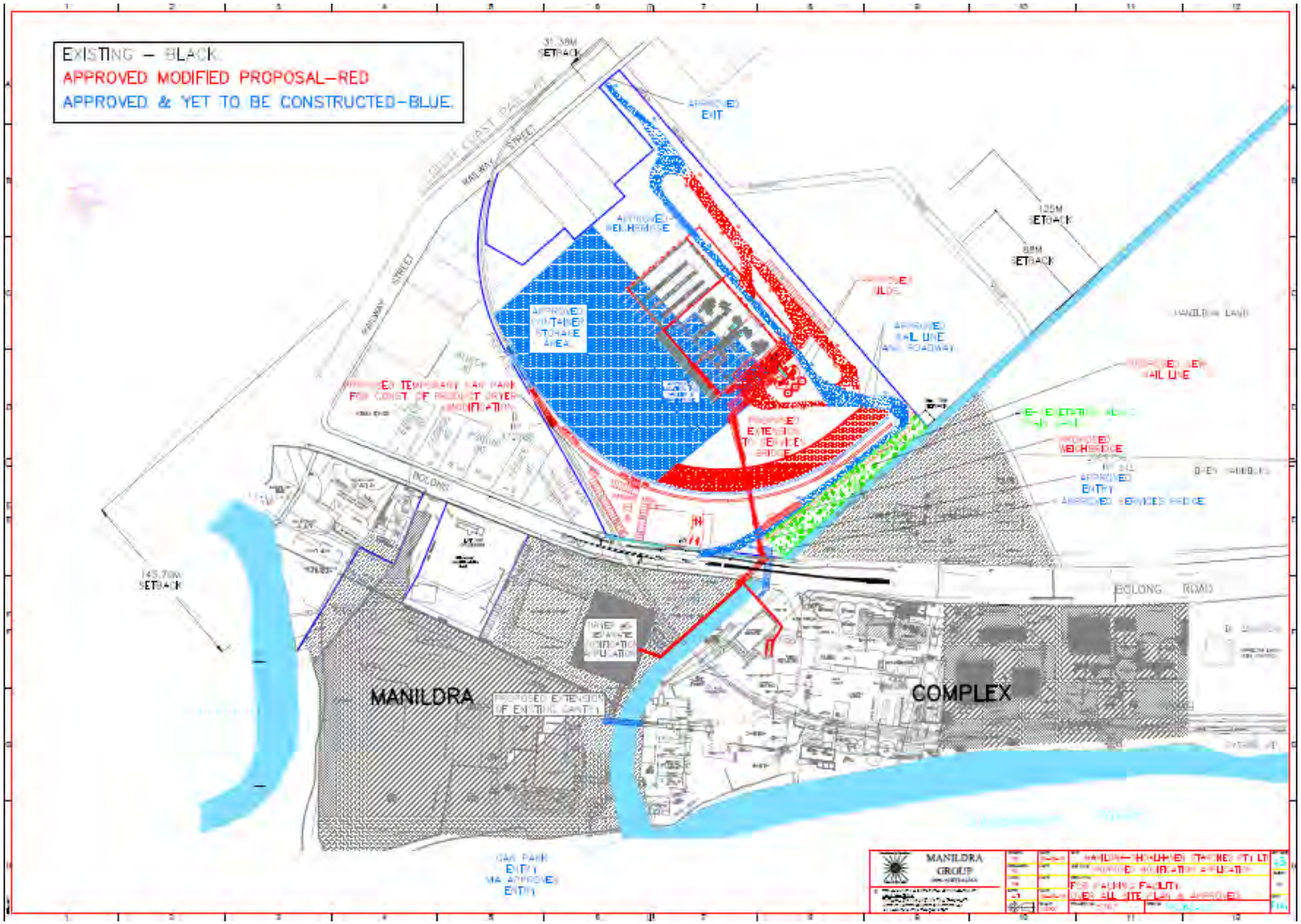


FIGURE 2-3 SHOALHAVEN STARCHES, BOMADERRY - ELEVATION

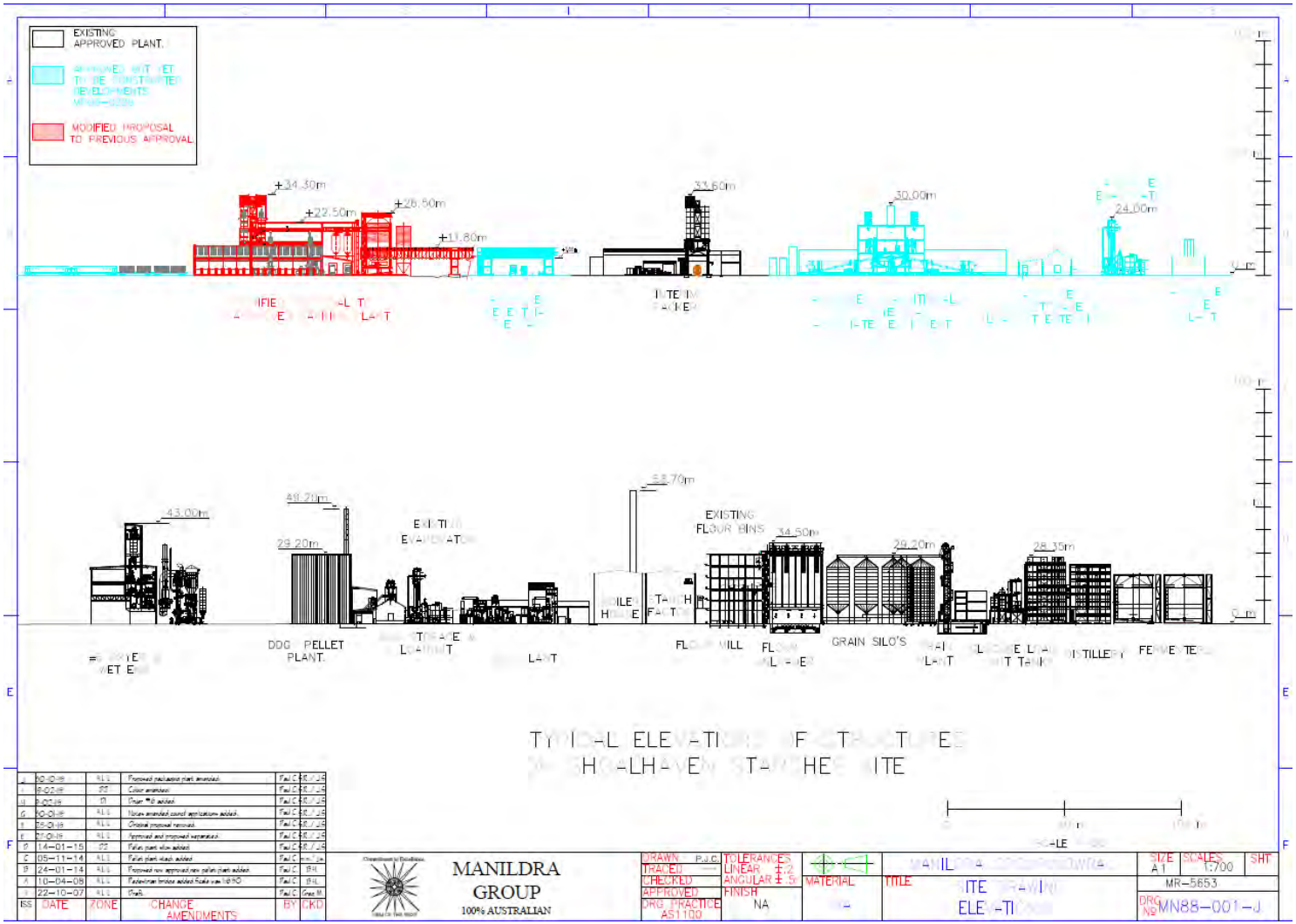
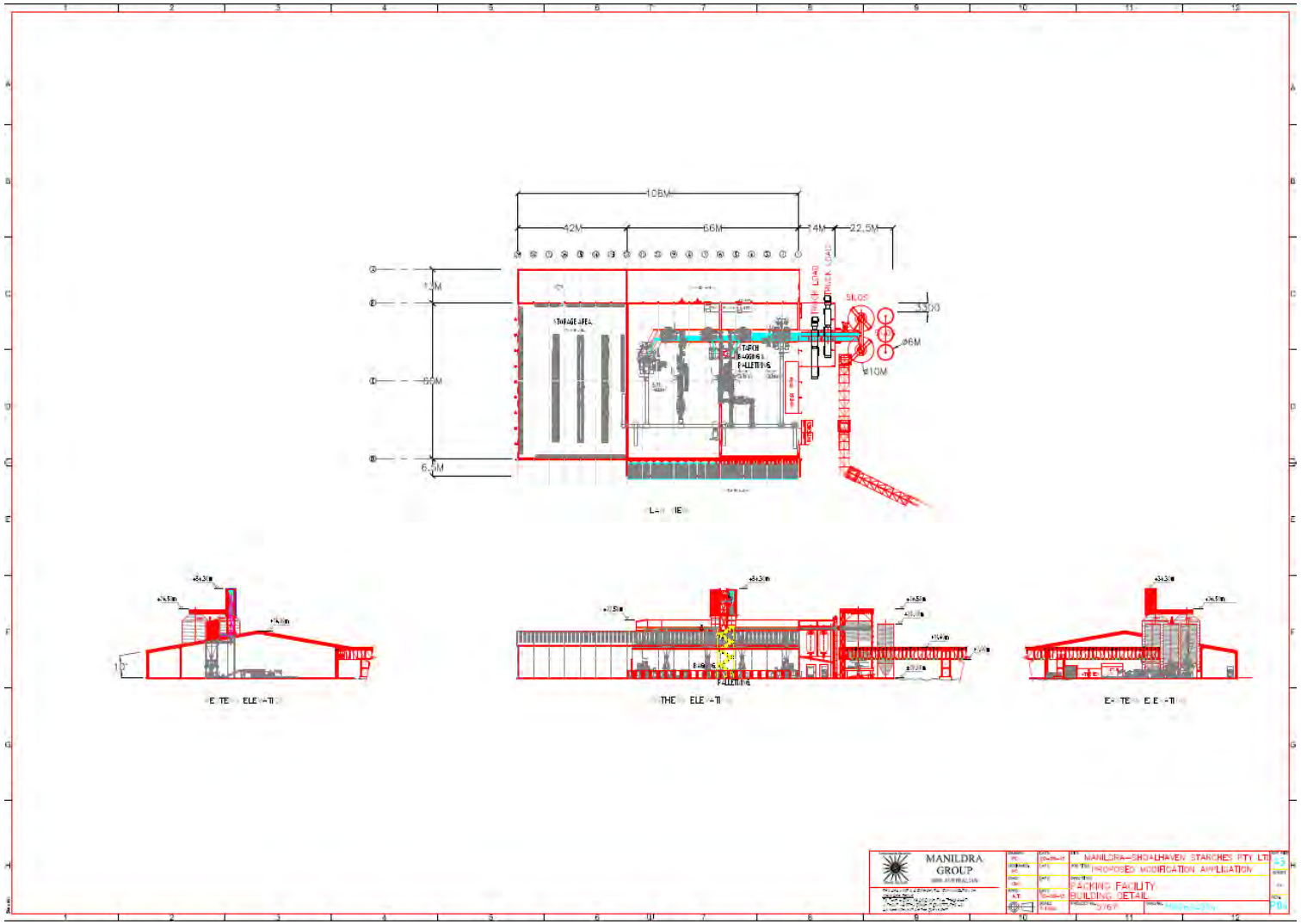


