Boral St Peters concrete plant and materials handling facility

Environmental Assessment
Modification 11

Prepared for Boral Resources (NSW) Pty Limited | July 2018

EMM

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Environmental Assessment

Final

Report J16208RP3 | Prepared for Boral Resources (NSW) Pty Ltd | 13 July 2018

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Date	13 July 2018	Date	13 July 2018

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Document Control

Version	Date	Prepared by	Reviewed by
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Executive Summary

ES1 Overview

Boral Resources (NSW) Pty Ltd (Boral) owns and operates a concrete batching plant (concrete plant) and construction materials handling facility (materials handling facility) at 25 Burrows Road South, St Peters (the site).

A modification to the site's development consent (Modification 11) is proposed to:

- increase concrete production; and
- increase the throughput of the materials handling facility.

The approved production limit for concrete at the site is 280,000 cubic metres (m^3) per annum. A concrete production limit of 750,000 m^3 per annum is being sought for the site, which is an increase of 470,000 m^3 per annum. To achieve this increase, the existing concrete plant would be upgraded to include an additional two alleys, with an additional six silos for cement storage and widening of existing raw material storage.

It is proposed to increase the throughput of the materials handling facility to 1 million tonnes per annum (tpa), which is an increase of 240,000 tpa over the existing limit of 760,000 tpa. Some changes to the layout and function of the materials handling facility are proposed to facilitate the increase in throughput.

To facilitate the proposed increase in concrete production and materials handling facility throughput, it is proposed to construct a new aggregate reclaiming conveyor, upgrade the site's surface water management system, and install a second weighbridge.

ES2 Approval history

The site operates under Development Consent No. DA 14/96, which was granted on 6 September 1996 by the then NSW Minister for Urban Affairs and Planning. Since the development consent was granted, ten modifications to the consent have been approved.

ES3 Approval pathway

The development consent for the site was issued by the then NSW Minister for Urban Affairs and Planning under Part 4 of the Environemntal Planning and Assessment Act, 1979 and under the provisions of the (SEPP 34) (now repealed) on 6 September 1996. Therefore, in accordance with the former clause 8J(8) of the EP&A Regulation, the consent is taken to be an approval under Part 3A. As a Part 3A 'major project', the proposed modification can rely on the former section 75W of the Act.

ES4 Impact assessment

ES4.1 Noise

Construction and operational noise from the proposed modifications satisfies the relevant criteria for day, evening and night periods at all assessment locations. The assessment showed that the proposed modification will increase site noise levels by no greater than 1 dB compared to existing operations.

Further, noise levels from the proposed modification are predicted to be significantly less than existing ambient noise levels at the assessment locations, where road traffic noise dominates the existing noise environment. Noise levels from the modification are therefore not expected to cause adverse impacts at any assessment location.

Traffic generated by the modification is not expected to generate any noticeable increase in road traffic noise levels at the nearest residential locations. Therefore, the impact of road traffic noise associated with the proposed modification is predicted to be negligible.

Construction vibration impacts from the proposed modification will be managed in the first instance, but are unlikely.

ES4.2 Air quality

Emissions of deposited dust, TSP, PM_{10} and $PM_{2.5}$ were estimated for peak concrete production operations for the proposed modification. The results of the dispersion modelling predict that the proposed modification will not result in exceedances of the applicable NSW Environment Protection Authority (NSW EPA) assessment criteria for TSP, PM_{10}, $PM_{2.5}$ or dust deposition.

Analysis of model predictions for dust deposition indicates that the key influencing source of emissions at the site is activities in the materials storage area, including the new overhead conveyor with tripper car and handling activities at ground level.

ES4.3 Traffic

Road network impacts of the additional traffic associated with the proposed modification have been assessed for the future average daily production at the following three intersections:

- Canal Road, Ricketty Street, Burrows Road and Burrows Road South;
- Canal Road/Talbot Street (the Container Terminal Access); and
- Princes Highway, Canal Road and Mary Street.

At the Canal Road, Talbot Street and at the Princes Highway, Canal Road and Mary Street intersections, the existing traffic delays will be only marginally affected by the additional proposed project traffic.

At the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection, the level of service category will remain at F for both the morning and afternoon peak hours assessed. Even though this intersection is currently operating with congested peak hour traffic conditions, there would be limited benefit of implementing any additional intersection capacity improvements in the short term, as the increased traffic capacity will not be required due to the longer term future forecast local area traffic reductions on the Canal Road - Ricketty Street route after the Westconnex project is completed.

For the maximum forecast future daily production, the proposed modification is expected to generate daily traffic increases on Burrows Road South of approximately 43%. However, as this section of Burrows Road South has a relatively high proportion of truck traffic currently, the future traffic flow impacts of the proposed modification would be acceptable on this route.

On the range of other traffic routes in the St Peters locality, the proportional project generated daily traffic increases would not be significant (between 0.4% and 4.5% typically) on any of the other routes considered and would not have any significant impact on the existing traffic flow conditions on any of these routes.

ES4.4 Surface water

The proposed modification seeks to upgrade the existing water management system to:

- improve the management of runoff from cementitious areas of the site;
- improve the management of return concrete;
- improve site drainage to prevent the discharge of untreated stormwater from the site during frequently occurring rainfall events;
- provide water quality treatment of all site runoff to meet the pollutant load reductions recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011); and
- increase stormwater harvesting to reduce stormwater discharge and potable water consumption.

Proposed changes are:

- **Drainage modifications** – including:
  - the aggregate storage and handling area will be regraded to prevent runoff from this area draining to the west and onto Burrows Road; and
  - additional stormwater drainage will be constructed to improve stormwater capture and prevent the discharge of untreated stormwater flows from the site during frequently occurring rainfall events.
- **Water quality control modifications** – including:
  - cementitious areas will be covered and bunded (where possible) to isolate them from the stormwater system;
  - the secondary return concrete area will be decommissioned and replaced with a reclaim facility;
  - sedimentation basins will be established to treat runoff from the aggregate storage and handling area; and
  - bioretention systems will be established to treat runoff from access roads and car parking areas.
- **Stormwater harvesting modifications** – including:
  - the existing stormwater harvesting system will be expanded to capture runoff from 72% of the site area;
  - the large steel tank that is located in the southern corner of the site will be modified to provide 500 KL of storage; and

- Collectively, the stormwater harvesting system will provide 1,106 KL of storage, equivalent to 53 mm of runoff from the harvesting area. The storage volume will provide water for 3 to 4 days of concrete production. The stormwater harvesting system will reduce site discharge volumes from the stormwater harvesting area by between 67% (wet year) to 91% (dry year) of total runoff.

The proposed water management system is expected to significantly improved water quality management at the Site.

ES4.5 Other matters

Other environmental matters were also assessed, including:

- groundwater: the proposed development will not have a significant impact on the groundwater resource as a consequence of incidental water take for the purposes of dewatering during the excavation, a water take that is well within the long-term annual average extraction limit of 14,684 ML/year set for the Botany Sands Groundwater Source on which the Site is located;
- hazard and risk: a preliminary screening analysis in accordancewith State Environment Planning Policy 33 indicates that the modification is not potentially hazardous or offensive development;
- contamination: past contamination identified at the site was previsouly remediated in accordance with the remediation strategy and was signed off by an accredited EPA Site Auditor;
- waste management: various wastes are and will be generated by the site, although most such as waste concrete are recycled;
- historic heritage: the site adjoins the Alexandra Canal, which is listed as a heritage item on the State Heritage Register (SHR) and the Marrickville LEP. No works are proposed near the canal and no imapcts are predicted;
- indigenous heritage: given that the site is highly modified and as no Aboriginal sites have been recorded in OEH's Aboriginal Heritage Information Management System, the potential for Indigenous heritage impacts is very low;
- ecology: vegetation on the site consists of Urban Native and Exotic Cover and does not correspond to any native vegetation listed under the EPBC Act or BC Act and the proposed works are not predicted to have an effect on the environment apart from the removal of priority weed species;
- visual: the scenic quality of the site and surrounding area is low and the proposed modification will not transform the visual character, nor does it represent a major change to the local perception of the surrounding area; and
- social and economic: the modification is in keeping with the surrounding land uses in the area and is not predicted to result in significant additional negative impacts. The modification would result in social economic benefits associated with the increase in concrete production to the local community and wider Sydney region.

ES4.6 Conclusion

This EA, and in particular the assessments for noise, air quality, traffic and surface water demonstrates that there is likely to be minimal impact on the amenity of the surrounding environment as a result of the modification when assessed against applicable criteria and standards. The site is located within an existing industrial precinct and has historically been used for significant industrial and commercial land uses. Subject to implementation of the existing and proposed environmental mitigation, management and monitoring measures, the concrete production increase and the materials handling facility increased throughput is not predicted to result in significant adverse environmental impacts and will result in social economic benefits associated with the increase in concrete production to the local community and wider Sydney region.

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1 Introduction

1.1 Overview

Boral Resources (NSW) Pty Ltd (Boral) owns and operates a concrete batching plant (concrete plant) and construction materials handling facility (materials handling facility) at 25 Burrows Road South, St Peters (the site). The site's regional setting and local context is illustrated in Figure 1.1 and Figure 1.2, respectively.

A modification to the site's development consent (Modification 11) is proposed to:

- increase concrete production; and
- increase the throughput of the materials handling facility.

The approved production limit for concrete at the site is 280,000 cubic metres (m^3) per annum. A concrete production limit of 750,000 m^3 per annum is being sought for the site, which is an increase of 470,000 m^3 per annum. To achieve this increase, the existing concrete plant would be upgraded to include an additional two alleys, with an additional six silos for cement storage and widening of existing raw material storage.

It is proposed to increase the throughput of the materials handling facility to 1 million tonnes per annum (tpa), which is an increase of 240,000 tpa over the existing limit of 760,000 tpa. Some changes to the layout and function of the materials handling facility are proposed to facilitate the increase in throughput.

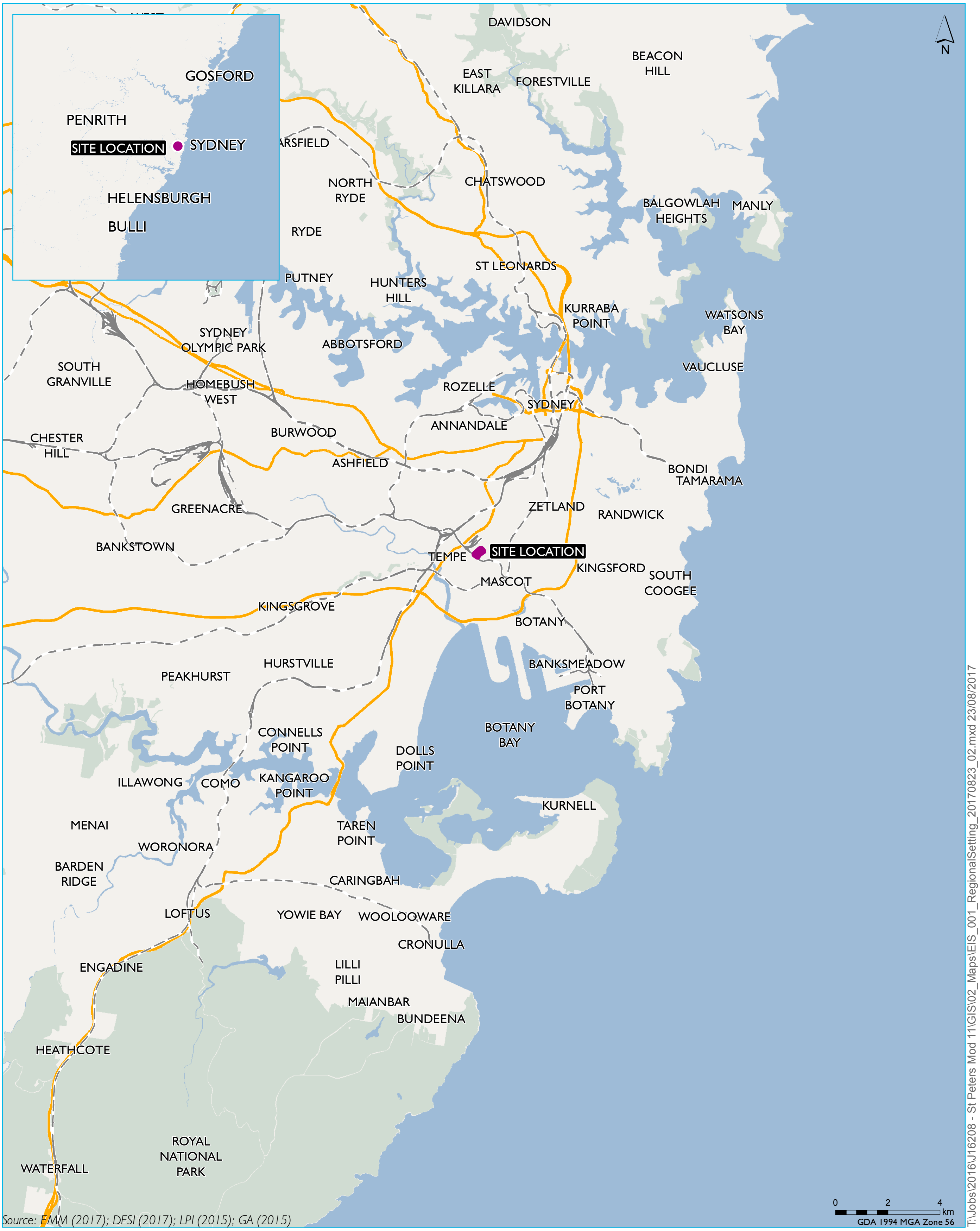
To facilitate the proposed increase in concrete production and materials handling facility throughput, it is proposed to construct a new aggregate reclaiming conveyor, upgrade the site's surface water management system, and install a second weighbridge.

1.2 Background

The site receives bulk construction materials (aggregate, sand and cement) predominantly by rail from Boral's Peppertree and Dunmore quarries and Berrima Cement Works and other sites as required. These construction materials are used to make concrete at the concrete plant, or are temporarily stored at the materials handling facility for later distribution to other concrete plants and asphalt plants within the Sydney metropolitan area. All concrete and construction materials are despatched from the site by truck.

On 6 September 1996, the then NSW Minister for Urban Affairs and Planning granted development consent to Boral under the provisions of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) for the construction and operation of the concrete plant and the materials handling facility at the site. The development consent also permitted Boral to construct and operate an asphalt plant. This plant was constructed and operated, but was subsequently decommissioned and demolished in 2002.

Since the development consent was granted, ten modifications to the consent have been approved, which are detailed in Section2.1. A copy of the consolidated development consent, as currently modified, is contained in Appendix A.



KEY

- Site location
- Highway
- Road
- Railway
- Watercourse
- Waterbody
- NPWS reserve

Regional setting

Environmental assessment

Modification 11

Boral St Peters

Figure 1.1

EMM

KEY

Site location

Local government area

Railway

Site location

Environmental assessment

Modification 11

Boral St Peters

Figure 1.2

Housing and infrastructure construction activities are continuing to drive record demands in the Sydney construction materials market. A healthy residential housing market along with a pipeline of fully funded infrastructure works including WestConnex, Sydney Light Rail and Sydney Metro is driving the demand for aggregate and concrete products.

As such, Boral has undertaken a review into its existing facilities within the Sydney area to identify where improvements can be made to increase efficiency and production.

The site is close to Sydney's Central Business District (CBD), with good linkages to major roadways. Its location within an existing industrial zone, as well as the ability to rail construction materials into the site, make it an ideal site for upgrading to increase efficiency and production.

Boral is therefore proposing to increase production of concrete and increase throughput of construction materials (aggregates and sand) at the site to meet the increasing demand for these products.

1.3 Site location and surrounding land uses

The site is located at 25 Burrows Road South St Peters, which is approximately 7 kilometres (km) south-west of the Sydney CBD. The site is legally described as Lot 1 in Deposited Plan (DP) 866946 (Figure 1.2).

The site is a completely modified industrial site, located within the Inner West Local Government Area (LGA), adjacent to its eastern boundary with the Botany LGA. The site was formerly within the Marrickville LGA, which was merged with the LGAs of Ashfield and Leichhardt on 12 May 2016 to form the Inner West LGA.

The site is surrounded by industrial land uses which correspond with the site's and surrounding properties' zoning as IN1 General Industrial under the *Marrickville Local Environmental Plan 2011* (Marrickville LEP).

The site is bordered by the Alexandra Canal to the south-east, Burrows Road South to the north-east, industrial land uses to the north-west and the Botany Goods Line to the south-west. It is serviced by arterial roads, with access to the Princes Highway via Burrows Roads South and Canal Road. The nearest residential properties are about 600 metres (m) to the north-west of the site on the northern side of the Princes Highway (Figure 1.3). Other surrounding features are:

- **North:** industrial land uses immediately north of the site, the Princes Highway, and residential areas on the northern side of the Princes Highway in Sydenham and St Peters.
- **East:** industrial land uses for approximately 1-1.5 km to the east, and beyond this, residential areas in Mascot.
- **South**: the Sydney Airport is about 300 m to the south of the site beyond the Alexandra Canal.
- **West:** the Botany Goods Line is a railway line immediately west of the site; beyond this are industrial and commercial land uses, and residential areas further west in Tempe.

Source: EMM (2017); DFSI (2017); LPI (2015); GA (2015)

KEY

- Site location
- Highway
- Railway
- Alexandra Canal
- Suburb boundary

Marrickville Local Environmental Plan 2011 - Zoning

- B1 Neighbourhood Centre
- B2 Local Centre
- B5 Business Development
- B6 Enterprise Corridor
- B7 Business Park
- IN1 General Industrial
- IN2 Light Industrial
- R1 General Residential
- R2 Low Density Residential
- R3 Medium Density Residential
- RE1 Public Recreation
- RE2 Private Recreation
- SP1 Special Activities
- SP2 Infrastructure

Surrounding land uses and zones

Environmental assessment

Modification 11

Boral St Peters

Figure 1.3

EMM

1.4 Approval pathway

The development consent for the site was issued by the then NSW Minister for Urban Affairs and Planning under Part 4 of the Environemntal Planning and Assessment Act, 1979 and under the provisions of the *State Environmental Planning Policy No 34—Major Employment-Generating Industrial Development* (SEPP 34) (now repealed) on 6 September 1996 (refer to Appendix A). Therefore, in accordance with the former clause 8J(8) of the EP&A Regulation, the consent is taken to be an approval under Part 3A. As a Part 3A 'major project', the proposed modification can rely on the former section 75W of the Act.

At the time of the repeal, there were numerous major projects which were at various stages of assessment and approval. The repeal process therefore included a transitional arrangement to allow those projects to continue as if Part 3A was still available. This meant that section 75W of the EP&A Act, which provides for the modification of Part 3A projects, also remained available to existing major projects during the transition period.

More recently, there were amendments made to the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017* to wind up the transitional arrangements, including those for section 75W provisions. The arrangement in those amendments was that if Secretary's Environmental Assessment Requirements (SEARs) were issued for the amended project prior to 1 March 2018, as they were with respect to this Project, then section 75W still applies.

The request to modify can be dealt with under S75W, unless it has not been determined by 1 September 2018 **and** if the "*Secretary is of the opinion that insufficient information has been provided to deal with the request and notifies the person who made the request that it will not be dealt with under section 75W*".

Modifications under section 75W are required to be accompanied by an environmental assessment (EA); this document. The statutory framework and approval pathway are described in detail in Chapter 4.

1.5 Proponent

Boral Resources (NSW) Pty Ltd (Boral) is the proponent for the proposed modification. Boral is a wholly owned subsidiary of Boral Limited.

Boral Limited is an Australian owned, international building and construction materials group, with its headquarters in Sydney, Australia. With more than $5.2 billion worth of annualised sales, Boral Limited primarily serves customers in the building and construction industries with operations concentrated in three key geographical markets – Australia, the USA and Asia. Boral Limited has around 11,000 full-time equivalent employees.

In Australia, Boral Limited has over 500 operating sites. Boral Limited produces and distributes a broad range of construction materials, including quarry products, cement, fly ash, pre-mix concrete and asphalt; and building products, including clay bricks and pavers, clay and concrete roof tiles, concrete masonry products, plasterboard and timber.

The Boral Australia division employs around 5,000 people alone in its quarry, concrete, asphalt, concrete placing and cement operations.

1.6 Document structure

This EA has been prepared to accompany the application for the modification. The structure of this EA is as follows:

- Chapter 1 – introduction;
- Chapter 2 – existing and approved operations - provides a background to the modification, including the original DA and subsequent ten modifications to the development consent, and details on existing and approved operations at the site, including the operation of the concrete plant and materials handling facility;
- Chapter 3 – proposed modification - provides details of the proposed modification, including a table identifying proposed changes to all conditions in the development consent;
- Chapter 4 – statutory framework - provides an overview of the statutory approval framework for the administrative modification;
- Chapter 5 – stakeholder consultation - provides details of consultation with the Inner West Council and State Government agencies; NSW Department of Environment and Planning (DPE), Inner West Council, NSW Environment Protection Authority (EPA), NSW Roads and Maritime Services (RMS);
- Chapter 6 – noise assessment - provides a summary of the results of a noise assessment;
- Chapter 7 – air quality assessment - provides a summary of the results of an air quality assessment;
- Chapter 8 – traffic assessment - provides a summary of the results of a traffic assessment;
- Chapter 9 – surface water assessment – provides a summary of the results of a surface water assessment;
- Chapter 10 – other matters - provides assessments of other matters; and
- Chapter 11 – justification and conclusion.

This EA contains seven appendices, including:

- Appendix A - a copy of the existing development consent for the site;
- Appendix B - copy of the SEARs issued 21 December 2017;
- Appendix C - plan of existing layout of the site;
- Appendix D - noise assessment;
- Appendix E - air quality assessment;
- Appendix F - traffic assessment;
- Appendix G – surface water assessment; and
- Appendix H – existing conditions of consent and compliance.

2 Current operations

2.1 Approvals history

The site operates under Development Consent No. DA 14/96 (refer to Appendix A), which was granted on 6 September 1996 by the then NSW Minister for Urban Affairs and Planning.

The development consent enabled the construction and operation of the concrete batching plant (concrete plant), an asphalt plant, and the materials handling facility. The asphalt plant has since been decommissioned and demolished. Since the development consent was granted, ten modifications to the consent have been approved. In most cases, the modifications have been relatively minor and related to site layout changes, as described in Table 2.1.

Table 2.1 Summary of modifications to Development Consent No. DA 14/96

Modification	Approval date	Description
Modification 1	12 May 1997	Alteration of approved site layout to improve operational aspects of the concrete plant, and addition of one line to railway siding, making a total of three spur lines.
Modification 2	8 December 1998	Alteration of the approved site layout of the asphalt plant and materials handling facility, and additional time to complete construction of the rail siding.
Modification 3	25 June 1999	Installation of liquefied gas tank to fuel asphalt dryer and bitumen heaters at asphalt plant.
Modification 4	7 April 2000	Rearrangement of the materials handling facility from the approved site layout, including construction of the storage bunkers for quarry product and additional cement silos, and delivery of cement by rail (in addition to road).
Modification 5	23 August 2001	Altered layout of weighbridge, office and single large ground storage bunker.
Modification 6	16 May 2003	Altered site layout to reflect decommissioning of the asphalt plant and subsequent changes to the materials handling facility.
Modification 7	11 February 2004	Altered site layout to improve materials handling, including introducing a manual truck loading system, rearrangement of existing storage bunkers and provision of new bunkers and changes to vehicle access in the materials handling facility. Overall changes to the traffic circulation on the site were also approved.
Modification 8	3 December 2012	Altered rail siding to accommodate the full length of 28 wagon trains to improve the efficiency of receival of construction materials by rail.
Modification 9	4 July 2013	Altered site layout to relocate the materials handling facility's site office and car park, reconfigured and increased the capacity of the aggregate and sand storage bunkers, relocated the weighbridge and wheel wash and improved traffic flow.
Modification 10	1 November 2016	Simplified the development consent (ie removed complexity), removed irrelevant conditions, and increased production at the concrete plant by 10%.

2.2 General description and site layout

The site has two uses; a concrete plant and a construction materials handling facility. Both uses predominantly receive bulk construction materials (aggregate, sand and cement) from Boral's Peppertree and Dunmore quarries and Berrima Cement Works.

The majority of aggregate and sand is received by rail. Some bulk construction materials as well as cement, fly ash, and admixtures used in the concrete plant are delivered by road.

All materials received are either used to make concrete at the concrete plant, or stored at the materials handling facility for subsequent distribution to other concrete plants and asphalt plants within the Sydney metropolitan area. Concrete from the concrete plant is despatched by road in concrete agitator trucks. All construction materials are despatched from the site by road in trucks.

The current layout of the site is illustrated in Figure 2.1 and Appendix C.

The following sections describe the materials handling facility, concrete plant, access and traffic circulation, rail infrastructure, and water management in further detail.

KEY

Site location

Concrete batching plant feature

Handling facility feature

Existing site layout

Environmental impact statement

Modification 11

Boral St Peters

Figure 2.1

EMM

2.3 Materials handling facility

The materials handling facility is located in the centre and north-eastern section of the site. The location and general arrangement of the materials handling facility is illustrated in Figure 2.1. Key components include:

- rail unloading area, for sand and aggregate material received by rail;
- elevated aggregate and sand storage bins;
- aggregate and sand stockpiles and bunkers;
- weighbridge; and
- office, amenities and car park.

The materials handling facility receives and temporarily stores aggregates and sand before despatching it by truck to other concrete batching plants and asphalt plants within the Sydney metropolitan area. Some aggregates and sand are also transferred internally by truck for use in the concrete plant onsite.

The majority of aggregates and sand are received by rail. Typical annual volumes of bulk construction materials received at the materials handling facility are presented in Table 2.2. The split between rail and road transport modes is approximate and varies from year to year, however, Boral uses rail freight for the delivery of bulk construction materials where ever practicable.

Table 2.2 Bulk construction material throughput – aggregates and sand (tpa)

Transport mode to site	Aggregates	Sand	Total
Rail	320,000	327,500	647,500
Road	15,000	97,500	112,500
Total			**760, 000**

Aggregates and sand received by rail (see Photograph 2.1) are bottom-dumped from rail wagons into one of the two pits below ground level at the rail unloading area (the other below-ground dumping pit is for material received for the concrete plant, described further in Section 2.4). The aggregates and sand are then transferred from the pits by conveyor (with covered roof and sides) to elevated, fully enclosed storage bins, located in the centre of the site (see Photograph 2.2).From here, the aggregates and sand are either loaded directly into trucks via an enclosed conveyor for despatch offsite (see Photograph 2.4), or are transferred to storage bunkers and stockpiles by a front-end-loader and/or dump truck.

Aggregates and sand received by road are unloaded directly into the stockpile area and moved by front-end-loader to storage bunkers and stockpiles.

The existing storage bunkers and stockpiles provide a total capacity of around 23,000 t. The design of the storage bunkers comprises concrete retaining walls against which material is stacked. The retaining walls have a shade cloth fence mounted on top to capture dust. Storage bunkers and stockpiles are fitted with a sprinkler system for additional dust suppression.

Materials stored in the stockpiles and bunkers are reclaimed by a front-end loader for loading into trucks and transport off-site.

A portion of the stockpiled material is transferred to the concrete plant for use as required. Photograph 2.2 to Photograph 2.4 show elevated storage bins, stockpiles and bunkers at the materials handling facility respectively.

Photograph 2.1 **A train on one of the sidings moving through train unloading area unloading aggregates and sand**

Photograph 2.2 **The materials handling facility's storage bins and storage bunkers**

Photograph 2.3 **The materials handling facility's stockpile area**

Photograph 2.4 **Loading trucks from the elevated storage bins**

2.3.1 Weighbridge

The weighbridge is located near Driveway 1 (see Figure 2.1). All trucks despatched from the materials handling facility are weighed at the weighbridge prior to exiting.

2.3.2 Office, amenities and car park

The materials handling facility's office and car park are adjacent to Burrows Road South. The car park has a sealed pavement with line markings and accommodates 27 vehicles.

2.4 Concrete plant

The concrete plant is in the south western section of the site. The location and general arrangement of the concrete plant is illustrated in Figure 2.1. Key components include:

- rail unloading area for the concrete plant, for sand and aggregate;
- unloading facility for internal or offsite trucks for sand and aggregates, transferred via covered conveyor to elevated storage bins;
- elevated aggregate and sand bins filled by conveyors from the materials handling facility;
- elevated cement/fly ash silos filled direct by rail and tanker;
- batching plant and slump stands;
- concrete returns bays;
- agitator truck washout bays; and
- office, amenities and car park.

2.4.1 Materials handling, storage, production and operation

The operation of the concrete plant involves the dry and wet batching of aggregates, sand, cement, fly ash and admixtures. Table 2.3 presents the approximate quantities of bulk construction material inputs to the concrete plant in a typical year.

Table 2.3 Bulk construction materials – Concrete plant (for an annual production of 280,000 m^3)

Material	Quantity (per annum)
Aggregate	289,000 t
Sand	224,000 t
Cement/fly ash	130,000 t
Admixtures	441,000 litres (L)

The aggregates and sand are delivered by rail to the materials handling facility are then transferred by conveyor (with covered roof and sides) to elevated, fully enclosed storage bins, located in the south-western corner of the site (see Photograph 2.5). The aggregates and sand are then transferred to the concrete plant as required via conveyor (with covered roof and sides).

Fly ash is transported to the site via road tanker and then transferred pneumatically (ie by pressurised hose) to elevated silos above the batching plant.

The concrete plant gravity dispenses the dry batched ingredients into concrete agitators preloaded with water (also known as transit mixers) in one of two loading alleys beneath the batching plant. (see Photograph 2.6 and Photograph 2.7).

During the batching process, cement (delivered to the site primarily by rail) and fly ash (delivered by road tanker) are conveyed inside sealed airslides from the silos to a sealed weighing hopper, from where they are gravity dispensed into a concrete agitator in the loading alley.

Admixtures are pumped directly from the delivery tanker to the storage tanks adjacent to the concrete plant, and dispensed in measured quantities into the concrete agitators as required. The concrete agitators are filled with dry materials and water at the load bay (approximately 95% of the water is added here) and mixed. The agitators then proceed to the slump stands (see Photograph 2.8) where additional water (approximately 5%) is added to concrete agitators, slump adjustments and final quality checks are completed at the slump stands until the desired concrete consistency is reached. The end product (concrete) is then transported by road to customers.

Empty concrete agitators returning to the concrete plant, discharge residual waste concrete into a dry bay, then proceed to agitator washout bays (see Photograph 2.9). Once full, waste from the dry bays and agitator wash out bays is dried before being sent by truck for recycling.

Photograph 2.5 **Elevated storage bins that receive aggregate and sand via conveyor for the concrete plant**

Photograph 2.6 Elevated cement and fly ash silos above the batching plant

Photograph 2.7 Alleys underneath batching plant where material is gravity dispensed into concrete agitators

Photograph 2.8 **Concrete agitators at the slump stands after exiting the batching plant (neighbouring site visible to the right of photograph)**

Photograph 2.9 **Concrete agitator truck washout bays**

2.4.2 Office, amenities and car park

The concrete plant's office and car park are located in the south-eastern portion of the site.

There are two existing car parking areas for the site employees and visitors; a car park for the concrete plant in the southern most corner adjacent to the concrete plant with capacity for 40 cars, and a smaller car park for the materials handling facility near the Burrows Road South exit which has capacity for 27 cars.

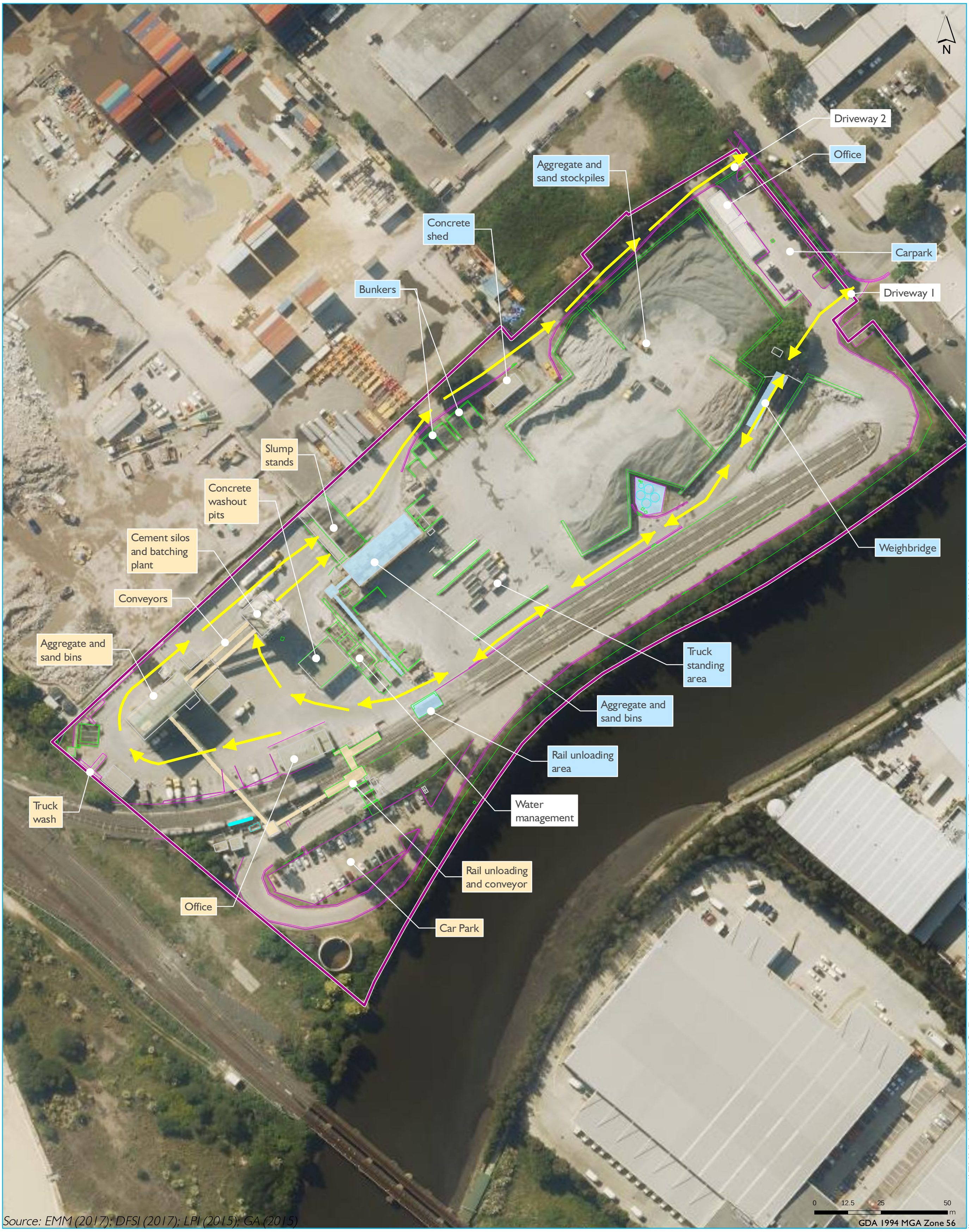
The office is located adjacent to the rail unloading area.

2.5 Site access and traffic circulation

The site is located at the southern end of Burrows Road South. Access is via Burrows Road South which intersects with Canal Road at right angles to the north-east.

The site has two driveways to Burrows Road South. Driveway 1 (or Gate 1) (see Photograph 2.10) is the site's primary driveway, located in the middle of the site's boundary with Burrows Road South, and provides two-way access. Vehicles accessing both the concrete plant and materials handling facility enter the site using this driveway. Vehicles accessing the materials handling facility also exit via this driveway. Driveway 2 (or Gate 2) (see Photograph 2.11) is located on Burrows Road South and is exit only. Trucks from the concrete plant exit via this driveway.

Internal traffic circulation is generally two-way along the south-eastern side of the site and one way on the north-western side of the site. Figure 2.2 illustrates traffic circulation on site.



Source: EMM (2017); DFSI (2017); LPI (2015); GA (2015)

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KEY

- Site location
- Direction of truck circulation
- Concrete plant feature
- Materials handling facility feature

Existing traffic circulation

Environmental assessment

Modification 11

Boral St Peters

Figure 2.1

EMM

Photograph 2.10 Driveway 1 (Gate 1) looking into the site from Burrows Road South

Photograph 2.11 Driveway 2 (Gate 2) looking into the site from Burrows Road South

2.6 Rail infrastructure

The site connects to the Botany Goods Line. The site has three sidings, which are positioned along the south-eastern side of the site (see Figure 2.1). Trains are parked and shunted along the rail sidings. There are two train unloading areas; one for the concrete plant and one for the materials handling facility (see Photograph 2.12).

Photograph 2.12 Rail unloading areas

2.7 Environmental management and monitoring regime

The existing Environmental Management and Monitoring Program (EMMP) has been developed to establish a framework for environmental management in accordance with Development Consent No. 14/96, as well as meet the requirements of Boral's Health, Safety, Environment and Quality (HSEQ) management system.

The site has established roles and responsibilities for personnel to implement the requirements of this EMMP. Personnel are supported by an organisational structure that provides appropriate levels of support and authority for the effective execution of roles for environmental management.

2.7.1 Air quality and noise management and monitoring

Boral has implemented environmental management and monitoring regimes to address air quality and noise impacts, these measures have been summarised in Table 2.4.

Table 2.4 Existing EMMP

Component	Management and monitoring
Air quality	Management of dust impacts through dust mitigation measures. These mitigation measures target wheel generated dust, material handling, concrete plant processes, and wind erosion of stockpiles and exposed services; and include: • watering all roads with a water cart, • use of water sprays and sprinklers on stockpiles, loading areas, sales area and on fixed plant,

Table 2.4 Existing EMMP

Component	Management and monitoring
	• cessation or reduction of dust generating activities in unfavourable meteorological conditions eg high winds, • wheel washing at the slump stand at the western exit, • vehicle loads appropriately covered, • enclosed aggregate and sand storage silos, • pneumatic loading of cement silos with dust filters, • dust extraction systems in concrete plant, • fully enclosed conveyors and storage bins; and • use of a street sweeper daily for onsite and offsite roads. Any complaint regarding dust impacts from the site will be acted on within 24-hours. Details of any dust-related complaint will be logged in an appropriate register, with investigation findings and actions noted. All complaints received will be listed in the Annual Review. There have been no air quality complaints to date.
Noise	Best practice techniques are used to minimise unnecessary noise on site and include: • Limiting on site vehicle speeds to 10-20 km/hr, • Regular plant and equipment maintenance to ensure that operational noise is minimised, • The majority of operational works are between the hours of 5.00 a.m. and 6.00 p.m. Monday to Sunday to minimise noise disturbance to sensitive receptors (if applicable), and • Where practicable, squawkers or other tonal suppressers are installed on reverse signals on vehicles. Noise monitoring occurs on at least an annual basis as well as in response to any complaints regarding noise. Vibration levels are monitored and assessed in accordance with the methodology provided in the EPA's *Assessing Vibration: a technical guideline.* If there is a complaint, or determination of an exceedance of the relevant noise and vibration criteria the source is to be identified and mitigation measures will be considered. There have been no vibration or noise complaints.

2.7.2 Water management system

Surface water runoff is largely captured and contained onsite. During storm events or during prolonged rain periods, water is discharged offsite.

At the concrete plant, drainage is via grid-covered drains sloping to the recycled water pits adjacent to the concrete washout bays. When the recycled water pits fill, rainwater is diverted and flows into the first flush collection pit. When the first flush collection pit is full, rainwater goes directly to the stormwater drain.

Water is captured and reused onsite for concrete production, dust suppression, cleaning of the concrete agitators, slump stands and washout pits. Water from the recycled water pits is dispensed in measured quantities into the concrete agitator to be mixed with the dry materials. All excess water accumulated during the concrete batching process is recycled to minimise consumption and prevent run-off to the canal or any adjacent properties. The plant is a net consumer of water and potable water is also used when required. Further information on the existing water management system is provided in Section 9.2 and Appendix G.

2.7.3 EMMP reporting, training and review

In accordance with Development Consent No. 14/96, the site reports on its environmental performance annually. This annual review describes development carried out in the previous calendar year, as well as development proposed to be carried out over the next year. Additionally, the annual review includes a comprehensive review of monitoring results, trends and complaints records. It is also required that any discrepancies between the predicted and actual impacts of development are identified, as well as non-compliance with measures to improve environmental performance.

Training and inductions, including basic environmental awareness are provided to site staff and subcontractor staff. Training records are maintained, and readily available in either hard copy and/or electronic copy, as verification that personnel have received the appropriate training, and are competent to fulfil their roles.

The review of the EMMP will be undertaken, at a minimum of every three years, or where there are significant changes to legislation. Reviews are to be conducted by the environmental manager in consultation with the site managers to ensure suitability and adequacy of the Environmental Management and Monitoring Plan and associated compliances tools.

3 Proposed modification

3.1 Overview

A modification to the site's development consent (Modification 11) is proposed to:

- increase concrete production; and
- increase the throughput of the materials handling facility.

A concrete production limit of 750,000 m^3 per annum is being sought, which is an increase of 470,000 m^3 per annum over the existing limit of 280,000 m^3. To achieve this increase, the existing concrete plant will be upgraded to include an additional two alleys, with an additional six silos for cement storage and widening of existing raw material storage.

It is proposed to increase the throughput of the materials handling facility to 1 million tpa, which is an increase of 240,000 tpa over the existing limit of 760,000 tpa. Some changes to the layout and function of the materials handling facility are proposed to facilitate the increase in throughput.

In addition to the above, it is proposed to construct a new concrete reclaiming machine, upgrade the site's surface water management system, and install a second weighbridge.

Details of the proposed modification are provided below.

3.2 Increased throughput of the materials handling facility

The layout of the materials handling facility will be modified to provide room for the construction of the concrete plant upgrades. This will include:

- a new dump station and conveyor that leads up to the existing elevated storage bins;
- new aggregate storage walls made of concrete in the north of the materials handling facility;
- new open aggregate storage bins in the south of the materials handling facility; these will be filled by trucks delivering aggregates and sand;
- new larger open aggregate storage bins on the northern side of the materials handling facility. These larger bins will be filled via a new overhead conveyor with a tripper car. This conveyor will be connected to the existing conveyor from the train unloading area and will eliminate the need for the larger bins to be filled by front-end loaders and trucks which currently occurs;
- a new second weighbridge; and
- tipper and drive over dump station.

Figure 3.1 shows the proposed site layout and components associated with the materials handling facility and Figure 3.2 shows the operational flow of the materials handling facility for the proposed modification.

3.3 Increase concrete production

To achieve a production limit of 750,000 m^3 per annum, it is proposed to widen the existing aggregate storage bins and install new silos and load bays.

The operation would involve the same process as the existing concrete plant. That is, it would involve the dry and wet batching of aggregates, sand, cement, fly ash and admixtures with water. To increase the concrete production limit to 750,000 m^3, the proposed modification includes the following components:

- aggregates, sand and cement will continue to be received at the site (primarily by rail), and stored at the existing elevated aggregate storage bins. The proposed modification includes widening the aggregate storage bins at their existing locations;

- cement will be transferred pneumatically from the train to the elevated silos located above the batching plant. Aggregates and sand will be transferred to the aggregate storage bins via a new aggregate incline conveyor from the materials handling facility's training unloading area (the existing conveyor becomes redundant and will be removed);

- aggregates and sand would then be dispensed via two new conveyors to new additional load bays that will be located directly north and south of the existing concrete batching plant;

- fly ash would be received via truck and stored in new and existing silos at the existing concrete plant. These would be gravity dispensed to the concrete plant below;

- admixtures would continue to be delivered by road tanker and stored in tanks prior to discharge as required by the batching plant;

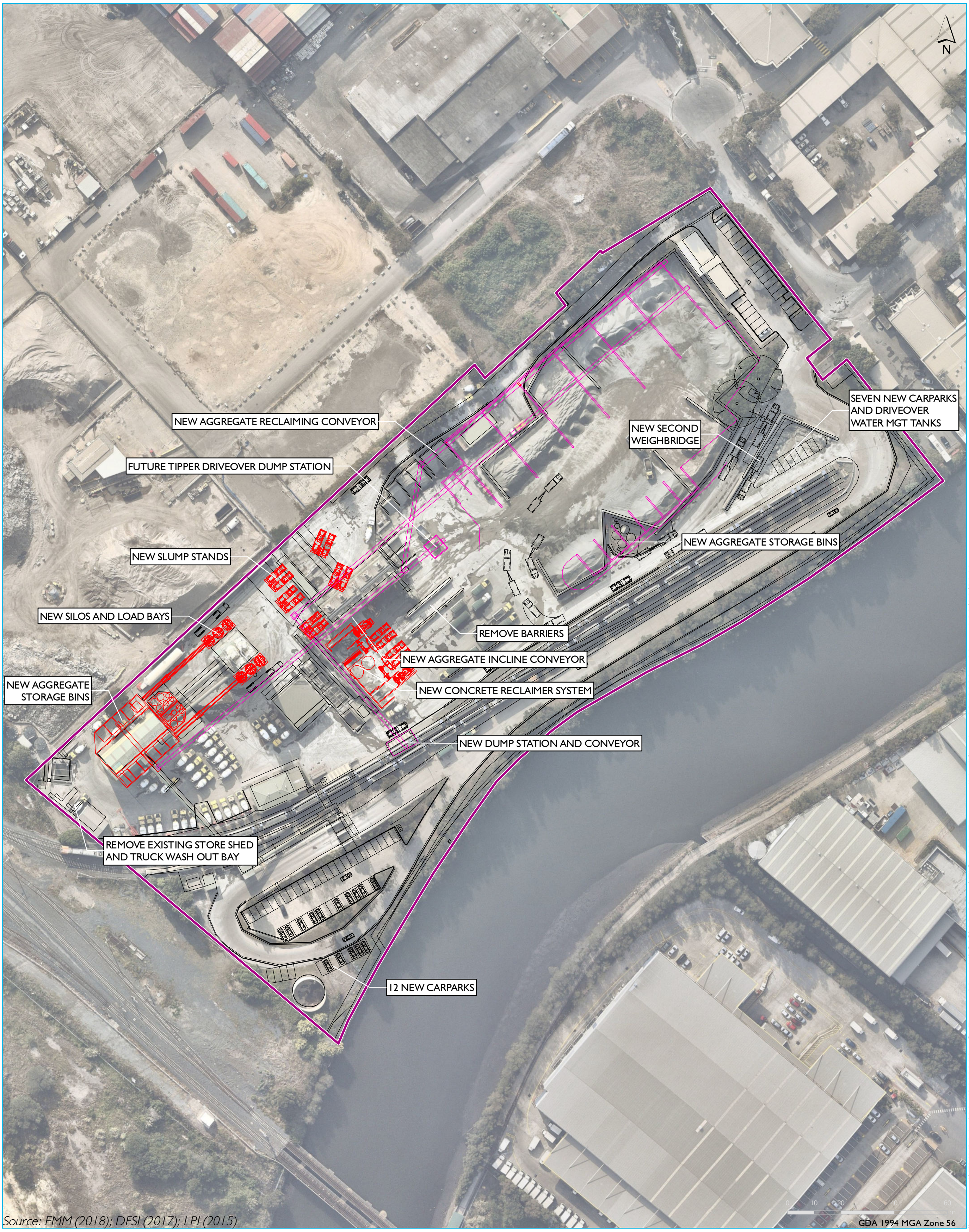
- similar to the current operations, the concrete agitators are filled with dry materials and water at the load bay and mixed. The agitators then proceed to the slump stands where an additional two double position slump stands will be built; and

- a new concrete reclaimer with dewatering plate-press to substantially improve the management of returned/waste concrete and the cement slurry water generated through cleaning agitator barrels.

Figure 3.1 shows the proposed site layout and components associated with the concrete plant and Figure 3.2 shows the operational flow of the materials handling facility for the proposed modification.

Increasing the production limit to 750,000 m^3 of concrete per annum at the site would result in an additional 336 additional daily truck deliveries (672 additional truck movements) on a future average production day and 533 additional daily truck deliveries (1,066 additional truck movements) on a future maximum production day. The majority of these are from concrete agitators, but also include an increase in the transport of constituent ingredients to the site (ie cement/fly ash, admixtures).

Further details on traffic movements are provided in the traffic assessment (Appendix F and Chapter 8).



Source: EMM (2018); DFSI (2017); LPI (2015)

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KEY

Site layout

Concrete plant feature (proposed)

Material handling plant feature (proposed)

Site location

Proposed modification

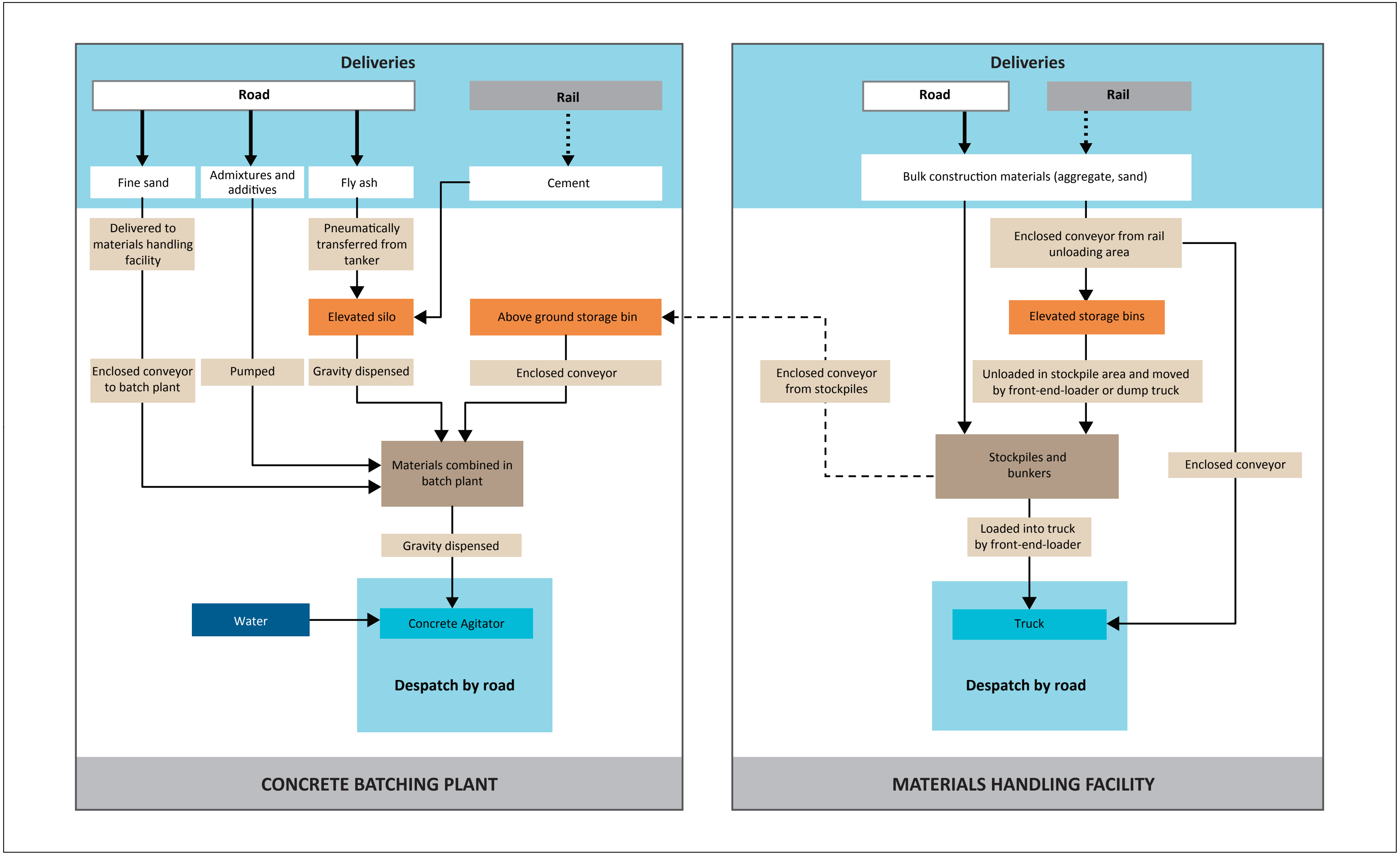
Environmental assessment

Modification 11

Boral St Peters

Figure 3.1

EMM



EMM

Operational flow diagram

Environmental impact statement
Modification 11
Boral St Peters
Figure 3.2

3.4 Office, amenities and car park

There are no proposed changes to the existing office and amenity facilities as part of this modification. The proposed modification includes 19 new car park spaces, comprising of:

- seven new car parks in the south-east corner of the site.
- 12 new car parks south of the existing 40 car parks in the south-west corner of the site.

3.5 Site access

Site access will remain the same.

3.6 Power facilities

The proposed modification will only incrementally increase the peak power demand, however utilisation of equipment will increase which will increase the total power usage.

The power facilities are adequate for the proposed upgrades. The site formerly accommodated an asphalt plant and hence the power facilities were designed for this additional load. The energy provider will be consulted at the detailed design stage to ensure adequate power facilities service the site.

3.7 Construction of the proposed modification

The construction period will be approximately nine months, with works staggered in stages to reduce overall disruption to production.

Standard construction hours will apply which include:

- Monday to Friday 7 am to 6 pm;
- Saturday 8 am to 1 pm; and
- no construction work is to take place on Sunday or public holidays.

Construction of the proposed modification will typically involve the following activities:

- the installation of safety fencing and site establishment;
- various hand tools that will be onsite for the duration of construction activities;
- small piling rig (with mast under 15 m) for one month;
- one 30 t excavator, for one month;
- two 13 t excavators, for four months;
- one vibro compaction roller, for two months;
- concrete pumps (four months), various hand tools for nine months.

All equipment will be brought in via road.

3.8 Proposed changes to the conditions of consent

Table 3.1 outlines the proposed changes to the existing conditions of consent as part of the proposed modification (Modification 11).

Table 3.1 Proposed changes to the conditions of consent

Condition no.	Condition summary	Proposed wording
5	The annual production of the concrete batching plant must not exceed 280,000 cubic metres and the annual throughput of the materials handling facility must not exceed 760,000 tonnes.	The annual production of the concrete batching plant must not exceed ~~280,000~~ **750,000** cubic metres and the annual throughput of the materials handling facility must not exceed ~~760,000~~ **1 million** tonnes.
36a	Prior to any increase in production at the concrete batching plant (as approved under Mod 10 to this consent), an off-site dust deposition monitor shall be established on Burrows Road South in the vicinity of sensitive receptors R3 and R4. The location of the monitor shall be approved by the EPA.	Remove condition Reason for removal: it is noted that the existing monitors are located on site, close to dust generating activities. The EPA assessment criterion is intended for application to off-site sensitive receptors (eg residences, schools, child care centres etc.). Accordingly the recorded fallout rates are not representative of off-site dust concentrations. An assessment of accessible areas in the vicinity of receptors R3 and R4 was undertaken by Boral site staff, however no feasible locations were found that comply with the Australian Standards AS/NZS 3580.10.1 for establishing a dust deposition monitor (not within 5 metres of a building, 1 metre of a fence line and within the shadow of an overhanging tree with less than 120° sky visibility). In addition, the availability of the land on private landholdings is scarce, with landholders along Burrows Road South generally unwilling to surrender space for dust monitoring. Given the above, it is considered impractical to monitor dust in the vicinity of receptors R3 and R4.

4 Statutory approval pathway

4.1 General

This chapter describes the statutory planning framework that applies to the modification, including the statutory planning approval process under the EP&A Act. An overview of the potential approval requirements under relevant Commonwealth and NSW legislation and environmental planning instruments (EPIs) is also provided.

4.2 Commonwealth legislation

The Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) provides a legal framework to protect and manage nationally and internationally important flora, fauna, ecological communities, heritage places and water resources which are defined as matters of national environmental significance (MNES). MNES, as defined under the EPBC Act, include:

- world heritage properties;
- places listed on the National Heritage Register;
- Ramsar wetlands of international significance;
- threatened flora and fauna species and ecological communities;
- migratory species;
- Commonwealth marine areas;
- nuclear actions (including uranium mining); and
- water resources, in relation to coal seam gas or large coal mining development.

Under the EPBC Act, an action that may have a significant impact on a MNES is deemed to be a 'controlled action' and can only proceed with the approval of the Commonwealth Minister for the Environment. An action that may potentially have an impact on a MNES is to be referred to the Commonwealth Department of the Environment (DoE) for determination as to whether or not it is a controlled action.

The proposed modification will not have a significant impact on any MNES and therefore is not required to be referred to DoE and does not require approval from the Commonwealth Minister for the Environment.

4.3 NSW legislation

4.3.1 NSW Environmental Planning and Assessment Act 1979

i General

Implementation of the EP&A Act is the responsibility of the Minister for Planning, statutory authorities and local councils. The EP&A Act has recently been updated (commencing 1 March 2018) since the last modification to the concrete plant, following the passing of the *Environmental Planning and Assessment Amendment Act 2017.*

The updated EP&A Act contains three parts that impose requirements for planning approval. Part 4 is the relevant section to this proposal, it provides for control of 'development' that requires development consent from the relevant consent authority.

The requirement for developments that require development consent and activities and SSI that do not require development consent is set out in EPIs – which include state environmental planning policies (SEPPs), regional environmental plans (REPs) and local environmental plans (LEPs).

ii Land use table and requirement for development consent

The site is zoned IN1 General Industrial under the Marrickville Local Environmental Plan 2011 (Marrickville LEP) and shown in Figure 1.3.

The land use table contained in the Marrickville LEP for the IN1 General Industrial zone is as follows:

Zone IN1 General Industrial

1 Objectives of zone

- To provide a wide range of industrial and warehouse land uses.
- To encourage employment opportunities.
- To minimise any adverse effect of industry on other land uses.
- To support and protect industrial land for industrial uses.
- To protect industrial land in proximity to Sydney Airport and Port Botany.
- To enable a purpose built dwelling house to be used in certain circumstances as a dwelling house.

2 Permitted without consent

Home occupations

3 Permitted with consent

Agricultural produce industries; Depots; Dwelling houses; **Freight transport facilities**; Garden centres; **General industries**; Hardware and building supplies; Industrial training facilities; Intensive plant agriculture; Kiosks; Light industries; Markets; Neighbourhood shops; Places of public worship; Roads; Take away food and drink premises; Timber yards; Warehouse or distribution centres; Any other development not specified in item 2 or 4

4 Prohibited

Agriculture; Air transport facilities; Airstrips; Amusement centres; Animal boarding or training establishments; Boat launching ramps; Boat sheds; Camping grounds; Caravan parks; Cemeteries; Charter and tourism boating facilities; Child care centres; Commercial premises; Community facilities; Correctional centres; Eco-tourist facilities; Educational establishments; Environmental facilities; Exhibition homes; Exhibition villages; Extractive industries; Farm buildings; Forestry; Function centres; Health services facilities; Heavy industrial storage establishments; Heavy industries; Helipads; Highway service centres; Home occupations (sex services); Information and education facilities; Jetties; Marinas; Mooring pens; Moorings; Offensive industries; Open cut mining; Passenger transport facilities; Port facilities; Public administration buildings; Recreation

> facilities (major); Recreation facilities (outdoor); Registered clubs; Research stations; Residential accommodation; Respite day care centres; Restricted premises; Rural industries; Tourist and visitor accommodation; Transport depots; Veterinary hospitals; Water recreation structures; Water supply systems; Wholesale supplies

The existing land uses on the site (ie concrete plant and materials handling facility) and the modification (an increase in production at the concrete plant) are consistent with the objectives of the IN1 General Industrial zone. Within the IN1 General Industrial zone, general industries and freight transport facilities are permitted but only with development consent. The concrete plant can be defined as a general industry while the materials handling facility can be defined as a freight transport facility.

General industry is defined under the Marrickville LEP as:

> ... a building or place (other than a heavy industry or light industry) that is used to carry out an industrial activity.

An industrial activity is defined as:

> ... the manufacturing, production, assembling, altering, formulating, repairing, renovating, ornamenting, finishing, cleaning, washing, dismantling, transforming, processing, recycling, adapting or servicing of, or the research and development of, any goods, substances, food, products or articles for commercial purposes, and includes any storage or transportation associated with any such activity.

The concrete plant is considered to be a general industry as it involves the manufacturing of concrete, which is a product used for commercial purposes.

A freight transport facility is defined under the Marrickville LEP as:

> ... a facility used principally for the bulk handling of goods for transport by road, rail, air or sea, including any facility for the loading and unloading of vehicles, aircraft, vessels or containers used to transport those goods and for the parking, holding, servicing or repair of those vehicles, aircraft or vessels or for the engines or carriages involved.

The site currently operates under Development Consent No. DA 14/96 which was granted by the then NSW Minister for Urban Affairs and Planning on 6 September 1996. The Minister was the consent authority pursuant to State Environmental Planning Policy No 34—Major Employment-Generating Industrial Development (SEPP 34) which deemed that the site and its operations were significant to the State. SEPP 34 has now been repealed. The development consent enables the construction and operation of the concrete plant, an asphalt plant and the materials handling facility. The asphalt plant has been decommissioned and demolished.

Since the development consent was granted, ten modifications to the consent have been approved. In most cases, the modifications have related to minor site layout changes.

iii Development consent modification process

The Department of Planning and Environment (DPE) is winding up the earlier transitional arrangements for the now repealed Part 3A of the EP&A Act. This proposed modification meets the criteria (described below) under which project modifications can be assessed under the provisions of the now repealed section 75W of the EP&A Act.

While the development consent for the site was a consent issued under Part 4 of the EP&A Act under the provisions of SEPP 34, transitional provisions within the NSW *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) allow for a consent to be modified under section 75W of the EP&A Act as if the consent were an approval under Part 3A. The Part 3A repeal process included a transitional arrangement to allow those projects to continue as if Part 3A was still available. This meant that section 75W of the EP&A Act, which provides for the modification of Part 3A projects, also remained available to existing major projects during the transition period.

More recently, there were amendments made to the *Environmental Planning and Assessment (Savings, Transitional and Other Provisions) Regulation 2017* to wind up the transitional arrangements, including those for section 75W provisions. The arrangement articulated in those amendments was that if SEARs were issued for the project prior to 1 March 2018, as they were with respect to this Project, then section 75W still applies.

The request to modify can be dealt with under S75W, unless it has not been determined by 1 September 2018 **and** if the "*Secretary is of the opinion that insufficient information has been provided to deal with the request and notifies the person who made the request that it will not be dealt with under section 75W*".

The former Section 75W of the EP&A Act states:

(1) In this section:

Minister's approval means an approval to carry out a project under this Part, and includes an approval of a concept plan.

Modification of approval means changing the terms of a Minister's approval, including:

(a) revoking or varying a condition of the approval or imposing an additional condition of the approval, and

(b) changing the terms of any determination made by the Minister under Division 3 in connection with the approval.

(2) The proponent may request the Minister to modify the Minister's approval for a project. The Minister's approval for a modification is not required if the project as modified will be consistent with the existing approval under this Part.

(3) The request for the Minister's approval is to be lodged with the Director- General. The Director-General may notify the proponent of environmental assessment requirements with respect to the proposed modification that the proponent must comply with before the matter will be considered by the Minister.

(4) The Minister may modify the approval (with or without conditions) or disapprove of the modification.

While the development consent for the site was issued under Part 4 of the EP&A Act under the provisions of SEPP 34, transitional provisions within the NSW *Environmental Planning and Assessment Regulation 2000* (EP&A Regulation) allow for a consent to be modified under the former section 75W of the EP&A Act as if the consent were an approval under Part 3A.

The former clause 8J(8) of the EP&A Regulation states:

> For the purposes only of modification, the following development consents are taken to be approvals under Part 3A of the Act and section 75W of the Act applies to any modification of such a consent:
>
> (a) a development consent granted by the Minister under section 100A or 101 of the Act,
>
> (b) a development consent granted by the Minister under *State Environmental Planning Policy No 34—Major Employment-Generating Industrial Development*,
>
> (c) a development consent granted by the Minister under Part 4 of the Act (relating to State significant development) before 1 August 2005 or under clause 89 of Schedule 6 to the Act,
>
> (d) a development consent granted by the Land and Environment Court, if the original consent authority was the Minister and the consent was of a kind referred to in paragraph (c).
>
> The development consent, if so modified, does not become an approval under Part 3A of the Act.

The development consent for the site was issued by the then NSW Minister for Urban Affairs and Planning under Part 4 of the Environemntal Planning and Assessment Act, 1979 and under under the provisions of SEPP 34 on 6 September 1996. Therefore, in accordance with the former clause 8J(8) of the EP&A Regulation, the consent is taken to be an approval under Part 3A. As a Part 3A 'major project', the proposed modification can rely on the former section 75W of the Act.

Further, as noted above, the proposed modification still has the benefit of determination under section 75W because of (a) the transitional arrangements and (b) the fact that SEARs were issued prior to 1 March 2018.

The NSW Minister for Planning is the consent authority for modifications under the former section 75W of the EP&A Act. However, pursuant to section 23 of the Act, the Minister may delegate the consent authority function to a range of public officers or authorities.

When accepting an application for a modification under the former section 75W of the EP&A Act, the NSW Minister for Planning has to be satisfied that the proposal is a modification of the original proposal, rather than being a new project in its own right. In this regard it is noted that:

- the primary purpose of the proposed modification is to upgrade the concrete plant to facilitate an increase in production;
- the primary function and purpose of the operations on the site would not change as a result of the proposed modification(ie concrete plant and materials handling facility); and
- any potential environmental impacts would likely be minor compared to those impacts of the approved operations.

Therefore, the application and determination of the proposed modification of the development consent can be made under the former section 75W of the EP&A Act.

iv Request for SEARs

An application for a modification under section 75W must be accompanied by an environmental assessment (EA) (this document). Before preparing an EA, an applicant must request the SEARs which specify what must be addressed in an EA. Details on Boral's request for SEARs are provided below.

Once finalised, this EA may be publicly exhibited (based on the discretion of officers from DPE). If the EA is exhibited, any person can make a written submission about the proposal (including objecting to it). DPE may require Boral to provide a written response to any issues raised in submissions.

On 21 December 2017, EMM, on behalf of Boral, submitted a request for SEARs to DPE for the proposed modification. On 21 December 2017, DPE responded, the response stated:

> In accordance with section 75W(3) of the *Environmental Planning and Assessment Act 1979*, the Secretary may notify the Proponent of SEARs with respect to the proposed modification. The Proponent must comply with these requirements before the matter is considered by the Minister for planning.
>
> The SEARs have been prepared in consultation with relevant government authorities, and are based in the information you have provide to date. Your modification request should be accompanied by an Environmental Assessment which addresses the requirements of the authorities and the following (refer to Appendix B and Table 4.1):

Table 4.1 Environmental Assessment Requirements

Requirement	Specifics	Where it is addressed in the EA
Strategic context	• justification for the proposal having regard to its location and impacts;	Chapter 11
	• consideration of all relevant legislation, strategies, environmental planning instruments, including identification and justification for any inconsistencies; and	Chapter 4
	• demonstration the proposal is subject to section 75W of the EP&A act.	Chapter 4
Details of the existing operations on the site	• a description of existing and approved operations/facilities, including any licences or statutory approvals that apply to these;	Chapter 2 and Chapter 4
	• a summary of the existing conditions of consent that would be relevant to the proposal;	Appendix H
	• a summary of the existing environmental management and monitoring regime;	Chapter 2
	• detailed plans of the existing and proposed site layout;	Appendix C, Chapter 2 & Chapter 3
	• detailed plans of all structures proposed to be constructed and modified; and	
	• a table detailing compliance with existing conditions of approval;	Appendix H
Description of the modification	• a detailed description of the proposed modification, including changes to existing operations and any staging;	Chapter 3
	• the justification and need for the modification;	Chapter 11
	• identification of conditions to be modified and proposed wording of any new or modified conditions;	Section 3.8
	• identification of any proposed variations to other licences and approvals; and	Appendix H
	• an assessment of all potential impacts of the proposal on the existing environment and measures to avoid, minimise, mitigate and/or manage these potential impacts;	Chapter 6 - 10
Traffic and access	• a quantitative traffic impact assessment which considers traffic types and volumes likely to be generated, impacts on road safety and impacts on the capacity of the road network;	Chapter 8, Appendix F
	• details of any necessary infrastructure upgrades;	
	• details of and justification for the selected site access arrangements,	

Table 4.1 Environmental Assessment Requirements

Requirement	Specifics	Where it is addressed in the EA
	internal road network and parking arrangements; and • an assessment of the accessibility of the site by public transport.	
Noise and vibration	• a quantitative noise and vibration impact assessment for construction and operational impacts prepared in accordance with relevant Environment Protection Authority guidelines; • a description of all potential noise and vibration sources during construction and operation, including road traffic noise along primary haulage routes; • cumulative impacts of other developments; and • details of proposed mitigation, management and monitoring measures.	Chapter 6, Appendix D
Air quality	• a quantitative assessment of the potential air quality impacts during construction and operation in accordance with relevant Environment Protection Authority guidelines; • details of fugitive dust management measures during construction and operation; and • details of proposed mitigation, management and monitoring measures.	Chapter 7, Appendix E
Soil and water	• an assessment of potential surface water, flooding and groundwater impacts, including impacts on nearby waterbodies (including the Alexandra Canal), surrounding properties, waterfront land (as defined under the Water Management Act 2000) and the Botany Sands groundwater source; • details of the surface water and stormwater management system(s) including: o on-site detention o systems and measures to treat, reuse or dispose of water; o a detailed site water balance; o details of proposed erosion and sediment controls during construction; and o details of proposed mitigation, management and monitoring measures.	Chapter 9 and Section 10.1
Hazard and risk	• a preliminary risk screening completed in accordance with State Environmental Planning Policy No. 33 - Hazardous and Offensive Development and Applying SEPP 33 (DoP, 2011), with a clear indication of class, quantity and location of all dangerous goods and hazardous materials associated with the development. Should preliminary screening indicate that the project is "potentially hazardous" a Preliminary Hazard Analysis (PHA) must be prepared in accordance with Hazardous Industry Planning Advisory Paper No.6 - Guidelines for Hazard Analysis (DoP, 2011) and Multi-Level Risk Assessment (DoP, 2011).	Section 10.2
Fire and incident management	• including technical information on the environmental protection equipment to be installed on the premises such as air, water and noise controls, spill clean-up equipment and fire management.	Section 10.2
Contamination	• including an assessment in accordance with Managing Land Contamination Planning Guidelines: SEPP 55 - Remediation of Land (DUAP, 1998).	Chapter 10.3

Table 4.1 Environmental Assessment Requirements

Requirement	Specifics	Where it is addressed in the EA
Heritage	• including a statement of heritage impact which considers any impact the proposal might have on the Alexandra Canal and any other heritage items within the vicinity.	Chapter 10.4
Visual	• including a description of the potential visual impacts from proposed buildings and associated structures; and details of the measures proposed to minimise visual impacts, such as landscaping.	Chapter 10.7
Waste management	• including details of how waste will be managed during construction and operation, including details of liquid waste and non-liquid waste management.	Chapter 10.4
Biodiversity	• including an assessment of impacts on existing flora or fauna on the site.	Chapter 10.6
Consultation	• including details of consultation with relevant government authorities and the community.	Chapter 5

This EA has been prepared to address the relevant key issues for assessment identified in Table 4.1.

v Environmental planning instruments

Marrickville Local Environmental Plan 2011

As previously stated, the site is within the IN1 General Industrial zone of the Macksville LEP. Within this zone, general industries and freight transport facilities are permitted with development consent.

Part 4 of the Marrickville LEP contains a number of principal development standards that relate to development in the Inner West LGA. None of these standards apply to the site or the modification.

Part 5 and Part 6 of the Marrickville LEP contain miscellaneous provisions relating to development in the Inner West LGA, such as development near zone boundaries, development in areas subject to aircraft noise and development in the coastal zone. None of these provisions are relevant to the site or the modification. While the site is in an area subject to aircraft noise, the modification does not trigger application of the provisions in the LEP.

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development

State Environmental Planning Policy No. 33 – Hazardous and Offensive Development (SEPP 33) applies to NSW, including the Inner West LGA. It requires the consent authority to consider whether a proposal is a potentially hazardous or offensive development.

Consideration of SEPP 33 and whether the modification is potentially hazardous or offensive development is provided in Section 10.3. This concludes that the modification is not potentially hazardous or offensive development.

State Environmental Planning Policy No. 55 – Remediation of Land

State Environmental Planning Policy No. 55 – Remediation of Land (SEPP 55) applies to NSW, including the Inner West LGA. It requires that a consent authority not grant development consent unless it has considered any potential contamination issues. Clause 7(1) of SEPP 55 states:

A consent authority must not consent to the carrying out of any development on land unless:

(a) it has considered whether the land is contaminated, and

(b) if the land is contaminated, it is satisfied that the land is suitable in its contaminated state (or will be suitable, after remediation) for the purpose for which the development is proposed to be carried out, and

(c) if the land requires remediation to be made suitable for the purpose for which the development is proposed to be carried out, it is satisfied that the land will be remediated before the land is used for that purpose.

Consideration of potential contamination issues at the site is provided in Section 9.3. It indicates that while the site was contaminated as a result of historic filling of ash from the former Bunnerong power station and previous industrial uses, this contamination was subsequently remediated in accordance with a remediation strategy. The remediation was signed off by an accredited EPA Site Auditor. Although the site was remediated in accordance with relevant legislation and guidelines (Greencap 2015; 2016) some asbestos containing material fragments may remain.

No activities have been undertaken since the remediation was undertaken which would lead to further contamination of the site.

4.3.2 NSW Protection of the Environment Operations Act 1997

The POEO Act is administered by EPA. It aims to protect, restore and enhance the quality of the environment, having regard for the need to maintain ecologically sustainable development (ESD). This is achieved through installing mechanisms to reduce risks to human health and prevent the degradation of the environment by regulating pollution to the land, air and waters.

An environment protection licence (EPL) is required to be obtained and held by entities that undertake activities listed under Schedule 1 of the POEO Act.

The site is not required to hold or obtain an EPL, as concrete plants and handling facilities are not listed under Schedule 1 of the POEO Act.

4.3.3 Roads Act 1993

The NSW *Roads Act 1993* (Roads Act), administered by Roads and Maritime Services (RMS) regulates activities that may impact on public roads in NSW. Approval is required under the Roads Act to carry out works in, on or over a public road, including the provision or upgrade of access to that road.

The proposed modification does not require any changes to the site's access to facilitate additional truck movements. It does not involve any works in, on or over a public road.

A traffic assessment has been prepared which assesses the modification's potential impact on the local and broader road network. This assessment concludes that the proposed modification is unlikely to have long-term significant impacts on the local road network.

4.3.4 National Parks and Wildlife Act 1974

The NSW *National Parks and Wildlife Act* 1974 (NP&W Act), administered by the Office of Environment and Heritage (OEH), aims to conserve nature and objects, places or features of cultural value. Generally, an Aboriginal heritage impact permit is required under section 90 of the NP&W Act to knowingly destroy, deface or damage, or knowingly cause or permit the destruction or defacement of, or damage to, a relic or Aboriginal place.

No relics or Aboriginal places would be impacted by the modification.

4.3.5 Biodiversity Conservation Act 2016

On 25 August 2017 the new *Biodiversity Conservation Act 2016* (BC Act) commenced operation. Under this Act, impacts to biodiversity are assessed and offset in accordance with the clearing thresholds prescribed by the *Biodiversity Conservation Regulation 2017*.

No native vegetation, threatened or endangered flora or fauna species or EECs would be cleared or otherwise impacted by the modification.

4.3.6 Water Act 1912 and Water Management Act 2000

The NSW *Water Act 1912* and *Water Management Act 2000* (WM Act) regulate the use and interference with surface water (streams, creeks, rivers etc) and groundwater in NSW.

The proposed modification will not use or interfere with any surface or groundwater sources in accordance with legislative requirements. Further details are provided in Section 10.1 and Chapter 9.

i Water Sharing Plan for the Greater Metropolitan Region Unregulated Water Sources 2011

Water Access Licences (WALs) in the St Peters area are administered by the Water Sharing Plan for the Greater Metropolitan Unregulated Water Sources 2011. The licensing provisions of the WM Act are also applicable to the plan area. The Water Sharing Plan is administered by DPI-Water.

5 Stakeholder engagement

5.1 Overview

Boral recognises that engagement and consultation with stakeholders is integral to the operation of the site and determination of the modification.

A meeting was held between Boral and officers from DPE on 16 December 2015 to discuss the proposed modification. Following the meeting, a request for SEARs was prepared and submitted to DPE on 5 February 2016. On 12 February 2016, DPE advised, via email, that formal SEARs were not required to be issued. However agency requirements from OEH, DPI, EPA, RMS and Inner West Council were received and were to be considered as part of the EA.

In response to several design changes and ongoing consultation with DPE, a second request for formal SEARs was prepared and submitted to DPE on 21 December 2017. Formal SEARs were received on 21 December 2017 and are outlined further in Section 4.3.1. It was instructed by DPE that the initial agency requirements were to be still considered as part of the EA.

5.2 Commonwealth government

As stated in Chapter 4, the modification is not predicted to have a significant impact on a MNES listed in the EPBC Act. Therefore DoE was not consulted regarding the modification.

5.3 State and local government

Government agencies (DPE, RMS, Inner West Council and EPA) have been consulted regarding the modification to seek guidance on assessment approaches and policies that apply to the site. This consultation is summarised in Table 5.2.

Table 5.1 Agency consultation

Agency	Date	Method	Issues raised
DPE	16/12/15 17/05/17	Meeting	A meeting and further discussions held to discuss the scope for the proposed modification and approval process for the proposed changes to the site.
	28/07/17 03/08/17	Email	Discussion regarding recent design changes that affect concrete production limits and material handling throughput.
	18/10/17	Email	Timeframes for lodging the EA
	19/12/17 21/12/17	Telephone and email	Request for formal SEARs submitted DPE issued formal SEARs
Inner West Council (formerly Marrickville Council)	04/03/16 28/06/16 20/07/16 10/10/17	Telephone and email	Details of the modification were discussed with a planning officer from Inner West Council (then Marrickville Council) by telephone. It was agreed that further consultation would not be required with Council until results of the technical assessments (noise, air quality and traffic) were available. Following the receipt of initial results of the technical assessments, two telephone messages were left with the planning officer at Council. There was no response to the messages. Telephone call and follow up email seeking further clarification and additional information in regards to their agency letter.

Table 5.1 Agency consultation

Agency	Date	Method	Issues raised
	30/05/17	Meeting	A meeting was held to discuss the proposed modification with Jamie Erkin and several other council officers.
EPA	03/03/16 03/08/17	Telephone and email	Details of the modification were discussed with an officer from the EPA by telephone, including the preparation of noise and air quality assessments to support the EA. The EPA officer Tenille Lawrence stated that it seemed all of the EPA's normal requirements were being addressed. Notwithstanding this, it was agreed that a copy of the request for SEARs document be provided to the EPA for their review to determine whether any additional information would be required to be provided to support the EA. The officer from the EPA stated that if no additional information was required to support the EA, they would wait to review the EA and provide comments, if required, to DPE prior to determination of the modification. No additional information requirements were received from the EPA following receipt of the request for SEARs document. Follow up telephone call to confirm EPA does not require a meeting to discuss the EPA's response to SEARs agency letter and have no further questions to date.
DPI	03/08/17 04/08/17 08/08/17	Telephone	Discussion to follow up on DPIs response to SEARs agency letter, DPI confirmed they do not require a meeting to discuss the SEARs and have no further questions to date.
RMS	03/03/16 07/03/16 10/03/16 03/08/17 06/09/17 10/10/17	Telephone and email	Two telephone messages were left with a relevant contact at RMS on 3 March and 7 March 2016. Correspondence was submitted to RMS on 10 March with a copy of the request for SEARs document and an offer to meet regarding the modification. The RMS did not respond or request a meeting with Boral. Follow up telephone messages were left between 3-10 August 2017 to discuss any further questions or if they require a meeting. The RMS did not respond or request a meeting with Boral.

5.4 Community

The closest residences are approximately 600 m from the site. No significant impacts are predicted to occur to air quality, noise levels, traffic or visual amenity due to the modification at residential assessment locations. A consultation letter was distributed to the surrounding businesses along Burrows Road South informing them of the proposed modification. No responses had been received by Boral at the time of submission of this EA. Notwithstanding this, during the public exhibition process, community members will be able to make a submission on the EA.

6 Noise assessment

6.1 Introduction

A noise assessment has been prepared by EMM to assess the potential noise impacts of the modification. The noise assessment is presented in Appendix D and the results are summarised in this chapter.

6.2 Existing environment

6.2.1 Assessment locations

The site is located within an industrial precinct and is immediately surrounded by Boral's recycling facility, Visy's paper and cardboard warehouse, Maritime Container Services' terminal and various warehousing and storage facilities. The closest residences are approximately 600 m to the north-west of the site across the Princes Highway. Other surrounding land uses are industrial, with the site directly bounded by industrial premises. The site's location in its local context is shown in Figure 1.3.

If the noise trigger levels (which are defined later in this chapter) can be satisfied at the assessment locations, which are closest to the site, then noise trigger levels will be satisfied at noise-sensitive locations that are further from the site. Nearest representative noise sensitive locations to the site have been identified and are provided in Table 6.1, hereafter referred as assessment locations. The assessment locations are shown in Figure 6.1.

Table 6.1 Assessment locations

ID	Receiver type[1]	Address
R1	Residential	10 Terry Street, Tempe
R2	Residential	383 Princes Highway, Sydenham (Cnr of Yelverton Street and Princes Highway)
R3	Commercial	Bellevue Street, Tempe

Notes: 1. As defined in the NPfI (EPA 2017).

6.2.2 Background noise environment

Unattended noise monitoring was previously conducted for the site as part of the noise assessment completed by EMM in 2016. The EMM report *Noise assessment - Modification of development consent, Boral St Peters* (2016) references the existing ambient noise environment surrounding the site. The noise monitoring data remain valid and representative of existing noise levels and hence has been used for the purpose of this assessment.

Noise logging was completed at 11 Yelverton Street (referred to as NM1) in March 2016. The monitoring location is representative of residences with the most potential to be affected by the site. The logger location is shown in Figure 6.1. The attended noise monitoring results from the EMM report (2016) are reproduced in Table 6.3.

Table 6.2 Existing and ambient background noise levels (EMM 2016)

Monitoring location	Period[1]	RBL[2], dB(A)	Ambient $L_{Aeq,\ period}$ noise level[3], dB
NM1 - 11 Yelverton Street	Day	54	69
	Evening	52	66
	Night	45	62

Notes: 1. Day: 7 am - 6 pm Monday - Saturday; 8 am - 6 pm Sundays and public holidays; Evening: 6 pm - 10 pm; Night: all remaining periods.

2. RBL is the overall single figure background level representing each assessment period (day/evening/night) over the whole monitoring period.

3. Represents the energy average noise level over the relevant period.

In addition to unattended noise monitoring, operator attended noise measurements were conducted by EMM in March 2016 to quantify and qualify the existing noise sources including the existing industrial noise contribution during day and night periods.

The attended noise monitoring showed that the ambient noise environment was largely dominated by road traffic noise on the Princess Highway, with no to little industrial noise audible. Boral's existing operations at St Peters (recycling facility, concrete plant and materials handling facility) were all inaudible at the monitoring locations. Aircraft noise and natural sounds such as birds and insects (ie constant during night measurement at 11 Yelverton St) were also identified at the monitoring locations. Attended noise monitoring results from the EMM report (2016) are reproduced in Table 6.3.

Table 6.3 Attended noise measurements (EMM 2016)

Monitoring location	Time (hours)	Period[1]	Total 15-minute noise levels, dB			Comments and typical maximum levels
			L_{Aeq}	L_{A90}	L_{Amax}	
84 Terry St (north-west of R1[2])	12:30	Day	58	46	78	Road traffic noise from the Princes Highway was the dominant source (45-50 dB). No industrial noise contribution observed. Occasional aircraft over flight noise (71-78 dB). Intermittent bird and foliage noise (45-46 dB).
	22:47	Night	42	39	70	Road traffic noise from the Princes Highway was the dominant source (40 dB). Occasional train noise from south of monitoring location (44-48 dB). Occasional car pass by noise in Terry Street (50-55 dB).
11 Yelverton St (near R2)	11:45	Day	67	60	84	Road traffic noise from the Princes Highway was the dominant noise source (55-65 dB). Occasional transient noise from nearby industrial site audible between breaks in road traffic. Occasional aircraft over flight noise (80-85 dB).
	13:42	Day	74	67	87	Road traffic noise from the Princes Highway was the dominant noise source (65-70 dB). No industrial noise contribution observed. Occasional aircraft over flight noise (80-84 dB).

Table 6.3 Attended noise measurements (EMM 2016)

Monitoring location	Time (hours)	Period[1]	Total 15-minute noise levels, dB			Comments and typical maximum levels
			L_{Aeq}	L_{A90}	L_{Amax}	
	22:25	Night	77	54	94	Road traffic noise from the Princes Highway was the dominant noise source (55-65 dB). Very occasional transient noise audible from an industrial site (40-45 dB per noise event). Occasional aircraft over flight noise (85-94 dB). Insect noise constant (approx. 50 dB).

Notes: 1. Day: 7 am - 6 pm Monday - Saturday; 8 am - 6 pm Sundays and public holidays; Evening: 6 pm - 10 pm; Night: all remaining periods.

2. This location is approximately 260 m north-west of the Princes Highway and hence the lower L_{A90} noise levels.

Attended noise monitoring identified road traffic and aircraft noise as the main contributors to the ambient noise environment during day and night periods at both locations, with existing industrial noise also a contributor. Generally, the industrial noise was best described as just audible, transient events that occurred at a significantly lower level than other ambient noise sources (ie road traffic and aircraft noise).

6.3 Assessment criteria

6.3.1 Construction noise

The ICNG (DECC 2009) provides guidelines for the assessment and management of noise from construction. This assessment has adopted the ICNG quantitative approach.

The ICNG noise management levels (NMLs) for activities during the recommended standard hours are 10 dB above the existing background levels. Standard hours are described in the ICNG as Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm and no work on Sundays or public holidays.

