Our ref: AU005108_PR150263_ID_L81835 **Your Ref OUT22/4008**

Date: 28 February 2023

135 Abbott Street
Cairns QLD 4870
T +61 7 4031 1336

Office of Coordinator General
Department of State Development, Infrastructure, Local Government and Planning
PO Box 15517,
City East Qld 4002

Catherine O'Neill, Senior Project Officer
Via email sdainfo@dsdip.qld.gov.au
Cc: Catherine O'Neill Catherine.ONeill@coordinatorgeneral.qld.gov.au 34527574

Dear Catherine O'Neill,

AP2022/011 Response to the request for additional information
SDA Application for a material change of use (MCU) for a high impact industry (asphalt manufacturing plant and concrete batching plant) and operational works in the Cairns South State Development Area (SDA).

We act on behalf of Koppen Construction Pty Ltd.

We refer to your request for additional information dated 19 September 2022.

Issue 1 Culvert Design

Information requested

***The proponent is requested to provide** the design of culverts that are appropriately sized and capable of handling the anticipated demand.*

Additional Information

Refer to response **Appendix A - OSE group letter dated 28 February 2023 including amended Drawings**

As per discussions with Cairns Regional Council, it is understood that Council requires further consideration of the upstream future developed catchment contributing to the flow and culvert sizing. As indicated in the discussions with Council, the existing upstream catchment topography slopes away from Warner Road to the Northeast. Therefore, only the road system is currently contributing to flows in the table drain which is approximately 1.5 Ha. However, we have assumed that possible future lots, similar in size to this proposed development, may be conditioned to discharge to Warner Road. It is noted the State will not be releasing any further land, but current farmland owned by others could potentially be converted. On this basis we have assumed an upstream developed catchment of 5 ha which may be conditioned to discharge to Warner Road prior to any formalised stormwater network flowing to the northeast is implemented. The drawings have been amended to include a 2No 1200x300 box culverts under the driveway accesses to achieve a 10 year immunity.

Issue 2 Wastewater Treatment

Information requested

It is recommended that it is considered to locate the Wastewater Treatment Plant at the amenities block and the Land Application Area (LAA) be dosed from the effluent chamber, therefore eliminating the need for the proposed collection tanks and pumps.

***The proponent is requested to provide** the following details in relation to the Sewerage Treatment and Disposal:*

a. Nominate the LAA setback distance from hardstand area and boundaries;

b. Actual inflows;

c. Siting of the LAA;

d. The method used to prevent leaching from the LAA;

e. Confirmation that there has been enough allowance for the proposed footprint of the Wastewater Treatment Plant; and

f. Nominate a LAA reserve area and exclude from any activity on the site.

Additional Information

See Appendix A - OSE group letter dated 28 February 2023 for full response

a. Setback from boundaries is 2.0m. No setback is required from hardstand areas as the greater width of the LAA than the bed will provide the required distance to prevent softening of upper layers.
b. As per Section 4 of our report, design flow is 840L/day, or 70L/person/day based on twelve persons with water closets and a kitchen in line with AS/NZS 1547-2012 On-site Domestic Wastewater Management.
c. The Land Application Area is shown in Drawing 21145-C002 at the north-western corner of the site.
d. The design of the system (including evapotranspiration), Land Application Area and setbacks is such that secondary treated effluent will not result in runaway build-up of nutrients.
e. The siting of the Wastewater Treatment Plant is shown in Drawing 21145-C002 adjacent the LAA, with sufficient space for a common “household” wastewater treatment plant.
f. Due to the limited available area and required vehicle turnpaths, as well as anticipated future development of the region, a reserve area has not been allowed for. As per Section 4 of our report, it is understood that the surrounds will be developed, including connection to sewer mains, in the coming years. For this reason, a reserve area is not considered necessary. In the event of catastrophic failure, a typical 3,000-5,000L collection tank has a three-to-six-day capacity based on an estimate of 840L/day, which could be pumped one to two times per week for transport to the local sewage treatment plant until connection to the sewer mains. Vehicle turn-paths restrict suitable locations for the Treatment Plant. In addition the siting of the office and amenities is restricted to provide best access for the plant operations. The collection tanks are also needed in lieu of a reserve LAA.

Issue 3 Drainage, Flooding and Filling

Information requested

The application has assumed that the State Development Area (SDA) has accounted for filling of the site to the 1% Annual Exceedance Probability (AEP) defined event level. No other evidence has been supplied such as State Government Assessment or other documentation to support the claim.

***The proponent is requested to provide** evidence that the SDA has accounted for the significant filling of the subject site or provide drainage study from a RPEQ to demonstrate that pre and post development impacts do not cause nuisance to surrounding properties and no ponding within the road reserve.*

Additional Information

As per discussions with Cairns Regional Council, a 2D flood study is not within the capacity of this development application. It is understood, the State is undertaking a comprehensive flood study to understand the impacts of the entire State Development Area.

Refer to response **Appendix A - OSE group letter dated 28 February 2023**

Issue 4 Traffic Impact

Information requested

It is anticipated that Warner Road will be transferred to Council once the new Pine-Creek Yarrabah Road is realigned and in service. It is currently signposted as 100km per hour and the applicant has recommended that the speed be reduced to 60km per hour. Warner Road may eventually reduce in speed limit, however until that process occurs, Council will have to consider the proposal as a reduction on the current situation not knowing the future signposted speed.

***The proponent is requested to provide** a Traffic Impact Assessment or Speed Review from a RPEQ to support the request for Warner Road to be reduced to 60km per hour to suit the proposed development and any augmentations to the existing road network required to provide safe and serviceable access to the site such as lane widening, safe intersection provision at access points, line-marking and any other necessary external works.*

Additional Information

Following discussions with Cairns Regional Council a Speed Limit Review report has been prepared. It recommends a speed posting of 70km/hr for the affected section of road. The drawings have been amended to reflect a sign posting of 70km/hr.

Refer to response **Appendix A - OSE group letter dated 28 February 2023**

Issue 5 Road Design

Information requested

The swept path analysis provided as part of the application material show that the Prime mover and semi trailer (19m) depicted in Site Vehicle Turn Movement Sketch 1 of 4 (Dwg. No 21145-SK001), may be unable to safely and efficiently exit to Warner Road without either going outside the designated access or given the close proximity to the edge of the access, will result in damage of infrastructure such as head walls, culverts etc due to consistent loads being placed on the outermost extent of the access.

***The proponent is requested to provide** an amended swept path analysis or access design to ensure that the type of vehicles utilising the subject site can be catered for by the proposed access to Warner Road.*

The project drawings specify that the existing road pavement be left and extended to suit the new traffic movements. The existing running lane will need to be cored and tested using a non-destructive method.

***The proponent is requested to provide** road pavement testing to confirm suitability for the expected traffic generation and movements.*

Additional Information

Drawing 21145-C010 has been amended to reflect a broader radius to the eastern access to accommodate the swept path. Refer amended drawings in Attachment A.

The drawings have been amended to reflect a broader radius to the eastern access to accommodate the swept path, and to include reconstruction of the entire road pavement in the affected vicinity of the new accesses.

Note that the site layout has been amended to achieve a more efficient traffic movement. New layout plans are included in Appendix A.

Refer to response **Appendix A - OSE group letter dated 28 February 2023**.

Our ref: P80775

Issue 6 Acoustic Assessment

Information requested

As stated in the environmental assessment report and planning report, there are a number of sensitive receptors located within the State Development Area (SDA) and in close proximity of the proposed activity. Therefore, an assessment of the likely impact of noise emissions from the activity on these sensitive receptors is required.

***The proponent is requested to provide** an estimation of the background noise levels for the area, the likely noise emitted by the proposed activity and the potential impact of this noise on neighbouring sensitive receptors.*

Additional Information

In response to discussions regarding the Environmental Authority application, an amended noise report has been prepared, based on more specific noise criteria received relating to the actual Muswellbrook plant that is to be relocated to the Warner Road site.

The recommendation of a 5m high acoustic fence has been removed due to its feasibility and the site is now modelled with a 2m chain wire fence.

Refer to **Response Appendix B - Environmental Noise Assessment - updated 220920D03A dated 2 Feb 2023.**

The report advised:

4 Assessment of Modelled Noise Levels

- *The site is situated in the Cairns State Development Area (SDA) area zoned as High Impact Industry. The asphalt plant will be the first development within the part of the SDA. Consequently, the region is about to commence a transition from a rural uses to industrial uses. With this in mind the Council, Industrial Goals and the State Planning Policy 5/10 have uniform criteria for the sensitive receptors close to the development and the High Impact industry Zone.*
- *The development will seek to readily meet noise level goals at all sensitive receptors and particularly at the sensitive receptors within the rural use precinct (east of the site). This will ensure other future industrial uses are not disadvantaged by virtue of not being the first development within the SDA.*
- *The calculated noise levels during the day will meet the noise level goals at all sensitive receptors without any mitigation measures.*
- *The calculated noise levels during the evening will meet the noise level goals at all sensitive receptors without any mitigation measures.*
- *The calculated noise levels during the night (without wind) will meet the noise level goals at all sensitive receptors except R1 and R2 without mitigation measures.*
- *The calculated noise levels during the night (with wind) will meet the noise level goals at all sensitive receptors except at R1, R2, R5 and R6 without any mitigation measures. There is an exceedance of up to 5 dB(A) during downwind case.*
- *Thus, the site complies with goals during the day and evening. It is likely that some limited operations could occur at night and this will be the subject of a detailed monitoring program post construction.*
- *It is proposed any vehicles operating onsite at night be fitted with broad-band squawker reversing alarms rather than tonal beepers. This effectively eliminates one of the main night adverse impacts.*
- *The noise emissions from the site operations are expected to comply with sleep disturbance goals at all sensitive receptors.*
-

4.1 Mitigation Measures

- *Internal traffic utilisation (loading machines, trucks, etc.) has been minimised by a thorough planning of plant design (piles, hoppers, silos, etc.). Ideally any waiting trucks will not que on the road network near the site but travel directly onto the site. This is relevant just prior to normal opening hours and during periods of peak production.*
- *It is proposed any vehicles operating onsite at night be fitted with broad-band squawker reversing alarms rather than tonal beepers.*
- *It was found that the noise goals are expected to be met at all sensitive receptors during the day and evening subject to the following provisions:*
    - *Vehicles operated at night to be fitted with broad-band squawker reversing alarms rather than tonal beepers.*
    - *Trucks do not que outside the site and are promptly admitted to the site*

The amended Noise report was submitted to Department of Environment and Services who have issued an Environmental Authority for the site. The Environmental Authority has set limits for the activity to ensure acoustic quality objectives are met at the sensitive receptors.

Refer to **Response Appendix G - Environmental authority P-EA-100304138**

Issue 7 Air Quality and Odour Assessment

Information requested

The environmental assessment report does include likely contaminants, proposed air quality limits and the height and velocity for the asphalt stack. However, there is no discussion included in the application as to the basis for these limits or why these limits are appropriate for the protection of environmental values. The application also does not include emissions associated with any vents for product or raw material storages located on the site. There are also a number of sensitive receptors located within the SDA and in close proximity of the proposed activity.

***The proponent is requested to provide** an assessment of the likely impacts of air emissions (including odour) from the activity on sensitive receptors and the air quality of the area. The assessment should include a detailed discussion as to the possible composition of the air and odour emissions, considering the materials being kept and handled on the site, details of the exhaust stacks and vents to be established including their location (coordinates in GDA2020), height, emission rates and the adequacy of each stack and/or vent to ensure dispersion of air emissions, and the potential impact of these air emissions on air quality and the neighbouring sensitive receptors.*

Additional Information

Refer to **Response Appendix C - 220920D04 Air Quality Assessment150** prepared by SE Group.

The report concluded that dust modelling demonstrates compliance with the PM2.5 24 hour and annual average critical level and PM10 (24 hour) emissions could potentially exceed at one site to the west of the site, however with a baghouse and windbreak for the concrete batching plants, it would result in compliance at all times.

The report also concluded that dust deposition (total dust) complies with the goals, all pollutants readily comply with the air quality goals at all sensitive receptors, and odour is expected to comply with the nominated requirements.

The report recommends trees or screens around the perimeter to encourage turbulence in the airflow which is going to be installed to meet the acoustic report recommendations and visual amenity requirements.

Stack heights and emissions are included in the report in detail. At this point in time, the exact location of the stack in GPS is unknown but can be provided upon commissioning.

The amended Noise report was submitted to Department of Environment and Services who have issued an Environmental Authority for the site. The Environmental Authority has set limits for the activity to ensure air quality and odour objectives are met.

Refer to **Response Appendix G - Environmental authority P-EA-100304138**

Issue 8 Greenhouse Gas Emissions

Information requested

Section 6.5 of the planning report states that there will be no net increases in the emission of greenhouse gases as this new development will replace the current asphalt plant.

***The proponent is requested to provide** a comparison of the greenhouse gas emissions between these two sites to validate this statement.*

Additional Information

The approval of the development of this site (Warner Road) will allow the proponent to cease operations at its current asphalt plant at Tingira Street Portsmith (NQ Asphalt) which is an older, less efficient plant. The proposed plant will be relocated from the Muswellbrook site. As a result, there will be net reduction in greenhouse gas emissions which have been calculated from recent air quality emissions testing data.

There has been no monitoring of greenhouse gas emissions from the Muswellbrook site, however our client has committed to relocating the existing Newpave Asphalt plant in Muswellbrook to the Warner Road site, so there will be no net increase in greenhouse gas emissions (as there will not be a “new” plant constructed at Warner road, rather it will be a “relocated” plant.

Additionally, the approval of the development of this site (Warner Road) will allow the proponent to cease operations at its current asphalt plant at Tingira Street Portsmith (NQ Asphalt) which is an older, less efficient plant. As such the emissions from the Tingira site will be completely removed from the overall greenhouse gas emissions. For comparison, for the NQ Asphalt Site, stack emissions testing under by Air Labs Environmental on 19th September 2022 has confirmed that 10L of diesel is consumed per tonne of product and 48 tonnes are produced per hour. Approximately 2.7kg of carbon dioxide is produced per litre of diesel. This equates to approximately 51,840kg per week and 2,488 tonne of CO2 emissions per year.

Refer to **Response Appendix D - Tingira Street NQ Asphalt Stack Test Report AUG22127.1**

Refer to **Response Appendix E - Muswellbrook Asphalt Plant Air Quality Impact Assessment**

As a result, there will be a net decrease in greenhouse gas emissions.

Issue 9 Stormwater Management

Information requested

Section 5.5.5 and 5.5.6 of the planning report states that the site will be discharging potentially impacted stormwaters offsite to Warner Road and that a bioretention system including a gross pollutant trap (GPT) will be installed to minimise the contaminant load. The Engineering report in Appendix G section 5 details the proposed system and has calculated the concentrations of total suspended solids, total nitrogen, total phosphorus, gross pollutants and hydrocarbons (for dry weather emergency spills only). However, there is no assessment or indication as to whether any other potential contaminants associated with the facility, including hydrocarbons, could potentially be entrained in stormwaters and how the proposed stormwater system will manage these.

The proponent is requested to provide *an assessment of the adequacy of the proposed stormwater management system in relation to all possible contaminants associated with the facility. Including likely contaminants to be present within any captured stormwaters and an estimate of the concentrations of these contaminants likely to be discharged offsite.*

Additional Information

The site will be fully sealed, with all hydrocarbon and bitumen tanks are bunded in accordance with AS1940, and all stormwaters will go through a hydrocarbon/water separator before reporting to a bio-retention swale that has been modelled using EPA SWMM with the following parameters:

- 120m length
- 4m width
- Grading at 0.5% with 600mm depth of sandy loam filter media

OSE Group undertook a stormwater quality and quantity assessment, please refer to the attached letter from earlier this year for the full report.

The water quality discharge limits have been designed in accordance with the *State Planning Policy – Water Quality Objectives* to meet the Wet Tropics design objectives for Total Suspended Solids, Total Phosphorus, Total Nitrogen and Gross Pollutants, and to limit the peak 1 year ARI event discharge within the receiving waterway to the pre-development peak 1 year discharge. This will ensure water quality for contaminants, nutrients and sediments are managed appropriately. In addition, the EA provides water quality release limits to reduce any potential for environmental harm to the receiving environment.

Environmental Authority

During the period to respond to this information request, the amended Noise and air quality reports were submitted to Department of Environment and Services who have issued an Environmental Authority for the site.

The Environmental Authority has imposed various conditions to control the impacts of the development on air, noise and water.

Refer to **Response Appendix F - Environmental authority P-EA-100304138**

Yours sincerely,

for RPS Australia East Pty Ltd

Ian Doust
Principal
ian.doust@rpsgroup.com.au

Attachments:

1. Response Appendix A - OSE group letter 21145_230125_28Feb2023
2. Response Appendix B - Environmental Noise Assessment - updated 220920D03A
3. Response Appendix C - 220920D04 Air Quality Assessment
4. Response Appendix D - Tingira Street NQ Asphalt Air Emissions Monitoring Portsmith
5. Response Appendix E - Muswellbrook Asphalt Plant Air Quality Impact Assessment
6. Response Appendix F - Environmental Authority_DN and Site-specific_Permit_Document - Koppen Constructions

28 February 2023 Our Reference: 21145_230228

RPS
135 Abbott St
Cairns, Queensland 4870

Attention: Ian Doust

Dear Ian,

AP2022/011 – SDA application for a material change of use for high impact industry (asphalt plant and concrete batching plant) in the Cairns South State Development Area – Request for Further Information

I refer to the above Request for Further Information and advise our responses to the engineering matters as follows:

The proponent is requested to provide the design of culverts that are appropriately sized and capable of handling the anticipated demand.

As per discussions with Cairns Regional Council, it is understood that Council requires further consideration of the upstream future developed catchment contributing to the flow and culvert sizing. As indicated in the discussions with Council, the existing upstream catchment topography slopes away from Warner Road to the Northeast. Therefore, only the road system is currently contributing to flows in the table drain which is approximately 1.5 Ha. However, we have assumed that possible future lots, similar in size to this proposed development, may be conditioned to discharge to Warner Road. It is noted the State will not be releasing any further land, but current farmland owned by others could potentially be converted. On this basis we have assumed an upstream developed catchment of 5 ha which may be conditioned to discharge to Warner Road prior to any formalised stormwater network flowing to the northeast is implemented. The drawings have been amended to include a 2No 1200x300 box culverts under the driveway accesses to achieve a 10 year immunity. Refer Attachment A for amended drawings.

The proponent is requested to provide following details in relation to the Sewerage Treatment and Disposal:

a. Nominate the Land Application Area (LAA) setback distance from hardstand area and boundaries;

Setback from boundaries is 2.0m. Given the retaining wall is approximately 1.0m high, this is considered suitable as flow of treated effluent will reach natural ground level before reaching the lot boundary.

No setback is required from hardstand areas as the greater width of the LAA than the bed will provide the required distance to prevent softening of upper layers. Additionally, vehicles will rarely frequent the area immediately adjacent the LAA.

b. Actual inflows;

As per Section 4 of our report, design flow is 840L/day, or 70L/person/day based on twelve persons with water closets and a kitchen in line with AS/NZS 1547-2012 *On-site Domestic Wastewater Management.* The closest premise type within the standard is a "rural factory" in Table H4 *Typical Domestic Wastewater Design Flow Allowances – Domestic Wastewater from Commercial Premises – New Zealand*, with a design flow of 50L/person/day. As such, our allowance is considered suitable.

Project Manager: peter.deroma@osegroup.com.au
Art Work Spaces I 36 Abbott St Cairns QLD 4870
PO Box 809 I Edge Hill Cairns Qld 4870

c. Siting of the LAA;

The Land Application Area is shown in Drawing 21145-C002 at the north-western corner of the site.

d. The method used to prevent leaching from the LAA;

The design of the system (including evapotranspiration), Land Application Area and setbacks is such that secondary treated effluent will not result in runaway build-up of nutrients.

e. Confirmation that there has been enough allowance for the proposed footprint of the Wastewater Treatment Plant; and

The siting of the Wastewater Treatment Plant is shown in Drawing 21145-C002 adjacent the LAA, with sufficient space for a common "household" wastewater treatment plant.

f. Nominate a LAA reserve area and exclude from any activity on the site.

Due to the limited available area and required vehicle turnpaths, as well as anticipated future development of the region, a reserve area has not been allowed for. As per Section 4 of our report, it is understood that the surrounds will be developed, including connection to sewer mains, in the coming years. For this reason, a reserve area is not considered necessary. In the event of catastrophic failure, a typical 3,000-5,000L collection tank has a three-to-six-day capacity based on an estimate of 840L/day, which could be pumped one to two times per week for transport to the local sewage treatment plant until connection to the sewer mains.

Note it is recommended to locate the Wastewater Treatment Plant at the amenities block and the LAA be dosed from the effluent chamber, therefore eliminating the need for the proposed collection tanks and pumps.

Vehicle turn-paths restrict suitable locations for the Treatment Plant. In addition the siting of the office and amenities is restricted to provide best access for the plant operations. The collection tanks are also needed in lieu of a reserve LAA.

The proponent is requested to provide evidence that the SDA has accounted for the significant filling of the subject site or provide drainage study from a RPEQ to demonstrate that pre and post development impacts do not cause nuisance to surrounding properties and no ponding within the road reserve.

As per discussions with Cairns Regional Council, a 2D flood study is not within the capacity of this development application. It is understood, the State is undertaking a comprehensive flood study to understand the impacts of the entire State Development Area.

The proponent is requested to provide a Traffic Impact Assessment or Speed Review from a RPEQ to support the request for Warner Road to be reduced to 60km per hour to suit the proposed development and any augmentations to the existing road network required to provide safe and serviceable access to the site such as lane widening, safe intersection provision at access points, line-marking and any other necessary external works.

Refer SMEC Speed Limit Review report in Attachment B. It recommends a speed posting of 70km/hr for the affected section of road. The drawings have been amended to reflect a sign posting of 70km/hr.

The proponent is requested to provide an amended swept path analysis or access design to ensure that the type of vehicles utilising the subject site can be catered for by the proposed access to Warner Road.

Drawing 21145-C010 has been amended to reflect a broader radius to the eastern access to accommodate the swept path. Refer amended drawings in Attachment A.

The proponent is requested to provide road pavement testing to confirm suitability for the expected traffic generation and movements.

The drawings have been amended to include reconstruction of the entire road pavement in the affected vicinity of the new accesses. Refer amended drawings Attachment A.

I trust the above additional information satisfies the request for further information.

Your sincerely,

Peter De Roma

Principal Engineer

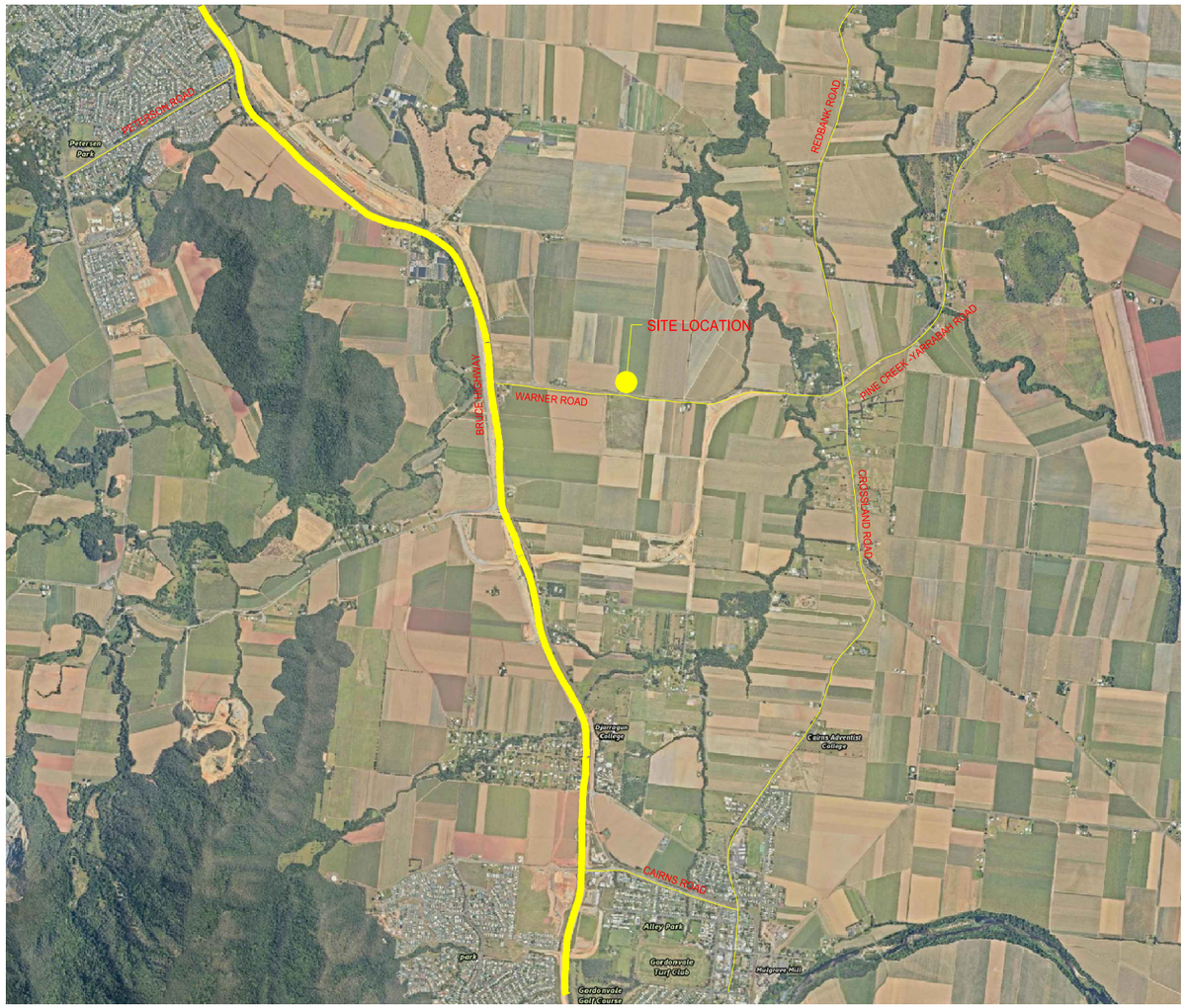
OSE Group Pty Ltd

Attachment A

Amended Design Drawings

CIVIL SITE WORKS FOR PROPOSED ASPHALT PLANT
WARNER ROAD - GORDONVALE

FOR KOPPEN CONSTRUCTION PTY LTD



DRAWING INDEX

21145-C000	COVER SHEET, DRAWING INDEX AND LOCALITY PLAN
21145-C001	ENGINEERING NOTES
21145-C002	INTERNAL SITE LAYOUT - GENERAL ARRANGEMENT PLAN
21145-C003	RETAINING WALL DETAILS
21145-C004	EARTHWORKS SECTION AND DETAILS
21145-C005	BIORETENTION SWALE SECTION & STORMWATER INVERT LEVELS
21145-C006	ON SITE SEWER TREATMENT SECTIONS AND DETAILS
21145-C007	SITE CONTOUR PLAN AND SETOUT
21145-C008	EROSION AND SEDIMENT CONTROL STRATEGY DURING CONSTRUCTION
21145-C009	EXTERNAL SITE WORKS - WARNER ROAD WIDENING UPGRADE GENERAL ARRANGEMENT
21145-C010	EXTERNAL SITE WORKS - WARNER ROAD WIDENING UPGRADE PAVEMENT, SURFACING AND SETOUT PLAN
21145-C011	EXTERNAL SITE WORKS - WARNER ROAD WIDENING UPGRADE LINEMARKING SETOUT
21145-C012	EXTERNAL SITE WORKS - WARNER ROAD WIDENING UPGRADE CONTOUR PLAN
21145-C013	EXTERNAL SITE WORKS - WARNER ROAD WIDENING UPGRADE ANNOTATED CROSS SECTIONS - SHEET 1 OF 2
21145-C014	EXTERNAL SITE WORKS - WARNER ROAD WIDENING UPGRADE ANNOTATED CROSS SECTIONS - SHEET 2 OF 2
21145-SK001	SITE VEHICLE TURN MOVEMENT SKETCHES 1 OF 4
21145-SK002	SITE VEHICLE TURN MOVEMENT SKETCHES 2 OF 4
21145-SK003	SITE VEHICLE TURN MOVEMENT SKETCHES 3 OF 4
21145-SK004	SITE VEHICLE TURN MOVEMENT SKETCHES 4 OF 4
21145-SK005	LANDSCAPING PLAN - AND PLANTING SCHEDULES

REV	DATE	REVISION NOTES
A	30.05.22	INITIAL ISSUE

DESIGNER
OSE GROUP
Address: 35 ABBOTT ST, CAIRNS 4870
Email: admin@osegroup.com.au

CLIENT
KOPPEN CONSTRUCTION

PROJECT
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE
COVER SHEET, DRAWING INDEX AND LOCALITY PLAN

SCALE	DRAWING No	REV
AS SHOWN	21145-C000	A

27/02/2023 3:41:56 PMFile: C:\OSE\OSE Group\Operations - Docs\Projects\2021\21145 Asphalt Plant Warner Rd\Drawings\Working\21145 Koppens Ashalt Plant Warner Road\21145-DESIGN.dwg

SURVEY & EXISTING SERVICES

1. HORIZONTAL DATUM IS MGA2020 - ZONE 55
2. LEVEL DATUM IS AHD.
3. THE ORIGIN FOR THE LEVELS IS - PM AND LOCATED AT E:370455.637 N:8114259.635
4. REFER RPS SURVEYORS FOR THE SURVEY STATION SETOUT DETAILS
5. THE EXISTING SERVICES SHOWN ON THESE DRAWINGS ARE DERIVED FROM SURFACE SURVEY AND COUNCIL RECORDS AND MAY NOT REPRESENT THE EXISTING SERVICES PRESENT BELOW THE SURFACE.
6. THE CONTRACTOR SHALL BE RESPONSIBLE TO LOCATE ALL EXISTING SERVICES PRIOR TO ANY EXCAVATION, PARTICULARLY ON FOOTPATHS.
7. ALL DAMAGE TO EXISTING SERVICES SHALL BE MADE GOOD TO THE SATISFACTION OF THE SUPERINTENDENT AND THE RELEVANT AUTHORITY, ALL AT THE CONTRACTORS EXPENSE. THE CONTRACTOR SHALL NOTIFY THE RELEVANT AUTHORITY IMMEDIATELY WHEN ANY DAMAGE OCCURS.
8. THE LINE AND LEVEL OF EXISTING UNDERGROUND SERVICES SHALL BE DETERMINED BY THE CONTRACTOR AND THE ENGINEER SHALL BE NOTIFIED OF ANY POTENTIAL CLASHES WITH DESIGN STRUCTURES AND SERVICES PRIOR TO COMMENCING CONSTRUCTION.
9. EXISTING OUTLET LEVELS OR CONNECTION LEVELS FOR ALL DESIGN STORMWATER AND SEWER SHALL BE CONFIRMED BY THE CONTRACTOR AND THE ENGINEER SHALL BE NOTIFIED OF ANY VARIATIONS PRIOR TO COMMENCING CONSTRUCTION.
10. EXISTING SERVICES ON THE DRAWINGS ARE PLOTTED FROM THE BEST INFORMATION AVAILABLE. NO RESPONSIBLY IS TAKEN BY THE PRINCIPAL OR SUPERINTENDENT FOR THE ACCURACY AND COMPLETENESS OF THE INFORMATION SHOWN.
11. PRIOR TO THE COMMENCEMENT OF CONSTRUCTION THE CONTRACTOR IS TO ESTABLISH ON SITE THE EXACT POSITION OF ALL UNDERGROUND SERVICES IN THE PROPOSED WORKS AREA. METHODS FOR ACHIEVING THIS WILL INCLUDE BUT NOT BE LIMITED TO:-
    - CAREFUL EXAMINATION OF THE CONTRACT DRAWINGS.
    - CONSULTATION WITH THE RELEVANT SERVICE AUTHORITIES.
    - COMPREHENSIVELY SCANNING THE AFFECTED AREAS WITH A CABLE DETECTOR AND MARKING ON THE GROUND THE POSITION OF ALL SERVICES.
    - HAND EXCAVATING TO EXPOSE ALL SUCH SERVICES WHICH MAY BE AFFECTED BY THE PROPOSED WORKS UNDER THE DIRECTION OF THE RELEVANT SERVICE AUTHORITY.
12. THE CONTRACTOR IS TO BRING TO THE SUPERINTENDENT'S ATTENTION ANY DISCREPANCIES BETWEEN THE EXISTING SERVICES THUS IDENTIFIED AND DOCUMENTED SERVICES WHICH MIGHT AFFECT THE PROPOSED WORKS. APPROPRIATE MEASURES TO RESOLVE ANY CONFLICT WILL BE DOCUMENTED BY THE SUPERINTENDENT.
13. THIS DESIGN HAS BEEN BASED ON SERVICE AUTHORITY "AS CONSTRUCTED" INFORMATION AND LIMITED POTHOLING OR NO POTHOLING HAS BEEN UNDERTAKEN TO VERIFY EXISTING SERVICE LOCATIONS AND DEPTHS. IT IS THE CONTRACTOR'S RESPONSIBILITY TO UNDERTAKE POTHOLING TO VERIFY THE DESIGN. NOTIFY THE DESIGN CONSULTANTS OF ANY SERVICE CLASHES.
14. THE CONTRACTOR SHALL EXCAVATE BY HAND TO EXPOSE THE WATER MAINS AND/OR SEWERS AND SHALL CONSTRUCT A CONCRETE SPANNING SLAB TO COUNCIL REQUIREMENTS OVER THE WATER MAINS OR SEWERS SO THAT NO LOADS ARE IMPOSED ONTO THOSE MAINS.

EARTHWORKS NOTES

1. ALL FOOTPATHS SHALL BE GRASSED (DRILL SEEDED WITH APPROVED GRASS SPECIES) IN ACCORDANCE WITH LANDSCAPE SPECIFICATIONS, FERTILIZED AND MAINTAINED FOR THE REQUIRED MAINTENANCE PERIOD.
2. CLEAR TREES, LARGE SHRUBS ETC FROM THE AREA OF LOTS AND ROAD RESERVES, ONLY FOR CONSTRUCTION OF ROADS AND SERVICES, AND EITHER REMOVE FROM SITE OR ALTERNATIVELY CHIP MULCH AND STOCKPILE FOR RE-USE IN LANDSCAPING. CONTRACTOR SHALL OBTAIN COUNCIL INSPECTION AND APPROVAL PRIOR TO COMMENCING ANY TREE AND VEGETATION CLEARING. ALL VEGETATION/CONSERVATION ZONES SHALL BE RETAINED AND SHALL BE ADEQUATELY FENCED/SEGREGATED PRIOR TO COMMENCING CONSTRUCTION.
3. SLASH THE EARTHWORKS AREA. CONTINUE SLASHING AREAS AS NECESSARY AND AS INSTRUCTED BY THE SUPERINTENDENT DURING THE CONTRACT AND MAINTENANCE PERIOD TO KEEP GRASS TO A MAXIMUM 50mm TO 100mm HIGH.
4. ALL GULLIES AND DEPRESSIONS REQUIRING FILLING SHALL BE CLEARED, GRUBBED AND CLEANED OUT OF SILT, BOULDERS, DEBRIS ETC TO PROVIDE A CLEAN, FIRM BASE PRIOR TO PLACING ANY FILL OR FILTER MATERIALS. COMPACT ALL NATURAL SUBGRADES WITH 6 TO 8 PASSES OF A 10 TONNE VIBRATING ROLLER PRIOR TO PLACING ANY FILL MATERIALS. PLACE SUBSOIL DRAINS/MATS TO ENGINEERS APPROVALS AT THE BASE OF ALL SUCH FILLS AND OUTLET TO THE STORMWATER DRAINAGE SYSTEM. NOTIFY THE SUPERINTENDENT FOR AN INSPECTION PRIOR TO PLACING ANY FILL MATERIALS.
5. WHERE FILL IS PLACED ON SLOPING EXISTING SURFACE, THE EXISTING SURFACE SHALL BE BENCHED AND THE BENCH COMPACTED TO 98% SRDD PRIOR TO PLACING THE FILL MATERIAL.
6. REMOVE SURFACE ROCKS AND REUSE IN SCOUR PROTECTION. REMOVE EXCESS FROM SITE OR STOCKPILE AS DIRECTED. ALL COSTS TO BE INCLUDED IN CONTRACT LUMP SUM.
7. THE CONTRACTOR SHALL ENSURE NO PONDING AREAS RESULT FROM THE EARTHWORKS OPERATION. ANY SUCH AREAS WHICH DEVELOP SHALL BE RECTIFIED AS DIRECTED BY THE SUPERINTENDENT. THE CONTRACTOR SHALL NOTIFY THE SUPERINTENDENT OF THE DEVELOPMENT OR EXISTENCE OF ANY SUCH PONDING AREAS.
8. BATTERS IN EXCESS OF 1.5m HIGH SHALL BE ASSESSED AND REPORTED FOR STABILITY (DURING CONSTRUCTION) BY A GEOTECHNICAL ENGINEER. COPIES OF REPORTS SHALL BE FORWARDED TO THE SUPERINTENDENT AND TO COUNCIL.
9. THE CONTRACTOR SHALL CONSTRUCT TEMPORARY BERMS AT THE TOP OF ALL BATTERS TO DIRECT AND CONTROL RUNOFF TO A SINGLE LOCATION. THE DISCHARGE OVER THE BATTER SHALL BE THROUGH A STABILISED CHUTE ADDRESSED IN THE CONTRACTORS PLAN, e.g. REINFORCED TURF, GEOTEXTILE, CONCRETE OR SIMILAR.
10. ALL BATTERS FRONTING THE ROAD RESERVES (AND NOT IN PRIVATE PROPERTY) SHALL BE FINISHED AT 1 ON 2 AND LANDSCAPED WITH LOW MAINTENANCE PLANTS IN ACCORDANCE WITH FNQROC DEVELOPMENT MANUAL.
11. THE CONTRACTOR SHALL ENSURE THE PROPOSED CONSTRUCTION EQUIPMENT TO BE USED ON THE SITE WILL NOT DAMAGE EXISTING UNDERGROUND INFRASTRUCTURE, IN PARTICULAR HEAVY EQUIPMENT TRAVERSING OVER A.C. MAINS WITH NOMINAL COVERS.

IMPORTED NON-PLASTIC FILL

1. AS METRIC SIEVE % PASSING BY WEIGHT
   75mm 100
   2.36mm 25 - 70
   75um 0 - 30
2. MINIATURE ABRASION LOSS PASSING 2.36mm 0 - 15
3. LINEAR SHRINKAGE PASSING 4.25um 0 - 8
4. MATERIAL RETAINED ON 2.36mm SIEVE SHALL CONSIST OF SOUND STONE
5. SOAKED CBR 15 AT 98% SRDD COMPACTION

PAVEMENT

1. 150mm BASE COURSE TYPE 2.2 (CBR 60) COMPACTED TO 100% SRDD.
2. 150mm SUB BASE COURSE TYPE 2.3 (CBR 45) COMPACTED TO 100% SRDD.
3. SUB GRADE (CBR 5 MINIMUM) TRIMMED AND COMPACTED TO 98% SRDD.
4. SUB GRADE CBR (SOAKED AT 98% SRDD) TO BE CHECKED AND SUBMITTED TO THE ENGINEER FOR CONFIRMATION OF PAVEMENT DESIGN (REFER PAVEMENT SUBGRADE NOTES).

GENERAL PAVEMENT NOTES

1. THE CONTRACTOR SHALL ADVISE THE ENGINEER, IN WRITING, OF THE SOURCE OF GRAVEL SUPPLY, PROOF OF GRADING, CBR AND TYPE, AT LEAST ONE WEEK PRIOR TO PAVEMENT GRAVEL BEING DELIVERED TO THE SITE.
2. NO PAVEMENT GRAVEL SHALL BE DELIVERED TO THE SITE UNTIL AFTER THE CONTRACTOR HAS RECEIVED WRITTEN CONFIRMATION OF THE PAVEMENT DESIGN FROM THE SUPERINTENDENT.
3. THE CONTRACTOR SHALL ENSURE THAT THE PAVEMENT COURSES ARE SET DOWN SUFFICIENTLY TO ALLOW FOR THE THICKNESS OF ASPHALT (AND/OR BITUMEN) SEAL COAT.

ASPHALT - INTERNAL SITE WORKS

1. THE PAVEMENT SHALL BE BROOMED CLEAN AND SHALL BE DRY PRIOR TO APPLYING PRIME COAT.
2. PRIME COAT SHALL BE APPLIED 48 HOURS PRIOR TO ASPHALT SEALING.
3. APPLY 40mm OF APPROVED ASPHALT.
4. THE PRIME COAT AND HOT MIX DESIGN SHALL BE SUPPLIED AND PLACED IN ACCORDANCE WITH TMR SPECIFICATION REQUIREMENTS, WITH POLYMER ADDITIVES.

ENVIRONMENTAL PROTECTION AND EROSION SEDIMENT CONTROL

1. THE CONTRACTOR IS RESPONSIBLE WITHIN THE LIMITS IMPOSED BY THE WORKS, TO PROTECT AND PRESERVE THE NATURAL ENVIRONMENT AND AVOID POLLUTION.
2.
3. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE INCORPORATION OF APPROPRIATE CONTROL MEASURES CONFORMING WITH THE REQUIREMENTS OF THE RELEVENT AUTHORITY.
4. ALL BARE EARTH AREAS, FOOTPATHS, DRAINS AND CUT BATTERS UP TO 1 on 4 SLOPES SHALL BE DRILLED SEEDED WITH APPROVED GRASS SPECIES, FERTILISED AND MAINTAINED FOR THE REQUIRED MAINTENANCE PERIOD.
5. ALL CUT AND FILL BATTERS STEEPER THAN 1 on 4 SHALL BE HYDROMULCHED WITH APPROVED SUITABLE GRASS SPECIES AND MAINTAINED FOR THE REQUIRED MAINTENANCE PERIOD.

EROSION SEDIMENT CONTROL STRATEGY AND ENVIRONMENTAL PROTECTION

1. THE CONTRACTOR SHALL BE RESPONSIBLE TO PROTECT AND PRESERVE THE NATURAL ENVIRONMENT AND SHALL AVOID ENVIRONMENTAL POLLUTION IN ACCORDANCE WITH THE ENVIRONMENTAL PROTECTION ACT.
2. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE INCORPORATION OF APPROPRIATE CONTROL AND MANAGEMENT MEASURES CONFORMING TO THE REQUIREMENTS OF THE ACT AND THE RELEVANT AUTHORITIES.
3. THE EROSION AND SEDIMENT CONTROL STRATEGY, SHOWN OR NOTED ON THESE DRAWINGS, HAS BEEN PROVIDED AS A GUIDE.
4. THE CONTRACTOR SHALL PROVIDE AN EROSION SEDIMENT CONTROL PLAN (ESCP) FOR EACH PHASE OF HIS PROPOSED CONSTRUCTION PROGRAM AND WORK METHODS, AND IS WHOLLY RESPONSIBLE FOR THE IMPLEMENTATION, CONTROL AND MANAGEMENT OF SUCH PLAN.
5. THE CONTRACTOR SHALL INSTALL ALL DEVICES/MEASURES NECESSARY TO COMPLY WITH THE PROVISIONS OF THE ESCP FNQROC DEVELOPMENT MANUAL, THE ENVIRONMENTAL PROTECTION ACT, AND COUNCIL REQUIREMENTS.
6. THE ESCP SHALL INCLUDE SUCH MEASURES AS SHOWN ON THE STRATEGIC PLAN.
7. OSE GROUP DO NOT ACCEPT RESPONSIBILITY FOR THE CONTRACTOR'S DESIGN & IMPLEMENTATION OF HIS ESCP NOR THE CONSEQUENCES OF HIS FAILURE TO APPLY ALL REASONABLE CONTROLS.
8. ALL STORMWATER INLETS, TRENCHES, ETC, SHALL BE CONSTRUCTED IN SUCH A WAY AS TO PREVENT THE ENTRY OF SEDIMENT INTO THE STRUCTURE. IF IT IS NECESSARY TO DISCHARGE INTO SUCH INLETS THEN SUITABLE SILT TRAPS SHALL BE CONSTRUCTED UPSTREAM OF THE INLETS SUCH THAT OVERFLOW FROM TRAPS ENTERS THE DRAINS AFTER THE SEDIMENT HAS DROPPED OUT.
9. ALL SEDIMENT CONTROL MEASURES SHALL REMAIN IN PLACE UNTIL THE END OF THE MAINTENANCE PERIOD, UNLESS NOTED OTHERWISE. ALL SEDIMENT CONTROL DEVICES ARE TO BE FULLY MAINTAINED IN AN EFFECTIVE WORKING CONDITION DURING CONSTRUCTION AND THE MAINTENANCE PERIOD. THE CONTRACTOR SHALL ENSURE THAT ALL SEDIMENT CONTROL DEVICES ARE KEPT FREE OF SEDIMENT BUILD-UP.
10. SEDIMENT FENCES SHALL BE INSTALLED SUCH THAT THE BASE OF THE FENCE IS PLACED 150MM MINIMUM BELOW GROUND LEVEL, AND ANCHORED SECURELY IN SUCH POSITION.
11. ALL VEHICLE EXIT POINTS SHALL HAVE SHAKER GRIDS, WASH BAYS OR SIMILAR TO PREVENT VEHICLES FROM TRACKING SOIL AND MUD OFF SITE.
12. ALL SOIL STOCKPILES SHALL BE PROTECTED AGAINST WIND EROSION BY COVERING AND AGAINST STORMWATER RUNOFF BY SILT FENCES AT THE DOWNHILL SLOPES. STOCKPILE LOCATIONS SHALL BE DETERMINED BY THE CONTRACTOR AND EROSION/CONTROL MEASURES IMPLEMENTED & MAINTAINED FOR THE LIFE OF THE STOCKPILE.
13. THE CONTRACTOR SHALL INSTALL TURF STRIPS BEHIND ALL KERB & CHANNEL, ADJACENT CONCRETE INVERTS AND ALLOTMENT DRAINS ETC WHERE DIRTY WATER SHEET FLOWS INTO DRAINAGE COLLECTION SYSTEMS.
14. DIVERT CLEAN WATER AROUND AREAS OF CONSTRUCTION.
15. DRILL SEED ALL ROAD SHOULDERS, FOOTPATHS, DRAINS AND CUT BATTERS UP TO 1 on 4 SLOPE SHALL BE DRILL SEEDED WITH APPROVED GRASS SPECIES, FERTILIZED AND MAINTAINED FOR THE REQUIRED MAINTENANCE PERIOD
16. HYDROMULCH ALL CUT AND FILL BATTERS STEEPER THAN 1 on 4, WITH APPROVED SUITABLE GRASS SPECIES AND MAINTAINED FOR THE REQUIRED MAINTENANCE PERIOD
17. THE CONTRACTOR SHALL CONSTRUCT TEMPORARY BERMS AT THE TOP OF ALL BATTERS TO DIRECT AND CONTROL RUNOFF TO A SINGLE LOCATION. THE DISCHARGE OVER THE BATTER SHALL BE THROUGH A STABILIZED CHUTE ADDRESSED IN THE CONTRACTORS PLAN, e.g. REINFORCED TURF, GEOTEXTILE, CONCRETE OR SIMILAR.
18. ALL WORKS AND MATERIALS SHALL BE IN ACCORDANCE WITH FNQROC.

TRENCHES (DRAINAGE, SEWERAGE, SERVICES)

1. PLACE AND COMPACT SAND BEDDING, SAND SURROUND AND SAND BACKFILL TO ALL TRENCHES UP TO THE UNDERSIDE OF THE PAVEMENT IN ROADWAYS AND DRIVEWAYS, AND UP TO 150mm BELOW FINISHED SURFACE LEVEL ELSEWHERE.

REV	DATE	REVISION NOTES
A	30.05.22	INITIAL ISSUE

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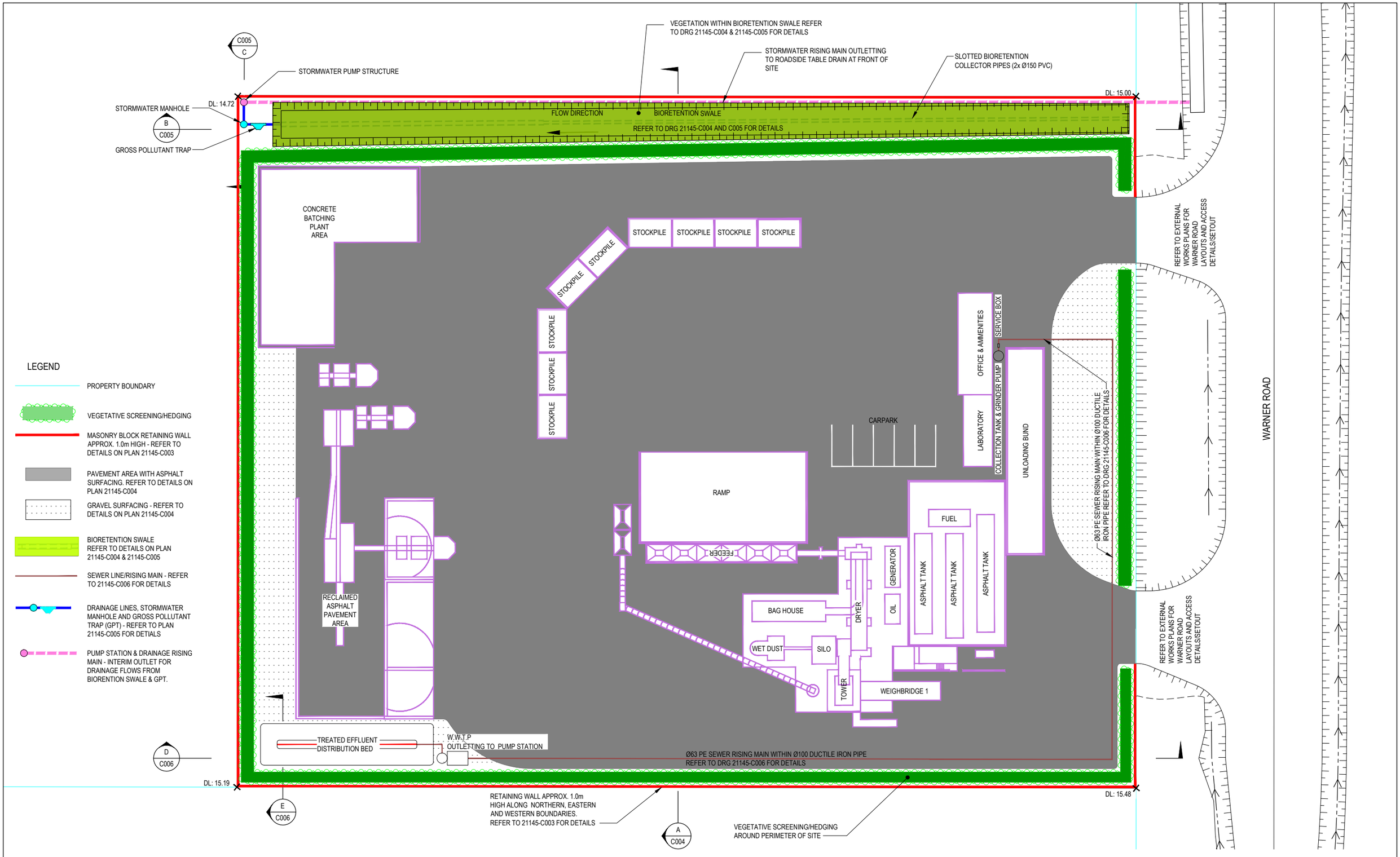
CLIENT
KOPPEN CONSTRUCTION

PROJECT
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE
ENGINEERING NOTES

SCALE	DRAWING No	REV
1:500 (A3)	21145-C001	A



LEGEND

- PROPERTY BOUNDARY
- VEGETATIVE SCREENING/HEDGING
- MASONRY BLOCK RETAINING WALL APPROX. 1.0m HIGH - REFER TO DETAILS ON PLAN 21145-C003
- PAVEMENT AREA WITH ASPHALT SURFACING. REFER TO DETAILS ON PLAN 21145-C004
- GRAVEL SURFACING - REFER TO DETAILS ON PLAN 21145-C004
- BIORETENTION SWALE REFER TO DETAILS ON PLAN 21145-C004 & 21145-C005
- SEWER LINE/RISING MAIN - REFER TO 21145-C006 FOR DETAILS
- DRAINAGE LINES, STORMWATER MANHOLE AND GROSS POLLUTANT TRAP (GPT) - REFER TO PLAN 21145-C005 FOR DETIALS
- PUMP STATION & DRAINAGE RISING MAIN - INTERIM OUTLET FOR DRAINAGE FLOWS FROM BIORENTION SWALE & GPT.

REV	DATE	REVISION NOTES
C	27.02.23	NEW INTERNAL PLANT LAYOUT
B	6.06.22	STORMWATER SCHEME AMMENDED
A	30.05.22	INITIAL ISSUE

2.5 0 2.5 5 7.5 10 12.5 m

SCALE 1:500

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KOPPEN CONSTRUCTION

PROJECT: ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE: INTERNAL SITE LAYOUT - GENERAL ARRANGEMENT PLAN

SCALE 1:500 (A3) | DRAWING No 21145-C002 | REV C

27/02/2023 3:41:58 PMFile: C:\OSE\OSE Group\Operations - Docs\Projects\2021\21145 Asphalt Plant Warner Rd\Drawings\Working\21145 Koppens Ashalt Plant Warner Road\21145-DESIGN.dwg

SITE PREPARATIONS, EARTHWORKS AND FOUNDATION NOTES

1. THE DESIGN OF THE STRUCTURE HAS BEEN BASED ON THE FOUNDATION HAVING A MINIMUM BEARING CAPACITY OF 100 KPA.
2. BEFORE ANY CONCRETE IS PLACED, THE SAFE BEARING CAPACITY OF THE GROUND SHALL BE VERIFIED WITH A GEOTECHNICAL INVESTIGATION. IF THE BEARING PRESSURE IS ASSESSED AS BEING LESS THAN THE SPECIFIED, THE DESIGN ENGINEER IS TO BE NOTIFIED IN WRITING.
3. DURING CONSTRUCTION THE CONTRACTOR SHALL BE RESPONSIBLE FOR MAINTAINING EXCAVATIONS IN STABLE CONDITIONS. PROTECT SURROUNDING PROPERTY AND SERVICES FROM ADVERSE EFFECTS OF GROUND WORKS. PROVIDE TEMPORARY WORKS AS REQUIRED. PROVIDE SHORING CERTIFIED BY SUITABLY QUALIFIED STRUCTURAL ENGINEER TO ALL DEEP EXCAVATIONS WHERE REQUIRED.
4. DO NOT UNDERMINE EXISTING FOOTINGS.
5. KEEP EXCAVATIONS FREE OF WATER. PROVIDE ADEQUATE DRAINAGE TO ENSURE FOUNDATION IS NOT AFFECTED BY MOISTURE. PREVENT FOUNDATION DRYING OUT DUE TO EXPOSURE. PLACE BLINDING, FOOTINGS, PILES AND BACKFILL AS SOON AS PRACTICABLE AFTER EXCAVATION.
6. EARTHWORKS SHALL BE IN ACCORDANCE WITH AS3798 "GUIDELINES ON EARTHWORKS FOR COMMERCIAL AND RESIDENTIAL DEVELOPMENTS" AND AS FOLLOWS.
7. STRIP BUILDING PLATFORM OF ALL TOPSOIL AND VEGETATION TO A MINIMUM DEPTH OF 150MM AND STOCKPILE. REMOVE ALL DELETERIOUS MATTER.
8. THE CONTRACTOR SHALL CHECK ALL EXCAVATIONS FOR ORGANIC MATERIAL AND RUBBISH. IF ANY OF THIS MATERIAL IS FOUND, IT SHALL BE REMOVED FROM THE WORKS TO A PLACE DESIGNATED BY THE SUPERINTENDENT.
9. UNLESS NOTED OTHERWISE IN SPECIFICATION, FOOTING AND SLABS SHALL BE FOUNDED ON COMPACTED MATERIAL OR CONTROLLED FILL COMPACTED IN ACCORDANCE WITH THE FOLLOWING AS APPROPRIATE FOR MATERIAL TYPE:
   (A) SANDS WITH 5% FINES OR LESS. FIELD DENSITY INDEX NOT LESS THAN 65% OF LABORATORY REFERENCE DENSITY DETERMINED IN ACCORDANCE WITH AS1289.5.6.1.
   (B) SILTS AND SANDS WITH MORE THAN 5% FINES, DRY DENSITY RATIO OF NOT LESS THAN 98% OF LABORATORY REFERENCE DENSITY DETERMINED IN ACCORDANCE WITH AS 1289.5.1.1.
   (C) CLAYS, DRY DENSITY RATIO OF NOT LESS THAN 95% OF LABORATORY REFERENCE DENSITY DETERMINED IN ACCORDANCE WITH AS 1289, 5.1.1 OR 90% IN ACCORDANCE WITH AS 1289.5.2.1-1. CLAY FILL SHOULD BE MOIST TO ALLOW COMPACTION AND REDUCE SUBSEQUENT MOVEMENT. REACTIVE CLAY FILL SHOULD BE AVOIDED.
8. EXPOSURE OF EXCAVATED FOOTINGS SHALL BE MINIMISED TO PREVENT LOCALISED MOISTURE CHANGES DURING THE CONSTRUCTION PERIOD.
9. BACKFILL AND REQUIRED FILL UNDER SLABS AND FOOTINGS SHALL BE CONTROLLED FILL OF APPROVED NON-PLASTIC/ GRANULAR MATERIAL, MIN SOAKED CBR VALUE OF 15%, COMPACTED IN 200MM MAXIMUM THICK LAYERS TO 98% SRDD AND PLACED STRICTLY TO AS 3798.
10. MATERIAL WON FROM THIS SITE TO BE INSPECTED BY THE GEOTECHNICAL ENGINEER FOR APPROVAL PRIOR TO USE AS FILL.
11. TREE REMOVAL: WHERE A TREE IS REMOVED, EXCAVATE 200MM BELOW EXTENT OF ROOT BALL. COMPACT EXPOSED SURFACE TO 98% SRDD TO A DEPTH OF AT LEAST 250MM. PLACE FILL AS UNDER CLAUSE 9.
12. A 50MM MINIMUM BLINDING LAYER OF SAND, COMPACTED TO 95% MAX DRY DENSITY SHALL BE APPLIED TO THE BASE OF ALL SLABS-ON-GROUND IMMEDIATELY AFTER VERIFICATION OF THE BEARING CAPACITY BY THE GEOTECHNICAL ENGINEER.
13. DAMP PROOF MEMBRANE UNDER FOUNDATIONS TO BE 0.2MM THICK POLYETHYLENE FILM. LAP JOINTS 200MM. SEAL LAP PENETRATIONS AND ANY PUNCTURES WITH DOUBLE-SIDED BUTYL ADHESIVE TAPE.
14. WHERE THE FOUNDING MATERIAL IS DEEPER THAN REQUIRED FOR THE FOOTING, THE EXCAVATION IS TO BE BACKFILLED WITH A WEAK MIX CONCRETE (N10) TO THE UNDERSIDE OF THE FOOTING.
15. FOLLOWING CONSTRUCTION FOUNDATION MAINTENANCE TO BE IN ACCORDANCE WITH CSIRO BUILDING TECHNOLOGY FILE 18 "FOUNDATION MAINTENANCE AND FOOTING PERFORMANCE: A HOMEOWNER'S GUIDE".

CONCRETE AND REINFORCEMENT NOTES

1. ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS3600.
2. MINIMUM COVER TO ALL REINFORCEMENT AGAINST SURFACES SHALL BE AS FOLLOWING U.N.O.
   (I) FOOTINGS - 75mm BOTTOM, 65mm SIDES AND TOP
   (II) COVER SHALL BE 45mm WHERE SURFACE IS EXTERIOR ABOVE GROUND.
   (V) WITHIN CONCRETE MASONRY BLOCK - 10mm.
3. SIZES OF CONCRETE ELEMENTS DO NOT INCLUDE THICKNESS OF APPLIED FINISHES. ALL CONCRETE THICKNESSES SHOWN ARE MINIMUM STRUCTURAL REQUIREMENTS; NO REDUCTION IN THICKNESS DUE TO FALLS OR TOPPING IS PERMITTED. REFER ARCHITECTS DRAWINGS FOR CONFIRMATION OF ALL SLAB FALLS AND STEPS.
4. NO HOLES, CHASES OR EMBEDMENT OF PIPES OTHER THAN THOSE SHOWN ON THE STRUCTURAL DRAWINGS SHALL BE MADE IN CONCRETE MEMBERS WITHOUT PRIOR APPROVAL OF THE ENGINEER.
5. CONSTRUCTION JOINTS SHALL HAVE CONCRETE FACES FULLY SCABBLED, CLEANED AND COATED WITH A CEMENT/WATER SLURRY IMMEDIATELY PRIOR TO PLACING ADJACENT CONCRETE; AND ARE TO BE USED ONLY WHERE SHOWN OR SPECIFICALLY APPROVED.
6. CONTROL JOINTS SHALL BE CONSTRUCTED AS SPECIFIED.
7. SAW CUTTING SHALL BE CARRIED OUT WITHIN 6 HOURS OF CONCRETE HARDENING.
8. STEEL REINFORCEMENT IS TO COMPLY WITH AS 3600 AND AS/NZ 4671., AND IS REPRESENTED DIAGRAMATICALLY, FSY = 500MPa.
9. U.N.O., SPLICING OF REINFORCEMENT IS TO BE A MINIMUM OF:
   N12 450mm
   N16 600mm
   N20 800mm
   MESH TWO CROSS WIRES PLUS 25mm
   HORIZONTAL BARS WITH MORE THAN 300mm CONCRETE UNDER THEM SHALL HAVE LAPS 1.25 TIMES THESE LENGTHS.
10. WELDING OR SITE BENDING OF REINFORCEMENT IS NOT PERMITTED WITHOUT APPROVAL OF THE ENGINEER.
11. ALL REINFORCEMENT SHALL BE SUPPORTED IN ITS CORRECT POSITION DURING CONCRETING, BAR CHAIRS AT 800mm MAX. CENTRES BOTH DIRECTIONS. SUPPORTS OVER MEMBRANES ARE TO BE PLACED SO AS TO PREVENT PUNCTURING OF THE MEMBRANE.
12. FORMWORK SHALL BE DESIGNED AND CONSTRUCTED IN ACCORDANCE WITH AS3610 - FORMWORK FOR CONCRETE AND ALL RELEVANT CONSTRUCTION SAFETY LEGISLATION. U.N.O, FINISHES SHALL BE CLASS 2. MINIMUM FORMWORK STRIPPING TIMES FOR IN-SITU CONCRETE SHALL BE IN ACCORDANCE WITH SECTION 5.4.3, TABLE 5.4.1 OF AS 3610.
13. CONCRETE SHALL HAVE THE FOLLOWING PROPERTIES.
    CONCRETE SPECIFICATION, U.N.O. ON DRAWINGS:

	CLASS & GRADE	SLUMP	MAX. AGG. SIZE
BASE SLAB OF RETAINING WALL	N32	80mm ± 15mm	20mm
FILLING 200 & 300 CM	N20	220mm ± 30mm	10mm

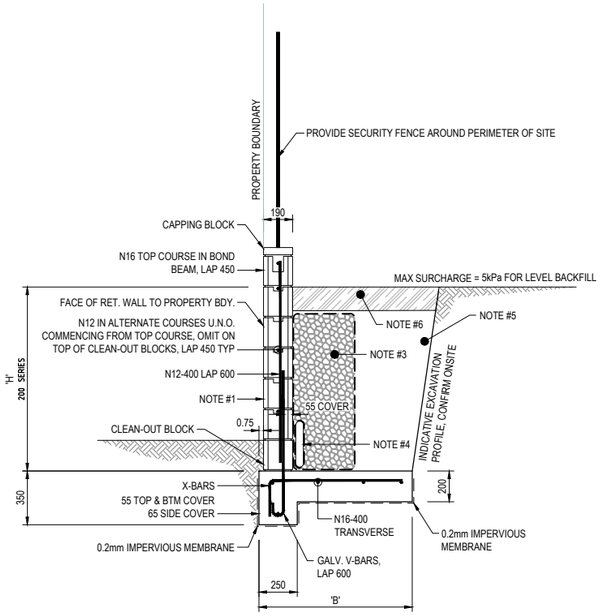
    METHOD OF PLACEMENT BY PUMP.
    PROJECT ASSESSMENT IS NOT REQUIRED.
14. PROVIDE A 10mm x 10mm CHAMFER TO EXPOSED EDGES ON CONCRETE UNO.
15. CURE CONCRETE IN ACCORDANCE WITH AS3600 FOR 7 DAYS AND PRIOR TO THE REMOVAL OF FORMWORK.

CONCRETE MASONRY NOTE

1. ALL WORKMANSHIP AND MATERIALS SHALL BE IN ACCORDANCE WITH AS3700.
2. REFER TO PUBLICATIONS "MA54 CONCRETE MASONRY WALLING- SINGLE-LEAF MASONRY DESIGN MANUAL","MA45 "CONCRETE MASONRY HANDBOOK" AND "MA55 DESIGN AND CONSTRUCTION OF CONCRETE MASONRY BUILDINGS" BY CMAA FOR DETAILS ON WORKMANSHIP, FIXING TO GABLE ENDS, BASEMENT WALLS, TANKING, WATERPROOFING ETC. MINIMUM OF 20MM GROUT COVER TO ANY STEEL REINFORCEMENT MEMBER.
3. CHASES OR HOLES SHALL NOT BE MADE WITHOUT THE WRITTEN APPROVAL OF THE ENGINEER. EMBEDDED ITEMS SHALL NOT BE PLACED INSIDE CORES CONTAINING REINFORCEMENT.
4. ALL WALL INTERSECTIONS SHALL BE OF BONDED CONSTRUCTION FOR INTERNAL NON-LOADBEARING UNREINFORCED WALLS (MASONRY MESH, 500 LONG, AT 400 CRS VERT) OR TIED FOR INTERNAL LOAD-BEARING REINFORCED WALLS (L8 TIES AT 400 CRS VERT., BENT DOWN 100mm INTO GROUTED CORES).
5. BUILD IN ALL FIXINGS FOR ARCHITECTURAL DETAILS NOT SPECIFICALLY SHOWN ON THE ENGINEER'S DRAWINGS.
6. CHARACTERISTIC UNCONFINED COMPRESSIVE STRENGTH OF CONCRETE BLOCKS TO AS/NZS 4455.1-2008 AND DR04313 SHALL BE f'UC = 15MPa.
7. REINFORCEMENT AND CONCRETE MASONRY BLOCK CORE FILLING SHALL COMPLY WITH THE NOTES ON "CONCRETE AND REINFORCEMENT". GROUT SHALL HAVE A CEMENT CONTENT OF NOT LESS THAN 300kg/m3.
8. PROVIDE CLEANOUT BLOCKS AT THE BASE OF EVERY CORE TO BE FILLED AND HAVE ALL MORTAR DROPPINGS REMOVED PRIOR TO COMMENCEMENT OF CORE FILLING. ALTERNATIVELY, THE BUILDER SHALL OPEN SUCH CORES FOR CLEANING BY AN APPROVED METHOD.
9. ALL CORES TO BE CONCRETE FILLED SHALL BE CLEANED OUT BY HOSING PRIOR TO FINAL SETTING OF MORTAR AT ALL LIFTS, OR BY RODDING PRIOR TO CONCRETE FILLING.
10. MORTAR USED IN BLOCKWORK THAT IS TO BE GROUTED OR REINFORCED SHALL BE OF CLASSIFICATION M3 TO AS 3700, FOR GENERAL PURPOSE APPLICATION WITH MODERATE EXPOSURE; REFER TO CMAA'S RECOMMENDATIONS IN "CM01 CONCRETE MASONRY - HAND BOOK"

CLASS	CEMENT	LIME	SAND	METHYL CELLULOSE (DYNEX) WATER THICKENER ADDED
M3 (CHARACTERISTIC COMPRESSIVE STRENGTH 20 MPa)	1	1	6	OPTIONAL
	1	0	5	YES
	- CEMENT CONTENT NOT LESS THAN 300kg/m³ - COARSE AGGREGATE SIZE MAX 10mm			

    FOR HIGH DURABILITY APPLICATIONS WITH SEVERE EXPOSURE USE MORTAR TYPE M4 AND
    REFER TO CMAA'S RECOMMENDATIONS IN "CM01 CONCRETE MASONRY - HAND BOOK".
11. BOND BEAM REINFORCING SHALL BE CONTINUOUS AT WALL INTERSECTIONS AND BARS ANCHORED AND LAPPED TO DEVELOP FULL TENSILE STRENGTH.
12. A CANTILEVER RETAINING WALL SHALL BE PROPPED UNTIL CORE FILL HAS ATTAINED ITS DESIGN STRENGTH, IF BACKFILL IS TO BE PLACED BEHIND THE WALL.
13. A PROPPED CANTILEVER RETAINING WALL SHALL BE PROPPED UNTIL THE SUPPORTING SLAB OVER HAS ATTAINED ITS DESIGN STRENGTH.
14. MAXIMUM HEIGHT FOR GROUT FILLING OF HOLLOW CORES IS LIMITED TO 2400mm IN ONE POUR AND TO 3000mm IN TWO POURS ABOUT 30 MINUTES APART.

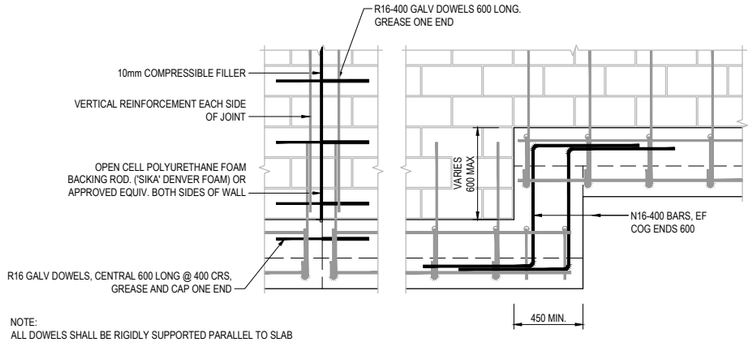


'H' = 800mm TO 1200mm

RETAINING WALLS - TYPE 1

SCALE: 1:20

PROVIDE WALL CONTROL JOINTS AT MAX 10m CENTRES. PROVIDE EXPANSION JOINT IN BASE SLAB AT SAME LOCATIONS.



NOTE:
ALL DOWELS SHALL BE RIGIDLY SUPPORTED PARALLEL TO SLAB SURFACE & SLAB LONGITUDINAL AXIS

EXPANSION JOINT DETAIL

SCALE: NTS

FOOTING STEP DETAIL

SCALE: NTS

RETAINING WALL SCHEDULE - TYPE 1

TOTAL HEIGHT 'H' (mm)	BLOCKWORK HEIGHT	REINFORCEMENT		BASE DIMENSIONS 'B'
	200 SERIES	X-BARS	V-BARS	LEVEL
800	800	N12-400	N12-400	800
1000	1000	N12-400	N12-400	900
1200	1200	N12-400	N12-400	1000

NOTES:

1. 'H' MASONRY BLOCKS (SEE DETAIL FOR WIDTH), FILL ALL CORES WITH 20MPa CONCRETE. PAINT SURFACE OF WALL INTERFACING SOIL WITH 2 COATS OF AN APPROVED BITUMASTIC SEALANT IN ACCORDANCE WITH THE MANUFACTURERS SPECIFICATION OR SIMILAR APPROVED WATER-PROOF MEMBRANE.
2. MIN. 10mm CRUSHED ROCK DRAINAGE FILL MATERIAL (300 MIN WIDE). WRAPPED IN GEOTEXTILE FABRIC, LAP 600.
3. 300 MEGAFLO (MIN.) SIZE TO BE CONFIRMED BY ENGINEER, ALTERNATIVELY; 2-Ø100 AGLINE PIPES WRAPPED IN GEOFABRIC SOCK
4. IMPORTED CLEAN BACKFILL MATERIAL COMPACTED TO 85% SRDD.
5. 150mm THICK COMPACTED CLAY SURFACE SEAL.
6. ADDITIONAL LOADS APPLIED FROM FENCING STRUCTURES PLACED ON TOP OF THE RETAINING WALLS HAVE NOT BEEN ALLOWED FOR IN THIS DESIGN. CONSULT ENGINEER IF FENCING STRUCTURES ARE PROPOSED.

REV	DATE	REVISION NOTES
A	30.05.22	INITIAL ISSUE

200 0 200 400 600 800 1000 mm SCALE 1:20

DESIGNER
OSE GROUP
Address: 35 ABBOTT ST, CAIRNS 4870
Email: admin@osegroup.com.au

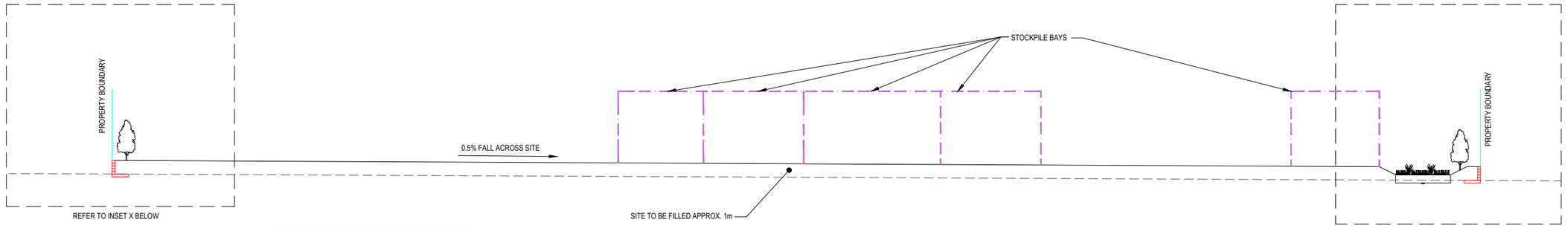
CLIENT
KOPPEN CONSTRUCTION

PROJECT
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

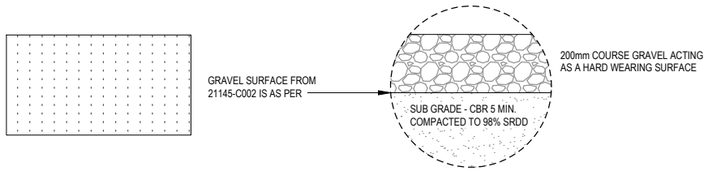
TITLE
RETAINING WALL DETAILS

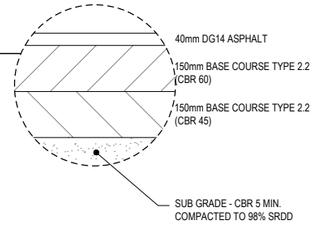
SCALE	DRAWING No	REV
AS SHOWN	21145-C003	A

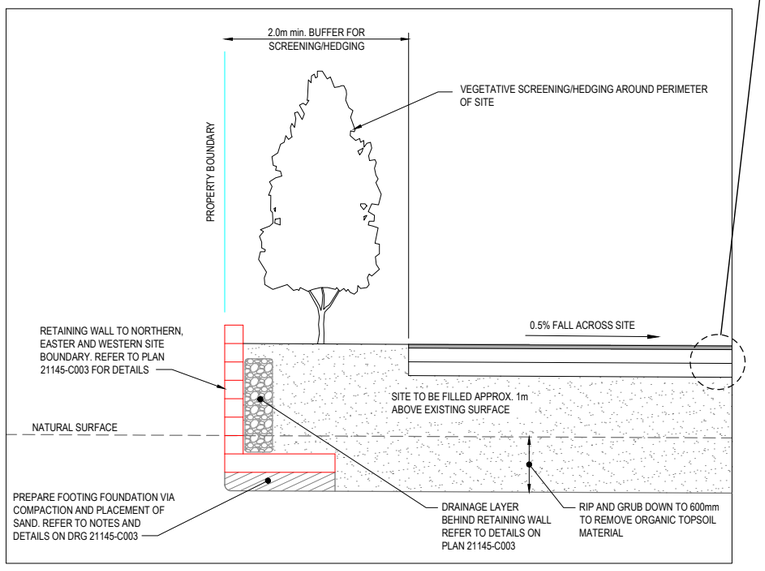


ALL EARTHWORKS TO BE COMPLETED IN ACCORDANCE WITH AS3798-2007

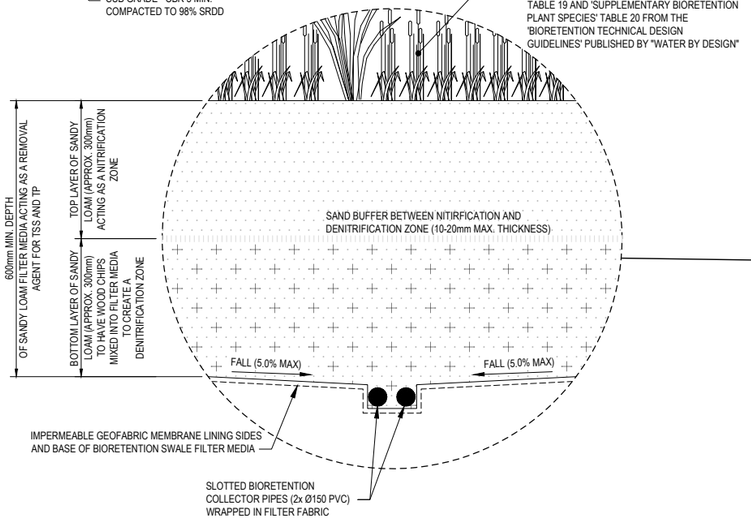
SECTION A / NTS C002

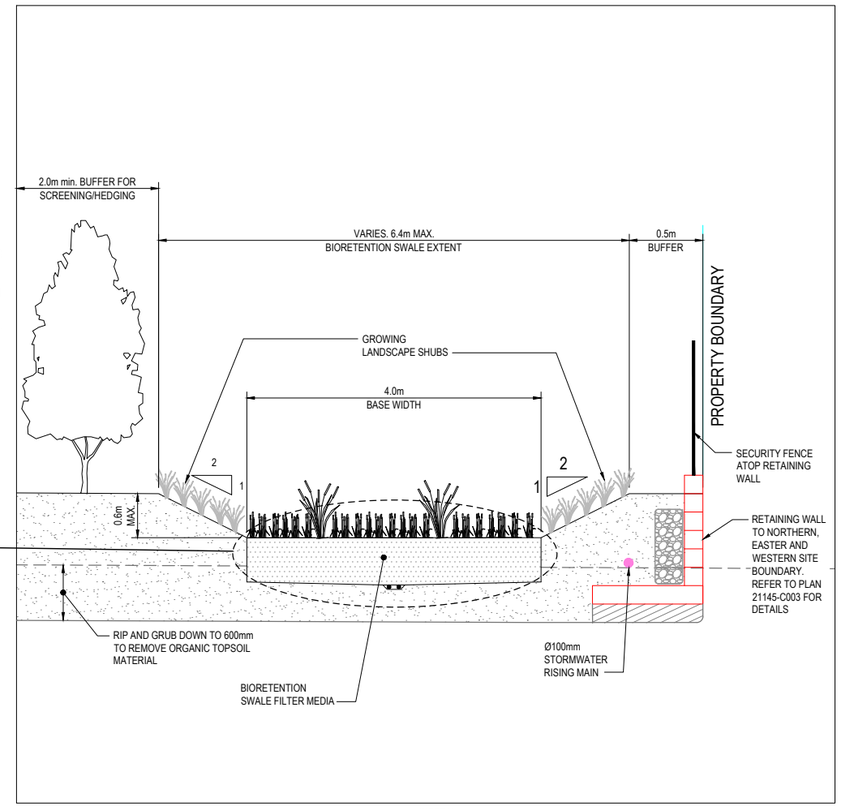






INSET X
NTS





INSET Y
NTS

REV	DATE	REVISION NOTES
A	30.05.22	INITIAL ISSUE

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OSE GROUP
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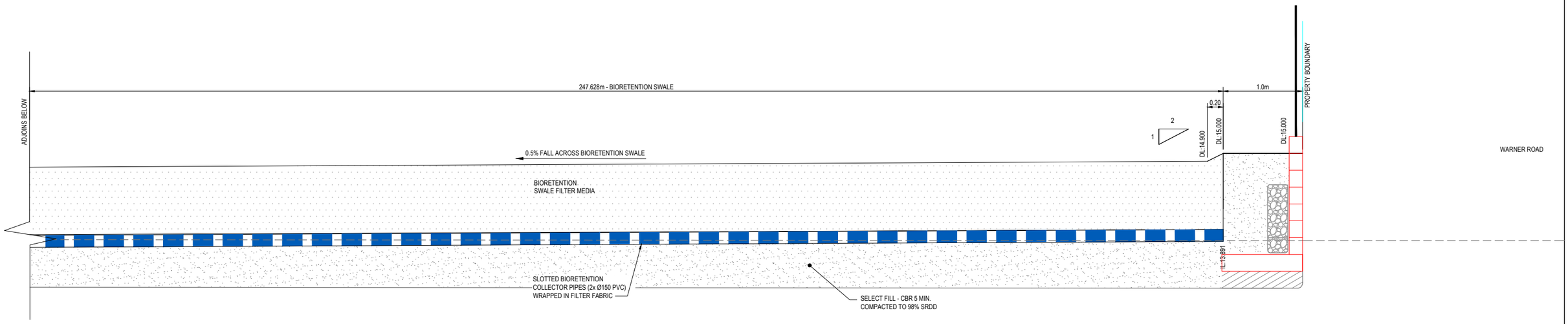
CLIENT
KOPPEN CONSTRUCTION

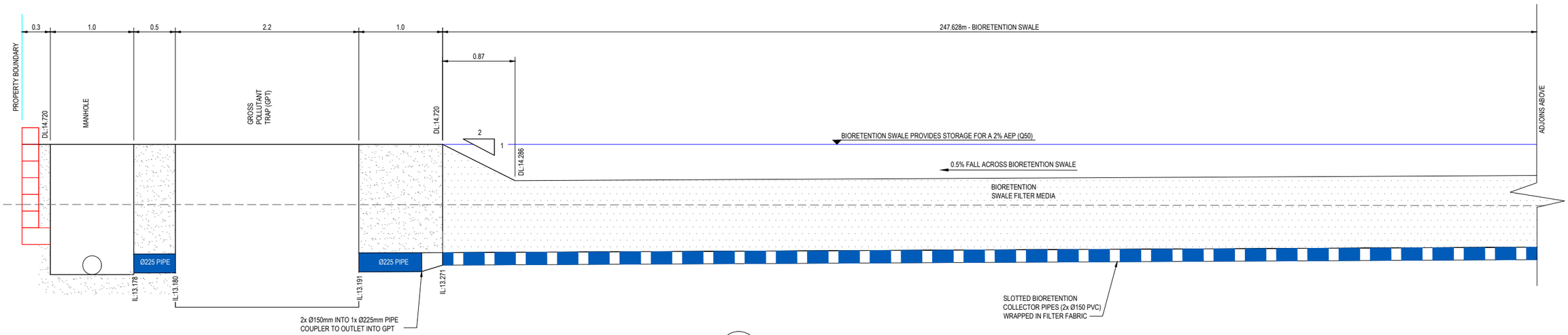
PROJECT
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	DATE -
DESIGNED	DESIGN REVIEW	
DJM	PDR	

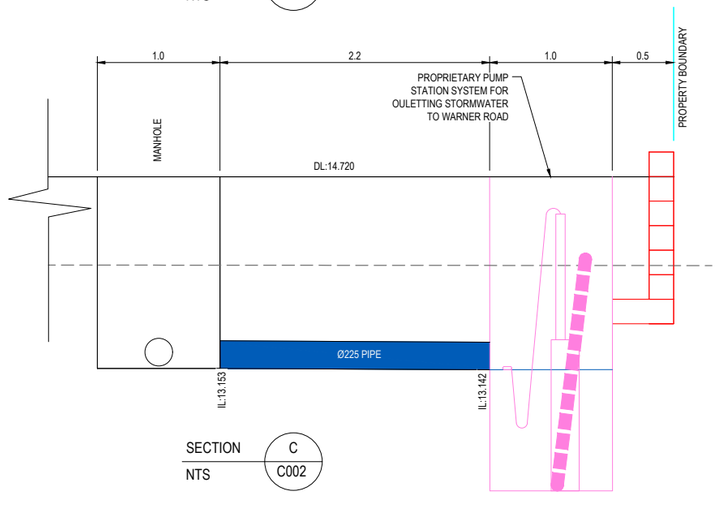
TITLE
EARTHWORKS SECTION AND DETAILS

SCALE	DRAWING No	REV
NOT TO SCALE	21145-C004	A





SECTION B
NTS
C002



SECTION C
NTS
C002

REV	DATE	REVISION NOTES
B	6.06.22	STORMWATER SCHEME AMMENDED
A	30.05.22	INITIAL ISSUE

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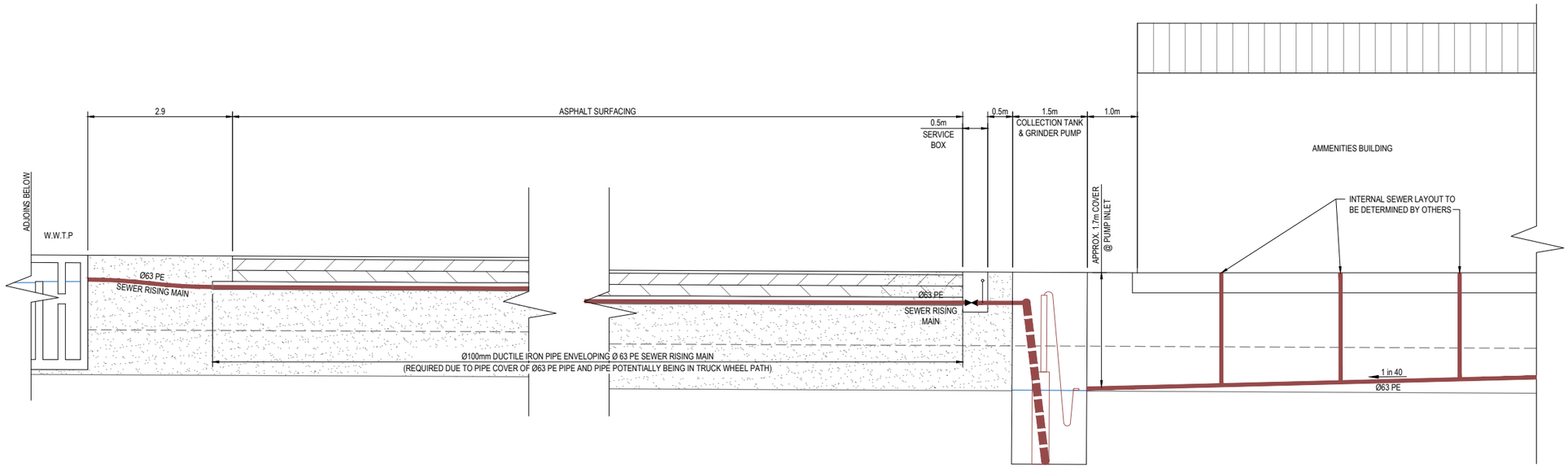
CLIENT
KOPPEN CONSTRUCTION

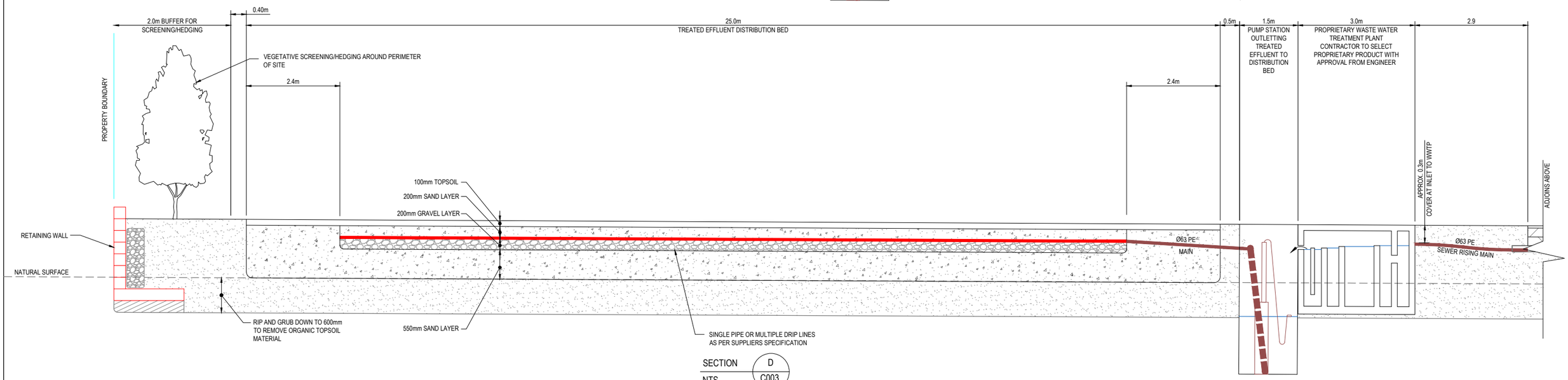
PROJECT
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

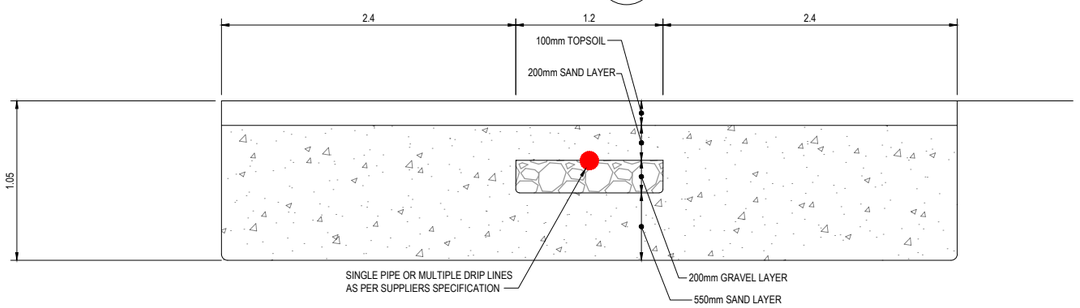
TITLE
BIORETENTION SWALE SECTION
& STORMWATER INVERT LEVELS

SCALE	DRAWING No	REV
NOT TO SCALE	21145-C005	B





SECTION D / NTS C003



TREATED EFFLUENT DISTRIBUTION BED
TYPICAL SECTION

SECTION E / NTS C003

REV	DATE	REVISION NOTES
B	27.02.23	NOTES ARROUND DICL ENVELOPER PIPE AMMENDED TO SUIT NEW PLANT LAYOUT
A	30.05.22	INITIAL ISSUE

DESIGNER
OSE GROUP
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CLIENT
KOPPEN CONSTRUCTION

PROJECT
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

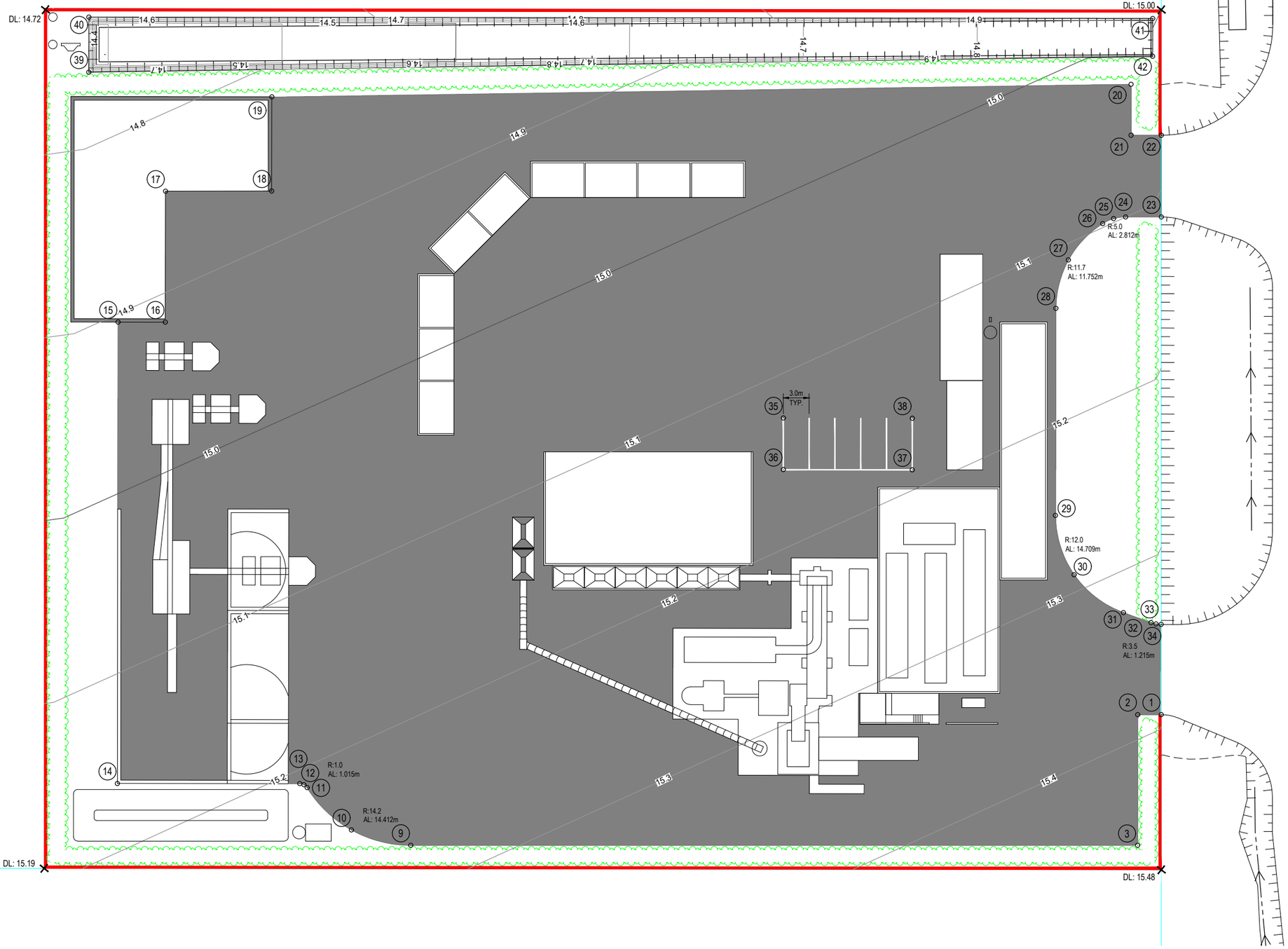
TITLE
ON SITE SEWER TREATMENT
SECTIONS AND DETAILS

SCALE NOT TO SCALE
DRAWING No 21145-C006
REV B

27/02/2023 3:42:00 PMFile: C:\OSE\OSE Group\Operations - Docs\Projects\2021\21145 Asphalt Plant Warner Rd\Drawings\Working\21145 Koppens Ashalt Plant Warner Road\21145-DESIGN.dwg

SITE SETOUT POINTS

POINT	EASTING	NORTHING	LEVEL
1	369940.814	8114312.587	15.393
2	369941.076	8114315.325	15.386
3	369925.945	8114316.769	15.460
9	369933.982	8114400.983	15.272
10	369936.419	8114407.682	15.248
11	369941.804	8114412.353	15.212
12	369942.184	8114412.682	15.210
13	369942.355	8114413.154	15.208
14	369944.385	8114434.289	15.161
15	369997.803	8114429.107	14.905
16	369997.271	8114423.642	14.916
17	370012.425	8114422.162	14.844
18	370011.269	8114409.866	14.870
19	370022.172	8114408.804	14.818
20	370014.127	8114309.129	15.026
21	370008.228	8114309.692	15.055
22	370007.894	8114306.184	15.064
23	369998.437	8114307.086	15.089
24	369998.832	8114311.226	15.100
25	369998.768	8114312.626	15.098
26	369998.319	8114313.954	15.098
27	69994.490	8114318.329	15.109
28	369989.025	8114320.315	15.134
29	369965.050	8114322.651	15.251
30	369957.969	8114321.146	15.290
31	369953.041	8114315.842	15.324
32	369951.584	8114312.765	15.337
33	369951.373	8114312.197	15.339
34	369951.263	8114311.600	15.343
35	369979.340	8114353.092	15.126
36	369973.362	8114353.674	15.155
37	369971.907	8114338.730	15.188
38	369977.884	8114338.148	15.159
39	370027.060	8114429.735	14.758
40	370033.430	8114429.119	14.728
41	370021.513	8114305.890	14.995
42	370017.136	8114306.319	15.016



B 27.02.23 UPDATED SETOUT TO SUIT NEW INTERNAL PLANT LAYOUT
A 30.05.22 INITIAL ISSUE

REV DATE REVISION NOTES

2.5 0 2.5 5 7.5 10 12.5 m

SCALE 1:500

DESIGNER

OSE GROUP

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CLIENT

KOPPEN CONSTRUCTION

PROJECT ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

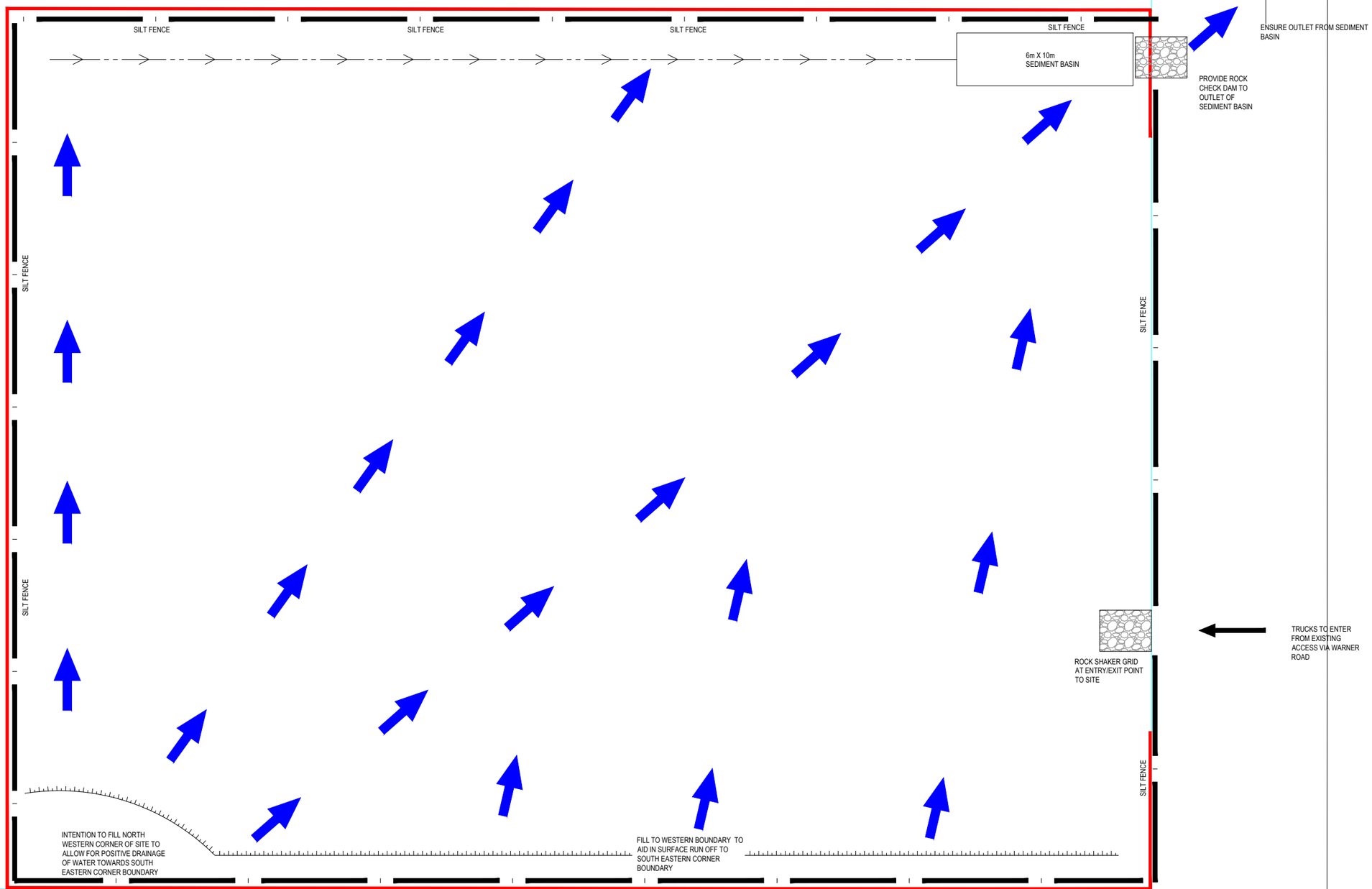
DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE
SITE CONTOUR PLAN
AND SETOUT