FIGURE 2-4 SHOALHAVEN STARCHES, PACKING PLANT DETAIL



3 PROPOSED PACKING PLANT MODIFICATION OPERATIONS

The proposed modified approved Packaging Plant will consist of seven silos, each dedicated to store either gluten or starch product. Three medium sized silos will store gluten product, two large silos will store starch product, one small silo will store gluten product, and one small silo will store starch product.

The medium and large silos will be filled 24 hours a day, seven days a week, while the small silos are currently scheduled to fill eight hours a day, seven days a week; however these eight hours could be spread over any time of the day.

This process and associated fill time detail may also be modified prior to plant operation.

As a worst case scenario, this assessment has assumed the small silos will also run 24 hours a day, seven days a week.

4 CONSTRUCTION DUST IMPACTS

Air quality impacts during construction would result from dust generated from earthworks, vehicular movements and other engineering activities during the construction phase. Shoalhaven Starches confirmed there will be no additional diesel locomotive movements in the area during construction.

To estimate the dust emissions during the construction, the emission factor was determined from the USEPA AP- 42 database. An emission factor is a representative value that attempts to relate the quantity an air pollutant with the process or activity associated with the release of that pollutant.

The general equation for estimating emissions is: $E = A \times EF \times (1-ER/100)$
Where, E = emissions
A= Activity Rate;
EF = emissions factor and;
ER = overall emission reduction efficiency

The emission factor variable (EF) for general construction activity operation is 2.69 megagrams (Mg)/hectare (ha)/month of activity. The Activity Rate in this instance is the area of construction activity.

Using these variables in the above equation, the estimated emissions from the construction of the modified Packaging Plant is 3.08 Mg/ha/month. This factor assumes no dust controls have been applied to the construction process. Therefore, this emissions estimate (E) can be considered a conservative estimate because it assumes construction dust emissions will be controlled by construction contractors on the site at the source of dust emissions. As these dust controls are currently in the process of being specified by construction contractors, in conjunction with Manildra Group, the final version of the variable has not yet been included in this estimate.

There are a number of common mitigation methods to control dust emissions from earthworks and construction. Prior to construction activity, a dust control plan is commonly created which identifies dust sources, and outlines management of emissions. The most common mitigation method during the construction period is dust suppression by watering down of roads and dust covered surfaces and on-site stockpiles of temporarily stored fill and topsoil to limit erosion by wind. The frequency of watering these surfaces is dependent on weather, soil type and traffic movement. Wind fences are also a common mitigation method, which prevent loose dust from leaving the site during periods of elevated wind speeds. Other mitigation methods include using temporary grassing or using jute mesh as groundcover, covering stockpiles and locating them in a position where they are protected from prevailing winds, covering truckloads when material is being transported and limiting speed on the construction site. As a result of this dust control plan and applied dust suppression techniques, dispersion modelling of dust emissions during construction has not formed part of this assessment

5 EMISSION MONITORING AT EXISTING PACKING PLANT

Emission monitoring for was conducted on 19 November 2015 on four existing Packing Plant emission points that are considered to be similar in dimensions, product and emissions to the seven silos in the proposed modified Packing Plant.

Shoalhaven Starches have nominated the following equivalencies between the four existing silos sampled and the proposed silos in the proposed modified Packing Plant.

- Gluten 1A is equivalent to the proposed Small Gluten Silo.
- Starch 4 is equivalent to the proposed Small Starch Silo.
- Gluten 1B is equivalent to the proposed Medium Gluten Silos 1, 2 and 3.
- Starch 6B is equivalent to the proposed Large Starch Silos 1 and 2.

Table 5.1 summarises the average emission results and the complete report is presented in Appendix A.

TABLE 5-1 AVERAGE EMISSION RESULTS EXISTING PACKING PLANT NOVEMBER 2015

Parameter	Units of measure	Packing Plant Sampling Location and Date			
		Gluten 1A 19/11/15	**Starch 4** 19/11/15	**Gluten 1B** 19/11/15	**Starch 6B** 19/11/15
Temperature	^oC	49.5	45.3	49.5	50.1
Pressure	kPa	101.3	101.3	101.3	101.3
Velocity	m/s	12.0	11.6	15.2	15.3
Normal Volumetric Flow	m^3/s	0.28	0.30	0.38	0.18
Odour	ou	157	56	129	61
Oxygen	%	20.9	20.9	20.9	20.9
Total Inspirable Dust	mg/m^3	0.21	0.44	0.91	3.29

Key:

^oC	=	degrees Celsius
kPa	=	kilo Pascals
m/s	=	metres per second
m^3/s	=	dry cubic metre per second 0^oC and 101.3 kilopascals (kPa)
ou	=	odour units
%	=	percentage
mg/m^3	=	milligrams per cubic metre at 0^oC and 101.3 kilopascals (kPa)

6 IMPACT ASSESSMENT CRITERIA

6.1 ODOUR IMPACT ASSESSMENT CRITERIA

The *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (AMMAAP) provides a GLC impact assessment criterion for a number of potential air emissions. This method states that dispersion modelling undertaken should assess the modelling predictions against the GLCs to determine if the predicted impact from the emissions exceeds the criteria.

The Impact Assessment Criteria (IAC) for complex mixtures of odours have been designed to take into account the range of sensitivity to odours within the community and to provide additional protection for individuals with a heightened response to odours. This is achieved by using a statistical approach dependent upon population size. As the population density increases, the proportion of sensitive individuals is also likely to increase, indicating that more stringent criteria are necessary in these situations.

The GLC assessment criteria for the complex odour compound emissions considered in the modelling are shown in Table 6.1. The predicted odour impact due to the pollutant source must be reported in units consistent with the IAC as peak concentrations (i.e. approximately 1 second average).

The odour criterion that has been selected for use in this assessment, to determine the maximum odour GLC concentration from the proposed modifications to the packing plant, is the 2.0 odour units (ou) criterion for the 100th percentile of predicted odour concentrations, which indicates that 100 percent of all odour predictions would fall below this concentration. This criterion has been chosen because there are residential areas in the vicinity of the Shoalhaven Starches facility, such that the population density of the area surrounding the facility as a whole is expected to be in excess of 2000 people.

TABLE 6-1 IMPACT ASSESSMENT CRITERIA FOR COMPLEX ODOROUS AIR POLLUTANTS

Population of affected community	Impact Assessment Criteria (ou)
Urban (>2000) and/or schools and hospitals	2.0
~ 500	3.0
~ 125	4.0
~ 30	5.0
~ 10	6.0
~ single rural residence (<= 2)	7.0

Key:
ou = odour unit
> = greater than
> = less than

6.1.1 ADJUSTMENT FOR PEAK-TO-MEAN RATIOS

AMMAAP notes that the evaluation of odour impacts requires the estimation of short or peak concentrations on the time scale of less than one second. The dispersion modelling predictions are valid for one-hour ground level concentrations or longer. Therefore the dispersion model, such as AERMOD, needs to supplemented to accurately simulate atmospheric dispersion of odours and the instantaneous perception of odours by the human nose.

AMMAAP Table 6.1, reproduced in Table 6.2 below, provides EPA recommended one-second to one-hour (P/M60) peak-to-mean ratios for estimating concentrations for different source types, stabilities and distances. It is important to note that these emission factors are for idealised situations for one source in flat terrain where the receptor is located along the centreline of the single plume and do not consider fluctuations away from the plume centre line, terrain influences or plume interactions from multiple sources.