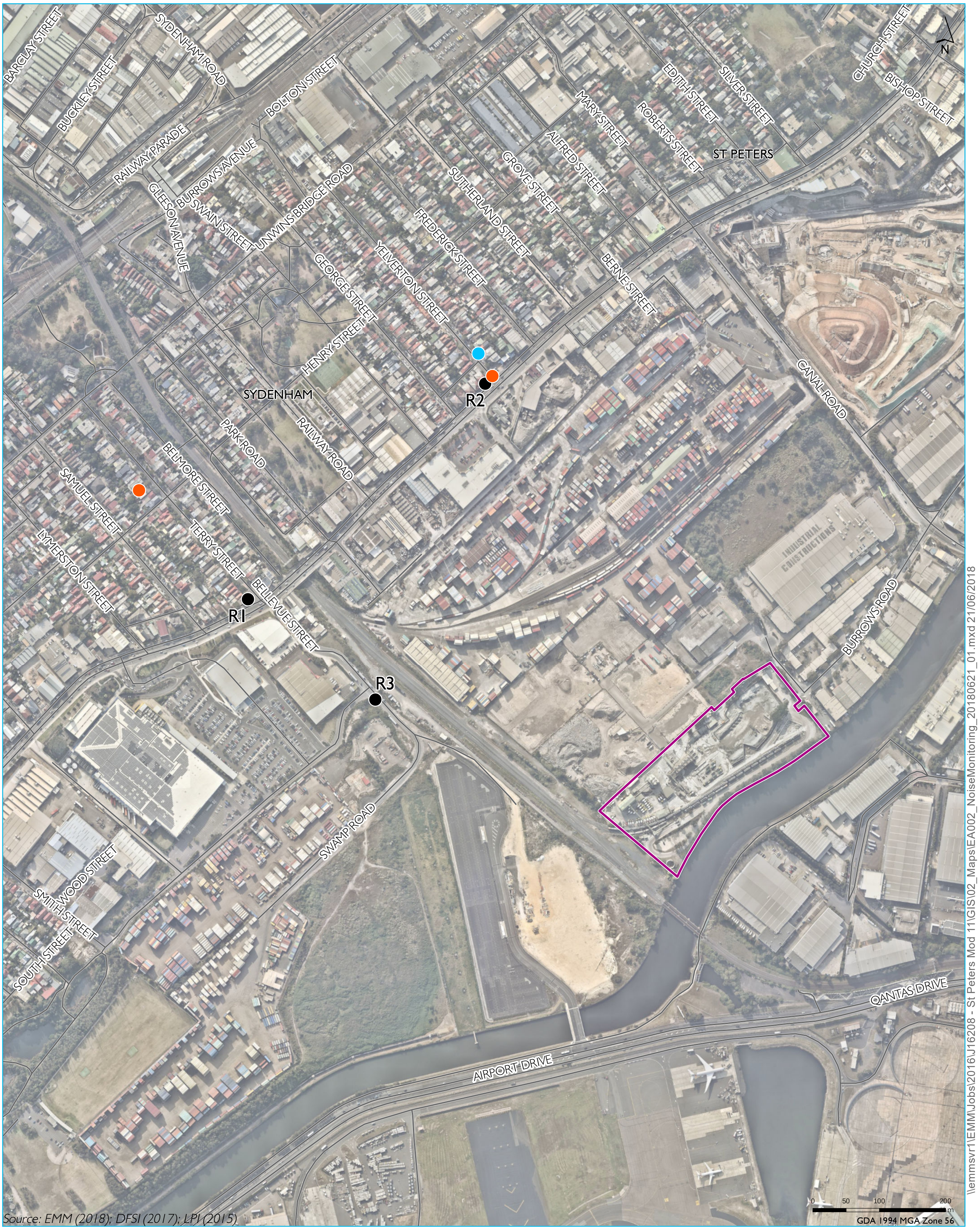
Construction works are proposed to be completed during standard hours only. The residential construction NMLs and NMLs for other sensitive land uses for the proposed works are provided in Table 6.4.

Table 6.4 Construction NMLs

Assessment location	Day[1] RBL, dB	Standard hours[2] NML, $L_{Aeq,15min}$, dB
R1 - Residence	54	64
R2 - Residence	54	64
R3 - Commercial	n/a	70

Notes: 1. Monday to Saturday 7 am to 6 pm, Sundays or Public Holidays 8 am to 6 pm.

2. Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm and no work on Sundays or Public Holidays.



KEY

- Assessment location
- Attended noise monitoring location
- Unattended noise monitoring location
- Site location

Noise monitoring and assessment locations

Environmental assessment

Modification 11

Boral St Peters

Figure 6.1

6.3.2 Operational noise

The project noise trigger level (PNTL) is the lower of the calculated intrusiveness or amenity noise levels and is provided in Table 6.5 for all assessment locations.

Table 6.5 Project Noise Trigger Levels

Location	Intrusiveness $L_{Aeq,15min}$ noise level, dB			Amenity $L_{Aeq,15min}$ noise level[1], dB			PNTL $L_{Aeq,15min}$[2], dB		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
R1 - Residence	59	57	50	**58**	**48**	**43**	58	48	43
R2 - Residence	59	57	50	**58**	**48**	**43**	58	48	43
R3 - Commercial	N/A	N/A	N/A	63 (when in use)			63 (when in use)		

Notes: 1. Project amenity noise level is the recommended amenity noise level minus 5 dB and $L_{Aeq,15min}$ is equal to $L_{Aeq,period}$ + 3 dB as per the NPfI (EPA 2017).

2. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; evening: 6 pm to 10 pm; night is the remaining periods.

3. Value in bold font and underlined is the lower of the intrusiveness and amenity noise levels for residences.

6.4 Sleep disturbance

The site will operate during the night-time period (24 hours) and therefore the assessment of potential sleep disturbance from maximum noise events at residences is required in accordance with the NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPfI) 2017. Sleep disturbance is defined as both awakenings and disturbance to sleep stages.

The NPfI provides the following sleep disturbance trigger levels for residences:

- $L_{Aeq,15min}$ 40 dB or the prevailing RBL plus 5 dB, whichever is the greater; and/or
- L_{Amax} 52 dB or the prevailing RBL plus 15 dB, whichever is the greater.

The sleep disturbance noise trigger levels for the residential assessment locations are shown in Table 6.6.

Table 6.6 Sleep disturbance noise trigger levels - residential assessment locations

Assessment location	Adopted night-time RBL, dB(A)	Recommended sleep disturbance trigger level, dB		Adopted sleep disturbance trigger level, dB	
		$L_{Aeq,15min}$	L_{Amax}	$L_{Aeq,15min}$	L_{Amax}
		Standard/RBL +5	Standard/RBL +15		
R1	45	40/**50**	52/**60**	50	60
R2	45	40/**50**	52/**60**	50	60

Notes: 1. Value in bold font and underlined is the greater of the sleep disturbance noise levels.

6.4.1 Road traffic noise

The principle guidance for assessing the impact of road traffic noise on receivers is in the NSW Department of Climate Change and Water (DECCW), Road Noise Policy (RNP) 2011. The majority of the traffic will travel to and from the site via Canal Road (northbound) and the Princes Highway.

The nearest noise sensitive receivers potentially affected by an increase in road traffic noise associated with the proposed activity are on the Princes Highway, which is classified as an arterial road according to the RNP.

The road noise assessment criteria for residential land uses from Table 3 of the RNP are reproduced in Table 6.7.

Table 6.7 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria, dB(A)	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	$L_{Aeq(15hr)}$ 60 (external)	$L_{Aeq(9hr)}$ 55 (external)

Source: RNP (DECCW 2011).

The RNP states that where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB.

6.4.2 Construction vibration

The DEC guideline for the assessment of vibration *Environmental Noise Management – Assessing Vibration: a technical guideline* (2006) (the guideline) is based on guidelines contained in BS 6472 – 2008, 'Evaluation of human exposure to vibration in buildings (1-80Hz)'.

The guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. Further information is provided in Appendix D.

6.5 Potential impacts

6.5.1 Method

i Assessment scenarios

Quantitative modelling of noise emissions from the site was completed using Brüel & Kjær Predictor noise prediction software. This software calculates total noise levels at assessment locations from the concurrent operation of multiple noise sources. The noise model incorporates factors such as:

- the lateral and vertical location of plant and equipment;
- source-to-receptor distances;
- ground effects;
- atmospheric absorption;
- topography; and
- meteorological conditions.

Three-dimensional digitised ground contours of the site and surrounding land were incorporated to model topographic effects. Equipment was modelled at locations and heights representative of potential construction and operational scenarios for the site.

The model was used to predict noise levels during standard meteorological conditions at each of the assessment locations (refer to Table 6.1).

6.5.2 Construction noise

Construction noise emissions have been modelled assuming worst-case distribution of construction equipment at the site over an ICNG 15-minute assessment period during standard construction hours for typical equipment listed in Section 3.7. The construction works are expected to be completed in approximately nine months, with works staggered in stages to reduce overall disruption to production.

Predicted noise levels during standard construction hours are shown in Table 6.8.

Table 6.8 Predicted noise levels – construction equipment

Location	Period	Predicted construction noise, $L_{Aeq,15min}$, dB	NML, dB	Exceedance above NML, dB
R1 - Residence	Standard hours[1]	53	64	Nil
R2 - Residence	Standard hours[1]	53	64	Nil
R3 - Commercial	When in use	60	70	Nil

Notes: 1. Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm and no work on Sundays or Public Holidays.

Noise levels generated by the proposed construction are predicted to satisfy the ICNG NMLs at all assessment locations. Notwithstanding, the proponent will manage and minimise the potential for construction noise impacts from site.

6.5.3 Operational noise

The difference in operating noise levels between the current approved operations and the proposed modification has been assessed. Operational noise sources and associated sound power levels used in the noise model are summarised in Appendix D.The plant and equipment items are based on the current site inventory and proposed equipment list, as provided by Boral. The sound power levels are based on an EMM database of similar plant and equipment.

Main operating assumptions adopted for a worst-case 15-minute period are as follows:

- the front end loaders, concrete agitators, trains, aggregate trucks, water truck, conveyors and the batch plant are assumed to operate continuously in any 15-minute period in the day, evening or night;
- the bobcat, forklift and dump truck are assumed to operate approximately 50% of the time in any 15-minute period in the day, evening or night; and
- all onsite vehicle movements are 20 km/hr or less.

6.5.4 Modelling results

The existing and predicted future noise levels at each assessment location for each assessment period are provided in Table 6.9.

Table 6.9 Predicted noise levels for approved and proposed operations during NPfI standard meteorological conditions

Assessment location	Existing operations, $L_{Aeq,15min}$, dB			Proposed operations, $L_{Aeq,15min}$, dB			Predicted change in noise level, dB			PNTL, $L_{Aeq,15min}$, dB		
	D	E	N	D	E	N	D	E	N	D	E	N
R1	41	41	41	42	42	42	+1	+1	+1	58	48	43
R2	<44	<44	<44	44	44	44	+1	+1	+1	58	48	43
R3	47	47	47	48	48	48	+1	+1	+1	63	63	63

Notes: 1. D = Day; E = Evening; N = Night.

Site noise emissions during proposed operations are predicted to comply with the relevant PNTLs at all assessment locations Operator attended noise surveys near the residential assessment locations R1 and R2 indicate that existing noise levels from the site were inaudible at the time of measurement and that the existing noise environment at the nearest residences is dominated by road traffic noise on the Princes Highway.

Significantly, and of most relevance to the proposed modification, is that the predicted noise levels demonstrate that operational noise from the proposed modification will not increase existing site noise levels by more than 1 dB. This outcome satisfies the requirement set-out in the NPfI, whereby noise levels from the proposed operations (with all feasible and reasonable measures in place) do not significantly increase the existing noise emissions. A change in sound levels of 1 to 2 dB is deemed 'typically indiscernible' to the human ear. Thus, an increase of 1 to 2 dB in site noise emissions is unlikely to be perceivable at the nearest assessment location and therefore it is unlikely that the changes in project noise emissions would cause adverse impacts at any residence.

6.6 Sleep disturbance assessment

The predictions are for the night period only (10 pm to 7 am) coinciding with the typical sleep period and in accordance with the NPfI. For the assessment of maximum L_{Amax} noise levels, maximum noise events with the potential to occur on site include the front end loader scraping concrete and/or loading aggregate trucks. This noise event has been modelled at L_{Amax} 126 dB and represents the likely highest maximum noise level event from the site.

Table 6.10 Predicted noise levels during the night period

Assessment location[1]	Predicted noise levels, dB		Maximum noise trigger level, dB		Exceedance, dB	
	$L_{Aeq,15min}$	L_{Amax}	$L_{Aeq,15min}$	L_{Amax}	$L_{Aeq,15min}$	L_{Amax}
R1	42	53	50	60	Nil	Nil
R2	<44	57	50	60	Nil	Nil

Notes: 1. The sleep disturbance assessment applies to residential assessment locations only.

Maximum noise levels from site are predicted to satisfy the NPfI sleep disturbance trigger levels at both representative residential assessment locations.

6.7 Road traffic noise assessment

The nearest residences potentially affected by an increase in road traffic volumes as a result of the proposed modification are on the Princes Highway. The existing traffic volumes on the Princes Highway were surveyed in December 2017 and are presented in Table 6.11.

Table 6.11 Summary of existing traffic volumes on the Princes Highway

Road	Intersection survey location	Estimated daily traffic[1]	Average week day heavy vehicles[1]	% heavy vehicles
Princes Highway	South of Canal Road	53,900	1,830	3.4
Princes Highway	North of Canal Road	30,100	900	3.0

Notes: 1. Daily heavy vehicle numbers and their % have been extrapolated from the am and pm peak hourly heavy vehicle traffic proportions.

Assessed traffic movements during operation have been based on peak production days. The proposed additional site daily traffic volumes on the public road network will consist of approximately 1,066 heavy vehicle movements and 50 light vehicle movements on peak production days.

The traffic assessment (EMM 2018) prepared for the proposed development indicates that approximately 40% of the site daily truck movements and 50% of light vehicles associated with the site operation will travel via the Princes Highway.

The traffic assessment (EMM 2018) estimated that site related traffic will increase the exiting daily traffic movements on Canal Road by 0.4% southbound and 0.7% northbound (on the Princes Highway). Given this relatively small increase in proposed traffic volumes, there would be a negligible increase in road traffic noise levels at the nearest residential locations. Therefore, the impact of road traffic noise associated with the proposed development is predicted to be negligible and within the 2 dB allowable increase for land use developments as described in the RNP (DECCW 2011).

6.8 Construction vibration assessment

As a guide, safe working distances for typical items of vibration intensive plant are listed in Table 6.12. The safe working distances are quoted for both “Cosmetic Damage” (refer British Standard BS 7385) and “Human Comfort” (refer British Standard BS 6472-1).

Table 6.12 Recommended safe working distances for vibration intensive plant

Plant Item	Rating/Description	Safe working distance	
		Cosmetic damage (BS 7385)	Human response (BS 6472)
Vibratory Roller	<50kN (Typically 1-2 tonnes)	5 m	15 to 20 m
	<100kN (Typically 2-4 tonnes)	6 m	20 m
	<200kN (Typically 4-6 tonnes)	12 m	40 m
	<300kN (Typically 7-13 tonnes)	15 m	100 m
	>300kN (Typically 13-18 tonnes)	20 m	100 m
	>300kN (>18 tonnes)	25 m	100 m
Small hydraulic hammer	(300 kg - 5 to 12 t excavator)	2 m	7 m
Medium hydraulic hammer	(900 kg - 12 to 18 t excavator)	7 m	23 m

Table 6.12 Recommended safe working distances for vibration intensive plant

Plant Item	Rating/Description	Safe working distance	
		Cosmetic damage (BS 7385)	Human response (BS 6472)
Large hydraulic hammer	(1600 kg - 18 to 34 t excavator)	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤ 800 mm	2 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

Source: Transport Infrastructure Development Corporation Construction's Construction Noise Strategy (Rail Projects) (November 2007).

The nearest building to the site is approximately 45 m from the eastern property boundary. It is therefore envisaged that cosmetic damage to nearby structures is unlikely. At such distance however, human response can be expected for construction activities that include the use of a vibratory roller and sheet piling rig. The safe working distances provided in Table 6.12 should be followed in the first instance and management of vibration levels may be required when the vibratory roller is in use.

6.9 Mitigation measures

6.9.1 Operations

Predictions indicate that operational noise emissions from the site as proposed to be modified will satisfy relevant PNTLs. Notwithstanding, there are mitigation measures that may be employed to further reduce noise impacts. These include:

- design traffic management to minimise the need for reversing especially during the night-time and early morning period;
- regular maintenance and servicing of plant and equipment;
- the use of broadband reversing alarms (growlers) on site equipment;
- plant and equipment to be switched off when not in use; and
- minimise material drop heights.

6.9.2 Construction

i Noise

Construction noise levels from the site are predicted to satisfy the NMLs at all assessment locations during standard construction hours. Nonetheless, the proponent shall manage construction noise from the site by adopting universal work practices such as:

- constructing during ICNG standard hours only;
- regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration;

- avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon residents;
- parking of vehicles in locations and ways to minimise noise;
- minimising the need for vehicle reversing for example, by arranging for one-way site traffic routes (largely achieved by virtue of site layout);
- use of broadband audible reverse alarms on vehicles and elevated work platforms used on site; and
- minimising the movement of materials and plant and unnecessary metal-on-metal contact.

ii Vibration

The following “baseline” vibration mitigation measures will be implemented where reasonably and feasibly practicable:

- all construction works will be carried out during ICNG standard hours and work generating high vibration levels will be scheduled during less sensitive time periods; and
- consecutive works in the same locality will be minimised.

6.10 Conclusion

Noise levels during construction are predicted to satisfy the ICNG NMLs at all assessment locations.

Operational noise from the proposed modifications satisfies the relevant PNTLs for day, evening and night periods at all assessment locations. The assessment showed that the proposed modification will result in an increase in site noise levels of no greater than 1 dB compared to existing operations. Further, noise levels from the proposed modification are predicted to be significantly less than existing ambient noise levels at the assessment locations where road traffic noise dominates the existing noise environment. Noise levels from the modification are therefore not expected to cause adverse impacts at any assessment location.

Sleep disturbance from proposed operations during the night period has been assessed. The highest predicted maximum noise levels ($L_{Aeq,15min}$ and L_{Amax}) from site are expected to be well below the NPfI trigger noise levels and therefore unlikely to cause sleep disturbance at residential assessment locations.

Traffic generated by the modification is not expected to generate any noticeable increase in road traffic noise levels at the nearest residential locations. Therefore, the impact of road traffic noise associated with the proposed modification is predicted to be negligible and within the 2 dB allowable increase for land use developments as described in the RNP.

Construction vibration impacts from the proposed modification will be managed in the first instance, but are unlikely.

7 Air quality assessment

7.1 Introduction

An air quality assessment has been prepared by Ramboll Environ to assess the potential air quality impacts of the modification. The air quality assessment is presented in Appendix E and the results are summarised in this chapter.

7.2 Existing environment

7.2.1 Assessment locations

The assessment locations for the air quality assessment have been adopted at representative residential and industrial/commercial receptors and are outlined in Table 7.1 and shown in Figure 7.1. The assessment locations shaded in grey are the same as those used for the noise assessment (refer to Section 6.2.1 and Figure 6.1).

Table 7.1 Air quality assessment/receptor locations

Receptor ID	Assessment location	Receptor type
R1	10 Terry Street, Tempe	Residential
R2	383 Princes Highway, Sydenham (Cnr of Yelverton Street and Princes Highway)	Residential
R3	2 Burrows Road South, St Peters	Commercial/industrial
R4	19 Burrows Road South, St Peters	Commercial
R5	293 Coward St, Mascot	Commercial
R6	304 Coward St, Mascot NSW	Commercial
R7	302 Coward St, Mascot	Commercial
R8	Canal Road, St Peters	Commercial
R9	Bellevue St, Tempe	Industrial
R10	6-10 Burrows Rd South, St Peters	Industrial
R11	4 Burrows Road South, St Peters	Commercial/industrial

Note: Assessment locations shaded in grey are the same assessment locations used for the noise and vibration impact assessment

KEY

- Air quality receptors
- Site location

Air quality assessment locations

Environmental assessment

Modification 11

Boral St Peters

Figure 7.1

EMM

7.2.2 Background air quality

The National Pollutant Inventory (NPI) database lists a large number of particulate matter (PM) emission sources within 10 km of the site. The majority of sources are in the large industrial areas approximately 5 km to the south-east of the site and are unlikely to cause significant direct cumulative impacts with emissions from the site.

Boral's recycling facility is adjacent the north-western boundary of the site and involves the delivery, handling, crushing, stockpiling of construction materials, and despatch of recycled product. Emissions from this facility have been explicitly included in the dispersion modelling for assessment of cumulative impacts.

Also adjacent the site on Burrows Road South is the Visy Recycling Facility, where kerb-side recyclables (glass, aluminium, paper, plastics and metal) are processed. Emissions from this site are not considered significant for cumulative assessment purposes.

Other activities in the surrounding area include WestConnex construction activities, shipping container storage facilities, several small materials recycling facilities and Sydney Airport. In addition, the following sources contribute to particulate matter emissions in the vicinity of the site:

- dust entrainment and tyre and break wear due to vehicle movements along public roads;
- petrol and diesel emission from vehicle movements along public roads;
- seasonal emissions from household wood burning fires; and
- sea salt in sea breezes.

More remote sources which contribute episodically to PM in the region include dust storms and bushfires.

PM concentrations 10 and 2.5 micrometers (or microns) or less in diameter (PM_{10} and $PM_{2.5}$) are recorded by OEH at the nearby Earlwood monitoring station, approximately 3.5 km west of the site. Daily-varying concentrations of PM_{10} and $PM_{2.5}$ have been collated for the period between 2010 and 2017 in the absence of onsite monitoring data. Both PM_{10} and $PM_{2.5}$ concentrations fluctuate daily throughout the presented period. Occasional exceedances of relevant criteria occur which are attributable to regional-scale events such as bushfires, hazard reduction burns and dust storms.

For background total suspended particulate (TSP) levels, in the absence of local TSP monitoring data, the PM_{10}/TSP relationship from the 2003-2004 NSW OEH monitoring reports has been applied to the NSW OEH Earlwood PM_{10} monitoring data collected between 2010 and 2017. The annual average TSP concentration adopted as background is therefore 38.5 $\mu g/m^3$.

Boral undertakes dust deposition monitoring at five locations near the site, however due to station siting in proximity of terminal and plant emission sources, the collected data is not appropriate to represent background deposition levels. For this reason, this assessment will focus on the incremental contribution from site-only emissions, assessed against the NSW EPA incremental criterion of $2g/m^2$/month, expressed as an annual average.

7.3 Potential impacts

7.3.1 Method

i Emissions estimation and assessment scenarios

The air quality assessment focussed on the primary particulate matter pollutants: TSP, PM_{10} and $PM_{2.5}$ in accordance with the *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales* (DEC 2005) (the Approved Methods). Dust deposition was also assessed.

Potential dust generating activities and emission sources associated with the site's operation were identified as follows:

- delivery of aggregate and sand to site by train and truck;
- transfer and handling of aggregate and sand at storage bins, materials handling facility and within the concrete plant;
- transferring cement and cement supplement into silos from delivery trucks;
- concrete plant conveying and loading to agitator trucks;
- wheel-generated dust from trucks movements across paved surfaces;
- wind erosion from material storage bins and adjacent paved surfaces; and
- diesel combustion by trucks, mobile plant and locomotive engines.

A single emissions scenario has been developed for the quantification of emissions and impacts from the modified site, focusing on maximum annual production (750,000 m3 pa of concrete). Two variations of the single emissions scenario have been developed:

- peak day emissions, based on maximum daily concrete agitator and aggregate truck movements; and
- average day emissions, based on maximum daily concrete agitator and aggregate truck movements.

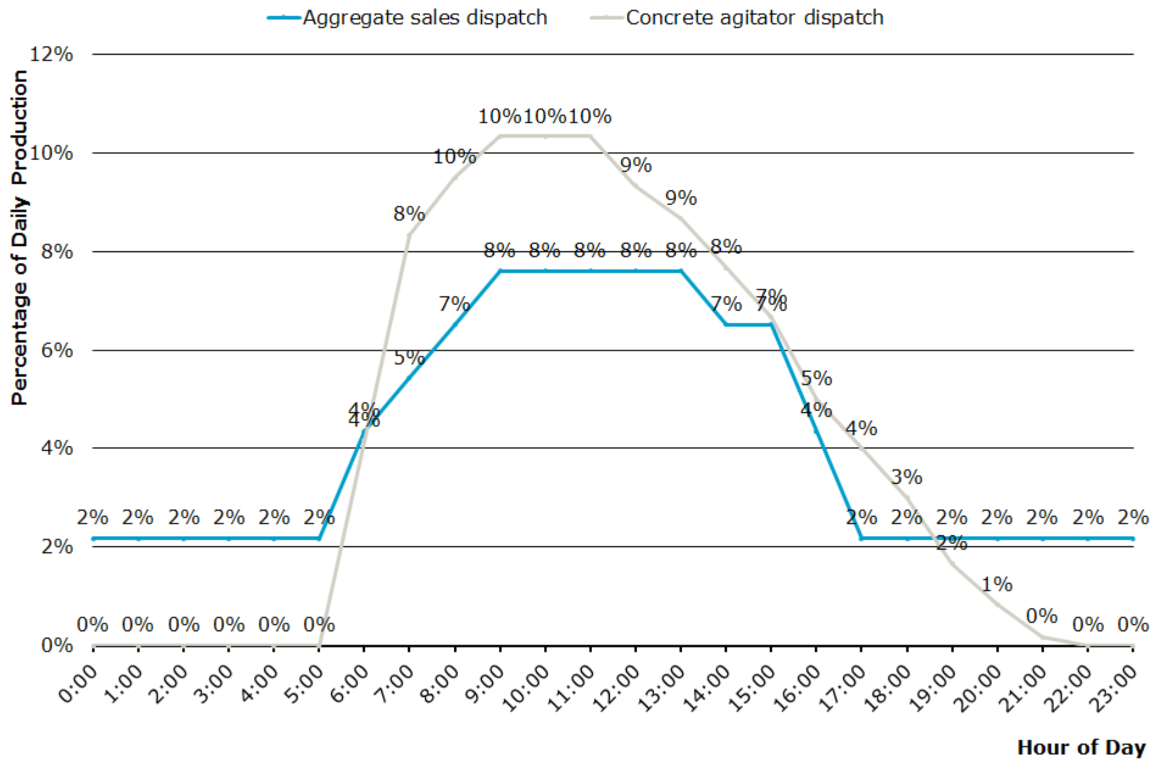
The peak day emissions profile will be used to predicted 24-hour average PM10 and PM2.5 concentrations, while the average day emissions profile will be used to predict annual average TSP, PM10, PM2.5 and dust deposition levels.

The following assumptions were made in quantifying emissions for the scenario:

- daily peak one-way truck numbers of 145 sand and aggregate deliveries, 42 cement and admixture deliveries and 625 concrete agitator dispatches are assumed for the peak days scenario;
- daily average one-way truck numbers of 92 sand and aggregate deliveries, 24 cement and admixture deliveries and 500 concrete agitator dispatches are assumed for the peak days scenario; and

- based on the ratio of peak to daily truck movement numbers, average production and/or throughput rates were upscaled by 1.25 for concrete batching activities and 1.57 for materials storage area activities.

While the site is a 24-hours per day, seven days a week operation, daily emissions were varied by indicative diurnal profiles provided by Boral for concrete agitators and aggregate sales dispatch, as illustrated in Figure 7.2.



Source: Ramboll 2018

Figure 7.2 Indicative truck dispatch profiles – concrete agitators and aggregate trucks

For the quantification of emissions generated by the movement of vehicles (material delivery/despatch trucks, agitator trucks) across paved surfaces, Ramboll completed site-specific road silt sampling in August 2017.

Additionally, the following assumed controls for fugitive dust emissions have been applied:

- paved roads wheel dust – 70% reduction for water flushing and sweeping (US-EPA AP-42, 2006);
- weigh hopper loading - 83% reduction for hooding with fabric filters (NPI, 2012);
- concrete mixer loading – controlled emission factors applied to account for dust extraction and wet process loading to trucks;
- unloading and handling at storage areas – 50% reduction for water sprays (NPI, 2012) and 75% reduction for three-sided enclosure (Katestone, 2011);

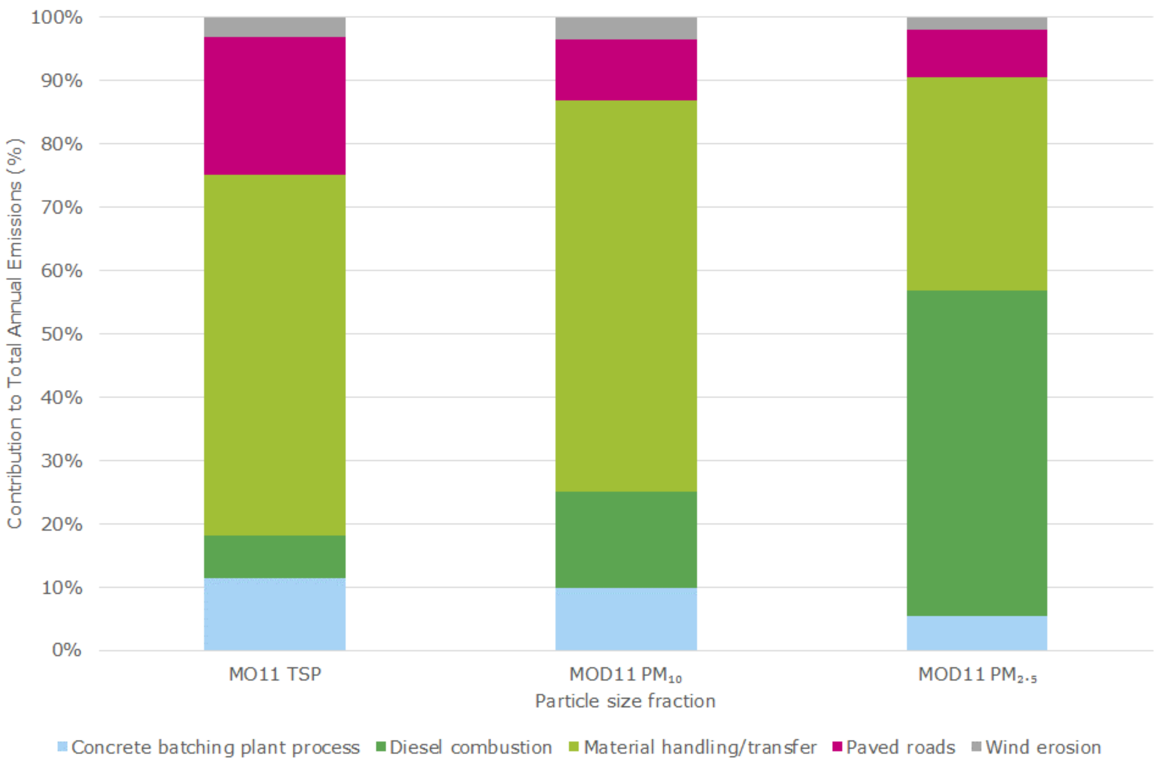
- wind erosion from material storage bins - 50% reduction for water sprays (NPI, 2012) and 75% reduction for underground unloading (Katestone, 2011); and
- cement/flyash silo loading – controlled emission factors applied to account for pneumatic loading of silos.

Further detail on the assumptions made for emission estimates are listed within Appendix 2 of Appendix E.

a. Annual emission estimate summary

A summary of site emissions by source type is presented in Appendix E and the relative contribution to total annual emissions by particle size fraction is illustrated in Figure 7.3. Control measures proposed for implementation, as outlined in the aforementioned section have been taken into account in the emission estimates.

The most significant emissions sources for TSP, PM_{10} and $PM_{2.5}$ associated with the proposed modification's site operations are the material handling and transfers (tripper car conveyor transfer, front end loader in materials storage area, truck loading/unloading, material conveying). The movement of vehicles across paved roads is also a significant contributor to annual emissions. The significance of diesel combustion emissions increases as particle size decreases.



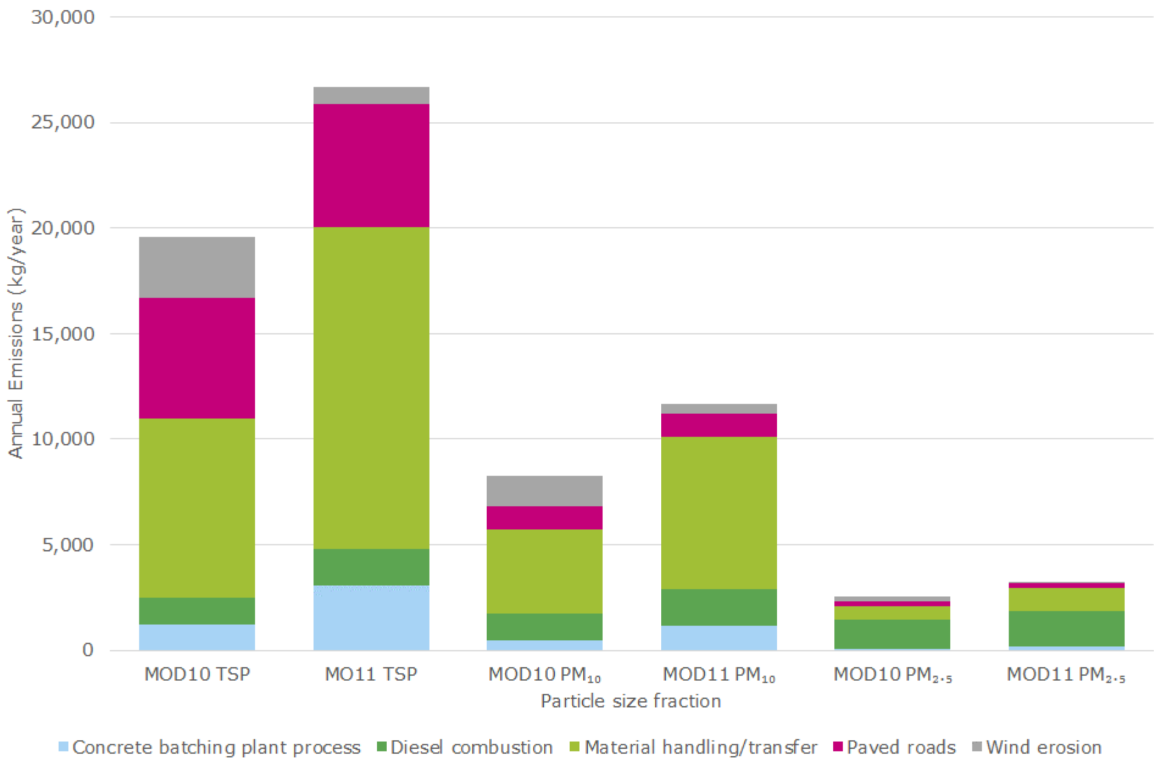
Source: Ramboll 2018

Figure 7.3 Relative contribution to annual TSP, PM_{10} and $PM_{2.5}$ emissions by source type

b. Comparison with the current emissions on site

The emissions calculated for the proposed modification's operations have been compared with the emissions calculated for the current site operations, with a summary plot presented in Figure 7.4. The following points are noted:

- the proposed modification's operations result in higher annual emissions for TSP, PM10 and PM2.5;
- the significance of material handling and transfers and concrete batching plant emissions increases for the proposed modification is consistent with the proposed increase in concrete production and material entering and leaving site;
- the annual amounts of paved roads emissions do not change significantly despite the increase in incoming/outgoing material. This is attributable to the increased use of material conveying at site (underground reclaimer conveyor, elevated conveyor with tripper car) reducing the reliance on truck haulage for material transportation; and
- wind erosion emissions reduce due to a slight reduction in stockpiling areas about site and an increase in the storage area bund walls.



Source: Ramboll 2018

Figure 7.4 Operational emission comparison - current site emissions vs proposed modification

ii Dispersion methodology

The atmospheric dispersion modelling completed within this assessment used the AMS/US-EPA regulatory model (AERMOD) (US-EPA, 2004). AERMOD is designed to handle a variety of pollutant source types, including surface and buoyant elevated sources, in a wide variety of settings such as rural and urban as well as flat and complex terrain. Simulations were undertaken for the 12 month period of 2015 using the AERMET-generated file based largely on the Bureau of Meteorology's (BoM) Sydney Airport automatic weather station (AWS) meteorological monitoring dataset as input.

The dispersion modelling incorporated the local meteorology and air dispersion characteristics, including wind speed, wind direction, cloud cover, temperature, precipitation, atmospheric stability and mixing heights. Other factors considered included terrain, emission source locations, plant and equipment types and numbers, operating hours and dust controls already in place at the site.

Dispersion of emissions from the site were modelled across a 2 km by 2 km area, with a receptor grid resolution of 50 m. The results are presented as contour diagrams in Appendix E. Air quality predictions were made at 11 assessment locations, shown in Figure 7.1, selected as representative of the closest (and potentially most affected) receptors. Assessment locations R1 and R2 are representative of residential receptors, while the remainder are industrial and commercial receptors.

iii Criteria

The modelling results were compared against the relevant air quality criteria so potential impacts could be assessed. The criteria are from the approved methods (DEC 2005). Aside from the dust deposition criterion, they relate to the total concentrations of air pollutants and not just the contribution from the concrete plant. In addition to the EPA's criteria, reference was made to the applicable air quality standards and goals in the *National Environment Protection (Ambient Air Quality) Measure* (NEPM).

The criteria used are designed to maintain ambient air quality that allows for the adequate protection of human health and well-being.

7.3.2 Assessment results

Predicted incremental TSP, PM_{10}, $PM_{2.5}$ concentration and dust deposition rates from the site under peak operations are presented in Table 7.2 for each of the selected receptor locations.

It can be seen from the results that all pollutants and averaging periods are below the applicable NSW EPA assessment criterion at all neighbouring receptors.

With the exception of dust deposition, the applicable assessment criteria are applicable to cumulative concentrations.

Table 7.2 Incremental particulate matter concentration and deposition results – proposed modification's operations

Receptor ID	TSP – annual Average	PM_{10} –24-hour maximum	PM_{10} – annual average	$PM_{2.5}$ –24-hour maximum	$PM_{2.5}$ –annual average	Dust deposition – annual average
1	0.1	0.2	<0.1	0.1	<0.1	<0.1
2	0.1	0.2	0.1	0.1	<0.1	0.1
3*	2.6	4.4	1.1	1.1	0.3	1.9

Table 7.2 Incremental particulate matter concentration and deposition results – proposed modification's operations

Receptor ID	TSP – annual Average	PM_{10} –24-hour maximum	PM_{10} – annual average	$PM_{2.5}$ –24-hour maximum	$PM_{2.5}$ –annual average	Dust deposition – annual average
4*	2.2	2.9	0.9	0.7	0.3	1.5
5*	0.7	0.8	0.3	0.3	0.1	0.4
6*	1.2	1.3	0.6	0.6	0.2	0.7
7*	1.5	1.8	0.8	1.0	0.4	0.8
8*	0.3	0.6	0.2	0.2	0.1	0.2
9*	0.2	0.3	0.1	0.1	<0.1	0.1
10*	2.4	3.6	1.1	0.7	0.3	1.7
11*	2.0	4.1	0.9	0.9	0.2	1.5
Criteria	**90**	**50**	**25**	**25**	**8**	**2**

*Notes: * denotes industrial/commercial receptor*

Predicted cumulative TSP, PM10, PM2.5 concentration from the site in combination with emissions from neighbouring Boral operations and ambient background are presented in Table 7.3 for each of the selected receptor locations.

It can be seen from the results that all predicted cumulative concentrations of pollutants are below the applicable NSW EPA assessment criterion at all neighbouring receptors.

Table 7.3 Cumulative particulate matter concentration results – MOD11, neighbouring Boral Recycling and ambient background

Receptor ID	Cumulative concentrations (µg/m³) or deposition (g/m2/month) due to MOD11, neighbouring Boral Recycling and ambient background				
	TSP – annual Average	PM10 – 24-hour 2nd highest	PM10 – annual average	PM2.5 –24-hour 3rd highest	PM2.5 –annual average
1	38.2	43.7	18.3	23.9	7.0
2	38.3	43.8	18.4	23.9	7.0
3*	40.9	44.7	19.5	24.3	7.3
4*	40.5	45.0	19.3	24.3	7.3
5*	38.9	44.3	18.6	24.1	7.1
6*	39.5	44.7	18.9	24.2	7.2
7*	39.8	45.0	19.1	24.4	7.4
8*	38.8	43.9	18.5	24.0	7.1
9*	38.4	43.8	18.4	24.0	7.1
10*	40.9	44.9	19.5	24.2	7.3
11*	40.2	44.3	19.2	24.1	7.2
Criteria	**90**	**50**	**25**	**25**	**8**

*Notes: 1. * Commercial/industrial assessment location.*

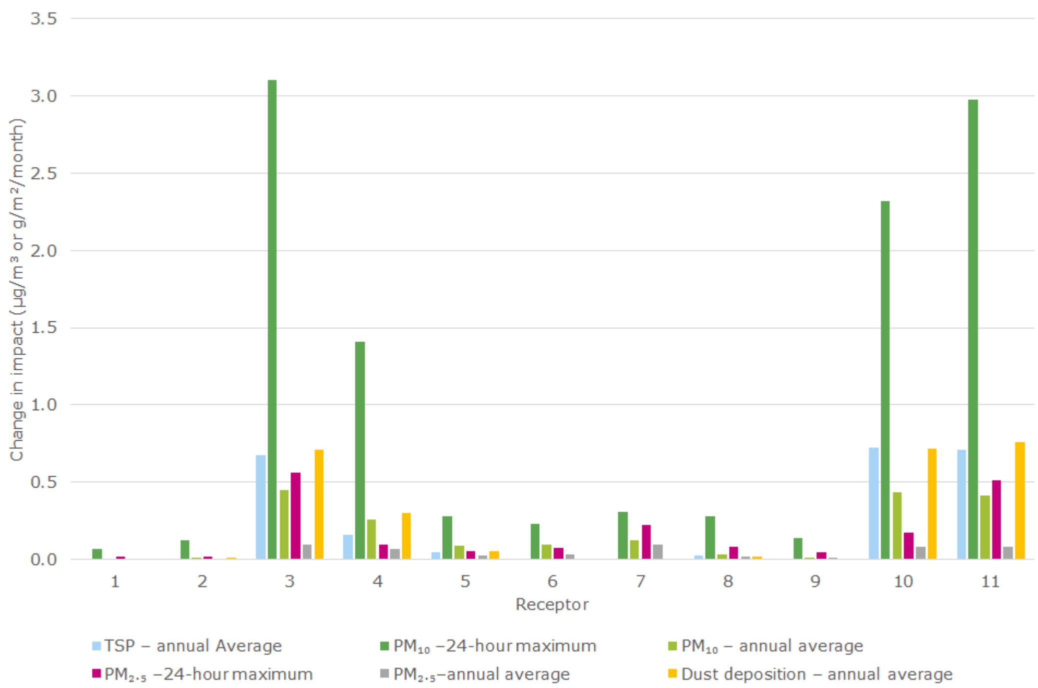
2. To account for the existing criteria exceedances in the NSW OEH Earlwood monitoring datasets for 2015 (one for 24-hour average PM_{10} and two for 24-hour average $PM_{2.5}$), the second highest cumulative 24-hour average PM_{10} and third highest cumulative 24-hour average $PM_{2.5}$ concentration is presented in Table 7.3.

i Comparison between current operations and the proposed modification

The change in predicted concentrations and deposition rates from the current site operations (using refined paved road silt loading values) with the proposed modification are presented in Figure 7.5. Across all receptors, predicted concentrations and deposition rates would increase for the proposed modification's operations. The maximum increase across neighbouring receptors would be:

- Annual average TSP – 0.7 µg/m³;
- 24-hour average PM_{10} – 3.1 µg/m³;
- Annual average PM_{10} – 0.4 µg/m³;
- 24-hour average $PM_{2.5}$ – 0.6 µg/m³;
- Annual average $PM_{2.5}$ – 0.1 µg/m³; and
- Dust deposition – 0.8 g/m^2/month.

The predicted increases in ground level concentrations are considered minor relative to existing air quality and applicable impact assessment criterion. The maximum increase in dust deposition is 0.8 g/m2/month vs a criterion of 2 g/m2/month, however it is reiterated that the dust removal effect of rainfall is not accounted for in the modelling.There are on average 129 rain days in the St Peters region. Consequently, dust deposition predictions should be viewed as conservative.



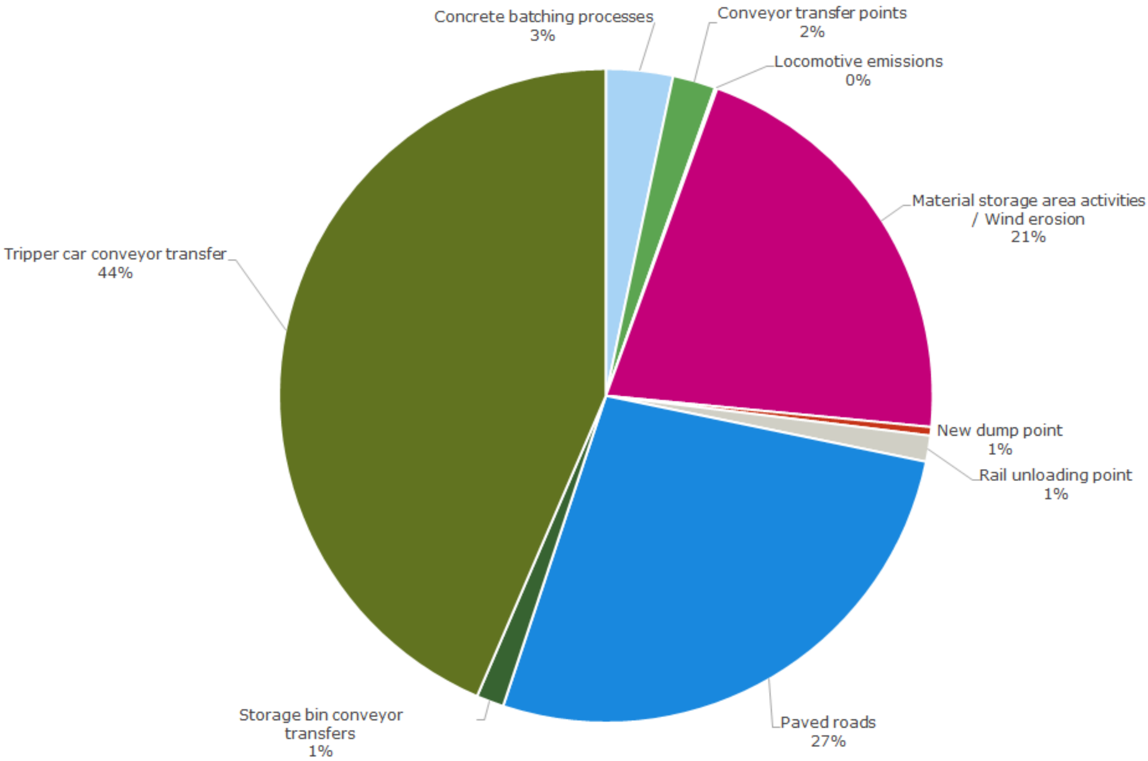
Source: Ramboll 2018

Figure 7.5 Change in predicted impacts – current operations vs proposed modification

ii Source significance analysis

Further analysis of the source contribution to the predicted TSP concentrations and dust deposition levels at receptor R3 from the proposed modification's operations are presented in Figure 7.6 to inform where mitigation measures should be targeted.

It can be seen that key contributing source to TSP/dust deposition impacts from the site are emissions from the new tipper car conveyor transfer at the material storage area. Material handling and wind erosion emissions from the materials storage area and paved road haulage emissions are also notable emission sources.



Source: Ramboll 2018

Figure 7.6 Contribution to predicted TSP/dust deposition impacts – receptor R3 – proposed modification's operations

7.4 Mitigation and management

7.4.1 Mitigation of particulate matter emissions

Predicted dust concentrations and deposition rates are arising from MOD11 operations at the site are below applicable NSW EPA impact assessment criteria at all surrounding receptors, suggesting that the control of these particle size fractions is effective at managing potential particulate matter-related impacts.

7.4.2 Air quality monitoring

Condition 36a of the conditions of consent for Modification 10 for the site included the requirement to monitor dust deposition near receptors R3 and R4 as follows:

> 36a. Prior to any increase in production at the concrete batching plant (as approved under MOD 10 to this consent), an offsite dust deposition monitor shall be established on Burrows Road South in the vicinity of sensitive receptors R3 and R4 (as identified in Figure 6.1 of the Environmental Assessment for MOD10. The location of the monitor shall be approved by the EPA.

Boral have investigated that the installation of a monitoring station at these locations has been investigated and no appropriate location compliant with the NSW EPA Approved Methods for Sampling and Analysis of Air Pollutants in NSW (AS 3580.1.1) could be established.

There are currently five dust monitoring locations on the site which are analysed on a monthly basis for total deposited solids. Boral believes that dust gauges 1, 4 (gravimetric) and 1A (directional) would provide adequate information to determine whether site-based activities are generating dust that would impact nearby sensitive receptors in adjoining properties and along Burrows Road South.

7.5 Conclusion

Emissions of TSP, PM10 and PM2.5 were estimated for peak concrete production operations under MOD11. Atmospheric dispersion modelling predictions of air pollution emissions for proposed operations were undertaken using the AERMOD dispersion model.

The results of the dispersion modelling conducted indicated that the proposed modification was unlikely to result in exceedances of the applicable NSW EPA assessment criteria for TSP, PM10, PM2.5 or dust deposition at any surrounding industrial, commercial or residential receptor.

8 Traffic assessment

8.1 Introduction

A traffic assessment has been prepared by EMM to assess the potential traffic and transport impacts of the proposed modification. In addition to the increase in trucks travelling to and from the concrete plant for concrete despatch, it considers traffic generated by the ongoing site operations (both the concrete plant and materials handling facility), and general background traffic on the surrounding road network. The traffic assessment is presented in Appendix F and the results are summarised in this chapter.

8.2 Existing environment

8.2.1 Site access and surrounding road network

The site's location in relation to the surrounding road networks is shown on Figure 8.1. Access to the site is from Burrows Road South, St Peters. The majority of the site traffic currently travels to and from the site via Canal Road and the Princes Highway. The three road routes which will generally be used by most site traffic are:

- Burrows Road and Burrows Road South – local industrial roads, having two traffic lanes (one in each direction) with parking permitted away from the major intersections;
- Canal Road and Ricketty Street – a significant arterial road route which connects the Princes Highway to Mascot. It is between four to six lanes wide between Kent Road (at Mascot) and the intersection with the Princes Highway (at St Peters), and
- The Princes Highway – a significant arterial road, which is generally at least six lanes wide. The road has peak hourly tidal flow arrangements south and east of the intersection with Canal Road, which change the direction of the central traffic lane on The Princes Highway, south of the intersection, with a corresponding closure of the kerbside lane at times on Canal Road west-bound.

The three intersections which will be used by most of the site traffic, as shown on Figure 8.1, are:

- Canal Road, Ricketty Street, Burrows Road and Burrows Road South;
- Canal Road at the St Peters Container Terminal access (Talbot Street); and
- The Princes Highway, Canal Road and Mary Street.

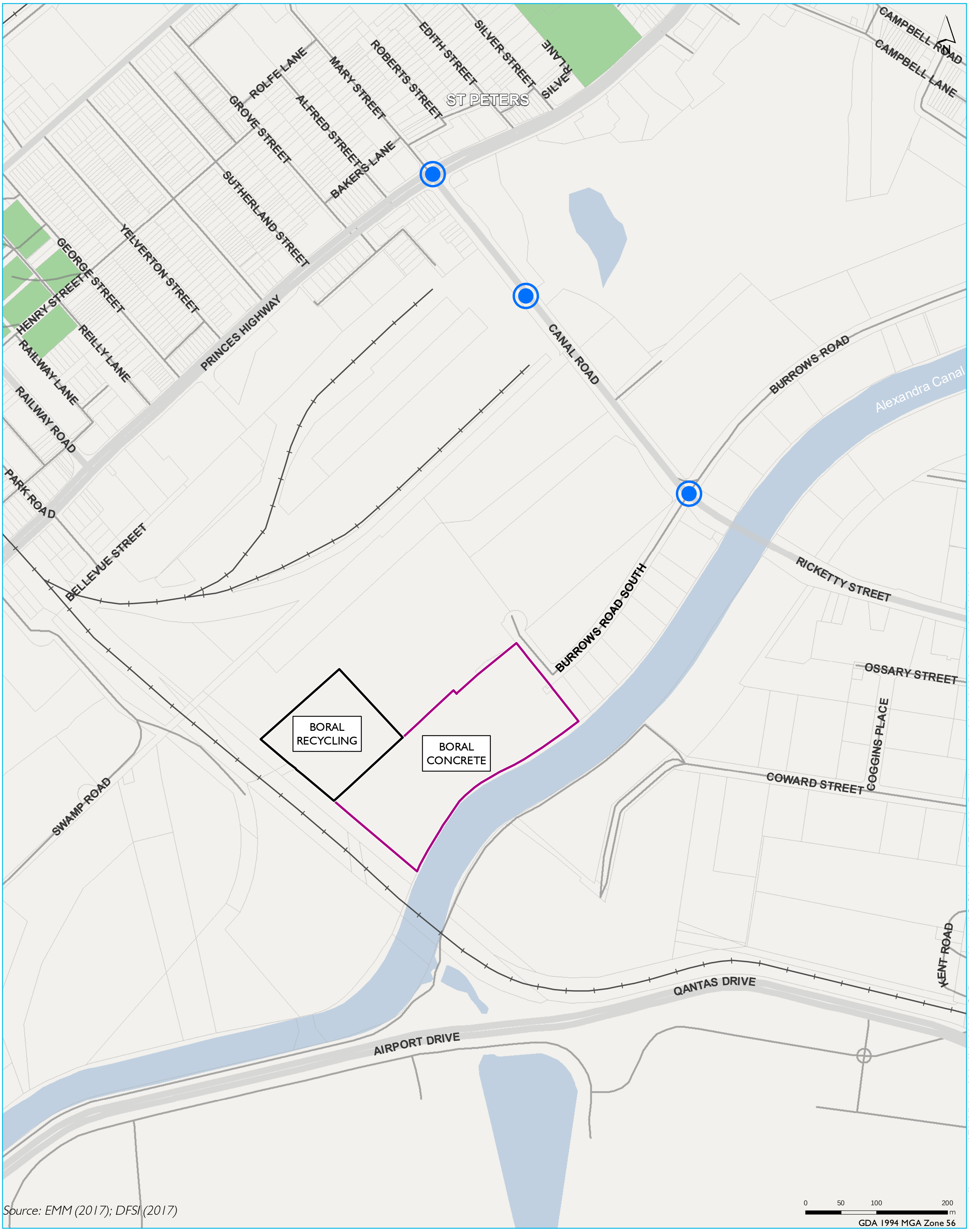
8.2.2 Traffic volumes

The existing hourly traffic volumes for the local road network based on peak hourly traffic surveys at the three main intersections (see Figure 8.1) are summarised in Table 8.1.

Table 8.1 Summary of existing traffic volumes from intersection traffic surveys

Road	Intersection survey location	Morning peak hour volume	Afternoon peak hour volume	Estimated daily traffic*	Average week day heavy vehicles*	% heavy vehicles
Burrows Road South	South of Canal Road	217	210	2,600	840	32.7
Burrows Road	North of Canal Road	489	542	6,200	950	15.4
Ricketty Street	East of Canal Road	2,816	2,891	34,200	1,670	4.9
Canal Road	West of Ricketty Street	2,846	2,915	34,600	2,010	5.8
Canal Road	East of Talbot Street	2,848	2,726	33,400	1,540	4.6
Canal Road	West of Talbot Street	2,851	2,704	33,300	1,400	4.2
Canal Road	East of Princes Highway	2,847	2,691	33,200	1,300	3.9
Talbot Street	South of Canal Road	47	52	600	470	78.4
Princes Highway	South of Canal Road	4,181	4,806	53,900	1,830	3.4
Princes Highway	North of Canal Road	2,055	2,966	30,100	900	3.0
Mary Street	West of Princes Highway	441	464	5,400	0	0.0

Notes: **Average daily traffic is estimated as 12 times the average peak hourly traffic for all roads. Daily heavy vehicle numbers and their % have been extrapolated from the am and pm peak hourly heavy vehicle traffic proportions.*



Source: EMM (2017); DFSI (2017)

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KEY

Site location

Boral Recycling

Intersections potentially affected by site traffic

Main road

Local road

Rail line

Watercourse

Waterbody

Cadastral boundary

Parks and recreation

Road network and intersections near the site

Environmental assessment

Modification 11

Boral St Peters

Figure 8.1

EMM

8.2.3 Intersection performance

The existing morning and afternoon peak hourly traffic operations and the levels of service at the two major road intersections have been determined using the SIDRA intersection traffic model which measures the intersection capacity and performance.

The existing intersection levels of service (LoS) for the morning and afternoon peak hour periods have been measured according to RMS defined ranges (Table 8.2) which range from A (best) to F (worst).

Table 8.2 LoS definitions

Description	LoS	Average vehicle delay (sec)
Very good	A	<14.5
Good	B	14.5 to ≤28.5
Satisfactory	C	28.5 to ≤42.5
Near capacity	D	42.5 to ≤56.5
At capacity	E	56.5 to ≤70.5
Over capacity	F	≥70.5

The SIDRA intersection results for the two peak hours analysed are summarised in Table 8.3.

Table 8.3 Existing SIDRA intersection traffic operations summary

Intersection	Peak hour	Traffic demand flow (vehicles)[1]	Average delay (seconds)	Level of service (LoS)	Degree of saturation	Maximum queue length (m)
Canal Road, Ricketty Street, Burrows Road and Burrows Road south	7.15 to 8.15 am	3,352	94.9	F	1.480	740 (Canal Rd)
	3.00 to 4.00 pm	3,452	132.4	F	1.146	913 (Ricketty St)
Canal Road, Talbot Street (Container Terminal)	7.30 to 8.30 am	3,065	4.4	A	0.606	134 (Canal Rd eastbound)
	5.00 to 6.00 pm	3,161	7.0	A	0.653	224 (Canal Rd westbound)
Princes Highway, Canal Road and Mary Street	7.30 to 8.30 am	5,013	42.5	C	0.931	531 (Princes Highway northbound)
	5.00 to 6.00 pm	5,735	49.6	D	0.916	376 (Princes Highway southbound)

Note 1: The SIDRA intersection program automatically adds 5% to all surveyed intersection traffic volumes as a contingency measure

The peak hour traffic signal operations at two of the three intersections are generally satisfactory. However, the Canal Road/Burrows Road intersection is operating over capacity during both the morning and afternoon peak hours, with average intersection delays of between 95 and 132 seconds per vehicle corresponding to LoS F.

The highest peak hour traffic queues occur in the directions of the main peak hourly traffic flows at each intersection which are:

- on Canal Road in the east bound direction (740 m) during the morning peak and on Ricketty Street in the west bound direction (913 m) in the afternoon commuter traffic peak;
- on Canal Road in the east bound direction (134 m) during morning peak and in the westbound direction (224 m) in the afternoon peak; and
- on the Princes Highway in the northbound direction (531 m) and travelling southbound (376 m) during the morning and afternoon commuter peak traffic periods, respectively.

8.2.4 Existing site traffic and parking

The existing site layout and traffic circulation patterns are outlined in Section 2.5.

Additionally, the site's peak hourly truck traffic movements for the morning and afternoon commuter peak traffic periods are approximately 10% of the total daily truck traffic and there are normally relatively few car traffic movements at the site during these peak hour periods. The site employee shift start and finish times are either earlier or later than the normal commuter peak traffic hours. The heavy vehicle traffic geographic distribution for the site is normally:

- approximately 40% travelling south and west via Canal Road and The Princes Highway, south of Canal Road;
- approximately 35% travelling east via Ricketty Street east of Canal Road; and
- approximately 25% travelling north via Burrows Road north of Canal Road.

There are two existing car parking areas for the site employees and visitors; a car park for the concrete plant in the southern most corner adjacent to the concrete plant with capacity for 40 cars, and a smaller car park for the materials handling facility near the Burrows Road South exit which has capacity for 27 cars.

The two site car parks currently have adequate capacity for the combined site employee and visitor car parking demand for the combined site operations.

8.2.5 Future St Peters locality road traffic changes following Westconnex

There will be significant future road traffic changes predicted from all three stages of the Westconnex project on a number of roads in the Alexandria, St Peters and Mascot areas, with significantly increased road traffic volumes occurring on some routes (Euston Road) and significantly reduced traffic volumes on other routes (Canal Road).

These forecast future traffic changes are outlined further in Appendix F, which show the predicted future daily traffic volumes changes over a large area of the Inner Western Sydney road network, as a result of the Westconnex project. This includes the Canal Road and Ricketty Street route through St Peters and Mascot will be one of the major beneficiaries of the overall Westconnex project.

Along this route there will be a significant future daily traffic reduction of over 10,000 daily vehicle movements, which is forecast to occur immediately following the completion of the Westconnex Stages 1 and 2 projects in 2023 and a further forecast reduction of between 5,000 to 10,000 daily vehicles, which is also forecast to occur following the subsequent completion of the Westconnex Stage 3 project in the years after 2023.

8.3 Impact assessment

8.3.1 Site traffic generation

The concrete plant currently produces up to 280,000 m^3 of concrete per annum. A production increase of 470,000 m^3 is sought, to enable the production of 750,000 m^3 of concrete per annum. The additional concrete production would not result in any additional road transport of bulk sand or aggregate materials to the site.

The daily truck traffic generation for site is compared in Table 8.4 for the existing site operations and the proposed increase in concrete production to 750,000 m^3 per annum. The additional future truck traffic generated by the increase in the materials handling facility throughput is also included in the traffic generation comparison in Table 8.4.

Table 8.4 Current and proposed daily site traffic generation (heavy vehicles)

Type of material	Current quantity	Daily truck loads	Proposed quantity	Daily truck loads
Concrete plant				
Product concrete (despatched by agitator trucks)	280,000 m^3pa (700,000 tpa)	200 average (250 maximum)	750,000 m^3pa (1,875,000 tpa)	500 average (625 maximum)
Cement/flyash tanker deliveries	130,000 tpa	9 average (15 maximum)	277,500 tpa	23 average (38 maximum)
Liquid admixtures	441,000 Lpa	0.2 average (1 maximum)	1,500,000 Lpa	0.75 average (4 maximum)
Materials handling facility				
Bulk construction materials (total quantity received, excluding materials for concrete production)	759,000 tpa	70 average (110 maximum)	1,000,000 tpa	92 average (145 maximum)
Total daily truck loads		**279.2 average (376 maximum)**		**615.75 average (812 maximum)**

Notes: Site traffic information provided by Boral 28 May 2018

Table 8.4 indicates that the proposed increase in the concrete plant production and bulk materials throughput will result in an approximate 336 increase in the overall site daily truck movements on an average day.

In comparison to the existing site daily truck loads moved on an average production day (which is 279 deliveries), there would be approximately 336 additional daily truck deliveries (672 additional truck movements) on a future average production day and 533 additional daily truck deliveries (1,066 additional truck movements) on a future maximum production day.

i Haulage routes

The additional site daily truck traffic movements would all use the primary haulage route which is via Burrows Road South, north of the site, continuing to Canal Road, from where this traffic may either travel to and from the west via Canal Road and the Princes Highway (40%), or north via Burrows Road (25%) or east via Ricketty Street (35%). Trucks from the site would not use Mary Street, west of the Princes Highway due to the load limit restrictions on this route.

ii Site car and truck parking

On-site parking will continue to be provided for the site based agitator truck fleet, site employees and occasional site visitors. The current car parking provision at the site (67 parking spaces) is more than adequate for the existing site demand. A further 12 car spaces are proposed for the area just to the east of the existing concrete plant operations car park; and a further 7 spaces are proposed for the area adjacent to Gate 1 to supplement the existing materials handling facility parking facilities, resulting in a total of 19 additional car parking spaces to accommodate any future growth in the site employee or visitor car parking demand.

The concrete agitator truck fleet is normally parked at the site during non-operational hours, where up to 40 trucks are parked each evening and night. With the proposed modification, up to 20 additional concrete agitator trucks would also be based at the site, resulting in a future total of up 60 concrete agitator trucks requiring parking at the site (or at the nearby truck marshalling area) during non-operational hours.

The planning approval requirements for new industrial developments in NSW normally require that all car and truck parking is accommodated on the actual site, or at nearby identified areas, which will be the case for this project.

iii Predicted traffic generation and distribution

In practice, approximately 10% of the additional site daily truck traffic increases are likely to occur during the normal morning commuter traffic peak hour (7.15 to 8.15 am) and the afternoon commuter traffic peak hour (3.00 to 4.00 pm) on the public roads in the Burrows Road locality of St Peters.

There would therefore be up to 34 additional trucks per hour travelling outbound from the site and 34 additional trucks per hour travelling inbound to the site during the during the morning and afternoon peak hours, on a future average production day and up to 53 additional trucks per hour travelling outbound from the site and 53 additional trucks per hour travelling inbound to the site during the same peak hours, on a future maximum production day.

There would however, be generally no change in the site employee or visitor car traffic during these traffic peak hours.

The installation and construction phase of the proposed modification will generate significantly lower daily heavy vehicle movements to and from the site during construction than during the subsequent site operations. The site construction stage traffic impacts will therefore be much lower and can be disregarded in terms of comparison between the relative site traffic impacts during the future operations phase.

8.4 External traffic impact at intersections

Road network impacts of the additional traffic associated with the increased concrete plant production and materials handling facility throughput under the proposed modification have been assessed for the future average daily production at the following three intersections:

- Canal Road, Ricketty Street, Burrows Road and Burrows Road South;
- Canal Road/Talbot Street (the Container Terminal Access); and
- Princes Highway, Canal Road and Mary Street.

The future traffic impacts have been assessed for the morning and afternoon peak hour traffic periods for the surrounding commuter traffic. A summary of the results for each intersection is provided in Table 8.5, Table 8.6 and Table 8.7.

Table 8.5 Future traffic operations at the Canal Road/Ricketty Street/ Burrows Road and Burrows Road South intersection

Situation	Peak hour	Traffic demand flow (vehicles)[1]	Average delay (seconds)	Level of service (LoS)	Degree of saturation	Maximum queue length (m)
Existing	7.15 to 8.15 am	3,352	94.9	F	1.480	740 (Canal Rd)
	3.00 to 4.00 pm	3,452	132.4	F	1.146	913 (Ricketty St)
Future	7.15 to 8.15 am	3,423	151.8	F	1.923	968 (Canal Rd)
	3.00 to 4.00 pm	3,523	216.8	F	1.324	1,177 (Ricketty St)

Note 1: The SIDRA intersection program automatically adds 5% to all surveyed intersection traffic volumes as a contingency measure

Table 8.6 Future traffic operations at the Canal Road/Container Terminal access intersection

Situation	Peak hour	Traffic demand flow (vehicles)[1]	Average delay (seconds)	Level of service (LoS)	Degree of saturation	Maximum queue length (m)
Existing	7.30 to 8.30 am	3,065	4.4	A	0.606	134 (Canal Rd e'bound)
	5.00 to 6.00 pm	3,161	7.0	A	0.653	224 (Canal Rd w'bound)
Future	7.30 to 8.30 am	3,095	4.4	A	0.613	137 (Canal Rd e'bound)
	5.00 to 6.00 pm	3,191	7.0	A	0.661	230 (Canal Rd w'bound)

Note 1: The SIDRA intersection program automatically adds 5% to all surveyed intersection traffic volumes as a contingency measure

Table 8.7 Future traffic operations at Princes Highway/Canal Road/Mary Street intersection

Situation	Peak hour	Traffic demand flow (vehicles)[1]	Average delay (seconds)	Level of service (LoS)	Degree of saturation	Maximum queue length (m)
Existing	7.30 to 8.30 am	5,013	42.5	C	0.931	531 (Princes Highway northbound)
	5.00 to 6.00 pm	5,735	49.6	D	0.916	376 (Princes Highway southbound)
Future	7.30 to 8.30 am	5,042	45.6	D	0.949	572 (Princes Highway northbound)
	5.00 to 6.00 pm	5,764	52.6	D	0.929	400 (Princes Highway southbound)

Note 1: The SIDRA intersection program automatically adds 5% to all surveyed intersection traffic volumes as a contingency measure

At the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection, the level of service category will remain at F for both the morning and afternoon peak hours assessed, with the average intersection traffic delay increasing by 56.9 seconds to 152 seconds during the morning peak hour, and increasing by 84.4 seconds to 217 seconds during the afternoon peak hour. The maximum morning peak hour traffic queue length, on the Canal Road approach will increase from 740 to 968 m and the maximum afternoon peak hour traffic queue length on the Ricketty Street approach will increase from 913 to 1,177 m.

At the Canal Road, Talbot Street intersection, there will be no change in the level of service for either the morning or afternoon peak hours assessed, with all remaining at LoS A. Furthermore, there will be no change in the average intersection traffic delay during either the morning or the afternoon peak hours. There will be negligible (3-6 m) increases in the maximum intersection traffic queue lengths during both the morning and afternoon peak hours.

At the Princes Highway, Canal Road and Mary Street intersection, there will be a lower level of service for the morning peak hour (from LoS C to D). The afternoon peak hour level of service will remain at LoS D. The average intersection traffic delays will increase marginally (by approximately 3 seconds) during both the morning peak hour and the afternoon peak hour. The maximum morning traffic queue length, on the Princes Highway northbound approach will increase from 531 to 572 m. The maximum afternoon traffic queue length, on the Princes Highway southbound approach will increase from 376 to 400 m.

In the shorter term future, the additional site traffic will increase both the morning and afternoon peak hourly traffic delays at the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection. However, the intersection is already operating at Level of Service F during both these peak hours.

In the longer term future after the year 2023, the Westconnex project, as described above, will have a significant overall future traffic reduction effect on the Canal Road – Ricketty Street route, including this intersection, significantly reducing the current through traffic by at least 10,000 daily vehicle movements, which will more than compensate for the additional localised traffic increases from the Boral site at the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection.

Even though the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection is operating with congested peak hour traffic conditions currently, there will be only limited future benefit at this location from implementing any additional intersection capacity improvements in the short term, as the increased traffic capacity will not be required after the Westconnex project is completed.

At the other two intersections assessed (at Canal Road, Talbot Street and at the Princes Highway, Canal Road and Mary Street) the existing traffic delays will be only marginally affected by the additional proposed project traffic.

8.5 External traffic impacts on local roads

The proposed modification would generate the following additional daily truck traffic movements at the site:

- on an average production day, an additional 336 daily truck loads (672 daily truck movements); and
- on a maximum production day, an additional 533 daily truck loads (1,066 daily truck movements).

There would also be approximately 50 additional daily car or other light vehicle traffic movements associated with the proposed concrete plant production increase and materials handling facility throughput on all future production days.

The effect of these daily traffic increases on a maximum production day, for the additional daily truck traffic movements distributed via Burrows Road South, Canal Road, Burrows Road, Ricketty Street and the other surrounding roads is presented in Table 8.8 in relation to the existing locality traffic volumes which were determined from the intersection traffic surveys in August 2016 and December 2017. The percentage daily traffic increases to each route, for a maximum production day at the future concrete plant facility, are also calculated in Table 8.8.

Table 8.8 Effect of the additional generated daily truck movements on the road network

Road	Survey location	Existing average weekday traffic*	Existing average weekday heavy vehicles*	Additional future Boral site generated daily traffic movements (on a maximum production day)	% Daily traffic increase
Burrows Road South	South of Canal Road	2,600	800	1,116	42.9
Canal Road	West of Ricketty Street	34,600	2,000	451	1.3
Ricketty Street	East of Canal Road	34,200	1,670	385	1.1
Burrows Road	North of Canal Road	6,200	1,000	280	4.5
Canal Road	East of Talbot Street	33,400	1500	451	1.4
Talbot Street	South of Canal Road	600	500	0	0
Canal Road	West of Talbot Street	33,300	1,400	451	1.4
Canal Road	East of Princes Highway	33,200	1,300	451	1.4
Princes Highway	South of Canal Road	53,900	1,800	225	0.4
Princes Highway	North of Canal Road	30,100	900	225	0.7
Mary Street	West of Princes Highway	5,400	0	0	0

*Notes: *Existing daily vehicle numbers have been determined from the am and pm peak period heavy vehicle traffic proportions.*

The additional generated daily truck traffic movements are proportionately greatest on the section of Burrows Road South between the site entry and exit driveways, and the intersection where Canal Road meets Ricketty Street, Burrows Road and Burrows Road South.

The future concrete plant site-generated daily traffic increases on this section of Burrows Road South would increase traffic by approximately 43%. However, this section of Burrows Road South has a relatively high proportion of truck traffic (approximately 33% of all traffic currently) and the traffic flow impacts of the additional site concrete plant production and related truck traffic, while significant, would not be out of character on this route.

On the range of other traffic routes which are considered in Table 8.8, the project generated proportional daily traffic increases would be far less, and not significant (between 0.4% and 4.5% typically) on any of the other routes considered and should not have any significant impact on the existing traffic flow conditions on any of these routes.

8.6 Provision of car and truck parking

The current total provision of the site car parking (67 spaces) is more than adequate for the parking demand currently from the site employees and visitor traffic. An additional 19 car spaces are proposed for the proposed modification which will be to accommodate any future growth in the site employee or visitor car parking demand.

All the site car parking space dimensions and surfacing has been designed to comply with the requirements of the Australian Standard AS 2890.1.

The concrete agitator truck fleet is normally parked at the site during non-operational hours, with up to 40 trucks parked each evening and night. With the proposed modification, up to 20 additional concrete agitator trucks would also be based at the site, resulting in a future total of up 60 concrete agitator trucks requiring parking. In the future these additional agitator trucks would be parked at the site or at the nearby proposed truck marshalling area during non-operational hours (currently subject to approval from Sydney Airports).

8.7 Safety and traffic management

The future potential road safety related traffic impacts from the proposed modification have primarily been considered for Burrows Road South between the site and the intersection of Canal Road, Ricketty Street, Burrows Road and Burrows Road South.

The two existing site access driveways are well constructed with heavy duty concrete pavements, and have adequate width to accommodate all the proposed turning traffic movements by large trucks. The two driveways have good visibility of the approaching traffic in both directions on Burrows Road South and the proposed additional truck traffic movements would have minimal effects on the traffic safety at these driveways.

At the intersection of Canal Road, Ricketty Street, Burrows Road and Burrows Road South, the existing intersection visibility for left and right turning traffic from Burrows Road South is relatively good, as both Burrows Road and Burrows Road South are straight and level at the intersection.

The left and right truck turning movements from the two major roads at the intersection (ie Canal Road and Ricketty Street) are controlled by the traffic signal phasing which has right turning arrows.

No additional traffic safety improvements will be required at the intersection to accommodate the proposed additional concrete plant truck traffic movements.

8.8 Conclusion

In comparison to the existing average site daily truck loads (279 deliveries), there would be approximately 336 additional daily truck deliveries (672 additional truck movements) on a future average production day and 533 additional daily truck deliveries (1,066 additional truck movements) on a future maximum production day.

During the morning and afternoon commuter traffic peaks hours, there would be up to 34 additional trucks per hour travelling outbound from the site and 34 additional trucks per hour travelling inbound to the site on a future average production day and up to 53 additional trucks per hour travelling outbound from the site and 53 additional trucks per hour travelling inbound to the site during the same peak hours, on a future maximum production day.

The additional site daily truck traffic movements would all use the primary haulage route which is via Burrows Road South, north of the site, continuing to Canal Road, from where this traffic may either travel:

- to and from the west via Canal Road and The Princes Highway (40%);
- north via Burrows Road (25%); or
- east via Ricketty Street (35%). Trucks from the site would not use Mary Street, west of the Princes Highway due to the load limit restrictions on this route.

Road network impacts of the additional traffic associated with the proposed modification have been assessed for the future average daily production at the following three intersections:

- Canal Road, Ricketty Street, Burrows Road and Burrows Road South;
- Canal Road/Talbot Street (the Container Terminal Access); and
- Princes Highway, Canal Road and Mary Street.

At the Canal Road, Talbot Street and at the Princes Highway, Canal Road and Mary Street intersections, the existing traffic delays will be only marginally affected by the additional proposed project traffic.

At the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection, the level of service category will remain at F for both the morning and afternoon peak hours assessed. Even though this intersection is currently operating with congested peak hour traffic conditions, there would be limited benefit of implementing any additional intersection capacity improvements in the short term, as the increased traffic capacity will not be required due to the longer term future forecast local area traffic reductions on the Canal Road - Ricketty Street route after the Westconnex project is completed.

For the maximum forecast future daily production, the proposed modification is expected to generate daily traffic increases on Burrows Road South of approximately 43%. However, as this section of Burrows Road South has a relatively high proportion of truck traffic currently, the future traffic flow impacts of the proposed modification would be acceptable on this route.

On the range of other traffic routes in the St Peters locality, the proportional project generated daily traffic increases would not be significant (between 0.4% and 4.5% typically) on any of the other routes considered and would not have any significant impact on the existing traffic flow conditions on any of these routes.

The future potential road safety related traffic impacts from the proposed modification have been reviewed and no additional traffic safety improvements will be required at the intersection to accommodate the proposed additional concrete plant site generated truck traffic movements.

The current and future proposed on site car and truck parking areas and the site's accessibility for walking, cycling and public transport users have also been reviewed in this assessment and found to be satisfactory for the anticipated levels of car and truck parking usage and/or travel by non car-based travel modes.

9 Surface water

A surface water assessment has been prepared by EMM to review the existing surface water environment at the site, describe the proposed water management system (including the supporting water balance and water quality modelling) and address water licensing requirements.

The surface water assessment is presented in Appendix G and the results are summarised in this chapter.

9.1 Surface water assessment framework and criteria

This surface water assessment has been prepared in accordance with the SEARs that were issued on 21 December 2017, as well as relevant agency assessment requirements, guidelines and polices summarised in this section.

Appendix G provides further details on relevant assessment requirements, guidelines, plans and policies that have been considered in this assessment.

9.1.1 Relevant plans and guidelines

All water plans and statutory provisions are outlined in Section 4.3.

Additionally, there are a number of guidance documents for water resource management and assessment in NSW. The following policies, plans and guidelines have been considered in this assessment.

i Botany Bay & Catchment Water Quality Improvement Plan

The Botany Bay & Catchment Water Quality Improvement Plan was developed by the Sydney Metropolitan Catchment Management Authority. The main objective of the plan is to set pollutant load reduction targets for contributing catchment areas to Botany Bay. Table 8 from the plan recommends the following pollutant load reduction targets are applied to large redevelopments:

- 85% reduction in the post development mean annual load of Total Suspended Solids (TSS);
- 60% reduction in the post development mean annual load of Total Phosphorous (TP); and
- 45% reduction in the post development mean annual load of Total Nitrogen (TN).

ii Alexandra Canal Flood Study

The Alexandra Canal Flood Study was prepared by WMAwater on behalf of Council. The study was adopted by Council in 2017 and provides information on flooding at the site. Section 9.2.3 describes existing flood characteristics at the site, referencing information from this flood study.

9.2 Existing environment

9.2.1 Rainfall data

There are a number of Bureau of Meteorology (BoM) operated rainfall gauges that provide representative records for the St Peters area.

Appendix G presents key information and statistical data from three local gauges that have long term records from Sydney Airport AMO (66037), Ashfield Bowling Club (66000) and Randwick Racecourse (66073).

The rainfall statistics from the Sydney Airport AMO and Ashfield Bowling Club gauges correlate well, while statistics from the Randwick gauge indicate that that the Randwick area receives generally higher rainfall than the Sydney Airport and Ashfield areas.

The Sydney Airport AMO gauge is the closest to the site and is representative of site conditions. Figure 9.1 plots the 10th, 50th and 90th percentile monthly rainfall totals that have been calculated from the Sydney Airport AMO gauge record. The chart clearly demonstrates the high variability in monthly rainfall across all seasons.

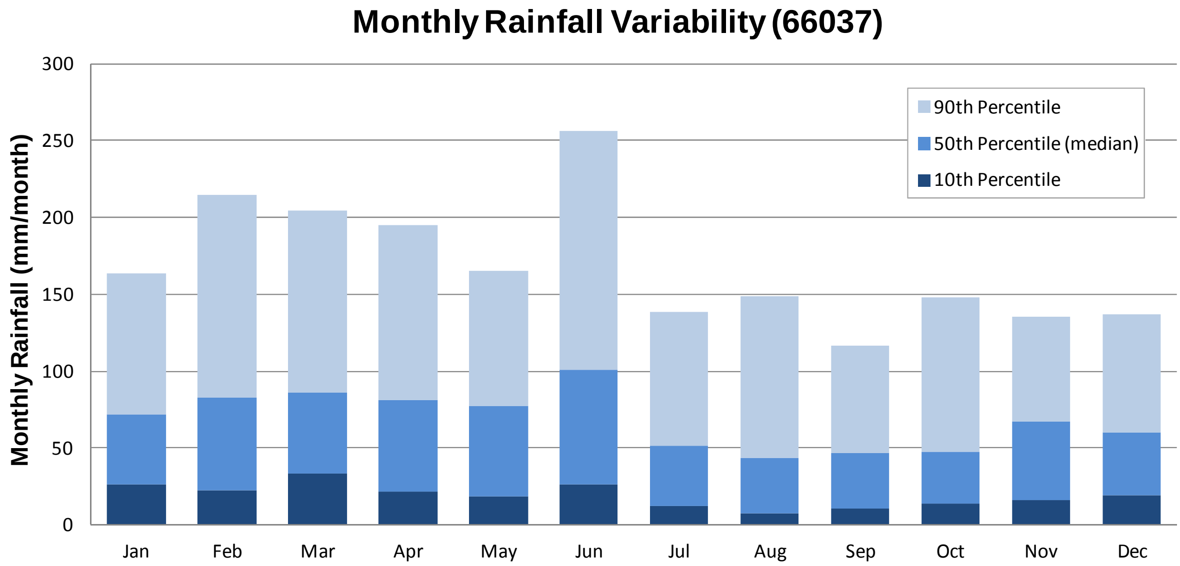


Figure 9.1 Monthly rainfall statistics at Sydney Airport AMO – 66037 (Source: BoM)

9.2.2 External drainage

i Alexandra Canal

Alexandra Canal is located to the south of the site and is a concrete lined channel that receives tidal flows as well as surface runoff. The contributing catchment has an area of approximately 1,565 ha which includes the suburbs of Alexandria, Rosebery, Erskineville, Beaconsfield, Zetland, Waterloo, Redfern, Newtown, Surry Hills and Moore Park (WMA, 2017). The catchment is characterised by predominantly high density urban and industrial land uses. The canal joins the Cooks River approximately 1.8 km to the west of the site. Cooks River flows into Botany Bay.

All runoff from the site drains either directly into the canal or into piped drainage systems that drain into the canal. Hence, the Alexandra Canal is the primary receiving water.

Photograph 9.1 shows the Alexandra Canal, looking downstream.

Photograph 9.1 Alexandra Canal (looking downstream)

ii Burrows road drainage

Burrows Road is located to the east of the site. Information provided by a Dial before you Dig inquiry indicates that Burrows Road drains into the Alexandra Canal via a piped drainage system.

iii Other drainage

A large culvert is located under the south-western portion of the site. The culvert receives runoff from the industrial area that is located to the north of the site. Survey commissioned by Boral indicates that this culvert has a diameter of 1300 mm.

9.2.3 Flooding

The Alexandra Canal Flood Study (WMAwater, 2017) was adopted by Inner West Council in 2017. Council provided the flood model and results to EMM for use in this assessment. Model results indicate that the Alexandra Canal, Burrows Road and low lying land to the north of the site are prone to flooding in the 1% Annual Exceedance Probability (AEP) and lower magnitude events. Table 9.1 presents peak flood levels in these areas that were extracted from the model results files that were provided by Inner West Council.

Table 9.1 Peak flood levels on land adjoining the site

	Flood Level (m AHD)[1]		
	Alexandra Canal	**Area to the north of the site**	**Burrows Road**
20% AEP	1.68	2.22	2.51
5% AEP	1.93	2.34	2.56
1% AEP	2.02	2.46	2.59
PMF	3.27	3.42	3.43

Notes: 1.Peak flood levels were extracted from model results provided by Council at locations adjacent to the site.

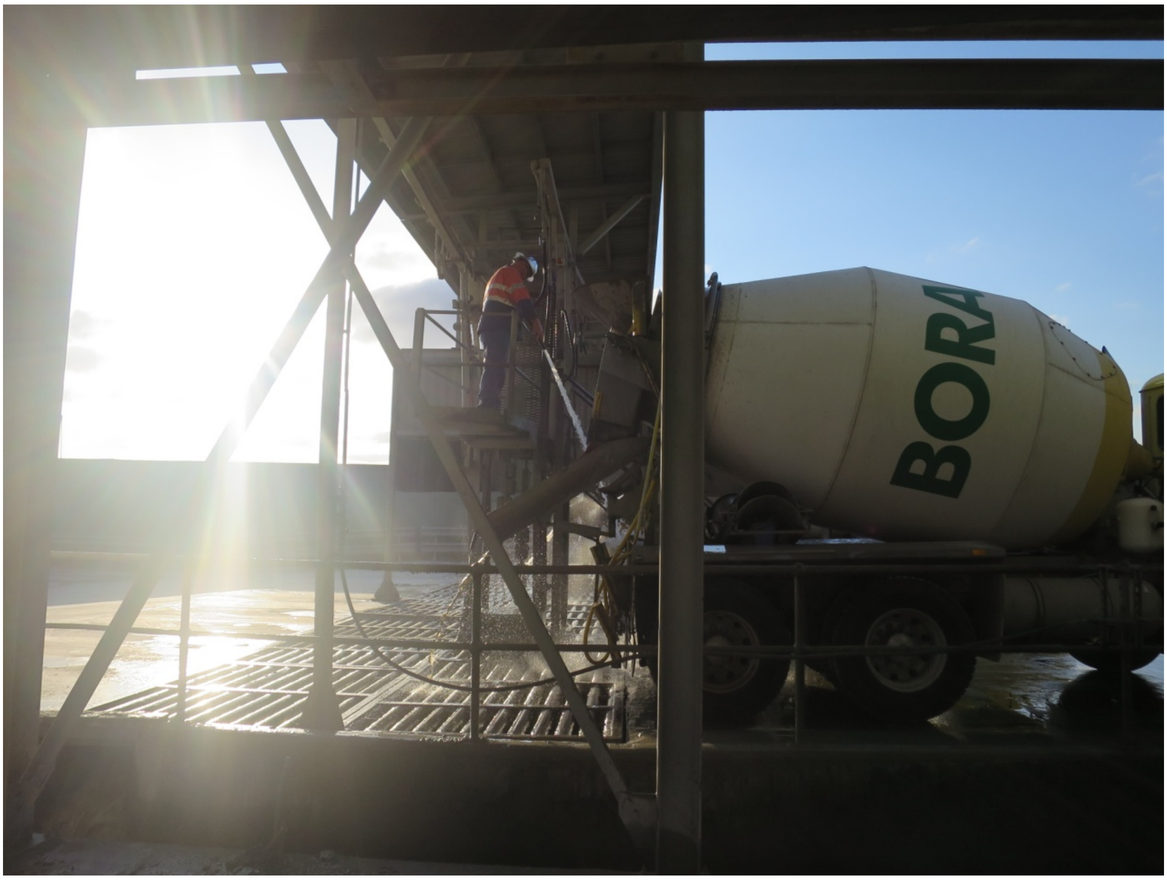
A topographic survey of the existing site is provided in Appendix G. The majority of the site is established above 2.7 m AHD, with the only exception being the northern and southern driveways that have levels between 2.3 and 2.4 m AHD at the interface with Burrows Road. With reference to Table 9.1, the 1% AEP flood levels on land adjacent to the site range from 2.02 to 2.59 m AHD. Hence, the site (except for the entrance driveways) is not prone to flooding during 1% AEP and lower magnitude flood events.