SCALE 1:500 (A3)

DRAWING No 21145-C007

REV B



REV	DATE	REVISION NOTES
A	30.05.22	INITIAL ISSUE

2,5 0 2,5 5 7,5 10 12,5 m

SCALE 1:500

DESIGNER

OSE GROUP

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CLIENT

KOPPEN CONSTRUCTION

PROJECT

ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE

EROSION AND SEDIMENT CONTROL STRATEGY
DURING CONSTRUCTION

SCALE		DRAWING No	REV
1:500	(A3)	21145-C008	A

BREAK PROVIDED IN CHEVRON TO ALLOW FOR ALL MOVEMENTS ENTERING/EXISTING ACCESS

W1

TRANSITION FROM EXISTING ROADSIDE DRAIN TO PROPOSED TABLE DRAIN SMOOTHLY

EXISTING TREE TO BE REMOVED

PROVIDE Ø50mm WATER PROPERTY CONNECTION BRANCH AS PER FNQROC GUIDELINES

EXISTING ACCESS TO REMAIN - START OF WORKS SHOULD NOT IMPACT ON STATE OF EXISTING ACCESS

HW INLET
PRECAST
E: 369934.455
N: 8114302.308
IL: 13.996

2/1200x300 RCBC

HW OUTLET
PRECAST
E: 369956.668
N: 8114300.459
IL: 13.818

PROPOSED TABLE DRAIN TO BE CUT IN BEYOND EXISTING ACCESS. PROVIDE LOCALIZED EARTHWORKS TO ALIGN INVERT OF DRAIN TO EXISTING CULVERT UNDER ACCESS (IF APPLICABLE) AND ENSURE TIE IN WORKS ARE GRADED AT 0.5% LONGITUDINALLY MIN. TO BE CONFIRMED ON SITE

WARNER ROAD - CONTROL LINE SETOUT

PT	EASTING	NORTHING	CHAINAGE
W1	369869.373	8114299.417	CH:120.000
W2	370088.368	8114278.410	CH:340.000

CAUTION DURING CONSTRUCTION OF UNDERGROUND WATER MAINS

WARNER ROAD

EXISTING 600x300 RCBC TO BE REMOVED

HW INLET
PRECAST
E: 369992.561
N: 8114297.438
IL: 13.592

2/1200x300 RCBC

HW OUTLET
PRECAST
E: 370015.534
N: 8114296.369
IL: 13.450

CAUTION DURING CONSTRUCTION OF UNDERGROUND WATER MAINS

CULVERT DESIGN - UPSTREAM CATCHMENT DATA (ASSUMED UPSTREAM IS A 'DEVELOPED' CATCHMENT)

- CATCHMENT AREA - 50000m^2
- T_C - 40 mins
- COEFFICIENT - 0.7
- Q_{10} (10% AEP) = 919.7 L/s

ROAD TO BE SIGNPOSTED AT 70km/h. REFER TO PLAN 21145-C011 FOR DETAILS

2m WIDE TABLE DRAIN TO CATER FOR DRAINAGE RUN OFF FROM PROPOSED PLANT SITE WORKS

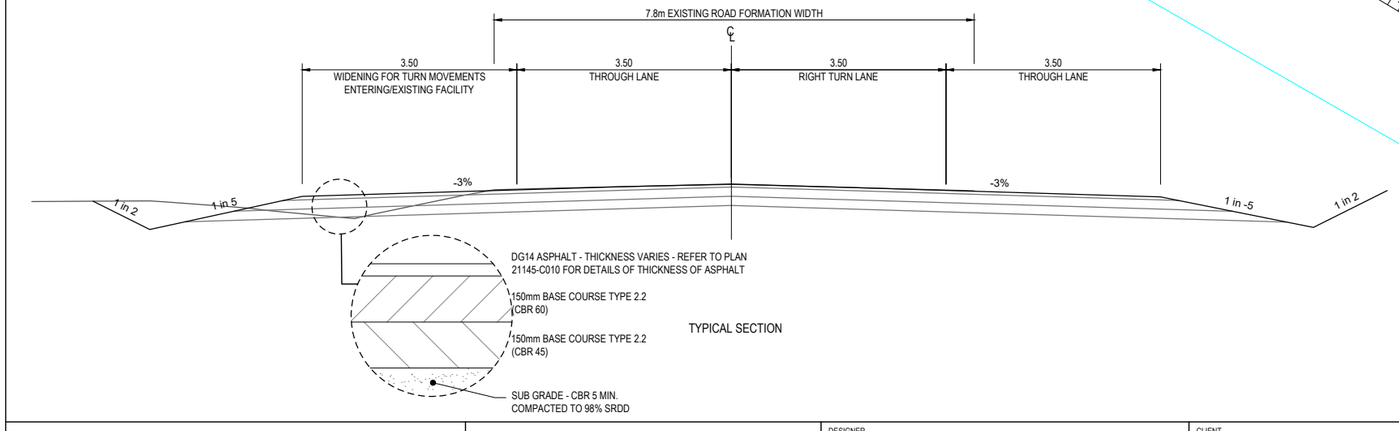
CONTINUE TO GRADE PROPOSED TABLE DRAIN TO A POINT AT WHICH LONGITUDINAL DRAIN GRADE (MIN. 0.5%) DAYLIGHTS WITH EXISTING ROADSIDE TABLE DRAIN. TO BE DETERMINED ON SITE

CONTINUE TO GRADE PROPOSED TABLE DRAIN TO A POINT AT WHICH LONGITUDINAL DRAIN GRADE (MIN. 0.5%) DAYLIGHTS WITH EXISTING ROADSIDE TABLE DRAIN. TO BE DETERMINED ON SITE

W2

LEGEND

- PROPERTY BOUNDARY
- PROPOSED ROAD WORKS
- ROADSIDE VEE DRAIN
- TOP OF BANK
- W — EXISTING UNDERGROUND WATER MAIN
- E — OVERHEAD POWER LINES
- PROPOSED CULVERT & HEADWALLS



TYPICAL SECTION

REV	DATE	REVISION NOTES
B	20.01.23	CULVERTS UNDER ACCESSES UPSIZED
A	30.05.22	INITIAL ISSUE

2.5 0 2.5 5 7.5 10 12.5 m

SCALE 1:500

DESIGNER
OSE GROUP
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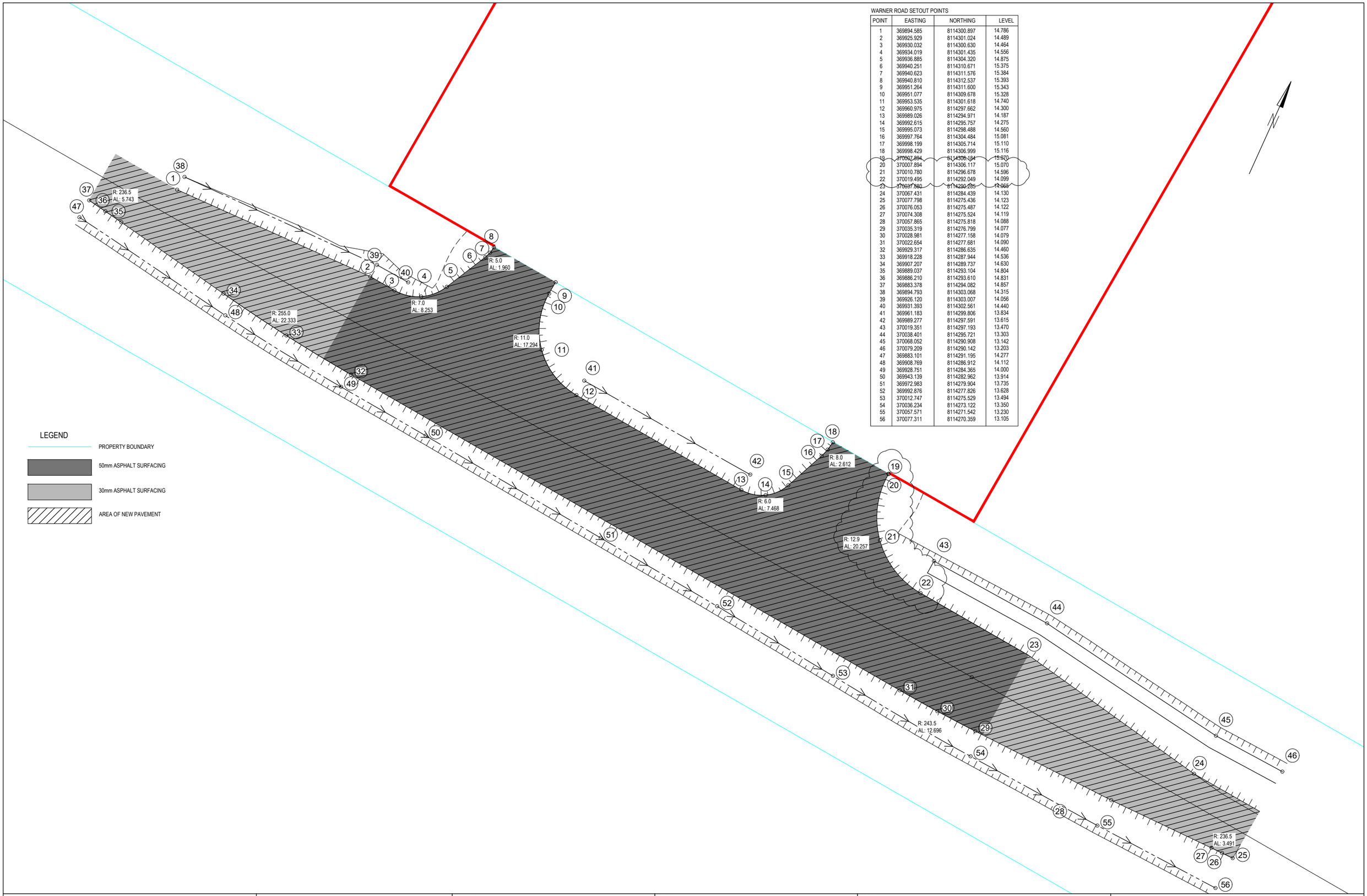
CLIENT
KOPPEN CONSTRUCTION

PROJECT
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE
EXTERNAL SITE WORKS - WARNER ROAD WIDENING UPGRADE
GENERAL ARRANGEMENT

SCALE	DRAWING No	REV
1:500 (A3)	21145-C009	A



LEGEND

- PROPERTY BOUNDARY
- 50mm ASPHALT SURFACING
- 30mm ASPHALT SURFACING
- AREA OF NEW PAVEMENT

WARNER ROAD SETOUT POINTS

POINT	EASTING	NORTHING	LEVEL
1	369894.585	8114300.897	14.786
2	369925.929	8114301.024	14.489
3	369930.032	8114300.630	14.464
4	369934.019	8114301.435	14.556
5	369936.885	8114304.320	14.875
6	369940.251	8114310.671	15.375
7	369940.623	8114311.576	15.384
8	369940.810	8114312.537	15.393
9	369951.264	8114311.600	15.343
10	369951.077	8114309.678	15.328
11	369953.535	8114301.618	14.740
12	369960.975	8114297.662	14.300
13	369989.026	8114294.971	14.187
14	369992.615	8114295.757	14.275
15	369995.073	8114298.488	14.560
16	369997.764	8114304.484	15.081
17	369998.199	8114305.714	15.110
18	369998.429	8114306.999	15.116
19	370007.894	8114306.184	15.070
20	370007.894	8114306.117	15.070
21	370010.780	8114296.678	14.596
22	370019.495	8114292.049	14.099
23	370037.980	8114290.285	13.965
24	370067.431	8114284.439	14.130
25	370077.798	8114275.436	14.123
26	370076.053	8114275.487	14.122
27	370074.308	8114275.524	14.119
28	370057.865	8114275.818	14.088
29	370035.319	8114276.799	14.077
30	370028.981	8114277.158	14.079
31	370022.654	8114277.681	14.090
32	369929.317	8114286.635	14.460
33	369918.228	8114287.944	14.536
34	369907.207	8114289.737	14.630
35	369889.037	8114293.104	14.804
36	369886.210	8114293.610	14.831
37	369883.378	8114294.082	14.857
38	369894.793	8114303.068	14.315
39	369926.120	8114303.007	14.056
40	369931.393	8114302.561	14.440
41	369961.183	8114299.806	13.834
42	369989.277	8114297.591	13.615
43	370019.351	8114297.193	13.470
44	370038.401	8114295.721	13.303
45	370068.052	8114290.908	13.142
46	370079.209	8114290.142	13.203
47	369883.101	8114291.195	14.277
48	369908.769	8114286.912	14.112
49	369928.751	8114284.365	14.000
50	369943.139	8114282.962	13.914
51	369972.983	8114279.904	13.735
52	369992.876	8114277.826	13.628
53	370012.747	8114275.529	13.494
54	370036.234	8114273.122	13.350
55	370057.571	8114271.542	13.230
56	370077.311	8114270.359	13.105

REV	DATE	REVISION NOTES
B	20.01.23	RETURN ON SOUTH EASTERN ENTRANCE AMMENDED - PAVEMENT EXTENT UPDAT'D
A	30.05.22	INITIAL ISSUE

2.5 0 2.5 5 7.5 10 12.5 m

SCALE 1:500

DESIGNER

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CLIENT

KOPPEN CONSTRUCTION

PROJECT

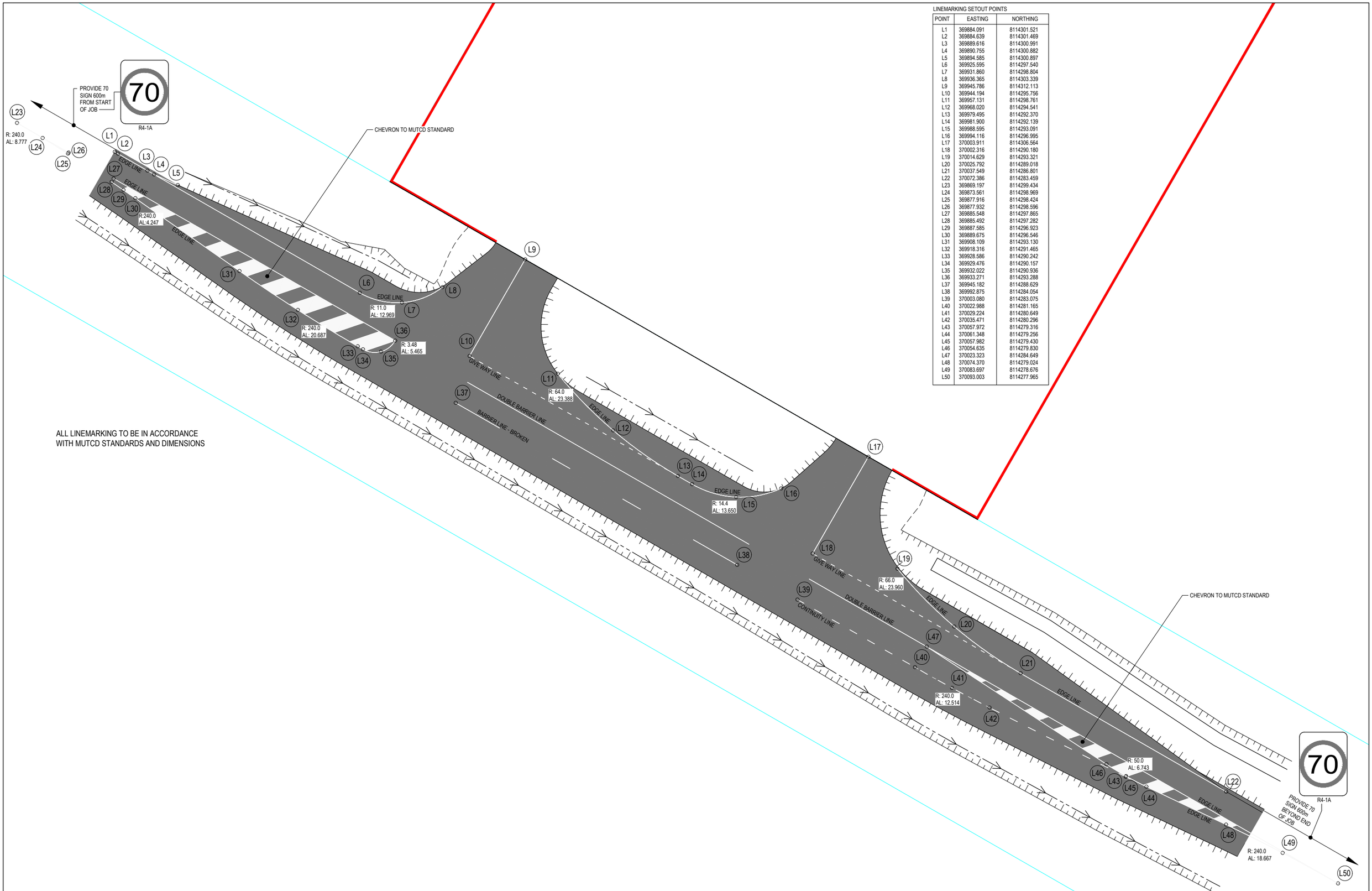
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE

EXTERNAL SITE WORKS - WARNER ROAD WIDENING UPGRADE
PAVEMENT, SURFACING AND SETOUT PLAN

SCALE		DRAWING No	REV
1:500	(A3)	21145-C010	B



ALL LINEMARKING TO BE IN ACCORDANCE
WITH MUTCD STANDARDS AND DIMENSIONS

LINEMARKING SETOUT POINTS

POINT	EASTING	NORTHING
L1	369884.091	8114301.521
L2	369884.639	8114301.469
L3	369889.616	8114300.991
L4	369890.755	8114300.882
L5	369894.585	8114300.897
L6	369925.595	8114297.540
L7	369931.860	8114298.804
L8	369936.365	8114303.339
L9	369945.786	8114312.113
L10	369944.194	8114295.756
L11	369957.131	8114298.761
L12	369968.020	8114294.541
L13	369979.495	8114292.370
L14	369981.900	8114292.139
L15	369988.595	8114293.091
L16	369994.116	8114296.995
L17	370003.911	8114306.564
L18	370002.316	8114290.180
L19	370014.629	8114293.321
L20	370025.792	8114289.018
L21	370037.549	8114286.801
L22	370072.386	8114283.459
L23	369869.197	8114299.434
L24	369873.561	8114298.969
L25	369877.916	8114298.424
L26	369877.932	8114298.596
L27	369885.548	8114297.865
L28	369885.492	8114297.282
L29	369887.585	8114296.923
L30	369889.675	8114296.546
L31	369908.109	8114293.130
L32	369918.316	8114291.465
L33	369928.586	8114290.242
L34	369929.476	8114290.157
L35	369932.022	8114290.936
L36	369933.271	8114293.288
L37	369945.182	8114288.629
L38	369992.875	8114284.054
L39	370003.080	8114283.075
L40	370022.988	8114281.165
L41	370029.224	8114280.649
L42	370035.471	8114280.296
L43	370057.972	8114279.316
L44	370061.348	8114279.256
L45	370057.982	8114279.430
L46	370054.635	8114279.830
L47	370023.323	8114284.649
L48	370074.370	8114279.024
L49	370083.697	8114278.676
L50	370093.003	8114277.965

REV	DATE	REVISION NOTES
B	20.01.23	SPEED SIGNS AMMENDED
A	30.05.22	INITIAL ISSUE

2.5 0 2.5 5 7.5 10 12.5 m

SCALE 1:500

DESIGNER

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CLIENT

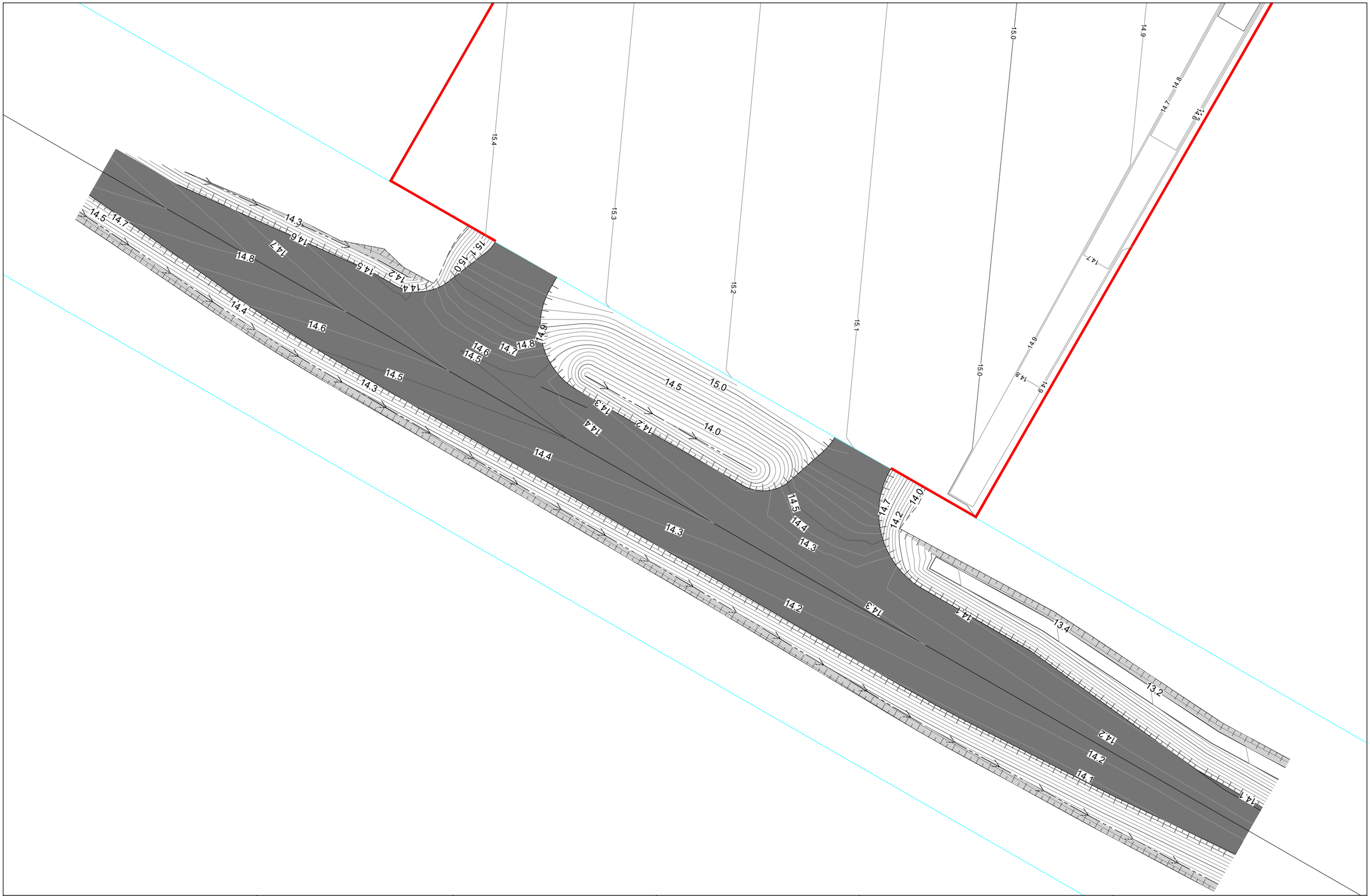
KOPPEN CONSTRUCTION

PROJECT: ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE: EXTERNAL SITE WORKS - WARNER ROAD WIDENING UPGRADE
LINEMARKING SETOUT

SCALE		DRAWING No	REV.
1:500	(A3)	21145-C011	B



REV	DATE	REVISION NOTES
B	20.01.23	RETURN ON SOUTH EASTERN ENTRANCE AMMENDED
A	30.05.22	INITIAL ISSUE

2.5 0 2.5 5 7.5 10 12.5 m

SCALE 1:500

DESIGNER

OSE GROUP

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Email: admin@osegroup.com.au

CLIENT

KOPPEN CONSTRUCTION

PROJECT

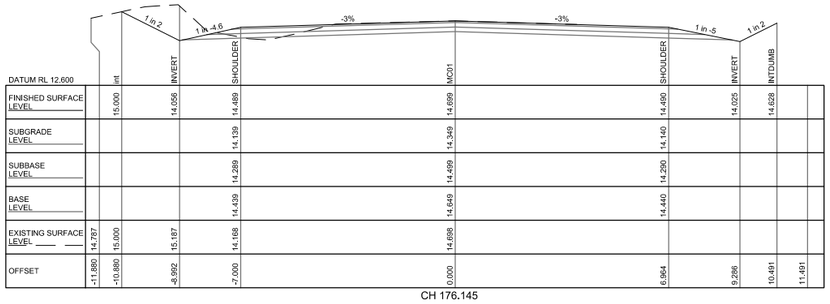
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE

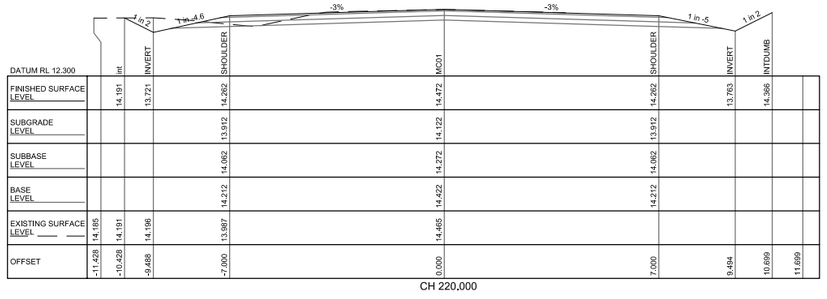
EXTERNAL SITE WORKS - WARNER ROAD WIDENING UPGRADE
CONTOUR PLAN

SCALE		DRAWING No	REV
1:500	(A3)	21145-C012	B



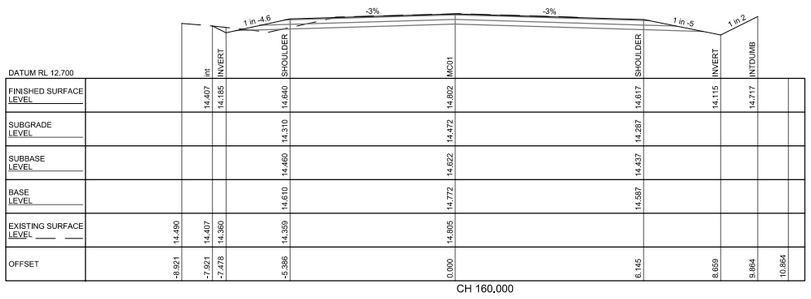
DATUM RL 12.600		int	INVERT	SHOULDER	MC01	SHOULDER	INVERT	INTDUMB		
FINISHED SURFACE LEVEL		15.000	14.056	14.489	14.699	14.490	14.025	14.628		
SUBGRADE LEVEL				14.139	14.349	14.140				
SUBBASE LEVEL				14.289	14.499	14.290				
BASE LEVEL				14.439	14.649	14.440				
EXISTING SURFACE LEVEL	14.797	15.000	15.187	14.168	14.698					
OFFSET	-11.880	-10.880	-8.992	-7.000	0.000	6.984	9.286	10.491	11.491	

CH 176.145



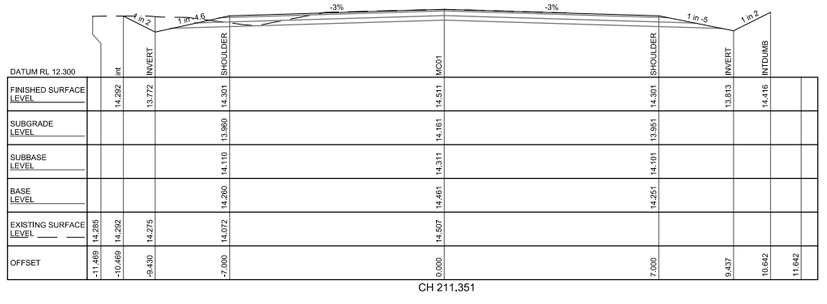
DATUM RL 12.300		int	INVERT	SHOULDER	MC01	SHOULDER	INVERT	INTDUMB		
FINISHED SURFACE LEVEL		14.191	13.721	14.262	14.472	14.262	13.763	14.366		
SUBGRADE LEVEL				13.912	14.122	13.912				
SUBBASE LEVEL				14.062	14.272	14.062				
BASE LEVEL				14.212	14.422	14.212				
EXISTING SURFACE LEVEL	14.165	14.191	14.196	13.987	14.465					
OFFSET	-11.428	-10.428	-9.488	-7.000	0.000	7.000	9.494	10.699	11.699	

CH 220.000



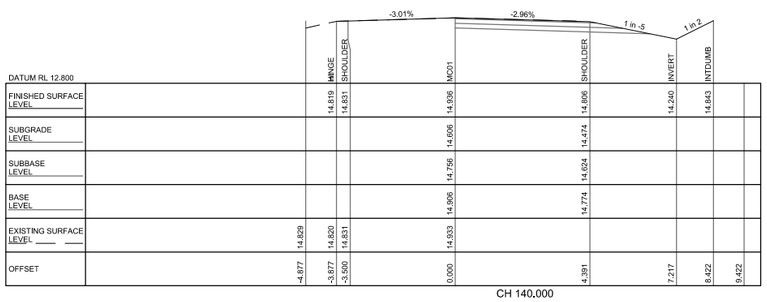
DATUM RL 12.700		int	INVERT	SHOULDER	MC01	SHOULDER	INVERT	INTDUMB		
FINISHED SURFACE LEVEL		14.407	14.185	14.640	14.802	14.617	14.115	14.717		
SUBGRADE LEVEL				14.310	14.472	14.287				
SUBBASE LEVEL				14.460	14.622	14.437				
BASE LEVEL				14.610	14.772	14.587				
EXISTING SURFACE LEVEL	14.490	14.407	14.360	14.359	14.805					
OFFSET	-8.921	-7.921	-7.478	-5.386	0.000	6.145	8.659	9.864	10.864	

CH 160.000



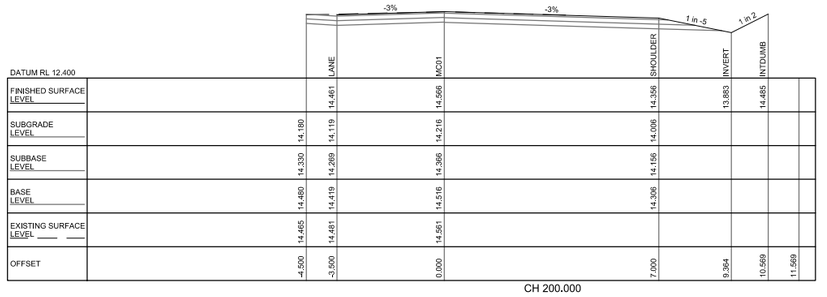
DATUM RL 12.300		int	INVERT	SHOULDER	MC01	SHOULDER	INVERT	INTDUMB		
FINISHED SURFACE LEVEL		14.292	13.772	14.301	14.511	14.301	13.813	14.416		
SUBGRADE LEVEL				13.960	14.161	13.951				
SUBBASE LEVEL				14.110	14.311	14.101				
BASE LEVEL				14.260	14.461	14.251				
EXISTING SURFACE LEVEL	14.285	14.292	14.275	14.072	14.507					
OFFSET	-11.469	-10.469	-9.430	-7.000	0.000	7.000	9.437	10.642	11.642	

CH 211.351



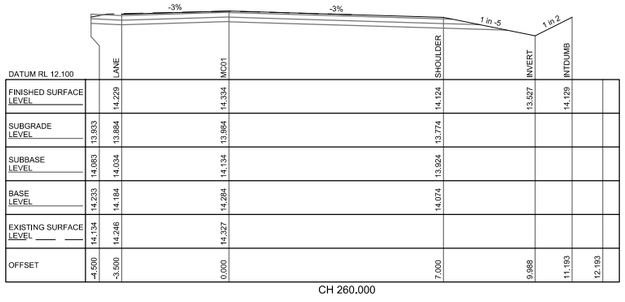
DATUM RL 12.800		HINGE	SHOULDER	MC01	SHOULDER	INVERT	INTDUMB			
FINISHED SURFACE LEVEL		14.819	14.831	14.906	14.806	14.240	14.843			
SUBGRADE LEVEL				14.606	14.474					
SUBBASE LEVEL				14.756	14.624					
BASE LEVEL				14.906	14.774					
EXISTING SURFACE LEVEL	14.829	14.820	14.831	14.933						
OFFSET	-4.877	-3.877	-3.500	0.000	4.391	7.217	8.422	9.422		

CH 140.000



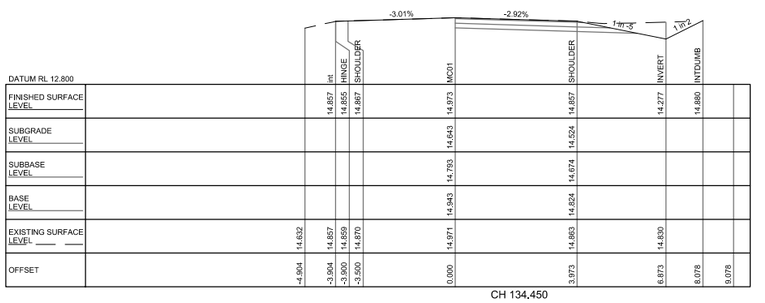
DATUM RL 12.400		LANE	MC01	SHOULDER	INVERT	INTDUMB				
FINISHED SURFACE LEVEL		14.461	14.566	14.356	13.883	14.485				
SUBGRADE LEVEL	14.180	14.119	14.216	14.006						
SUBBASE LEVEL	14.330	14.269	14.366	14.156						
BASE LEVEL	14.480	14.419	14.516	14.306						
EXISTING SURFACE LEVEL	14.465	14.481	14.561							
OFFSET	-4.500	-3.500	0.000	7.000	9.364	10.569	11.569			

CH 200.000



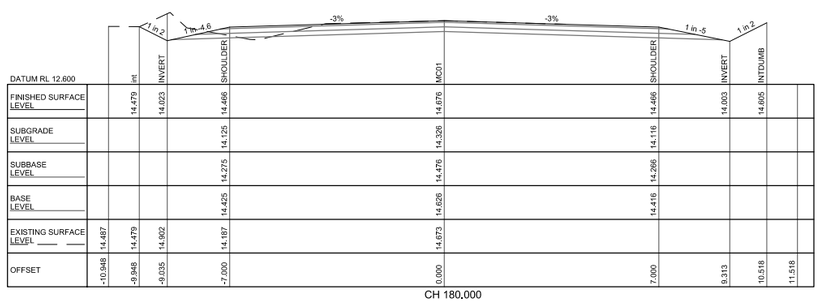
DATUM RL 12.100		LANE	MC01	SHOULDER	INVERT	INTDUMB				
FINISHED SURFACE LEVEL		14.229	14.334	14.124	13.527	14.129				
SUBGRADE LEVEL	13.933	13.884	13.984	13.774						
SUBBASE LEVEL	14.083	14.034	14.134	13.924						
BASE LEVEL	14.233	14.184	14.284	14.074						
EXISTING SURFACE LEVEL	14.134	14.246	14.327							
OFFSET	-4.500	-3.500	0.000	7.000	9.988	11.193	12.193			

CH 260.000



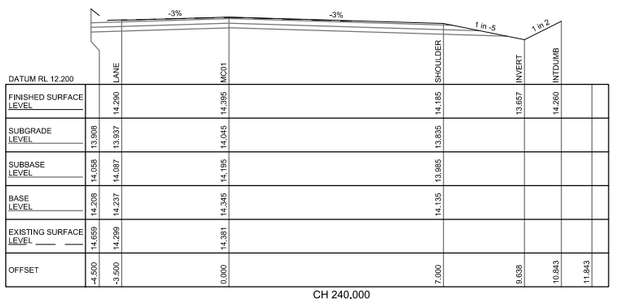
DATUM RL 12.800		int	HINGE	SHOULDER	MC01	SHOULDER	INVERT	INTDUMB		
FINISHED SURFACE LEVEL		14.857	14.855	14.867	14.973	14.857	14.277	14.880		
SUBGRADE LEVEL					14.643	14.524				
SUBBASE LEVEL					14.793	14.674				
BASE LEVEL					14.943	14.824				
EXISTING SURFACE LEVEL	14.632	14.857	14.859	14.870	14.971	14.863	14.830			
OFFSET	-4.994	-3.994	-3.900	-3.500	0.000	3.973	6.873	8.078	9.078	

CH 134.450



DATUM RL 12.600		int	INVERT	SHOULDER	MC01	SHOULDER	INVERT	INTDUMB		
FINISHED SURFACE LEVEL		14.479	14.023	14.466	14.676	14.466	14.003	14.605		
SUBGRADE LEVEL				14.125	14.326	14.116				
SUBBASE LEVEL				14.275	14.476	14.266				
BASE LEVEL				14.425	14.626	14.416				
EXISTING SURFACE LEVEL	14.487	14.479	14.902	14.187	14.673					
OFFSET	-10.948	-9.948	-9.035	-7.000	0.000	7.000	9.313	10.518	11.518	

CH 180.000



DATUM RL 12.200		LANE	MC01	SHOULDER	INVERT	INTDUMB				
FINISHED SURFACE LEVEL		14.290	14.395	14.185	13.657	14.290				
SUBGRADE LEVEL	13.908	13.937	14.045	13.835						
SUBBASE LEVEL	14.058	14.087	14.195	13.985						
BASE LEVEL	14.208	14.237	14.345	14.135						
EXISTING SURFACE LEVEL	14.459	14.299	14.381							
OFFSET	-4.500	-3.500	0.000	7.000	9.638	10.843	11.843			

CH 240.000

REV	DATE	REVISION NOTES
B	24.01.23	ROAD PAVEMENT UPDATED TO FULL PAVEMENT REPLACEMENT
A	30.05.22	INITIAL ISSUE

1000 0 1000 2000 3000 4000 5000 mm

SCALE 1:100

DESIGNER

OSE GROUP

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CLIENT

KOPPEN CONSTRUCTION

PROJECT

ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

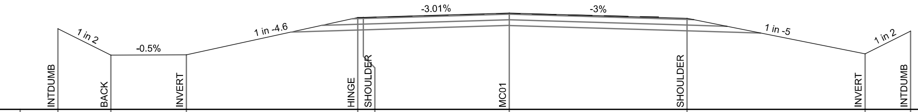
DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE

WARNER ROAD - ANNOTATED CROSS SECTIONS
SHEET 1 OF 2

SCALE	DRAWING No	REV
1:100	21145-C013	B

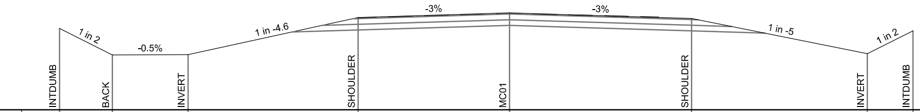
27/02/2023 3:42:05 PMFile: C:\OSE\OSE Group\Operations - Docs\Projects\2021\21145 Asphalt Plant Warner Rd\Drawings\Working\21145 Koppens Ashalt Plant Warner Road\21145-DESIGN.dwg



DATUM RL 11.700

		INTDUMB	BACK	INVERT	HINGE	SHOULDER	MC01	SHOULDER	INVERT	INTDUMB	
FINISHED SURFACE LEVEL		13.833	13.133	13.143	14.129	14.133	14.249	14.108	13.166	13.769	
SUBGRADE LEVEL							13.919	13.778			
SUBBASE LEVEL							14.069	13.928			
BASE LEVEL							14.219	14.078			
EXISTING SURFACE LEVEL					14.119	14.123	14.229				
OFFSET	-12.941	-11.941	-10.541	-8.541	-4.006	-3.861	0.000	4.704	9.414	10.619	11.619

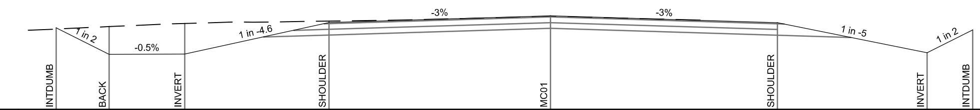
CH 320.000



DATUM RL 11.700

		INTDUMB	BACK	INVERT	SHOULDER	MC01	SHOULDER	INVERT	INTDUMB	
FINISHED SURFACE LEVEL		13.842	13.142	13.152	14.130	14.250	14.105	13.176	13.779	
SUBGRADE LEVEL					13.765	13.920	13.775			
SUBBASE LEVEL					13.915	14.070	13.925			
BASE LEVEL					14.065	14.220	14.075			
EXISTING SURFACE LEVEL						14.230				
OFFSET	-12.901	-11.901	-10.501	-8.501	-4.003	0.000	4.815	9.461	10.666	11.666

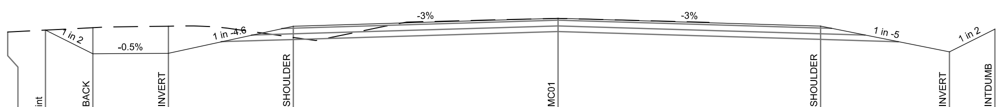
CH 318.583



DATUM RL 11.800

		INTDUMB	BACK	INVERT	SHOULDER	MC01	SHOULDER	INVERT	INTDUMB	
FINISHED SURFACE LEVEL		13.945	13.245	13.255	14.086	14.261	14.081	13.289	13.891	
SUBGRADE LEVEL					13.756	13.931	13.751			
SUBBASE LEVEL					13.906	14.081	13.901			
BASE LEVEL					14.056	14.231	14.051			
EXISTING SURFACE LEVEL		13.914	13.977	14.059	14.122	14.247				
OFFSET	-14.082	-13.082	-11.682	-9.682	-5.861	0.000	6.009	9.971	11.176	12.176

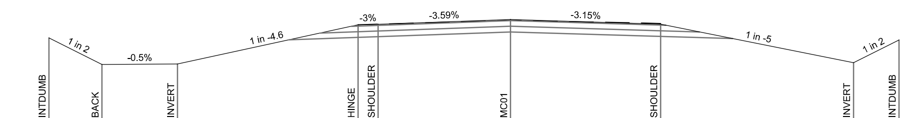
CH 300.000



DATUM RL 11.900

		int	BACK	INVERT	SHOULDER	MC01	SHOULDER	INVERT	INTDUMB	
FINISHED SURFACE LEVEL		13.977	13.352	13.362	14.080	14.290	14.081	13.400	14.002	
SUBGRADE LEVEL					13.730	13.940	13.731			
SUBBASE LEVEL					13.880	14.090	13.881			
BASE LEVEL					14.030	14.240	14.031			
EXISTING SURFACE LEVEL	13.926	13.977	14.040	14.081	13.783	14.287				
OFFSET	-14.554	-13.554	-12.303	-10.303	-7.000	0.000	6.941	10.349	11.554	12.554

CH 280.000



DATUM RL 11.600

		INTDUMB	BACK	INVERT	HINGE	SHOULDER	MC01	SHOULDER	INVERT	INTDUMB	
FINISHED SURFACE LEVEL		13.760	13.060	13.070	14.108	14.124	14.250	14.125	13.105	13.707	
SUBGRADE LEVEL							13.920				
SUBBASE LEVEL							14.070				
BASE LEVEL							14.220				
EXISTING SURFACE LEVEL					14.110	14.126	14.226				
OFFSET	-13.204	-12.204	-10.804	-8.804	-4.031	-3.500	0.000	3.969	9.070	10.275	11.275

CH 329.763

REV	DATE	REVISION NOTES
B	24.01.23	ROAD PAVEMENT UPDATED TO FULL PAVEMENT REPLACEMENT
A	30.05.22	INITIAL ISSUE

1000 0 1000 2000 3000 4000 5000 mm

SCALE 1:100

DESIGNER

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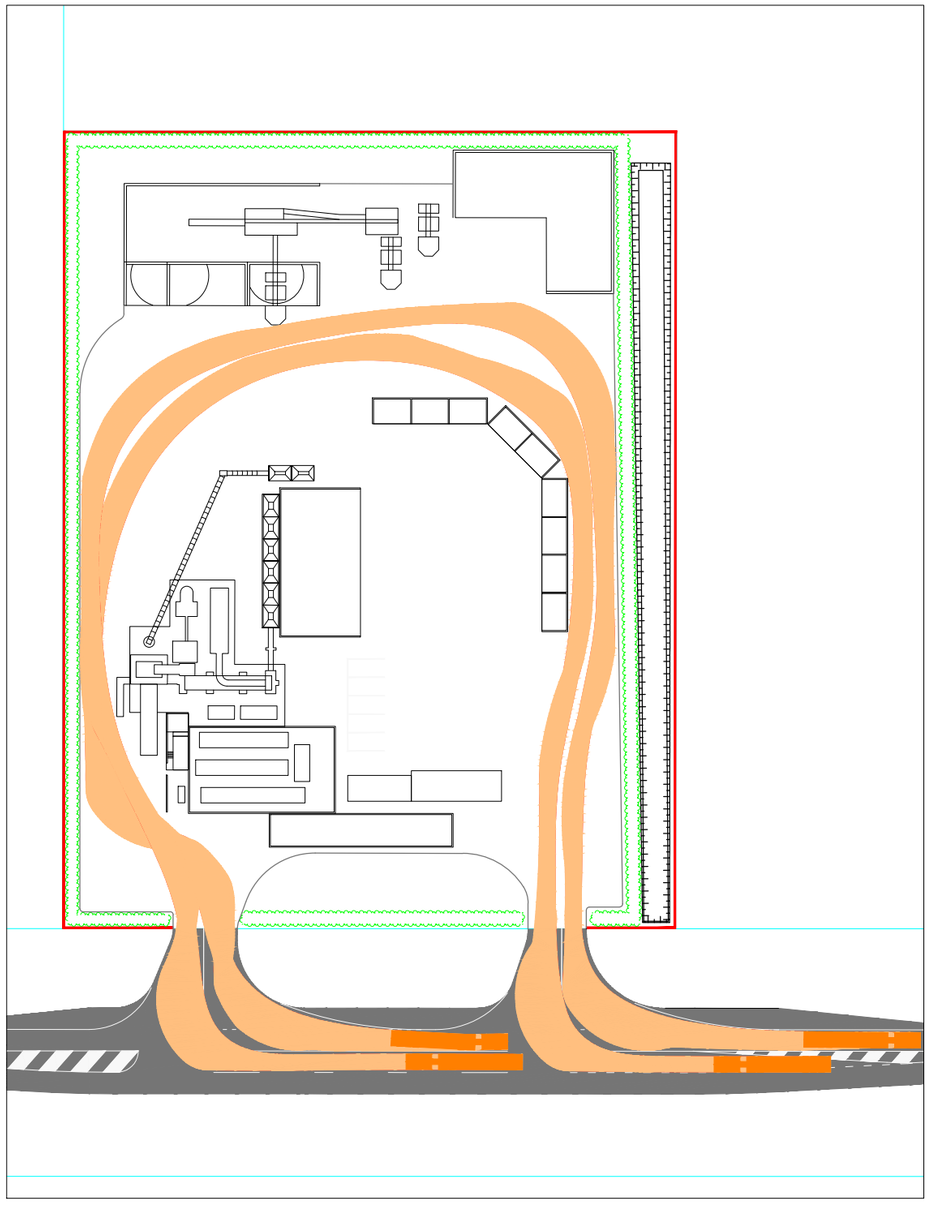
KOPPEN CONSTRUCTION

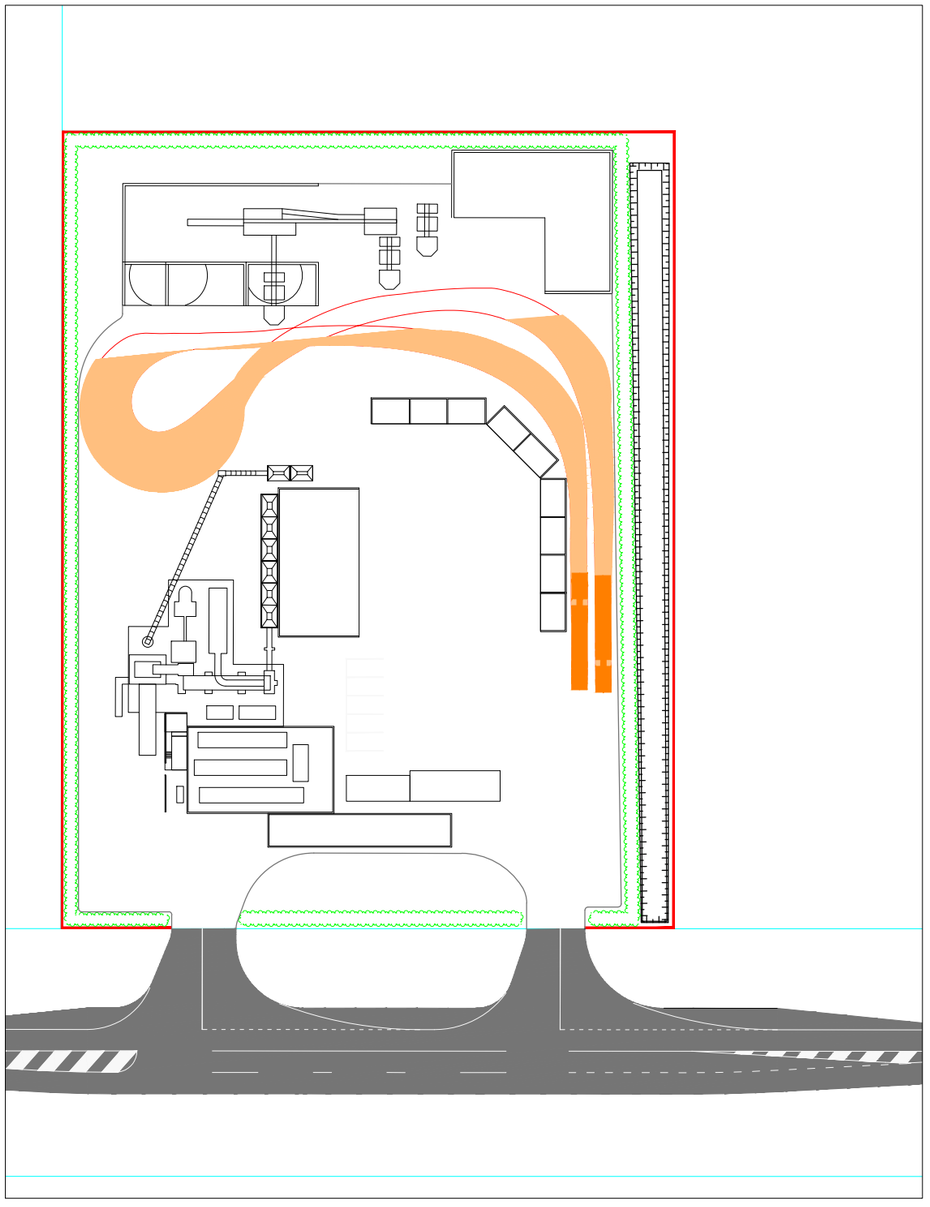
PROJECT
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

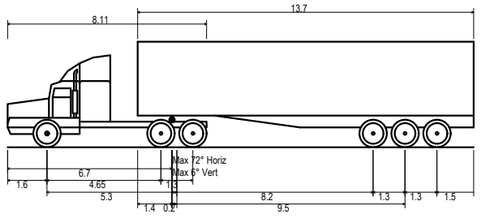
TITLE
WARNER ROAD - ANNOTATED CROSS SECTIONS
SHEET 2 OF 2

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	
DJM	PDR	DATE -

SCALE	DRAWING No	REV
1:100	21145-C014	B







Prime mover and semi-trailer (19 m)
Overall Length 19.000m
Overall Width 2.500m

REV	DATE	REVISION NOTES
B	27.02.23	NEW INTERNAL PLANT LAYOUT
-	-	INITIAL ISSUE

DESIGNER
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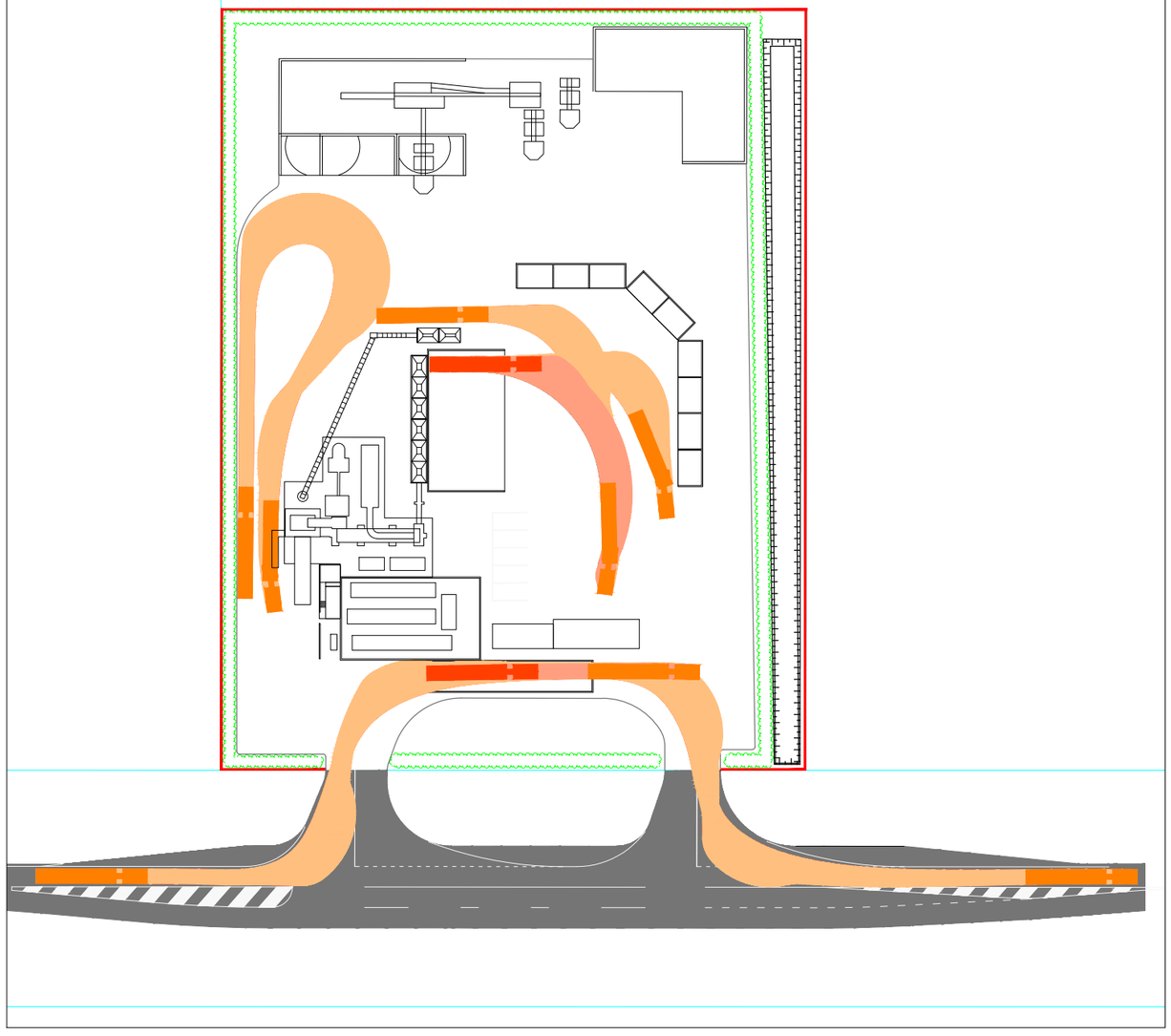
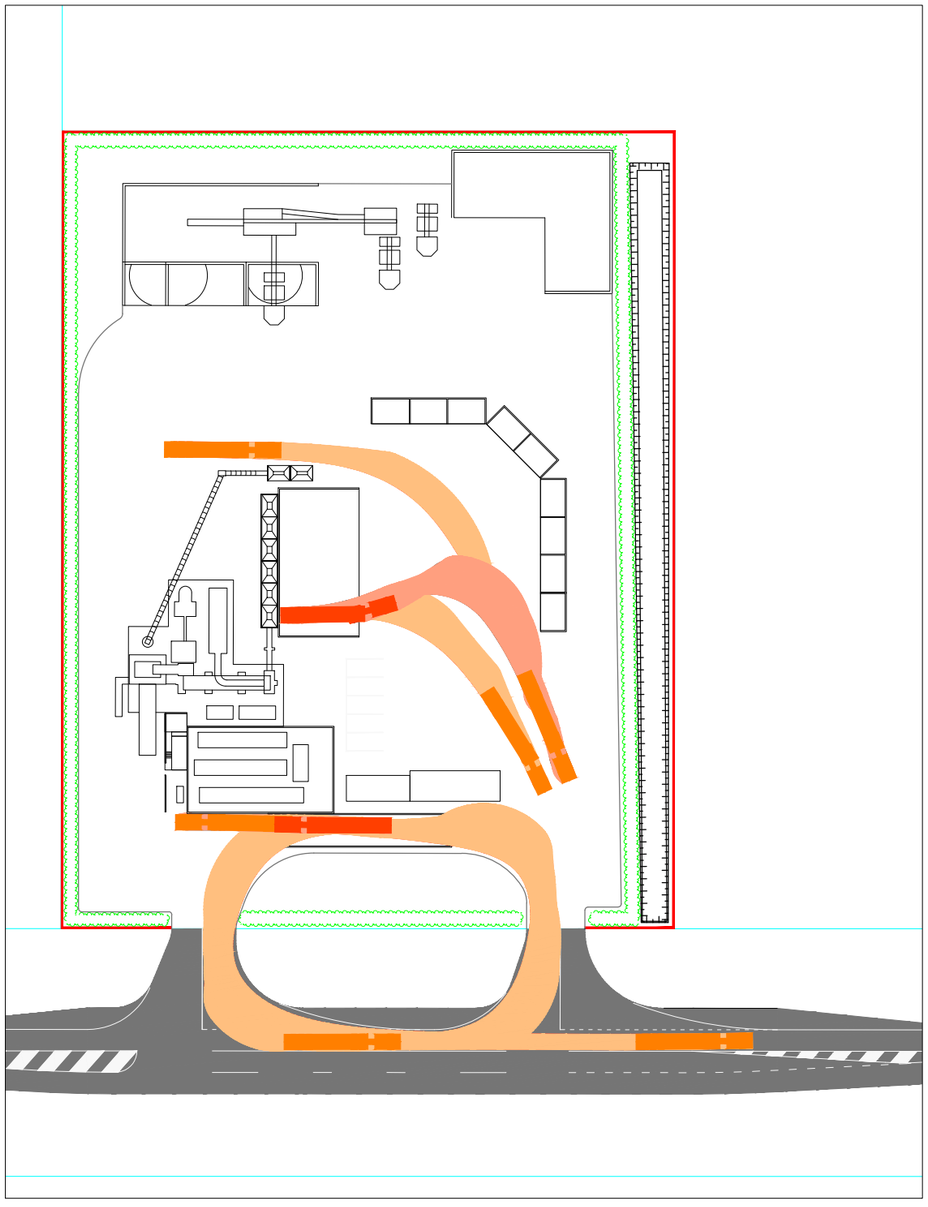
WARNER ROAD - GORDONVALE

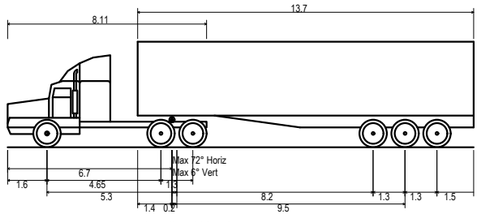
DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE
SITE VEHICLE TURN MOVEMENT SKETCHES
SKETCH 1 OF 4

SCALE	DRAWING No	REV
NOT TO SCALE	21145-SK001	B







Prime mover and semi-trailer (19 m)

Overall Length	19.000m
Overall Width	2.500m

REV	DATE	REVISION NOTES
B	27.02.23	NEW INTERNAL PLANT LAYOUT
-	-	INITIAL ISSUE

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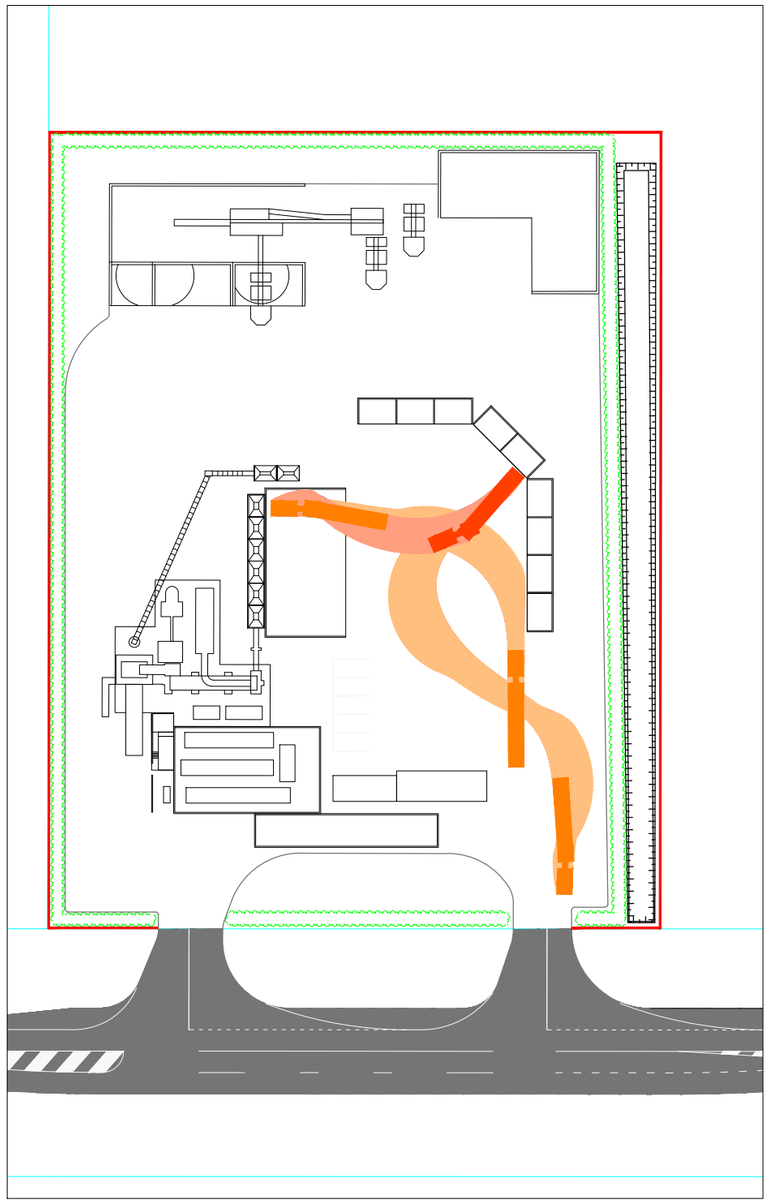
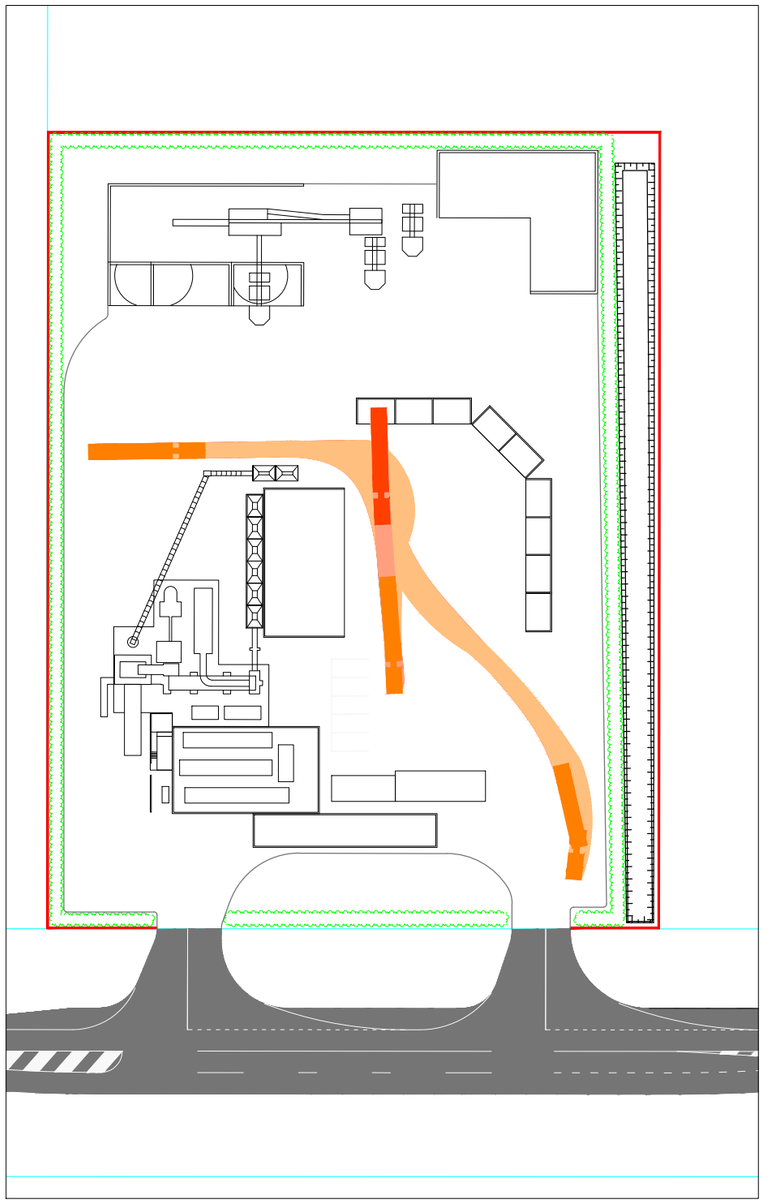
WARNER ROAD - GORDONVALE

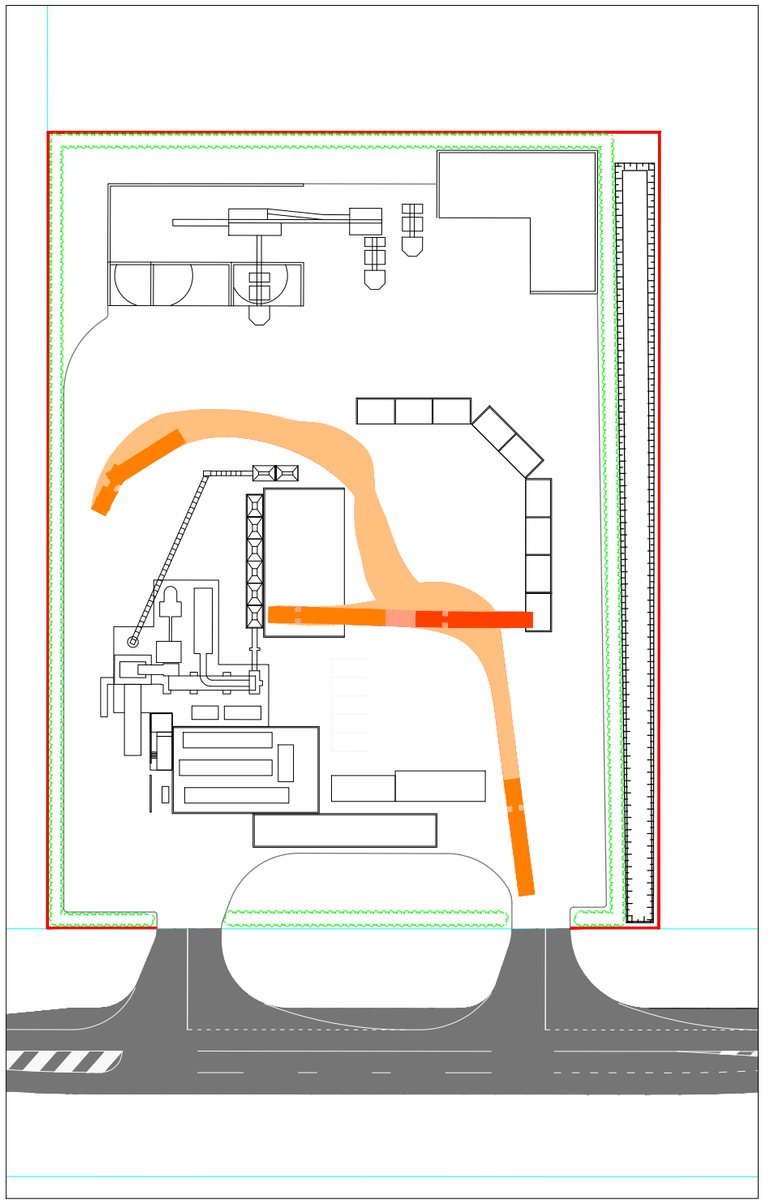
DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

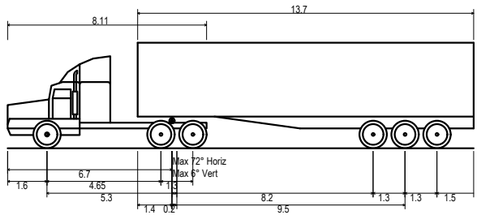
TITLE: SITE VEHICLE TURN MOVEMENT SKETCHES
SKETCH 2 OF 4

SCALE	DRAWING No	REV
NOT TO SCALE	21145-SK002	B









Prime mover and semi-trailer (19 m)
Overall Length 19.000m
Overall Width 2.500m

REV	DATE	REVISION NOTES
B	27.02.23	NEW INTERNAL PLANT LAYOUT
-	-	INITIAL ISSUE

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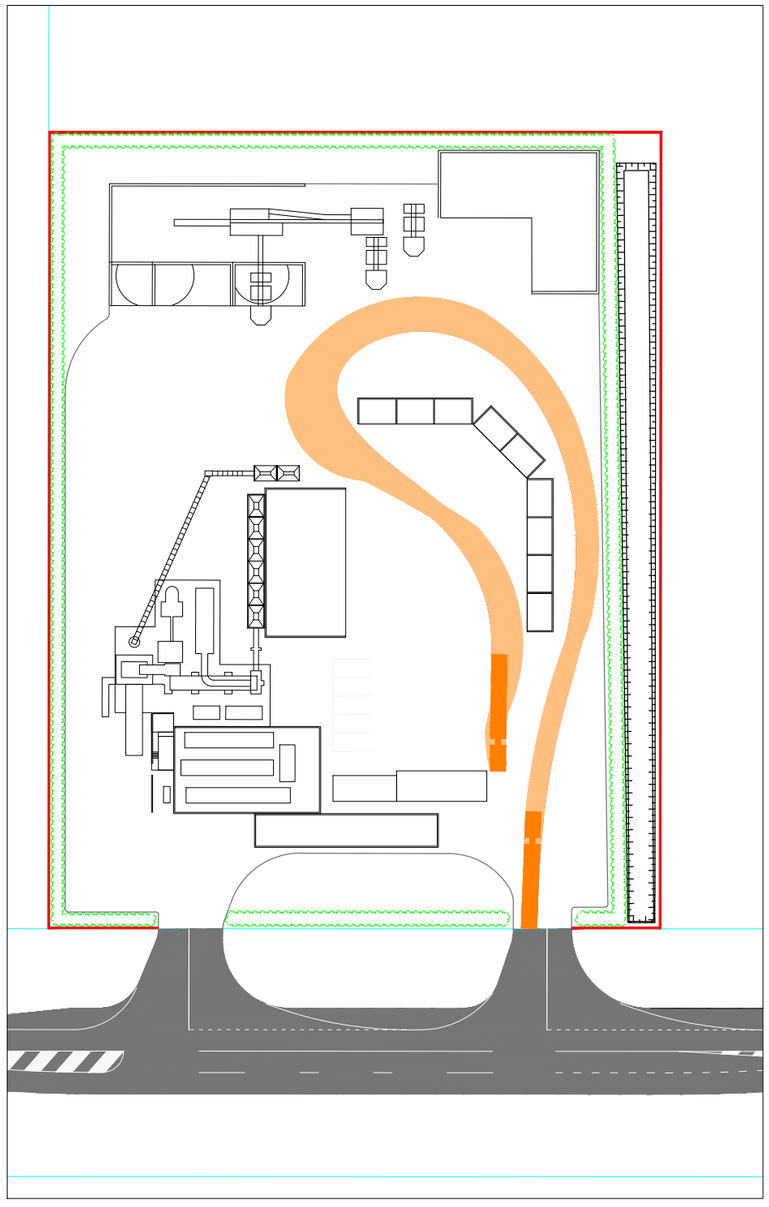
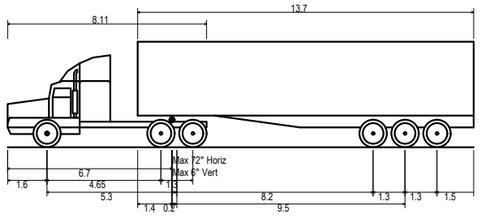
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE
SITE VEHICLE TURN MOVEMENT SKETCHES
SKETCH 3 OF 4

SCALE	DRAWING No	REV
NOT TO SCALE	21145-SK003	B





Prime mover and semi-trailer (19 m)
Overall Length 19.000m
Overall Width 2.500m

REV	DATE	REVISION NOTES
B	27.02.23	NEW INTERNAL PLANT LAYOUT
-	-	INITIAL ISSUE

DESIGNER
OSE GROUP
Address: 35 ABBOTT ST, CAIRNS 4870
Email: admin@osegroup.com.au

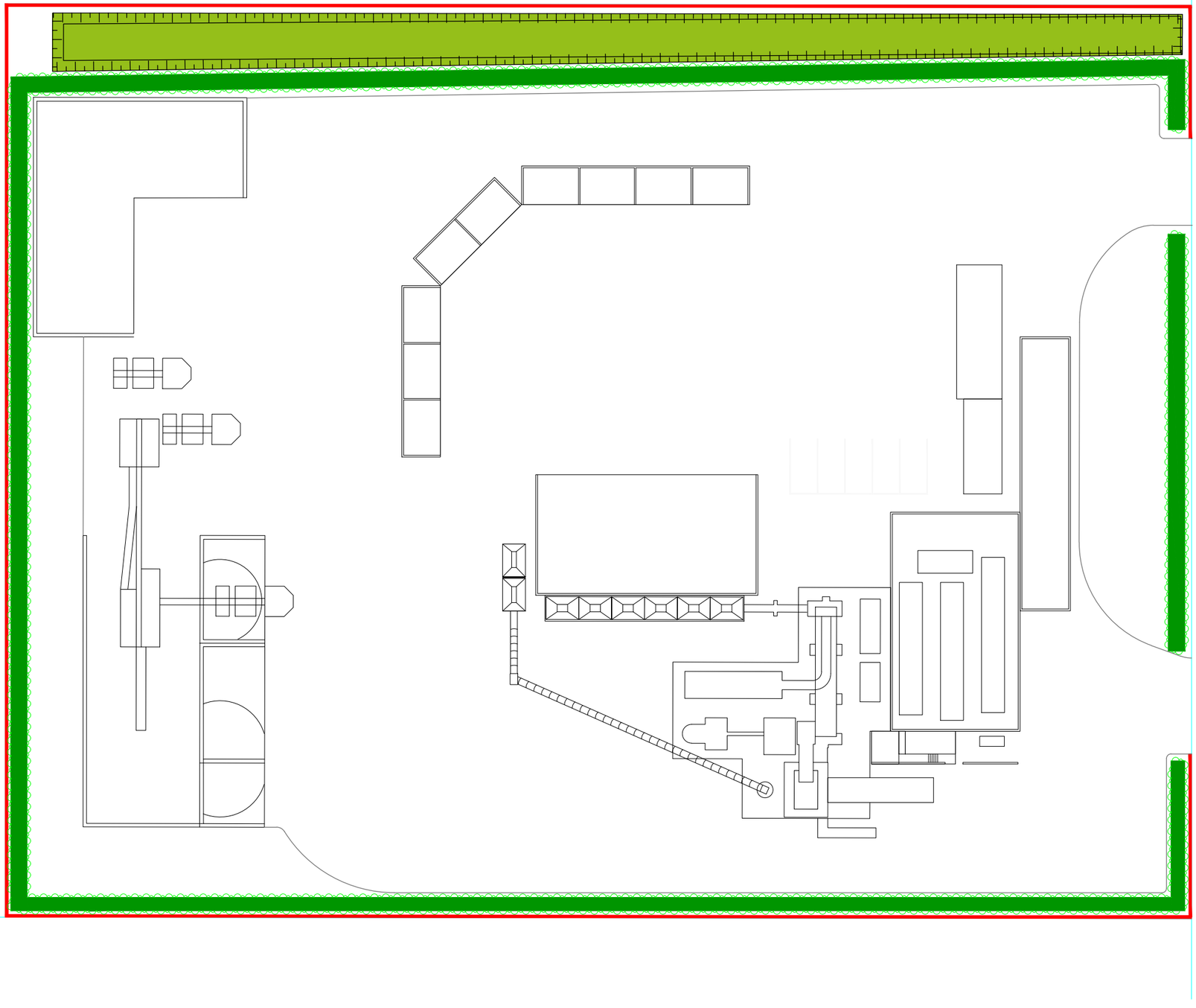
CLIENT
KOPPEN CONSTRUCTION

PROJECT
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE
SITE VEHICLE TURN MOVEMENT SKETCHES
SKETCH 4 OF 4

SCALE	DRAWING No	REV
NOT TO SCALE	21145-SK004	B

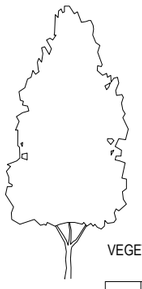


BIORETENTION SWALE PLANT TYPES

	TYPE:	NOTES
1.	Ficinia nodosa	Mix of adjacent planted at 8 per square meter
2.	Gahnia aspera	
3.	Carex appressa	
4.	Imperata cylindrica	
5.	Lomandra hystrix	

GRASS AND GROUND COVER SPECIES

	TYPE:	NOTES
1.	Lomandra hystrix	Mix of species planted at density 3/sq.m
2.	Phyllanthus multifolius	
3.	Gardenia psidioides "Glennie River"	



VEGETATIVE SCREENING/HEDGING PLANT TYPES

	TYPE:	NOTES
1.	Acmena smithhii	Mix of species, max 3 of same type in a row, planted at 800mm centres
2.	Leea indica	
3.	Phyllanthus lamprophyllus	
4.	Syzygium australe	

REV	DATE	REVISION NOTES
B	27.02.23	NEW INTERNAL PLANT LAYOUT
-	-	INITIAL ISSUE

2.5 0 2.5 5 7.5 10 12.5 m

SCALE 1:500

DESIGNER

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CLIENT

KOPPEN CONSTRUCTION

PROJECT

ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

TITLE

LANDSCAPING PLAN
AND PLANTING SCHEDULES

SCALE		DRAWING No	REV
1:500	(A3)	21145-SK005	B

27/02/2023 3:42:10 PMFile: C:\OSE\OSE Group\Operations - Docs\Projects\2021\21145 Asphalt Plant Warner Rd\Drawings\Working\21145 Koppens Ashalt Plant Warner Road\21145-DESIGN.dwg

Attachment B

SMEC Speed Limit Review Report

SMEC

Member of the Surbana Jurong Group

SMEC INTERNAL REF. 30034001

Speed Limit Review

Warner Road Asphalt Plant

Client Reference No. OSE
Prepared for: OSE Group
22 December 2022

Through our specialist expertise, we deliver advanced infrastructure solutions for our clients and partners.

Leveraging our 70-year history of delivering nation-building infrastructure, we provide technical expertise and advanced engineering services to resolve complex challenges.

Through our network of global specialists collaborating with local partners, we connect you with the best teams and capabilities to deliver innovative and sustainable solutions.

We're redefining exceptional

Document Control

Document Type	Speed Limit Review
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Project Number	30034001
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Revision Number	01

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Revision No.	Date	Prepared By	Reviewed By	Approved for Issue By
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Distribution List	Date Issued	Number of Copies
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1. Introduction

1.1 Project Background

In support the application to develop an Asphalt and Concrete Batching Plant on Warner Road, Gordonvale the client has been requested by Cairns Regional Council (CRC) to submit a Speed Limit Review (SLR) of Warner Road within the vicinity of 1 Warner Road, Gordonvale which currently has a posted speed limit of 100km/h.

1.2 Development Details

Figure 1 presents the location of proposed development while the site layout and key design plans are shown in Appendix A.

Figure 1-1: Site Location

Key design features to note are:

- Frequent Heavy Vehicle (HV) access off Warner Road is required
- Two (2) driveway crossovers are proposed
- Both driveways to cater for entry and exit
- Road widening works are proposed to ensure adequate HV access to the site
- A right in turning bay is proposed

Note, CRC has indicated the Warner Road / Bruce Highway intersection is to be closed though the timing of this closure is currently unknown.

1.3 Scope and Purpose

The aim of this report is to step through the process outlined in the Dept. of Transport and Main Roads (TMR) Manual of Uniform Traffic Control Devices (MUTCD), Part 4. The information collected through following this process has been collated within this report in summary form and entered into the TMR Speed Limit Review Technical Tool spreadsheet to quantity the information collected (Refer to Appendix B for the spreadsheet results).

The aim of a SLR is to determine and implement an appropriate speed limit for an identified section of road. The specific objectives are to undertake a staged technical assessment, and to make a recommendation for endorsement, approval and implementation.

In accordance with Section 3.3 of MUTCD Part 4, a homogenous section of road has been assessed, as shown in figure 2, extending 1500m from the Bruce Highway intersection.

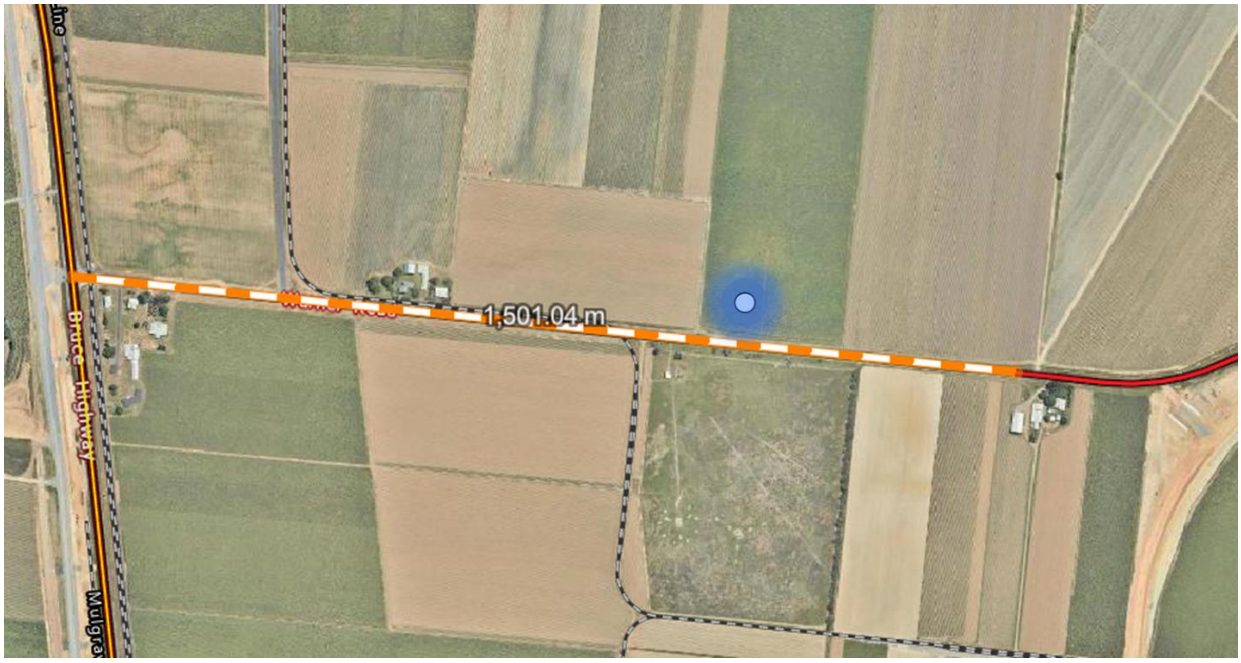


Figure 1-2: Length of Warner Road assessed as part of the Speed Limit Review

1.4 Speed Limit Review Process

In accordance with Section 3.5 of MUTCD Part 4, and as shown in Figure 3 below, a SLR is an eight-stage process. In summary the eight-stage process includes the following, with only Stages 2 to 6 forming part of this Report:

- Stage 1: Assess the need to undertake a SLR:
  - Stage 1 has been undertaken by CRC who confirmed the need to undertake a SLR of Warner Road
- Stage 2: Criteria Based Speed Limit (CBSL) Assessment, refer to Section 2.1
- Stage 3: Determination of the Risk Assessment Speed Limit (RASL), refer to Section 2.2
- Stage 4: Determination of the Speed Data Speed Limit, refer to Section 2.3
- Stage 5: Option Selection, refer to Section 2.4
- Stage 6: Engineer Recommendation, refer to section 2.5
- Stage 7: Approve and Implement:
  - Stage 7 is to be undertaken in consultation between the Client and CRC. This stage does not for part of this Report
- Stage 8: Monitor and Evaluate:
  - Stage 8 is to be undertaken by CRC and does not form part of this Report

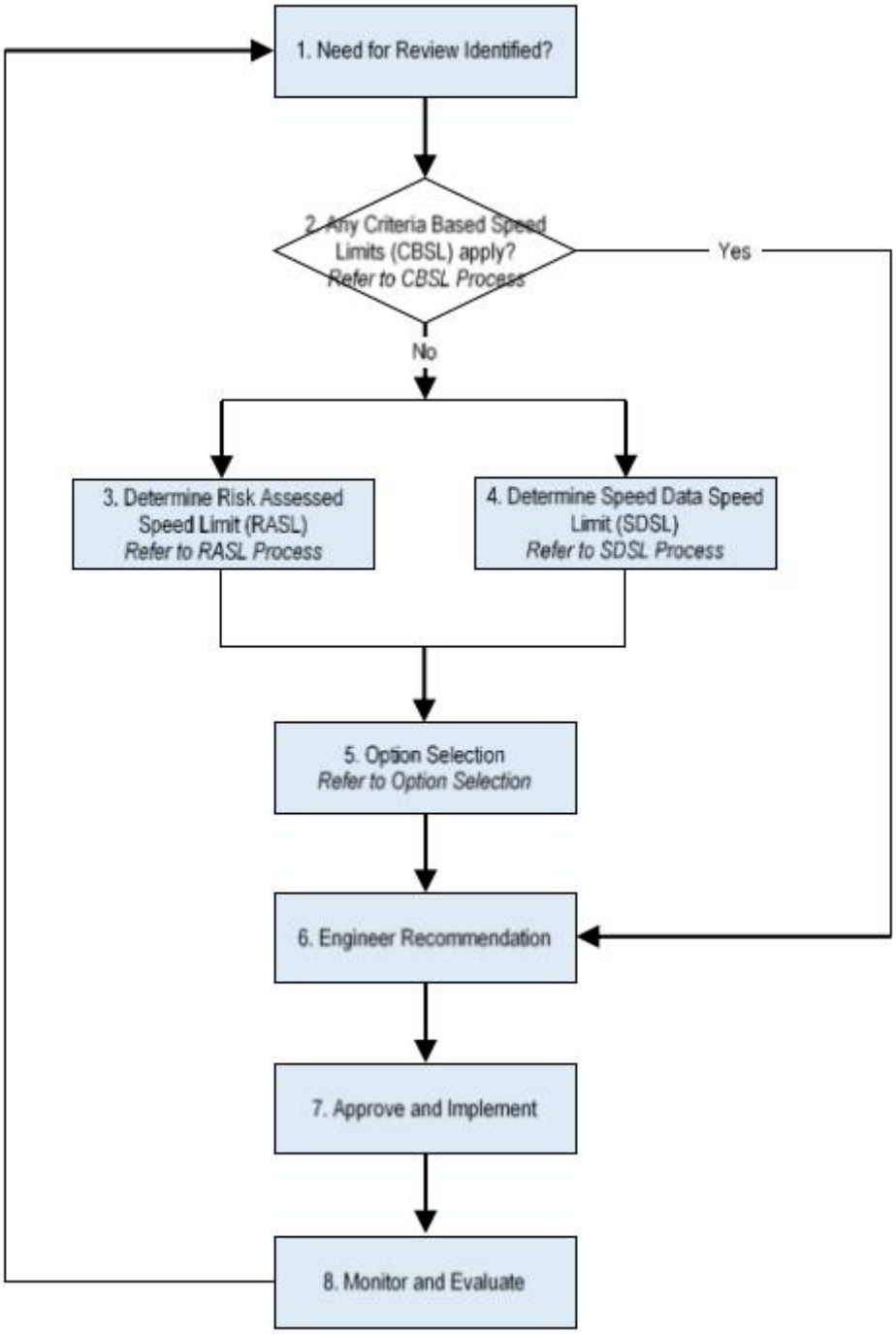


Figure 1-3: Eight stage process for undertaking a Speed Limit Review (extract from TMR MUTCD Part 4, Section 3.5)

1.5 References

This SLR has been undertaken in accordance with TMR's:

- TMR Infrastructure Risk Rating (IRR) Manual, 2018
- TMR Manual of Uniform Traffic Control Devices (MUTCD) Part 4, 2022
- TMR Queensland Road Safety Technical User Volumes (QRSTUV): Guide to Speed Management, 2022

2. Speed Limit Review

2.1 Criteria Based Speed Limit (SBSL)

Based on the following review, the CBSL does not apply to Warner Road.

The process required to determine a CBSL is presented within Section 4 of the MUTCD Part 4 and is based around seven questions reproduced below. If the answer to any of the seven questions is yes, then specific speed limit requirements automatically apply. A response to each question is presented below.

1. Is the speed zone a foreshore?
   - No, Warner Road is not related to a foreshore
2. Is the road considering a car park or access driveway?
   - Warner Road is not considered a car park or access driveway
3. Are traffic calming devices present?
   - Traffic calming devices are not present
4. Is the road segment a shared zone?
   - Warner road is not a shared zone
5. Is the road unsealed or have a narrow seal?
   - Warner Road is not unsealed and does not have a narrow seal
   - Note, a narrow seal is where there is insufficient width for two vehicles to pass without use of the shoulder or verge
6. Is the speed zone a High Active Transport User Area (HATUA) zone?
   - the Warner Road speed zone is not a HATUA zone
7. Is the speed zone an Urban Local / Access Street?
   - Warner Road is not an Urban Local / Access Street

2.2 Risk Assessment Speed Limit (RASL)

In accordance with Section 5.1 of the MUTCD Part 4, the RASL is the speed limit determined through consideration of four criteria, namely: crash risk, infrastructure risk, environmental context class, and road functional class. The determination of these four (4) criteria follows the following six steps. The information collected through these six (6) steps have been entered into the TMR Speed Limit Review Technical Tool spreadsheet in Appendix B.

2.2.1 Step 1 - Infrastructure and Crash Data

In accordance with MUTCD Part 4 Section 5.1.1, a category and risk score must be assigned to the following eight (8) road attributes and assessed to determine the Crash Risk Rating (CRR), Infrastructure Risk Rating (IRR) and Road Risk Metric (RRM).

a. Road stereotype (refer Section 3.1 of the IRR Manual, 2018)
   - As seen in Figure 2-1 below, the section of Warner Road under review is a sealed two-lane undivided road

Figure 2-1: Warner Road looking east mid-way along section under review. Sealed undivided two-lane road (Source: Google Streetview)

Table 2-1: Road Stereotype risk score taken extracted from Section 3.1 of the IRR Manual, 2018

Category	Risk Score	Description
Unsealed	10.0	Any road that is unsealed
Two lane undivided	3.7	An undivided road with one lane in each direction
Multi-lane undivided	3.4	An undivided road with more than one lane in each direction. Includes roads with two lanes in one direction and one lane in the other direction.
Divided (traversable)	3.0	Divided road with a traversable median
Divided (non-traversable)	1.0	Divided road with a non-traversable median
One way	1.0	One way streets

b. Road alignment (refer Section 3.2 of the IRR Manual, 2018)

- As seen in Table 2-2, the section of Warner Road under review is considered straight

Table 2-2: Road alignment risk score (extract from Section 3.2 of the IRR Manual, 2018)

Category	Risk Score	Definition	Description
Tortuous	6.0	≥300 degrees of turn/km	Consecutive curves and numerous sharp curves (typical radii of 350m to 500m) and very sharp curves (typical radii <350m). Can generally be driven at less than 75 km/h for rural roads.
Winding	3.5	≥150 and <300 degrees of turn/km	Many consecutive curves and sharp curves (typical radii of 350m to 500m). Can generally be driven at 75 to 85 km/h for rural roads.
Curved	1.5	≥50 and <150 degrees of turn/km	Moderate curves (typical radii of 500m to 1500m). Can generally be driven at 85 to 100 km/h for rural roads. Some straight sections or isolated curves may be present.
Straight	1.0	<50 degrees of turn/km	Straight or gently curved (typical radii of >1500m). Can generally be driven at 100 km/h or more for rural roads.

c. Carriageway width (refer Section 3.3 of the IRR Manual, 2018)

- As seen in Table 2-3, the section of Warner Road under review has lane widths of approximately 3.3m and a road shoulder <0.3m.

Table 2-3: Carriageway width risk score (extract from Section 3.3 of the IRR Manual, 2018)

Category	Description
Narrow (<3.0m)	Narrow lane width (<3.0m) is generally present
Medium (3.0-3.5m)	Medium lane width (3.0m to 3.5m) is generally present
Wide (>3.5m)	Wide lanes (>3.5m) are generally present

Category	Description
Very narrow shoulder (0 to <0.5m)	Very narrow with little or no shoulder (<0.5m) is generally present
Narrow shoulder (0.5 to <1.0m)	Noticeable but narrow shoulder (0.5m to <1.0m) is generally present
Wide Shoulder (1.0m to 2.0m)	Good wide shoulder (1.0m to <2.0m) is generally present
Very wide shoulder (≥2.0m)	Very wide shoulder (≥2.0m) is generally present

		Lane Width Category		
		Narrow (<3.0m)	**Medium (3.0-3.5m)**	**Wide (>3.5m)**
Sealed Shoulder Width Category	**Very narrow shoulder (0 to <0.5m)**	2.01	1.79	1.58
	Narrow shoulder (0.5 to <1.0m)	1.79	1.45	1.18
	Wide Shoulder (1.0m to 2.0m)	1.22	1.00	0.85
	Very wide shoulder (≥2.0m)	1.00	0.78	0.66

d. Roadside hazards (refer Section 3.4 of the IRR Manual, 2018)

- The following roadside hazard observations are noted from a desktop review:
  - There are approximately 19 frangible roadside signs located along both sides of the Warner Road section under review
  - There are no formal car parks, buildings or barriers
  - Drainage swales with steep batters close to the road edge
  - Six (6) culverts and associated headwalls along the length of the Warner Road section under review
  - Sugar cane rail cross located at mid-point along the Warner Road section under review
  - Sugar cane train parked alongside at the mid-point along the Warner Road section under review. Offset approximately 5.5m from the edge of the road
  - A High Category has been adopted based on the presence of deep drainage swales close to roadside at a number of locations, sugar cane train crossing mid-point along Warner Road and the sugar cane train occasionally parked adjacent to the road

Figure 2-2: Warner Road looking east from Bruce Highway intersection (Minimal roadside hazards)

Figure 2-3: Warner Road looking west from the end of the section under review

Table 2-4: Roadside Hazard risk score (extract from Section 3.4 of the IRR Manual, 2018)

Category	Risk Score	Description	Example Hazards
Severe	2.80	• **Aggressive/severe** continuous hazards and cliffs, **within 5m*** OR • **20+ non-frangible** point hazards per kilometre (1+ per 50m) or **rigid structures/ bridges/ buildings, within 5m**	Aggressive/severe continuous hazards can include: • Aggressive vertical faces • Deep drainage ditches • Cliffs with steep or high drop offs, and/or deep water, that would result in death regardless of speed Examples of non-frangible point hazards include: • Trees, signs, posts, poles >=10cm diameter • Large boulders (>=20cm diameter) • Unprotected barrier ends
High	2.28	• **Cliffs** or **deep water** at **5m to <10m*** • **Roll-over up-slopes** and downslopes (e.g. >15^0 and >1m high) at **<5m***	
Moderate	1.43	• **Aggressive/severe and moderate** continuous hazards at **5m to <10m**, excluding cliffs and deep water* OR • **20+ non-frangible** point hazards per kilometre (1+ per 50m) or **rigid structures/ bridges/ buildings at 5m to <10m** OR • **Car parking** or **semi-rigid** structures or buildings at **<5m***	Aggressive/severe and moderate continuous hazards can include: • Aggressive vertical faces • Deep drainage ditches • Roll-over up-slopes and downslopes (e.g. >15^0 and >1m high) Non-frangible point hazards can include: • Trees, signs, posts, poles >=10cm diameter • Large boulders (>=20cm diameter) • Unprotected barrier ends
Minor	0.67	• Metal and concrete **safety barriers** at **<5m*** • **Car parking** or **semi-rigid** structures or buildings at **5m to <10m***	
Low	0.40	• Metal and concrete **safety barriers** at **5m+*** • Low severity property damage hazards at any distance* • All hazards at **>=10m***	Low severity property damage hazards can include: • Kerbs • Wire-rope barriers • Level and safe slopes (<=15^0 and <=1m high) with no hazards • Frangible trees, posts, poles <10cm diameter

* ***>=50% of the length, where they occur intermittently***

e. Land use (refer Section 3.5 of the IRR Manual, 2018)

- The Land Use adjacent to Warner Road is predominately Remote Rural with more Rural Residential immediately adjacent to the Bruce Highway intersection

Table 2-5: Lane Use risk score (extract from Section 3.5 of the IRR Manual, 2018)

Category	Risk Score	Environment	Description
Commercial strip shopping	5.0	Urban	Numerous shops facing the street-front with high levels of pedestrian and cyclist activity. High occupancy on-street parking present resulting in many vehicle movements to and from the road. Regular intersections and accesses will also be present.
Commercial big box / industrial	4.0	Urban	Large (big box) shops and/or industry/factories with intermittent accesses leading to large off-street parking areas. Regular intersections and some pedestrian and cyclist activity may be present.
Urban residential	3.0	Urban	Urban residential area dominated by housing with frequent driveways and on-street parking. Regular intersections are likely to be present. Pedestrian and cyclist activity is also likely, particularly at certain times of the day.
Rural town	2.5	Urban	Rural town with mixture of residential activity and some shops or a low density urban road on the outskirts of an urban centre. Some intersections and accesses are likely to be present. Some pedestrian and cyclist activity may also be present.
Controlled access	2.0	Urban	Road with roadside development and controlled access, such as an urban highway or arterial where there are few accesses to the road, e.g. as a result of a service road. Some pedestrian and cyclist activity may be present but with few crossing movements.
Rural residential	1.5	Rural	Rural area with medium to low density accesses to private dwellings and farms. Accesses may also be provided to industry/factory developments. Some pedestrian and cyclist activity may also be present, particularly at certain times of the day, but with few crossing movements.
Remote rural	1.0	Rural	Accesses and intersection densities are low or very low. Surrounding land is rural with few houses and almost no industry.
No access (motorway / freeway)	1.0	Rural	No accesses or at grade intersections are present and pedestrians and cyclists are not allowed, e.g. motorway.

f. Intersection density (refer Section 3.6 of the IRR Manual, 2018)

- Along the section of Warner Road under review there are two (2) at grade intersections. One (1) intersection with Bruce Highway and another with a private sealed service road linking through to Harris Road.