AMMAAP further requires that the P/M60 ratio for wake-affected point sources be applied to the proposed packing plant stacks to determine the maximum permissible stack concentration. Therefore, maximum permissible stack source emission rate will need to be multiplied by 2.3 when checking for compliance with the ambient odour GLC criterion.

TABLE 6-2 PEAK-TO-MEAN FACTORS

Source type	Pasquill–Gifford stability class	Near-field P/M60*	Far-field P/M60*
Area	A, B, C, D	2.5	2.3
	E, F	2.3	1.9
Line	A–F	6	6
Surface wake-free point	A, B, C	12	4
	D, E, F	25	7
Tall wake-free point	A, B, C	17	3
	D, E, F	35	6
Wake-affected point	A–F	2.3	2.3
Volume	A–F	2.3	2.3

* Ratio of peak 1-second average concentrations to mean 1-hour average concentrations

Source: *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*

6.2 TOTAL SUSPENDED PARTICULATE MATTER IMPACT ASSESSMENT CRITERIA

The AMMAAP criterion for Total Suspended Particulate Matter is outlined in Table 6-3.

TABLE 6-3 IMPACT ASSESSMENT CRITERIA FOR TOTAL SUSPENDED PARTICULATE MATTER

Pollutant	Averaging Period	Impact Assessment Criteria (µg/m³)	Source
TSP	Annual	90	NHMRC (1996)

Key:

TSP	=	Total suspended particulate matter
µg/m³	=	micrograms per cubic metre
NHMRC	=	National Health and Medical Research Council

7 DISPERSION MODELLING INPUT DATA

AERMOD is a recommended Gaussian dispersion modelling system as it accurately estimates Ground Level Concentrations (GLC's) of source emissions. AERMOD requires the following input data – meteorological, buildings and structures on site, surrounding terrain data, discrete receptors and emissions and source information. These are all detailed in this section.

7.1 TERRAIN INPUT DATA

The terrain surrounding the Shoalhaven Starches site ranges from flat terrain in the immediate vicinity to mountains between 100 and 200 metres above sea level in approximately 5km north-west of the plant. The township of Bomaderry, west of Shoalhaven Starches exists in moderately hilly terrain with slopes ranging from approximately 20 to 50 metres above sea level. The Shoalhaven River extends eastward from the south-east of the area under consideration, with a resultant river valley between Bomaderry and Nowra. The terrain is relatively flat around the river for the area east of Bomaderry.

7.2 METEOROLOGICAL INPUT DATA

The area considered in AQIA dispersion modelling experiences typical coastal weather in addition to locally influenced patterns. A mountain range to the north of the site means northerly winds are much less common than the east-west wind patterns occurring as a result of the coastal sea breeze cycle. The meteorological (MET) file was provided by Lakes Environmental Met Data Services and included hourly data for temperatures, wind speed, wind direction, and mixing heights from January 1st to December 31st 2013. Figure 7-1 presents this wind data. The arms in the figure represent the direction from which the wind is blowing and shows that westerlies and north westerlies were the most predominant for the 12 month period, which was considered typical meteorological data.

7.3 BUILDING INPUT DATA

Buildings greater than 0.4 times the height of stack and within a distance of 5L must be incorporated into modelling, where L is the lesser of the height or width of the building. The proposed modified packing plant has height of 18 metres above ground, and a total width of 60 metres. The proposed silos have heights of 34.3, 26.5 and 20.7 metres above the ground. The buildings incorporated into the modelling assessment were the proposed packing plant building as well as all seven proposed silos. Figure 7-2 presents the building profile incorporated into the modelling assessment.

7.4 RECEPTORS OF INTEREST

The receptors of interest chosen for this assessment include four (4) residential areas, which are Bomaderry, North Nowra, Nowra and Terara. These areas are highlighted in Figure 7-3. For this assessment, the highest odour and TSP GLCs in each of these areas was observed and included in this report.

7.5 EMISSION INPUT DATA

Stack emission input data was derived from two sources. The Manildra Group provided proposed physical stack information including process function, stack locations, dimensions and expected flow rate.

SEMA conducted emission monitoring tests, including odour and TSP on the existing packing plant exhaust stacks, and used the resulting concentrations and exhaust temperatures as input data. TSP and odour concentrations were derived from emission results from tests conducted in November 2015 on four exhaust points servicing the existing packing plant (two starch and two gluten silos).

Table 7-1 presents the emissions data for odour and TSP used as input data for the dispersion model and Table 7-2 presents physical stack data for the proposed modified packing plant stacks.

TABLE 7-1 PACKING PLANT EMISSION INPUT DATA

Proposed Emission Point	TSP		Odour			
	Emission Conc. (mg/m^3)	**Mass Emission Rate (MER)** (g/s)	**Emission Conc.** (ou)	**Total Odour MER** ($ou.m^3/s$)	**Peak to Mean Ratio**	**Corrected Total Odour MER** ($ou.m^3/s$)
Small Gluten Silo	0.9	0.001	160	93	2.3	215
Small Starch Silo	3.3	0.002	60	35	2.3	81
Medium Gluten Silo 1	0.9	0.001	160	173	2.3	399
Medium Gluten Silo 2	0.9	0.001	160	173	2.3	399
Medium Gluten Silo 3	0.9	0.001	160	173	2.3	399
Large Starch Silo 1	3.3	0.005	60	85	2.3	196
Large Starch Silo 2	3.3	0.005	60	85	2.3	196

Key overleaf

TABLE 7-2 PHYSICAL STACK DATA – PROPOSED MODIFIED PACKING PLANT

Proposed Emission Point	**Stack Height** (m)	**Stack Exit Diameter** (m)	**Exit Velocity** (m/s)	**Exhaust Temperature** (°C)	**Normal Flow Rate** (m^3/min)
Small Gluten Silo	34.3	0.20	18.6	50	35.0
Small Starch Silo	34.3	0.20	18.6	50	35.0
Medium Gluten Silo 1	20.7	0.4 * 0.4	6.8	50	65.0
Medium Gluten Silo 2	20.7	0.4 * 0.4	6.8	50	65.0
Medium Gluten Silo 3	20.7	0.4 * 0.4	6.8	50	65.0
Large Starch Silo 1	26.5	0.4 * 0.4	8.9	50	85.0
Large Starch Silo 2	26.5	0.4 * 0.4	8.9	50	85.0

Key:

Conc.	=	concentration
mg/m^3	=	milligrams per cubic metre @ 0 C and one atmosphere pressure
ou	=	odour units
°C	=	Degrees Celsius
m	=	metres
m/s	=	metres per second
g/s	=	grams per second
$ou/m^3/s$	=	odour units per cubic metre per second
TSP	=	total suspended particulates