Model results indicate that the site is prone to flooding during a Probable Maximum Flood (PMF) event. With reference to Table 9.1, PMF levels are approximately 3.4 m AHD, indicating that flood depths of up to 0.7 m would occur within low lying portions of the site. Flood hazard maps provided in the Alexandra Canal Flood Study (WMAwater, 2017) identify the majority of the site as having low hydraulic hazard during PMF conditions.

9.2.4 Existing process water system

The process water system receives all concrete washout water and any other water produced from cementitious areas. The system is bunded to prevent stormwater ingress and comprises a number of continuously stirred tanks that hold process water prior to use. Photograph 9.2 shows a concrete agitator being washed out at the slump stand and Photograph 9.3 shows the continuously stirred tanks.

The system supplies water to the wash out facility and the concrete plant for concrete production and wash out. The system requires constant top-up. Top-up water is preferentially sourced from two first flush pits (when water is available) and then from mains water.



Photograph 9.2 Washout water entering the process water system at the slump stands.

Photograph 9.3 Continuously stirred process water tanks

9.2.5 Existing stormwater system

Figure 9.2 shows existing catchment areas, first flush pits, piped drainage systems and offsite discharge locations. Table 9.2 provides additional information on the drainage functionality and water management controls in each catchment.

Source: EMM (2018); DFSI (2017)

Existing water management system

Modification 11
Boral St Peters
Figure 9.2

EMM

Table 9.2 Description of existing water management system

Catchment	Area	Current Use	Stormwater system
EC1	0.37 ha	• Truck parking • Aggregate storage bins	• Aggregate storage bins are covered to prevent rainfall ingress. • The catchment drains to a first flush pit which has a volume of 62KL, equivalent to 17mm of runoff from the contributing catchment area. Captured water is used for concrete production. • Bypass flow is discharged offsite into an external drainage system.
EC2	0.48 ha	• Cement silos and batching plant • Slump stands • Concrete washout pits • Aggregate storage bins • Water management system	• Slump stands are partially covered to prevent rainfall ingress. • Concrete washout pits are covered to prevent rainfall ingress. • The catchment drains to a first flush storage which has a volume of 74KL, equivalent to 15mm of runoff from the contributing catchment area. Captured water is used for concrete production. • Bypass flow is discharged into the Alexandra Canal via a piped drainage system.
EC3	0.28 ha	• Aggregate and sand stockpiles • Access roads	• Runoff from the aggregate and sand stockpiles seeps through the barrier wall. • All runoff from the catchment discharges to external drainage on Burrows Road as either piped or overland flows. No water quality treatment is provided.
EC4	0.37 ha	• Aggregate and sand stockpiles • Access roads	• Runoff from the aggregate and sand stockpiles seeps through the barrier wall. • All runoff from the catchment discharges to drainage on Burrows Road as overland flows. No water quality treatment is provided.
EC5	0.12 ha	• Access roads	• All runoff from the catchment discharges into the Alexandra Canal via a piped drainage system. No water quality treatment is provided.
EC6	0.39 ha	• Access roads • Staff parking	• All runoff from the catchment discharges into the Alexandra Canal via a piped drainage system. No water quality treatment is provided.
EC7	0.09 ha	• Secondary return concrete area	• Runoff from this catchment is retained behind a bund (indicated in Appendix G). Captured water is pumped into the process water system and is used for concrete production.
EC8	1.22 ha	• Aggregate and sand stockpiles • Truck standing area	• The majority of runoff from the catchment discharges into the Alexandra Canal via a piped drainage system. During and following intense rainfall, some overland flows may spill into the property to the north. No water quality treatment is provided.
EC9	0.13 ha	• Administration buildings • Staff parking	• Runoff from this catchment drains to a sump which is pumped into the process water system for use in concrete production.
EC10	0.46 ha	• Rail sidings	• All stormwater is expected to infiltrate into the underlying Botany Sands aquifer.

9.3 Proposed water management system

The proposed modification seeks to upgrade the existing water management system to achieve the following objectives:

- improve the management of runoff from cementitious areas of the site;
- improve the management of return concrete;
- improve site drainage to prevent the discharge of untreated stormwater from the site during frequently occurring rainfall events;
- provide water quality treatment of all site runoff to meet the pollutant load reductions recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011); and
- increase stormwater harvesting to reduce stormwater discharge and potable water consumption.

Key changes include:

- **Drainage modifications** – including:
  - the aggregate storage and handling area will be regraded to prevent runoff from this area draining to the west and onto Burrows Road; and
  - additional stormwater drainage will be constructed to improve stormwater capture and prevent the discharge of untreated stormwater flows from the site during frequently occurring rainfall events.
- **Water quality control modifications** – including:
  - cementitious areas will be covered and bunded (where possible) to isolate them from the stormwater system;
  - the secondary return concrete area will be decommissioned and replaced with a reclaim facility;
  - sedimentation basins will be established to treat runoff from the aggregate storage and handling area; and
  - bioretention systems will be established to treat runoff from access roads and car parking areas.
- **Stormwater harvesting modifications** – including:
  - the existing stormwater harvesting system will be expanded to capture runoff from 72% of the site area;
  - the large steel tank that is located in the southern corner of the site will be modified to provide 500 KL of storage; and

- collectively, the stormwater harvesting system will provide 1,106 KL of storage, equivalent to 53 mm of runoff from the harvesting area. The storage volume will provide water for 3 to 4 days of concrete production.

9.3.1 Water management plan

The functionality of the proposed water management system is diagrammatically described in Figure 9.3. Figure 9.4 presents a Water Management Plan (WMP) which locates the proposed surface water infrastructure and Table 9.3 provides information on the proposed use and water management controls in each catchment that is indicated in Figure 9.4.

Key aspects of the WMP are discussed further in Appendix G.

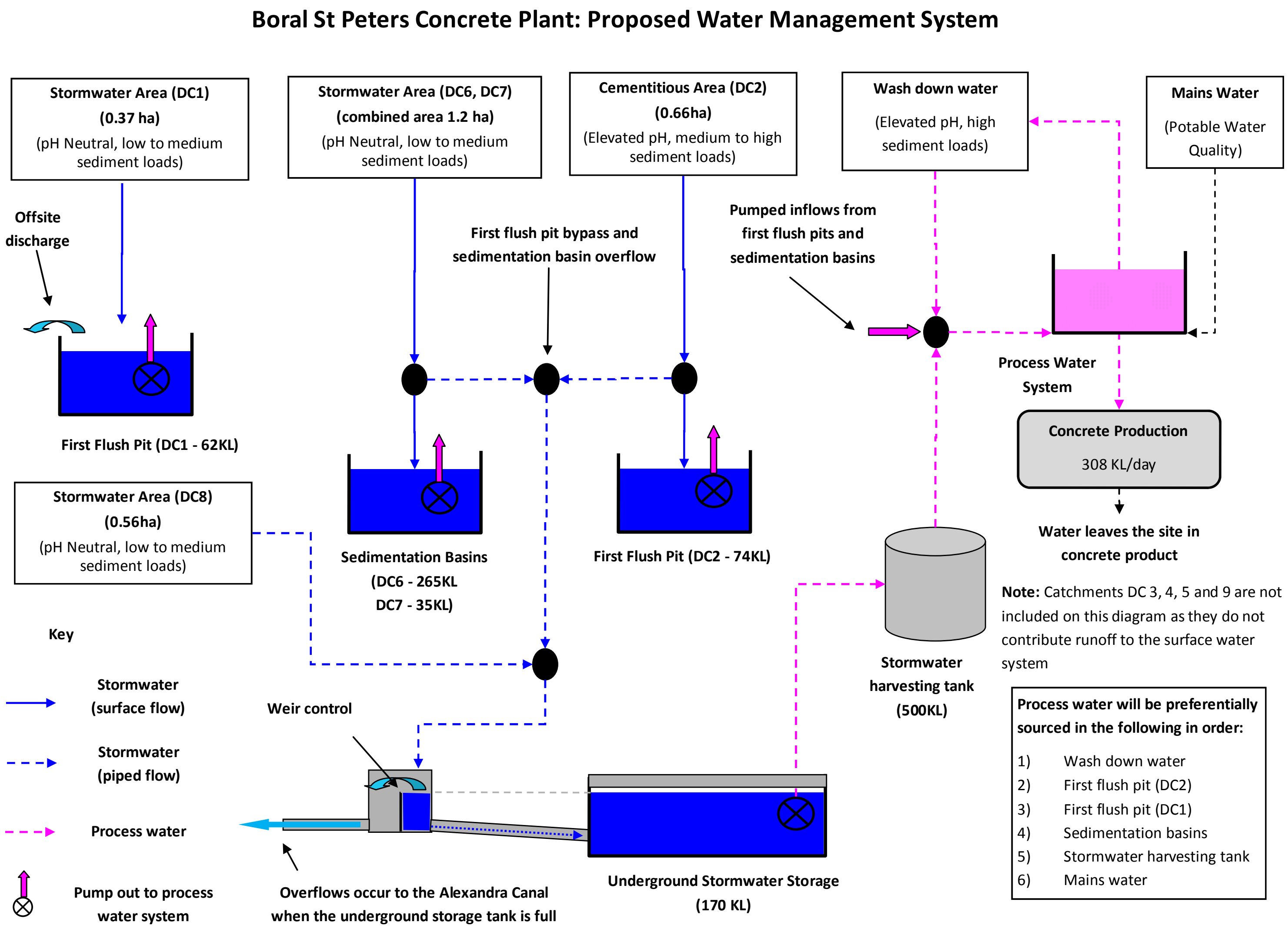


Figure 9.3 Proposed water management system functionality

\\emmsvr1\EMM\Jobs\2016\J16208 - St Peters Mod 11\GIS\02_Maps\EIS_009_WaterManagementSystemPlan_20180625_06.mxd 28/06/2018

Source: EMM (2018); DFSI (2017)

Proposed water management system

Modification 11
Boral St Peters
Figure 9.4

EMM

Table 9.3 Proposed changes to catchment areas and the stormwater system

Catchment	Area	Proposed use	Proposed changes
DC1	0.37 ha	• Truck parking • Aggregate storage bins	The existing stormwater management system will be maintained and includes the following controls: • Aggregate storage bins are covered to prevent rainfall ingress. • The catchment will continue to drain the existing first flush pit which has a volume of 62KL. Captured water will be used for concrete production. • Bypass flow is discharged offsite (the discharge location is indicated in Appendix G).
DC2	0.66 ha	• Cement silos and batching plant (increased footprint) • Slump stands (increased footprint) • Concrete washout and reclaim facility • Aggregate conveyors • Process water system	• The catchment area is expected to increase from 0.48 to 0.66ha due to site regrading. • Slump stands will be fully covered to prevent rainfall ingress. • Concrete washout and reclaim area will be fully covered to prevent rainfall ingress. • Where possible, all runoff from roofed areas will drain directly into the piped drainage to reduce clean water inflows into the first flush pit. • The catchment will continue to drain to the existing first flush pit which has a volume of 74KL. Captured water will be used for concrete production. • Bypass flow will drain to the underground stormwater storage that will be dewatered via pumping to the stormwater harvesting tank.
DC3	0.09 ha	• Access roads	• Regrading the aggregate storage area will reduce the catchment area from 0.28ha to 0.09ha. • All runoff from this catchment will be treated in a bio-retention area. Treated runoff will be discharged into the existing drainage on Burrows Road.
DC4	0.12ha	• Access roads	• All runoff from this catchment will be treated in a bio-retention system. • Treated runoff will be discharged into the Alexandra Canal via a piped drainage system.
DC5	0.39 ha	• Access roads • Staff parking	• All runoff from this catchment will be treated in a bio-retention system. • Treated runoff will be discharged into the Alexandra Canal via a piped drainage system.
DC6	1.06 ha	• Aggregate storage and handling	• The aggregate storage and handling area will be regraded to drain to a sedimentation basin that will be located in the south-eastern portion of the catchment. All drainage will be via surface drains. • The surface drains will drain into a sediment wedge pit that will overflow into a sedimentation basin. • All basin overflows will drain to the underground stormwater storage that will be dewatered via pumping to the stormwater harvesting tank.
DC7	0.14 ha	• Access roads	• All runoff from this catchment will drain into a sedimentation basin. • All basin overflows will drain to the underground stormwater storage that will be dewatered via pumping to the stormwater harvesting tank.

Table 9.3 Proposed changes to catchment areas and the stormwater system

Catchment	Area	Proposed use	Proposed changes
DC8	0.56 ha	• Access roads • Administration buildings • Staff parking	• A new piped stormwater drainage system will be constructed in south-eastern portion of the site. This drainage system will capture runoff this portion of the site that currently flows onto Burrows Road as overland flow. • The piped drainage system will drain the underground stormwater storage that will be dewatered via pumping to the stormwater harvesting tank.
DC9	0.46 ha	• Rail sidings	• All stormwater from the rail siding is expected to infiltrate into the underlying Botany Sands aquifer.

9.3.2 Drainage modifications

The drainage system will be modified to improve general site drainage and prevent the discharge of untreated stormwater from the site during frequently occurring rainfall events. The proposed modifications are described further in Appendix G.

9.3.3 Stormwater basins

The proposed water management system will include the following stormwater basins:

- The existing first flush pits located in catchments DC 1 and DC 2 will be maintained. These first flush pits are configured to capture initial runoff. Once full, all additional runoff bypasses the pit.

- Sedimentation basins will be constructed in catchments DC6 and DC7. The sedimentation basins will receive all runoff from the catchment and will overflow into the piped drainage system.

- The underground stormwater storage will be located in catchment DC8. The functionality of this storage is described in Section 1.1.1.

The volumes of the sedimentation basins and underground stormwater storage have been established using water quality modelling that is detailed in Appendix G. This modelling has demonstrated that the proposed basin size combined with stormwater harvesting will achieve the pollutant load reductions recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011).

9.3.4 Bioretention systems

Bioretention systems will be established to treat runoff from catchments DC3, DC4 and DC5 which comprise access roads and car parking areas. In each catchment, the existing drainage system will be modified so that gutter flows drain into the bio-retention systems. The bioretention systems will be unlined allowing for infiltration into the underlying sand aquifer. Bioretention systems will be sized to meet the pollutant load reductions recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011).

9.3.5 Stormwater harvesting system

Concrete production requires approximately 150 litres of water per cubic metre of concrete. Hence, a concrete plant capacity of 750,000 m^3/pa will require 112,500 KL/pa of water. This equates to an average daily water use of 308 KL/day. Accordingly, there is an opportunity to harvest stormwater to supply water for concrete production. This will reduce mains water demands and the volume and frequency of stormwater discharge from the site.

It is proposed to expand the existing stormwater harvesting system to capture runoff from 72% of the site area (catchments DC1, DC2, DC6, DC7 and DC8). Water will be harvested directly from the first flush pits and the sedimentation basins. The functionality of the stormwater harvesting system is described diagrammatically in Appendix G.

Collectively, the stormwater harvesting system will provide 1,106 KL of storage, equivalent to 53 mm of runoff from the harvesting area. The storage volume will provide water for 3 to 4 days of concrete production.

9.3.6 Process water system

The process water system will receive water from the concrete reclaim facility and any other wash out and wash down water. The system will supply water for concrete production and will therefore require constant top-up. Top-up water will be preferentially sourced from storages that are more likely to have poorer water quality and/or have lower storage capacity. As described in Appendix G, top-up water will preferentially be sourced as follows:

1) water from the reclaim facility;
2) first flush pit (DC2);
3) first flush pit (DC1);
4) sedimentation basins;
5) stormwater harvesting tank; then
6) mains water.

9.3.7 Potable water supply

The project will be connected to mains water supply. Mains water will be used to top-up the process water system when stormwater storages are empty.

9.3.8 Waste water management

The existing waste water management system will continue to be operated.

9.4 Water Balance

A water balance model was developed for the proposed stormwater harvesting scheme. The objectives of the model are to estimate:

- the volume of surface water that is captured and used for process water;
- site discharge volumes; and
- the volume of mains water that will be imported to meet process water demands.

The water balance model was developed for the proposed stormwater harvesting scheme and includes all contributing catchments and storages that are shown in Table 9.3. Catchments DC3, DC4, DC5 and DC9 were not included as these catchments will not contribute runoff to the stormwater harvesting scheme.

Appendix G details the water balance model approach, framework and assumptions in further detail.

9.4.1 Results

Water balance results are presented in Appendix G for dry, average and wet rainfall years respectively. In summary, the results indicate that harvesting stormwater for process water use will:

- reduce site discharge volumes from the stormwater harvesting area by between 67% (wet year) to 91% (dry year) of total runoff; and
- reduce mains water consumption by between 12% (dry year) to 17% (wet year).

9.5 Water quality modelling

The MUSIC water quality model was applied to simulate the volume and quality of runoff from the site and assess the effectiveness of the proposed water quality controls. Specifically, the model results are compared to the pollution reduction targets that are recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011).

9.5.1 Model Results

Table 9.4 presents the following model results (as annualised averages):

- runoff volume / pollutant load generated from the concrete plant area. This is referred to as source loads;
- the residual runoff volume / pollutant load after stormwater controls; and
- the percentage reduction achieved by stormwater controls.

Predicted pollutant load reductions are also compared to the council targets.

Table 9.4 MUSIC Model Results

		Annual Volume / Load		Volume / Load reduction		
	Units	**Source**	**Residual**	**Reduction**	**Council Target**	**Target Achieved**
Runoff Volume[1]	ML/yr	26.7	10.0	63%	N/A	N/A
Total Suspended Solids (TSS)	Kg/yr	5,020	612	88%	85%	Yes
Total Phosphorous (TP)	Kg/yr	7.9	2.0	75%	60%	Yes
Total Nitrogen (TN)	Kg/yr	58.7	20.5	65%	45%	Yes

Notes: 1. Runoff volumes are greater than the volumes presented in the water balance results due to the inclusion of catchments DC3, DC4 and DC5 in the water quality model. These catchments were not included in the water balance model which assessed the stormwater harvesting area only.

Model results presented in Table 9.4 indicate that the pollutant load reductions for TSS, TN and TP meet the targets recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011). This indicates that the proposed water management system is appropriately configured.

9.6 Water management during construction

Construction of the proposed modifications will be undertaken in a staged manner over a nine month period. Erosion and sediment control plans will be prepared for each construction stage as part of the detailed design documentation. The erosion and sediment control plans will be prepared in accordance with the methods recommended in Managing Urban Stormwater: Soils and Construction (Landcom, 2004).

Some phases of the construction will require excavations that will intercept groundwater. Dewatering requirements and management methods are discussed in Section 10.1 of the EA.

9.7 Additional design development

The following additional design development will be undertaken as part of the detailed design phase of the project:

- a site grading plan will be prepared for all portions of the site that will be regraded;
- hydraulic analysis of the proposed drainage system will be undertaken;
- detailed designs of all stormwater infrastructure will be prepared; and
- sediment and erosion control plans will be prepared for each construction stage.

9.8 Water licensing

Stormwater will be extracted from the existing first flush pits and proposed sedimentation basins and underground stormwater storage. Extracted water will be either directly reticulated into the process water system or reticulated to the stormwater harvesting tank.

Water extraction (or water take) from the existing first flush pits and proposed sedimentation basins and underground stormwater storage is excluded works under Water Management (General) Regulation 2011, Schedule 1, item 3 (dams solely for the capture, containment or recirculation of drainage). Accordingly, the project is expected to have no requirements for water licensing.

9.9 Impacts to waterfront land

The proposed works will be undertaken with the existing site area. Works within 40m of the Alexandra Canal will be limited to:

- construction of bioretention systems in Catchment DC4 and DC 5; and
- modifications to the car park in catchment DC 5.

These works are not expected to impact the canal.

9.10 Surface water monitoring program

A surface water monitoring program will be implemented by Boral. The objectives of the monitoring program are to collect sufficient data to:

- enable the effectiveness of water quality controls to be assessed;
- identify and quantify water quality impacts; and
- enable compliance with relevant consent and licence conditions to be assessed.

9.10.1 Monitoring locations

Monitoring will be undertaken from the following site discharge locations:

- SW 1 – will monitor the combined discharge from the catchments DC2, DC4, DC6, DC7 and DC8. Discharge will only occur when the underground stormwater storage is full and by-pass flow occurs.

- SW 2 – will monitor discharge from catchment DC1. Discharge will occur when the first flush pit is full and bypass flows occur.

Monitoring locations are indicated in Figure 9.3.

9.11 Monitoring plan

The monitoring program will comprise:

- inspection of the condition and functionality of stormwater infrastructure;

- daily monitoring of pH during discharge; and

- biannual monitoring of a range of analytes during discharge conditions.

Table 9.5 describes the monitoring plan further.

Table 9.5 Monitoring plan

Aspect	Objective	Description
Inspection	To inspect the condition and functionality of stormwater infrastructure	To be undertaken informally on an ongoing basis and formally on a quarterly basis.
Daily monitoring	To progressively monitor the pH of site discharge.	Analysis of pH using a hand held meter during discharge. Monitoring will be undertaken from two monitoring locations (SW1 and SW2) on a daily basis when discharge is occurring.
Biannual comprehensive monitoring.	To monitor the water quality of site discharge.	Comprehensive monitoring will be undertaken from two monitoring locations (SW1 and SW2) on two occasions every year when discharge is occurring. Refer to Table 7-2 for a description of the proposed analytes and monitoring methods.

Table 9.6 details the proposed comprehensive analytes and monitoring methods. Boral will keep a record of all monitoring results.

Table 9.6 Comprehensive monitoring analytes

Category	Proposed sampling analytes	Analysis method
Physiochemical Properties	pH, electrical conductivity (EC) and turbidity.	To be measured using a portable water quality meter in the field
	total suspended solids, total dissolved solids, total hardness, total hydrocarbons	Analysis to be undertaken by a NATA certified laboratory
Nutrients	total nitrogen, ammonia, nitrate, nitrite , total Kjeldahl nitrogen, total phosphorus and reactive phosphorous	Analysis to be undertaken by a NATA certified laboratory

9.12 Conclusion

The site (except for the entrance driveways) is not prone to flooding up to 1% AEP events. Lower lying parts of the site are predicted to flood by up to 0.7 m during a probable maximum flood, although flood hazard maps identify most of the site as having low hydraulic hazard in these conditions.

Concrete production requires water and the site currently recycles some storm runoff and process water. Minor modifications are proposed to improve aspects of process water management and these modifications will: reduce potable water consumption in the process water circuit by up to 17%; reduce the discharge of stormwater by up to 91%; and will ensure that site runoff meets the pollutant load reductions recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011).

The proposed changes will improve the site's environmental performance and the proposed comprehensive analyte monitoring at two discharge locations will provide an ongoing check of this performance.

10 Other matters

10.1 Groundwater

10.1.1 General

The site lies within the Botany Basin, which occupies an erosional depression formed within the Triassic Hawkesbury Sandstone. During the Tertiary period, various incised valleys were created within the sandstone and during the Quaternary period, these valleys were filled with unconsolidated sands, silts, clays and peats (Sydney 100,000 Geological Sheet 1983). The quaternary alluvial sediment on the site forms the remnants of an ancient palaeochannel.

The alluvium supports an extensive shallow and highly productive groundwater system, known as the Botany Sands Aquifer. The groundwater system is recharged by direct rainfall percolating through unconfined outcropping areas. Indirect rainfall recharge also occurs at the contact with impermeable urban and industrial areas, similar to the majority of the Inner West LGA, where surface water runoff is enhanced by the impermeability of transport and industrial infrastructure. The major discharge areas from the Botany Sands Aquifer, relative to the site include Alexandra Canal and Cooks River, both of which eventually discharge into Botany Bay.

Groundwater at the site is intercepted at a reported depth of 1.3 mbgl (reference level). Groundwater flow is likely to be towards the Alexandra Canal, south-east of the site.

10.1.2 Sensitive groundwater dependent receivers

There are no landholder bores located within 500 m of the site.

There are no listed High Priority groundwater dependent ecosystems located within 3 km of the site. Similarly, there are no mapped potential groundwater dependent ecosystems located within 1 km of the site (BoM 2018).

10.1.3 Dewatering requirements

As described in Section 3, the construction phase of the project will involve various excavations. All excavations will intercept groundwater at depths of approximately 1.3 mBGL and will therefore require dewatering to allow installation of precast structures and the pouring of in-situ concrete structures. Boral has committed to completing all excavations within 10 days (cumulatively) to ensure the total predicted groundwater take remains low.

Based on the understanding of the site, a groundwater inflow rate of 1.76 L/sec has been calculated over the 10 day excavation period. This rate was calculated using a modified version of the Marinelli equation for unconfined, steady state conditions.

The ten day excavation period will allow sufficient time to line the pits sealing off groundwater inflows prior to the installation of pre-cast and pouring in-situ linings and bins.

A hydraulic conductivity value of 5.3 x 10-1 m/day was adopted to provide an estimate of the maximum potential inflow rate. This adopted value is conservative and based on the groundwater flow potential in silt/clay material.

The estimated total dewatering requirement over the ten days of extraction is 2.9 megalitres (ML). Due to the conservative assumptions used in calculating this estimate, actual dewatering requirements may be less than 2.9 ML.

Boral will commit to sheet piling all excavations where the rate of groundwater inflow exceeds the 1.76 L/s.

All extracted water will be used by adjacent Boral operations.

10.1.4 Summary

A total dewatering requirement of 2.9 ML has been estimated over the construction period of the development, well within the long-term annual average extraction limit of 14,684 ML/year set for the Botany Sands Groundwater Source. This estimate is based on a calculated groundwater inflow rate of 1.76 L/sec over a period of ten days during construction, and is considered to be conservative.

There are no predicted impacts to groundwater users in the vicinity of the site. The shallow depth of the various excavations is predicted to confine groundwater drawdown to the extent of the site boundary, with the closest groundwater user approximately 550 m from the site.

There are no predicted impacts to listed high priority GDEs.

The proposed development will not have a significant impact on the groundwater resource as a consequence of incidental water take for the purposes of dewatering during the excavation.

10.2 Hazard and risk

10.2.1 General

As stated in Section 4.3.1, SEPP 33 requires consent authorities ensure that in considering any application (including an application to modify a development consent) to carry out potentially hazardous or offensive development, that the authority has sufficient information to assess whether the development is hazardous or offensive and to impose conditions to reduce or minimise any adverse impact.

In determining whether a development is potentially hazardous or offensive, consideration must be given to current circulars or guidelines published by DPE relating to hazardous or offensive development.

An assessment as to whether operations on the site were potentially hazardous or offensive was undertaken as part of the EIS that accompanied the DA for the site in 1996, which included the asphalt plant. The results of this assessment indicated that site operations were not hazardous or offensive, or presented an unacceptable risk to human health or the environment.

10.2.2 Potentially hazardous industry

A potentially hazardous development requires a preliminary hazard analysis (PHA) to accompany a DA or application to modify a development consent. A development is considered to be potentially hazardous if the storage of hazardous substances exceeds specific screening thresholds. Further assessment is then required, including a risk assessment to ascertain the potential likelihood and consequence of a risk to people, property and the environment both before and after the application of mitigation measures to reduce the risk. A development can also be considered potentially hazardous based on the number of traffic movements involving hazardous materials associated with the development. If a development is found to be hazardous with respect to transportation, a route evaluation study is also required.

A PHA was prepared to accompany the DA for the site in 1996 by Alara Risk Management Services. The PHA stated that application of the criteria provided in SEPP 33 indicated that the development was not potentially hazardous or potentially offensive. In terms of the concrete plant, principally this was because:

- the core constituents of concrete (aggregate, sand and cement) are not classified as dangerous substances or goods; and

- the concrete additives (or admixtures) proposed to be stored on-site were not classified as dangerous substances or goods.

As previously stated, the core constituents of concrete (aggregate, sand and cement) are not classified as dangerous goods and nor their transport is not a trigger for being considered hazardous. A site inspection was undertaken to determine whether concrete admixtures currently used and stored at the concrete plant are classed as dangerous goods, and if so, determine their storage method, location and capacity, and transport volumes. The only admixtures currently stored on site are Sika ViscoFlow® 12 retaining admixture and SikaRapid® -4 set accelerator. These are not classed as dangerous goods as their hazards are occupational only and associated with personnel coming into contact with the material. Spills are unlikely to cause any off-site threats to people and the environment.

As the modification application will not change the potentially hazardous nature of the operation, the proposed modification does not constitute a potentially hazardous development. Accordingly, no PHA is required.

10.2.3 Potentially offensive industry

A development is generally considered to be potentially offensive if it requires an EPL from the EPA in accordance with provisions of the POEO Act. If it cannot obtain the necessary EPL, it is deemed to be an offensive development. In addition, the results of noise, air quality and surface water assessments of a development can also be used to determine if that development is potentially offensive.

As stated in Section 4.2.2, concrete plants are not required to be licensed under the POEO Act (ie do not require an EPL). As such, they are inherently not considered to be potentially offensive industries by the EPA. In addition, the results of the noise, air quality and surface water technical assessments described in chapters 6, 7 and 9 indicate that the modification is not potentially offensive.

The noise assessment concludes that the site would continue to comply with the relevant noise criteria derived from the INP.

The air quality assessment concludes that the modification is unlikely to result in exceedances of the applicable EPA assessment criteria for TSP, PM_{10}, $PM_{2.5}$ or dust deposition.

A proposed water water management system forms part of the proposed modificiation. The proposed water management system will result in significantly improved water quality management relative the existing facility.

10.2.4 Summary

The preliminary screening analysis indicates that the modification is not potentially hazardous or offensive development.

10.3 Contamination

As stated in Section 4.3.1, SEPP 55 requires consent authorities to consider the contamination status of land, and where rehabilitated, whether it is suitable for the development to be carried out.

Contamination investigations were undertaken as part of the DA for the site in 1996, including installation of forty nine pits and fifteen hand auger bores to a maximum depth of 4.5 m below ground level (bgl). Twenty four of these locations were equipped with piezometers to enable groundwater monitoring.

The results of the investigations indicated that the site was contaminated as a result of historic filling of ash from the former Bunnerong power station and previous industrial uses. Ash from the former Bunnerong power station was deposited in 0.2 to 0.8 m thick in bands and lenses within the site, primarily in the northern and western sections.

The results indicated that contamination within the site can be subdivided into six categories, namely hydrocarbon, metals and ash (all in soil), as well as hydrocarbons, nutrients and metals (all in groundwater).

Approximately 7,800 m^3 of in situ hydrocarbon soil contamination located between the railway spur and Alexandria Canal was found to be above the relevant criteria. Of this volume, approximately 2,800 m^3 contained bitumen based hydrocarbons, with the remaining volume of approximately 5,000 m^3 being non-bitumen based hydrocarbons (primarily lower fraction petroleum hydrocarbons).

The deeper hydrocarbon contaminated material was primarily contained in 1.5 m thick dredged sands, and in some cases, extended below the water table at 0.9 - 1.7 m below surface (generally 1.3 - 1.5 m). The majority of hydrocarbon contamination did not extend deeper than 2.5 m, with some penetration into the underlying silty muds originating from the pre dredged Sheas Creek (now Alexandra Canal).

Approximately 600 m^3 of metal contaminated soil was located, although it was primarily associated with the hydrocarbon contaminated material. Metals contamination was generally limited to the top 0.2 m in fill, whilst the hydrocarbon affected material extends into the Botany Sands, below the water table, to a maximum of approximately 2 m bgl in isolated hot spots.

To address the contamination, a remediation strategy was prepared to accompany the DA. The remediation strategy proposed excavation of all of the hydrocarbon contaminated soil and fill (approximately 7,800 m^3) and all of the metals contaminated soil and fill (approximately 600 m^3).It proposed that the bituminous material be excavated first and taken to landfill, and the underlying hydrocarbon contamination be subsequently removed to an offsite bioremediation facility.

The remediation strategy did not envisage removal of the large volume of ash containing fill as minimal leaching of contaminants (polycyclic aromatic hydrocarbons) was occurring.

Remediation was subsequently undertaken at the site in accordance with the remediation strategy.

Since the construction and operation of the concrete batching plant, no new sources of contamination have been used on sites and nor new contamination pathways created.

10.4 Waste management

10.4.1 Description of waste

The types of waste products generated throughout the construction and on-going operation of the proposed modification include:

- rejected concrete;
- cementitious waste water;
- concrete washout waste; slurry and solids;
- silt from settling pits;
- steel;
- timber (pallets etc);
- domestic refuse; and
- other waste.

10.4.2 Management of waste

Table 10.1 provides a description of the types of waste products, approximate quantities and proposed management processes.

Table 10.1 Management of waste

Type of waste	Description	Approximate waste quantity	Management process	Waste destination
Rejected / Returned Concrete	Rejected (non compliant / excess) concrete is expected to be returned to the concrete plant. The slurry water is recycled in a closed loop for the next load of concrete. The separated aggregates are stored in a drying bay before removal offsite.	Approx 3% of production ie peak avg rate would be 90 m3 returned or around 200 t	On return agitator trucks discharge into reclaiming machine which separates slurry water from sand and aggregates. Slurry is recycled with production water, Sand/aggregate are re-used within Boral either as concrete aggregates or within other construction materials ie roadbase. Increase in waste managed via a new concrete reclaimer system and a dedicated staff member to oversee and operate.	Boral Recycling Facility

Table 10.1 Management of waste

Type of waste	Description	Approximate waste quantity	Management process	Waste destination
Cementitious Waste Water	Highly alkaline (high pH) cementitious waste water is produced from the contact of water with concrete and cementitious products.	Approx 50,000 L per peak avg day	Waste water will be fully captured by the site's water settling pits and then reused back in the batching process.	Reused on site.
Concrete Washout Waste	The washout pit is used to store and dry the concrete washout waste material prior to disposal.	Approx 1% of production is lost to residue within the agitator barrel each day ie approx 30 m3 or 72 t	Stored in washout pit and dried before removal by a licenced contractor.	Boral Recycling Facility.
Slurry from Waste Water	Slurry build up in water pits reduces the water storage capacity of the pits. Build up is regularly monitored and pumped back through a plate press dewatering system, clean water is pumped back to the pits and/or used in production of concrete. Slurry 'cakes' are sent to a licenced facility for use with construction materials ie roadbase.	36 t per day	Dried slurry is extracted from pits via a dewatering plate-press. Dried slurry 'cakes' are transported to a licenced facility.	Boral Recycling Facility
Steel	Small volumes of steel will be generated on-site during construction and will be placed in skip bin for recycling.	Limited to construction.	A steel skip bin will be on-site during construction and emptied as required by licenced contractor.	Contractor
Timber	Timber will be used throughout construction for form work for laying concrete and from delivery pallets.	Limited to construction	Removed and reused by contractor or recycled offsite	Contractor
Domestic Refuse	Domestic refuse.	20-40 kg per day	Domestic refuse will be sorted into general waste and recycling then removed by a licensed contractor at regular intervals as required.	Contractor
Other Waste	Other waste includes contaminated material, for example; sand or absorbent material that has been used to clean up a spill and cannot be included with other household rubbish.	Small quantities as generated	Removed from site where required and recycled by licensed contractor	Contractor

10.5 Historic heritage

The site adjoins the Alexandra Canal, which is listed as a heritage item on the State Heritage Register (SHR) and the Marrickville LEP. The canal is also listed on Botany Bay and Sydney City's LEPs. The listing on the SHR states:

> Alexandra Canal is of high historic, aesthetic and technical/research significance. Historically, it is a rare example of 19th century navigational canal construction in Australia, being one of only two purpose built canals in the State, with one other known example in Victoria. It has the ability to demonstrate the NSW Government's initiative to create water transport as a means of developing an industrial complex in the Alexandria and Botany areas and exploiting the use of unemployed labour to achieve its scheme.
>
> It played a seminal role in the changing pattern and evolution of the occupation and industrial uses of the local area and nearby suburbs, which included filling large areas of low lying land for development.
>
> ...

Consideration of heritage impacts was undertaken as part of the EIS that accompanied the DA for the site in 1996. This assessment was undertaken prior to the Alexandra Canal being listed on the SHR.

The site is highly modified due to years of industrial activity by both Boral and previous uses on the site and immediate surrounds. The modification would result in an increase in truck traffic associated with concrete transport, however it would not result in any changes to the site that would affect its visual character that might affect the aesthetic significance of the Alexandra Canal. Given the nature of the site, the potential for historic heritage impacts is very low. The modification is not expected to have any impact on the heritage significance of the Alexandra Canal.

10.6 Indigenous heritage

The site has been highly modified by current and previous land uses, and it is unlikely that any archaeological deposits would remain on the site. No Aboriginal sites have been recorded in OEH's Aboriginal Heritage Information Management System (AHIMS) on the site.

The modification would result in an increase in truck traffic associated with concrete transport, however it would not result in any additional physical impacts to the site. Given the nature of the site, the potential for Indigenous heritage impacts is very low.

10.7 Ecology

10.7.1 Introduction

EMM completed a site inspection and ecological assessment to identify any possible ecological impacts caused by the removal of vegetation, in accordance with requirements under the Commonwealth and NSW legislation (refer also to Section 4.2 and 4.3):

10.7.2 Existing environment

i Desktop assessment

A preliminary desktop assessment was undertaken to identify any possible threatened species or ecological communities. Vegetation mapping from the Sydney Metropolitan Catchment Management Authority (CMA) indicates that the vegetation within the site consists of Urban Native and Exotic Cover. This vegetation mapping is consistent with the flora species found within the site during site inspections (refer to Photograph 10.1).

Photograph 10.1 Flora species found within the site

A search for threatened species was completed in the NSW Atlas of the NSW Office of Environment and Heritage (a 10 km buffer around the site, referred to as the assessment area). The search indicated there are 36 threatened species within the assessment area listed under the BC Act and include:

- two species of amphibians;
- 24 bird species;
- six species of mammals; and
- four flora species.

Of the 36 listed species, additional research on species sightings in the area indicated that only one of the species is likely to occur within this site, the Grey-headed flying fox. This species is associated with rainforest trees such as Fig trees. There are two Ficus sp. on site that would provide suitable habitat and food for the Grey-headed flying fox. However these two trees will not be removed as part of the proposed modification and therefore there will be no foreseen impacts on this threatened species.

ii Site inspection

A site inspection was undertaken on 31 May 2018 and identified approximately 93 trees planned for removal near the northern boundary of the property and near the southern car park. In the far south-western corner numerous exotic weeds were noted. No fauna were observed.

As a result of industrial and commercial development within the area, the fragmented vegetation does not associate with a particular plant community type. Furthermore the vegetation is not part of a listed ecological community (refer to (Photograph 10.2).

Vegetation observed within the site consists of Urban Native and Exotic Cover (under CMA mapping nomenclature) with the additional presence of weeds. The following was observed:

- the majority of the trees planned for removal are Swamp Oak (*Casuarina glauca*), none of which are associated with the Coastal Swamp Oak threatened community. The largest diameter at breast height (DBH) of all Swamp Oak trees was 50 cm;

- three exotic species were identified within the site; Lantana (*Lantana camara*), Pampas grass (*Cortaderia selloana*) and Oleander (*Nerium oleander*). Lantana and Pampas grass are listed with the DPI as "prohibited on dealings", these weeds are not to be sold in NSW under the *Biosecurity Act 2015*. Lantana is recognised as a weed of national significance by the DPI; and

- the vegetation has the potential to provide sub-standard occasional foraging and roosting habitat for urban fauna, such as birds. However, it is not plausible that fauna species would depend on limited resources provided by the fragmented vegetation and exotic species for their long-term survival.

Photograph 10.2 Vegetation adjacent to the canal

A full list of flora observed on site is provided in Table 10.2.

Table 10.2 List of flora present on site

Family	Scientific Name	Common Name	N, E or HTE
Casuarinaceae	*Casuarina glauca*	Swamp Oak	N
Fabaceae	*Acacia longifolia subsp. sophorae*	Coastal wattle	N
Myrtaceae	*Lophostemon confertus*	Brush Box	N
Arecaceae	*Sayagrus romanzoffiana*	Queen Palm	E
-	-	Exotic sp.	E
Myrtaceae	*Tristania neriifolia*	Water Gum	N
Proteaceae	*Persoonia levis*	Broad-leaved Geebung	N
Cupressaceae	*Cupressus leylandii*	Leyland cypress	E
Apocynaceae	*Nerium oleander*	Oleander	E
Verbenaceae	*Lantana camara*	Lantana	HTE
Poaceae	*Cortaderia selloana*	Common pampas grass	E

Notes: 1.N – Native

2. E – Exotic

3. HTE – High Threat Exotic

10.7.3 Impact assessment

Vegetation within the site consists of Urban Native and Exotic Cover and does not correspond to any native vegetation listed under the EPBC Act or BC Act.

The vegetation within the site has limited biodiversity value as occasional habitat for urban fauna. It is not likely that any fauna species would depend on roosting or feeding resources provided by the fragmented native vegetation and exotic species within the site for their long-term survival.

The proposed works are unlikely to cause any significant impact on the existing environment.

The proposed clearance of vegetation within the site would contribute to the removal of exotic species including one high threat exotic species and priority weeds.

10.7.4 Impact avoidance

No specific impact avoidance is required.

10.7.5 Management and mitigation measures

Prior to commencement of construction, Lantana should be removed by:

- Manual removal by cutting through thickets and pulling out regrowth;
- Mechanical control by slashing followed by herbicide control of seedlings; or
- Chemical control with herbicides such as foliar spraying, basal bark application and/or cut stump.

It is recommended before removing the common pampas grass, that the seed heads are removed, disposed of in a plastic bag and destroyed appropriately (DPI 2018b).

Oleander is a highly toxic weed to humans; all parts of the plant are poisonous and if ingested or burnt can cause serious illness. It is therefore recommended that gloves should be worn during the removal and the plant be disposed of appropriately (DPI 2018c).

10.8 Visual

The methodology for investigating the visual impact of the proposed modification involves consideration of the landscape values, the visual sensitivity and the potential visual change.

Particular combinations of the current landform, vegetation and existing development create landscape character. The following section provides a description of the existing landscape and environment of the site and surrounding areas.

10.8.1 Landform

The landform of the site is flat, with an elevation of approximately 2.7 m AHD. The topography of the landscape surrounding the site is generally subtle and incorporates the larger landscapes of the Botany Basin to the east, Sydney harbour catchment to the north, the Cumberland Plain to the west and the Cooks River valley to the south.

10.8.2 Vegetation

The vegetation within the site consists of urban native and exotic cover and does not correspond to any native vegetation listed under the EPBC Act or BC Act. It has limited biodiversity value as occasional habitat for urban fauna and has limited visual appeal.

10.8.3 Land use

The site is surrounded by industrial land uses which correspond with the site's and surrounding properties' zoning as IN1 General Industrial under the Marrickville LEP. Other surrounding features are:

- **North:** industrial land uses immediately north of the site, the Princes Highway, and residential areas on the northern side of the Princes Highway in Sydenham and St Peters.
- **East:** industrial land uses for approximately 1-1.5 km to the east, and beyond this, residential areas in Mascot.
- **South**: the Sydney International Airport is about 300 m to the south of the site beyond the Alexandra Canal.
- **West:** the Botany Goods Line is immediately west of the site; beyond this are industrial and commercial land uses, and residential areas further west in Tempe.

10.8.4 Scenic quality

To quantify the scenic significance of the study area, the visual quality of the landscape is summarised in Table 10.3. This table provides a landscape visual quality rating for a number of landscape characteristics when viewed from the areas immediately adjacent to the site. The applicable qualitative ratings of the site are shaded in light grey.

The rating is divided into low, moderate and high. Each characteristic has a series of criteria to define an appropriate rating for scenic quality. Higher scenic quality is generally associated with variety, uniqueness, prominence and naturalness of landform, vegetation and water form. Lower scenic quality is generally associated with urban and industrial land uses. Table 10.3 indicates that the visual quality of the site is low.

Table 10.3 Scenic quality rating

	Low	Moderate	High
Relief	Flat terrain dominant.	Undulating terrain dominant.	High hills in foreground and middle ground.
Vegetation	One or two vegetation types in foreground.	3 or 4 vegetation types in foreground. Few emergent trees.	High degree of patterning in vegetation. 4 or more distinct vegetation types.
Naturalness	Dominance of development.	Some evidence of development but not dominant.	Absence of development or minimal dominance.
Water	Little or no view of water. Water in background.	Moderate extent of water.	Dominance of water in foreground and middle ground.
Development	Commercial and industrial structures. Large scale development. Newer residential development prominent.	Established residential development. Small scale industrial development in middle ground.	Rural structures, heritage buildings and other structures apparent. Isolated domestic structures.
Cultural	Area free of cultural landmarks. Presence of new development.	Established, well landscaped development, especially in middle ground and background.	Established, maintained landscapes, old towns and buildings etc.

1.The qualitative ratings for the Project site are shaded light grey.

10.8.5 Impact

i Scale and dominance

The site is located within an existing industrial precinct and has historically been used for significant industrial and commercial land uses. Therefore, the scale of the proposed modification in relation to the surrounding industrial landscape is minor. The tallest planned structure is 23 m high which is consistent with the height of the existing infrastructure.

The proposed modification will not be visually intrusive feature of the landscape as it will sit within an already industrial landscape.

Burrows Road South is not a common commuter route and is mostly used by heavy vehicles and staff accessing the site. Bike riders using the cycleway on the opposite side of Alexandra Canal will not be able to see the site due to the existing vegetation that screens the site.

ii Visual sensitivity

Visual sensitivity is a measure of the level of concern attached by a user-group to a change in the existing landscape. It is largely determined by visibility and the distance from viewing areas, but is also influenced by the disposition of the viewer to development of this type.

Importantly, the scenic quality of the site and surrounding area is low and the proposed modification will not transform the visual character, nor does it represent a major change to the local perception of the surrounding area.

10.9 Social and economic

The site has operated as a concrete plant and materials handling facility since 1996. It was originally developed to meet market demands in the Sydney CBD area, and to supply significant infrastructure projects that were planned in the Sydney metropolitan area. Social impacts relate to changes in amenity of the surrounding area. This EA, and in particular the assessments for noise, air quality, traffic and surface water demonstrate that there is likely to be minimal impact on the amenity of the surrounding environment as a result of the modification when assessed against applicable criteria and standards. The site is located within an existing industrial precinct and has historically been used for significant industrial and commercial land uses. Therefore, the modification is in keeping with the surrounding land uses in the area.

The modification would result in social economic benefits associated with the increase in concrete production to the local community and wider Sydney region. Concrete forms the basis of many construction projects across Australia. As the second most consumed substance behind water, concrete provides a durable, strong, inexpensive and flexible construction material.

Greater Sydney is currently home to around 4.7 million people and is set to grow to 8.3 million people by 2056. In response to this forecasted growth, the Greater Sydney Commission (GSC) has released a series of plans that set out a vision to structure the city. These plans account for the need to retain and protect industrial areas in the greater Sydney region.

For example, construction markets within Sydney requiring the supply of concrete include:

- residential homes, with Greater Sydney projected to need an additional 725,000 homes over the next 20 years to accommodate for the forecasted population growth of an additional 1.24 million people by 2036. One home requires an average of 53m3 of concrete;
- high rise residential buildings, where just one tower can require up to 61,000 m3 of concrete; and
- road infrastructure projects, where 1 km of a two-lane highway requires over 8,000 m3 of concrete.

This modification builds on an existing industrial facility in an established industrial area. There are no sensitive receivers within proximity of the site and hence it is ideally suited to the current location and is well buffered from the closest residential areas.

11 Justification and conclusion

11.1 Need for the modification

The purpose for the modification is to increase production limits to the concrete plant and throughput limits to the materials handling facility to meet increased demand for concrete and aggregates in the region.

The site is close to Sydney's CBD, with good linkages to major roadways heading south and north. Its location within an existing industrial zone, as well as the ability to rail construction materials into the site, make it an ideal site for increasing production of concrete and the throughput of construction materials to meet the demand from the housing market and infrastructure works. This demand is principally due to the existing and planned developments in the Sydney metropolitan area (CBD and South East Light Rail, medium and high density residential projects, WestConnex, and Sydney Metro City & Southwest) all of which will require a significant amount of concrete and construction materials for their construction. Most of these projects are in the inner and middle ring suburbs of Sydney, and in the case of WestConnex, is close to the site.

In order to maintain product quality and integrity, once water is added to the dry concrete mix, a concrete agitator truck has no more than 45 minutes to deliver and pour the concrete. For this reason, concrete plants must be near their markets to ensure the concrete maintains its material properties. Close proximity is also needed to ensure that the construction schedule is not disrupted by delays to concrete deliveries. The site's location in St Peters and its ability to receive construction materials by rail means it is well positioned and setup to provide construction materials to such projects.

11.2 Objects of the Environmental Planning and Assessment Act 1979

The EP&A Act provides the framework for environmental planning and assessment in NSW. The objects of the EP&A Act are listed in section 1.3 of the Act and are as follows:

> (a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,
>
> (b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,
>
> (c) to promote the orderly and economic use and development of land,
>
> (d) to promote the delivery and maintenance of affordable housing,
>
> (e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,
>
> (f) to promote the sustainable management of built and cultural heritage (including Aboriginal cultural heritage),
>
> (g) to promote good design and amenity of the built environment,
>
> (h) to promote the proper construction and maintenance of buildings, including the protection of the health and safety of their occupants,

(i) to promote the sharing of the responsibility for environmental planning and assessment between the different levels of government in the State,

(j) to provide increased opportunity for community participation in environmental planning and assessment.

There are four objects of the EP&A Act relevant to the modification, being:

(a) to promote the social and economic welfare of the community and a better environment by the proper management, development and conservation of the State's natural and other resources,

The concrete plant and materials handling facility would continue to facilitate the distribution of bulk construction materials and concrete to the building and construction market. The site is ideally located with access to rail infrastructure which enables efficient delivery of quarry products to the site.

(c) to promote the orderly and economic use and development of land,

The modification involves an increase in the capacity of the concrete plant and throughput of the materials handling facility, both modifications is a more economically efficient use compared with developing a new concrete plant or materials handling facility.

(e) to protect the environment, including the conservation of threatened and other species of native animals and plants, ecological communities and their habitats,

The modification would not result in impacts to native animals and plants, and would operate in a manner that generally avoids or minimises impacts to the environment.

(b) to facilitate ecologically sustainable development by integrating relevant economic, environmental and social considerations in decision-making about environmental planning and assessment,

The proposal is consistent with the four ESD principles described in the EP&A Regulation. This is discussed further in Section 11.3.

11.3 Principles of ecologically sustainable development

Schedule 2 of the EP&A Regulation describes the four principles of ESD. Table 11.1 demonstrates how the modification is consistent with these four principles.

Table 11.1 Compliance with ESD principles

Principle	Application	Compliance
The precautionary principle	Proposals need to be carefully evaluated to ensure they avoid serious or irreversible environmental damage.	The modification avoids serious and irreversible environmental damage through the efficient use of an existing site, requiring no additional land disturbance. Potential environmental impacts from the modification would be managed to an acceptable level. Detailed modelling and assessments used leave little doubt as to the expected impacts of the Modification.

Table 11.1 Compliance with ESD principles

Principle	Application	Compliance
Inter-generational equity	The proposal needs to consider the health, diversity and productivity of the environment for future generations.	Potential environmental impacts from the modification would be managed to an acceptable level, thereby maintaining health, diversity and productivity of the environment of future generations.
Conservation of biological diversity and ecological integrity	The conservation of biodiversity and ecological integrity needs to be considered in the proposal.	The modification would not result in impacts to biodiversity or ecological integrity. There would be no disturbance to native vegetation.
Improved valuation, pricing and incentive mechanisms	The proposal needs to consider environmental factors in the valuation of assets and services.	This EA has considered environmental factors and demonstrated that potential environmental impacts from the modification would be managed to an acceptable level.

11.4 Conclusion

Boral’s St Peters concrete plant and materials handling facility has been operating in accordance with its existing consent since 1996. It is a major supplier of construction materials in the Sydney region. It receives bulk construction materials (aggregate, sand and cement) predominantly by rail from Boral's Peppertree and Dunmore quarries and Berrima Cement Works. These construction materials are used to make concrete, or are temporarily stored for later distribution t within the Sydney metropolitan area. Concrete and construction materials are despatched by road.

Housing and infrastructure construction are continuing to drive record demands in the Sydney construction materials market. A healthy residential housing market along with a pipeline of fully funded infrastructure works including North West Rail Link, WestConnex, NorthConnex, the CBD and South East Light Rail and Sydney Metro is driving the demand for aggregate and concrete products.

As such, Boral has undertaken a review into all existing facilities within the Sydney area to identify where site improvements can be made to increase efficiency and production. The site's location makes it an ideal site for upgrading to increase efficiency and production.

An application under section 75W of the EP&A Act (Modification 11) is proposed to modify the site's development consent to:

- increase production at the concrete plant from 280,000 m3 to 750,000 m3 per annum;
- increase the throughput of the materials handling facility from 759,000 tpa to 1 Mtpa; and
- upgrade the concrete and materials handling facility to facilitate these increases in production and throughput.

Detailed modelling and assessment for this EA focussed on investigating any potential environmental impacts from the concrete plant to produce more concrete and to increase throughput of the materials handling facility. This included the potential effects of increased traffic from despatch of concrete, surface water management, and increased noise and air quality.

Subject to implementation of the existing environmental mitigation, management and monitoring measures applied at the site, the concrete production increase and increasing the materials handling facility would not result in significant adverse environmental impacts.

References

Catchment Management Authority Sydney Metropolitan 2011, Botany Bay & Catchment Water Quality Improvement Plan.

Department of Environment and Conservation 2005, *Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales*, NSW Government.

Department of Environment and Climate Change 2005, Liquid Chemical Storage, Handling and Spill Management: Review of Best Practice Regulation, NSW Government.

Department of Environment and Climate Change 2007, Storing and Handling Liquids: Environmental Protection: Participant's Manual, NSW Government.

Department of Planning 2011,*Hazardous and Offensive Development Application Guidelines: Applying SEPP 33*, NSW Government.

EMM Consulting 2016, Noise assessment - Modification of development consent, Boral St Peters.

Environment Protection Authority 2000,*NSW Industrial Noise Policy*, NSW Government.

EPA 2011,*Road Noise Policy*, NSW Government.

Roads and Traffic Authority 2002, *Guide to Traffic Generating Developments*, NSW Government.

Department of Primary Industries 2018a, NSW Weed Wise – Lantana (Lantana camara), NSW Goverment. http://weeds.dpi.nsw.gov.au/Weeds/Details/78

Department of Primary Industries 2018b, NSW Weed Wise – Pampas grass (Cortaderia species), NSW Goverment. http://weeds.dpi.nsw.gov.au/Weeds/Details/100

Department of Primary Industries 2018c, NSW Weed Wise – Oleander (Nerium oleander), NSW Government. http://weeds.dpi.nsw.gov.au/Weeds/Details/246

WMAwater 2017, 'Alexandra Canal Flood Study'.

Appendix A

Development consent

NOTICE OF DETERMINATION OF DEVELOPMENT APPLICATION

Issued under the Environmental Planning and Assessment Act 1979
Section 92, and State Environmental Planning Policy No. 34 -
Major Employment Generating Industrial Development

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development application

applicant name	Boral Resources (NSW) Pty Ltd
application date	9 April 1996
applicant address	Greystanes Road South Wentworthville NSW 2145
land	Burrows Road South, St Peters Lots 1 and 2 DP 441113 and Vol. 4898 Fol. 159.

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determination

made on	6·9·96
determination	Consent granted to option "A" of the proposal subject to conditions shown in the attached Schedule A.
consent commences from	10.9.96
consent lapses on	10.9.2001 if works have not commenced by this date.
reasons for conditions	To ensure the impact of development is managed in a satisfactory manner.
right of appeal	If you are dissatisfied with this decision, section 97 of the Environmental Planning and Assessment Act 1979 gives you the right to appeal to the Land and Environment Court within 12 months after the date

on which you receive this notice.

Signed

signature

name Craig Knowles, MP
Minister for Urban Affairs and Planning
Minister for Housing

date 6.9.96

Mod 1	Site Rearrangements
Mod 2	Site Rearrangements
Mod 3	Butane Storage Vessel
Mod 4	Materials Handling Rearrangement
Mod 5	Bunker & other Site Rearrangements
Mod 6	Rearrangements Post Asphalt Plant Decommission
Mod 7	Bunker rearrangements
Mod 8	Rail Siding
Mod 9	Site Rearrangements
Mod 10	CBP Production Increase and Administrative Modifications

SCHEDULE A

Conditions of Consent
Boral Concrete Batching Plant and
Associated Materials Handling Facility
Burrows Road South, St Peters –
Lots 1 & 2 DP 441113 and Vol 4898 Fol 159

DEFINITIONS

Act	*Environmental Planning and Assessment Act 1979*
applicant	Boral Resources (NSW) Pty Ltd
BCA	Building Code of Australia
construction	the demolition of buildings or works, the carrying out of works, including bulk earthworks, and erection of buildings and other infrastructure covered by this consent
Council	Inner West Council
dB(A)	decibel (A-weighted scale)
Department	NSW Department of Planning and Environment or its successors
development	the development the subject of this development consent as described in the SEE and any subsequent modifications
DPI	Department of Primary Industries
dust	any solid material that may become suspended in air or deposited
EPA	NSW Environment Protection Authority
feasible	feasible relates to engineering considerations and what is practical to build
incident	a set of circumstances causing or threatening material harm to the environment, and/or an exceedance of the limits or performance criteria in this consent
$L_{Aeq\ (15\ minute)}$	equivalent average sound pressure level that is measured over a 15 minute period
Minister	NSW Minister for Planning, or delegate
mobile plant	includes on-site mobile plant such as forklifts, loaders, water carts and dump trucks, but does not include concrete agitators
MOD 10	Modification 10 to this consent, as described in Condition 2n)
POEO Act	*Protection of the Environment Operations Act 1997*
Principal Certifying Authority	the Minister or an accredited certifier, appointed under section 109E of the Act, to issue a Part 4A Certificate as provided under section 109C of the Act
reasonable	reasonable relates to the application of judgment in arriving at a decision, taking into account: mitigation benefits, costs of mitigation versus benefits provided, community views, and the nature and extent of potential improvements
reasonably practicable	that which is, or was at a particular time, reasonably able to be done
Regulation	*Environmental Planning and Assessment Regulation 2000*
Secretary	Secretary of the Department of Planning and Environment
RMS	Roads and Maritime Service
site	the land to which this consent applies

GENERAL

1. This consent is granted under section 91 (1) of the Environmental Planning and Assessment Act, 1979 for the operation of a concrete batching plant and associated materials handling facilities at Burrows Road South, St Peters.

2. The development shall be carried out in accordance with:
   a) The development application (DA 14/96), supporting Environmental Impact Statement

(EIS), and the option described as “Option A” in the EIS;

b) supplementary material prepared by S A Smits and Associates Pty Ltd, dated April 1996, June 1996, 21 September 1998, 25 September 1998, 22 March 1999, 7 May 1999, 21 May 1999, 17 November 1999, 26 November 1999 and 1 March 2000;

c) modification application DA 14/96 (Mod 1), granted 12 May 1997 and supporting information provided by S A Smits and Associates Pty Ltd;

d) modification application DA 14/96 (Mod 2), granted 8 December 1998 and supporting information provided by S A Smits and Associates Pty Ltd;

e) modification application DA 14/96 Mod 03-99 (Mod 3), granted 25 June 1999 and supporting information provided by S A Smits and Associates Pty Ltd;

f) modification application DA 14/96-M1 Mod 11-99 (Mod 4), granted 7 April 2000 and supporting information provided by S A Smits and Associates Pty Ltd;

g) modification application DA 14/96 (Mod 5) granted 23 August 2001 and supporting information provided by S A Smits and Associates Pty Ltd;

h) modification application MOD-10-2-2003-I (Mod 6), granted 16 May 2003 and supporting information provided by S A Smits and Associates Pty Ltd;

i) modification application MOD-34-3-2004-i (Mod 7) granted 11 February 2004 and supporting information provided by S A Smits and Associates Pty Ltd;

j) modification application DA 14/96 Mod 8 dated 11 December 2012 and supporting information provided EMGA Mitchell McLennan (EMM);

k) details of alterations to the layout of the materials handling facility detailed in the letter from S A Smits and Associates dated 25 March 2004, including drawings numbered SEK287-C-009 revision D (11 February 2004) and SEK287-M-001 revision C (11 February 2004);

l) details of the cross-over and associated third rail siding detailed in letter from EMM dated 11 December 2012, including drawing number 2569-01;

m) modification application DA 14/96 Mod 9 dated 28 February 2013 and supporting information provided by EMM dated 28 February 2013, Boral dated 12 April 2013 and 23 April 2013 and Environ dated 15 May 2013;

n) modification request DA 14/96 Mod 10, and supporting documents, including the report titled ‘*Boral St Peters Concrete batching plant and quarry materials handling facility, Environmental Assessment*’ dated 21 July 2016, prepared by EMM and a letter dated 12 September 2016 from EMM.

3. If there is any inconsistency between the plans and documentation listed under Condition 2 above, the most recent document shall prevail to the extent of the inconsistency. However, conditions of this consent prevail to the extent of any inconsistency.

4. The applicant shall ensure that employees, contractors and sub-contractors are aware of, and comply with, the conditions of this consent relevant to their respective activities.

LIMITS OF CONSENT

5. The annual production of the concrete batching plant must not exceed 280,000 cubic metres and the annual throughput of the construction materials handling facility must not exceed 760,000 tonnes.

CONSTRUCTION AND MAINTENANCE

6. Deleted.

7. Lighting at the site shall not cause hazard to aircraft using Sydney Kingsford Smith airport. Any change in lighting at the site must be undertaken in consultation with and to the approval of Sydney Airport Corporation Limited.

8. Deleted.

9. The applicant shall ensure that the rail siding and ancillary works are maintained to a standard which facilitates their use for materials handling and transport at all times.

ROADS, TRAFFIC AND PARKING

10. Deleted.

11. The applicant shall meet the full cost of any works required to be carried out by Council, DPI, Sydney Water or the RMS in connection with drainage, crossing, alterations to kerb and guttering, footpaths and roads that may be needed as a result of the development in addition to any such works specified in other conditions.

12. The applicant shall provide and maintain off-street car and truck parking spaces to cater for peak parking demands.

13. All loading and unloading associated with the development shall be carried out wholly within the property.

14. All parking spaces and turning areas shall be used exclusively for parking and not for storage or any other purpose.

15. All vehicles entering and leaving the development shall do so in a forward direction.

16. All vehicles associated with the development shall be accommodated wholly within the property and not be parked on the adjoining roads or footpaths.

17. All vehicles carrying materials to or from the site shall have their loads covered with tarpaulins or similar covers at all times so that no material is discharged onto public roads.

18. Deleted.

18a. Deleted.

LANDSCAPING

19. Deleted.

20. The landscaping of the site shall be maintained at all times, to the satisfaction of Council. This includes suitable perimeter landscaping adjacent to Burrows Road South and a 10 metre wide landscaped buffer strip adjacent to the Alexandra Canal.

REMEDIATION

21. Deleted.

HYDROLOGY

22. The applicant shall ensure all roof and surface stormwater from the site and any catchment external to the site that presently drains into the site, shall be collected in a system of pits and pipelines/channels and major storm event surface flow paths and discharged to a Sydney Water controlled stormwater drainage system.

23. Deleted.

24. Deleted.

25. Deleted.

26. Buildings, plant and equipment including material storage areas shall be set at a minimum height of 500mm above the 1 % Annual Exceedance Probability (AEP) flood event for Alexandra Canal. Details of existing and proposed site levels and means of providing 500mm freeboard above the 1% AEP flood event shall be submitted to Council with the Building Application. Variations below 500mm shall only be with the written agreement of Council's Director, Technical Services.

27. Deleted.

DEMOLITION AND CONSTRUCTION

28. Deleted.

28a. Deleted.

28b. Deleted.

PLANT OPERATIONS

29. Garbage shall be stored in a location approved by the Council and be disposed of in an approved manner. All liquid wastes, (other than stormwater) shall be discharged to the sewer in accordance with the requirements of the Sydney Water Corporation.

30. All vehicles exiting the site must pass through an operational and efficient wheel wash and/or vibration grid.

31. All wash down areas, the truck washing facility and all other areas likely to be contaminated shall be isolated from the stormwater drainage system.

32. Prior to any increase in production at the concrete batching plant (as approved under MOD 10 to this consent) the applicant shall submit to the Secretary for approval evidence of best practice refuelling procedures for the refuelling of site-based mobile plant to ensure appropriate containment and management of spills.

33. All materials associated with the operation of the proposal shall be stored in suitably constructed and enclosed containers or similar facilities on the premises in a neat and tidy manner and at all times.

DUST

33a. Prior to any increase in production at the concrete batching plant (as approved under MOD 10 to this consent) the applicant shall review and improve existing dust control measures on the site to ensure:

a) the premises is maintained in a condition that minimizes the emission of dust and silt loading on paved surfaces; and
b) all reasonable and feasible best practice measures are implemented to minimise dust generated during operations.

Evidence of this review and details of any improvements must be submitted to the Secretary for approval prior to any increase in production at the concrete batching plant (as approved under MOD 10 to this consent).

33b. No stockpile on site should exceed a height of 4m above ground level or the combined height of the concrete barrier and green mesh fencing, whichever is the lesser.

NOISE

33c. The applicant shall ensure that the noise from the development does not exceed the noise limits presented in Table 1.

Table 1: Development Noise Limits (dBA)

Day and Night $LA_{eq\ (15\ minute)}$	**Location**
42	Bellevue Street
44	Yelverton Street

Notes:
Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy.

PUBLIC UTILITIES

34. Deleted.

SECTION 94

35. Deleted.

ENVIRONMENTAL MANAGEMENT AND MONITORING

36. The applicant shall update the existing Environmental Management and Monitoring Plan for the site. The updated Plan shall show how odour, dust, noise and water impacts will be measured, monitored, managed and mitigated. The Plan is to include, but not be limited to, the following:
    a) the management of dust impacts, including the impacts of operation of the development;
    b) baseline background dust data;
    c) a contingency plan to manage any unpredicted impacts and their consequences;
    d) the management of any vibration transmitted to a place of another land user and any sound level at any point on the boundary of the site greater than the levels specified in the NSW EPA's Industrial Noise Policy;
    e) the management of polluted waters including the details of the pollution control systems, silt arrestors and separator pits intended to collect and dispose of any polluted water;
    f) the management of stormwater collection and discharge from the plant including details of first flush tanks from the designated 'dirty' area; and
    g) a maintenance program for cleaning oil skimmer pits, stormwater pits and traps.

36a. Prior to any increase in production at the concrete batching plant (as approved under MOD 10 to this consent), an off-site dust deposition monitor shall be established on Burrows Road South in the vicinity of sensitive receptors R3 and R4 (as identified in Figure 6.1 of the Environmental Assessment for MOD 10). The location of the monitor shall be approved by the EPA.

ANNUAL REVIEW

36b. Within 12 months of the approval of MOD 10, and each subsequent year, the applicant shall review the environmental performance of the development to the satisfaction of the Secretary. This review must:
    a) describe the development that was carried out in the previous calendar year, and the development that is proposed to be carried out over the next year;
    b) include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, which includes a comparison of these results against the:
        (i) the relevant statutory requirements, limits or performance measures/criteria;
        (ii) requirements of any plan or program required under this consent;
        (iii) the monitoring results of previous years; and
        (iv) the relevant predictions in the EIS;
    c) identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance;
    d) identify any trends in the monitoring data over the life of the development;
    e) identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and
    f) describe what measures will be implemented over the next year to improve the environmental performance of the development.

EMERGENCY PROCEDURES

37. Deleted.

SIGNAGE

38. Deleted.

RAIL QUARRY PRODUCT DELIVERY

39. The applicant shall maximise the use of rail freight for quarry product delivery wherever reasonably practicable.

40. The Department may require at the applicant's expense, an independent audit of rail use for quarry product delivery if it considers that rail use has not been used wherever reasonably practicable.

41. Deleted.

SAFETY STUDIES

42. Deleted.

43. Deleted.

HAZARD AUDIT

44. Deleted.

45. Within three months of the approval of a modification, an annual review (under Condition 36b.), an independent audit of rail use (under Condition 40) or the submission of an incident report (under Condition 48), the applicant shall review, and if necessary revise, the strategies, plans, and programs required under this consent to the satisfaction of the Secretary.

46. The applicant shall obtain all relevant Part 4A Certificates as described under section 109C of the Act for relevant structures and buildings on the site.

47. Deleted.

INCIDENT REPORTING

48. The applicant shall notify the Secretary and any other relevant agencies of any incident or potential incident with actual or potential significant off-site impacts on people or the biophysical environment associated with the development after the applicant becomes aware of the incident. Within 7 days of the date of this incident, the applicant shall provide the Secretary and any relevant agencies with a detailed report on the incident.

The applicant is further advised that the following points have been raised by Council or agencies, and should be taken into account under appropriate statutes and regulation during construction and operation of the proposal.

A Building Application shall be submitted to Council in the prescribed manner, including plans and specifications to comply with the provisions of the Building Code of Australia.

Details of all finished surface materials, including colour and texture to be used in construction shall be submitted to Council's satisfaction prior to the release of the stamped approved building plans.

A detailed plan showing the height, colour and material of all fencing within the development shall be submitted to the Council’s satisfaction prior to release of the stamped approved building plans.

Approval is required under Section 68 of the Local Government Act 1993 to demolish the existing structures on the subject site. The applicant shall ensure all relevant approvals and permits should be obtained before commencement of demolition.

Any person/organisation undertaking demolition should obtain all necessary permits and should comply with all of the requirements of Council, the WorkCover Authority and Environment Protection Authority prior to the commencement of demolition works and during demolition works.

The demolition of existing buildings/improvements on the site shall be carried out in accordance with the following and any other requirements or permits:

(a) The requirements of Australian Standard AS 2601-1991 with specific reference to health and safety of the public, health and safety of site personnel, protection of adjoining buildings, and protection of the immediate environment.

(b) The Worksafe Code of Practice for Removal of Asbestos and the requirements of the WorkCover Authority and the Environment Protection Authority.

(c) All building materials arising from the demolition being disposed of in an approved manner in accordance with the requirements of the Environment Protection Authority.

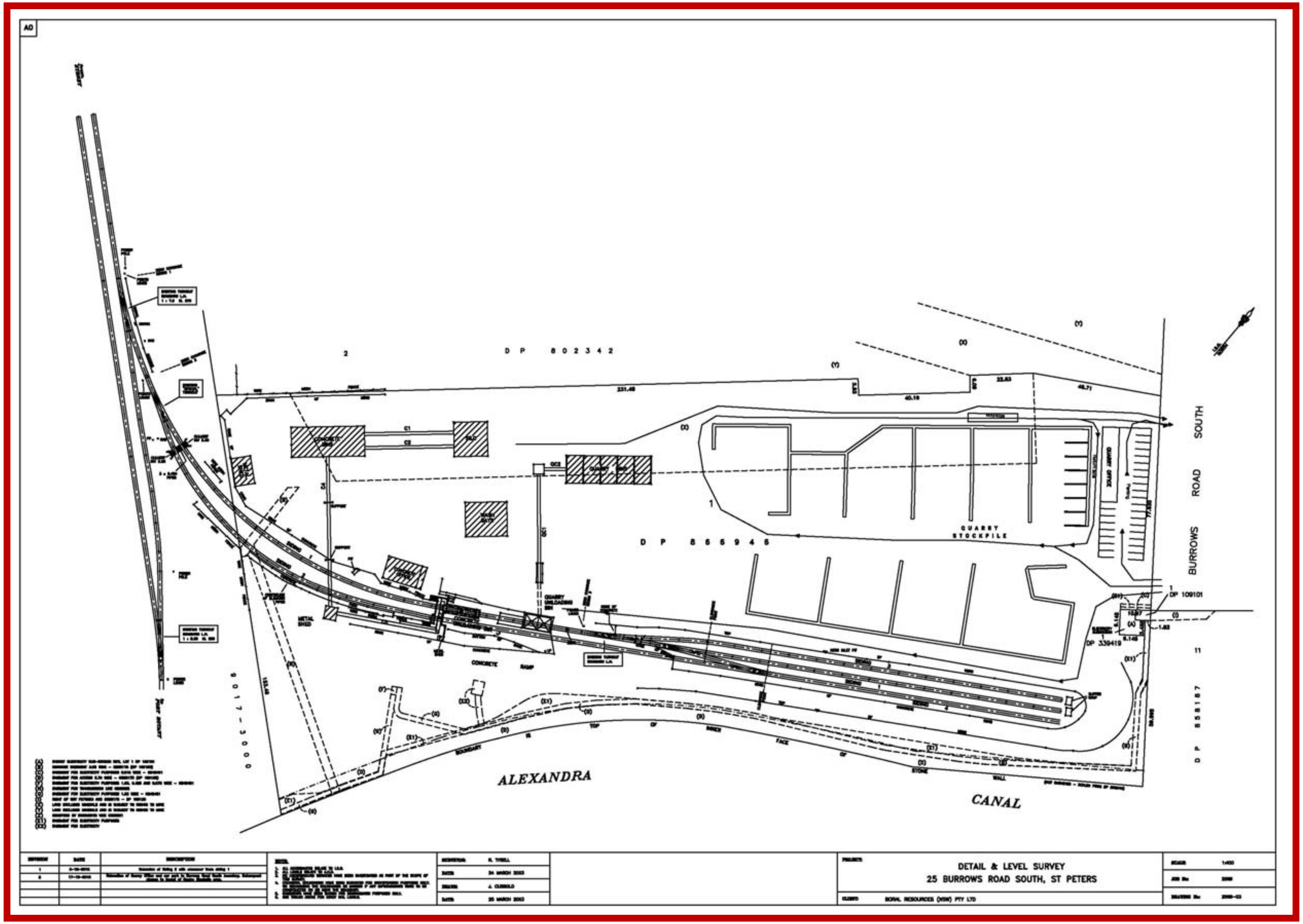
(d) Sanitary drainage, storm water drainage, water, electricity and telecommunications being disconnected in accordance with the requirements of the responsible authorities.

The applicant shall meet the statutory requirements of all public authorities having statutory responsibilities in respect of the development, and shall negotiate with all authorities having an interest in the proposed development with a view to meeting any requirements related to the proposed development.

The applicant shall obtain and comply with all necessary approvals and licenses for the development, including (but not restricted to) approvals or licenses from Sydney Water, the EPA, LA WC and the F AC. Any relevant information shall be submitted to the EPA to form the basis of, approvals and to comply with the relevant provisions of the Clean Waters Act, the Clean Air Act and the Noise Act.

The applicant shall comply with the requirements of the RMS and Council regarding the use and any routes of 'B-Double' trucks.

2569-01



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DP 339419
DP 858167
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CONCRETE RAMP
QUARRY UNLOADING BIN
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CANAL
DETAIL & LEVEL SURVEY
25 BURROWS ROAD SOUTH, ST PETERS

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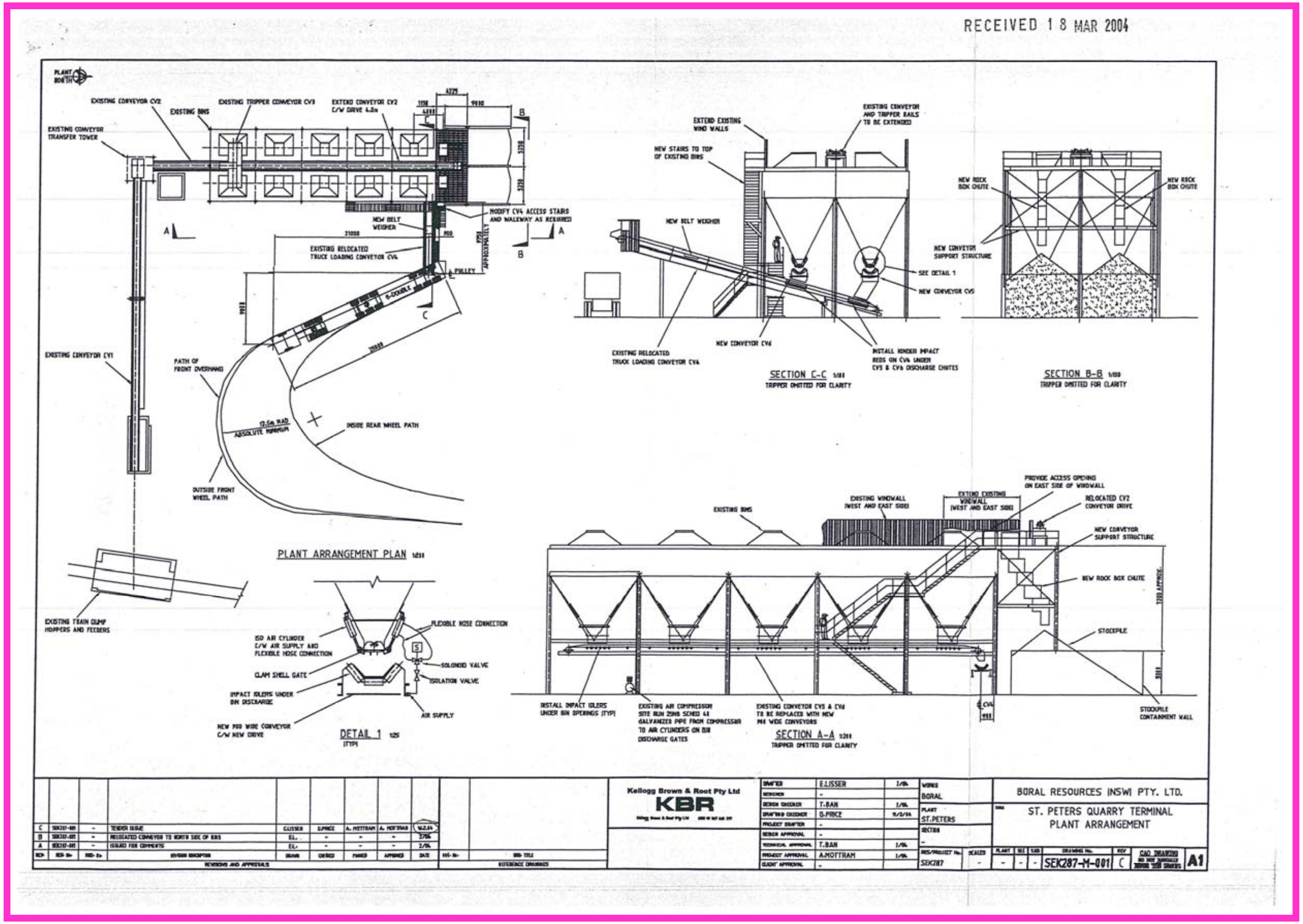

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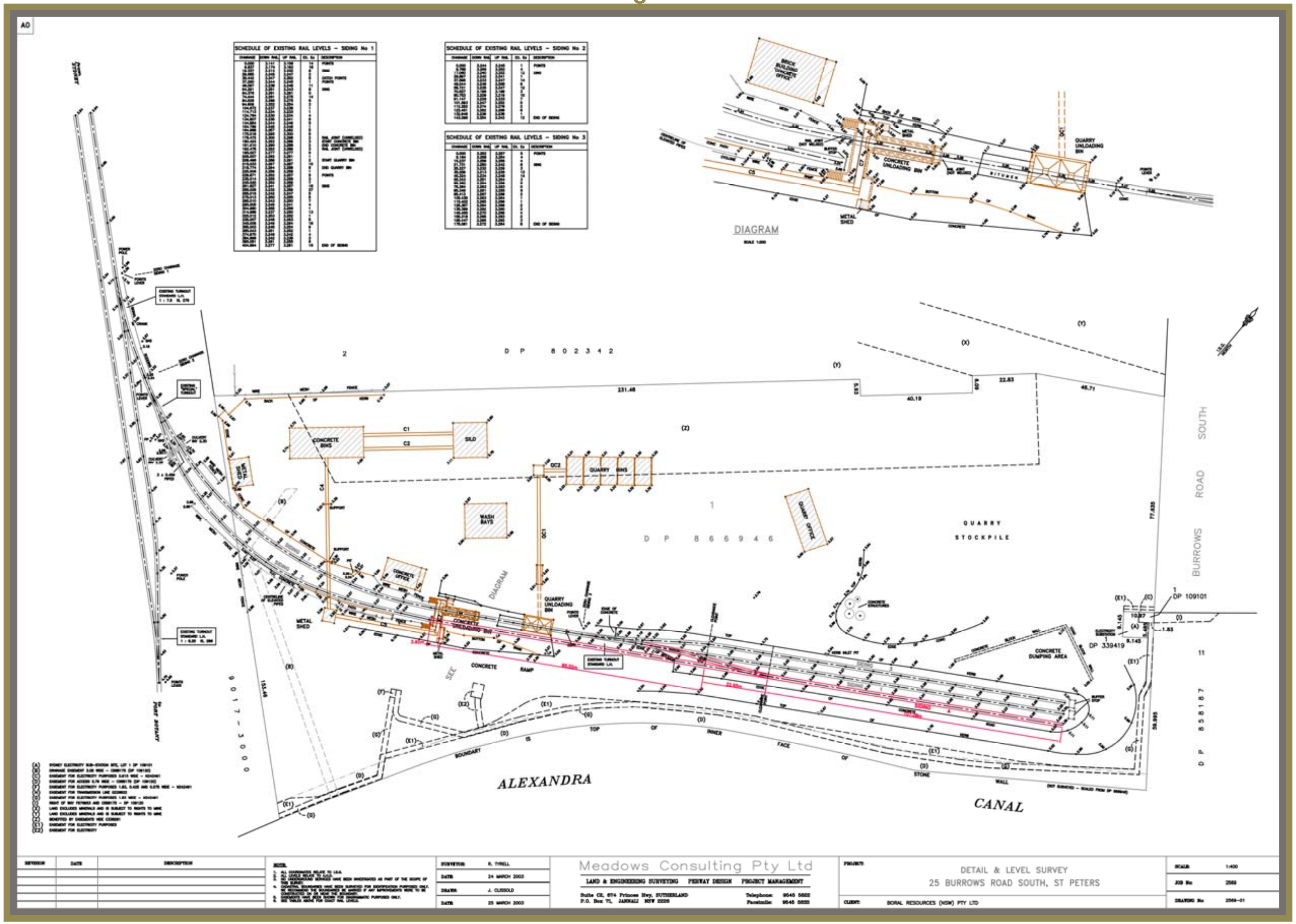


Appendix B

Secretary's Environmental Assessment Requirements issued 21 December 2016

NSW GOVERNMENT | Planning & Environment

Contact: Sally Munk
Phone: (02) 9274 6431
Email: sally.munk@planning.nsw.gov.au

DA 14/96 MOD 11

Ms Kate Jackson
Planning and Development Manager (Southern Region)
Boral Resources (NSW) Pty Limited
PO Box 42
Prospect NSW 2145

Email: kate.jackson@boral.com.au

Dear Ms Jackson

Upgrade and Expansion of Boral Concrete Batching Plant, St Peters (DA 14/96 MOD 11)
Environmental Assessment Requirements

I refer to your request seeking environmental assessment requirements (EARs) to modify the Minister's approval for the upgrade and expansion of the Boral Resources (NSW) Pty Limited concrete batching plant and quarry materials handling facility at 25 Burrows Road South, St Peters, in the Inner West local government area (LGA). This request is under section 75W of the *Environmental Planning and Assessment Act 1979* (EP&A Act).

In accordance with section 75W(3) of the *Environmental Planning and Assessment Act 1979* (EP&A Act), the Secretary may notify the Proponent of EARs with respect to the proposed modification. The Proponent must comply with these requirements before the matter is considered by the Minister for Planning.

The EARs have been prepared in consultation with relevant government authorities, and are based on the information you have provided to date. Your modification request should be accompanied by an Environmental Assessment (EA) which addresses the requirements of the authorities (**Attachment 1**) and the following:

- **strategic context**, including:
  - justification for the proposal having regard to its location and impacts;
  - consideration of all relevant legislation, strategies, environmental planning instruments, including identification and justification for any inconsistencies; and
  - demonstration the proposal is subject to section 75W of the EP&A Act;
- **details of the existing operations on the site**, including:
  - a description of existing and approved operations/facilities, including any licences or statutory approvals that apply to these;
  - a summary of the existing conditions of consent that would be relevant to the proposal;
  - a summary of the existing environmental management and monitoring regime;
  - detailed plans of the existing and proposed site layout;
  - detailed plans of all structures proposed to be constructed and modified; and
  - a table detailing compliance with existing conditions of approval;
- **description of the modification**, including:
  - a detailed description of the proposed modification, including changes to existing operations and any staging;
  - the justification and need for the modification;
  - identification of conditions to be modified and proposed wording of any new or modified conditions;
  - identification of any proposed variations to other licences and approvals; and
  - an assessment of all potential impacts of the proposal on the existing environment and measures to avoid, minimise, mitigate and/or manage these potential impacts;
- **traffic and access**, including:
  - a quantitative traffic impact assessment which considers traffic types and volumes likely to be generated, impacts on road safety and impacts on the capacity of the road network;
  - details of any necessary infrastructure upgrades;
  - details of and justification for the selected site access arrangements, internal road network and parking arrangements; and

  - an assessment of the accessibility of the site by public transport.
- **noise and vibration**, including:
  - a quantitative noise and vibration impact assessment for construction and operational impacts prepared in accordance with relevant Environment Protection Authority guidelines;
  - a description of all potential noise and vibration sources during construction and operation, including road traffic noise along primary haulage routes;
  - cumulative impacts of other developments; and
  - details of proposed mitigation, management and monitoring measures;
- **air quality**, including:
  - a quantitative assessment of the potential air quality impacts during construction and operation in accordance with relevant Environment Protection Authority guidelines;
  - details of fugitive dust management measures during construction and operation; and
  - details of proposed mitigation, management and monitoring measures;
- **soil and water**, including:
  - an assessment of potential surface water, flooding and groundwater impacts, including impacts on nearby waterbodies (including the Alexandra Canal), surrounding properties, waterfront land (as defined under the *Water Management Act 2000*) and the Botany Sands groundwater source;
  - details of the surface water and stormwater management system(s) including on-site detention systems and measures to treat, reuse or dispose of water;
  - a detailed site water balance;
  - details of proposed erosion and sediment controls during construction; and
  - details of proposed mitigation, management and monitoring measures.
- **hazard and risk,** including:
  - a preliminary risk screening completed in accordance with *State Environmental Planning Policy No. 33 – Hazardous and Offensive Development* and *Applying SEPP 33* (DoP, 2011), with a clear indication of class, quantity and location of all dangerous goods and hazardous materials associated with the development. Should preliminary screening indicate that the project is "potentially hazardous" a Preliminary Hazard Analysis (PHA) must be prepared in accordance with *Hazardous Industry Planning Advisory Paper No. 6 - Guidelines for Hazard Analysis* (DoP, 2011) and *Multi-Level Risk Assessment* (DoP, 2011).
- **fire and incident management**, including technical information on the environmental protection equipment to be installed on the premises such as air, water and noise controls, spill clean-up equipment and fire management;
- **contamination,** including an assessment in accordance with *Managing Land Contamination Planning Guidelines: SEPP 55 – Remediation of Land* (DUAP, 1998);
- **heritage,** including a statement of heritage impact which considers any impact the proposal might have on the Alexandra Canal and any other heritage items within the vicinity;
- **visual,** including a description of the potential visual impacts from proposed buildings and associated structures; and details of the measures proposed to minimise visual impacts, such as landscaping;
- **waste management,** including details of how waste will be managed during construction and operation, including details of liquid waste and non-liquid waste management;
- **biodiversity**, including an assessment of impacts on existing flora or fauna on the site;
- **consultation**, including details of consultation with relevant government authorities and the community;
- updated management plans; and
- a table indicating where each element of the EARs is addressed in the EA.