Figure 2-4: Intersections along Warner Road

Table 2-6: Intersection Density risk score (extract from Section 3.6 of the IRR Manual, 2018)

Category	Risk Score
10+ intersections / km	5.00
5 to <10 intersections / km	2.60
3 to <5 intersections / km	1.50
2 to <3 intersections / km	1.25
1 to <2 intersections / km	1.15
<1 intersections / km	1.00

g. Access density (refer Section 3.7 of the IRR Manual, 2018)

- Along the section of Warner Road under review there are 15 at grade access points as illustrated in Figure 2-5

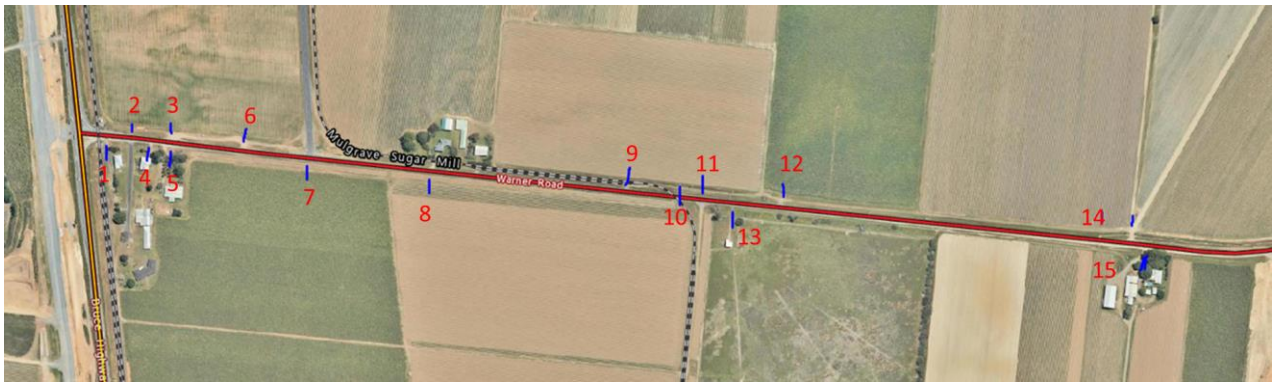


Figure 2-5: Location of access and crossing points

Table 2-7: Intersection Density risk score taken from Section 3.6 of the IRR Manual, 2018

Category	Risk Score
20+ accesses / km	1.30
10 to <20 accesses / km	1.10
5 to <10 accesses / km	1.06
2 to <5 accesses / km	1.03
1 to <2 accesses / km	1.01
<1 accesses / km	1.00

h. Traffic volume (refer Section 3.4 of the IRR Manual, 2018)

- As seen in Figure 2-6, data available from the Dept. of Resources, Queensland Globe mapping system indicates an AADT of 2297 vehicles in 2019, it is noted that less traffic was recorded in 2020 which is considered as an impact of COVID-19, the 2019 AADT was selected in this assessment conservatively.

Figure 2-6: AADT's for Warner Road (Source Dept. of Resources – Queensland Globe)

Table 2-8: Intersection Density risk score taken from Section 3.7 of the IRR Manual, 2018

Category	Risk Score
18,000+ veh/day	3.4
12,000 to <18,000 veh/day	3.0
6,000 to <12,000 veh/day	2.2
1,000 to <6,000 veh/day	1.4
<1,000 veh/day	1.0

2.2.2 Step 2 – Determination of the Crash Risk Rating (CRR)

CRR is a risk classification determined by a quantitative measure of personal crash risk based on frequency of occurrence of casualty crashes along the speed zone. CRR is a historic measure of crashes that have occurred and is determined in accordance with Appendix C of the MUTCD Part 4.

As seen in Figure 2-7, one (1) crash has occurred in the period between 2017-2021 along the section of Warner Road under review. The crash resulted in Hospitalisation following a left-off carriageway crash on a straight segment of road and hitting an object (DCA code 703 and DCA group 16), it is noted that this crash occurred in 2021 and is a single vehicle crash.

Measure of crash exposure in vehicles kilometres travelled (expressed as 10^8 VKT) is calculated to be 0.0629 while the Estimated Fatal and Serious Injury Casualty Rate is calculated to be 10.5 which represents a medium Crash Risk Rating (CRR) Band.

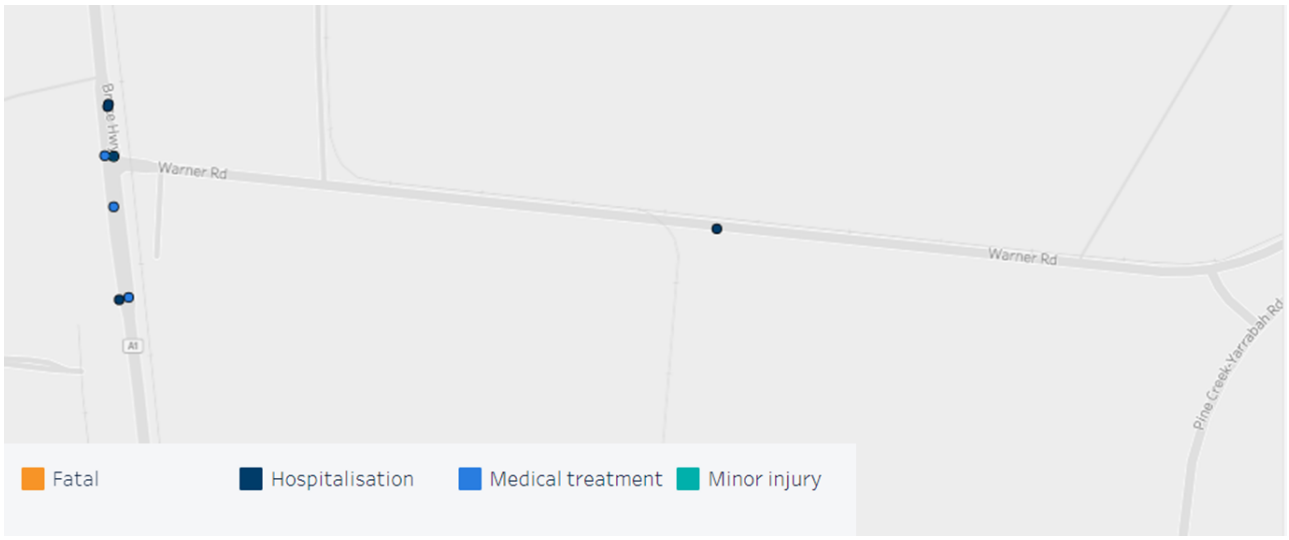


Figure 2-7: Warner Road crash history between 2017-2021 (Source Dept. of Resources – Queensland Globe mapping system)

2.2.3 Step 3 – Determination of the Infrastructure Risk Rating (IRR)

IRR is a measure of the expected risk associated with the road infrastructure based on an objective assessment of the road attribute data presented in Step 1 above. IRR is determined in accordance with the process described in the Transport and Main Roads Infrastructure Risk Rating Manual. Based on the assessment, the Infrastructure Risk Rating (IRR) is determined to be 1.43 and is rated as Medium.

2.2.4 Step 4 – Calculation of Road Risk Metric (RRM)

The RRM is a descriptive risk classification that is a combination of the CRR (Medium) and the IRR (Medium), according to Table 5.1.4 of TMR MUTCD Part 4, the Road Risk Metric (RRM) is defined to be Medium.

Table 2-9: Road Risk Metric Matrix (extract from Section 5.1.4 of TMR MUTCD part 4)

		Infrastructure Risk Rating				
		Low	**Low Medium**	**Medium**	**Medium High**	**High**
Crash Risk Rating	**High**	High	High	High	High	High
	Medium	Medium	Medium	Medium	Medium	High
	Low	Low	Low	Medium	Medium	High

2.2.5 Step 5 – Determination of the environmental context and functional classification

RASL is the determination of the environment context classification and the road functional classification. Based on the context presented in Section 2.2.1, the environment context is classified as rural while Warner Road is classified as a collector street.

2.2.6 Step 6 – Determination of the Risk Assessed Speed Limit

The RASL is determined to be 70km/h, also refer to Table 2-10.

Table 2-10: RASL: Roads in a rural environment (extract from TMR MUTCD Part 4 Section 5.1.5)

Road class	Functional description	Road Risk Metric		
		Low	Medium	High
Access / local street	Only for roads that provide direct access to property	80 km/h	70 km/h	60 km/h
Collector road	Used for access to properties and other roads and for local neighbourhood access within the rural residential areas, generally used only by owners of properties along those roads and by other people living within the rural areas	80 km/h	70 km/h	60 km/h
Trunk collector road	Used to travel through an area or as a major connector into an area, significant use by motorists from outside the area	100 km/h	100 km/h	80 km/h
Arterial road	These roads form the principal avenues for communications between major regions including direct connections between cities, between a capital city and adjoining states and their capital cities, between a capital city and key towns and between key towns	100 km/h	100 km/h	90 / 80[1] km/h

2.2.7 Summary

The results of RASL have been summarised below in Table 2-11, it is noted that a risk assessed speed limit is determined to be 70km/h.

Table 2-11: RASL Assessment

Crash Risk Rating (CRR)					Infrastructure Risk Rating (IRR)	
DCA Group	**Description**	**(L) FSI Index**	**(H) FSI Index**	**No. Casualty Crashes**	**Road Attribute**	**Category**
1	Intersection, from adjacent approaches	0.46	0.73		Road stereotype	Two lane undivided (3.7)
2	Head-on	0.85	1.44		Alignment	Straight or gentle (1)
3	Opposing vehicles, turning	0.53	0.84		Sealed shoulder width	Very narrow shoulder (1.79)
4	Rear-end	0.25	0.37		Lane width	Medium (as above)
5	Lane change	0.34	0.42		Roadside hazard risk - left side	High (2.28)
6	Parallel lanes, turning	0.36	0.59		Roadside hazard risk - right side	High (2.28)
7	U-turn	0.39	0.57		Land use	Remote Rural (1)
8	Entering roadway	0.38	0.71		At-grade intersection density	1 to <2 intersection (1.15)
9	Overtaking, same direction	0.50	0.65		Access density	10 to <20 accesses/km (1.1)
10	Hit parked vehicle	0.43	0.81		Traffic volume	1000 to <6000 vpd (1.4)
11	Hit train	1.07	0.90		**IRR Score**	**1.43**
12	Pedestrian	0.60	0.98			
13	Permanent obstruction on carriageway	0.28	0.53		**Road Risk Metric (RRM)**	
14	Hit animal	0.53	0.55		**CRR Band**	**Medium**
15	Off carriageway, on straight	0.54	0.70		**IRR Band**	**Medium**
16	Off carriageway, on straight, hit object	0.60	0.66	1	**RRM**	**Medium**
17	Out of control, on straight	0.55	0.73			
18	Off carriageway, on curve	0.65	0.59		**Road Classification**	
19	Off carriageway, on curve, hit object	0.65	0.71		**Environmental Context Class**	**Rural**
20	Out of control, on curve	0.67	0.66		**Functional Classification**	**Collector Road**
21	Other	0.51	0.63			
Est. FSI per 10^8 VKT	0.66 (FSI Index * Crashes) 365*5*2297(Volume)*1.5(Length in km) / 100,000,000 = 0.0629 Est. FSI per 108 VKT = 0.66/0.0629 = 10.50 (CRR: Medium)				**Risk Assessed Speed Limit (km/h)**	**70km/h**
Crash Data Period (5 years)						
From (inclusive):	1/1/2017					
To (inclusive):	31/12/2021					

2.3 Speed Data Speed Limit (SDSL)

Speed Data was collected over a 14-day period starting from 2 Dec 2022 by Matrix Traffic and Transport Data. Vehicle data recorded on Monday-Friday between 6am and 6pm was utilised for the speed data analysis. The speed data was collected on a straight segment, away from Bruce Highway/Warner Road intersection. The conditions at the time were clear and dry. The road was free of any road works and maintenance. It is considered that the location of tube count station is representative of the general road environment and traffic conditions within study extent.

It is noted that for the RASL presented in Section 2.2, traffic volume in both directions have been considered based on the criteria stated in Section 3.8 of IRR Manual. However, for the Speed Data Speed Limit (SDSL), only Gazettal direction speed data has been assessed and tabulated in Table 2-12. The traffic survey data has been provided in Appendix C.

Based on the SDSL assessment, the Gazettal speed data does not conform with the existing speed limit and the speed limit suggested by the speed data is 70km/h in accordance with the upper limit of the 15km/h pace. It should be noted that the against-Gazettal carriageway came out with the same SDSL.

Table 2-12: Speed Survey Calculation

Bin Range (km/h)	Mid-Point of Bin Range (km/h)	No. samples in Bin (vehicles)	% of Samples in Bin	3-bin Moving Sum	Speed Upper Limit (km/h)	% less than or equal to speed	Mid-Point * Number of Samples
0-40	20	126	0.9%	0.9%	40	0.9%	2520
40-45	42.5	320	2.2%	3.1%	45	3.1%	13,600
45-50	47.5	320	2.2%	5.3%	50	5.3%	15,200
50-55	52.5	1481	10.3%	14.8%	55	15.6%	77,752.5
55-60	57.5	1481	10.3%	22.8%	60	26.0%	85,157.5
60-65	62.5	2959	20.6%	41.2%	65	46.5%	184,937.5
65-70	67.5	2959	20.6%	51.5%	70	67.1%	199,732.5
70-75	72.5	1876	13.1%	**54.3%**	**75**	80.2%	136,010
75-80	77.5	1876	13.1%	46.7%	80	93.3%	145,390
80-85	82.5	405	2.8%	28.9%	85	96.1%	33,412.5
85-90	87.5	405	2.8%	18.7%	90	98.9%	35,437.5
90-95	92.5	64	0.4%	6.1%	95	99.3%	5,920
95-100	97.5	64	0.4%	3.7%	100	99.8%	6,240
100-120	110	30	0.2%	1.1%	120	100.0%	3,300
Sum		14366	100.0%				928,490
Mean Speed	64.63km/h						
15km/h Pace	Percentage in Pace is the maximum value in the column "3-bin Moving Sum" = 54.3%						
	Upper Limit of Pace is corresponding value 75km/h						

2.4 Option Selection

In accordance with Section 6 of the MUTCD Part 4, the process of selection of a speed limit is based on both RASL and SDSL shown in Section 2.2 and 2.3 of this report. It is noted that RASL correlates with SDSL, both assessments suggest that a 70km/h speed limit should be adopted.

2.5 Engineering Recommendation

The RASL, due to the IRR appears to indicate a Medium RRM score for this rural collector Road, indicates that a speed limit of 70km/h is appropriate for the speed zone. The SDSL also indicates that drivers are driving below the existing 100km/h. This would indicate that retention of a 70km/h speed limit would appear appropriate without any additional measures necessary.

It is noted the speed limit on the intersecting Bruce Highway which is currently under construction and the western section of Warner Road is 80km/h. It is hence recommended that the speed limit for both directions along Warner

Road study extent be reduced to 70km/h as an interim speed limit until the construction along Bruce Highway and Warner Road completed. This is generally in line with the adjacent speed limit.

Considering the traffic generated from the development, it is also recommended that speed management activities to be installed to support lower vehicle speeds to levels compatible with the considered speed limit 70km/h, for example, static signages including repeater speed limit signs, new speed limit signs and road work ahead signs. These signages could also reduce the safety risks associated with development traffic movements.

3. Conclusions and Recommendations

This report details the SLR undertaken for the 1.5km section of Warner Road. The aim of this SLR is to determine and implement an appropriate speed limit to ensure the safe movements in relation to the new development, i.e. an asphalt and concrete batching plant on Warner Road, Gordonvale.

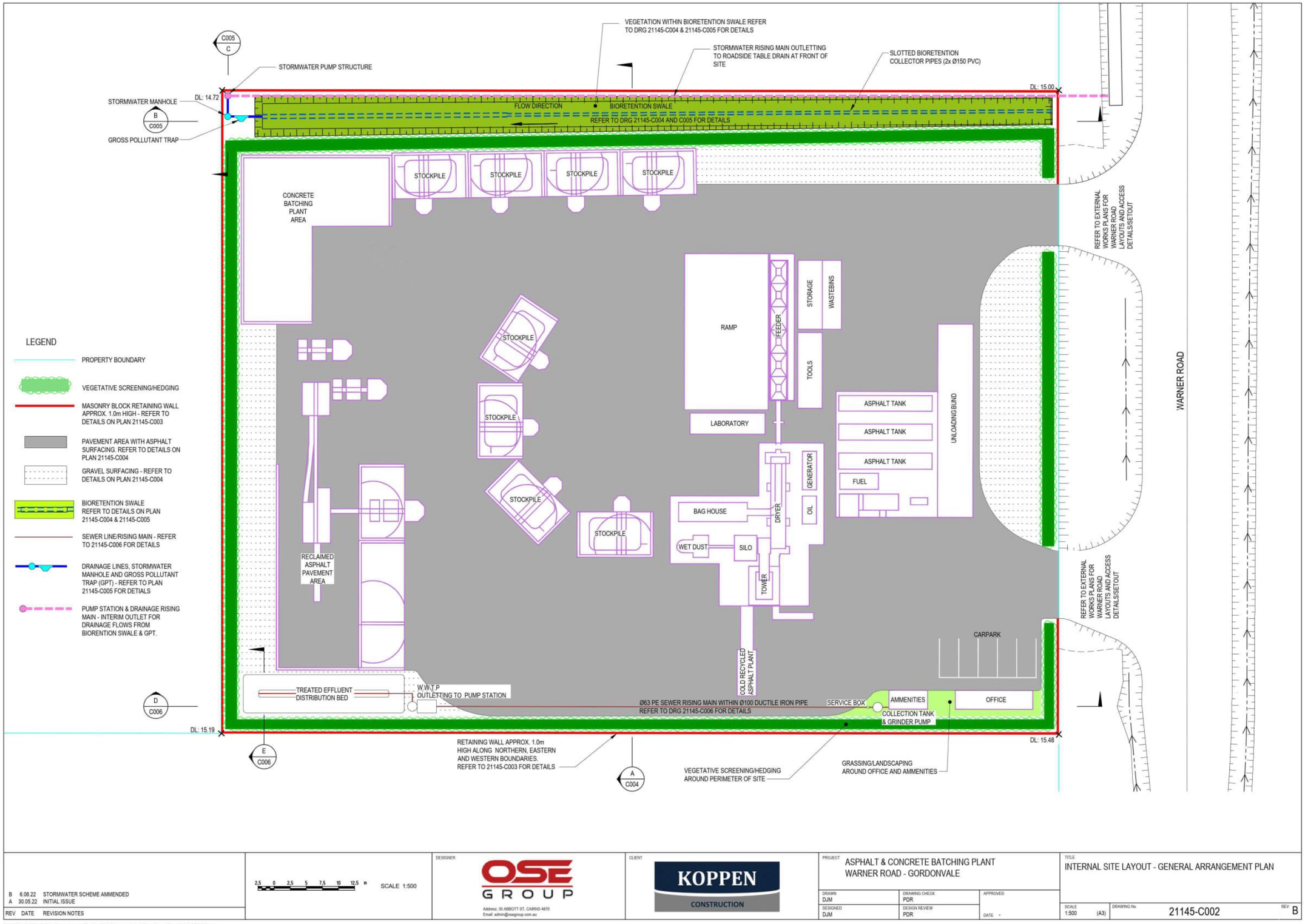
This report has stepped through the process outlined in the MUTCD Part 4 and the information collected has been collated within this report in summary form and entered into the TMR Speed Limit Review Technical Tool spreadsheet to quantity the information (Refer to Appendix B for the spreadsheet results).

Based on the technical assessment undertaken, it could be summarised that the no CBSL's apply (Section 2.1). The assessments of the SLR found that a 70km/h speed limit was appropriate given the function of Warner Road (Rural, Collector) and the level of assessed risk (Medium). Additionally, analysis of the vehicle speeds along Warner Road indicates that drivers were generally driving at speeds commensurate to a speed limit of 70km/h. To achieve greater uniformly of vehicle speeds along Warner Road the SLR process recommends that the speed limit be reduced to 70km/h for the Gazettal direction.

It is noted the speed limit on the intersecting Bruce Highway which is currently under construction and the Against-Gazettal carriageway of Warner Road(westbound) is 80km/h. For the against-gazettal direction, the SDSL shows a same result of 70km/h. It is hence recommended that the speed limit for both directions along Warner Road study extent be reduced to 70km/h as an interim speed limit until the construction along Bruce Highway and Warner Road completed. The reduction of the speed limit could also improve the safety and community acceptance.

Appendix A

Design Plans


C005
C
STORMWATER PUMP STRUCTURE
VEGETATION WITHIN BIORETENTION SWALE REFER TO DRG 21145-C004 & 21145-C005 FOR DETAILS
STORMWATER RISING MAIN OUTLETTING TO ROADSIDE TABLE DRAIN AT FRONT OF SITE
SLOTTED BIORETENTION COLLECTOR PIPES (2x Ø150 PVC)
STORMWATER MANHOLE
DL: 14.72
DL: 15.00
FLOW DIRECTION
BIORETENTION SWALE
REFER TO DRG 21145-C004 AND C005 FOR DETAILS
B
C005
GROSS POLLUTANT TRAP
STOCKPILE
CONCRETE BATCHING PLANT AREA
RAMP
FEEDER
STORAGE
WASTEBINS
TOOLS
LABORATORY
ASPHALT TANK
ASPHALT TANK
FUEL
UNLOADING BUND
GENERATOR
OIL
DRYER
BAG HOUSE
WET DUST
SILO
TOWER
RECLAIMED ASPHALT PAVEMENT AREA
COLD RECYCLED ASPHALT PLANT
CARPARK
REFER TO EXTERNAL WORKS PLANS FOR WARNER ROAD LAYOUTS AND ACCESS DETAILS/SETOUT
WARNER ROAD
LEGEND
PROPERTY BOUNDARY
VEGETATIVE SCREENING/HEDGING
MASONRY BLOCK RETAINING WALL APPROX. 1.0m HIGH - REFER TO DETAILS ON PLAN 21145-C003
PAVEMENT AREA WITH ASPHALT SURFACING. REFER TO DETAILS ON PLAN 21145-C004
GRAVEL SURFACING - REFER TO DETAILS ON PLAN 21145-C004
BIORETENTION SWALE REFER TO DETAILS ON PLAN 21145-C004 & 21145-C005
SEWER LINE/RISING MAIN - REFER TO 21145-C006 FOR DETAILS
DRAINAGE LINES, STORMWATER MANHOLE AND GROSS POLLUTANT TRAP (GPT) - REFER TO PLAN 21145-C005 FOR DETIALS
PUMP STATION & DRAINAGE RISING MAIN - INTERIM OUTLET FOR DRAINAGE FLOWS FROM BIORENTION SWALE & GPT.
D
C006
TREATED EFFLUENT DISTRIBUTION BED
W.W.T.P OUTLETTING TO PUMP STATION
Ø63 PE SEWER RISING MAIN WITHIN Ø100 DUCTILE IRON PIPE REFER TO DRG 21145-C006 FOR DETAILS
SERVICE BOX
AMMENITIES
COLLECTION TANK & GRINDER PUMP
OFFICE
DL: 15.19
DL: 15.48
E
C006
RETAINING WALL APPROX. 1.0m HIGH ALONG NORTHERN, EASTERN AND WESTERN BOUNDARIES. REFER TO 21145-C003 FOR DETAILS
A
C004
VEGETATIVE SCREENING/HEDGING AROUND PERIMETER OF SITE
GRASSING/LANDSCAPING AROUND OFFICE AND AMMENITIES
B 6.06.22 STORMWATER SCHEME AMMENDED
A 30.05.22 INITIAL ISSUE
REV DATE REVISION NOTES
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SCALE 1:500
DESIGNER
OSE GROUP
Address: 35 ABBOTT ST, CAIRNS 4870
Email: admin@osegroup.com.au
CLIENT
KOPPEN CONSTRUCTION
PROJECT
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE
DRAWN DJM
DRAWING CHECK PDR
APPROVED
DESIGNED DJM
DESIGN REVIEW PDR
DATE -
TITLE
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SCALE 1:500 (A3)
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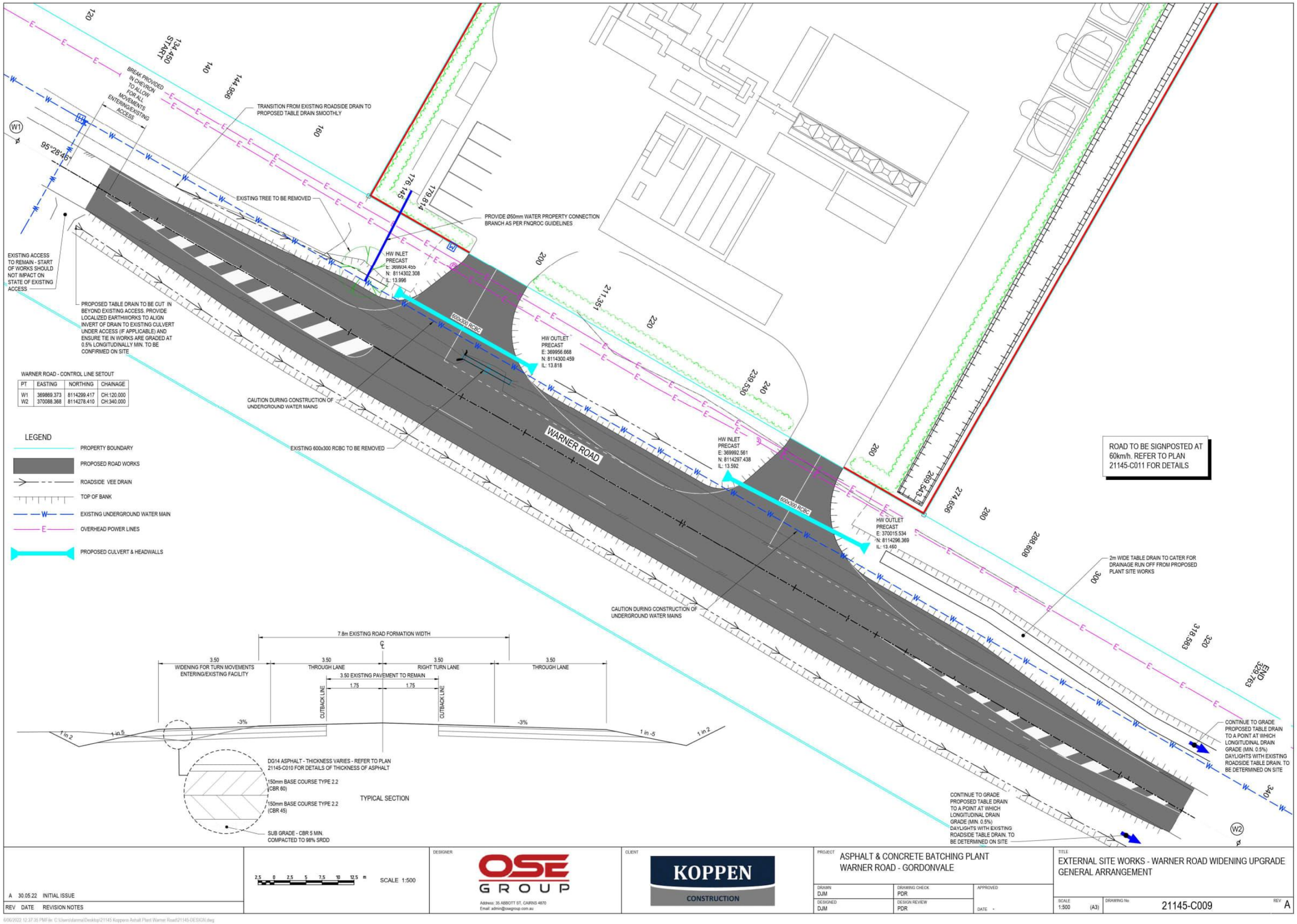
BREAK PROVIDED IN CHEVRON TO ALLOW FOR ALL MOVEMENTS ENTERING/EXITING ACCESS
TRANSITION FROM EXISTING ROADSIDE DRAIN TO PROPOSED TABLE DRAIN SMOOTHLY
EXISTING TREE TO BE REMOVED
PROVIDE Ø50mm WATER PROPERTY CONNECTION BRANCH AS PER FNQROC GUIDELINES
EXISTING ACCESS TO REMAIN - START OF WORKS SHOULD NOT IMPACT ON STATE OF EXISTING ACCESS
PROPOSED TABLE DRAIN TO BE CUT IN BEYOND EXISTING ACCESS. PROVIDE LOCALIZED EARTHWORKS TO ALIGN INVERT OF DRAIN TO EXISTING CULVERT UNDER ACCESS (IF APPLICABLE) AND ENSURE TIE IN WORKS ARE GRADED AT 0.5% LONGITUDINALLY MIN. TO BE CONFIRMED ON SITE
HW INLET PRECAST E: 369934.455 N: 8114302.308 IL: 13.996
HW OUTLET PRECAST E: 369956.668 N: 8114300.459 IL: 13.818
HW INLET PRECAST E: 369992.561 N: 8114297.438 IL: 13.592
HW OUTLET PRECAST E: 370015.534 N: 8114296.369 IL: 13.460
600x300 RCBC
WARNER ROAD
CAUTION DURING CONSTRUCTION OF UNDERGROUND WATER MAINS
EXISTING 600x300 RCBC TO BE REMOVED
ROAD TO BE SIGNPOSTED AT 60km/h. REFER TO PLAN 21145-C011 FOR DETAILS
2m WIDE TABLE DRAIN TO CATER FOR DRAINAGE RUN OFF FROM PROPOSED PLANT SITE WORKS
CONTINUE TO GRADE PROPOSED TABLE DRAIN TO A POINT AT WHICH LONGITUDINAL DRAIN GRADE (MIN. 0.5%) DAYLIGHTS WITH EXISTING ROADSIDE TABLE DRAIN. TO BE DETERMINED ON SITE
CONTINUE TO GRADE PROPOSED TABLE DRAIN TO A POINT AT WHICH LONGITUDINAL DRAIN GRADE (MIN. 0.5%) DAYLIGHTS WITH EXISTING ROADSIDE TABLE DRAIN. TO BE DETERMINED ON SITE
95°28'46"
WARNER ROAD - CONTROL LINE SETOUT
PT | EASTING | NORTHING | CHAINAGE
W1 | 369869.373 | 8114299.417 | CH:120.000
W2 | 370088.368 | 8114278.410 | CH:340.000
LEGEND
PROPERTY BOUNDARY
PROPOSED ROAD WORKS
ROADSIDE VEE DRAIN
TOP OF BANK
EXISTING UNDERGROUND WATER MAIN
OVERHEAD POWER LINES
PROPOSED CULVERT & HEADWALLS
7.8m EXISTING ROAD FORMATION WIDTH
3.50 WIDENING FOR TURN MOVEMENTS ENTERING/EXISTING FACILITY
3.50 THROUGH LANE
3.50 RIGHT TURN LANE
3.50 THROUGH LANE
3.50 EXISTING PAVEMENT TO REMAIN
1.75
1.75
CUTBACK LINE
CUTBACK LINE
-3%
-3%
1 in 2
1 in 5
1 in -5
1 in 2
DG14 ASPHALT - THICKNESS VARIES - REFER TO PLAN 21145-C010 FOR DETAILS OF THICKNESS OF ASPHALT
150mm BASE COURSE TYPE 2.2 (CBR 60)
150mm BASE COURSE TYPE 2.2 (CBR 45)
SUB GRADE - CBR 5 MIN. COMPACTED TO 98% SRDD
TYPICAL SECTION
A 30.05.22 INITIAL ISSUE
REV DATE REVISION NOTES
SCALE 1:500
DESIGNER OSE GROUP
Address: 35 ABBOTT ST, CAIRNS 4870
Email: admin@osegroup.com.au
CLIENT KOPPEN CONSTRUCTION
PROJECT ASPHALT & CONCRETE BATCHING PLANT WARNER ROAD - GORDONVALE
DRAWN DJM
DESIGNED DJM
DRAWING CHECK PDR
DESIGN REVIEW PDR
APPROVED
DATE -
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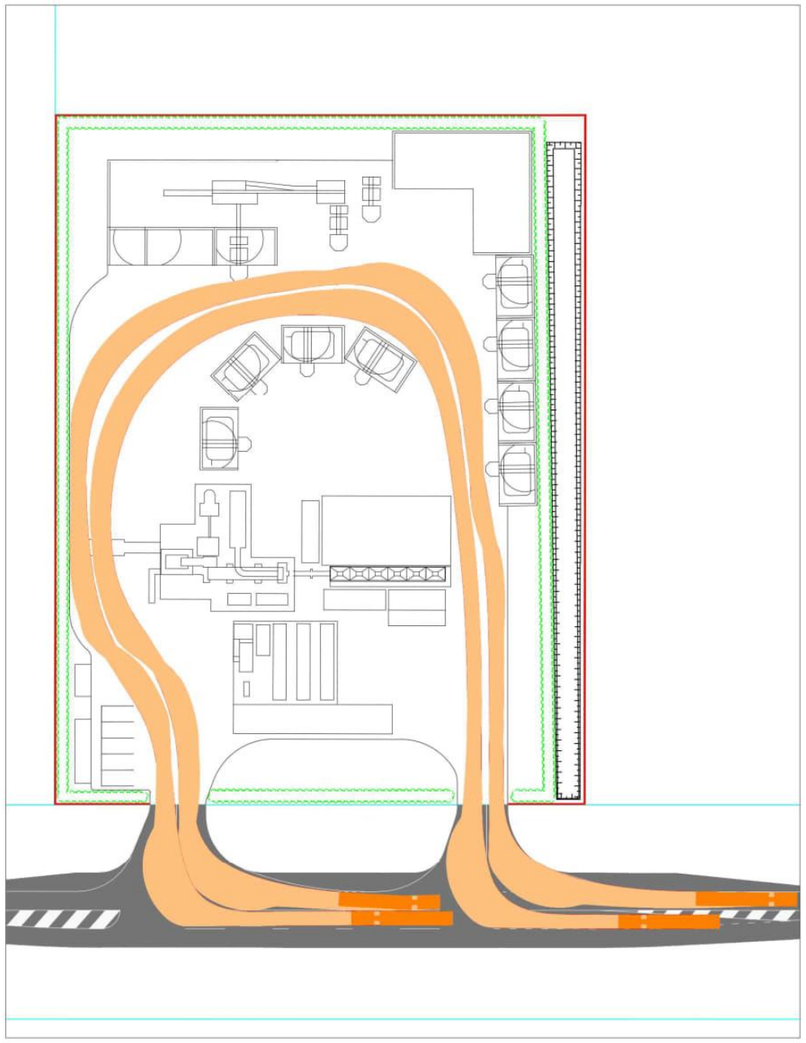

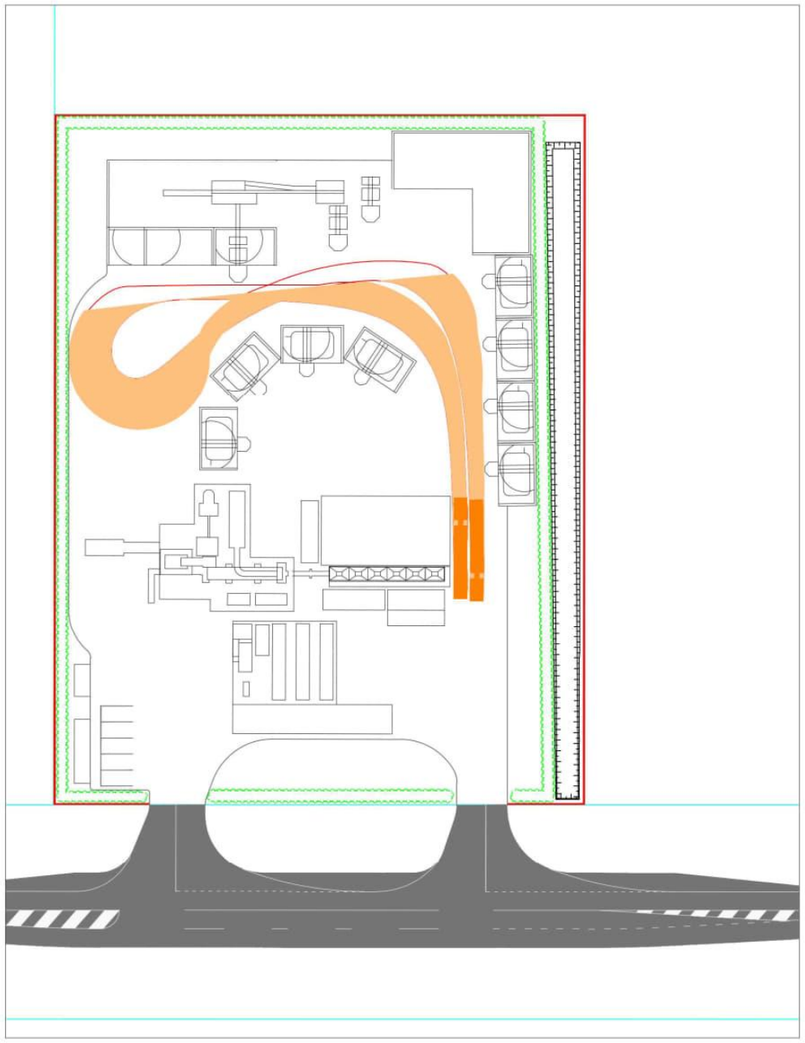

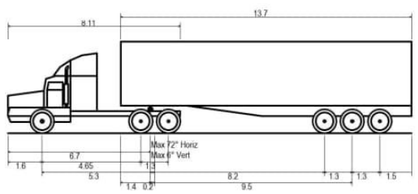

Prime mover and semi-trailer (19 m)
Overall Length 19.000m
Overall Width 2.500m

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Address: 35 ABBOTT ST, CAIRNS 4870
Email: admin@osegroup.com.au

CLIENT: KOPPEN CONSTRUCTION

PROJECT: ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE

DRAWN	DRAWING CHECK	APPROVED
DJM	PDR	
DESIGNED	DESIGN REVIEW	DATE -
DJM	PDR	

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SKETCH 1 OF 4

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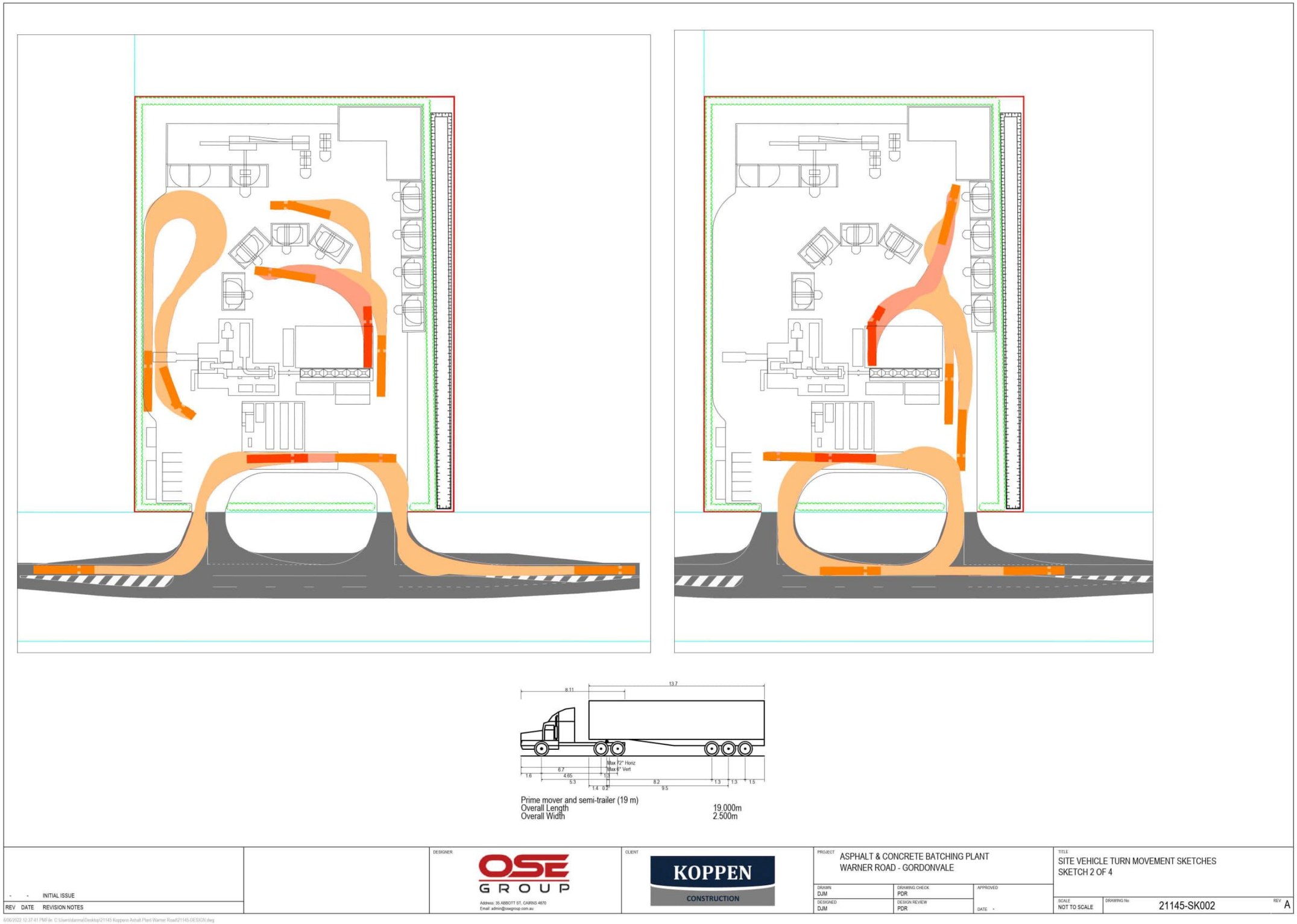
8.11
13.7
Max 72° Horiz
Max 6° Vert
1.6
6.7
4.65
5.3
1.3
1.4
0.2
8.2
9.5
1.3
1.3
1.5
Prime mover and semi-trailer (19 m)
Overall Length 19.000m
Overall Width 2.500m
- - INITIAL ISSUE
REV DATE REVISION NOTES
DESIGNER
OSE GROUP
Address: 35 ABBOTT ST, CAIRNS 4870
Email: admin@osegroup.com.au
CLIENT
KOPPEN CONSTRUCTION
PROJECT
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE
DRAWN DJM
DRAWING CHECK PDR
APPROVED
DESIGNED DJM
DESIGN REVIEW PDR
DATE -
TITLE
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SKETCH 2 OF 4
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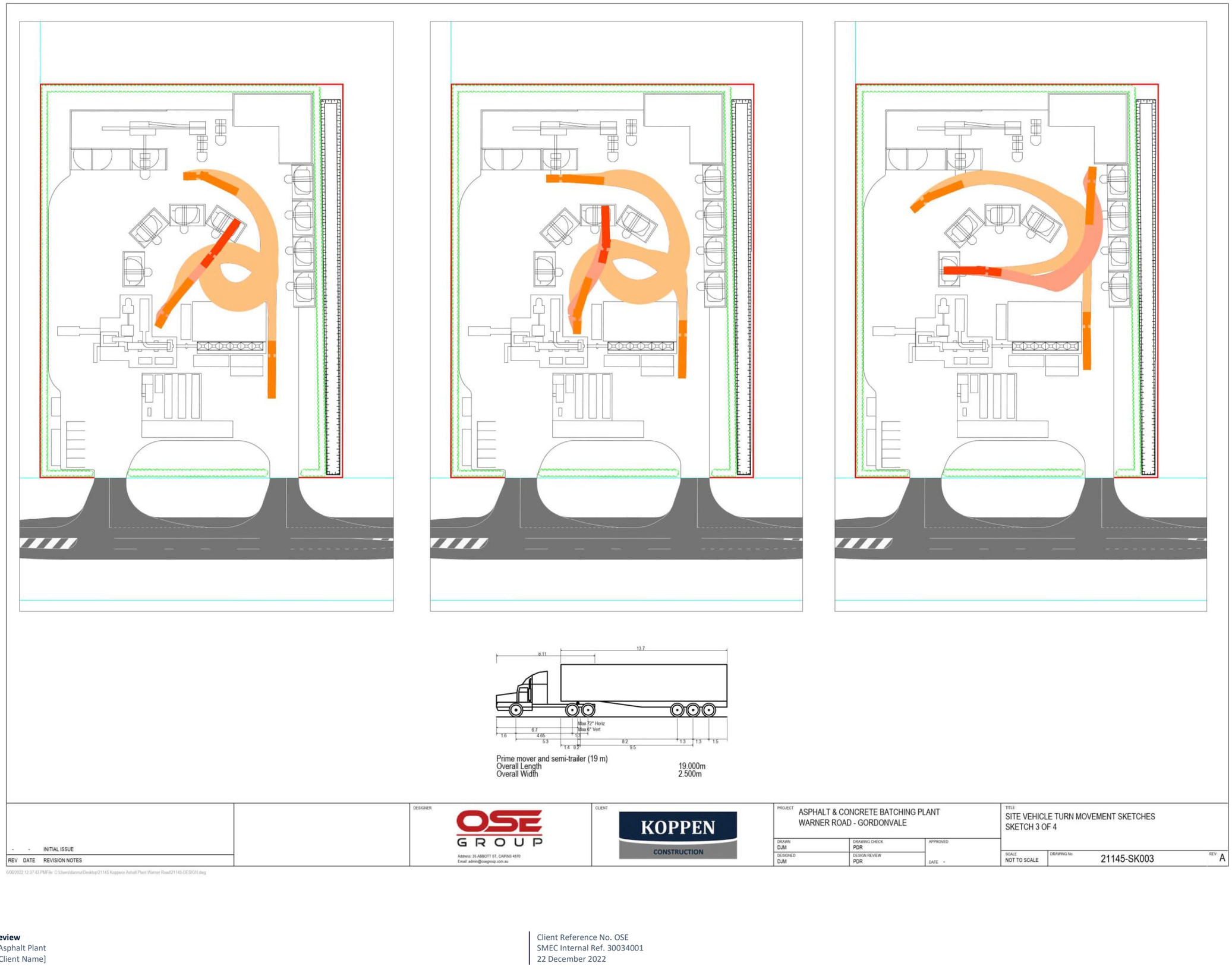
8.11
13.7
Max 12" Horiz
Max 6" Vert
1.6
6.7
4.65
5.3
1.3
1.4
0.2
8.2
9.5
1.3
1.3
1.5
Prime mover and semi-trailer (19 m)
Overall Length 19.000m
Overall Width 2.500m
- - INITIAL ISSUE
REV DATE REVISION NOTES
DESIGNER
OSE GROUP
Address: 35 ABBOTT ST, CAIRNS 4870
Email: admin@oseagroup.com.au
CLIENT
KOPPEN CONSTRUCTION
PROJECT
ASPHALT & CONCRETE BATCHING PLANT
WARNER ROAD - GORDONVALE
DRAWN DJM
DESIGNED DJM
DRAWING CHECK PDR
DESIGN REVIEW PDR
APPROVED
DATE -
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Appendix B

Speed Limit Review Spreadsheet

TMR Speed Limit Review Tool Version 01.09

Clear All

SITE INPUTS

Queensland Government

ROAD AUTHORITY:	Local government
ROAD SECTION ID: (if applicable)	
ROAD NAME:	Warner Road
SUBURB: (where multiple suburbs, separate each with a ",")	Gordonvale
LOCAL GOVERNMENT: (where multiple, separate each with a ",")	Cairns Regional Council
TMR DISTRICT:	Far North
DIRECTION: (Both, Gazettal or Anti-gazettal)	Both
EXISTING SPEED LIMIT: (km/h)	100
DAILY TRAFFIC VOLUME:	2297
SEGMENT LENGTH: (km)	1.5

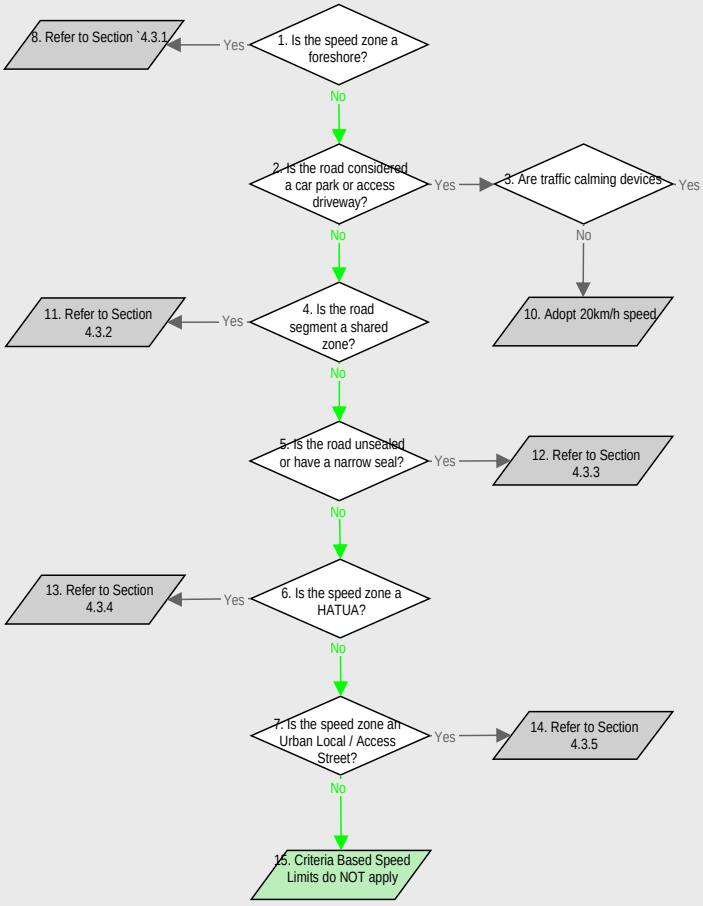
	TDIST (if applicable)	LATITUDE	LONGITUDE
SEGMENT START:		17°03'03.5"S	145°46'04.9"E
SEGMENT END:		17°03'08.5"S	145°46'56.6"E

ADDITIONAL COMMENTS: (if required)

TMR Speed Limit Review Tool Version 01.09

CRITERIA BASED SPEED LIMITS

Queensland Government



Clear All

Instructions

CRITERIA BASED SPEED LIMIT:
CBSL do NOT apply

Additional Comments (if required):
Criteria Based Speed Limits does not apply to Warner Road.

IDENTIFY ROAD CLASSIFICATION

	Input	Class
More...	ROAD ENVIRONMENTAL CONTEXT CLASS	Rural
More...	ROAD FUNCTIONAL CLASSIFICATION	Collector

CRASH RISK RATING (CRR)

	DCA Group	Description	No. of Casualty Crashes	Risk Score
More...	1	INTERSECTION, FROM ADJACENT APPROACHES	0	0
More...	2	HEAD-ON	0	0
More...	3	OPPOSING VEHICLES, TURNING	0	0
More...	4	REAR-END	0	0
More...	5	LANE CHANGE	0	0
More...	6	PARALLEL LANES, TURNING	0	0
More...	7	U-TURN	0	0
More...	8	ENTERING ROADWAY	0	0
More...	9	OVERTAKING, SAME DIRECTION	0	0
More...	10	HIT PARKED VEHICLE	0	0
More...	11	HIT TRAIN	0	0
More...	12	PEDESTRIAN	0	0
More...	13	PERMANENT OBSTRUCTION ON CARRIAGEWAY	0	0
More...	14	HIT ANIMAL	0	0
More...	15	OFF CARRIAGEWAY, ON STRAIGHT	0	0
More...	16	OFF CARRIAGEWAY, ON STRAIGHT, HIT OBJECT	1	0.66
More...	17	OUT OF CONTROL, ON STRAIGHT	0	0
More...	18	OFF CARRIAGEWAY, ON CURVE	0	0
More...	19	OFF CARRIAGEWAY, ON CURVE, HIT OBJECT	0	0
More...	20	OUT OF CONTROL, ON CURVE	0	0
More...	21	OTHER	0	0
More...		TOTAL	1	0.66

RISK ASSESSED SPEED LIMIT

INFRASTRUCTURE RISK RATING (IRR)

	Item	Description	Input	Risk Score
More...	1	ROAD STEREOTYPE	Two lane undivided	3.7
More...	2	ALIGNMENT	Straight or gentle	1
More...	3A	SEALED SHOULDER WIDTH	Very narrow shoulder	1.79
More...	3B	LANE WIDTH	Medium	
More...	4a	ROADSIDE HAZARD RISK - LEFT SIDE	High	2.28
More...	4b	ROADSIDE HAZARD RISK - RIGHT SIDE	High	2.28
More...	5	LAND USE	Remote rural	1
More...	6	AT-GRADE INTERSECTION DENSITY	1 to <2 intersections/km	1.15
More...	7	ACCESS DENSITY	10 to <20 accesses/km	1.1
More...	8	TRAFFIC VOLUME	1000 to <6000 vpd	1.4

Clear All

Estimate Risk Assessed Speed Limit

Instructions

ROAD RISK METRIC (RRM)

Input	Risk Levels	Risk Score
Crash Risk Rating (Step 2)	Medium	10.49612061
Infrastructure Risk Rating (Step 3)	Medium	1.427208163

ROAD RISK METRIC:	Medium

RISK ASSESSED SPEED LIMIT (RASL)

Input	Result
Road Environmental Context Class	Rural
Road Functional Classification	Collector
Road Risk Metric	Medium

RISK ASSESSED SPEED LIMIT:	70km/h

ADDITIONAL COMMENTS

Additional Comments (if required):
5 -year crash history assessed from 1/1/2017 to 31/12/ 2021 inclusive.

SPEED DATA SPEED LIMIT

Queensland Government

SPEED DATA INPUTS

	Item	Input
More...	MEAN SPEED (km/h)	64.63
More...	UPPER LIMIT OF 15km/h PACE SPEED	75
More...	PERCENTAGE WITHIN PACE SPEED	54.3

Clear All | Estimate Speed Data Speed Limit | Instructions

SPEED DATA SPEED LIMIT

Input	Result
Speed Data Conforms with Speed Limit?	N
Speed Limit Suggested by Speed Data	70km/h

SPEED DATA SPEED LIMIT:	70km/h

ADDITIONAL COMMENTS

Additional Comments (if required):
Gazettal results shown in this spreadsheet, against-gazettal shows the same SDSL of 70km/h.

TMR Speed Limit Review Tool Version 01.09

OPTION SELECTION

Queensland Government

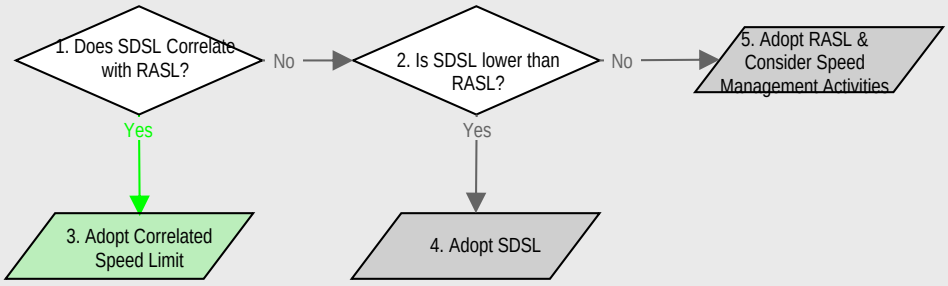
Clear All

Undertake Option Selection

Instructions

OPTION SELECTION INPUTS

Inputs	Result
Risk Assessed Speed Limit	70km/h
Speed Data Speed Limit	70km/h



TMR Speed Limit Review Tool Version 01.09

ENGINEER'S RECOMMENDATION

Queensland Government

Clear All | Summarise Findings of SLR Technical Assessments | Instructions

SUMMARY OF TECHNICAL ASSESSMENTS

The Criteria Based Speed Limit assessment determined that no Criteria Based Speed Limits apply.

Accordingly, Risk Assessed Speed Limit and Speed Data Speed Limit assessments were undertaken. The Risk Assessed Speed Limit and Speed Data Speed Limits both indicated a speed limit of 70km/h was appropriate for the speed zone.

INTERPRETATION OF ASSESSMENT

Based on the information input into the Speed Limit Review tool the Speed Limit Review found that the speed limit along Warner Road should be reduced to 70 km/h.

The findings of the speed limit review found that a 70 km/h speed limit was appropriate given the function of Warner Road (Rural, Collector) and the level of assessed risk (Medium). Additionally, analysis of the vehicle speeds along Warner Road indicated that drivers were generally driving at speeds commensurate to a speed limit of 70 km/h. To achieve greater uniformity of vehicle speeds along Warner Road the speed limit review process recommends that the speed limit be reduced to 70 km/h.

If passing this information on to others, consider describing the attributes and function (Rural, Collector), including the variety of movements and types of road users which are typical of Warner Road.

The above has been provided as a suggestion only to help with communicating the outcome of the speed limit review to interested stakeholders.

Communication material needs to be tailored to the specific situation under review. The responsibility for communicating the outcome of the speed limit review remains with the Responsible Officer.

ENGINEER'S RECOMMENDATION

Queensland Government

ENGINEER'S RECOMMENDATIONS

Name	RPEQ Number	Date
Anthony Burke	20190	21/12/2022

Accept Recommendations of Technical Process?	Yes

Alternate Recommendations (if Applicable) or Other Circumstances (Section 7.2) to be Provided:

Additional Comments / Justification for Alternate Recommendations:

RESPONSIBLE OFFICER'S ACCEPTANCE

Name	Position	Date

Do you (the Responsible Officer) Accept the Engineers Recommendations?	

Appendix C

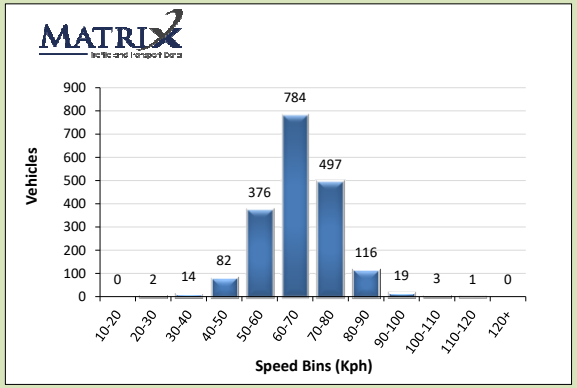
Traffic Survey Data

Job No	AUQLD5402
Client	JACOBS
Site	Warner Rd 200m east of Bruce Hwy 25-29 Nov
Location	Gordonvale
Site No	1
Start Date	25-Nov-22
Day	Weekday Ave
Direction	EB
Description	Speed Summary

Select Site

1. Warner Rd 200m east of Bruce Hwy 25-29 Nov

Select Day Weekday Ave **Select Direction** EB



Bin Summary	
10-20	0.0%
20-30	0.1%
30-40	0.7%
40-50	4.3%
50-60	19.9%
60-70	41.4%
70-80	26.2%
80-90	6.1%
90-100	1.0%
100-110	0.2%
110-120	0.0%
120+	0.0%
66.1	**75.4**

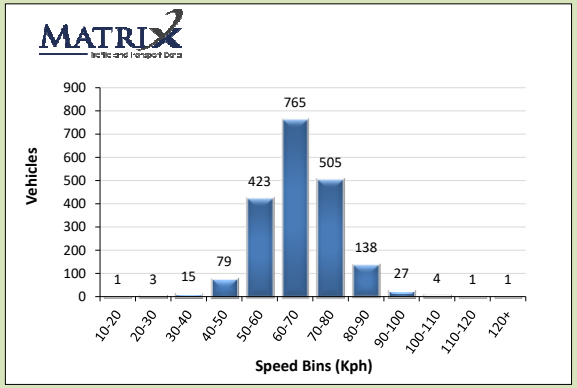
Hour	Vehicle Speed Bins (kph)												Speed	
Starting	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120+	Ave	85%ile
0:00	0	0	0	0	0	2	2	1	1	0	0	0	74.9	0
1:00	0	0	0	0	0	1	1	0	0	0	0	0	73.1	0
2:00	0	0	0	0	1	1	1	1	0	0	0	0	69.9	0
3:00	0	0	0	1	1	2	1	1	0	0	0	0	63.6	78.9
4:00	0	0	0	0	3	3	2	1	0	0	0	0	65.8	68.5
5:00	0	0	0	2	14	27	15	2	1	0	0	0	65.3	73.7
6:00	0	0	0	5	31	56	28	9	2	0	0	0	65.9	75.9
7:00	0	0	2	10	33	73	44	8	0	0	0	0	65.2	74.8
8:00	0	0	1	5	31	62	34	4	0	0	0	0	65.0	74.0
9:00	0	0	1	10	29	45	22	4	1	0	0	0	63.3	73.2
10:00	0	0	2	5	28	43	17	3	1	0	0	0	63.2	72.2
11:00	0	0	1	6	26	47	21	6	1	0	0	0	64.8	74.2
12:00	0	0	1	8	28	43	25	5	1	0	0	0	64.1	74.6
13:00	0	0	2	7	30	47	24	5	0	0	0	0	63.4	72.9
14:00	0	1	1	9	26	52	30	6	0	0	0	0	64.5	73.9
15:00	0	0	0	5	27	68	43	10	1	0	0	0	66.8	75.3
16:00	0	0	0	2	20	65	57	14	2	0	0	0	69.3	78.1
17:00	0	0	1	3	14	57	54	14	3	0	0	0	69.7	79.1
18:00	0	0	0	0	11	30	28	7	2	0	0	0	69.7	78.3
19:00	0	0	0	1	6	17	16	4	0	0	0	0	67.7	77.6
20:00	0	0	0	1	6	17	13	4	0	0	0	0	68.6	78.4
21:00	0	0	0	0	6	14	10	4	1	0	0	0	69.5	79.9
22:00	0	0	0	1	2	8	7	2	0	0	0	0	69.3	77.1
23:00	0	0	0	1	1	5	4	1	0	0	0	0	68.6	75.5
Total	0	2	14	82	376	784	497	116	19	3	1	0	66.1	75.4

Job No	AUQLD5402
Client	JACOBS
Site	Warner Rd 200m east of Bruce Hwy 25-29 Nov
Location	Gordonvale
Site No	1
Start Date	25-Nov-22
Day	Weekday Ave
Direction	WB
Description	Speed Summary

Select Site

1. Warner Rd 200m east of Bruce Hwy 25-29 Nov

Select Day Weekday Ave **Select Direction** WB



Bin Summary	
10-20	0.1%
20-30	0.2%
30-40	0.7%
40-50	4.0%
50-60	21.6%
60-70	39.0%
70-80	25.7%
80-90	7.1%
90-100	1.4%
100-110	0.2%
110-120	0.0%
120+	0.0%
66.3	**76.2**

Hour	Vehicle Speed Bins (kph)												Speed	
Starting	10-20	20-30	30-40	40-50	50-60	60-70	70-80	80-90	90-100	100-110	110-120	120+	Ave	85%ile
0:00	0	0	0	0	0	1	1	0	0	0	0	0	72.5	0
1:00	0	0	0	0	0	1	1	0	0	0	0	0	71.9	0
2:00	0	0	0	0	0	0	0	1	0	0	0	0	76.4	0
3:00	0	0	0	0	0	1	1	1	0	0	0	0	74.0	0
4:00	0	0	0	0	2	3	4	4	2	0	0	0	73.8	85.2
5:00	0	0	1	2	10	13	15	8	4	1	0	0	71.0	84.9
6:00	0	0	1	6	22	41	47	16	3	0	0	0	69.2	79.9
7:00	0	0	1	13	50	90	46	11	1	0	0	0	64.8	74.0
8:00	0	0	2	7	43	62	39	9	1	0	0	0	64.7	74.7
9:00	0	0	1	4	28	51	27	7	0	0	0	0	65.2	74.9
10:00	0	0	1	7	25	48	29	7	2	0	0	0	65.5	76.6
11:00	0	0	1	5	28	46	26	9	2	0	0	0	65.5	76.0
12:00	0	0	1	4	19	44	34	8	1	0	0	0	67.1	77.2
13:00	0	1	1	5	28	49	32	7	1	0	0	0	65.3	75.3
14:00	0	0	0	6	36	56	34	7	2	0	0	0	65.6	74.8
15:00	1	1	2	11	46	79	38	6	1	0	0	0	63.9	73.5
16:00	0	0	1	2	31	59	40	9	1	0	0	0	66.6	75.8
17:00	0	0	1	3	23	43	36	10	2	0	0	0	67.7	77.6
18:00	0	0	0	1	9	29	21	9	2	1	0	0	70.6	81.1
19:00	0	0	0	1	9	17	11	4	1	0	0	0	66.8	76.2
20:00	0	0	0	1	5	15	10	2	0	0	0	0	67.2	75.3
21:00	0	0	0	0	4	9	7	2	0	0	0	0	68.4	77.3
22:00	0	0	0	0	4	5	5	2	0	0	0	0	68.3	78.5
23:00	0	0	0	0	1	3	1	0	0	0	0	0	68.6	0
Total	1	3	15	79	423	765	505	138	27	4	1	1	66.3	76.2

Job No	AUQLD5402
Client	JACOBS
Site	Warner Rd 200m east of Bruce Hwy 25-29 Nov
Location	Gordonvale
Site No	1
Start Date	25-Nov-22
Description	Volume Summary
Direction	EB

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	28-Nov	29-Nov	30-Nov	1-Dec	25-Nov	26-Nov	27-Nov		
AM Peak	179	164	163	173	175	108	105		
PM Peak	161	168	152	162	188	142	113	**1894**	**1719**
0:00	5	6	6	7	9	10	8	7	7
1:00	2	4	0	3	8	6	2	3	4
2:00	2	5	4	4	5	10	3	4	5
3:00	4	3	2	4	20	6	15	7	8
4:00	8	5	8	3	17	6	2	8	7
5:00	65	68	62	57	51	24	13	61	49
6:00	143	143	124	105	142	63	25	131	106
7:00	179	164	163	173	175	57	35	171	135
8:00	122	143	135	154	132	70	39	137	114
9:00	118	111	108	103	120	108	76	112	106
10:00	98	91	94	114	90	102	85	97	96
11:00	105	118	103	94	115	108	105	107	107
12:00	113	100	120	119	103	132	104	111	113
13:00	108	110	105	120	136	142	106	116	118
14:00	116	112	139	128	131	115	106	125	121
15:00	136	150	149	160	179	91	113	155	140
16:00	161	145	152	160	188	97	80	161	140
17:00	134	168	127	162	137	70	63	146	123
18:00	60	67	88	96	83	48	59	79	72
19:00	34	35	46	58	51	41	28	45	42
20:00	33	38	39	55	41	26	20	41	36
21:00	32	35	30	41	47	32	22	37	34
22:00	13	24	8	25	32	37	21	20	23
23:00	8	9	5	25	17	22	10	13	14
Total	1799	1854	1817	1970	2029	1423	1140	1894	1719

7-19	1450	1479	1483	1583	1589	1140	971	1517	1385
6-22	1692	1730	1722	1842	1870	1302	1066	1771	1603
6-24	1713	1763	1735	1892	1919	1361	1097	1804	1640
0-24	1799	1854	1817	1970	2029	1423	1140	1894	1719

Job No	AUQLD5402
Client	JACOBS
Site	Warner Rd 200m east of Bruce Hwy 25-29 Nov
Location	Gordonvale
Site No	1
Start Date	25-Nov-22
Description	Volume Summary
Direction	WB

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	28-Nov	29-Nov	30-Nov	1-Dec	25-Nov	26-Nov	27-Nov		
AM Peak	218	210	195	217	221	156	99		
PM Peak	175	170	185	219	176	107	131	**1960**	**1764**
0:00	2	1	2	2	5	6	6	2	3
1:00	3	3	1	3	2	3	5	2	3
2:00	1	1	1	2	2	3	1	1	2
3:00	4	1	3	3	6	3	3	3	3
4:00	14	19	12	10	18	14	5	15	13
5:00	56	54	63	50	46	15	10	54	42
6:00	155	139	136	114	143	45	25	137	108
7:00	218	210	195	217	221	72	23	212	165
8:00	170	175	168	156	147	90	54	163	137
9:00	106	117	108	122	141	156	88	119	120
10:00	105	116	130	107	138	118	99	119	116
11:00	113	104	129	118	121	122	98	117	115
12:00	105	108	92	123	134	93	131	112	112
13:00	125	141	111	115	124	102	85	123	115
14:00	175	126	155	116	133	107	80	141	127
15:00	168	170	185	219	176	85	97	184	157
16:00	143	132	136	170	140	77	97	144	128
17:00	112	120	108	135	108	86	95	117	109
18:00	63	63	58	91	90	75	64	73	72
19:00	33	37	30	55	59	48	34	43	42
20:00	16	22	24	64	43	27	21	34	31
21:00	21	12	16	30	33	30	12	22	22
22:00	11	10	15	22	22	17	7	16	15
23:00	5	2	4	7	9	11	4	5	6
Total	1924	1883	1882	2051	2061	1405	1144	1960	1764

7-19	1603	1582	1575	1689	1673	1183	1011	1624	1474
6-22	1828	1792	1781	1952	1951	1333	1103	1861	1677
6-24	1844	1804	1800	1981	1982	1361	1114	1882	1698
0-24	1924	1883	1882	2051	2061	1405	1144	1960	1764

Job No	AUQLD5402
Client	JACOBS
Site	Warner Rd 200m east of Bruce Hwy 25-29 Nov
Location	Gordonvale
Site No	1
Start Date	25-Nov-22
Description	Volume Summary
Direction	Combined

Hour Starting	Day of Week							W'Day Ave	7 Day Ave
	Mon	Tue	Wed	Thu	Fri	Sat	Sun		
	28-Nov	29-Nov	30-Nov	1-Dec	25-Nov	26-Nov	27-Nov		
AM Peak	397	374	358	390	396	264	203		
PM Peak	304	320	334	379	355	244	235	**3854**	**3483**
0:00	7	7	8	9	14	16	14	9	11
1:00	5	7	1	6	10	9	7	6	6
2:00	3	6	5	6	7	13	4	5	6
3:00	8	4	5	7	26	9	18	10	11
4:00	22	24	20	13	35	20	7	23	20
5:00	121	122	125	107	97	39	23	114	91
6:00	298	282	260	219	285	108	50	269	215
7:00	397	374	358	390	396	129	58	383	300
8:00	292	318	303	310	279	160	93	300	251
9:00	224	228	216	225	261	264	164	231	226
10:00	203	207	224	221	228	220	184	217	212
11:00	218	222	232	212	236	230	203	224	222
12:00	218	208	212	242	237	225	235	223	225
13:00	233	251	216	235	260	244	191	239	233
14:00	291	238	294	244	264	222	186	266	248
15:00	304	320	334	379	355	176	210	338	297
16:00	304	277	288	330	328	174	177	305	268
17:00	246	288	235	297	245	156	158	262	232
18:00	123	130	146	187	173	123	123	152	144
19:00	67	72	76	113	110	89	62	88	84
20:00	49	60	63	119	84	53	41	75	67
21:00	53	47	46	71	80	62	34	59	56
22:00	24	34	23	47	54	54	28	36	38
23:00	13	11	9	32	26	33	14	18	20
Total	3723	3737	3699	4021	4090	2828	2284	3854	3483

7-19	3053	3061	3058	3272	3262	2323	1982	3141	2859
6-22	3520	3522	3503	3794	3821	2635	2169	3632	3281
6-24	3557	3567	3535	3873	3901	2722	2211	3687	3338
0-24	3723	3737	3699	4021	4090	2828	2284	3854	3483

Job No	AUQLD5402
Client	JACOBS
Site	Warner Rd 200m east of Bruce Hwy 25-29 Nov
Location	Gordonvale
Site No	1
Start Date	25-Nov-22
Day	Weekday Ave
Description	Class Summary
Classification	AustRoads94

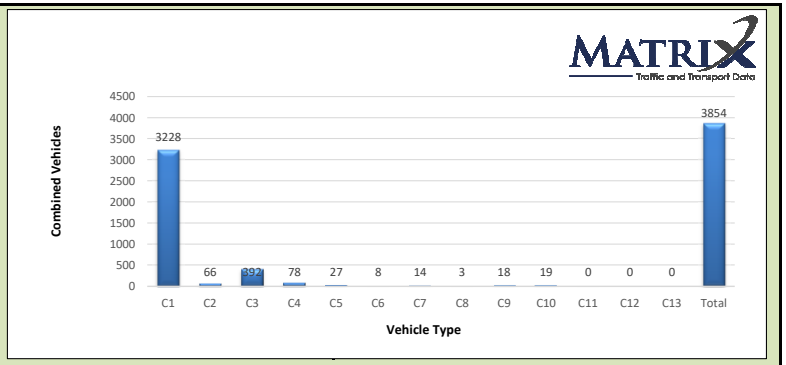
Select Site

1. Warner Rd 200m east of Bruce Hwy 25-29 Nov ▼

Select Day

Weekday Ave ▼

Class Summary		C	EB	WB
Light	C1	**84%**	87%	81%
	C2	**2%**	2%	2%
Medium	C3	**10%**	7%	13%
	C4	**2%**	2%	2%
	C5	**1%**	1%	1%
Heavy	C6	**0%**	0%	0%
	C7	**0%**	0%	1%
	C8	**0%**	0%	0%
	C9	**0%**	0%	0%
	C10	**0%**	0%	0%
	C11	**0%**	0%	0%
	C12	**0%**	0%	0%
Unclassified	C13	**0%**	0%	0%



	EB														WB														COMBINED													
	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13		C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	C13	
Hour Starting	Short	Short Towing	2 axle Truck or bus	3 Axle Truck or Bus	4 or 5 Axle Truck	3 axle Articulated	4 Axle Articulated	5 Axle Articulated	6 Axle Articulated	B Double	Double Road Train	Triple Road Train	Unclassifiable	**Total**	Short	Short Towing	2 axle Truck or bus	3 Axle Truck or Bus	4 or 5 Axle Truck	3 axle Articulated	4 Axle Articulated	5 Axle Articulated	6 Axle Articulated	B Double	Double Road Train	Triple Road Train	Unclassifiable	**Total**	Short	Short Towing	2 axle Truck or bus	3 Axle Truck or Bus	4 or 5 Axle Truck	3 axle Articulated	4 Axle Articulated	5 Axle Articulated	6 Axle Articulated	B Double	Double Road Train	Triple Road Train	Unclassifiable	**Total**
0:00	6	0	0	0	0	0	0	0	0	0	0	0	0	**7**	2	0	0	0	0	0	0	0	0	0	0	0	0	**2**	9	0	0	0	0	0	0	0	0	0	0	0	0	**9**
1:00	3	0	0	0	0	0	0	0	0	0	0	0	0	**3**	2	0	1	0	0	0	0	0	0	0	0	0	0	**2**	5	0	1	0	0	0	0	0	0	0	0	0	0	**6**
2:00	4	0	0	0	0	0	0	0	0	0	0	0	0	**4**	1	0	0	0	0	0	0	0	0	0	0	0	0	**1**	5	0	0	0	0	0	0	0	0	0	0	0	0	**5**
3:00	5	0	0	0	1	0	0	0	0	0	0	0	0	**7**	3	0	0	0	0	0	0	0	0	0	0	0	0	**3**	9	0	0	0	1	0	0	0	0	0	0	0	0	**10**
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23:00	12	0	0	0	0	0	0	0	0	0	0	0	0	**13**	5	0	1	0	0	0	0	0	0	0	0	0	0	**5**	17	0	1	0	0	0	0	0	0	0	0	0	0	**18**
Total	1642	35	139	38	13	3	4	2	9	9	0	0	0	**1894**	1585	32	253	40	14	5	10	1	10	10	0	0	0	**1960**	3228	66	392	78	27	8	14	3	18	19	0	0	0	**3854**

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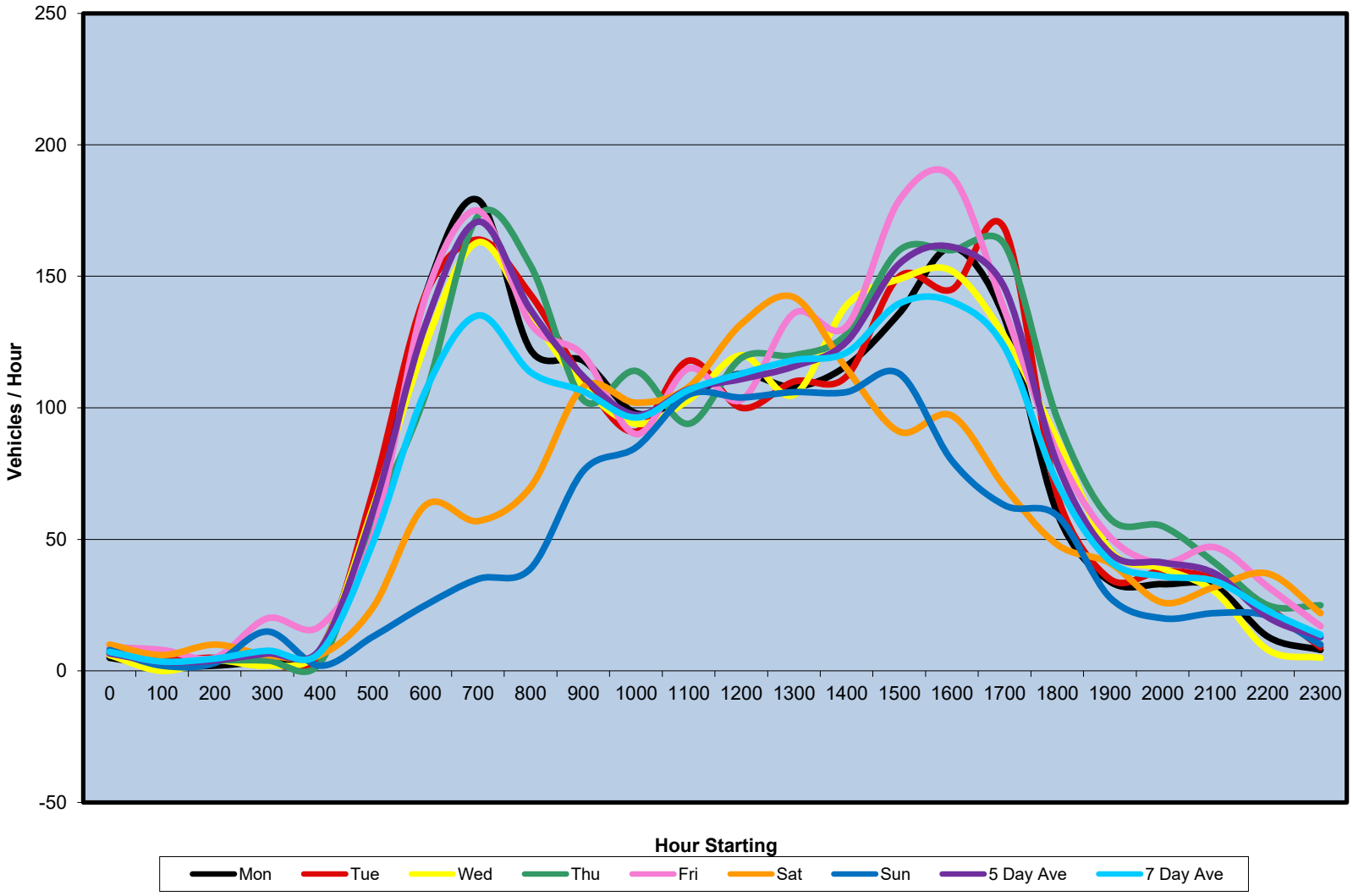
Select direction EB



MATRIX Traffic and Transport Data

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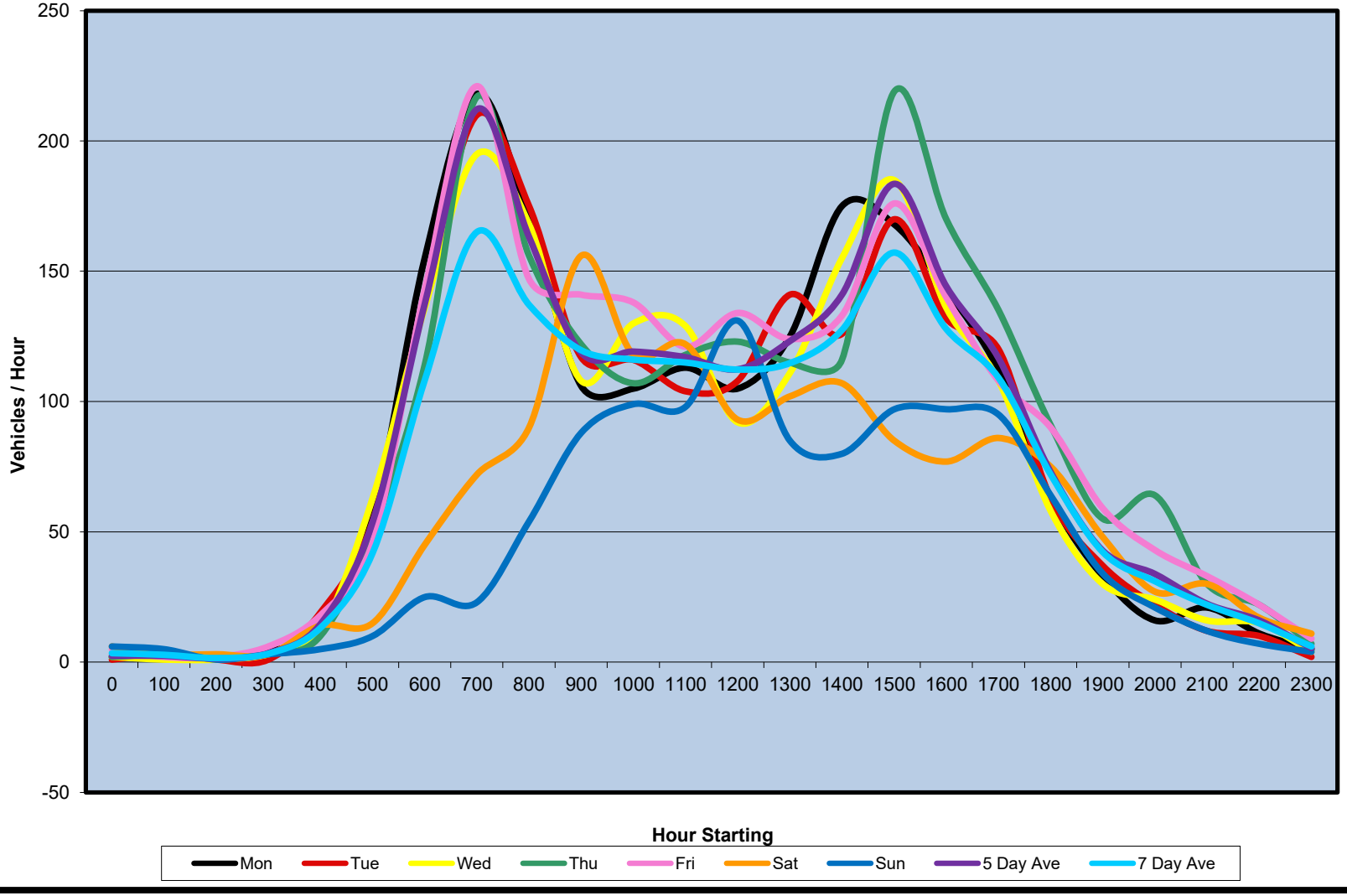

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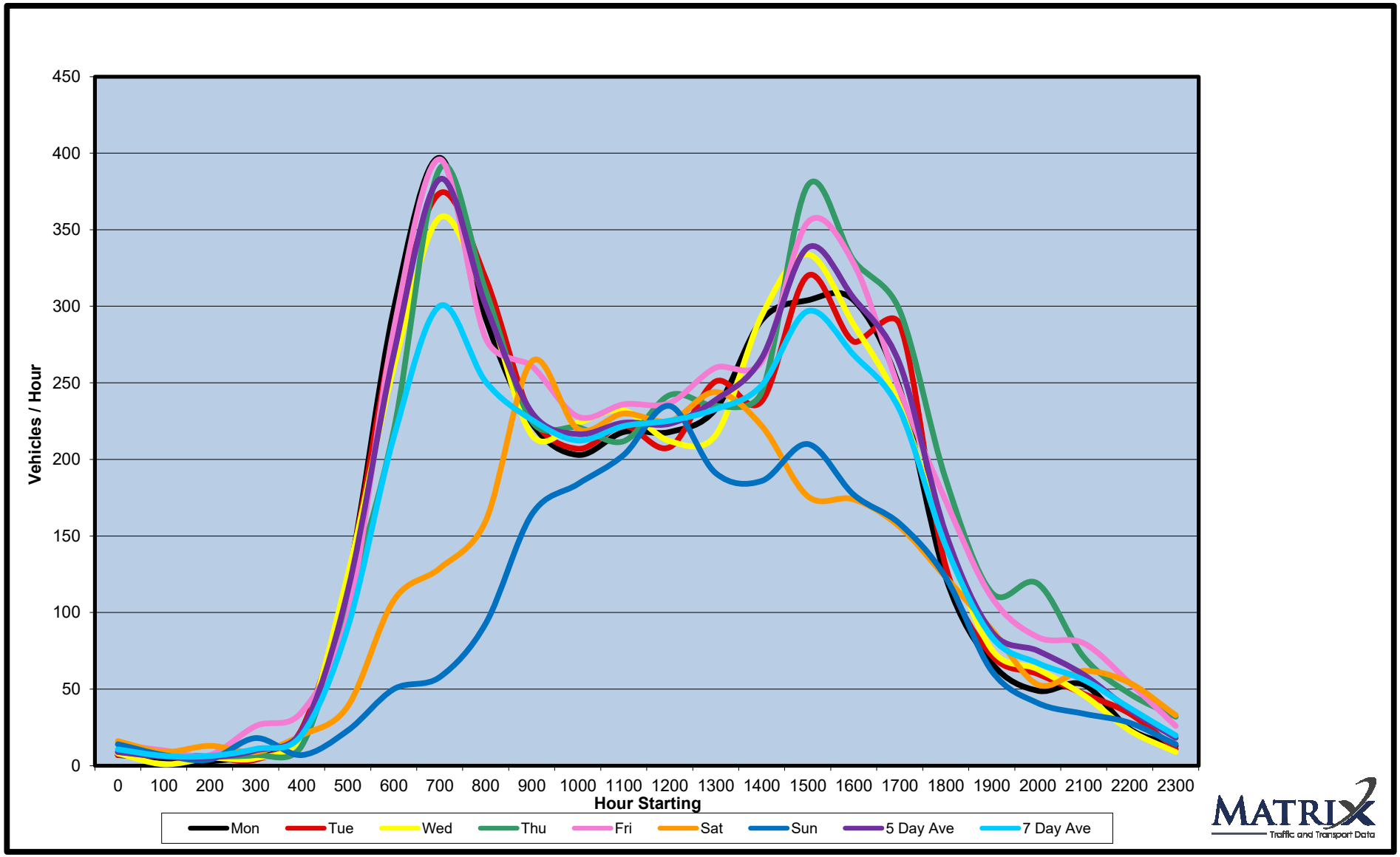

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220920D03a	2 Feb 2023	Final	Confirm hours of operation and reduce mitigation measures.

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1 Introduction

RPS Group on behalf of Koppen Construction Pty Ltd (KC), engaged Simpson Engineering Group (SEG) to prepare a noise assessment for an asphalt plant (the Project) within the Cairns State Development Area (SDA) area zoned as High Impact Industry. The site is situated on Warner Road, Wrights Creek.

The objective of this assessment is to inform the relevant aspects of Department of Environment and Science Guideline ESR/2015/1838 – Application requirements for activities with noise impacts.

This noise and vibration assessment addresses the following issues:

- likely change in the noise environment following commencement of operations;
- development of appropriate noise goals;
- assessment of noise at sensitive receptors and comparison to the noise goals; and,
- recommendations for relevant impact mitigation measures.

1.1 Project Description

The proposed Environmentally Relevant Activities to be undertaken on Lot 1 on RP717908 at 1010 Warner Road, Wrights Creek include:

- ERA 6 Asphalt manufacturing more than 1000t in a year.
- ERA 54 Mechanical Waste Reprocessing (1) operating a facility for mechanically reprocessing more than 5,000 tonne of inert, non-putrescible waste or green waste only in a year.

Koppens propose to reuse shredded tyres within the road asphalt and reuse road plannings or scrapings to recycle where feasible. Crumbing of tyres will occur on a separate site, however, road plannings or scrapings may need to be reprocessed through screening or sizing to be able to be reused within the operations.

The Asphalt and Concrete Plant development will generally consist of the following elements:

- Asphalt storage tanks, 27m tower and associated mixing plant (Capacity 160 tonnes per hour and 80,000 tonnes per annum)
- Reclaimed Asphalt plant (storage and reuse of 5,000 tonnes per annum)
- Raw material stockpiles
- Laboratory, site office, amenities buildings and carpark
- Concrete batching plant (Capacity 80m^3 per hour)
- General truck movement areas loading and unloading locations
- Associated miscellaneous infrastructure

It is proposed that the site operate 7am to 6pm Monday to Saturday. However, from time to time it will be desirable to operate throughout the night, i.e. 24 day and potentially 7 days a week.

1.2 Locality Description

The project is situated in a well-established grazing and cane farming region. The location of the Project is shown on Figure 1. The Edmonton is 5km to the NW and Gordonvale is approximately 5km to the south. The two closest dwellings are approximately 500m from the site boundary.

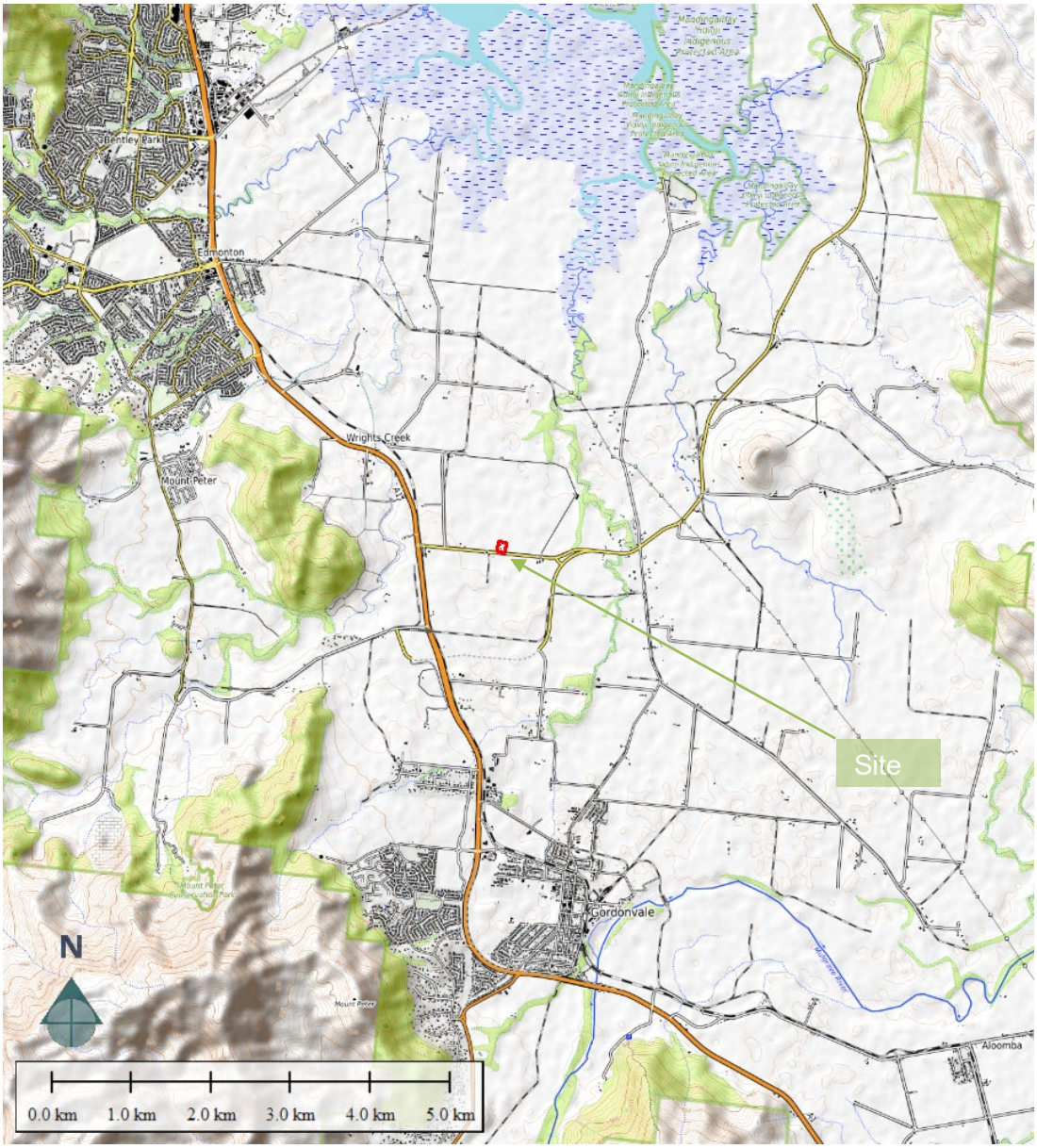


Figure 1: Regional View Showing the Project Area

The site layout is shown in Figure 2.

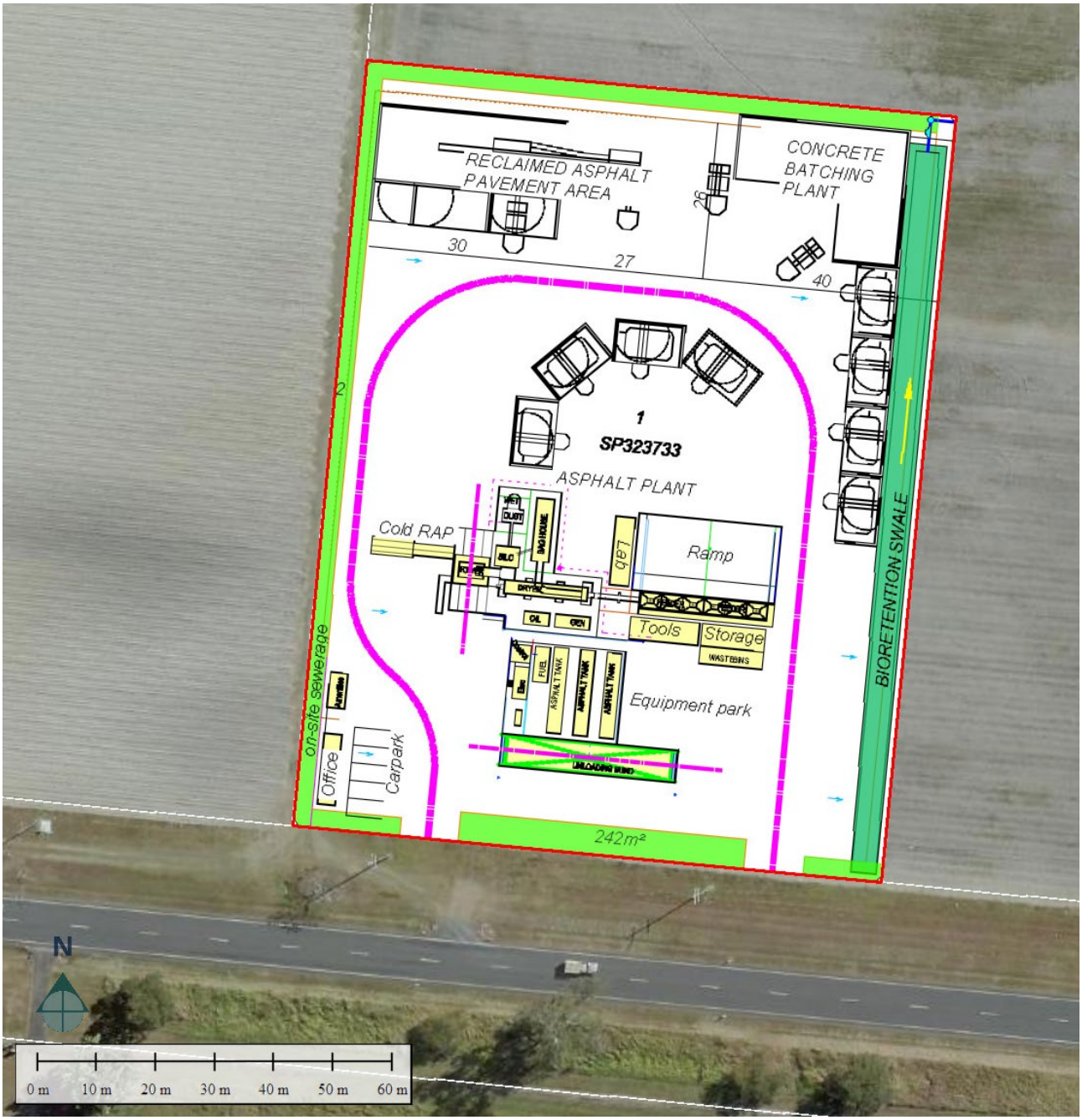


Figure 2: Site and Surroundings

1.3 Existing Noise Environment

Twelve dwellings have been identified as the relevant sensitive receptors for this assessment. The locations and separation distances are contained in Table 1 and presented on a map in Figure 3: Site and Sensitive Receptors (R1 to R12). In some instance, a sensitive receptor represents the closest of a group of nearby sensitive receptors.