FIGURE 7-1 ANNUAL WIND ROSE- JANUARY 1ST –DECEMBER 31ST 2013

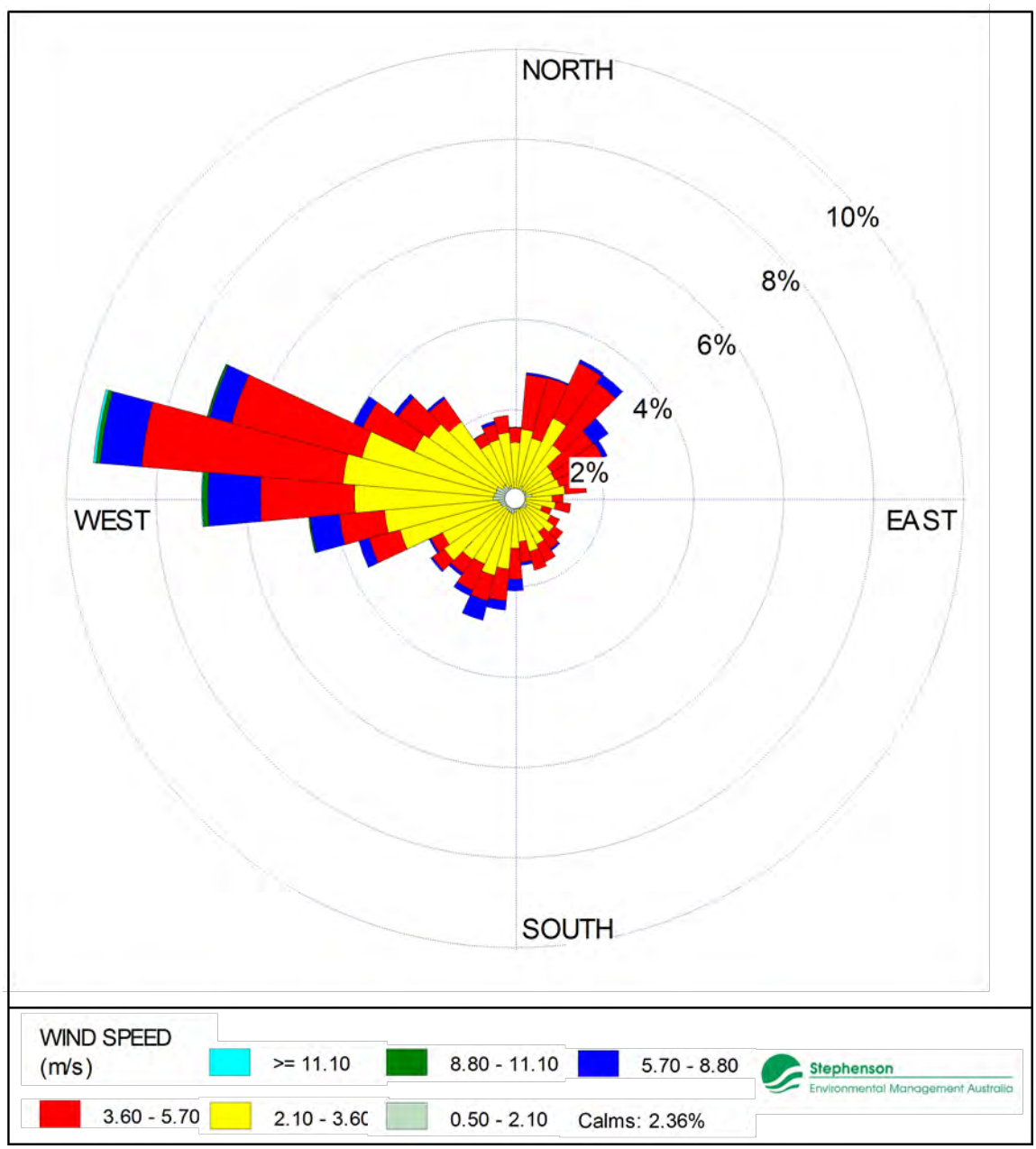
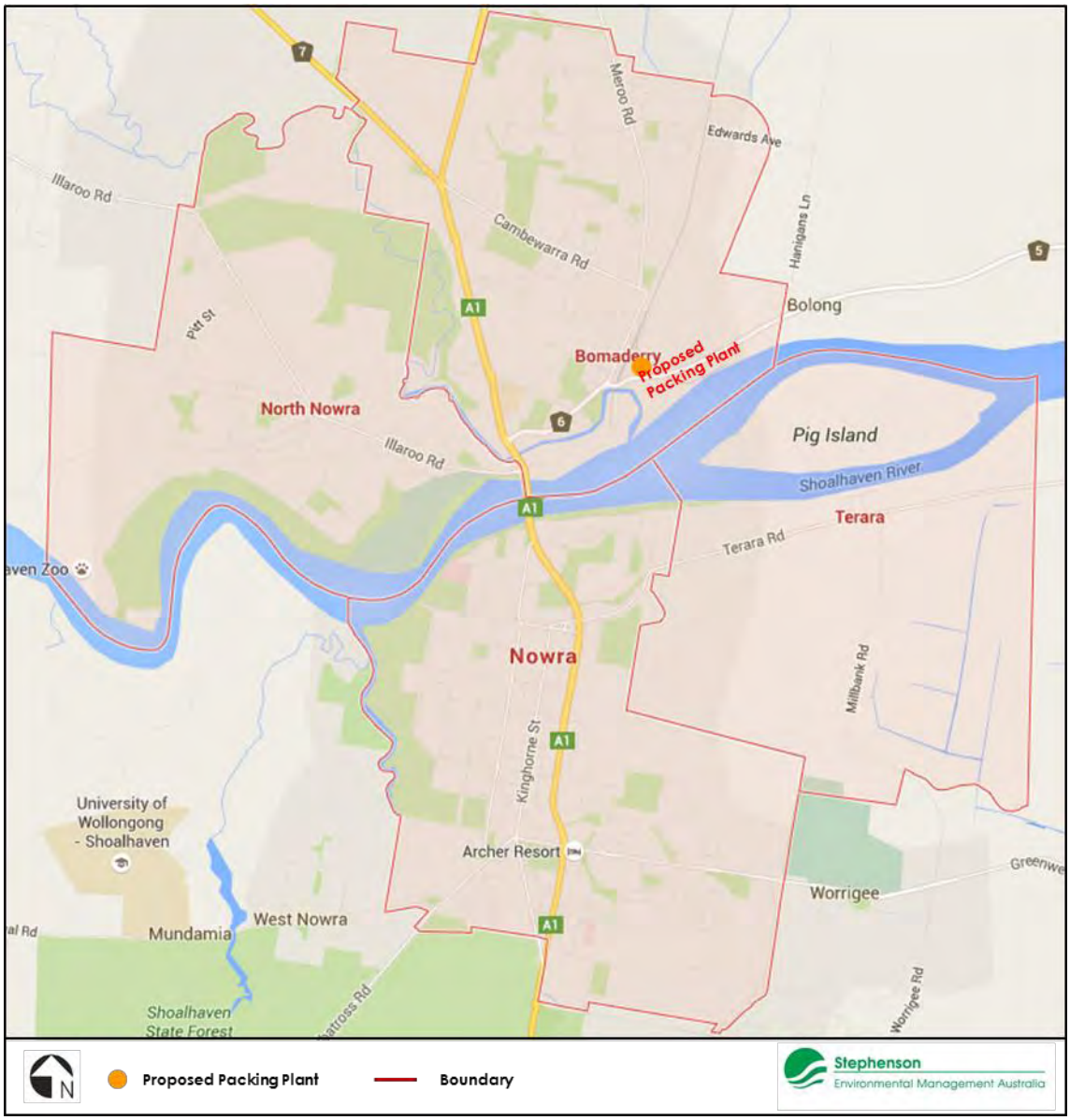


FIGURE 7-2 BUILDING INPUT DATA

FIGURE 7-3 RECEPTORS OF INTEREST LOCATIONS



8 IMPACT ASSESSMENT PREDICTIONS

SEMA estimates the proposed modifications to the Packing Plant will emit a combined 1,882 ou.m^3/s of odour into the atmosphere. The maximum odour concentration at ground level is predicted to be 0.7 ou from the additional emission points of the proposed modified Packing Plant. The highest impact from the proposed modified Packing Plant stacks on the northwest boundary would be a GLC of 0.4 ou. The maximum predicted worst case TSP GLC is 0.16 µg/m^3 on the boundary of the site.

The air quality impact assessment predictions and concentrations for odour and TSP are presented in Tables 8-1 and 8-2 and in Figures 8-1 and 8-2.

TABLE 8-1 PROPOSED MODIFIED PACKING PLANT PREDICTED ODOUR GLC

Location	Parameter	Averaging Time	Modified packing plant * GLC (ou)	Impact Assessment Criteria (ou)
Site NW boundary	Odour	1 second using peak-to-mean ratio	0.4	2.0
Bomaderry	Odour	1 second using peak-to-mean ratio	0.5	2.0
N Nowra	Odour	1 second using peak-to-mean ratio	0.2	2.0
Nowra	Odour	1 second using peak-to-mean ratio	0.2	2.0
Terara	Odour	1 second using peak-to-mean ratio	0.2	2.0

TABLE 8-2 PROPOSED MODIFIED PACKING PLANT PREDICTED TSP GLC

Location	Parameter	Averaging Time	Modified packing plant* GLC (µg/m^3)	Whole site ** GLC (µg/m^3)	Impact Assessment Criteria (µg/m^3)
Worst case	TSP	Annual	0.161	-	90
Bomaderry	TSP	Annual	0.015	2	90
N Nowra	TSP	Annual	0.002	1	90
Nowra	TSP	Annual	0.008	1	90
Terara	TSP	Annual	0.008	1.5	90

Key:
ou = odour units
µg/m^3 = micrograms per cubic metre
TSP = Total Suspended Particulate Matter
GLC = Ground Level Concentration
* = SEMA prediction (2015)
** = GHD 2008 Ethanol Upgrade predictions (2008)