In preparing the EA, the Department strongly recommends that you directly consult with relevant government authorities.

Following the provision of the EA, the Department will advise you of the applicable fee (under Division 1A, Part 15 of the *Environmental Planning and Assessment Regulation 2000*) and consultation requirements.

If you have any enquiries about these requirements, please contact Sally Munk, Principal Environmental Planner, on the above details.

Yours sincerely

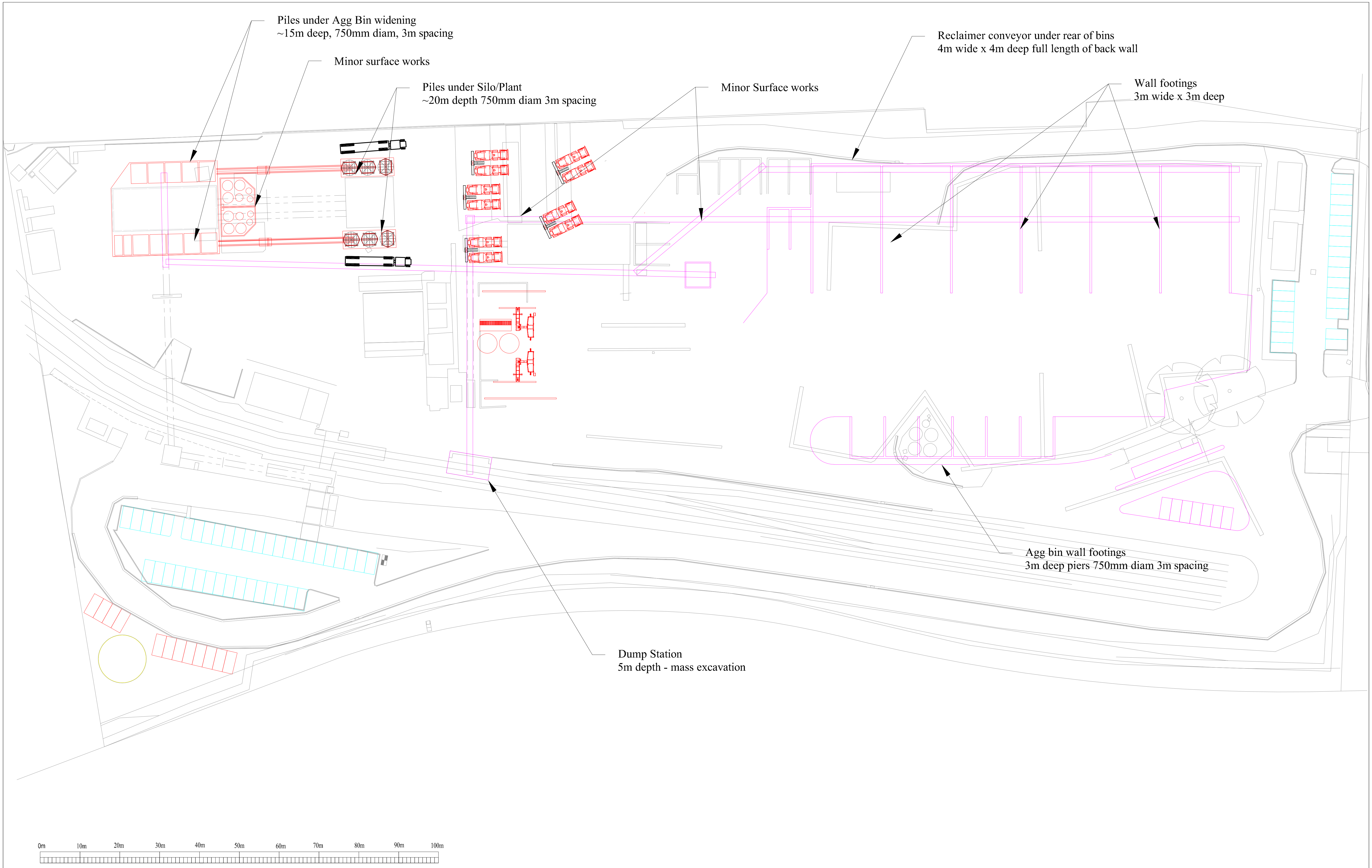
C. Ritchie

21/12/17.

Chris Ritchie
Director, Industry Assessments
as the Secretary's nominee

Appendix C

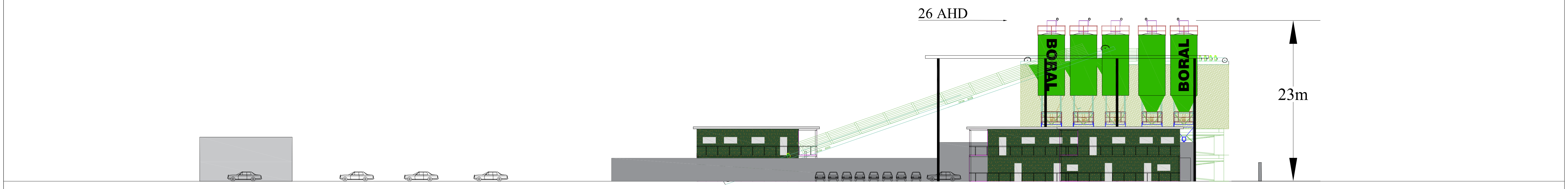
Plan of existing layout of the site



Revision	Amendment	Date

BORAL RESOURCES (NSW) PTY LTD
Triniti 2, 39 Delhi Road, North Ryde NSW 2113
www.boral.com.au

Client	BORAL RESOURCES (NSW) PTY. LTD.	Drawn	RF	Scale	1:1000
Project	St Peters Mod 11	Designed	RF	Date	25/05/18
		Checked	PM		
Title	Excavation Details	Size A3	Drawing No. STP001	Sheet 7	Revision 1

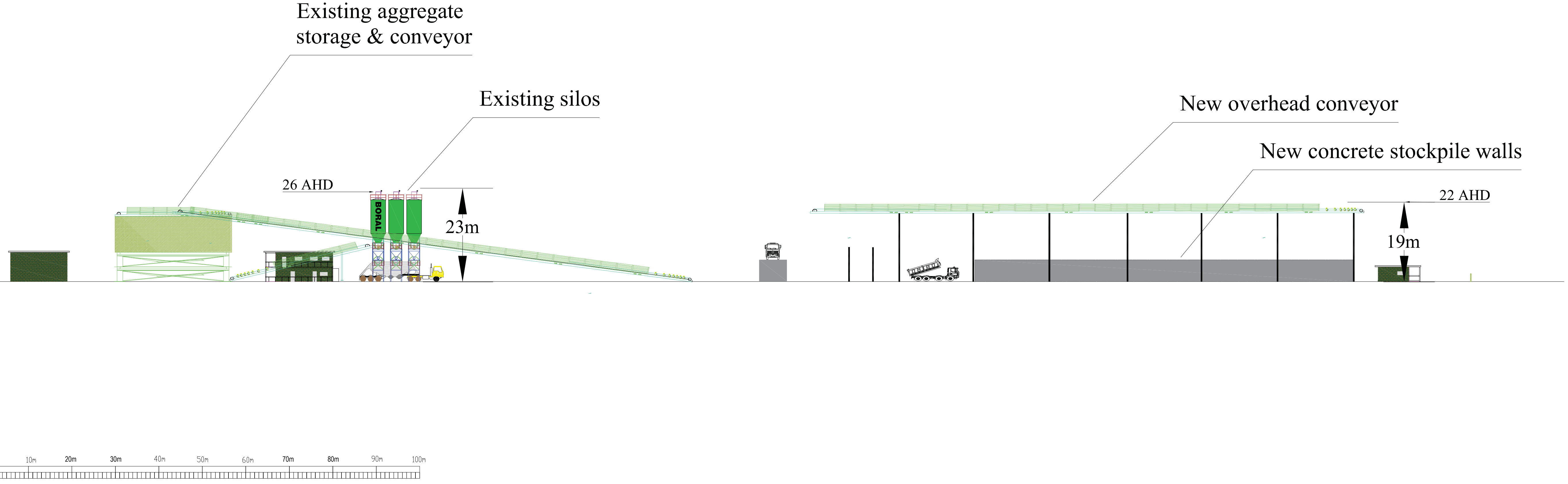


Revision	Amendment	Date

BORAL RESOURCES (NSW) PTY LTD
Triniti 2, 39 Delhi Road, North Ryde NSW 2113
www.boral.com.au

BORAL®

Client	BORAL RESOURCES (NSW) PTY. LTD.	Drawn	RF	Scale	NTS
Project	St Peters Concrete Batch Plant Mod 11	Designed	RF	Date	11/03/18
		Checked	RF		
Title	North East Elevation	Size A3	Drawing No. STP002	Sheet 2	Revision 1



Revision	Amendment	Date

BORAL RESOURCES (NSW) PTY LTD
Triniti 2, 39 Delhi Road, North Ryde NSW 2113
www.boral.com.au

Client	BORAL RESOURCES (NSW) PTY. LTD.	Drawn	RF	Scale	NTS
Project	St Peters Concrete Batch Plant Mod 11	Designed	RF	Date	11/03/18
		Checked	RF		
Title	South East Elevation	Size A3	Drawing No. STP002	Sheet 1	Revision 1

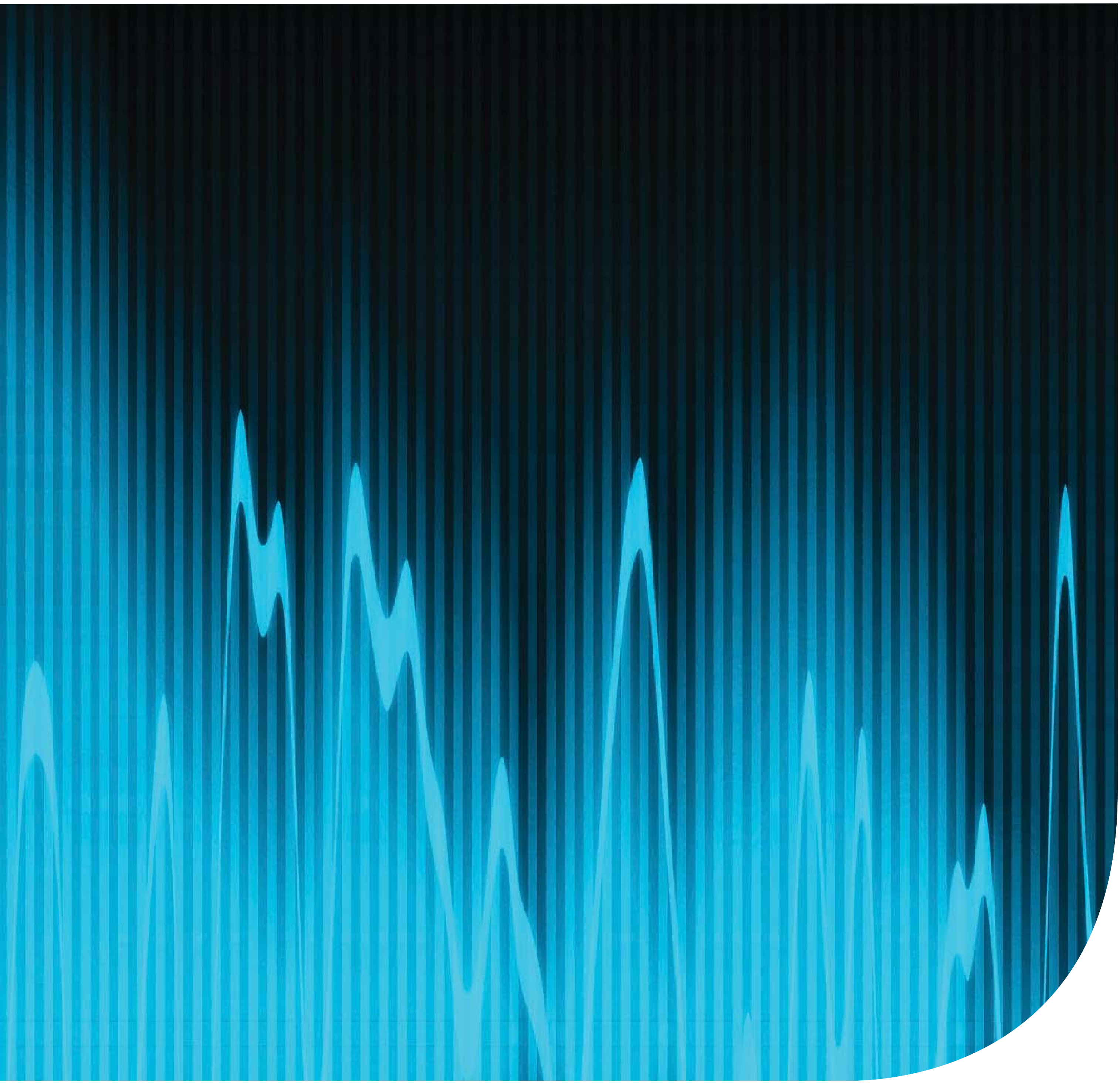
Appendix D

Noise assessment

Noise and vibration impact assessment

Modification 11 | Boral St Peters

Prepared for Boral Resources (NSW) Pty Ltd | 28 June 2018



Noise and vibration impact assessment

Modification 11 | Boral St Peters

Prepared for Boral Resources (NSW) Pty Ltd | 28 June 2018

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Noise and vibration impact assessment

Final

Report J16208RP1 | Prepared for Boral Resources (NSW) Pty Ltd | 28 June 2018

Prepared by	**Teanuanua Villierme**	Approved by	**Najah Ishac**
Position	Senior Acoustic Consultant	Position	Director
Signature		Signature	
Date	28 June 2018	Date	28 June 2018

Document Control

Version	Date	Prepared by	Reviewed by
V1	6/6/18	Teanuanua Villierme	Najah Ishac
V2	28/6/18	Teanuanua Villierme	Najah Ishac

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Tables

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Figures

1 Introduction

Boral Resources (NSW) Pty Ltd (Boral) owns and operates a concrete batching plant (the concrete plant) and construction materials handling facility (the handling facility) at 25 Burrows Road South, St Peters (the site).

On 6 September 1996, the then NSW Minister for Urban Affairs and Planning granted development consent to Boral under the provisions of the NSW Environmental Planning and Assessment Act 1979 (EP&A Act) for the construction and operation of the concrete plant and the handling facility at the site. The development consent also permitted Boral to construct and operate an asphalt plant. This plant was constructed and operated, but was subsequently decommissioned and demolished in 2002.

A modification to the site's development consent (Modification 11) is proposed, which includes an increase in concrete production and throughput of the handling facility. An increase in concrete production of 470,000 m^3 per annum over the exiting 280,000 m^3 limit is sought by Boral, which would equate to a total concrete production limit of 750,000 m^3. Boral is seeking to increase the throughput of the handling facility to 1 million tpa, which is an increase of 240,000 tpa over the existing limit of 760,000 tpa. To achieve the proposed increases, some upgrades to the existing concrete plant and changes to the layout and function of the handling facility are proposed.

This report presents the results and findings of a noise assessment which has been prepared to accompany the modification with reference to the following guidelines and policies:

- NSW Environment Protection Authority (EPA), Noise Policy for Industry (NPfI) 2017;
- NSW Department of Climate Change and Water (DECCW), Road Noise Policy (RNP) 2011;
- NSW Department of Climate Change (DECC), Interim Construction Noise Guideline (ICNG) 2009; and
- NSW Department of Environment and Conservation (DEC), Assessing Vibration: a technical guideline 2006.

This noise assessment also evaluates the existing level of noise from the site in accordance with the methodology outlined in the NPfI for the assessment of noise from existing industrial premises.

1.1 Glossary of acoustic terms

A number of technical terms are required for the discussion of noise. These are explained in Table 1.1.

Table 1.1 Glossary of acoustic terms

Term	Description
dB	Noise is measured in units called decibels (dB). There are several scales for describing noise, the most common being the ‘A-weighted’ scale. This attempts to closely approximate the frequency response of the human ear.

Table 1.1 Glossary of acoustic terms

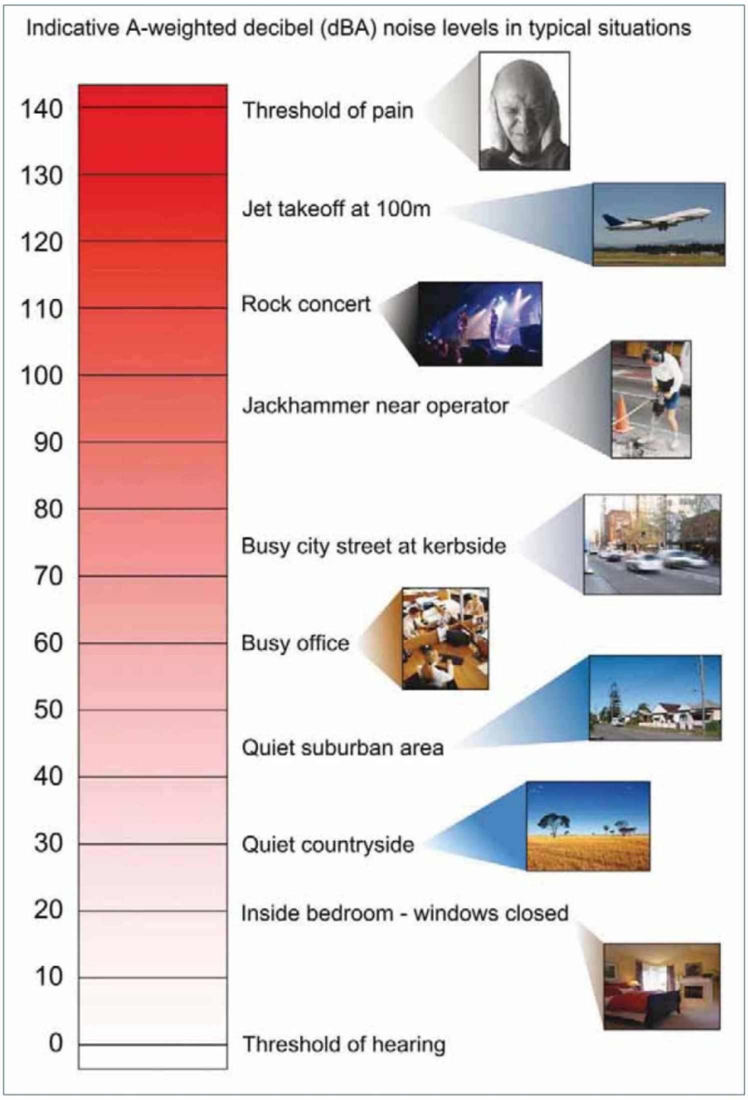
Term	Description
L_{A1}	The noise level exceeded for 1% of a measurement period.
L_{A10}	A noise level which is exceeded 10% of the time. It is approximately equivalent to the average of maximum noise levels.
L_{A90}	Commonly referred to as the background noise, this is the level exceeded 90% of the time.
L_{Aeq}	It is the energy average noise from a source, and is the equivalent continuous sound pressure level over a given period. The $L_{Aeq,15min}$ descriptor refers to an L_{Aeq} noise level measured over a 15-minute period.
L_{Amax}	The maximum root mean squared sound pressure level received at the microphone during a measuring interval.
L_{Amin}	The minimum root mean squared sound pressure level received at the microphone during a measuring interval.
RBL	The Rating Background Noise Level (RBL) is an overall single value background level representing each assessment period over the whole monitoring period.
Sound power level	This is a measure of the total power radiated by a source. The sound power of a source is a fundamental property of the source and is independent of the surrounding environment.
Temperature inversion	A positive temperature gradient. A meteorological condition where atmospheric temperature increases with altitude.

It is useful to have an appreciation of decibel, the unit of noise measurement. Table 1.2 gives an indication as to what an average person perceives about changes in noise levels.

Table 1.2 Perceived change in noise

Change in noise level (dB)	Perceived change in noise
1 to 2	typically indiscernible
3	just perceptible
5	noticeable difference
10	twice (or half) as loud
15	large change
20	four times (or quarter) as loud

Examples of common noise levels are provided in Figure 1.1.



Source: RNP (DECCW 2011).

Figure 1.1 Common noise levels

2 Project and site description

2.1 Background

The site is located within the Inner West local government area (LGA). The south-eastern boundary of the site adjoins the Alexandra Canal. The Sydney International Airport is located approximately 300 m to the south of the site. The nearest private residences are located about 600 m to the north-west of the site on the opposite (north) side of the Princes Highway.

The site has two existing land uses; the concrete plant and the construction materials handling facility. Both uses predominantly receive bulk construction materials (aggregate, sand and cement) by rail from Boral's Peppertree and Dunmore quarries and Berrima Cement Works. There are two train unloading areas on one of four rail sidings; one unloading area for the concrete plant and one for the handling facility. Trains are parked and shunted in the rail sidings. Some fly ash and special admixtures used in the concrete plant are delivered to the site by road.

2.1.1 Concrete batching plant

The concrete plant is located in the south-western section of the site.

Aggregates and sand are stored in large elevated bins, and cement and fly ash are stored in large elevated silos located above the batching plant. Aggregates and sand are transferred from the concrete plant train unloading area to the storage bins by conveyor.

The concrete batching plant mixes the aggregates, sand, cement and admixtures, and gravity dispenses the batched product into concrete agitators inside the loading bays building. Once loaded, the concrete agitators drive out of the loading bay building and proceed to the slump stands where water is added. The concrete agitators mix all ingredients and the end product (concrete) is then transported to customers by road.

2.1.2 Handling facility

The handling facility is located in the centre and north-eastern section of the site. The handling facility receives and temporarily stores aggregates and sand from Boral's Peppertree and Dunmore quarries and cement from Berrima Cement Plant before despatching them by truck to other concrete batching plants and asphalt plants within the Sydney metropolitan area.

The aggregates and sand are transferred from the handling facility's train unloading area to storage bins by conveyor, which are then loaded into trucks for dispatch offsite or for transfer to storage bunkers or stockpiles.

2.2 The proposal

A modification (Modification 11) to the site's development consent is proposed to increase concrete production at the concrete plant and increase the throughput of the handling facility.

A concrete production limit of 750,000 m^3 per annum is being sought for the site, which is an increase of 470,000 m^3 per annum over the existing limit of 280,000 m^3. To achieve this increase, the existing concrete plant will be upgraded to include an additional two alleys, with an additional six silos for cement storage and widening of existing raw material storage.

It is proposed to increase the throughput of the handling facility to 1 milion tpa, which is an increase of 240,000 tpa over the existing limit of 760,000 tpa. Some changes to the layout and function of the handling facility are proposed to facilitate the increase in throughput.

In addition to the above, it is proposed to construct a new concrete reclaiming machine, upgrade the site's surface water management system, and install a second weighbridge.

The proposed modification is shown in Figure 2.1.

2.3 Current noise limits

Noise assessment criteria for the site are stipulated in the site's development consent. The noise assessment criteria are specified for day and night periods at locations which are considered to be representative of residences with the most potential to be impacted by the site. The condition regarding noise is reproduced from the development consent as follows:

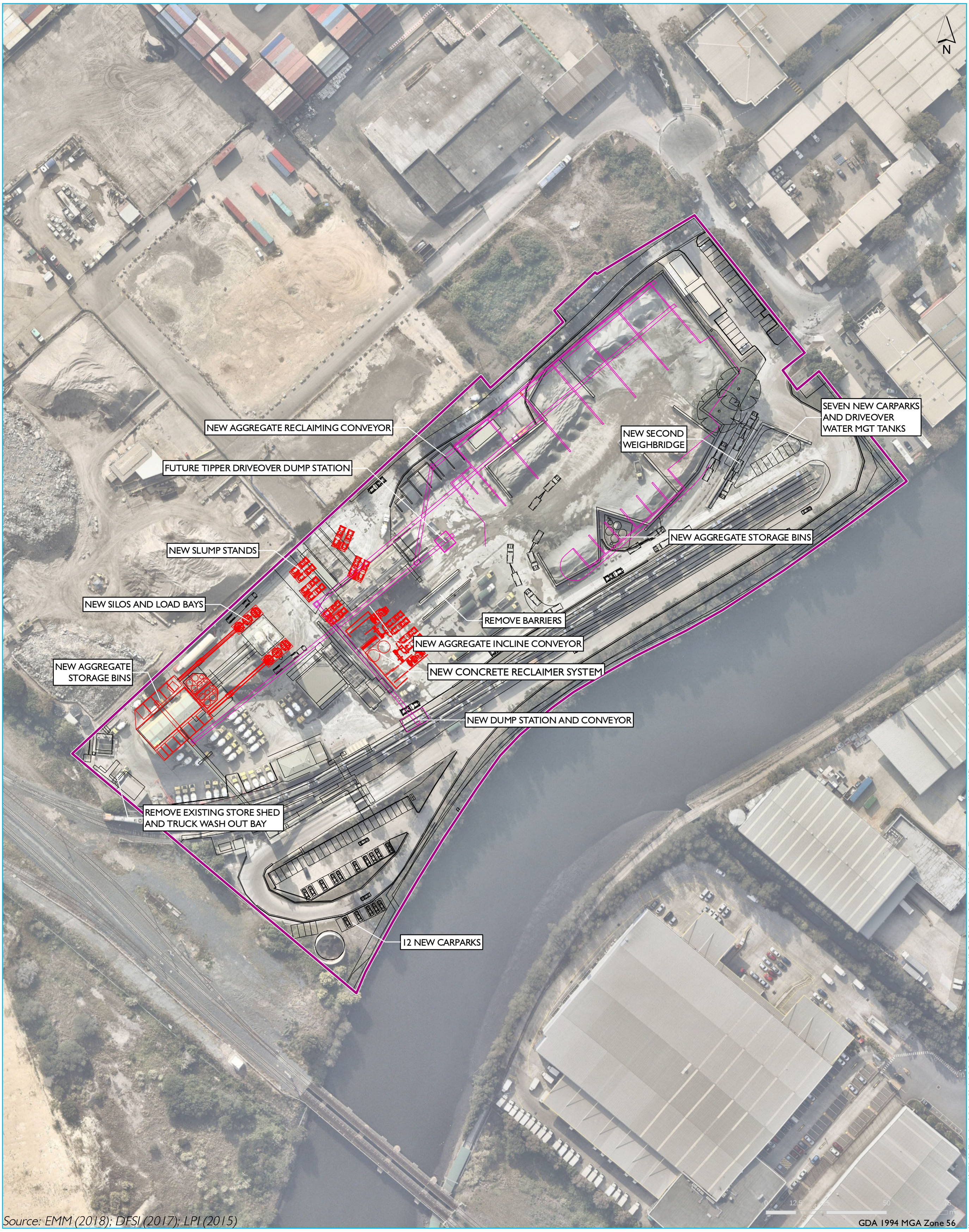
33c. The Applicant shall ensure that the noise from the development does not exceed the noise limits presented in Table 1.

Table 1: Development Noise Limits (dBA)

Day and Night LAeq (15 minute)	Location
42	Bellevue Street
44	Yelverton Street

Notes:
Noise generated by the development is to be measured in accordance with the relevant requirements, and exemptions (including certain meteorological conditions), of the NSW Industrial Noise Policy.

It is of note that the location in Bellevue Street is no longer a residential premise.



Source: EMM (2018); DFSI (2017); LPI (2015)

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KEY

Site layout

Concrete plant feature (proposed)

Material handling plant feature (proposed)

Site location

Proposed modification

Noise and vibration impact assessment

Modification 11

Boral St Peters

Figure 2.1

3 Existing environment

3.1 Noise sensitive receivers

The site is located within an industrial precinct and is immediately surrounded by other sites such as Boral's recycling facility, Visy's paper and cardboard warehouse, Maritime Container Services' terminal and various warehousing and storage facilities. The closest residences are approximately 600 m to the north-west of the site on the opposite (north) side of the Princes Highway. Otherwise surrounding land uses are industrial, with the site directly bounded by industrial premises. The site's location in its local context is shown in Figure 3.1. It is considered that if the noise trigger levels (refer to Section 4) can be satisfied at the assessment locations, which are closest to the site, then noise trigger levels will be satisfied at noise-sensitive locations that are further from the site.

Nearest representative noise sensitive locations to the site have been identified and are provided in Table 3.1, hereafter referred to in this report as assessment locations. The assessment locations are shown in Figure 3.1.

Table 3.1 Assessment locations

ID	Receiver type[1]	Address
R1	Residential	10 Terry Street, Tempe
R2	Residential	383 Princes Highway, Sydenham (Cnr of Yelverton Street and Princes Highway)
R3	Commercial	Bellevue Street, Tempe

Notes: 1. As defined in the NPfI (EPA 2017).

3.2 Background and ambient noise levels

Unattended noise monitoring was previously conducted for the site as part of the noise assessment completed by EMM in 2016. The EMM report *Noise assessment - Modification of development consent, Boral St Peters* (2016) references the existing ambient noise environment surrounding the site. We consider the noise monitoring data to remain valid and representative of existing noise levels and hence has been used for the purpose of this assessment.

Noise logging was completed at 11 Yelverton Street (NM1) in March 2016. The monitoring location is representative of residences with the most potential to be affected by the site. The logger location is shown in Figure 3.1. The unattended noise monitoring results from the EMM report (2016) are reproduced in Table 3.2.

Table 3.2 Existing and ambient background noise levels (EMM 2016)

Monitoring location	Period[1]	RBL[2], dB(A)	Ambient $L_{Aeq, period}$ noise level[3], dB
NM1 (11 Yelverton Street)	Day	54	69
	Evening	52	66
	Night	45	62

Notes: 1. Day: 7 am - 6 pm Monday - Saturday; 8 am - 6 pm Sundays and public holidays; Evening: 6 pm - 10 pm; Night: all remaining periods.

2. RBL is the overall single figure background level representing each assessment period (day/evening/night) over the whole monitoring period.

3. Represents the energy average noise level over the relevant period.

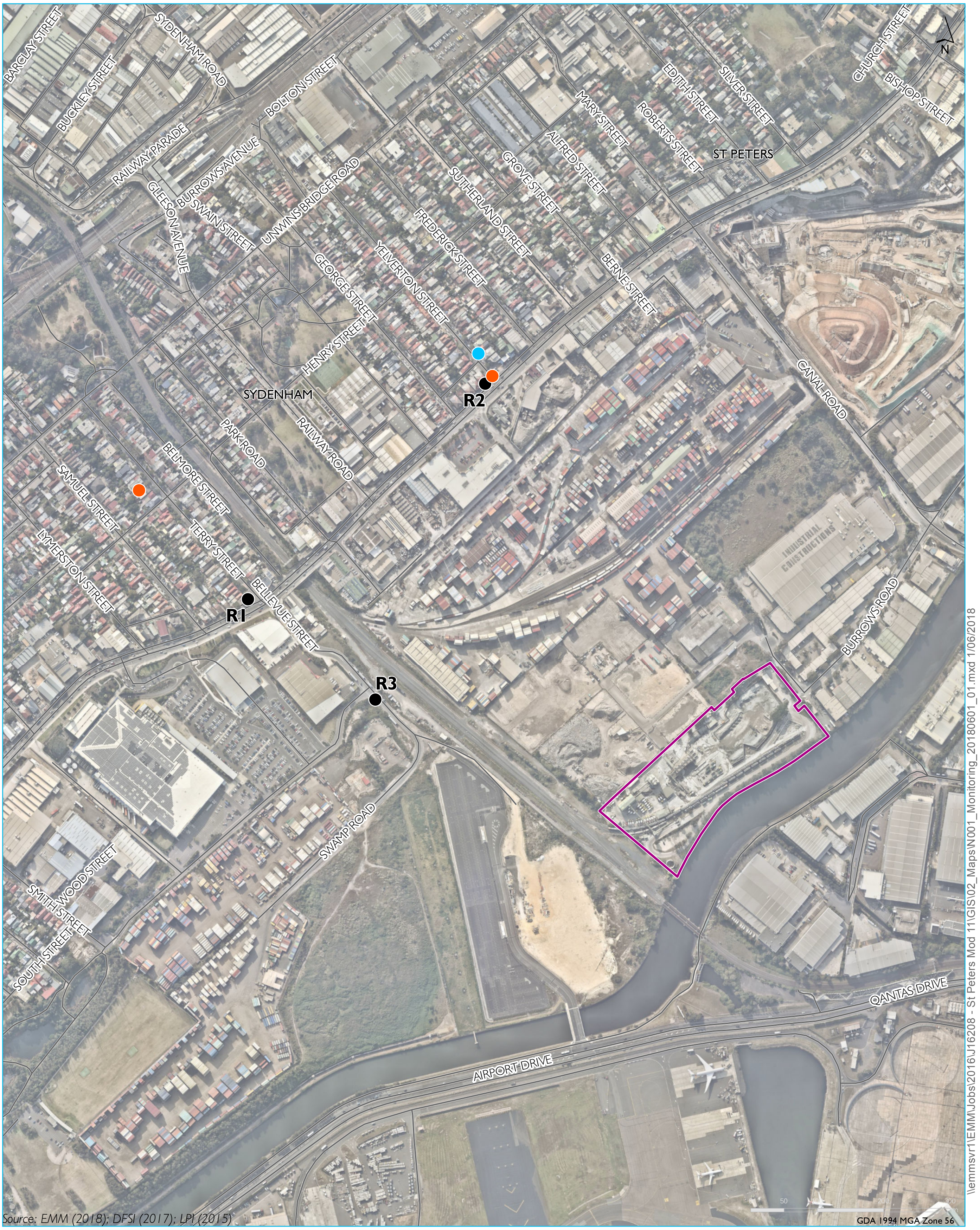
In addition to unattended noise monitoring, operator attended noise measurements were conducted by EMM in March 2016 to quantify and qualify the existing noise sources including the existing industrial noise contribution during the day and night periods. The attended noise monitoring results showed that the ambient noise environment was largely dominated by road traffic noise on the Princess Highway, with no to little industrial noise audible. Boral's existing operations at St Peters (recycling facility, concrete plant and materials handling facility) were all inaudible at the monitoring locations. Aircraft noise and natural sounds such as birds and insects (ie constant during night measurement at 11 Yelverton St) were also identified to be present at the monitoring locations. Attended noise monitoring results from the EMM report (2016) are reproduced in Table 3.3. The attended noise monitoring locations are shown in Figure 3.1.

Table 3.3 Attended noise measurements (EMM 2016)

Monitoring location	Time (hours)	Period[1]	Total 15-minute noise levels, dB			Comments and typical maximum levels
			L_{Aeq}	L_{A90}	L_{Amax}	
84 Terry St (north-west of R1[2])	12:30	Day	58	46	78	Road traffic noise from the Princes Highway was the dominant source (45-50 dB). No existing industrial noise contribution observed. Occasional aircraft over flight noise (71-78 dB). Intermittent bird foliage noise (45-46 dB).
	22:47	Night	42	39	70	Road traffic noise from the Princes Highway was the dominant source (40 dB). Occasional train noise from south of monitoring location (44-48 dB). Occasional car pass by noise in Terry Street (50-55 dB).
11 Yelverton St (near R2)	11:45	Day	67	60	84	Road traffic noise from the Princes Highway was the dominant noise source (55-65 dB). Occasional transient noise from nearby industrial site audible between breaks in road traffic. Occasional aircraft over flight noise (80-85 dB).
	13:42	Day	74	67	87	Road traffic noise from the Princes Highway was the dominant noise source (65-70 dB). No existing industrial noise contribution observed. Occasional aircraft over flight noise (80-84 dB).
	22:25	Night	77	54	94	Road traffic noise from the Princes Highway was the dominant noise source (55-65 dB). Very occasional transient noise audible from an industrial site (40-45 dB per noise event). Occasional aircraft over flight noise (85-94 dB). Insect noise constant (approx. 50 dB).

Notes: 1. Day: 7 am - 6 pm Monday - Saturday; 8 am - 6 pm Sundays and public holidays; Evening: 6 pm - 10 pm; Night: all remaining periods.

2. This location is approximately 260 m north-west of the Princes Highway and hence the lower L_{A90} noise levels.



KEY

- Assessment location
- Attended noise monitoring location
- Unattended noise monitoring location
- Site location

Noise monitoring and assessment locations

Noise and vibration impact assessment

Modification 11

Boral St Peters

Figure 3.1

3.3 Noise-enhancing meteorological conditions

Noise propagation over distance can be significantly affected by the meteorological conditions. Of most interest are source-to-receiver winds, the presence of temperature inversions or the combination of both, as these conditions can enhance received noise levels. To account for these phenomena, the NPfI specifies the following two options:

1. adopt the noise-enhancing meteorological conditions for all assessment periods for noise impact assessment purposes without an assessment of how often these conditions occur (conservative approach); and

2. determine the significance of noise-enhancing conditions.

3.3.1 Wind

Source-to-receiver wind (as being the directional component of wind) can enhance noise levels from a development at receivers.

The NPfI requires that where wind is identified to be a significant feature of the area then assessment of noise impacts should consider the highest wind speed up to 3 m/s, which is considered to prevail for at least 30% of the time. The NPfI defines 'significant' as the presence of source-to-receiver wind speed (measured at 10 m above ground level) of 3 m/s or less, occurring for 30% of the time or more in any assessment period and season.

3.3.2 Temperature inversion

The NPfI requires that the assessment of the impact of temperature inversion be confined to the night-time noise assessment period where temperature inversions generally occur. Sigma-theta data is required to determine the prevalence of temperature inversions, that is, if they occur for 30% of the time or more during the night period.

3.3.3 Significant noise-enhancing meteorological conditions analysis

A thorough review of the vector components of the 15-minute wind data was undertaken using weather data recorded between 2013 and 2018 from the BoM's Sydney Airport automatic weather station (AWS). The analysis showed that the frequency of occurrence of winds up to 3 m/s does not trigger the 30% NPfI assessment requirement for any assessment period (ie day, evening or night). Therefore, noise-enhancing meteorological conditions were not found to be significant for the project area.

An analysis of sigma-theta data from the weather data also showed that the frequency of F or G class temperature inversions for the night assessment period does not trigger the 30% NPfI assessment requirement. Therefore, temperature inversion conditions were not found to be significant for the project area.

3.3.4 Adopted meteorological conditions for modelling

The use of 'standard' meteorological conditions (NPfI option 2) was adopted for the modelling. Standard meteorological conditions as presented in Table D1 of the NPfI (EPA 2017) are reproduced in Table 3.4.

Table 3.4 Standard meteorological conditions

Meteorological condition	Meteorological parameters
Standard	Day/evening/night: stability categories A-D with wind speed up to 0.5 m/s at 10 m AGL

Notes: 1. m/s - metres per second; AGL = above ground level; stability categories are based on the Pasquill-Gifford stability classification scheme.

2. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; evening: 6 pm to 10 pm; night is the remaining periods.

Noise levels from the site have been modelled at all assessment locations based on the meteorological parameters shown in Table 3.5.

Table 3.5 Meteorological conditions adopted for noise modelling

Assessment period	Meteorological condition	Air temperature	Relative humidity	Wind speed (m/s)	Wind direction	Stability category
Day	Standard	$20^{o}C$	70%	0	N/A	D class
Evening	Standard	$10^{o}C$	90%	0	N/A	D class
Night	Standard	$10^{o}C$	90%	0	N/A	D class

4 Assessment criteria

4.1 Construction noise

The ICNG (DECC 2009) provides guidelines for the assessment and management of noise from construction works. This assessment has adopted the ICNG quantitative approach.

The ICNG suggests the following time restriction for construction activities where the noise is audible at residential premises:

- Monday to Friday 7 am to 6 pm;
- Saturday 8 am to 1 pm; and
- no construction work is to take place on Sundays or public holidays.

The ICNG acknowledges that works outside standard hours may be necessary, however justification should be provided to the relevant authorities. Table 4.1 is an extract from the ICNG and provides noise management levels for residential receivers for standard and out-of-hours periods. These time restrictions are the primary management tool of the ICNG.

Table 4.1 ICNG residential noise management levels

Time of day	Management level $L_{Aeq,15min}$	How to apply
Recommended standard hours: Monday to Friday 7 am to 6 pm Saturday 8 am to 1 pm No work on Sundays or public holidays	Noise affected RBL + 10 dB	The noise affected level represents the point above which there may be some community reaction to noise. • Where the predicted or measured LAeq,15-min is greater than the noise affected level, the proponent should apply all feasible and reasonable work practices to meet the noise affected level. • The proponent should also inform all potentially impacted residents of the nature of works to be carried out, the expected noise levels and duration, as well as contact details.
	Highly noise affected 75 dB	The highly noise affected level represents the point above which there may be strong community reaction to noise. Where noise is above this level, the relevant authority (consent, determining or regulatory) may require respite periods by restricting the hours that the very noisy activities can occur, taking into account: i) times identified by the community when they are less sensitive to noise (such as before and after school for works near schools, or mid-morning or mid-afternoon for works near residences; and ii) if the community is prepared to accept a longer period of construction in exchange for restrictions on construction times.

Table 4.1 ICNG residential noise management levels

Time of day	Management level $L_{Aeq,15min}$	How to apply
Outside recommended standard hours	Noise affected RBL +5 dB	• A strong justification would typically be required for works outside the recommended standard hours. • The proponent should apply all feasible and reasonable work practices to meet the noise affected level. • Where all feasible and reasonable practices have been applied and noise is more than 5 dBA above the noise affected level, the proponent should negotiate with the community. • For guidance on negotiating agreements see Section 7.2.2.

In summary, the ICNG noise management levels (NMLs) for activities during the recommended standard hours are 10 dB above the existing background levels. Standard hours are described in the ICNG as Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm and no work on Sundays or public holidays.

Construction works are proposed to be completed during standard hours only. The residential construction NMLs and NMLs for other sensitive land uses for the proposed works are provided in Table 4.2.

Table 4.2 Construction NMLs

Assessment location	Day[1] RBL, dB	Standard hours[2] NML, $L_{Aeq,15min}$, dB
R1 - Residence	54	64
R2 - Residence	54	64
R3 - Commercial	n/a	70

Notes: *1. Monday to Saturday 7 am to 6 pm, Sundays or Public Holidays 8 am to 6 pm.*

2. Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm and no work on Sundays or Public Holidays.

4.2 Operational noise

Noise from industrial sites or processes in NSW are regulated by the local council, the Department of Planning and Environment (DPE) and/or the EPA, and if considered a scheduled activity under the *Protection of the Environment Operations Act 1997* (POEO Act), a licence will be required stipulating noise limits. These limits are generally derived from operational noise trigger levels applied at assessment locations. They are based on NPfI guidelines (EPA 2017) or noise levels that can be achieved at a specific site following the application of all reasonable and feasible noise mitigation.

The NPfI guidelines for assessing industrial facilities have been used for this assessment. With respect to the noise trigger levels, the NPfI states:

> The project noise trigger level provides a benchmark or objective for assessing a proposal or site. It is not intended for use as a mandatory requirement. The project noise trigger level is a level that, if exceeded, would indicate a potential noise impact on the community.

Regarding decisions on developments, The NPfI also states:

> Planning decisions for proposed developments take into account social, economic and environmental factors. Noise impact is one factor taken into account and decisions can be made that result in residual noise impacts.

The objectives of noise assessment noise trigger levels for industry are to protect the community from excessive intrusive noise and preserve amenity for specific land uses.

To ensure these objectives are met, the EPA provides two separate noise trigger levels: intrusiveness noise level and amenity noise level. These are discussed further in the following sections.

4.2.1 Intrusiveness

The intrusiveness noise levels require that $L_{Aeq,15min}$ noise levels from the site during the relevant operational periods do not exceed the RBL by more than 5 dB at any residence.

The RBLs adopted for residences are based on the review of unattended noise data provided in Table 3.2. The intrusiveness noise levels determined for the site were based on the RBLs adopted for all residences surrounding the site and are presented in Table 4.3.

Table 4.3 Intrusiveness noise levels

Assessment location	Adopted RBL, dB(A)			Intrusiveness $L_{Aeq,15min}$ noise level, dB		
	Day	Evening	Night	Day	Evening	Night
R1	54	52	45	59	57	50
R2	54	52	45	59	57	50

Notes: 1. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; Evening: 6 pm to 10 pm; Night: all remaining periods.

4.2.2 Amenity

The assessment of amenity is based on trigger noise levels specific to the land use. The trigger noise levels relate only to industrial noise and exclude road or rail noise.

Residences potentially affected by the proposed activity have been categorised in the NPfI 'urban' amenity category, in accordance with the definitions provided in Table 2.3 of the NPfI (EPA 2017). The NPfI states:

> An area with an acoustical environment that:
>
> - is dominated by 'urban hum' or industrial source noise, where urban hum means the aggregate sound of many unidentifiable, mostly traffic and/or industrial related sound sources;
> - has through-traffic with characteristically heavy and continuous traffic flows during peak periods;
> - is near commercial districts or industrial districts; and/or
> - has a combination of the above.

The corresponding recommended amenity noise levels for site are given in Table 4.4.

Table 4.4 Amenity noise levels

Assessment location	Amenity area	Assessment period	Recommended amenity L_{Aeq} noise level[1], dB	Project amenity $L_{Aeq,15min}$ noise level[2], dB
Residence (R1-R2)	Urban	Day	60	58
		Evening	50	48
		Night	45	43
Commercial (R3)	All	When in use	65	63

Notes: 1. Recommended amenity noise level as per Table 2.2 in the NPfI (EPA 2017).

2. Project amenity noise level is the recommended amenity noise level minus 5 dB and $L_{Aeq,15min}$ is equal to $L_{Aeq,period}$ + 3 dB as per the NPfI (EPA 2017).

3. In accordance with Table 2.2 of the NPfI (EPA 2017).

4.2.3 Noise trigger levels

The project trigger noise level (PNTL) is the lower of the calculated intrusiveness or amenity noise levels and is provided in Table 4.5 for all assessment locations.

Table 4.5 Project Noise Trigger Levels

Location	Intrusiveness $L_{Aeq,15min}$ noise level, dB			Amenity $L_{Aeq,15min}$ noise level[1], dB			PNTL $L_{Aeq,15min}$[2], dB		
	Day	Evening	Night	Day	Evening	Night	Day	Evening	Night
R1 - Residence	59	57	50	**58**	**48**	**43**	58	48	43
R2 - Residence	59	57	50	**58**	**48**	**43**	58	48	43
R3 - Commercial	N/A	N/A	N/A	63 (when in use)			63 (when in use)		

Notes: 1. Project amenity noise level is the recommended amenity noise level minus 5 dB and $L_{Aeq,15min}$ is equal to $L_{Aeq,period}$ + 3 dB as per the NPfI (EPA 2017).

2. Day: 7 am to 6 pm Monday to Saturday; 8 am to 6 pm Sundays and public holidays; evening: 6 pm to 10 pm; night is the remaining periods.

3. Value in bold font and underlined is the lower of the intrusiveness and amenity noise levels for residences.

4.3 Sleep disturbance

The site will operate during the night-time period (24 hours) and therefore the assessment of potential sleep disturbance from maximum noise events at residences is required in accordance with the NPfI. Sleep disturbance is defined as both awakenings and disturbance to sleep stages.

The NPfI provides the following sleep disturbance trigger levels for residences:

- $L_{Aeq,15min}$ 40 dB or the prevailing RBL plus 5 dB, whichever is the greater; and/or
- L_{Amax} 52 dB or the prevailing RBL plus 15 dB, whichever is the greater.

A detailed maximum noise level event assessment is required if at least one of these trigger levels is exceeded. The detailed assessment should cover the maximum noise level, the extent to which the maximum noise level exceeds the RBL, and the number of times this happens during the night-time period. Some further guidance in regards to potential impact on sleep is provided in the RNP (DECCW 2011).

The RNP calls upon a number of studies that have been conducted into the effect of maximum noise levels on sleep, and provides the following factors that are key in assessing the extent of impacts on sleep:

- how often high noise events would occur;
- the distribution of likely events across the night-time period and the exiting ambient maximum events in the absence of the project;
- whether there are times of day when there is a clear change in the noise environment (such as during early-morning shoulder periods); and
- current scientific literature available at the time of the assessment regarding the impact of maximum noise level events at night.

The sleep disturbance noise trigger levels for the residential assessment locations are shown in Table 4.6.

Table 4.6 Sleep disturbance noise trigger levels - residential assessment locations

Assessment location	Adopted night-time RBL, dB(A)	Recommended sleep disturbance trigger level, dB		Adopted sleep disturbance trigger level, dB	
		$L_{Aeq,15min}$	L_{Amax}	$L_{Aeq,15min}$	L_{Amax}
		Standard/RBL +5	Standard/RBL +15		
R1	45	40/**<u>50</u>**	52/**<u>60</u>**	50	60
R2	45	40/**<u>50</u>**	52/**<u>60</u>**	50	60

Notes: 1. Value in bold font and underlined is the greater of the sleep disturbance noise levels.

4.4 Road traffic noise

The principle guidance for assessing the impact of road traffic noise on receivers is in the RNP. The majority of the traffic will travel to and from the site via Canal Road (northbound) and the Princes Highway. The nearest noise sensitive receivers potentially affected by an increase in road traffic noise associated with the proposed activity are located on the Princes Highway which is classified as an arterial road according to the RNP.

The road noise assessment criteria for residential land uses from Table 3 of the RNP are reproduced in Table 4.7.

Table 4.7 Road traffic noise assessment criteria for residential land uses

Road category	Type of project/development	Assessment criteria, dB(A)	
		Day (7 am to 10 pm)	Night (10 pm to 7 am)
Freeway/arterial/sub-arterial roads	Existing residences affected by additional traffic on existing freeway/arterial/sub-arterial roads generated by land use developments.	$L_{Aeq(15hr)}$ 60 (external)	$L_{Aeq(9hr)}$ 55 (external)

Source: RNP (DECCW 2011).

The RNP states that where existing road traffic noise criteria are already exceeded, any additional increase in total traffic noise level should be limited to 2 dB.

4.5 Construction vibration

4.5.1 Human comfort

i Human perception of vibration

People are far more sensitive to vibration than is commonly realised. They can detect vibration levels which are well below those causing any risk of damage to a building or its contents.

The actual perception of motion or vibration may not, in itself, be disturbing or annoying. An individual's response to that perception, and whether the vibration is 'normal' or 'abnormal', depends very strongly on previous experience and expectations, and on other connotations associated with the perceived source of the vibration. For example, the vibration that a person responds to as 'normal' in a car, bus or train is considerably higher than what is perceived as 'normal' in a shop, office or dwelling.

Human tactile perception of random motion, as distinct from human comfort considerations, was investigated by Diekmann and subsequently updated in German Standard DIN 4150 Part 2 1975. On this basis, the resulting degrees of perception for humans are suggested by the vibration level categories given in Table 4.8.

Table 4.8 Peak vibration levels and human perception of motion

Approximate vibration level	Degree of perception
0.10 mm/s	Not felt
0.15 mm/s	Threshold of perception
0.35 mm/s	Barely noticeable
1.0 mm/s	Noticeable
2.2 mm/s	Easily noticeable
6.0 mm/s	Strongly noticeable
14.0 mm/s	Very strongly noticeable

Notes: 1. These are approximate vibration levels (in floors of building) for vibration having a frequency content in the range of 8 Hz to 80 Hz.

Table 4.8 suggests that people can start to feel ground vibration at levels of about 0.15 mm/s and that the motion becomes 'noticeable' at a level of approximately 1 mm/s.

ii Assessing vibration: a technical guideline

The DEC guideline for the assessment of vibration *Environmental Noise Management – Assessing Vibration: a technical guideline* (2006) (the guideline) is based on guidelines contained in BS 6472 – 2008, 'Evaluation of human exposure to vibration in buildings (1-80Hz)'.

The guideline presents preferred and maximum vibration values for use in assessing human responses to vibration and provides recommendations for measurement and evaluation techniques. At vibration values below the preferred values, there is a low probability of adverse comment or disturbance to building occupants. Where all feasible and reasonable mitigation measures have been applied and vibration values are still beyond the maximum value, it is recommended the proponent or operator negotiate directly with the affected community.

The guideline defines three vibration types and provides direction for assessing and evaluating the applicable criteria. Table 2.1 of the guideline provides examples of the three vibration types and has been reproduced in Table 4.9.

Table 4.9 Examples of types of vibration

Continuous vibration	Impulsive vibration	Intermittent vibration
Machinery, steady road traffic, continuous construction activity (such as tunnel boring machinery).	Infrequent: Activities that create up to 3 distinct vibration events in an assessment period, e.g. occasional dropping of heavy equipment, occasional loading and unloading. Blasting is assessed using ANZECC (1990).	Trains, intermittent nearby construction activity, passing heavy vehicles, forging machines, impact pile driving, jack hammers. Where the number of vibration events in an assessment period is three or fewer these would be assessed against impulsive vibration criteria.

Source: Table 2.1 of the guideline (DEC 2006).

The types of vibration of relevance to the site are continuous and intermittent vibration, and hence impulsive vibration has not been discussed further.

a. Continuous vibration

Appendix C of the guideline outlines acceptable criteria for human exposure to continuous vibration (1-80 Hz). The criteria are dependent on both the time of activity (usually daytime or night-time) and the occupied place being assessed. Table 4.10 reproduces the preferred and maximum criteria relating to measured peak velocity.

Table 4.10 Criteria for exposure to continuous vibration

Place	Time	Peak velocity[1,2]	
		Preferred	Maximum
Critical working areas (eg hospital operating theatres, precision laboratories)	Day or night-time	0.14	0.28
Residences	Daytime	0.28	0.56
	Night-time	0.20	0.40
Offices	Day or night-time	0.56	1.1
Workshops	Day or night-time	1.1	2.2

Notes: 1. Root mean square velocity (mm/s) and vibration velocity value (dB re 10^{-9} mm/s).

2. Values given for most critical frequency >8 Hz assuming sinusoidal motion.

b. Intermittent vibration

Intermittent vibration (as defined in Section 2.1 of the guideline) is assessed using the vibration dose concept which relates to vibration magnitude and exposure time.

Intermittent vibration is representative of activities such as impact hammering, rolling or general excavation work (such as an excavator tracking).

Section 2.4 of the guideline provides acceptable values for intermittent vibration in terms of vibration dose values (VDV) which requires the measurement of the overall weighted root mean square (rms) acceleration levels over the frequency range 1 Hz to 80 Hz.

To calculate VDV, Section 2.4.1 of the guideline provides the following formula:

$$VDV = \left[\int_0^T a^4(t)dt \right]^{0.25}$$

Where VDV is the vibration dose value in $m/s^{1.75}$, *a (t)* is the frequency-weighted rms of acceleration in m/s^2 and *T* is the total period of the day (in seconds) during which vibration may occur.

The acceptable VDV for intermittent vibration are reproduced in Table 4.11.

Table 4.11 Acceptable VDV for intermittent vibration

Location	Daytime		Night-time	
	Preferred value, $m/s^{1.75}$	**Maximum value, $m/s^{1.75}$**	**Preferred value, $m/s^{1.75}$**	**Maximum value, $m/s^{1.75}$**
Critical Areas	0.10	0.20	0.10	0.20
Residences	0.20	0.40	0.13	0.26
Offices, schools, educational institutions and places of worship	0.40	0.80	0.40	0.80
Workshops	0.80	1.60	0.80	1.60

Notes: 1. Daytime is 7 am to 10 pm and night-time is 10 pm to 7 am.

2. These criteria are indicative only, and there may be a need to assess intermittent values against continuous or impulsive criteria for critical areas.

There is a low probability of adverse comment or disturbance to building occupants at vibration values below the preferred values. Adverse comment or complaints may be expected if vibration values approach the maximum values. The guideline states that activities should be designed to meet the preferred values where an area is not already exposed to vibration.

4.5.2 Structural vibration

Most commonly specified ‘safe’ structural vibration limits are designed to minimise the risk of threshold or cosmetic surface cracks, and are set well below the levels that have potential to cause damage to the main structure.

In terms of the most recent relevant vibration damage criteria, Australian Standard AS 2187.2 - 2006 'Explosives - Storage and Use - Use of Explosives' recommends the frequency dependent guideline values and assessment methods given in BS 7385 Part 2-1993 - 'Evaluation and measurement for vibration in buildings Part 2' (the standard) be used as they are ‘applicable to Australian conditions’.

The standard sets guide values for building vibration based on the lowest vibration levels above which damage has been credibly demonstrated. These levels are judged to give a minimum risk of vibration induced damage, where minimal risk for a named effect is usually taken as a 95% probability of no effect.

Sources of vibration that are considered in the standard include activities such as demolition, piling, ground treatments (eg compaction), tunnelling, the use of construction equipment and industrial machinery, road and rail traffic.

The recommended limits (guide values) for transient vibration to ensure minimal risk of cosmetic damage to residential and industrial buildings are presented numerically in Table 4.12 and graphically in Figure 4.1.

Table 4.12 Transient vibration guide values - minimal risk of cosmetic damage

Line	Type of building	Peak component particle velocity in frequency range of predominant pulse	
		4 Hz to 15 Hz	15 Hz and above
1	Reinforced or framed structures: Industrial and heavy commercial buildings	50 mm/s at 4 Hz and above	
2	Unreinforced or light framed structures: Residential or light commercial type buildings	15 mm/s at 4 Hz increasing to 20 mm/s at 15 Hz	20 mm/s at 15 Hz increasing to 50 mm/s at 40 Hz and above

The standard states that the guide values in Table 4.12 relate predominantly to transient vibration that does not give rise to resonant responses in structures and low-rise buildings.

Where the dynamic loading caused by continuous vibration is such as to give rise to dynamic magnification due to resonance, especially at the lower frequencies where lower guide values apply, then the guide values in Table 4.12 may need to be reduced by up to 50%.

Sheet piling activities (for example) are considered to have the potential to cause dynamic loading in some structures (eg residences) and it may therefore be appropriate to reduce the transient values by 50%.

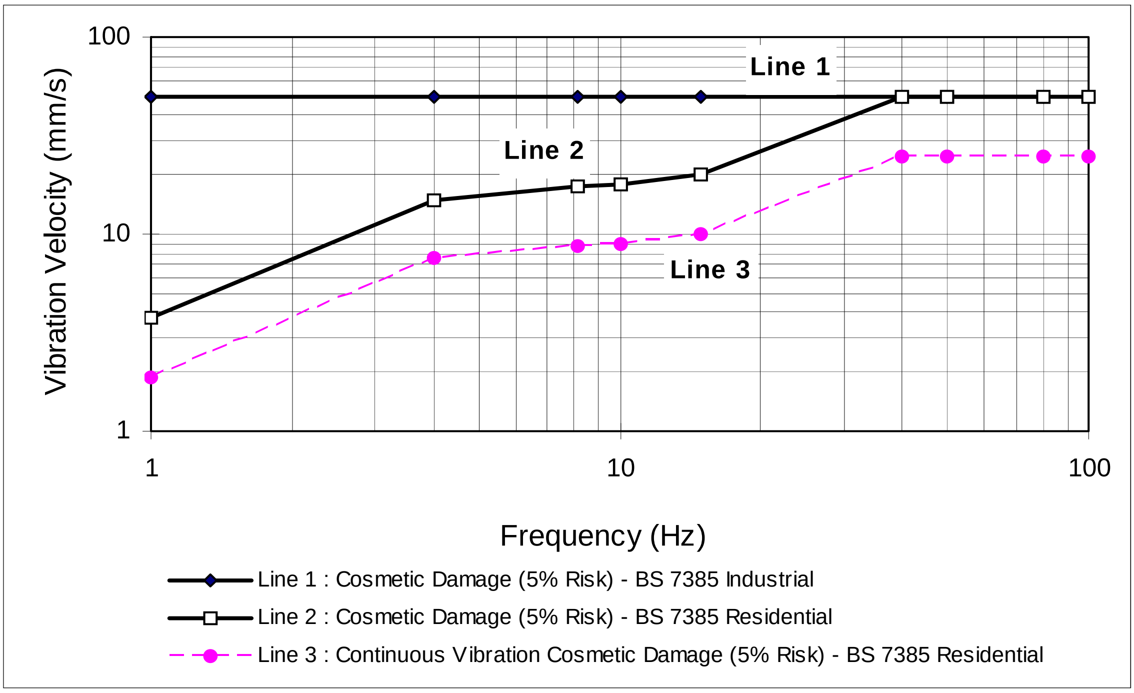


Figure 4.1 Transient vibration guide values for cosmetic damage

In the lower frequency region where strains associated with a given vibration velocity magnitude are higher, the guide values for building types corresponding to Line 2 are reduced.

Below a frequency of 4 Hz where a high displacement is associated with the relatively low peak component particle velocity value, a maximum displacement of 0.6 mm (zero to peak) is recommended. This displacement is equivalent to a vibration velocity of 3.7 mm/s at 1 Hz.

The standard goes on to state that minor damage is possible at vibration magnitudes which are greater than twice those given in Table 4.12, and major damage to a building structure may occur at values greater than four times the tabulated values.

Fatigue considerations are also addressed in the standard, which concludes that unless calculation indicates that the magnitude and number of load reversals is significant (in respect of the fatigue life of building materials) then the guide values in Table 4.12 should not be reduced for fatigue considerations.

In order to assess the likelihood of cosmetic damage due to vibration, AS 2187 specifies that vibration should be measured at the base of the building and the highest of the orthogonal vibration components (transverse, longitudinal and vertical directions) should be compared with the criteria curves presented in Table 4.12.

In addition to the guide values nominated in Table 4.12, the standard states that:

> Some data suggests that the probability of damage tends towards zero at 12.5 mm/s peak component particle velocity. This is not inconsistent with an extensive review of the case history information available in the UK.

Also that:

> A building of historical value should not (unless it is structurally unsound) be assumed to be more sensitive.

5 Noise assessment

5.1 Noise modelling method

Quantitative modelling of noise emissions from the site was completed using Brüel & Kjær Predictor noise prediction software. This software calculates total noise levels at assessment locations from the concurrent operation of multiple noise sources. The noise model incorporates factors such as:

- the lateral and vertical location of plant and equipment;
- source-to-receptor distances;
- ground effects;
- atmospheric absorption;
- topography; and
- meteorological conditions.

Three-dimensional digitised ground contours of the site and surrounding land were incorporated to model topographic effects. Equipment was modelled at locations and heights representative of potential construction and operational scenarios for the site.

The model was used to predict noise levels during standard meteorological conditions (Table 3.5) at each of the assessment locations (Table 3.1).

5.2 Construction noise

Construction noise levels have been predicted to nearest assessment locations outlined in Table 3.1 using the model. Construction noise emissions have been modelled assuming worst-case distribution of construction equipment at the site over an ICNG 15-minute assessment period during standard construction hours.

The construction works are expected to be completed in approximately nine months, with works staggered in stages to reduce overall disruption to production. It is noted that some of the equipment items will not be required on-site for the entire construction period, however all items have been conservatively modelled as operating concurrently and at full power for the purpose of this assessment. The construction noise impact assessment has adopted equipment noise emission values obtained from the EMM noise database for equipment used on similar projects. The list of construction equipment items and quantities provided by Boral with typical sound power levels adopted in the noise modelling are shown in Table 5.1.

Table 5.1 Construction equipment

Equipment	Quantity	Sound power level – L_{Aeq}, dB
Piling rig (small with <15 m mast)	1	115
30 tonne excavator	1	107
13 tonne excavator	2	104
Vibro compaction roller	1	116
Concrete pumps	2	113
Delivery truck	1	103
Hand tools (eg grinder, drill, etc.)	1	104

Predicted noise levels during standard construction hours are shown in Table 5.2.

Table 5.2 Predicted noise levels – construction equipment

Location	Period	Predicted construction noise, $L_{Aeq,15min}$, dB	NML, dB	Exceedance above NML, dB
R1 - Residence	Standard hours[1]	53	64	Nil
R2 - Residence	Standard hours[1]	53	64	Nil
R3 - Commercial	When in use	60	70	Nil

Notes: 1. Monday to Friday 7 am to 6 pm, Saturday 8 am to 1 pm and no work on Sundays or Public Holidays.

Noise levels generated by the proposed construction are predicted to satisfy the ICNG NMLs at all assessment locations. Notwithstanding, the proponent will manage and minimise the potential for construction noise impacts from site, as discussed further in Section 7.1.1.

5.3 Operational noise

The difference in operating noise levels between the current approved operations and the proposed modification has been assessed. Operational noise sources and associated sound power levels used in the noise model are summarised in Table 5.3. The plant and equipment items are based on the current site inventory and proposed equipment list, as provided by Boral. The sound power levels are based on an EMM database of similar plant and equipment.

Table 5.3 Operational plant and equipment sound power levels

Plant and equipment	Current quantity	Proposed quantity	Sound power level - L_{Aeq}, dB
Concrete agitator	3	7	103
Concrete agitator slumping	2	7	111
Cement tanker	1	1	110
Front-end loader (FEL)	1	1	105
Water truck	1	1	96
Batching plant – Mixing bowl[1]	1	2	100
Train (loco idling)	1	1	103
Bobcat	1	1	100
Forklift	1	1	105
Aggregate truck	1	1	104

Table 5.3 Operational plant and equipment sound power levels

Plant and equipment	Current quantity	Proposed quantity	Sound power level - L_{Aeq}, dB
Aggregate truck idling	1	1	97
Articulated dump truck	1	1	108
concrete plant conveyor[2] – train to storage bins	1	1	78 (per metre)
concrete plant conveyor[2] – storage bins to batch plant	2	4	78 (per metre)
HF conveyor[2] – train to storage bins	1	1	78 (per metre)
HF conveyor[2] – storage bins to truck stand	1	1	78 (per metre)
HF conveyor[2] – storage bins to stockpiles	-	1	78 (per metre)
Aggregate incline conveyor[2]	-	1	78 (per metre)

Notes: 1. As the batching plant is proposed to have enclosed loading facilities with automatic doors, it has been afforded a 10 dB emission reduction (ie 110-10=100 dB).

2. As the conveyors are enclosed (existing) or proposed to be enclosed (new), they have been afforded a 10 dB emission reduction (ie 88-10=78 dB).

In addition to the sound power levels and quantities provided, main operating assumptions adopted for a worst-case 15-minute period are as follows:

- the FEL, concrete agitators, trains, aggregate trucks, water truck, conveyors and the batch plant are assumed to operate continuously in any 15-minute period in the day, evening or night;
- the bobcat, forklift and dump truck are assumed to operate approximately 50% of the time in any 15-minute period in the day, evening or night; and
- all onsite vehicle movements are 20 km/hr or less.

5.3.1 Modelling results

The existing and predicted future noise levels at each assessment location for each assessment period are provided in Table 5.4.

Table 5.4 Predicted noise levels for approved and proposed operations during NPfI standard meteorological conditions

Assessment location	Existing operations, $L_{Aeq,15min}$, dB			Proposed operations, $L_{Aeq,15min}$, dB			Predicted change in noise level, dB			PNTL, $L_{Aeq,15min}$, dB		
	D	E	N	D	E	N	D	E	N	D	E	N
R1	41	41	41	42	42	42	+1	+1	+1	58	48	43
R2	<44	<44	<44	44	44	44	+1	+1	+1	58	48	43
R3	47	47	47	48	48	48	+1	+1	+1	63	63	63

Notes: 1. D = Day; E = Evening; N = Night.

Site noise emissions during proposed operations are predicted to comply with the relevant PNTLs at all assessment locations considered as part of this assessment.

It is of note that results of the operator attended noise surveys undertaken near the residential assessment locations R1 and R2 indicate that existing operational noise levels from the site were inaudible at the time of measurement and that the existing noise environment at the nearest residences is dominated by road traffic noise on the Princes Highway.

Significantly, and of most relevance to the proposed modification, is that the predicted noise levels demonstrate that operational noise from the proposed modification will not increase existing site noise levels by more than 1 dB. This outcome satisfies the requirement set-out in the NPfI, whereby noise levels from the proposed operations (with all feasible and reasonable measures in place) do not significantly increase the existing noise emissions. A change in sound levels of 1 to 2 dB is deemed 'typically indiscernible' to the human ear. Thus, an increase of 1 to 2 dB in site noise emissions is unlikely to be perceivable at the nearest assessment location and therefore it is unlikely that the changes in project noise emissions would cause adverse impacts at any residence.

5.4 Sleep disturbance assessment

The predicted maximum noise levels from the site at all residential assessment locations are presented for standard meteorological conditions in Table 5.5. The predictions are for the night period only (10 pm to 7 am) coinciding with the typical sleep period and in accordance with the NPfI.

For the assessment of maximum L_{Amax} noise levels, maximum noise events with the potential to occur on site include the FEL scraping concrete and/or loading aggregate trucks. This noise event has been modelled at L_{Amax} 126 dB and represents the likely highest maximum noise level event from the site.

Table 5.5 Predicted noise levels during the night period

Assessment location[1]	Predicted noise levels, dB		Maximum noise trigger level, dB		Exceedance, dB	
	$L_{Aeq,15min}$	L_{Amax}	$L_{Aeq,15min}$	L_{Amax}	$L_{Aeq,15min}$	L_{Amax}
R1	42	53	50	60	Nil	Nil
R2	<44	57	50	60	Nil	Nil

Notes: 1. The sleep disturbance assessment applies to residential assessment locations only.

Maximum noise levels from site are predicted to satisfy the NPfI sleep disturbance trigger levels at both representative residential assessment locations (R1 and R2).

5.5 Road traffic noise assessment

The nearest residences potentially affected by an increase in road traffic volumes as a result of the proposed modification are located on the Princes Highway.

The existing traffic volumes on the Princes Highway were surveyed in December 2017 and are presented in Table 5.6.

Table 5.6 Summary of existing traffic volumes on the Princes Highway

Road	Intersection survey location	Estimated daily traffic[1]	Average week day heavy vehicles[1]	% heavy vehicles
Princes Highway	South of Canal Road	53,900	1,830	3.4
Princes Highway	North of Canal Road	30,100	900	3.0

Notes: 1. Daily heavy vehicle numbers and their % have been extrapolated from the am and pm peak hourly heavy vehicle traffic proportions.

Assessed traffic movements during operation have been based on peak production days. The proposed additional site daily traffic volumes on the public road network will consist of approximately 1,066 heavy vehicle movements and 50 light vehicle movements on peak production days.

The traffic assessment (EMM 2018) prepared for the proposed development indicates that approximately 40% of the site daily truck movements and 50% of light vehicles associated with the site operation will travel via the Princes Highway.

The traffic assessment (EMM 2018) estimated that site related traffic will increase the exiting daily traffic movements on Canal Road by 0.4% southbound and 0.7% northbound (on the Princes Highway). Given this relatively small increase in proposed traffic volumes, there would be a negligible increase in road traffic noise levels at the nearest residential locations. Therefore, the impact of road traffic noise associated with the proposed development is predicted to be negligible and within the 2 dB allowable increase for land use developments as described in the RNP (DECCW 2011).

6 Construction vibration assessment

6.1 Ground-borne vibration (safe working distances)

As a guide, safe working distances for typical items of vibration intensive plant are listed in Table 6.1. The safe working distances are quoted for both “Cosmetic Damage” (refer British Standard BS 7385) and “Human Comfort” (refer British Standard BS 6472-1).

Table 6.1 Recommended safe working distances for vibration intensive plant

Plant Item	Rating/Description	Safe working distance	
		Cosmetic damage (BS 7385)	Human response (BS 6472)
Vibratory Roller	<50kN (Typically 1-2 tonnes)	5 m	15 to 20 m
	<100kN (Typically 2-4 tonnes)	6 m	20 m
	<200kN (Typically 4-6 tonnes)	12 m	40 m
	<300kN (Typically 7-13 tonnes)	15 m	100 m
	>300kN (Typically 13-18 tonnes)	20 m	100 m
	>300kN (>18 tonnes)	25 m	100 m
Small hydraulic hammer	(300 kg - 5 to 12t excavator)	2 m	7 m
Medium hydraulic hammer	(900 kg - 12 to 18t excavator)	7 m	23 m
Large hydraulic hammer	(1600 kg - 18 to 34t excavator)	22 m	73 m
Vibratory pile driver	Sheet piles	2 m to 20 m	20 m
Pile boring	≤ 800 mm	2 m (nominal)	N/A
Jackhammer	Hand held	1 m (nominal)	Avoid contact with structure

Source: Transport Infrastructure Development Corporation Construction’s Construction Noise Strategy (Rail Projects) (November 2007).

The safe working distances presented in Table 6.1 are indicative and will vary depending on the particular item of plant and local geotechnical conditions. They apply to cosmetic damage of typical buildings under typical geotechnical conditions.

In relation to human comfort (response), the safe working distances in Table 6.1 relate to continuous vibration and apply to residential receivers. For most construction activities, vibration emissions are intermittent in nature and for this reason, higher vibration levels, occurring over shorter periods are allowed, as specified in British Standard 6472 – 2008, 'Evaluation of human exposure to vibration in buildings (1-80Hz)'.

6.2 Summary of potential construction vibration impacts

The nearest building to the site is approximately 45 m from the eastern property boundary. It is therefore envisaged that cosmetic damage to nearby structures is unlikely. At such distance however, human response can be expected for construction activities that include the use of a vibratory roller. The safe working distances provided in Table 6.1 should be followed in the first instance and management of vibration levels may be required when the vibratory roller is in use. Construction vibration management measures are presented in Section 7.2.2.

7 Management and mitigation

7.1 Operations

Noise predictions indicate that operational noise emission levels from the site will satisfy relevant PNTLs. Notwithstanding, there are mitigation measures that may be employed to further reduce noise impacts. These include:

- design traffic management to minimise the need for reversing especially during the night-time and early morning period;
- regular maintenance and servicing of plant and equipment;
- the use of broadband reversing alarms (growlers) on site equipment;
- plant and equipment to be switched off when not in use; and
- minimise material drop heights.

7.2 Construction

7.2.1 Noise

Construction noise levels from the site are predicted to satisfy the NMLs at all assessment locations during standard construction hours. Nonetheless, the proponent shall manage construction noise from the site by adopting universal work practices such as:

- constructing during ICNG standard hours only;
- regular reinforcement (such as at toolbox talks) of the need to minimise noise and vibration;
- avoiding the use of portable radios, public address systems or other methods of site communication that may unnecessarily impact upon residents;
- parking of vehicles in locations and ways to minimise noise;
- minimising the need for vehicle reversing for example, by arranging for one-way site traffic routes (largely achieved by virtue of site layout);
- use of broadband audible reverse alarms on vehicles and elevated work platforms used on site; and
- minimising the movement of materials and plant and unnecessary metal-on-metal contact.

7.2.2 Vibration

The following “baseline” vibration mitigation measures will be implemented where reasonably and feasibly practicable:

- all construction works will be carried out during ICNG standard hours and work generating high vibration levels will be scheduled during less sensitive time periods; and

- consecutive works in the same locality will be minimised.

8 Conclusion

EMM has completed a noise assessment for the proposed modification (Modification 11) at Boral's concrete plant and handling facility site in St Peters. The noise assessment has been prepared in accordance with the methodologies outlined in the ICNG, NPfI and RNP.

The proposed modification includes an increase in concrete production at the concrete plant and throughput of the handling facility. To achieve the modification, some upgrades to the existing concrete plant and changes to the layout and function of the handling facility are also proposed.

Modelling of construction noise from the proposed modification was undertaken for standard construction hours. Noise levels during construction are predicted to satisfy the ICNG NMLs at all assessment locations.

Operational noise from the proposed operations was modelled. The assessment found that operational noise from the proposed modifications satisfies the relevant PNTLs for day, evening and night periods at all assessment locations. The assessment showed that the proposed modification will result in an increase in site noise levels of no greater than 1 dB compared to existing operations. Further, noise levels from the proposed modification are predicted to be significantly less than existing ambient noise levels at the assessment locations where road traffic noise dominates the existing noise environment. Noise levels from the modification are therefore not expected to cause adverse impacts at any assessment location.

Sleep disturbance from proposed operations during the night period has been assessed. The highest predicted maximum noise levels ($L_{Aeq,15min}$ and L_{Amax}) from site are expected to be well below the NPfI trigger noise levels and therefore unlikely to cause sleep disturbance at residential assessment locations.

Traffic generated by the modification is not expected to generate any noticeable increase in road traffic noise levels at the nearest residential locations. Therefore, the impact of road traffic noise associated with the proposed modification is predicted to be negligible and within the 2 dB allowable increase for land use developments as described in the RNP.

Construction vibration impacts from the proposed modification will be managed in the first instance, but considered to be unlikely.

References

Australian Standard AS 1055-1997, *Acoustics - Description and Measurement of Environmental Noise – Parts 1, 2 and 3.*

EMM Consulting Pty Ltd (EMM) 2018, *Boral St Peters Traffic Impact Assessment*.

NSW Department of Environment, Climate Change and Water (DECCW) 2011, *Road Noise Policy*.

NSW Environmental Protection Authority (EPA) 2017, *Noise Policy for Industry.*

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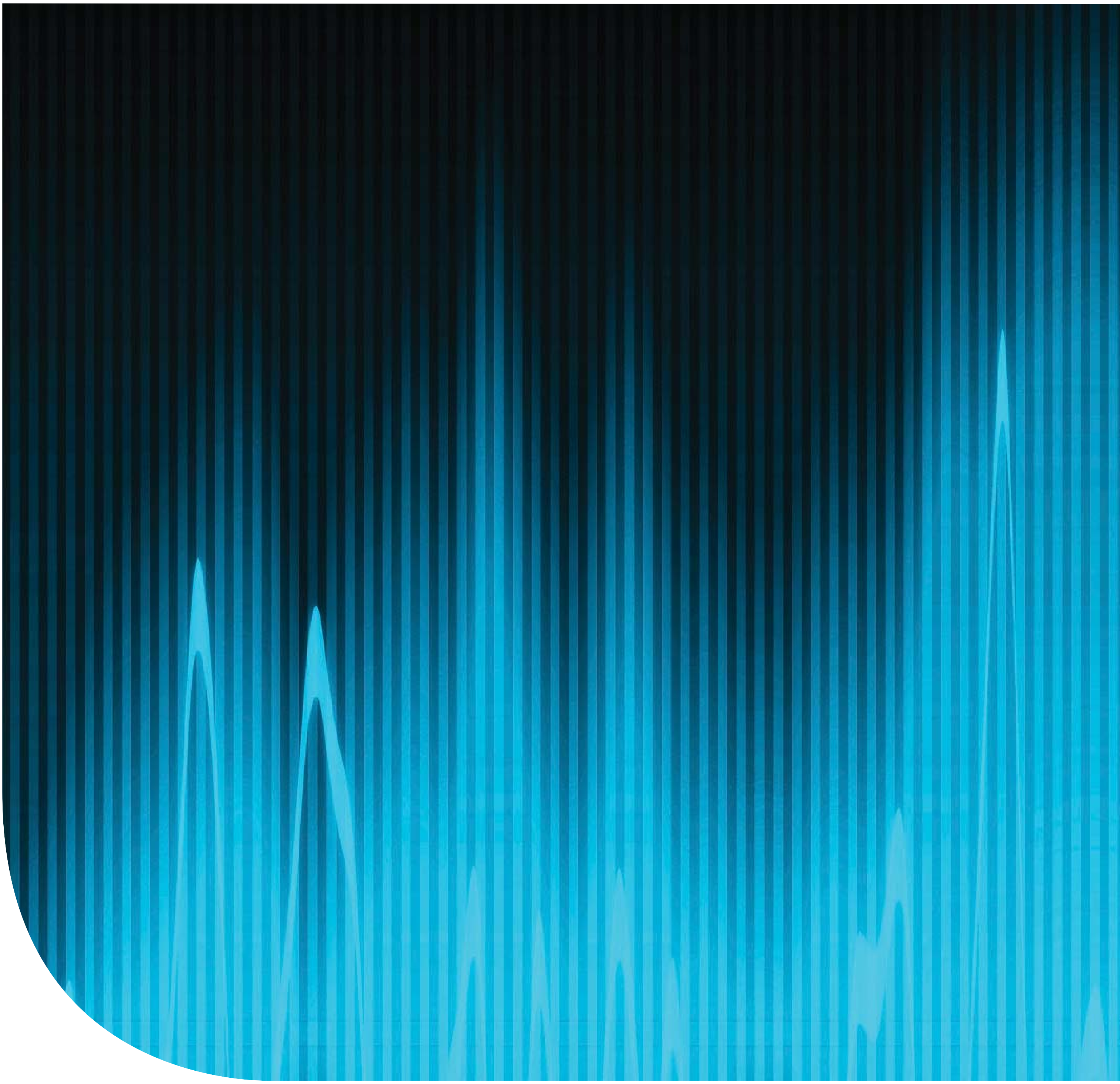

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Appendix E

Air quality assessment

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Report

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AIR QUALITY IMPACT ASSESSMENT
BORAL ST PETERS TERMINAL - MODIFICATION 11

RAMBOLL

AIR QUALITY IMPACT ASSESSMENT
BORAL ST PETERS TERMINAL - MODIFICATION 11

Version	Date	Made by	Checked by	Approved by	Signature
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EXECUTIVE SUMMARY

Boral Resources (NSW) Pty Ltd (Boral) owns and operates a concrete batching plant (concrete plant) and construction materials handling facility (the handling facility) at 25 Burrows Road South, St Peters (the site). A modification to the site's development consent (Modification 11, hereafter MOD11) is proposed to:

- Upgrade the concrete plant to allow an increase in concrete production; and
- increase the throughput of the handling facility.

A concrete production limit of 750,000 m^3 per annum is being sought for the site, which is an increase of 470,000 m^3 per annum over the existing limit of 280,000 m^3. To achieve this increase, the existing concrete plant will be upgraded to include an additional two alleys, with an additional six silos for cement storage and widening of existing raw material storage.

Ramboll Environ Australia Pty Ltd (Ramboll Environ) has been commissioned by EMM Consulting Pty Ltd (EMM) on behalf of Boral to conduct an air quality assessment for MOD11.

Emissions of total suspended particulates (TSP), particulate matter less than 10 microns in aerodynamic diameter (PM_{10}), and particulate matter less than 2.5 microns in aerodynamic diameter ($PM_{2.5}$) were estimated for proposed MOD11 operations associated with the site.

Existing air quality and meteorological conditions were analysed through a number of data resources, with particular weighting given to the Bureau of Meteorology Sydney Airport automatic weather station and NSW Office of Environment and Heritage Earlwood air quality monitoring station.

Atmospheric dispersion modelling predictions of calculated air pollution emissions were undertaken using the AERMOD dispersion model.

The results of the dispersion modelling conducted indicated that the proposed modification was unlikely to result in exceedances of the applicable NSW Environment Protection Authority (NSW EPA) assessment criteria for TSP, PM_{10}, $PM_{2.5}$ or dust deposition.

1. INTRODUCTION

Boral Resources (NSW) Pty Ltd (Boral owns and operates a concrete batching plant and construction materials rail terminal facility at 25 Burrows Road South, St Peters (the site).

Boral's existing St Peters operation receives construction materials (predominantly aggregate, sand and cement) by rail from its quarry and cement operations. These construction materials are either used in the production of concrete at the concrete plant or temporarily stored at the terminal for later distribution to other plants. The concrete plant currently produces up to a maximum of 280,000m^3 of concrete per annum (pa).

A modification to the site's development consent (Modification 11, hereafter MOD11) is proposed to:

- Upgrade the concrete plant to allow an increase in concrete production; and
- increase the throughput of the handling facility.

A concrete production limit of 750,000 m^3 per annum is being sought for the site, which is an increase of 470,000 m^3 per annum over the existing limit of 280,000 m^3. To achieve this increase, the existing concrete plant will be upgraded to include an additional two alleys, with an additional six silos for cement storage and widening of existing raw material storage.

Ramboll Australia Pty Ltd (Ramboll) has been commissioned by EMM Consulting Pty Ltd (EMM) on behalf of Boral to conduct an air quality assessment for the proposed MOD11.

This air quality assessment provides:

- characterisation of the existing environment, specifically the existing air quality, prevailing meteorology and regulatory context;
- review of potential emission sources and mitigation measures;
- calculation of annual particulate matter emissions from the proposed MOD11 operations; and
- atmospheric dispersion modelling of calculated emissions to predict potential particulate matter impacts at the surrounding sensitive receptor locations and determine the significance of the proposed activity to ambient air quality.

Ramboll completed an air quality impact assessment for a proposed modification (referred to as MOD10) to the St Peters Terminal in 2016 (the 2016 AQIA). Resources developed for the 2016 AQIA will be referenced and adopted in this report wherever practicable.

The AQIA is guided by the NSW Environment Protection Authority (NSW EPA) document Approved Methods for the Modelling and Assessment of Air Pollutants in New South Wales ("the Approved Methods for Modelling", EPA 2016).

The Secretary's Environmental Assessment Requirements (SEARs) for MOD11 are listed in a letter from the NSW Department of Planning and Environment dated 21 December 2017. With regards to air quality, the SEARs for MOD11 require:

- a quantitative assessment of the potential air quality impacts during construction and operation in accordance with relevant Environment Protection Authority guidelines;
- details of fugitive dust management measures during construction and operation; and
- details of proposed mitigation, management and monitoring measures.

The AQIA has been prepared specifically to address the SEARs requirements.

2. PROJECT SETTING AND DESCRIPTION

2.1 Project setting and surrounding receptor locations

The site is located within the Inner West local government area (LGA) (formerly Marrickville LGA) adjacent to its eastern boundary with the Bayside LGA. The site is principally surrounded by industrial land uses which correspond with the site's and surrounding properties zoning as IN1 General Industrial under the *Marrickville Local Environmental Plan 2011* (Marrickville LEP). The regional setting and local context of the site can be seen in **Figure 2-1**.

The area surrounding the site consists of commercial and industrial receptors. Residential receptors are located further afield, with the closest located approximately 600m to the west of the site. A number of commercial, industrial, and residential receptors, representative of the region, have been selected to assess air quality impacts from the site. The selected receptor locations are presented in **Table 2-1** and illustrated in **Figure 2-2**.

Table 2-1: Sensitive receptor locations surrounding the site

Receptor ID	Receptor Type	Location (m, MGA56S)		Elevation (m, AHD)
		Easting	Northing	
1	Residential	330580	6245145	16
2	Residential	330940	6245470	14
3	Commercial/industrial	331405	6245045	3
4	Commercial	331440	6245000	5
5	Commercial	331535	6244910	4
6	Commercial	331425	6244820	2
7	Commercial	331325	6244750	4
8	Industrial	330915	6244990	6
9	Industrial	330775	6244995	8
10	Industrial	331250	6245060	4
11	Commercial/industrial	331375	6245095	6

Figure 2-1 Site location

Source: EMM (2018)

Figure 2-2 Surrounding Receptor Locations

2.2 Proposed modification

MOD11 proposes to:

- increase concrete production; and
- increase the throughput of the handling facility.

A concrete production limit of 750,000 m^3 per annum is being sought for the site, which is an increase of 470,000 m^3 per annum over the existing limit of 280,000 m^3. To achieve this increase, the existing concrete plant will be upgraded to include an additional two alleys, with an additional six silos for cement storage and widening of existing raw material storage.

It is proposed to increase the throughput of the handling facility to 1 million tpa, which is an increase of 240,000 tpa over the existing limit of 760,000 tpa. Some changes to the layout and function of the handling facility are proposed to facilitate the increase in throughput.

In addition to the above, it is proposed to construct a new concrete reclaiming machine, upgrade the site's surface water management system, and install a second weighbridge.