Table 1: Sensitive Receptors Surrounding the Site

Receptors	Distance [m] from edge of site	Angle (degrees)
R1	445	110
R2	460	270
R3	840	265
R4	1020	300
R5	1230	335
R6	1050	50
R7	1230	90
R8	1220	90
R8	1630	110
R10	1250	150
R11	1580	180
R12	1170	225

Figure 3: Site and Sensitive Receptors (R1 to R12)

A noise survey has been carried out at R2. The measurements were obtained with an Norsonic Nor 140 over the period 3 Nov 2022 to 10 Nov 2022. The sound level meter was configured to record 15-minute statistics. The noise levels have been tabulated in Table 2 and charted in Figure 4.

It is interesting to note that there was an increase in noise levels at approximately 5:30am most likely due to the dawn chorus. The lowest noise level over the entire week at this site was 34 dB(A) and the rating background noise level was 38 dB(A). Given the location in the tropics and within a cane growing region it is expected there will be insects and amphibian noise throughout the night and year. Consequently, the measured background noise levels are considered to be appropriate throughout the year.

Table 2: Measured Noise Levels [dB(A)] at R2

Date	L_{A01}			L_{A10}			L_{Aeq}			L_{A90}		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
3/11/2022	61	56	53	56	50	41	52	47	42	41	40	38
4/11/2022	62	58	49	57	52	43	53	48	43	43	39	38
5/11/2022	61	58	50	56	51	44	52	47	43	40	40	39
6/11/2022	60	57	51	55	48	43	51	47	43	40	40	37
7/11/2022	62	57	50	57	49	44	54	46	42	44	40	39
8/11/2022	61	58	49	55	49	41	52	46	41	41	40	37
9/11/2022	47	44	44	47	43	41	44	42	40	40	40	37
Median/RBN	**61**	**57**	**50**	**56**	**49**	**43**	**52**	**47**	**42**	**41**	**40**	**38**
Week Day	61	57	50	55	49	41	52	46	42	41	40	37

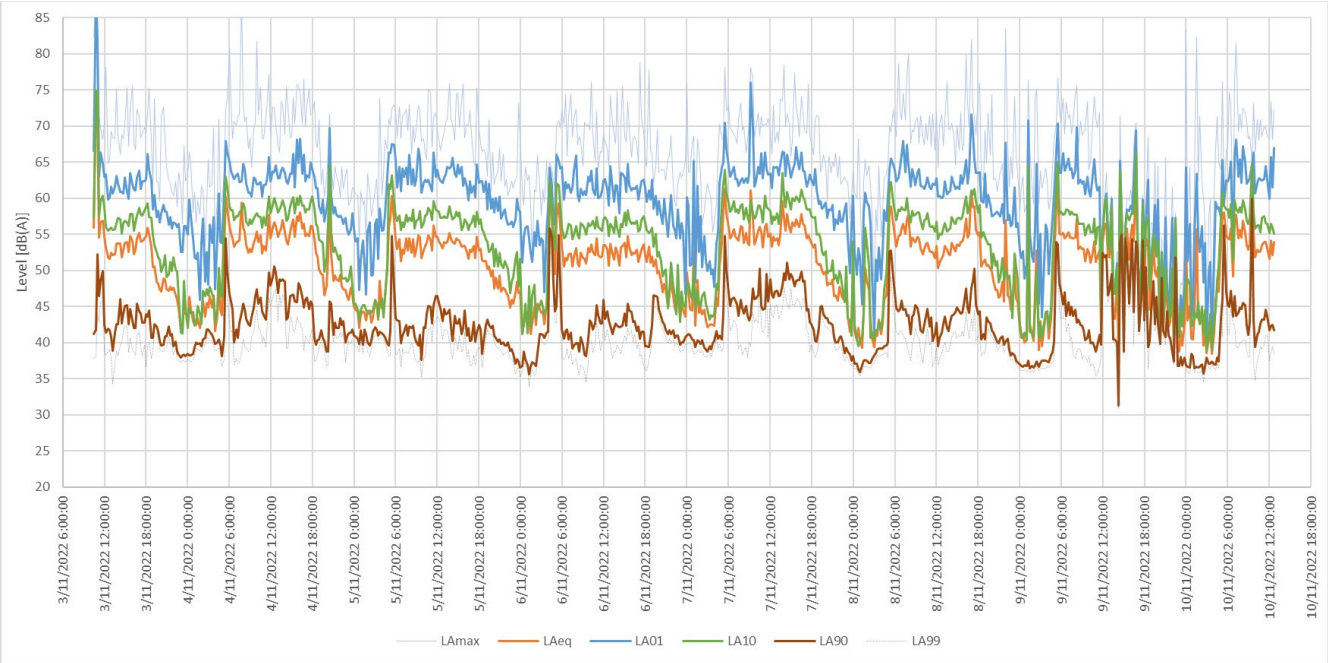


Figure 4 Chart of Sound Pressure Level Measurements at R2.

2 Noise Criteria

2.1 Cairns Regional Council

Cairns Regional Council 9.3.2 Environmental performance code is designed to ensure development is designed and operated to avoid or mitigate impacts on sensitive receiving environments. The requirements of code are described in Table 3.

Table 3: Environmental Performance Code Extract

Table 9.3.2.3.a – Environmental performance code – benchmarks for assessable development	
Noise	
PO3 Potential noise generated from the development is avoided through design, location and operation of the activity. *Note – Planning Scheme Policy – Environmental Management Plans provides guidance on preparing a report to demonstrate compliance with the purpose and outcomes of the Code.*	AO3.1 Development does not involve activities that would cause noise related environmental harm or nuisance; or AO3.2 Development ensures noise does not emanate from the site through the use of materials, structures and architectural features to not cause an adverse noise impact on adjacent uses. and AO3.3 The design and layout of development ensures car parking areas avoid noise impacting directly on adjacent sensitive land uses through one or more of the following: (a) car parking is located away from adjacent sensitive land uses; (b) car parking is enclosed within a building; (c) a noise ameliorating fence or structure is established adjacent to car parking areas where the fence or structure will not have a visual amenity impact on the adjoining premises; (d) incorporating a densely vegetated buffer adjacent to car parking areas. *Note – The Environmental Protection (Noise) Policy 2008, Schedule 1 provides guidance on acoustic quality objectives to ensure environmental harm (including nuisance) is avoided.*

Cairns Regional Council 9.3.4.1 Industry design Code purpose is to ensure that industry activities and areas protect public safety, provide a high quality of design and amenity and are appropriately located to ensure their long-term viability. The requirements of noise are described in Table 4

Table 4: Industry Design Code Extract

Table 9.3.4.3.a – Industry design code – benchmarks for assessable development and requirements for accepted development	
Air and Noise Pollution	
PO9 Development should not result in sensitive land uses being exposed to air, noise and odour emissions from industrial uses, major sport, recreation and entertainment facilities or other noisy sport and recreation activities that have the potential to adversely impact on human health, amenity and wellbeing. *Editor's note – Noisy sport and recreation activities include shooting and motor sport facilities.*	**AO9.1** The use is designed to ensure that: a) the indoor noise objectives set out in the Environmental Protection (Noise) Policy 2019 are met; b) the air quality objectives in the Environmental Protection (Air) Policy 2008, and any relevant national or international standard (for example the World Health Organisation Guidelines for Air Quality 2000) are met; c) noxious and offensive odours are not experienced at the location of sensitive land uses. Editor's note – The Queensland odour impact assessment guideline, available from the Department of Environment and Heritage Protection website, provides a methodology for assessing odour impacts. www.ehp.qld.gov.au. Note – Design measures may include: 1) landscape buffers and physical barriers such as fences and that set appropriate setback/separation distances 2) adequate allotment design that reduces impacts of emissions 3) adequate construction materials and positioning of rooms and windows to mitigate impact of emissions.

2.2 ERS/2015/1838

The Guideline ESR/2015/1838 describes types of impacts that environmentally relevant activities can have in relation to noise and outlines the information to be provided to the department as part of the ERA application process.

There are three key areas to be identified and addressed through the ERA application process:

- Identify the environmental values of the receiving acoustic environment including the identification of any nearby sensitive places.
- Identify the possible impacts due to the proposed activity and all associated risks to environmental values.
- Identify the strategies to mitigate the identified risks to the environmental values

It is necessary to identify the environmental values of the site including but not limited to:

1. Identify sensitive places
2. Provide a site description.
3. Provide details of a background noise survey.

The department seeks to determine possible impacts to identified environmental values. To assist with this the following information is sought:

1. Identify all noise, vibration, and air blast overpressure sources, including stationary and mobile sources, associated with the activity. Also provide a scaled map which shows the source of all noise emissions in relation to any existing noise sensitive places
2. Describe in detail, the characteristics of the noise emissions produced.
3. Describe how noise, vibration or airblast overpressure emissions will be avoided, minimised or otherwise managed in accordance with the noise management hierarchy provided in the EPP (Noise).

If it is not possible to mitigate the impacts associated with the noise emission, applicants are to provide a noise impact assessment, which identifies the likely effect of noise from the activity on nearby sensitive places and include:

- Noise modelling contour maps to show predicted noise levels at all potential noise source locations.
- Analysis on whether noise emissions associated with the activity will adversely affect the environmental values of the receiving environment (including noise sensitive places).
- Description of controls (e.g. noise emission limits or operational controls such as operating hours) which are appropriate to protect environmental values.
- A vibration risk assessment for blasting activities, if applicable.
- If blasting is to occur, that blasting activities will be managed in accordance with AS 2187: Explosives.

Due to the rapid growth and increasing density of noise-producing activities in Queensland, the consideration of cumulative noise impacts and background creep is particularly important. For applications where background creep is likely, applicants are encouraged to use modelling to demonstrate that the activity will, to the extent it is reasonable to do so, ensure that background creep in an area or place is prevented or minimised. If the acoustic quality objectives for an area or place are not being achieved or maintained, the noise experienced in the area or place must, to the extent it is reasonable to do so, be dealt with in a way that progressively improves the acoustic environment of the area or place.

2.3 Environmental Protection Act 1994

The objective of the EP Act is to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends.

The EP Act states a person must not carry out any activity that causes, or is likely to cause, environmental harm unless the person takes all reasonable and practicable measures to prevent or minimise the harm. This is termed the 'general environmental duty'.

Environmental harm is defined as any adverse effect, or potential adverse effect (whether temporary or permanent and of whatever magnitude, duration or frequency) on an environmental value, and includes environmental nuisance.

The noise level goals for operations may be determined from the *Environmental Protection (Noise) Policy 2019* (EPP (Noise) 2019). The EPP (Noise) 2019 came into effect on 1 Sept 2019.

The purpose of the EPP(Noise) is to achieve the objects of the Act and achieved by:

a) identifying and declaring the environmental values of the acoustic environment; and
a) stating acoustic quality objectives that are directed at enhancing or protecting the environmental values; and
b) providing a framework for making consistent, equitable and informed decisions that relate to the acoustic environment.

The environmental values to be enhanced or protected under the EPP(Noise) are:

(a) the qualities of the acoustic environment that are conducive to protecting the health and biodiversity of ecosystems; and
(b) the qualities of the acoustic environment that are conducive to human health and wellbeing, including by ensuring a suitable acoustic environment for individuals to do any of the following-
    a. sleep;
    b. study or learn;
    c. be involved in recreation, including relaxation and conversation; and
(c) the qualities of the acoustic environment that are conducive to protecting the amenity of the community.

There are two main considerations namely:

1. Acoustic quality objective (noise levels that are conducive to human health and well-being, ensuring a suitable acoustic environment for individuals to sleep, study or learn, be involved in recreation, including relaxation and conversation; and preserve the qualities of the acoustic environment that are conducive to protecting the amenity of the community); and
2. Management Intent

2.3.1 Acoustic Quality Objectives

The 'Acoustic Quality Objectives' seek to protect the amenity of an acoustic environment. The indoor night-time goals effectively address sleep disturbance and sleep awakenings, while during the day it protects conversation. It should be noted that these are not strictly design limits for individual sources but objectives that are considered to provide acceptable health and wellbeing for the community.

The acoustic quality objectives are expressed as indoor noise level goals for dwellings at Night (10 pm to 7 am) and outdoor noise level goals during the Day (7 am to 6 pm) and Evening (6 pm to 10 pm. These objectives are all contained in Table 5.

The equivalent external noise levels (for the dwelling indoor noise level goals in Table 5) measured at least 4 m from the dwelling would be 5 dB higher (to allow for the reduction of noise through the building envelope) for windows wide open. If windows are closed the external noise goals would be 15 dB(A) higher than the internal noise level goals.

Table 5: Acoustic Quality Objectives for Dwellings and Other Receivers Relevant to the Project during the Day (7 am to 6 pm), Evening (6 pm to 10 pm) and Night (10 pm to 7 am).

Location	Time of Day	Acoustic Quality Objectives (Measured at the receptors) dB(A)			Environmental Value
		$L_{Aeq, adj, 1 hr}$	$L_{A10, adj, 1 hr}$	$L_{A1, adj, 1 hr}$	
Dwelling outdoors	Daytime & evening	50	55	65	Health and wellbeing
Dwelling indoors	Daytime & evening	35	40	45	Health and wellbeing
Dwelling indoors	Night-time	30	35	40	Health and wellbeing, in relation to the ability to sleep
School or playground outdoors	When the children usually play outside	55	-	-	Health and wellbeing, and community amenity
Protected area or critical area	anytime	The level of noise that preserves the amenity of the existing area or place			Health and biodiversity of ecosystems

Source: EPP (Noise) 2019

2.3.2 Managing Intent For Noise

It is intended that noise from an activity that affects or may affect an environmental value to be enhanced or protected under the EPP(Noise) be appropriately managed.

To the extent it is reasonable to do so, noise must be dealt with in a way that ensures-

a) the noise does not have any adverse effect, or potential adverse effect, on an environmental value under this policy; and
b) background creep in an area or place is prevented or minimised.

In the situation where existing noise levels exceed the Acoustic Quality objectives, to the extent it is reasonable to do so, noise at that sensitive place must be dealt with in a way that progressively improves the acoustic environment of the area or place.

Background creep, for noise in an area or place, is described as a gradual increase in the total amount of background noise in the area or place.

The EPP(Noise) does not provide any guidance nor limits regarding how to address background creep.

However, the guiding principles are:

i. Background creep in an area is to be prevented or minimised
ii. Any control requirements are to be reasonable

Background creep can be prevented by ensuring the noise from activity is always below the background noise level. However, this may be excessively onerous for many situations. The EPP(Noise) does not include any guidance regarding how to assess “reasonable” noise control. A work practice or abatement measure is feasible if it is capable of being put into practice or of being engineered and is practical to build given project constraints such as safety and maintenance requirements. Selecting reasonable measures from those that are feasible involves making a judgement to determine whether the overall noise-reduction benefits outweigh the overall adverse social, economic and environmental effects, including the cost of the noise abatement measure. To make such a judgement, consideration may be given to aspects such as noise level impacts, noise mitigation benefits, cost effectiveness and community views.

2.4 Sleep Disturbance WHO Guidelines

Research has shown that the ability to get to sleep and, when asleep, the probability of experiencing a change of sleep state or ultimately of awakening are related to both the ambient and maximum instantaneous noise levels at the ear of the sleeper and the number of events during the night period (WHO 1999).

As a rule in planning for short-term or transient noise events, for good sleep over eight hours, the indoor sound pressure level measured as a maximum instantaneous value should not exceed approximately 45dBA maxLpA more than 10-15 times per night. According to Guideline Ecoaccess Planning for Noise Control (EPA 2004), the corresponding external noise level, assuming partially closed windows, is 52dBA maxLpA (L_{Amax}), measured in the free field. With fully closed windows the corresponding external noise level is 60dBA maxLpA (L_{Amax}),

For larger number of events per night, the noise level goal is reduced by 10*log(Number of events/10). Hence if there are 100 events per night (over an 8 hour period) the external noise level goal would 10 dB(A) lower.

2.5 DEHP State Planning Policy 5/10 Air, Noise and Hazardous Materials

The DEHP This Policy seeks to complement the existing management framework by providing a more strategic focus on the location and protection of industrial land uses. The direction in this Policy ultimately seeks to ensure that planning instruments provide strategic direction about:

- where industrial land uses should be located to protect communities and individuals from the impacts of air, noise and odour emissions, and the impacts from hazardous materials, and
- how land for industrial land uses will be protected from unreasonable encroachment by incompatible land uses.

The performance outcomes required by the policy are contained in Table 6.

Table 6: Performance Requirements for Industrial Developments (Source: SPP 5/10)

Air and Noise Pollution	
PO2 Development must not result in sensitive land use being exposed to industrial air, noise and odour emissions that impact on human health, amenity and wellbeing.	**AO2.1** The use is designed to ensure that: • the indoor noise objectives set out in the Environmental Protection (Noise) Policy 2019 are met; • the air quality objectives in the Environmental Protection (Air) Policy 2008, and any relevant national or international standard (for example the World Health Organisation Guidelines for Air Quality 2000) are met; Design measures may include: • landscaping • setting back sensitive land uses from existing and future industrial noise sources • positioning buildings in the most appropriate geographic locations (e.g. placing bedrooms away from existing and future industrial noise sources) • using barriers, mounds and fences • screening sensitive land uses from industrial noise sources.

	Note: an air and/or noise impact assessment can be prepared by a suitably qualified professional to demonstrate compliance with acceptable outcome AO2.1. Refer to the SPP Guideline (Annexes 3 and 4) to see the minimum requirements for an air or noise impact assessment.
	AO2.2 Noxious and offensive odours are not experienced at the location of sensitive uses. Note: the Queensland Odour Impact Assessment Guideline provides a methodology for assessing odour impacts

2.6 DEHP Ecoaccess Guideline - Low Frequency Noise

The DEHP Ecoaccess Guideline "Assessment of Low Frequency Noise" identifies a number of industrial sources and processes having high noise levels and frequency content less than 200 Hz.

Industrial sources may exhibit a spectrum that characteristically shows a general increase in sound pressure level with decrease in frequency. Annoyance due to low frequency noise can be high, even though the dB(A) level measured is relatively low. Typically, annoyance is experienced in the otherwise quiet environs of residences, offices and factories adjacent to, or near, low frequency noise sources. Generally, low level/low frequency noises become annoying when the masking effect of higher frequencies is absent. This loss of high frequency components may occur as a result of transmission through the fabric of a building, or in propagation over long distances.

Where a noise emission occurs exhibiting an unbalanced frequency spectra, the overall sound pressure level inside residences should not exceed 50 dB(Linear) to avoid complaints of low frequency noise annoyance.

2.7 Road Traffic Noise Goals

Queensland Department of Transport and Main Roads (QDMR) is responsible for setting noise level limits from road traffic on public roads in Queensland. Typically, the planning goals for roads are met close to the road, i.e. distances up to about 30 m or thereabouts. There are no criteria in Queensland to assess the impact of noise from a road traffic-generating development. However, for existing roads with regular traffic an increase of 3 dB(A) over a short period of time is considered to be a significant increase in traffic noise and an increase which justifies consideration of noise control.

Since the hourly traffic to and from the site is minor, road traffic impacts on public roads will not be considered further.

2.8 Summary of Noise Goals

The site is situated in the Cairns State Development Area (SDA) area zoned as High Impact Industry. The asphalt plant will be the first development within the part of the SDA. Consequently, the region is about to commence a transition from a rural uses to industrial uses. With this in mind the Council, Industrial Goals and the State Planning Policy 5/10 have uniform criteria for the sensitive receptors close to the development and the High Impact industry Zone.

The development will seek to readily meet noise level goals at all sensitive receptors and particularly at the sensitive receptors within the rural use precinct (east of the site). This will ensure other future industrial uses are not disadvantaged by virtue of not being the first development within the SDA.

Application of Cairns Regional Council

The Cairns Regional Council has indicated that the noise limits for industrial developments are to comply with the residential indoor Acoustic Quality objectives from the EP Act. In this instance the noise level limits for day evening and night are based on the windows closed for all sensitive receptors. This is a reasonable assumption as most properties have air-conditioning to permit windows being closed. Additionally, this assumption is inherent in the Acoustic Quality Objectives.

Application of SPP 5/10

The Cairns Regional Council and SPP 5/10 have identical noise level goals.

Application of the EP Act

The EP act provides the framework for all noise impacts. However, it does not provide source limits, rather it provides noise quality objectives to be met in Queensland, ensuring the quality of the environment does not deteriorate. In this instance the Council and SPP5/10 indicate the indoor quality objectives are to be used as limits for the development.

Application of Low Frequency Noise Goals

It is possible that, due to the propagation of noise over the large separation distances between the source of noise and the receiver, a loss of high frequency components may occur. Thus, the low frequency noise goal of 50 dB(Linear) applies inside noise sensitive receptors. The same 15 dB reduction from outside to inside applies, i.e. the equivalent external noise is 65 dB(Linear).

Application of Sleep Disturbance Goals

It is proposed to adopt an L_{Amax} of 52dB(A) as the appropriate noise level goal.

A summary of the noise goals for this project is contained in Table 7. The limits are component levels, i.e. directly attributable to the use (modelled noise levels), rather than measured levels.

Measured noise levels include background and other noise sources.

Table 7: Summary of Component Noise Goals (free-field)

Location	**Time Period**	$L_{Aeq,\ adj,\ 1\ hr}$ ***[dB(A)]***	$L_{A10,\ adj,\ 1\ hr}$ ***[dB(A)]***	$L_{A01,\ adj,\ 1\ hr}$ ***[dB(A)]***	$L_{Amax,\ adj,\ 1\ hr}$ ***[dB(A)]*** ***Sleep disturbance***	**Low Frequency** $L_{eq,\ adj,\ 1\ hr}$ **[dB]**
All Residential Receptors	Day	*50*	55	60	-	-
	Evening	*50*	55	60	-	-
	Night	45	50	55	60	65

3 Predicted Noise Levels

3.1 Modelling Methodology

A digital terrain noise model of the site and surroundings has been developed using PEN3D software. The PEN3D General Prediction Model (GPM) is based on the method contained in a book by Bies and Hansen (1988, pages 117, 127). The implementation is a more complex variation of the approach to sound propagation described in Concawe (1981). Concawe is one of the most commonly used methodologies to predict outdoor noise propagation from industrial sites. PEN3D also draws on aspects from ISO 9613-2. The PEN3D software was originally developed in 1993 and has been in constant development and review. The basic equation adopted by the GPM is:

$$Lp = Lw - 20 \log10(r) - 10\log10(4\pi) + AE$$

Where:

Lp is the sound pressure level at an observer

Lw is the sound power level of the source, in octave bands from 63 Hz to 8 kHz

$20 \log10(r) + 10\log10(4\pi)$ is the distance attenuation (spherical)

AE is the excess attenuation factors.

The excess attenuation factors AE comprise:

$$AE = Aa + Ag + Am + Ab + Af$$

Where:

Aa = Excess attenuation due to air absorption from Sutherland *et. al*. (1974)

Ag = Excess attenuation due to ground reflection

Am = Excess attenuation due to meteorological effects

Ab = Excess attenuation due to barriers

Af = Excess attenuation due to forests.

PEN3D is a sophisticated environmental noise model incorporating a 3D terrain model that permits accurate representation of the ground, ground cover, tree zones, mounds, barriers and weather conditions. PEN3D calculates a curved noise path based on surface friction, vertical temperature gradients and wind speed. All the noise calculations are based on this curved path. A finite differences approximation method is used to calculate the curved path. The curvature of the path determines the meteorology corrections. The meteorology corrections are frequency and distance dependent and are limited to +12 dB (downwind at night) and –7 dB (upwind and during the day) similar to the Concawe Category 1 and Category 6 meteorological corrections.

The excess attenuation due to ground reflection is obtained by combining the direct wave and the reflected wave incoherently, that is the energy from the ground wave is added to the direct wave. The ground reflection attenuation (or ground effects) will be between 0 and –3 dB (a negative value is an increase in noise levels) for all cases. This contrasts with the coherent reflection approach. The coherent approach is considered to be an “exact” method. For those situations where the source and receiver are located close to the same very hard reflecting plane and the path difference between the direct path and the reflected path is small, then the addition of the reflected wave and the direct wave will result in 6 dB increase rather than a 3 dB increase. However, at large distances the sound pressure level reduces at 12 dB per doubling with the coherent model (not 6 dB as per the incoherent model). This approach, while “exact”, is dubious as Digital Terrain Models (DTM) models are neither of sufficient accuracy nor can noise models truly account for the effects of atmospheric turbulence. Other methods such as the Nordic method or ISO 9613-2 divide the region between the source and receiver into three zones, and those zones closest to the source and to the receiver can potentially have higher absorption values. Consequently, if a noise source was measured say at a distance of 30 m and the sound power level is calculated by the commonly adopted formula PWL = SPL + 10log10(2 π r^2) then the calculations using the PEN3D methodology would remain conservatively high for all distances.

The ground reflection (or ground effects) is a complex calculation using the flow resistivity for the surface likely to provide the ground reflection and the likely angle of incidence of the reflected wave to the ground. In those instances where the ground is highly absorptive the excess correction will approach zero. For those surfaces which are highly reflective the correction will be - 3dB, i.e. will lead to an increase in noise levels of 3 dB(A) (simulates hemispherical propagation).

While there are numerous methods to calculate ground effects (some of which provide significant attenuation [reduction of noise levels]), the PEN3D implementation is one of the more conservative estimates of ground effect in the far field. Bies & Hansen (1988) indicate “as the distance from the source or frequency increases, the incoherent model will become more appropriate”.

The theoretical approach to meteorology implies that PEN3D is likely to provide more significant corrections than other models. Thus, at night or during downwind predictions, the PEN3D calculations are likely to result in conservatively high results, i.e. the modelled noise levels are likely to be higher than the measured levels.

The likely barrier attenuations are calculated for four possible curved paths, namely:

- source, to the top of barrier then to the receiver;
- source, reflection from ground (source side), top of barrier, receiver;
- source, top of barrier, reflection from ground (receiver side), receiver; and
- source, reflection from ground (source side), top of barrier, reflection from ground (receiver side), receiver.

These are combined to obtain effective barrier attenuation. In the situation where the source and receiver are well above the ground and the barrier just intercepts line-of-sight then the barrier effect will be 5 dB(A). However, if the source and receiver are close to the ground and the noise barrier just intercepts line of sight (a pebble) the barrier effect will tend to zero.

Once the most likely curved path has been calculated, the method determines if it intercepts any tree zones within the digital terrain model. If the curved noise path travels in the lower 75% of the tree zone then the full excess attenuation is applied for the distance travelled in the tree zone. If the curved noise path travels in the upper 25% of the tree zone then:

a) the average propagation height is determined;
b) the length in the zone is determined; and,
c) the forest excess attenuation is taken to be linearly interpolated between zero at the top of the tree zone and full excess attenuation at 75% height.

Tree zones can potentially provide extremely high attenuation if the tree coverage is large. However, in practice, the curved path adopted in the PEN3D methodology usually results in the noise rays passing above tree zones (at night or during downwind conditions) and only intercepting tree zones if they exist on the tops of hills or whenever the noise ray approaches the ground. Tree zones can potentially provide higher than expected attenuation during calm neutral conditions.

PEN3D has an advanced option to undertake statistical analysis of noise levels for large meteorological simulations. This allows a detailed modelling of environmental exposure.

3.2 Meteorology

The meteorology for the site has been analysed to address frequent wind speeds, wind directions and inversions. The meteorology was prepared for the Air Quality Assessment (SEG 2022) and is based on a 2-year modelling simulation.

Weather conditions may have a significant effect on environmental sound propagation. The meteorological conditions for the site have been analysed to determine how meteorology may affect noise propagation from the subject site.

Over large distances sound waves are refracted (curved) by the air temperature gradient. There are three basic cases neutral, inversion and turbulent atmosphere.

For many projects neutral meteorology is adopted as the preferred modelling case. For neutral case the air temperature reduces with elevation at the normal adiabatic lapse rate. For neutral meteorology, noise tends to travel without any curvature through the air. Neutral meteorology typically occurs at dusk and dawn. Neutral meteorology also implies low wind speeds. It is the default modelling case for all near field assessments up to nominally 500m.

During temperature inversions, warmer air is held above the cooler air. Typically, temperature inversions involve clear sky, dew, horizontal smoke patterns and ground fog in low-lying areas. Inversion conditions occur between dusk and dawn. Inversion conditions permit noise to travel greater distances since noise travels through the atmosphere with a downward curvature. Thus, depending on the inversion strength, noise may have sufficient curvature in the atmosphere to clear obstacles, barriers and even sizable hills. This effect

is enhanced downwind of a noise source and lessened upwind. Since noise travels more readily during inversion conditions it may not represent the quietest ambient noise levels likely to occur at a given location. Inversion conditions allow many distant ambient noise sources to become evident and affect the background noise levels.

A turbulent atmosphere typically occurs during the day when the sun is heating the earth and this heat is then transferred to the atmosphere. Very strong solar insolation leads to strong heating of the atmosphere and an upward curvature of noise. This implies that noise generated on the ground will curve upwards and potentially never to return to the earth, i.e. a shadow zone is formed. Thus, the noise will only be measurable within the illuminated zone and not measurable in the shadow zone. As a demonstration of this effect, it has been observed that the lowest noise levels for distant rural locations occurs during the period 9am to 11am, rather than at night. Turbulent atmospheres also occur during periods of elevated wind speeds.

The Pasquill stability classes are presented in Table 8. Stability classes A, B and C represent turbulent atmospheres. Stability Class D represents a neutral atmosphere and Stability Classes E and F represent inversion conditions.

Table 8: Meteorological conditions defining Pasquill stability classes.

	Daytime Insolation			Night-time Conditions	
Surface Wind Speed (m/s)	Strong	Moderate	Slight	Thin Overcast >4/8 low cloud	<= 4/8 Cloudiness
<2	A	A – B	B	E	F
2 – 3	A – B	B	C	E	F
3 – 5	B	B – C	C	D	E
5 – 6	C	C – D	D	D	D
>6	C	D	D	D	D

The annual average frequency of the stability classes by time of day is contained in

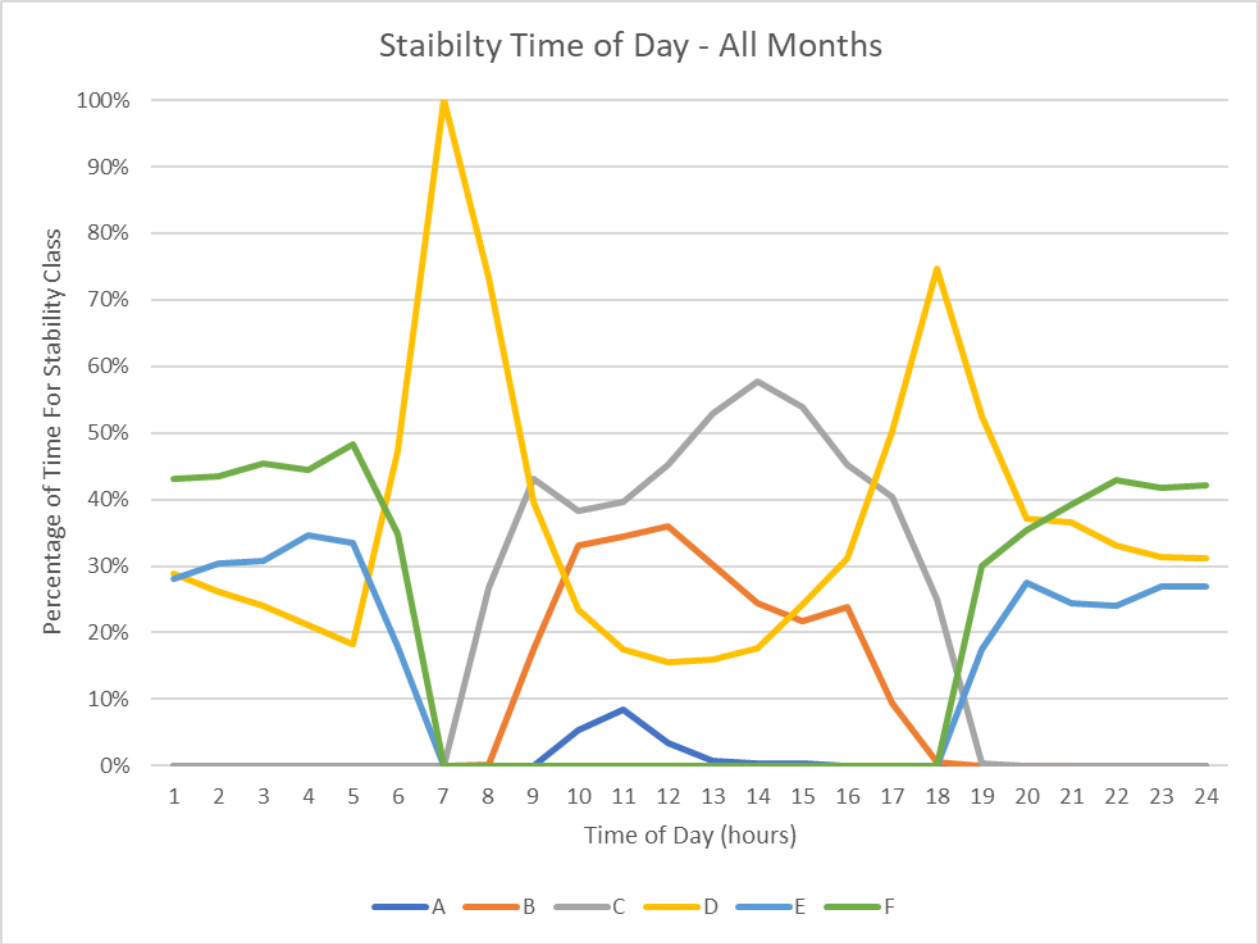


Figure 5. It is noted that neutral D is the most common Stability class at the site. Highly Stable F class occurs extensively at night.

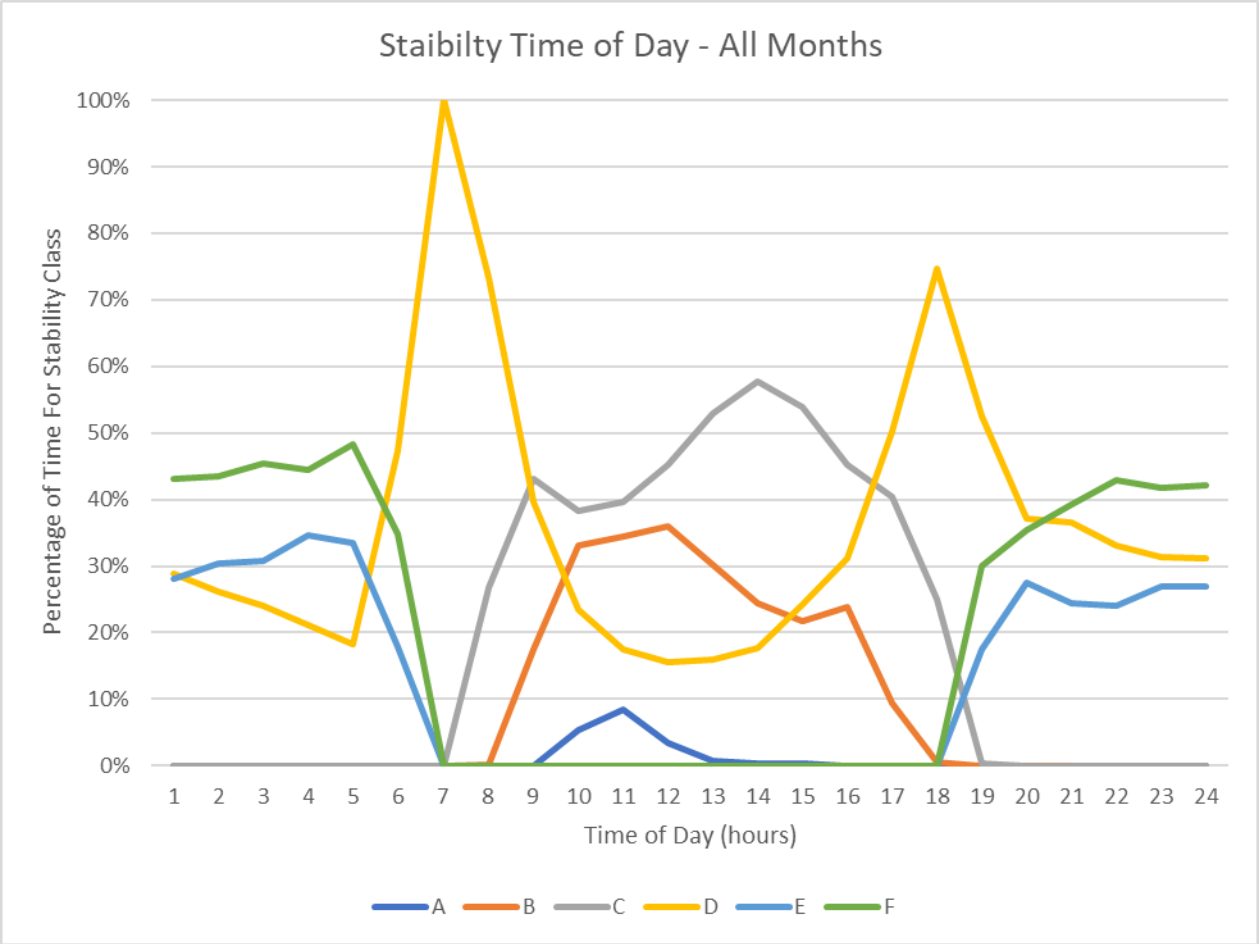
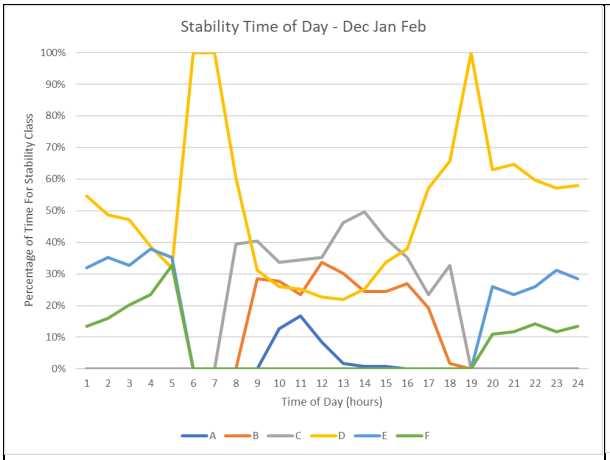
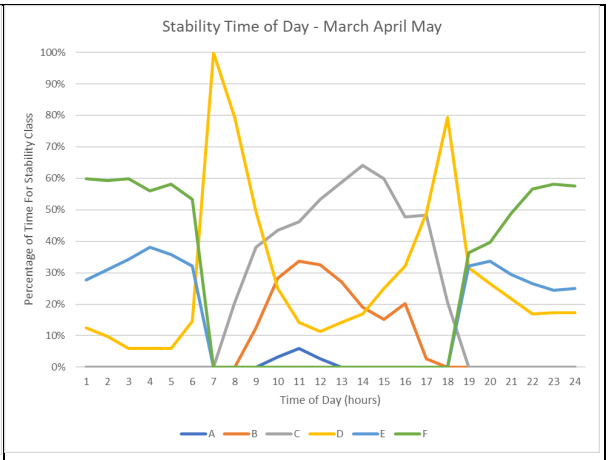


Figure 5:Annual Stability By Time of Day

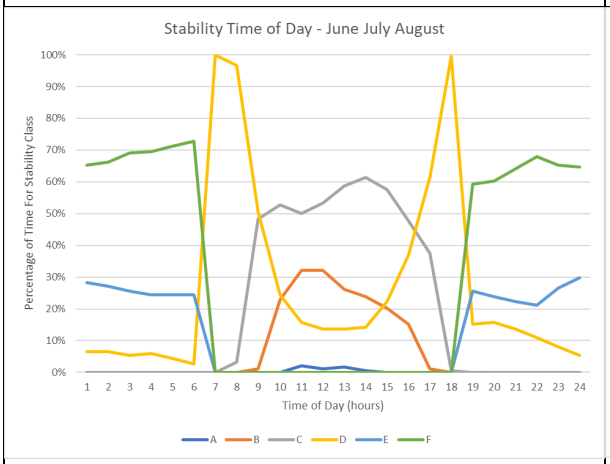
The stability by season is contained in Figure 6. This shows that during the day the site has significant solar insolation throughout the year. Whilst at night the site experiences inversion conditions moderate to strong inversions.



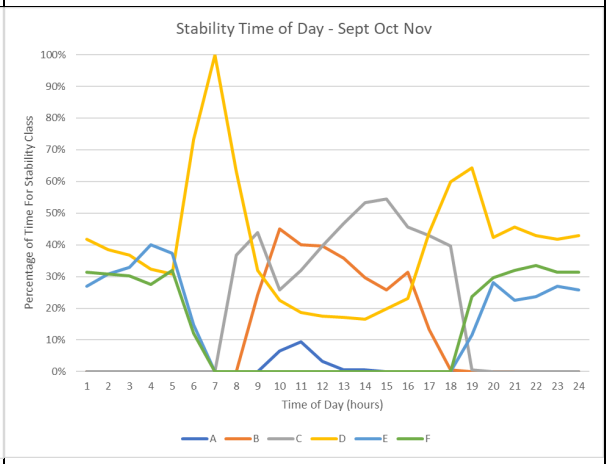
Summer Stability



Autumn Stability



Winter Stability



Spring Stability

Figure 6: Seasonal Stability

3.2.1 Temperature Inversions

The total night-time period during winter (June, July and August) has been analysed to determine the frequency of inversions. Temperature inversions generally occur during the night-time and early morning periods. The likelihood of inversions reduces with wind speed. Since the terrain is flat coastal it is likely the dominant (katabatic) drainage flows will be strongly influenced by that interaction.

The night winds during winter have been analysed to determine the frequency of wind and direction for all Stability classes, see Figure 7. It is noted that the winds at night during winter are predominantly from the south, i.e. >80% of the time. The windspeeds for the E and F class Stability are analysed in Figure 8. For the stronger inversion the wind speeds are typically around 1.5 to 2m/s from the south.

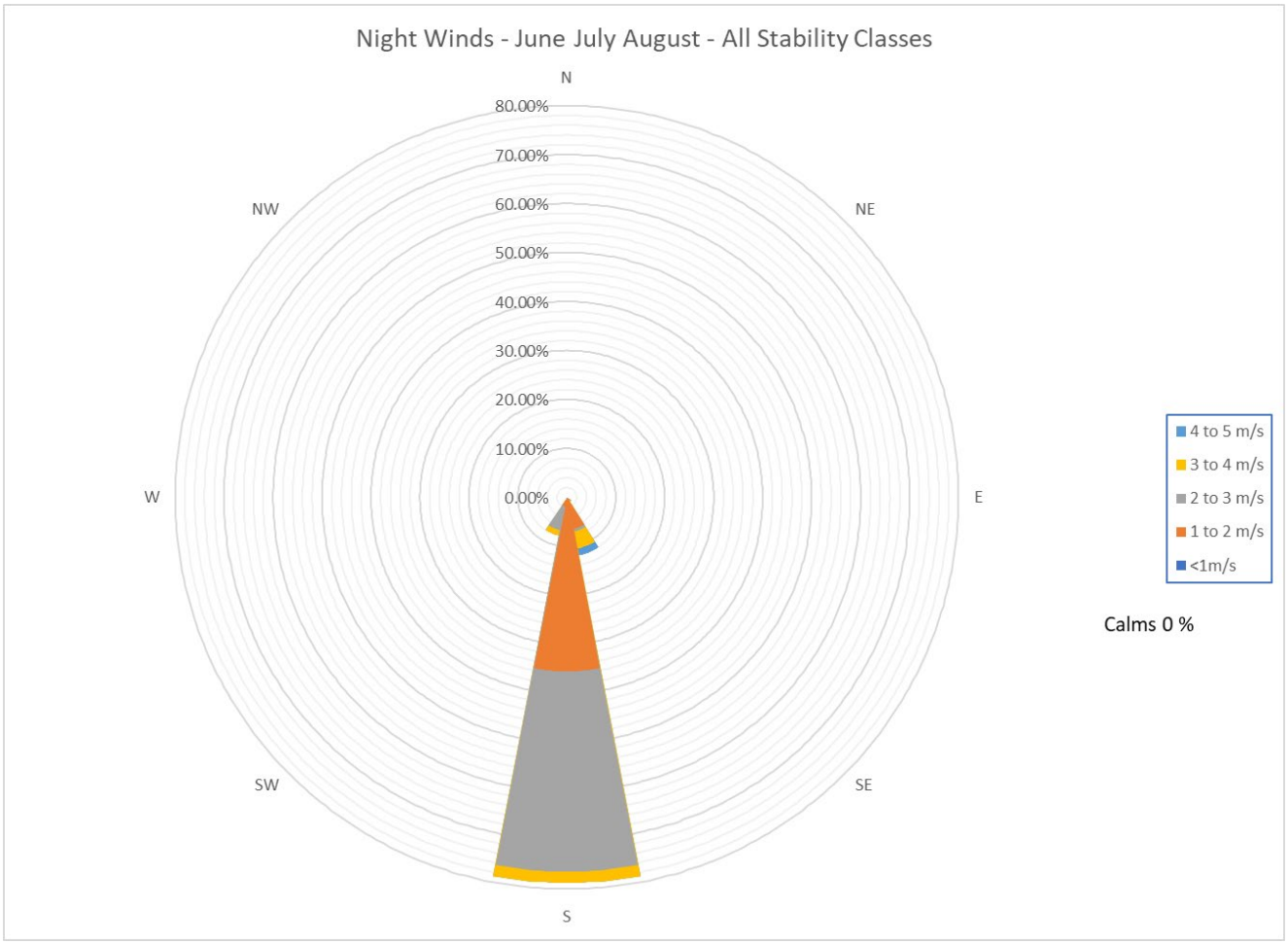


Figure 7: Windrose 6pm to 7am – Winter

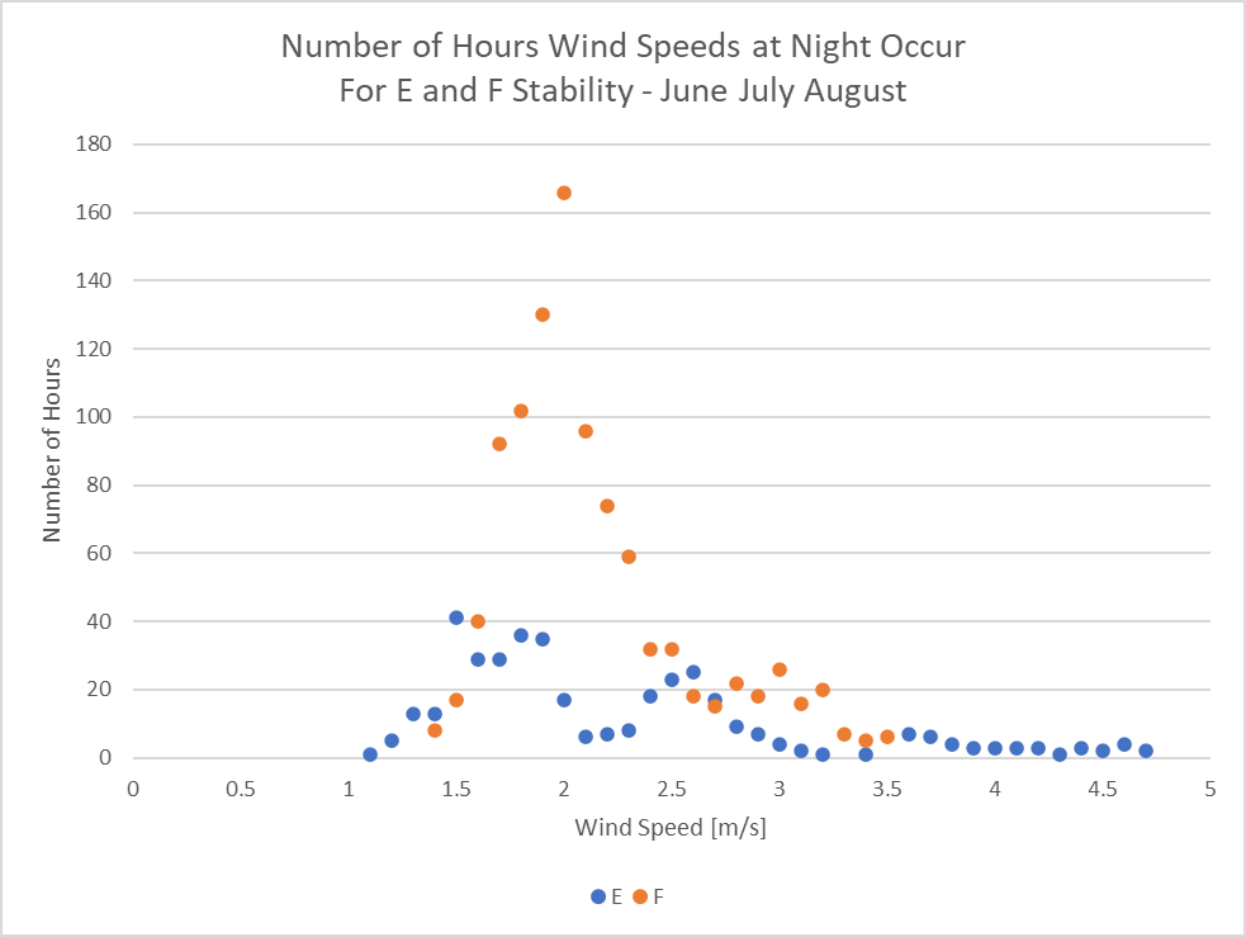


Figure 8: Wind Speed Distribution for E and F Stability

Similar analyses have been carried out for other seasons, refer to Figure 8. It is noted the wind direction and wind speeds are similar to the winter case. Throughout the year south winds of 2m/s dominate.

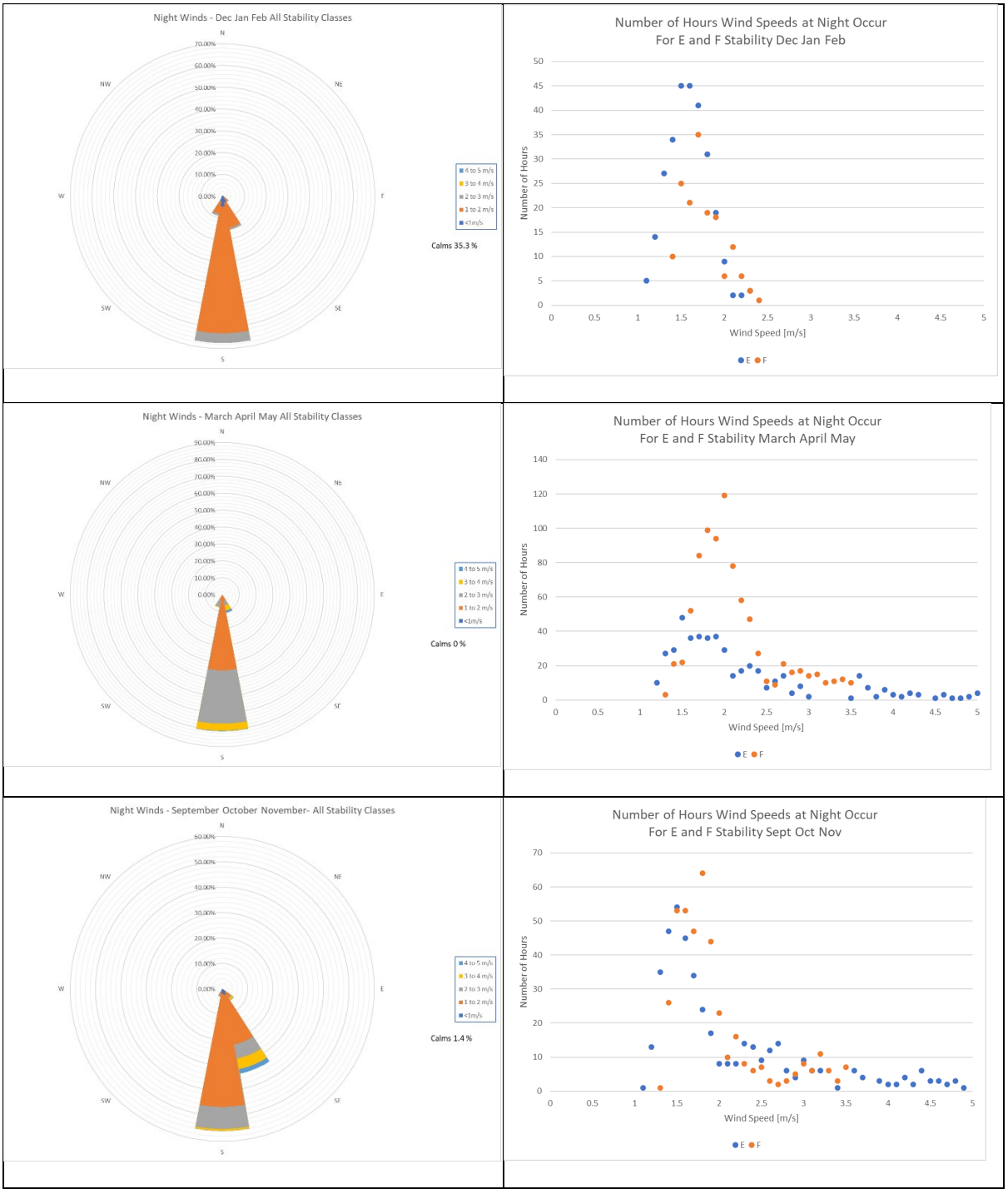


Figure 9: Seasonal Windroses and Wind Speed Analysis

3.2.2 Wind Effects

Wind effects are typically assessed when wind is a feature of the area. Wind is a feature when source-to-receiver wind speeds (at 10 m height) of 3 m/s or below occur for 30 percent of the time or more in any assessment period (day, evening, night) in any season. This differs from the procedure used with temperature inversions, in that the 30 percent occurrence applies to all seasons and each assessment period–and not just the winter season and night/early morning assessment period.

The wind direction and wind speeds were analysed to determine whether wind effects need to be considered. For this analysis, the wind speed was limited to 2.5 m/s since higher wind speeds tend to increase the ambient noise. Each season and each time period (day, evening and night) was analysed and winds were not found to occur more than 30 percent of the time in any direction. Specifically, although the southerly direction is strongly dominant, the winds speeds are greater than 2.5m/s most of the time. This higher wind speed leads to higher background noise levels and is not representative of the conditions leading to the lowest background noise and the basis of setting limits.

It is noted however than southerly winds are common throughout the year and as a consequence a single wind case at night has been included in the noise model. An southerly wind will tend to reduce noise levels in the areas north of the operations.

The modelling cases adopted in Table 9 are based on the wind distribution.

Table 9: Meteorology Modelling Cases Assessed

Case	**Wind speed [m/s]**	**Wind Direction [degrees from North]**	**Vertical Temp Profile [ºC/100 m]**	**Air Temp [ºC]**
Day	0	0	-3	25
Evening (Neutral)	0	0	0	22
Night (Inversion)	0	0	2	20
Night ESE wind	2.5	180	2	20

3.3 Noise Model Parameters

The DTM of the Project has been based on NASA Shuttle Radar telemetry and contoured at 2m intervals for a zone approximately 5km from the main noise sources. The noise model has an adopted ground cover of ‘thick grass' as a representation of the combination of the roughness provided by pasture and the taller vegetation that exists throughout the region. The model does not incorporate excess attenuation factors associated with tree zones.

The $L_{Aeq(60\ min)}$ equipment noise levels are contained in Table 10. The noise levels are expressed as a sound power level. The overall sound power levels are “A” weighted. The “A” weighting emulates the way the human ear responds to sound. These noise levels are based on measurements by SEG and published data. It is assumed all plant is operating at 100% utilisation.

Table 10: Typical Sound Power Levels ($L_{Aeq(1\ hr)}$) in dB(A) for Major Plant with 100% utilisation

Plant	Octave dB Sound Power Levels in dB at Octave band Hz								Totals	
	63	125	250	500	1000	2000	4000	8000	dB(A)	dB(Z)
Asphalt plant (Ensemble)	123	114	112	111	103	95	94	94	111	124
Concrete batching plant (Ensemble)	113	113	106	100	102	99	92	83	106	117
Delivery truck	107	104	101	94	98	95	91	89	102	110
Front end loader	115	115	108	102	104	101	94	85	108	118

There are several items of minor plant not included in Table 10. Minor noise sources are comparatively quiet or operated infrequently. The exclusion of this plant from the noise model will not make a noticeable difference in the calculated noise levels at sensitive receptors.

3.4 Noise Modelling Results

A noise model has been developed for plant representing the peak production of the asphalt plant and concrete batching plant. All the noise models are to obtain the $L_{Aeq(1\ hr)}$. Each item of equipment goes through a repeating short duration cycle representative of operations. The L_{Aeq} noise model incorporates the fluctuating noise levels to obtain the L_{Aeq} at the receiver. This is a mathematically correct analysis as it is independent of the time the noise is generated. However, it is also a conservative methodology as it requires the meteorology to remain constant for the entire hour (i.e. it ignores the small variations in a turbulent atmosphere that lead to variations of actual noise level below the calculated noise level).

Table 11 contains the calculated $L_{Aeq(15\ min)}$ noise levels at the sensitive receptor for all modelling cases in tabular format, Appendix A contains the noise contour diagrams. The results are summarised for the day, evening and night periods.

The shorter duration modelling period (10 min or 15 min) can be readily applied from the longer (1 hour) averaging time period without loss of accuracy.

Table 11: Predicted Noise Level at Sensitive Receptors (Normal Operations)

Sites	Day			Evening			Night				
	L_{Aeq}	L_{A10}	L_{A01}	L_{Aeq}	L_{A10}	L_{A01}	L_{Aeq}	L_{A10}	L_{A01}	L_{Amax} *Sleep disturbance*	$L_{eq\ (lin)}$ Low frequency
Goal	**50**	**55**	**60**	**50**	**55**	**60**	**45**	**50**	**55**	**60**	**65**
R1	49	52	54	49	52	54	50 [49]	53 [52]	55 [54]	57 [53]	63 [58]
R2	48	51	53	49	52	54	50 [50]	53 [53]	55 [55]	57 [54]	62 [59]
R3	42	45	47	43	46	48	44 [44]	47 [47]	49 [49]	51 [48]	58 [54]
R4	35	38	40	38	41	43	42 [45]	45 [48]	47 [50]	49 [49]	57 [59]
R5	39	42	44	40	43	45	40 [46]	43 [49]	45 [51]	47 [50]	55 [60]
R6	40	43	45	41	44	46	42 [47]	45 [50]	47 [52]	49 [51]	57 [61]
R7	39	42	44	40	43	45	40 [40]	43 [43]	45 [45]	47 [44]	55 [51]
R8	39	42	44	39	42	44	40 [40]	43 [43]	45 [45]	47 [44]	55 [51]
R9	35	38	40	36	39	41	37 [36]	40 [39]	42 [41]	44 [40]	53 [48]
R10	30	33	35	35	38	40	40 [15]	43 [18]	45 [20]	47 [19]	55 [40]
R11	35	38	40	36	39	41	37 [34]	40 [37]	42 [39]	44 [38]	53 [51]
R12	39	42	44	40	43	45	41 [38]	44 [41]	46 [43]	48 [42]	55 [53]

Note1:The night calculated noise levels without brackets represents the no wind meteorological case and the [xx] represent a 2m/s S wind. This wind occurs most of the time.

4 Assessment of Modelled Noise Levels

Operational Noise Assessment

The calculated noise levels during the day will meet the noise level goals at all sensitive receptors without any mitigation measures. The modelled L_{Aeq} noise levels at each dwelling during the day are typically similar to or less than the background noise level at all sites except R1 and R2. The modelled L_{A10} and L_{A01} are below existing measured L_{A10} and L_{A01} noise levels.

The calculated noise levels during the evening will meet the noise level goals at all sensitive receptors without any mitigation measures. The modelled L_{Aeq} noise levels at each dwelling during the evening are typically similar to or less than the background noise level. The modelled L_{A10} and L_{A01} are below existing measured L_{A10} and L_{A01} noise levels.

The calculated noise levels during the night (without wind) will meet the noise level goals at all sensitive receptors except R1 and R2 without mitigation measures. The modelled L_{Aeq} noise levels at night without wind at each dwelling are typically higher than the background noise level at all sites. The modelled L_{A10} and L_{A01} are similar or lower than the measured L_{A10} and L_{A01} noise levels.

The calculated noise levels during the night (with wind) will meet the noise level goals at all sensitive receptors except at R1, R2, R5 and R6 without any mitigation measures. There is an exceedance of up to 5 dB(A) during downwind case. The modelled L_{Aeq} noise levels at night with wind at each dwelling are typically higher than the background noise level north of the site or below background noise levels south of the site. The same apples with the modelled L_{A10} and L_{A01} comparisons.

Thus, the site complies with goals during the day and evening. It is likely that some limited operations could occur at night and this will be the subject of a detailed monitoring program post construction.

The night works comprise the process plant and are mostly continuous type noises. One of the L_{Amax} at night is likely to be reversing beepers on vehicles and other mechanical noise events. Typically, tonal noises would attract a plus 5 dB(A) noise correction to be added to the modelled noise level. It is also considered to be a very intrusive noise. It is proposed any vehicles operating onsite at night be fitted with broad-band squawker reversing alarms rather than tonal beepers. This effectively eliminates one of the main night adverse impacts.

Sleep Disturbance Goals

The noise emissions from the site operations are expected to comply with sleep disturbance goals at all sensitive receptors.

Low Frequency Noise Objectives

The low frequency noise emissions from the operations are expected to comply with the proposed environmental goals at all noise sensitive receptors.

4.1 Mitigation Measures

Noise emissions to the surroundings are due to internal and external traffic and processes in the asphalt production.

Internal traffic utilisation (loading machines, trucks, etc.) has been minimised by a thorough planning of plant design (piles, hoppers, silos, etc.). Ideally any waiting trucks will not que on the road network near the site but travel directly onto the site. This is relevant just prior to normal opening hours and during periods of peak production.

Noise occurs at different places in the process. The overall solution to noise problems is to shield the emitting source and/or reduce the noise from the source. Often the burner constitutes a major source and often sound absorber screens close to the intake are provided. Additionally, dust collector fans are often sources of noise and this are usually fitted with silencers for occupational noise reasons.

If all the individual noise sources were quantified, (rather than modelling an ensemble of noise sources) it would be possible to design mitigation solutions targeted to each noise generating source. The alternative mitigation design would require the plant to be constructed and operational and the key noise sources identified and quantified. However, it is likely that property boundary noise barriers would still be a feature to address road trucks, loaders and other mobile plant.

It is proposed any vehicles operating onsite at night be fitted with broad-band squawker reversing alarms rather than tonal beepers.

5 Conclusions and Recommendations

The assessment of the Project has been based on a conservative modelling methodology.

The assessment includes measurement of noise a nearby noise sensitive receptor to obtain the existing ambient noise levels.

An investigation of the environmental values was undertaken, and suitable limits developed based on Council guidelines, Environmental Protect Act, etc. The noise goals have been developed and found to comply with the Environmental Quality Objectives.

Initially the meteorology for the site was assessed in detail to determine whether inversions and/or winds were likely to be frequent for the site. It was determined that inversions are frequent. Assessment of wind occurrence indicated that adverse winds occur during the evening and night. A significant feature of the winds is the predominance of winds from the south. These tend to reduce noise levels south of the site and increase noise levels north of the site.

The likely noise levels from operating equipment have been robustly established based on an EIS conducted for this plant in Muswellbrook NSW in 2019. The likely noise emissions were also compared with measurements from similar equipment from other manufacturers to ensure that noise levels were accurate and appropriate.

The DTM map for the site and surroundings was based on NASA shuttle radar mission. The adoption of these contours provides the major features without over emphasising possible noise screening effects of smaller landforms.

One modelling case was adopted representing operations at 100% utilisation throughout the day, evening, night and night with wind.

It was found that the noise goals are expected to be met at all sensitive receptors during the day and evening subject to the following provisions:

1. Vehicles operated at night to be fitted with broad-band squawker reversing alarms rather than tonal beepers.
2. Trucks do not que outside the site and are promptly admitted to the site

It is desirable the nearby dwellings be surveyed to determine if the building structures are likely to achieve the 15 dB(A) reduction from outside to inside. Essentially, this involves confirming the dwelling have air conditioning which will permit windows to be closed in bedrooms at night.

List of References

AS 1055.1-1997 Acoustics-Description and measurement of environmental noise Part 1: General procedures.

AS 1055.2-1997 Acoustics-Description and measurement of environmental noise Part 2: Application to specific situations.

AS/NZS 2107:2000 Acoustics–Recommended design sound levels and reverberation times for building interiors.

Bies, A.D. & Hansen, C.H. 1988, *Engineering Noise Control - Theory and Practice,* Unwin Hyman, University Of Adelaide.

Bies A. D. & Hansen C. H. 1996, *Engineering Noise Control, 2nd edn*, E. & F. N. Spon, London.
Concawe Report 4/81. 1981. *The propagation of noise from petroleum and petrochemical complexes to neighbouring communities*.

DERM Guideline 2004, *Noise and Vibration from Blasting.*

DERM Guideline 2001, *Noise Measurement Manual*.

EPA Qld 2004, *Guideline – Noise – Planning for Noise Control*

Federal Transit Administration FTA (2006) *Transit Noise and Vibration Impact Assessment (FTA0VA-90-1003-06)*

ISO 9613-2 (1996) Acoustics – Attenuation of sound propagation outdoors Part 2: General Method of Calculation.

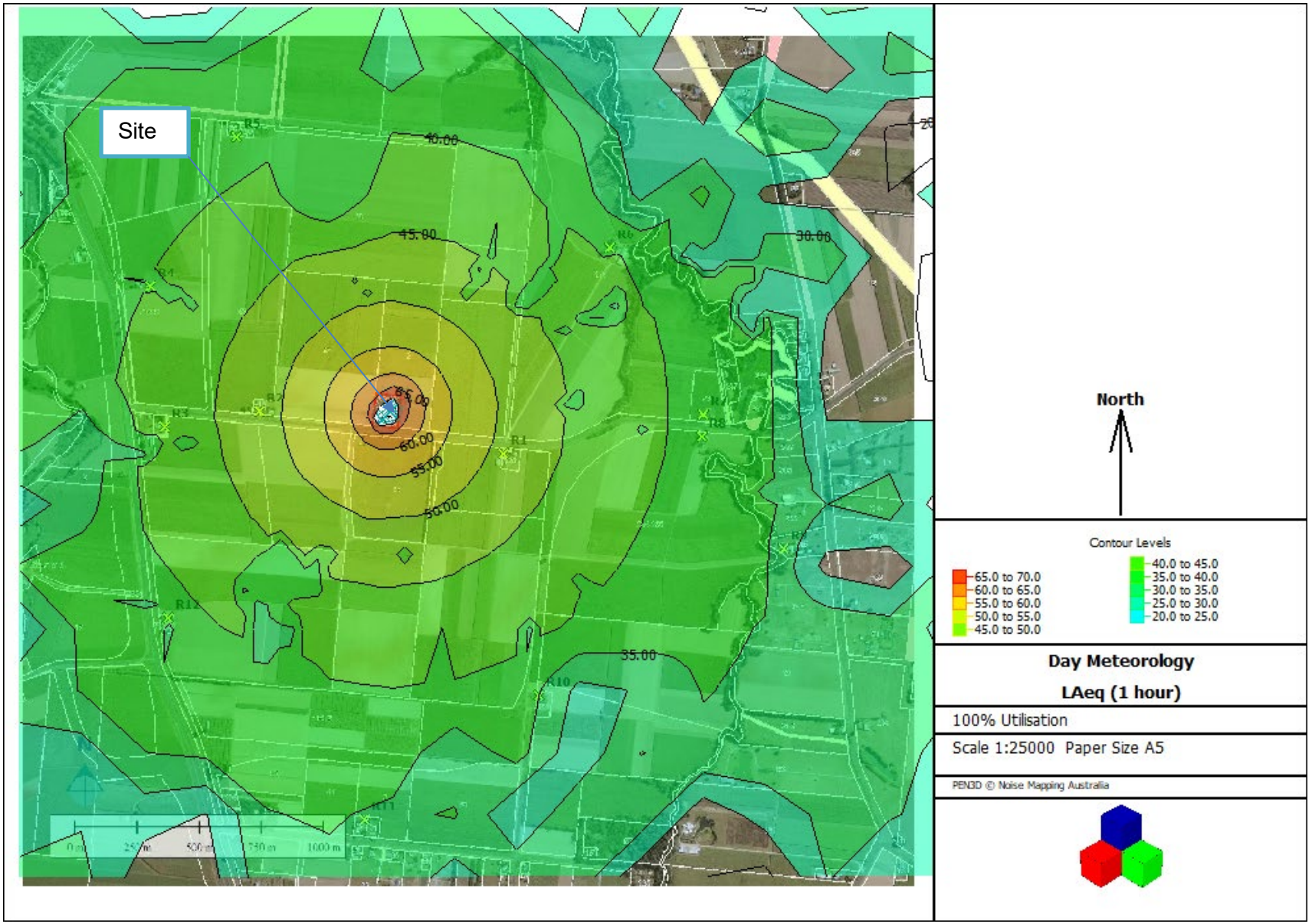
SLR Consulting Australia Pty Ltd, (2019) Muswellbrook Asphalt Plant Noise Impact Assessment Lot 14 DP 1119843 report No 630.12689-R01-v1.0

Sutherland, L.C. Piercy, H.E. Bass & L.B. Evans 1974. *Method for calculating the absorption of sound by the atmosphere*. Journal of the Acoustical Society of America 56, Supplement 1 (abstract).

Tonin, R. 1985, "*Estimating Noise Levels from Petrochemical Plants, Mines and Industrial Complexes*", Acoustics Australia, 1d3(2):59-67.

WHO 1999, *Guidelines For Community Noise*

Appendix A: Calculated $L_{Aeq\ 1hr}$ Noise Levels Contour Diagrams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40.00
45.00
30.00
65.00
60.00
55.00
50.00
35.00
North
Contour Levels
65.0 to 70.0
60.0 to 65.0
55.0 to 60.0
50.0 to 55.0
45.0 to 50.0
40.0 to 45.0
35.0 to 40.0
30.0 to 35.0
25.0 to 30.0
20.0 to 25.0
Day Meteorology
LAeq (1 hour)
100% Utilisation
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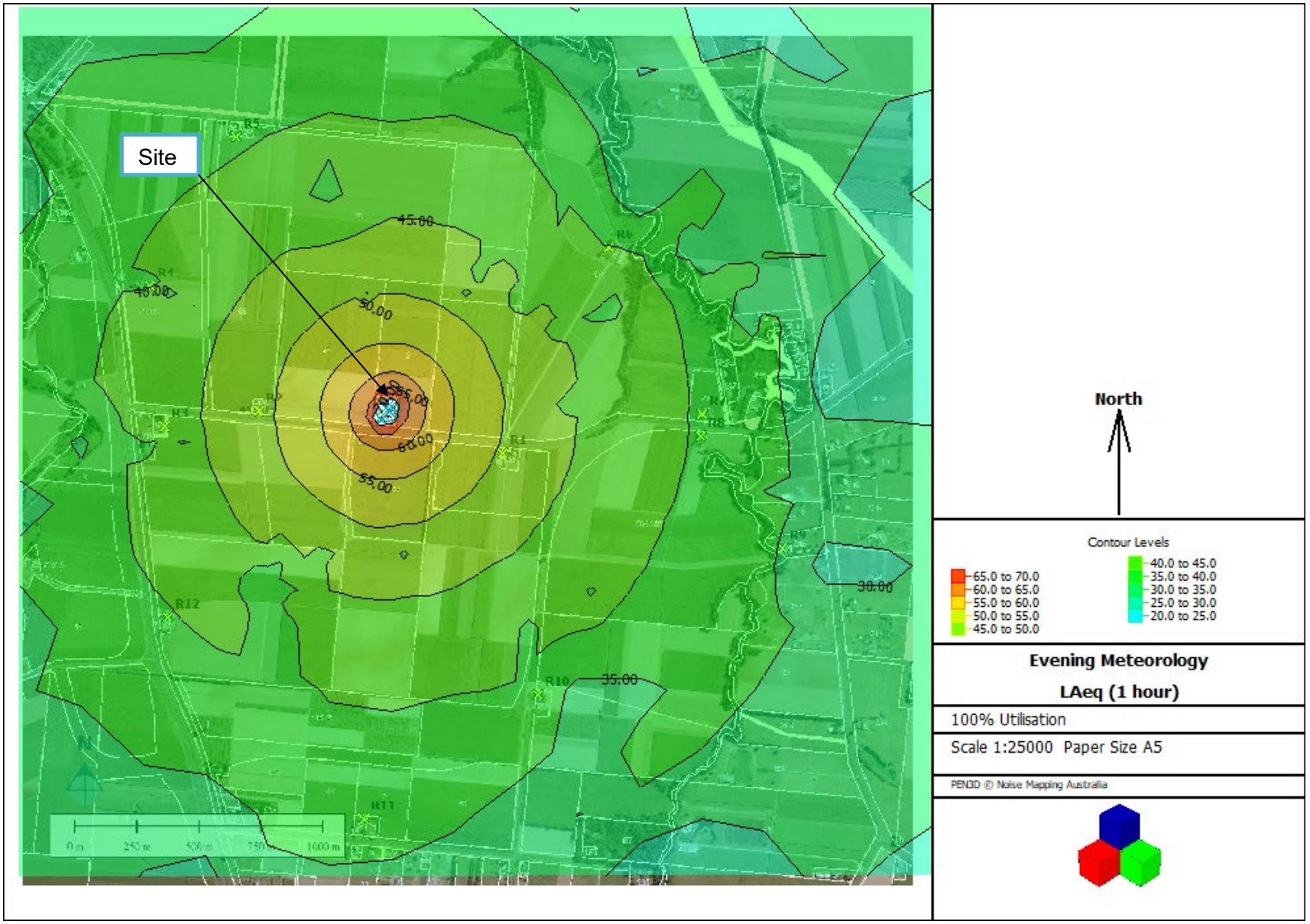
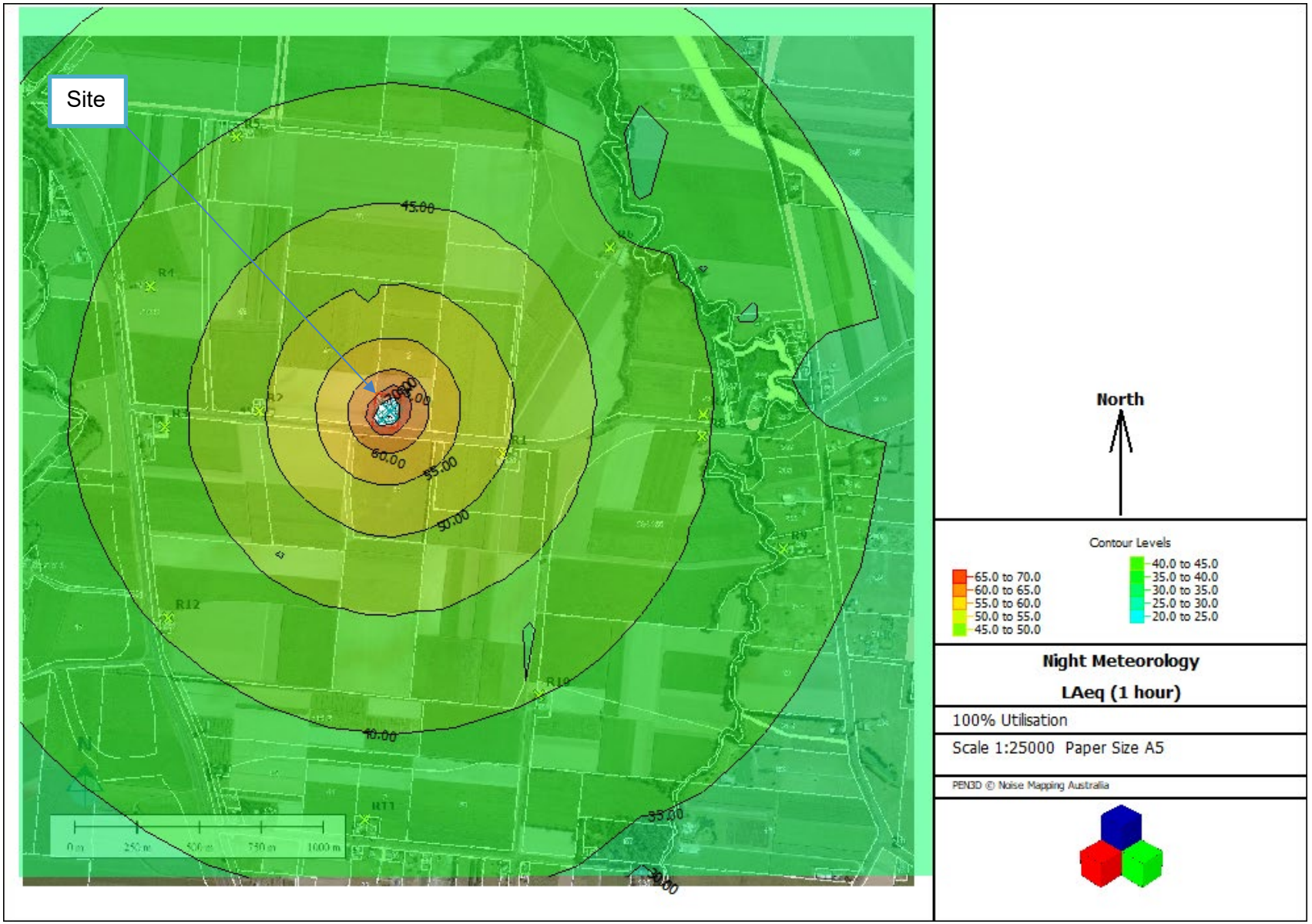
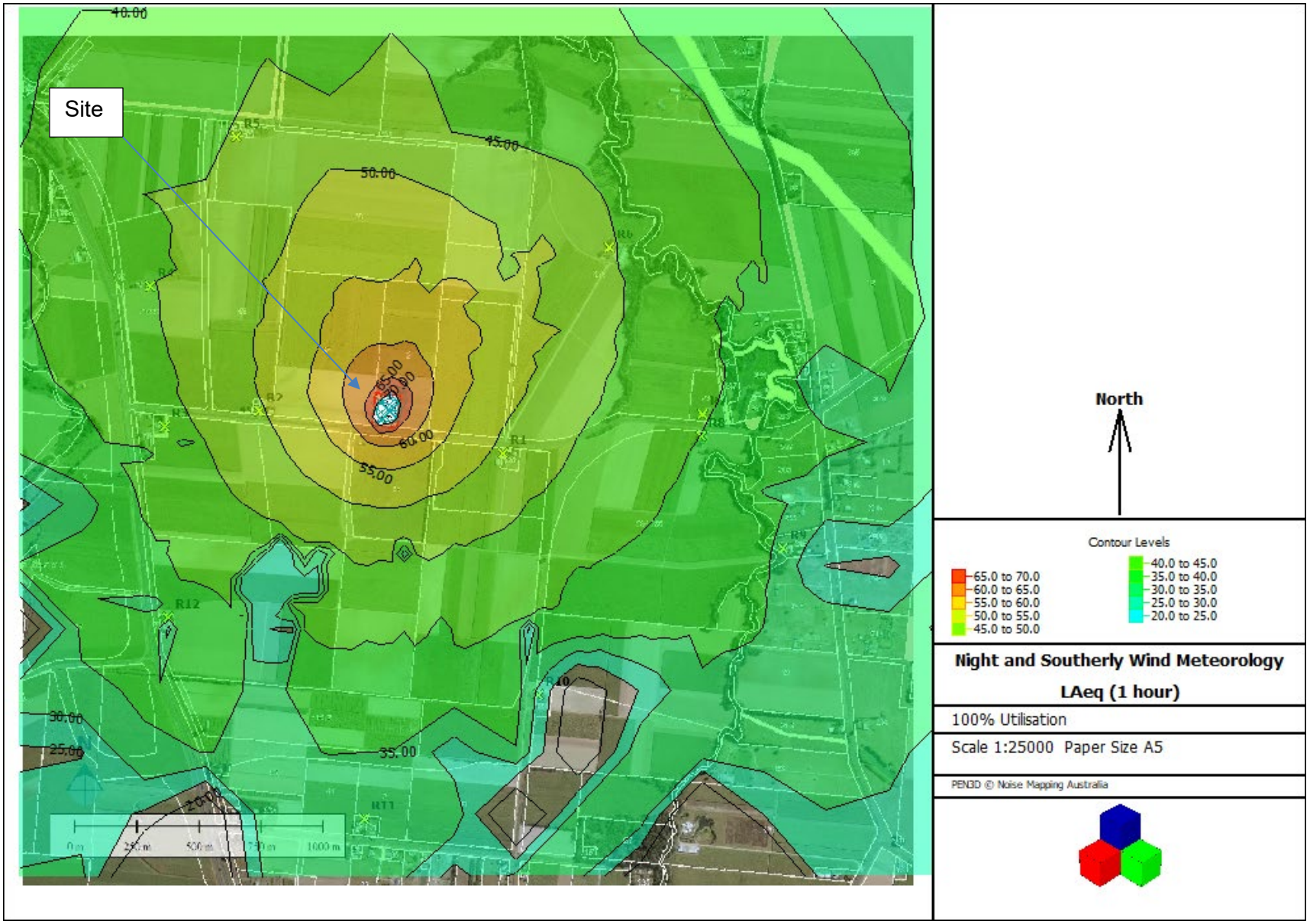
PEN3D © Noise Mapping Australia


Site
45.00
40.00
50.00
55.00
60.00
35.00
30.00
35.00
R1
R2
R3
R4
R5
R6
R7
R8
R9
R10
R11
R12
North
Contour Levels
65.0 to 70.0
60.0 to 65.0
55.0 to 60.0
50.0 to 55.0
45.0 to 50.0
40.0 to 45.0
35.0 to 40.0
30.0 to 35.0
25.0 to 30.0
20.0 to 25.0
Evening Meteorology
LAeq (1 hour)
100% Utilisation
Scale 1:25000 Paper Size A5
PEN3D © Noise Mapping Australia
0 m
250 m
500 m
750 m
1000 m


Site
45.00
60.00
55.00
50.00
40.00
35.00
R1
R4
R5
R7
R8
R9
R10
R11
R12
0 m
250 m
500 m
750 m
1000 m
North
Contour Levels
65.0 to 70.0
60.0 to 65.0
55.0 to 60.0
50.0 to 55.0
45.0 to 50.0
40.0 to 45.0
35.0 to 40.0
30.0 to 35.0
25.0 to 30.0
20.0 to 25.0
Night Meteorology
LAeq (1 hour)
100% Utilisation
Scale 1:25000 Paper Size A5
PEN3D © Noise Mapping Australia


Site
40.00
45.00
50.00
55.00
60.00
65.00
30.00
25.00
35.00
R12
R11
North
Contour Levels
65.0 to 70.0
60.0 to 65.0
55.0 to 60.0
50.0 to 55.0
45.0 to 50.0
40.0 to 45.0
35.0 to 40.0
30.0 to 35.0
25.0 to 30.0
20.0 to 25.0
Night and Southerly Wind Meteorology
LAeq (1 hour)
100% Utilisation
Scale 1:25000 Paper Size A5
PEN3D © Noise Mapping Australia

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Revision:	Date:	Status:	Comment:
220920D04	6 Nov 2022	Draft	Review by client
220920D04	8 Nov 2022	Final	Includes mitigation measures modelling and various typographical corrections

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1 Introduction

RPS Group on behalf of Koppen Construction Pty Ltd (KC), engaged Simpson Engineering Group (SEG) to prepare an air quality and odour assessment for an asphalt plant (the Project) within the Cairns State Development Area (SDA) area zoned as High Impact Industry. The site is situated on Warner Road, Wrights Creek.

SEG specifically has assessed air quality impacts from the site onto all nearby sensitive receptors.

This air quality assessment addresses the following issues:

- likely change in the air quality and odour environment following commencement of operations;
- development of appropriate air quality and odour goals;
- assessment of air quality and odour at sensitive receptors and comparison to goals; and,
- recommendations for relevant impact mitigation measures.

1.1 Locality Description

The project is situated in a well-established grazing and cane farming region. The location of the Project is shown on Figure 1. Edmonton is 5km to the NW and Gordonvale is approximately 5km to the south. The two closest dwellings are within approximately 500m from the site boundary.

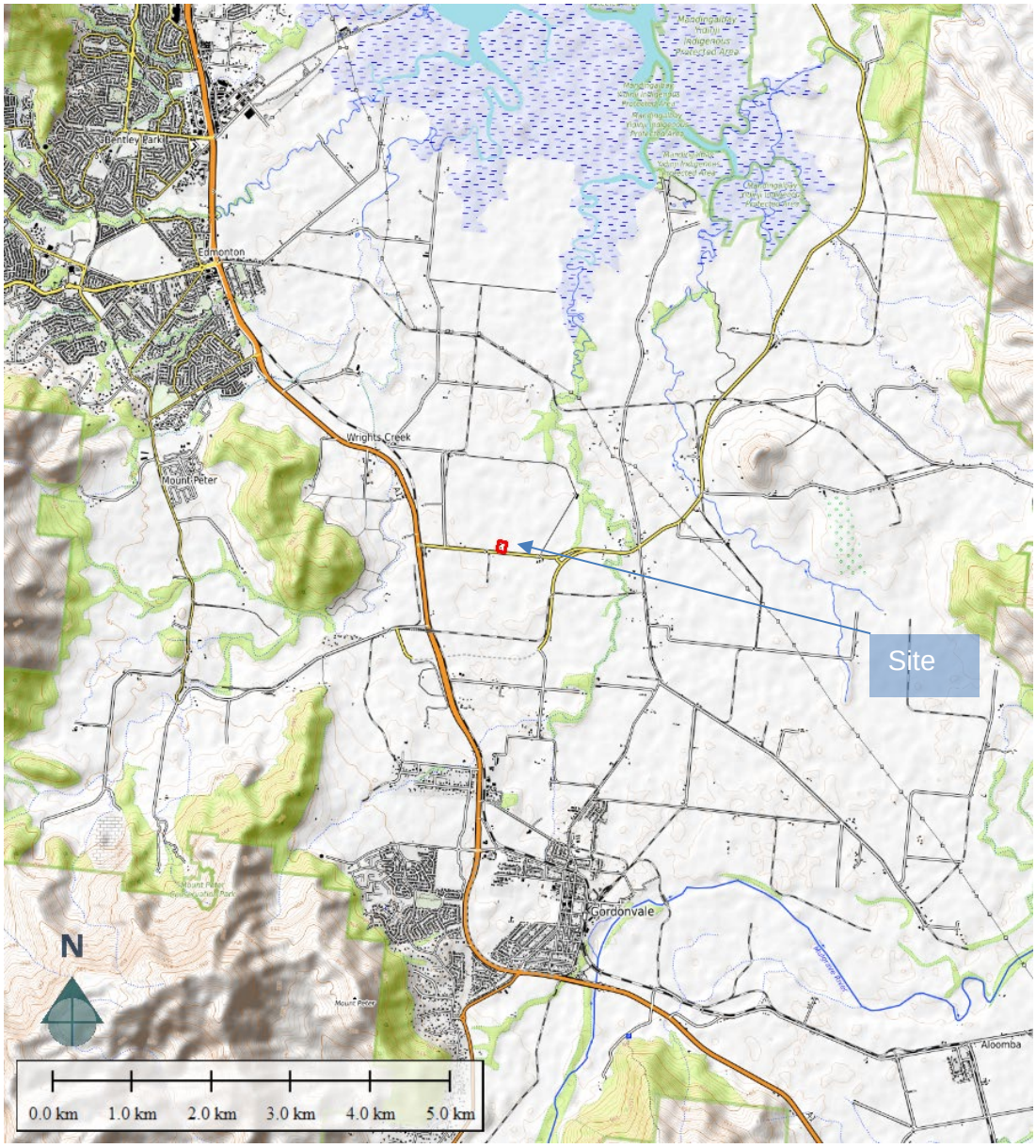


Figure 1: Site and Surroundings (North Up)

1.2 Description of the Proposed Development

The proposed Environmentally Relevant Activities to be undertaken on Lot 1 on RP717908 at 1010 Warner Road, Wrights Creek include:

- ERA 6 Asphalt manufacturing more than 1000t in a year.
- ERA 54 Mechanical Waste Reprocessing (1) operating a facility for mechanically reprocessing more than 5,000 tonne of inert, non-putrescible waste or green waste only in a year.

Koppens propose to reuse shredded tyres within the road asphalt and reuse road plannings or scrapings to recycle where feasible. Crumbing of tyres will occur on a separate site, however, road plannings or scrapings may need to be reprocessed through screening or sizing to be able to be reused within the operations.

The Asphalt and Concrete Plant development will generally consist of the following elements:

- Asphalt storage tanks, 27m tower and associated mixing plant (Capacity 160 tonnes per hour, 80,000 tonnes per annum)
- Reclaimed Asphalt plant (storage and reuse of 5,000 tonnes per annum)
- Raw material stockpiles
- Laboratory, site office, amenities buildings and carpark
- Concrete batching plant (Capacity 80m^3 per hour, average demand 40m^3 per 8-hours)
- General truck movement areas loading and unloading locations
- Associated miscellaneous infrastructure

It is proposed that the site operate 7am to 6pm Monday to Saturday. However, from time to time it will be necessary to operate throughout the night, i.e. 24 day and potentially 7 days a week.

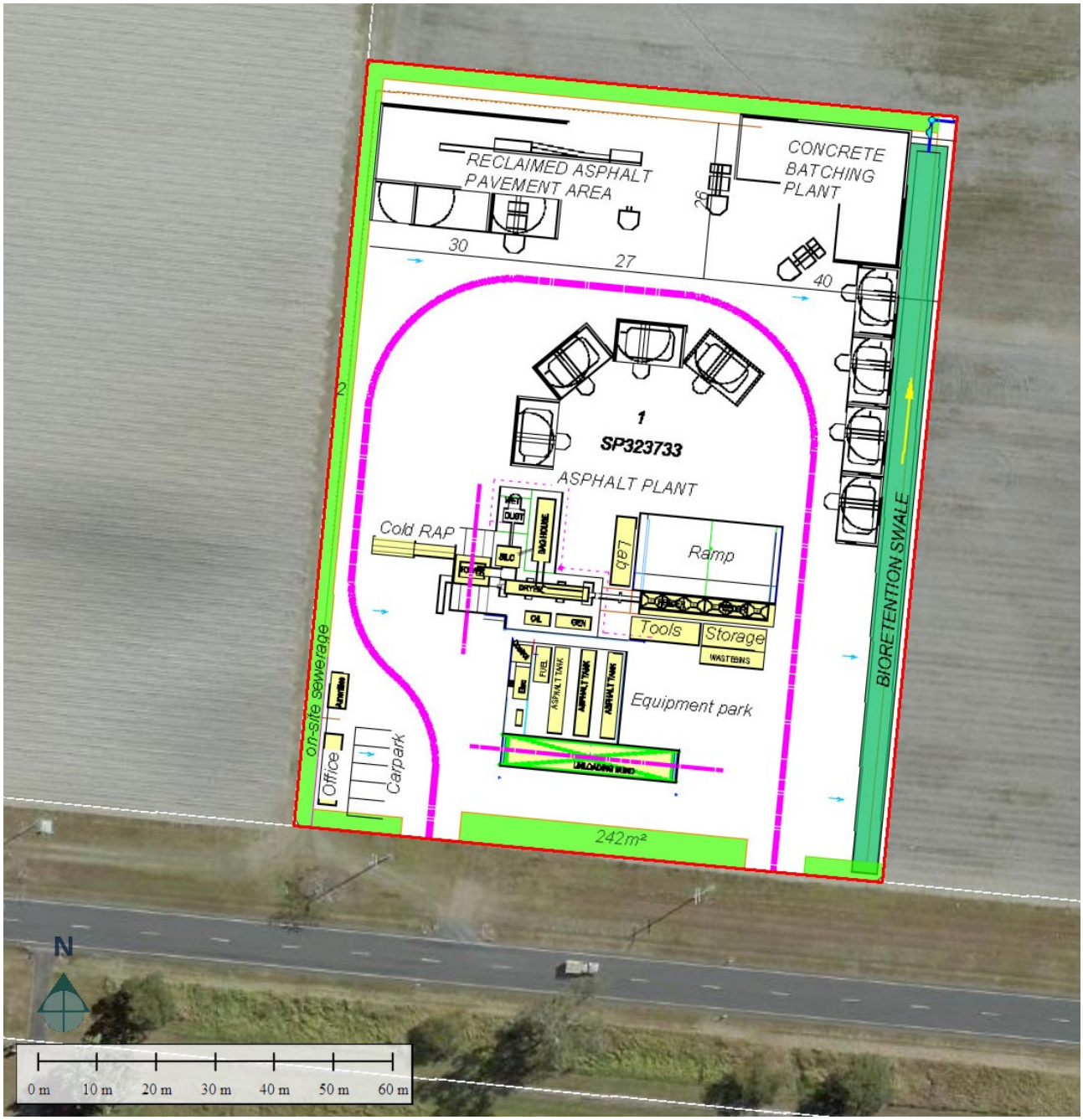


Figure 2: Site Layout (North up)

2 Air Quality Criteria

2.1 Cairns Regional Council

Cairns Regional Council 9.3.2 Environmental performance code is designed to ensure development is designed and operated to avoid or mitigate impacts on sensitive receiving environments. The requirements of code are described in Table 1.

Table 1: Environmental Performance Code Extract

Table 9.3.2.3.a – Environmental performance code – benchmarks for assessable development	
Odour	
PO2 Potential odour causing activities associated with the development are avoided through design, location and operation of the activity. *Note – Planning Scheme Policy – Environmental Management Plans provides guidance on preparing a report to demonstrate compliance with the purpose and outcomes of the Code.*	AO2.1 The development does not involve activities that create odorous air emissions; or AO2.2 The use does not result in odour that causes environmental harm or nuisance with respect to surrounding land uses.
Airborne particles and other emissions	
PO4 Potential airborne particles and emissions generated from the development are avoided through design, location and operation of the activity. *Note – Planning Scheme Policy – Environmental Management Plans provides guidance on preparing a report to demonstrate compliance with the purpose and outcomes of the Code.*	AO4.1 Development does not involve activities that will result in airborne particles or emissions being generated; or AO4.2 The design, layout and operation of the development activity ensures that no airborne particles or emissions cause environmental harm or nuisance. *Note – Examples of activities which generally cause airborne particles include spray painting, abrasive blasting, manufacturing activities and car wash facilities.* *Note – Examples of emissions include exhaust ventilation from basement or enclosed parking structures, air conditioning/refrigeration ventilation and exhaustion.* *Note – The Environmental Protection (Air) Policy 2008, Schedule 1 provides guidance on air quality objectives to ensure environmental harm (including nuisance) is avoided*.

Cairns Regional Council 9.3.4.1 Industry design Code purpose is to ensure that industry activities and areas protect public safety, provide a high quality of design and amenity and are appropriately located to ensure their long-term viability. The requirements of noise are described in Table 2

Table 2: Industry Design Code Extract

<table>
<tr><td colspan="2">Table 9.3.4.3.a – Industry design code – benchmarks for assessable development and requirements for accepted development</td></tr>
<tr><td colspan="2">Air and Noise Pollution</td></tr>
<tr><td>PO9

Development should not result in sensitive land uses being exposed to air, noise and odour emissions from industrial uses, major sport, recreation and entertainment facilities or other noisy sport and recreation activities that have the potential to adversely impact on human health, amenity and wellbeing.

Editor's note – Noisy sport and recreation activities include shooting and motor sport facilities.</td><td>AO9.1

The use is designed to ensure that:

a) the indoor noise objectives set out in the Environmental Protection (Noise) Policy 2019 are met;
b) the air quality objectives in the Environmental Protection (Air) Policy 2019, and any relevant national or international standard (for example the World Health Organisation Guidelines for Air Quality 2000) are met;
c) noxious and offensive odours are not experienced at the location of sensitive land uses.

Editor's note – The Queensland odour impact assessment guideline, available from the Department of Environment and Heritage Protection website, provides a methodology for assessing odour impacts. www.ehp.qld.gov.au.

Note – Design measures may include:

1) landscape buffers and physical barriers such as fences and that set appropriate setback/separation distances
2) adequate allotment design that reduces impacts of emissions
3) adequate construction materials and positioning of rooms and windows to mitigate impact of emissions.</td></tr>
</table>

2.2 Guideline ESR/2015/1840 ERA

The Guideline ESR/2015/1840 ERA describes types of impacts that environmentally relevant activities can have in relation to air and outlines the information to be provided to the department as part of the ERA application process.

There are three key areas to be identified and addressed through the ERA application process:

- Identify the environmental values of the receiving air environment including the identification of any nearby sensitive places.
- Identify the possible impacts due to the proposed activity and all associated risks to environmental values.
- Identify the strategies to mitigate the identified risks to the environmental values

It is necessary to identify the environmental values of the site, this is assisted by the following:

1. Describe the surrounding land
2. Use of a scaled map with site and sensitive receptors
3. Describe site topography
4. Analyse and describe the prevailing site wind direction and speed.
5. Provide a description of the localised ambient air quality.

The department seeks to determine possible impacts to identified environmental values. To assist with this the following information is sought:

1. Identify and provide an overview of emissions and processes.
2. Describe the characteristics of the emissions
3. Identify if an odour impact assessment is required
4. Describe how air emissions will be avoided, minimised or otherwise managed in accordance with the EPP (Air).