FIGURE 8-1 PREDICTED ODOUR CONCENTRATIONS, PROPOSED MODIFIED PACKING PLANT

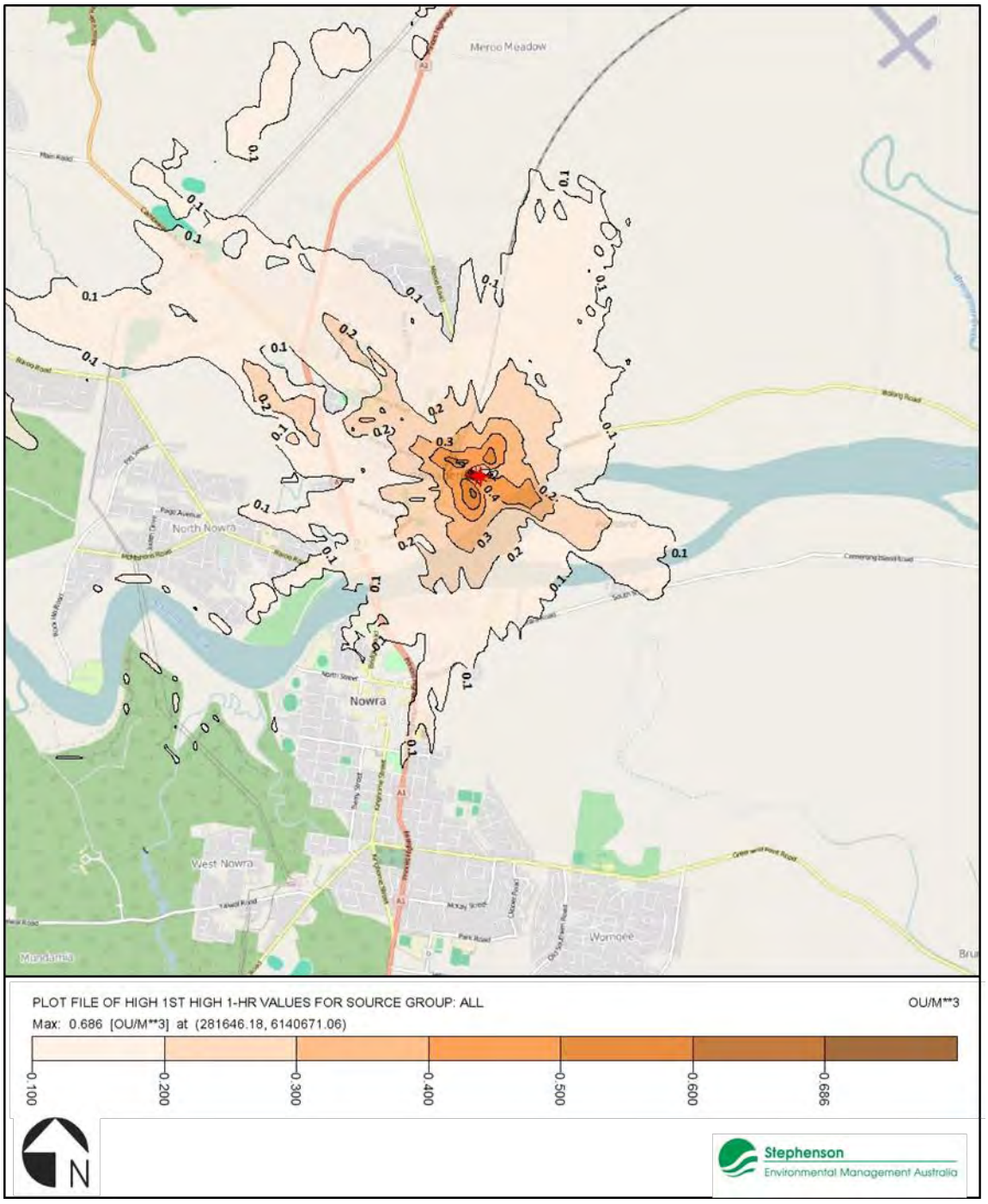
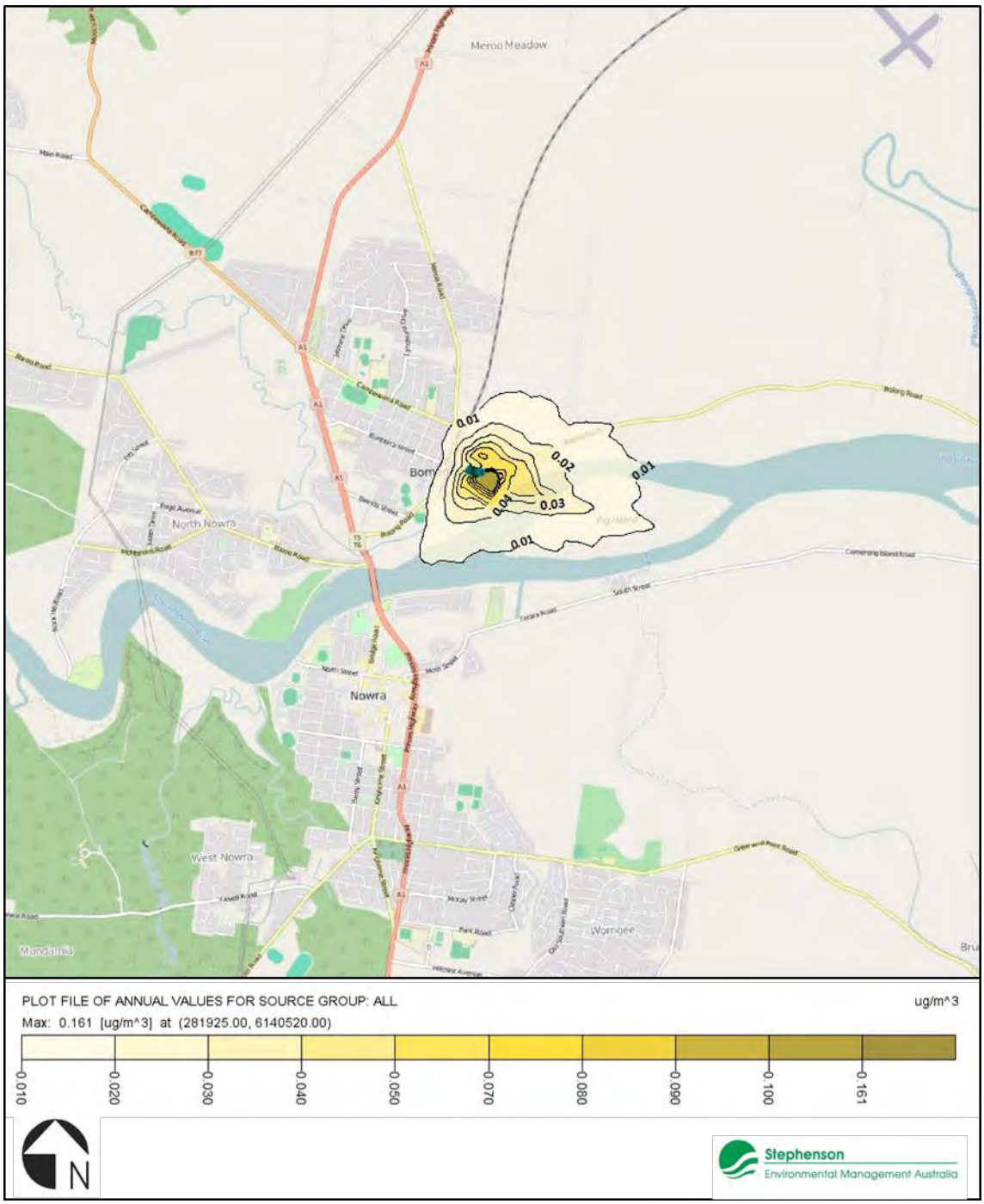


FIGURE 8-2 PREDICTED TSP CONCENTRATIONS, PROPOSED MODIFIED PACKING PLANT



9 CONCLUSIONS

The proposed modification to the approved Packing Plant is not predicted to make a significant contribution to either the factory's total odour or TSP impact.

The requirements issued by the NSW Department of Planning & Environment required that this air quality assessment include a comparison with measured impacts (odour units) and approved impacts. It is important to note that the Environmental Audit undertaken by GHD between December 2006 and July 2007, and then the subsequent Air Quality Assessment undertaken by GHD in 2008 that supported the Shoalhaven Starches Expansion Project, did not identify the existing or proposed packing plant as a principal source of odour emissions that warranted specific consideration in these previous assessments.

Based on available data, measurement results and dispersion modelling, SEMA has estimated that the modified Packing Plant will emit a combined 1,882 $ou.m^3/s$ of odour into the atmosphere. This is an additional 0.3% of total odour emissions from the Shoalhaven Starches factory complex at Bomaderry. The Shoalhaven Starches – Report on Ethanol Upgrade Air Quality Assessment July 2008 estimated that the total odour emissions from the Shoalhaven Starches factory before implementation of odour controls is 604,811 $ou.m^3/s$. Refer to Appendix B.

Based on available data and measurement results, SEMA has estimated that the proposed modified packing plant will emit a combined 0.015 g/s of TSP into the atmosphere. This is an additional 0.1% of TSP emissions for the total site. Refer to Appendix C for the 2008 TSP Emissions Inventory.

A Dust Management Control Plan will need to be developed identifying dust sources and outlining the management and control of emissions and air quality impacts, during construction, from dust generated from earthworks, vehicular movements and other engineering activities.

APPENDIX A – PACKING PLANT EMISSION SURVEY 2015

Stephenson
Environmental Management Australia

Peter W Stephenson & Associates Pty Ltd
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EMISSION TEST REPORT NO. 5600

PACKING PLANT EMISSION SURVEY

SHOALHAVEN STARCHES PTY LTD

BOMADERRY, NSW

PROJECT NO.: **5600/S23968A/15**

DATE OF SURVEY: **19 NOVEMBER 2015**

DATE OF ISSUE: **25 NOVEMBER 2015**

NATA

1 EMISSION TEST REPORT NO. 5600

The sampling and analysis was commissioned by:

Client:	Shoalhaven Starches Pty Ltd
Contact:	John Studdert
Address:	Bolong Road, Bomaderry, NSW 2541
Telephone:	02 4423 8254
Email:	John.studdert@manildra.com.au
Project Number:	5600/S23968A/15
Test Date:	19 November 2015
Production Conditions:	Normal operating conditions during emission testing.
Analysis Requested:	Flow, temperature, odour, oxygen, stack pressure, total inspirable dust and velocity
Sample Locations:	Packing Plant- Gluten 1A, Gluten 1B, Starch 4, Starch 6B
Sample ID Nos.:	See Attachment A

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NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025.

Identification	The samples are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.	
Test	*Test Method Number for Sampling and Analysis*	*NATA Laboratory Analysis By: NATA Accreditation No. & Report No.*
Flow	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 5600
Oxygen	NSW TM-25, USEPA M3A	SEMA, Accreditation No. 15043, Emission Test Report No. 5600
Odour	AS 4323.3, AS 4323.4	SEMA, Accreditation No. 15043, Emission Test Report No. 5600
Stack Pressure	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 5600
Stack Temperature	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 5600
Total Inspirable Dust	AS 3640-2009	SEMA, Accreditation No. 15043, Particle Test Report No. 1965
Velocity	NSW TM-2, USEPA M2	SEMA, Accreditation No. 15043, Emission Test Report No. 5600

Deviations from Test Methods	Nil
Sampling Times	NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.
Reference Conditions	NSW – As per (1) Environment Protection Licence conditions, or (2) Schedule 4 and 5 of the Protection of the Environment Operations (Clean Air) Regulations

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Attachment A.