Details of the proposed modification are provided below.

2.2.1 Increased throughput of the materials handling facility

The layout of the handling facility will be modified to facilitate the construction of the concrete plant upgrades. This will include:

- a new dump station and conveyor that leads up to the existing materials handling facility elevated storage bins;
- new aggregate storage walls made of concrete to the north of the materials handling facility;
- new open aggregate storage bins to the south of the materials handling facility, these will be filled by trucks delivering aggregates and sand to the site.;
- new larger open aggregate storage bins on the northern side of the materials handling facility, these larger bins will be filled via a new overhead conveyor with a tripper car. This conveyor will be connected to the existing conveyor from the materials handling facility training and unloading area and will eliminate the need for the larger bins to be filled by front-end loaders and trucks which currently occurs;
- new second weighbridge; and
- future tipper and drive over dump station.

The throughput of the handling facility will be increased from 760,000 tpa to 1 million tpa.

Figure 2-3 shows the proposed site layout associated with MOD11.

2.2.2 Increased concrete production

To achieve a production limit of 750,000 m^3 per annum, it is proposed to widen the existing aggregate storage bins and install new silos and load bays around the existing concrete plant to increase the existing concrete plant's production capacity.

The operation would involve the same process as the existing concrete plant. That is, it would involve the dry and wet batching of aggregates, sand, cement, fly ash and admixtures with water. The proposed modification includes the following components:

- aggregates, sand and cement will continue to be received at the site (primarily by rail for aggregate and sand, cement by truck) and stored at the existing elevated concrete plant aggregate storage bins, the proposed modification includes widening the aggregate storage bins at the existing location;
- aggregates, sand and cement will be transferred to the aggregate storage bins via a new aggregate incline conveyor from the materials handling facility's train unloading area.
- aggregates, sand, and cement would then be dispensed via two new conveyors to new additional load bays that will be located directly north and south of the existing concrete batching plant.
- fly ash and admixtures would be received via truck and stored at the existing concrete plant.

- similar to the current operations, the concrete agitators are filled with dry materials and water at the load bay, whereby they then proceed to the slump stands where an additional two double position slump stands will be built. Additional water is added to concrete agitators at the slump stands until the desired concrete consistency is reached.
- the concrete agitators would blend the dry batched product and water, and the end product (concrete) would then be transported by road to customers.

Error! Reference source not found. shows the proposed site layout and components associated with the concrete plant.

Increasing the production limit to 750,000 m^3 of concrete per annum at the site would result in approximately 336 additional daily truck deliveries on a future average production day and 533 additional daily truck deliveries on a future maximum production day. The majority of these are from concrete agitators, but also include an increase in the transport of constituent ingredients to the site (i.e. fly ash, admixtures).

2.2.3 Office, amenities and car park

There are no proposed changes to the existing office and amenity facilities on the site as part of this modification.

The proposed modification includes 47 new car park spaces, including:

- seven new car parks in the south-east corner of the site.
- 12 new car parks south of the existing 40 car parks in the south-west corner of the site.

2.2.4 Construction of the proposed modification

Overall the construction period will be approximately nine months, with works staggered in stages to reduce overall disruption to production.

Standard construction hours will apply which include:

- Monday to Friday 7 am to 6 pm;
- Saturday 8 am to 1 pm; and
- no construction work is to take place on Sunday or public holiday.

Construction of the proposed modification will involve the following activities:

- The installation of safety fencing and site establishment at the existing concrete plant and materials handling facility;
- Various hand tools that will be onsite for the duration of construction activities (approximately nine months);
- piling rig (small ones with mast under 15m) which will be onsite for one month;
- one 30t excavator, which will be onsite for one month);
- two 13t excavators, which will be onsite for four months;
- one vibro compaction roller, which will be onsite for two months; and
- concrete pumps (4 months), various hand tools (onsite 9 months).

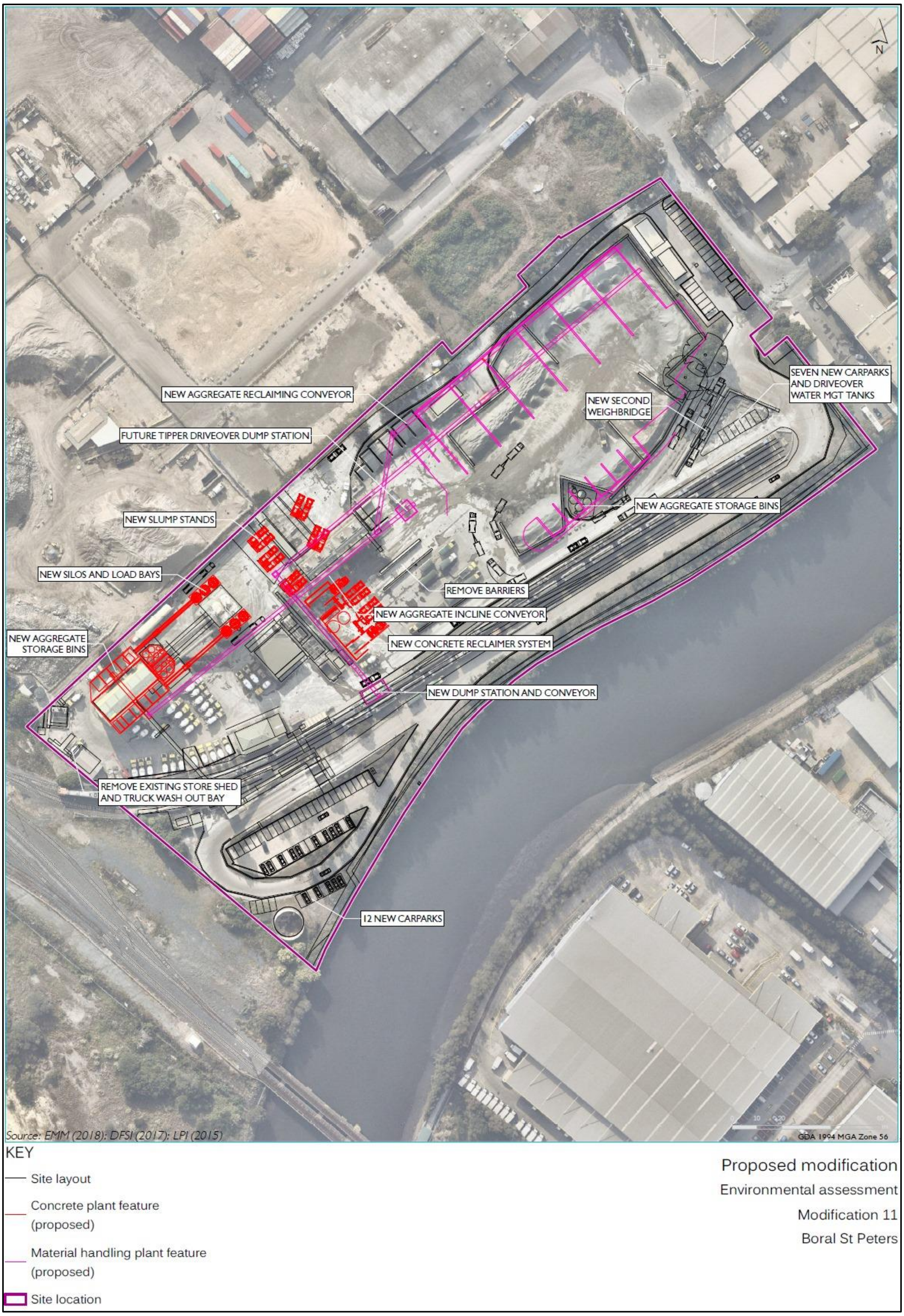


Figure 2-3 Site layout for MOD11

Source: EMM (2018)

3. AIR QUALITY ASSESSMENT CRITERIA

The proposed activity must demonstrate compliance with the impact assessment criteria outlined in the Approved Methods for Modelling (EPA, 2016). The impact assessment criteria are designed to maintain ambient air quality that allows for the adequate protection of human health and well-being.

The Approved Methods for Modelling specifies that the impact assessment criteria for 'criteria pollutants' are applied at the nearest existing or likely future off-site sensitive receptor and compared against the 100th percentile (i.e. the highest) dispersion modelling prediction. Both the incremental and cumulative impacts need to be presented, requiring consideration of existing ambient background concentrations for the criteria pollutants assessed.

The proposed activity has the potential to generate fugitive emissions of particulate matter and metals from concrete batching plant operations and fuel combustion-related pollutants (PM, oxides of nitrogen, sulphur dioxide, carbon monoxide and volatile organic compounds) from mobile plant and trucks operating about the site.

This assessment will only focus on the quantification of particulate matter from the proposed activity (fugitive releases and diesel combustion related particulate matter). Emissions and impacts from other pollutants associated with the site are considered to be minor and have not been addressed further in this assessment.

Criteria applicable to particulate matter are presented in the following sections. For proposed developments within NSW, ground level assessment criteria specified by the NSW EPA within the Approved Methods for Modelling are applicable. These assessment criteria are designed to maintain an ambient air quality that allows for adequate protection of human health and well-being.

3.1 Goals applicable to airborne particulate matter

When first regulated, airborne PM was assessed based on concentrations of TSP. In practice, this typically referred to PM smaller than about 30-50 micrometres (µm) in diameter. As air sampling technology improved and the importance of particle size and chemical composition become more apparent, ambient air quality standards have been revised to focus on the smaller particle sizes, thought to be most dangerous to human health. Contemporary air quality assessment typically focuses on "fine" and "coarse" inhalable PM, based on health-based ambient air quality standards set for PM_{10} and $PM_{2.5}$.

Air quality criteria for PM in Australia are given for particle size metrics including TSP, PM_{10} and $PM_{2.5}$. The 2016 update to the Approved Methods for Modelling includes particle assessment criteria that are consistent with revised National Environment Protection (Ambient Air Quality) Measure (AAQ NEPM) national reporting standards (National Environment Protection Council [NEPC], 1998; NEPC, 2015).

The air quality criteria applied for PM in this assessment are presented in **Table 3-1**.

The revised AAQ NEPM also establishes long-term goals for $PM_{2.5}$ to be achieved by 2025 (NEPC, 2015). It is noted that the purpose of the AAQ NEPM is to attain *'ambient air quality that allows for the adequate protection of human health and wellbeing',* and compliance with the AAQ NEPM is assessed through air quality monitoring data collected and reported by each state and territory. The long-term goals for $PM_{2.5}$ are therefore not applicable to the assessment of impacts of emissions sources on individual sensitive receptors, and are shown in **Table 3-1** for information only.

Table 3-1: Impact assessment criteria for PM

Pollutant	Averaging Period	Concentration (µg/m³)	Reference
TSP	Annual	90	NSW EPA impact assessment criteria
PM_{10}	24 hours	50	
	Annual	25	
$PM_{2.5}$	24 hours	25	
	Annual	8	
	24 hours	20	AAQ NEPM long term goal for 2025
	Annual	7	

3.2 Dust deposition criteria

Nuisance dust deposition is regulated through the stipulation of maximum permissible dust deposition rates. The NSW EPA impact assessment goals for dust deposition are presented in **Table 3-2**, detailing the allowable increment in dust deposition rates above ambient (background) dust deposition rates which would be acceptable so that dust nuisance could be avoided.

Table 3-2: 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

4. CLIMATE AND DISPERSION METEOROLOGY

Meteorological mechanisms govern the generation, dispersion, transformation and eventual removal of pollutants from the atmosphere. Emission generation rates are particularly dependent on wind energy and on the moisture budget, which is a function of rainfall and evaporation rates.

In the absence of onsite meteorological monitoring data, a combination of local area observational data and meteorological modelling techniques were used. Details regarding the meteorological modelling are presented in **Section 4.1**.

The following data were used in the meteorological analysis for the proposed activity:

- Hourly average meteorological data and historical climate data from the BoM Automatic Weather Station (AWS) at Sydney Airport Meteorological Office (Station Number 066037) located 2.7 km south of the proposed activity.

The meteorological input dataset developed for the 2016 AQIA has been adopted for this report. Relevant information from the 2016 AQIA has been reproduced in the following sections.

4.1 Meteorological modelling

Section 4.1 of DEC (2005) specifies that meteorological data representative of a site can be used in the absence of suitable on-site observations. Data should cover a period of at least one year with a percentage completeness of at least 90%. Site representative data can be obtained from either a nearby meteorological monitoring station or synthetically generated using the CSIRO prognostic meteorological model The Air Pollution Model (TAPM).

As stated, the meteorological input dataset developed for the 2016 AQIA, which focused on the 2015 calendar year, has been adopted for this report. The 2016 AQIA demonstrated through comparison with inter-annual wind roses, that the 2015 dataset is representative of the Sydney Airport AMO location and considered appropriate for use in this assessment.

To supplement the BoM Sydney Airport meteorological observation dataset, the CSIRO meteorological model TAPM was used to generate parameters not routinely measured, specifically the vertical temperature profile.

TAPM was configured and run in accordance with the Section 4.5 of the Approved Methods for Modelling, with the following refinements:

- Modelling to 300 m grid cell resolution (beyond 1 km resolution specified).
- Inclusion of high resolution (90 m) regional topography (improvement over default 250 m resolution data).

The TAPM vertical temperature profile was adopted to account for upper air atmospheric conditions in the AERMOD modelling conducted.

4.2 Prevailing wind regime

A wind rose showing wind speed and direction data recorded at the BoM Sydney Airport AMO AWS is presented in **Figure 4-1**. The annual recorded wind pattern is dominated by southerly, northeasterly and northwesterly airflow. The highest wind speeds recorded are most frequently experienced from the south and northeast. The average recorded wind speed for 2015 was 5.6 m/s, with a frequency of calm conditions (wind speeds less than 0.5 m/s) occurring in the order of 1% of the time.

Seasonal and diurnal (dividing the day into night and day) wind roses for the meteorological dataset are presented within **Appendix 1**.

Seasonal variation in wind speed and direction is evident in the recorded data from the BoM Sydney Airport AMO AWS. Spring and summer are dominated by defined northeasterly and southerly components. Autumn experiences airflow from the southerly quadrant, however the northeasterly flow is replaced by northwesterly flow. The winter months are dominated by west to northwesterly airflow. Wind speeds are similar throughout the year, with comparable average wind speeds and incidence of calm conditions recorded across all seasons.

Diurnal variation is less defined at the BoM Sydney Airport AMO AWS. Airflow from the southern, northeastern and northwestern quadrants occur during both daylight and night hours. Wind speeds are slightly higher during the day hours relative to the night.

4.3 Air temperature

Monthly mean minimum temperatures are in the range of 7°C to 19°C, with mean maxima of 17°C to 27°C, based on the long-term average records from the BoM Sydney Airport AMO AWS. Peaks occur during summer months with the highest temperatures typically being recorded between November and February. The lowest temperatures are usually experienced between June and August.

The 2015 BoM Sydney Airport AWS temperature dataset has been compared with long-term trends recorded at the same location to determine the representativeness of the dataset. **Figure 4-2** presents the monthly variation in recorded temperature during 2015 compared with the recorded station mean, minimum and maximum temperatures. There is good agreement between temperatures recorded during 2015 and the recorded historical trends, indicating that the 2015 temperature dataset is representative of the location.

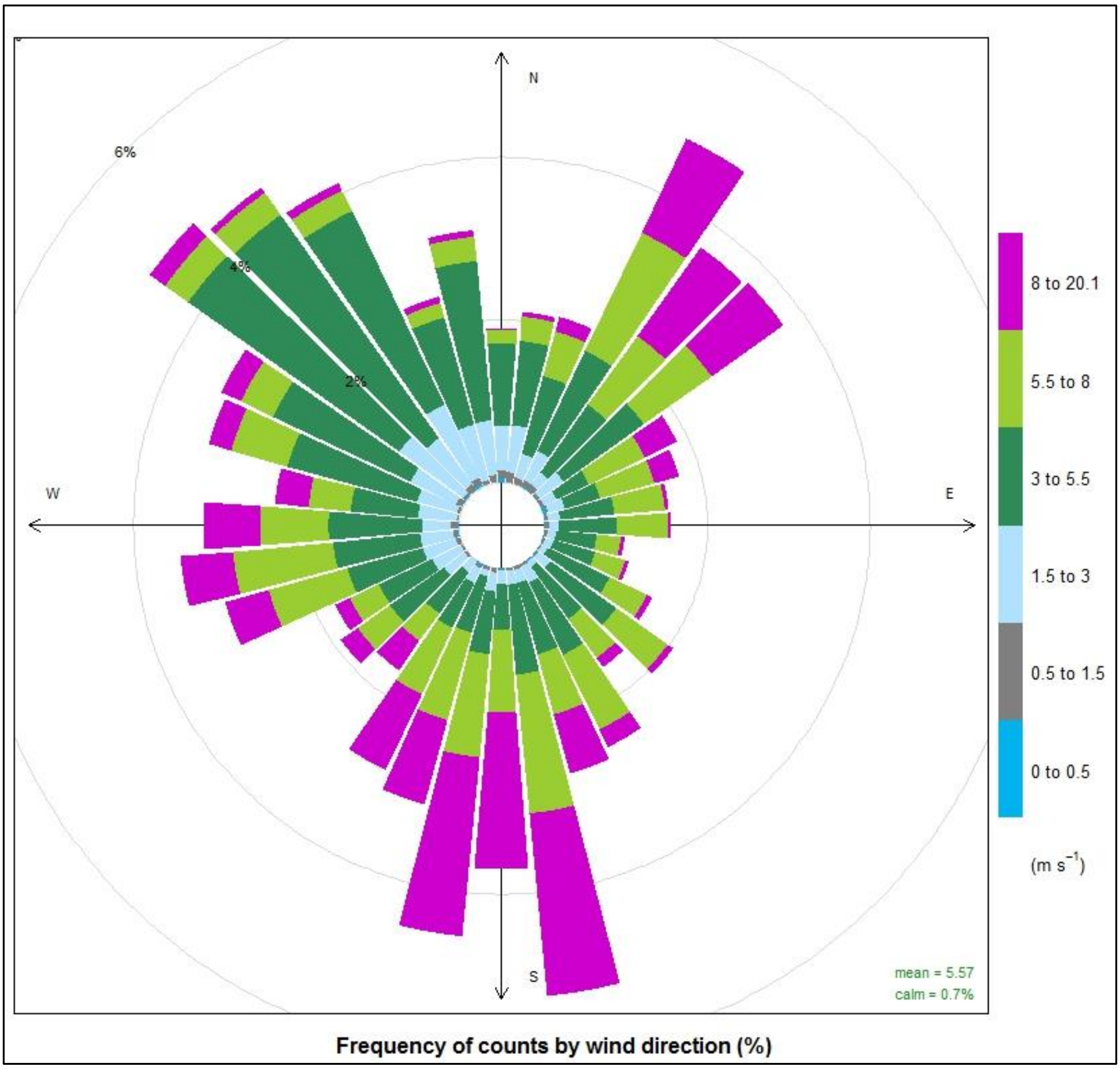
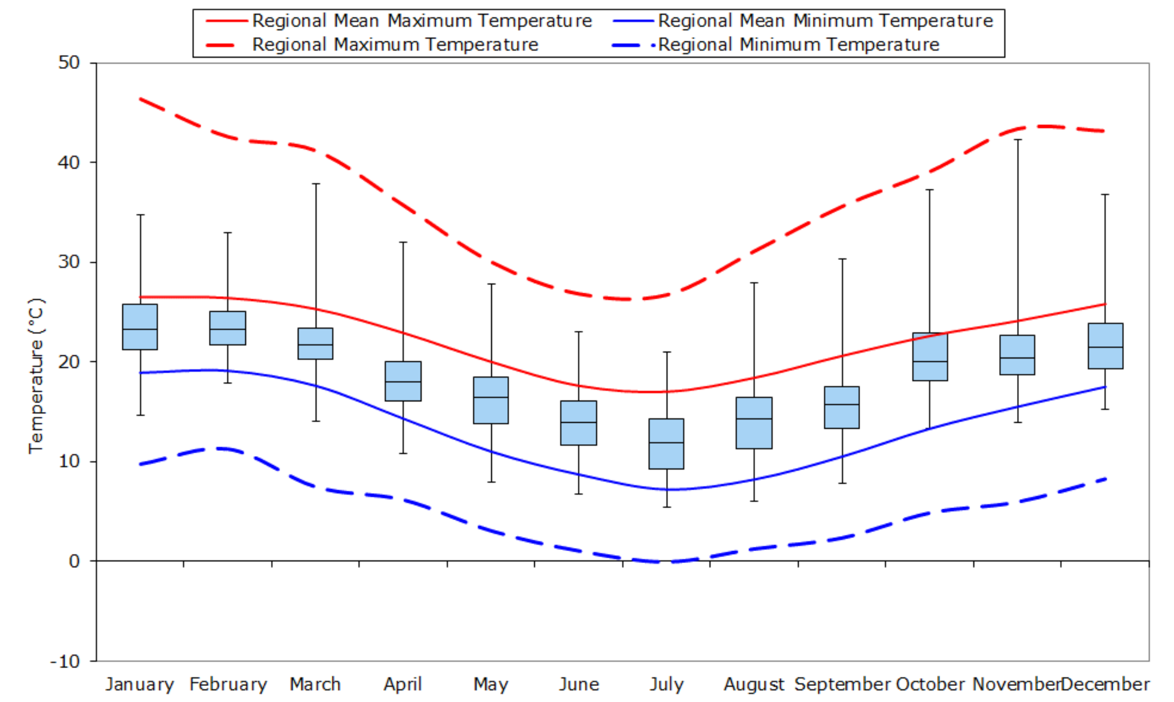


Figure 4-1 Annual average wind rose – Sydney Airport AMO AWS – 2015



Note: 2015 data from Sydney Airport AMO AWS are illustrated by the 'box and whisker' indicators. Boxes indicate 25th, median and 75th percentile temperature values while upper and lower whiskers indicate maximum and minimum values. Maximum and minimum temperatures from long-term measurements at Sydney Airport AMO AWS are depicted as line graphs.

Figure 4-2 Temperature comparison between Sydney Airport AMO AWS 2015 dataset and historical averages (1939-2017) – Sydney Airport AMO AWS BoM

4.4 Rainfall

Precipitation is important to air pollution studies since it impacts on dust generation potential and represents a removal mechanism for atmospheric pollutants.

Based on historical data recorded at Sydney Airport AMO AWS, the area is characterised by moderate to high rainfall, with a mean annual rainfall of approximately 1,080 mm, and an annual rainfall range between 520mm and 2,025mm. Rainfall is most pronounced between summer and autumn, with lower rainfall during mid-winter to early spring. According to the long-term records, an average of 129 rain days occur per year.

To provide a conservative (upper bound) estimate of the airborne particulate matter concentrations occurring due to the site, wet deposition (removal of particles from the air by rainfall) was excluded from the dispersion modelling simulations undertaken in this report.

4.5 Atmospheric stability

Atmospheric stability refers to the degree of turbulence or mixing that occurs on the atmosphere and is a controlling factor in the rate of atmospheric dispersion of pollutants.

The Monin-Obukhov length (L) provides a measure of the stability of the surface layer (i.e. the layer above the ground in which vertical variation of heat and momentum flux is negligible; typically about 10% of the mixing height). Negative L values correspond to unstable atmospheric conditions, while positive L values correspond to stable atmospheric conditions. Very large positive or negative L values correspond to neutral atmospheric conditions.

Figure 4-3 illustrates the seasonal variation of atmospheric stability derived from the Monin-Obukhov length calculated by AERMET for the site. The diurnal profile presented illustrates that atmospheric instability increases during daylight hours as convective energy increases, whereas stable atmospheric conditions prevail during the night-time. This profile indicates that the potential for atmospheric dispersion of emissions would be greatest during day time hours and lowest during evening through to early morning hours.

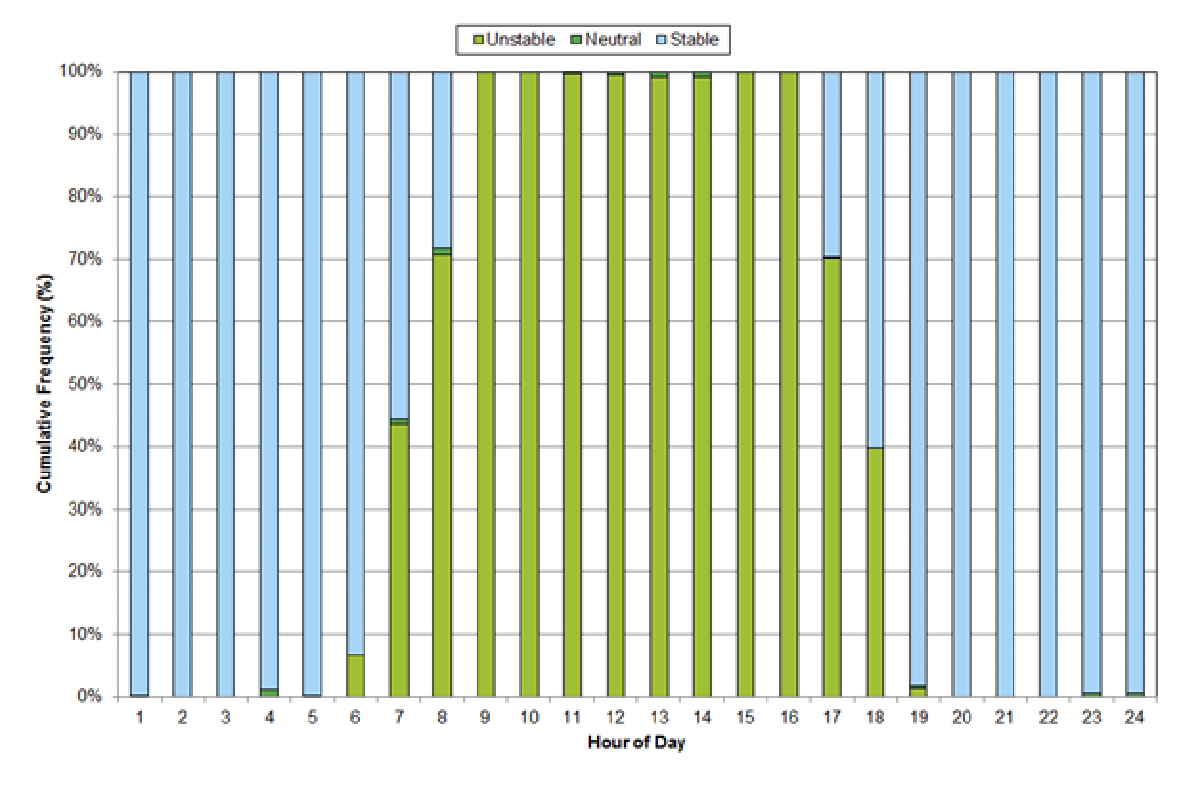
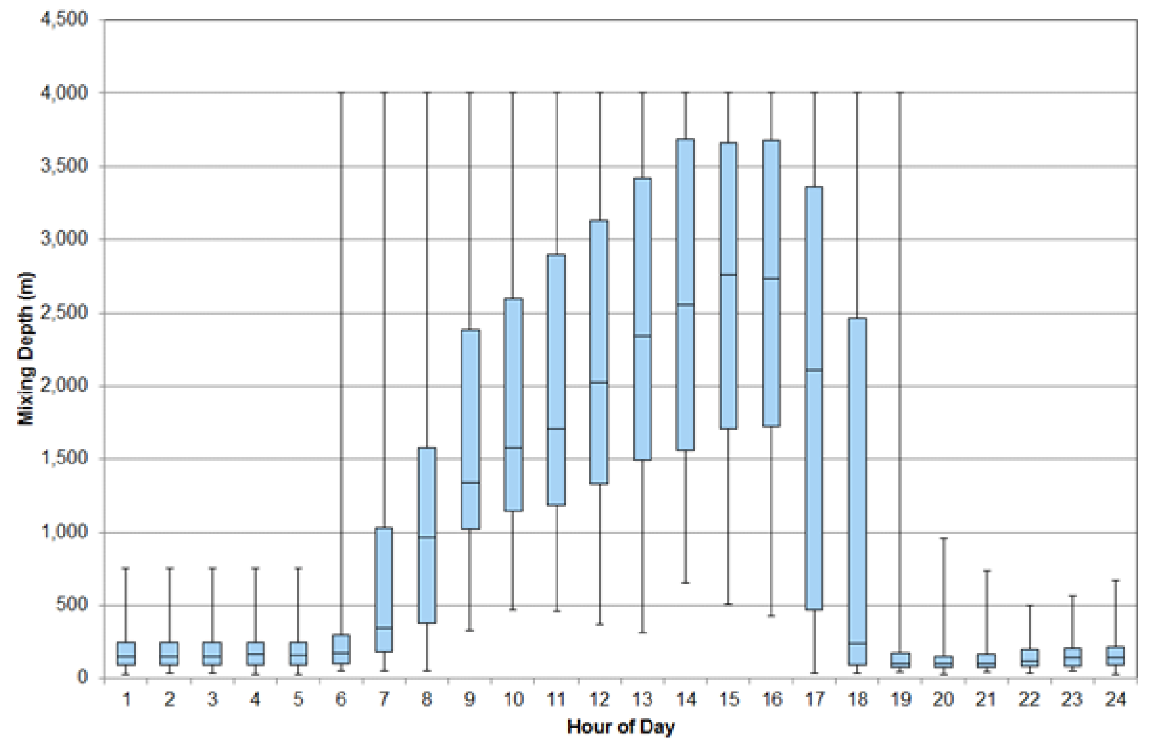


Figure 4-3 AERMET-calculated diurnal variation in atmospheric stability– Site 2015

4.6 Mixing depth

Hourly-varying atmospheric boundary layer depths were generated for the site by AERMET, the meteorological processor for the AERMOD dispersion model (see **Section 7.1** for further information), using a combination of surface observations from the BoM Sydney Airport AMO AWS, sunrise and sunset times and adjusted TAPM-predicted upper air temperature profile.

The variation in average boundary layer depth by hour of the day for the site is illustrated in **Figure 4-4**. It can be seen that greater boundary layer depths are experienced during the day time hours, peaking in the mid to late afternoon. Higher day-time wind velocities and the onset of incoming solar radiation increases the amount of mechanical and convective turbulence in the atmosphere. As turbulence increases so too does the depth of the boundary layer, generally contributing to higher mixing depths and greater potential for atmospheric dispersion of pollutants.



Note: Boxes indicate 25th, Median and 75th percentile of AERMET-calculated mixing height data while upper and lower whiskers indicate maximum and minimum values.

Figure 4-4 AERMET-calculated diurnal variation in atmospheric mixing depth – Site 2015

5. EXISTING AIR QUALITY ENVIRONMENT

The quantification of cumulative air pollution concentrations and the assessment of compliance with ambient air quality limits necessitate the characterisation of baseline air quality. Given that particulate matter emissions represent the primary pollutant of concern generated by the site, it is pertinent that existing sources and ambient air pollutant concentrations of these pollutants are considered.

5.1 Existing Local Sources of Atmospheric Emissions

The National Pollutant Inventory (NPI) database lists a large number of reporting emission sources within 10 km of the site. The majority of sources are located in the large industrial estates approximately 5 km to the southeast of the site and unlikely to cause significant direct cumulative impacts with emissions from the site.

Boral's recycling facility is located adjacent the north-western boundary of the site and involves the delivery, handling, crushing, stockpiling of construction materials and dispatch of final recycled product to market. Emissions from this facility have been explicitly included in the dispersion modelling for assessment of cumulative impacts (further details in **Section 5.1.1**).

Also adjacent to the site on Burrows Road South is the Visy Recycling Facility, where curb side recyclables (glass, aluminium, paper, plastics and metal) are processed. Emissions from this site are not considered significant for cumulative assessment purposes. Other activities in the surrounding area include the WestConnex construction activities, shipping container storage facilities, several small materials recycling facilities and Sydney Airport.

In addition to the above operations, it is considered that the following sources contribute to particulate matter emissions in the vicinity of the site:

- Dust entrainment and tyre and break wear due to vehicle movements along public roads;
- Petrol and diesel exhaust emissions from vehicle movements along public roads;
- Seasonal emissions from household wood burning fires; and
- Sea salt contained in sea breezes.

More remote sources which contribute episodically to PM concentrations in the region include dust storms and bushfires.

5.1.1 Neighbouring Boral operational emissions

Emissions from Boral's waste recycling facility have the potential to cause direct cumulative impacts with emissions from the proposed activity. The scaled emissions data for the Boral recycling facility presented in the 2016 AQIA have again been adopted in this report, with the annual TSP, PM_{10} and $PM_{2.5}$ emissions presented in **Table 5-1**.

Table 5-1: Annual emissions inventory totals – neighbouring Boral operations

Pollutant	Annual emissions (kg/year) from Boral Recycling
TSP	6,477
PM_{10}	1,544
$PM_{2.5}$	199

Ground level concentrations and deposition rates arising from the neighbouring Boral Recycling operations were predicted through the dispersion model established to assess emissions from the proposed activity (see **Section 7.1**). Model predictions of TSP, PM_{10}, $PM_{2.5}$ and dust deposition at each of the selected sensitive receptors are presented in **Table 5-2**.

Table 5-2: Incremental particulate matter concentration and deposition results – neighbouring Boral recycling operations

Receptor ID	Incremental concentration (µg/m³) or deposition (g/m²/month) due to neighbouring Boral operations					
	TSP – annual average	PM_{10} –24-hour maximum	PM_{10} – annual average	$PM_{2.5}$ –24-hour maximum	$PM_{2.5}$ –annual average	Dust deposition – annual average
1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
2	0.1	0.1	<0.1	<0.1	<0.1	<0.1
3*	0.1	0.1	<0.1	<0.1	<0.1	0.1
4*	0.1	0.1	<0.1	<0.1	<0.1	0.1
5*	0.1	0.1	<0.1	<0.1	<0.1	0.1
6*	0.1	0.1	<0.1	<0.1	<0.1	0.1
7*	0.2	0.1	<0.1	<0.1	<0.1	0.1
8*	0.3	0.2	0.1	<0.1	<0.1	0.2
9*	0.1	0.1	<0.1	<0.1	<0.1	0.1
10*	0.4	0.2	0.1	<0.1	<0.1	0.3
11*	0.1	0.1	<0.1	<0.1	<0.1	0.1

Note: * denotes industrial/commercial receptor

The predictions listed in **Table 5-2** have been combined with the background monitoring data (see subsequent sections) and site-only increment model predictions (**Section 8.1**) to assess cumulative impacts at surrounding receptor locations.

5.2 Background PM_{10} and $PM_{2.5}$

Particulate matter concentrations (PM_{10} and $PM_{2.5}$) are recorded by the NSW OEH at the nearby Earlwood monitoring station, approximately 3.5km west of the proposed activity. Daily-varying concentrations of PM_{10} and $PM_{2.5}$ have been collated for the period between 2010 and 2017 in the absence of onsite monitoring data.

The daily varying (24-hour average) PM_{10} concentrations recorded at the NSW OEH Earlwood monitoring station recorded between 2010 and 2017 are illustrated in **Figure 5-1** for PM_{10} and **Figure 5-2** for $PM_{2.5}$.

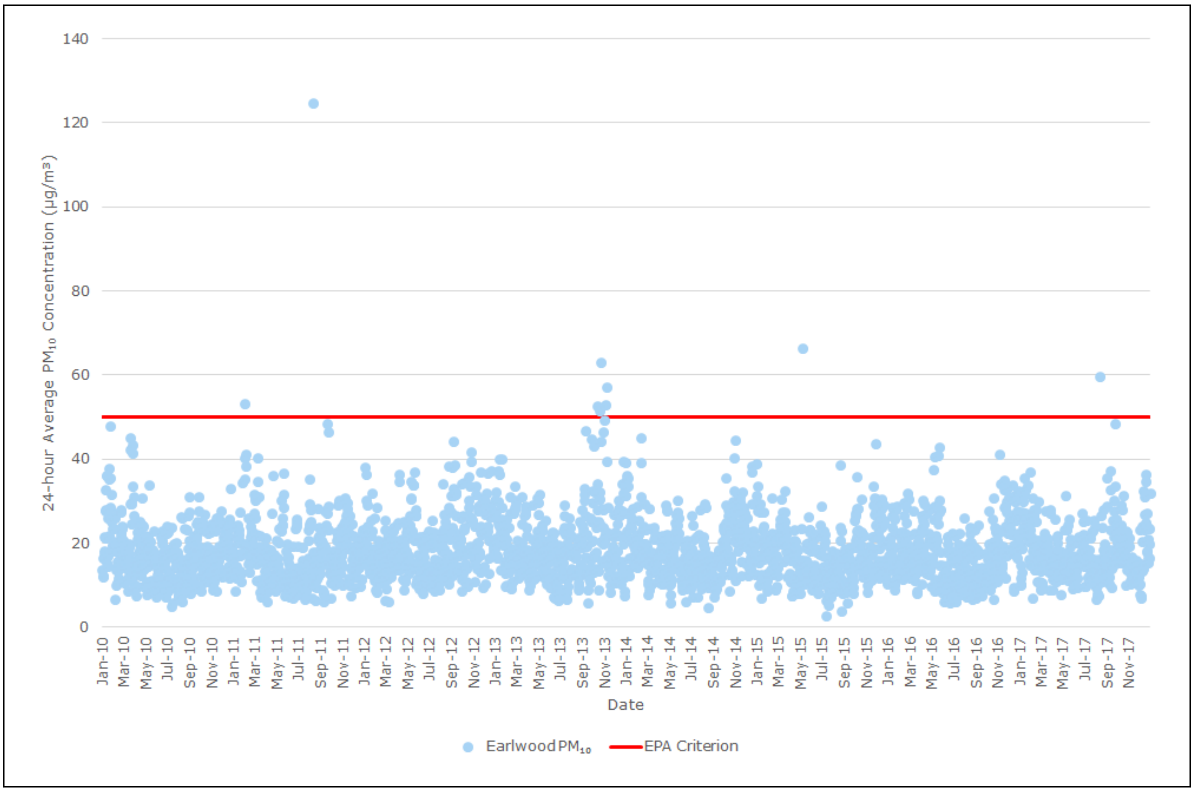


Figure 5-1 Time-series of 24-hour Average PM_{10} Concentrations recorded at OEH Earlwood – 2010 to 2017

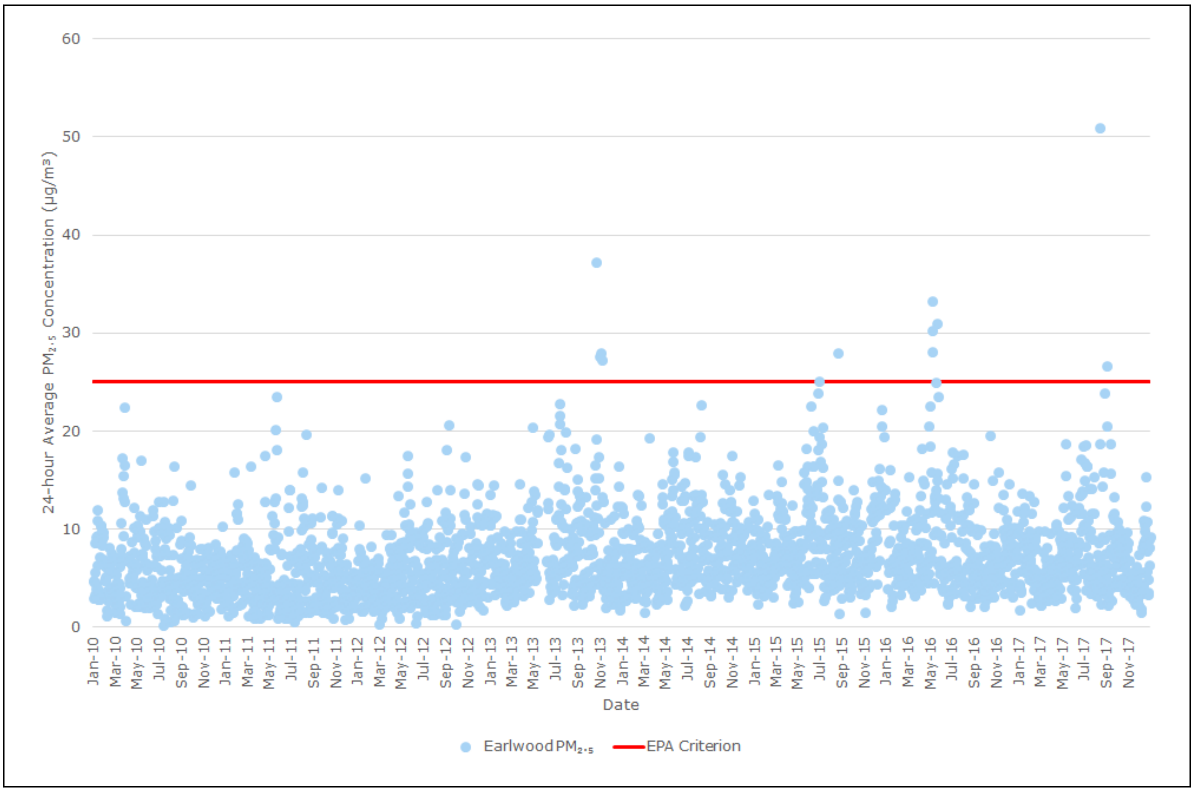


Figure 5-2 Time-series of 24-hour Average $PM_{2.5}$ Concentrations recorded at OEH Earlwood – 2010 to 2017

It can be seen from the **Figure 5-1** and **Figure 5-2** that both PM_{10} and $PM_{2.5}$ concentrations fluctuate daily throughout the presented period. Occasional exceedances of the NSW EPA criterion for PM_{10} and $PM_{2.5}$ occur, attributable to regional-scale events such as bushfires, hazard reduction burns and dust storms.

Percentile statistics of the 2010 to 2017 OEH Earlwood PM_{10} and $PM_{2.5}$ concentration datasets are presented in **Table 5-3**.

Table 5-3: PM_{10} and $PM_{2.5}$ monitoring data statistics – NSW OEH Earlwood station - 2010 to 2017

Statistic	Earlwood OEH monitoring station data statistics	
	PM_{10}	$PM_{2.5}$
Maximum	124.9	50.9
99.9th percentile	60.2	31.5
99.5th percentile	46.5	23.9
99th percentile	41.3	20.5
90th percentile	27.8	12.2
75th percentile	22.2	8.9
50th percentile	16.9	6.2
Period Average	18.3	7.0

To assess the cumulative 24-hour average PM_{10} and $PM_{2.5}$ impacts for the site, a contemporaneous impact assessment approach has been adopted. At each receptor locations, this approach will pair the predicted ground level concentrations from the site and neighbouring Boral operations with the corresponding ambient background concentration from the NSW OEH Earlwood 2015 monitoring dataset (concurrent with the 2015 meteorological period used in the 2016 AQIA). Further discussion on cumulative impacts is provided in **Section 8.2**.

The annual average $PM_{2.5}$ concentrations for the NSW OEH Earlwood 2015 dataset was 8.5 $\mu g/m^3$, which is above the applicable NSW EPA criteria. Therefore, to assess cumulative impacts for annual average $PM_{2.5}$, the 2010 to 2017 period average, 7.0 $\mu g/m^3$ as presented in **Table 5-3**, will be adopted as the ambient background. For consistency, the corresponding 2010 to 2017 period average PM_{10} concentration (18.3 $\mu g/m^3$) will be adopted for background annual PM_{10}.

5.3 Background TSP

Historically, the NSW OEH recorded concurrent 24-hour average TSP and PM_{10} concentrations on a one-in-six day sampling regime in the Sydney Metropolitan Region, with this monitoring discontinuing in 2004. NSW OEH quarterly air quality monitoring reports for 2003 and 2004 were reviewed for concurrent PM_{10} and TSP concentrations. This data highlighted that on average, the ratio of PM_{10} to TSP concentrations was approximately 0.48.

In the absence of local TSP monitoring data, the PM_{10}/TSP relationship from the 2003-2004 NSW OEH monitoring reports has been applied to the NSW OEH Earlwood PM_{10} monitoring data collected between 2010 and 2017 (**Section 5.2**). The annual average TSP concentration adopted as background is therefore 38.1 $\mu g/m^3$.

5.4 Background Dust Deposition

Boral undertakes dust deposition monitoring at five locations near the site, however due to station siting in proximity of terminal and plant emission sources, the collected data is not considered appropriate to represent background deposition levels. For this reason, this assessment will focus on the incremental contribution from site-only emissions, assessed against the NSW EPA incremental criterion of 2g/m^2/month, expressed as an annual average.

6. EMISSION ESTIMATION

Fugitive dust sources associated with the modified configuration and operation of the site were principally quantified through the application of emission estimation techniques (specifically, United States Environmental Protection Agency (US-EPA) AP-42 emission factor equations). Particulate matter emissions were quantified for each particle size fraction, with the TSP size fraction also used to provide an indication of dust deposition rates. Fine and coarse particulate matter (PM_{10} and $PM_{2.5}$) were estimated using ratios for the different particle size fractions available within the literature (principally the US-EPA AP-42).

6.1 Sources of Operational Emissions

Air emissions associated with the site would primarily comprise fugitive particulate matter releases. Potential sources of emission were identified as follows:

- Delivery of aggregate and sand to site by train and truck;
- Transfer and handling of aggregate and sand at storage bins, handling facility and within the concrete plant;
- Transferring cement and flyash into silos from delivery trucks;
- Concrete plant conveying and loading to agitator trucks;
- Wheel-generated dust from trucks movements across paved surfaces;
- Wind erosion from material storage bins and adjacent paved surfaces; and
- Diesel combustion by trucks, mobile plant and locomotive engines.

Emission estimates for fugitive dust (TSP, PM_{10} and $PM_{2.5}$) were quantified through the application of emission factors listed in the following US-EPA AP-42 (US-EPA 1995) emissions literature:

- US-EPA AP-42 *Chapter 11.12 Concrete Batching* (US-EPA, 2011a);
- US-EPA AP-42 *Chapter 13.2.1 Paved Roads* (US-EPA, 2011b);
- US-EPA AP-42 *Chapter 13.2.4 Aggregate Handling and Storage Piles* (US-EPA, 2006a); and
- US-EPA AP-42 *Chapter 13.2.5 - Industrial Wind Erosion* (US-EPA, 2006b).

Emissions of particulate matter (TSP, PM_{10} and $PM_{2.5}$) associated with diesel combustion by onsite plant was quantified using the USEPA Tier 2 PM emission factor of 0.2g/kWh and equipment specific engine specifications.

6.2 Emission scenario and assumptions

A single emissions scenario has been developed for the quantification of emissions and impacts from the modified site, focusing on maximum annual production (750,000m^3 pa of concrete). Two variations of the single emissions scenario have been developed:

- Peak day emissions, based on maximum daily concrete agitator and aggregate truck movements; and
- Average day emissions, based on maximum daily concrete agitator and aggregate truck movements.

The peak day emissions profile will be used to predicted 24-hour average PM_{10} and $PM_{2.5}$ concentrations, while the average day emissions profile will be used to predict annual average TSP, PM_{10}, $PM_{2.5}$ and dust deposition levels.

The following assumptions were made in quantifying emissions for the scenario:

- Daily peak one-way truck numbers of 145 sand and aggregate deliveries, 42 cement and admixture deliveries and 625 concrete agitator dispatches are assumed for the peak days scenario;
- Daily average one-way truck numbers of 92 sand and aggregate deliveries, 24 cement and admixture deliveries and 500 concrete agitator dispatches are assumed for the peak days scenario; and
- Based on the ratio of peak to daily truck movement numbers, average production and/or throughput rates were upscaled by 1.25 for concrete batching activities and 1.57 for materials storage area activities.

While the site is a 24-hours per day, seven days a week operation, daily emissions were varied by indicative diurnal profiles provided by Boral for concrete agitators and aggregate sales dispatch, as illustrated in **Figure 6-1**.

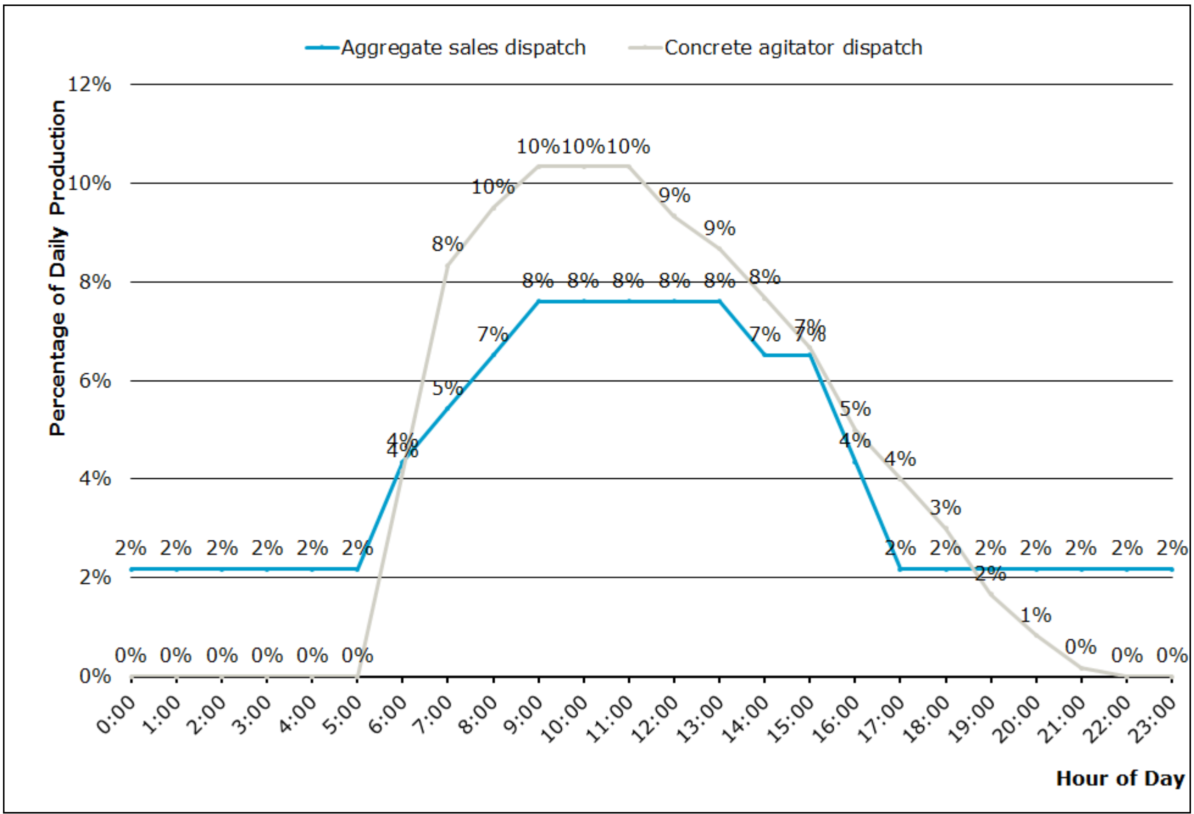


Figure 6-1 Indicative truck dispatch profiles – concrete agitators and aggregate trucks

For the quantification of emissions generated by the movement of vehicles (material delivery/dispatch trucks, agitator trucks) across paved surfaces, the 2016 AQIA applied a default silt loading value of 12 g/m^2 uniformly to all travel paths. Ramboll completed site-specific road silt sampling in August 2017. The results showed wide variance in silt loading for roads about site, including:

- Site entry and exit roads – 1.5 g/m^2;
- Silo area and truck marshalling area – 6.6 g/m^2; and
- Materials storage area – 23 g/m^2.

Emission reductions for fugitive dust emissions have been applied as follows:

- Train unloading - 50% reduction for water sprays (NPI, 2012) and 75% reduction for underground (Katestone, 2011);
- Paved roads wheel dust – 70% reduction for water flushing and sweeping (US-EPA AP-42, 2006). Additional 75% reduction for three-sided enclosure movements within the handling facility walls (Katestone, 2011);

- Aggregate and sand conveyor transfer points - 50% reduction for water sprays (NPI, 2012) and 75% reduction for enclosure (Katestone, 2011);
- Loading to enclosed aggregate and sand storage silos and CPB components - 83% reduction for hooding with fabric filters (NPI, 2012);
- Automatic closing doors at agitator truck loading point – 99.5% reduction for truck loader emission control (Air Control Techniques, 2005)
- Aggregate transfer from elevated conveyor - 50% reduction for water sprays (NPI, 2012);
- Unloading and handling at storage areas – 50% reduction for water sprays (NPI, 2012) and 75% reduction for three-sided enclosure (Katestone, 2011);
- Wind erosion from material storage bins - 50% reduction for water sprays (NPI, 2012) and 75% reduction for three-sided enclosure (Katestone, 2011);
- Cement/flyash silo loading – Controlled emission factors applied to account for pneumatic loading of silos.

The control factor for wind breaks has been increased for this assessment relative to the 2016 AQIA. The new materials storage bunker walls will be 12m high and will provide a significant wind break to emissions from the materials storage area.

Further details on the assumptions made for the operational scenario are listed within **Appendix 2**.

6.3 Annual emissions summary

A summary of annual average site emissions by source type is presented in **Table 6-1**, while the relative contribution to total annual emissions by particle size fraction is illustrated in **Figure 6-2.** Control measures proposed for implementation, as documented in **Section 6.2**, have been taken into account in the emission estimates.

Based on **Table 6-1** and **Figure 6-2** , the most significant emissions sources for TSP, PM_{10} and $PM_{2.5}$ associated with the MOD11 site operations are the material handling and transfers (tripper car conveyor transfer, front end loader (FEL) in materials storage area, truck loading/unloading, material conveying). The movement of vehicles across paved roads is also a significant contributor to annual emissions. The significance of diesel combustion emissions increases as particle size decreases.

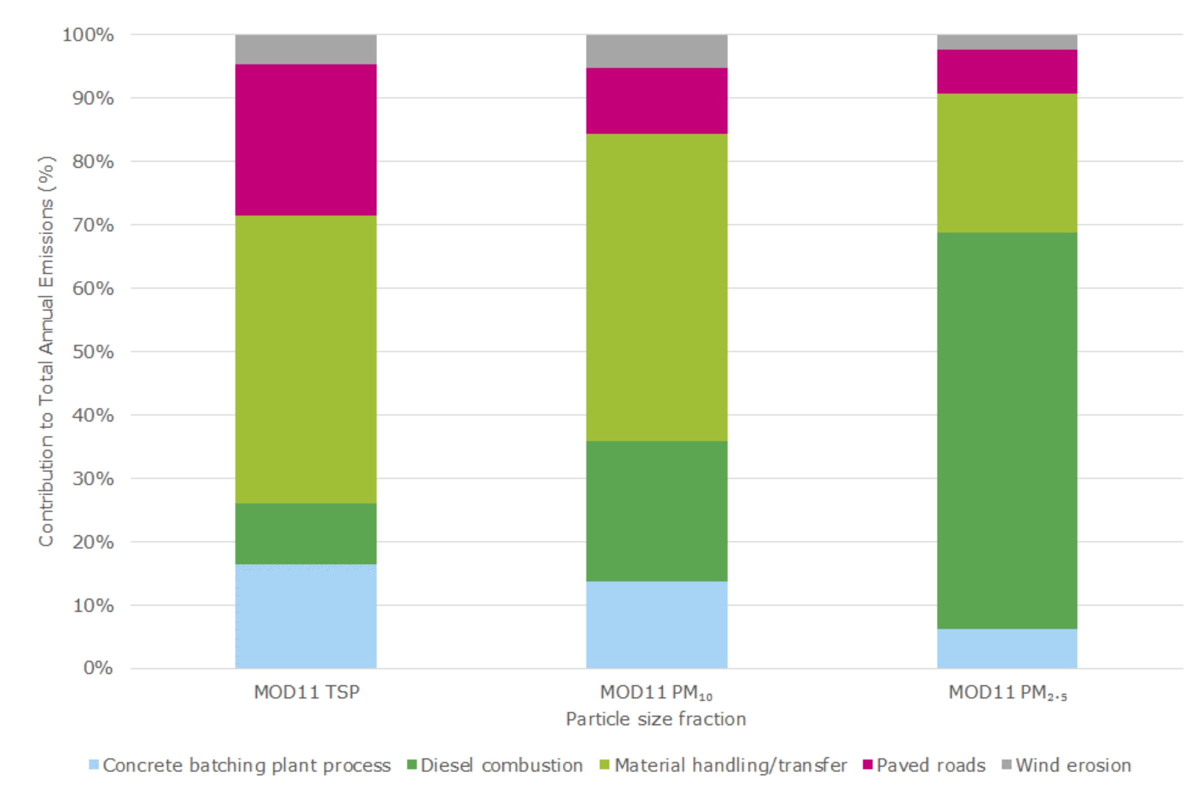


Figure 6-2 Relative contribution to annual TSP, PM_{10} and $PM_{2.5}$ emissions by source type

6.4 Comparison with MOD10 emissions

The emissions calculated for MOD11 operations have been compared with the emissions calculated for MOD10 site operations (applying revised silt loading values), with a summary plot presented in **Figure 6-3**. The following points are noted:

- MOD11 operations result in higher annual emissions for TSP, PM_{10} and $PM_{2.5}$;
- The significance of material handling and transfers and concrete batching plant emissions increases for MOD11, consistent with the proposed increase in concrete production and material entering and leaving site;
- The annual amounts of paved roads emissions do not change significantly despite the increase in incoming/outgoing material. This is attributable to the increased use of material conveying at site (underground reclaimer conveyor, elevated conveyor with tripper car) reducing the reliance on truck haulage for material transportation; and
- Wind erosion emissions reduce due to a slight reduction in stockpiling areas about site and an increase in the storage area bund walls.

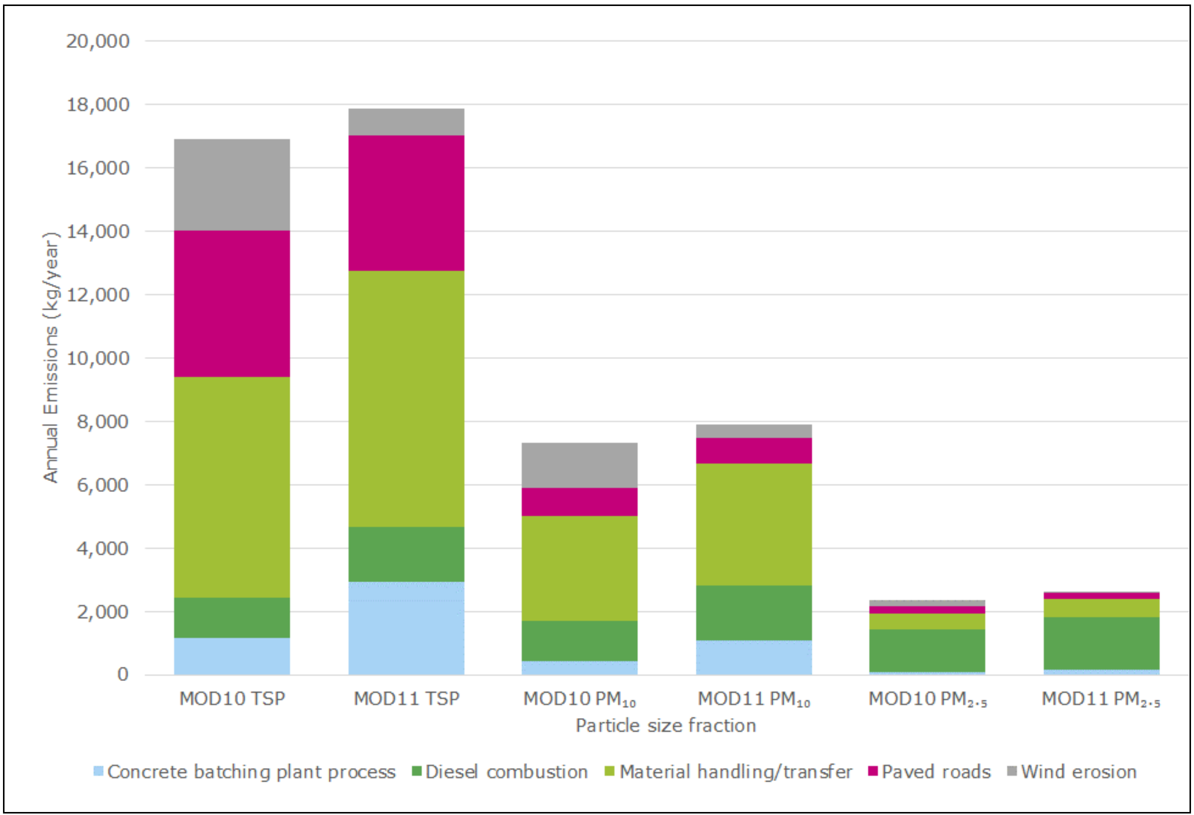


Figure 6-3 MOD10 vs MOD11 operational emission comparison

Table 6-1: Annual emissions inventory – proposed modification 11 operations

Site area	Emission source	Annual emissions (kg/year)		
		TSP	PM_{10}	$PM_{2.5}$
CBP	Cement/ Admix Delivery - Paved	755.0	144.9	35.1
	Aggregate pre-silos conveyor transfer	594.6	110.2	26.7
	Sand pre-silos conveyor transfer	150.5	19.1	4.6
	Aggregate Transfer to Storage	808.7	281.2	42.6
	Sand Transfer to Storage	204.7	71.2	10.8
	Cement unloading to silos	173.4	382.5	57.9
	Aggregate transfer storage to weigh hopper	639.4	96.8	14.7
	Sand transfer storage to weigh hopper	137.2	59.0	5.9
	Weigh hopper loading	759.7	302.4	45.8
	Mixer Loading (Truck Mixer)	1,939.0	64.9	9.8
	Agitator Truck Dispatch - Paved	3,723.7	714.8	152.4
Materials Storage Area	Aggregate truck Unloading to stockpiles	15.1	7.1	1.1
	Sand truck Unloading to stockpiles	27.1	12.8	1.9
	Aggregate Unloading from train	769.4	363.9	55.1
	Sand Unloading from train	182.8	86.5	13.1
	Aggregate Elevated Conveyor Transfer	769.4	363.9	55.1
	Sand Elevated Conveyor Transfer	213.3	100.9	15.3
	Aggregate tripper car to stockpiles	3,077.6	1,455.6	220.4
	Sand tripper car to stockpiles	731.3	345.9	52.4
	Sand to internal truck	12.0	5.7	0.9
	Aggregate/Sand internal transport to new dump station	84.4	16.2	3.9
	Sand to new dump station	48.2	22.8	3.4
	Aggregate truck loading - sales	316.5	149.7	22.7
	Sand truck loading - sales	124.3	58.8	8.9
	Aggregate/Sand delivery and dispatch - Paved	1,145.0	219.8	52.8
	Wind Erosion - Storage Bins	836.7	418.3	62.8
Diesel Combustion	Diesel Combustion – mobile plant	528.9	528.9	484.9
	Diesel Combustion – trucks	179.4	179.4	164.4
	Diesel Combustion - locomotive engines	885.0	885.0	858.4
Total		**19,832.3**	**7,468.2**	**2,483.7**

6.5 Metal Emissions

The US-EPA provide emission factors for various metals and metalloids associated with the handling and transfer of cement and cement additive at a CBP (US-EPA, 2006).

However, the transfer of cement will be conducted via enclosed transfer points fitted with dust capture filter systems. Therefore, potential emissions and related air quality impacts from metals associated with the site will be negligible. Consequently, emissions of metals and metalloids have not been considered further within this assessment.

6.6 Construction phase emissions

In addition to the MOD11 operations, the establishment of the MOD11 site configuration has the potential to generate particulate matter emissions. However, the construction phase requires limited earthworks and is not anticipated to generate emissions or impacts greater than MOD11 operations. Construction emissions are therefore unlikely to result in impacts greater than the operational phase and have not been considered further in this assessment.

7. ASSESSMENT METHODOLOGY

7.1 Dispersion Model Selection and Application

The atmospheric dispersion modelling completed within this assessment used the AMS/US-EPA regulatory model (AERMOD) (US-EPA, 2004). AERMOD is designed to handle a variety of pollutant source types, including surface and buoyant elevated sources, in a wide variety of settings such as rural and urban as well as flat and complex terrain.

Predicted concentrations were calculated for a regular Cartesian receptor grid covering a 2 km by 2 km computational domain centred over the site, with a grid resolution of 50 m applied. Additionally, concentrations were predicted at the sensitive receptor locations listed in **Table 2-1**.

Consistent with the 2016 AQIA, simulations were undertaken for the 12-month period of 2015 using the AERMET-generated file based largely on the BoM Sydney Airport AMO AWS meteorological monitoring dataset as input (see **Section 4** for description of input meteorology).

7.2 Presentation of Model Results

Dispersion simulations were undertaken to predict the concentrations of TSP, PM_{10}, $PM_{2.5}$ and dust deposition, for both the site and the neighbouring Boral operations. Model results are expressed as the maximum predicted concentration for each averaging period at the selected assessment locations over 2015 modelling period.

The results are presented in the following formats:

- Tabulated results of particulate matter concentrations and dust deposition rates at the selected assessment locations are presented and discussed in **Section 8**.
- Isopleth plots, illustrating spatial variations in incremental TSP, PM_{10} and $PM_{2.5}$ concentrations and dust deposition rates from the site are provided in **Appendix 3**. Isopleth plots of the maximum 24-hour average concentrations presented in **Appendix 3** do not represent the dispersion pattern on any individual day, but rather illustrate the maximum daily concentration that was predicted to occur at each model calculation point given the range of meteorological conditions occurring over the 2015 modelling period.

7.3 Cumulative impacts assessment

Cumulative impacts in the surrounding environment have been assessed through the combination of model predictions for the site and neighbouring Boral operations with the ambient background from NSW OEH Earlwood monitoring station. Cumulative concentrations have been calculated in the in the following way:

- For 24-hour average PM_{10} and $PM_{2.5}$, the daily varying predicted concentrations have been combined with the corresponding PM_{10} and $PM_{2.5}$ concentrations recorded at the NSW OEH Earlwood monitoring station; and
- For annual average pollutants, the predicted annual average project increment has been combined with the corresponding annual average background concentration.

8. DISPERSION MODELLING RESULTS

8.1 Incremental results

Predicted incremental TSP, PM_{10}, $PM_{2.5}$ concentration and dust deposition rates from the site under peak operations are presented in **Table 8-1** for each of the selected receptor locations.

It can be seen from the results presented in **Table 8-1**, all pollutants and averaging periods are below the applicable NSW EPA assessment criterion at all neighbouring receptors. With the exception of dust deposition, the applicable assessment criteria are applicable to cumulative concentrations. Analysis of cumulative impact compliance is presented in **Section 8.2**.

Isopleth plots of incremental concentrations and deposition rates from the site are presented in **Appendix 3**.

Table 8-1: Incremental particulate matter concentration and deposition results – proposed MOD11 operations

Receptor ID	Incremental concentration (µg/m³) or deposition (g/m²/month) due to MOD11					
	TSP – annual Average	PM_{10} –24-hour maximum	PM_{10} – annual average	$PM_{2.5}$ –24-hour maximum	$PM_{2.5}$ –annual average	Dust deposition – annual average
1	0.1	0.2	<0.1	0.1	<0.1	<0.1
2	0.1	0.2	0.1	0.1	<0.1	0.1
3*	2.6	4.4	1.1	1.1	0.3	1.9
4*	2.2	2.9	0.9	0.7	0.3	1.5
5*	0.7	0.8	0.3	0.3	0.1	0.4
6*	1.2	1.3	0.6	0.6	0.2	0.7
7*	1.5	1.8	0.8	1.0	0.4	0.8
8*	0.3	0.6	0.2	0.2	0.1	0.2
9*	0.2	0.3	0.1	0.1	<0.1	0.1
10*	2.4	3.6	1.1	0.7	0.3	1.7
11*	2.0	4.1	0.9	0.9	0.2	1.5
Criteria	**90**	**50**	**25**	**25**	**8**	**2**

Note: * denotes industrial/commercial receptor

8.2 Cumulative results

Predicted cumulative TSP, PM_{10}, $PM_{2.5}$ concentration and dust deposition rates from the site in combination with emissions from neighbouring Boral operations and ambient background are presented in **Table 8-2** for each of the selected receptor locations. No cumulative dust deposition predictions are provided as an appropriate background level was not available (**Section 5.4**).

It can be seen from the results presented in **Table 8-2**, all predicted cumulative concentrations of pollutants are below the applicable NSW EPA assessment criterion at all neighbouring receptors.

It is noted that to account for the existing criteria exceedances in the NSW OEH Earlwood monitoring datasets for 2015 (one for 24-hour average PM_{10} and two for 24-hour average $PM_{2.5}$), the second highest cumulative 24-hour average PM_{10} and third highest cumulative 24-hour average $PM_{2.5}$ concentration is presented in **Table 8-2**. As the second and third highest cumulative concentrations at each receptor are below the applicable NSW EPA impact assessment criteria, it is determined that the MOD11 operations at the site would not result in any additional exceedance events. Consequently, it is considered that compliance with the cumulative 24-hour average criteria for PM_{10} and $PM_{2.5}$ is achieved.

Table 8-2: Cumulative particulate matter concentration results – MOD11, neighbouring Boral Recycling and ambient background

Receptor ID	Cumulative concentrations (µg/m³) due to MOD11, neighbouring Boral Recycling and ambient background				
	TSP – annual Average	PM_{10} – 24-hour 2nd highest	PM_{10} – annual average	$PM_{2.5}$ –24-hour 3rd highest	$PM_{2.5}$ –annual average
1	38.2	43.7	18.3	23.9	7.0
2	38.3	43.8	18.4	23.9	7.0
3*	40.9	44.7	19.5	24.3	7.3
4*	40.5	45.0	19.3	24.3	7.3
5*	38.9	44.3	18.6	24.1	7.1
6*	39.5	44.7	18.9	24.2	7.2
7*	39.8	45.0	19.1	24.4	7.4
8*	38.8	43.9	18.5	24.0	7.1
9*	38.4	43.8	18.4	24.0	7.1
10*	40.9	44.9	19.5	24.2	7.3
11*	40.2	44.3	19.2	24.1	7.2
Criteria	**90**	**50**	**25**	**25**	**8**

Note: * denotes industrial/commercial receptor

8.3 Comparison with MOD10 results

The change in predicted concentrations and deposition rates from MOD10 operations (using refined paved road silt loading values) with the proposed changes to site under MOD11 are presented in **Figure 8-1**. Across all receptors, predicted concentrations and deposition rates would increase for MOD11 operations. The maximum increase across neighbouring receptors would be:

- Annual average TSP – 0.7 µg/m³;
- 24-hour average PM_{10} – 3.1 µg/m³;
- Annual average PM_{10} – 0.4 µg/m³;
- 24-hour average $PM_{2.5}$ – 0.6 µg/m³;
- Annual average $PM_{2.5}$ – 0.1 µg/m³; and
- Dust deposition – 0.8 g/m²/month.

The predicted increases in ground level concentrations are considered minor relative to existing air quality and applicable impact assessment criterion. The maximum increase in dust deposition is considered significant relative to the incremental criteria at the closest industrial receptors (0.8 g/m²/month vs a criterion of 2 g/m²/month), however it is reiterated that wet removal processes (i.e. rainfall) are not accounted for in the modelling. As stated in **Section 4.4**, there are on average 129 rain days in the St Peters region. Consequently, dust deposition predictions should be viewed as conservative.

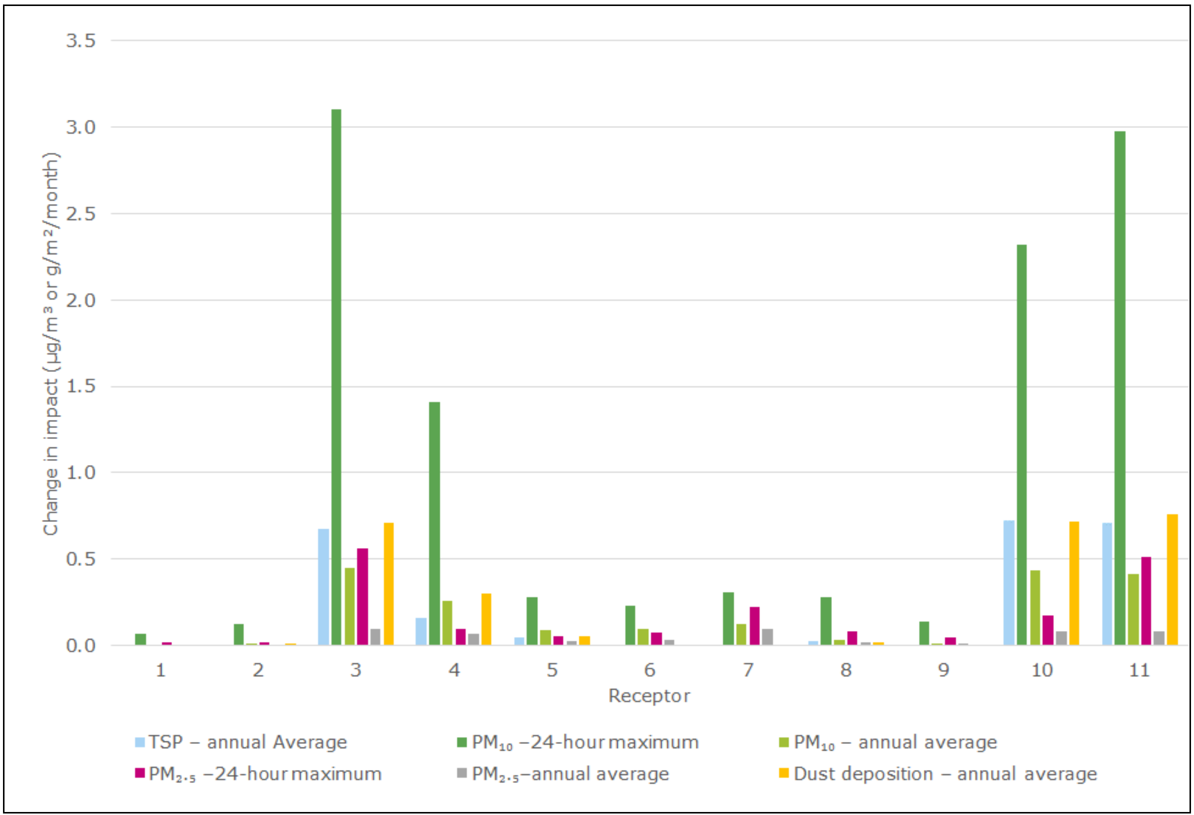


Figure 8-1 Change in predicted impacts - MOD10 vs MOD11

8.4 Source significance analysis

Further analysis of the source contribution to the predicted TSP concentrations and dust deposition levels at receptor R3 from MOD11 operations are presented in **Figure 8-2** to inform where mitigation measures should be targeted. It can be seen that the key contributing source to TSP/dust deposition impacts from the site are emissions from the new tripper car conveyor transfer at the material storage area. Material handling and wind erosion emissions from the materials storage area and paved road haulage emissions are also notable emission sources.

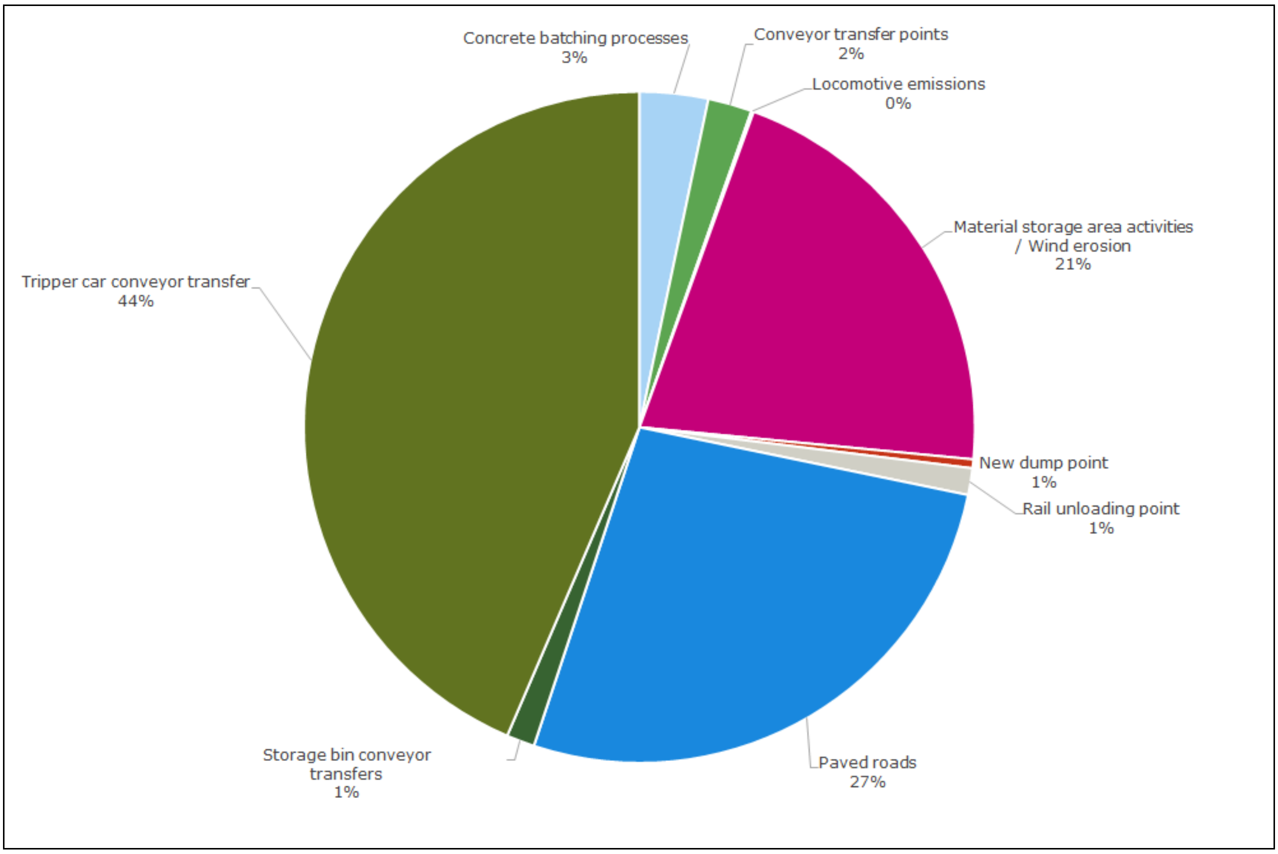


Figure 8-2: Contribution to predicted TSP/dust deposition impacts – receptor R3 – MOD11 operations

9. MITIGATION AND MONITORING

9.1 Mitigation of particulate matter emissions

Section 6 details the various particulate matter mitigation measures proposed for implementation at the site under MOD11. These controls were incorporated into the modelling wherever an appropriate emission reduction factor was available.

Predicted concentrations and deposition rates are arising from MOD11 operations at the site are below applicable NSW EPA impact assessment criteria at all surrounding receptors, suggesting that the control of these particle size fractions is effective at managing potential particulate matter-related impacts.

9.2 Air quality monitoring

As stated in **Section 5.4**, Boral currently undertake dust deposition monitoring the site. Condition 36a of the conditions of consent for Modification 10 for the site included the requirement to monitor dust deposition near receptors R3 and R4 as follows:

36a. "Prior to any increase in production at the concrete batching plant (as approved under MOD 10 to this consent), an offsite dust deposition monitor shall be established on Burrows Road South in the vicinity of sensitive receptors R3 and R4 (as identified in Figure 6.1 of the Environmental Assessment for MOD10. The location of the monitor shall be approved by the EPA".

Boral have investigated that the installation of a monitoring station at these locations has been investigated and no appropriate location compliant with the NSW EPA Approved Methods for Sampling and Analysis of Air Pollutants in NSW (AS 3580.1.1) could be established.

There are currently five dust monitoring locations on the site which are analysed on a monthly basis for total deposited solids. Boral believes that dust gauges 1, 4 (gravimetric) and 1A (directional) would provide adequate information to determine whether site-based activities are generating dust that would impact nearby sensitive receptors in adjoining properties and along Burrows Road South.

10. CONCLUSIONS

Ramboll was commissioned by EMM to undertake an AQIA for proposed MOD11 operations at the site on behalf of Boral.

Emissions of TSP, PM_{10} and $PM_{2.5}$ were estimated for peak concrete production operations under MOD11. Atmospheric dispersion modelling predictions of air pollution emissions for proposed operations were undertaken using the AERMOD dispersion model.

The results of the dispersion modelling conducted indicated that the proposed modification was unlikely to result in exceedances of the applicable NSW EPA assessment criteria for TSP, PM_{10}, $PM_{2.5}$ or dust deposition at any surrounding industrial, commercial or residential receptor.

11. GLOSSARY OF ACRONYMS AND SYMBOLS

Approved Methods	Approved Methods for the Modelling and Assessment of Air Pollutants in NSW
AHD	Australian Height Datum
BoM	Bureau of Meteorology
Boral	Boral Resources (NSW) Pty Ltd
CBP	Concrete batching plant
CSIRO	Commonwealth Scientific and Industrial Research Organisation
EPA	Environmental Protection Authority
EMM	EMM Consulting Pty Limited
µg	Microgram (g x 10-6)
µm	Micrometre or micron (metre x 10-6)
m^3	Cubic metre
NPI	National Pollutant Inventory
OEH	NSW Office of Environment and Heritage
PM_{10}	Particulate matter less than 10 microns in aerodynamic diameter
$PM_{2.5}$	Particulate matter less than 2.5 microns in aerodynamic diameter
Ramboll	Ramboll Australia Pty Ltd
TAPM	"The Air Pollution Model"
TSP	Total Suspended Particulates
The 2016 AQIA	2016 air quality impact assessment completed by Ramboll for the Boral St Peters Terminal MOD10 application
The site	Site of Boral St Peters Terminal
US-EPA	United States Environmental Protection Agency
VKT	Vehicle Kilometres Travelled

12. REFERENCES

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APPENDIX 1
WIND ROSES

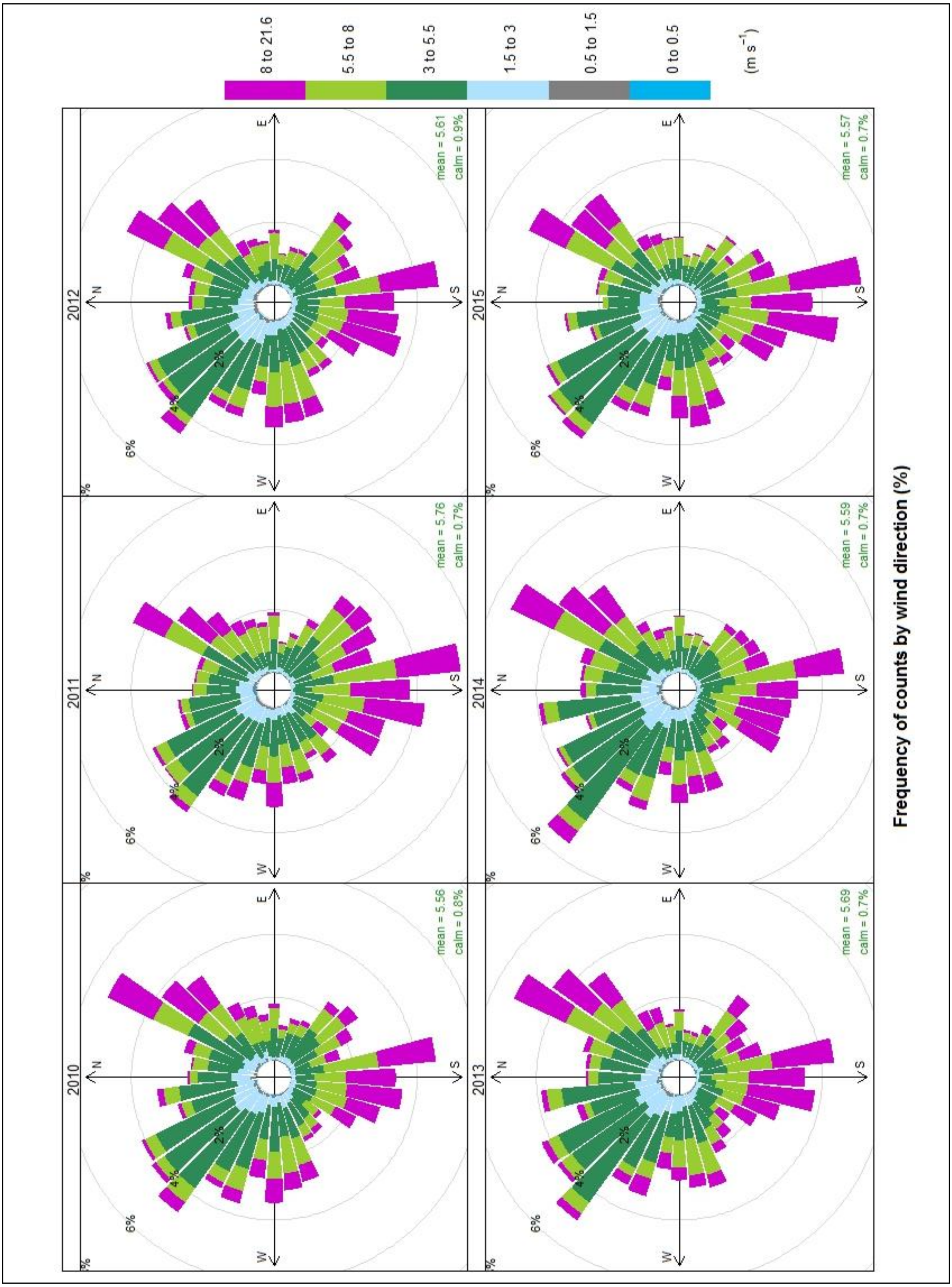

Figure A1.1 Annual Wind Roses – BoM Sydney Airport AWS – 2010 - 2015

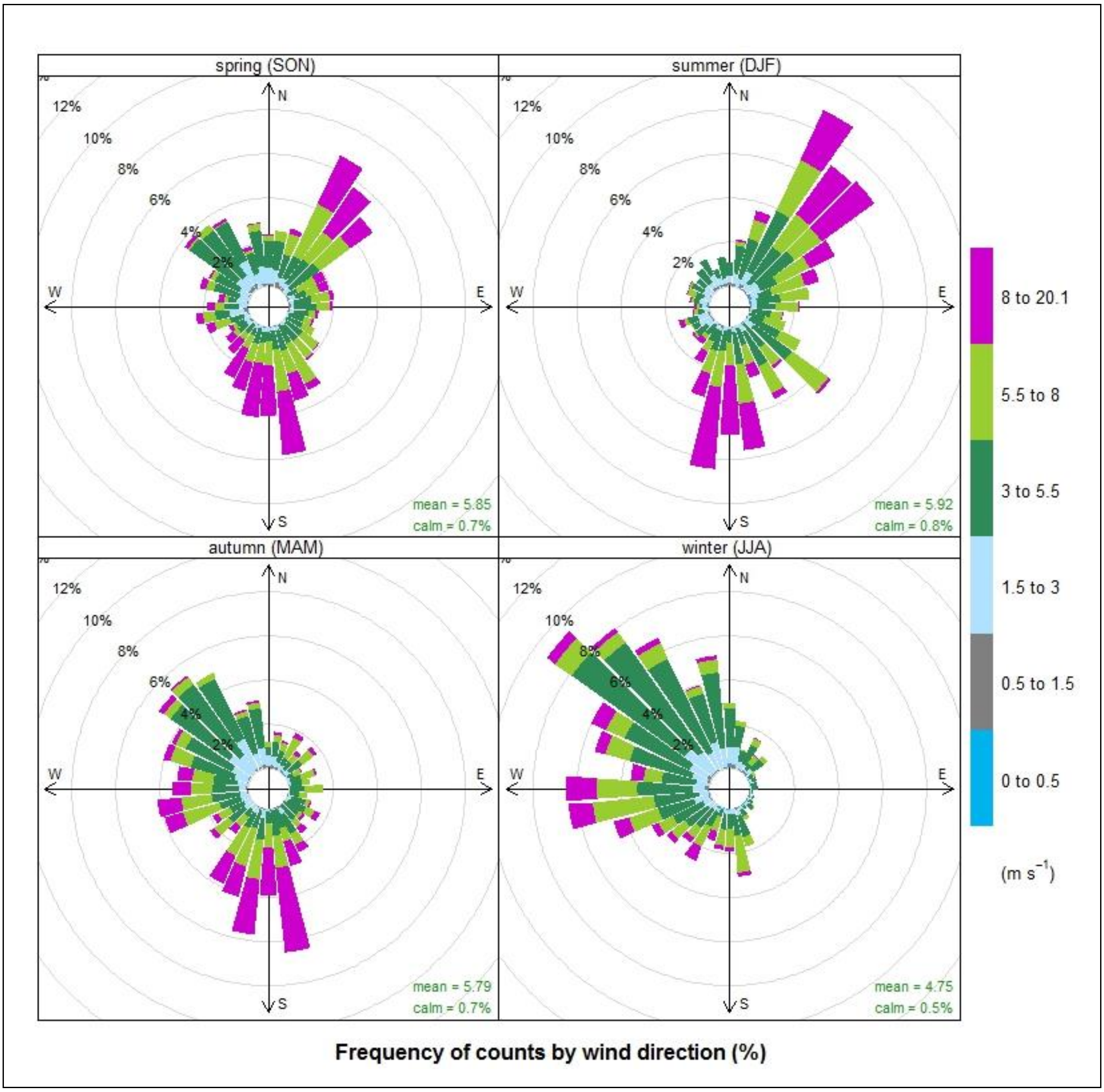

Figure A1.2 Seasonal Wind Roses – BoM Sydney Airport AWS – 2015

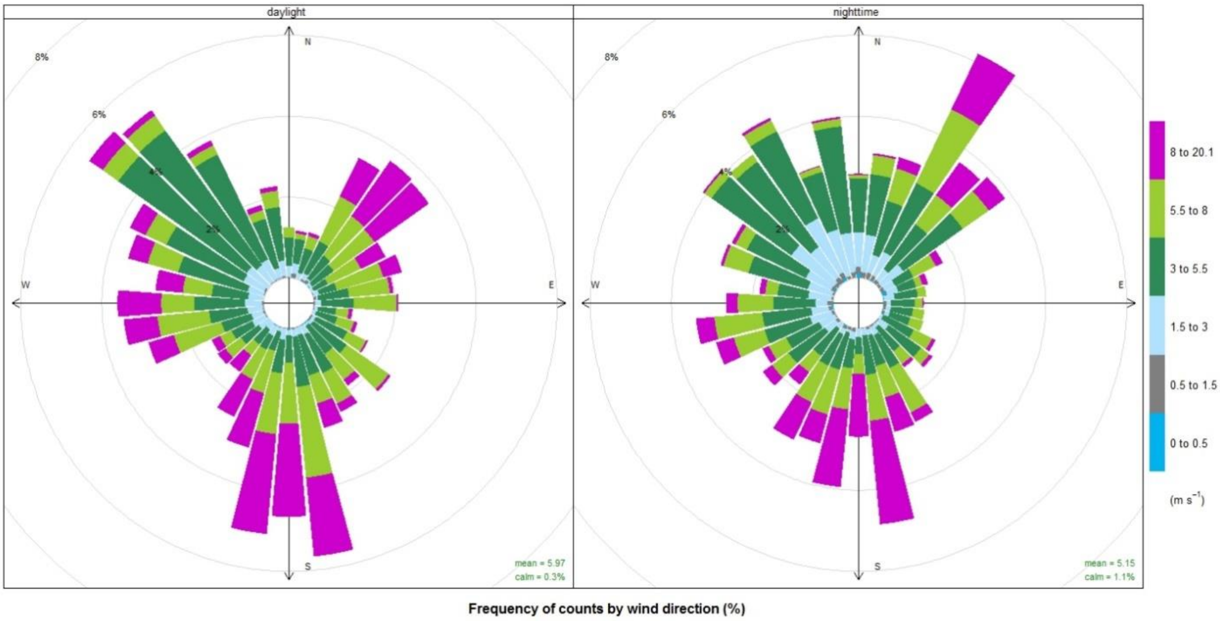

Figure A1.3 Diurnal Wind Roses – BoM Sydney Airport AWS – 2015

APPENDIX 2
EMISSIONS INVENTORY

Introduction

Air emission sources associated with the site were identified and quantified through the application of accepted published emission estimation factors, collated from a combination of United States Environmental Protection Agency (US-EPA) AP-42 Air Pollutant Emission Factors and NPI emission estimation manuals, including the following:

- NPI Emission Estimation Technique Manual for Mining (NPI, 2012);
- US-EPA AP-42 Chapter 11.12 Concrete Batching (US-EPA, 2011a);
- US-EPA AP-42 Chapter 13.2.1 Paved Roads (US-EPA, 2011b);
- US-EPA AP-42 Chapter 13.2.4 Aggregate Handling and Storage Piles (US-EPA, 2006a); and
- US-EPA AP-42 Chapter 13.2.5 - Industrial Wind Erosion (US-EPA, 2006b).