Once the value and risk of each impact to the environmental value is known, mitigation strategies can be devised to address the risk. When selecting a mitigation strategy, the following will be provided:

1. Describe the control measure including equipment and techniques used.
2. Identify contingency plans in case of failure in a control measure

2.3 Environmental Protection (Air) Policy

The Queensland Environmental Protection (Air) Policy 2019 (EPP(Air) 2019) commenced in 2019. The EPP (Air) 2019 (Part 2 Section 5) aims to achieve the object of the *Environmental Protection Act 1994* (the Act) in relation to Queensland's air environment. The object of the Act is "... to protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (ecologically sustainable development)."

Specifically, the EPP (Air) 2019 addresses the environmental values to be enhanced or protected namely—

(a) the qualities of the air environment that are conducive to protecting the health and biodiversity of ecosystems; and

(b) the qualities of the air environment that are conducive to human health and wellbeing; and

(c) the qualities of the air environment that are conducive to protecting the aesthetics of the environment, including the appearance of buildings, structures and other property; and

(d) the qualities of the air environment that are conducive to protecting agricultural use of the environment .

To meet the environmental values, Schedule 1 of the EPP (Air) nominates relevant air quality indicators and goals. Relevant air quality indicators from Schedule 1 dealing with emissions and particulates are included in Table 1.

Table 3: Selected Design Ground Level Concentrations for Sensitive Receptors (EPP(Air) Air quality objectives)

Pollutant Type	Design Concentration (including background)	Averaging Period	Environmental Value
$PM_{2.5}$	25 µg/m^3	24 hours	health and wellbeing
	8 µg/m^3	Annual average	health and wellbeing
PM_{10}	50 µg/m^3	24 hours	health and wellbeing
	25 µg/m^3	Annual average	health and wellbeing
TSP	90 µg/m^3	Annual average	health and wellbeing
NO_2	250 µg/m^3	1 hours	health and wellbeing
	62 µg/m^3	Annual average	health and wellbeing
	33 µg/m^3	Annual average	health and biodiversity of ecosystems
CO	11000 µg/m^3	8 hours	health and wellbeing
SO_2	570 µg/m^3	1 hour	health and wellbeing
	229 µg/m^3	24 hours	health and wellbeing
	57 µg/m^3	Annual average	health and wellbeing
	31 µg/m^3	Annual average	protecting agriculture
	21 µg/m^3	Annual Average	health and biodiversity of ecosystems
Benzene	590 µg/m^3	Annual Average	health and wellbeing
Ethylbenzene	8,000 µg/m^3	1 hour	health and wellbeing
Toluene	958 µg/m^3	1 hour	odour

	4,100 µg/m^3	24 hour	health and wellbeing
	410 µg/m^3	Annual Average	health and wellbeing
Xylenes	1,200 µg/m^3	24 hour	health and wellbeing
	950 µg/m^3	Annual Average	health and wellbeing

Note 1: µg/m^3 is a measure of the concentration of pollutant in the atmosphere and is in micrograms per cubic meter of air

Particulates are often described as respirable and inhalable. Respirable particulates are those small enough to penetrate the nose and deep into the lung. Respirable particulates that penetrate past the nose and upper respiratory system are likely to be retained in the body. This involves Particulates having an aerodynamic diameter of up to 10 µm. Inhalable particulates are particulates which enter the body but are collected in the nose and upper respiratory system and rejected. Inhalable particulates are those having an aerodynamic diameter of nominally 10 µm and larger.

As a general guide particulates having diameters of 7 to 10 µm are mostly large enough to be caught by nose and throat. Particles in the range 0.5 to 7 µm are small enough to reach the lung yet large enough to be retained. Since these particulates remain in the lung they may be hazardous to health and well-being.

Odour Limits

The odour limits are described in the Queensland Guideline - Odour Impact Assessment from Developments. Specifically, the modelled odour concentrations at the "most exposed sensitive receptors" should be compared with the following guideline values.

- 0.5 OU, 1-hour average, 99.5th percentile for tall stacks
- 2.5 OU, 1-hour average, 99.5th percentile for ground-level sources and down-washed plumes from short stacks

These guideline values are based upon application, to the default annoyance threshold of 5 OU, of conservative default peak to mean ratios 10:1 for tall stacks and 2:1 for ground-level or down-washed plumes from short stacks.

In adopting a one hour average criteria, which simplifies dispersion modelling, it is considered necessary to distinguish essentially ground level sources and stacks. This is because the peak to mean ratios in each case and hence concentration fluctuations over the hour are expected to vary significantly and thus dual criteria are considered the fairest approach. It is noted that researchers are undertaking studies to more reliably define peak to mean ratios in a variety of scenarios. EPA will refine guidelines in the light of generally accepted research findings. Note that it is generally accepted that if a stack complies with the criteria in the USEPA Good Engineering Practice (1985) guidance (that is 2.5 times higher that any nearby building) then building downwash is unlikely to occur.

An OU is an odour unit and is defined as the concentration of odourant(s) at standard conditions that is just detectable by 50% of the population. This is detection limit, not an odour identification limit which is usually significantly higher.

A sensitive receptor includes residential dwellings and residential premises and the curtilage attached to the premises.

There are essentially two odour emission points:

1. Dryer stack (taken to be a tall stack and having a 10:1 peak-to-mean ratio) and a limit of 0.5 OU, 1- hour average, 99.5th percentile
2. Loading and tarping an asphalt batch onto trucks (taken to be a ground based source and having a 2:1 peak-to mean ratio) and a limit of 2.5 OU, 1-hour average, 99.5th percentile.

2.4 NEPM

The current National Environment Protection (Ambient Air Quality) Measure (NEPM) has been reviewed iand it is noted more stringent standards than the EPP(Air) apply for two pollutants. These are detailed in Table 4.

Table 4: Selected Design Ground Level Concentrations for Sensitive Receptors (NEPM)

Pollutant Type	Design Concentration (including background)	Averaging Period	Environmental Value
NO_2	167 µg/m^3	1 hours	health and wellbeing
	31 µg/m^3	annual average	health and wellbeing
SO_2	285 µg/m^3	1 hour	health and wellbeing
	57 µg/m^3	24 hours	health and wellbeing

2.5 Site Specific Air Quality Criteria

In summary, the applicable dust quality criteria (from EPP Air and NEPM) are:

- Particulate concentration of $PM_{2.5}$ 25 µg/m^3 averaged over 24 hours;
- Particulate concentration of $PM_{2.5}$ 8 µg/m^3 averaged over one year;
- Particulate concentration of PM_{10} of 50 µg/m^3 over a 24-hour averaging time;
- Particulate concentration of PM_{10} of 25 µg/m^3 over one year;
- Total suspended particulate 90 µg/m^3 averaged over a year; and,
- Dust deposition of 120 mg/m^2/day averaged over one month;

All these indicators (except deposition) are qualities of the air environment that are important to human health and wellbeing. The deposition (or dust fallout) is for assessing dust nuisance.

The applicable goal from odour at the sensitive receptor comprises:

- 0.5 OU, 1-hour average, 99.5th percentile for tall stacks; and
- 2.5 OU, 1-hour average, 99.5th percentile for ground-level sources and down-washed plumes from short stacks.

The air pollution limits are contained in Table 5.

Table 5: Ground Level Concentrations for Sensitive Receptors

Pollutant Type	Design Concentration (including background)	Averaging Period	Environmental Value
NO_2	167 µg/m^3	1 hours	health and wellbeing
	31 µg/m^3	Annual average	health and wellbeing
	33 µg/m^3	Annual average	health and biodiversity of ecosystems
CO	11000 µg/m^3	8 hours	health and wellbeing
SO_2	285 µg/m^3	1 hour	health and wellbeing
	57 µg/m^3	24 hours	health and wellbeing
	57 µg/m^3	Annual average	health and wellbeing
	31 µg/m^3	Annual average	Protecting agriculture

	21 µg/m^3	Annual Average	health and biodiversity of ecosystems
Benzene	590 µg/m^3	Annual Average	Health and wellbeing
Ethylbenzene	8,000 µg/m^3	1 hour	Health and wellbeing
Toluene	958 µg/m^3 4,100 µg/m^3 410 µg/m^3	1 hour 24 hour Annual Average	Odour Health and wellbeing Health and wellbeing
Xylenes	1,200 µg/m^3 950 µg/m^3	24 hour Annual Average	Health and wellbeing Health and wellbeing

Note 1: µg/m^3 is a measure of the concentration of pollutant in the atmosphere and is in micrograms per cubic meter of air

3 Air Pollution

3.1 Air Emissions Inventory

The estimated emission from the asphalt plant have been based on the National Pollution Inventory "Emission Estimation Technique Manual for Hot Mix Asphalt Manufacturing" from June 1999. The dryer stack details have been obtained from Muswellbrook Asphalt Plant Air Quality Impact Assessment (SLR2019).

The client advised the typical production rate will be 300tonnes production of asphalt per 12 hour working day with peak production being 600 tonnes of asphalt per 12 hour working day. This assessment is based on the peak production of 600 tonnes during the day. It is understood that from time to time it may be necessary to work at night and the peak production is also applied to the night period. Consequently, the case modelled comprises peak production of 1200 tones over a 24 hour period throughout the year. Thus, the modelled results will significantly overestimate the long-term averages (30 day to a year), but appropriately model short averaging periods, i.e. up to 24 hours.

In the batch mixing process, the aggregate is transported from storage piles and is placed in the appropriate hoppers of a cold feed unit. The material is metered from the hoppers onto a conveyor belt and is transported into a gas fired rotary dryer. Although a batch process the plant can potentially run almost continuously.

As hot aggregate leaves the dryer, it drops into a bucket elevator and is transferred to a set of vibrating screens that drops the aggregate into individual hot bins according to size. To control aggregate size distribution in the final batch mix, the operator opens various hot bins over a weigh hopper until the desired mix and weight for individual components are obtained. Recycled asphalt pavement may also be added at this point. Concurrent with the aggregate being weighed, liquid bitumen is pumped from a heated storage tank to an asphalt bucket, where it is weighed to achieve the desired mix.

Dryer Stack

The most significant source of emissions from hot mix asphalt plants is the dryer. Combustion emissions from the dryer include products of complete and incomplete combustion. The dryer stack parameters and emission rates are contained Table 6. These parameters are for an uncontrolled process.

Table 6: Dryer Stack Modelling Parameters and Emission Rates (uncontrolled)

Parameter	Value	Source
Temperature	350°C	SLR 2019
Stack Height	18m	Client
Stack diameter	1.5m	Client
Hours of operation	24 hours	Client
Emission Rates		
Odour	10,322 OU/s	SLR 2019
PM_{10}	0.42 g/s	NPI
$PM_{2.5}$	0.42 g/s	NPI
CO	0.49 g/s	NPI
NOx	1.17 g/s	NPI
SO_2	1.67 g/s	NPI
Benzene	0.0028 g/s	NPI
Toluene	0.01 g/s	NPI
Xylene	0.0011	NPI

The plant contains a baghouse for emissions from the dryer stack. NPI rates baghouse efficiency between 99 to 99.9% efficient for $PM_{2.5}$ and PM_{10}. This would result in operational dust emissions to less than 0.0042g/s. Modelling has been conducted with the baghouse not in operation to demonstrate the effects if controls are not in operation.

Diesel Generator

Diesel generators may be used at this site to provide electricity. Maximum electricity generation during process operations is usually less than 500 kilowatts (kW), with rates of 20 to 50 kW at other times. Emissions for the diesel generation have been based on the NPI Emission estimation technique manual for Combustion engines Version 3.0 from June 2008. It is assumed the diesel generator has a 500kW power unit. Refer to Table 7.

It is relevant to note the CO emissions from both the dryer and the diesel engine are similar. However, NOx emissions from the diesel generator exceed that from the dryer stack. This implies the diesel generator, if installed would be a major source.

Table 7: Diesel Exhaust Stack Modelling Parameters and Emission Rates

Parameter	Value	Source
Temperature	350 °C	SEG
Stack Height	18 m	SEG
Stack diameter	0.2 m	Data sheet
Hours of Operation	24 hours	Client
Emission Rates		
PM_{10}	0.059	NPI
$PM_{2.5}$	0.058	NPI
CO	0.458 g/s	NPI
NOx	2.08 g/s	NPI
SO_2	0.00003 g/s	NPI

Load Out

The truck loading and tarping are fugitive odour sources. It is understood that truck loading (typical 15 tonne batch) takes up to 10 minutes. After the batch is loaded the truck tray is tarped to help maintain the heat in the mix.

The odour emission rates from the load out operation at the proposed plant were estimated based on SLR Muswellbrook plant (SLR2016) of the same plant. The emission estimate is based on an area source of 3m by 5m (truck bed) and having a total emission rate of 3,000 ou/s.

Storage Tank Heater

The bitumen storage tank heater is diesel fired with a fuel consumption of 64 kg/hour when is use. The emission factors for Asphalt Oil Heaters are described in the NPI. It is assumed the emissions from the boiler are ducted to the Dryer stack. Refer to Table 8 for modelling parameters for the Storage Tank Heater.

Table 8: Modelling Parameters for Storage Tank Heater

Parameter	Value	Source
Temperature	350 °C	SEG
Stack Height	18 m	SEG
Stack diameter	1.5 m	Data sheet
Fuel consumption	64 kg/h of diesel	Data sheet
Hours of operation	24 hours	Client
Emission Rates		
PM_{10}	0.002489 g/s	NPI
$PM_{2.5}$	0.000533 g/s	NPI
CO	0.012089 g/s	NPI
NOx	0.048356 g/s	NPI
SO_2	0.000343 g/s	NPI
PAH	0.000004 g/s	NPI
VOC	0.000484 g/s	NPI

Storage Tanks

Storage tanks are used to store fuel oils and heated liquid asphalts at hot mix asphalt plants and may be a source of VOC emissions. Emissions from fixed-roof tanks (closed or enclosed) are generally divided into two categories: working losses and breathing losses. Tank working losses refer to the combined loss from filling and emptying the tank. Filling losses occur when the VOCs contained in the saturated air are displaced from a fixed-roof vessel during loading. Emptying losses occur when air drawn into the tank becomes saturated and expands, exceeding the capacity of the vapour space. Breathing losses are the expulsion of vapour from a tank through vapour expansion caused by changes in temperature and pressure. Emissions from bitumen tanks are particularly low, due to their low vapour pressure. Thus, in accordance with NPI advice of low emissions the bitumen tanks are not modelled.

Concrete Batching Plant.

The concrete batching plant is a source of particulates. The emission factors have been sourced from NPI Emission Estimation Technique Manual for Concrete Batching and Concrete Product Manufacturing. Table 9 contains the emission factors for the concrete batching plant. Concrete batching plant was modelled at the rate of 80 m3/hr but the likely usage is 40m^3 in an 8-hour period.

Table 9: Modelling Parameters for Concrete Batching Plant

Parameter	Value	Source
Area source	30m by 50m	Site map
Concrete production	80 m^3/hr	client
Hours of operation	7am to 6pm	client
Emission Rates (NPI Table 6 Uncontrolled Emissions) (g/s)		
Process	PM_{10}	$PM_{2.5}$
Sand & aggregate transferred	0.000444	0.000056
Cement unloading	0.003810	0.000476
Weight Hopper loading	0.000348	0.000043
Mixer Loading	0.000696	0.000087
Truck Loading	0.000348	0.000043

The site design and layout features windbreaks that would add a 30% control factor to the emissions.

3.2 Background Air Quality

The Department of Environment and Science (DES) conducts monitoring of various air pollution at several sites throughout Queensland. The background concentrations for Benzene, Toluene and Xylene are from the DES monitoring site Memorial Park (Gladstone Region). The background concentrations for NO, NO_2, NO_x and SO_2 are from the DES monitoring site North Ward (Townsville Region). The background concentrations for CO is from the DES monitoring site Boyne Island (Gladstone Region). It is based on monitoring data from 2017 to 2021.

Table 10: Assumed Background Levels

Pollutant	Time Period	Value [µg/m^3]
Benzene	Annual Average	4.7
Toluene	Annual Average	8.2
	24 Hour 70th Percentile	8.9
	1 Hour 70th Percentile	9.8
Xylene	Annual Average	33.5
	24 Hour 70th Percentile	33.2
CO	8 hour	30.8
NO	24 Hour 70th Percentile	1.9
	1 Hour 70th Percentile	2.2
NO_2	24 Hour 70th Percentile	5.5
	1 Hour 70th Percentile	6.1
NOx	24 Hour 70th Percentile	8.1
	1 Hour 70th Percentile	8.6
SO_2	24 Hour 70th Percentile	1.4
	1 Hour 70th Percentile	2.8
SO_2	8 Hour 70th Percentile	31
	1 Hour 70th Percentile	1.2

Based on the most recent published DES Queensland National Environment Protection (Ambient Air Quality) Measure monitoring of dust deposition and average PM_{10}, $PM_{2.5}$ monitoring for Townsville[1] the expected particulate and dust exposure levels at all receptor locations at are:

- Dust deposition of 11.6 mg/m^2/day
- Particulate concentration of:
    - $PM_{2.5(24\ hour)}$ = 8 µg/m^3
    - $PM_{2.5(annual\ average)}$ = 7 µg/m^3
    - $PM_{10(24\ hour)}$ = 22 µg/m^3
    - $PM_{10(annual\ average)}$ = 16 µg/m^3

3.3 Air Pollution Model

The model Calpuff was used to model the dispersion of pollutants from the asphalt plant and concrete patching plant. The model is an approved model for modelling these types of sources. Specifically, the model comprised:

(i) One stack sources for the dryer
(ii) One point source for the diesel generator exhaust. This may be ducted to the dryer stack or independent
(iii) One area source for the truck loading and tarping
(iv) One area source for the concrete batching plant and operations.

Refer to Figure 3 for the location of the sources. The Lakes Environment Pre/Processor was used to prepare all datafiles for Calpuff as well as Calmet.

[1] *Queensland air monitoring 2019, Queensland Government, State of the Environment, (https://www.qld.gov.au/__data/assets/pdf_file/0032/68657/air-monitoring-report.pdf)*

Figure 3: Locations for Air Pollution, dust and Odour Sources

3.3.1 Receptor Locations

Calpuff provides results on a computational grid as well as at discrete receptors. The computational grid is approximately 4km by 4km and grid spacing of 100m. The modelling domain greatly exceeds the site. However, the discrete receptors are used to produce contours and detailed calculation at each sensitive receptor.

The modelling has been carried out at modelling heights of 0m. Contours have been presented for each pollutant, odour and dusts. Calculations at each of the receptor locations has also been carried out.

3.4 Meteorology

To determine the likely meteorology for the site a TAPM meteorological model was developed. Specifically, the TAPM model based on a 2-year modelling simulation period 2020 & 2021 and was resolved to a 300m inner grid with 40 by 40 grid points. Five nested gridded domains were processed with grid spacings of 30000m, 10000m, 3000m, 1000m and 300m. Since the terrain surrounding the site is at most gently undulating a grid finer than 300m is unlikely to produce significantly different results. Additionally, the adoption of 300m grid means that the closest grid point to the subject site is 150m away from the site, improving interpolation accuracy. Simulation tests carried by Hurley et al (2005) indicate that even with a 3 km grid spacing, winds are predicted well, with no significant bias. Hence the adoption of 300m inner grid is expected to provide an accurate prediction of winds for the subject site.

The meteorological file was nudged with 2 years of hourly data obtained from the Bureau of Meteorology and DES at 12 locations. A summary of the sites and location is included in Table 11.

Table 11: Meteorology Nudge Sites

Site	Data Source	Latitude	Longitude
Coastguard	DES	-19.2542	146.8257
Enviroment Park	DES	-19.2631	146.8308
Lennon Drive	DES	-19.2589	146.8264
North Ward	DES	-19.2486	146.8074
Abbot Point	DES	-19.9496	148.0482
Ayr	DES	-19.5839	147.4059
31222 CAIRNS RACECOURSE	BOM	-16.9463	145.7474
31011 CAIRNS AERO	BOM	-16.8736	145.7458
31210 MAREEBA AIRPORT	BOM	-17.0704	145.4293
200879 ARLINGTON REEF	BOM	-16.7226	146.1124
32197 INNISFAIL AERODROME	BOM	-17.5581	146.0119
32037 SOUTH JOHNSTONE EXP STN	BOM	-17.6053	145.9972

TAPM predicts meteorology and optionally pollutant concentration for a range of pollutants important for air pollution applications. The model consists of coupled prognostic meteorological and air pollution concentration components, eliminating the need to have site-specific meteorological observations. Instead, the model predicts the flows important to local-scale air pollution, such as sea breezes and terrain induced flows, against a background of larger-scale meteorology provided by synoptic analyses.

Initially the 3D wind data was transferred from TAPM into Calmet (using Caltapm). Within Calmet a 100m wind grid of 100 by 100 points adopted.

3.4.1 Meteorology Validation

Windroses for the site were prepared for the subject year. This is included in Appendix A: Windroses and Meteorological Data Analysis. The wind roses for Cairns Aero[2] from the Bureau of Meteorology are also included in the appendix.

The two wind roses show high correlation for wind speed and wind direction. This validates that the modelled meteorology modelled is representative for the site and the general trends of the area.

[2] *Wind Speed and direction rose http://www.bom.gov.au/climate/averages/tables/cw_031011.shtml*

3.5 Calculated Pollutant Concentration

The calculated pollutant concentrations were determined for each sensitive receptor and a 40 by 40 gid with 100m spacing over the site. A summary of the results is included in:

- Table 14: Calculated Pollutants for Each Sensitive Receptor
- Table 15: Calculated BTEX Pollutants for Each Sensitive Receptor
- Table 16: Calculated Odour Exposure for Each Sensitive receptor

Emission rates of Ethylbenzene is not provided in literature. However, VOC (volatile organic compounds) and PAH (polycyclic aromatic hydrocarbons) emission rates are provided. Since Ethylbenzene is both a VOC and PAH, it is conservatively assumed Ethylbenzene may be modelled by the maximum of either VOC or PAH.

The calculated pollution contours are contained in **Appendix C.**

PM_{10} 24-hour maximum in Table 12 shows an exceedance of goals at R2 for one time period with a value of 35.6 µg/m^3 plus background of 22 µg/m^3 to give a value of 51.7 µg/m^3 exceeding the goal of 50 µg/m^3. By tracing the source of the pollution that makes up the 35.6 µg/m^3 it was found that the concrete batching plant contributed 34.9 µg/m^3. The values presented in Table 12 for the concrete batching pant do not include site controls. The site is designed to include windbreaks in the design. Modelling with the windbreak has been included in Table 13.

Table 12: Calculated Particulates for Each Sensitive Receptor Including Background Levels.

Pollutant	$PM_{2.5}$		PM_{10}		TSP	Dust Dep
Averaging Time	24 Hour	Annual	24 Hour	Annual	Annual	
Criteria	25	8	50	25	90	120
Background	8	7	22	20	30	12
Receptor	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	mg/m2/month
R1	9.4	7.0	26.1	20.2	30.2	24.4
R2	13.2	7.5	51.7	22.9	32.9	32.6
R3	11.9	7.2	39.5	21.0	31.0	23.3
R4	10.8	7.3	35.9	21.3	31.3	29.0
R5	11.3	7.5	37.5	22.9	32.9	40.6
R6	8.6	7.0	19.1	20.0	30.0	14.0
R7	8.4	7.0	18.3	20.0	30.0	13.1
R8	8.3	7.0	17.4	20.0	30.0	13.1
R9	8.2	7.0	17.3	20.0	30.0	12.5
R10	8.6	7.0	19.7	20.1	30.1	17.0
R11	9.2	7.1	22.3	20.2	30.2	50.5
R12	9.8	7.0	25.2	20.2	30.2	19.4

Table 13: PM10 modelling with and without windbreak.

Pollutant	PM_{10} without windbreak		PM_{10} with windbreak	
Averaging Time	24 Hour	Annual	24 Hour	Annual
Criteria	50	25	50	25
Background	22	20	22	20
Receptor	µg/m^3	µg/m^3	µg/m^3	µg/m^3
R1	26.1	20.2	28.0	20.1
R2	51.7	22.9	43.1	21.7
R3	39.5	21.0	35.6	20.6
R4	35.9	21.3	33.8	20.7
R5	37.5	22.9	34.6	21.6
R6	19.1	20.0	23.7	20.0
R7	18.3	20.0	23.3	20.0
R8	17.4	20.0	22.8	20.0
R9	17.3	20.0	22.7	20.0
R10	19.7	20.1	24.2	20.0
R11	22.3	20.2	25.6	20.1
R12	25.2	20.2	27.2	20.1

Table 14: Calculated Pollutants for Each Sensitive Receptor

Pollutant	NO_2	NO_2	CO	SO_2	SO_2	SO_2
Averaging Time	1 hour 99.9	Annual	8 hours	1hr 99.9	24 hours	Annual
Criteria	167	31	11000	285	57	21
Background	8.1	8.6	31	2.82	1.3	1.5
Receptor	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
R1	28.9	8.6	34.3	6.2	2.0	1.5
R2	130.8	10.9	43.6	17.3	6.0	1.8
R3	79.8	9.6	38.2	15.0	5.0	1.7
R4	61.4	10.0	36.9	12.9	4.5	1.9
R5	49.3	10.7	37.8	11.6	4.8	2.0
R6	15.9	8.6	32.4	6.7	2.2	1.5
R7	11.8	8.6	31.9	5.4	1.8	1.5
R8	11.8	8.6	31.7	5.4	1.8	1.5
R9	11.6	8.6	31.3	4.6	1.7	1.5
R10	16.8	8.6	32.0	6.1	2.3	1.5
R11	39.3	8.9	35.9	8.5	3.2	1.5
R12	39.1	8.8	34.4	11.6	3.6	1.5

Table 15: Calculated BTEX Pollutants for Each Sensitive Receptor

Pollutant	Benzene	Toluene	Toluene	Toluene	Ethylbenzene Note 1	Xylene	
Averaging Time	Annual	1 Hour	24 Hour	Annual	1 Hour	24 Hour	Annual
Criteria	590	958	4,100	410	8000	1200	950
Background	4.7	9.8	8.9	8.2	0	33.2	33.5
Receptor	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3	µg/m^3
R1	4.7	9.8	8.9	8.2	0.9	33.2	33.5
R2	4.7	9.8	8.9	8.2	3.8	33.2	33.5
R3	4.7	9.8	8.9	8.2	2.7	33.2	33.5
R4	4.7	9.8	8.9	8.2	2.4	33.2	33.5
R5	4.7	9.8	8.9	8.2	2.1	33.2	33.5
R6	4.7	9.8	8.9	8.2	0.7	33.2	33.5
R7	4.7	9.8	8.9	8.2	0.5	33.2	33.5
R8	4.7	9.8	8.9	8.2	0.4	33.2	33.5
R9	4.7	9.8	8.9	8.2	0.4	33.2	33.5
R10	4.7	9.8	8.9	8.2	0.6	33.2	33.5
R11	4.7	9.8	8.9	8.2	1.4	33.2	33.5
R12	4.7	9.8	8.9	8.2	1.9	33.2	33.5

Note 1: Ethylbenzene modelling based on VOC results

Table 16: Calculated Odour Exposure for Each Sensitive receptor

Source Type	Stack Sources	Ground Based Sources
Averaging Time	1 Hour 99.5	1 hour 99.5
Criteria	0.5	2.5
Receptor	OU	OU
R1	0.00	0.4
R2	0.08	0.9
R3	0.06	0.3
R4	0.06	0.6
R5	0.05	0.8
R6	0.00	0.0
R7	0.00	0.0
R8	0.00	0.0
R9	0.00	0.0
R10	0.01	0.1
R11	0.03	0.1
R12	0.03	0.1

Table 17: Calculated PAH and VOC Pollutants for Each Sensitive Receptor (For Information Purposes)

Pollutant	VOC	PAH	PAH
Averaging Time	1 hour	1 Hour	24 Hour
Criteria	For Information Purposes		
Background	-	-	-
Receptor	ug/m3	ug/m3	ug/m3
R1	0.934	0.025	0.002
R2	3.773	0.039	0.011
R3	2.738	0.034	0.009
R4	2.442	0.029	0.008
R5	2.056	0.026	0.009
R6	0.700	0.029	0.002
R7	0.461	0.020	0.001
R8	0.441	0.019	0.001
R9	0.359	0.013	0.001
R10	0.610	0.021	0.002
R11	1.373	0.025	0.005
R12	1.880	0.027	0.006

3.5.1 Odour Concentration Contours

The odour contours for the tall stack sources are contained in Figure 4. based on the 99.5% contours. It is noted under these conditions the highest ground level odour exposure North West of R2 and generally between sensitive receptors R2, R3 and R4. Since the emission for stack based sources is well above the ground, the highest pollution levels always occur at some distance from the emission point.

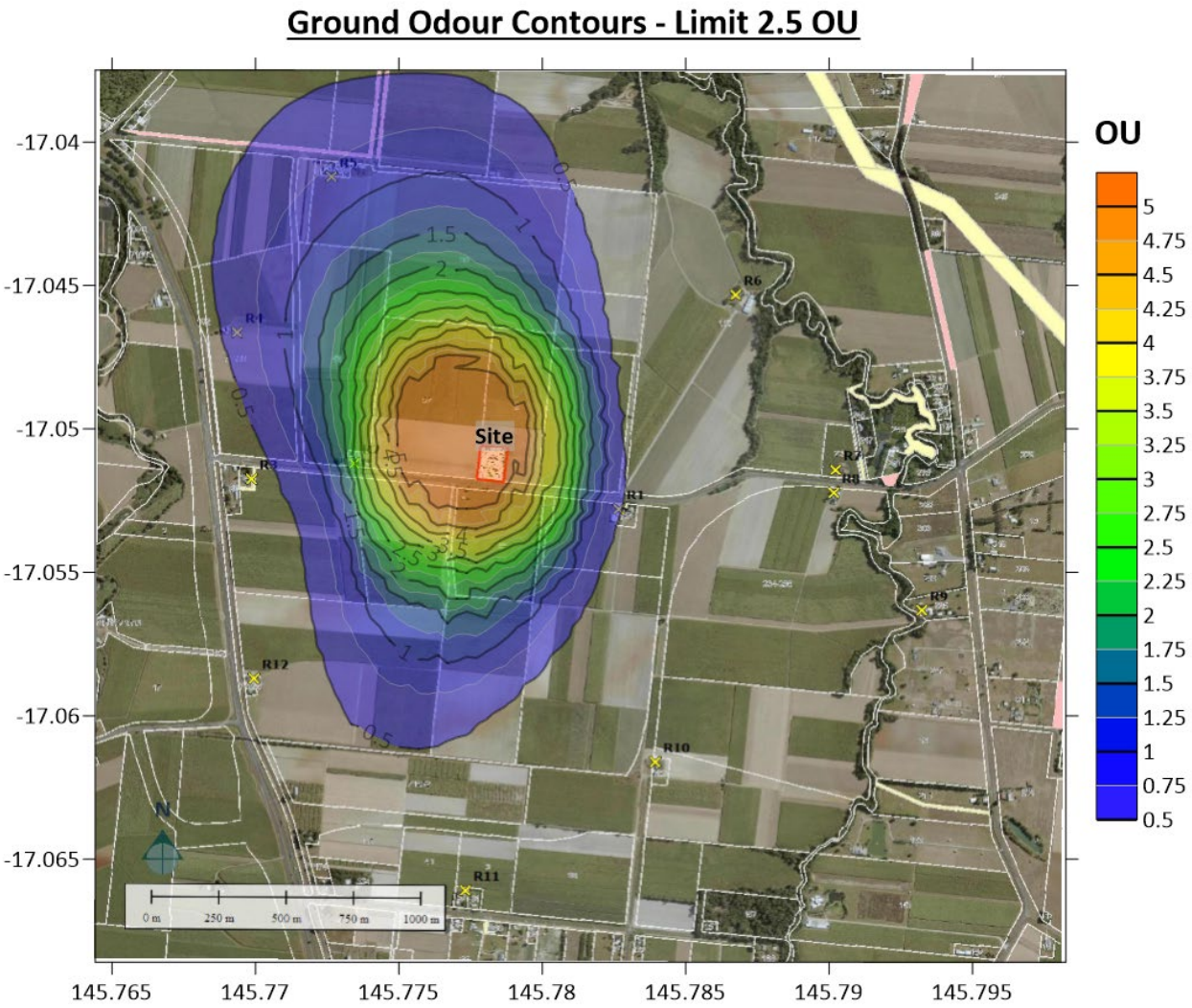


Figure 4: Odour Exposure Stack Based Sources

For ground-based sources, the emission point is close to the ground and the highest pollution levels occur close to the source and reduce with increasing distance from the source. Refer to Figure 5. In this instance the highest odour levels are towards the NW.

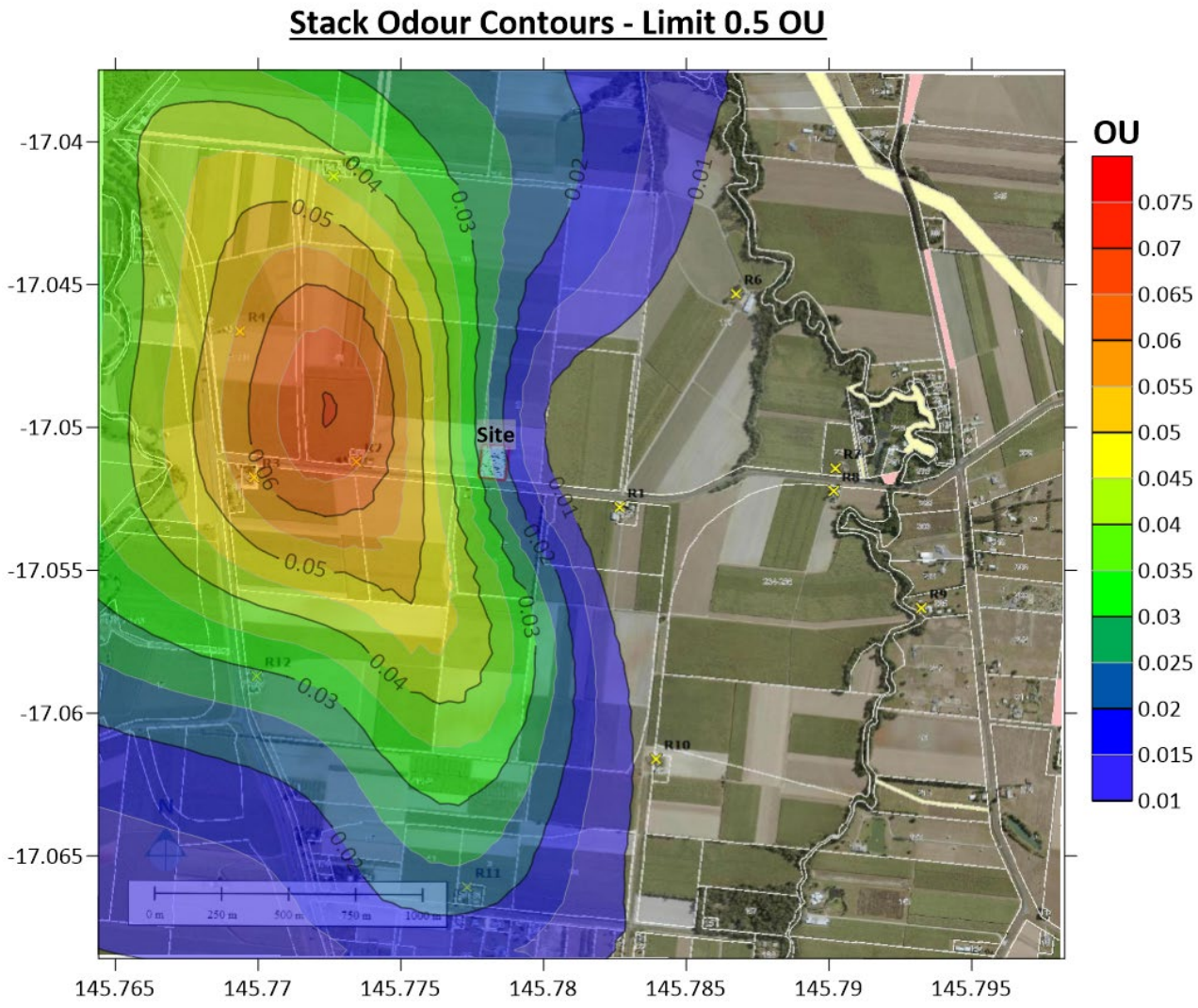


Figure 5: Odour Exposure Ground Based Sources

3.6 Air Quality Assessment

The modelling of dust demonstrates all sites comply with the $PM_{2.5}$ 24 hour and annual average criteria level. $PM_{2.5}$ is predominantly caused by combustion process and this site has two significant combustion sources.

The modelling shows that for uncontrolled emissions the $PM_{10\ (24\ hour)}$ is potentially exceeded at one site, R2, to the west of the site. Tracing the emissions (within the modelling files) it reveals that the concrete batching plant was the dominant contributor.

The site was remodelled including a including the baghouse and windbreak for the concrete batching plant would result in the $PM_{10\ (24hour)}$ complying at all times.

The dust deposition (maximum month) at all sensitive receptors readily complies with the deposition goals.

All pollutants ready comply with the air quality goals at all sensitive receptors for all modelling period.

Odour from the site is expect to comply with odour goals at all sensitive receptors.

3.7 Air Quality Recommendations

The plant is required to use and maintain the baghouse on the project as well as windbreak on the site.

It is recommended the project provide trees, mounds or other screens around the perimeter of the site to encourage turbulence in the airflow. These do not need to be continuous but the higher and more dense would encourage dispersion and dilution of the pollutants. The concrete batching plant to retain the usual dust mitigation measures.

Finally, it is recommended that all internal roads are to be kept clean to avoid particulates from vehicle traffic and wind erosion

4 Conclusions

The proposed asphalt and concrete batching plant development site was investigated with regards to air quality impacts.

The background air quality is based on the recent and relevant publication of long-term monitoring conducted by DSITI.

The meteorology for the site was predicted using TAPM over a two-year period, 2020 & 2021. The modelling of the pollution utilised the approved model Calpuff configured in according to the recommended settings.

The emission factors for the asphalt plant was drawn from various National Pollution Inventory documents and reports of the same Asphalt to be located in Muswellbrook NSW.

Only one modelling case was considered comprising 24 hour operation and at a production rate of 600 tonnes per day shift (7am to 6 pm) and 600 tonnes per night shift (6pm to 7 am) a combined total of 1,200 tonnes of asphalt over a 24 hour period. This production rate was applied for each day of the 2-year modelling simulation. The concrete batching plant was operating at a production rate of 80m^3 of concrete between 7am and 6pm for each day of the modelling simulation. This modelling case is considered to be the peak production rate for the site.

With the site operating with controls described in Section 3.7 it was found that the air quality and odour at the proposed development readily meets all air quality and odour goals for realistic meteorological conditions both now and into the future.

When modelled with no controls, the $PM_{10\ (24\ hour)}$ is potentially exceeded at one site, R2, to the west of the site. The exceedance is comparatively minor and occurs at 1 day over a two year modelling simulation. For the remaining days the $PM_{10(24hour)}$ complies with the air quality goals. When the controls of the plant are included the site no exceedance occurs, demonstrating that controls aer to be used and maintained on the project.

Thus, the asphalt and concrete batching plant development may proceed without any adverse air quality impacts onto sensitive uses.

5 References

Brisbane City Council (2016) Schedule 6 Planning Scheme Policies (PSP) Air Quality PSP http://eplan.brisbane.qld.gov.au/?doc=TransportAirQualityOC

Department of Science, Information Technology and Innovation (2015) Queensland air monitoring report 2014

Department of Science, Information Technology and Innovation (2018), Meteorological Monitoring data for Mountain Creek

Department of Transport and Main Roads (June 2014), Manual Road Traffic Air Quality Management

Hurley PJ, Physick WL, Luhar AK Edwards M (2005) The Air Pollution Model (TAPM) Version 3. Part 2: Summary of Some Verification Studies. CSIRO Atmospheric Research

NPI (Nov 1999), Emissions Estimation Technique Manual for Aggregated Emissions from Service Stations http://www.npi.gov.au/resource/emission-estimation-technique-manual-aggregated-emissions-service-stations

NPI (Nov 1999), Emissions Estimation Technique Manual for Fibreglass Product Manufacturing http://www.npi.gov.au

NPI (Nov 1999), Emissions Estimation Technique Manual for Shipbuilding Repair and Maintenance http://www.npi.gov.au

SLR (2019) Muswellbrook Asphalt Plant, Air Quality Impact Assessment 630.12689-R02-v1.0

State of QLD (2018), Environmental Protection (Air) Policy 2020

Appendix A: Windroses and Meteorological Data Analysis

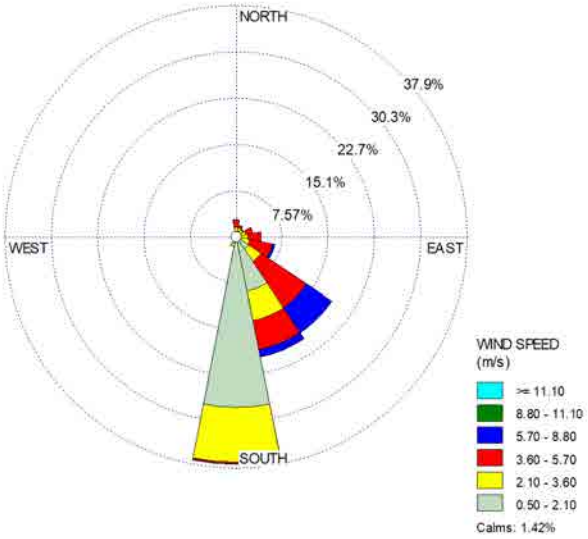


Figure 6: Wind Rose All Hours

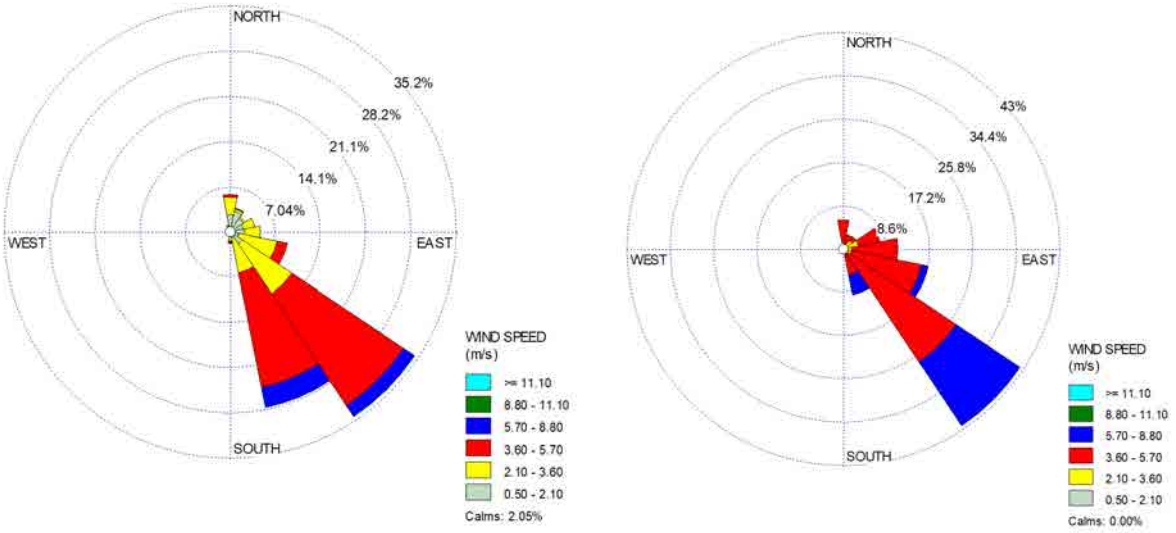


Figure 7:Wind Rose 9am and 3pm

The general features of winds affecting plume dispersion are illustrated in the wind rose diagrams. The wind roses summarise the wind statistics at a 10m height on site, as calculated by the TAPM meteorological model.

The wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points – N, NNE, NE, ENE ,E etc. The length of the bar represents the frequency of occurrence of winds from that direction, and the colour of the bar sections correspond to wind speed categories. It is noted that the predominant wind direction during the year is from the north-east through to the south-east.

The 9am and 3pm windroses from TAPM compare favourably with the BOM windroses for the same time periods. However, there will be differences involved since the two locations are separated by some distance and the proximity to major terrain features that influence wind flows.

The representative frequency of Pasquil stability classes for the region is based on data from TAPM. Pasquil stability classes represent the stability of the atmosphere. The stability Class F conditions (stable conditions), which result in poor dispersion of pollutants does not occur during the day.

Table 18 shows the frequency of stability classes for the site.

Table 18: Stability Distribution

Stability	Description	Percentage of Time
A	Very unstable	1%
B	Moderately unstable	10%
C	Slightly unstable	19%
D	Neutral	36%
E	Slightly stable	13%
F	Stable	20%

The diurnal distribution of the mixing height is contained in Figure 8. The mixing height is defined as the height of the layer closest to the ground which will contain all non-buoyant pollutants emitted within the layer.

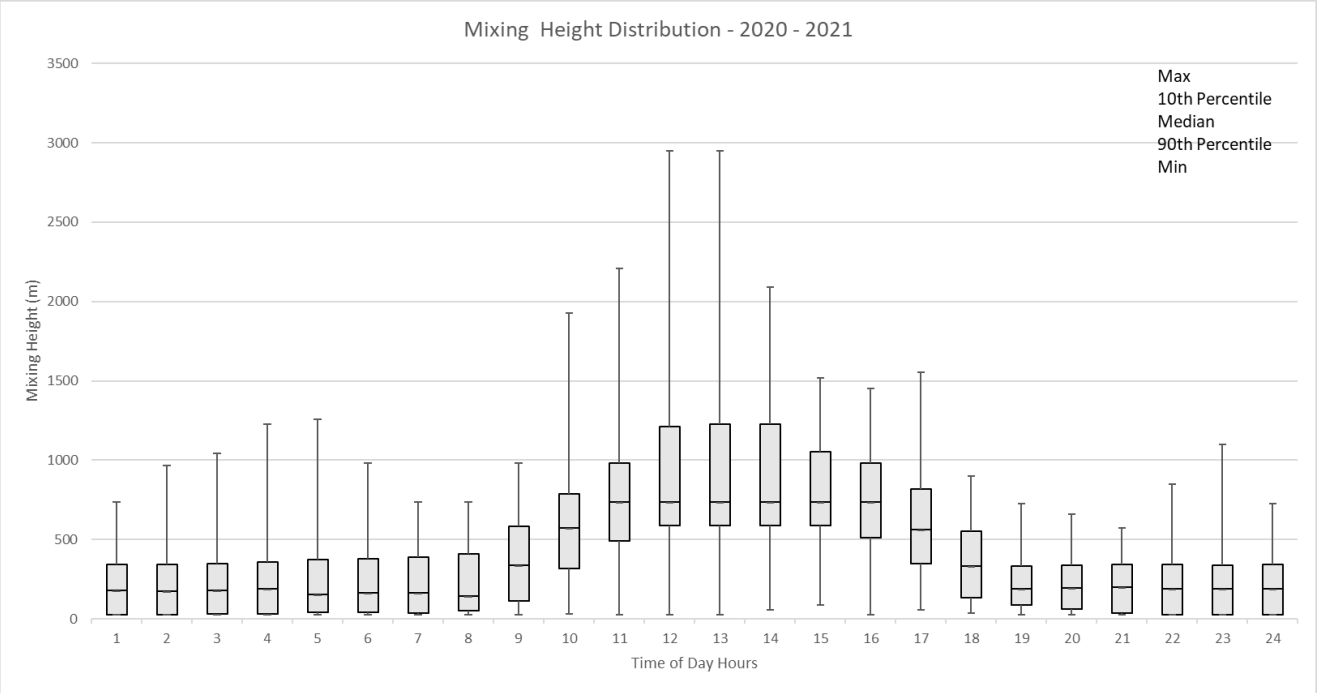


Figure 8: Mixing Height Distribution from Meteorological File (2020-2021)

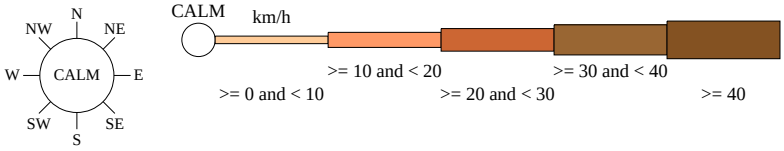
Rose of Wind direction versus Wind speed in km/h (05 May 1941 to 10 Aug 2022)

Custom times selected, refer to attached note for details

CAIRNS AERO

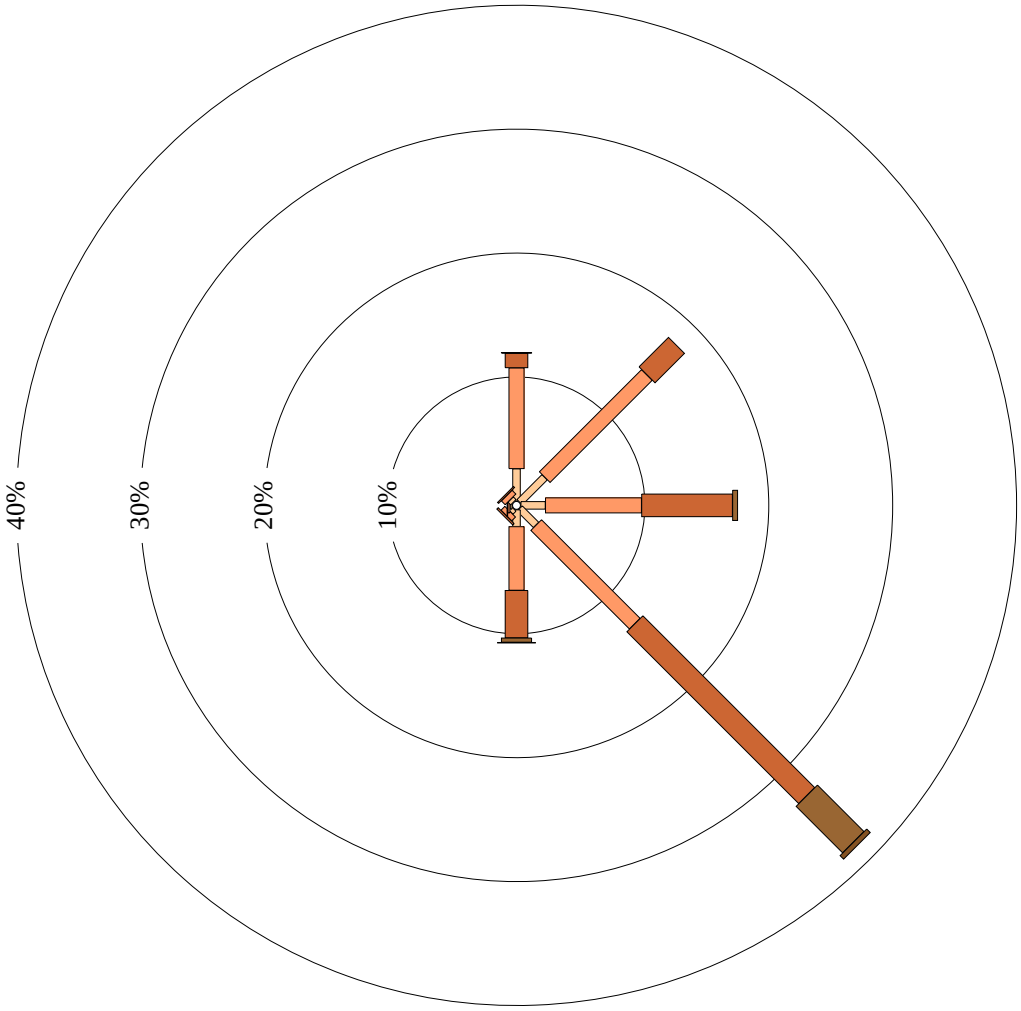
Site No: 031011 • Opened May 1941 • Still Open • Latitude: -16.8736° • Longitude: 145.7458° • Elevation 2.2m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



3 pm
29487 Total Observations

Calm 2%



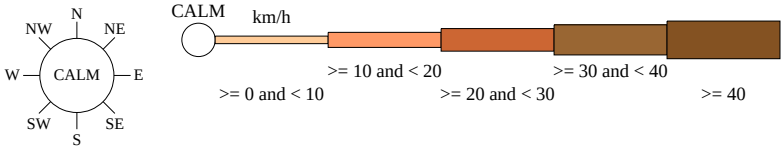
Rose of Wind direction versus Wind speed in km/h (05 May 1941 to 10 Aug 2022)

Custom times selected, refer to attached note for details

CAIRNS AERO

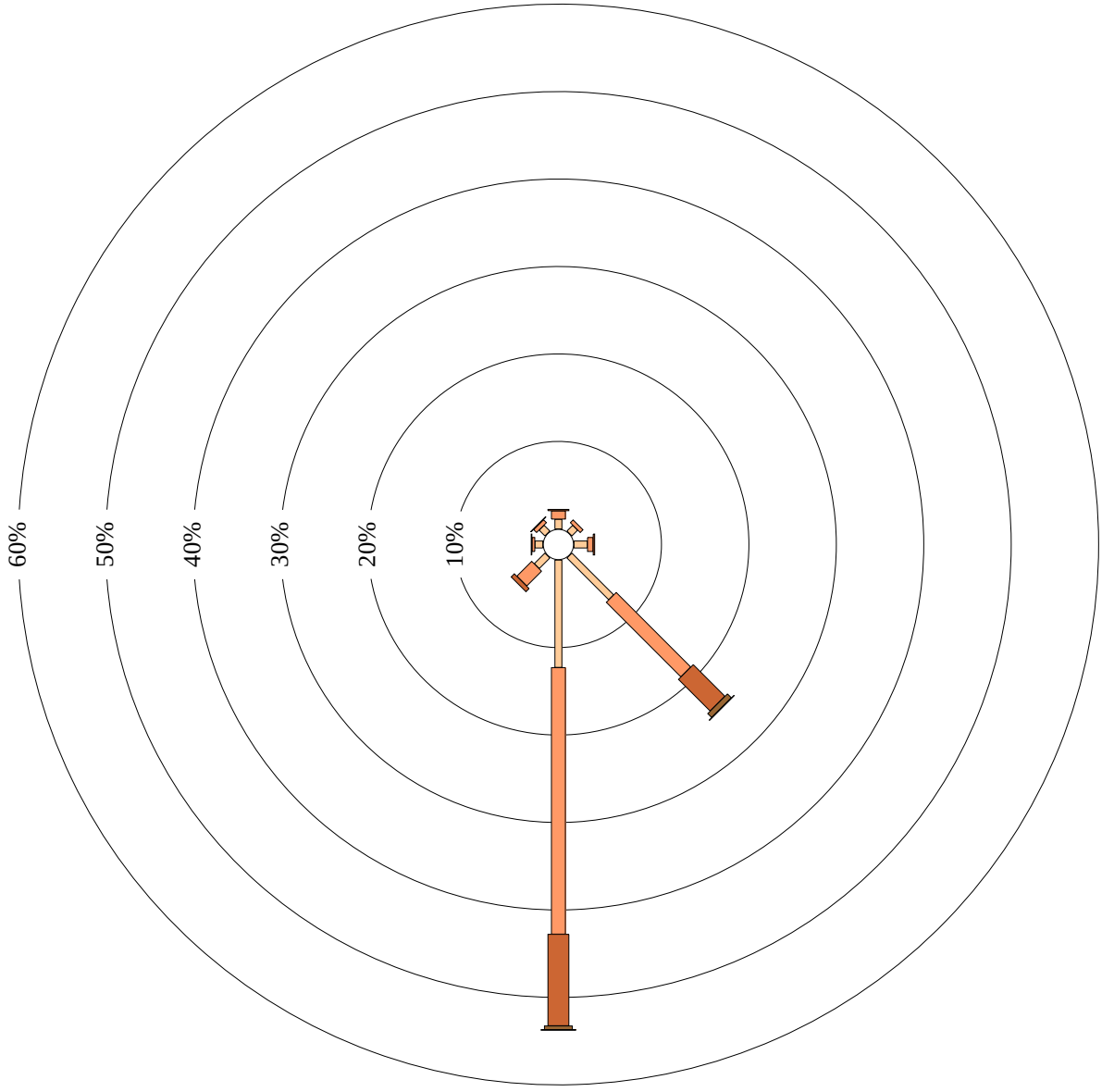
Site No: 031011 • Opened May 1941 • Still Open • Latitude: -16.8736° • Longitude: 145.7458° • Elevation 2.2m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am
29538 Total Observations

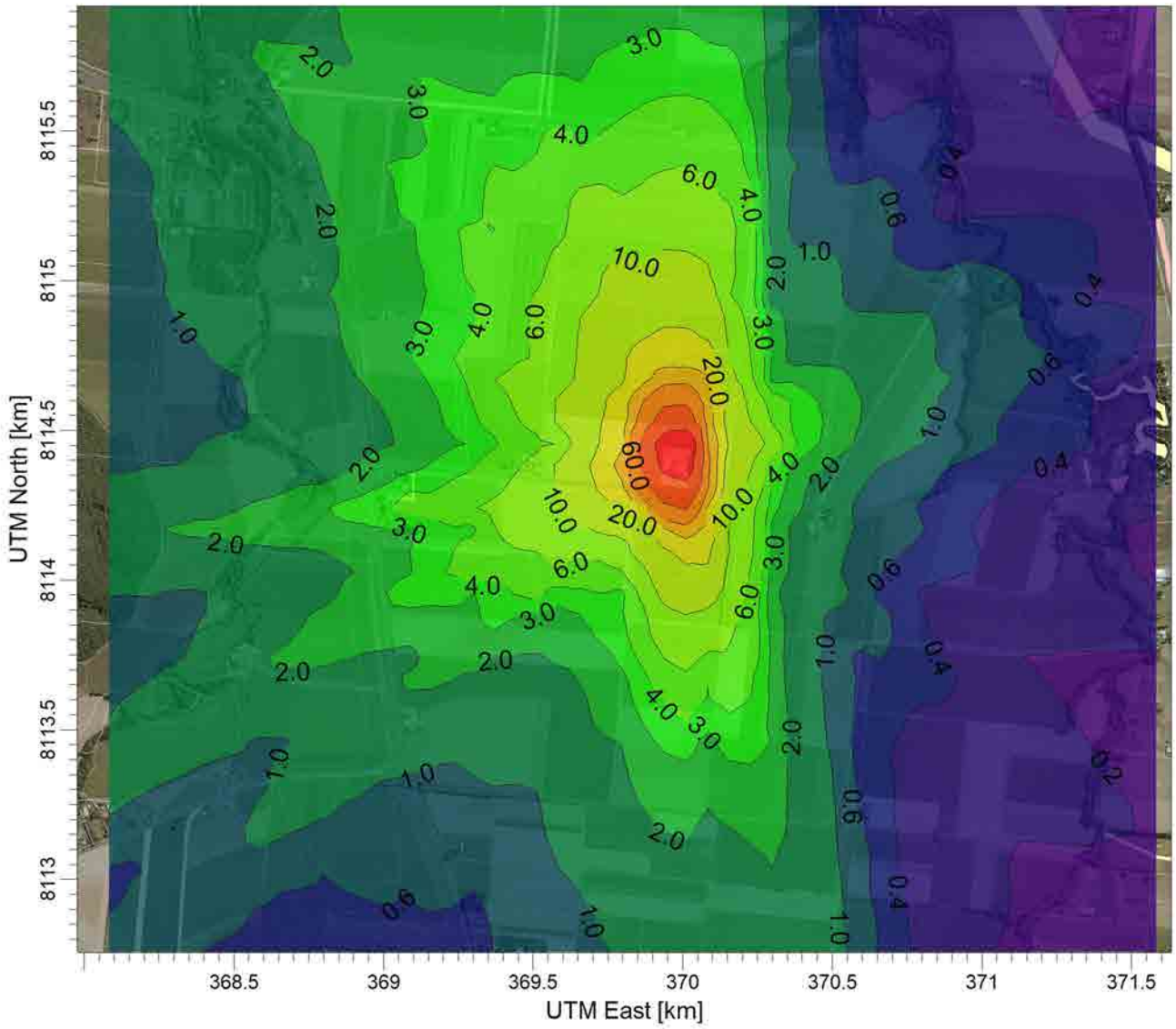
Calm 9%



Appendix B: Modelled Air Quality - Contours

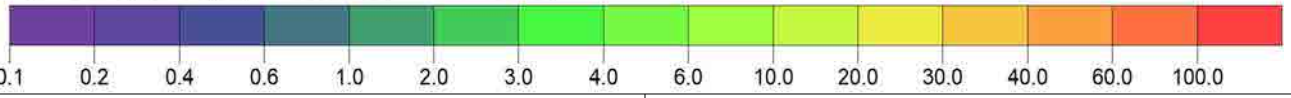
PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
PM2.5 24 Hour Maximum



1 RANK 24 HOUR AVERAGE CONCENTRATION (PM2.5) ug/m**3

Max = 206.2 [ug/m**3] at (X = 369983.00, Y = 8114456.00)



COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

Simpson Engineering Group

DATE:

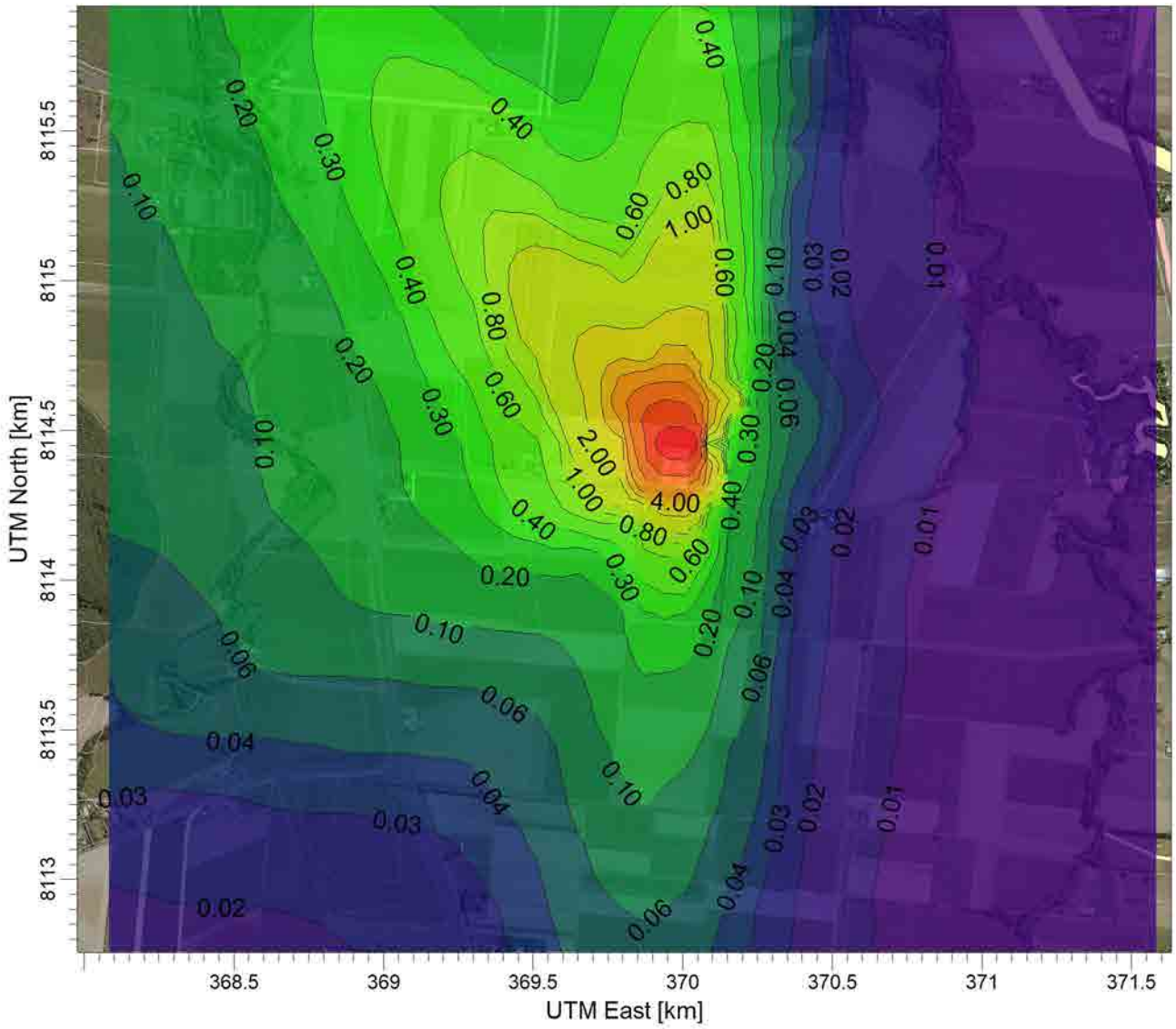
6/12/2022

PROJECT NO.:

220920

PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
PM2.5 Annual Average



VALUE RUN LENGTH AVERAGE CONCENTRATION (PM2.5) ug/m**3

Max = 63.58 [ug/m**3] at (X = 369983.00, Y = 8114456.00)

0.00 0.01 0.02 0.03 0.04 0.06 0.10 0.20 0.30 0.40 0.60 0.80 1.00 2.00 3.00 4.00 6.00 10.00 20.00

COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

Simpson Engineering Group

DATE:

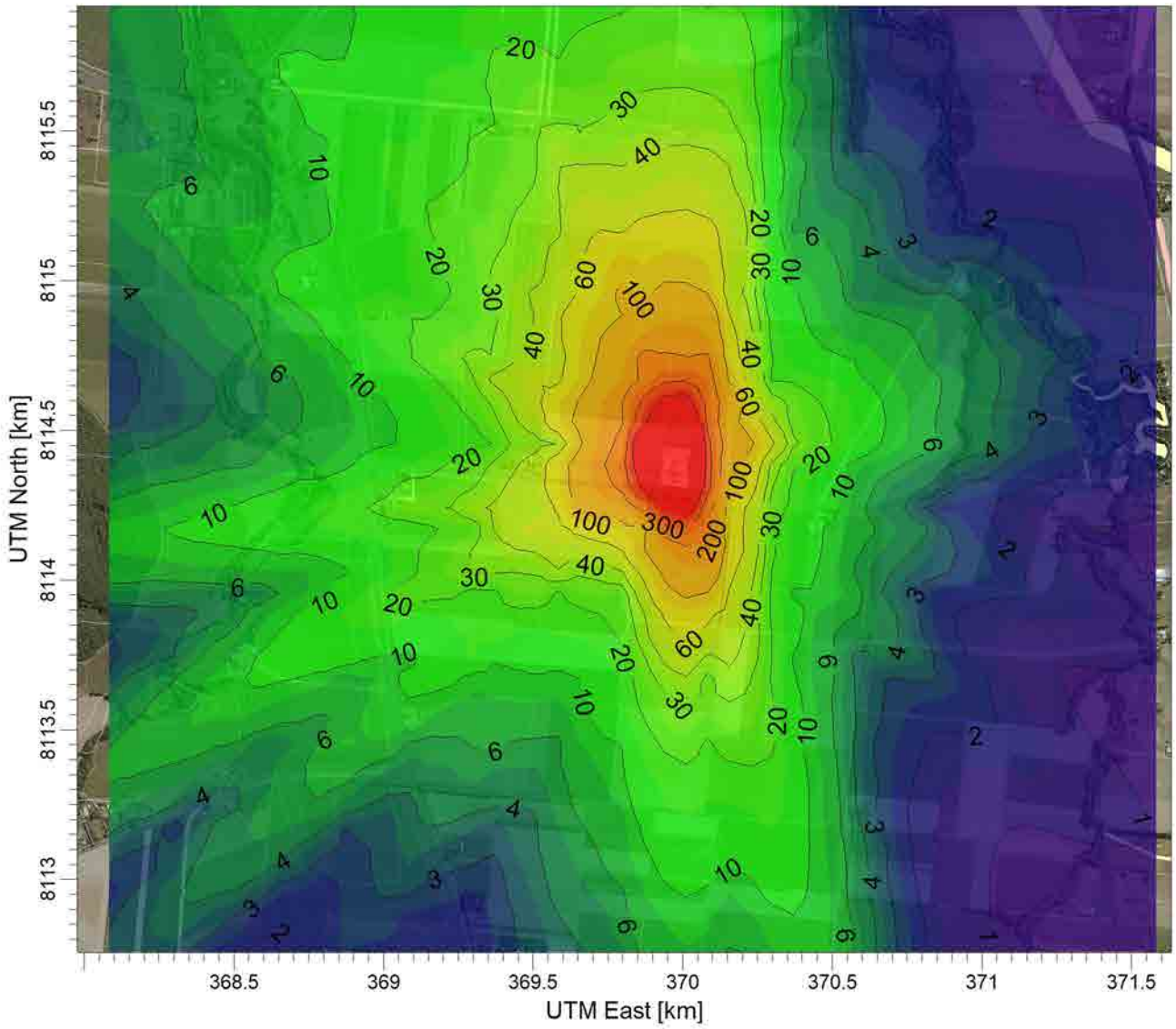
6/12/2022

PROJECT NO.:

220920

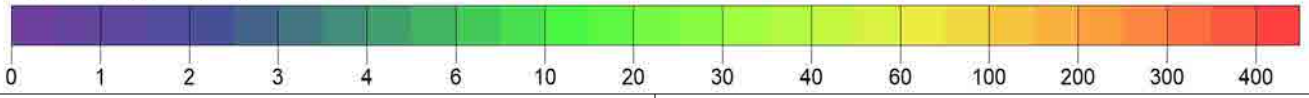
PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
PM10 24 Hour Maximum



1 RANK 24 HOUR AVERAGE CONCENTRATION (PM10) ug/m**3

Max = 1649 [ug/m**3] at (X = 369983.00, Y = 8114456.00)



COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

Simpson Engineering Group

DATE:

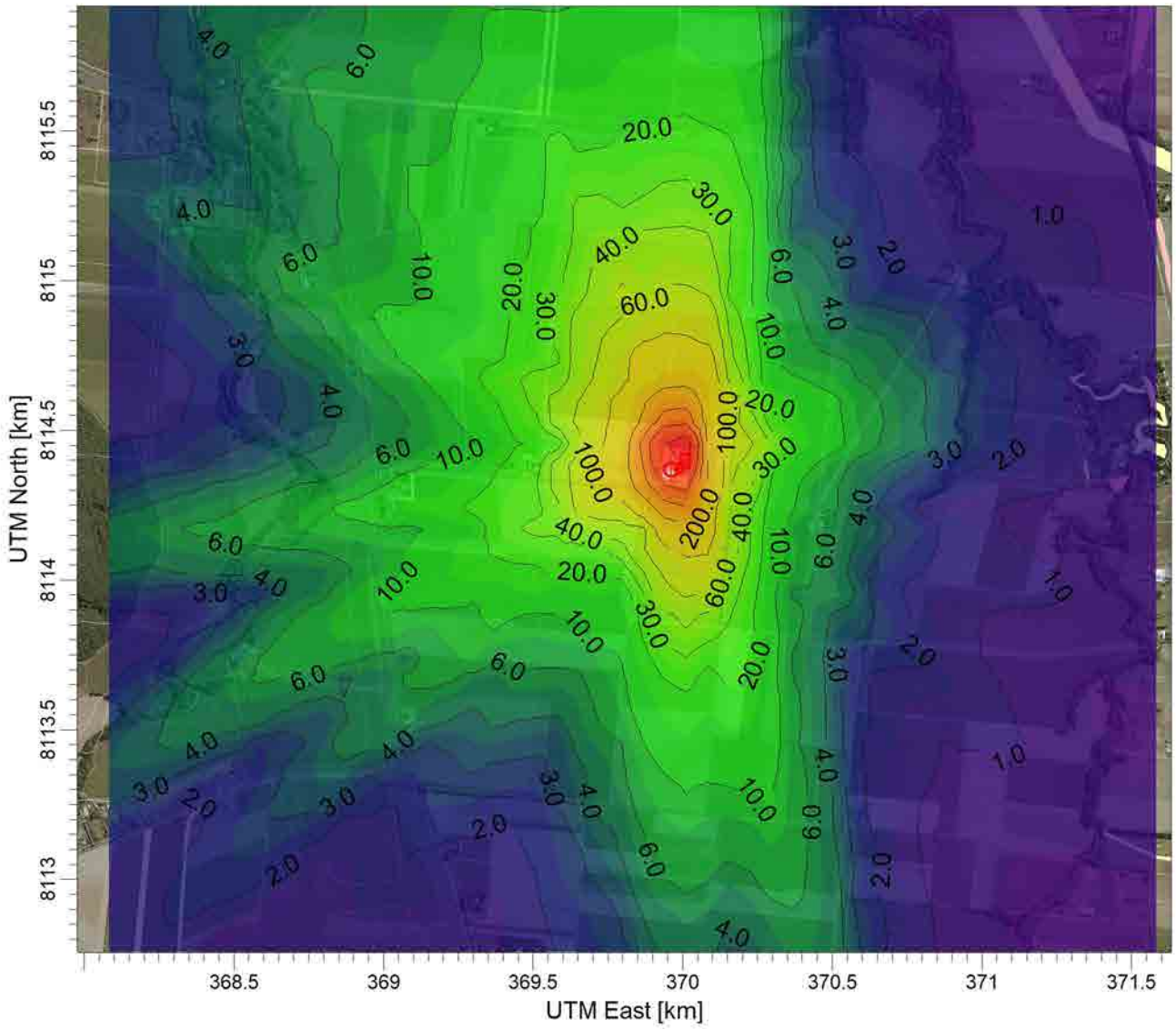
6/12/2022

PROJECT NO.:

220920

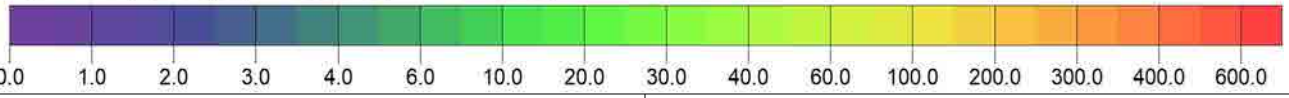
PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
PM10 24 Hour Maximum with Dust Controls



1 RANK 24 HOUR AVERAGE CONCENTRATION (PM10) ug/m**3

Max = 972.3 [ug/m**3] at (X = 369983.00, Y = 8114456.00)



COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

DATE:

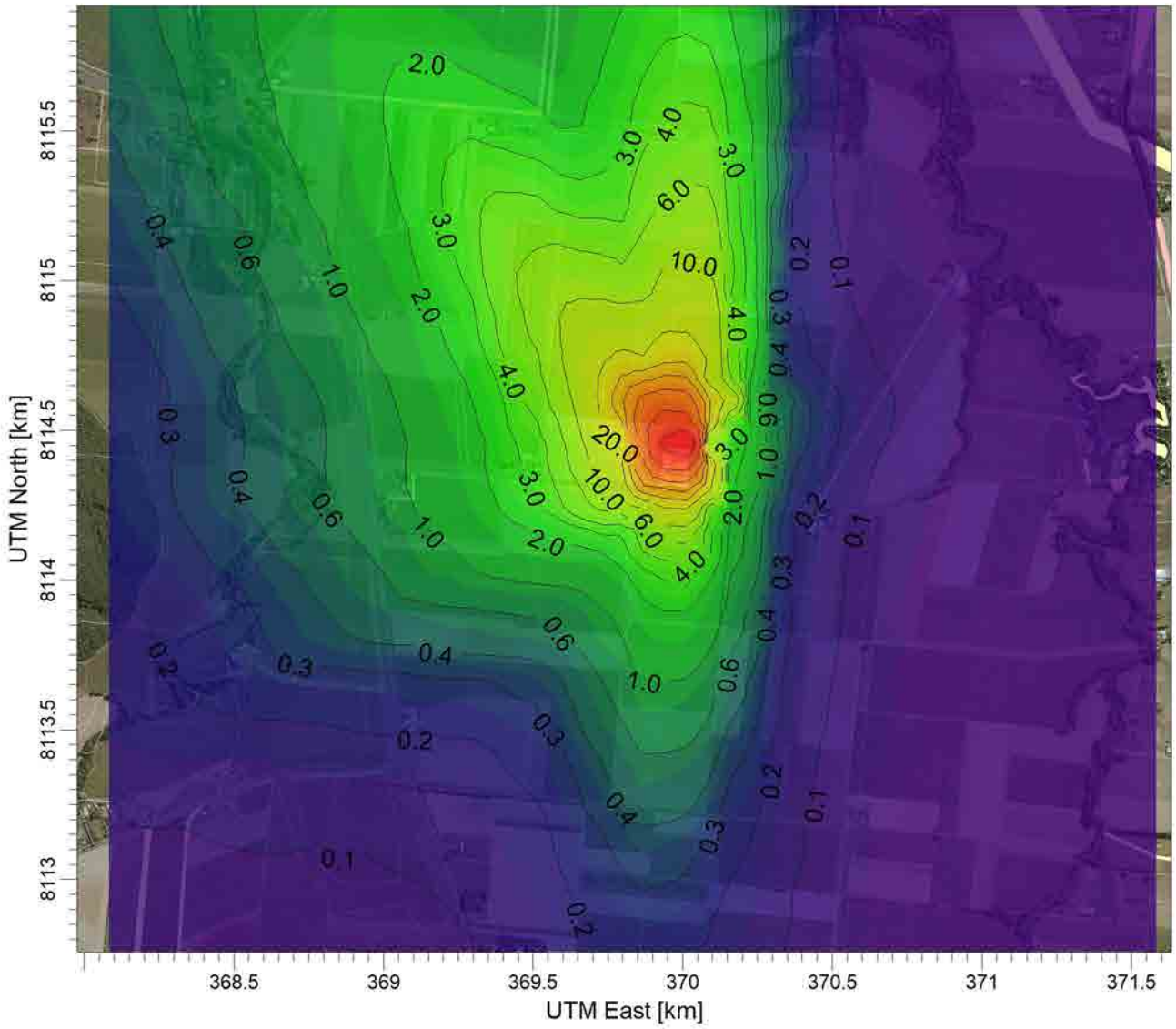
8/12/2022

PROJECT NO.:

220920

PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
PM10 Annual Average



VALUE RUN LENGTH AVERAGE CONCENTRATION (PM10) ug/m**3

Max = 508.6 [ug/m**3] at (X = 369983.00, Y = 8114456.00)

0.0 0.1 0.2 0.3 0.4 0.6 1.0 2.0 3.0 4.0 6.0 10.0 20.0 30.0 40.0 60.0 100.0 200.0

COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

Simpson Engineering Group

DATE:

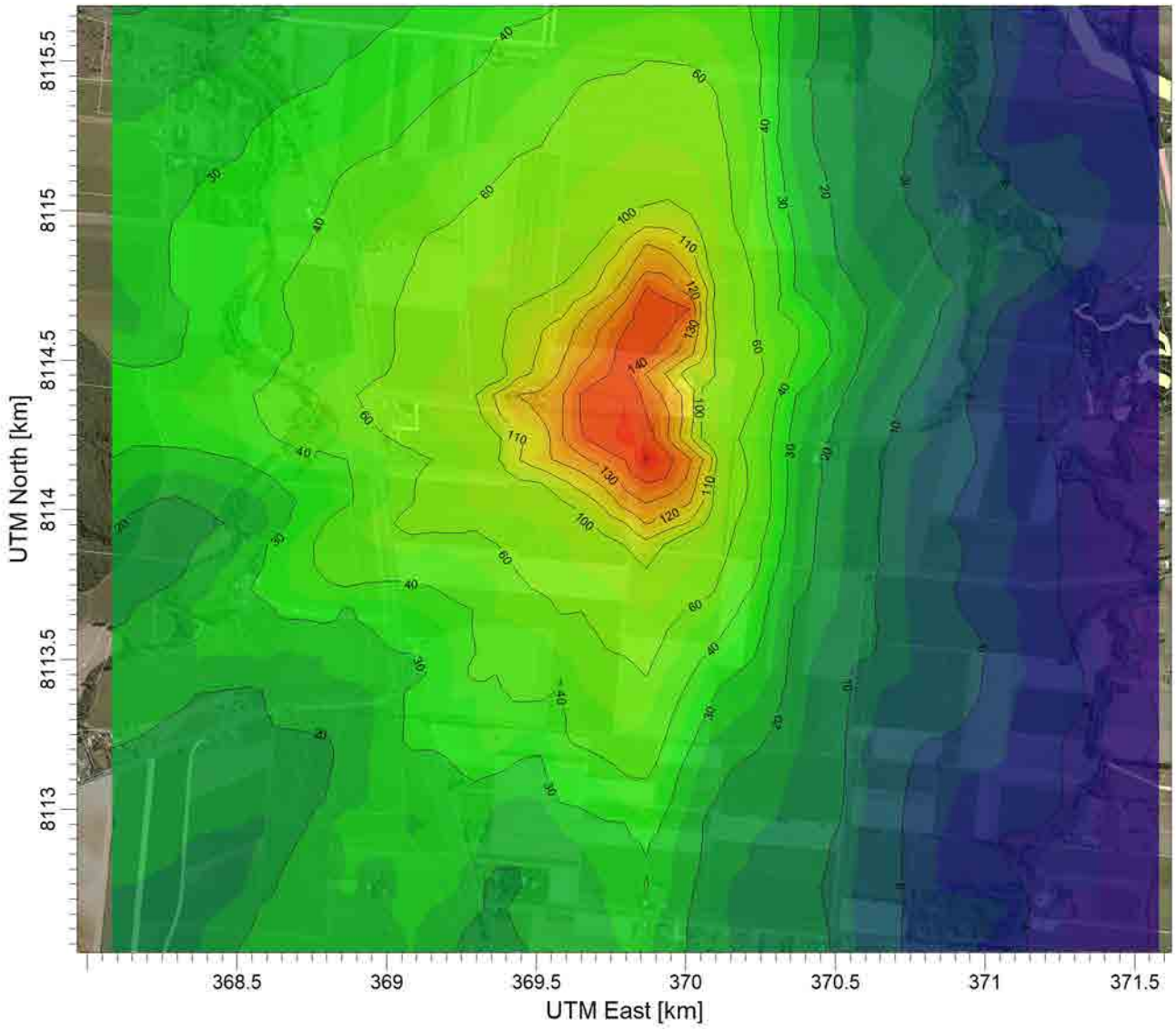
6/12/2022

PROJECT NO.:

220920

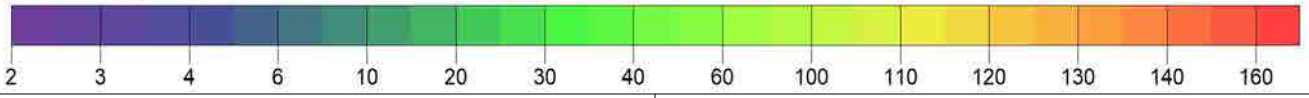
PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
NO2 1 Hour 99.9th Percentile



VALUE 99.90TH PERCENTILE 1 HOUR AVERAGE CONCENTRATION (NO2) ug/m**3

Max = 170 [ug/m**3] at (X = 369883.00, Y = 8114155.00)



COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

Simpson Engineering Group

DATE:

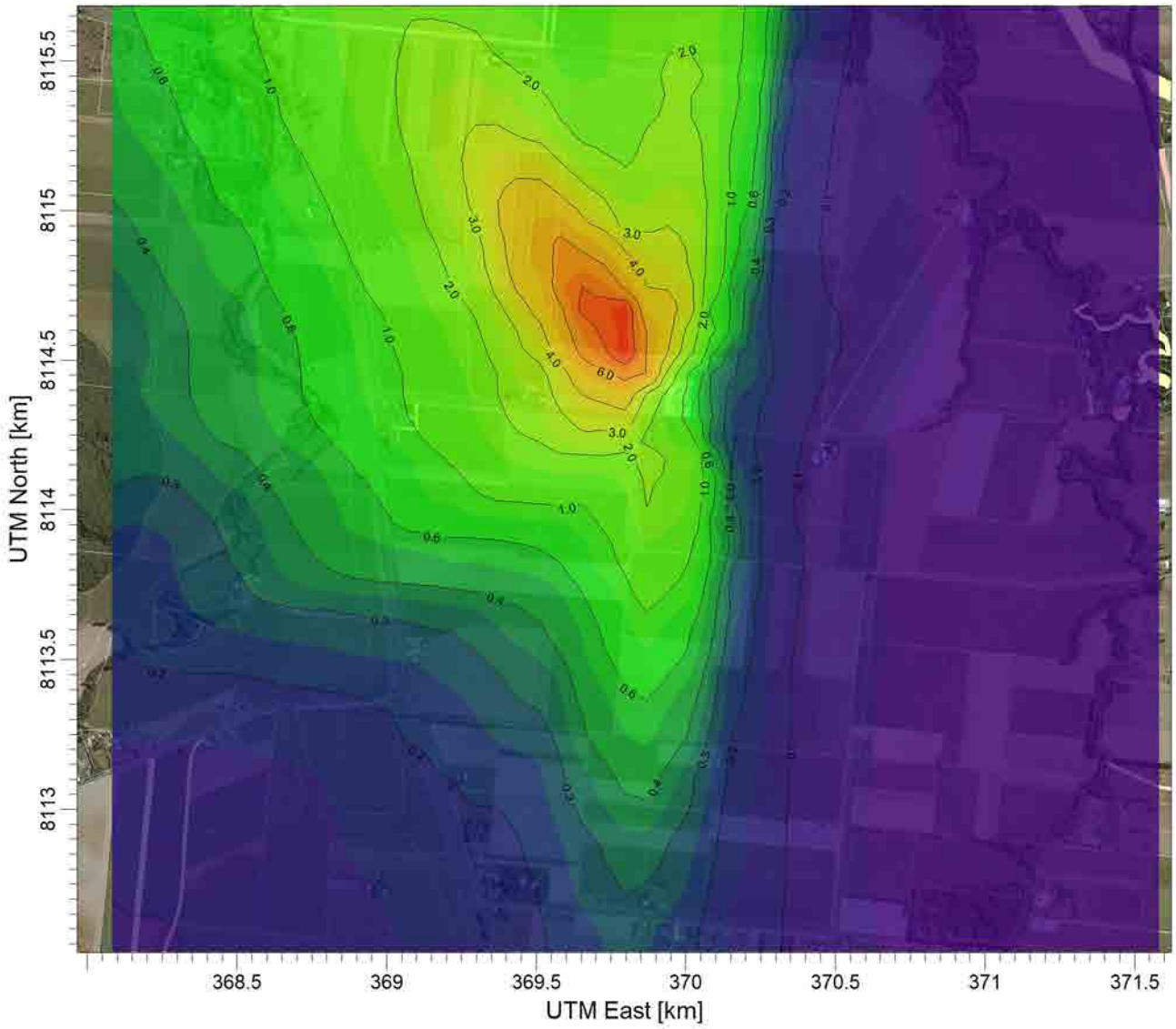
6/12/2022

PROJECT NO.:

220920

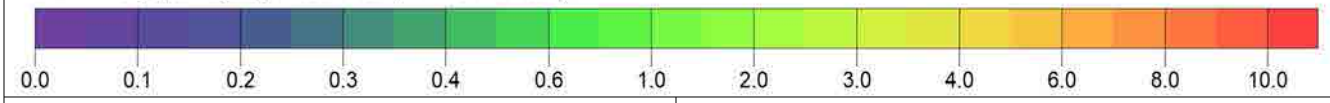
PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
NO2 Annual Average



VALUE RUN LENGTH AVERAGE CONCENTRATION (NO2) ug/m**3

Max = 12.1 [ug/m**3] at (X = 369783.00, Y = 8114556.00)



COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

DATE:

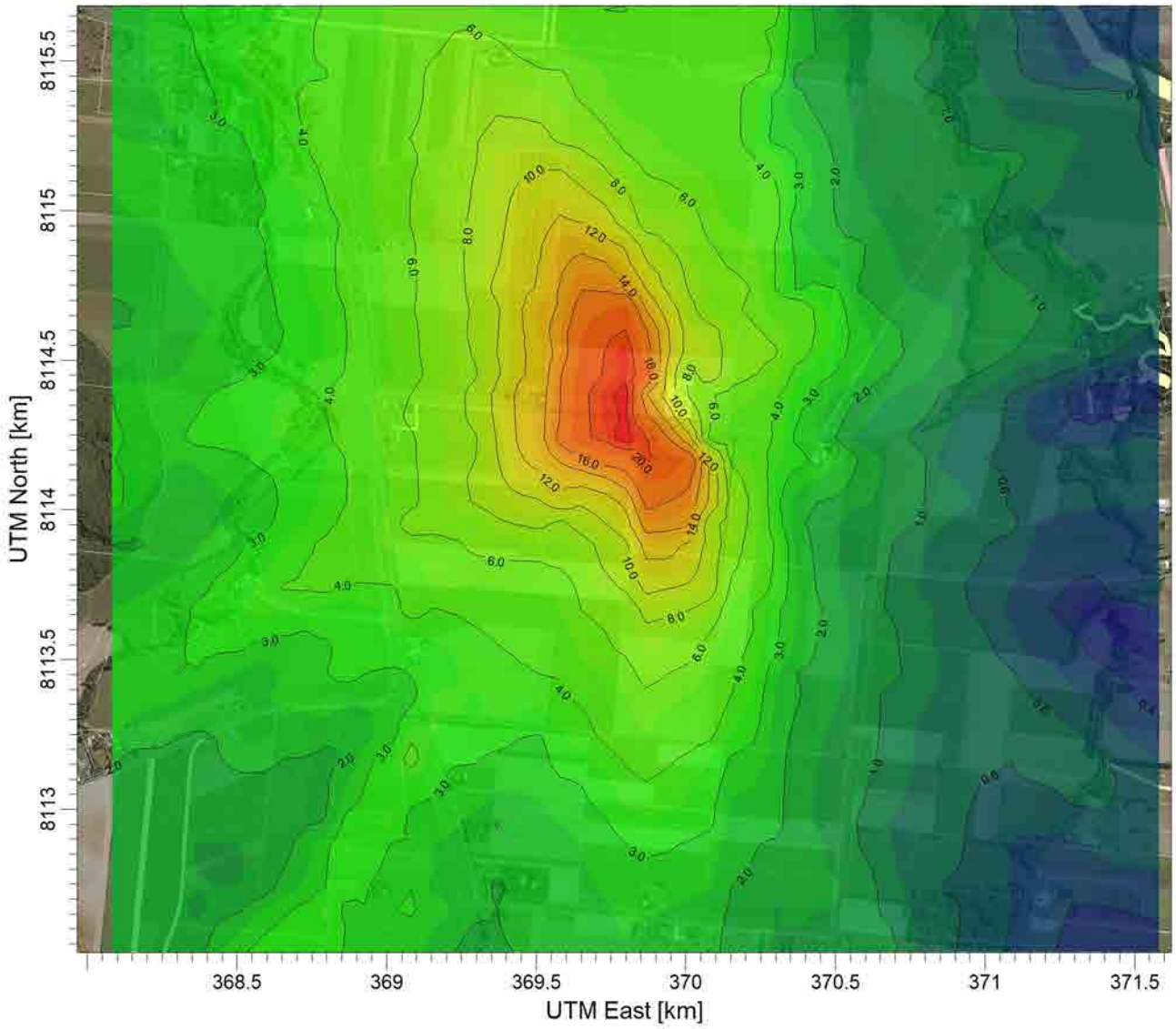
6/12/2022

PROJECT NO.:

220920

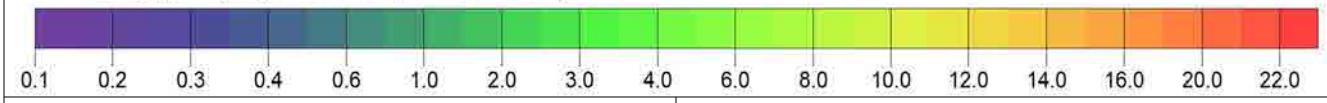
PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
CO 8 Hour 99.9th Percentile



VALUE 99.90TH PERCENTILE 8 HOUR AVERAGE CONCENTRATION (CO) ug/m**3

Max = 25.6 [ug/m**3] at (X = 369783.00, Y = 8114355.00)



COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

Simpson Engineering Group

DATE:

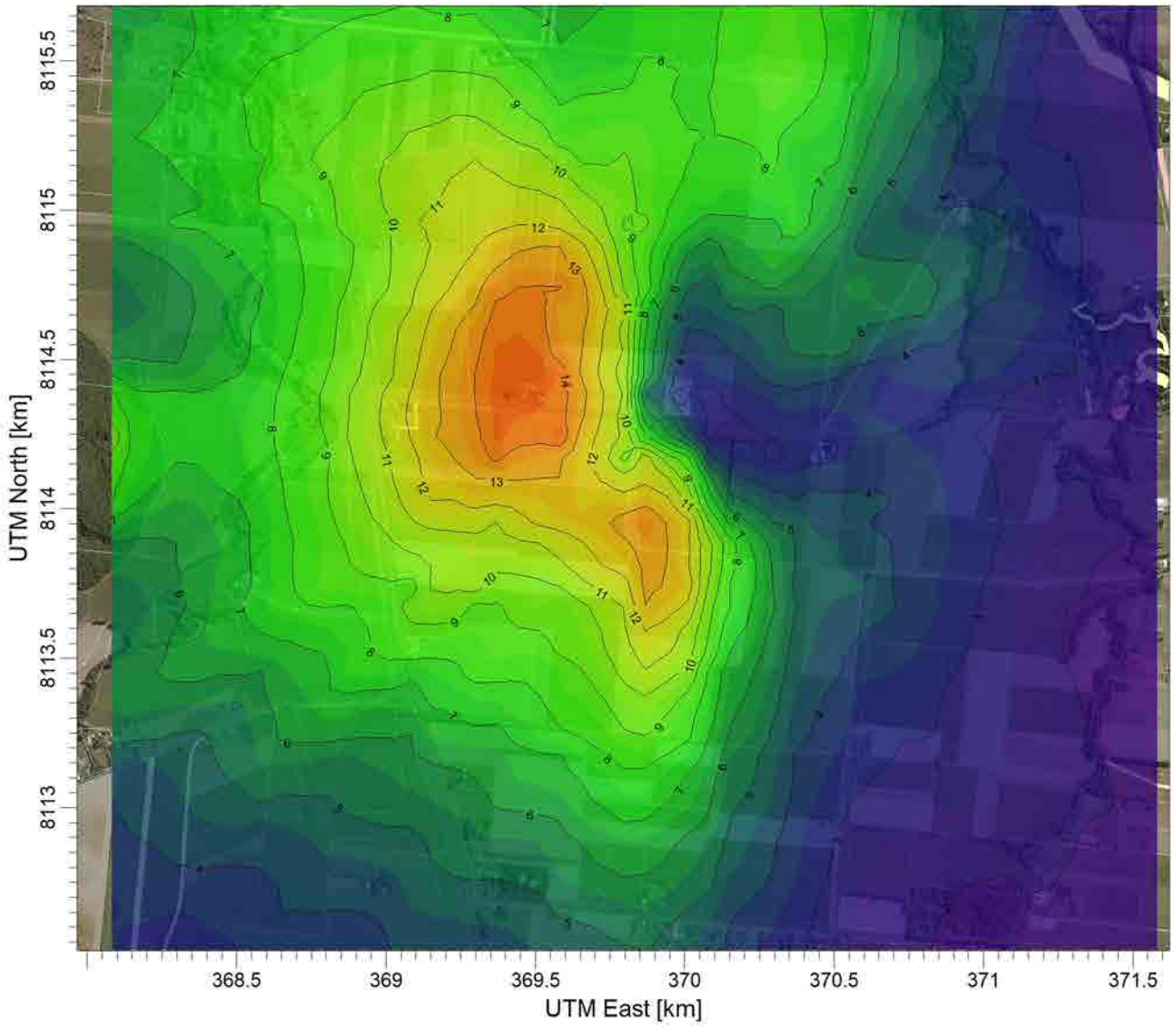
6/12/2022

PROJECT NO.:

220920

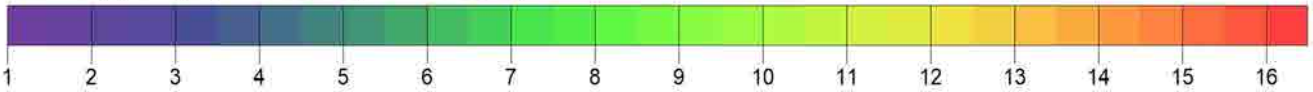
PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
SO2 1 Hour 99.9th Percentile



VALUE 99.90TH PERCENTILE 1 HOUR AVERAGE CONCENTRATION (SO2) ug/m**3

Max = 15 [ug/m**3] at (X = 369383.00, Y = 8114355.00)



COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

DATE:

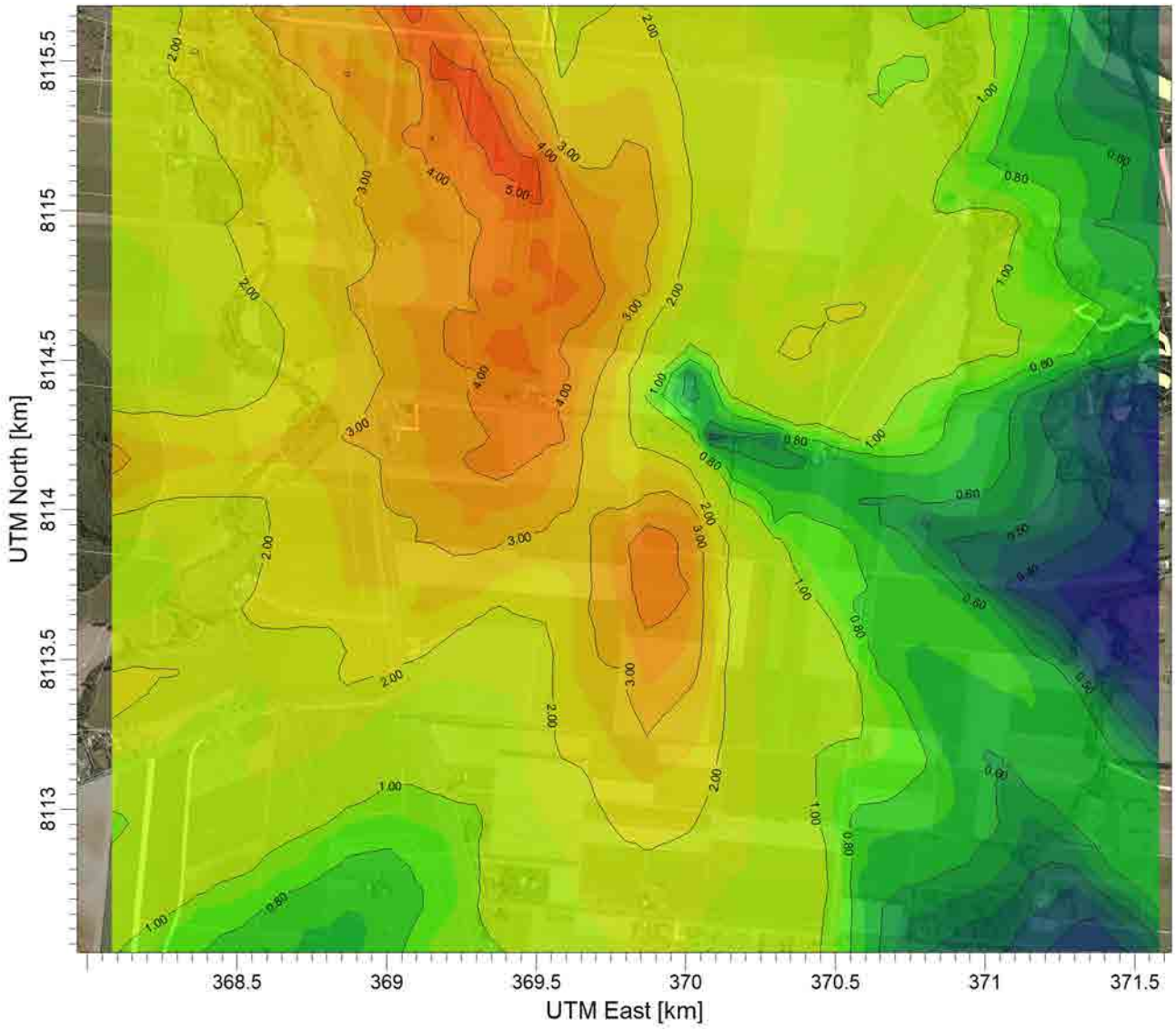
6/12/2022

PROJECT NO.:

220920

PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
SO2 24 Hour Maximum



1 RANK 24 HOUR AVERAGE CONCENTRATION (SO2) ug/m**3

Max = 6.17 [ug/m**3] at (X = 369283.00, Y = 8115355.00)

COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

DATE:

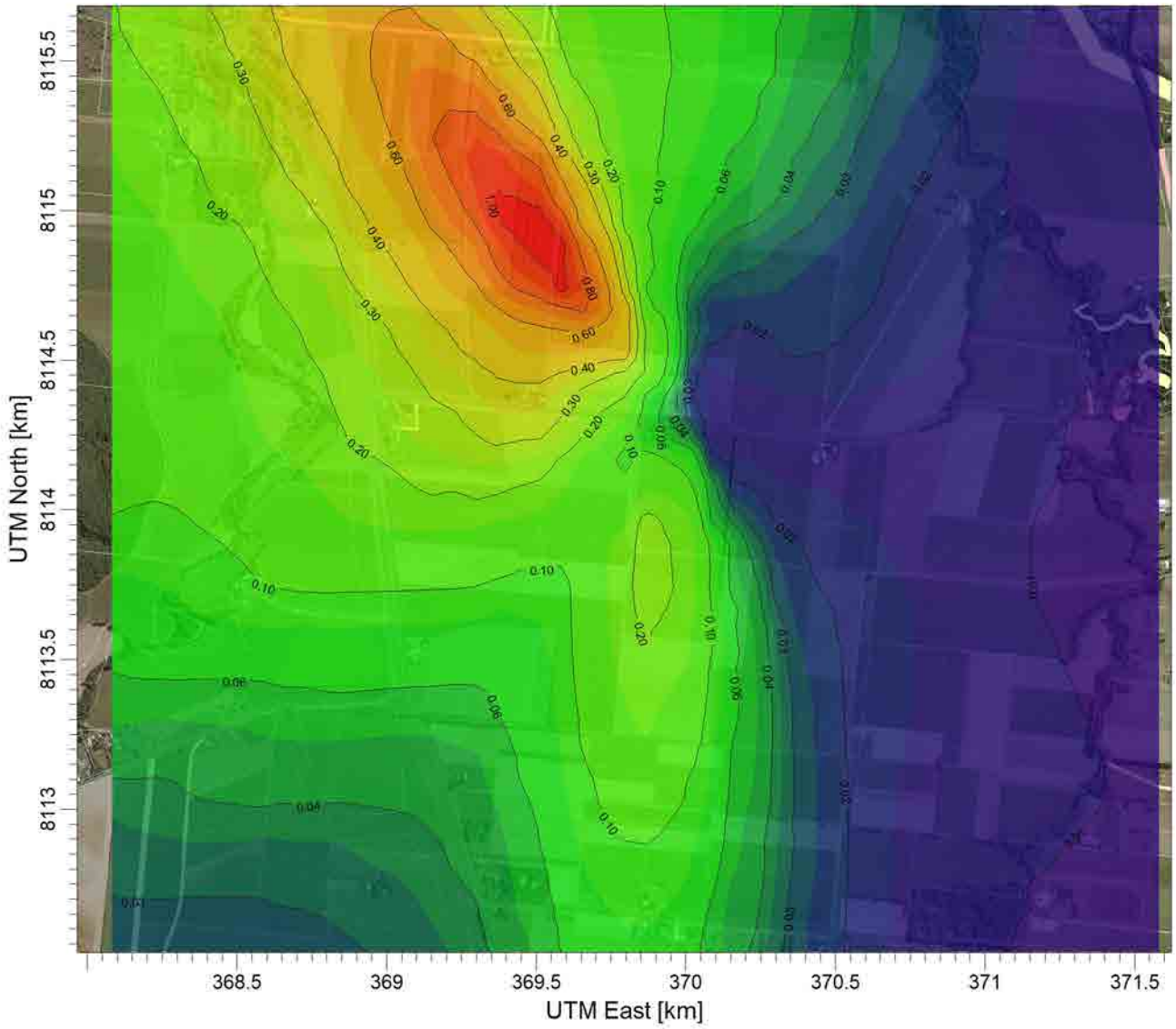
6/12/2022

PROJECT NO.:

220920

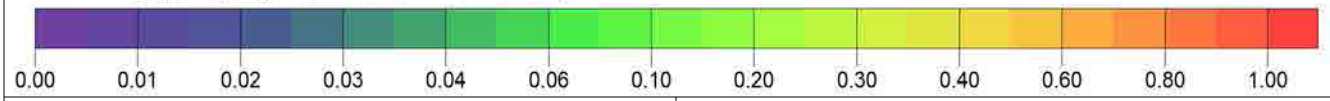
PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
SO2 Annual Average



VALUE RUN LENGTH AVERAGE CONCENTRATION (SO2) ug/m**3

Max = 1.15 [ug/m**3] at (X = 369583.00, Y = 8114855.00)



COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

DATE:

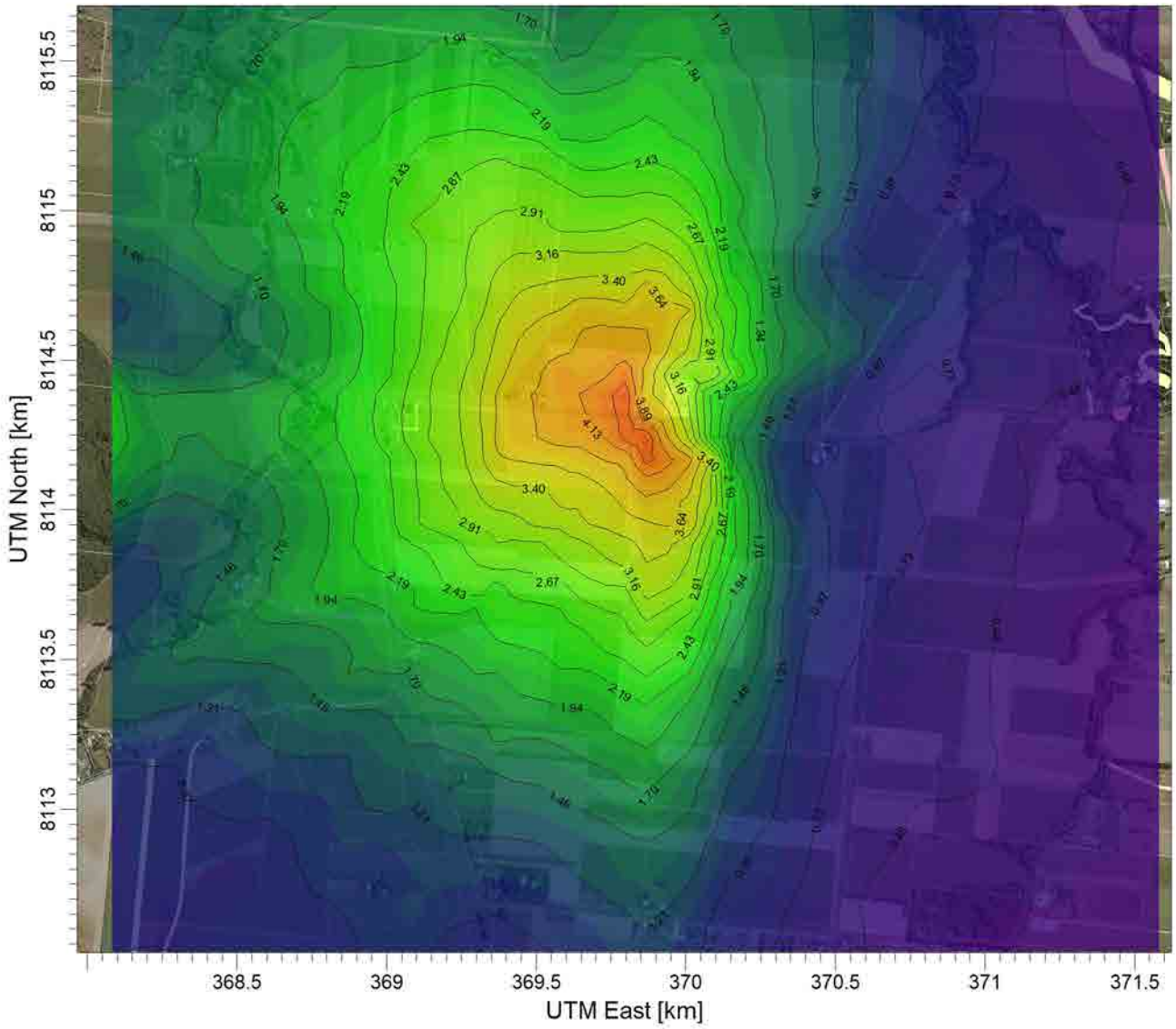
6/12/2022

PROJECT NO.:

220920

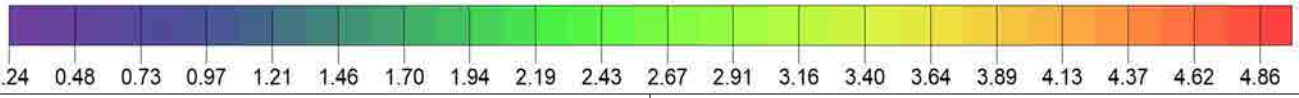
PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
VOC 1 Hour 99.9th Percentile



VALUE 99.90TH PERCENTILE 1 HOUR AVERAGE CONCENTRATION (VOC) ug/m**3

Max = 4.86 [ug/m**3] at (X = 369783.00, Y = 8114355.00)



COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

Simpson Engineering Group

DATE:

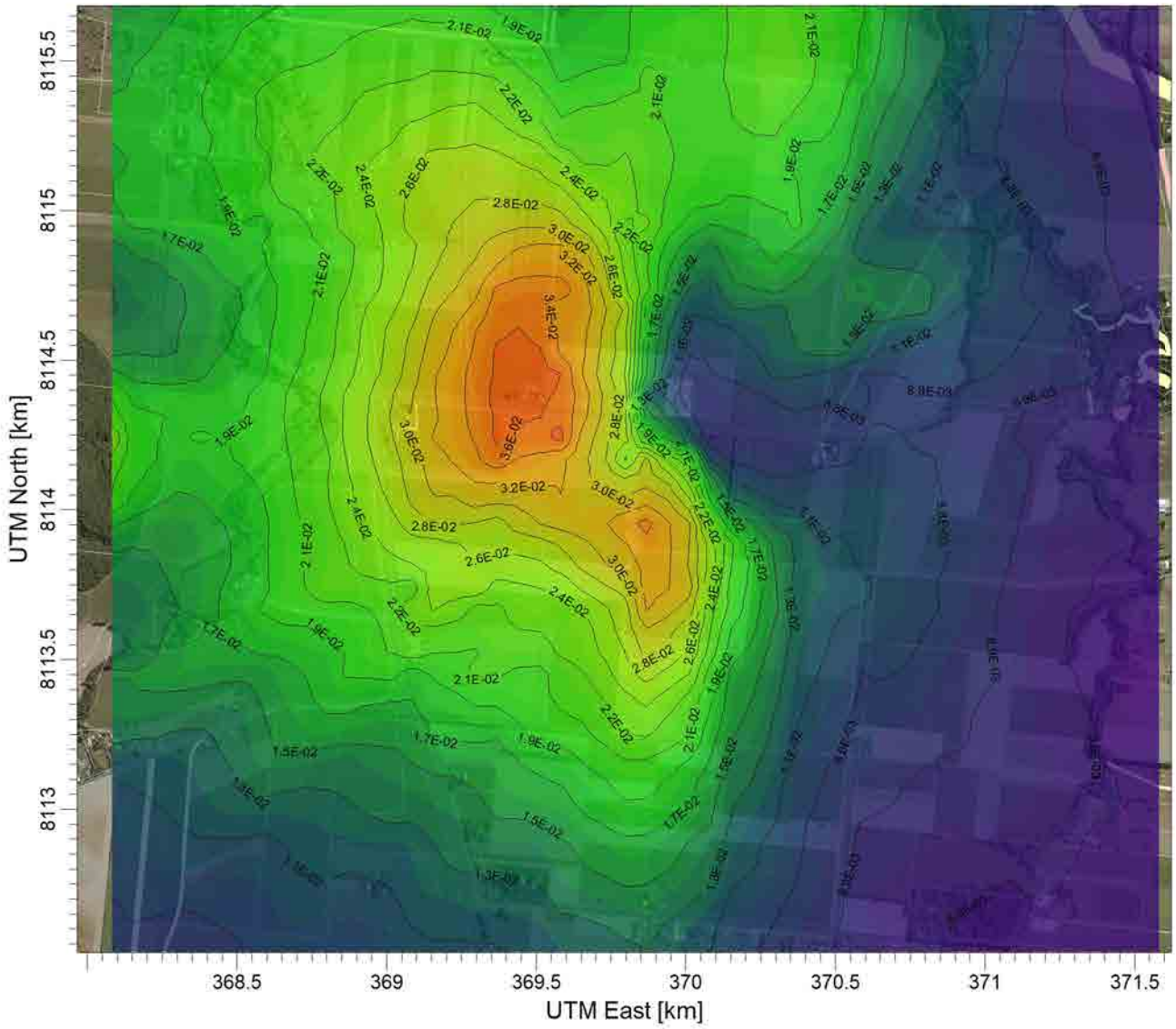
6/12/2022

PROJECT NO.:

220920

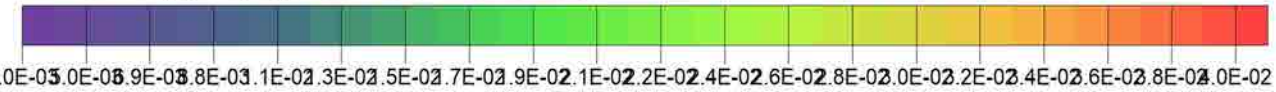
PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
Benzo(a)Pyrene as marker for PAH 1 Hour 99.9th Percentile



VALUE 99.90TH PERCENTILE 1 HOUR AVERAGE CONCENTRATION (BENZOAPYRENE) ug/m**3

Max = 3.7E-02 [ug/m**3] at (X = 369383.00, Y = 8114355.00)



COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

Simpson Engineering Group

DATE:

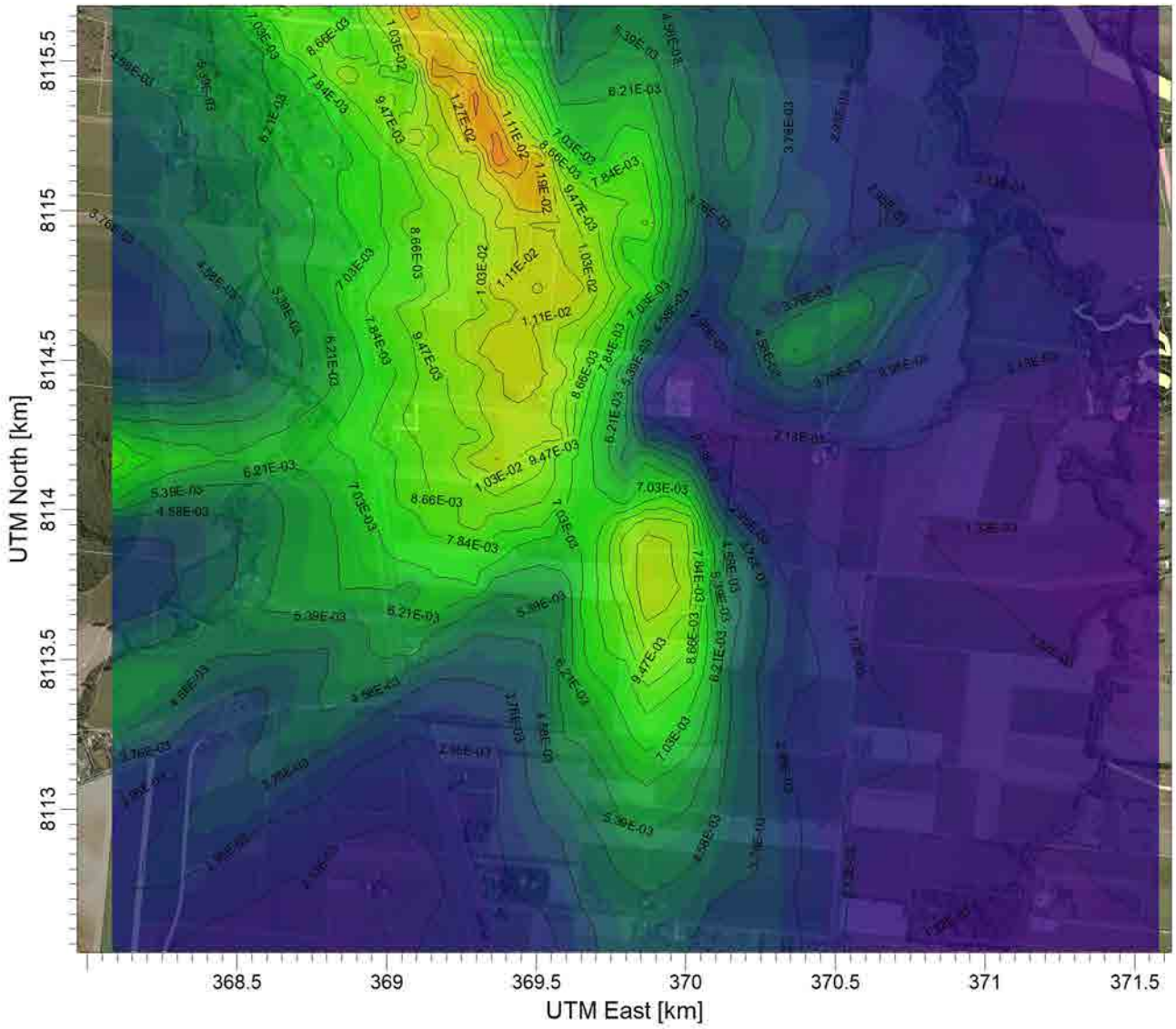
6/12/2022

PROJECT NO.:

220920

PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
Benzo(a)Pyrene as marker for PAH 24 Hour



1 RANK 24 HOUR AVERAGE CONCENTRATION (BENZOAPYRENE) ug/m**3

Max = 1.55E-02 [ug/m**3] at (X = 369283.00, Y = 8115355.00)

5.00E-04 32E-03 13E-03 95E-03 76E-03 58E-03 39E-03 21E-03 03E-03 84E-03 66E-03 47E-03 03E-02 11E-02 19E-02 27E-02 36E-02 44E-02 52E-02 60E-02

COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

DATE:

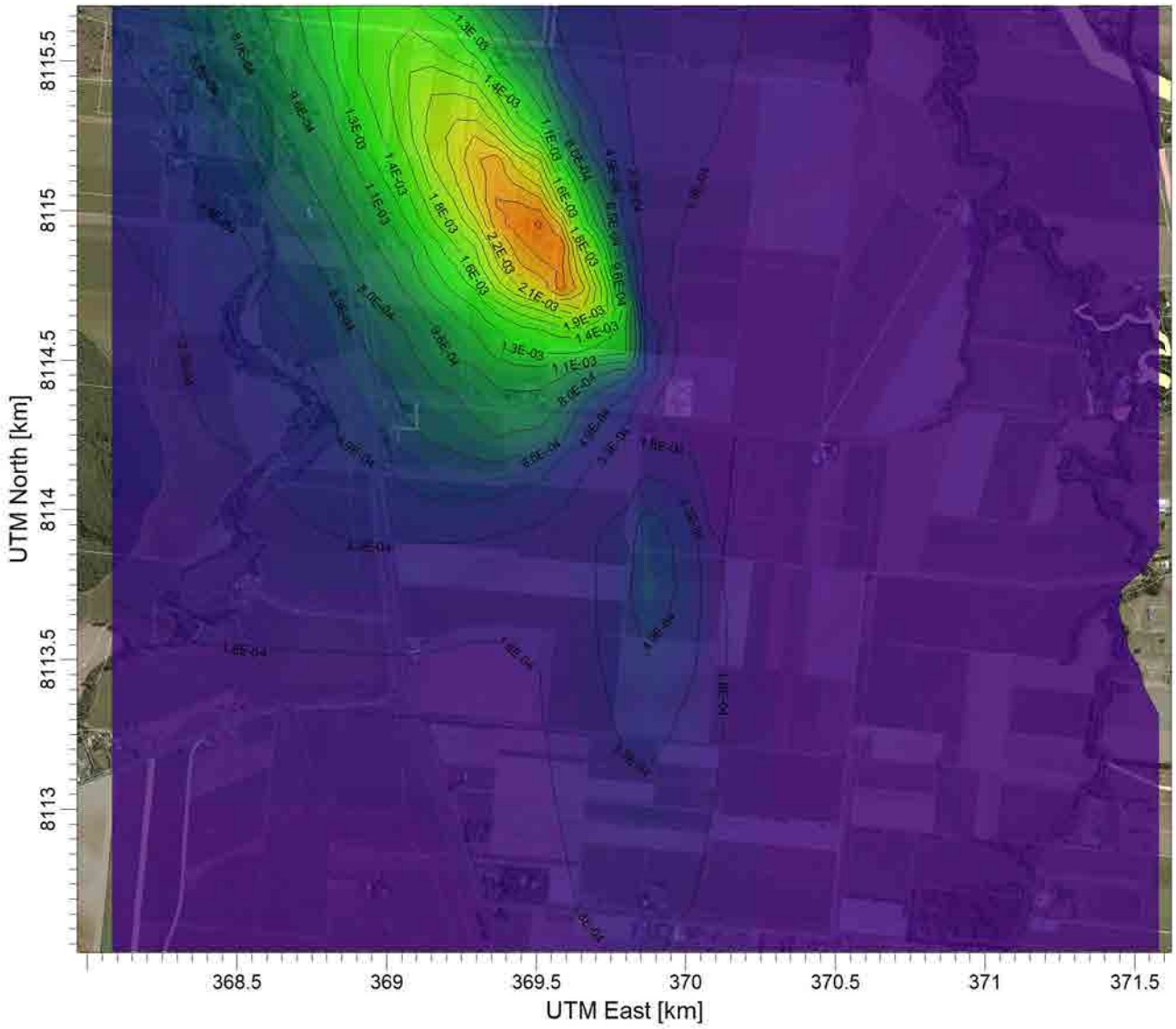
6/12/2022

PROJECT NO.:

220920

PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
Benzo(a)Pyrene as marker for PAH Annual Average



VALUE RUN LENGTH AVERAGE CONCENTRATION (BENZOAPYRENE) ug/m**3

Max = 2.9E-03 [ug/m**3] at (X = 369583.00, Y = 8114855.00)

COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

Simpson Engineering Group

DATE:

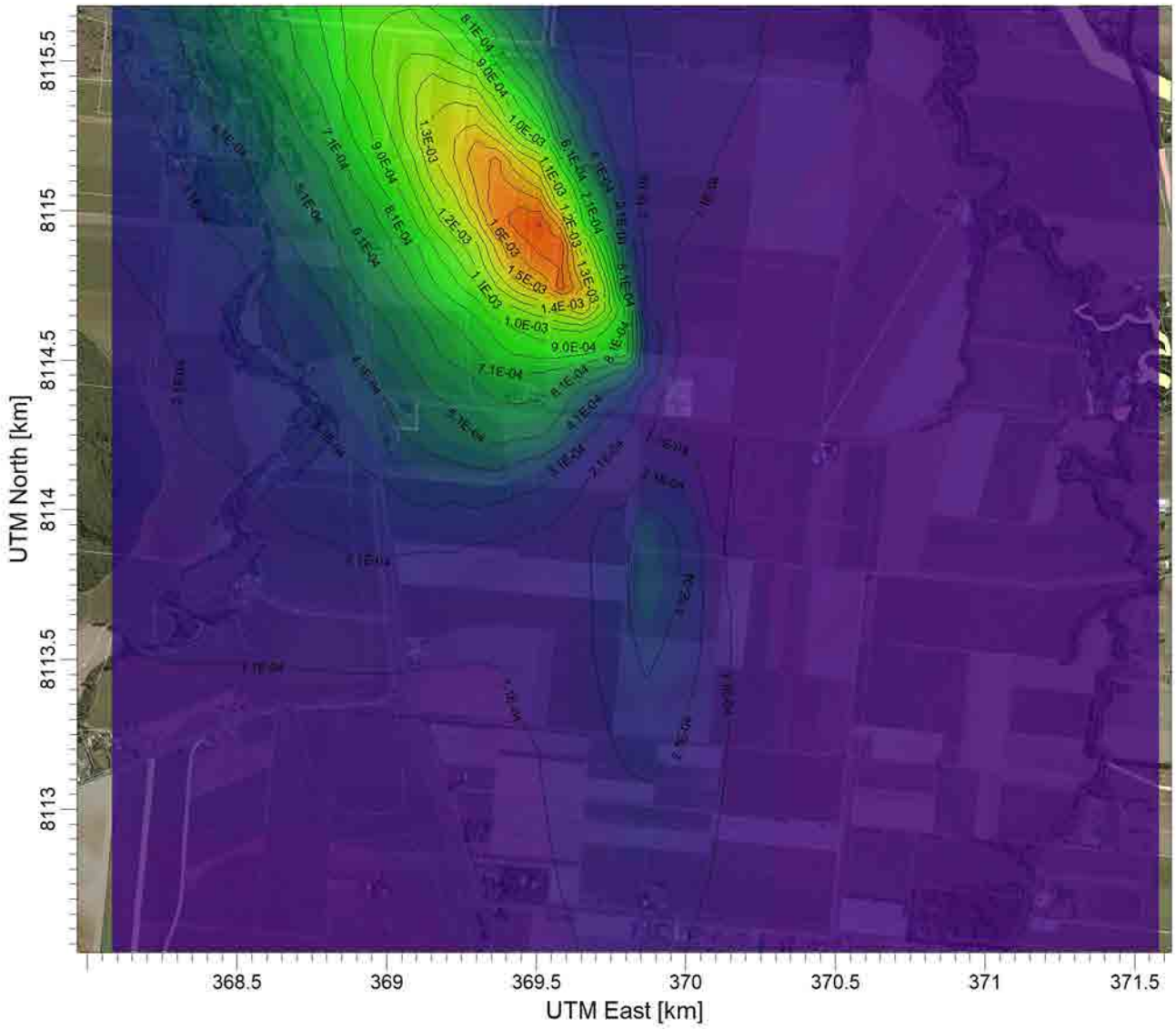
6/12/2022

PROJECT NO.:

220920

PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
Benzene Annual Average



COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

DATE:

6/12/2022

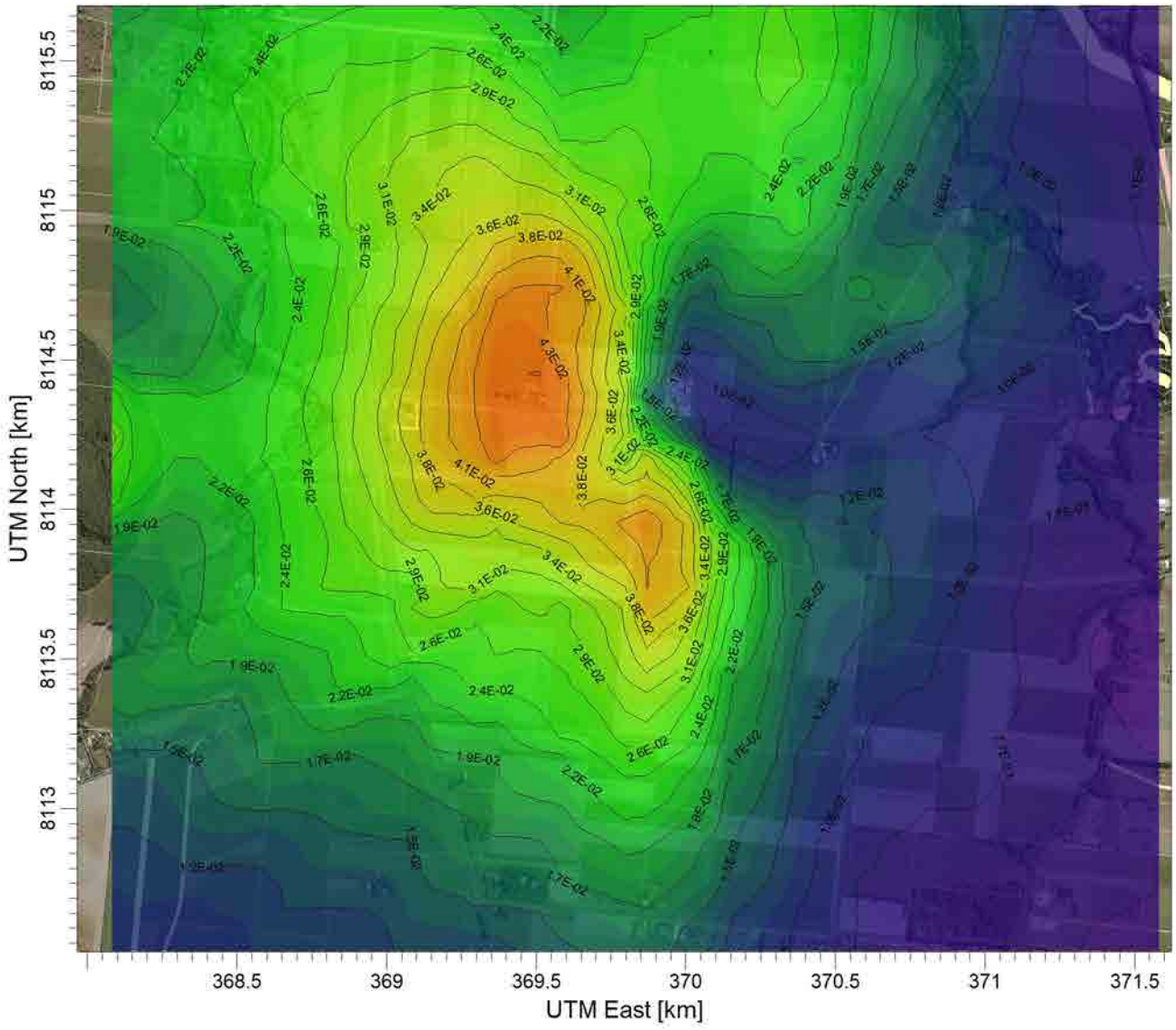
PROJECT NO.:

220920

Simpson Engineering Group

PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
Toluene 1 Hour 99.9th Percentile



VALUE 99.90TH PERCENTILE 1 HOUR AVERAGE CONCENTRATION (TOLUENE) ug/m**3

Max = 4.6E-02 [ug/m**3] at (X = 369383.00, Y = 8114355.00)

COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

Simpson Engineering Group

DATE:

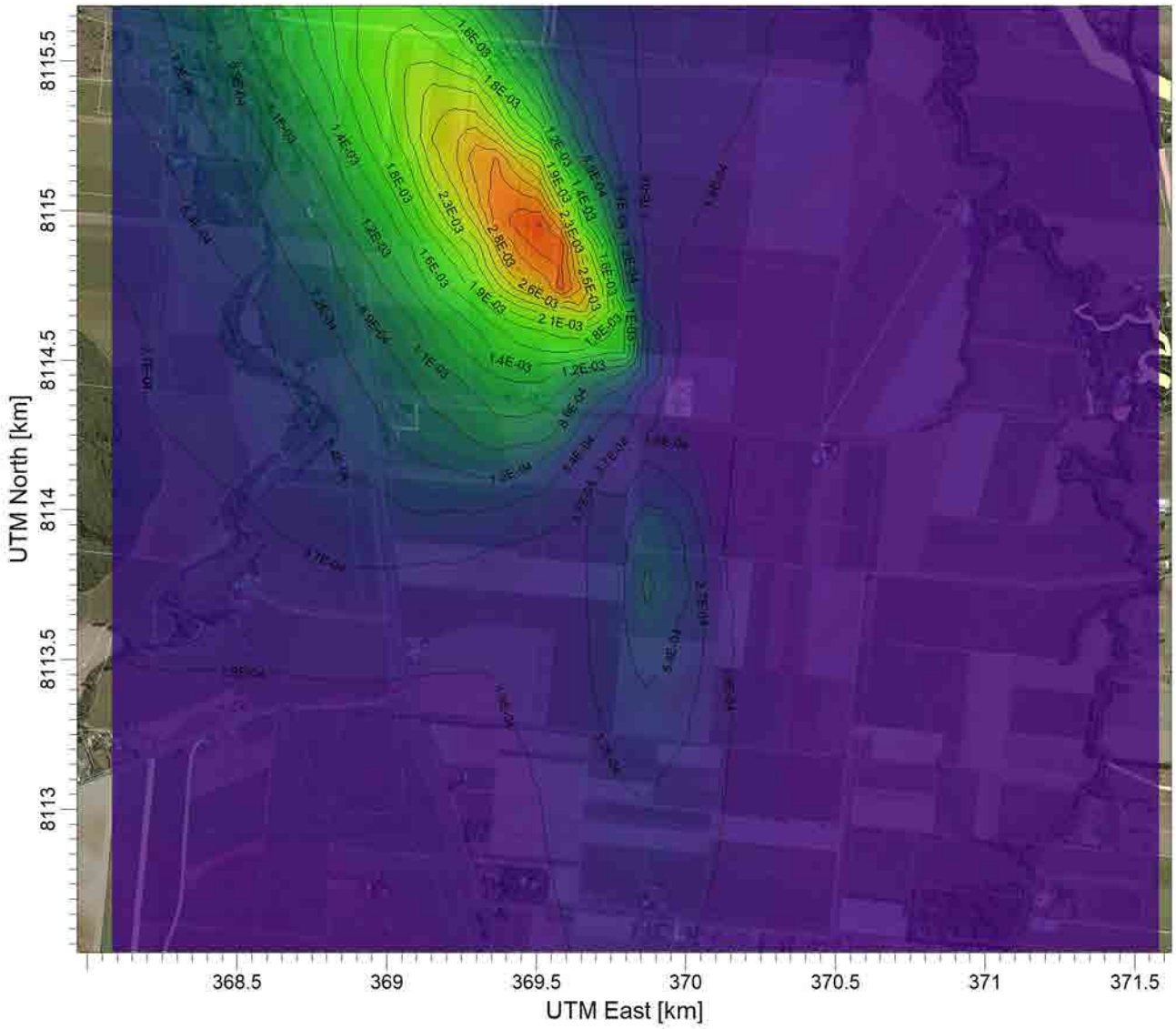
6/12/2022

PROJECT NO.:

220920

PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
Toluene Annual Average



COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

Simpson Engineering Group

DATE:

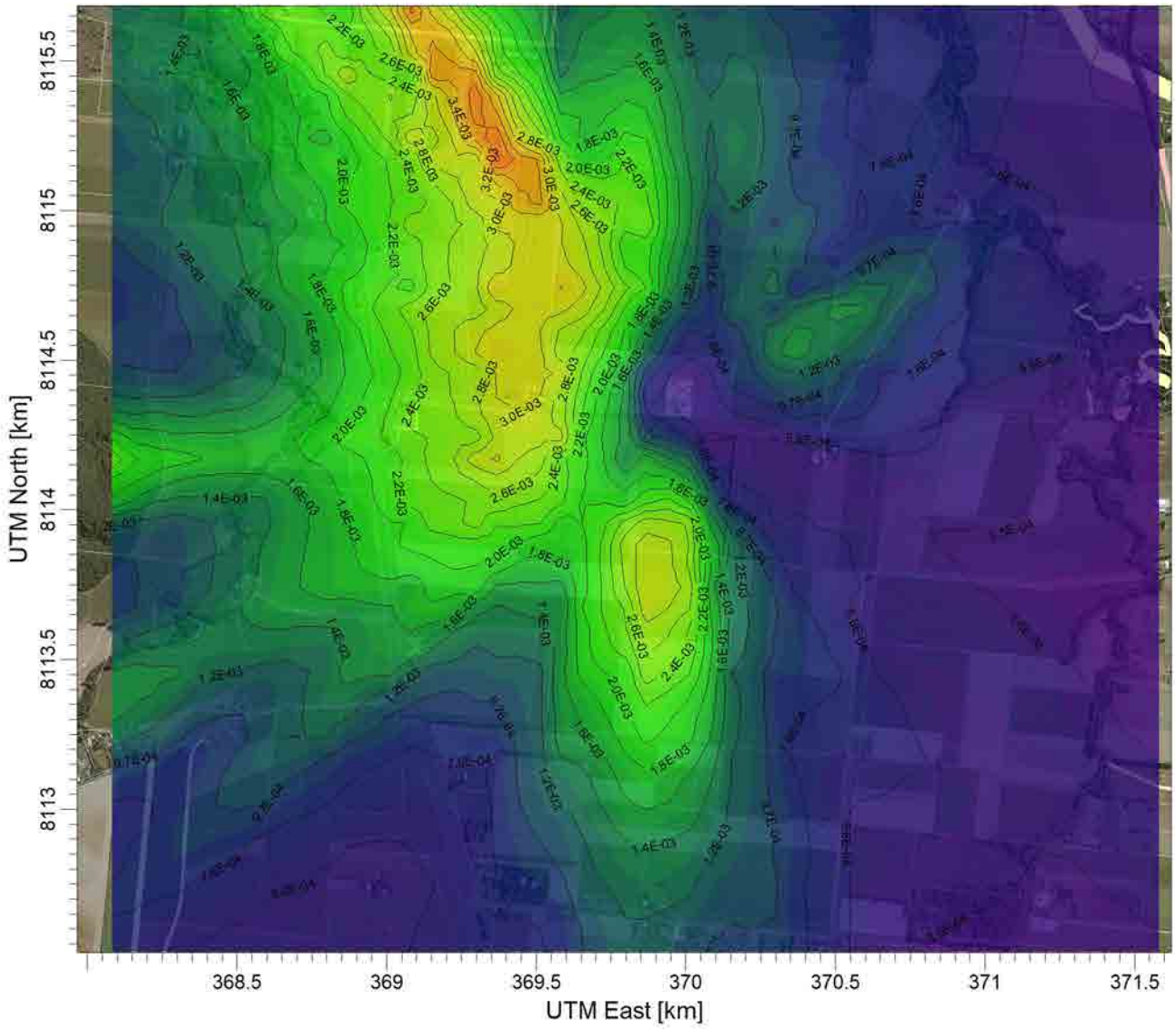
6/12/2022

PROJECT NO.:

220920

PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
Xylene 24 Hour Maximum



1 RANK 24 HOUR AVERAGE CONCENTRATION (XYLENE) ug/m**3

Max = 4.2E-03 [ug/m**3] at (X = 369283.00, Y = 8115355.00)

1.5E-03 3.5E-05 6.6E-07 4.6E-09 9.7E-04 2.2E-03 3.4E-03 4.6E-03 5.8E-03 7.0E-03 8.2E-03 9.4E-03 1.0E-02 1.1E-02 1.2E-02 1.3E-02 1.4E-02 1.5E-02 1.6E-02 1.7E-02 1.8E-02 1.9E-02 2.0E-02 2.1E-02 2.2E-02

COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

Simpson Engineering Group

DATE:

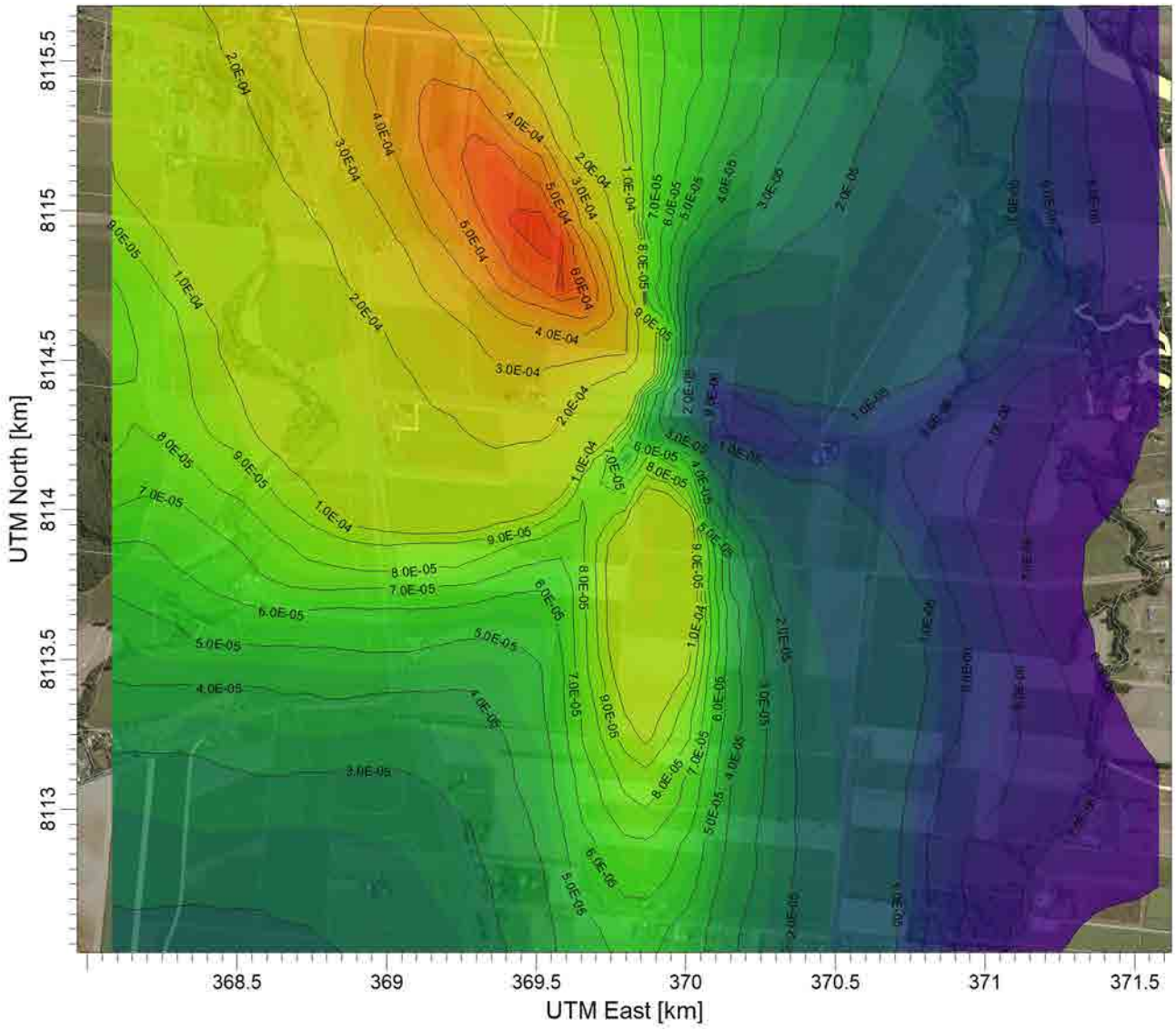
6/12/2022

PROJECT NO.:

220920

PROJECT TITLE:

Asphalt Plant - Wrights Creek - Air Quality Assessment
Xylene Annual Average



VALUE RUN LENGTH AVERAGE CONCENTRATION (XYLENE) ug/m**3

Max = 7.9E-04 [ug/m**3] at (X = 369583.00, Y = 8114855.00)

COMMENTS:

COMPANY NAME:

Simpson Engineering Group

MODELER:

Chris Simpson

SCALE: 1:23,000

0 0.5 km

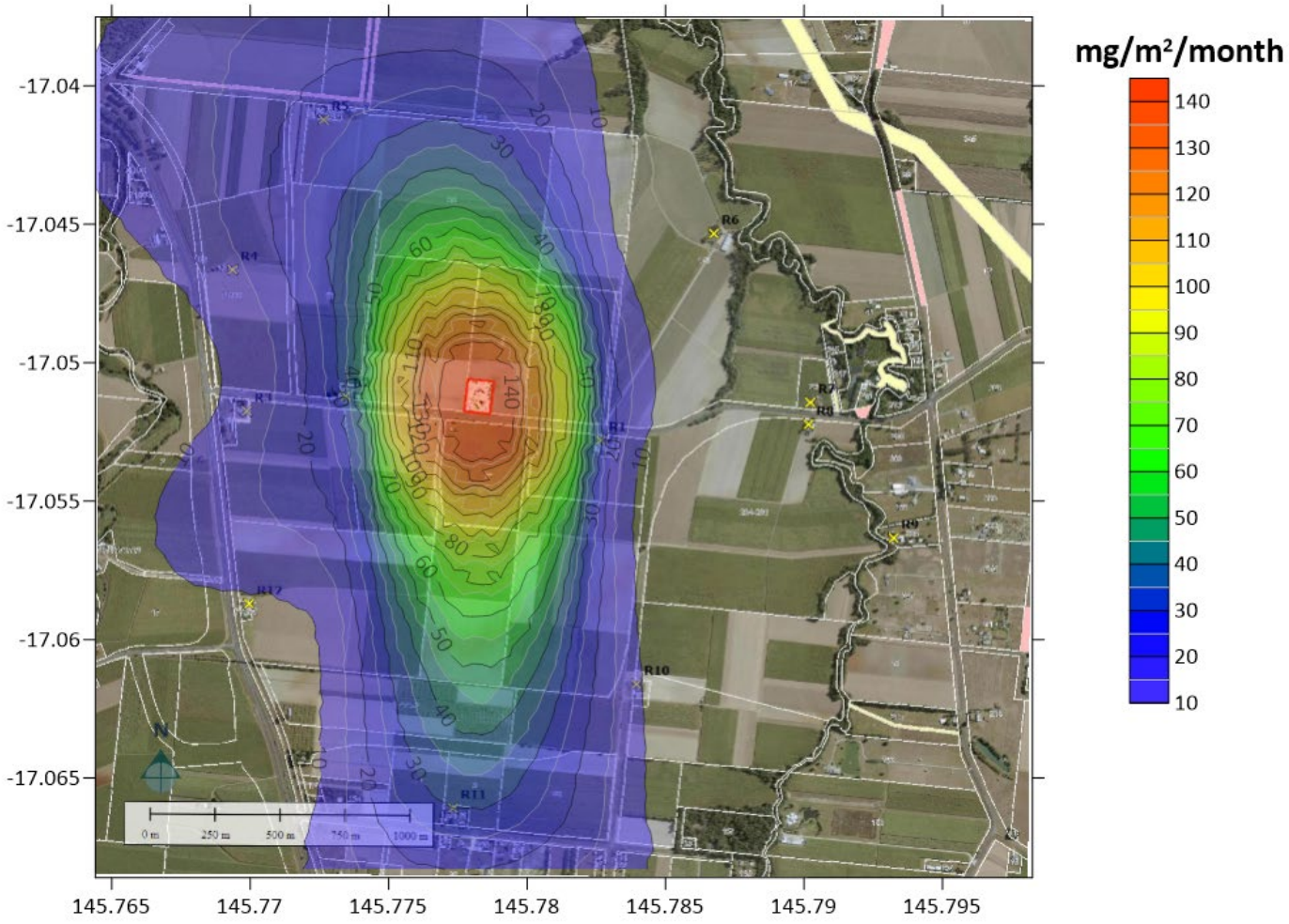
DATE:

6/12/2022

PROJECT NO.:

220920

Dust Deposition Maximum Month



DATE OF REPORT: 19TH SEPTEMBER 2022

Gordon Wilton
Operations Manager
NQ Asphalt
97-101 Tingira Street
Portsmith QLD 4870

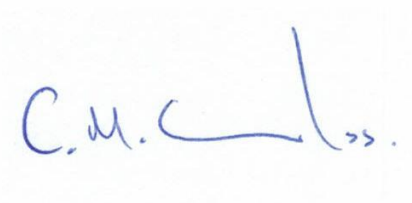
TEST REPORT NO. AUG22127.1

AIR EMISSIONS MONITORING CONDUCTED ON THE ASPHALT PLANT STACK AT NQ ASPHALT IN PORTSMITH

DATE OF TESTING: 11TH AUGUST 2022

ACCREDITATION:

AUTHORISATION:



Dr. C.M. Clunies-Ross *PhD(Chem.Eng.)*
LABORATORY MANAGER

EXECUTIVE SUMMARY

Airlabs Environmental Pty Ltd was commissioned by NQ Asphalt in Portsmith to conduct air emissions monitoring of the asphalt plant stack on 11th August 2022. Testing was conducted whilst the plant was producing 48 tph of asphalt. The results of this testing and a comparison with the limits contained in their Environmental Authority (EA) #805 are provided in Table 1 below:

Table 1: Summary of Test Results

Test Parameter	Measured Stack Concentration	EA Maximum Release Limit	Complies with EA Limit (Yes/No)	Mass Emission Rate
Total Particulate Matter	45 mg/Nm^3 dry at 15% O_2	**50 mg/Nm^3 dry at 15% O_2**	Yes	7.4 g/min
Nitrogen Oxides (NO_x as NO_2)	31 – 38 (Av. 35) mg/Nm^3 dry at 15% O_2	**100 mg/Nm^3 dry at 15% O_2**	Yes	5.1 – 6.3 (Av. 5.8) g/min
Total VOCs (as Total Carbon)	32 mg/Nm^3 dry at 15% O_2	**40 mg/Nm^3 dry at 15% O_2**	Yes	5.3 g/min
Total Heavy Metals[a]	0.092 mg/Nm^3 dry at 15% O_2	**1 mg/Nm^3 dry at 15% O_2**	Yes	0.015 g/min

[a] Total heavy metals comprise the total of antinomy, arsenic, cadmium, lead, mercury, chromium, cobalt, manganese, nickel, selenium, tin, vanadium, beryllium and their compounds expressed as the metals.

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INTRODUCTION

Airlabs Environmental Pty Ltd (Airlabs) was commissioned by NQ Asphalt Pty Ltd to monitor air emissions from the Asphalt Plant Chimney Stack in Portsmith for the following parameters:

- Gas Velocity and Volume Flow Rate
- Temperature
- Moisture Concentration
- Concentration of Oxygen (O_2) and Carbon Dioxide (CO_2)
- Dry Gas Density and Molecular Weight of Gases
- Concentration and Mass Emission Rate of:
  - Total Solid Particulates at 15% O_2
  - Nitrogen Oxides (NO_x as NO_2) at 15% O_2
  - Volatile Organic Compounds (expressed as total carbon) at 15% O_2
  - Total Heavy Metals[b] at 15% O_2.

All sampling was undertaken on 11th August 2022 whilst the plant was producing 48 tph of asphalt.

QUALITY STATEMENT

Airlabs Environmental is committed to providing the highest quality data to all our clients, as reflected in our ISO/IEC 17025 (NATA) accreditation. This requires strict adherence to, and continuous improvement of, all our processes and test work. Our goal is to exceed the QA/QC requirements as set by our clients and appropriate governmental entities and to ensure that all data generated is scientifically valid and defensible.

Airlabs Environmental is NATA accredited for all sampling undertaken for this project. Analysis was undertaken by Airlabs Environmental and the National Measurement Institute (NATA Accreditation No. 198) in accordance with our terms of accreditation.

PLANT OPERATIONAL DATA

The following plant operational data was recorded during the testing conducted on 11th August 2022:

Table 2: Plant Operational Data

Parameter	Details
Plant Production Rate at the Time of Sampling	48 tonnes/hour
Fuel Type and Consumption Rate	Diesel at 10 L/tonne on average
Any Atypical Factors that may Influence Odour and Particulate Emissions	Nil
The Odour and Particulates Treatment System Operating, System Status and Rate	Wet Scrubber System with Settling Ponds

[b] Total heavy metals comprise the total of antinomy, arsenic, cadmium, lead, mercury, chromium, cobalt, manganese, nickel, selenium, tin, vanadium, beryllium and their compounds expressed as the metals.

TEST METHODS

All sampling was undertaken by Airlabs Environmental. Airlabs Environmental is NATA accredited for all sampling undertaken for this project (NATA Accredited Laboratory No. 15463). Analysis was undertaken by Airlabs Environmental and the National Measurement Institute (NMI, NATA Accreditation No. 198) in accordance with our terms of accreditation. Specific details of the test methods used are available upon request.

Table 3: Summary of Test Methods

Test Parameter	Test Method	Method Detection Limit	Estimated Measurement Uncertainty	NATA Accredited	
				Sampling	Analysis
Sample Plane Criteria	AS 4323.1	N/A	N/A	✓	N/A
Gas Velocity & Volume Flow Rate	US EPA 2	3 m/s	± 13%	✓	✓
Temperature	US EPA 2	273K (0°C)	± 2.6%	✓	✓
Moisture Content	US EPA 4	0.1%	± 12%	✓	✓
Oxygen	US EPA 3A	0.1%	± 6%	✓	✓
Carbon Dioxide	US EPA 3A	0.1%	± 13%	✓	✓
Dry Molecular Weight & Gas Density	US EPA 3	N/A	± 13%	✓	✓
Total Solid Particulates[c]	AS 4323.2	1 mg/Nm^3	± 15%	✓	✓
Oxides of Nitrogen (as NO_2)	US EPA 7E	2 mg/Nm^3	± 13%	✓	✓
Volatile Organic Compounds as Total Carbon	US EPA 25A	0.1 mg/Nm^3	± 13%	✓	✓
Heavy Metals	US EPA 29	0.003 mg/Nm^3 (as total metals)	± 29%	✓	✓[d]

DEVIATIONS AND FACTORS INFLUENCING THE RESULTS

No deviations from the test methods or other influencing factors were recorded.

[c] Total solid particulates were determined in conjunction with heavy metals, as the sampling procedure for the particulate phase of the metals train by USEPA 29 is identical to AS 4323.2. US EPA 29 stipulates that 'This method may be used to determine particulate emissions in addition to the metals emissions if the prescribed procedures and precautions are followed'.

[d] Heavy metal analysis was performed by NMI Laboratory, with results included in their Report No. RN1364079.

DEFINITIONS

Table 4: Terms and Definitions

EA	Environmental Authority
US EPA	United States Environmental Protection Agency.
AS	Australian Standard.
NMI	National Measurement Institute.
STP	Standard temperature and pressure (0°C and 1013.25 mB).
m/s	Meters per second.
Am^3/min	Actual gas flow rate at stack conditions in cubic metres per minute (wet basis).
m^3/min	Normalised gas flow rate in dry cubic metres per minute expressed at STP.
Nm^3/min	Normalised gas flow rate in dry cubic metres per minute expressed at STP and referenced to 15% oxygen concentration.
mg/Nm^3	Milligrams (10^{-3} grams) of substance per dry cubic metre of gas at STP and referenced to 15% oxygen concentration.
g/min	Grams per minute.
VOCs	Volatile organic compounds.
<	Less than. The value stated is the limit of detection.
N/A	Not applicable.

SUITABILITY OF SAMPLING PLANE

Section 4.1 in AS4323.1-1995 'Stationary Source Emissions, Method 1: Selection of Sampling Provisions' states that, in the absence of cyclonic flow activity, ideal sampling plane conditions are found to exist at the positions given in Table 5 below:

Table 5: Criteria for the Selection of Sampling Planes

Type of flow disturbance	Minimum distance upstream from disturbance, diameters (*D*)	Minimum distance downstream from disturbance, diameters (*D*)
Bend, connection, junction, direction change	>2D	>6D
Louvre, butterfly damper (partially closed or closed)	>3D	>6D
Axial fan	>3D	>8D (see Note)
Centrifugal fan	>3D	>6D

NOTE: The plane should be selected as far as practicable from a fan. Flow straighteners may be required to ensure the position chosen meets the check criteria listed in Items (a) to (f) below.

Section 4.1 of AS 4323.1-1995 (Ideal Sampling Positions) states that the location of the sampling plane shall be such that it meets the following criteria:

(a) The gas flow is basically in the same direction at all points along each sampling traverse.

(b) The gas velocity at all sampling points is greater than 3 m/s.

(c) The gas flow profile at the sampling plane shall be steady, evenly distributed and not have a cyclonic component which exceeds an angle of 15° to the duct axis, when measured near the periphery of a circular sampling plane.

(d) The temperature difference between adjacent points of the survey along each sampling traverse is less than 10% of the absolute temperature, and the temperature at any point differs by less than 10% from the mean.

(e) The ratio of the highest to lowest pitot pressure difference shall not exceed 9:1 and the ratio of highest to lowest gas velocities shall not exceed 3:1. For isokinetic testing with the use of impingers, the gas velocity ratio across the sampling plane should not exceed 1.6:1.

(f) The gas temperature at the sampling plane should preferably be above the dewpoint.

The sampling plane location satisfied the requirements of AS 4323.1-1995 Section 4.1. In addition, the gas characteristics satisfied the requirements of AS 4323.1-1995 Section 4.1 (a) - (f). As such, the sampling plane location is ideal.

AS 4323.1-1995 states that, for rectangular stacks, the sampling plane is divided into equal areas by imaginary lines, which are parallel to the sides of the stack. A sampling point is located at the center of each such area. For a rectangular stack of dimensions 0.49m x 0.42m at the sampling plane, AS 4323.1-1995 specifies a minimum of two sample ports. The sampling provisions meet the requirements of this standard.

The sampling plane details and required number of sampling points are provided in Table 6 below:

SUITABILITY OF SAMPLING PLANE Continued

Table 6: Sampling Plane Details for the Asphalt Plant Chimney Stack

Parameter	
Stack Shape	Rectangular
Stack Dimensions at Sampling Plane (m)	0.490 x 0.420
Stack Area at Sampling Plane (m^2)	0.206
Equivalent Diameter of Circle with Same Area (m)	0.512
Stack Dimensions at Point of Discharge (m)	0.690 x 0.620
Stack Area at Point of Discharge (m^2)	0.428
Direction of Discharge to Air	Vertical
Type of Flow Disturbance	Centrifugal Fan
Sampling Plane Distance Downstream from Disturbance	3.50m (6.8 D) (>6 D)
Type of Flow Disturbance	Stack Expansion & Exit
Sampling Plane Distance Upstream from Disturbance	1.12m (2.2 D) (>2 D)
Compliance with AS 4232.1 Section 4.1 Criteria for Selection of Sampling Planes	Yes
Required No. and Orientation of Access Holes	2 across one side
Available No. and Orientation of Access Holes	2
Compliance with AS 4232.1 Section 6 Sampling Access Holes	Yes
Standard No. of Sampling Points per Traverse	2
Standard No. of Traverses	2
Correction Factor	N/A
Corrected No. of Sampling Points per Traverse	2
Total No. of Sampling Points	4
Gas Flow Direction is Consistent at all Points	Yes
Minimum Velocity at any Sample Point (m/s)	15 (>3)
Stratified Gas Flow	No
Cyclonic Gas Flow	No (<15°)
Absolute Temperature Difference (K)	3 (<10%)
Pitot Pressure Difference	1.8:1 (<9:1)
Gas Velocity Difference (Isokinetic)	1.3:1 (<1.6:1)
Gas Temperature above Dew Point	Yes
Compliance with AS 4232.1 Section 4.1 (a)-(f)	Yes

Figure 1: Asphalt Plant Chimney Stack Sampling Locations

RESULTS

Company NQ Asphalt

Site 97-101 Tingira Street, Portsmith

Source Tested Asphalt Plant Chimney Stack

Date of Test 11th August 2022

Sampling Period 08:37 – 10:02

Testing Officers C. Clunies-Ross

Sampling Position Two 90mm sockets in a rectangular stack

Table 7: Gas Flow Conditions for the Asphalt Plant Chimney Stack

Test Conditions	
Stack dimensions at sampling plane (m)	0.490 x 0.420
Stack dimensions at point of discharge (m)	0.690 x 0.620
Average stack gas temperature (K)	338 (65°C)
Average barometric pressure (mB)	1017.6
Average static pressure (mB)	- 1.98
Average stack pressure (mB)	1015.6
Average moisture content (%v/v)	16.7
Average oxygen concentration, dry (%v/v)	14.2
Average carbon dioxide concentration, dry (%v/v)	4.57
Dry gas density of stack gas (kg/m^3)	1.308
Dry molecular weight of stack gas (g/g mole)	29.30
Wet molecular weight of stack gas (g/g mole)	27.41
Average velocity at sampling plane (m/s)	17.5
Average velocity at point of discharge (m/s)	8.42
Actual gas flow rate (Am^3/min)	216
Gas flow rate at STP, dry (m^3/min)	145
Gas flow rate at STP, dry & 15% O_2 reference (Nm^3/min)	165

RESULTS Continued

Table 8: Test Results for the Asphalt Plant Chimney Stack

Parameter	Reference Conditions	Concentration (mg/Nm^3)	Maximum Release Limit (mg/Nm^3)	Emission Rate (g/min)
Total Particulate Matter	Dry, STP, 15% O_2	45	**50**	7.4
Nitrogen Oxides (NO_x as NO_2)	Dry, STP, 15% O_2	31 – 38 (Av. 35)	**100**	5.1 – 6.3 (Av. 5.8)
Volatile Organic Compounds (as total carbon)	Dry, STP, 15% O_2	32	**40**	5.3
Total Heavy Metals	Dry, STP, 15% O_2	0.092	**1**	0.015

Table 9: Concentration of Individual Metals and their Compounds

Metal/Metal Compound	Concentration (mg/Nm^3)	Emission Rate (g/min)
Antinomy (Sb) & its compounds as Sb	0.000045	0.0000074
Arsenic (As) & its compounds as As	0.0010	0.00017
Beryllium (Be) & its compounds as Be	< 0.0003	< 0.00005
Cadmium (Cd) & its compounds as Cd	0.000029	0.0000048
Chromium (Cr) & its compounds as Cr	0.0027	0.00045
Cobalt (Co) & its compounds as Co	0.0010	0.00017
Lead (Pb) & its compounds as Pb	0.0052	0.00086
Manganese (Mn) & its compounds as Mn	0.074	0.012
Mercury (Hg) & its compounds as Hg	0.000020	0.0000033
Nickel (Ni) & its compounds as Ni	0.0050	0.00083
Selenium (Se) & its compounds as Se	< 0.0003	< 0.00005
Tin (Sn) & its compounds as Sn	0.00016	0.000026
Vanadium (V) & its compounds as V	0.0026	0.00043
Total of Sb, As, Be, Cd, Cr, Co, Pb, Mn, Hg, Ni, Se, Sn, V and their compounds expressed as the metals	**0.092**	**0.015**

END OF REPORT

MUSWELLBROOK ASPHALT PLANT

Air Quality Impact Assessment

Prepared for:

Newpave Asphalt Pty Ltd
c/- ADW Johnson Pty Ltd
7/335 Hillsborough Road
Warners Bay NSW 2282

SLR Ref: 630.12689-R02
Version No: -v1.0
June 2019

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BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Newpave Asphalt Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.12689-R02-v1.0	17 June 2019	A Naghizadeh	G Starke	G Starke

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1 Introduction

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by Newpave Asphalt Pty Ltd (Newpave) to undertake an Air Quality Impact Assessment (AQIA) for a proposed asphalt plant (the Project) located at 43-4 Enterprise Crescent, Muswellbrook NSW on Lot 14 DP 1119843 (the Project Site).

The scope of this AQIA addresses the Secretary's Environmental Assessment Requirements issued for the Project and considers the following issues:

- identification of construction, operation and road traffic dust, odour and greenhouse gas emissions and potential cumulative impacts;
- modelling and assessment of the predicted air quality impacts on the closest sensitive receivers; and
- identification of any required management and mitigation measures to comply with the relevant policies and guidelines.

1.1 Secretary's Environmental Assessment Requirements

The NSW Department of Planning and Environment (DP&E) issued Secretary's Environmental Assessment Requirements (SEARs) for the Project (SEAR 1278). **Table 1** below identifies the SEARs relevant to air quality issues and notes where they have been addressed in this report.

Table 1 Secretary's Environmental Assessment Requirements – Muswellbrook Asphalt Plant

Agency	Assessment Requirement	Addressed in Section
NSW Department of Planning and Environment	A description of all potential sources of air and odour emissions	**Section 2.3**
	An air quality impact assessment in accordance with relevant Environment Protection Authority Guidelines	**Section 1.2**
	A description and appraisal of air quality impact mitigation and monitoring measures	**Section 7.3**

1.2 Relevant Policies, Guidelines and Plans

This assessment has been prepared with consideration of the following policies, guidelines and plans:

- Approved Methods for the Modelling and Assessment of Air Pollutants in NSW (NSW EPA, 2017)
- Approved Methods for the Sampling and Analysis of Air Pollutants in NSW (NSW DEC, 2005)
- Protection of the Environment Operations Act 1997 (NSW Parliament, 1997)
- Protection of the Environment Operations (Clean Air) Regulation 2010 (NSW Parliament, 2010)
- Technical Framework: Assessment and Management of Odour from Stationary Sources in NSW (NSW DEC, 2006)
- Technical Notes: Assessment and Management of Odour from Stationary Sources in NSW (NSW DEC, 2006)

The New South Wales Environment Protection Authority (EPA) "*Approved Methods for the Modelling and Assessment of Air Pollutants in NSW*" (NSW EPA, 2017) (the Approved Methods) outlines the requirements for conducting an 'air quality impact assessment' as follows. Also indicated are the relevant sections of this report where the requirements are met:

- Description of local topographic features and sensitive receptor locations (Section 2.1.2 and Section 2.1.3 respectively).
- Establishment of air quality assessment criteria (**Section 3**).
- Analysis of climate and dispersion meteorology for the region (**Section 4.1**).
- Description of existing air quality environment (**Section 4.2**).
- Compilation of a comprehensive emissions inventory for the existing and proposed activities (**Section 6**).
- Completion of atmospheric dispersion modelling and analysis of results (Section 5.2 and Section 7).
- Preparation of an air quality impact assessment report comprising the above.

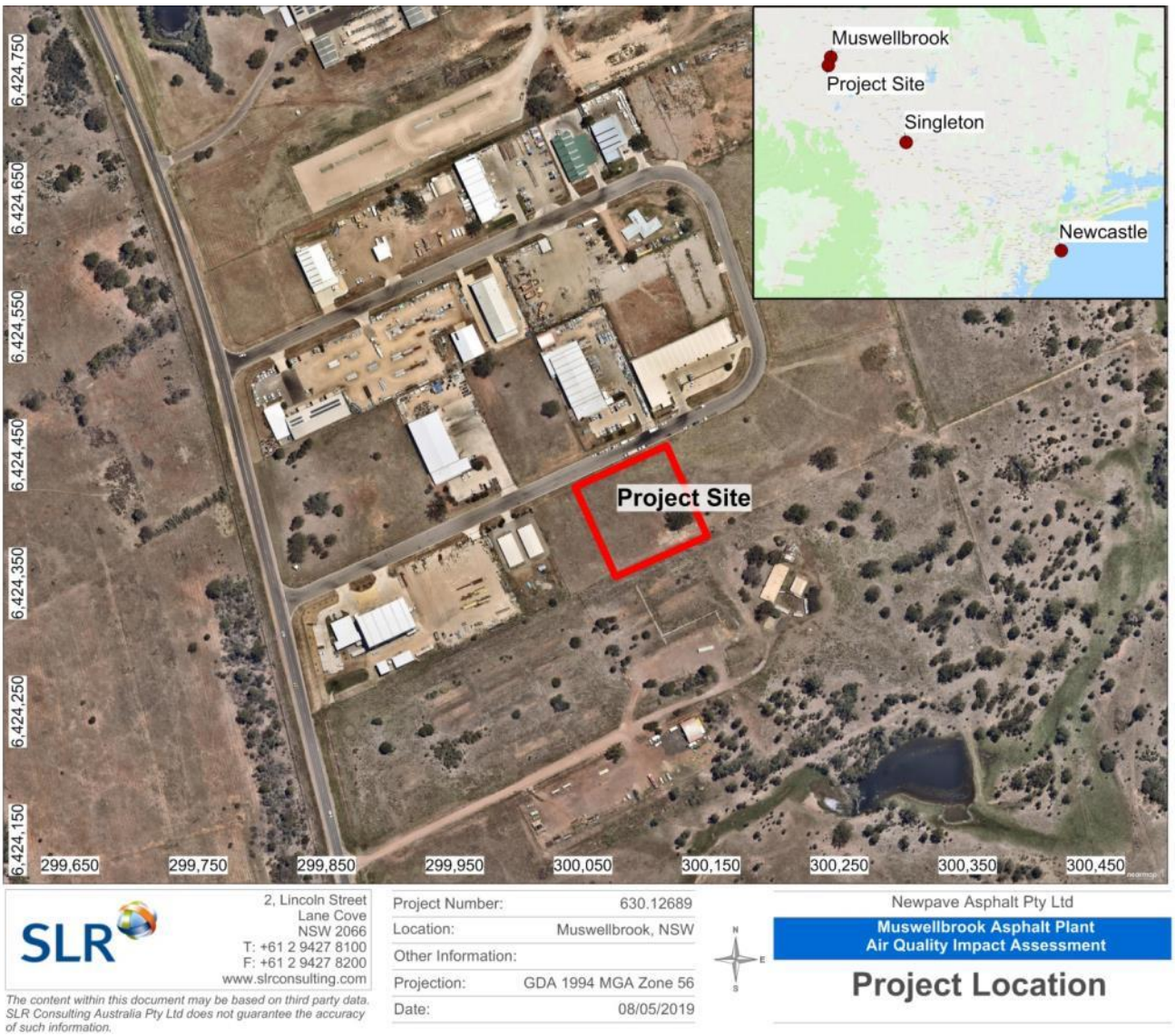
2 Development Overview

2.1 Site Description

2.1.1 Site Location

Newpave is proposing to establish and operate an asphalt plant at 43-45 Enterprise Crescent, Muswellbrook NSW located approximately 40 km northwest of Singleton and 100 km northwest of Newcastle in the local Government Area of Muswellbrook. The location of the Project Site is shown in **Figure 1**.

Figure 1 Site Location

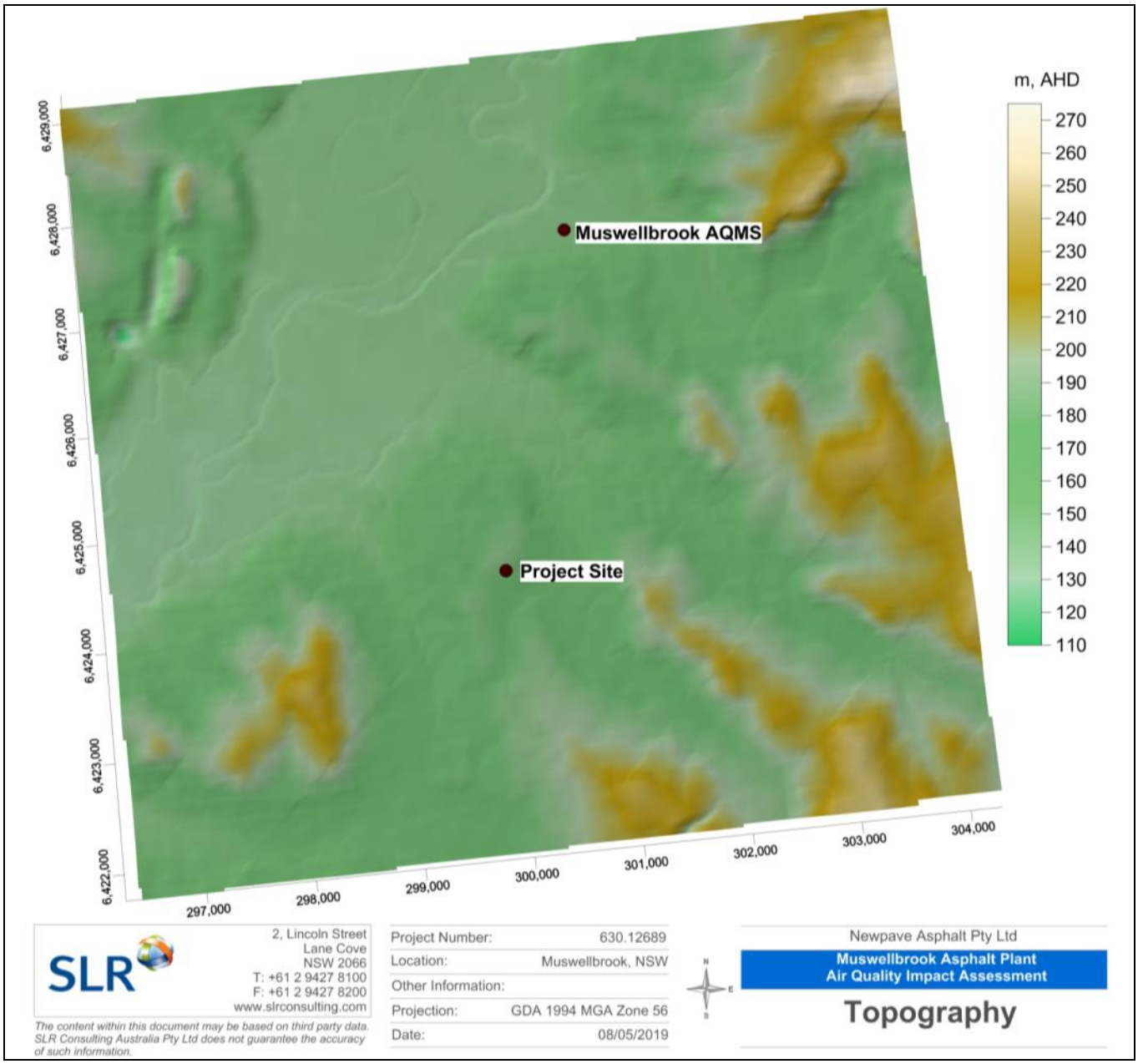


2.1.2 Topography

Figure 2 illustrates the topography of the region surrounding the proposed development. The topographical data used in the modelling assessment was sourced from the United States Geological Service's Shuttle Radar Topography Mission database that has recorded topography across Australia with a 1 arc second (approximately 30 metre [m]) spacing.

The topography of the area surrounding the Project Site is characterised by elevated terrain to the northeast and east of the site which continues to form the Barrington Tops National Park. To the south and east, the terrain is generally more open creating the Hunter Valley region. The terrain features of the surrounding area which form the Hunter Valley region, follow a northwest to southeast orientation, have a significant effect on the local wind distribution patterns and flows.

Figure 2 Local Topographical Features



2.1.3 Land Use and Sensitive Receptors

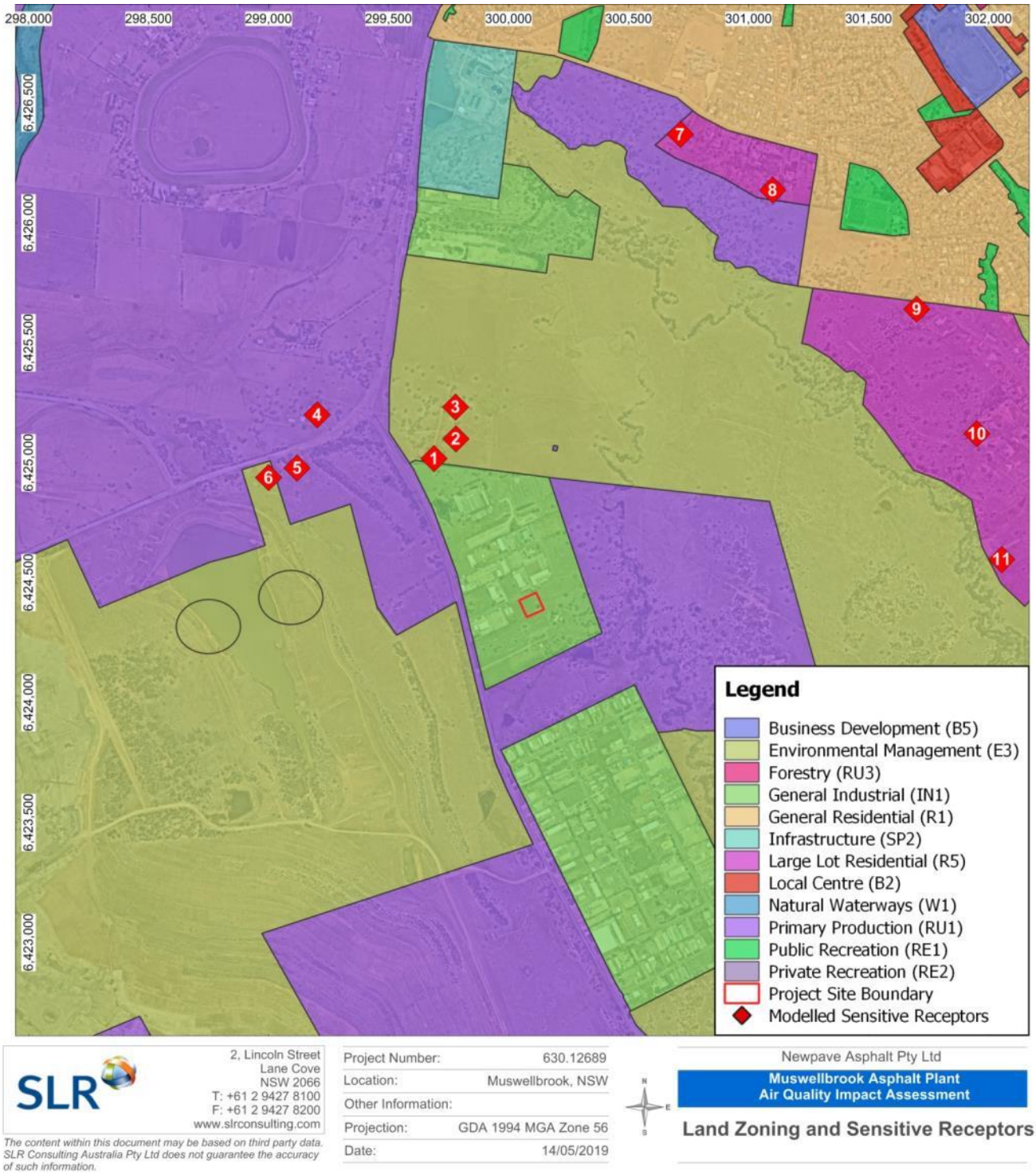
Based on available aerial images, the nearest residential receptors that have the potential to be impacted by air emissions during construction and operation of the Project have been identified for investigation in this assessment. The locations of the nearest sensitive receptors are shown in **Table 2** and **Figure 3.** The closest residential receptors are located approximately 690 m northwest of the Project Site. It is noted that a number of existing industrial facilities are present to the north,west and south of the Project Site and vacant industrial land is located to the east. It is also noted that the industrial estate within which the Project Site is situated, is located adjacent to the eastern fringe of the Mt Arthur Coal Mine.

As illustrated in **Figure 3**, the Project Site is located within a 'General Industrial' (IN1) zone in the Muswellbrook Local Environmental Plan (LEP) 2009, and is surrounded by land zoned General Industrial (IN1). The industrial estate within which the Project Site is situated is surrounded by land zoned Primary Production (RU1) and Environmental Management (E3).

Table 2 Location of the Identified Sensitive Receptors

ID	Easting (m)	Northing (m)	Distance from Site
R1	299,689	6,425,017	690
R2	299,780	6,425,099	720
R3	299,778	6,425,233	840
R4	299,202	6,425,200	1,160
R5	299,119	6,424,978	1,100
R6	298,999	6,424,938	1,190
R7	300,715	6,426,368	2,020
R8	301,100	6,426,136	1,970
R9	301,701	6,425,640	2,010
R10	301,951	6,425,121	1,980
R11	302,054	6,424,597	1,980

Figure 3 Surrounding Land Use and Sensitive Receptors



2.2 Project Description

2.2.1 Overview

The Project intends to provide asphalt for road projects in the Upper Hunter Valley. Upper Hunter projects are currently serviced by Newpave from its Newcastle operations. The Project will be capable of operating 24 hours/day, 7 days a week (24/7) however will typically be operating during the day period (7 am – 6 pm) with night works only occurring due to specific projects demand.

The Project will be capable of producing up to 125,000 tonnes per annum (tpa) of asphalt with a peak production of 1,200 tonnes per day (tpd), however typical daily production is estimated to be 75 tpd.

In order to provide a conservative assessment of potential off-site air quality impacts, this assessment assumes the installation of a 1,200 tpd batch mix plant, operating 24/7.

Further details regarding the proposed construction and operational phase activities are provided below.

2.2.2 Construction Phase

Council is currently considering DA 38/2019, which is a proposed storage solution (of the asphalt plant) for the proponent and includes the following works:

- Construction of a concrete slab (including associated earthworks and drainage works)
- Landscaping.
- Installation of the asphalt plant to a height of not greater than 15 m.

The construction phase of the Designated Development application (which this AQIA has been produced to support) will involve completion of all works for full installation and operation of the Project. The works will include:

- Clearing of vegetation (managed grassland and removal of one tree)
- Bulk earthworks to grade/level the site, surface water management works and establishment of hardstand areas.
- Installation of elements of the asphalt plant above 15 m in height, and construction of associated infrastructure (ie, raw material storage area, internal hardstand).

The construction schedule is anticipated to have a duration of approximately 3 weeks. The equipment that will be used on site during the construction phase includes:

- excavators
- scrapers
- dump trucks
- graders
- raw material delivery trucks, truck and dog semi-trailers
- rollers
- asphalt pavers

- cranes
- concrete pumps and concrete delivery trucks.

2.2.3 Operational Phase

The layout of the Project Site is shown in **Figure 4**. The proposed development includes:

- bitumen storage area, with an associated loading/unloading area
- raw materials storage area for the storage of aggregate and sand with an associated loading/unloading area and loader work area
- Intrame M280 modular batch asphalt plant (see **Figure 5**) consisting of:
  - mixing tower and screen
  - hot elevator
  - dryer bins
  - compressor
  - exhaust stack serving a baghouse
  - truck load out area
  - associated control building
- amenities block and breakout building
- staff/visitor parking area

Other plant and equipment to be used onsite includes delivery trucks, a generator, front end loader, bobcat and other ancillary buildings (amenities and demountable staff room).

The operation of the Project will consist of:

- Transporting aggregate from storage piles to the appropriate hoppers of a cold feed unit
- Metering of material from the hoppers onto a conveyor belt and transporting the material into a diesel fired rotary dryer
- Transferring of hot aggregate from the dryer to a set of vibrating screens that drops the aggregate into individual hot bins according to size
- Opening various hot bins over a weigh hopper until the desired mix and weight for individual components are obtained
- Pumping liquid bitumen from a heated storage tank to an asphalt bucket, where it is weighed to achieve the desired mix. This is done concurrent with the aggregate being weighed
- Anticipated utilisation rates for various plant and equipment per day is shown in **Table 3**

Table 3 Plant and Equipment Utilisation Rates

Plant and Equipment	Typical Daily Utilisation (hours)
Asphalt plant	5
Front end loader	4
Generator (500kva)	8
Compressor	6

The trucks used for materials and asphalt delivery would be truck and dog combinations, which typically would carry between 25-30 tonnes. It is proposed that at maximum production, 136 heavy vehicle movements per day (ie 68 truckloads) would occur. This is comprised of up to 96 movements for asphalt delivery (ie 48 truckloads) and 40 movements for material delivery (ie 20 truckloads).

Figure 4 Proposed Site Layout

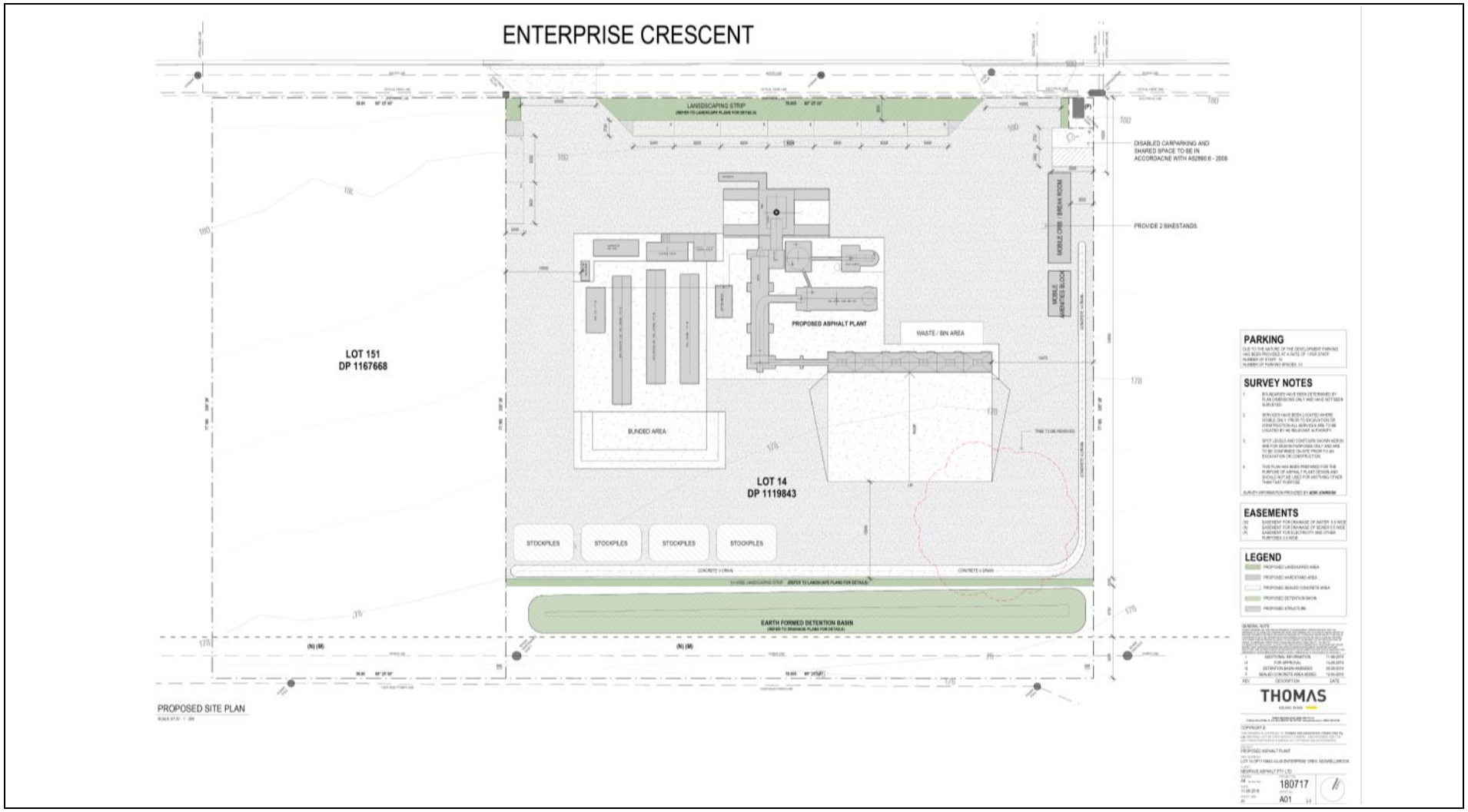
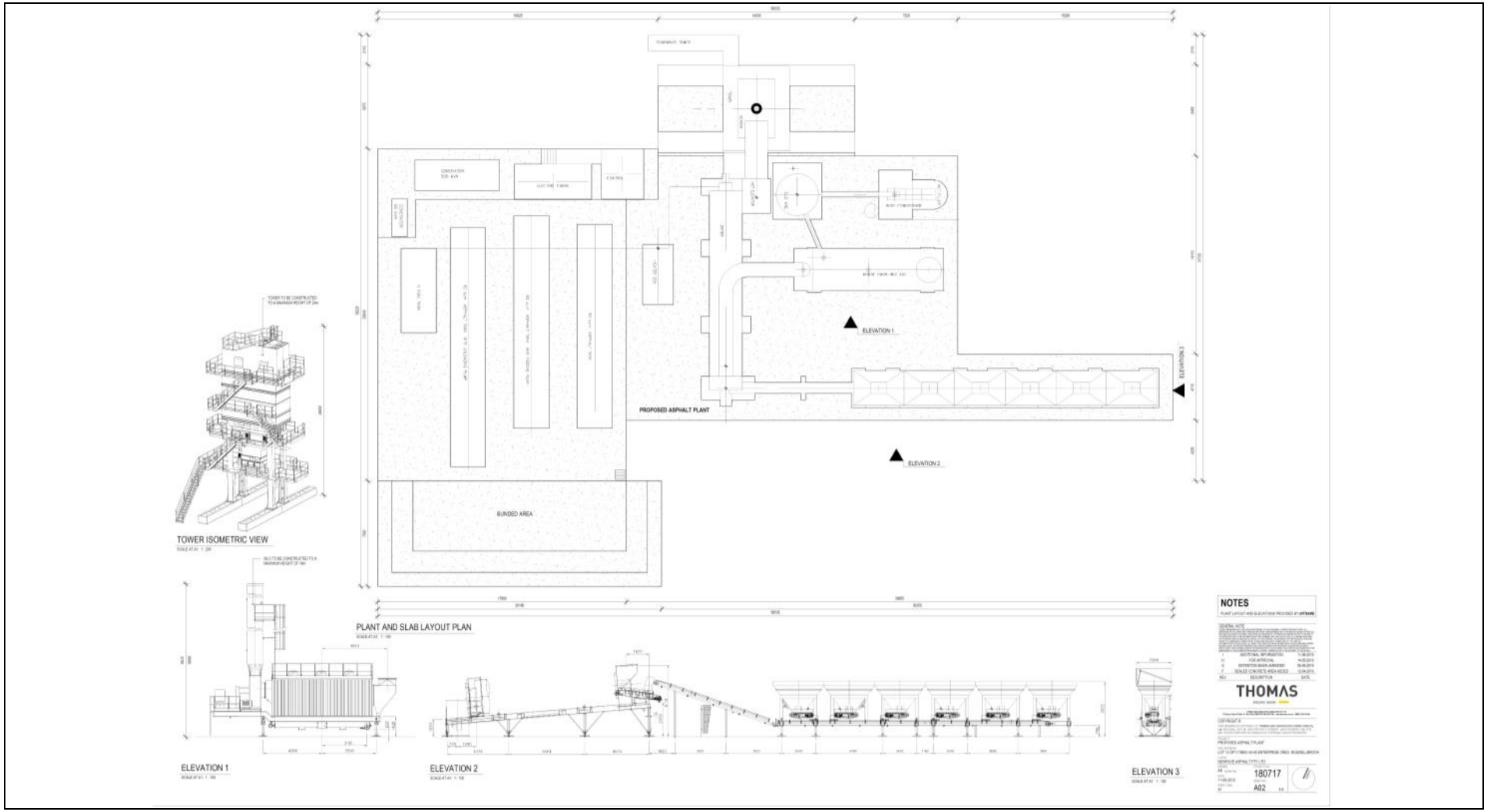


Figure 5 Plant Diagrams



2.3 Identification of Potential Emissions to Atmosphere

2.3.1 Construction Phase

The key potential air pollution and amenity issues associated with construction at the site are:

- annoyance due to dust deposition (soiling of surfaces) and visible dust plumes
- elevated PM_{10} concentrations due to dust-generating activities
- exhaust emissions from diesel-powered construction equipment

Construction activities are expected to have limited, and transient impacts on air quality and therefore a detailed dust dispersion study is not required. Instead these impacts will be managed through implementing dust management practices for the construction. A qualitative risk assessment has been performed to identify the most relevant dust management measures for the construction phase as outlined in **Section 5.1**.

2.3.2 Operational Phase

The key potential air emission sources associated with the operation of the Project will be:

- Fugitive particulate matter from:
  - wind erosion of the stockpiles
  - onsite material handling
  - wheel generated dust from onsite vehicle movements
- Products of combustion (including particulate matter) from:
  - the dryer exhaust stack
  - the generator stack
  - vehicle exhaust emissions from raw material delivery trucks and product trucks
- Volatile Organic Compounds (VOCs) and associated odours from:
  - the dryer exhaust stack
  - storage tanks containing fuel oils and heated liquid asphalts
  - transport and handling of the hot-mix from the mixer to the storage silo
  - the load-out operations to the delivery trucks
  - transfer of liquid and gaseous fuels

Site layout and plant schematics are shown in **Figure 4** and **Figure 5.**

3 Relevant Air Quality Criteria

The Approved Methods lists the statutory methods for modelling and assessing air pollutants from stationary sources and specifies criteria which reflect the environmental outcomes adopted by the EPA. The Approved Methods are referred to in the *POEO (Clean Air) Regulation 2002* for assessment of impacts of air pollutants.

The air quality criteria set out in the Approved Methods relevant to the Project Site are reproduced and discussed below.

3.1 Particulate Matter

3.1.1 Suspended Particulate (TSP, PM_{10} and $PM_{2.5}$)

Airborne contaminants that can be inhaled directly into the lungs can be classified on the basis of their physical properties as gases, vapours or particulate matter. In common usage, the terms "dust" and "particulates" are often used interchangeably. The term "particulate matter" refers to a category of airborne particles, typically less than 30 microns (µm) in diameter and ranging down to 0.1 µm and is termed total suspended particulate (TSP).

The annual goal for TSP recommended by the NSW EPA is 90 micrograms per cubic metre of air (µg/m^3). The TSP goal was developed before the more recent results of epidemiological studies which suggested a relationship between health impacts and exposure to concentrations of finer particulate matter.

PM_{10} and $PM_{2.5}$ are considered important pollutants due to their ability to penetrate into the respiratory system. In the case of the $PM_{2.5}$ category, recent health research has shown that this penetration can occur deep into the lungs. Potential adverse health impacts associated with exposure to PM_{10} and $PM_{2.5}$ include increased mortality from cardiovascular and respiratory diseases, chronic obstructive pulmonary disease and heart disease, and reduced lung capacity in asthmatic children.

Table 4 Air Quality Assessment Criteria for Suspended Particulates

Pollutant	Averaging Period	Criterion (µg/m3)
TSP	Annual	90
PM_{10}	24-hour	50
	Annual	25
$PM_{2.5}$	24-hour	25
	Annual	8

3.1.2 Deposited Dust

The preceding section is concerned in large part with the health impacts of airborne particulate matter. Nuisance impacts need also to be considered, mainly in relation to deposited dust. In NSW, accepted practice regarding the nuisance impact of dust is that dust-related nuisance can be expected to impact on residential areas when annual average dust deposition levels exceed 4 grams per square metre per month (g/m^2/month).

Table 5 presents the impact assessment goals set out in the Approved Methods for dust deposition, showing the allowable increase in dust deposition level over the ambient (background) level to avoid dust nuisance.

Table 5 Air Quality Impact Assessment Criteria for Dust Deposition

Averaging Period	Maximum Increase in Deposited Dust Level	Maximum Total Deposited Dust Level
Annual	2 g/m^2/month	4 g/m^2/month

3.2 Products of Combustion

The main products of fuel combustion that would be emitted by the asphalt plant operations (predominantly from the dryer but also from vehicles entering and leaving the site) include oxides of nitrogen (NO_x), carbon monoxide (CO), sulphur dioxide (SO_2) and particulates (TSP, PM_{10} and $PM_{2.5}$). Volatile organic compounds (VOCs) are also emitted as a result of incomplete combustion of fossil fuels and these pollutants are discussed in **Section 3.3** along with emissions of VOCs from the handling of hot mix and from the heated bitumen storage tanks.

Oxides of nitrogen (NO_x) is a general term used to describe any mixture of nitrogen oxides formed during combustion. In atmospheric chemistry, NO_x generally refers to the total concentration of nitric oxide (NO) and nitrogen dioxide (NO_2). NO is a colourless and odourless gas that does not significantly affect human health. However, in the presence of oxygen, NO can be oxidised to NO_2 which can have significant health effects including damage to the respiratory tract and increased susceptibility to respiratory infections and asthma. NO will be converted to NO_2 soon after leaving a vehicle exhaust.

CO is an odourless, colourless gas formed from the incomplete burning of fuels. It can be a common pollutant at the roadside and highest concentrations are found at the kerbside with concentrations decreasing rapidly with increasing distance from the road.

Sulfur in the burner fuel will convert to sulfur oxides during combustion, hence emissions of sulphur dioxide (SO_2) are directly related to the concentration of sulfur in the fuel and the burner operation has little effect on the percent of this. Diesel contains more sulfur than gas, as there is negligible sulfur content in Australian natural gas and LPG.

NSW OEH has established ground level air quality impact assessment criteria for criteria air pollutants to achieve appropriate environmental outcomes and to minimise associated risks to human health as published in the Approved Methods. A summary of the relevant impact assessment criteria is given in **Table 6**.

Table 6 Air Quality Impact Assessment Criteria for Combustion Related Pollutants

Pollutant	Averaging Period	Criterion	
		(pphm)	($\mu g/m^3$)
Nitrogen dioxide (NO_2)	1 hour	12	246
	Annual	3	62
Carbon monoxide (CO)	15 minutes	87,000	100,000
	1 hour	25,000	30,000
	8 hours	9,000	10,000
Sulphur dioxide (SO_2)	10 minutes	25	712
	1 hour	20	570
	24 hours	8	228
	Annual	2	60

Note: Particulate criteria are presented in **Table 4**

3.3 VOCs

VOCs are organic chemicals that have a high vapour pressure at ordinary room temperature. Their high vapour pressure results from a low boiling point, which causes large numbers of molecules to evaporate or sublimate from the liquid or solid form of the compound and enter the surrounding air, a trait known as volatility. They include both human-made and naturally occurring chemical compounds.

The potential impacts of emissions of VOCs into the ambient environment include:

- human health impacts due to the toxicity of some individual VOCs
- odour nuisance impacts due to the odorous nature of some VOCs even at very low concentrations
- visibility and health impacts due to their contribution to the creation of photochemical smog under certain conditions.

VOC emissions from an asphalt plant include a range of individual chemical species. For the purposes of this assessment, emissions of VOCs have been assessed based on four indicator compounds:

- benzene
- toluene
- ethylbenzene
- xylenes

These compounds are often referred to as 'BTEX' and are commonly used as indicators of ambient VOC levels as they are emitted from a wide range of sources including industry and vehicle exhausts. They also provide an indication of both potential health impacts and odour nuisance impacts of VOC emissions.