Issue Date
25 November 2015

Peter Stephenson
Managing Director

Deviations from Test Methods	Nil
Sampling Times	NSW - As per Test Method requirements or if not specified in the Test Method then as per Protection of the Environment Operations (Clean Air) Regulations Part 2.
Reference Conditions	NSW – As per (1) Environment Protection Licence conditions, or (2) Schedule 4 and 5 of the Protection of the Environment Operations (Clean Air) Regulations

All associated NATA endorsed Test Reports/Certificates of Analysis are provided separately in Attachment A.

Issue Date
25 November 2015

Peter Stephenson
Managing Director

1.1 SUMMARY OF AVERAGE EMISSION RESULTS – TEST REPORT NO. 5600

Parameter	Units	Gluten 1A	Gluten 1B	Starch 4	Starch 6B
		19/11/15	19/11/15	19/11/15	19/11/15
Temperature	°C	49.5	49.5	45.3	50.1
Pressure	kPa	101.3	101.3	101.3	101.3
Velocity	m/s	12.0	15.2	11.6	15.3
Normal Volumetric Flow	m^3/s	0.28	0.38	0.30	0.18
Odour	ou	157	129	56	61
Oxygen	%	20.9	20.9	20.9	20.9
Total Inspirable Dust	mg/m^3	0.21	0.91	0.44	3.29

Key:

°C	=	degrees Celsius
%	=	percentage
kPa	=	kilo Pascals
m^3/s	=	dry cubic metre per second 0°C and 101.3 kilopascals (kPa)
ou	=	odour units
m/s	=	metres per second
mg/m^3	=	milligrams per cubic metre at 0°C and 101.3 kilopascals (kPa)

1.2 ESTIMATED UNCERTAINTY OF MEASUREMENT

Pollutant	Methods	Uncertainty
Odour	AS4323.3, AS4323.4	50%
Oxygen	TM-25, USEPA M3A	1% actual
Particulate > 20 mg/m^3	NSW TM-15, AS4323.2,	15%
Particulate < 20 mg/m^3	NSW TM-15, AS4323.2,	50%
Velocity	AS4323.1, NSW TM-2, USEPA M2	5%

Key:

Unless otherwise indicated the uncertainties quoted have been determined @ 95% level of Confidence level (i.e. by multiplying the repeatability standard deviation by a co-efficient equal to 1.96) (Source – Measurement Uncertainty)

Sources: *Measurement Uncertainty – implications for the enforcement of emission limits by Maciek Lewandowski (Environment Agency) & Michael Woodfield (AEAT) UK*

Technical Guidance Note (Monitoring) M2 Monitoring of stack emissions to air Environment Agency Version 3.1 June 2005.

Note: ISO 9096 is for 20-1000 mg/m^3 which AS4323.2 is based on. Note DSEN 13284-1 testing for < 5 mg/m^3 correlates to 5 mg/m^3 with most quoted uncertainties of ± 5.3 mg/m^3 @ 6.4 mg/m^3. From Clean Air Engineering in the United States the lowest practical limit of USEPA M5 is 5 mg/m^3 under lab conditions.

1.3 SAMPLING LOCATIONS – PACKING PLANT

PHOTOGRAPH 1-1 GLUTEN 1A

PHOTOGRAPH 1-2 GLUTEN 1B

PHOTOGRAPH 1-3 STARCH 4

PHOTOGRAPH 1-4 STARCH 6B

1.4 INSTRUMENT CALIBRATION DETAILS

SEMA Asset No.	Equipment Description	Date Last Calibrated	Calibration Due Date
859	Digital Temperature Reader	14-Jul-15	14-Jan-16
863	Thermocouple	06-Aug-15	06-Feb-16
613	Barometer	02-Mar-15	02-Mar-16
676	Personal Sampler	13-Apr-15	13-Apr-16
833	Personal Sampler	13-Apr-15	13-Apr-16
17	Personal Sampler	06-Aug-15	06-Aug-16
931	Personal Sampler	08-Oct-15	08-Oct-16
832	Personal Sampler	13-Apr-15	13-Apr-16

ATTACHMENT A – NATA CERTIFICATES OF ANALYSIS

Odour Research Laboratories Australia
A Division of Peter W. Stephenson & Associates Pty Ltd
ACN 002 600 526 (Incorporated in NSW)
ABN 75 002 600 526

Newington Business Park
Unit 7/2 Holker Street
Newington NSW 2127 Australia
Tel: (02) 9737 9991
Fax: (02) 9737 9993
E-Mail: pstephenson@orla.com.au

Olfactometry Test Report

The measurement was commissioned by SEMA on behalf of:

Client	Organisation:	Shoalhaven Starches
	Address:	Bolong Road, Bomaderry NSW 2541
	Contact:	John Studdert
	Sampling Site:	Packing Plant
	Telephone:	4423 8254
	Email:	John.studdert@manildra.com.au
Project	ORLA Report Number:	5600/ORLA/01
	Project Manager:	Peter Stephenson
	Testing operator:	Ali Naghizadeh
	ORLA Sample number(s):	4347 to 4350 inclusive
	SEMA Sample number(s):	725182 to 725185 inclusive
Order	Analysis Requested:	Odour Analysis
	Order requested by:	SEMA on behalf of Shoalhaven Starches
	Date of order:	20 November 2015
	Order number:	4499
	Telephone:	02 9737 9991
	Signed by:	Ali Naghizadeh
	Order accepted by:	Ali Naghizadeh
Report	Date of issue:	23 November 2015

NATA accredited laboratory number 15043.

Accredited for Compliance with ISO/IEC 17025.

Investigated Item	Odour concentration in odour units "ou" determined by forcery odour concentration measurements, of an odour sample supplied in a sampling bag. All samples were received in good condition.
Analytic Method	The samples were analysed in accordance with AS/NZS4323.3:2001.
Identification	The odour sample bags were labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or identification) sampling date and time, dilution ratio (if dilution was used) and whether further chemical analysis was required.
Method	The odour concentration measurements were performed using dynamic olfactometry according to the Australian Standard 'Determination of Odour Concentration by Dynamic Olfactometry AS/NZS4323.3:2001. The odour perception characteristics of the panel within the presentation series for the samples were analogous to that for n-butanol calibration. Any deviation from the Australian standard is recorded in the 'Comments' section of this report.
Instrument Used	The Olfactometer used during this testing session was: AC'SCENT International Olfactometer
Measuring Range	The measuring range of the AC'SCENT International olfactometer is $12 \leq y \leq 76,172$ ou. If the measuring range was insufficient the odour samples will have been pre-diluted.
Environment	The measurements were performed in an air- and odour-conditioned room. The room temperature is maintained between 2 3°C
Measuring Dates	The date of each measurement is specified with the results
Instrument Precision	The precision of this instrument (expressed as repeatability) for a sensory calibration must be $r \leq 0.09$ in accordance with the Australian Standard AS/NZS4323.3:2001. AC'SCENT International Olfactometer: r = 0.0833 (February 2015) Compliance = Yes
Instrumental Accuracy	The accuracy of this instrument for a sensory calibration must be $A \geq 0.20$ in accordance with the Australian Standard AS/NZS4323.3:2001. AC'SCENT International Olfactometer: A = 0.277 (February 2015) Compliance = Yes
Lowest Detection Limit (LDL)	The LDL for the AC'SCENT International Olfactometer has been determined to be 12 ou
Traceability	The measurements have been performed using standards for which the traceability to the national standard has been demonstrated. The assessors are individually selected to comply with fixed criteria and are monitored every session to keep within the limits of the standard. The results from the assessors are traceable to primary standards of n-butanol in nitrogen.

23 November 2015

Peter Stephenson
Managing Director

Odour Research Laboratories Australia

Odour Olfactometry Results - 5600/ORLA/01

Sample Location	Sample ID No.	Sampling Date & Time	ORLA Sample No.	Analysis Date & Time (Completed)	Panel Size	Valid ITEs	Sample Pre-Dilution	Sample Odour Concentration (ou) [1,*]	Sample Odour Concentration (ou) [2,*]	Odour Character & Hedonic Tone [3,*]
Sample ID: Gluten 1A	725182	19/11/2015 10:25	4347	20/11/2015 10:30	4	8	Nil	157	157	Hessian, garbage, dirty, vegetable, mouldy, fish, cereal (+0.3)[4]
Sample ID: Gluten 1B	725183	19/11/2015 11:00	4348	20/11/2015 11:00	4	8	Nil	170	170	Hessian, garbage, swamp, stale water, musty storage room, fishy (-3.8)[4]
Sample ID: Starch 4	725184	19/11/2015 11:48	4349	20/11/2015 11:30	4	8	Nil	59	55	Fruit salad, rotten vegetables, organic chemicals, earthy, musty (-0.8)[4]
Sample ID: Starch 6B	725185	19/11/2015 10:10	4350	20/11/2015 11:00	4	8	Nil	91	91	Fruit salad, vegetables, dusty, sweet, acetic, cereal, rancid, musty (0.0)[4]

Odour Research Laboratories Australia

Odour Panel Calibration Results – 5600/ORLA/01

Reference Odorant	ORLA Sample No.	Concentration of Reference Gas (ppm)	Reference Gas Measured Concentration (ou)	Panel Average Measured Concentration (ppb) [3]	Does this panel calibration measurement comply with AS/NZS4323.3:P2001 (Yes/No) [4]
n-butanol	4348	41	1,000	40	Yes

Comments: All samples were collected by Stephenson Environmental Management Australia and analysed by Odour Research Laboratories Australia at their Sydney Laboratory.