Sources of Particulate Matter Emissions

Air emissions associated with the site would primarily comprise fugitive particulate matter releases. Potential sources of emission were identified as follows:

- Delivery of raw aggregate, sand and cement material to site by truck and train;
- Unloading of aggregate and sand to material storage area;
- Handling of aggregate and sand at material storage area and transfer to the CBP storage via dump station and overhead conveyor system;
- Transferring cement into silos from delivery trucks;
- CBP processes, including material conveying, weigh hopper and mixer loading and product loading to agitator trucks;
- Wheel-generated dust from trucks movements across paved surfaces;
- Wind erosion from material storage area; and
- Diesel combustion by trucks, locomotives and mobile plant.

Operational Assumptions

To compile an emissions inventory for MOD11 operations at the site, the following general assumptions were made:

- Operational activities occur 24 hours a day, 365 days per year;
- Total wind erodible area for the site of 0.73 ha
- Average truck weights (average of loaded and unloaded weights):
  - Aggregate/sand truck – 32.75 t;
  - Cement/supplement truck – 30.25 t; and
  - Agitator truck – 21.6 t.
- Peak daily truck movements were adopted continuously for 24-hour emission purposes:
  - Aggregate/sand truck delivery and dispatch – 145;
  - Cement/supplement truck – 42;
  - Agitator truck – 625.
- Average daily truck movements were adopted for annual average emission purposes:
  - Aggregate/sand truck delivery and dispatch – 92;
  - Cement/supplement truck – 24;
  - Agitator truck – 500.
- Assumed three locomotives per train. Two trains per day. Onsite idling time of eight hours per train.

Particulate Matter Emission Factors Applied

The emission factor equations applied within the assessment are documented in this subsection. **Table A2.1** lists the uncontrolled emission factors that were applied for the two emission scenarios, references the source of the listed factors and whether the factor is derived from a specific equation or a published default emission factor.

Table A2.1 Emission Estimation Factors Applied

Emission Source	TSP Emission Factor	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Emission Factor Unit	Source of Factor
Cement/Supplement/Admix Delivery - Paved - RD1	0.11	0.02	0.00505	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Cement/Supplement/Admix Delivery - Paved - RD3	0.49	0.09	0.02288	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Cement/Supplement/Admix Delivery - Paved - RD4	0.11	0.02	0.00505	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Aggregate pre-silos conveyor transfer	0.0046	0.0022	0.00033	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Sand pre-silos conveyor transfer	0.0014	0.0007	0.00010	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Aggregate Transfer to Storage	0.0046	0.0022	0.00033	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Sand Transfer to Storage	0.0014	0.0007	0.00010	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Cement unloading to silos	0.0005	0.0002	0.00002	kg/tonne	US-EPA AP42 11.12 - Cement unloading to elevated storage silos (controlled)
Aggregate transfer storage to weigh hopper	0.0046	0.0022	0.00033	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Sand transfer storage to weigh hopper	0.0014	0.0007	0.00010	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Weigh hopper loading	0.0026	0.0013	0.00020	kg/tonne	US-EPA AP42 11.12 - Weigh hopper loading
Mixer Loading (Truck Mixer)	1.1180	0.3100	0.0500	kg/tonne	US-EPA AP42 11.12 - Truck loading (truck mix)
Agitator Truck Dispatch - Paved - RD1	0.08	0.02	0.00327	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Agitator Truck Dispatch - Paved - RD3	0.08	0.02	0.00327	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Agitator Truck Dispatch - Paved - RD4	0.08	0.02	0.00327	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Aggregate truck Unloading to stockpiles	0.0046	0.0022	0.00033	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation

Emission Source	TSP Emission Factor	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Emission Factor Unit	Source of Factor
Sand truck Unloading to stockpiles	0.0014	0.0007	0.00010	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Aggregate Unloading from train	0.0046	0.0022	0.00033	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Sand Unloading from train	0.0014	0.0007	0.00010	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Aggregate Elevated Conveyor Transfer	0.0046	0.0022	0.00033	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Sand Elevated Conveyor Transfer	0.0014	0.0007	0.00010	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Aggregate tripper car to stockpiles	0.0046	0.0022	0.00033	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Sand tripper car to stockpiles	0.0014	0.0007	0.00010	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Sand to internal truck	0.0014	0.0007	0.00010	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Sand internal transport - RD5	1.97	0.38	0.09076	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Sand internal transport to new dump station - RD6	0.53	0.10	0.02443	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Sand to new dump station	0.0014	0.0007	0.00010	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Aggregate truck loading - sales	0.0046	0.0022	0.00033	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Sand truck loading - sales	0.0014	0.0007	0.00010	kg/tonne	US-EPA AP42 13.2.4 - Materials Handling Equation
Aggregate/Sand Delivery and dispatch - Paved - RD5	1.97	0.38	0.09076	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Aggregate/Sand Delivery and dispatch - Paved - RD6	0.53	0.10	0.02443	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation

Emission Source	TSP Emission Factor	PM_{10} Emission Factor	$PM_{2.5}$ Emission Factor	Emission Factor Unit	Source of Factor
Aggregate/Sand Delivery and dispatch - Paved - RD1	0.12	0.02	0.00539	kg/Vehicle KM Travelled	AP-42 13.2.1 - Paved Road Equation
Wind Erosion - Materials storage area	9169.1	4584.6	687.7	kg/ha/year	AP-42 13.2.5 - Industrial Wind Erosion

Details relating to the emission equations referenced in **Table A2.1** are presented in the following sections.

Paved Roads Equation

The emissions factors for paved roads, as documented within AP42 Chapter 13.2.2 - "Paved Roads" (US-EPA 2011), was applied as follows:

$E = k\ (sL)^{0.91}(W)^{1.02}$

Where:

E = Emissions Factor (g/VKT)

sL = road surface silt loading (g/m^2)

W = mean vehicle weight (tonnes)

k = constant of 1.5 for PM_{10}

Material parameters are listed in **Table A2.4**.

Materials Handling

Particulate matter emissions from material transfer operations were calculated through the application of the US-EPA predictive emission factor equation for continuous and batch drop loading and tipping operations (AP42, Section 13.2.4), given as follows:

$$E = k(0.0016) * \left(\frac{\left(\frac{U}{2.2}\right)^{1.3}}{\left(\frac{M}{2}\right)^{1.4}} \right)$$

where,

E =Emissions (kg/tonne transferred)

U = mean wind speed (m/s)

M = material moisture content (%)

k = 0.74 for TSP, 0.35 for PM_{10} and 0.053 for $PM_{2.5}$

Wind Erosion Sources

Wind-blown dust from storage bins and the handling facility was estimated by applying the complex, predictive emission estimation procedure documented within AP-42 Chapter 13.2.5 "Industrial Wind Erosion" November 2006, as described below.

The predictive emission factor equation for industrial wind erosion is given as follows:

$$\mathrm{E} = \mathrm{k} \sum_{\mathrm{i}=1}^{\mathrm{N}} \mathrm{Pi}$$

Where,

k = particle size multiplier (k = 1 for TSP, 0.5 for PM_{10} and 0.075 for $PM_{2.5}$)

N = number of disturbances per year

Pi = erosion potential corresponding to the observed (or probable) fastest mile of wind for the ith period between disturbances (g/m²), calculated by:

$P = 58(u^* - ut^*) + 25(u^* - ut^*)$

$$P = 0 \text{ for } u^* \leq ut^*$$

Where,

u* = friction velocity (m/s)

ut* = threshold friction velocity (m/s)

Diesel Calculations

Diesel combustion emissions of $PM_{2.5}$ are described in the tables below. It is assumed that 92% of PM_{10} emissions from diesel combustion is $PM_{2.5}$, emissions have been up-scaled accordingly.

Table A2.2 Diesel Fuel Assumptions

Plant	Make/ Model	Number	Power	Hours per Year	kWh /year	Load Factor	Emission factor USEPA Tier 2 (g/kWh)	Annual PM_{10} (kg/ annum)	Annual $PM_{2.5}$ (kg/ annum)
Front End Loader	CAT 930	1	115	6.570	755,550	0.5	0.4	164.8	151.1
Internal haul truck	Komatsu HM300	1	254	6.570	1,668,780	0.5	0.4	364.1	333.8

Assumes 75% utilisation for each equipment

Diesel combustion emissions of $PM_{2.5}$ from trucks are described in the tables below. It is assumed that 92% of PM_{10} emissions from diesel combustion is $PM_{2.5}$, emissions have been up-scaled accordingly.

Table A2.3 $PM_{2.5}$ Emissions – Trucks Moving Onsite

Equipment	PM Emission Factor (g/VKT) - 1996 ADR70/00	Annual VKT	Annual Emissions (kg/year)
Trucks moving on site	0.584	140,010	81.8

Emission Factor Source: NSW EPA (2012) Technical Report No. 7, Air Emissions Inventory for the Greater Metropolitan Region in New South Wales, 2008 Calendar Year, On-Road Mobile Emissions.

Table A2.4 $PM_{2.5}$ Emissions – Trucks Idling Onsite

Equipment	Trucks onsite at any hour	Emission Factor PM (g/hr) - USEPA	Hours per year	Annual Emissions (kg/year)
Trucks Idling on site	26	1.196	1,196 (10mins per truck)	45.4

Emission Factor Source: NSW EPA (2012) Technical Report No. 7, Air Emissions Inventory for the Greater Metropolitan Region in New South Wales, 2008 Calendar Year, On-Road Mobile Emissions.

Finally, in order to quantify emissions associated with idling locomotive engines at site, the following assumptions were made:

- Three trains per day;
- Each train with two locomotives of TT class;
- Time idling on site per train is eight hours;
- Locomotive gross power rating of 4,490 bhp;
- Locomotive engines are assumed to be in notch 1 when idling. Based on Table 5-2 of US-EPA (1998), idling power output is 202 bhp;
- Locomotive emissions were estimated based on US-EPA Tier 0+ emission factors (US-EPA, 2009);
- US-EPA emission factor is for PM_{10}. TSP is assumed to be 100% PM_{10}, while PM_{10} is assumed to be 97% $PM_{2.5}$ (US-EPA, 2009).

Calculated annual emissions from idling locomotives for both scenarios are as follows:

- 885.0 kg TSP/PM_{10}; and
- 858.4 kg $PM_{2.5}$.

Project Related Input Data

Material property inputs used in the emission equations presented in **Table A2.1** are detailed in **Table A2.5**. It is noted that minimal details relating to the material properties were available at the time of reporting. To compensate, values were adopted from the literature.

Table A2.5 Material Property Inputs for Emission Estimation Factors Applied

Material Properties	Units	Value	Source of Information
Moisture Content of aggregate	%	1.77	Default value for aggregate – US-EPA AP42 (2006c)
Moisture Content of sand	%	4.14	Default value for Sand – US-EPA AP42 (2006c)
Silt Loading of Paved Roads	g/m^2	1.5	Cement deliveries and Concrete dispatch, as per St Peters Terminal sampling
		6.6	Aggregate deliveries, as per St Peters Terminal sampling
		23.9	Material storage area movements, as per St Peters Terminal sampling

Key operational details by process used in the emission calculations are listed in **Table A2.6**.

Table A2.6 Emission Estimation Activity Rates Applied for Emission Calculations

Emissions source	Unit	Value
Cement/Admix Delivery - Paved	Annual vehicles kilometre travelled	5,957
Aggregate Unloading from trains	Tonnes of material	1,585,455
Sand Unloading from trains	Tonnes of material	1,358,689
Aggregate Unloading from trucks	Tonnes of material	19,763
Sand Unloading from trucks	Tonnes of material	127,800
Sand to new dump station	Tonnes of material	89,479
Aggregate to reclaimer conveyor	Tonnes of material	882,185
Sand to reclaimer conveyor	Tonnes of material	805,315
Aggregate to CBP storage	Tonnes of material	980,206
Sand to CBP storage	Tonnes of material	894,794
Cement unloading to silos	Tonnes of material	277,500
Aggregate transfer storage to weigh hopper	Tonnes of material	750,000

Emissions source	Unit	Value
Sand transfer storage to weigh hopper	Tonnes of material	600,000
Weigh hopper loading	Tonnes of material	1,375,000
Mixer loading	Tonnes of material	277,500
Sand and aggregate for dispatch	Tonnes of material	1,000,000
Sand and aggregate truck dispatch - Paved	Annual vehicles kilometre travelled	9,402
Agitator Truck Dispatch - Paved	Annual vehicles kilometre travelled	124,100
Wind Erosion - Storage Bins	Area (m^2)	7,300

APPENDIX 3
INCREMENTAL ISOPLETH PLOTS

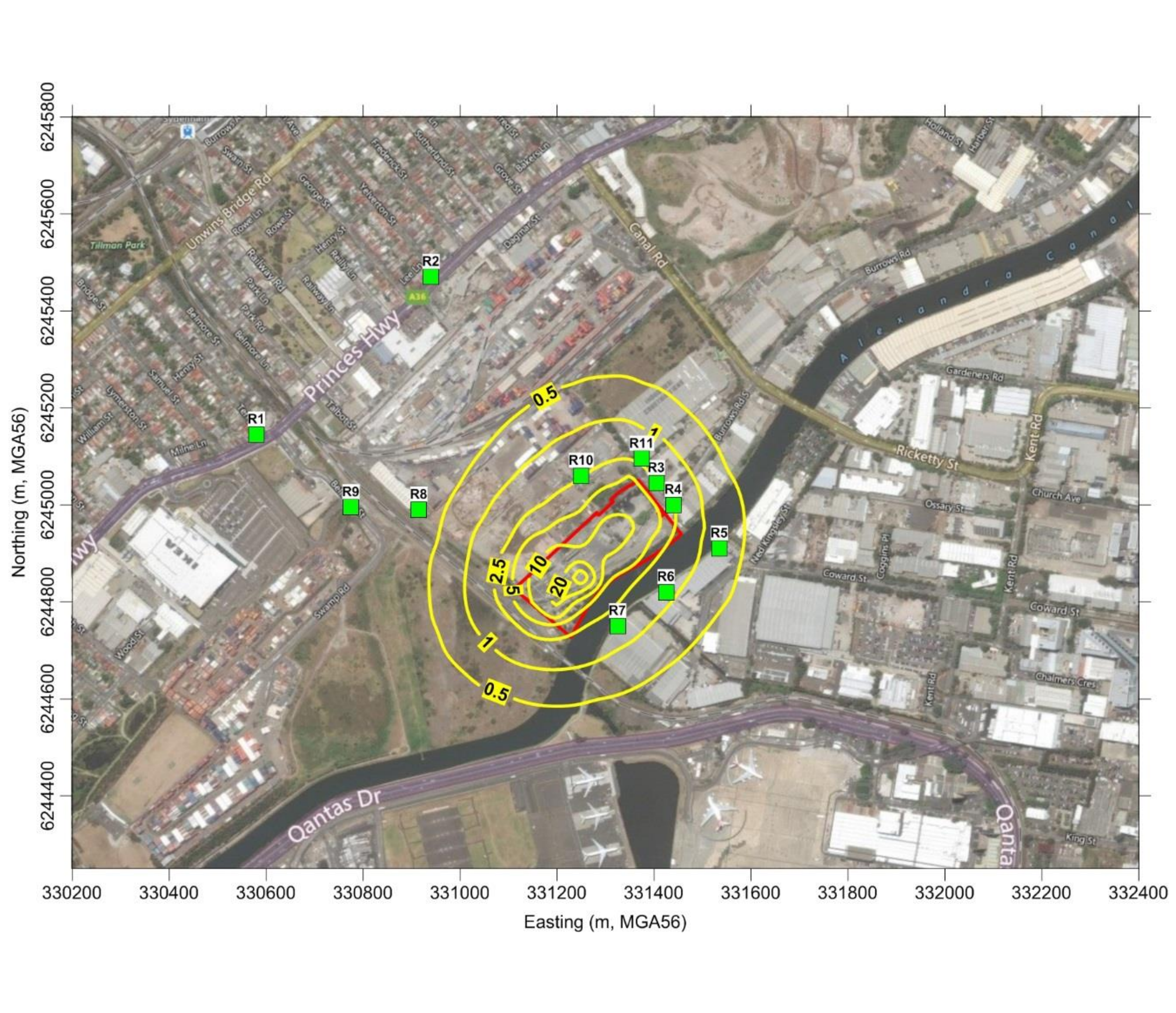

Figure A3.1 Predicted Incremental Annual Average TSP Concentrations (µg/m³)

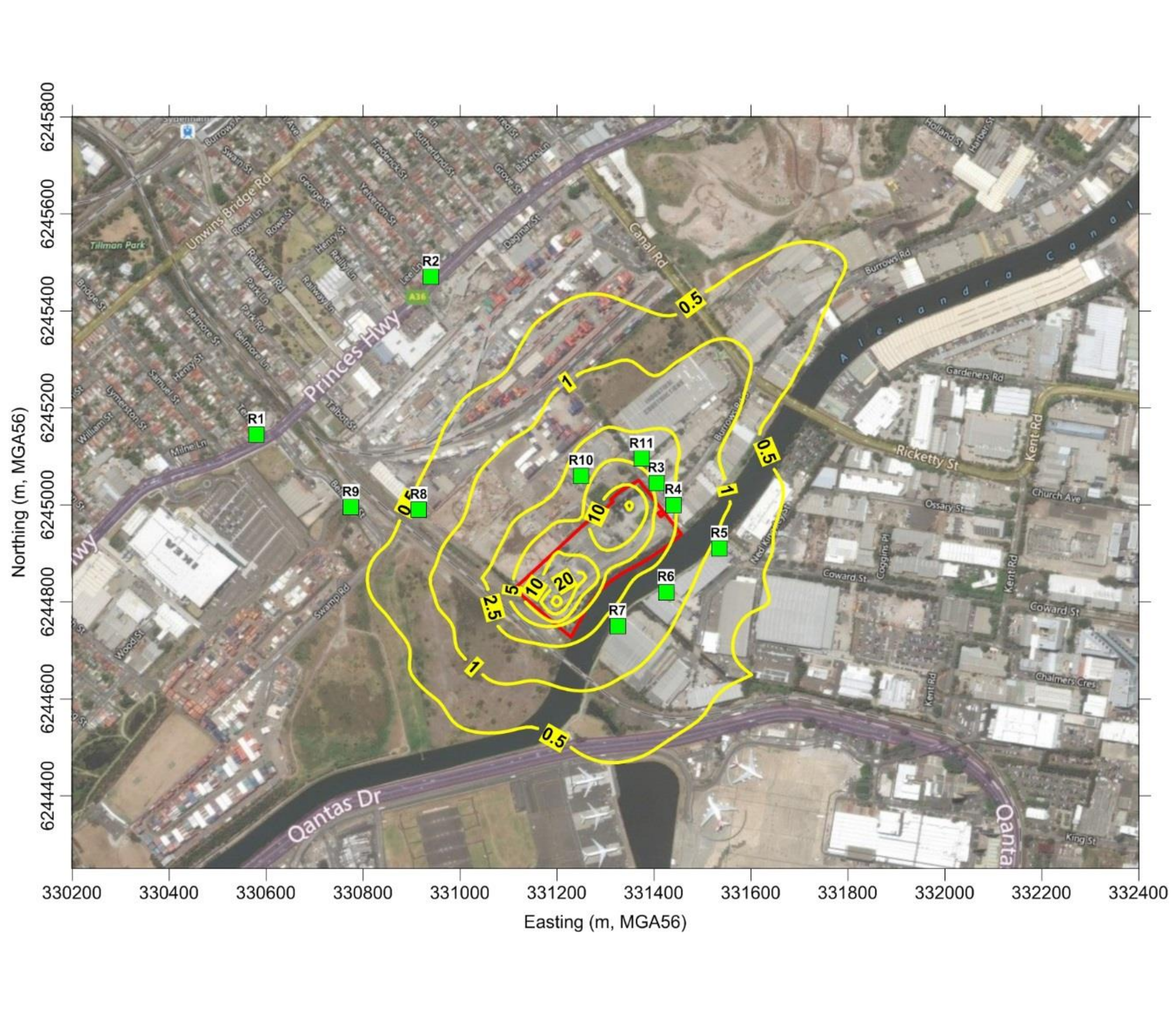

Figure A3.2 Predicted Incremental Maximum 24-hour Average PM_{10} Concentrations (µg/m³)

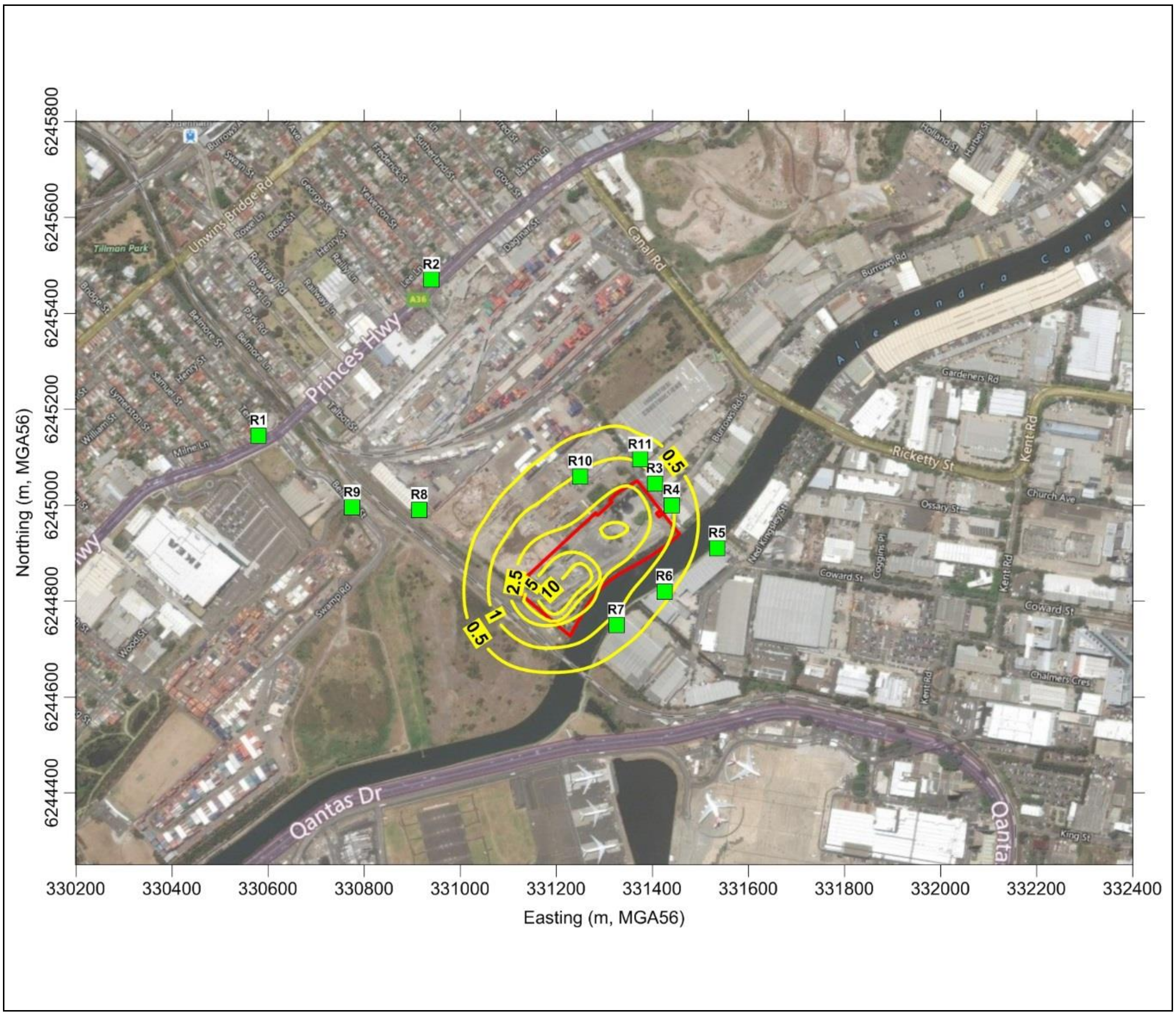

Figure A3.3 Predicted Incremental Annual Average PM_{10} Concentrations (μg/m³)

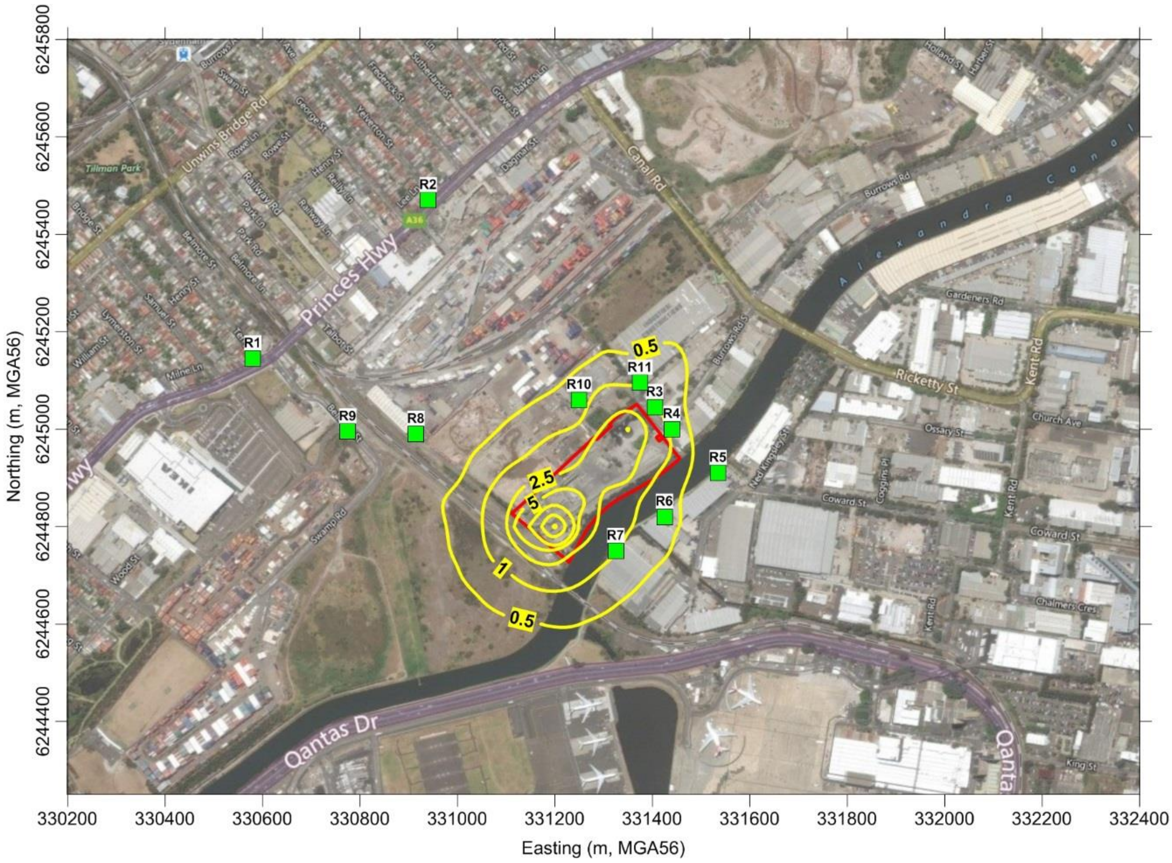

Figure A3.4 Predicted Incremental Maximum 24-hour Average $PM_{2.5}$ Concentrations (µg/m³)

Figure A3.5 Predicted Incremental Annual Average $PM_{2.5}$ Concentrations ($\mu g/m^3$)

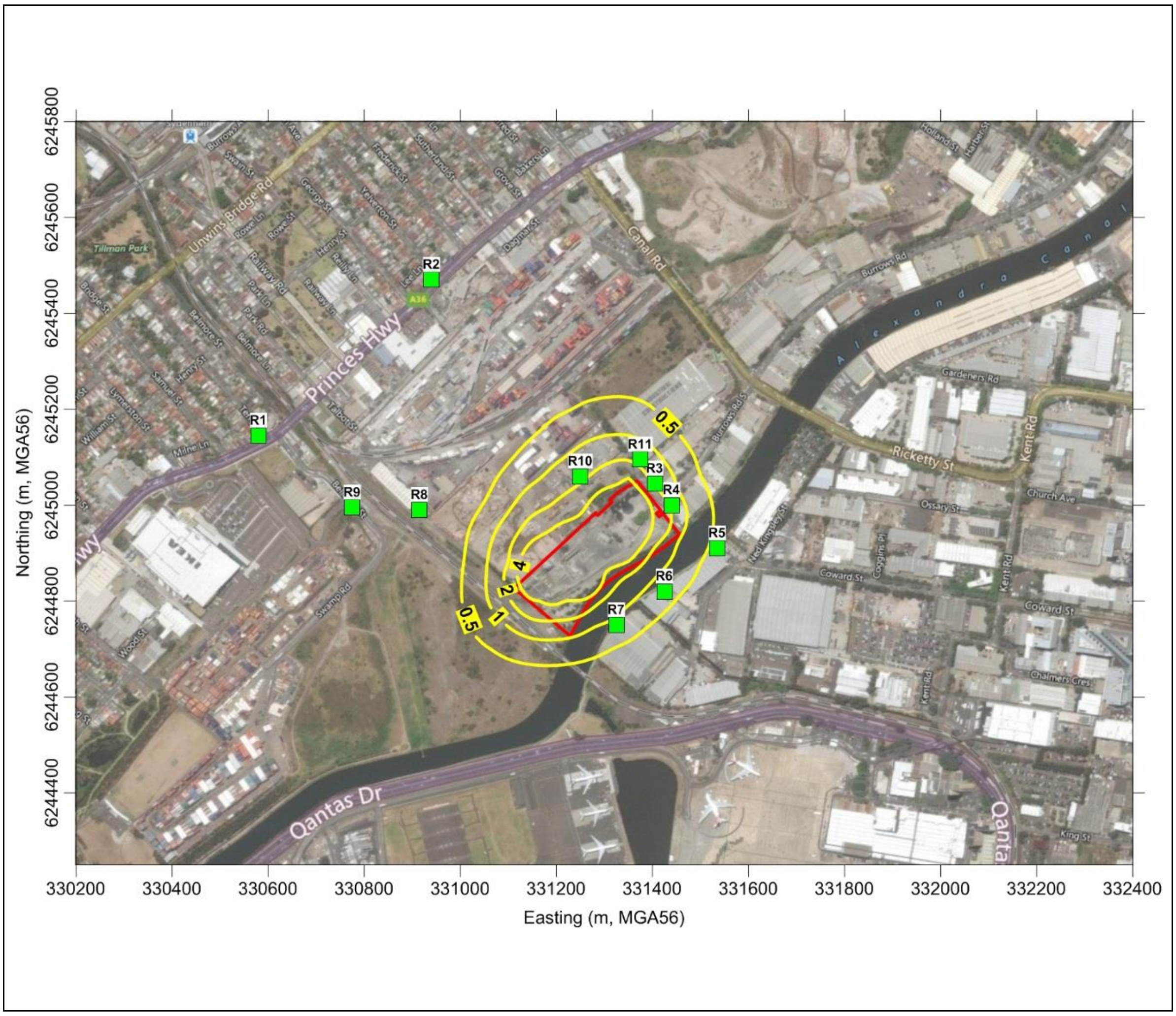

Figure A3.6 Predicted Incremental Annual Average Dust Deposition Levels (g/m²/month)

Appendix F

Traffic assessment

Traffic impact assessment

Modification 11 | Boral St Peters

Prepared for Boral Resources (NSW) Pty Limited | 28 June 2018

Traffic impact assessment

Modification 11 | Boral St Peters

Prepared for Boral Resources (NSW) Pty Limited | 28 June 2018

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Traffic impact assessment

Final

Report J16208RPT | Prepared for Boral Resources (NSW) Pty Limited | 28 June 2018

Prepared by	**Tim Brooker**	Approved by	**Allan Young**
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Date	28 June 2018	Date	28 June 2018

Document Control

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Appendices

Tables

Figures

Photographs

1 Introduction

Boral Resources (NSW) Pty Ltd (Boral) owns and operates a concrete batching plant (concrete plant) and construction materials handling facility at 25 Burrows Road South, St Peters (the site). The site location and the surrounding regional road network are shown in Figure 1.1.

The site receives raw materials including bulk construction materials (aggregate, sand and cement) predominantly by rail. All concrete and construction materials are despatched from the site by truck.

A modification to the site's development consent (modification 11) is proposed to increase the annual production limit for the concrete plant, which will require a number of alterations and improvements to the site layout to facilitate the increased production output.

The new annual production limit sought for the concrete plant is 750,000 m^3 which will be a 470,000 m^3 increase in the currently approved (modification 10) production rate of 280,000 m^3 , at which the plant is operating currently.

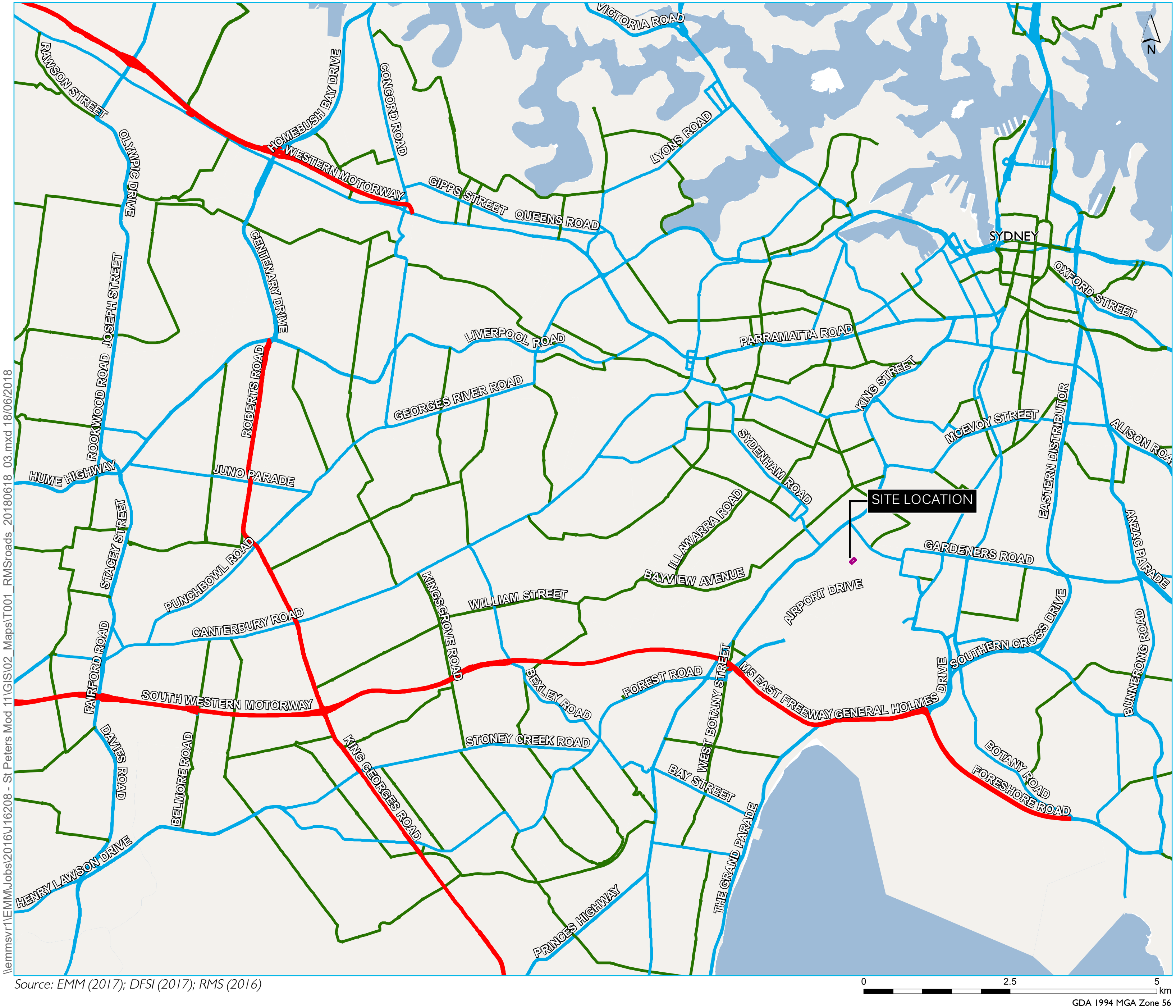
In addition, as part of modification 11, the amount of aggregate material received at the site (mainly by rail) and the stockpiled prior to onward delivery by road to Boral customers throughout the Sydney Metropolitan region, is also proposed to increase from 759,000 tonnes per annum currently, to 1,000,000 tonnes per annum in the future.

This traffic impact assessment has been prepared in accordance with the Roads and Traffic Authority (RTA) - now Roads and Maritime Services (RMS) - *Guide to Traffic Generating Developments* (RTA 2002), to assess the impact of the modification on the surrounding road network.

The network traffic impacts of the additional traffic associated with the proposed modification have been assessed at the following three intersections for the future average daily concrete production traffic and the increased average daily throughput of bulk construction materials:

- Canal Road, Ricketty Street, Burrows Road and Burrows Road South;
- Canal Road/Talbot Street (the Container Terminal Access); and
- Princes Highway, Canal Road and Mary Street.

This traffic impact assessment has also considered the future effects of the new road capacity from the Westconnex project in this area of St Peters and Mascot/Alexandria, which will substantially relieve the existing peak hour traffic movements along the Canal Road and Ricketty Street route, as there will be two additional bridge crossings provided over the Alexandra Canal by means of the Campbell Road and Gardeners Road extensions, which are both now under construction.



KEY

Site location

RTA classified roads

Auslink

State

Regional

Source: EMM (2017); DFSI (2017); RMS (2016)

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Site location

Boral St Peters
Concrete batching plant
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Figure 1.1

EMM

2 Existing conditions

2.1 Site location and access

The Boral site is approximately 7 kilometres (km) south-west of the Sydney CBD. The site access is via Burrows Road South, approximately 300 metres (m) south of the intersection with Canal Road and Ricketty Street. The Princes Highway is approximately 570 m further to the west via Canal Road. Between these two intersections, approximately 320 m to the west of Burrows Road, is the entry to the St Peters Container Terminal (Talbot Street) from Canal Road. The Boral site's location in relation to the surrounding road networks is shown on Figure 2.1. Additional internal site details including the general traffic circulation paths and car parking are discussed in further detail in Section 2.6.

The speed limit on Burrows Road South is 50 kilometres per hour (km/hr). On the external major roads in the locality, Canal Road, Ricketty Street and the Princes Highway, the speed limit is generally higher (60 km/hr).

Views of Burrows Road South at the site frontage, Burrows Road in the vicinity of the Canal Road and Ricketty Street intersection, Ricketty Street and Kent Road looking north towards Ricketty Street are shown in Photographs 2.1 to 2.4. The other additional future locality road connections which are either approved and/or proposed to be constructed in the St Peters and Mascot localities as part of the Westconnex project, are shown on Figure 2.2. Burrows Road South is identified by Roads and Maritime Services (RMS) as a B Double truck access route.

2.2 Road network

The road routes which will generally be used by most site traffic are:

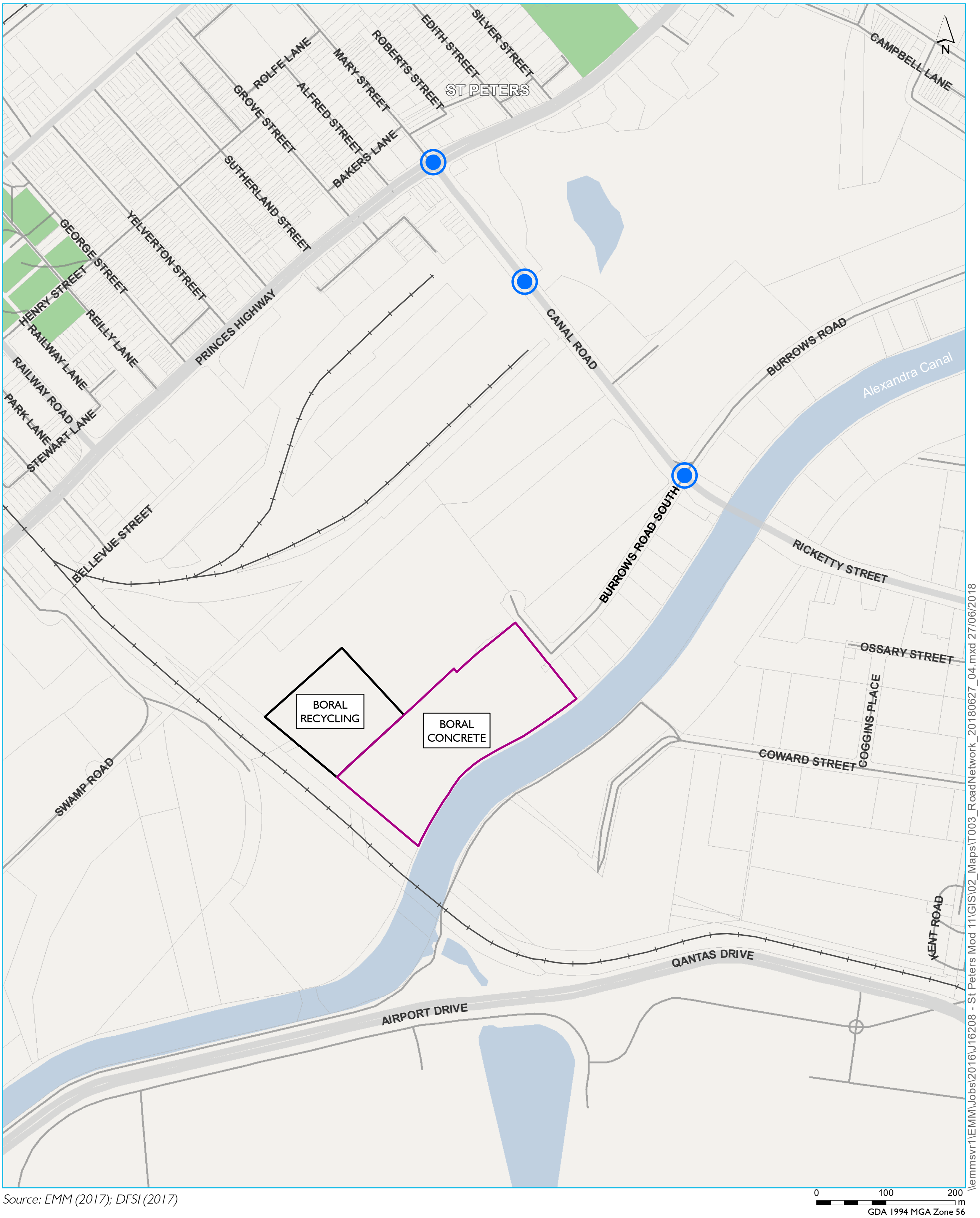
- Burrows Road and Burrows Road South – local industrial roads, having two traffic lanes (one in each direction) with parking permitted away from the major intersections;
- Canal Road and Ricketty Street – a significant arterial road route which connects the Princes Highway to Mascot. It is between four to six lanes wide between Kent Road (at Mascot) and the intersection with the Princes Highway (at St Peters); and
- The Princes Highway – a significant arterial road, which is generally at least six lanes wide. The road has peak hourly tidal flow arrangements south and east of the intersection with Canal Road, which change the direction of the central traffic lane on The Princes Highway, south of the intersection, with a corresponding closure of the kerbside lane at times on Canal Road west-bound.

The roads carrying largest proportion of the site traffic are Canal Road and the Princes Highway.

2.3 Intersections

The three intersections which will be used by most of the site traffic, as shown on Figure 2.1, are:

- Canal Road, Ricketty Street, Burrows Road and Burrows Road South;
- Canal Road at the St Peters Container Terminal access (Talbot Street); and
- The Princes Highway, Canal Road and Mary Street.



Source: EMM (2017); DFSI (2017)

KEY

- Site location
- Intersections potentially affected by site traffic
- Main road
- Local road
- Rail line
- Watercourse
- Waterbody
- Cadastral boundary
- Parks and recreation

Road network and intersections near the site

Boral St Peters
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Figure 2.1

EMM

Source: EMM (2017); DFSI (2017)

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KEY

- Site location
- Rail line
- Main road
- Local road
- 25/26m B-Double route
- Approved route (with travel conditions)

Westconnex

- St Peters interchange surface road (Stage 2)
- St Peters interchange tunnel (Stage 2)
- M4-M5 link mainline tunnel (Stage 3)
- Future Sydney Airport Gateway

- Watercourse
- Waterbody
- Parks and recreation

Future locality road network including Westconnex

Boral St Peters

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Figure 2.2

Photograph 2.1 Burrows Road South looking into the site near Gate 1

Photograph 2.2 Burrows Road South looking north towards the Canal Road intersection

Photograph 2.3 Ricketty Street showing the bridge over the Alexandria Canal looking west

Photograph 2.4 Kent Road looking north towards the Ricketty Street intersection

Based on the observed peak hour intersection traffic distribution at the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection, which is shown by the traffic survey results in Appendix B, the major proportion of all traffic (including truck traffic) from all the Burrows Road South industrial sites (including the Boral concrete plant and materials handling facility) currently travels west via Canal Road and then splits either south or north via The Princes Highway.

Approximately 40% of the total truck traffic leaving the Burrows Road South industrial sites travels to and from the west. The other truck traffic proportions which travel via Burrows Road north of Canal Road and via Ricketty Street east of Canal Road are approximately 25% and 35% respectively.

Site employee and other visitor light vehicle traffic also use these routes, but have a slightly higher proportion (approximately 50%) travelling via the Canal Road and Princes Highway routes.

The operating performance of the existing peak hourly traffic volumes at the existing major road intersections are assessed in Section 2.5, based on the existing peak hourly traffic volumes which are summarised in Section 2.4.

2.4 Traffic volumes

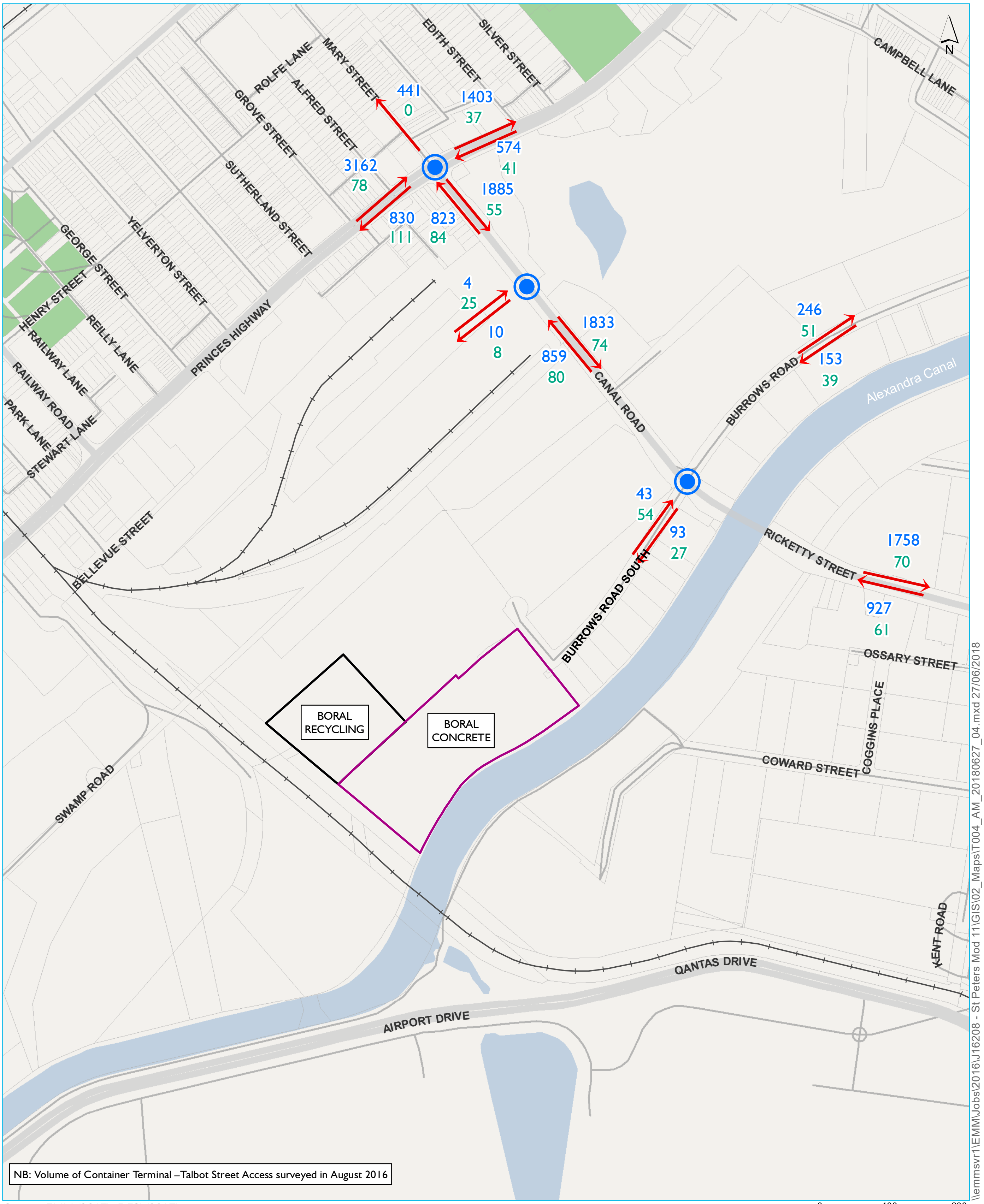
The existing traffic volumes using the road network in the locality of Burrows Road South at St Peters were determined by peak hourly traffic surveys at the main intersections, Figure 2.1, which are at Canal Road, Ricketty Street, Burrows Road and Burrows Road South (in December 2017) and at the Canal Road Container Terminal Access, also known as Talbot Street (in August 2016) and at the Princes Highway, Canal Road and Mary Street intersection (in December 2017).

The external major road intersection traffic surveys are included in Appendix B. The average weekday peak hourly traffic volumes which were recorded for the locality road network from the Wednesday and Thursday traffic surveys are shown graphically on Figure 2.3 and Figure 2.4 and are summarised in Table 2.1, including the corresponding estimated daily traffic volumes and heavy vehicle traffic proportions.

Table 2.1 Summary of existing traffic volumes from intersection traffic surveys

Road	Intersection survey location	Morning peak hour volume	Afternoon peak hour volume	Estimated daily traffic*	Average week day heavy vehicles*	% heavy vehicles
Burrows Road South	South of Canal Road	217	210	2,600	840	32.7
Burrows Road	North of Canal Road	489	542	6,200	950	15.4
Ricketty Street	East of Canal Road	2,816	2,891	34,200	1,670	4.9
Canal Road	West of Ricketty Street	2,846	2,915	34,600	2,010	5.8
Canal Road	East of Talbot Street	2,848	2,726	33,400	1,540	4.6
Canal Road	West of Talbot Street	2,851	2,704	33,300	1,400	4.2
Canal Road	East of Princes Highway	2,847	2,691	33,200	1,300	3.9
Talbot Street	South of Canal Road	47	52	600	470	78.4
Princes Highway	South of Canal Road	4,181	4,806	53,900	1,830	3.4
Princes Highway	North of Canal Road	2,055	2,966	30,100	900	3.0
Mary Street	West of Princes Highway	441	464	5,400	0	0.0

Notes: **Average daily traffic is estimated as 12 times the average peak hourly traffic for all roads. Daily heavy vehicle numbers and their % have been extrapolated from the am and pm peak hourly heavy vehicle traffic proportions.*



Source: EMM (2017); DFSI (2017)

KEY

- Site location
- Intersections potentially affected by site traffic
- Main road
- Local road
- 00 Cars
- 00 Trucks
- Rail line
- Watercourse
- Waterbody
- Cadastral boundary
- Parks and recreation

December 2017 average weekday site and locality road traffic volumes - AM peak hour

Boral St Peters

Concrete batching plant

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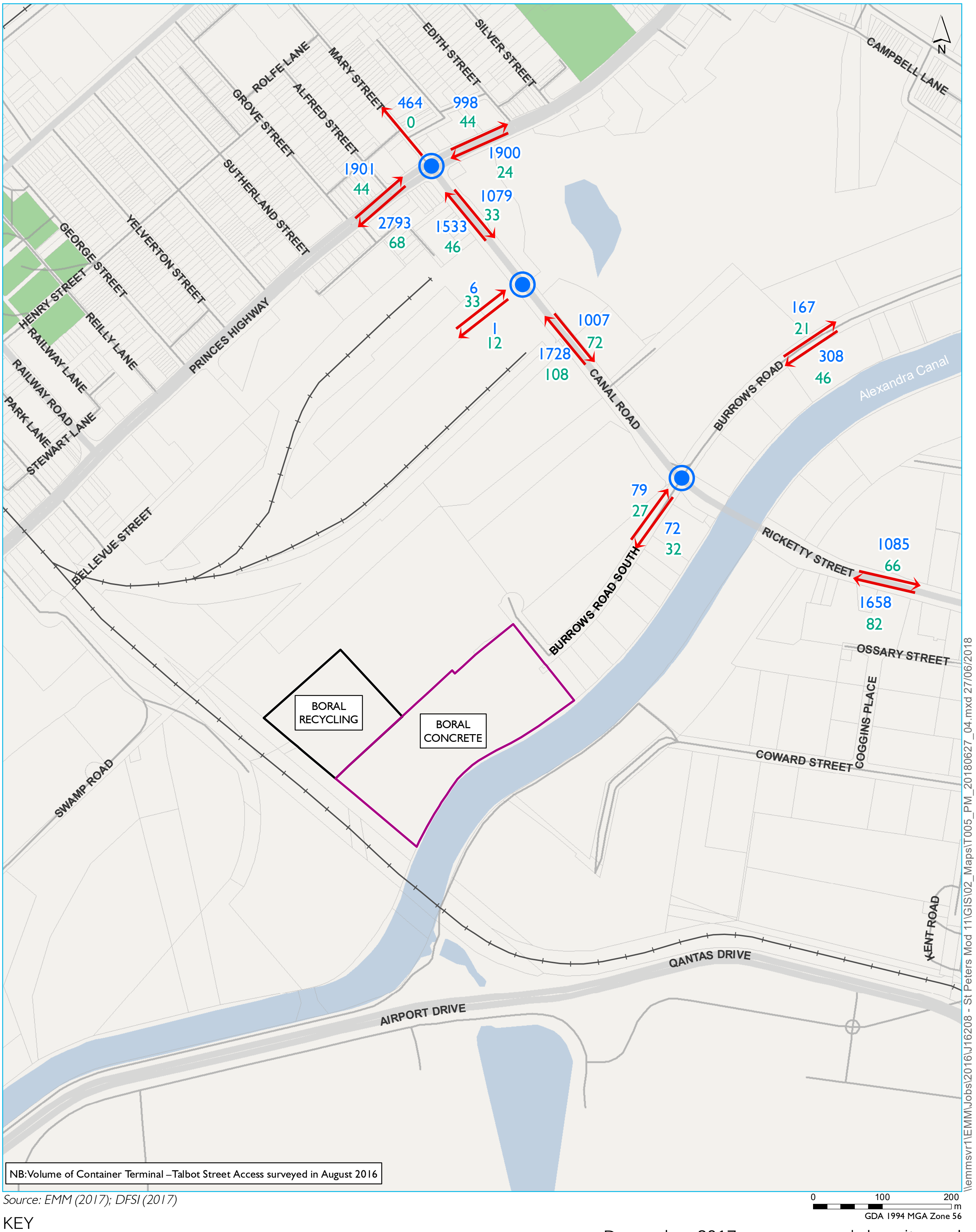
Figure 2.3



Source: EMM (2017); DFSI (2017)

KEY

- Site location
- Intersections potentially affected by site traffic
- Main road
- Local road
- 00 Cars
- 00 Trucks
- Rail line
- Watercourse
- Waterbody
- Cadastral boundary
- Parks and recreation

December 2017 average weekday site and locality road traffic volumes - PM peak hour

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Figure 2.4

EMM

The proportion of heavy vehicle traffic on Burrows Road South between the site and Canal Road is approximately 33% of all traffic. This high proportion is a reflection of the industrial nature of the land uses in this area, which generate large amounts of truck traffic. On Burrows Road, north of Canal Road, the proportion of heavy vehicles is also relatively high at approximately 15%.

On the other major traffic routes in the locality (Canal Road, Ricketty Street and the Princes Highway) the surveyed proportions of heavy vehicles are much closer to the normal range for major roads being 3.0% and 3.4% respectively for the Princes Highway north and south of Canal Road, between 3.9% to 5.8% at various locations on Canal Road and 4.9% on Ricketty Street.

The proportion of trucks on Talbot Street (78.4%) is very high due to this being the entrance to a shipping container terminal.

The heavy vehicle traffic proportion is effectively zero (0%) on Mary Street, west of the Princes Highway, where there is a load limit restricting heavy vehicle access.

2.5 Intersection performance

The existing morning and afternoon peak hourly traffic operations and the levels of service at the two major road intersections have been determined using the SIDRA intersection traffic model. The SIDRA intersection program measures the intersection capacity and performance by calculating parameters such as average vehicle delay, maximum queue length, degree of saturation and level of service, based on the RTA/RMS Guide to traffic generating developments standards (Roads and Traffic Authority, 2002) which were developed from the international Highway Capacity Manual standards.

The existing intersection levels of service (LoS) for the morning and afternoon peak hour periods have been measured according to RMS defined ranges (Table 2.2) which range from A (best) to F (worst).

Table 2.2 LoS definitions

Description	LoS	Average vehicle delay (sec)
Very good	A	<14.5
Good	B	14.5 to ≤28.5
Satisfactory	C	28.5 to ≤42.5
Near capacity	D	42.5 to ≤56.5
At capacity	E	56.5 to ≤70.5
Over capacity	F	≥70.5

The SIDRA intersection results for the two peak hours analysed are provided in Appendix C and summarised in Table 2.3.

Table 2.3 Existing SIDRA intersection traffic operations summary

Intersection	Peak hour	Traffic demand flow (vehicles)[1]	Average delay (seconds)	Level of service (LoS)	Degree of saturation	Maximum queue length (m)
Canal Road, Ricketty Street, Burrows Road and Burrows Road south	7.15 to 8.15 am	3,352	94.9	F	1.480	740 (Canal Rd)
	3.00 to 4.00 pm	3,452	132.4	F	1.146	913 (Ricketty St)
Canal Road, Talbot Street (Container Terminal)	7.30 to 8.30 am	3,065	4.4	A	0.606	134 (Canal Rd eastbound)
	5.00 to 6.00 pm	3,161	7.0	A	0.653	224 (Canal Rd westbound)
Princes Highway, Canal Road and Mary Street	7.30 to 8.30 am	5,013	42.5	C	0.931	531 (Princes Highway northbound)
	5.00 to 6.00 pm	5,735	49.6	D	0.916	376 (Princes Highway southbound)

Note 1: The SIDRA intersection program automatically adds 5% to all surveyed intersection traffic volumes as a contingency measure

The peak hour traffic signal operations at two of the three intersections are generally satisfactory. However, the Canal Road/Burrows Road intersection is operating over capacity during both the morning and afternoon peak hours, with average intersection delays of between 95 and 132 seconds per vehicle corresponding to LoS F.

The highest peak hour traffic queues occur in the directions of the main peak hourly traffic flows at each intersection which are:

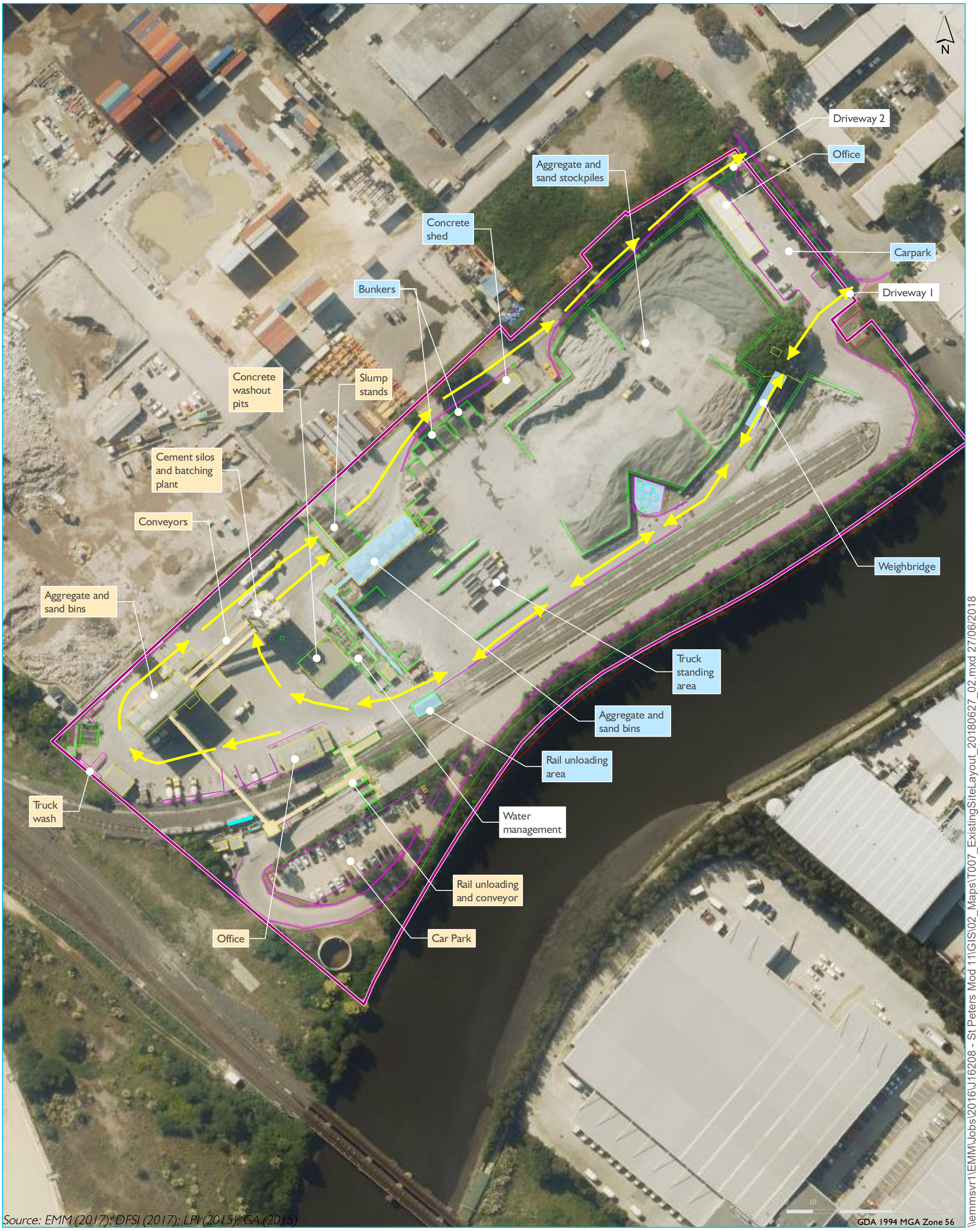
- on Canal Road in the east bound direction (740 m) during the morning peak and on Ricketty Street in the west bound direction (913 m) in the afternoon commuter traffic peak;
- on Canal Road in the east bound direction (134 m) during morning peak and in the westbound direction (224 m) in the afternoon peak; and
- on the Princes Highway in the northbound direction (531 m) and travelling southbound (376 m) during the morning and afternoon commuter peak traffic periods, respectively.

2.6 Existing site traffic and parking

The existing site layout and traffic circulation patterns are shown in Figure 2.5.

The site's peak hourly truck traffic movements for the morning and afternoon commuter peak traffic periods are approximately 10% of the total daily truck traffic and there are normally relatively few car traffic movements at the site during these peak hour periods. The site employee shift start and finish times are either earlier or later than the normal commuter peak traffic hours. The heavy vehicle traffic geographic distribution for the site is normally:

- approximately 40% travelling south and west via Canal Road and The Princes Highway, south of Canal Road;



KEY

Site location

Direction of truck circulation

Concrete plant feature

Materials facility feature

Existing site layout

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Figure 2.5

EMM

- approximately 35% travelling east via Ricketty Street east of Canal Road, and
- approximately 25% travelling north via Burrows Road north of Canal Road.

There are two existing car parking areas for the site employees and visitors; a car park for the concrete plant in the southern most corner adjacent to the concrete plant with capacity for 40 cars, shown in Photograph 2.6, and a smaller car park for the materials handling facility near the Burrows Road South exit which has capacity for 27 cars.

The two site car parks currently have adequate capacity for the combined site employee and visitor car parking demand for the combined site operations. In August 2017, the combined occupancy of both car parks was 52 vehicles, which represented 78% occupancy for the combined site car parking capacity of 67 cars.

Photograph 2.5 Existing concrete plant site car park occupancy in August 2017

2.7 Public transport

The site is located over 1 km walking distance from the nearest railway station at Sydenham. Public bus services in the St Peters area via Canal Road and Ricketty Street are provided by Sydney Buses route 418 which is a cross regional service operating from Bondi Junction to Burwood. The route 418 service has bus stops located on Canal Road and Ricketty Street near the intersection with Burrows Road South. These bus stops are within approximately 400 m walking distance from the site.

The bus route 418 journey times from the Canal Road locality of St Peters are approximately 40 minutes each way to or from Bondi Junction or 45 minutes each way to or from Burwood railway station.

The route 418 bus service operates with 38 or 39 daily bus trips in each direction, which provides an approximate half hourly service in both directions through the major part of the day on weekdays, with some additional weekday peak hourly services between 7-9 am and 3-6 pm.

2.8 Pedestrian and cycling access

There are paved footpaths provided on both sides of Burrows Road South and Canal Road in the vicinity of the site, which are shown in Photographs 2.3 to 2.5.

Pedestrian and cyclist access is generally feasible to and from the concrete plant and handling facility site via these roads. Bicycle use in the area is low due to the volume of traffic and percentage of heavy vehicles. Cyclists predominantly travel via the roadway along Burrows Road South, and then via the footpaths along Canal Road, due to the significantly higher car and truck traffic volumes on Canal Road (see Table 2.1).

2.9 Traffic safety

Traffic safety on major roads in urban areas, where the larger intersections are controlled by traffic signals, is generally good, in particular where the right turning traffic is controlled by right turn traffic signal arrows and does not make filter turns through an opposing traffic stream.

This is generally the case for the right turn access at the two intersections analysed, at Canal Road/Princes Highway and at Canal Road/Ricketty Street/Burrows Road/Burrows Road South where right turning arrow movements are provided for the turning traffic directions which are used by the Boral site traffic.

Also, the major road approaches at these two intersections are generally straight and reasonably level, (except for the Hump backed bridge over the canal on Ricketty Road) and there generally good sight lines for the approaching traffic to either proceed through or safely stop at these intersections.

2.10 Future St Peters locality road traffic changes following Westconnex

There are significant future road traffic changes predicted from all three stages of the Westconnex project on a number of roads in the Alexandria, St Peters and Mascot areas, with significantly increased road traffic volumes occurring on some routes (Euston Road) and significantly reduced traffic volumes on other routes (Canal Road).

The forecast future extent of the traffic changes for Canal Road and Ricketty Street are shown on the maps from the M4-M5 EIS traffic report in Appendix D, which show the predicted future daily traffic volumes changes over a large area of the Inner Western Sydney road network, as a result of the Westconnex project.

From the maps in Appendix D, it can be interpreted that along both Canal Road and Ricketty Street, there will be a significant future daily traffic reduction of approximately 10,000 daily vehicle movements, immediately following the completion of the Westconnex Stages 1 and 2 projects in 2023, together with a further forecast daily traffic reduction of at least 5,000 daily vehicle movements, following the subsequent completion of the Westconnex Stage 3 project, in the years after 2023.

3 The modification

3.1 Site layout

The site has two driveways to Burrows Road South; the main driveway (Gate 1) is located in the middle of the site's northern boundary, and a second driveway (Gate 2) is located in the western edge of the northern boundary. The current external road daily traffic movements from the other industrial sites fronting Burrows Road South in the vicinity of the two Boral site gates are relatively low and do not affect the overall operation and efficiency of the Boral site access gates and driveways, such that a detailed future assessment of the Boral site driveway traffic operations is not required.

The future proposed changes to the internal layout and traffic circulation patterns for the Boral site are shown on Figure 3.1. Further proposed swept path drawings showing additional key details of the proposed new site traffic circulation patterns are also included in Appendix A. The key vehicle movement paths are shown for the materials handling facility sand and aggregate deliveries, the cement and fly ash road tanker deliveries and for concrete agitator trucks travelling to and from their respective loading and cleaning points within the site.

The truck loading areas within the site have been designed to meet the vehicle swept path requirements which are shown in Appendix A. Further details of the types of trucks which are normally used at the site for the concrete plant and the materials handling facility are shown in Photographs 3.1 to 3.8.

The site has two car parking areas currently, which provide a total of 67 car parking spaces. In addition to these areas, a further 12 new spaces are proposed for the area just to the east of the existing concrete plant operations car park and a further 7 spaces are proposed for the area adjacent to Gate 1, to supplement the existing handling facility parking facilities, resulting in a total of 19 additional car parking spaces for the site.

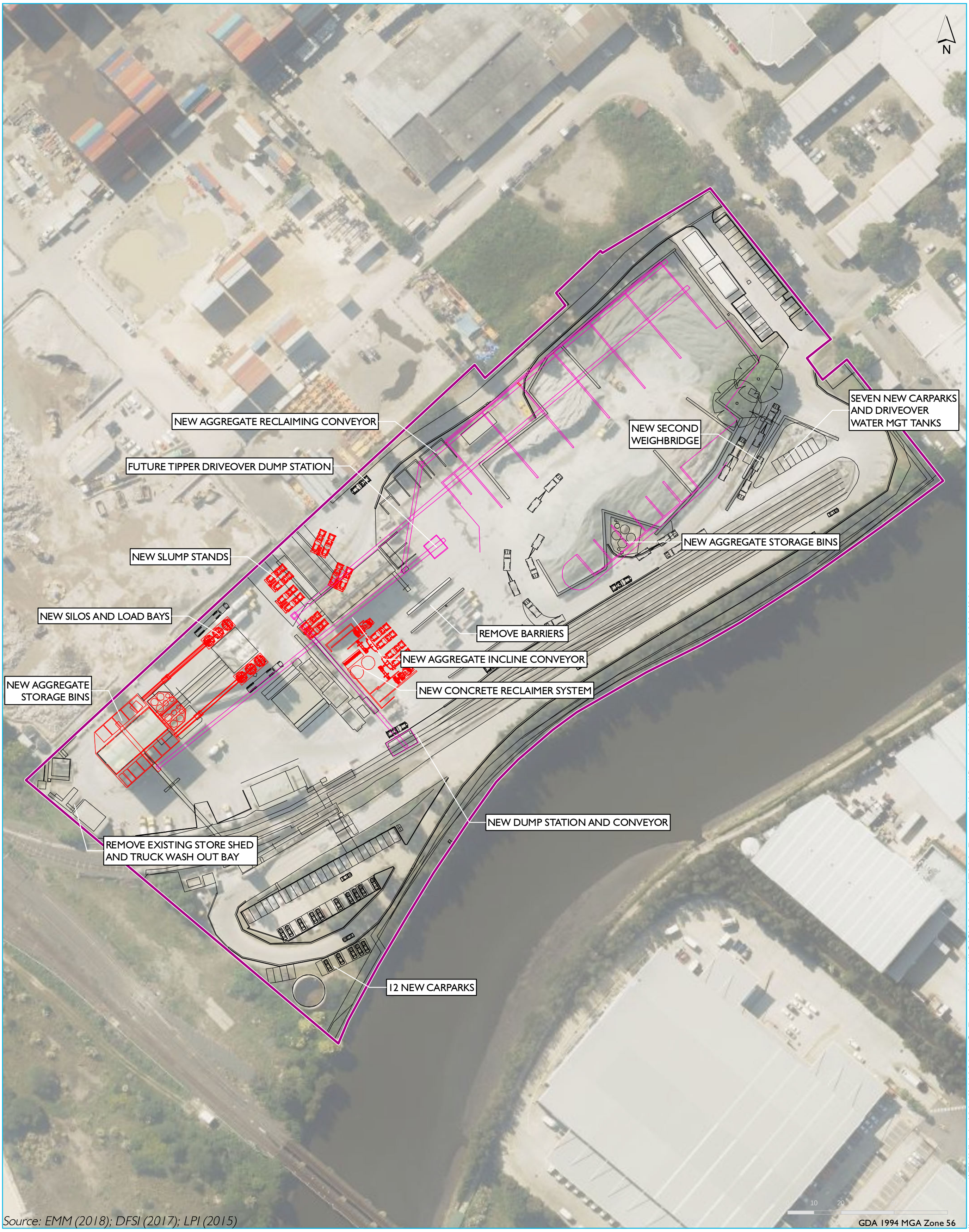
3.1.1 Traffic generation

i Heavy vehicle traffic

A substantial proportion of bulk construction materials are transported to the site (both concrete plant and handling facility) by rail, with some transported by road. All concrete and bulk materials despatched from the site are transported by road. The total site truck traffic varies between 558 to 752 daily vehicle movements from the combined concrete plant and materials handling facility operations. The current annual throughput of bulk construction materials (sand and aggregate) used for concrete production at the plant is approximately 513,000 tonnes (t) (excluding cement and admixtures). This is summarised in Table 3.1.

Table 3.1 Current and proposed bulk construction material quantities for concrete plant production

Material received	Current annual quantity	Proposed annual quantity
Aggregate	289,000 t	775,000 t
Sand	224,000 t	600,000 t
Cement/fly ash	130,000 t	277,500 t
Admixtures	441,000 litres (L)	1,500,000 litres (L)



Source: EMM (2018); DFSI (2017); LPI (2015)

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KEY

Site layout

Concrete plant feature (proposed)

Material handling plant feature (proposed)

Site location

Proposed modification

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Figure 3.1

EMM

Photograph 3.1 Group of parked agitator trucks waiting in the agitator truck parking area

Photograph 3.2 Volvo off road type dumper truck used for internal site materials transport

Photograph 3.3 Truck and Three-axle Dog Trailer vehicle loading aggregate at the site

Photograph 3.4 Truck and Quad Dog trailer vehicle arriving at the site to collect aggregate

Photograph 3.5 Group of three empty agitator trucks returning to the site simultaneously

Photograph 3.6 Cement/Flyash Tanker truck making a delivery to the site

The concrete plant has approval to produce up to 280,000 cubic metres (m^3) of concrete per annum currently. This corresponds to approximately 209 daily truck loads (418 daily truck movements) on an average day and a maximum of 266 daily truck loads (532 movements).

Independently of the concrete plant production, a further 759,000 t of sand and aggregate are currently received by rail and road each year at the handling facility for distribution by road to Boral sites and other customers across the Sydney Metropolitan Region. This corresponds to approximately 70 daily truck loads (140 daily truck movements) on an average day and a maximum of 110 daily truck loads (220 movements).

ii Light vehicles

The existing total site car traffic for the workforce and site visitors is approximately 150 daily vehicle movements. This car traffic is anticipated to increase by up to 50 additional daily vehicle movements with the proposal. This traffic is currently uniformly distributed between the potential traffic approach routes geographically, with equal proportions travelling to or from the north, east, west and south of St Peters.

The additional site daily car traffic is anticipated to travel via similar routes on the surrounding road network to the existing site car traffic, which corresponds to approximately 50% travelling west to and from Burrows Road South via Canal Road, and 25% each via Burrows Road (north) and Ricketty Street.

3.2 Increase in production of concrete plant

The concrete plant currently produces up to 280,000 m^3 of concrete per annum. A production increase of 470,000 m^3 is sought to enable the production of 750,000 m^3 of concrete per annum. The additional concrete production would not result in any additional road transport of bulk sand or aggregate materials to the site. The daily truck traffic generation for site is compared in Table 3.2 for the existing site operations and the proposed increase in concrete production to 750,000 m^3 per annum. The additional future truck traffic generated by the increase in the materials handling facility throughput is also included in the traffic generation comparison in Table 3.2.

Table 3.2 Current and proposed daily site traffic generation (heavy vehicles)

Type of material	Current quantity	Daily truck loads	Proposed quantity	Daily truck loads
Concrete plant				
Product concrete (despatched by agitator trucks)	280,000 m^3pa (700,000 tpa)	200 average (250 maximum)	750,000 m^3pa (1,875,000 tpa)	500 average (625 maximum)
Cement/flyash tanker deliveries	130,000 tpa	9 average (15 maximum)	277,500 tpa	23 average (38 maximum)
Liquid admixtures	441,000 Lpa	0.2 average (1 maximum)	1,500,000 Lpa	0.75 average (4 maximum)
Handling facility				
Bulk construction materials (total quantity received, excluding materials for concrete production)	759,000 tpa	70 average (110 maximum)	1,000,000 tpa	92 average (145 maximum)
Total daily truck loads		**279.2 average (376 maximum)**		**615.75 average (812 maximum)**

Notes: Site traffic information provided by Boral 28 May 2018

The summary of the existing and proposed site daily truck movements in Table 3.2 indicates that the proposed increase in the concrete plant production and bulk materials throughput will result in an approximate 336 increase in the overall site daily truck movements on an average day.

In comparison to the existing site daily truck loads moved on an average production day (which is 279 deliveries), there would be approximately 336 additional daily truck deliveries (672 additional truck movements) on a future average production day and 533 additional daily truck deliveries (1,066 additional truck movements) on a future maximum production day.

3.3 Haulage routes

The additional site daily truck traffic movements would all use the primary haulage route which is via Burrows Road South, north of the site, continuing to Canal Road, from where this traffic may either travel to and from the west via Canal Road and The Princes Highway (40%), or north via Burrows Road (25%) or east via Ricketty Street (35%). Trucks from the site would not use Mary Street, west of the Princes Highway due to the load limit restrictions on this route.

3.4 Site car and truck parking

On-site parking will continue to be provided for the site based agitator truck fleet, site employees and occasional site visitors. The maximum number of site visitor cars requiring parking at the site will be generally low - a maximum of two or three cars at any one time. The current car parking provision at the site (67 parking spaces) is more than adequate for the existing site demand. A further 12 car spaces are proposed for the area just to the east of the existing concrete plant operations car park; and a further 7 spaces are proposed for the area adjacent to Gate 1 to supplement the existing handling facility parking facilities, resulting in a total of 19 additional car parking spaces to accommodate any future growth in the site employee or visitor car parking demand.

The concrete agitator truck fleet is normally parked at the site (or at the nearby truck marshalling area, which is shown on Figures 2.1, 2.2 and 2.5) during non-operational hours, where up to 40 trucks are parked each evening and night. With the proposed modification, up to 20 additional concrete agitator trucks would also be based at the site, resulting in a future total of up 60 concrete agitator trucks requiring parking at the site (or at the nearby truck marshalling area) during non-operational hours.

The planning approval requirements for new industrial developments in NSW normally require that all car and truck parking is accommodated on the actual site, or at nearby identified areas, which will be the case for this project.

3.5 Predicted traffic generation and distribution

In practice, approximately 10% of the additional site daily truck traffic increases are likely to occur during the normal morning commuter traffic peak hour (7.15 to 8.15 am) and the afternoon commuter traffic peak hour (3.00 to 4.00 pm) on the public roads in the Burrows Road locality of St Peters.

There would therefore be up to 34 additional trucks per hour travelling outbound from the site and 34 additional trucks per hour travelling inbound to the site during the during the morning and afternoon peak hours, on a future average production day and up to 53 additional trucks per hour travelling outbound from the site and 53 additional trucks per hour travelling inbound to the site during the same peak hours, on a future maximum production day.

There would however be generally no change in the site employee or visitor car traffic during these traffic peak hours.

The installation and construction phase of the proposed modification works will generate significantly lower daily heavy vehicle movements to and from the site during construction than during the subsequent site operations. The site construction stage traffic impacts will therefore be much lower and can be disregarded in terms of comparison between the relative site traffic impacts during the future operations phase.

4 Traffic impact assessment

4.1 External traffic impact at intersections

EMM consulted with the RMS regarding the Secretary's Environmental Assessment (SEARs) requirements for the project. In a letter dated 11 October 2016, the RMS advised that the future traffic conditions associated with the proposed development should be examined / modelled at the following four intersections.

- Canal Road/Ricketty Street/Burrows Road/Burrows Road South;
- Canal Road/Talbot Street (the Container Terminal Access);
- Princes Highway/Canal Road/Mary Street; and
- Kent Road/Ricketty Street (entry to the Mascot Residential Precinct).

At the first three intersections, the future traffic increases resulting from the additional project traffic are directly assessed using the SIDRA 8 intersection analysis program. At the fourth intersection (Kent Road/Ricketty Street), which is in a different locality (Mascot) on the eastern side of the Alexandria Canal, the detailed SIDRA 8 intersection analysis is not considered to be necessary as the majority of the future site generated traffic is unlikely to be travelling in that direction from the site.

The future traffic impacts have been assessed for the morning and afternoon peak hour traffic periods for the surrounding commuter traffic. The proposed peak hour heavy vehicle movements for the additional average daily production, which is 34 loads or 68 additional heavy vehicle movements, has been assessed in this scenario.

The detailed SIDRA intersection analysis results are included in Appendix C and a summary of the results for each intersection is provided in Table 4.1, Table 4.2 and Table 4.3.