The NSW OEH has established ground level air quality impact assessment criteria for BTEX as published in the Approved Methods. A summary of the relevant impact assessment criteria is given in **Table 5**.

Table 7 Air Quality Impact Assessment Criteria for BTEX

Pollutant	Averaging Period	Criterion	
		(ppm)	($\mu g/m^3$)
Benzene	1 hour	0.009	29
Toluene	1 hour	0.09	360
Ethylbenzene	1 hour	1.8	8,000
Xylene	1 hour	40	190

3.4 Odour

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance goals guide decisions on odour management, but are generally not intended to achieve "no odour".

The detectability of an odour is a sensory property that refers to the theoretical minimum concentration that produces an olfactory response or sensation. This point is called the *odour threshold* and defines one odour unit (ou). An odour goal of less than 1 OU would theoretically result in no odour impact being experienced.

In practice, the character of a particular odour can only be judged by the receiver's reaction to it, and preferably only compared to another odour under similar social and regional conditions. Based on the literature available, the level at which an odour is perceived to be a nuisance can range from 2 ou to 10 ou depending on a combination of the following factors:

- **Odour quality**: whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds.
- **Population sensitivity**: any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it contains.
- **Background level**: whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour.
- **Public expectation**: whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.
- **Source characteristics**: whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily than diffuse sources. Emissions from point sources can be more easily controlled using control equipment. Point sources tend to be located in urban areas, while diffuse sources are more often located in rural locations.
- **Health effects**: whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

The NSW OEH recommends within the *Assessment and management of odour from stationary sources in NSW* technical framework (NSW DEC, 2006a) that, as a design goal, no individual be exposed to ambient odour levels of greater than 7 ou. This is based on experience gained through odour assessments from proposed and existing facilities in NSW indicating that an odour performance goal of 7 ou is likely to represent the level below which "offensive" odours should not occur (for an individual with a 'standard sensitivity' to odours). This is expressed as the 99th percentile value, as a nose response time average (approximately one second).

Odour performance goals need to be designed to take into account the range in sensitivities to odours within the community, and provide additional protection for individuals with a heightened response to odours, using a statistical approach which depends on the size of the affected population. As the affected population size increases, the number of sensitive individuals is also likely to increase, which suggests that more stringent goals are necessary in these situations. In addition, the potential for cumulative odour impacts in relatively sparsely populated areas can be more easily defined and assessed than in highly populated urban areas. It is often not possible or practical to determine and assess the cumulative odour impacts of all odour sources that may impact on a receptor in an urban environment. Therefore, the proposed odour performance goals allow for population density, cumulative impacts, anticipated odour levels during adverse meteorological conditions and community expectations of amenity.

The equation used by the NSW EPA to determine the appropriate impact assessment criteria for complex mixtures of odorous air pollutants, as specified in the Odour Framework, is expressed as follows:

$$Impact\ assessment\ criterion\ (ou) = \frac{(\log_{10} population - 4.5)}{-0.6}$$

A summary of the impact assessment criteria given for various population densities, as drawn from the Odour Framework, is given in **Table 8**.

Table 8 NSW EPA Impact Assessment Criteria for Complex Mixtures of Odorous Air Pollutants

Population of Affected Community (number of receptors)	Impact Assessment Criteria for Complex Mixtures of Odours (ou) (nose-response-time average, 99th percentile)
Urban area (≥ 2000)	2.0
~500	3.0
~125	4.0
~30	5.0
~10	6.0
Single residence (≤ 2)	7.0

For areas such as that surrounding the Project Site, with a small number of scattered rural residential receptors, the relevant odour impact assessment criterion set by the Approved Methods for complex mixtures of odorous air pollutants is 5 ou (nose-response-time average, 99th percentile).

The Approved Methods states that the impact assessment criteria for complex mixtures of odorous air pollutants must be applied at the nearest existing or likely future off-site sensitive receptor(s).

3.5 Summary of Impact Assessment Criteria

The air quality goals, which conform to current NSW EPA air quality criteria, are summarised in **Table 9**. All criteria are referenced as mass concentration.

The impact assessment criteria are required to be applied as follows:

- At the nearest existing or likely future off-site sensitive receptor.
- The incremental impact (predicted impacts due to the pollutant source alone) for each pollutant must be reported in units and averaging periods consistent with the impact assessment criteria.
- For individual toxic air pollutants, the incremental impact for each pollutant must be reported in concentration units consistent with the criteria (mg/m^3 or ppm), for an averaging period of 1 hour and as the 99.9th percentile of dispersion model predictions for Level 2 impact assessments.
- Background concentrations must be included using the procedures specified in Section 5 of the Approved Methods.
- Total cumulative impact (incremental impact plus background) must be reported as the 100th percentile (P=100) (or 99th percentile (P=99) for odour) in concentration or deposition units consistent with the impact assessment criteria and compared with the relevant impact assessment criteria.

Table 9 Project Air Quality Goals

Pollutant	Averaging Time	Goal
TSP	Annual	90 µg/m^3
PM_{10}	24 hours	50 µg/m^3
	Annual	25 µg/m^3
$PM_{2.5}$	24 hours	25 µg/m^3
	Annual	8 µg/m^3
Deposited dust	Annual	2 g/m^2/month (maximum increase) 4 g/m^2/month (maximum cumulative)
NO_2	1 hour	246 µg/m^3
	Annual	62 µg/m^3
CO	15 minutes	100 mg/m^3
	1 hour	30 mg/m^3
	8 hours	10 mg/m^3
SO_2	10 minutes	712 µg/m^3
	1 hour	570 µg/m^3
	24 hours	228 µg/m^3
	Annual	60 µg/m^3
Benzene	1 hour	29 µg/m^3
Toluene	1 hour	360 µg/m^3
Ethylbenzene	1 hour	8,000 µg/m^3

Pollutant	Averaging Time	Goal
Xylene	1 hour	190 µg/m^3
Odour	nose response time	5 ou (99th percentile)

4 Existing Air Environment

4.1 Local Meteorology

Local wind speed and direction influence the dispersion of air pollutants. Wind speed determines both the distance of downwind transport and the rate of dilution as a result of 'plume' stretching. Wind direction, and the variability in wind direction, determines the general path pollutants will follow and the extent of crosswind spreading. Surface roughness (characterised by features such as the topography of the land and the presence of buildings, structures and trees) affects the degree of mechanical turbulence, which also influences the rate of dispersion of air pollutants.

The Bureau of Meteorology (BoM) maintains and publishes data from weather stations across Australia. The closest such station to the Project Site is the Scone Airport Automatic Weather Station (AWS), which is located approximately 29 km to the north-northwest of the Project Site. Considering the distance between the Project Site and Scone Airport AWS and the topographical features, data from this AWS is not deemed to be a good representation of meteorological conditions at the Project Site.

Air quality monitoring is performed by the NSW Office of Environment and Heritage (OEH) at a number of monitoring stations across NSW. Many of these stations monitor and record meteorological conditions as well as air quality data. The closest such station is the Muswellbrook Air Quality Monitoring Station (AQMS), located approximately 3 km north-northeast of the Project Site. Considering the close proximity of this AQMS and the lack of significant topographical features between the two sites (refer **Figure 2**), it can be assumed that the meteorological conditions recorded at the Muswellbrook AQMS are a reasonable representation of the conditions experienced at the Project.

The Muswellbrook AQMS was commissioned in 2010 and is located in Bowman Park on Lorne Street, 400 m south-west of the Hunter River and is at an elevation of 145 m. This AQMS has data available for the following parameters:

- wind speed (m/s) and wind direction (degrees)
- temperature (°C)
- rainfall (mm)
- relative humidity (%).

A review of the long term data collected by this station is provided in the following sections.

4.1.1 Wind Speed and Direction

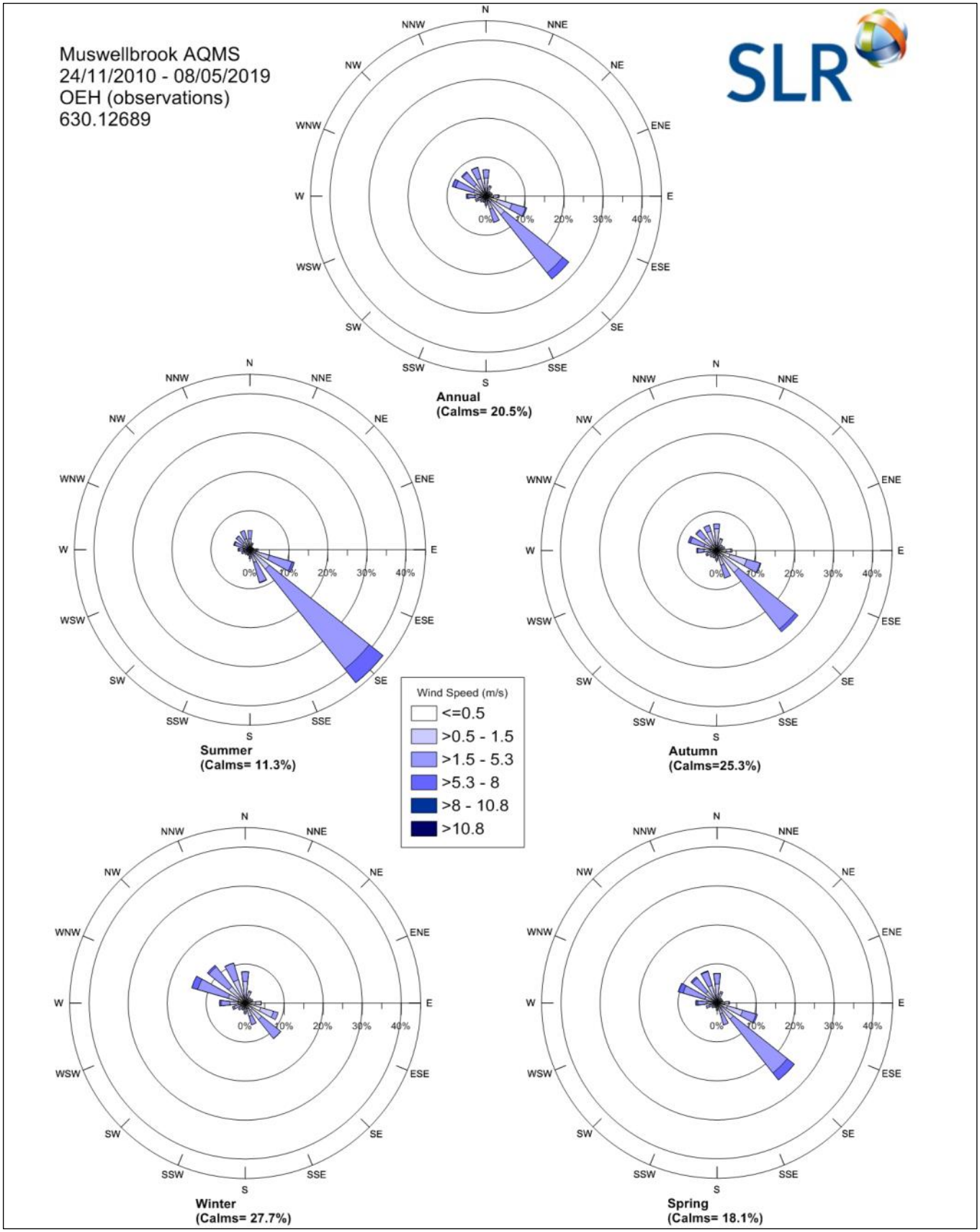
Annual and seasonal wind roses for the years 2010 to 2019 compiled from data recorded by the Muswellbrook AQMS are presented in **Figure 6**. The wind roses show the frequency of occurrence of winds by direction and strength. The bars correspond to the 16 compass points (degrees from north). The bar at the top of each wind rose diagram represents winds blowing from the north (i.e. northerly winds), and so on. The length of the bar represents the frequency of occurrence of winds from that direction, and the widths of the bar sections correspond to wind speed categories, the narrowest representing the lightest winds. Thus, it is possible to visualise how often winds of a certain direction and strength occur over a long period, either for all hours of the day, or for particular periods during the day.

The annual wind rose indicates that winds at Muswellbrook AQMS predominantly blow from the southeast (blowing air emissions from the Project Site towards the nearest residential receptors) consistent with the northwest to southeast orientation of the Hunter Valley. Calm wind conditions were observed to occur 20.5% of the time.

The seasonal wind roses indicate that:

- In summer, winds are predominantly light (between 1.5 m/s and 5.3 m/s) and blow from the southeast. Low frequencies of winds from other directions were recorded. Calm wind conditions were observed to occur 11.3% of the time during summer.
- In autumn, winds are predominantly light and blow from the southeast. A very low frequency of winds from the northeast and southwest quadrants was recorded. Calm wind conditions were observed to occur 25.3% of the time during autumn.
- In winter, wind speeds are predominantly light and blow from the northwest quadrant. A very low frequency of winds from the northeast and southwest quadrants was recorded. Calm wind conditions were observed to occur 27.7% of the time during winter.
- In spring, winds are predominantly light and blow from the southeast. A very low frequency of winds from the northeast and southwest quadrants was recorded. Calm wind conditions were observed to occur 18.1% of the time during spring.

Figure 6 Muswellbrook AQMS Seasonal Wind Roses, 2010-2019



4.1.2 Rainfall

According to available rainfall data obtained for the Muswellbrook AQMS, monitoring of rainfall data commenced in April of 2017 therefore, long term data is not available. Rainfall statistics for the available months are summarised in **Figure 7.** The average monthly rainfall is relatively high from October to December as well as February and March, generally reducing from mid-autumn to early spring. The lowest average monthly rainfall of 3.4 mm/month was recorded during July. The highest average monthly rainfall of 110.4 mm/month occurred in March, with an average of 11 rain days recorded in this month.

4.1.3 Relative Humidity

Available humidity statistics (9 am and 3 pm monthly averages) for Muswellbrook AQMS are summarised in **Figure 8**. Morning humidity levels range from an average of around 61% in late spring to around 86% in early winter. Afternoon humidity levels are lower, at around 59% in early winter and dropping to a low of 37% in min to early spring.

4.1.4 Temperature

Available temperature statistics for Muswellbrook AQMS are summarised in **Figure 9**. Mean maximum temperatures range from 16.7°C in winter to 31.8°C in summer, while mean minimum temperatures range from 4.1°C in winter to around 19.1°C in summer. Maximum temperatures above 42°C and minimum temperatures less than -4°C have been recorded.

Figure 7 Monthly Rainfall Data for Muswellbrook AQMS

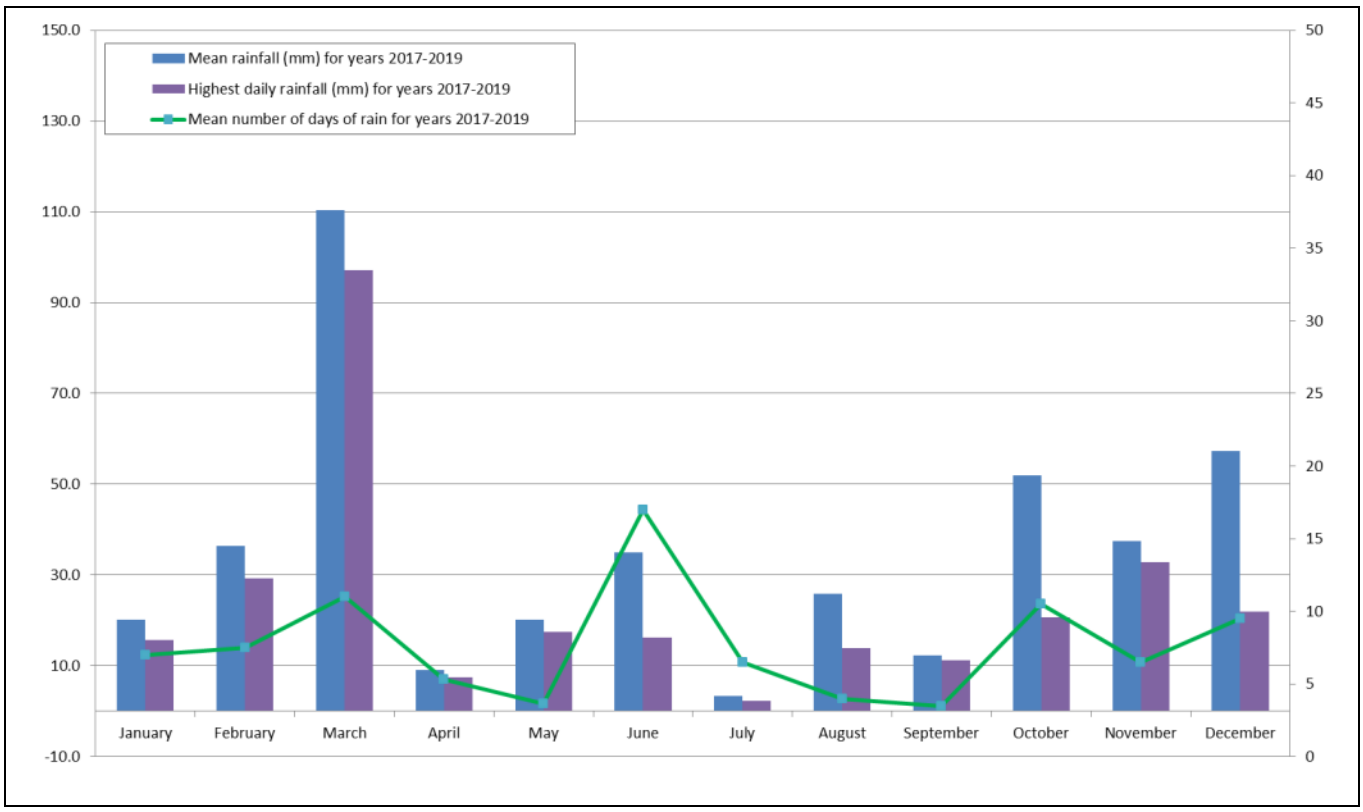


Figure 8 Humidity Data for Muswellbrook AQMS

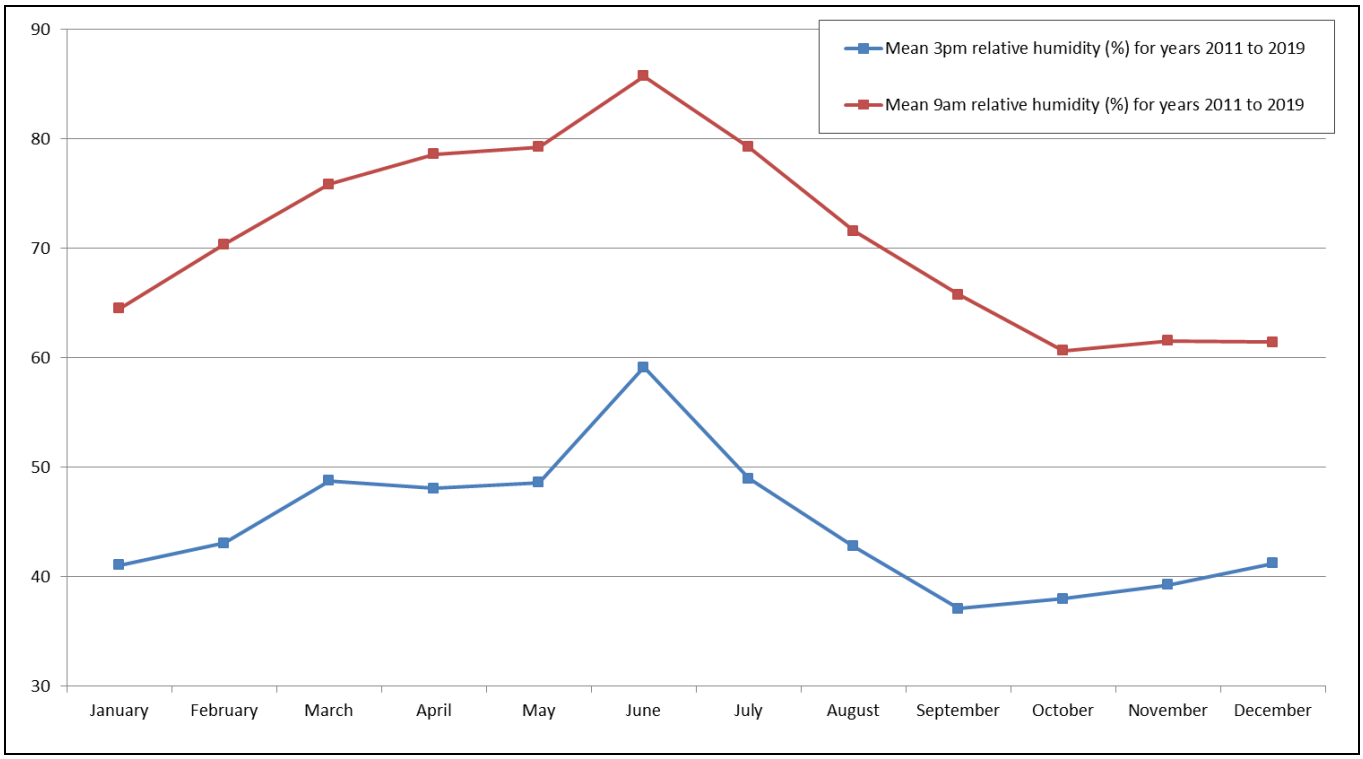
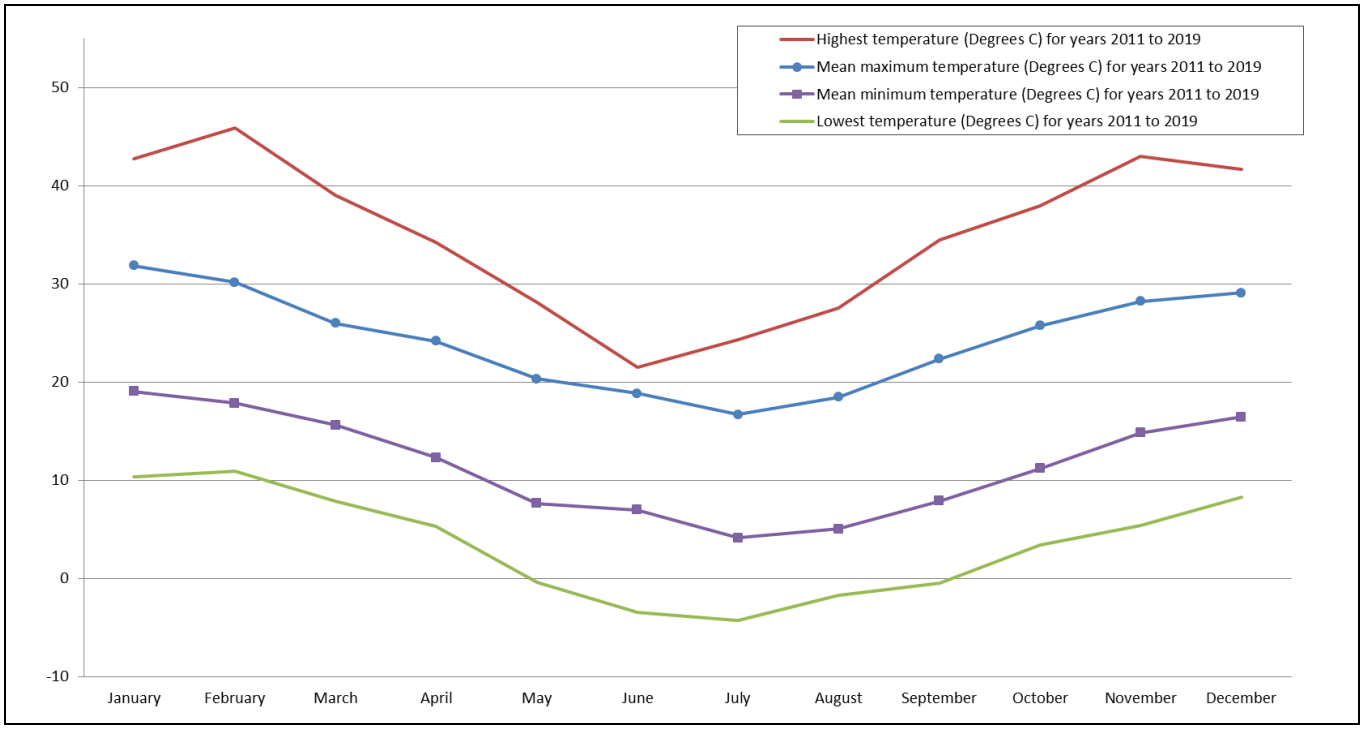


Figure 9 Temperature Data for Muswellbrook AQMS



4.2 Ambient Air Quality

Ambient air quality criteria are developed to protect health and amenity based on the pollutant exposure levels that the public may be exposed to. To fully assess compliance with the ambient air quality criteria for a specific project, it is therefore necessary to consider the existing ambient pollutant levels in order to provide an assessment of the total cumulative impacts.

As mentioned in **Section 4.1**, the NSW OEH maintains a network of Air Quality Monitoring Stations (AQMSs) across NSW. Ambient air quality monitoring data representative of the Project Site have therefore been sourced from the regional air quality monitoring network maintained by the NSW OEH. A summary of the data available is provided below.

Air quality monitoring data recorded by the Muswellbrook AQMS were obtained for the calendar years 2014 - 2018 and are summarised in **Table 10**. It is noted that CO and VOCs are currently not monitored by the Muswellbrook AQMS.

A review of the data shows that exceedances of the 24-hour average PM_{10} criterion were recorded by the Muswellbrook AQMS in 2014, 2015, 2017 and 2018. Exceedances of the 24-hour average $PM_{2.5}$ criterion were recorded by the Muswellbrook AQMS for all years analysed.

A review of the PM_{10} and $PM_{2.5}$ exceedances recorded indicates that they were due to various reasons including natural events (bushfires, dust storms, hazard reduction burns), wood smoke, and factory fires. In 2015 (the year the modelling has been carried out for), according to the Upper Hunter Air Quality Monitoring Network 2015 Annual Report (NSW OEH, 2016), two exceedances of the 24-hour average PM_{10} and three exceedances of the 24-hour average $PM_{2.5}$:

- PM_{10} exceedances- on 6 May 2015, when the region was impacted by a state-wide dust storm originating from the Victorian Mallee and southwestern NSW regions, while on 26 November 2015 fires were present in or near the region.
- $PM_{2.5}$ exceedances- occurred over the winter period when wood smoke contributes up to 62% to fine particle levels.

In circumstances where the existing ambient air pollutant concentrations exceed the impact assessment criteria the Approved Methods requires the applicant to demonstrate that no additional exceedances of the impact assessment criteria will occur as a result of the proposed activity. Therefore, for the purpose of this AQIA, data recorded by the Muswellbrook AQMS during the above-mentioned events have been replaced with annual averages for the contemporaneous analysis of 24-hour average PM_{10} and $PM_{2.5}$ concentrations.

Ambient concentrations of NO_2 were below the relevant criteria for all years in the period. The maximum 1-hour SO_2 concentration exceeded the relevant criteria in 2016. According to the Upper Hunter Air Quality Monitoring Network 2016 Annual Newsletter (NSW OEH, 2017), this brief exceedance was the first exceedance of an SO_2 criteria by the NSW air quality monitoring network since 1994.

Table 10 Summary of Muswellbrook AQMS Data (2014 – 2018)

Pollutant	Averaging Period	Criteria	Year	Muswellbrook AQMS		Units
				Maximum Concentration	Number of Exceedances	
NO_2	1-hour	12 pphm	2014	3.9	0	pphm
			2015	4.2	0	pphm
			2016	4.2	0	pphm
			2017	4.5	0	pphm
			2018	4.7	0	pphm
	Annual	3 pphm	2014	1.0	0	pphm
			2015	0.9	0	pphm
			2016	0.9	0	pphm
			2017	1.0	0	pphm
			2018	1.0	0	pphm
SO_2	1-hour	20 pphm	2014	19.0	0	pphm
			2015	10.4	0	pphm
			2016	21.0[3]	0	pphm
			2017	11.3	0	pphm
			2018	12.0	0	pphm
	24-hour	8 pphm	2014	1.8	0	pphm
			2015	1.7	0	pphm
			2016	2.3	0	pphm
			2017	2.2	0	pphm
			2018	2.1	0	pphm
	Annual	2 pphm	2014	0.3	0	pphm
			2015	0.2	0	pphm
			2016	0.2	0	pphm
			2017	0.3	0	pphm
			2018	0.3	0	pphm
PM_{10}	24-hour	50 µg/m^3	2014	53.1[1]	1	µg/m^3
			2015	72.6[2]	2	µg/m^3
			2016	43.9	0	µg/m^3
			2017	56.5[4]	2	µg/m^3
			2018	185.9[5]	14	µg/m^3
	Annual	25 µg/m^3	2014	21.4	0	µg/m^3
			2015	19.1	0	µg/m^3
			2016	19.2	0	µg/m^3
			2017	21.7	0	µg/m^3
			2018	27.3	0	µg/m^3

Pollutant	Averaging	Criteria	Year	Muswellbrook AQMS		Units
$PM_{2.5}$	24-hour	25 µg/m^3	2014	27.4[1]	3	µg/m^3
			2015	31.2[2]	3	µg/m^3
			2016	29.4[3]	1	µg/m^3
			2017	31.1[4]	2	µg/m^3
			2018	26.5[5]	2	µg/m^3
	Annual	8 µg/m^3	2014	9.7	0	µg/m^3
			2015	8.7	0	µg/m^3
			2016	8.4	0	µg/m^3
			2017	9.5	0	µg/m^3
			2018	9.5	0	µg/m^3

Notes:

[1] For 2014, the maximum 24-hour average PM_{10} and $PM_{2.5}$ were recorded on 15 November and 4 July respectively.

[2] For 2015, the maximum 24-hour average PM_{10} and $PM_{2.5}$ were recorded on 6 May and 14 June respectively.

[3] For 2016, the maximum 24-hour average $PM_{2.5}$ and 1-hour average SO_2 were recorded on 4 July and 23 December respectively.

[4] For 2017, the maximum 24-hour average PM_{10} and $PM_{2.5}$ were recorded on 12 February and 27 June respectively.

[5] For 2018, the maximum 24-hour average PM_{10} and $PM_{2.5}$ were recorded on 22 November and 25 June respectively.

5 Assessment Methodology

5.1 Construction Phase Qualitative Impact Assessment

The proposed construction works, including minor vegetation clearance and earthworks have the potential to generate fugitive dust emissions. These emissions have the potential to result in elevated TSP, PM_{10} and $PM_{2.5}$ concentrations and dust deposition rates in the vicinity of the works.

Where diesel-powered mobile machinery and vehicles are being used, localised elevations in ambient concentrations of combustion-related pollutants would also be anticipated, but fugitive dust emissions generally have the greatest potential to give rise to downwind air quality impacts.

Modelling of dust from construction projects is generally not considered appropriate, as emission rates can vary significantly depending on a combination of the construction activity and prevailing meteorological conditions (ie rainfall and wind speed), which cannot be reliably predicted. The following section therefore describes the methods used to perform a qualitative assessment of the potential risks to air quality associated with dust from development-related construction activities.

5.1.1 Construction Dust Risk Assessment Method

For this assessment, the *IAQM Guidance on the Assessment of Dust from Demolition and Construction* (IAQM, 2014) developed in the United Kingdom by the Institute of Air Quality Management (IAQM) has been used to provide a qualitative assessment method (see **Appendix A** for the full methodology). The IAQM method uses a four-step process for assessing dust impacts from construction activities:

- **Step 1**: Screening based on distance to the nearest sensitive receptor; whereby the sensitivity to dust deposition and human health impacts of the identified sensitive receptors is determined.
- **Step 2**: Assess risk of dust effects from activities based on:
  - the scale and nature of the works, which determines the potential dust emission magnitude; and
  - the sensitivity of the area surrounding dust-generating activities.
- **Step 3**: Determine site-specific mitigation for remaining activities with greater than negligible effects.
- **Step 4**: Assess significance of remaining activities after management measures have been considered.

5.2 Operational Phase Dispersion Modelling Study

The assessment of air emissions from the operational phase of the Development has been performed quantitatively through the use of dispersion modelling techniques.

5.2.1 Dispersion Modelling

Emissions from the proposed operations of the Development identified as having the potential to impact upon the nearby residences have been modelled using the US EPA's CALPUFF (Version 6) modelling system. The CALPUFF dispersion model is approved by NSW EPA/OEH for the modelling of air quality impacts in NSW and it has been used in numerous air quality impact assessments in NSW and across Australia.

CALPUFF is a transport and dispersion model that ejects "puffs" of material emitted from modelled sources, simulating dispersion and transformation processes along the way. In doing so it typically uses the fields generated by a meteorological pre-processor CALMET, discussed further in **Section 5.2.2.2**. Temporal and spatial variations in the meteorological fields selected are explicitly incorporated in the resulting distribution of puffs throughout a simulation period.

The primary output files from CALPUFF contain hourly concentrations or deposition values evaluated at selected receptor locations. The CALPOST post-processor is then used to process these files, producing tabulations that summarise results of the simulation for user-selected averaging periods.

5.2.2 Meteorological Modelling

Meteorological mechanisms govern the dispersion, transformation and eventual removal of pollutants from the atmosphere. The extent to which pollution will accumulate or disperse in the atmosphere is dependent on the degree of thermal and mechanical turbulence within the earth's boundary layer. Dispersion comprises vertical and horizontal components of motion. The stability of the atmosphere and the depth of the surface-mixing layer define the vertical component. The horizontal dispersion of pollution in the boundary layer is primarily a function of the wind field. The wind speed determines both the distance of downwind transport and the rate of dilution as a result of plume 'stretching'. The generation of mechanical turbulence is similarly a function of the wind speed, in combination with the surface roughness. The wind direction, and the variability in wind direction, determines the general path pollutants will follow, and the extent of crosswind spreading.

Pollution concentration levels therefore fluctuate in response to changes in atmospheric stability, to concurrent variations in the mixing depth, and to shifts in the wind field (Oke, 1988).

To adequately characterise the dispersion meteorology of the study site, information is needed on the prevailing wind regime, mixing height and atmospheric stability and other parameters such as ambient temperature, rainfall and relative humidity.

Meteorological data collected over the period 2014-2018 at the nearest AQMS station (Muswellbrook) were analysed to select a representative year for dispersion modelling. The analysis showed that data collected during the 2015 calendar year are in reasonably good agreement with 5-year averages compared to other years and was therefore selected for use in this assessment.

5.2.2.1 Meteorological Modelling - TAPM

In order to calculate all required meteorological parameters required by the dispersion modelling process, meteorological modelling using The Air Pollution Model (TAPM, v 4.0.4) has been performed. TAPM, developed by the Commonwealth Scientific and Industrial Research Organisation (CSIRO) is a prognostic model which may be used to predict three-dimensional meteorological data and air pollution concentrations.

TAPM model predicts wind speed and direction, temperature, pressure, water vapour, cloud, rain water and turbulence. The program allows the user to generate synthetic observations by referencing databases (covering terrain, vegetation and soil type, sea surface temperature and synoptic scale meteorological analyses) which are subsequently used in the model input to generate site-specific hourly meteorological observations at user-defined levels within the atmosphere.

TAPM model may assimilate actual local wind observations so that they can optionally be included in a model solution. However, given that TAPM is known to under-predict calm wind conditions, the wind speed and direction observations obtained from the nearest BoM and OEH AQMS stations have also been used in the subsequent CALMET component of the modelling as described in **Section 5.2.2.2**.

The three dimensional upper air data from TAPM output was used as input for the diagnostic meteorological model (CALMET).

Table 11 Meteorological Parameters used for this Study (TAPM v 4.0.4)

Modelling Period	1 January 2014 to 31 December 2014
Centre of analysis	299,919 mE 6,424,328 mN (UTM Coordinates)
Number of grid points	25 × 25 × 25
Number of grids (spacing)	4 (30 km, 10 km, 3 km, 1 km)
Data assimilation	Murrurundi Gap AWS, Merriwa AWS, Scone Airport AWS, Singleton AWS, Paterson AWS, Cessnock Airport AWS, Merriwa AQMS, Wybong AQMS, Aberdeen AQMS, Muswellbrook AQMS, Muswellbrook NW AQMS, Jerry Plains AQMS, Camberwell AQMS, Maison Dieu AQMS, Warkworth AQMS, Singleton NW AQMS, Singleton AQMS, Singleton South AQMS, Mt Thorley AQMS, Bulga AQMS
Terrain	AUSLIG 9 second DEM

5.2.2.2 Meteorological Modelling - CALMET

In the simplest terms, CALMET is a meteorological model that develops wind and temperature fields on a three-dimensional gridded modelling domain. Associated two-dimensional fields such as mixing height, surface characteristics, and dispersion properties are also included in the file produced by CALMET. The interpolated wind field is then modified within the model to account for the influences of topography, as well as differential heating and surface roughness associated with different land uses across the modelling domain. These modifications are applied to the winds at each grid point to develop a final wind field. The final wind field thus reflects the influences of local topography and current land uses.

CALMET modelling was conducted using the 'No Obs' CALMET approach. TAPM generated three dimensional meteorological data were used as input to CALMET model. A horizontal grid spacing of 100 m was used to adequately represent the important local terrain features and land use. **Table 12** details the parameters used in the meteorological modelling.

Table 12 CALMET Configuration Used for this Study

Modelling Period	1 January 2014 to 31 December 2014
Centre of analysis	295.154 mE 6,419,125 mS (UTM Coordinates)
Meteorological grid domain (Meteorological grid resolution)	10 km x 10 km (0.1 km)
Vertical Resolution (Cell Heights)	10 (0 m, 20 m, 40 m, 80 m, 160 m, 320 m, 640 m, 1200 m, 2000 m, 3000 m, 4000 m)
Data Assimilation	None

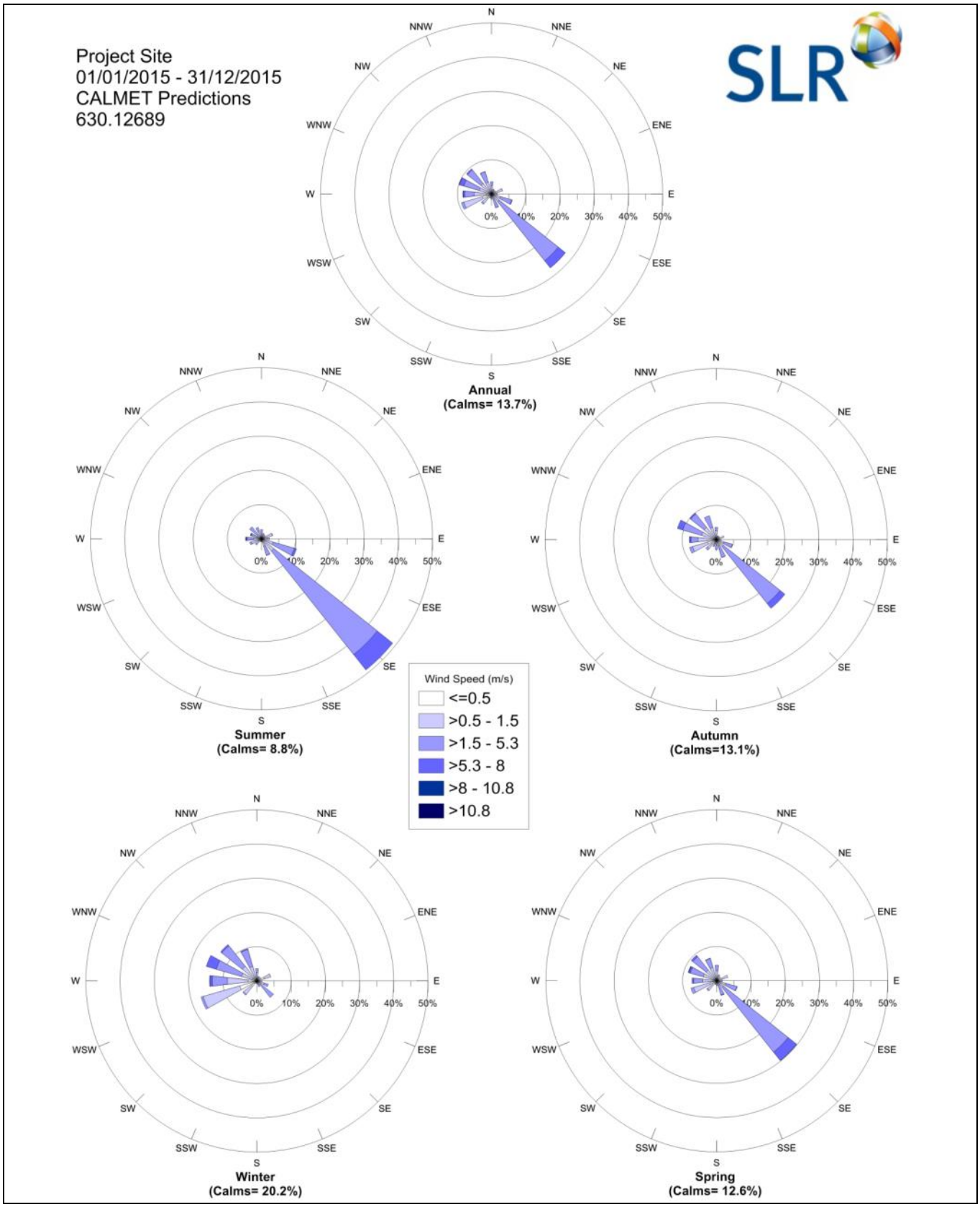
5.2.3 Meteorological Data Used in Modelling

5.2.3.1 Wind Speed and Direction

A summary of the annual wind behaviour predicted by CALMET at the Project Site is presented as wind roses in **Figure 10**. Analysis of the wind roses indicates that on an annual basis dominant winds are light (between 1.5 m/s and 5.3 m/s) and blow from the southeast with few winds from the northwest quadrants. Calm wind conditions (wind speed less than 0.5 m/s) were predicted to occur approximately 14% of the time throughout the modelling period.

The seasonal wind roses indicate that in summer, the winds are similar to the annual distribution with winds typically from the southeast. The autumn and spring distributions are relatively similar with winds from the southeast most frequent and a higher portion of winds from the northwest quadrant compared to summer. The winter distribution is different to that of the other distributions with winds predominantly blowing from the west to north-northwest.

Figure 10 Predicted Seasonal Wind Roses for the Project Site (CALMET, 2014)



5.2.3.2 Atmospheric Stability

Atmospheric stability refers to the tendency of the atmosphere to resist or enhance vertical motion. The Pasquill-Gifford-Turner (PGT) assignment scheme identifies six stability classes, A to F, to categorise the degree of atmospheric stability as follows:

- A = Extremely unstable conditions
- B = Moderately unstable conditions
- C = Slightly unstable conditions
- D = Neutral conditions
- E = Slightly stable conditions
- F = Moderately stable conditions

The meteorological conditions defining each PGT stability class are shown in **Table 13**.

Table 13 Meteorological Conditions Defining PGT Stability Classes

Surface **W**ind **S**peed (m/s)	Daytime **I**nsolation			Night-**T**ime **C**onditions	
	Strong	**Moderate**	**Slight**	**Thin overcast or > 4/8 low cloud**	**<= 4/8 cloudiness**
< 2	A	A - B	B	E	F
2 - 3	A - B	B	C	E	F
3 - 5	B	B - C	C	D	E
5 - 6	C	C - D	D	D	D
> 6	C	D	D	D	D

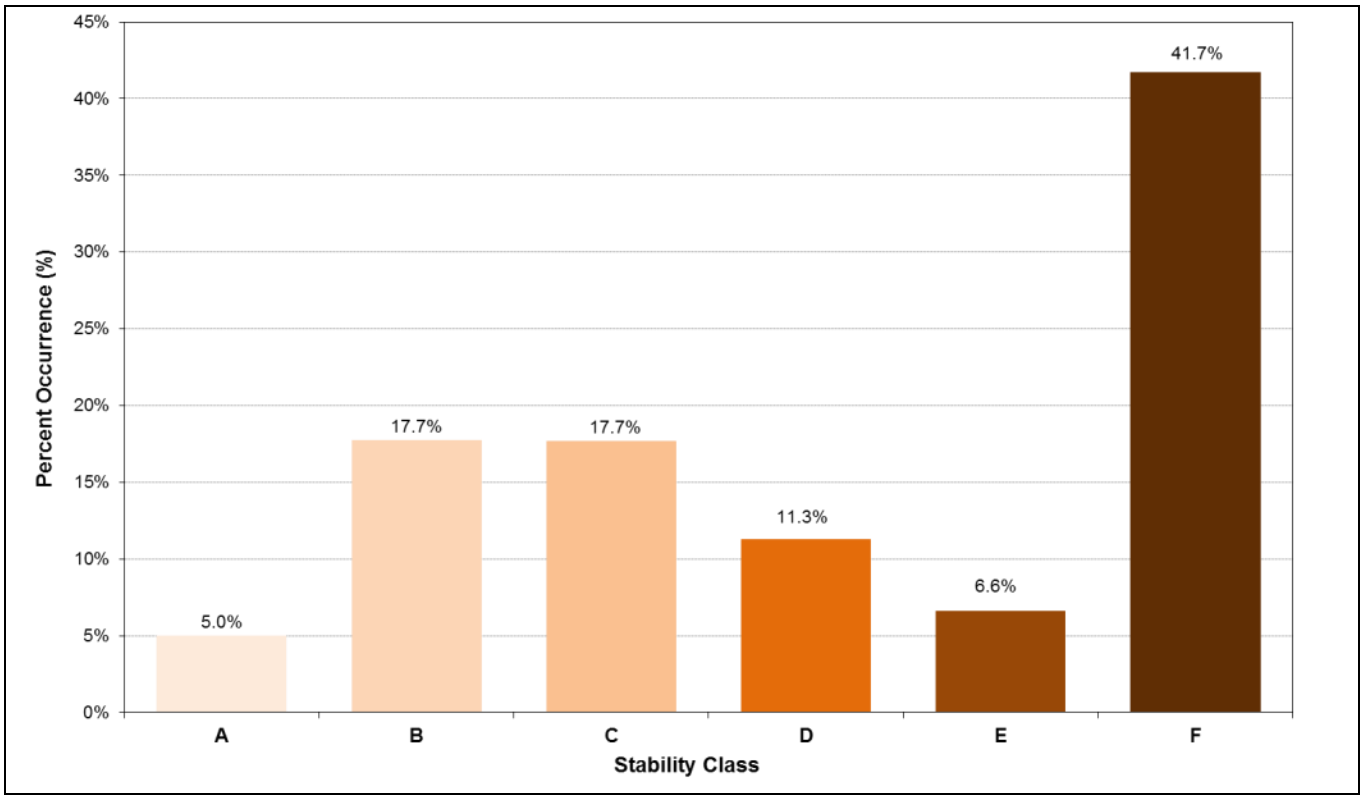
Source: (NOAA, 2018)

Notes:

1. Strong insolation corresponds to sunny midday in midsummer in England; slight insolation to similar conditions in midwinter.
2. Night refers to the period from 1 hour before sunset to 1 hour after sunrise.
3. The neutral category D should also be used, regardless of wind speed, for overcast conditions during day or night and for any sky conditions during the hour preceding or following night as defined above.

The frequency of each stability class predicted by CALMET, extracted at the Project Site, during the modelling period is presented in **Figure 11**. The results indicate a high frequency of conditions typical to Stability Class F. Stability Class F is indicative of very stable night time conditions, conducive to a low level of pollutant dispersion due to mechanical mixing.

Figure 11 Predicted Stability Class Frequencies at the Project Site (CALMET predictions, 2015)

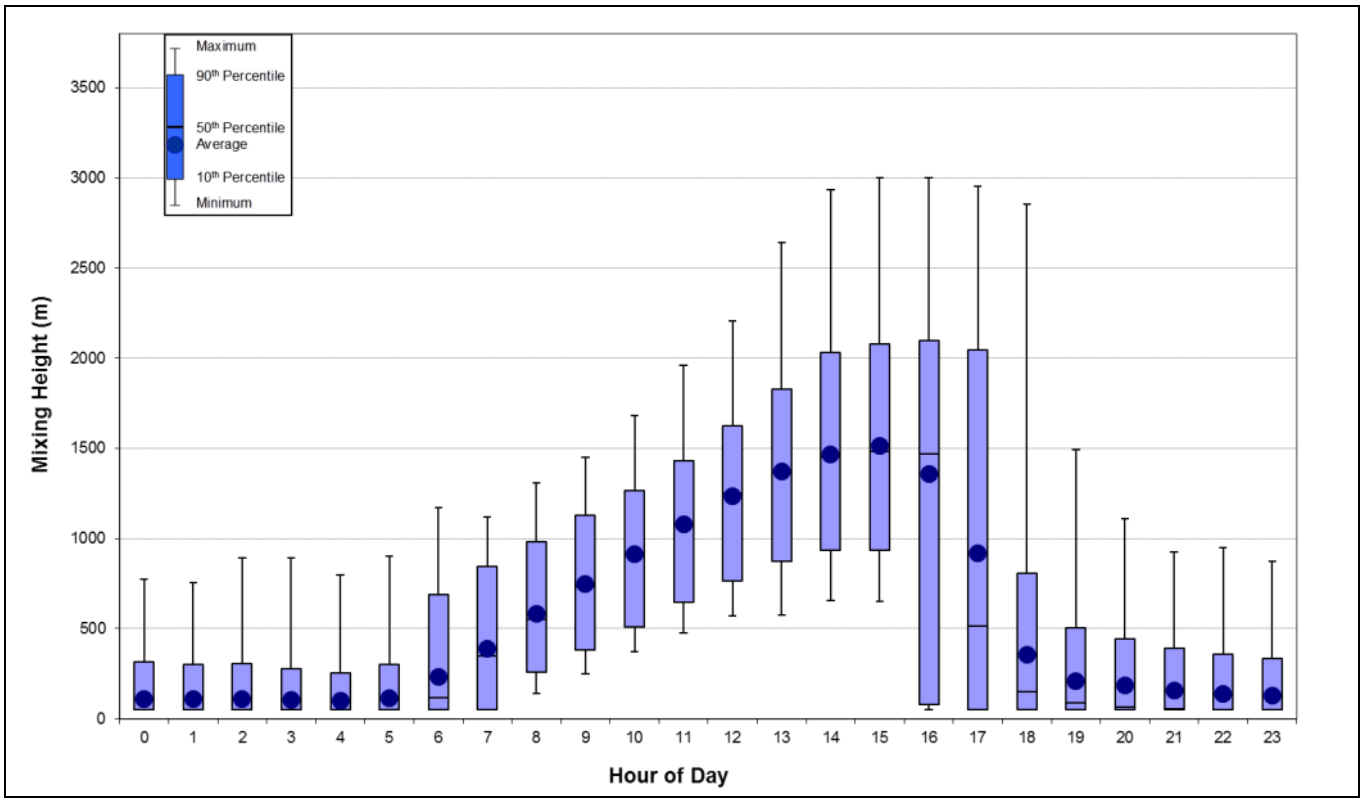


5.2.3.3 Mixing Heights

Diurnal variations in maximum and average mixing heights predicted by CALMET at the Project site during the 2015 modelling period are illustrated in **Figure 12**.

As would be expected, an increase in mixing depth during the morning is apparent, arising due to the onset of vertical mixing following sunrise. Maximum mixing heights occur in the mid to late afternoon, due to the dissipation of ground based temperature inversions and growth of the convective mixing layer.

Figure 12 Predicted Mixing Heights at the Project Site (CALMET predictions, 2015)



5.2.4 Peak to Mean Ratios

Peak-to-mean ratios have been applied to the modelled odour emission rates, consistent with the Approved Methods, to enable estimation of the peak 1-second average downwind odour concentrations from the 1-hour average odour concentrations given by the dispersion modelling. Peak-to-mean ratios are used to cover a range of atmospheric conditions. The odour emissions were modelled for all stability classes and a range of wind speeds. For conditions where the odour sources are considered as volume sources or point sources with building wake effect, a peak-to-mean ratio of 2.3 is applied for both the near field and far field.

5.2.5 NOx to NO_2 conversion

NO_x emitted from combustion processes mainly consist of nitrogen oxide (NO) with a small portion (approximately 10%) of nitrogen dioxide. In the atmosphere however, NO emitted from the source oxidises to NO_2 in the presence of ozone (O_3) and sunlight as it travels further from the source. The rate of oxidation depends on a number of parameters including the ambient O_3 concentration. The following methods can be applied to take account the oxidation of NO to NO_2 in estimating downwind NO_2 concentrations at receptor locations.

Method 1 – 100% Conversion

This method is usually used as a screening level assessment and assumes 100% conversion of NO to NO_2 before the plume arrives at the receptor location. Use of this method can significantly over-predict NO_2 concentrations at nearfield receptors.

Method 2 – Ambient Ozone Limiting Method (OLM)

This method assumes that all the available ozone in the atmosphere will react with NO in the plume until either all the O_3 or all the NO is used up. This approach assumes that the atmospheric reaction is instantaneous. In reality, the reaction takes place over a number of hours (NSW OEH 2005). NO_2 concentrations can be estimated by this method using the following equation:

$[NO_2]_{total} = \{0.1 \times [NO_x]_{pred}\} + MIN\{(0.9) \times [NO_x]_{pred}$ or $(46/48) \times [O3]_{bkgd}\} + [NO_2]_{bkgd}$

In absence of any hourly varying ozone data available for the local area, Method 1 (100% conversion) has been adopted for this assessment.

5.2.6 Conversion of Averaging Times

For pollutants with short-term (sub-hourly) air quality impact assessment criteria, the short term impacts have been estimated using the stability dependent formula cited in the *Air Dispersion Modelling Guideline for Ontario* document (Ontario Ministry of the Environment, 2004) as follows:

$$C_1 = C_0 \times ({}^{t_0}/_{t_1})^n$$

Where

C_1 = concentration for the longer time-averaging period;

C_0 = concentration for the shorter time-averaging period;

t_0 = shorter averaging time;

t_1 = longer averaging time; and

n = power law exponent which is dependent on the Pasquill stability class, 0.5 for Class A & B, 0.33 for Class C, 0.20 for Class D, and 0.167 for Class E & F.

6 Emission Estimation

6.1 Dryer Stack

Potential air emissions and relevant stack parameters for the dryer stack were estimated based on publicly available measured data from similar operations. The measured emission rates were scaled up or down as relevant, based on the ratio of the maximum hourly throughput of the proposed facility and the referenced facility. **Table 14** presents a summary of stack parameters and emission rates for the dryer stack.

Table 14 Stack Parameters and Emission Rates – Dryer Stack

Parameter	Data	Unit	Reference/Base
Temperature	90	°C	Newpave
Stack height	18	m	Newpave
Exit velocity	19	m/s	Calculated based on a 120,000 m^3/s exit flow rate scaled from flow rate data used in the Tomago Asphalt Plant AQIA (RCA Australia, 2015) and stack exit diameter
Stack diameter	1.5	m	Newpave
Odour emission rate	10,322	ou/s	Scaled from emission rates presented in the Bushells Ridge Asphalt Plant AQIA (SLR Consulting Australia, 2016)
TSP emission rate	1.04	g/s	AP-42 emission factors for Batch Mix Asphalt Plants burning fuel oil
PM_{10} emission rate	0.41	g/s	
$PM_{2.5}$ emission rate	0.41	g/s	
CO emission rate	16.67	g/s	
NO_x emission rate	5.00	g/s	
SO_2 emission rate	3.67	g/s	
Benzene emission rate	0.012	g/s	
Toluene emission rate	0.042	g/s	
Xylene emission rate	0.113	g/s	
Ethylbenzene emission rate	0.092	g/s	

6.2 Generator Stack

Potential air emissions and relevant stack parameters for the generator stack were estimated based on the CAT C15 500 kVA diesel engine technical specifications. **Table 17** presents a summary of stack parameters and emission rates for the dryer stack.

Table 15 Stack Parameters and Emission Rates – Dryer Stack

Parameter	Data	Unit	Reference/Base
Temperature	523.6	°C	Engine specification
Stack height	5	m	Newpave
Exit velocity	15	m/s	assumed
Stack diameter	0.2	m	Engine specification
TSP emission rate	0.01*	g/s	Engine specification
PM_{10} emission rate	0.01	g/s	
$PM_{2.5}$ emission rate	0.01*	g/s	
CO emission rate	0.23	g/s	
NO_x emission rate	4.58	g/s	

* assumed from PM_{10}

6.3 Load out Area

Potential odour emission rates from the load out operation at the proposed plant were estimated based on publicly available measured data from similar operations documented in the Bushells Ridge Asphalt Plant AQIA (SLR Consulting Australia, 2016). The measured emission rate was scaled up based on the ratio of the maximum hourly throughput of the proposed facility and the hourly throughput of the monitored facility during the odour measurement. **Table 16** presents a summary of parameters and emission rates for the load out area.

Table 16 Estimated Odour Emission Rates – Load out Area

Parameter	Data	Unit	Reference/Base
Area	18.5	m^2	Site layout
Odour emission rate	3,000	ou/s	Scaled from emission rates presented in the Bushells Ridge Asphalt Plant AQIA (SLR Consulting Australia, 2016)

6.4 Bitumen Tanks

Potential BTEX emission rates from on-site bitumen tanks were estimated based on publicly available measured data from similar operations documented in the Bushells Ridge Asphalt Plant AQIA (SLR Consulting Australia, 2016). The measured data were scaled based on the ratio of the maximum hourly throughput of the proposed facility and the hourly throughput of the monitored facility. **Table 17** presents a summary of parameters and emission rates for the bitumen tanks.

Table 17 Estimated Emission Rates – Bitumen Tanks

Parameter	Data	Unit	Reference/Base
Area	122	m^2	Site layout
Benzene emission rate	0.010	g/s	Scaled from emission rates presented in the Bushells Ridge Asphalt Plant AQIA (SLR Consulting Australia, 2016)
Toluene emission rate	0.037	g/s	
Xylene emission rate	0.079	g/s	
Ethylbenzene emission rate	0.028	g/s	

6.5 Fugitive Particulate Emission Sources

Fugitive particulate emissions are likely to be generated from material handling, wind erosion from stockpiles and wheel generated dust from onsite vehicle movements. Potential particulate emissions from the proposed facility were estimated based on the relevant AP-42 and NPI emission factors. A brief summary of the variables used to estimate emissions, emission factors used and estimated particulate emissions for each potential source is presented in **Table 18**.

Table 18 Estimated Particulate Emissions

Source	Emission Factors			Unit	Estimated Emissions			Unit	Variables	Reference
	TSP	PM_{10}	$PM_{2.5}$		TSP	PM_{10}	$PM_{2.5}$			
Material handling	0.0003	0.0001	0.00002	kg/t	0.023	0.011	0.0016	g/s	Wind speed factor[1] = 1.08 Moisture Content = 6%[2]	AP-42
Wheel Generated Dust – Paved Road	0.26	0.05	0.012	kg/VKT	0.089	0.017	0.0042	g/s	Silt loading = 3 g/m² Average vehicle weight = 28 t Average vehicle capacity = 25 t Number of trucks = 136 trucks/day Onsite distance = 340 m Vehicle speed < 30 km/hr = 40% control	AP-42
Wind erosion - storage piles	0.4	0.2	0.02	kg/ha/hr	0.0027	0.0014	0.00014	g/s	Bins area = 65 m² Stockpile area = 180 m²	NPI

[1] Wind speed factor – (Wind speed/2.2)^1.3

[2] assumed similar to Bushells Ridge asphalt plant

7 Assessment of Air Quality Impacts

7.1 Construction Phase

The following sections present a qualitative risk assessment of fugitive dust emissions during the construction phase of the Project. For further details of the methodology refer to **Appendix C**.

The nearest existing sensitive receptor have been identified as being located approximately 690 m northwest of the Project Site (R1). Given that no sensitive receptors are located within 350 m of the site boundary or within 500 m of the site entrance, the risk of adverse impacts at sensitive receptors due to the construction works is concluded to be minimal and no further assessment is required by the IAQM methodology.

7.2 Operational Phase

As discussed in **Section 6**, emissions to air from the site were estimated based on the maximum daily throughput and data from similar operations where available, or relevant published emission factors. The CALPUFF dispersion model, utilising a 1-year dataset of site-representative 3-dimensional meteorological data generated by TAPM and CALMET, was then used to predict potential worst case off site impacts at surrounding sensitive receptors based on the estimated emission rates and source parameters presented in **Section 6**.

It is noted that the use of this approach is likely to significantly overestimate the annual average downwind air pollutant concentrations as the site will not operate at maximum capacity on every day of the year.

The results of the dispersion modelling study are presented in the following sections.

7.2.1 Odour

Table 19 presents the ground level odour concentrations (99th percentile, nose response averaging period) predicted by the dispersion modelling at the nearest residential receptor locations for the proposed operation. A contour plot presenting isopleths of the predicted odour concentrations across the modelling domain is presented in **Appendix D**.

Table 19 Predicted Odour Concentrations at Residential Receptors

Receptor ID	Predicted Incremental Odour Concentration (99^{th} Percentile Nose Response Average)
R1	0.2
R2	0.2
R3	0.1
R4	0.1
R5	0.1
R6	0.0
R7	0.0
R8	0.0
R9	0.0
R10	0.0
R11	0.0
Criterion	**5.0**

Table 19 shows that the odour concentrations predicted at the surrounding sensitive receptors are below the adopted odour criterion of 5 ou.

The contour plot of the predicted incremental odour concentrations presented in **Appendix D** shows that the odour concentrations predicted at the nearby industrial facilities are also well below the adopted criterion of 5 ou.

Based on the results of the modelling, it is concluded that operation of the Project is unlikely to cause odour nuisance at any surrounding residential receptor.

It is noted that these modelling results are based on estimated odour emission rates for the Project, which are in turn based on a limited number of emission tests from a similar facility. Given the limited data available on the potential odour emission from the plant, it is noted that there is potential for odour emission rates from the proposed plant to vary slightly from the emission rates used in this assessment. However, if the odour emission rate was higher than assumed in this modelling study, the modelling would still indicate a high level of amenity for the surrounding sensitive receptors.

7.2.2 Particulates

7.2.2.1 $PM_{2.5}$

Table 20 presents maximum 24-hour and annual average incremental and cumulative $PM_{2.5}$ concentrations at surrounding residential receptor locations. The isopleths of predicted incremental $PM_{2.5}$ concentrations are presented in **Appendix D**.

Table 20 shows that the cumulative maximum 24-hour average $PM_{2.5}$ concentrations are predicted to be below the relevant criterion at all residential receptor locations modelled. The annual average background $PM_{2.5}$ concentration was estimated at 8.7 µg/m^3, which exceeds the annual average criterion for $PM_{2.5}$ of 8 µg/m^3. The incremental contributions of emissions from the Project are predicted to be minimal at all residential included in the modelling (0.3 µg/m^3 or less) and would not have a significant impact on annual average concentrations compared to background levels.

Table 20 Predicted $PM_{2.5}$ Concentrations at Residential Receptors

Receptor ID	Increment (µg/m³)		Cumulative (µg/m³)	
	Maximum 24-Hour	Annual	Maximum 24-Hour	Annual
R1	1.2	0.3	24.6	8.9
R2	0.7	0.2	24.6	8.8
R3	0.6	0.1	24.6	8.8
R4	0.8	0.2	24.5	8.8
R5	0.6	0.1	24.5	8.8
R6	0.5	0.1	24.5	8.7
R7	0.2	<0.1	24.6	8.7
R8	0.2	<0.1	24.6	8.7
R9	0.2	<0.1	24.6	8.7
R10	0.2	<0.1	24.6	8.7
R11	0.3	<0.1	24.6	8.7
Criteria			**25.0**	**8.0**

7.2.2.2 PM_{10}

Table 21 presents the maximum 24-hour and annual average incremental and cumulative PM_{10} concentrations predicted at surrounding residential receptor locations. Isopleths of the predicted incremental PM_{10} concentrations are presented in **Appendix D**.

Table 21 shows that the cumulative 24-hour average and annual average PM_{10} concentrations are predicted to be below the relevant criterion at all residential receptor locations modelled.

Table 21 Predicted PM_{10} Concentrations at Residential Receptors

Receptor ID	Increment (µg/m³)		Cumulative (µg/m³)	
	Maximum 24-Hour	Annual	Maximum 24-Hour	Annual
R1	1.4	0.4	47.9	19.4
R2	1.0	0.3	47.4	19.3
R3	0.8	0.2	47.2	19.2
R4	0.9	0.2	47.7	19.3
R5	0.7	0.2	47.5	19.2
R6	0.6	0.1	47.2	19.1
R7	0.2	<0.1	46.9	19.1
R8	0.2	<0.1	46.9	19.1
R9	0.2	<0.1	46.9	19.1
R10	0.2	<0.1	46.9	19.1
R11	0.3	<0.1	46.9	19.1
Criteria			**50.0**	**25.0**

7.2.3 TSP and Dust Deposition

The annual average incremental TSP concentrations and dust deposition rates predicted at the surrounding residential receptor locations are presented in **Table 22**. The predicted incremental annual average TSP concentrations and dust deposition rates are presented as contour plots in **Appendix D.**

The modelling results show that the incremental annual average TSP concentrations and dust deposition rates predicted at all sensitive receptors are minimal.

As outlined in **Section 4.2**, site-representative ambient background TSP and dust deposition data are not available. A cumulative assessment of TSP and dust deposition impacts has therefore not been possible. The modelling results show, however, that the incremental TSP and dust deposition concentrations are predicted to be minimal (<1% of the relevant criteria) at all sensitive receptor locations modelled. On this basis it can be concluded that emissions from the Project would not cause any exceedances of relevant TSP and dust deposition criteria at any surrounding sensitive receptor locations.

Table 22 Predicted TSP Concentrations and Dust Deposition Rates at Residential Receptors

Receptor ID	TSP (µg/m³)	Dust Deposition (g/m²/month)
	Increment	Increment
R1	0.9	<0.1
R2	0.6	<0.1
R3	0.4	<0.1
R4	0.5	<0.1
R5	0.4	<0.1
R6	0.2	<0.1
R7	0.1	<0.1
R8	0.1	<0.1
R9	0.1	<0.1
R10	0.1	<0.1
R11	0.1	<0.1
Criteria	**90.0**	**4.0**

7.2.4 Combustion Gases

7.2.4.1 NO_2

Table 23 presents the incremental and cumulative maximum 1-hour and annual average NO_2 concentrations predicted at surrounding residential receptor locations. Contour plots of the predicted incremental NO_x concentrations are presented in **Appendix D**.

The modelling results showed that the predicted cumulative maximum 1-hour and annual average NO_2 concentrations are below the relevant ambient air quality criteria at all residential receptor locations modelled.

It is noted that modelling results presented in **Table 23** are based on the assumption that all NO will be converted to NO_2 by the time the plume reaches the surrounding sensitive receptors. Considering the short distance between the source and receptors (<3km), complete conversion of NO to NO_2 at the receptor locations is highly unlikely. The NO_2 results presented in **Table 23** are therefore likely to be significantly overestimated.

Table 23 Predicted NO_2 Concentrations at Residential Receptors

Receptor ID	Increment (µg/m³)		Cumulative (µg/m³)	
	Maximum 1-Hour	Annual	Maximum 1-Hour	Annual
R1	40.2	0.4	188	27
R2	45.7	0.3	189	23
R3	47.4	0.3	156	21
R4	34.2	0.4	140	25
R5	28.7	0.4	119	21
R6	21.1	0.4	98	19
R7	30.2	0.3	125	18
R8	19.6	0.3	112	18
R9	24.2	0.4	107	18
R10	32.3	0.7	94	18
R11	28.1	0.7	101	18
Criteria			**246**	**62**

7.2.4.2 CO

Table 24 presents the maximum incremental 15-minute, 1-hour and 8-hour average CO concentrations predicted at surrounding residential receptor locations. Contour plots of the predicted incremental CO concentrations are presented in **Appendix D**.

As outlined in **Section 4.2**, site-representative ambient background CO data are not available. A cumulative assessment of CO impacts has therefore not been possible. The modelling results show, however, that the incremental CO concentrations are predicted to be minimal (<1% of the relevant criteria) at all surrounding residential receptor locations. On this basis it can be concluded that emissions from the Project would not cause any exceedances of relevant CO criteria at any surrounding sensitive receptor locations.

Table 24 Predicted CO Concentrations at Residential Receptors

Receptor ID	Increment (mg/m³)		
	Maximum 15-Minute*	Maximum 1-Hour	Maximum 8-Hour
R1	0.256	0.178	0.071
R2	0.306	0.167	0.054
R3	0.286	0.143	0.048
R4	0.240	0.182	0.047
R5	0.177	0.114	0.041
R6	0.200	0.100	0.039
R7	0.110	0.070	0.021
R8	0.132	0.083	0.024
R9	0.132	0.066	0.011
R10	0.154	0.077	0.017
R11	0.126	0.066	0.023
Criteria	**100**	**30**	**10**

* The 1-hour average CO concentrations predicted by the modelling were converted to 15-minute averages using the stability dependent power law formula.

7.2.4.3 SO_2

Table 25 presents the incremental and cumulative maximum 10-minute, 1-hour, 24-hour and annual average SO_2 concentrations predicted at surrounding residential receptor locations. Isopleths of the predicted incremental SO_2 concentrations are presented in **Appendix D**.

The modelling results show that that cumulative SO_2 concentrations are predicted to be well below the relevant criteria at all surrounding residential receptor locations.

Table 25 Predicted SO_2 Concentrations at Residential Receptors

Receptor ID	Increment (µg/m³)				Cumulative (µg/m³)			
	10-Minute*	1-Hour	24-Hour	Annual	10-Minute	1-Hour	24-Hour	Annual
R1	68	39	10.0	1.7	615	296	48	8
R2	82	36	5.0	0.9	613	296	47	7
R3	76	31	3.8	0.6	611	296	47	7
R4	57	40	7.0	1.2	610	296	47	8
R5	47	25	4.8	0.8	609	296	47	7
R6	53	22	4.7	0.5	608	296	47	7
R7	28	15	1.5	0.1	607	296	46	7
R8	33	18	1.7	0.1	607	296	46	7
R9	35	14	0.9	0.1	607	296	46	7
R10	41	17	1.3	0.1	607	296	46	7
R11	33	14	1.7	0.2	607	296	46	7
Criteria					**712**	**570**	**228**	**60**

* The 1-hour average SO_2 concentrations predicted by the modelling were converted to 10-minute averages using the stability dependent power law formula.

7.2.5 BTEX Compounds

Predicted incremental concentrations of BTEX compounds at surrounding residential receptor locations are presented in **Table 26**. As discussed in **Section 4.2**, no background data are available for these compounds at any nearby monitoring stations and background levels have been assumed to be negligible.

Based on the modelling results presented in **Table 26**, it is concluded that air emissions from the Project would not result in any exceedances of relevant ambient air quality criteria for any of the BTEX compounds at any surrounding residential or industrial receptor locations. The maximum incremental impacts are predicted to occur at receptor R3, where the 99.9th percentile 1-hour average benzene concentration is predicted to be 3% of the relevant air quality impact assessment criterion.

Table 26 Predicted 99.9th Percentile Incremental 1-Hour Average Concentrations of BTEX Compounds

Receptor ID	Predicted Increment (mg/m^3)			
	Benzene	Toluene	Ethylbenzene	Xylene
R1	0.00092	0.00341	0.00258	0.00728
R2	0.00090	0.00334	0.00253	0.00714
R3	0.00071	0.00261	0.00198	0.00558
R4	0.00030	0.00110	0.00084	0.00234
R5	0.00032	0.00119	0.00090	0.00254
R6	0.00026	0.00096	0.00074	0.00206
R7	0.00023	0.00086	0.00065	0.00185
R8	0.00022	0.00080	0.00060	0.00170
R9	0.00029	0.00107	0.00081	0.00229
R10	0.00033	0.00122	0.00093	0.00261
R11	0.00024	0.00088	0.00066	0.00188
Criterion	**0.029**	**0.360**	**8.0**	**0.190**

7.3 Mitigation and Management

7.3.1 Construction

The IAQM Methods notes that, for almost all construction activity, the aim should be to prevent significant effects on receptors through the use of effective mitigation and that experience shows this is normally possible. Given the limited duration of the construction activities, the lack of demolition activities, and the expectation that water would be readily available for dust suppression when required, residual impacts associated with fugitive dust emissions due to construction of the proposed Project Site are anticipated to be 'negligible'.

7.3.2 Operation

The following mitigation and management measures will be implemented at the site to minimise off-site air quality and odour impacts during the operational phase.

- The asphalt plant will be fitted with pollution control equipment to minimise off site air quality impacts. Specifically:
  - Emissions from the dryer will be controlled by the baghouse, which will remove particulate from the exhaust gas stream prior to discharge to atmosphere. The dryer will be fitted with pressure sensors and an alarm system to warn of any broken filter bags.
- Water sprays will be used to minimise emissions from on-site stockpiles and material handling.
- Hardstand areas and driveways will be kept clean by use of a sweeper to minimise dust from wind erosion and vehicle movements.
- A vehicle speed limit of 30 km/hr will be imposed across all areas of the site.
- All on-site, fixed and mobile diesel powered plant will be maintained in accordance with the manufacturers' specifications.

8 Conclusions

A qualitative risk assessment of potential construction phase fugitive dust emissions indicates that the risk of any adverse off-site impacts would be negligible.

Potential emissions to air from the operation of the Project were estimated based on measured data from similar facilities (where available) and appropriate NPI or USEPA AP-42 emission factors/equations. The emission calculations were based on a maximum potential throughput of 1,200 tpd. The emissions investigated in this assessment included odour, particulate matter (as TSP, PM_{10} and $PM_{2.5}$), NO_X, CO, SO_2 and VOCs (benzene, toluene, ethyl benzene and xylenes).

The estimated emissions from the site during the operational phase were modelled based on the plant operating at maximum production, 24 hours/day, 7 days a week to assess the potential worst case impacts at surrounding sensitive receptors. This approach is considered conservative as it overestimates the annual average air pollutant emissions from the Project which will not be operating at maximum capacity on every hour of the year.

The modelling results indicated the following:

- Predicted 99th percentile, nose-response average odour concentrations are predicted to be well below the relevant odour criterion of 5 ou at the nearest existing residential receptors modelled.
- The cumulative maximum 24-hour average $PM_{2.5}$ concentrations are predicted to be below the relevant criteria at all residential receptor locations modelled.
- The existing annual average background $PM_{2.5}$ concentration was monitored at 8.7 µg/m^3, which exceeds the annual average criterion for $PM_{2.5}$ of 8 µg/m^3. The incremental contributions of emissions from the Project are predicted to be minimal at all residential receptors included in the modelling (0.3 µg/m^3 or less) and would not have a significant impact on annual average concentrations compared to background levels.
- The cumulative 24-hour average and annual average PM_{10} concentrations are predicted to be below the relevant criteria at all receptor locations modelled.
- Annual average incremental TSP concentrations and cumulative dust deposition rates predicted at surrounding residential receptor locations minimal.
- Cumulative NO_2 (1-hour and annual), cumulative SO_2 (10-minute, 1-hour and 24-hour) and incremental CO (15-minute, 1-hour and 8-hour) concentrations predicted at surrounding residential receptor locations are well below the relevant ambient air quality criteria for each pollutant.
- Predicted 1-hour average incremental concentrations of BTEX compounds at surrounding residential receptors are minimal (3% or less of the relevant guideline).

Based on the results of the modelling, it is concluded that air emissions from the operation of the Project would not have a significant impact on local air quality, and would not be anticipated to give rise to any adverse amenity (odour) or health impacts in the surrounding area.

Mitigation measures that will be incorporated in the design of the plant to minimise air emissions include use of a baghouse to control particulate emissions from the dryer.

Fugitive dust emissions will be minimised during the operational phase by:

- Installation of water sprays on the on-site stockpiles and material handling areas.

- Keeping paved roadways, hardstand areas and driveways clean by use of a sweeper to minimise dust from wind erosion and vehicle movements.
- Implementation of a 30 km/hr vehicle speed limit across all areas of the site.

All on-site, fixed and mobile diesel powered plant will be maintained in accordance with the manufacturers' specifications.

9 References

IAQM. (2014). *IAQM Guidance on the assessment of dust from demolition and construction.* London: Institute of Air Quality Management.

NOAA. (2018, February 14). *Air Resources Laboratory*. Retrieved February 20, 2018, from National Oceannic and Atmospheric Association: https://www.ready.noaa.gov/READYpgclass.php

NSW DEC. (2005, August). Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales. Prepared by the NSW DEC, which is now part of the NSW Office of Environment and Heritage (OEH).

NSW DEC. (2005). *Approved Methods for the Sampling and Analsysis of Air Pollutants in NSW.* Sydney: NSW Department of Environment and Conservation.

NSW DEC. (2006). *Technical Framework - Assessment and management of odour from stationary sources in NSW.* Sydney: NSW Department of Environment and Conservation.

NSW DEC. (2006). *Technical Notes - Assessment and management of odour from stationary sources in NSW.* Sydney: NSW Department of Environment and Conservation.

NSW DEC. (2006a). *Technical Framework - Assessment and management of odour from stationary sources in NSW.* Sydney: NSW Department of Environment and Conservation.

NSW EPA. (2017, January). *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales.* Prepared by NSW Environment Protection Authority, which is part of the NSW Office of Environment and Heritage (OEH).

NSW EPA. (2017, January). Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales. Prepared by NSW Environment Protection Authority, which is part of the NSW Office of Environment and Heritage (OEH).

NSW OEH. (2016). *Upper Hunter Air Quality Monitoring Network 2015 Annual Report.*

NSW OEH. (2017). *Upper Hunter Air Quality Monitoring Network 2016 Annual Newsletter.*

NSW OEH. (n.d.). *Clearing the Air - New South Wales Air Quality Statement 2017.*

NSW Parliament. (1997). *Protection of the Environment Operations Act 1997.*

NSW Parliament. (2010). *Protection of the Environment Operations (Clean Air) Regulation 2010.*

Oke, T. R. (1988). *Boundary Layer Climates.* London & New York: Taylor & Francis Group.

Ontario Ministry of the Environment. (2004). *Air Dispersion Modelling Guideline for Ontario.*

RCA Australia. (2015). *Revised Air Quality Impact Assessment, Proposed Asphalt Batching Plant, 4 to 6 Foresight Avenue, Tomago.*

SLR Consulting Australia. (2016). *Bushells Ridge Asphalt Plant Air Quality and Greenhouse Gas Impact Assessment.*

APPENDIX A

SELECTION OF REPRESENTATIVE METEOROLOGICAL DATA

Once emitted to atmosphere, the emissions will:

- Rise according to the momentum and buoyancy of the emission at the discharge point relative to the prevailing atmospheric conditions;
- Be advected from the source according to the strength and direction of the wind at the height which the plume has risen in the atmosphere;
- Be diluted due to mixing with the ambient air, according to the intensity of turbulence; and
- (Potentially) be chemically transformed and/or depleted by deposition processes.

Dispersion is the combined effect of these processes. Dispersion modelling is used as a tool to simulate the air quality effects of specific emission sources, given the meteorology typical for a local area together with the expected emissions. Selection of a year when the meteorological data is atypical means that the resultant predictions may not appropriately represent the most likely air quality impacts. Therefore, in dispersion modelling, one of the key considerations is the representative nature of the meteorological data used.

The year of meteorological data used for the dispersion modelling was selected by reviewing the most recent five years of historical surface observations at Muswellbrook AQMS (2014 to 2018 inclusive) to determine the year that is most representative of average conditions. Wind direction, wind speed and ambient temperature were compared to averages for the region to determine the most representative year.

Data collected from 2014 to 2018 is summarised in **Figure A1** to **Figure A3**. Examination of the data indicates the following:

- **Figure A1** indicates relatively similar wind roses for all years analysed.
- **Figure A2** indicates that 2015 exhibit wind speeds that are closest to the long term average.
- **Figure A3** shows that temperatures in 2014 and 2015 more closely reflect the long term average.

Given the above, the year 2015 was selected as the representative year of meteorology.

Figure A1 Frequency of Winds at Muswellbrook AQMS for 2014 – 2018

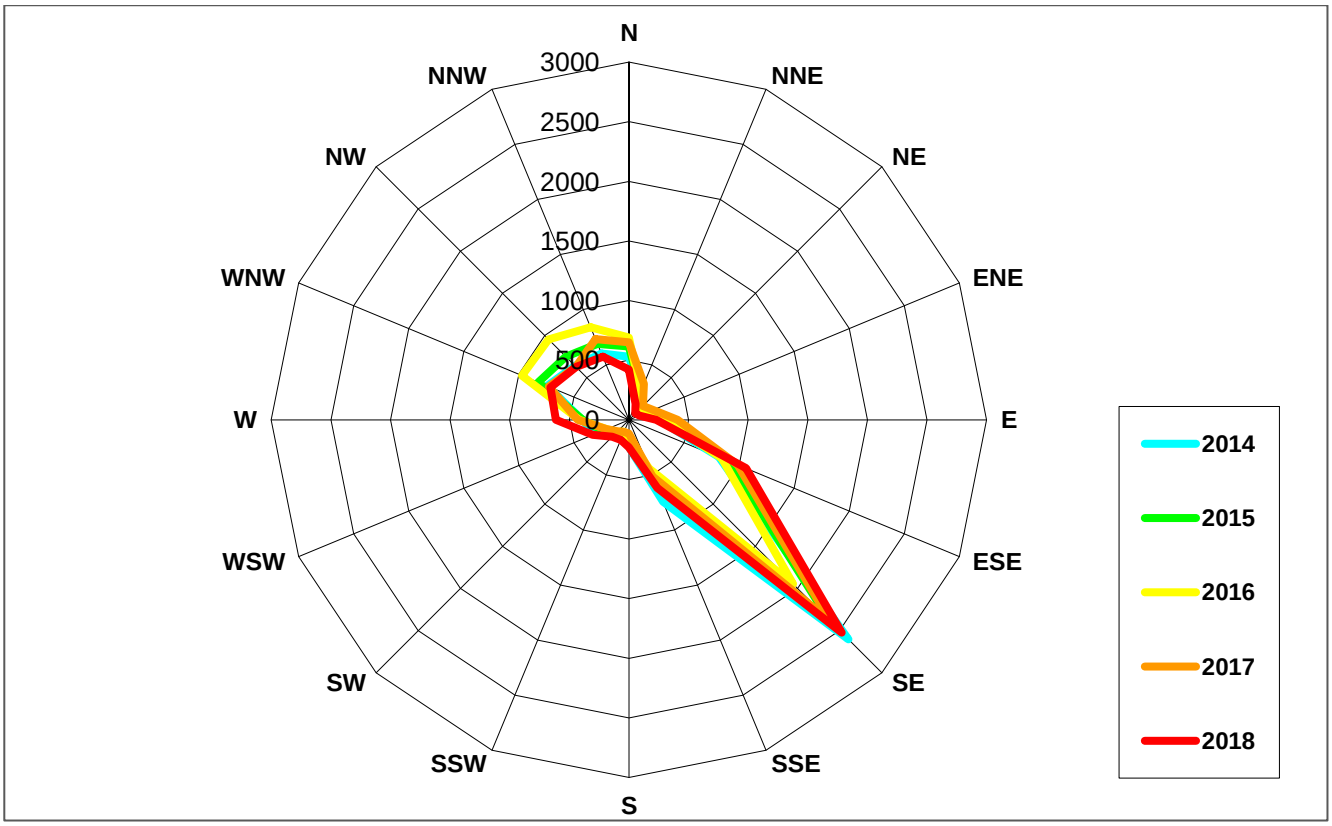


Figure A2 Monthly Average Wind Speed at Muswellbrook AQMS for 2014 – 2018

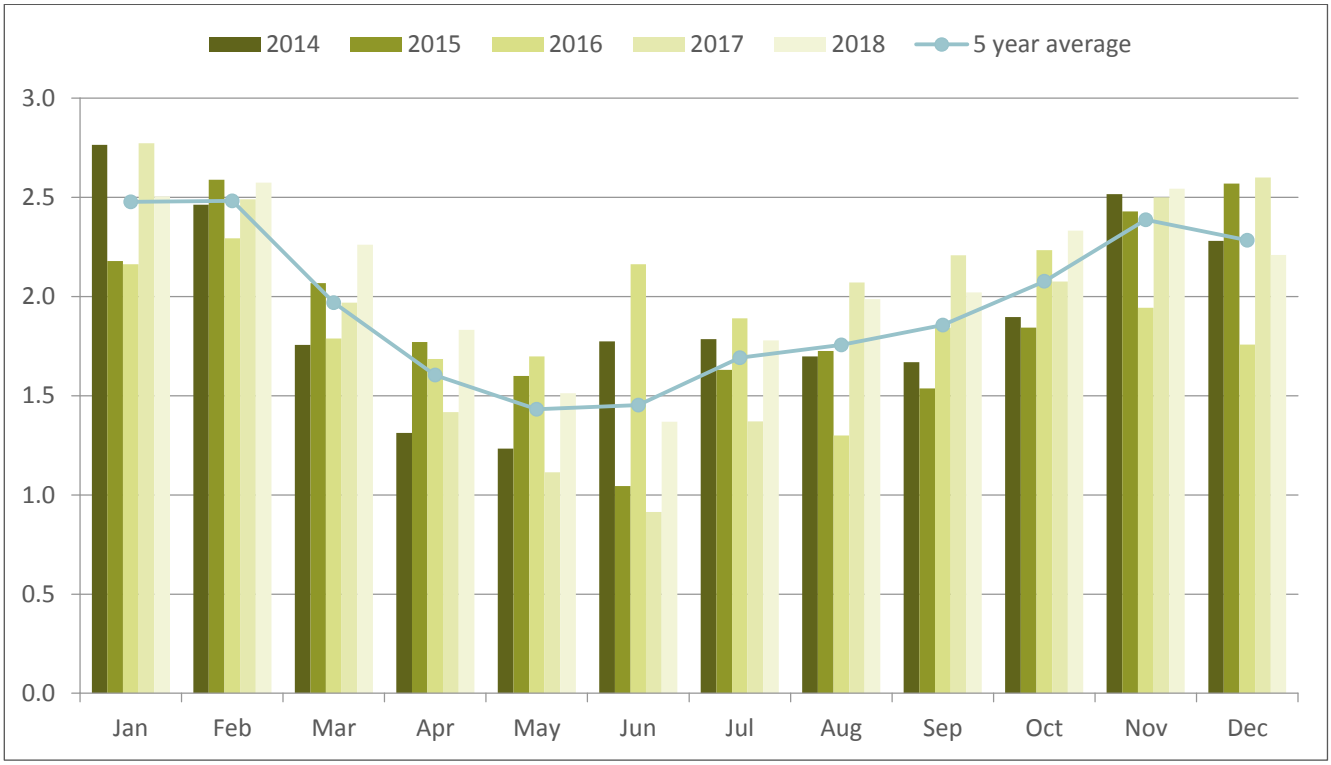
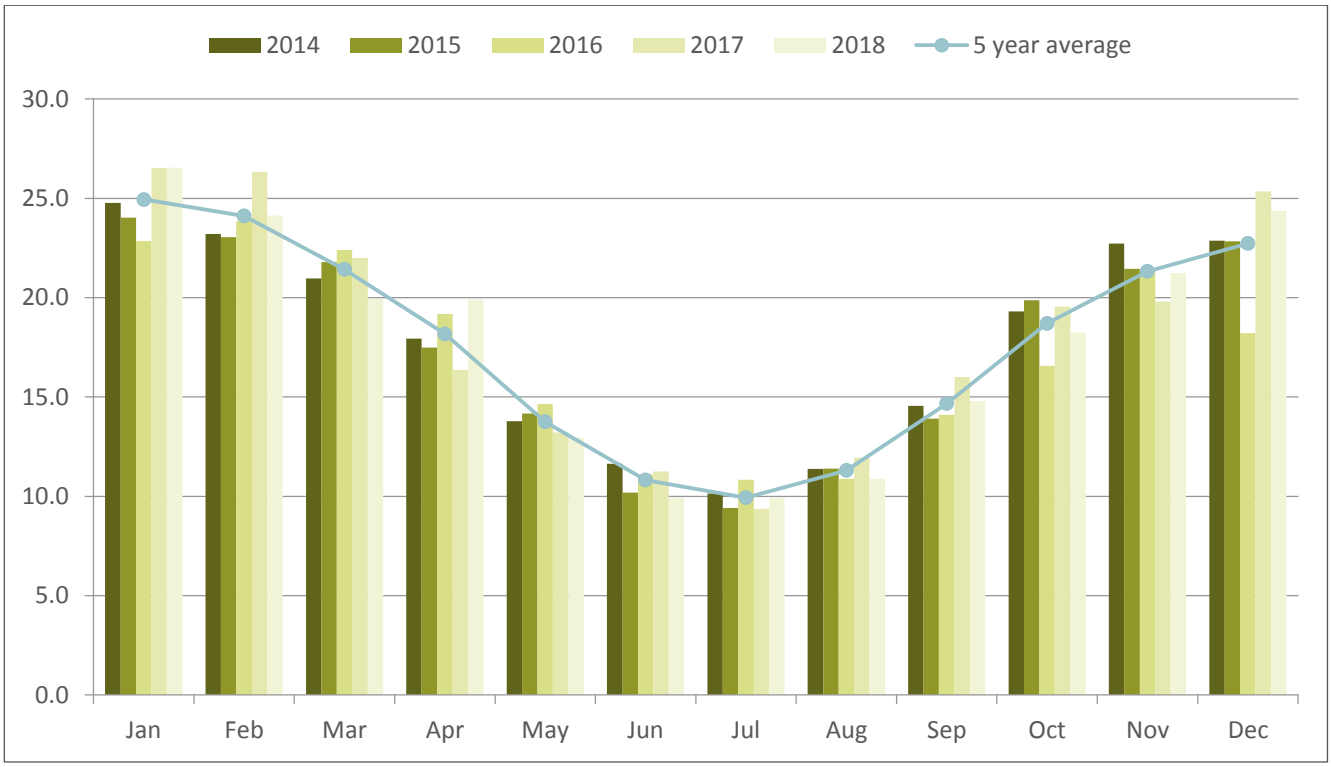


Figure A3 Monthly Average Temperature at Muswellbrook AQMS for 2014 – 2018



APPENDIX B

VARIABLE EMISSION FILES – CALCULATION STEPS

A brief summary of the steps used in calculating the hourly varying emission rates for each source are presented below.

Step 1: Calculate annual average emission rate (kg/year) for FP, CM and RE

$FP_{annual} = PM_{2.5,\ annual}$	(FP) Fine Particulate – particulate of size less than 2.5 µm
$CM_{annual} = PM_{10,annual} – PM_{2.5,\ annual}$	(CM) Coarse Particulate – particulate of size between 10 µm and 2.5 µm
$RE_{annual} = TSP_{annual} - PM_{10,annual}$	(RE) Rest Particulate – particulate of size greater than 10 µm

Step 2: Identify the operating hours for each activity

Step 3: Classify the sensitivity of each type of activity to wind speed

- Wind insensitive: activities with emission factor that is independent of wind speed (e.g. wheel generated particulate emissions)
- Wind sensitive: activities with emission factor that is a function of (Wind speed/2.2) $^{1.3}$ (e.g. loading)
- Wind erosion: emission from exposed areas/stockpiles

Step 4: Identify the number of sources associated with each activity

- Note that each wind erosion source is modelled as an independent source.

Step 5: Calculate the hourly average emission rate for each activity per source

$$FP_{AC,i,h} = \frac{FP_{annual,i} \times 1000}{N_{days} \times OH_i \times 3600 \times N_{s,i}} \times WSFactor_{i,h}$$

$$CM_{AC,i,h} = \frac{CM_{annual,i} \times 1000}{N_{days} \times OH_i \times 3600 \times N_{s,i}} \times WSFactor_{i,h}$$

$$RE_{AC,i,h} = \frac{RE_{annual,i} \times 1000}{N_{days} \times OH_i \times 3600 \times N_{s,i}} \times WSFactor_{i,h}$$

For wind insensitive activities

$$WSFactor_{i,h} = 1$$

For wind sensitive activities

$$WSFactor_{i,h} = \frac{\left(\frac{WS_h}{2.2}\right)^{1.3}}{\frac{\sum_{j=1}^{n}\left(\frac{WS_j}{2.2}\right)^{1.3}}{n}}$$

For wind erosion activities

$$WSFactor_{i,h} = \frac{(WS_h)^3}{\frac{\sum_{j=1}^{n}(WS_j)^3}{n}}$$

Where:

$FP_{AC,i,h}$- Fine Particulates emission rate for Activity i (g/s) at hour h

$CM_{AC,i,h}$- Coarse Particulates emission rate for Activity i (g/s) at hour h

OH_i-daily Operating Hours (1- 24) for Activity i

N_{days} -Number of days in the meteorological data file

$N_{s,i}$ -Number of sources associated with Activity i

WS_h-Wind Speed at the hour

n -number of hours in the meteorological data file

Note: If the activity was modelled as area source, the equation on the left column of the table needs to be divided by the area of that activity.

Step 5: Calculate hourly average emission rate for each source

To calculate the emission rate for a particular source for a particular hour, add up the calculated emission rate for each activity associated with source.

For example, if Source 1 is associated with Activity 1, Activity 2 and Activity 3, then:

- $ER_{S1,h,FP} = FP_{AC,1,h} + FP_{AC,2,h} + FP_{AC,3,h}$
- $ER_{S1,h,CM} = CM_{AC,1,h} + CM_{AC,2,h} + CM_{AC,3,h}$
- $ER_{S1,h,RE} = RE_{AC,1,h} + RE_{AC,2,h} + RE_{AC,3,h}$

APPENDIX C

CONSTRUCTION PHASE RISK ASSESSMENT METHODOLOGY

Step 1 – Screening Based on Separation Distance

The Step 1 screening criteria provided by the IAQM guidance suggests screening out any assessment of impacts from construction activities where sensitive receptors are located more than 350 m from the boundary of the site, more than 50 m from the route used by construction vehicles on public roads and more than 500 m from the site entrance. This step is noted as having deliberately been chosen to be conservative, and will require assessments for most projects.

Step 2a – Assessment of Scale and Nature of the Works

Step 2a of the assessment provides "dust emissions magnitudes" for each of four dust generating activities; demolition, earthworks, construction, and track-out (the movement of site material onto public roads by vehicles). The magnitudes are: *Large*; *Medium*; or *Small*, with suggested definitions for each category. The definitions given in the IAQM guidance for earthworks, construction activities and track-out, which are most relevant to this Development, are as follows:

Demolition *(Any activity involved with the removal of an existing structure [or structures]. This may also be referred to as de-construction, specifically when a building is to be removed a small part at a time)*:

- ***Large***: Total building volume >50,000 m^3, potentially dusty construction material (e.g. concrete), on-site crushing and screening, demolition activities >20 m above ground level;
- ***Medium***: Total building volume 20,000 m^3 – 50,000 m^3, potentially dusty construction material, demolition activities 10-20 m above ground level; and
- ***Small***: Total building volume <20,000 m^3, construction material with low potential for dust release (e.g. metal cladding or timber), demolition activities <10m above ground, demolition during wetter months.

Earthworks *(Covers the processes of soil-stripping, ground-levelling, excavation and landscaping)*:

- ***Large***: Total site area greater than 10,000 m^2, potentially dusty soil type (eg clay, which will be prone to suspension when dry due to small particle size), more than 10 heavy earth moving vehicles active at any one time, formation of bunds greater than 8 m in height, total material moved more than 100,000 t.
- ***Medium***: Total site area 2,500 m^2 to 10,000 m^2, moderately dusty soil type (eg silt), 5 to 10 heavy earth moving vehicles active at any one time, formation of bunds 4 m to 8 m in height, total material moved 20,000 t to 100,000 t.
- ***Small***: Total site area less than 2,500 m^2, soil type with large grain size (eg sand), less than five heavy earth moving vehicles active at any one time, formation of bunds less than 4 m in height, total material moved less than 20,000 t, earthworks during wetter months.

Construction *(Any activity involved with the provision of a new structure (or structures), its modification or refurbishment. A structure will include a residential dwelling, office building, retail outlet, road, etc)*:

- ***Large***: Total building volume greater than 100,000 m^3, piling, on site concrete batching; sandblasting.

- ***Medium***: Total building volume 25,000 m^3 to 100,000 m^3, potentially dusty construction material (eg concrete), piling, on site concrete batching.
- ***Small***: Total building volume less than 25,000 m^3, construction material with low potential for dust release (eg metal cladding or timber).

Track-out *(The transport of dust and dirt from the construction / demolition site onto the public road network, where it may be deposited and then re-suspended by vehicles using the network)*:

- ***Large***: More than 50 heavy vehicle movements per day, surface materials with a high potential for dust generation, greater than 100 m of unpaved road length.
- ***Medium***: Between 10 and 50 heavy vehicle movements per day, surface materials with a moderate potential for dust generation, between 50 m and 100 m of unpaved road length.
- ***Small***: Less than 10 heavy vehicle movements per day, surface materials with a low potential for dust generation, less than 50 m of unpaved road length.

Note: No demolition of existing structures will be performed as part of this Development.

In order to provide a conservative assessment of potential impacts, it has been assumed that if at least one of the parameters specified in the 'large' definition is satisfied, the works are classified as large, and so on.

Step 2b – Risk Assessment

Assessment of the Sensitivity of the Area

- Step 2b of the assessment process requires the sensitivity of the area to be defined. The sensitivity of the area takes into account:
- The specific sensitivities that identified sensitive receptors have to dust deposition and human health impacts;
- The proximity and number of those receptors;
- In the case of PM_{10}, the local background concentration; and
- Other site-specific factors, such as whether there are natural shelters such as trees to reduce the risk of wind-blown dust.
- Individual receptors are classified as having *high*, *medium* or *low* sensitivity to dust deposition and human health impacts (ecological receptors are not addressed using this approach). The IAQM method provides guidance on the sensitivity of different receptor types to dust soiling and health effects as summarised in **Table A1**. It is noted that user expectations of amenity levels (dust soiling) is dependent on existing deposition levels.