Notes from Odour Olfactometry Results:

[1] Sample Odour Concentration: as received in the bag

[2] Sample Odour Concentration: allowing for pre-dilution

[3] Panel Average Measured Concentration: indicates the sensitivity of the panel for the session completed

[4] Target Range for reference gas n-butanol is $20 \leq \chi \leq 80$ ppb and compliance with AS/NZ4323.3:2001 is based on the individuals rolling average and not on the panel average measured concentration. Panellist Rolling Average: SR = 52, PR = 38, PRA = 34, TL = 38, DS = 30

* As of July 2015 all odour concentrations are reported in two significant figures as requested by NATA's Chemical Testing Accreditation Advisory Committee.

^ denotes the Average Hedonic Tone: describes the pleasantness of the odour being presented where (+5) represents Very Pleasant, (0) represents Neutral and (-5) represents Very Unpleasant and has been derived from the panellist responses at the recognition threshold.

+ This value is not part of our NATA Scope of Accreditation and AS4323.3

----------END OF TEST REPORT----------

ODOUR RESEARCH LABORATORIES AUSTRALIA VERSION: 3.6 PAGE 4 OF 4

Stephenson
Environmental Management Australia

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Newington NSW 2127 Australia
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E-Mail: info@stephensonenv.com.au

Particle Test Report No. 1965

The analysis was commissioned by SEMA on behalf of:

Client	Organisation:	Shoalhaven Starches
	Contact:	John Studdert
	Address:	Bolong Road, Bomaderry, NSW 2541
	Telephone:	02 4423 8254
	Email:	John.studdert@manildra.com.au
	Project Number:	5600/S23968A/15
	Analysis Requested:	Gravimetric
	Chain of Custody Number	S24042
	Date Analysis Completed:	23 November 2015
	No. of Samples Tested:	4
	Sample Locations:	Packing Plant (Gluten 1A, Gluten 1B, Starch 4, Starch 6B)
	Sample ID Nos.:	725192, 725193, 725194, 725195
	Filter ID Nos.:	14632, 14629, 14630, 14628

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NATA accredited laboratory number 15043.
Accredited for Compliance with ISO/IEC 17025.

Identification	The filters are labelled individually. Each label recorded the testing laboratory, sample number, sampling location (or Identification) sampling date and time and whether further analysis is required.

Test	*Analysis Test Method*
TSP	Gravimetric

Deviations from Test Methods	Nil

Issue Date
24 November 2015

Jay Weber
Testing Supervisor

Gravimetric Results – Test Report No. 1965

Sample Location	Sample ID No.	Filter ID No	Sampling Date	Analysis Date (Completed)	Sample Mass (g)
Packing plant Gluten 1A	725192	14632	19/11/2015	23/11/2015	0.00010
Packing plant Gluten 1B	725193	14629	19/11/2015	23/11/2015	0.00044
Packing plant Starch 4	725194	14630	19/11/2015	23/11/2015	0.00021
Packing plant Starch 6B	725195	14628	19/11/2015	23/11/2015	0.00158

Key:
g = grams

APPENDIX B – ODOUR EMISSION INVENTORY 2008

The OER inventory presented in the following sub-sections is limited to the principal factory and environmental farm odour sources identified in the Audit Report plus the potential odour sources associated with the ethanol upgrade. The odour reduction at each stage of odour control implementation is also included for each source or source group.

NB: The existing scenario includes emission sources that have been granted Development Approval (flour mill, starch dryer No. 5 and fermentation tanks No. 10 – 13). These odour sources have been included in the group of principal (existing) factory odour sources. The OERs for these sources have been derived from the OERs for similar equipment examined in the Audit Report.

In all cases, the adopted and projected odour emission rates for each odour source should be verified by odour emission testing following installation and commission of odour control measures to confirm performance against projected odour emission rates.

5.1.1 Factory

A breakdown of the principal odour sources from the existing factory OER and proposed ethanol upgrade at the different stages of odour control implementation is given in Table 5-1.

OERs in the following tables are expressed in odour units (OU) volumes per second (OU m^3/s). OERs are taken directly from Table 23 in the Audit Report except where footnoted. Definitions of the abbreviations used to denote odour control actions are also given in the footnotes (refer to previous sections for detail on the odour control actions and their anticipated odour reduction efficiencies).

Table 5-1 Odour Emission Inventory – Existing Factory and Ethanol Upgrade

Plant	Odour Source	ID	OER Before Control OU m^3/s	Stage 1 Odour Control [1] OU m^3/s		Stage 2 Odour Control [1] OU m^3/s		Stage 3 Odour Control [1] OU m^3/s	
				Control	OER	Control	OER	Control	OER
Existing Factory									
DDG (liquids)	Feed dump tank	DDG 20	8,900	BIO	1,338	BIO	1,338	BIO	1,338
DDG (liquids)	Condensate tank [14]	DDG 23	25,711	BIO	3,857	BIO	3,857	BIO	3,857
DDG (liquids)	Vent condensor	DDG 24	3,500	BIO	525	BIO	525	BIO	525
DDG (liquids)	Condensor drain	DDG 25	3,167	Nil	3,167	BIO	475	BIO	475
DDG (liquids)	Finish Feed tank	DDG 26	18,333	BIO	2,750	BIO	2,750	BIO	2,750
DDG (liquids)	Finisher pump tank	DDG 28	1,433	BIO	215	BIO	215	BIO	215

Plant	Odour Source	ID	OER Before Control OU m^3/s	Stage 1 Odour Control [1] OU m^3/s		Stage 2 Odour Control [1] OU m^3/s		Stage 3 Odour Control [1] OU m^3/s	
				Control	OER	Control	OER	Control	OER
DDG (liquids)	Dryer feed tank	DDG 30	1,433	BIO	215	BIO	215	BIO	215
DDG (liquids)	Feed holding tank	DDG 31	1,317	BIO	198	BIO	198	BIO	198
DDG (liquids)	CIP tank	DDG 32	417	BIO	63	BIO	63	BIO	63
DDG (solids)	DDG tent storage area	DDG 36	12,862	PP	1,929	PP	1,929	PP	1,929
DDG (solids)	DDG product storage sheds	DDG 34	6,820	PP	1,023	PP	1,023	PP	1,023
DDG (solids)	Grounds	DDG 37	203	HK	0	HK	0	HK	0
DDG (solids)	DDG - palmer cooler [7]	DDG 16	17,666	BIO	2,650	BIO	2,650	BIO	2,650
DDG (solids)	DDG heat exchanger [6]	DDG 45	2,333	Repair	0	-	0	-	0
DDG (solids)	Decanter 3&4	DDG 5	1,700	Nil	1,700	BIO	255	BIO	255
DDG (solids)	Decanter 1&2	DDG 2	260	Nil	260	BIO	39	BIO	39
DDG (solids)	Decanter feed tank	DDG 1	217	WL	108	BIO	33	BIO	33
DDG (solids)	Feed dryer baghouses	DDG 18	867	BIO	130	BIO	130	BIO	130
DDG (liquid)	Light phase tank	DDG 19	450	Nil	450	Nil	450	BIO	68
DDG (solids)	DDG Dryer building	DDG 39	70,504	IV	7,050	IV / BIO[16]	7,050	IV / BIO[16]	7,050
DDG	Cooling towers	DDG 46	68,333	HK	6,833	HK	6,833	HK	6,833
Distillery	Incondensible gases vent	D6	400	Nil	400	Nil	400	Nil	400
Distillery	Molecular Sieve - Vacuum drum	D2	1,350	Nil	1,350	Nil	1,350	BIO	203
Distillery	DME vent	D12	107	Nil	107	Nil	107	Nil	107

Plant	Odour Source	ID	OER Before Control OU m^3/s	Stage 1 Odour Control [1] OU m^3/s		Stage 2 Odour Control [1] OU m^3/s		Stage 3 Odour Control [1] OU m^3/s	
				Control	OER	Control	OER	Control	OER
Ethanol	Grain silo - baghouse	E1	183	Nil	183	Nil	183	Nil	183
Ethanol	Cooling towers	E23	65,833	D	0	D	0	D	0
Ethanol	Propagator tanks 4 & 5	E15	28,333	Nil	28,333	BIO	4,250	BIO	4,250
Ethanol	Grain retention - tank 2	E8	6,500	WL	3,250	BIO	975	BIO	975
Ethanol	Propagator-tanks 1,2&3	E14	5,500	Nil	5,500	BIO	825	BIO	825
Ethanol	Jet cooker2&4	E7	1,133	Nil	1,133	Nil	1,133	BIO	170
Ethanol	Jet cooker 1 - retention tank	E13	1,067	Nil	1,067	Nil	1,067	BIO	160
Ethanol	Rejects tank	E10	183	Nil	183	Nil	183	Nil	183
Ethanol	Feed to distillery	E22	167	WL	83	WL	25	WL	25
Ethanol	Fermentation vent [2]	FER M10	518	Nil	518	Nil	518	Nil	518
Ethanol	Fermentation vent [2]	FER M11	719	Nil	719	Nil	719	Nil	719
Ethanol	Farm tank	F18	7,667	WL	3,834	BIO	1,150	BIO	1,150
Flour	Cyclone and fabric filter [3]	4	1,654	ID	1,654	ID	1,654	ID	1,654
Flour	Cyclone and fabric filter [3]	5	617	ID	617	ID	617	ID	617
Flour	Cyclone and fabric filter [3]	6	1,477	ID	1,477	ID	1,477	ID	1,477
Flour	Cyclone and fabric filter [3]	7	551	ID	551	ID	551	ID	551
Glucose	Drum vacuum receiver	C4	3,500	Nil	3,500	Nil	3,500	BIO	525
Glucose	Ion exchange effluent tank	C18	250	Nil	250	Nil	250	BIO	38
Glucose	Enzyme Tanks (7 of)	B7	4,083	WL	2,042	BIO	613	BIO	613
Glucose	Cooker A & B Flash Tanks	B3	950	Nil	950	Nil	950	BIO	143
Starch	Dry gluten bin	S7	4,500	Nil	4,500	Nil	4,500	CTS	4,500