Table 4.1 Future traffic operations at the Canal Road/Ricketty Street/ Burrows Road and Burrows Road South intersection

Situation	Peak hour	Traffic demand flow (vehicles)[1]	Average delay (seconds)	Level of service (LoS)	Degree of saturation	Maximum queue length (m)
Existing	7.15 to 8.15 am	3,352	94.9	F	1.480	740 (Canal Rd)
	3.00 to 4.00 pm	3,452	132.4	F	1.146	913 (Ricketty St)
Future	7.15 to 8.15 am	3,423	151.8	F	1.923	968 (Canal Rd)
	3.00 to 4.00 pm	3,523	216.8	F	1.324	1,177 (Ricketty St)

Note 1: The SIDRA intersection program automatically adds 5% to all surveyed intersection traffic volumes as a contingency measure

Table 4.2 Future traffic operations at the Canal Road/Container Terminal access intersection

Situation	Peak hour	Traffic demand flow (vehicles)[1]	Average delay (seconds)	Level of service (LoS)	Degree of saturation	Maximum queue length (m)
Existing	7.30 to 8.30 am	3,065	4.4	A	0.606	134 (Canal Rd e'bound)
	5.00 to 6.00 pm	3,161	7.0	A	0.653	224 (Canal Rd w'bound)
Future	7.30 to 8.30 am	3,095	4.4	A	0.613	137 (Canal Rd e'bound)
	5.00 to 6.00 pm	3,191	7.0	A	0.661	230 (Canal Rd w'bound)

Note *1: The SIDRA intersection program automatically adds 5% to all surveyed intersection traffic volumes as a contingency measure*

Table 4.3 Future traffic operations at Princes Highway/Canal Road/Mary Street intersection

Situation	Peak hour	Traffic demand flow (vehicles)[1]	Average delay (seconds)	Level of service (LoS)	Degree of saturation	Maximum queue length (m)
Existing	7.30 to 8.30 am	5,013	42.5	C	0.931	531 (Princes Highway northbound)
	5.00 to 6.00 pm	5,735	49.6	D	0.916	376 (Princes Highway southbound)
Future	7.30 to 8.30 am	5,042	45.6	D	0.949	572 (Princes Highway northbound)
	5.00 to 6.00 pm	5,764	52.6	D	0.929	400 (Princes Highway southbound)

Note *1: The SIDRA intersection program automatically adds 5% to all surveyed intersection traffic volumes as a contingency measure*

At the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection, the level of service category will remain at F for both the morning and afternoon peak hours assessed, with the average intersection traffic delay increasing by 56.9 seconds to 152 seconds during the morning peak hour, and increasing by 84.4 seconds to 217 seconds during the afternoon peak hour. The maximum morning peak hour traffic queue length, on the Canal Road approach will increase from 740 to 968 m and the maximum afternoon peak hour traffic queue length on the Ricketty Street approach will increase from 913 to 1,177 m.

At the Canal Road, Talbot Street intersection, there will be no change in the level of service for either the morning or afternoon peak hours assessed, with all remaining at LoS A. Furthermore, there will be no change in the average intersection traffic delay during either the morning or the afternoon peak hours. There will be negligible (3-6 m) increases in the maximum intersection traffic queue lengths during both the morning and afternoon peak hours.

At the Princes Highway, Canal Road and Mary Street intersection, there will be a lower level of service for the morning peak hour (from LoS C to D). The afternoon peak hour level of service will remain at LoS D. The average intersection traffic delays will increase marginally (by approximately 3 seconds) during both the morning peak hour and the afternoon peak hour.

The maximum morning traffic queue length, on the Princes Highway northbound approach will increase from 531 to 572 m. The maximum afternoon traffic queue length, on the Princes Highway southbound approach will increase from 376 to 400 m.

In the shorter term future, the additional project traffic will increase both the morning and afternoon peak hourly traffic delays at the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection. However the intersection is already operating at Level of Service F during both these peak hours.

In the longer term future after the year 2023, as shown in Section 2.10 and on the Westconnex M4-M5 EIS traffic flow maps in Appendix D, the Westconnex project will have a significant overall future traffic reduction effect on the Canal Road – Ricketty Street route, including this intersection. The current through traffic will be reduced by at least 10,000 daily vehicle movements, which will more than compensate for the additional localised traffic increases from the proposed modification at the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection.

Even though the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection is operating with congested peak hour traffic conditions currently, there will be only limited future demand at this location for implementing any additional intersection capacity improvements in the short term, due to the subsequent future traffic reductions after the Westconnex project is completed.

At the other two intersections assessed, which are at Canal Road, Talbot Street and The Princes Highway, Canal Road and Mary Street, the existing traffic delays will be only marginally affected by the additional proposed project traffic.

4.2 External traffic impacts on local roads

The predicted daily truck traffic generation has been summarised in Table 3.2 for both an average day and a maximum operating day for the combined concrete plant and materials handling facility. The proposed concrete plant production increase and additional materials handling facility throughput would generate the following additional daily truck traffic movements at the site:

- on an average production day, an additional 336 daily truck loads (672 daily truck movements); and
- on a maximum production day, an additional 533 daily truck loads (1,066 daily truck movements).

There would also be approximately 50 additional daily car or other light vehicle traffic movements associated with the proposed concrete plant production increase and materials handling facility throughput on all future production days.

The effect of these daily traffic increases on a maximum production day, for the additional daily truck traffic movements distributed via Burrows Road South, Canal Road, Burrows Road, Ricketty Street and the other surrounding roads is presented in Table 4.4 in relation to the existing locality traffic volumes which were determined from the intersection traffic surveys in August 2016 and December 2017. The percentage daily traffic increases to each route, for a maximum production day at the future concrete plant, are also calculated in Table 4.4.

Table 4.4 Effect of the additional generated daily truck movements on the road network

Road	Survey location	Existing average weekday traffic*	Existing average weekday heavy vehicles*	Additional future Boral site generated daily traffic movements (on a maximum production day)	% Daily traffic increase
Burrows Road South	South of Canal Road	2,600	800	1,116	42.9
Canal Road	West of Ricketty Street	34,600	2,000	451	1.3
Ricketty Street	East of Canal Road	34,200	1,670	385	1.1
Burrows Road	North of Canal Road	6,200	1,000	280	4.5
Canal Road	East of Talbot Street	33,400	1500	451	1.4
Talbot Street	South of Canal Road	600	500	0	0
Canal Road	West of Talbot Street	33,300	1,400	451	1.4
Canal Road	East of Princes Highway	33,200	1,300	451	1.4
Princes Highway	South of Canal Road	53,900	1,800	225	0.4
Princes Highway	North of Canal Road	30,100	900	225	0.7
Mary Street	West of Princes Highway	5,400	0	0	0

*Notes: *Existing daily vehicle numbers have been determined from the am and pm peak period heavy vehicle traffic proportions.*

The additional generated daily truck traffic movements are proportionately greatest on the section of Burrows Road South between the site entry and exit driveways, and the intersection where Canal Road meets Ricketty Street, Burrows Road and Burrows Road South.

The future site-generated daily traffic increases on this section of Burrows Road South would increase traffic by approximately 43%. However, this section of Burrows Road South has a relatively high proportion of truck traffic (approximately 33% of all traffic currently) and the traffic flow impacts of the additional site production and related truck traffic, while significant, would not be out of character on this route.

On the range of other traffic routes which are considered in Table 4.4, the project generated proportional daily traffic increases would be far less, and not significant (between 0.4% and 4.5% typically) on any of the other routes considered and should not have any significant impact on the existing traffic flow conditions on any of these routes.

4.3 Safety and traffic management

The future potential road safety related traffic impacts from the modification have primarily been considered for Burrows Road South between the site and the intersection of Canal Road, Ricketty Street, Burrows Road and Burrows Road South.

The two existing site access driveways are well constructed with heavy duty concrete pavements, and have adequate width to accommodate all the proposed turning traffic movements by large trucks. The two driveways have good visibility of the approaching traffic in both directions on Burrows Road South and the proposed additional truck traffic movements would have minimal effects on the traffic safety at these driveways.

At the intersection of Canal Road, Ricketty Street, Burrows Road and Burrows Road South, the existing intersection visibility for left and right turning traffic from Burrows Road South is relatively good, as both Burrows Road and Burrows Road South are straight and level at the intersection.

The left and right truck turning movements from the two major roads at the intersection (ie Canal Road and Ricketty Street) are controlled by the traffic signal phasing which has right turning arrows. No additional traffic safety improvements will be required at the intersection to accommodate the proposed additional concrete plant truck traffic movements.

4.4 Provision of car and truck parking

The current total provision of the site car parking (67 spaces) is more than adequate for the parking demand currently from the site employees and visitor traffic (52 cars were observed parked at the site in October 2015) which corresponds to 78% occupancy. An additional 19 car spaces are proposed for the proposed modification which will be to accommodate any future growth in the site employee or visitor car parking demand.

All the site car parking space dimensions and surfacing has been designed to comply with the requirements of the Australian Standard AS 2890.1.

The concrete agitator truck fleet is normally parked at the site during non-operational hours, with up to 40 trucks parked each evening and night. With the proposed modification, up to 20 additional concrete agitator trucks would also be based at the site, resulting in a future total of up 60 concrete agitator trucks requiring parking. In the future these additional agitator trucks would be parked at the site or at the nearby proposed truck marshalling area during non-operational hours (currently subject to approval from Sydney Airports).

4.5 Pedestrian, cycling and public transport access

The current arrangements for the site public transport, pedestrian and cyclist access to and from Burrows Road and Canal Road at St Peters are summarised in Sections 2.6 and 2.7. This access is generally adequate for the current site public transport, pedestrian and cyclist access demand.

The Boral St Peters concrete plant and materials handling facility sites will continue to provide adequate on-site car and truck parking for all the anticipated daily site travel demand by either site employees or visitors.

The future increased travel demand for persons either walking, cycling or travelling by public transport to and from the site will be minimal and will require no improvement to the locality public transport, pedestrian and cyclist access and services.

5 Summary and conclusions

This report has assessed the traffic impacts of the proposed concrete plant and related materials handling facility modification at the Boral St Peters site, which is located on Burrows Road South, approximately 300 m south of the major road access intersection at Canal Road, Ricketty Street and Burrows Road.

In comparison to the existing average site daily truck loads (279 deliveries), there would be approximately 336 additional daily truck deliveries (672 additional truck movements) on a future average production day and 533 additional daily truck deliveries (1,066 additional truck movements) on a future maximum production day.

During the morning and afternoon commuter traffic peaks hours, there would be up to 34 additional trucks per hour travelling outbound from the site and 34 additional trucks per hour travelling inbound to the site on a future average production day and up to 53 additional trucks per hour travelling outbound from the site and 53 additional trucks per hour travelling inbound to the site during the same peak hours, on a future maximum production day.

The additional site daily truck traffic movements would all use the primary haulage route which is via Burrows Road South, north of the site, continuing to Canal Road, from where this traffic may either travel:

- to and from the west via Canal Road and The Princes Highway (40%);
- north via Burrows Road (25%); or
- east via Ricketty Street (35%).

Trucks from the site would not use Mary Street, west of the Princes Highway due to the load limit restrictions on this route.

The total site car traffic for the workforce and site visitors is currently approximately 150 daily vehicle movements. This car traffic is anticipated to increase by up to 50 additional daily vehicle movements with the proposal. There would however, be generally no change in the site employee or visitor car traffic during the normal commuter traffic peak hours.

Road network impacts of the additional traffic associated with the increased concrete plant production and materials handling facility throughput under the modification have been assessed for the future average daily production at the following three intersections:

- Canal Road, Ricketty Street, Burrows Road and Burrows Road South;
- Canal Road/Talbot Street (the Container Terminal Access); and
- Princes Highway, Canal Road and Mary Street.

At the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection, the level of service category will remain at F for both the morning and afternoon peak hours assessed, although the average intersection traffic delay will increase to 152 seconds during the morning peak hour, and 217 seconds during the afternoon peak hour.

Even though the Canal Road, Ricketty Street, Burrows Road and Burrows Road South intersection is currently operating with congested peak hour traffic conditions (Level of Service F), there will be only limited future benefit at this location from implementing any additional intersection capacity improvements in the short term, as the increased traffic capacity will not subsequently be required with the longer term future forecast traffic reductions for the Canal Road - Ricketty Street route with all three stages of the Westconnex project.

At the other two intersections assessed (at Canal Road, Talbot Street and at the Princes Highway, Canal Road and Mary Street) the existing traffic delays will be only marginally affected by the additional proposed project traffic.

For the maximum forecast future daily production, the future concrete plant generated daily traffic increases on Burrows Road South would be approximately 43%. However, as this section of Burrows Road South has a relatively high proportion of truck traffic currently, the future traffic flow impacts of the additional site concrete plant production and related truck traffic would be acceptable on this route.

On the range of other traffic routes in the St Peters locality, the proportional project generated daily traffic increases would not be significant (between 0.4% and 4.5% typically) on any of the other routes considered and would not have any significant impact on the existing traffic flow conditions on any of these routes.

The future potential road safety related traffic impacts from the modification have been reviewed for Burrows Road South between the site access gates and the intersection of Canal Road, Ricketty Street, Burrows Road and Burrows Road South. The traffic turning movements at the relevant major road access intersection are controlled by the traffic signal phasing which has right turning arrows. No additional traffic safety improvements will be required at the intersection to accommodate the proposed additional concrete plant site generated truck traffic movements.

The current and future proposed on site car and truck parking areas and the site's accessibility for walking, cycling and public transport users have also been reviewed in this assessment and found to be satisfactory for the anticipated levels of car and truck parking usage and/or travel by non car-based travel modes.

References

Roads and Traffic Authority (2002) *Guide to Traffic Generating Developments*.

Roads and Maritime Services (2017) *M4-M5 Link, Environmental Impact Statement, Technical Working Paper, Traffic and Transport*.

Appendix A

Site layout plan

Notes

This drawing is prepared for information purposes only. It is not to be used for construction.

TRAFFIX is responsible for vehicle swept path diagrams and/or drawing mark-ups only. Base drawing prepared by others.

Vehicle swept path diagrams prepared using computer generated turning path software and associated CAD drawing platforms. Vehicle data based upon relevant Australian Standards (*AS/NZS 2890.1-2004 Parking facilities - Off-street car parking*, and/or *AS 2890.2-2002 Parking facilities - Off-street commercial vehicle facilities*). These standards embody a degree of tolerance, however the vehicle characteristics in these standards represent a suitable design vehicle and do not account for all variations in vehicle dimensions / specifications and/or driver ability or behaviour.

no.	revision note	by.	date

Swept Path Legend:

- Wheel Path
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- Clearance Envelope (300mm)

architect

client

EMM Consulting
Ground Floor Suite 1
20 Chandos Street
St Leonards NSW 2065

scale

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0m 2 4 6 8

project

Burrows Road
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drawing title

19.0m Articulated Vehcile (AV) Design Vehicle
Swept Path Analysis Entry Maneuvere

drawn:	JP	checked:	KB	date:	15-06-2018

18.084d04v02 TRAFFIX Design Review.dwg

project no.	drawing phase.	drawing no.	rev
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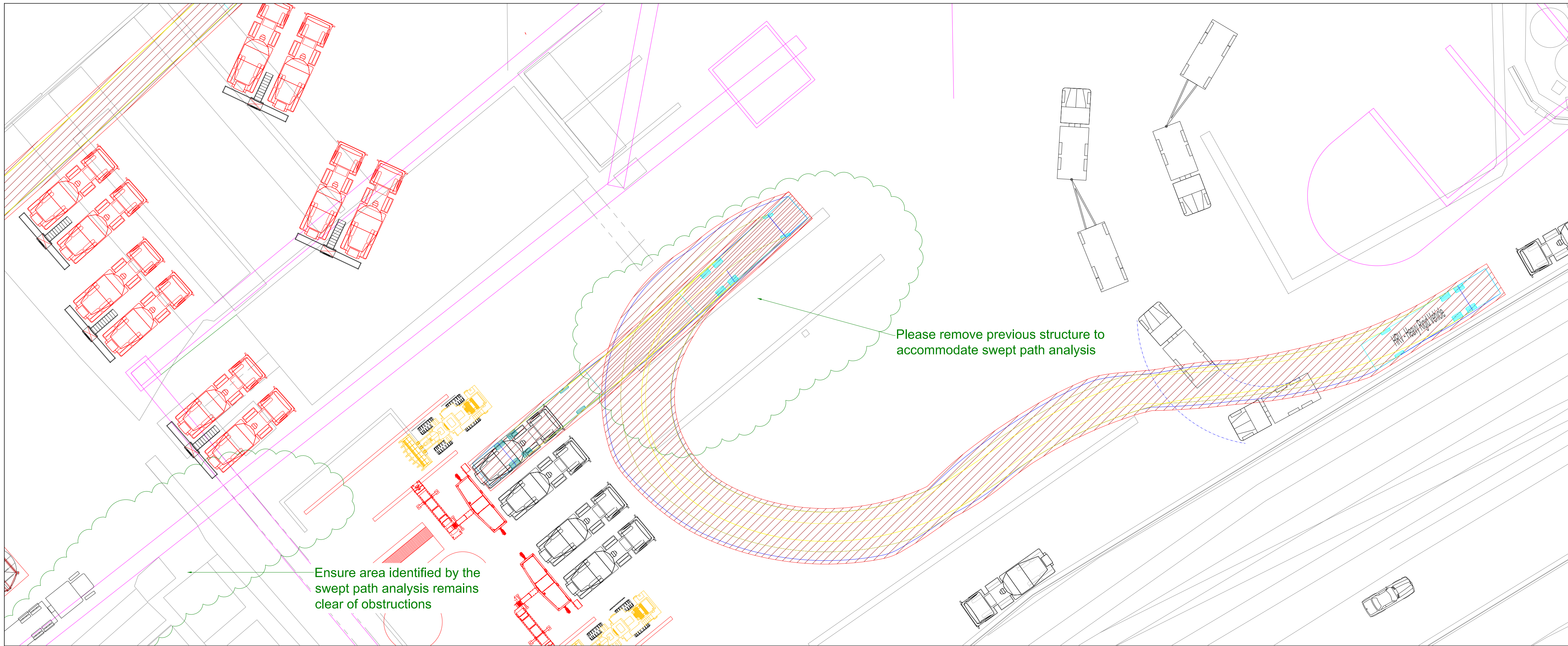

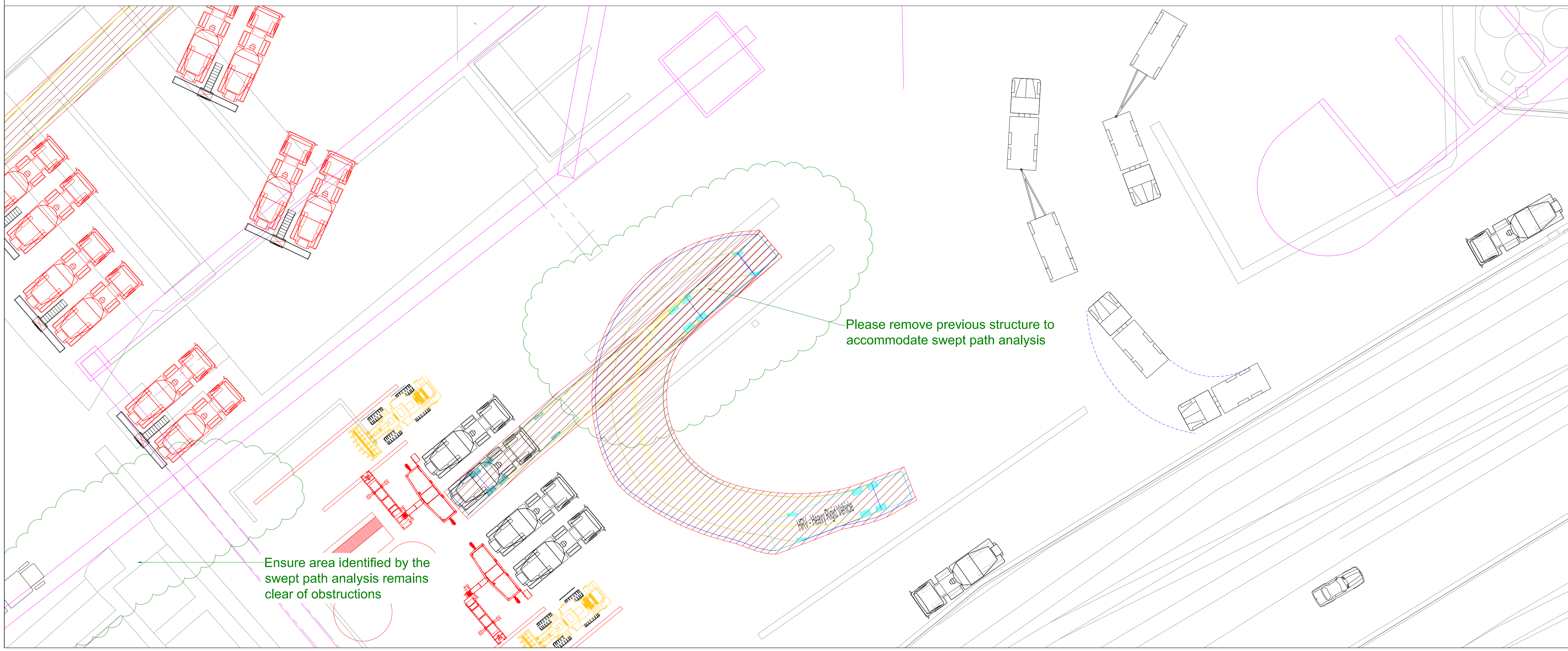

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drawing title

12.5m Heavy Rigid Vehcile (HRV) Design Vehicle
Reverse Parking Maneuver

drawn: JP | checked: KB | date: 15-06-2018

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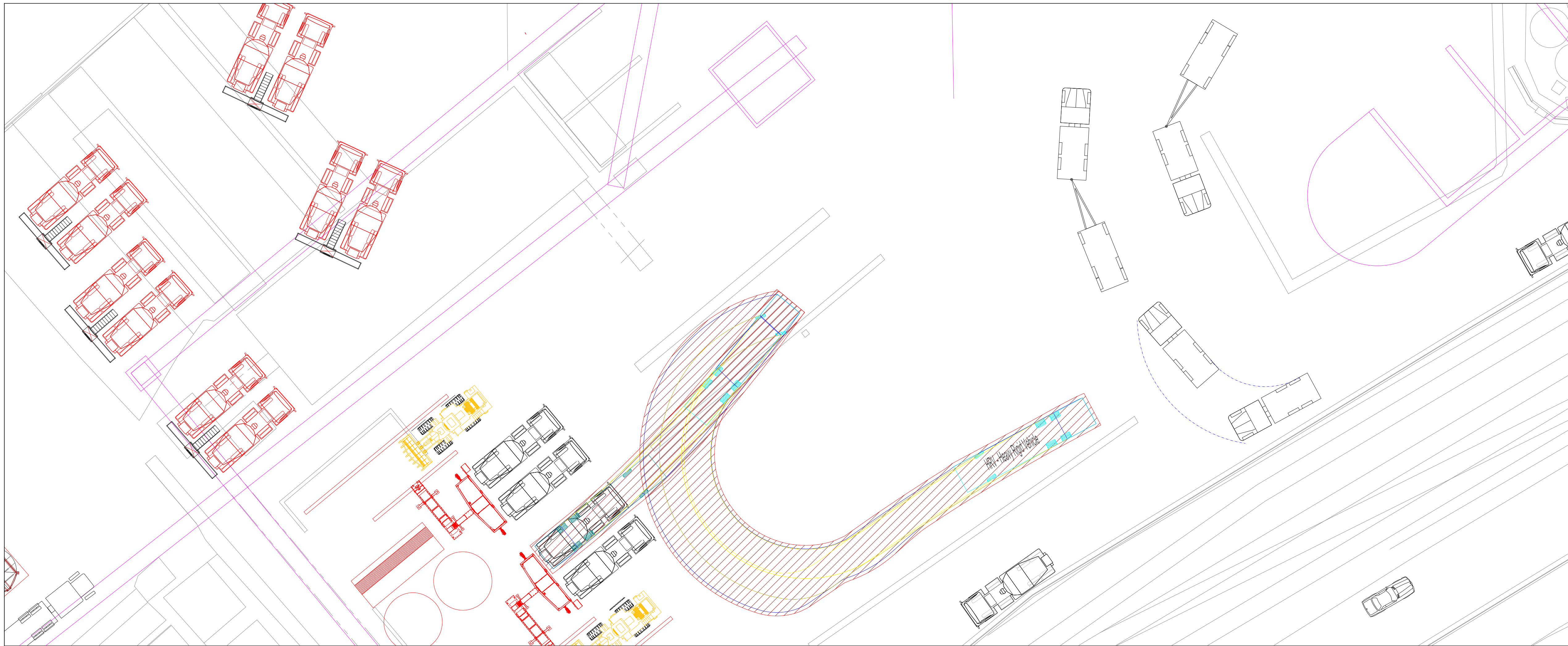

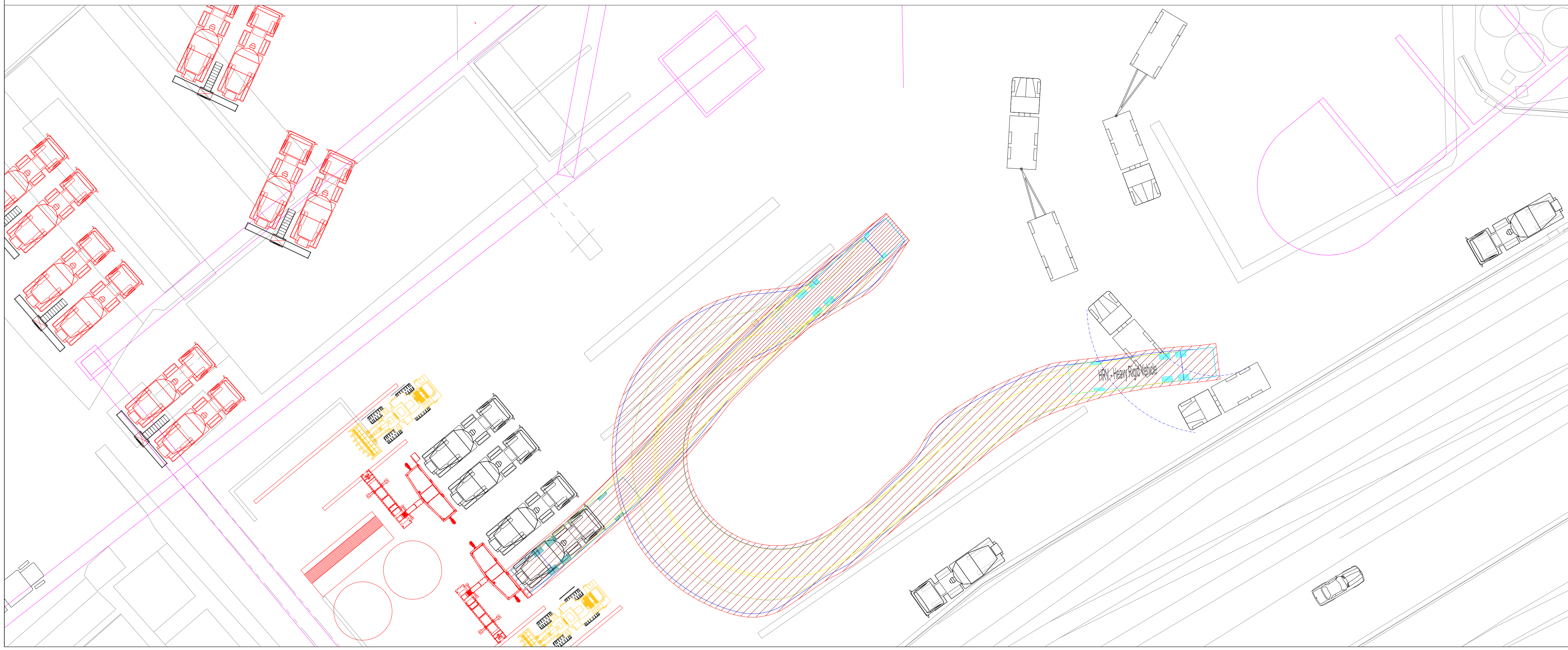

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drawing title

12.5m Heavy Rigid Vehicle (HV) Design Vehicle
Swept Path Analysis Reverse Parking Maneuvere

drawn: JP | checked: KB | date: 15-06-2018

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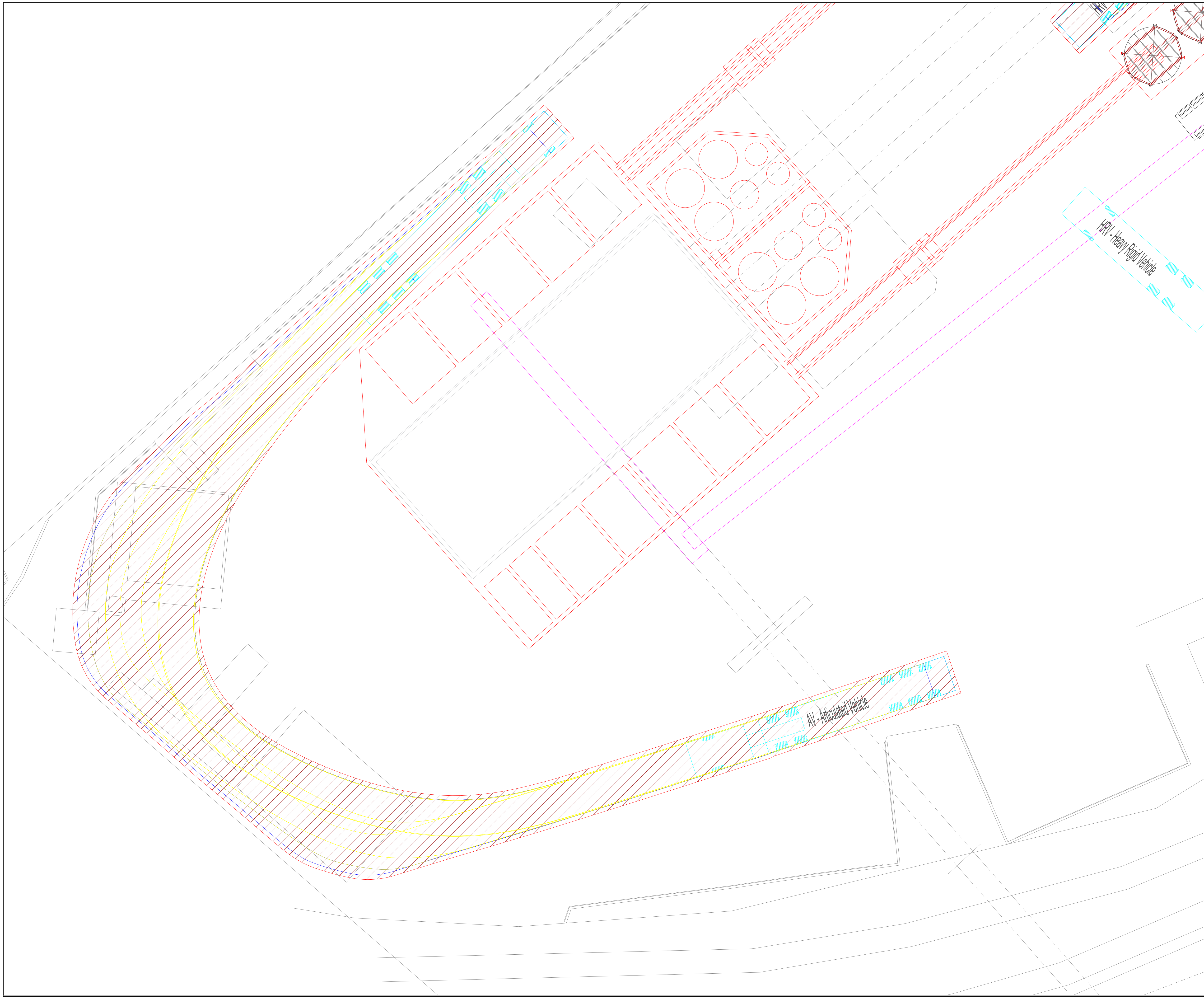

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Swept Path Analysis Entry Maneuvere

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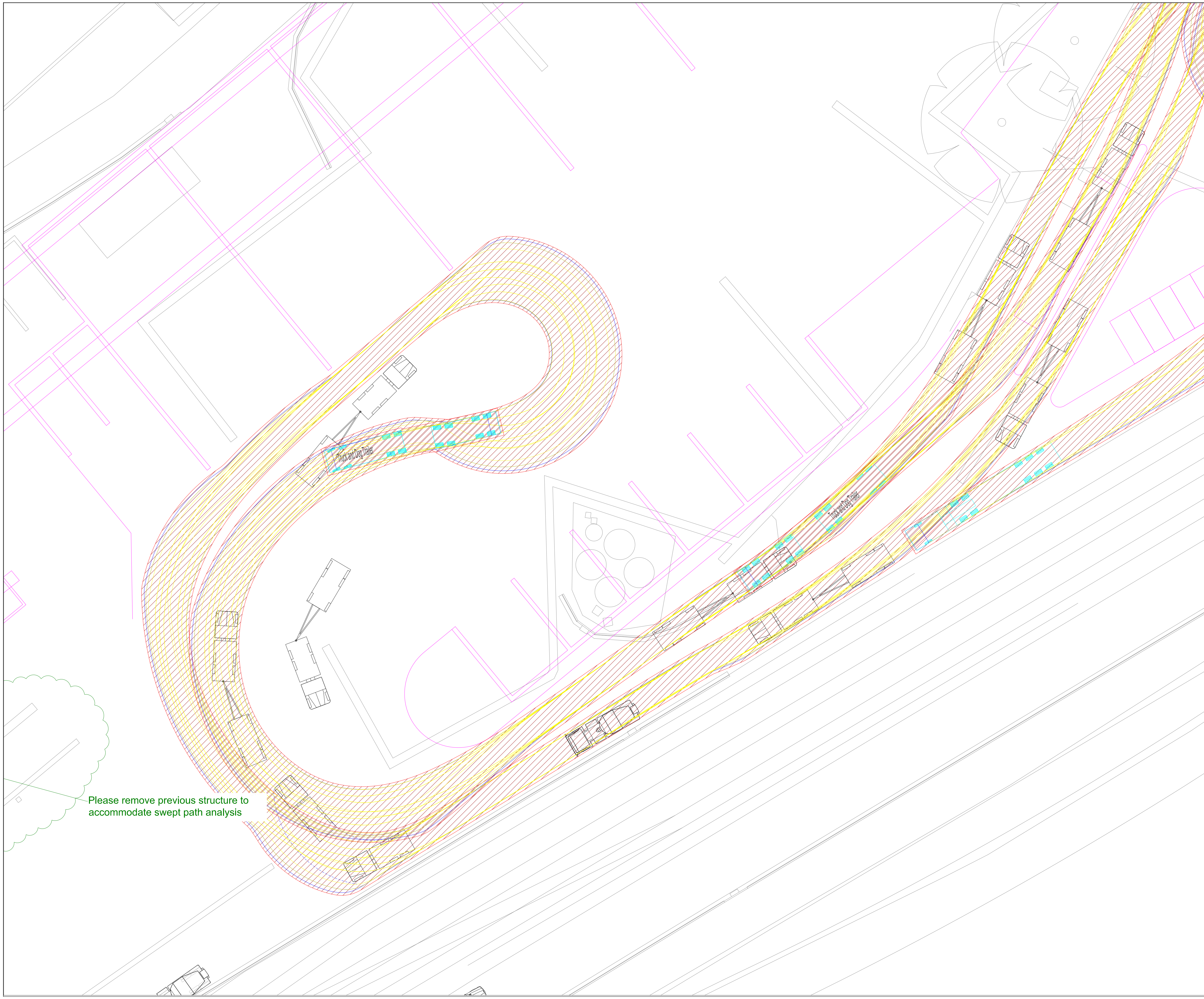

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drawing title

19.6m Truck & Dog Design Vehicle. Entry & Exit and Circulation. Swept Path Analysis

drawn:	JP	checked:	KB	date:	15-06-2018

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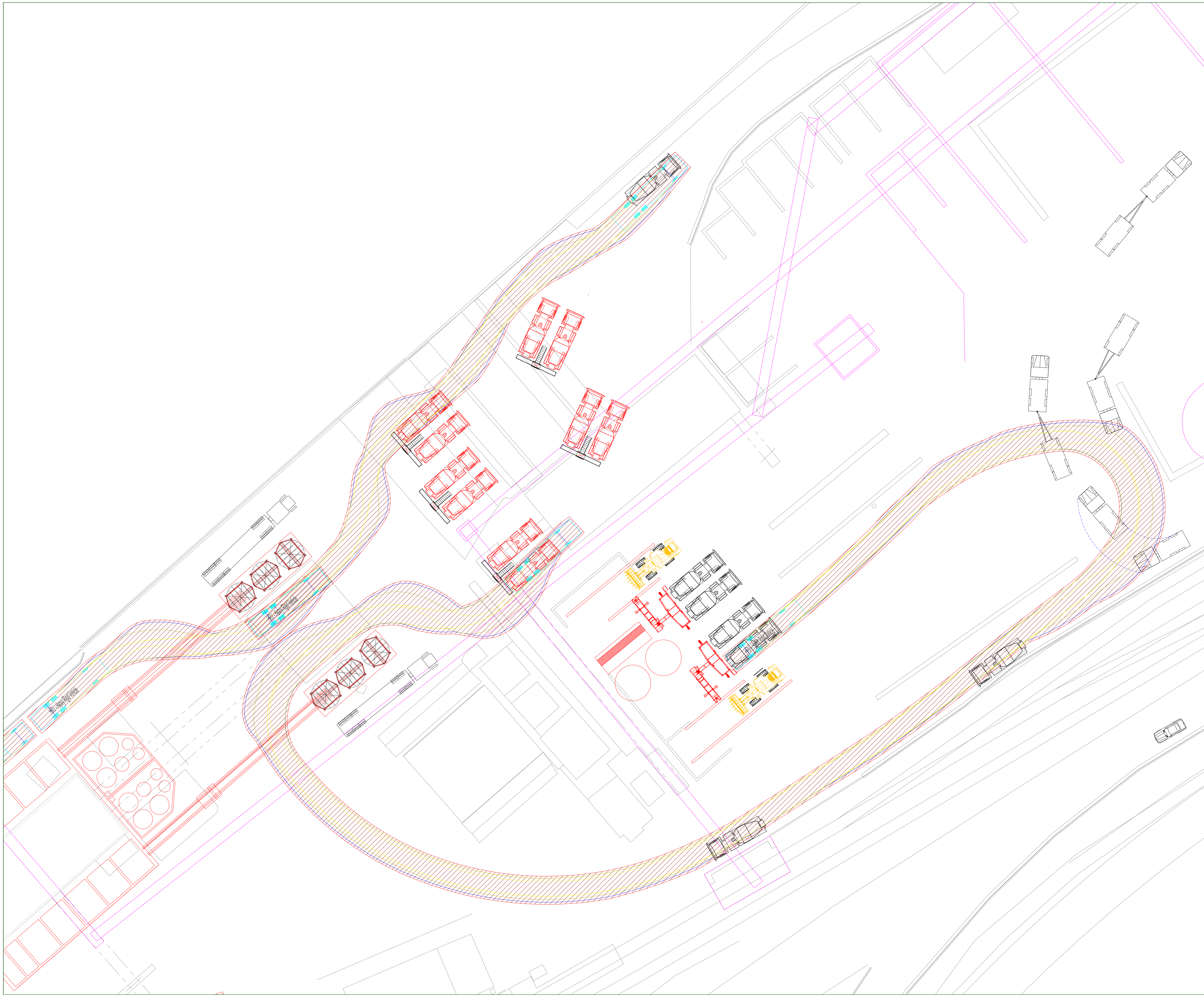

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Wheel Path

Vehicle Body Envelope

Clearance Envelope (300mm)

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traffic & transport planners

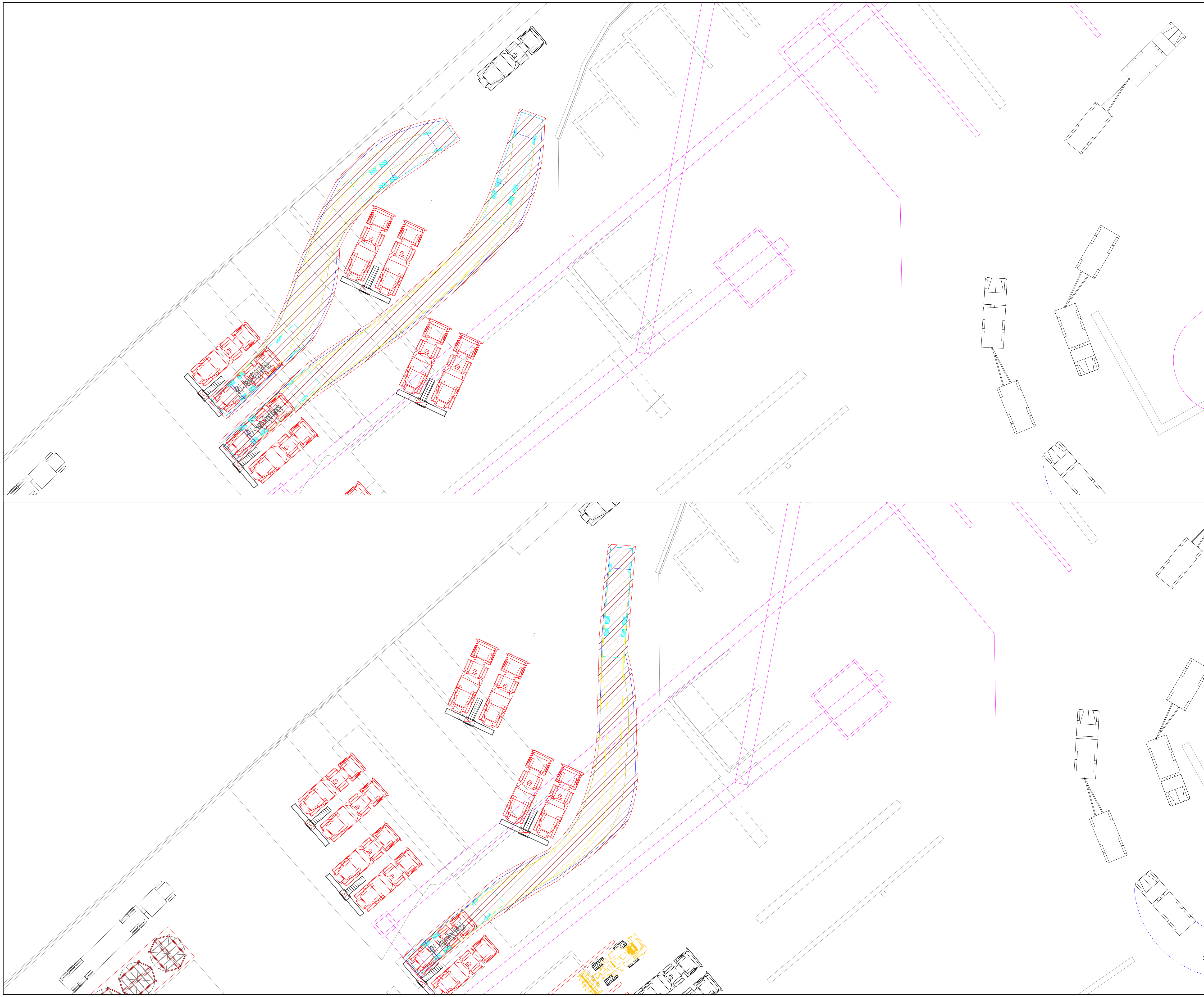
drawing title

12.5m Heavy Rigid Vehicle (HV) Design Vehicle Swept Path Internal Circulation

drawn: JP | checked: KB | date: 15-06-2018

18.084d04v02 TRAFFIX Design Review.dwg

project no.	drawing phase.	drawing no.	rev
18.084	04	TX.06	02



Notes

This drawing is prepared for information purposes only. It is not to be used for construction.

TRAFFIX is responsible for vehicle swept path diagrams and/or drawing mark-ups only. Base drawing prepared by others.

Vehicle swept path diagrams prepared using computer generated turning path software and associated CAD drawing platforms. Vehicle data based upon relevant Australian Standards (*AS/NZS 2890.1-2004 Parking facilities - Off-street car parking*, and/or *AS 2890.2-2002 Parking facilities - Off-street commercial vehicle facilities*). These standards embody a degree of tolerance, however the vehicle characteristics in these standards represent a suitable design vehicle and do not account for all variations in vehicle dimensions / specifications and/or driver ability or behaviour.

no.	revision note	by.	date

Swept Path Legend:

- Wheel Path
- Vehicle Body Envelope
- Clearance Envelope (300mm)

architect

client

EMM Consulting
Ground Floor Suite 1
20 Chandos Street
St Leonards NSW 2065

scale

1:400 @ A3

0m 4 8 12 16

project

Burrows Road
St Peters

drawing prepared by

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drawing title

12.5m Heavy Rigid Vehicle (HV) Design Vehicle
Swept Path Analysis Internal Circulation

drawn:	JP	checked:	KB	date:	15-06-2018

18.084d04v02 TRAFFIX Design Review.dwg

project no.	drawing phase.	drawing no.	rev
18.084	04	TX.08	02

Appendix B

Intersection traffic counts

R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Mob.0418-239019

Client : EMM
Job No/Name : 6673 ST PETERS Boral
Day/Date : Wednesday 13th December 2017

Lights	NORTH			WEST			SOUTH			EAST			
	Burrows Rd			*Canal Rd*			*Burrows Rd S*			*Ricketty St*			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	**TOT**
0600 - 0615	26	2	7	60	408	8	6	2	2	2	161	14	**698**
0615 - 0630	22	6	4	44	371	15	3	2	1	3	154	21	**646**
0630 - 0645	31	1	1	43	379	16	1	2	1	4	169	29	**677**
0645 - 0700	30	3	3	74	465	27	3	9	2	6	163	16	**801**
0700 - 0715	20	7	9	39	322	16	2	1	1	3	191	24	**635**
0715 - 0730	25	1	6	33	390	16	5	3	3	7	199	25	**713**
0730 - 0745	27	1	7	44	391	10	2	3	6	9	220	17	**737**
0745 - 0800	11	10	9	34	427	16	4	6	2	2	195	26	**742**
0800 - 0815	41	5	10	32	433	7	5	2	2	9	197	21	**764**
0815 - 0830	29	3	3	24	390	17	3	7	5	10	161	21	**673**
0830 - 0845	20	3	7	29	393	10	4	4	7	6	167	30	**680**
0845 - 0900	23	1	4	30	338	14	5	6	2	11	230	24	**688**
Period End	**305**	**43**	**70**	**486**	**4707**	**172**	**43**	**47**	**34**	**72**	**2207**	**268**	**8454**

Lights	NORTH			WEST			SOUTH			EAST			
	Burrows Rd			*Canal Rd*			*Burrows Rd S*			*Ricketty St*			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	**TOT**
0600 - 0700	109	12	15	221	1623	66	13	15	6	15	647	80	**2822**
0615 - 0715	103	17	17	200	1537	74	9	14	5	16	677	90	**2759**
0630 - 0730	106	12	19	189	1556	75	11	15	7	20	722	94	**2826**
0645 - 0745	102	12	25	190	1568	69	12	16	12	25	773	82	**2886**
0700 - 0800	83	19	31	150	1530	58	13	13	12	21	805	92	**2827**
0715 - 0815	104	17	32	143	1641	49	16	14	13	27	811	89	**2956**
0730 - 0830	108	19	29	134	1641	50	14	18	15	30	773	85	**2916**
0745 - 0845	101	21	29	119	1643	50	16	19	16	27	720	98	**2859**
0800 - 0900	113	12	24	115	1554	48	17	19	16	36	755	96	**2805**
PEAK HOUR	**104**	**17**	**32**	**143**	**1641**	**49**	**16**	**14**	**13**	**27**	**811**	**89**	**2956**

Heavies	NORTH			WEST			SOUTH			EAST			
	Burrows Rd			*Canal Rd*			*Burrows Rd S*			*Ricketty St*			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	**TOT**
0600 - 0615	2	2	5	6	15	2	0	0	0	5	10	2	**49**
0615 - 0630	2	7	6	3	9	3	4	5	2	1	16	3	**61**
0630 - 0645	2	1	8	2	19	1	1	3	3	4	10	2	**56**
0645 - 0700	2	4	5	8	13	4	0	6	8	2	14	3	**69**
0700 - 0715	2	2	5	9	22	2	3	1	3	3	10	1	**63**
0715 - 0730	1	3	10	9	10	3	5	4	6	4	8	3	**66**
0730 - 0745	0	2	3	5	15	0	4	6	1	3	9	1	**49**
0745 - 0800	2	2	2	3	12	0	6	3	6	3	10	3	**52**
0800 - 0815	1	4	9	5	10	2	2	5	6	1	12	4	**61**
0815 - 0830	1	3	6	3	9	3	1	4	1	3	14	1	**49**
0830 - 0845	0	0	3	4	10	3	5	3	1	7	10	3	**49**
0845 - 0900	2	1	2	5	12	5	2	3	6	8	12	1	**59**
Period End	**17**	**31**	**64**	**62**	**156**	**28**	**33**	**43**	**43**	**44**	**135**	**27**	**683**

Heavies	NORTH			WEST			SOUTH			EAST			
	Burrows Rd			*Canal Rd*			*Burrows Rd S*			*Ricketty St*			
Peak Per	L	T	R	L	T	R	L	T	R	L	T	R	**TOT**
0600 - 0700	8	14	24	19	56	10	5	14	13	12	50	10	**235**
0615 - 0715	8	14	24	22	63	10	8	15	16	10	50	9	**249**
0630 - 0730	7	10	28	28	64	10	9	14	20	13	42	9	**254**
0645 - 0745	5	11	23	31	60	9	12	17	18	12	41	8	**247**
0700 - 0800	5	9	20	26	59	5	18	14	16	13	37	8	**230**
0715 - 0815	4	11	24	22	47	5	17	18	19	11	39	11	**228**
0730 - 0830	4	11	20	16	46	5	13	18	14	10	45	9	**211**
0745 - 0845	4	9	20	15	41	8	14	15	14	14	46	11	**211**
0800 - 0900	4	8	20	17	41	13	10	15	14	19	48	9	**218**
PEAK HOUR	**4**	**11**	**24**	**22**	**47**	**5**	**17**	**18**	**19**	**11**	**39**	**11**	**228**

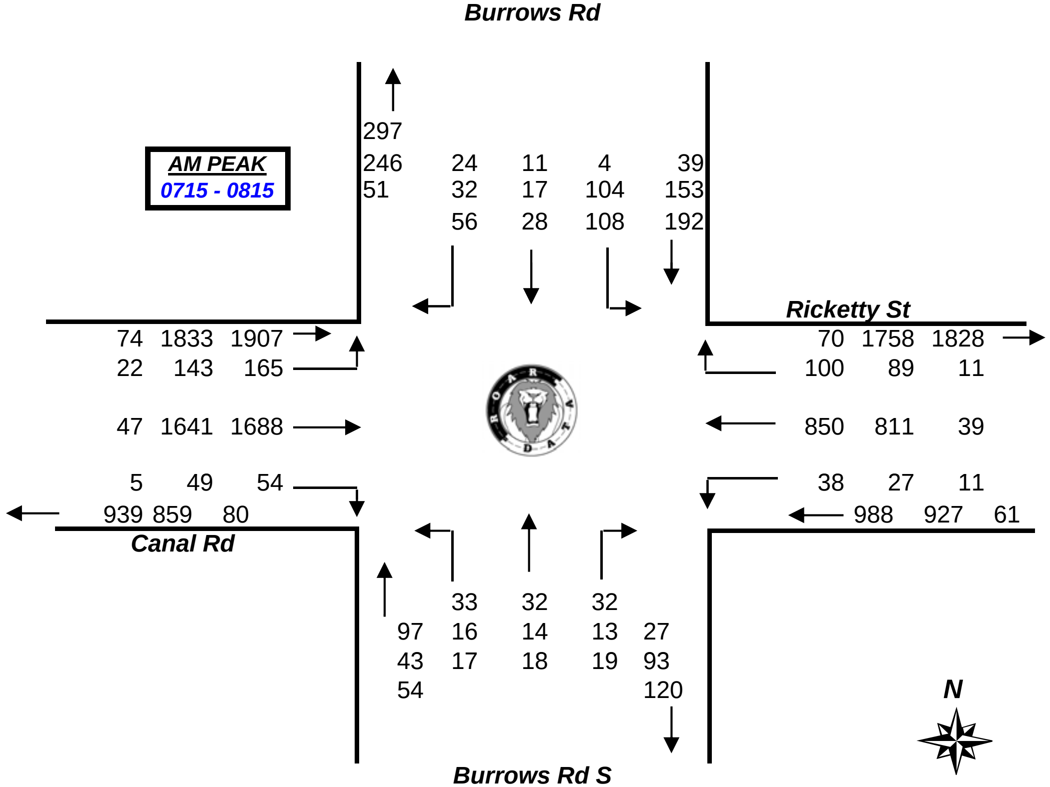
Combined	NORTH			WEST			SOUTH			EAST			
	Burrows Rd			*Canal Rd*			*Burrows Rd S*			*Ricketty St*			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	**TOT**
0600 - 0615	28	4	12	66	423	10	6	2	2	7	171	16	**747**
0615 - 0630	24	13	10	47	380	18	7	7	3	4	170	24	**707**
0630 - 0645	33	2	9	45	398	17	2	5	4	8	179	31	**733**
0645 - 0700	32	7	8	82	478	31	3	15	10	8	177	19	**870**
0700 - 0715	22	9	14	48	344	18	5	2	4	6	201	25	**698**
0715 - 0730	26	4	16	42	400	19	10	7	9	11	207	28	**779**
0730 - 0745	27	3	10	49	406	10	6	9	7	12	229	18	**786**
0745 - 0800	13	12	11	37	439	16	10	9	8	5	205	29	**794**
0800 - 0815	42	9	19	37	443	9	7	7	8	10	209	25	**825**
0815 - 0830	30	6	9	27	399	20	4	11	6	13	175	22	**722**
0830 - 0845	20	3	10	33	403	13	9	7	8	13	177	33	**729**
0845 - 0900	25	2	6	35	350	19	7	9	8	19	242	25	**747**
Period End	**322**	**74**	**134**	**548**	**4863**	**200**	**76**	**90**	**77**	**116**	**2342**	**295**	**9137**

Combined	NORTH			WEST			SOUTH			EAST			
	Burrows Rd			*Canal Rd*			*Burrows Rd S*			*Ricketty St*			
Peak Per	L	T	R	L	T	R	L	T	R	L	T	R	**TOT**
0600 - 0700	117	26	39	240	1679	76	18	29	19	27	697	90	**3057**
0615 - 0715	111	31	41	222	1600	84	17	29	21	26	727	99	**3008**
0630 - 0730	113	22	47	217	1620	85	20	29	27	33	764	103	**3080**
0645 - 0745	107	23	48	221	1628	78	24	33	30	37	814	90	**3133**
0700 - 0800	88	28	51	176	1589	63	31	27	28	34	842	100	**3057**
0715 - 0815	108	28	56	165	1688	54	33	32	32	38	850	100	**3184**
0730 - 0830	112	30	49	150	1687	55	27	36	29	40	818	94	**3127**
0745 - 0845	105	30	49	134	1684	58	30	34	30	41	766	109	**3070**
0800 - 0900	117	20	44	132	1595	61	27	34	30	55	803	105	**3023**
PEAK HOUR	**108**	**28**	**56**	**165**	**1688**	**54**	**33**	**32**	**32**	**38**	**850**	**100**	**3184**

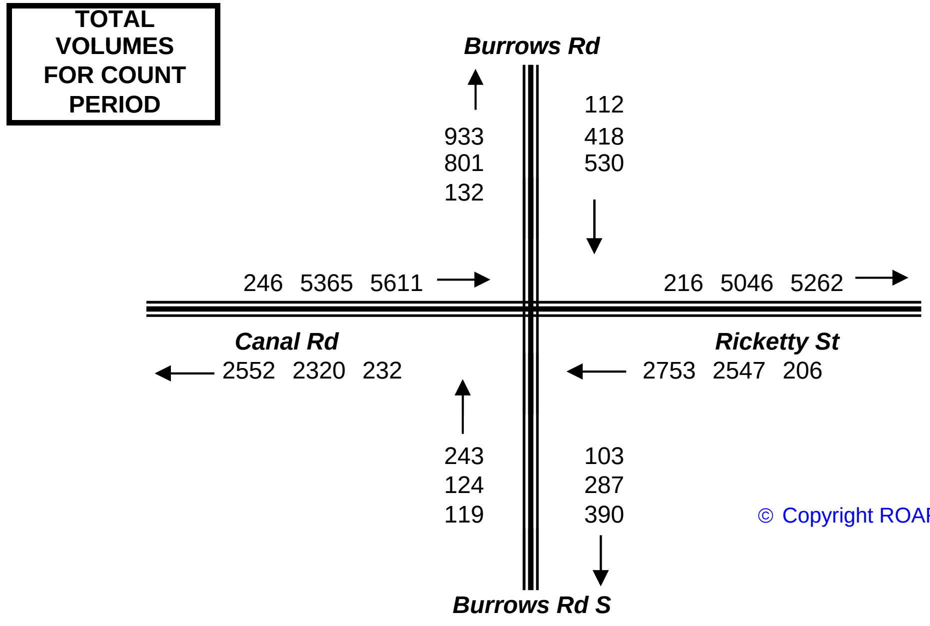
R.O.A.R DATA

Reliable, Original & Authentic Results
Ph.88196847, Mob.0418-239019

Client : EMM
Job No/Name : 6673 ST PETERS Boral
Day/Date : Wednesday 13th December 2017



Peds	NORTH *Burrows Rd*	WEST *Canal Rd*	SOUTH *Burrows Rd S*	EAST *Ricketty St*	
Time Per	**UNCLASSIFIED**	**UNCLASSIFIED**	**UNCLASSIFIED**	**UNCLASSIFIED**	**TOT**
0600 - 0615	2	2	1	0	**5**
0615 - 0630	0	0	0	0	**0**
0630 - 0645	2	3	2	0	**7**
0645 - 0700	0	2	1	0	**3**
0700 - 0715	2	5	6	0	**13**
0715 - 0730	3	2	5	0	**10**
0730 - 0745	2	2	5	0	**9**
0745 - 0800	0	3	0	0	**3**
0800 - 0815	1	2	7	0	**10**
0815 - 0830	0	4	0	0	**4**
0830 - 0845	2	3	1	0	**6**
0845 - 0900	3	3	3	0	**9**
Period End	**17**	**31**	**31**	**0**	**79**



Peds	NORTH *Burrows Rd*	WEST *Canal Rd*	SOUTH *Burrows Rd S*	EAST *Ricketty St*	
Peak Per	**UNCLASSIFIED**	**UNCLASSIFIED**	**UNCLASSIFIED**	**UNCLASSIFIED**	**TOT**
0600 - 0700	4	7	4	0	**15**
0615 - 0715	4	10	9	0	**23**
0630 - 0730	7	12	14	0	**33**
0645 - 0745	7	11	17	0	**35**
0700 - 0800	7	12	16	0	**35**
0715 - 0815	6	9	17	0	**32**
0730 - 0830	3	11	12	0	**26**
0745 - 0845	3	12	8	0	**23**
0800 - 0900	6	12	11	0	**29**
PEAK HR	**6**	**9**	**17**	**0**	**32**

R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Mob.0418-239019

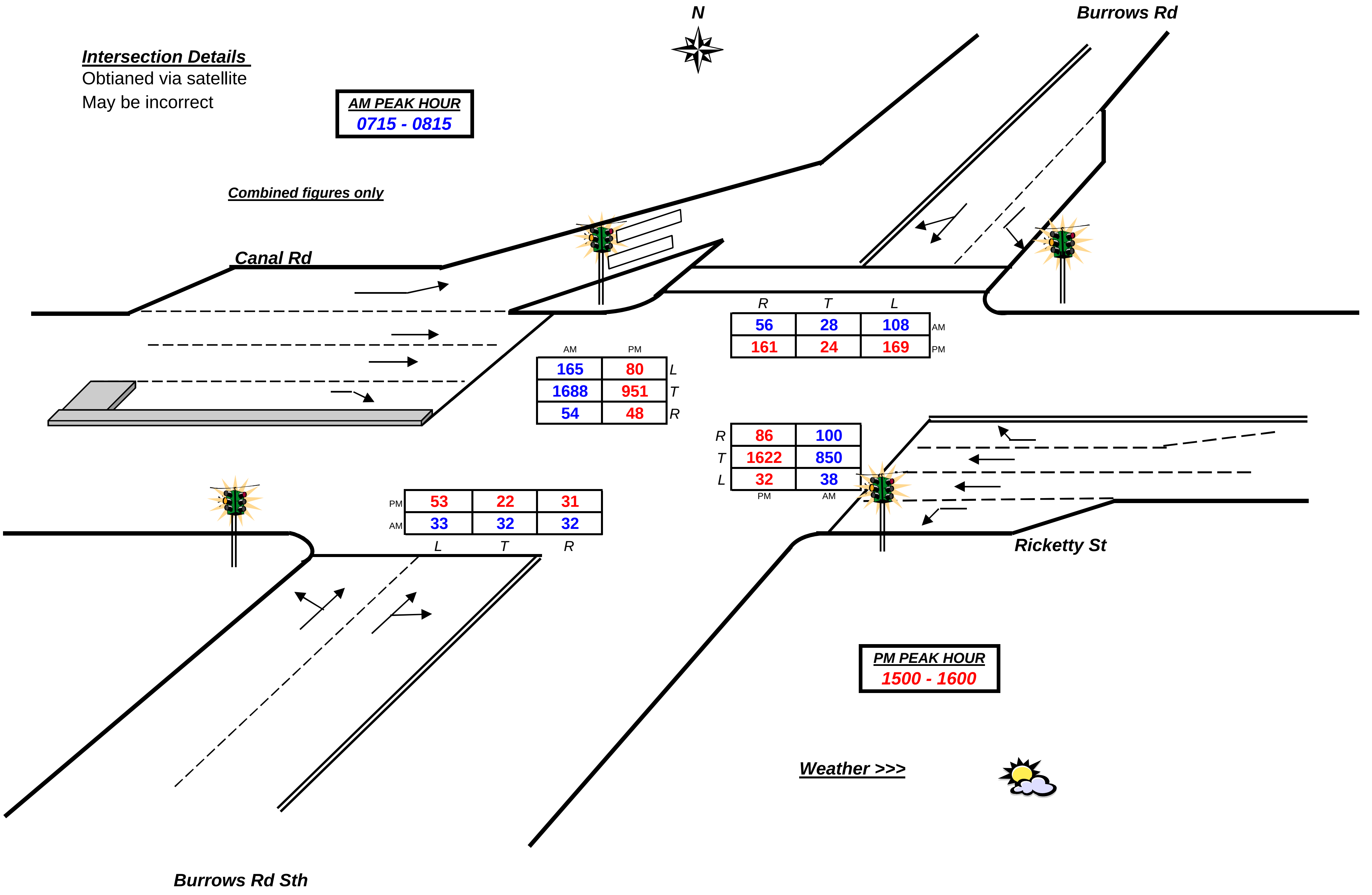
Client	: EMM
Job No/Name	: 6673 ST PETERS Boral
Day/Date	: Wednesday 13th December 2017

Intersection Details

Obtianed via satellite

May be incorrect

Combined figures only



Burrows Rd

	R	T	L
AM	56	28	108
PM	161	24	169

Canal Rd

	AM	PM
L	165	80
T	1688	951
R	54	48

Ricketty St

	PM	AM
R	86	100
T	1622	850
L	32	38

Burrows Rd Sth

	L	T	R
PM	53	22	31
AM	33	32	32

R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Mob.0418-239019

Client : EMM
Job No/Name : 6673 ST PETERS Boral
Day/Date : Wednesday 13th December 2017

Lights

Time Per	NORTH Burrows Rd L	T	R	WEST Canal Rd L	T	R	SOUTH Burrows Rd S L	T	R	EAST Ricketty St L	T	R	TOT
1500 - 1515	55	2	47	22	258	10	10	4	5	7	443	25	**888**
1515 - 1530	47	3	28	14	196	7	14	4	7	2	410	24	**756**
1530 - 1545	27	2	37	11	227	11	8	2	2	10	396	14	**747**
1545 - 1600	32	3	25	19	222	10	9	7	7	5	301	21	**661**
1600 - 1615	28	3	23	18	216	8	8	5	15	5	285	26	**640**
1615 - 1630	29	6	36	13	219	7	12	6	10	4	256	11	**609**
1630 - 1645	38	3	27	8	179	7	15	2	2	1	393	17	**692**
1645 - 1700	33	1	31	10	217	8	9	5	11	4	328	13	**670**
1700 - 1715	41	2	30	11	243	5	19	1	12	1	279	15	**659**
1715 - 1730	23	2	36	21	216	7	8	2	10	3	333	12	**673**
1730 - 1745	33	0	25	10	250	3	11	1	14	1	359	14	**721**
1745 - 1800	27	4	42	7	225	7	5	1	11	2	396	22	**749**
Period End	**413**	**31**	**387**	**164**	**2668**	**90**	**128**	**40**	**106**	**45**	**4179**	**214**	**8465**

Lights

Peak Time	NORTH Burrows Rd L	T	R	WEST Canal Rd L	T	R	SOUTH Burrows Rd S L	T	R	EAST Ricketty St L	T	R	TOT
1500 - 1600	161	10	137	66	903	38	41	17	21	24	1550	84	**3052**
1515 - 1615	134	11	113	62	861	36	39	18	31	22	1392	85	**2804**
1530 - 1630	116	14	121	61	884	36	37	20	34	24	1238	72	**2657**
1545 - 1645	127	15	111	58	836	32	44	20	34	15	1235	75	**2602**
1600 - 1700	128	13	117	49	831	30	44	18	38	14	1262	67	**2611**
1615 - 1715	141	12	124	42	858	27	55	14	35	10	1256	56	**2630**
1630 - 1730	135	8	124	50	855	27	51	10	35	9	1333	57	**2694**
1645 - 1745	130	5	122	52	926	23	47	9	47	9	1299	54	**2723**
1700 - 1800	124	8	133	49	934	22	43	5	47	7	1367	63	**2802**
PEAK HOUR	**161**	**10**	**137**	**66**	**903**	**38**	**41**	**17**	**21**	**24**	**1550**	**84**	**3052**

Heavies

Time Per	NORTH Burrows Rd L	T	R	WEST Canal Rd L	T	R	SOUTH Burrows Rd S L	T	R	EAST Ricketty St L	T	R	TOT
1500 - 1515	2	2	5	6	15	2	4	0	1	3	19	1	**60**
1515 - 1530	2	7	7	3	15	1	3	2	4	2	22	1	**69**
1530 - 1545	2	1	6	3	7	5	1	3	2	2	21	0	**53**
1545 - 1600	2	4	6	2	11	2	4	0	3	1	10	0	**45**
1600 - 1615	2	2	3	3	9	2	1	0	0	1	12	3	**38**
1615 - 1630	1	3	7	1	11	5	2	0	2	0	14	2	**48**
1630 - 1645	0	2	1	1	12	1	0	0	1	2	18	3	**41**
1645 - 1700	2	2	3	2	12	2	3	0	2	1	9	3	**41**
1700 - 1715	1	4	0	0	9	4	2	1	1	0	8	0	**30**
1715 - 1730	1	3	1	4	5	0	0	0	3	1	6	1	**25**
1730 - 1745	0	0	2	1	2	1	3	0	1	3	12	1	**26**
1745 - 1800	29	1	3	2	6	0	0	0	1	0	15	0	**57**
Period End	**44**	**31**	**44**	**28**	**114**	**25**	**23**	**6**	**21**	**16**	**166**	**15**	**533**

Heavies

Peak Per	NORTH Burrows Rd L	T	R	WEST Canal Rd L	T	R	SOUTH Burrows Rd S L	T	R	EAST Ricketty St L	T	R	TOT
1500 - 1600	8	14	24	14	48	10	12	5	10	8	72	2	**227**
1515 - 1615	8	14	22	11	42	10	9	5	9	6	65	4	**205**
1530 - 1630	7	10	22	9	38	14	8	3	7	4	57	5	**184**
1545 - 1645	5	11	17	7	43	10	7	0	6	4	54	8	**172**
1600 - 1700	5	9	14	7	44	10	6	0	5	4	53	11	**168**
1615 - 1715	4	11	11	4	44	12	7	1	6	3	49	8	**160**
1630 - 1730	4	11	5	7	38	7	5	1	7	4	41	7	**137**
1645 - 1745	4	9	6	7	28	7	8	1	7	5	35	5	**122**
1700 - 1800	31	8	6	7	22	5	5	1	6	4	41	2	**138**
PEAK HOUR	**8**	**14**	**24**	**14**	**48**	**10**	**12**	**5**	**10**	**8**	**72**	**2**	**227**

Combined

Time Per	NORTH Burrows Rd L	T	R	WEST Canal Rd L	T	R	SOUTH Burrows Rd S L	T	R	EAST Ricketty St L	T	R	TOT
1500 - 1515	57	4	52	28	273	12	14	4	6	10	462	26	**948**
1515 - 1530	49	10	35	17	211	8	17	6	11	4	432	25	**825**
1530 - 1545	29	3	43	14	234	16	9	5	4	12	417	14	**800**
1545 - 1600	34	7	31	21	233	12	13	7	10	6	311	21	**706**
1600 - 1615	30	5	26	21	225	10	9	5	15	6	297	29	**678**
1615 - 1630	30	9	43	14	230	12	14	6	12	4	270	13	**657**
1630 - 1645	38	5	28	9	191	8	15	2	3	3	411	20	**733**
1645 - 1700	35	3	34	12	229	10	12	5	13	5	337	16	**711**
1700 - 1715	42	6	30	11	252	9	21	2	13	1	287	15	**689**
1715 - 1730	24	5	37	25	221	7	8	2	13	4	339	13	**698**
1730 - 1745	33	0	27	11	252	4	14	1	15	4	371	15	**747**
1745 - 1800	56	5	45	9	231	7	5	1	12	2	411	22	**806**
Period End	**457**	**62**	**431**	**192**	**2782**	**115**	**151**	**46**	**127**	**61**	**4345**	**229**	**8998**

Combined

Peak Per	NORTH Burrows Rd L	T	R	WEST Canal Rd L	T	R	SOUTH Burrows Rd S L	T	R	EAST Ricketty St L	T	R	TOT
1500 - 1600	169	24	161	80	951	48	53	22	31	32	1622	86	**3279**
1515 - 1615	142	25	135	73	903	46	48	23	40	28	1457	89	**3009**
1530 - 1630	123	24	143	70	922	50	45	23	41	28	1295	77	**2841**
1545 - 1645	132	26	128	65	879	42	51	20	40	19	1289	83	**2774**
1600 - 1700	133	22	131	56	875	40	50	18	43	18	1315	78	**2779**
1615 - 1715	145	23	135	46	902	39	62	15	41	13	1305	64	**2790**
1630 - 1730	139	19	129	57	893	34	56	11	42	13	1374	64	**2831**
1645 - 1745	134	14	128	59	954	30	55	10	54	14	1334	59	**2845**
1700 - 1800	155	16	139	56	956	27	48	6	53	11	1408	65	**2940**
PEAK HOUR	**169**	**24**	**161**	**80**	**951**	**48**	**53**	**22**	**31**	**32**	**1622**	**86**	**3279**

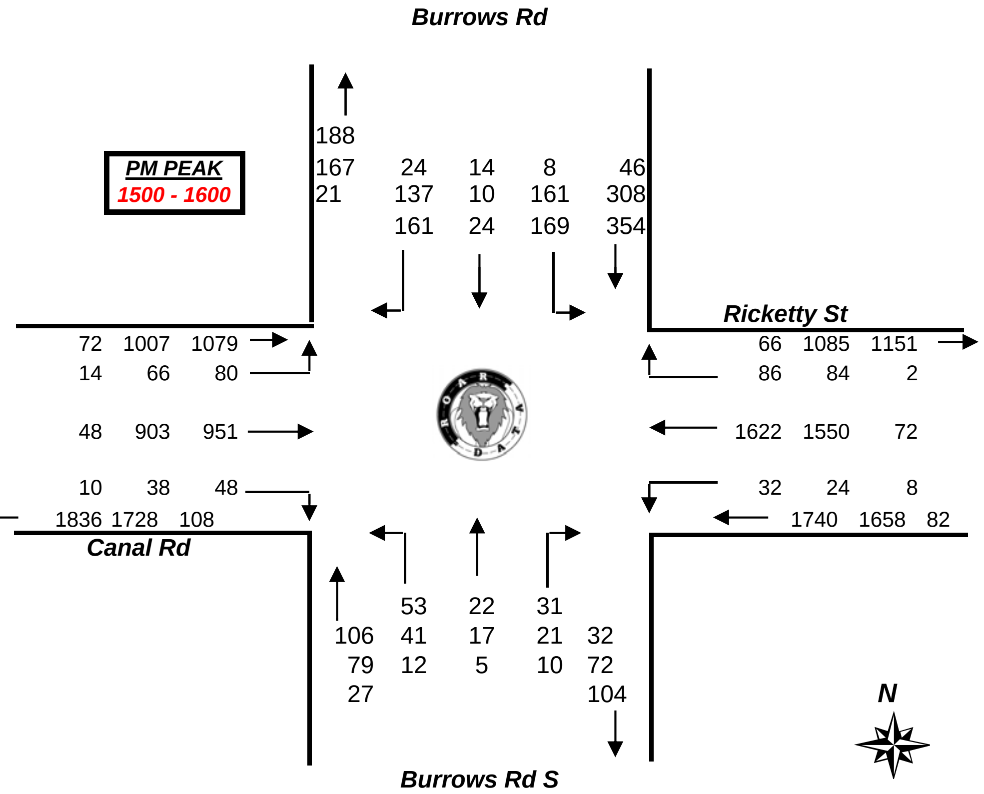
R.O.A.R DATA

Reliable, Original & Authentic Results

Ph.88196847, Mob.0418-239019

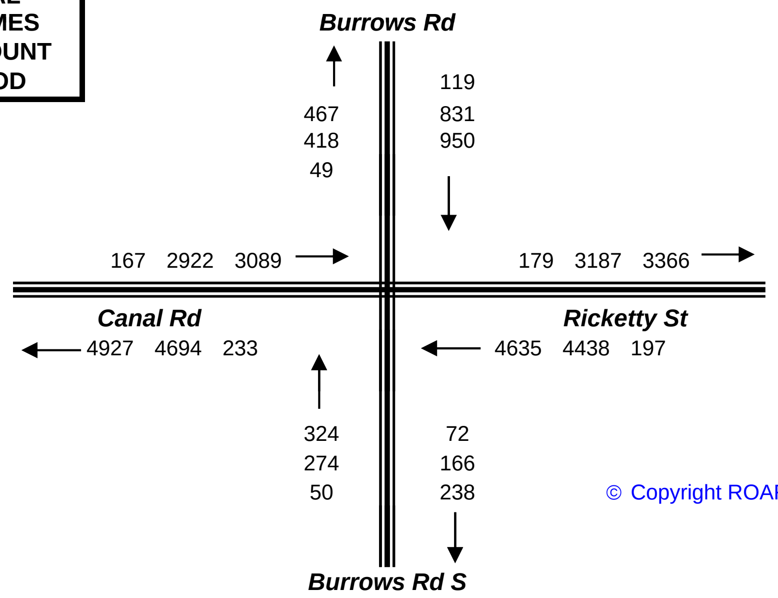
Client : EMM
Job No/Name : 6673 ST PETERS Boral
Day/Date : Wednesday 13th December 2017

PM PEAK
1500 - 1600



Peds	NORTH *Burrows Rd*	WEST *Canal Rd*	SOUTH *Burrows Rd S*	EAST *Ricketty St*	
Time Per	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	**TOT**
1500 - 1515	0	0	2	0	**2**
1515 - 1530	0	3	2	0	**5**
1530 - 1545	0	2	2	0	**4**
1545 - 1600	2	3	4	0	**9**
1600 - 1615	3	10	2	0	**15**
1615 - 1630	4	2	4	0	**10**
1630 - 1645	2	4	1	0	**7**
1645 - 1700	2	2	6	0	**10**
1700 - 1715	1	3	8	0	**12**
1715 - 1730	1	2	3	0	**6**
1730 - 1745	0	2	5	0	**7**
1745 - 1800	3	1	2	0	**6**
Period End	**18**	**34**	**41**	**0**	**93**

TOTAL VOLUMES FOR COUNT PERIOD



Peds	NORTH *Burrows Rd*	WEST *Canal Rd*	SOUTH *Burrows Rd S*	EAST *Ricketty St*	
Peak Per	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	**TOT**
1500 - 1600	2	8	10	0	**20**
1515 - 1615	5	18	10	0	**33**
1530 - 1630	9	17	12	0	**38**
1545 - 1645	11	19	11	0	**41**
1600 - 1700	11	18	13	0	**42**
1615 - 1715	9	11	19	0	**39**
1630 - 1730	6	11	18	0	**35**
1645 - 1745	4	9	22	0	**35**
1700 - 1800	5	8	18	0	**31**
PEAK HR	**2**	**8**	**10**	**0**	**20**

R.O.A.R. DATA
Reliable, Original & Authentic Results
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Mobile.0418239019

Client : EMM
Job No/Name : 6193 ST PETERS Boral
Day/Date : Wednesday 24th August 2016

PEDS	WEST	SOUTH	EAST	
Time Per	Canal Rd	Container	Canal Rd	TOT
0600 - 0615	0	1	0	1
0615 - 0630	0	0	0	0
0630 - 0645	0	0	0	0
0645 - 0700	1	0	0	1
0700 - 0715	0	11	2	13
0715 - 0730	1	1	0	2
0730 - 0745	0	0	0	0
0745 - 0800	0	1	0	1
0800 - 0815	0	0	0	0
0815 - 0830	0	2	0	2
0830 - 0845	0	1	0	1
0845 - 0900	0	3	0	3
Per End	2	20	2	24

PEDS	WEST	SOUTH	EAST	
Peak Per	Canal Rd	Container	Canal Rd	TOT
0600 - 0700	1	1	0	2
0615 - 0715	1	11	2	14
0630 - 0730	2	12	2	16
0645 - 0745	2	12	2	16
0700 - 0800	1	13	2	16
0715 - 0815	1	2	0	3
0730 - 0830	0	3	0	3
0745 - 0845	0	4	0	4
0800 - 0900	0	6	0	6
PEAK HR	1	1	0	2

Lights	WEST		SOUTH		EAST		
	Canal Rd		Container		Canal Rd		
Time Per	T	R	L	R	L	T	TOT
0600 - 0615		6	0	0	1		7
0615 - 0630		2	1	0	1		4
0630 - 0645		3	0	0	0		3
0645 - 0700		3	0	1	0		4
0700 - 0715		2	0	0	0		2
0715 - 0730		0	0	0	2		2
0730 - 0745		1	0	1	0		2
0745 - 0800		2	0	2	0		4
0800 - 0815		5	0	0	0		5
0815 - 0830		1	0	1	1		3
0830 - 0845		1	0	1	0		2
0845 - 0900		0	0	1	0		1
Per End	0	26	1	7	5	0	39

Heavies	WEST		SOUTH		EAST		
	Canal Rd		Container		Canal Rd		
Time Per	T	R	L	R	L	T	TOT
0600 - 0615		1	1	1	2		5
0615 - 0630		0	5	9	3		17
0630 - 0645		1	4	4	2		11
0645 - 0700		0	2	5	0		7
0700 - 0715		1	3	2	3		9
0715 - 0730		1	3	8	1		13
0730 - 0745		1	3	4	0		8
0745 - 0800		0	6	4	1		11
0800 - 0815		1	1	3	2		7
0815 - 0830		3	1	3	0		7
0830 - 0845		3	4	8	0		15
0845 - 0900		3	3	5	0		11
Per End	0	15	36	56	14	0	121

Combined	WEST		SOUTH		EAST		
	Canal Rd		Container		Canal Rd		
Time Per	T	R	L	R	L	T	TOT
0600 - 0615	0	7	1	1	3	0	12
0615 - 0630	0	2	6	9	4	0	21
0630 - 0645	0	4	4	4	2	0	14
0645 - 0700	0	3	2	6	0	0	11
0700 - 0715	0	3	3	2	3	0	11
0715 - 0730	0	1	3	8	3	0	15
0730 - 0745	0	2	3	5	0	0	10
0745 - 0800	0	2	6	6	1	0	15
0800 - 0815	0	6	1	3	2	0	12
0815 - 0830	0	4	1	4	1	0	10
0830 - 0845	0	4	4	9	0	0	17
0845 - 0900	0	3	3	6	0	0	12
Per End	0	41	37	63	19	0	160

Lights	WEST		SOUTH		EAST		
	Canal Rd		Container		Canal Rd		
Peak Per	T	R	L	R	L	T	TOT
0600 - 0700	0	14	1	1	2	0	18
0615 - 0715	0	10	1	1	1	0	13
0630 - 0730	0	8	0	1	2	0	11
0645 - 0745	0	6	0	2	2	0	10
0700 - 0800	0	5	0	3	2	0	10
0715 - 0815	0	8	0	3	2	0	13
0730 - 0830	0	9	0	4	1	0	14
0745 - 0845	0	9	0	4	1	0	14
0800 - 0900	0	7	0	3	1	0	11
PEAK HR	0	14	1	1	2	0	18

Heavies	WEST		SOUTH		EAST		
	Canal Rd		Container		Canal Rd		
Peak Per	T	R	L	R	L	T	TOT
0600 - 0700	0	2	12	19	7	0	40
0615 - 0715	0	2	14	20	8	0	44
0630 - 0730	0	3	12	19	6	0	40
0645 - 0745	0	3	11	19	4	0	37
0700 - 0800	0	3	15	18	5	0	41
0715 - 0815	0	3	13	19	4	0	39
0730 - 0830	0	5	11	14	3	0	33
0745 - 0845	0	7	12	18	3	0	40
0800 - 0900	0	10	9	19	2	0	40
PEAK HR	0	2	12	19	7	0	40

Combined	WEST		SOUTH		EAST		
	Canal Rd		Container		Canal Rd		
Peak Per	T	R	L	R	L	T	TOT
0600 - 0700	0	16	13	20	9	0	58
0615 - 0715	0	12	15	21	9	0	57
0630 - 0730	0	11	12	20	8	0	51
0645 - 0745	0	9	11	21	6	0	47
0700 - 0800	0	8	15	21	7	0	51
0715 - 0815	0	11	13	22	6	0	52
0730 - 0830	0	14	11	18	4	0	47
0745 - 0845	0	16	12	22	4	0	54
0800 - 0900	0	17	9	22	3	0	51
PEAK HR	0	16	13	20	9	0	58

R.O.A.R. DATA
Client : EMM

Reliable, Original & Authentic Results
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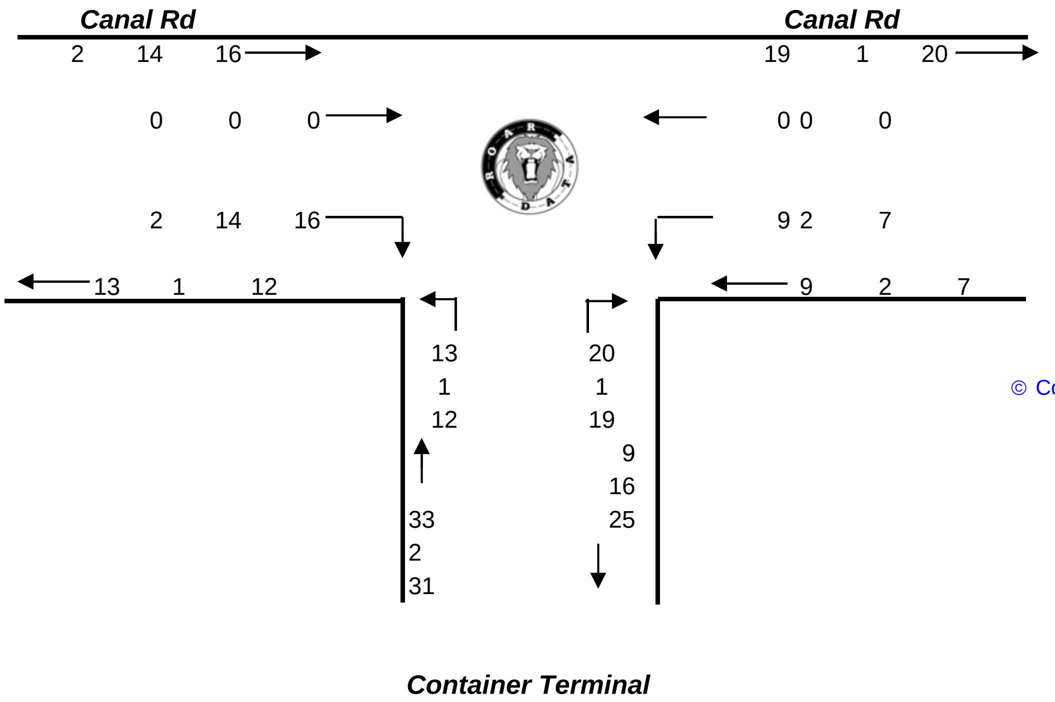
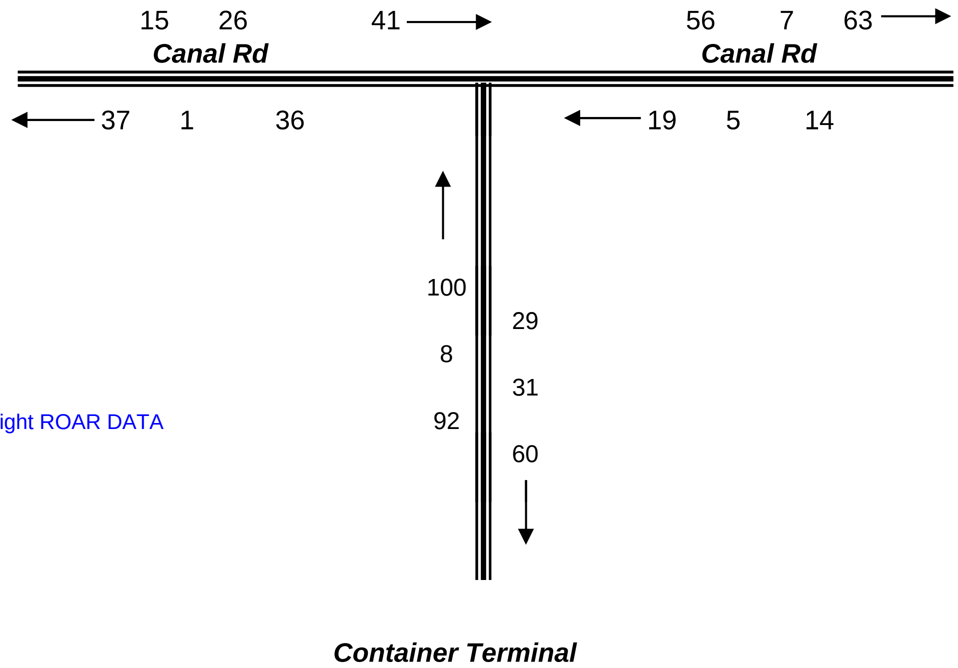
Job No/Name : 6193 ST PETERS Boral
Day/Date : Wednesday 24th August 2016