Table A1 IAQM Guidance for Categorising Receptor Sensitivity

Value	High Sensitivity Receptor	Medium Sensitivity Receptor	Low Sensitivity Receptor
Dust soiling	Users can reasonably expect a high level of amenity; or The appearance, aesthetics or value of their property would be diminished by soiling, and the people or property would reasonably be expected to be present continuously, or at least regularly for extended periods as part of the normal pattern of use of the land.	Users would expect to enjoy a reasonable level of amenity, but would not reasonably expect to enjoy the same level of amenity as in their home; or The appearance, aesthetics or value of their property could be diminished by soiling; or The people or property wouldn't reasonably be expected to be present here continuously or regularly for extended periods as part of the normal pattern of use of the land.	The enjoyment of amenity would not reasonably be expected; or Property would not reasonably be expected to be diminished in appearance, aesthetics or value by soiling; or There is transient exposure, where the people or property would reasonably be expected to be present only for limited periods of time as part of the normal pattern of use of the land.
	Examples: Dwellings, museums, medium and long term car parks and car showrooms.	*Examples: Parks and places of work.*	*Examples: Playing fields, farmland (unless commercially-sensitive horticultural), footpaths, short term car parks and roads.*
Health effects	Locations where the public are exposed over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where the people exposed are workers, and exposure is over a time period relevant to the air quality objective for PM_{10} (in the case of the 24-hour objectives, a relevant location would be one where individuals may be exposed for eight hours or more in a day).	Locations where human exposure is transient.
	Examples: Residential properties, hospitals, schools and residential care homes.	*Examples: Office and shop workers, but will generally not include workers occupationally exposed to PM10.*	*Examples: Public footpaths, playing fields, parks and shopping street.*

According to the IAQM methods, the sensitivity of the identified individual receptors (as described above) is then used to assess the *sensitivity of the area* surrounding the active construction area, taking into account the proximity and number of those receptors, and the local background PM_{10} concentration (in the case of potential health impacts) and other site-specific factors. Additional factors to consider when determining the sensitivity of the area include:

- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area and if relevant, the season during which the works will take place;
- any conclusions drawn from local topography;
- the duration of the potential impact (as a receptor may be willing to accept elevated dust levels for a known short duration, or may become more sensitive or less sensitive (acclimatised) over time for long-term impacts); and

- any known specific receptor sensitivities which go beyond the classifications given in the IAQM document.

The IAQM guidance for assessing the sensitivity of an area to dust soiling is shown in **Table A2**. The sensitivity of the area should be derived for each of activity relevant to the project (ie construction and earthworks).

Table A2 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Soiling Effects

Receptor Sensitivity	Number of receptors	Distance from the source (m)			
		<20	<50	<100	<350
High	>100	High	High	Medium	Low
	10-100	High	Medium	Low	Low
	1-10	Medium	Low	Low	Low
Medium	>1	Medium	Low	Low	Low
Low	>1	Low	Low	Low	Low

Note: Estimate the total number of receptors within the stated distance. Only the *highest level* of area sensitivity from the table needs to be considered. For example, if there are 7 high sensitivity receptors < 20m of the source and 95 high sensitivity receptors between 20 and 50 m, then the total of number of receptors < 50 m is 102. The sensitivity of the area in this case would be high.

A modified version of the IAQM guidance for assessing the *sensitivity of an area* to health impacts is shown in **Table A3**. For high sensitivity receptors, the IAQM methods takes the existing background concentrations of PM_{10} (as an annual average) experienced in the area of interest into account and is based on the air quality objectives for PM_{10} in the UK. As these objectives differ from the ambient air quality criteria adopted for use in this assessment (ie an annual average of 19.8 µg/m^3 for PM_{10}) the IAQM method has been modified slightly.

- This approach is consistent with the IAQM guidance, which notes that in using the tables to define the *sensitivity of an area*, professional judgement may be used to determine alternative sensitivity categories, taking into account the following factors:
- any history of dust generating activities in the area;
- the likelihood of concurrent dust generating activity on nearby sites;
- any pre-existing screening between the source and the receptors;
- any conclusions drawn from analysing local meteorological data which accurately represent the area, and if relevant the season during which the works will take place;
- any conclusions drawn from local topography;
- duration of the potential impact; and
- any known specific receptor sensitivities which go beyond the classifications given in this document.

Table A3 IAQM Guidance for Categorising the Sensitivity of an Area to Dust Health Effects

Receptor sensitivity	Annual mean PM_{10} conc.	Number of receptors [a,b]	Distance from the source (m)				
			<20	<50	<100	<200	<350
High	>25 µg/m^3	>100	High	High	High	Medium	Low
		10-100	High	High	Medium	Low	Low
		1-10	High	Medium	Low	Low	Low
	21-25 µg/m^3	>100	High	High	Medium	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	High	Medium	Low	Low	Low
	17-21 µg/m^3	>100	High	Medium	Low	Low	Low
		10-100	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	<17 µg/m^3	>100	Medium	Low	Low	Low	Low
		10-100	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Medium	>25 µg/m^3	>10	High	Medium	Low	Low	Low
		1-10	Medium	Low	Low	Low	Low
	21-25 µg/m^3	>10	Medium	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	17-21 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
	<17 µg/m^3	>10	Low	Low	Low	Low	Low
		1-10	Low	Low	Low	Low	Low
Low	-	>1	Low	Low	Low	Low	Low

Notes:

(a) Estimate the total within the stated distance (e.g. the total within 350 m and not the number between 200 and 350 m); noting that only the highest level of area sensitivity from the table needs to be considered.

(b) In the case of high sensitivity receptors with high occupancy (such as schools or hospitals) approximate the number of people likely to be present. In the case of residential dwellings, just include the number of properties.

Risk Assessment

The dust emission magnitude from Step 2a and the receptor sensitivity from Step 2b are then used in the matrices shown in **Table A4** (earthworks and construction) and **Table A5** (track-out) to determine the risk category with no mitigation applied.

Table A4 Risk Category from Earthworks and Construction Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Medium Risk	Low Risk
Low	Low Risk	Low Risk	Negligible

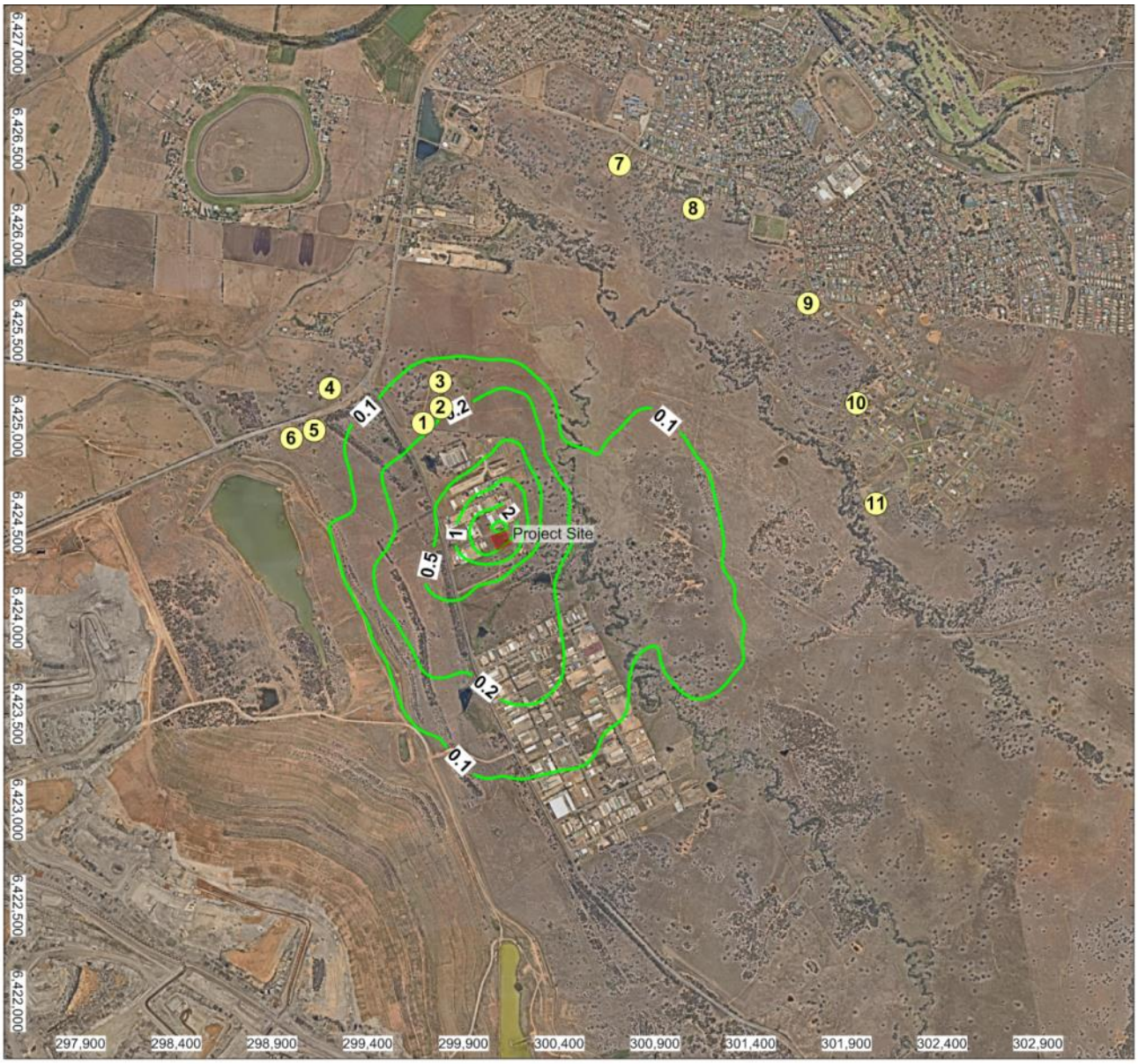
Table A5 Risk Category from Track-out Activities

Sensitivity of Area	Dust Emission Magnitude		
	Large	Medium	Small
High	High Risk	Medium Risk	Low Risk
Medium	Medium Risk	Low Risk	Negligible
Low	Low Risk	Low Risk	Negligible

APPENDIX D

Incremental Contour Plots

Figure D 1 Predicted 99th Percentile 1-hr Average (Nose Response Time) Odour Concentrations - Incremental



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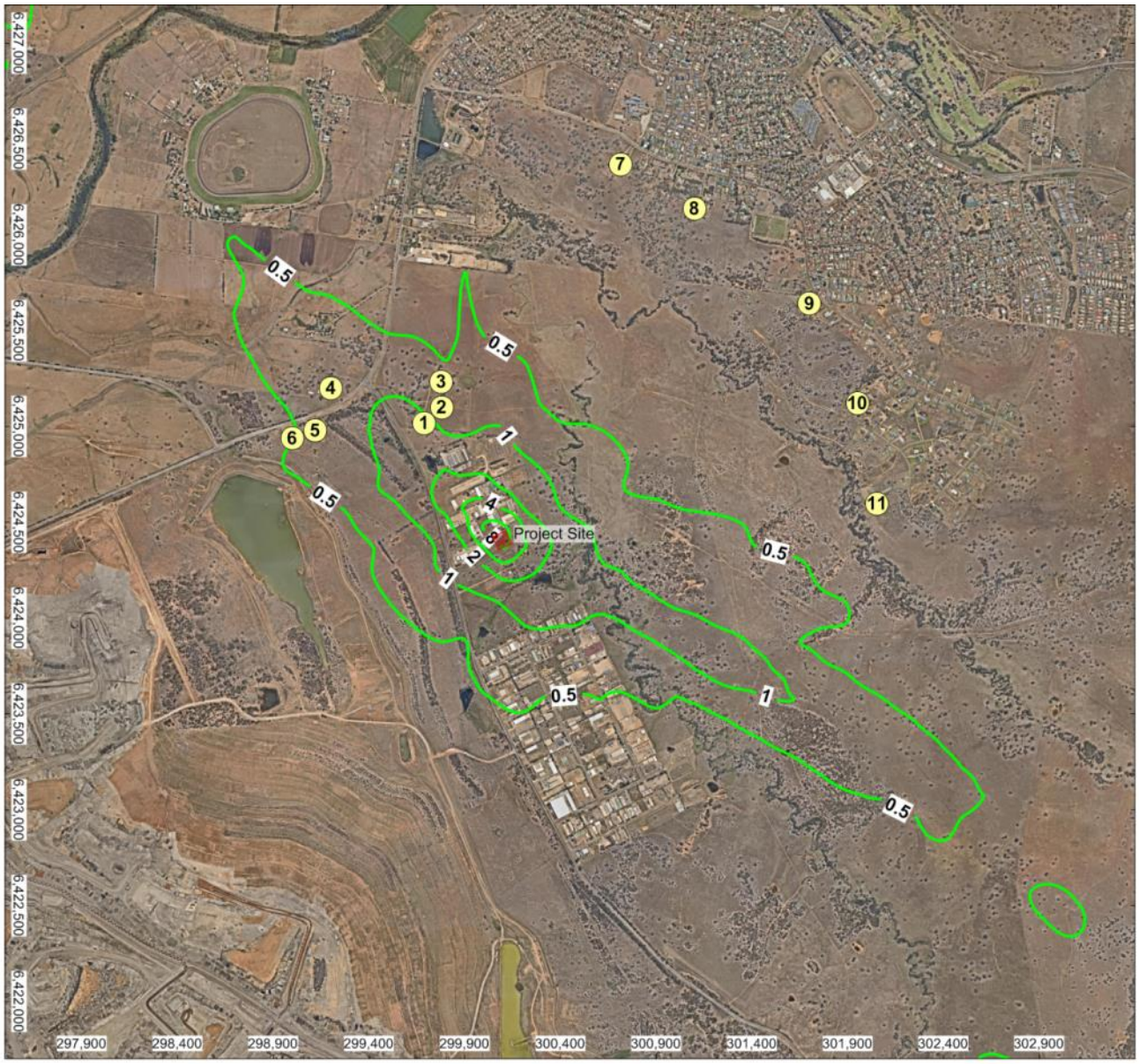
Newpave Asphalt Pty Ltd
Muswellbrook Asphalt Plant
Air Quality Impact Assessment
Proposed Operations

Pollutant	Odour	Averaging Period (1-Hr average (Nose Response Time))	Unit	OU

Figure D 2 Predicted Maximum 24-hr Average $PM_{2.5}$ Concentrations - Incremental



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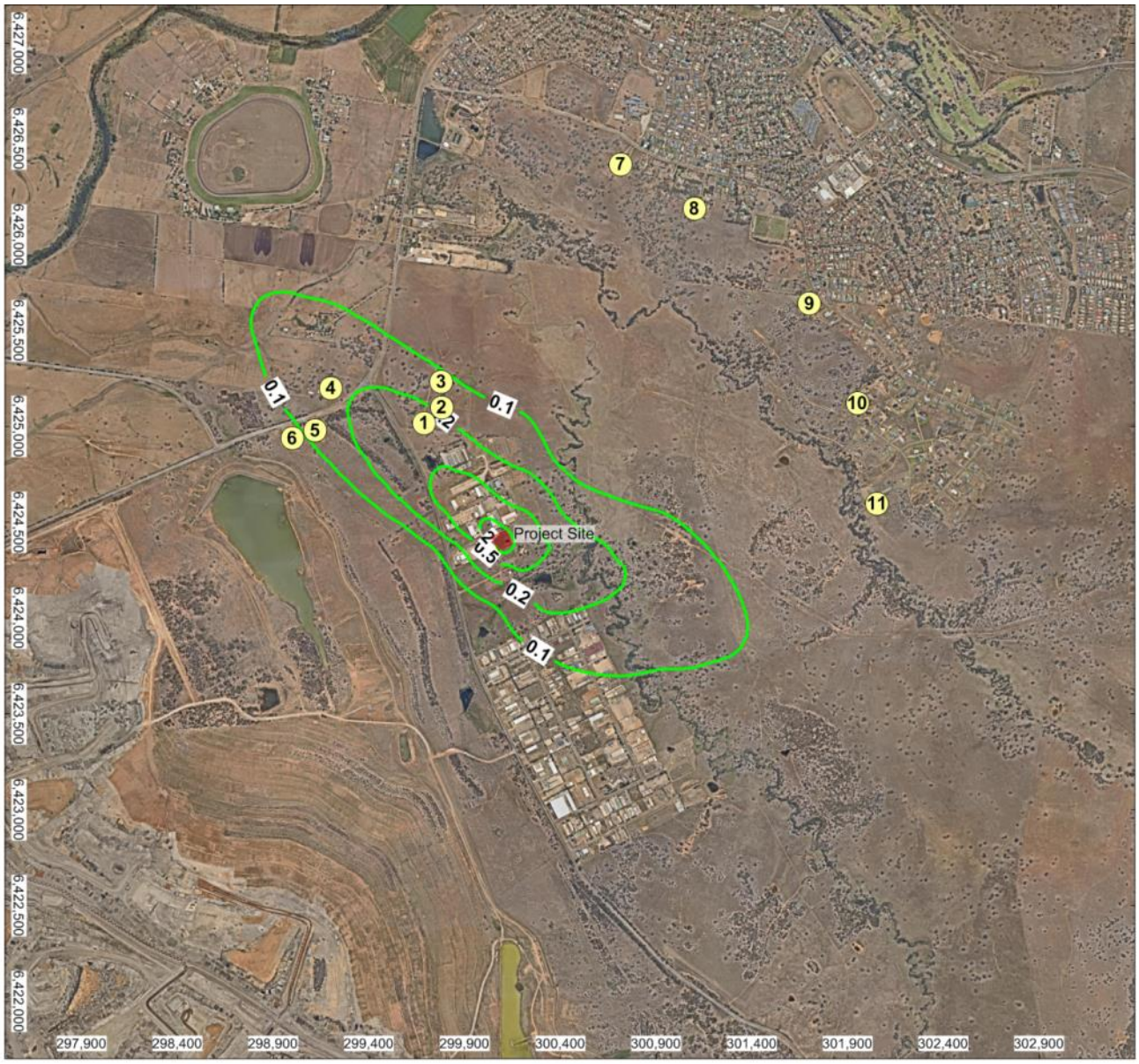
Proposed Operations

Pollutant	$PM_{2.5}$	Averaging Period	24-Hour	Unit	µg/m³

Figure D 3 Predicted Maximum Annual Average $PM_{2.5}$ Concentrations - Incremental



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Air Quality Impact Assessment

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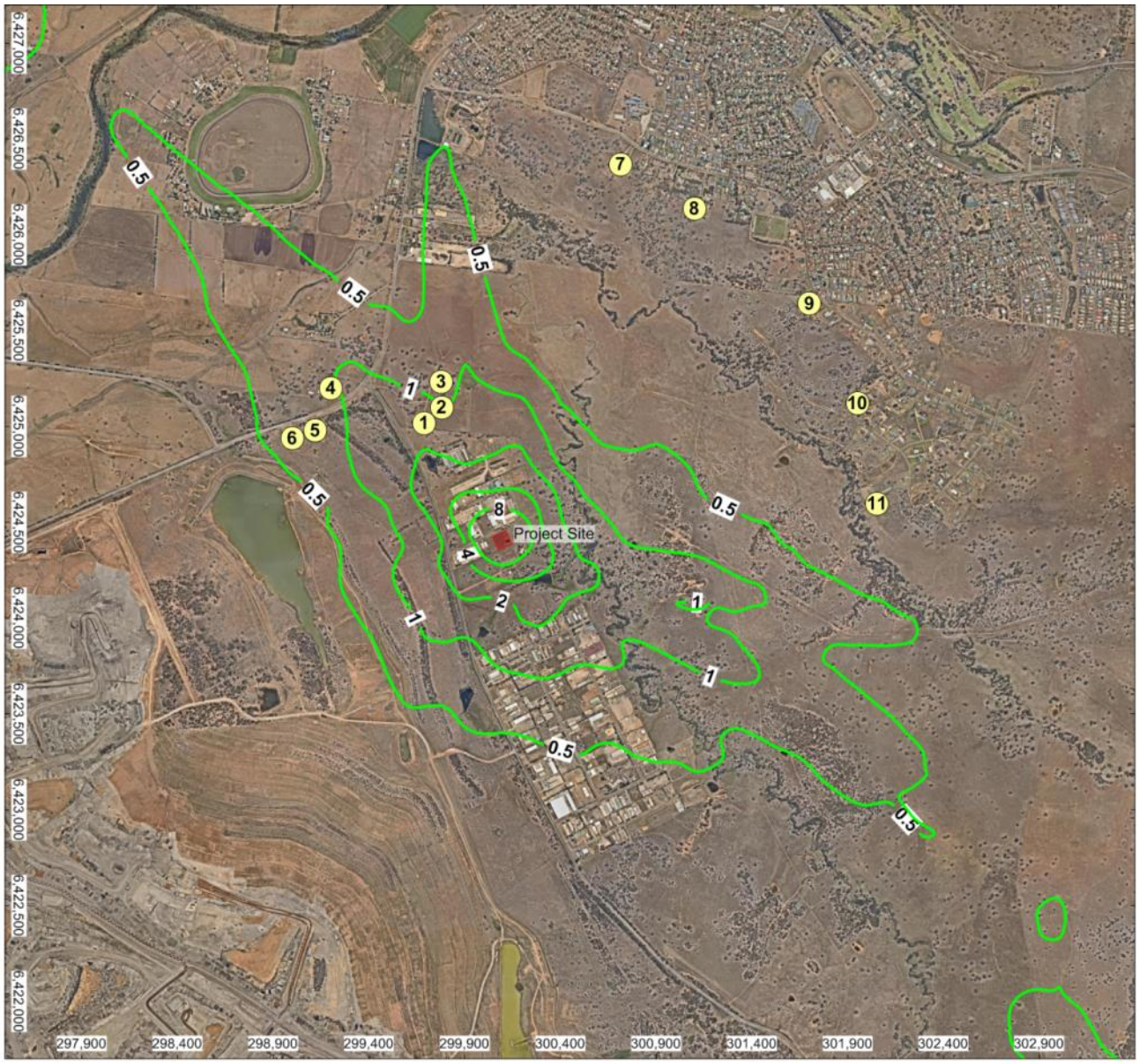
Pollutant	$PM_{2.5}$	Averaging Period	Annual	Unit	µg/m³

Figure D 4 Predicted Maximum 24-hr Average PM_{10} Concentrations - Incremental



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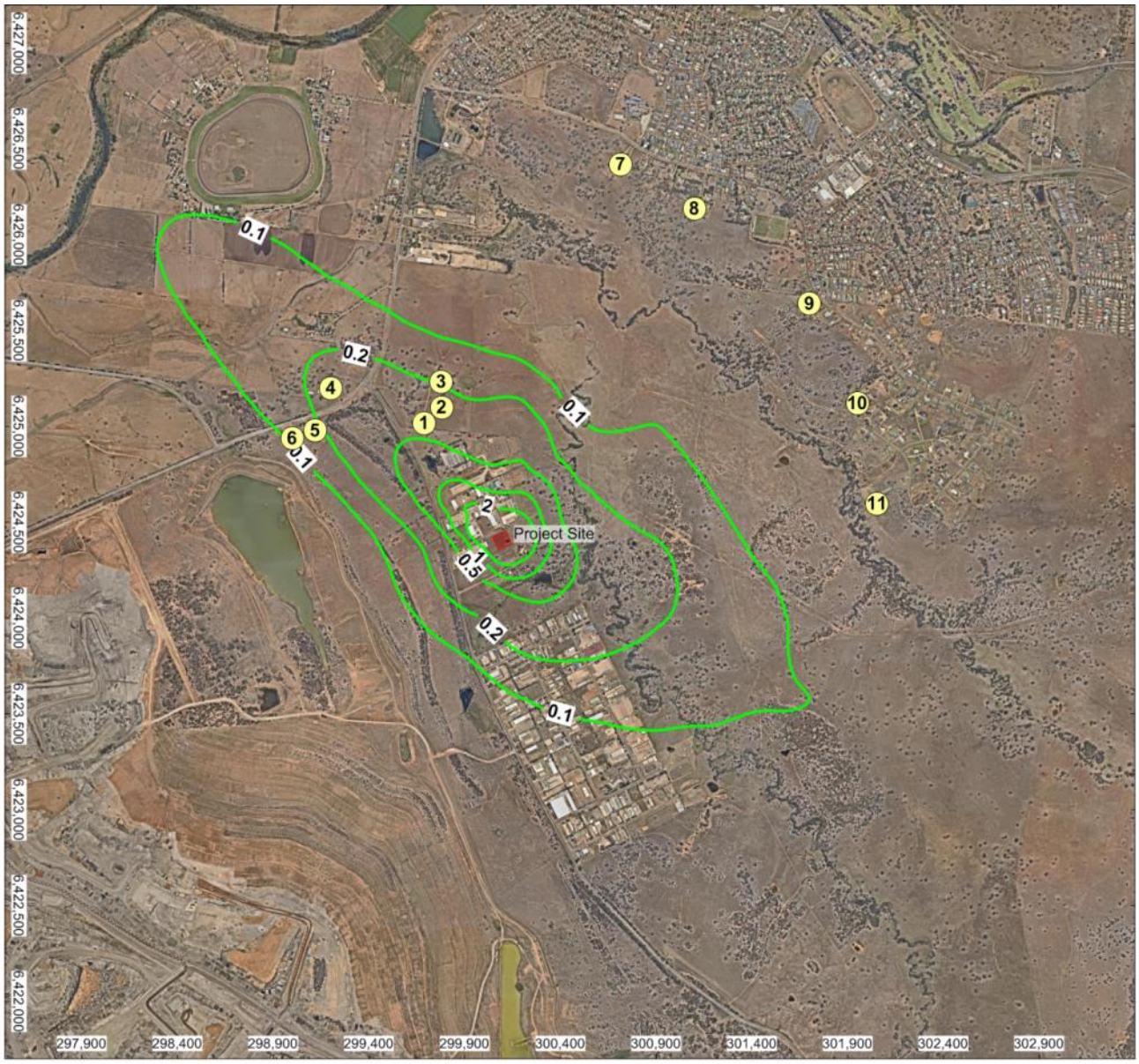
Newpave Asphalt Pty Ltd

Muswellbrook Asphalt Plant
Air Quality Impact Assessment

Proposed Operations

Pollutant	PM_{10}	Averaging Period	24-Hour	Unit	µg/m³

Figure D 5 Predicted Maximum Annual Average PM_{10} Concentrations - Incremental



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Muswellbrook Asphalt Plant
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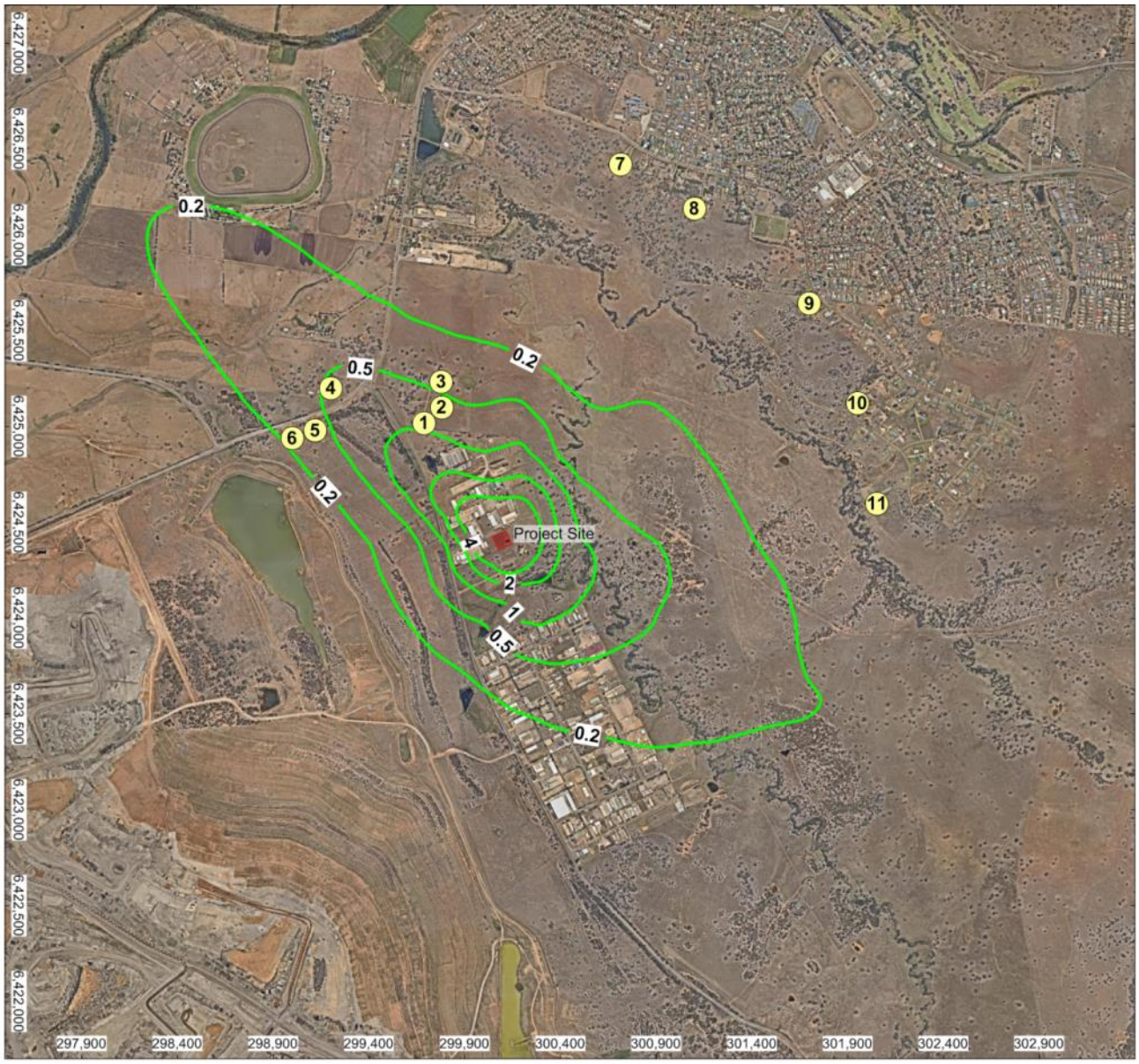
Pollutant	PM_{10}	Averaging Period	Annual	Unit	µg/m³

Figure D 6 Predicted Maximum Annual Average TSP Concentrations - Incremental



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Newpave Asphalt Pty Ltd
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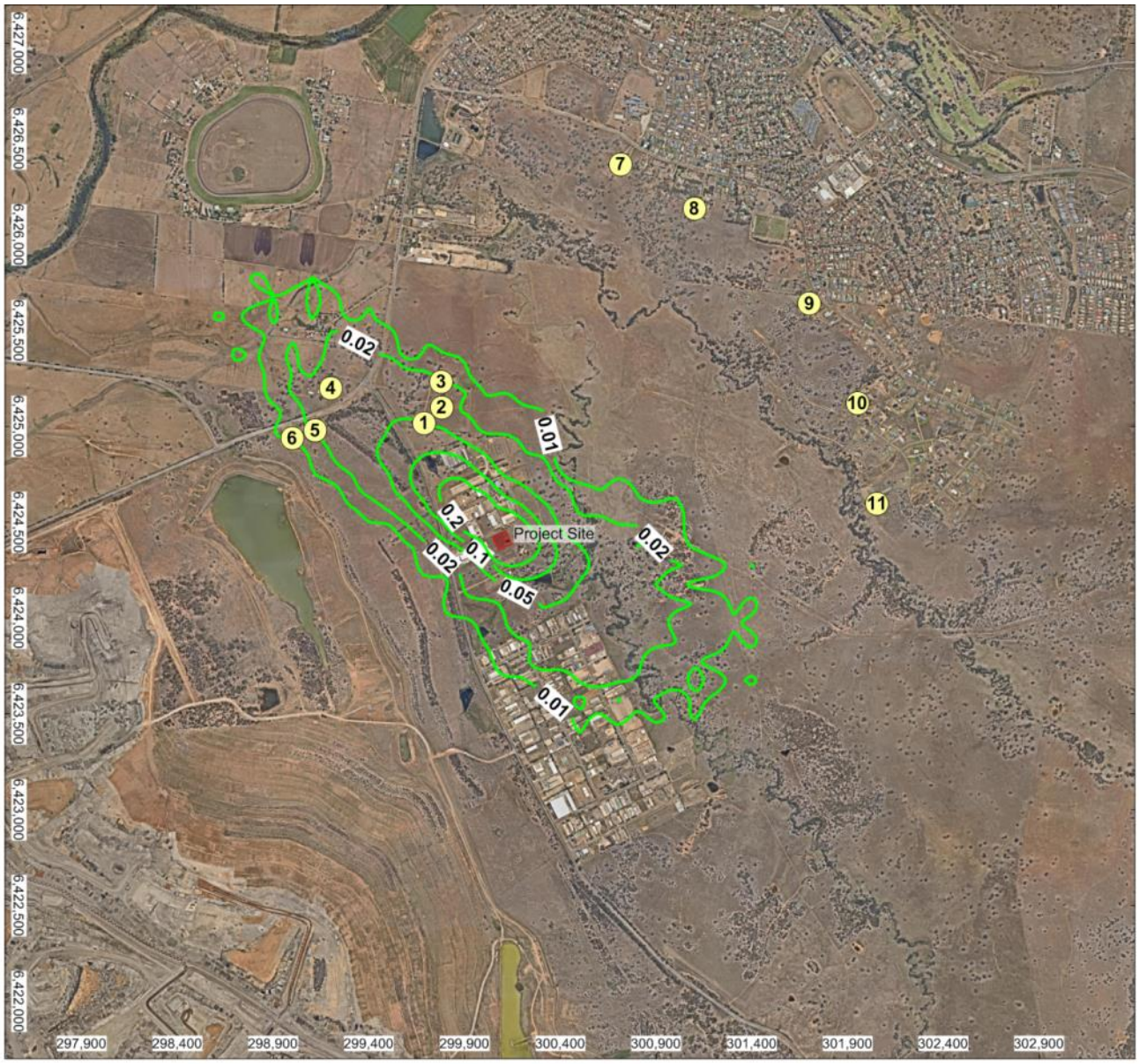
Proposed Operations

Pollutant	TSP	Averaging Period	Annual	Unit	µg/m³

Figure D 7 Predicted Maximum Annual Average Dust Deposition Rates - Incremental



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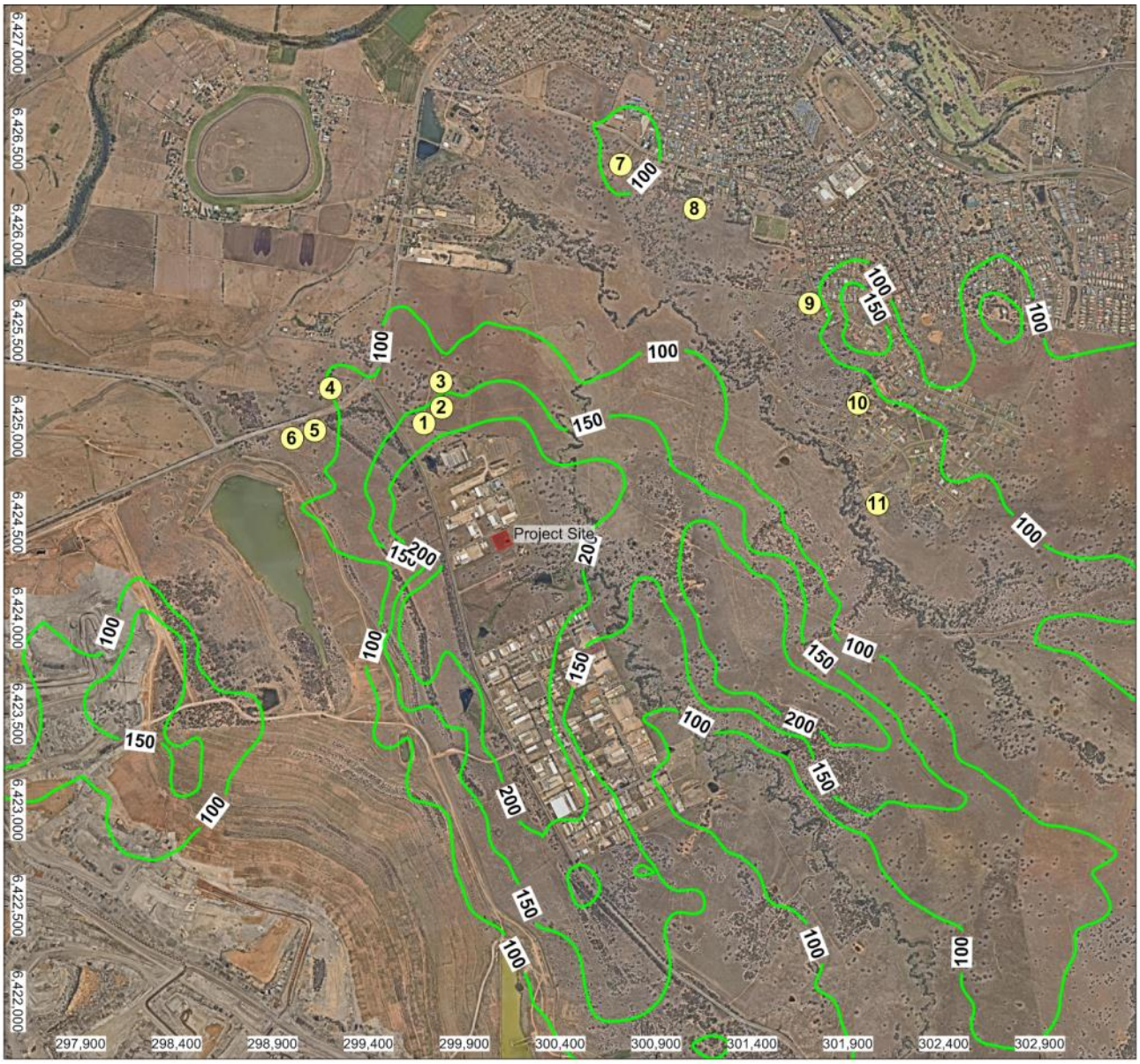
Air Quality Impact Assessment
Proposed Operations

Pollutant	Dust Deposition	Averaging Period	Annual	Unit	g/m²/month

Figure D 8 Predicted Maximum 1-hr Average NO_X Concentrations - Incremental



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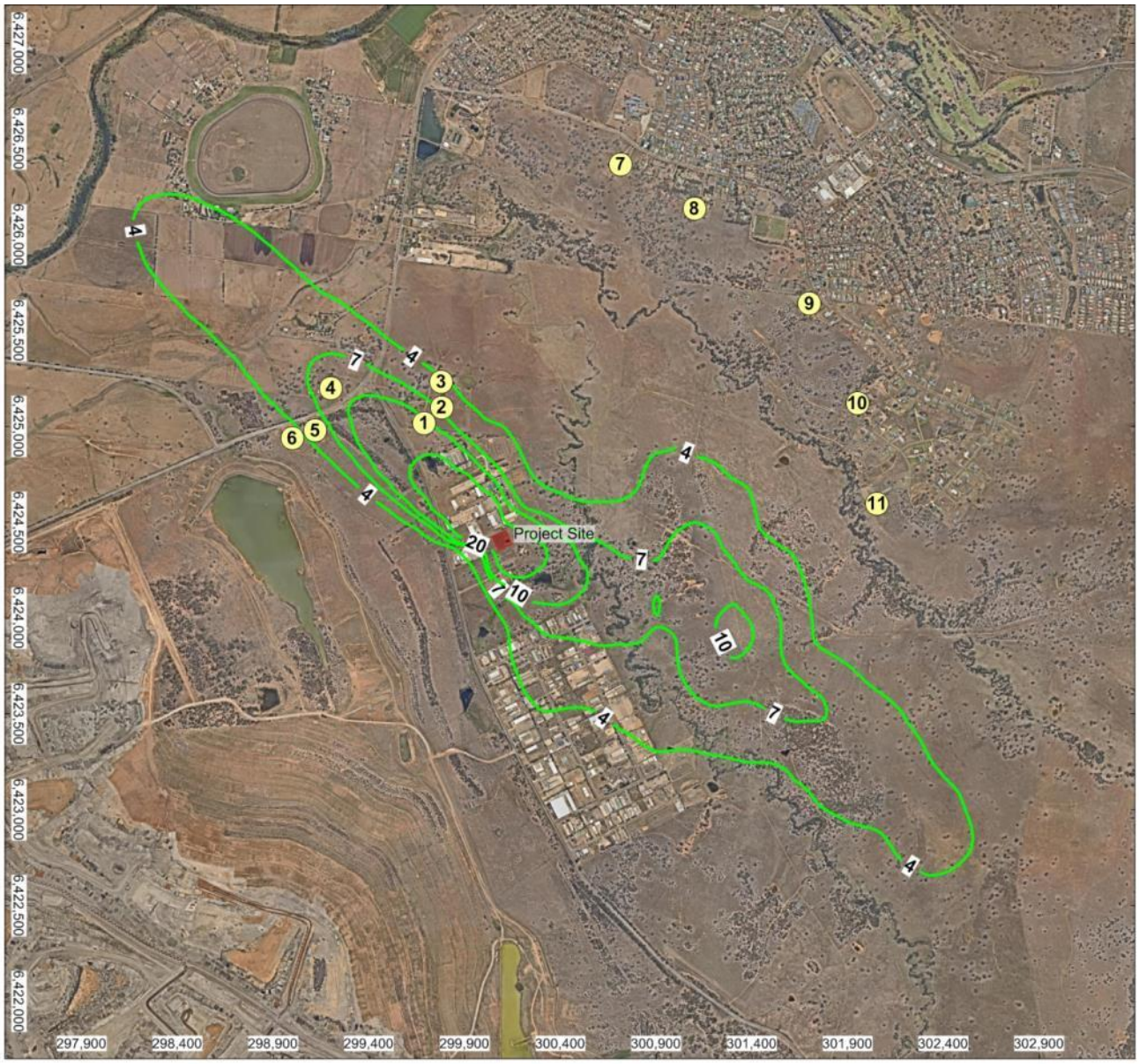
Pollutant	NOx	Averaging Period	1-Hour	Unit	µg/m³

Figure D 9 Predicted Maximum Annual Average NO_X Concentrations - Incremental



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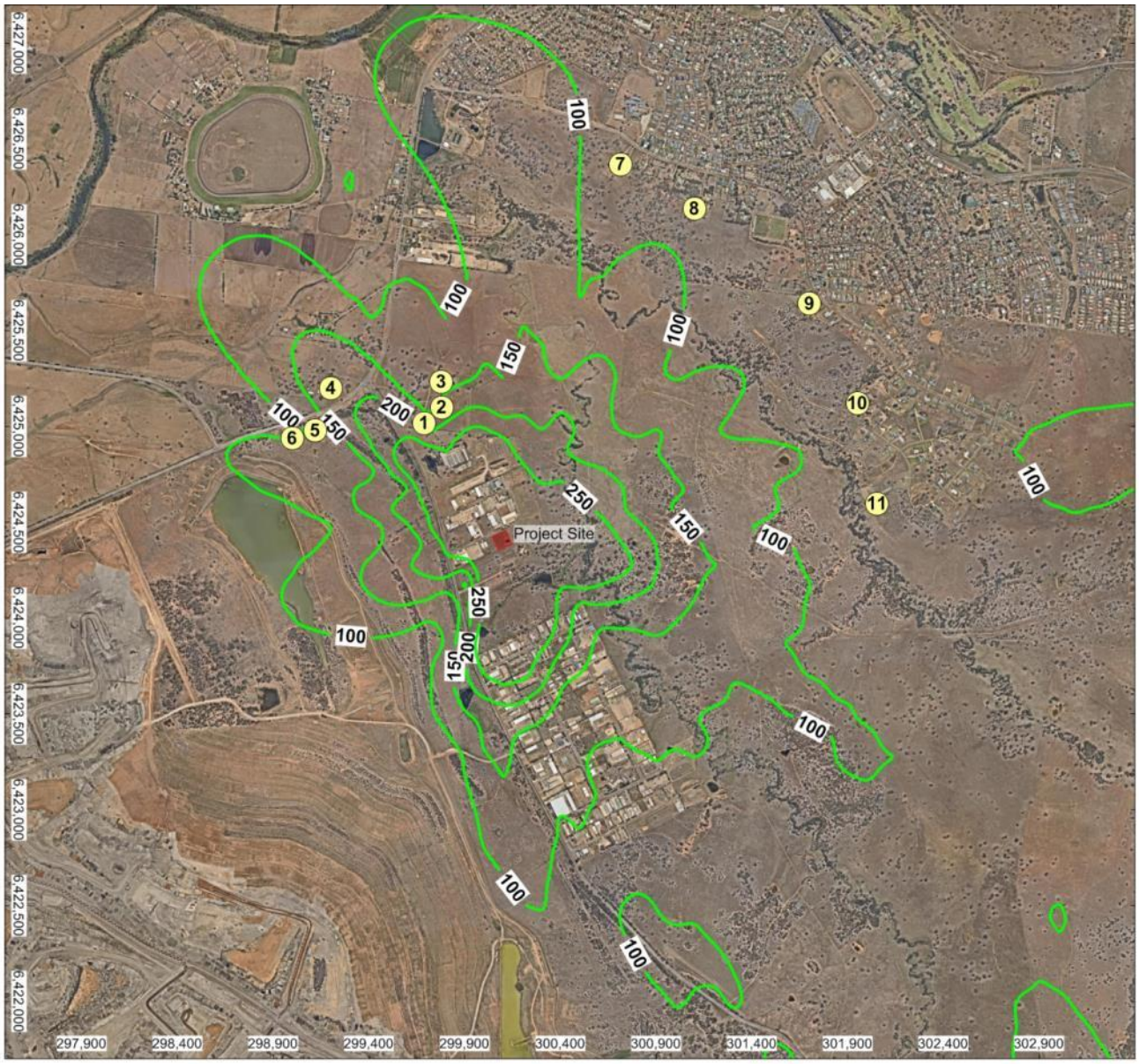
Proposed Operations

Pollutant	NO_x	Averaging Period	Annual	Unit	µg/m³

Figure D 10 Predicted Maximum 1-hr Average CO Concentrations - Incremental



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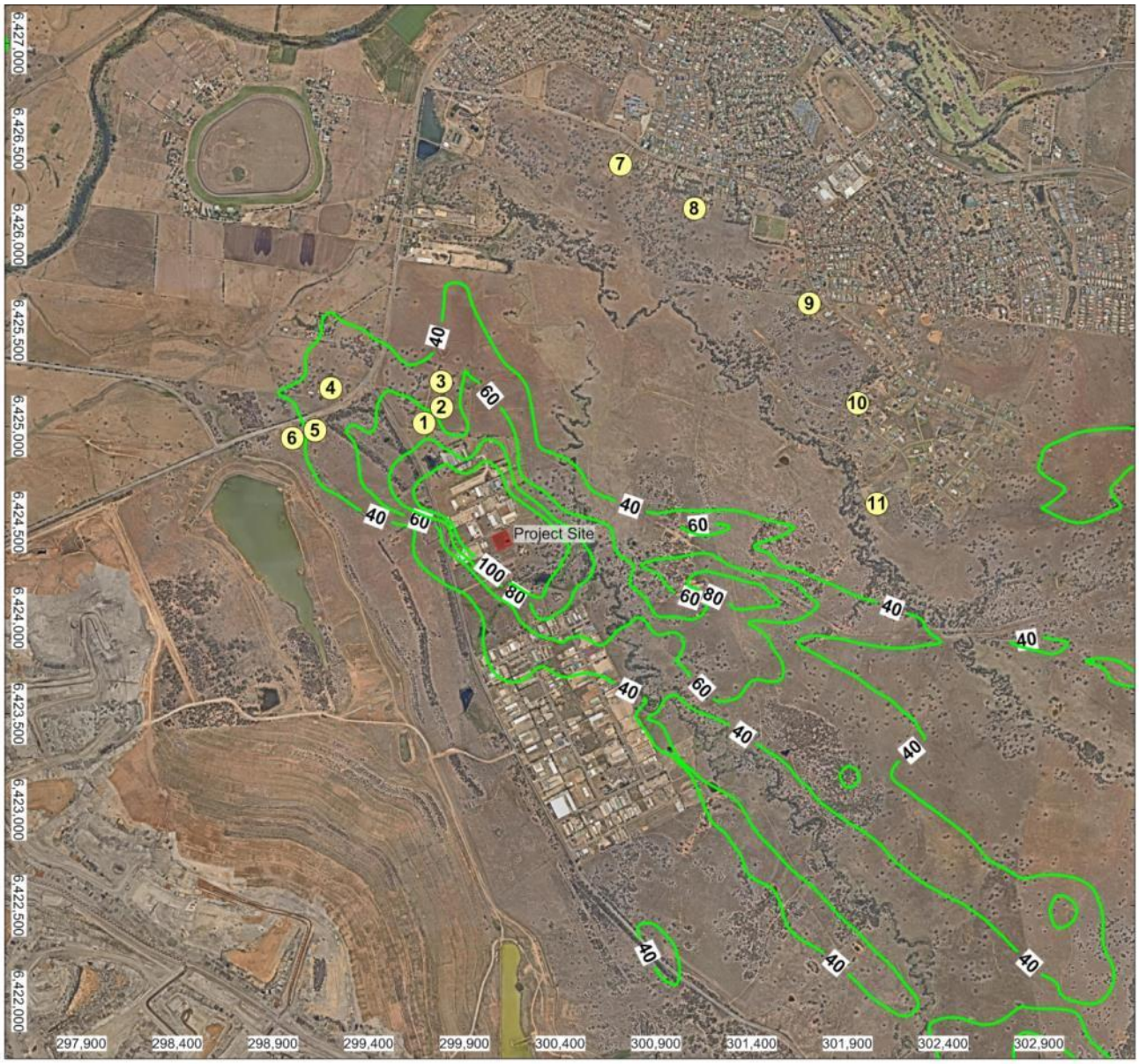
Pollutant	CO	Averaging Period	1-Hour	Unit	µg/m³

Figure D 11 Predicted Maximum 8-hr Average CO Concentrations - Incremental



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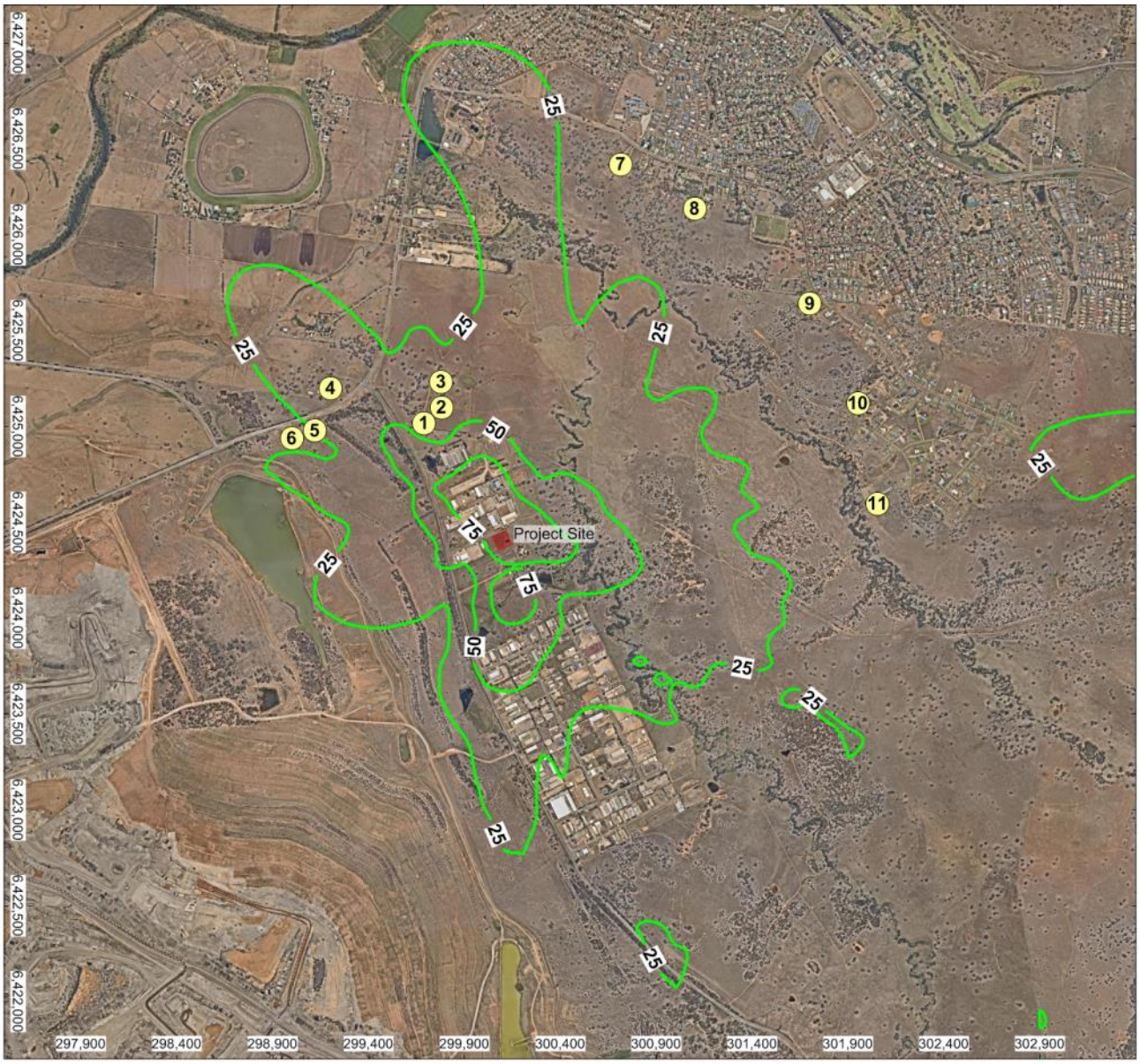
Proposed Operations

Pollutant	CO	Averaging Period	8-Hour	Unit	µg/m³

Figure D 12 Predicted Maximum 1-hr Average SO_2 Concentrations - Incremental



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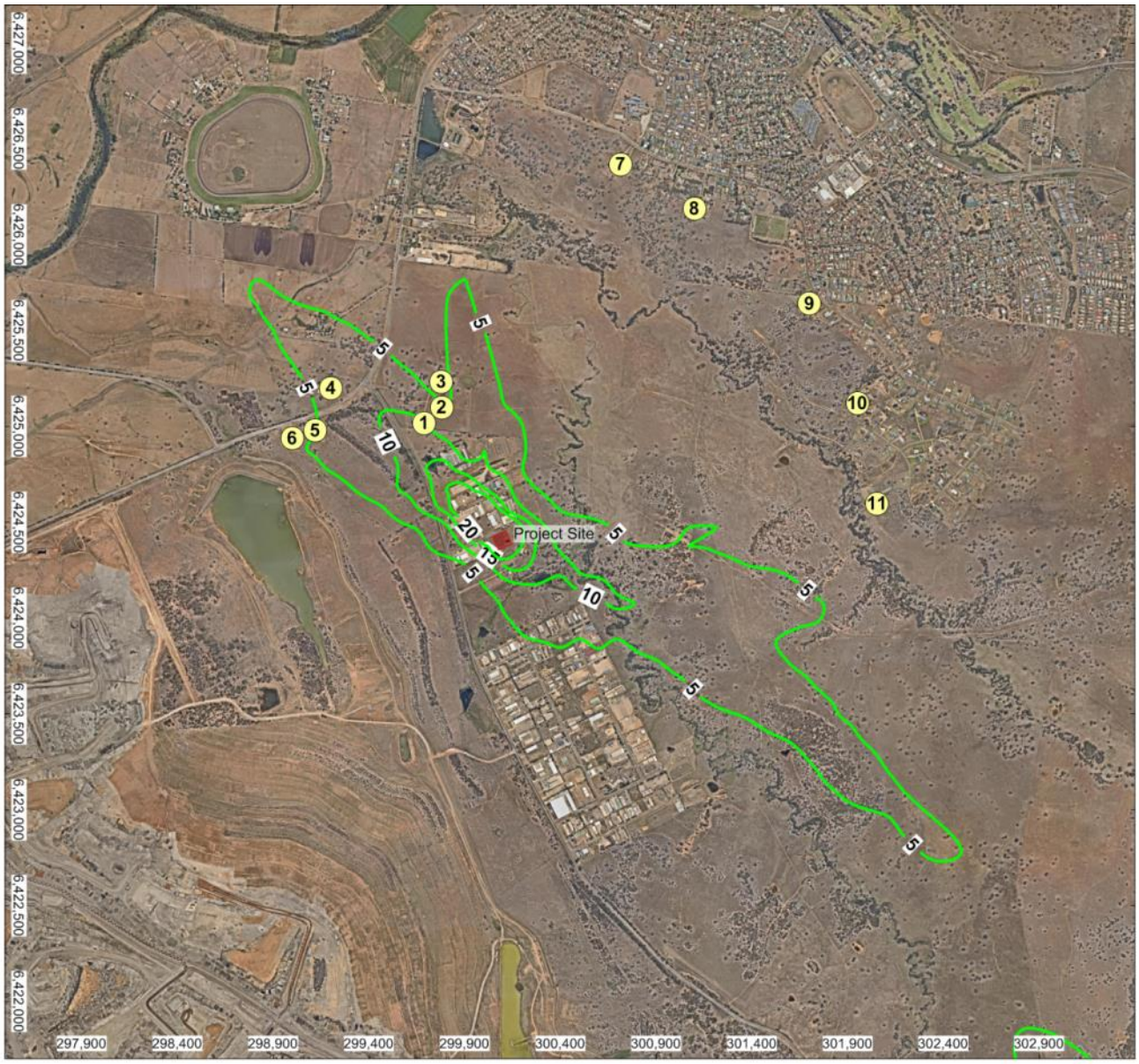
Proposed Operations

Pollutant	SO_2	Averaging Period	1-Hour	Unit	µg/m³

Figure D 13 Predicted Maximum 24-hr Average SO_2 Concentrations - Incremental



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Proposed Operations

Pollutant	SO_2	Averaging Period	24-Hour	Unit	µg/m³

Figure D 14 Predicted Maximum Annual Average SO_2 Concentrations - Incremental

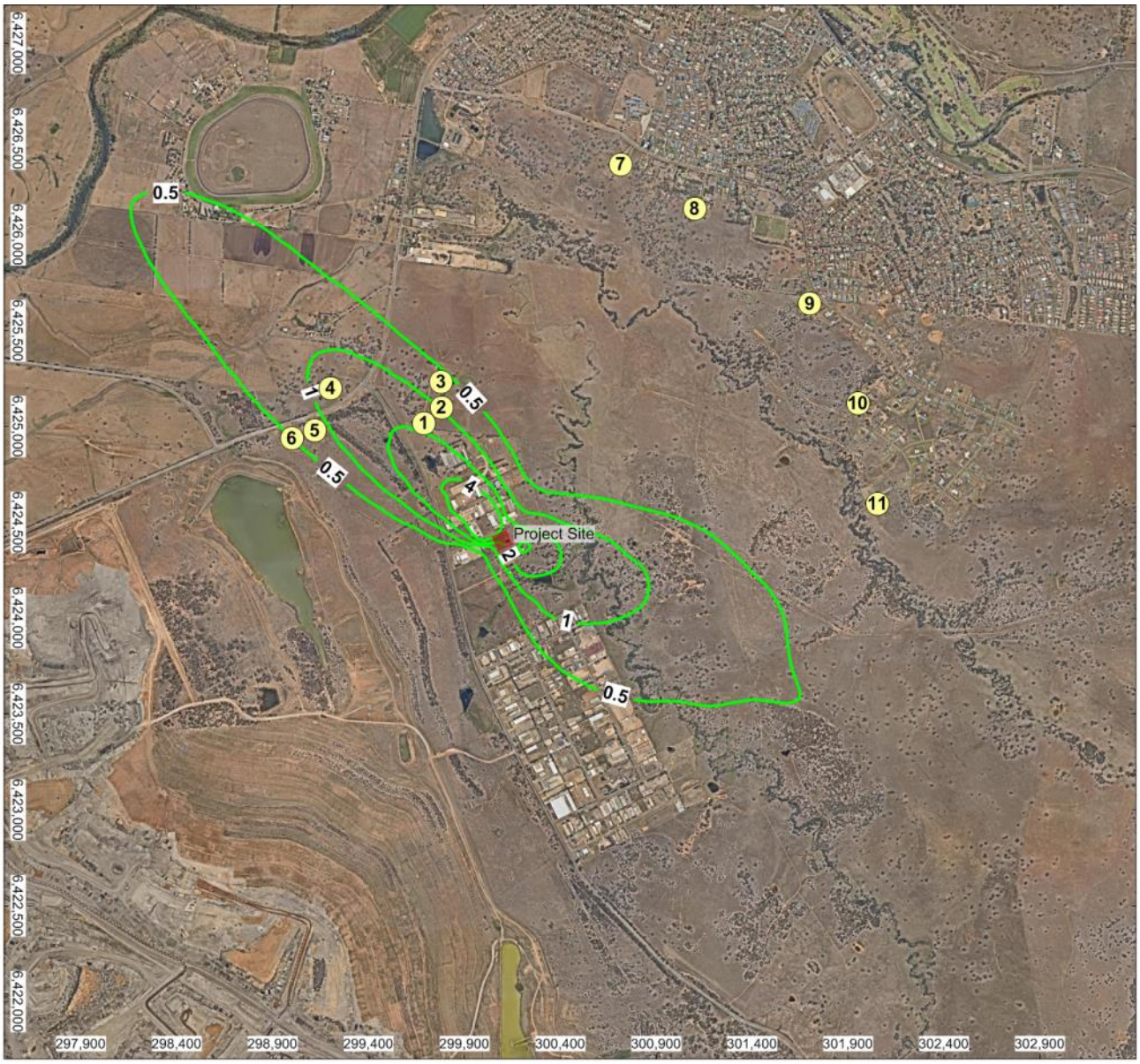
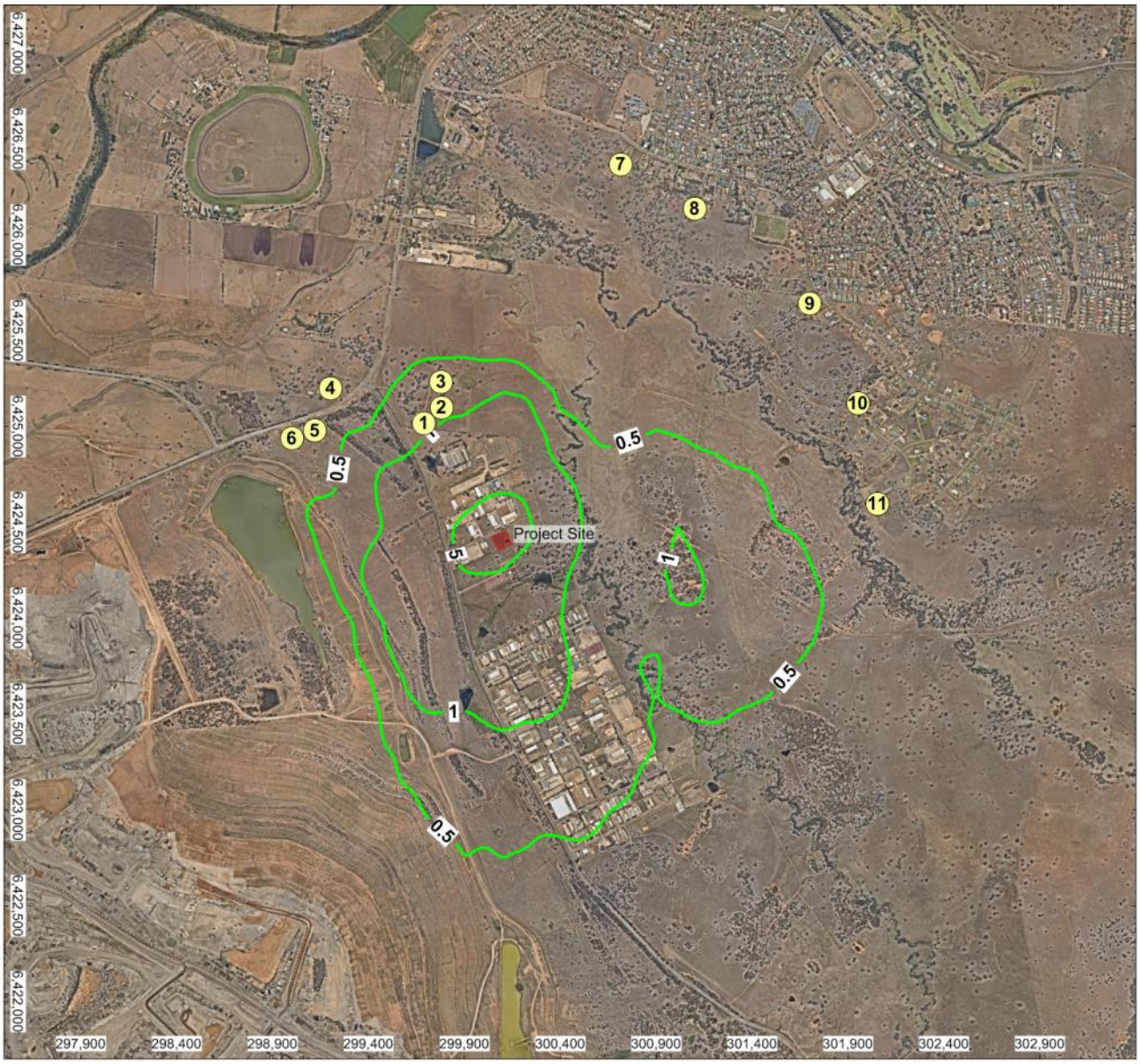


Figure D 15 Predicted 99.9th Percentile 1-hr Average Benzene Concentrations - Incremental



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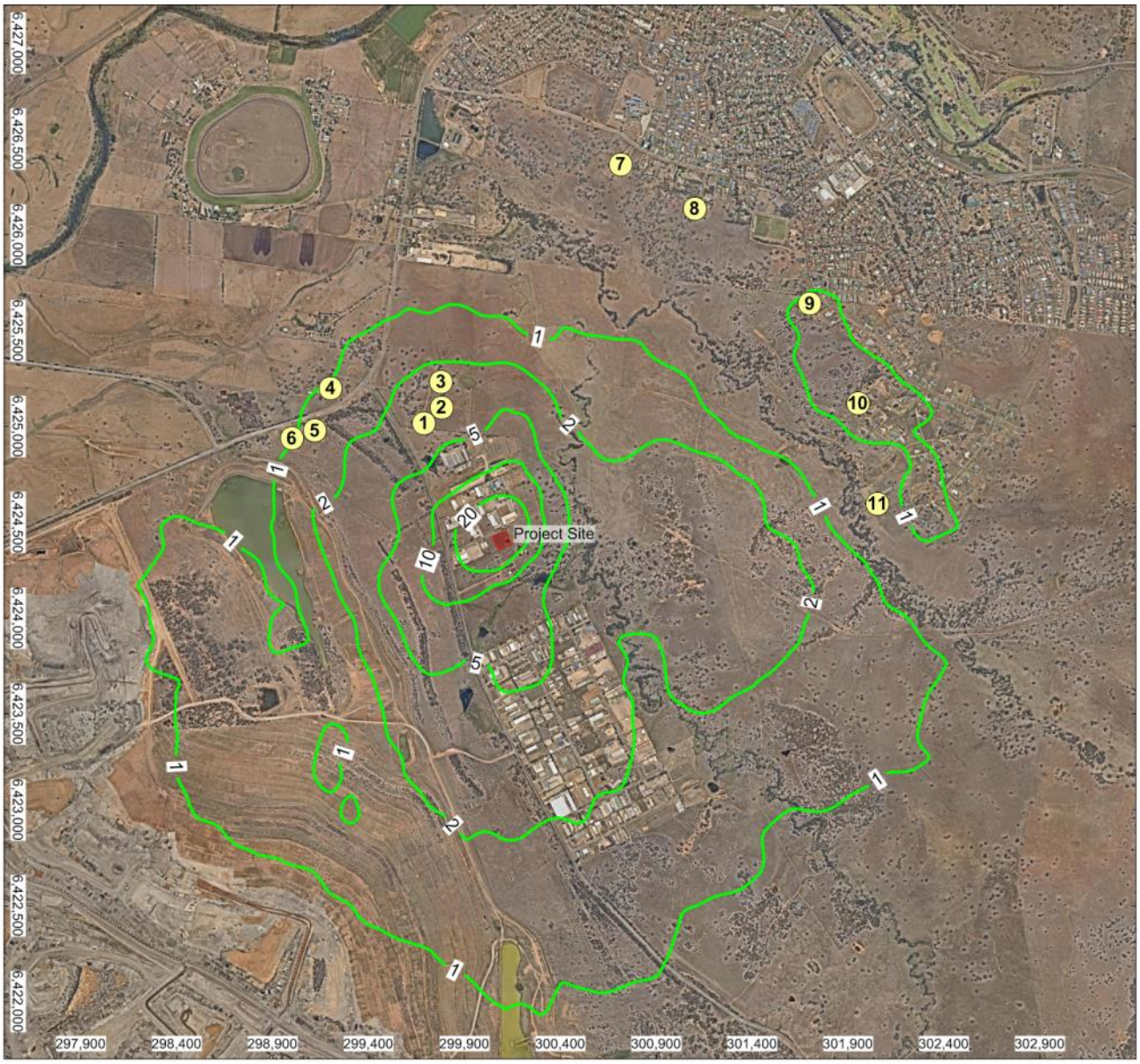
Pollutant	Benzene	Averaging Period	1-Hour	Unit	µg/m³

Figure D 16 Predicted 99.9th Percentile 1-hr Average Toluene Concentrations - Incremental



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Proposed Operations

Pollutant	Toluene	Averaging Period	1-Hour	Unit	µg/m³

Figure D 17 Predicted 99.9th Percentile 1-hr Average Ethylbenzene Concentrations - Incremental

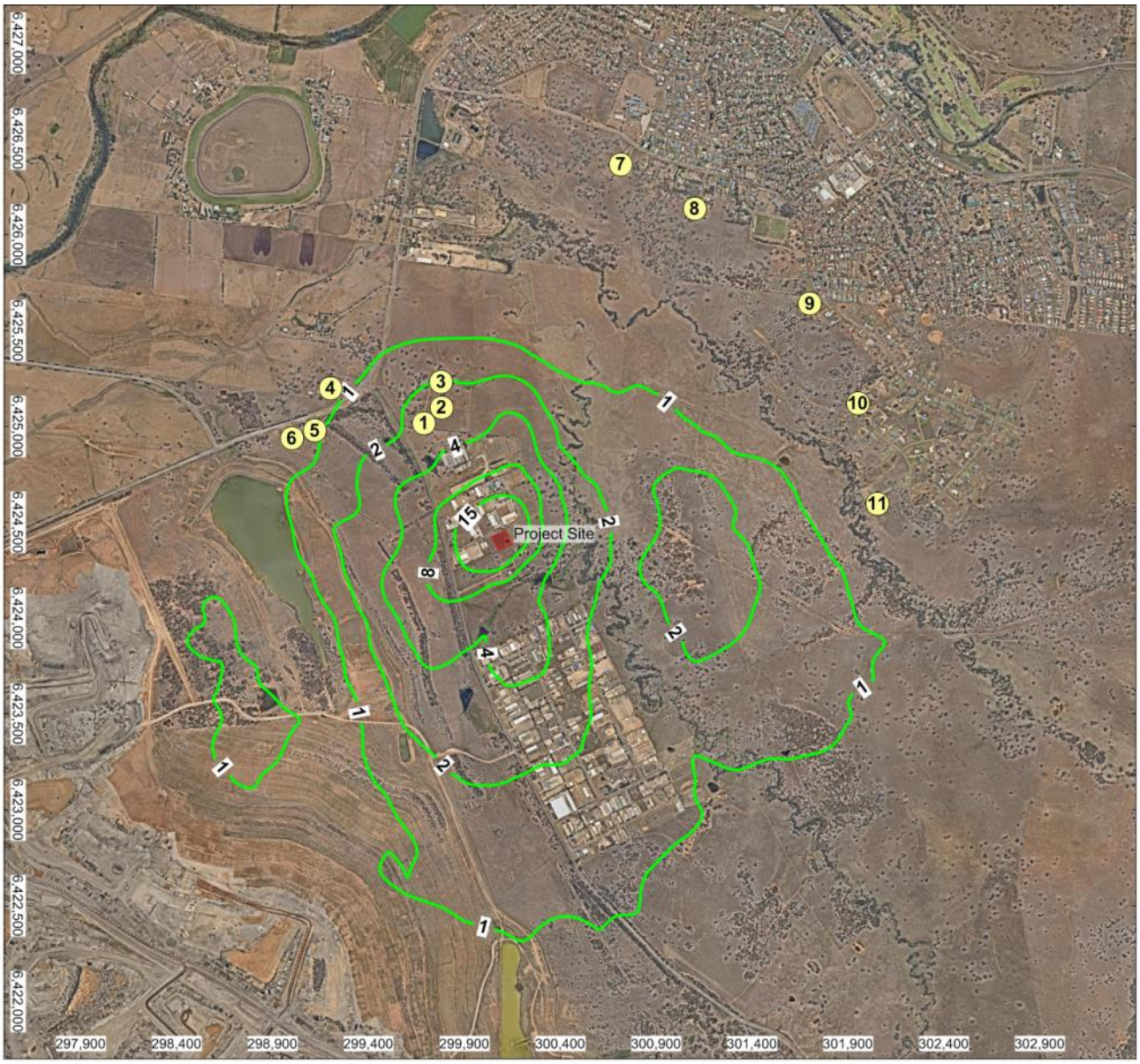
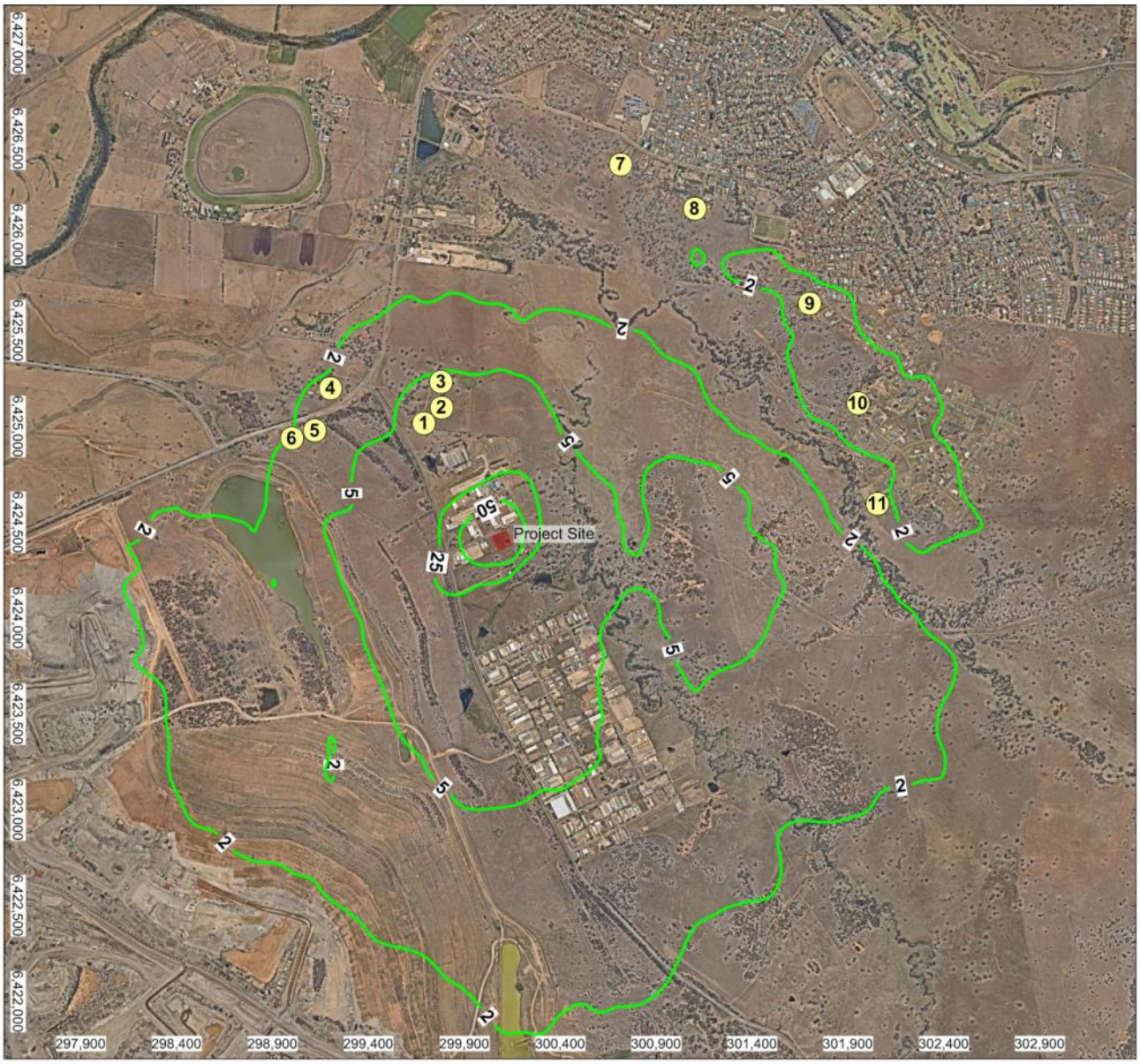


Figure D 18 Predicted 99.9th Percentile 1-hr Average Xylene Concentrations - Incremental



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Pollutant	Xylene	Averaging Period	1-Hour	Unit	µg/m³

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Notice

Environmental Protection Act 1994

Decision about an application for an environmental authority

This statutory notice is issued by the administering authority pursuant to section 198 of the Environmental Protection Act 1994 *to advise you of a decision on your application for an environmental authority.*

: KOPPEN CONSTRUCTION PTY LTD
4/10 Grafton Street
CAIRNS CITY QLD 4870

info@koppens.com.au

ATTN: Megan Davis

Your reference: A-EA-NEW-100302674

Our reference: C-EA-100304137; P-EA-100304138

Decision about an application for an environmental authority

1 Application details

The application for an environmental authority was received by the administering authority on 30-Aug-2022.

Application reference number: A-EA-NEW-100302674

Land description: 1010 Warner Road Gordonvale QLD 4870

2 Decision

The administering authority has decided to approve the application.

3 Annual fee

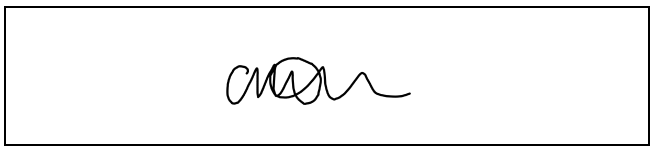
The first annual fee is payable within 20 business days of the effective date shown in the attached environmental authority.

The anniversary day of this environmental authority is the same day each year as the effective date.

ABN 46 640 294 485

4 Human rights

A human rights assessment was carried out in relation to this decision/action and it was determined that **the decision/action is compatible with human rights.**



Signature

3 February 2023

Date

Clancy Mackaway
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
Energy and Extractive Resources
GPO Box 2454, BRISBANE QLD 4001
Phone: (07) 3330 5737
Email: EnergyandExtractive@des.qld.gov.au

Attachments

Environmental authority P-EA-100304138

Permit

Environmental Protection Act 1994

Environmental authority P-EA-100304138

This environmental authority is issued by the administering authority under Chapter 5 of the Environmental Protection Act 1994.

Environmental authority number: P-EA-100304138

Environmental authority takes effect on 3 February 2023. This is the take effect date.

The first annual fee is payable within 20 business days of the take effect date.

The anniversary date of this environmental authority is the same day each year as the take effect date. The payment of the annual fee will be due each year on this day.

Environmental authority holder(s)

Name(s)	Registered address
KOPPEN CONSTRUCTION PTY LTD	4/10 Grafton Street CAIRNS CITY QLD 4870

Environmentally relevant activity and location details

Environmentally relevant activity/activities	Location(s)
ERA 54 - Mechanical waste reprocessing - 1 - Operating a facility for receiving and mechanically reprocessing, in a year, more than 5,000t of inert, non-putrescible waste or green waste only	1010 Warner Road Gordonvale QLD 4870
ERA 06 - Asphalt manufacturing - 1 - Manufacturing more than 1000t of asphalt in a year	

ABN 46 640 294 485

Additional information for applicants

Environmentally relevant activities

The description of any environmentally relevant activity (ERA) for which an environmental authority (EA) is issued is a restatement of the ERA as defined by legislation at the time the EA is issued. Where there is any inconsistency between that description of an ERA and the conditions stated by an EA as to the scale, intensity or manner of carrying out an ERA, the conditions prevail to the extent of the inconsistency.

An EA authorises the carrying out of an ERA and does not authorise any environmental harm unless a condition stated by the EA specifically authorises environmental harm.

A person carrying out an ERA must also be a registered suitable operator under the *Environmental Protection Act 1994* (EP Act).

Contaminated land

It is a requirement of the EP Act that an owner or occupier of contaminated land give written notice to the administering authority if they become aware of the following:

- the happening of an event involving a hazardous contaminant on the contaminated land (notice must be given within 24 hours); or
- a change in the condition of the contaminated land (notice must be given within 24 hours); or
- a notifiable activity (as defined in Schedule 3) having been carried out, or is being carried out, on the contaminated land (notice must be given within 20 business days) that is causing, or is reasonably likely to cause, serious or material environmental harm.

For further information, including the form for giving written notice, refer to the Queensland Government website www.qld.gov.au, using the search term 'duty to notify'.

Take effect

Please note that, in accordance with section 200 of the EP Act, an EA has effect:

a) if the authority is for a prescribed ERA and it states that it takes effect on the day nominated by the holder of the authority in a written notice given to the administering authority - on the nominated day; or

b) if the authority states a day or an event for it to take effect-on the stated day or when the stated event happens; or

c) otherwise on the day the authority is issued.

However, if the EA is authorising an activity that requires an additional authorisation (a relevant tenure for a resource activity, a development permit under the *Planning Act 2016* or an SDA Approval under the *State Development and Public Works Organisation Act 1971*), this EA will not take effect until the additional authorisation has taken effect.

If this EA takes effect when the additional authorisation takes effect, you must provide the administering authority written notice within 5 business days of receiving notification of the related additional authorisation taking effect. The anniversary day of this environmental authority is the same day each year as the original take effect date unless you apply to change the anniversary day. The payment of the annual fee will be due each year on this day. An annual return will be due each year on 01 April.

If you have incorrectly claimed that an additional authorisation is not required, carrying out the ERA without the additional authorisation is not legal and could result in your prosecution for providing false or misleading information or operating without a valid environmental authority.

	**3 February 2023**
Signature	Date

Clancy Mackaway
Department of Environment and Science
Delegate of the administering authority
Environmental Protection Act 1994

Enquiries:
Energy and extractive Resources
GPO Box 2454, BRISBANE QLD 4001
Phone: (07) 3330 5715
Email: EnergyandExtractive@des.qld.gov.au

Privacy statement

Pursuant to section 540 of the EP Act, the Department is required to maintain a register of certain documents and information authorised under the EP Act. A copy of this document will be kept on the public register. The register is available for inspection by members of the public who are able take extracts, or copies of the documents from the register. Documents that are required to be kept on the register are published in their entirety, unless alteration is required by the EP Act. There is no general discretion allowing the Department to withhold documents or information required to be kept on the public register. For more information on the Department's public register, search 'public register' at www.qld.gov.au. For queries about privacy matters please email privacy@des.qld.gov.au or telephone 13 74 68.

Obligations under the *Environmental Protection Act 1994*

In addition to the requirements found in the conditions of this environmental authority, the holder must also meet their obligations under the EP Act, and the regulations made under the EP Act. For example, the holder must comply with the following provisions of the Act:

- general environmental duty (section 319)
- duty to notify environmental harm (section 320-320G)
- offence of causing serious or material environmental harm (sections 437-439)
- offence of causing environmental nuisance (section 440)
- offence of depositing prescribed water contaminants in waters and related matters (section 440ZG)
- offence to place contaminant where environmental harm or nuisance may be caused (section 443)

Other permits required

This permit only provides an approval under the *Environmental Protection Act 1994*. In order to lawfully operate you may also require permits / approvals from your local government authority, other business units within the department and other State Government agencies prior to commencing any activity at the site. For example, this may include permits / approvals with your local Council (for planning approval), the Department of Transport and Main Roads (to access state controlled roads), the Department of Resources (to clear vegetation), and the Department of Agriculture and Fisheries (to clear marine plants or to obtain a quarry material allocation).

Obligations under the *Mining and Quarrying Safety and Health Act 1999*

If you are operating a quarry, other than a sand and gravel quarry where there is no crushing capability, you will be required to comply with the *Mining and Quarrying Safety and Health Act 1999*. For more information on your obligations under this legislation contact Mine Safety and Health at https://www.rshq.qld.gov.au/, or phone 13 QGOV (13 74 68) or your local Mines Inspectorate Office.

Development Approval

This permit is not a development approval under the *Planning Act 2016*. The conditions of this environmental authority are separate, and in addition to, any conditions that may be on the development approval. If a copy of this environmental authority is attached to a development approval, it is for information only, and may not be current. If you are unsure that you have the most current version of the environmental authority relating to this site please visit https://apps.des.qld.gov.au/env-authorities/ to access all environmental authorities currently approved.

Conditions of environmental authority

Agency interest: General	
Condition number	**Condition**
G1	All reasonable and practicable measures must be taken to prevent or minimise environmental harm caused by the activities.
G2	Any breach of a condition of this environmental authority must be reported to the administering authority as soon as practicable within 24 hours of becoming aware of the breach. Records must be kept including full details of the breach and any subsequent actions taken.
G3	Other than as permitted by this environmental authority, the release of a contaminant into the environment must not occur.
G4	Environmental monitoring results must be kept until surrender of this environmental authority. All other information and records that are required by the conditions of this environmental authority must be kept for a minimum of five (5) years. All information and records required by the conditions of this environmental authority must be provided to the administering authority, or nominated delegate upon request**,** within the required timeframe and in the specified format.
G5	An appropriately qualified person(s) must monitor, record and interpret all parameters that are required to be monitored by this environmental authority and in the manner specified by this environmental authority.
G6	All analyses required under this environmental authority must be carried out by a laboratory that has National Association of Testing Authorities **(**NATA) certification, or an equivalent certification, for such analyses.
G7	When required by the administering authority**,** monitoring must be undertaken in the manner prescribed by the administering authority, to investigate a complaint of environmental nuisance arising from the activity. The monitoring results must be provided within 10 business days to the administering authority upon its request.
G8	The activity must be undertaken in accordance with written procedures that: 1. identify potential risks to the environment from the activity during routine operations, closure and an emergency; 2. establish and maintain control measures that minimise the potential for environmental harm; 3. ensure plant, equipment and measures are maintained in a proper and effective condition; 4. ensure plant, equipment and measures are operated in a proper and effective manner; 5. ensure that staff are trained and aware of their obligations under the *Environmental Protection Act 1994;* 6. ensure that reviews of environmental performance are undertaken at least annually.

G9	Chemicals and fuels in containers of greater than 15 litres must be stored within a secondary containment system.
Agency interest: Waste	
Condition number	**Condition**
W1	All waste generated in carrying out the activity must be reused, recycled or removed to a facility that can lawfully accept the waste.
Agency interest: Air	
Condition number	**Condition**
A1	Other than as permitted within this environmental authority, odours or airborne contaminants must not cause environmental nuisance to any sensitive place or commercial place.
A2	Dust and particulate matter emissions must not exceed the following concentrations at any sensitive place or commercial place: a) dust deposition of 120 milligrams per square metre per day, when monitored in accordance with Australian Standard AS 3580.10.1 (or more recent editions), or b) a concentration of particulate matter with an aerodynamic diameter of less than 10 micrometre (µm) (PM10) suspended in the atmosphere of 50 micrograms per cubic metre over a 24 hour averaging time, when monitored in accordance with Australian Standard AS 3580.9.6 (or more recent editions) or any other method approved by the administering authority.
A3	Contaminants must only be released from point source(s) to air in accordance with Table – Point sources air release limits.

Table – Point source air release limits

Release Point	Minimum release height	Minimum velocity	Contaminant release	Maximum release limit (Note 3)	Monitoring Frequency
Dryer Stack	18m	10 m/s	Total Solid Particulates (TSP)	50 mg/Nm^3 dry	The stacks must be monitored for the contaminants during commissioning of the facility and annually thereafter.
			Carbon Monoxide (CO)	125 mg/Nm^3 dry	
			Oxides of Nitrogen (as NO_2)	350 mg/Nm^3 (dry)	
			Volatile Organic Compounds (as n-propane equivalent)	40 mg/Nm^3 (dry)	
			Polycyclic Aromatic Hydrocarbons (PAH) (as BaP equivalent) (Note 2)	20 µg/Nm^3 (dry)	
			Total Heavy Metals (Note 3)	1 mg/Nm^3 (dry)	
			Oxides of Sulphur (sulphur dioxide and sulphur trioxide as SO2 equivalent)	200 mg/Nm^3 (dry)	
			Hydrogen Sulphide (H_2S)	5 mg/Nm^3 (dry)	
Diesel Exhaust Stack	18m	10 m/s	Carbon Monoxide (CO)	125 mg/Nm^3 dry @ 7% O_2	The stacks must be monitored for the contaminants during commissioning of the facility and annually thereafter.
			Oxides of Nitrogen (as NO_2)	350 mg/Nm^3 (dry) @ 7% O_2	

Note 1: Normal cubic metre (Nm3) means the volume of dry gaseous contaminant which occupies 1 cubic metre at a temperature of zero degrees Celsius and at an absolute pressure of 101.3 kilopascals.

Note 2: PAH includes the total of the 16 priority PAH pollutants, namely, Naphthalene, Acenaphthylene, Acenaphthene, Fluorene, Phenanthrene, Anthracene, Fluoranthene, Pyrene, Benz(α) anthracene, Chrysene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(α)pyrene, Indeno[123cd] pyrene, Dibenz[ah]anthracene and Benzo[ghi] perylene, expressed as Benzo(α)pyrene equivalents using the potency equivalence factors specified by the World Health Organisation.

Note 3: Total heavy metals limit is for the total of Type 1 and Type 2 Substances as explained in the New South Wales Protection of the Environment Operations (Clean Air) Regulation 2021:

a) *Type 1 Substance* means the elements antimony, arsenic, cadmium, lead or mercury or any compound containing one or more of those elements.
b) *Type 2 Substance* means the elements beryllium, chromium, cobalt, manganese, nickel, selenium, tin or vanadium or any compound containing one or more of those elements.

A4	The release of contaminants specified in condition A3 must be monitored in accordance with the following requirements: 1. Monitoring must be undertaken during a release and at the authorised release points, frequency and for the contaminants specified in Table - Point source air release limits. 2. Monitoring must be undertaken when emissions are expected to be representative of actual operating conditions for the plant. 3. All monitoring devices must be effectively calibrated and maintained in accordance with the manufacturer's instructions and Australian and international standards. 4. Air monitoring must be in accordance with: a. The current edition of the administering authority's Air Quality Sampling Manual. If monitoring requirements are not described in the Air Quality Sampling Manual, monitoring protocols must be in accordance with a method as approved by New South Wales EPA, Victorian EPA or United States EPA; and b. Australian Standard AS 4323.1 - 1995 "Stationary source emissions Method 1: Selection of sampling provisions". 5. All air emission stack monitoring must be conducted by an experienced person or body which holds current NATA certification. 6. The following must be recorded for each sample collected in accordance with Table - Point source air release limits.: a. gas velocity and volume flow rate; b. temperature and oxygen content; c. water vapour concentration; d. plant throughput rate at the time of sampling; and e. any typical factors that may influence air pollutant emissions.
Agency interest: Land	
Condition number	**Condition**
L1	Contaminants must not be released to land.
Agency interest: Acoustic	
Condition number	**Condition**
N1	Other than as permitted within this environmental authority, noise generated by the activity must not cause environmental nuisance to any sensitive place or commercial place.

<table>
<tr><td>N2</td><td>Noise from the activity must not include substantial low frequency noise components and must not exceed the levels identified in Table – Noise limits at any nuisancesensitive place or commercial place.
Table – Noise limits
<table>
<tr><th rowspan="2">Noise level measured in dB(A)</th><th colspan="3">Monday to Saturday</th><th colspan="3">Sunday and Public Holidays</th></tr>
<tr><th>7am–6pm</th><th>6pm–10pm</th><th>10pm–7am</th><th>9am–6pm</th><th>6pm–10pm</th><th>10pm–9am</th></tr>
<tr><td></td><td colspan="6">Noise measured at a sensitive place</td></tr>
<tr><td>$L_{Aeq\ adj,\ 1\ hr}$</td><td>45</td><td>35</td><td>30</td><td>45</td><td>35</td><td>30</td></tr>
<tr><td>$L_{Amax,\ 1\ hr}$</td><td>-</td><td>-</td><td>49</td><td>-</td><td>-</td><td>49</td></tr>
<tr><td></td><td colspan="6">Noise measured at a commercial place</td></tr>
<tr><td>$L_{Aeq\ adj,\ 1\ hr}$</td><td>50</td><td>50</td><td>40</td><td>50</td><td>50</td><td>40</td></tr>
</table></td></tr>
<tr><td>N3</td><td>Condition N2 does not apply at a sensitive place within the designated Cairns South State Development Area to the extent that an alternative arrangement permits an exceedance of the noise levels in condition N2 to occur at that sensitive place.</td></tr>
<tr><td>N4</td><td>All monitoring of noise emissions from the activity must be undertaken when the activity is in operation.</td></tr>
<tr><td>N5</td><td>The following must be recorded when undertaking monitoring of noise emissions from the activity:
a) All equipment in operation at the time of the noise measurement; and
b) The mode of operation at the time of the noise measurement.</td></tr>
<tr><td>N6</td><td>Noise measurements must be taken using a class 1 sound level meter as classified under AS IEC 61672.</td></tr>
<tr><td>N7</td><td>All monitoring of noise emissions from the activity must be undertaken in accordance with the most recent version of Queensland Government’s ‘Noise Measurement Manual’ (ESR/2016/2195), the relevant Australian Standard and the Environmental Protection Regulation 2019 (Chapter 5, Part 4).</td></tr>
<tr><td colspan="2">Agency interest: Water</td></tr>
<tr><td>Condition number</td><td>Condition</td></tr>
<tr><td>WA1</td><td>Other than as permitted within this environmental authority, contaminants must not be released to any waters.</td></tr>
<tr><td>WA2</td><td>Contaminants must not be released to groundwater or at a location where they are likely to release to groundwater.</td></tr>
</table>

<table>
<tr><td>WA3</td><td>Stormwater that is not contaminated by the activity must be diverted away from areas where it may become contaminated by the activity. Stormwater that is contaminated by the activity must be directed to a treatment system.</td></tr>
<tr><td>WA4</td><td>The only contaminants to be released to surface waters is treated stormwater and must be in accordance with Table – Surface Water release limits and associated requirements.

Table – Surface Water release limits
<table>
<tr><th colspan="3">Release Points (GDA 2020)</th><th rowspan="2">Contaminant</th><th rowspan="2">Release limit</th><th rowspan="2">Minimum monitoring frequency</th></tr>
<tr><th>Reference</th><th>Latitude</th><th>Longitude</th></tr>
<tr><td rowspan="2">RP 1</td><td rowspan="2">-17.05181</td><td rowspan="2">145.77637</td><td>pH</td><td>6.5 – 8.0</td><td rowspan="4">Within 2 hours of the commencement of any release from stormwater treatment system and weekly thereafter until 24 hours after cessation of any release.</td></tr>
<tr><td>Total Suspended Solids</td><td>10 mg/L</td></tr>
<tr><td rowspan="2">RP 2</td><td rowspan="2">-17.05097</td><td rowspan="2">145.77872</td><td>pH</td><td>6.5 – 8.0</td></tr>
<tr><td>Total Suspended Solids</td><td>10 mg/L</td></tr>
</table>
Associated monitoring requirements
1. Monitoring must be in accordance with the methods prescribed in the current edition of the administering authority’s Monitoring and Sampling Manual.
2. Monitoring must be undertaken during a release and at the frequency stated.
3. Samples must be taken using representative samples.
4. All monitoring devices must be correctly calibrated and maintained</td></tr>
<tr><td>WA5</td><td>Realese to surface waters must not:
1. have any other properties at a concentration that is capable of causing environmental harm
2. produce any slick or other visible evidence of oil or grease, nor contain visible floating oil, grease, scum, litter or other visually objectionable matter.
3. result in visible scouring or erosion or pooling or vegetation die-off.</td></tr>
</table>

Definitions

Key terms and/or phrases used in this document are defined in this section. Where a term is not defined, the definition in the *Environmental Protection Act 1994*, its regulations or environmental protection policies must be used. If a word remains undefined it has its ordinary meaning.

Activity means the environmentally relevant activities, whether resource activities or prescribed activities, to which the environmental authority relates.

Administering authority means the Department of Environment and Science or its successor or predecessors.

Appropriately qualified person(s) means a person or persons who has professional qualifications, training, skills or experience relevant to the EA requirement and can give authoritative assessment, advice and analysis in relation to the EA requirements using the relevant protocols, standards, methods or literature.

Commercial place means a place used as a workplace, an office or for business or commercial purposes and includes a place within the curtilage of such a place reasonably used by persons at that place.

Environmental nuisance as defined in Chapter 1 of the *Environmental Protection Act 1994*.

Groundwater means water that occurs naturally in, or is introduced artificially into, an aquifer.

Land means any land, whether above or below the ordinary high-water mark at spring tides (i.e. includes tidal land).

Measures has the broadest interpretation and includes:

- Procedural measures such as standard operating procedures for dredging operations, environmental risk assessment, management actions, departmental direction and competency expectations under relevant guidelines
- Physical measures such as plant, equipment, physical objects (such as bunding, containment systems etc.), ecosystem monitoring and bathymetric surveys.

NATA means National Association of Testing Authorities.

Records include breach notifications, written procedures, analysis results, monitoring reports and monitoring programs required under a condition of this authority.

Release of a contaminant into the environment means to:

1. deposit, discharge, emit or disturb the contaminant
2. cause or allow the contaminant to be deposited, discharged, emitted or disturbed
3. fail to prevent the contaminant from being deposited, discharged emitted or disturbed
4. allow the contaminant to escape
5. fail to prevent the contaminant from escaping.

Secondary containment system means a system designed, installed and operated to prevent any release of contaminants from the system, or containers within the system, to land, groundwater, or surface waters.

Sensitive place includes the following and includes a place within the curtilage of such a place reasonably used by persons at that place:

1. a dwelling, residential allotment, mobile home or caravan park, residential marina or other residential premises; or
2. a motel, hotel or hostel; or
3. a kindergarten, school, university or other educational institution; or
4. a medical centre or hospital; or
5. a protected area under the *Nature Conservation Act 1992*, the *Marine Parks Act 2004* or a World Heritage Area; or
6. a public park or garden; or

7. for noise, a place defined as a sensitive receptor for the purposes of the Environmental Protection (Noise) Policy 2019.

Stormwater that is not contaminated by the activity includes stormwater runoff from external or undisturbed catchments.

Substantial low frequency noise means a noise emission that has an unbalanced frequency spectrum shown in a one-third octave band measurement, with a predominant component within the frequency range 10 to 200 Hz. It includes any noise emission likely to cause an overall sound pressure level at a sensitive place exceeding 55 dB(Z).

Waters includes river, stream, lake, lagoon, pond, swamp, wetland, unconfined surface water, unconfined water, natural or artificial watercourse, bed and bank of any waters, dams, non-tidal or tidal waters (including the sea), stormwater channel, stormwater drain, roadside gutter, stormwater run-off, and groundwater and any part thereof.

You means the holder of the environmental authority.

END OF ENVIRONMENTAL AUTHORITY