Plant	Odour Source	ID	OER Before Control OU m^3/s	Stage 1 Odour Control [1] OU m^3/s		Stage 2 Odour Control [1] OU m^3/s		Stage 3 Odour Control [1] OU m^3/s	
				Control	OER	Control	OER	Control	OER
Starch	High protein dust collector	S8	600	Nil	600	Nil	600	Nil	600
Starch	Flour bin	S6	283	Nil	283	Nil	283	Nil	283
Starch	Flour bin aspirator	S13	1,000	Nil	1,000	Nil	1,000	Nil	1,000
Starch	Pellet silo	S12	350	Nil	350	Nil	350	Nil	350
Starch	No.4 Gluten Dryer [4]	S5	13,331	HK	9,998	HK	9,998	CTS	9,998
Starch	No.3 Gluten Dryer [4]	S3	19,501	HK	14,625	HK	14,625	CTS	14,625
Starch	No.1 Gluten Dryer [4]	S2	13,182	HK	9,886	HK	9,886	CTS	9,886
Starch	No.2 Gluten Dryer [4]	S4	5,511	HK	4,133	HK	4,133	CTS	4,133
Starch	No. 4 Starch Dryer [4]	S19	7,151	HK	5,363	HK	5,363	CTS	5,363
Starch	No. 3 Starch Dryer [4]	S18	6,436	HK	4,827	HK	4,827	CTS	4,827
Starch	No. 1 Starch Dryer [4]	S1	6,315	HK	4,736	HK	4,736	CTS	4,736
Starch	No. 5 Starch Dryer [5]	8	6,794	HK	5,095	HK	5,095	HK	5,095
Starch	Spray dryer	S20	983	HK	738	HK	738	HK	738
Starch	Kestner dryer	DDG 40	3,000	D	0	D	0	D	0
Factory	**TOTAL**		**468,105**		**158,296**		**118,659**		**111,266**
ETHANOL UPGRADE									
DDG	DDG tank vents	-	36,000	BIO	5,400	IV	5,400	IV	5,400
DDG	DDG transfer cyclones (6 units) [8]	-	9,083	BIO	1,362	BIO	1,362	BIO	1,362
DDG	DDG dryers (6 units) [8]	-	6,321	BIO	948	BIO	948	BIO	948
DDG	Decanters (10 units) [9]	-	8,417	BIO	1,263	BIO	1,263	BIO	1,263
DDG	Pelletiser baghouses (2 units) [10]	-	34,378	BIO	5,157	BIO	5,157	BIO	5,157

Plant	Odour Source	ID	OER Before Control OU m^3/s	Stage 1 Odour Control [1] OU m^3/s		Stage 2 Odour Control [1] OU m^3/s		Stage 3 Odour Control [1] OU m^3/s	
				Control	OER	Control	OER	Control	OER
DDG	General ventilation [15]	-	722	BIO	108	BIO	108	BIO	108
Ethanol	Propagation tank [11]	2	14,167	Nil	14,167	BIO	2,125	BIO	2,125
Ethanol	Fermenters (3 tanks) [12]	3	1,856	ID	1,856	ID	1,856	ID	1,856
Starch	No. 5 Gluten dryer [13]	9	12,881	HK	9,661	HK	9,661	HK	9,661
Starch	Gluten grinder [13]	10	12,881	HK	9,661	HK	9,661	HK	9,661
SUB-TOTAL	**Upgrade**		**136,706**		**49,583**		**37,541**		**37,541**
SUB-TOTAL	**Factory**		**468,105**		**158,296**		**117,852**		**111,266**
TOTAL	**Factory + upgrade**		**604,811**		**207,879**		**155,393**		**148,807**

Footnotes to table above:

1. Odour control abbreviations used are as follows: BIO – bioscrubber; WL - wet-leg installed on tanks to condense vapour emissions; D – decommissioned plant item; HK - housekeeping actions such as ductwork cleaning and maintenance, IV: industrial ventilation improvements; ID – improve dispersion from discharge points; PP – DDG pelletiser plant installation; CTS – common tall stack; Nil – no odour control at this stage.
2. Plant item was not commissioned at the time of the odour audit. OER taken from SEMA odour testing report (March 2008).
3. The flourmill was not commissioned at the time of this assessment. OER adopted from the Short Mill Flour Environmental Assessment report (GHD, March 2007).
4. A limited quantity of OER data for the gluten and starch dryers was available from the Audit Report (singleton samples were collected using pre-dilution). Extensive emission testing has been conducted by SEMA on these sources as a result of routine emission testing, as set out in Shoalhaven Starch's licence conditions (samples were collected without pre-dilution) and data was also available also from tests conducted by SEMA to determine the potential for odour emission reduction from ductwork cleaning in March 2008 (samples here were collected with and without static pre-dilution). Consideration was given to all available data with respect to data quality and quantity. Odour concentrations reported in the Audit Report were an order of magnitude higher than the odour emissions that were reported on a consistent basis during routine testing. The Audit report the gluten and starch dryers were treated as outliers by GHD. For the purpose of this assessment, OER data was adopted from the SEMA emission survey report (March 2008), which was conducted as part of the ductwork cleaning trials.

APPENDIX C – TSP EMISSION INVENTORY 2008

The emission rate data used for TSP and PM10 in this air quality assessment were primarily based on emission testing conducted by SEMA, which was either reported in the SEMA emission survey report (March, 2008) or in the quarterly discharge license monitoring reports (in the case of Boiler No. 5/6).

Fugitive emissions of TSP and PM10 have not been included in this assessment. It is assumed that the application of standard dust mitigation measures around the site (e.g. housekeeping) would provide adequate control to minimise air quality impacts.

Table 5-3 shows the factory emission inventory for particulate matter as TSP and PM10.

Table 5-3 Emission Inventory – Particulate Matter

Discharge Point	Emission Control	In-stack TSP (mg/m^3) at Stack Gas Condition	In-stack TSP (mg/m^3) at Reference Condition	In-stack TSP Concentration Standard (mg/m^3)	TSP g/s	PM10 g/s
Boiler No. 1 [12]	Gas-fired	ND	ND	-	0.07	0.07
Boiler No. 2 [1]	Cyclone	543	881 [7]	250 [8]	3.2	0.62
Boiler No. 3 [12]	Gas-fired	ND	ND	-	0.04	0.04
Boiler No. 4 [1]	Cyclone	741	723 [7]	250 [8]	6.1	1.2
Boiler No. 5/6 [2]	Cyclone & Fabric filter	32	32	50 [9]	1.0	0.75
Gluten dryer No. 1 [1]	Fabric filter	0.83	0.83	250 [8]	0.015	0.0003
Gluten dryer No. 2 [1]	Fabric filter	1.3	1.3	250 [8]	0.015	0.001
Gluten dryer No. 3 [1]	Fabric filter	0.56	0.56	250 [8]	0.02	0.02
Gluten dryer No. 4 [1,3]	Fabric filter	0.56	0.56	250 [8]	0.02	0.02
Starch dryer No. 1 [1,4]	Wet-scrubber	60	60	250 [8]	0.59	0.18
Starch dryer No. 3 [1]	Wet-scrubber	2	2	250 [8]	0.04	0.013
Starch dryer No. 4 [1]	Wet-scrubber	63	63	250 [8]	1.2	0.31
Starch dryer No. 5 (approved) [10]	Wet-scrubber	25	25	100 [8]	0.39	0.12

Discharge Point	Emission Control	In-stack TSP (mg/m^3) at Stack Gas Condition	In-stack TSP (mg/m^3) at Reference Condition	In-stack TSP Concentration Standard (mg/m^3)	TSP g/s	PM10 g/s
Spray dryer [5]	Fabric filter	60	60	250 [8]	0.48	0.14
Flour Mill (approved)	Fabric filter	<10	<10	20 [8]	0.03	0.009
Other (aggregate) [11]	Fabric filter	<10	<10	250 [8]	0.1	0.1
Total existing					**13**	**3.6**
Gluten dryer No. 5 (proposed) [6]	Fabric filter	<10	<10	20 [8]	0.02	0.02
Gluten grinder (proposed) [6]	Fabric filter	<10	<10	20 [8]	0.02	0.02
Boiler No. 7 (proposed) [12]	Gas-fired	ND	ND	-	0.07	0.07
Co-generator turbine No. 1 (proposed) [13]	Gas-fired	ND	ND	-	0.1	0.1
Co-generator turbine No. 2 (proposed) [13]	Gas-fired	ND	ND	-	0.1	0.1
Total – increment for proposed upgrade					**0.31**	**0.31**
Total – existing + upgrade					**13.3**	**3.9**

Footnotes to table above:

ND: No data

1. TSP and PM10 mass emission rate adopted from SEMA report "Stack Emission Survey – Particles, Odour, Metals & Gases" (April 2008).
2. Highest PM10 emission rate selected from recent discharge licence test results reported by SEMA "Emission survey – Boilers No. 5 and 6" (April 2007).
3. TSP concentration reported was 35 mg/m^3. GHD was advised by Shoalhaven Starches that this test result indicated a failure in the fabric filter control system, which would be fixed. Therefore, the emission rate measured for gluten dryer No. 3 was adopted.