AM PEAK
0600 - 0700

N

TOTAL VOLUMES FOR COUNT PERIOD

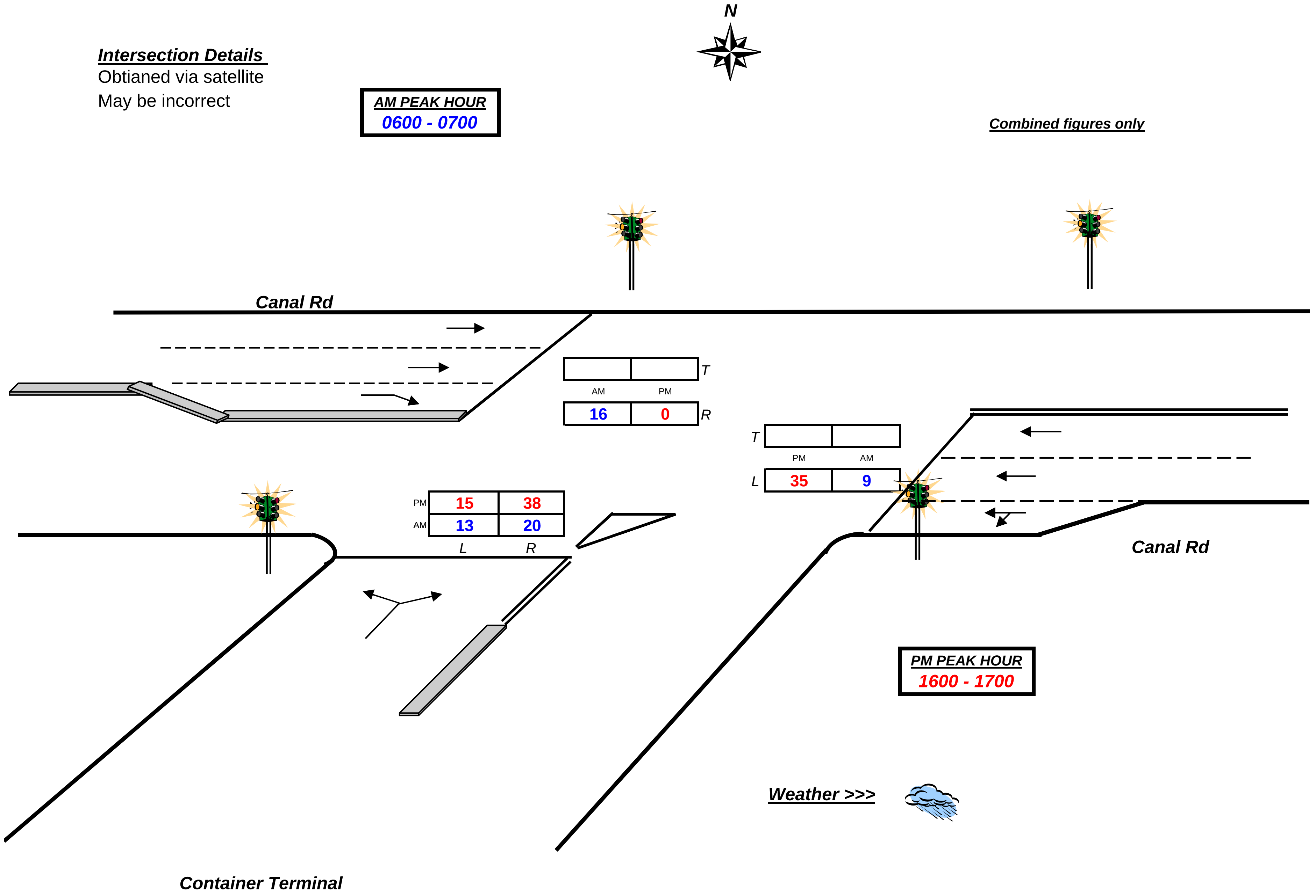




R.O.A.R. DATA
Reliable, Original & Authentic Results
Ph.88196847, Fax 88196849, Mob.0418-239019

Client : EMM
Job No/Name : 6193 ST PETERS Boral
Day/Date : Wednesday 24th August 2016

Intersection Details
Obtianed via satellite
May be incorrect



Weather >>>

R.O.A.R. DATA

Reliable, Original & Authentic Results
Ph.88196847, Fax 88196849.
Mobile.0418239019

Client : EMM
Job No/Name : 6193 ST PETERS Boral
Day/Date : Wednesday 24th August 2016

PEDS	WEST	SOUTH	EAST	
Time Per	*Canal Rd*	*Container*	*Canal Rd*	TOT
1500 - 1515	0	1	0	**1**
1515 - 1530	0	0	0	**0**
1530 - 1545	0	1	0	**1**
1545 - 1600	0	0	0	**0**
1600 - 1615	0	0	0	**0**
1615 - 1630	0	1	0	**1**
1630 - 1645	0	0	0	**0**
1645 - 1700	0	1	0	**1**
1700 - 1715	0	2	0	**2**
1715 - 1730	0	2	0	**2**
1730 - 1745	0	0	0	**0**
1745 - 1800	0	0	0	**0**
Per End	**0**	**8**	**0**	**8**

PEDS	WEST	SOUTH	EAST	
Peak Per	*Canal Rd*	*Container*	*Canal Rd*	TOT
1500 - 1600	0	2	0	**2**
1515 - 1615	0	1	0	**1**
1530 - 1630	0	2	0	**2**
1545 - 1645	0	1	0	**1**
1600 - 1700	0	2	0	**2**
1615 - 1715	0	4	0	**4**
1630 - 1730	0	5	0	**5**
1645 - 1745	0	5	0	**5**
1700 - 1800	0	4	0	**4**
PEAK HR	**0**	**2**	**0**	**2**

Lights	WEST		SOUTH		EAST		
	Canal Rd		*Container*		*Canal Rd*		
Time Per	T	R	L	R	L	T	TOT
1500 - 1515		1	1	2	0		**4**
1515 - 1530		0	2	2	0		**4**
1530 - 1545		0	0	2	0		**2**
1545 - 1600		0	0	0	1		**1**
1600 - 1615		0	3	0	0		**3**
1615 - 1630		0	0	0	0		**0**
1630 - 1645		0	1	2	1		**4**
1645 - 1700		0	0	0	0		**0**
1700 - 1715		0	0	2	0		**2**
1715 - 1730		0	2	1	1		**4**
1730 - 1745		0	1	0	0		**1**
1745 - 1800		0	0	0	0		**0**
Per End	**0**	**1**	**10**	**11**	**3**	**0**	**25**

Heavies	WEST		SOUTH		EAST		
	Canal Rd		*Container*		*Canal Rd*		
Time Per	T	R	L	R	L	T	TOT
1500 - 1515		2	4	11	7		**24**
1515 - 1530		0	1	7	3		**11**
1530 - 1545		0	3	7	2		**12**
1545 - 1600		0	3	5	2		**10**
1600 - 1615		0	2	7	10		**19**
1615 - 1630		0	3	8	7		**18**
1630 - 1645		0	5	5	11		**21**
1645 - 1700		0	1	16	6		**23**
1700 - 1715		0	5	9	3		**17**
1715 - 1730		0	5	3	8		**16**
1730 - 1745		0	1	6	1		**8**
1745 - 1800		0	1	3	0		**4**
Per End	**0**	**2**	**34**	**87**	**60**	**0**	**183**

Combined	WEST		SOUTH		EAST		
	Canal Rd		*Container*		*Canal Rd*		
Time Per	T	R	L	R	L	T	TOT
1500 - 1515	0	3	5	13	7	0	**28**
1515 - 1530	0	0	3	9	3	0	**15**
1530 - 1545	0	0	3	9	2	0	**14**
1545 - 1600	0	0	3	5	3	0	**11**
1600 - 1615	0	0	5	7	10	0	**22**
1615 - 1630	0	0	3	8	7	0	**18**
1630 - 1645	0	0	6	7	12	0	**25**
1645 - 1700	0	0	1	16	6	0	**23**
1700 - 1715	0	0	5	11	3	0	**19**
1715 - 1730	0	0	7	4	9	0	**20**
1730 - 1745	0	0	2	6	1	0	**9**
1745 - 1800	0	0	1	3	0	0	**4**
Per End	**0**	**3**	**44**	**98**	**63**	**0**	**208**

Lights	WEST		SOUTH		EAST		
	Canal Rd		*Container*		*Canal Rd*		
Peak Per	T	R	L	R	L	T	TOT
1500 - 1600	0	1	3	6	1	0	**11**
1515 - 1615	0	0	5	4	1	0	**10**
1530 - 1630	0	0	3	2	1	0	**6**
1545 - 1645	0	0	4	2	2	0	**8**
1600 - 1700	0	0	4	2	1	0	**7**
1615 - 1715	0	0	1	4	1	0	**6**
1630 - 1730	0	0	3	5	2	0	**10**
1645 - 1745	0	0	3	3	1	0	**7**
1700 - 1800	0	0	3	3	1	0	**7**
PEAK HR	**0**	**0**	**4**	**2**	**1**	**0**	**7**

Heavies	WEST		SOUTH		EAST		
	Canal Rd		*Container*		*Canal Rd*		
Peak Per	T	R	L	R	L	T	TOT
1500 - 1600	0	2	11	30	14	0	**57**
1515 - 1615	0	0	9	26	17	0	**52**
1530 - 1630	0	0	11	27	21	0	**59**
1545 - 1645	0	0	13	25	30	0	**68**
1600 - 1700	0	0	11	36	34	0	**81**
1615 - 1715	0	0	14	38	27	0	**79**
1630 - 1730	0	0	16	33	28	0	**77**
1645 - 1745	0	0	12	34	18	0	**64**
1700 - 1800	0	0	12	21	12	0	**45**
PEAK HR	**0**	**0**	**11**	**36**	**34**	**0**	**81**

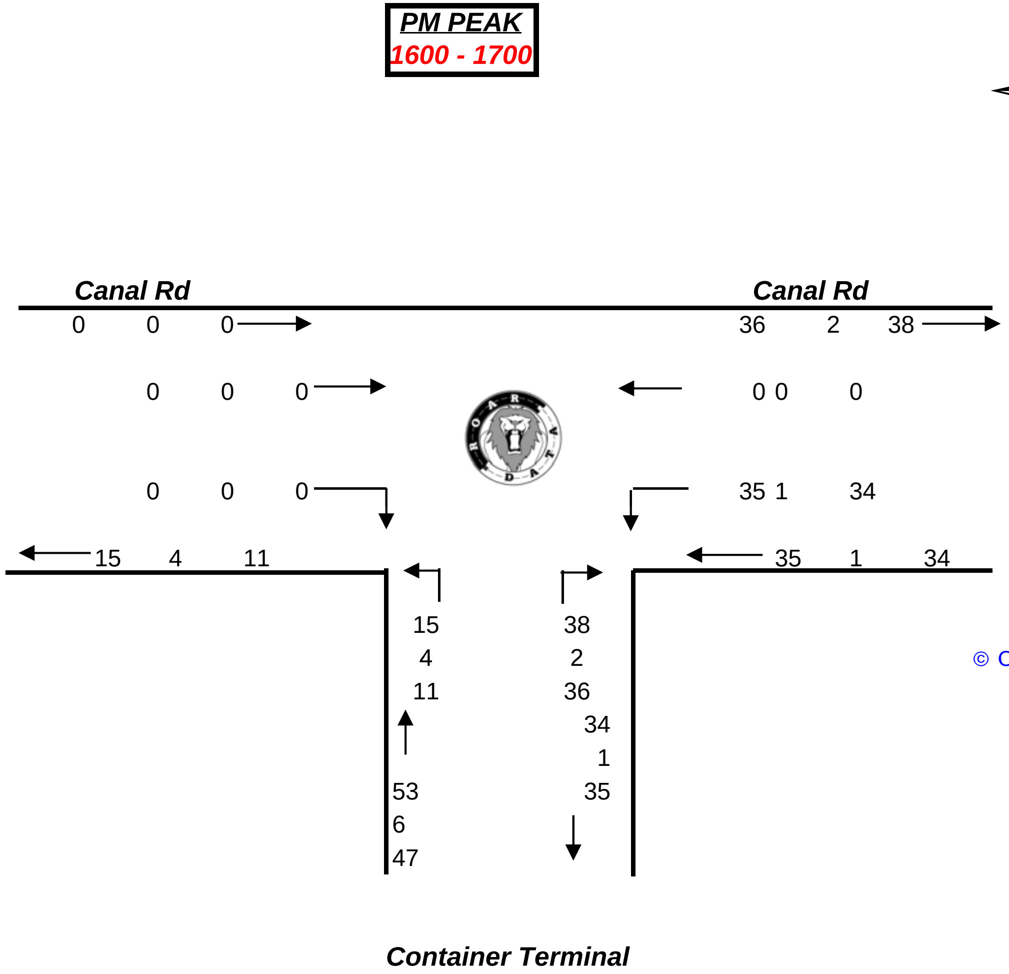
Combined	WEST		SOUTH		EAST		
	Canal Rd		*Container*		*Canal Rd*		
Peak Per	T	R	L	R	L	T	TOT
1500 - 1600	0	3	14	36	15	0	**68**
1515 - 1615	0	0	14	30	18	0	**62**
1530 - 1630	0	0	14	29	22	0	**65**
1545 - 1645	0	0	17	27	32	0	**76**
1600 - 1700	0	0	15	38	35	0	**88**
1615 - 1715	0	0	15	42	28	0	**85**
1630 - 1730	0	0	19	38	30	0	**87**
1645 - 1745	0	0	15	37	19	0	**71**
1700 - 1800	0	0	15	24	13	0	**52**
PEAK HR	**0**	**0**	**15**	**38**	**35**	**0**	**88**

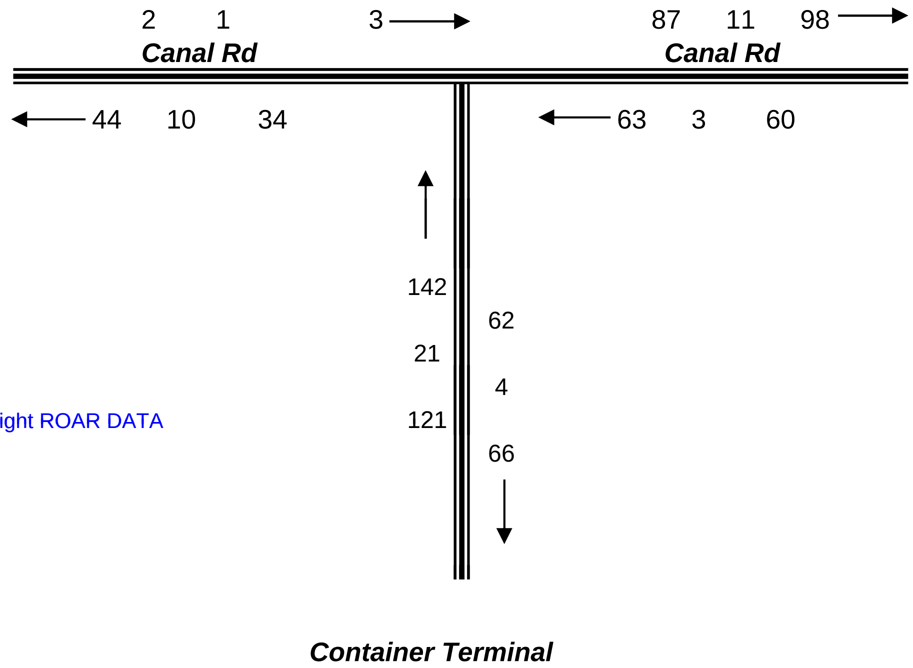
R.O.A.R. DATA
Reliable, Original & Authentic Results
Ph.88196847, Fax 88196849, Mob.0418-239019

Client : EMM
Job No/Name : 6193 ST PETERS Boral
Day/Date : Wednesday 24th August 2016

PM PEAK
1600 - 1700

TOTAL VOLUMES FOR COUNT PERIOD





R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Mob.0418-239019

Client : EMM

Job No/Name : 6973 ST PETERS Boral

Day/Date : Wednesday 13th December 2017

Lights

	NORTH			WEST			SOUTH			EAST			
	Princess Hwy			*Mary St*			*Princess Hwy*			*Canal Rd*			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	**TOT**
0600 - 0615	30	77	0	0	0	0	17	383	351	59	56	16	**989**
0615 - 0630	35	93	0	0	0	0	15	378	403	81	52	11	**1068**
0630 - 0645	31	108	0	0	0	0	17	369	445	70	75	6	**1121**
0645 - 0700	32	77	0	0	0	0	12	353	432	84	92	20	**1102**
0700 - 0715	35	87	0	0	0	0	9	343	431	86	89	13	**1093**
0715 - 0730	29	93	0	0	0	0	16	370	376	83	82	10	**1059**
0730 - 0745	33	91	0	0	0	0	21	380	433	92	80	23	**1153**
0745 - 0800	31	104	0	0	0	0	14	317	410	125	87	10	**1098**
0800 - 0815	41	88	0	0	0	0	21	355	472	88	106	12	**1183**
0815 - 0830	42	144	0	0	0	0	30	286	423	98	82	20	**1125**
0830 - 0845	35	88	0	0	0	0	15	315	401	81	85	20	**1040**
0845 - 0900	41	79	0	0	0	0	23	279	365	95	89	25	**996**
Period End	**415**	**1129**	**0**	**0**	**0**	**0**	**210**	**4128**	**4942**	**1042**	**975**	**186**	**13027**

Lights

	NORTH			WEST			SOUTH			EAST			
	Princess Hwy			*Mary St*			*Princess Hwy*			*Canal Rd*			
Peak Time	L	T	R	L	T	R	L	T	R	L	T	R	**TOT**
0600 - 0700	128	355	0	0	0	0	61	1483	1631	294	275	53	**4280**
0615 - 0715	133	365	0	0	0	0	53	1443	1711	321	308	50	**4384**
0630 - 0730	127	365	0	0	0	0	54	1435	1684	323	338	49	**4375**
0645 - 0745	129	348	0	0	0	0	58	1446	1672	345	343	66	**4407**
0700 - 0800	128	375	0	0	0	0	60	1410	1650	386	338	56	**4403**
0715 - 0815	134	376	0	0	0	0	72	1422	1691	388	355	55	**4493**
0730 - 0830	147	427	0	0	0	0	86	1338	1738	403	355	65	**4559**
0745 - 0845	149	424	0	0	0	0	80	1273	1706	392	360	62	**4446**
0800 - 0900	159	399	0	0	0	0	89	1235	1661	362	362	77	**4344**
PEAK HOUR	**147**	**427**	**0**	**0**	**0**	**0**	**86**	**1338**	**1738**	**403**	**355**	**65**	**4559**

Heavies

	NORTH			WEST			SOUTH			EAST			
	Princess Hwy			*Mary St*			*Princess Hwy*			*Canal Rd*			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	**TOT**
0600 - 0615	2	3	0	0	0	0	0	11	14	13	0	1	**44**
0615 - 0630	1	8	0	0	0	0	0	10	10	29	0	1	**59**
0630 - 0645	2	2	0	0	0	0	0	20	13	14	1	1	**53**
0645 - 0700	2	3	0	0	0	0	1	15	21	23	0	2	**67**
0700 - 0715	1	2	0	0	0	0	0	8	18	12	1	0	**42**
0715 - 0730	0	4	0	0	0	0	0	16	24	31	1	0	**76**
0730 - 0745	1	4	0	0	0	0	0	7	15	12	0	1	**40**
0745 - 0800	1	5	0	0	0	0	0	5	7	20	0	3	**41**
0800 - 0815	2	11	0	0	0	0	0	7	13	26	0	0	**59**
0815 - 0830	4	13	0	0	0	0	0	12	12	20	0	2	**63**
0830 - 0845	2	6	0	0	0	0	0	9	18	20	1	1	**57**
0845 - 0900	1	4	0	0	0	0	0	10	18	25	0	0	**58**
Period End	**19**	**65**	**0**	**0**	**0**	**0**	**1**	**130**	**183**	**245**	**4**	**12**	**659**

Heavies

	NORTH			WEST			SOUTH			EAST			
	Princess Hwy			*Mary St*			*Princess Hwy*			*Canal Rd*			
Peak Per	L	T	R	L	T	R	L	T	R	L	T	R	**TOT**
0600 - 0700	7	16	0	0	0	0	1	56	58	79	1	5	**223**
0615 - 0715	6	15	0	0	0	0	1	53	62	78	2	4	**221**
0630 - 0730	5	11	0	0	0	0	1	59	76	80	3	3	**238**
0645 - 0745	4	13	0	0	0	0	1	46	78	78	2	3	**225**
0700 - 0800	3	15	0	0	0	0	0	36	64	75	2	4	**199**
0715 - 0815	4	24	0	0	0	0	0	35	59	89	1	4	**216**
0730 - 0830	8	33	0	0	0	0	0	31	47	78	0	6	**203**
0745 - 0845	9	35	0	0	0	0	0	33	50	86	1	6	**220**
0800 - 0900	9	34	0	0	0	0	0	38	61	91	1	3	**237**
PEAK HOUR	**8**	**33**	**0**	**0**	**0**	**0**	**0**	**31**	**47**	**78**	**0**	**6**	**203**

Combined

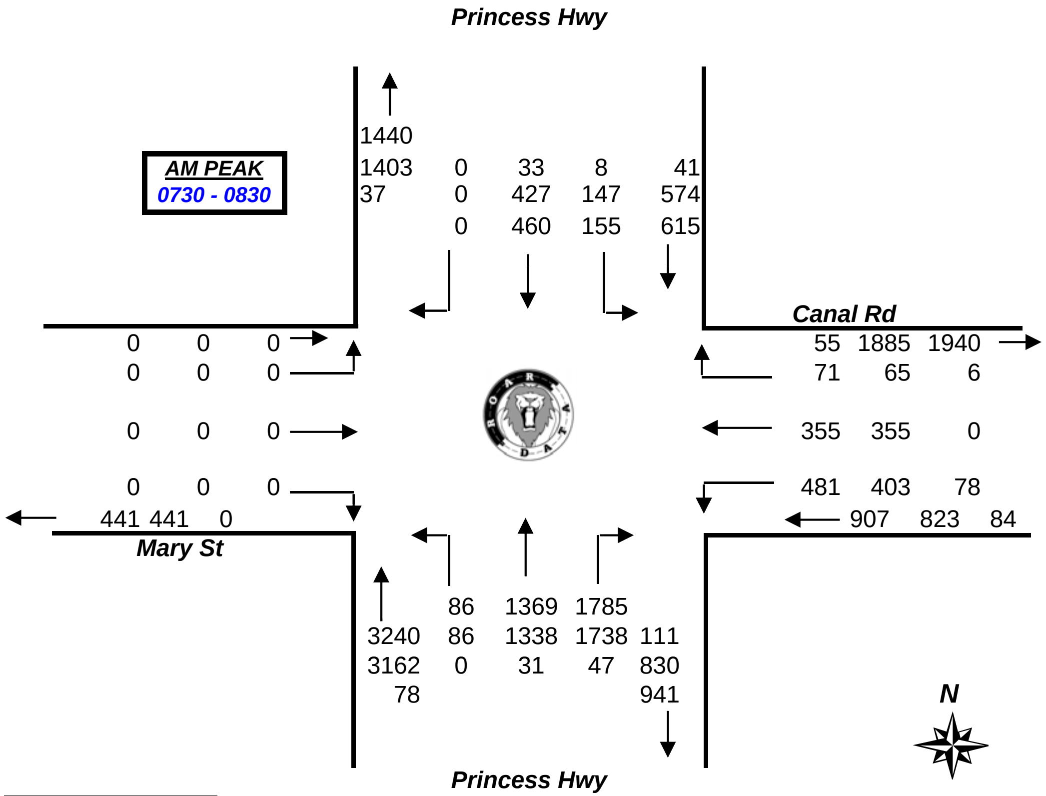
	NORTH			WEST			SOUTH			EAST			
	Princess Hwy			*Mary St*			*Princess Hwy*			*Canal Rd*			
Time Per	L	T	R	L	T	R	L	T	R	L	T	R	**TOT**
0600 - 0615	32	80	0	0	0	0	17	394	365	72	56	17	**1033**
0615 - 0630	36	101	0	0	0	0	15	388	413	110	52	12	**1127**
0630 - 0645	33	110	0	0	0	0	17	389	458	84	76	7	**1174**
0645 - 0700	34	80	0	0	0	0	13	368	453	107	92	22	**1169**
0700 - 0715	36	89	0	0	0	0	9	351	449	98	90	13	**1135**
0715 - 0730	29	97	0	0	0	0	16	386	400	114	83	10	**1135**
0730 - 0745	34	95	0	0	0	0	21	387	448	104	80	24	**1193**
0745 - 0800	32	109	0	0	0	0	14	322	417	145	87	13	**1139**
0800 - 0815	43	99	0	0	0	0	21	362	485	114	106	12	**1242**
0815 - 0830	46	157	0	0	0	0	30	298	435	118	82	22	**1188**
0830 - 0845	37	94	0	0	0	0	15	324	419	101	86	21	**1097**
0845 - 0900	42	83	0	0	0	0	23	289	383	120	89	25	**1054**
Period End	**434**	**1194**	**0**	**0**	**0**	**0**	**211**	**4258**	**5125**	**1287**	**979**	**198**	**13686**

Combined

	NORTH			WEST			SOUTH			EAST			
	Princess Hwy			*Mary St*			*Princess Hwy*			*Canal Rd*			
Peak Per	L	T	R	L	T	R	L	T	R	L	T	R	**TOT**
0600 - 0700	135	371	0	0	0	0	62	1539	1689	373	276	58	**4503**
0615 - 0715	139	380	0	0	0	0	54	1496	1773	399	310	54	**4605**
0630 - 0730	132	376	0	0	0	0	55	1494	1760	403	341	52	**4613**
0645 - 0745	133	361	0	0	0	0	59	1492	1750	423	345	69	**4632**
0700 - 0800	131	390	0	0	0	0	60	1446	1714	461	340	60	**4602**
0715 - 0815	138	400	0	0	0	0	72	1457	1750	477	356	59	**4709**
0730 - 0830	155	460	0	0	0	0	86	1369	1785	481	355	71	**4762**
0745 - 0845	158	459	0	0	0	0	80	1306	1756	478	361	68	**4666**
0800 - 0900	168	433	0	0	0	0	89	1273	1722	453	363	80	**4581**
PEAK HOUR	**155**	**460**	**0**	**0**	**0**	**0**	**86**	**1369**	**1785**	**481**	**355**	**71**	**4762**

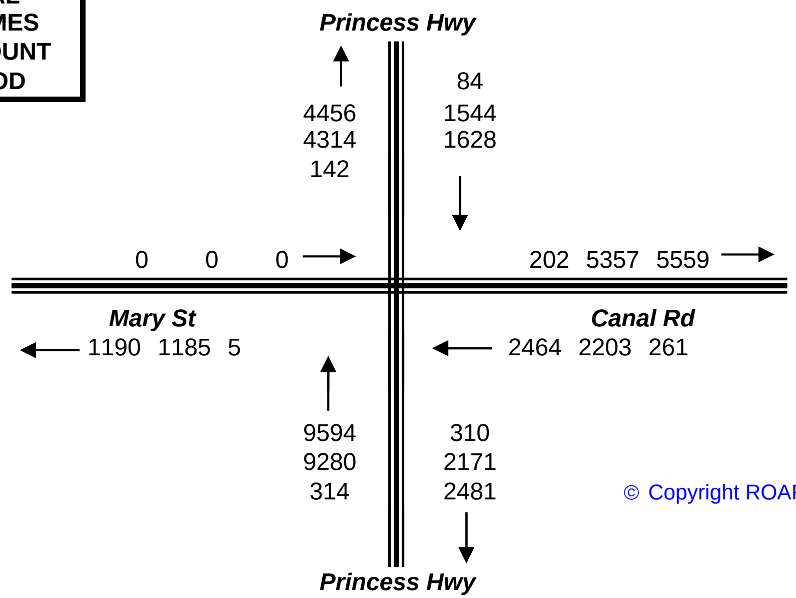
R.O.A.R DATA
Reliable, Original & Authentic Results
Ph.88196847, Mob.0418-239019

Client : EMM
Job No/Name : 6973 ST PETERS Boral
Day/Date : Wednesday 13th December 2017



Peds	NORTH	WEST	SOUTH	EAST	
	Princess Hwy	Mary St	Princess Hwy	Canal Rd	
Time Per	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	TOT
0600 - 0615	3	0	0	1	**4**
0615 - 0630	9	3	0	5	**17**
0630 - 0645	11	3	0	3	**17**
0645 - 0700	8	0	0	7	**15**
0700 - 0715	5	0	0	5	**10**
0715 - 0730	5	3	0	1	**9**
0730 - 0745	5	3	0	5	**13**
0745 - 0800	8	1	0	6	**15**
0800 - 0815	5	1	0	10	**16**
0815 - 0830	5	2	0	9	**16**
0830 - 0845	8	1	0	11	**20**
0845 - 0900	7	0	0	5	**12**
Period End	**79**	**17**	**0**	**68**	**164**

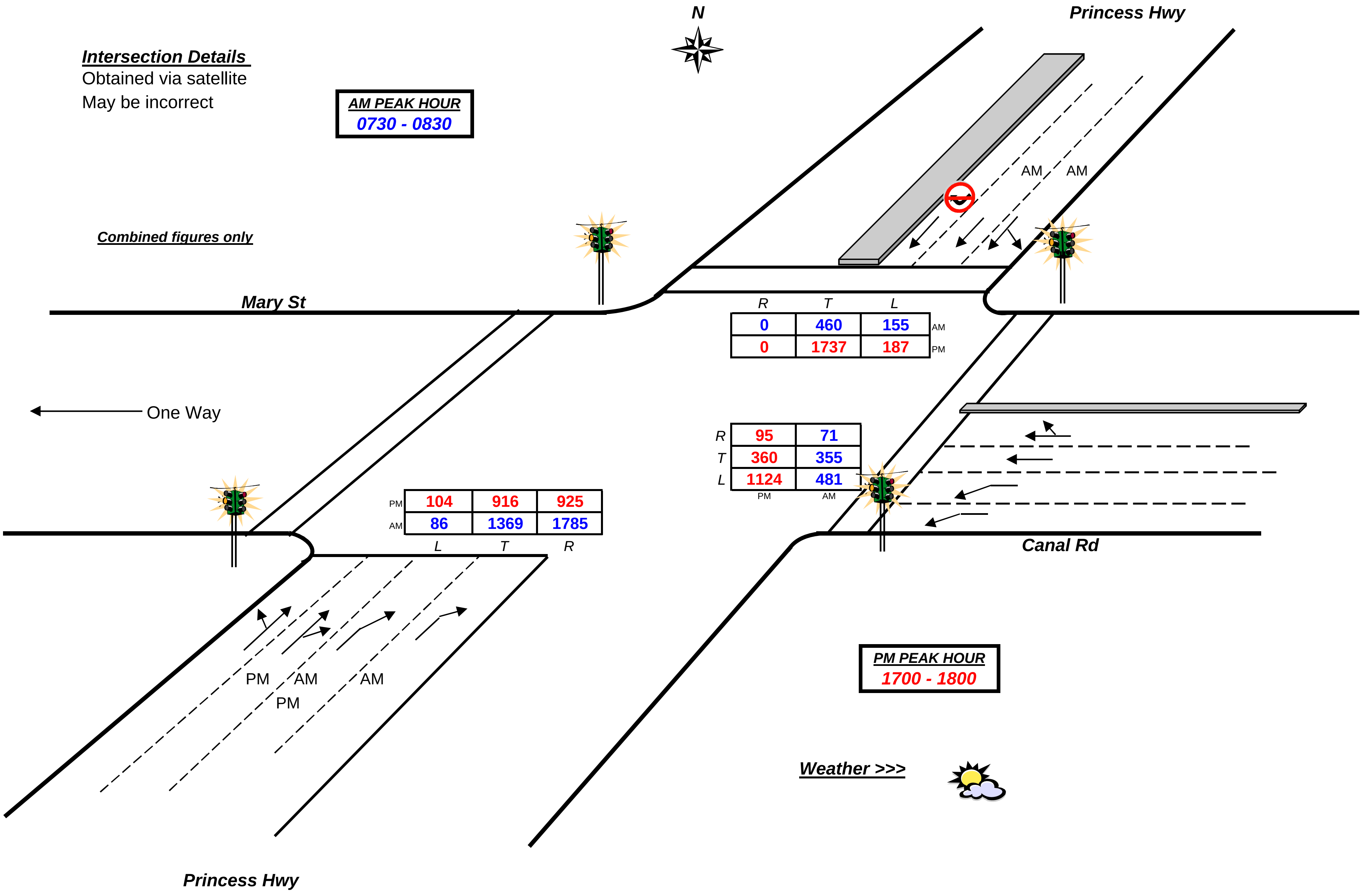
TOTAL VOLUMES FOR COUNT PERIOD



Peds	NORTH	WEST	SOUTH	EAST	
	Princess Hwy	Mary St	Princess Hwy	Canal Rd	
Peak Per	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	TOT
0600 - 0700	31	6	0	16	**53**
0615 - 0715	33	6	0	20	**59**
0630 - 0730	29	6	0	16	**51**
0645 - 0745	23	6	0	18	**47**
0700 - 0800	23	7	0	17	**47**
0715 - 0815	23	8	0	22	**53**
0730 - 0830	23	7	0	30	**60**
0745 - 0845	26	5	0	36	**67**
0800 - 0900	25	4	0	35	**64**
PEAK HR	**23**	**7**	**0**	**30**	**60**

R.O.A.R. DATA
Reliable, Original & Authentic Results
Ph.88196847, Mob.0418-239019

Client : EMM
Job No/Name : 6973 ST PETERS Boral
Day/Date : Wednesday 13th December 2017



R.O.A.R. DATA

Reliable, Original & Authentic Results

Ph.88196847, Mob.0418-239019

Client : EMM

Job No/Name : 6973 ST PETERS Boral

Day/Date : Wednesday 13th December 2017

Lights

	NORTH			WEST			SOUTH			EAST			
	Princess Hwy			*Mary St*			*Princess Hwy*			*Canal Rd*			
Time Per	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**TOT**
1500 - 1515	62	302	0	0	0	0	23	174	240	315	142	35	**1293**
1515 - 1530	42	321	0	0	0	0	8	186	185	239	139	34	**1154**
1530 - 1545	47	361	0	0	0	0	12	163	164	241	122	25	**1135**
1545 - 1600	42	411	0	0	0	0	18	226	223	206	84	23	**1233**
1600 - 1615	46	469	0	0	0	0	28	228	227	221	108	23	**1350**
1615 - 1630	32	369	0	0	0	0	18	217	238	235	109	10	**1228**
1630 - 1645	24	390	0	0	0	0	9	190	178	253	115	32	**1191**
1645 - 1700	39	407	0	0	0	0	23	237	199	225	93	18	**1241**
1700 - 1715	58	439	0	0	0	0	29	198	234	310	70	21	**1359**
1715 - 1730	36	438	0	0	0	0	28	235	182	239	62	26	**1246**
1730 - 1745	39	375	0	0	0	0	24	204	267	257	107	23	**1296**
1745 - 1800	52	463	0	0	0	0	23	266	211	272	121	25	**1433**
Period End	**519**	**4745**	**0**	**0**	**0**	**0**	**24**	**2524**	**2548**	**3013**	**1272**	**295**	**14940**

Lights

	NORTH			WEST			SOUTH			EAST			
	Princess Hwy			*Mary St*			*Princess Hwy*			*Canal Rd*			
Peak Time	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**TOT**
1500 - 1600	193	1395	0	0	0	0	61	749	812	1001	487	117	**4815**
1515 - 1615	177	1562	0	0	0	0	66	803	799	907	453	105	**4872**
1530 - 1630	167	1610	0	0	0	0	76	834	852	903	423	81	**4946**
1545 - 1645	144	1639	0	0	0	0	73	861	866	915	416	88	**5002**
1600 - 1700	141	1635	0	0	0	0	78	872	842	934	425	83	**5010**
1615 - 1715	153	1605	0	0	0	0	79	842	849	1023	387	81	**5019**
1630 - 1730	157	1674	0	0	0	0	89	860	793	1027	340	97	**5037**
1645 - 1745	172	1659	0	0	0	0	104	874	882	1031	332	88	**5142**
1700 - 1800	185	1715	0	0	0	0	104	903	894	1078	360	95	**5334**
PEAK HOUR	**185**	**1715**	**0**	**0**	**0**	**0**	**104**	**903**	**894**	**1078**	**360**	**95**	**5334**

Heavies

	NORTH			WEST			SOUTH			EAST			
	Princess Hwy			*Mary St*			*Princess Hwy*			*Canal Rd*			
Time Per	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**TOT**
1500 - 1515	1	6	0	0	0	0	0	2	16	24	0	1	**50**
1515 - 1530	2	5	0	0	0	0	0	9	12	30	0	1	**59**
1530 - 1545	1	9	0	0	0	0	0	10	11	23	0	0	**54**
1545 - 1600	1	8	0	0	0	0	0	2	9	26	0	4	**50**
1600 - 1615	0	7	0	0	0	0	0	5	11	19	1	1	**44**
1615 - 1630	0	16	0	0	0	0	0	7	15	36	0	1	**75**
1630 - 1645	0	5	0	0	0	0	0	4	4	17	0	1	**31**
1645 - 1700	2	6	0	0	0	0	0	3	6	18	0	0	**35**
1700 - 1715	1	10	0	0	0	0	0	3	11	10	0	0	**35**
1715 - 1730	0	4	0	0	0	0	0	2	11	7	0	0	**24**
1730 - 1745	1	4	0	0	0	0	0	4	5	17	0	0	**31**
1745 - 1800	0	4	0	0	0	0	0	4	4	12	0	0	**24**
Period End	**9**	**84**	**0**	**0**	**0**	**0**	**0**	**55**	**115**	**239**	**1**	**9**	**512**

Heavies

	NORTH			WEST			SOUTH			EAST			
	Princess Hwy			*Mary St*			*Princess Hwy*			*Canal Rd*			
Peak Per	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**TOT**
1500 - 1600	5	28	0	0	0	0	0	23	48	103	0	6	**213**
1515 - 1615	4	29	0	0	0	0	0	26	43	98	1	6	**207**
1530 - 1630	2	40	0	0	0	0	0	24	46	104	1	6	**223**
1545 - 1645	1	36	0	0	0	0	0	18	39	98	1	7	**200**
1600 - 1700	2	34	0	0	0	0	0	19	36	90	1	3	**185**
1615 - 1715	3	37	0	0	0	0	0	17	36	81	0	2	**176**
1630 - 1730	3	25	0	0	0	0	0	12	32	52	0	1	**125**
1645 - 1745	4	24	0	0	0	0	0	12	33	52	0	0	**125**
1700 - 1800	2	22	0	0	0	0	0	13	31	46	0	0	**114**
PEAK HOUR	**2**	**22**	**0**	**31**	**0**	**0**	**0**	**13**	**31**	**46**	**0**	**0**	**114**

Combined

	NORTH			WEST			SOUTH			EAST			
	Princess Hwy			*Mary St*			*Princess Hwy*			*Canal Rd*			
Time Per	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**TOT**
1500 - 1515	63	308	0	0	0	0	23	176	256	339	142	36	**1343**
1515 - 1530	44	326	0	0	0	0	8	195	197	269	139	35	**1213**
1530 - 1545	48	370	0	0	0	0	12	173	175	264	122	25	**1189**
1545 - 1600	43	419	0	0	0	0	18	228	232	232	84	27	**1283**
1600 - 1615	46	476	0	0	0	0	28	233	238	240	109	24	**1394**
1615 - 1630	32	385	0	0	0	0	18	224	253	271	109	11	**1303**
1630 - 1645	24	395	0	0	0	0	9	194	182	270	115	33	**1222**
1645 - 1700	41	413	0	0	0	0	23	240	205	243	93	18	**1276**
1700 - 1715	59	449	0	0	0	0	29	201	245	320	70	21	**1394**
1715 - 1730	36	442	0	0	0	0	28	237	193	246	62	26	**1270**
1730 - 1745	40	379	0	0	0	0	24	208	272	274	107	23	**1327**
1745 - 1800	52	467	0	0	0	0	23	270	215	284	121	25	**1457**
Period End	**528**	**4829**	**0**	**0**	**0**	**0**	**243**	**2579**	**2663**	**3252**	**1273**	**304**	**15671**

Combined

	NORTH			WEST			SOUTH			EAST			
	Princess Hwy			*Mary St*			*Princess Hwy*			*Canal Rd*			
Peak Per	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**L**	**T**	**R**	**TOT**
1500 - 1600	198	1423	0	0	0	0	61	772	860	1104	487	123	**5028**
1515 - 1615	181	1591	0	0	0	0	66	829	842	1005	454	111	**5079**
1530 - 1630	169	1650	0	0	0	0	76	858	898	1007	424	87	**5169**
1545 - 1645	145	1675	0	0	0	0	73	879	905	1013	417	95	**5202**
1600 - 1700	143	1669	0	0	0	0	78	891	878	1024	426	86	**5195**
1615 - 1715	156	1642	0	0	0	0	79	859	885	1104	387	83	**5195**
1630 - 1730	160	1699	0	0	0	0	89	872	825	1079	340	98	**5162**
1645 - 1745	176	1683	0	0	0	0	104	886	915	1083	332	88	**5267**
1700 - 1800	187	1737	0	0	0	0	104	916	925	1124	360	95	**5448**
PEAK HOUR	**187**	**1737**	**0**	**0**	**0**	**0**	**104**	**916**	**925**	**1124**	**360**	**95**	**5448**

R.O.A.R DATA
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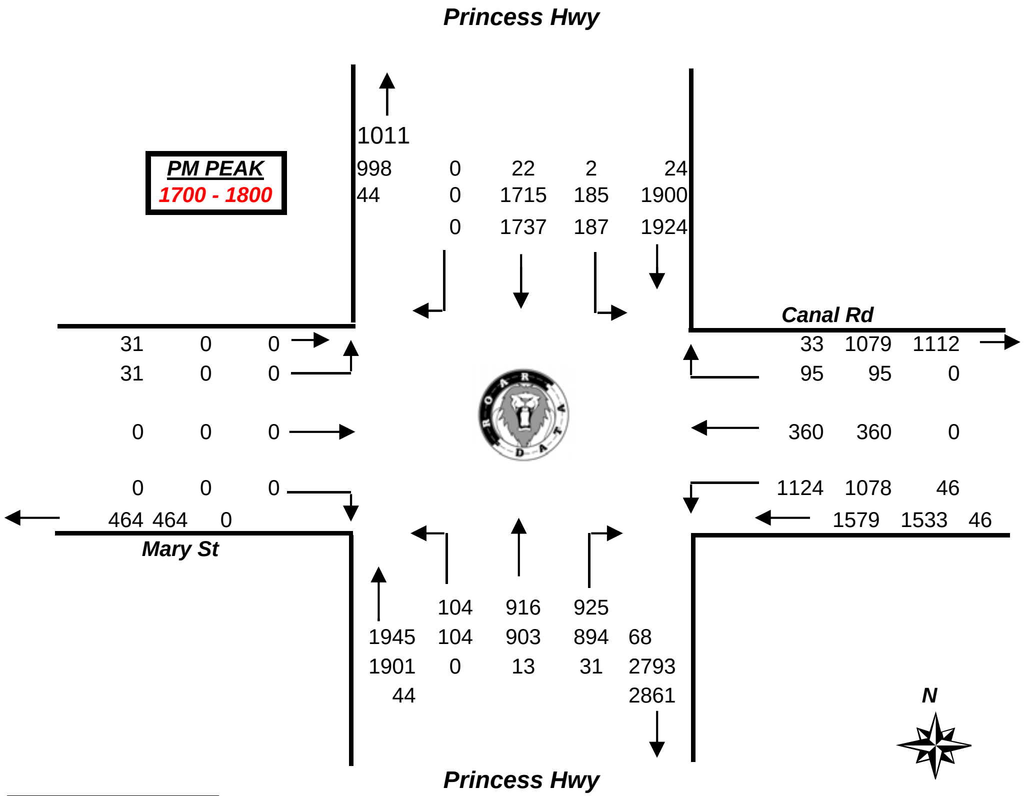
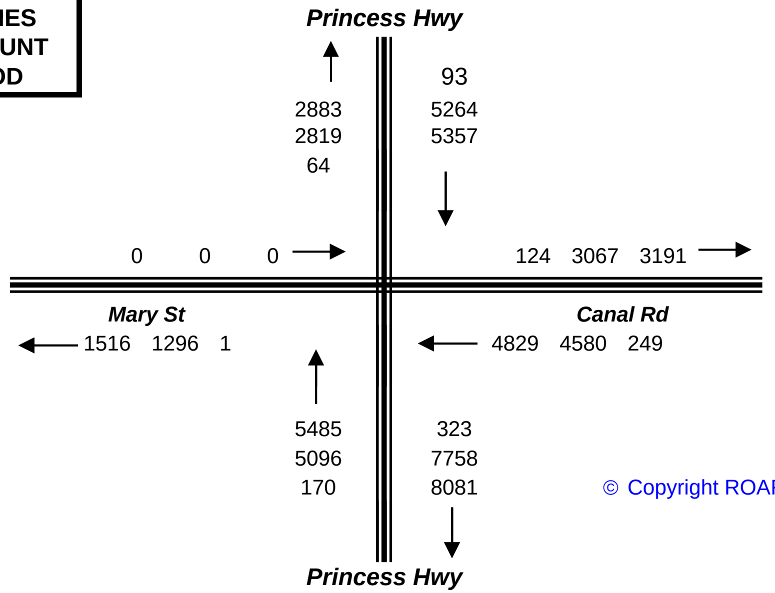
Client : EMM
Job No/Name : 6973 ST PETERS Boral
Day/Date : Wednesday 13th December 2017



Peds	NORTH *Princess Hwy*	WEST *Mary St*	SOUTH *Princess Hwy*	EAST *Canal Rd*	
Time Per	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	TOT
1500 - 1515	3	0	0	3	**6**
1515 - 1530	5	4	0	2	**11**
1530 - 1545	12	0	0	7	**19**
1545 - 1600	5	0	0	3	**8**
1600 - 1615	3	3	0	4	**10**
1615 - 1630	9	2	0	9	**20**
1630 - 1645	6	1	0	5	**12**
1645 - 1700	9	0	0	6	**15**
1700 - 1715	6	1	0	8	**15**
1715 - 1730	18	3	0	12	**33**
1730 - 1745	9	4	0	11	**24**
1745 - 1800	19	1	0	15	**35**
Period End	**104**	**19**	**0**	**85**	**208**

Peds	NORTH *Princess Hwy*	WEST *Mary St*	SOUTH *Princess Hwy*	EAST *Canal Rd*	
Peak Per	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	UNCLASSIFIED	TOT
1500 - 1600	25	4	0	15	**44**
1515 - 1615	25	7	0	16	**48**
1530 - 1630	29	5	0	23	**57**
1545 - 1645	23	6	0	21	**50**
1600 - 1700	27	6	0	24	**57**
1615 - 1715	30	4	0	28	**62**
1630 - 1730	39	5	0	31	**75**
1645 - 1745	42	8	0	37	**87**
1700 - 1800	52	9	0	46	**107**
PEAK HR	**52**	**9**	**0**	**46**	**107**

TOTAL VOLUMES FOR COUNT PERIOD



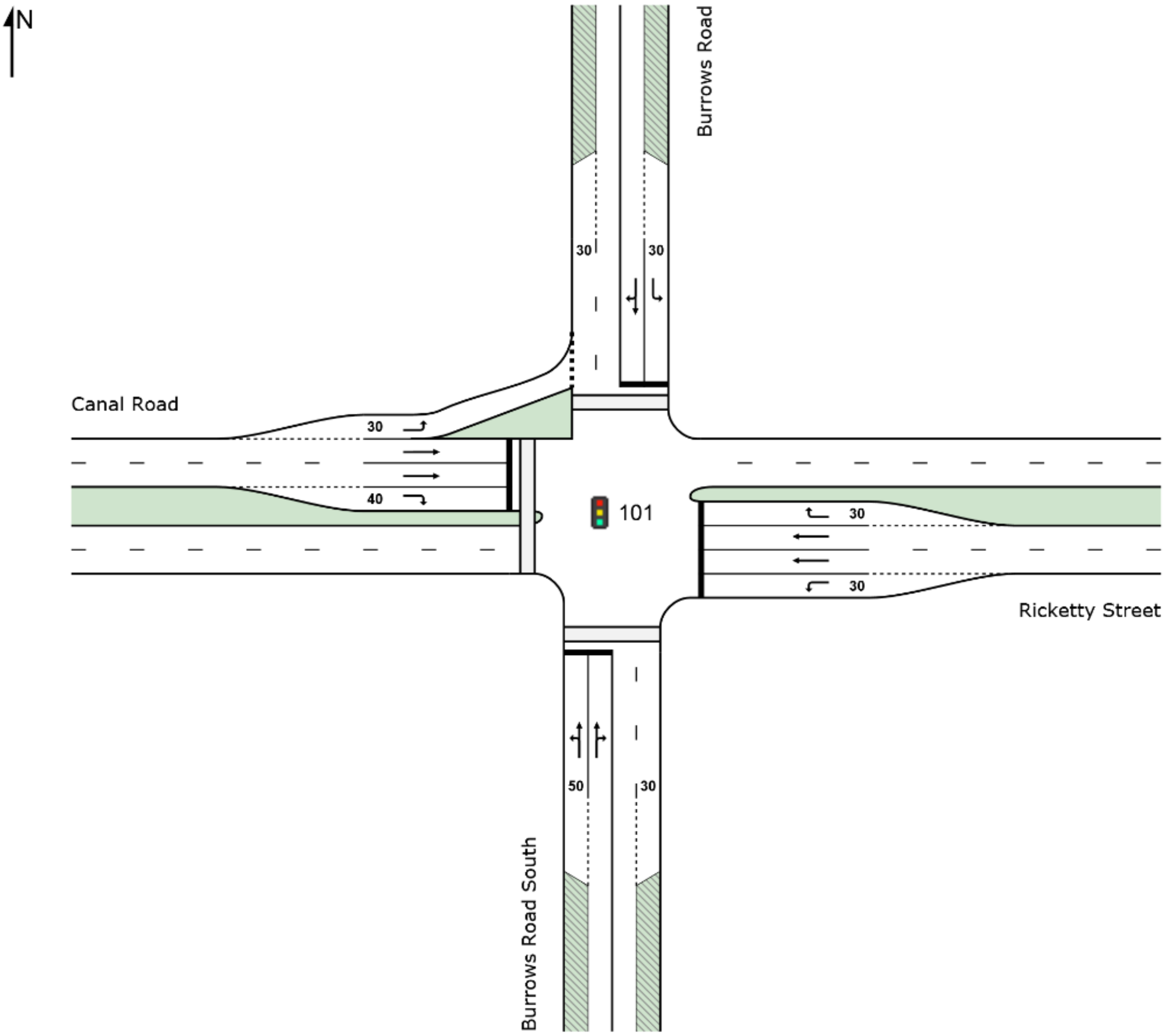
Appendix C

SIDRA intersection analysis results

SITE LAYOUT

Site: 101 [Canal Road/Burrows Road/Ricketty Street AM Peak 2017]

Four way traffic signal controlled intersection
Site Category: (None)
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 101 [Canal Road/Burrows Road/Ricketty Street AM Peak 2017]

Four way traffic signal controlled intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 130 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Burrows Road South												
1	L2	35	51.5	0.227	55.6	LOS D	3.2	32.6	0.89	0.73	0.89	30.9
2	T1	34	56.3	0.832	55.3	LOS D	3.2	32.6	0.92	0.78	1.07	30.5
3	R2	34	59.4	0.832	74.7	LOS F	3.0	31.7	1.00	0.90	1.48	26.6
Approach		102	55.7	0.832	61.8	LOS E	3.2	32.6	0.94	0.80	1.15	29.3
East: Ricketty Street												
4	L2	40	28.9	0.053	24.0	LOS B	1.3	11.3	0.55	0.68	0.55	41.6
5	T1	895	4.6	0.550	23.3	LOS B	20.4	148.5	0.72	0.63	0.72	43.4
6	R2	105	11.0	0.993	109.5	LOS F	9.0	68.6	1.00	1.10	1.79	21.2
Approach		1040	6.2	0.993	32.1	LOS C	20.4	148.5	0.74	0.68	0.82	39.2
North: Burrows Road												
7	L2	114	3.7	0.292	51.7	LOS D	6.1	43.8	0.88	0.78	0.88	31.9
8	T1	29	39.3	1.480	479.7	LOS F	17.9	170.4	1.00	1.59	3.58	6.3
9	R2	59	42.9	1.480	485.8	LOS F	17.9	170.4	1.00	1.59	3.58	6.3
Approach		202	20.3	1.480	240.8	LOS F	17.9	170.4	0.93	1.13	2.06	11.4
West: Canal Road												
10	L2	174	13.3	0.120	6.1	LOS A	0.7	5.3	0.12	0.58	0.12	53.3
11	T1	1777	2.8	1.058	126.4	LOS F	103.3	740.2	1.00	1.47	1.70	19.3
12	R2	57	9.3	0.530	73.4	LOS F	3.7	28.1	1.00	0.75	1.00	26.8
Approach		2007	3.9	1.058	114.5	LOS F	103.3	740.2	0.92	1.38	1.54	20.6
All Vehicles		3352	7.2	1.480	94.9	LOS F	103.3	740.2	0.87	1.13	1.34	23.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	11	22.2	LOS C	0.0	0.0	0.58	0.58
P3	North Full Crossing	11	22.2	LOS C	0.0	0.0	0.58	0.58
P4	West Full Crossing	21	56.4	LOS E	0.1	0.1	0.93	0.93
All Pedestrians		42	39.3	LOS D			0.76	0.76

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [Canal Road/Burrows Road/Ricketty Street AM Peak Future]

Four way traffic signal controlled intersection
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 150 seconds (Site Optimum Cycle Time - Minimum Delay)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Burrows Road South												
1	L2	49	66.0	0.270	57.4	LOS E	5.0	54.3	0.86	0.74	0.86	30.4
2	T1	42	65.0	0.990	63.9	LOS E	5.2	57.6	0.89	0.81	1.08	28.5
3	R2	46	70.5	0.990	115.0	LOS F	5.2	57.6	1.00	1.07	1.84	20.5
Approach		138	67.2	0.990	78.7	LOS F	5.2	57.6	0.92	0.87	1.26	25.7
East: Ricketty Street												
4	L2	53	46.0	0.082	30.1	LOS C	2.1	20.7	0.59	0.70	0.59	38.6
5	T1	895	4.6	0.600	30.3	LOS C	24.4	177.3	0.76	0.67	0.76	40.1
6	R2	105	11.0	1.097	184.8	LOS F	12.9	99.1	1.00	1.21	2.06	14.3
Approach		1053	7.3	1.097	45.8	LOS D	24.4	177.3	0.78	0.73	0.88	33.9
North: Burrows Road												
7	L2	114	3.7	0.236	51.5	LOS D	6.5	46.6	0.83	0.77	0.83	32.0
8	T1	38	52.8	1.923	883.7	LOS F	27.1	265.5	1.00	1.90	4.08	3.7
9	R2	59	42.9	1.923	889.7	LOS F	27.1	265.5	1.00	1.90	4.08	3.7
Approach		211	23.5	1.923	436.0	LOS F	27.1	265.5	0.91	1.29	2.32	7.1
West: Canal Road												
10	L2	174	13.3	0.120	6.2	LOS A	0.8	6.0	0.11	0.58	0.11	53.4
11	T1	1777	2.8	1.146	203.3	LOS F	135.0	967.8	1.00	1.70	1.98	13.6
12	R2	72	27.9	0.770	88.6	LOS F	5.7	49.1	1.00	0.86	1.23	24.0
Approach		2022	4.6	1.146	182.3	LOS F	135.0	967.8	0.92	1.57	1.79	14.7
All Vehicles		3423	9.1	1.923	151.8	LOS F	135.0	967.8	0.88	1.27	1.52	16.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	11	27.6	LOS C	0.0	0.0	0.61	0.61
P3	North Full Crossing	11	27.6	LOS C	0.0	0.0	0.61	0.61
P4	West Full Crossing	21	56.4	LOS E	0.1	0.1	0.87	0.87
All Pedestrians		42	42.0	LOS E			0.74	0.74

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [Canal Road/Burrows Road/Ricketty Street PM Peak 2017]

Four way traffic signal controlled intersection
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 150 seconds (Site Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Burrows Road South												
1	L2	56	22.6	0.212	59.0	LOS E	4.3	36.2	0.87	0.74	0.87	30.1
2	T1	23	22.7	0.778	58.5	LOS E	4.3	36.2	0.91	0.78	1.04	29.6
3	R2	33	32.3	0.778	74.8	LOS F	2.9	25.3	1.00	0.84	1.37	26.8
Approach		112	25.5	0.778	63.5	LOS E	4.3	36.2	0.92	0.78	1.05	29.0
East: Ricketty Street												
4	L2	34	25.0	0.051	32.9	LOS C	1.4	12.1	0.62	0.69	0.62	37.8
5	T1	1707	4.4	1.146	203.8	LOS F	125.7	913.4	1.00	1.69	1.98	13.5
6	R2	91	2.3	0.743	85.3	LOS F	7.0	49.8	1.00	0.84	1.16	24.7
Approach		1832	4.7	1.146	194.8	LOS F	125.7	913.4	0.99	1.63	1.91	14.0
North: Burrows Road												
7	L2	178	4.7	0.411	44.1	LOS D	9.4	68.6	0.78	0.77	0.78	34.2
8	T1	25	58.3	1.120	200.4	LOS F	26.1	214.7	1.00	1.37	2.09	13.4
9	R2	169	14.9	1.120	206.1	LOS F	26.1	214.7	1.00	1.37	2.09	13.3
Approach		373	13.0	1.120	128.4	LOS F	26.1	214.7	0.89	1.08	1.46	18.8
West: Canal Road												
10	L2	84	17.5	0.059	6.1	LOS A	0.3	2.4	0.10	0.57	0.10	53.3
11	T1	1001	5.0	0.756	39.9	LOS C	30.9	226.0	0.89	0.79	0.89	36.3
12	R2	51	20.8	0.781	92.1	LOS F	4.1	33.7	1.00	0.86	1.29	23.5
Approach		1136	6.7	0.781	39.8	LOS C	30.9	226.0	0.83	0.78	0.85	36.2
All Vehicles		3452	6.9	1.146	132.4	LOS F	125.7	913.4	0.93	1.26	1.49	18.6

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	11	31.4	LOS D	0.0	0.0	0.65	0.65
P3	North Full Crossing	11	34.0	LOS D	0.0	0.0	0.67	0.67
P4	West Full Crossing	21	59.9	LOS E	0.1	0.1	0.89	0.89
All Pedestrians		42	46.3	LOS E			0.78	0.78

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 101 [Canal Road/Burrows Road/Ricketty Street PM Peak Future]

Four way traffic signal controlled intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)
Variable Sequence Analysis applied. The results are given for the selected output sequence.

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Burrows Road South												
1	L2	71	38.8	0.249	54.1	LOS D	5.4	50.9	0.84	0.75	0.84	31.2
2	T1	32	43.3	0.913	59.5	LOS E	5.4	50.9	0.89	0.82	1.09	29.4
3	R2	45	51.2	0.913	92.7	LOS F	4.4	44.2	1.00	0.99	1.69	23.6
Approach		147	43.6	0.913	67.1	LOS E	5.4	50.9	0.90	0.84	1.15	28.0
East: Ricketty Street												
4	L2	46	45.5	0.090	39.1	LOS C	2.2	21.3	0.69	0.71	0.69	35.3
5	T1	1707	4.4	1.324	356.9	LOS F	162.0	1177.0	1.00	2.21	2.63	8.5
6	R2	91	2.3	0.826	89.4	LOS F	7.2	51.5	1.00	0.89	1.29	24.0
Approach		1844	5.4	1.324	335.8	LOS F	162.0	1177.0	0.99	2.11	2.51	9.0
North: Burrows Road												
7	L2	178	4.7	0.368	39.5	LOS C	8.8	64.2	0.73	0.76	0.73	35.7
8	T1	34	68.8	1.219	278.3	LOS F	32.4	273.3	1.00	1.56	2.43	10.3
9	R2	169	14.9	1.219	284.1	LOS F	32.4	273.3	1.00	1.56	2.43	10.2
Approach		381	14.9	1.219	169.4	LOS F	32.4	273.3	0.87	1.19	1.63	15.3
West: Canal Road												
10	L2	84	17.5	0.059	6.1	LOS A	0.3	2.4	0.10	0.57	0.10	53.3
11	T1	1001	5.0	0.873	56.1	LOS D	36.6	267.5	0.96	0.94	1.08	31.2
12	R2	65	38.7	1.121	205.0	LOS F	8.6	79.7	1.00	1.22	2.22	13.1
Approach		1151	7.9	1.121	60.9	LOS E	36.6	267.5	0.90	0.93	1.07	29.8
All Vehicles		3523	8.8	1.324	216.8	LOS F	162.0	1177.0	0.94	1.57	1.89	12.8

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

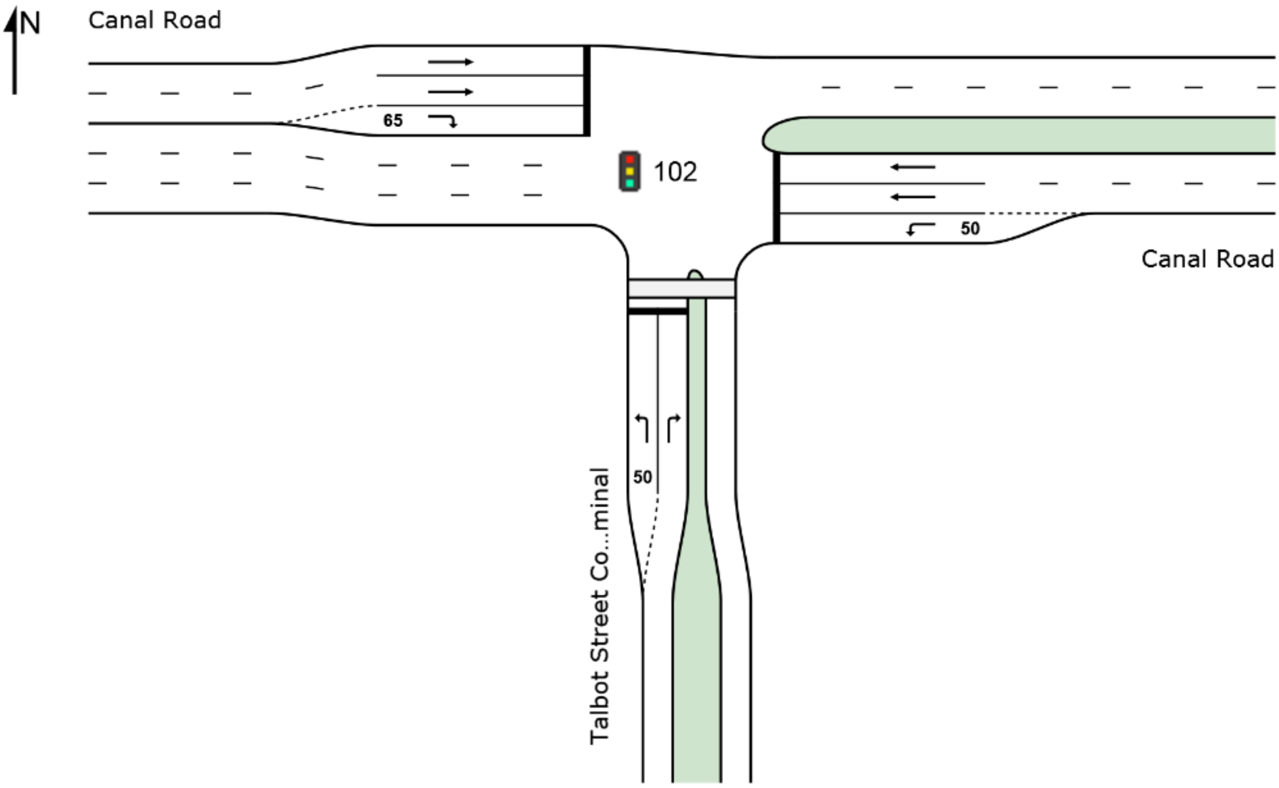
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	11	36.8	LOS D	0.0	0.0	0.70	0.70
P3	North Full Crossing	11	38.9	LOS D	0.0	0.0	0.72	0.72
P4	West Full Crossing	21	53.8	LOS E	0.1	0.1	0.85	0.85
All Pedestrians		42	45.8	LOS E			0.78	0.78

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: 102 [Canal Road/Container Terminal 2017 AM Peak]

Existing Three Way intersection
Site Category: (None)
Signals - Fixed Time Isolated



Organisation: EMM CONSULTING | Created: Wednesday, 13 June 2018 4:25:00 PM
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MOVEMENT SUMMARY

Site: 102 [Canal Road/Container Terminal 2017 AM Peak]

Existing Three Way intersection
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Talbot Street Container Terminal												
1	L2	14	92.3	0.102	71.8	LOS F	0.9	11.5	0.92	0.70	0.92	26.4
3	R2	21	95.0	0.475	91.1	LOS F	1.7	21.3	1.00	0.73	1.02	23.2
Approach		35	93.9	0.475	83.5	LOS F	1.7	21.3	0.97	0.72	0.98	24.4
East: Canal Road												
4	L2	9	77.8	0.009	7.6	LOS A	0.1	0.9	0.13	0.59	0.13	49.7
5	T1	979	7.8	0.330	4.3	LOS A	9.4	70.6	0.29	0.26	0.29	56.1
Approach		988	8.5	0.330	4.3	LOS A	9.4	70.6	0.29	0.27	0.29	56.0
West: Canal Road												
11	T1	2025	2.8	0.606	2.4	LOS A	18.6	133.5	0.28	0.26	0.28	57.7
12	R2	17	12.5	0.247	86.0	LOS F	1.3	9.9	1.00	0.70	1.00	24.6
Approach		2042	2.8	0.606	3.1	LOS A	18.6	133.5	0.28	0.27	0.28	57.1
All Vehicles		3065	5.7	0.606	4.4	LOS A	18.6	133.5	0.29	0.27	0.29	55.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	11	5.1	LOS A	0.0	0.0	0.26	0.26
All Pedestrians		11	5.1	LOS A			0.26	0.26

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 102 [Canal Road/Container Terminal AM Peak Future]

Existing Three Way intersection
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Talbot Street Container Terminal												
1	L2	14	92.3	0.102	71.8	LOS F	0.9	11.5	0.92	0.70	0.92	26.4
3	R2	21	95.0	0.475	91.1	LOS F	1.7	21.3	1.00	0.73	1.02	23.2
Approach		35	93.9	0.475	83.5	LOS F	1.7	21.3	0.97	0.72	0.98	24.4
East: Canal Road												
4	L2	9	77.8	0.009	7.6	LOS A	0.1	0.9	0.13	0.59	0.13	49.7
5	T1	994	9.2	0.338	4.3	LOS A	9.7	73.0	0.30	0.27	0.30	56.0
Approach		1003	9.9	0.338	4.3	LOS A	9.7	73.0	0.29	0.27	0.29	56.0
West: Canal Road												
11	T1	2040	3.5	0.613	2.4	LOS A	19.0	137.1	0.28	0.27	0.28	57.7
12	R2	17	12.5	0.247	86.0	LOS F	1.3	9.9	1.00	0.70	1.00	24.6
Approach		2057	3.5	0.613	3.1	LOS A	19.0	137.1	0.29	0.27	0.29	57.1
All Vehicles		3095	6.6	0.613	4.4	LOS A	19.0	137.1	0.30	0.28	0.30	55.9

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	11	5.1	LOS A	0.0	0.0	0.26	0.26
All Pedestrians		11	5.1	LOS A			0.26	0.26

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 102 [Canal Road/Container Terminal 2017 PM Peak]

Existing Three Way intersection
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Talbot Street Container Terminal												
1	L2	16	73.3	0.092	68.0	LOS E	1.0	11.7	0.90	0.71	0.90	27.3
3	R2	40	94.7	0.601	87.9	LOS F	3.1	39.7	1.00	0.79	1.09	23.7
Approach		56	88.7	0.601	82.3	LOS F	3.1	39.7	0.97	0.77	1.04	24.6
East: Canal Road												
4	L2	37	97.1	0.038	7.8	LOS A	0.3	4.2	0.13	0.59	0.13	49.0
5	T1	1896	4.1	0.653	7.6	LOS A	30.9	223.8	0.48	0.45	0.48	53.3
Approach		1933	5.9	0.653	7.6	LOS A	30.9	223.8	0.47	0.45	0.47	53.2
West: Canal Road												
11	T1	1171	3.0	0.356	2.2	LOS A	8.4	60.1	0.22	0.20	0.22	57.9
12	R2	2	50.0	0.038	85.0	LOS F	0.2	1.6	0.98	0.62	0.98	24.5
Approach		1173	3.1	0.356	2.4	LOS A	8.4	60.1	0.22	0.20	0.22	57.8
All Vehicles		3161	6.3	0.653	7.0	LOS A	30.9	223.8	0.39	0.36	0.39	53.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	5	5.9	LOS A	0.0	0.0	0.28	0.28
All Pedestrians		5	5.9	LOS A			0.28	0.28

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 102 [Canal Road/Container Terminal PM Peak Future]

Existing Three Way intersection
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site User-Given Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Talbot Street Container Terminal												
1	L2	16	73.3	0.092	68.0	LOS E	1.0	11.7	0.90	0.71	0.90	27.3
3	R2	40	94.7	0.601	87.9	LOS F	3.1	39.7	1.00	0.79	1.09	23.7
Approach		56	88.7	0.601	82.3	LOS F	3.1	39.7	0.97	0.77	1.04	24.6
East: Canal Road												
4	L2	37	97.1	0.038	7.8	LOS A	0.3	4.2	0.13	0.59	0.13	49.0
5	T1	1911	4.8	0.661	7.7	LOS A	31.5	230.0	0.49	0.46	0.49	53.3
Approach		1947	6.6	0.661	7.7	LOS A	31.5	230.0	0.48	0.46	0.48	53.2
West: Canal Road												
11	T1	1185	4.2	0.363	2.2	LOS A	8.6	62.0	0.22	0.20	0.22	57.9
12	R2	2	50.0	0.038	85.0	LOS F	0.2	1.6	0.98	0.62	0.98	24.5
Approach		1187	4.3	0.363	2.4	LOS A	8.6	62.0	0.22	0.20	0.22	57.7
All Vehicles		3191	7.2	0.661	7.0	LOS A	31.5	230.0	0.39	0.37	0.39	53.7

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

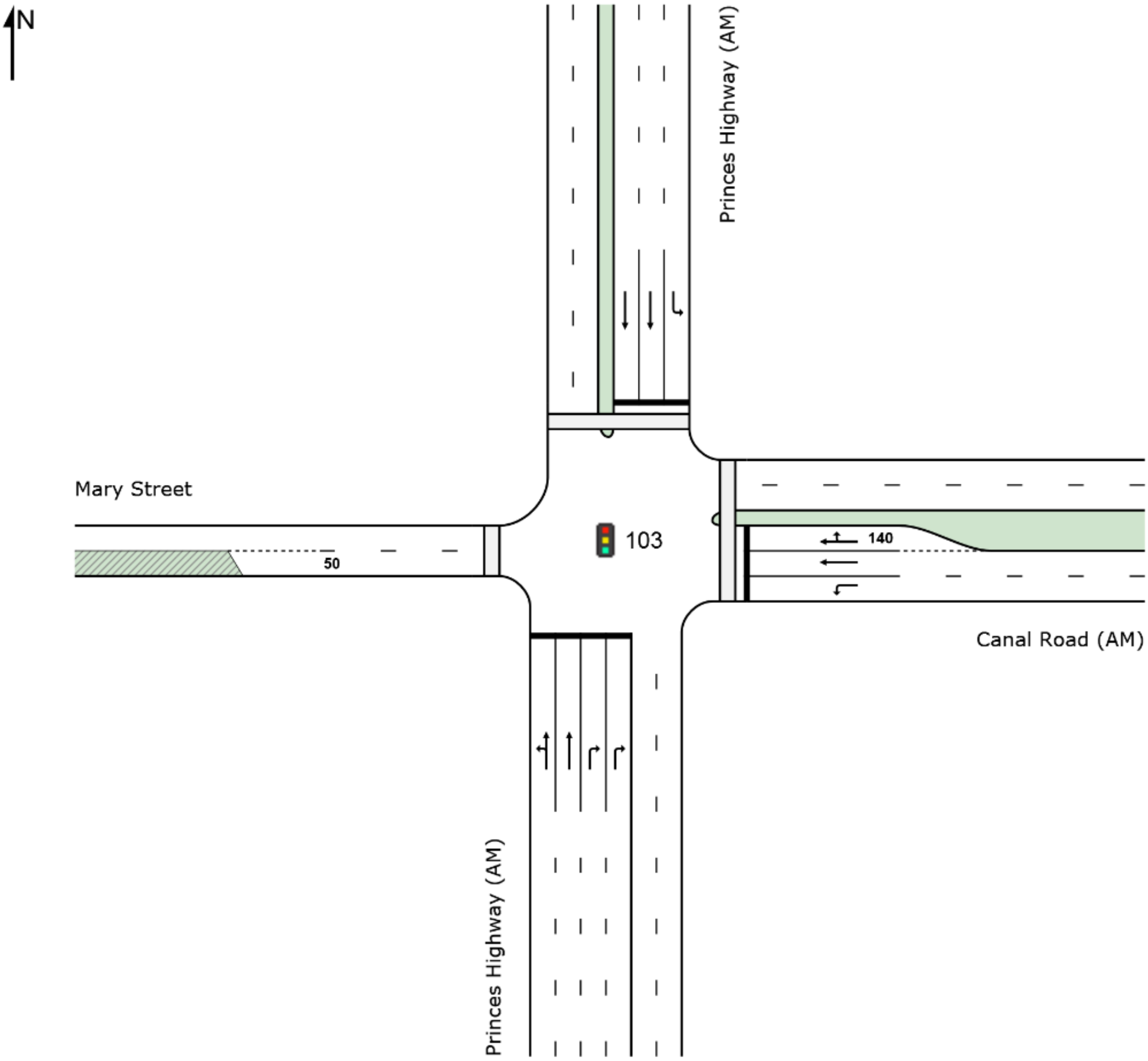
Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P1	South Full Crossing	5	5.9	LOS A	0.0	0.0	0.28	0.28
All Pedestrians		5	5.9	LOS A			0.28	0.28

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

SITE LAYOUT

Site: 103 [Princes Highway/Canal Road 2017 AM Peak]

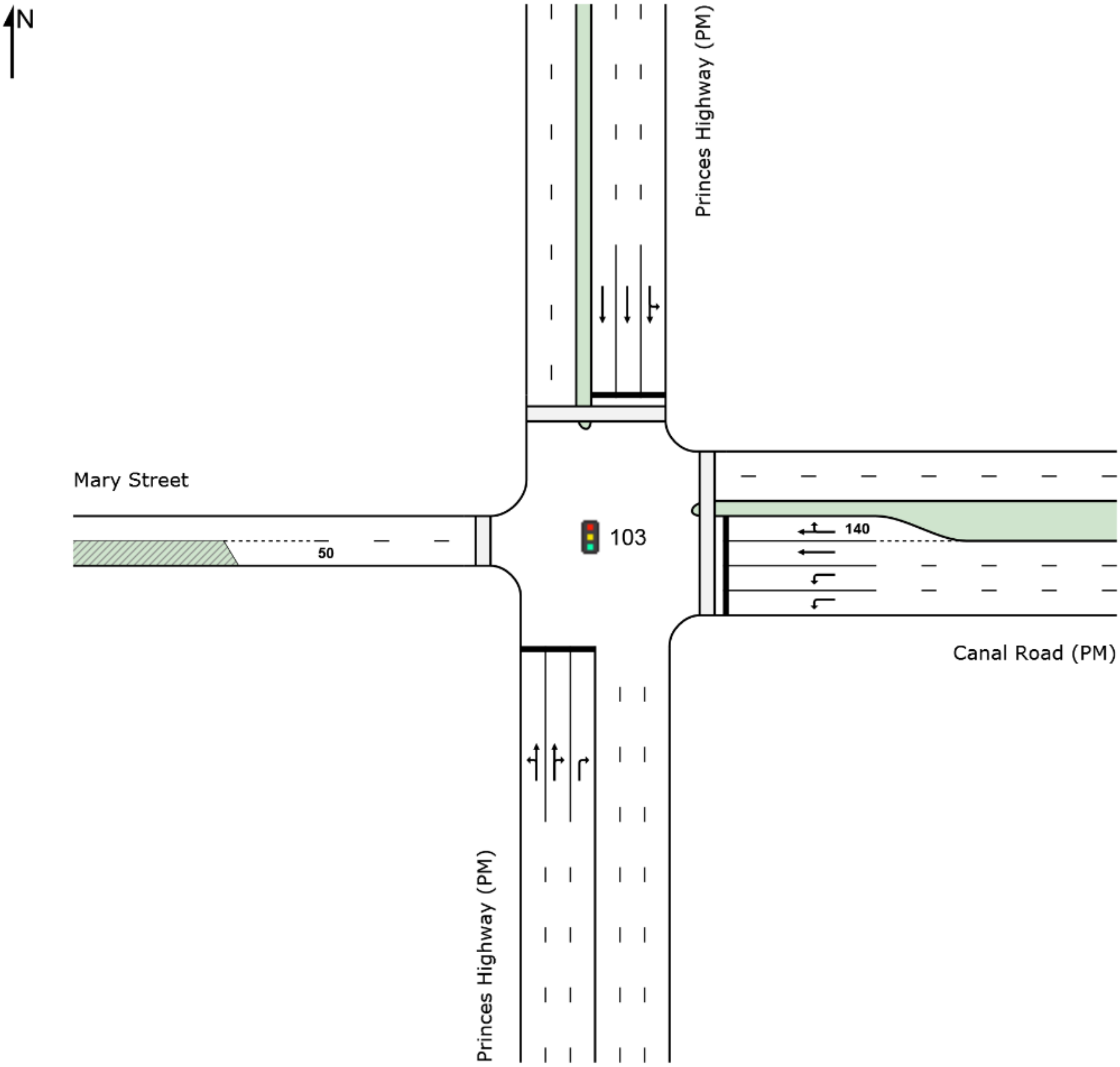
Existing Four Way Intersection with Tidal Flow
Site Category: (None)
Signals - Fixed Time Isolated



SITE LAYOUT

Site: 103 [Princes Highway/Canal Road 2017 PM Peak]

Existing Four Way Intersection with Tidal Flow
Site Category: (None)
Signals - Fixed Time Isolated



MOVEMENT SUMMARY

Site: 103 [Princes Highway/Canal Road 2017 AM Peak]

Existing Four Way Intersection with Tidal Flow
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Princes Highway (AM)												
1	L2	91	0.0	0.545	14.8	LOS B	24.2	172.1	0.48	0.48	0.48	50.4
2	T1	1441	2.3	0.545	9.3	LOS A	24.3	173.2	0.48	0.46	0.48	51.9
3	R2	1879	2.6	0.931	54.9	LOS D	74.2	530.8	1.00	0.99	1.12	31.2
Approach		3411	2.4	0.931	34.5	LOS C	74.2	530.8	0.77	0.75	0.84	38.0
East: Canal Road (AM)												
4	L2	506	16.2	0.390	11.2	LOS A	11.4	91.0	0.34	0.69	0.34	49.1
5	T1	374	0.0	0.927	75.3	LOS F	28.1	199.8	0.97	0.97	1.18	26.8
6	R2	75	8.5	0.927	89.6	LOS F	28.1	199.8	1.00	1.08	1.31	24.8
Approach		955	9.3	0.927	42.4	LOS C	28.1	199.8	0.64	0.83	0.75	34.9
North: Princes Highway (AM)												
7	L2	163	5.2	0.651	72.7	LOS F	11.5	84.4	1.00	0.82	1.01	27.0
8	T1	484	7.2	0.928	88.3	LOS F	20.7	154.2	1.00	1.07	1.37	24.6
Approach		647	6.7	0.928	84.3	LOS F	20.7	154.2	1.00	1.01	1.27	25.1
All Vehicles		5013	4.3	0.931	42.5	LOS C	74.2	530.8	0.77	0.80	0.88	35.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P2	East Full Crossing	15	69.2	LOS F	0.1	0.1	0.96	0.96
P3	North Full Crossing	21	62.6	LOS F	0.1	0.1	0.91	0.91
P4	West Full Crossing	6	59.9	LOS E	0.0	0.0	0.89	0.89
All Pedestrians		42	64.5	LOS F			0.93	0.93

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 103 [Princes Highway/Canal Road AM Peak Future]

Existing Four Way Intersection with Tidal Flow
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Princes Highway (AM)												
1	L2	91	0.0	0.550	15.3	LOS B	24.8	176.4	0.49	0.49	0.49	50.1
2	T1	1441	2.3	0.550	9.8	LOS A	24.9	177.5	0.49	0.47	0.49	51.5
3	R2	1886	3.0	0.949	62.9	LOS E	79.7	572.2	1.00	1.01	1.17	29.2
Approach		3418	2.6	0.949	39.2	LOS C	79.7	572.2	0.77	0.77	0.87	36.2
East: Canal Road (AM)												
4	L2	514	17.4	0.399	11.3	LOS A	11.7	94.1	0.35	0.69	0.35	49.0
5	T1	374	0.0	0.921	73.6	LOS F	28.2	204.0	0.97	0.95	1.17	27.1
6	R2	82	16.7	0.921	87.9	LOS F	28.2	204.0	1.00	1.06	1.29	25.0
Approach		969	10.6	0.921	41.8	LOS C	28.2	204.0	0.64	0.82	0.74	35.2
North: Princes Highway (AM)												
7	L2	171	9.3	0.699	74.2	LOS F	12.3	92.9	1.00	0.84	1.04	26.6
8	T1	484	7.2	0.928	88.3	LOS F	20.7	154.2	1.00	1.07	1.37	24.6
Approach		655	7.7	0.928	84.6	LOS F	20.7	154.2	1.00	1.01	1.28	25.1
All Vehicles		5042	4.8	0.949	45.6	LOS D	79.7	572.2	0.78	0.81	0.90	34.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P2	East Full Crossing	15	69.2	LOS F	0.1	0.1	0.96	0.96
P3	North Full Crossing	21	61.7	LOS F	0.1	0.1	0.91	0.91
P4	West Full Crossing	6	59.9	LOS E	0.0	0.0	0.89	0.89
All Pedestrians		42	64.0	LOS F			0.92	0.92

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 103 [Princes Highway/Canal Road 2017 PM Peak]

Existing Four Way Intersection with Tidal Flow
Site Category: (None)
Signals - Fixed Time Isolated   Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Princes Highway (PM)												
1	L2	109	0.0	0.775	19.5	LOS B	48.5	343.5	0.69	0.67	0.69	47.4
2	T1	964	1.4	0.775	14.0	LOS A	48.5	343.5	0.69	0.67	0.69	48.5
3	R2	974	3.4	0.915	77.5	LOS F	40.3	290.5	1.00	0.98	1.21	26.3
Approach		2047	2.3	0.915	44.5	LOS D	48.5	343.5	0.84	0.82	0.94	34.6
East: Canal Road (PM)												
4	L2	1183	4.1	0.615	31.3	LOS C	29.5	213.8	0.75	0.82	0.75	38.9
5	T1	379	0.0	0.916	71.7	LOS F	29.5	206.3	0.97	0.94	1.15	27.4
6	R2	100	0.0	0.916	85.6	LOS F	29.5	206.3	1.00	1.05	1.27	25.5
Approach		1662	2.9	0.916	43.8	LOS D	29.5	213.8	0.81	0.86	0.87	34.5
North: Princes Highway (PM)												
7	L2	197	1.1	0.907	64.8	LOS E	52.5	371.3	1.00	1.00	1.14	29.7
8	T1	1828	1.3	0.907	59.1	LOS E	53.1	375.8	1.00	1.01	1.13	30.5
Approach		2025	1.2	0.907	59.6	LOS E	53.1	375.8	1.00	1.01	1.13	30.4
All Vehicles		5735	2.1	0.916	49.6	LOS D	53.1	375.8	0.89	0.90	0.99	33.0

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P2	East Full Crossing	22	39.6	LOS D	0.1	0.1	0.73	0.73
P3	North Full Crossing	20	60.8	LOS F	0.1	0.1	0.90	0.90
P4	West Full Crossing	5	31.4	LOS D	0.0	0.0	0.65	0.65
All Pedestrians		47	47.7	LOS E			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

MOVEMENT SUMMARY

Site: 103 [Princes Highway/Canal Road PM Peak Future]

Existing Four Way Intersection with Tidal Flow
Site Category: (None)
Signals - Fixed Time Isolated Cycle Time = 150 seconds (Site Practical Cycle Time)

Movement Performance - Vehicles

Mov ID	Turn	Demand Flows Total veh/h	Demand Flows HV %	Deg. Satn v/c	Average Delay sec	Level of Service	95% Back of Queue Vehicles veh	95% Back of Queue Distance m	Prop. Queued	Effective Stop Rate	Aver. No. Cycles	Average Speed km/h
South: Princes Highway (PM)												
1	L2	109	0.0	0.782	20.2	LOS B	49.7	351.8	0.71	0.69	0.71	47.0
2	T1	964	1.4	0.782	14.6	LOS B	49.7	351.8	0.71	0.69	0.71	48.1
3	R2	981	4.1	0.927	80.9	LOS F	41.7	302.0	1.00	1.00	1.24	25.7
Approach		2055	2.6	0.927	46.6	LOS D	49.7	351.8	0.85	0.83	0.96	33.9
East: Canal Road (PM)												
4	L2	1191	4.7	0.613	30.7	LOS C	29.4	214.1	0.74	0.82	0.74	39.1
5	T1	379	0.0	0.911	70.2	LOS E	29.6	210.6	0.96	0.93	1.13	27.8
6	R2	107	6.9	0.911	84.1	LOS F	29.6	210.6	1.00	1.04	1.26	25.7
Approach		1677	3.8	0.911	43.0	LOS D	29.6	214.1	0.81	0.86	0.86	34.7
North: Princes Highway (PM)												
7	L2	204	4.6	0.929	72.0	LOS F	55.5	396.4	1.00	1.03	1.19	28.0
8	T1	1828	1.3	0.929	66.0	LOS E	56.6	400.4	1.00	1.05	1.18	28.8
Approach		2033	1.6	0.929	66.6	LOS E	56.6	400.4	1.00	1.04	1.18	28.7
All Vehicles		5764	2.6	0.929	52.6	LOS D	56.6	400.4	0.89	0.92	1.01	32.1

Site Level of Service (LOS) Method: Delay (RTA NSW). Site LOS Method is specified in the Parameter Settings dialog (Site tab).
Vehicle movement LOS values are based on average delay per movement.
Intersection and Approach LOS values are based on average delay for all vehicle movements.
SIDRA Standard Delay Model is used. Control Delay includes Geometric Delay.
Gap-Acceptance Capacity: SIDRA Standard (Akçelik M3D).
HV (%) values are calculated for All Movement Classes of All Heavy Vehicle Model Designation.

Movement Performance - Pedestrians

Mov ID	Description	Demand Flow ped/h	Average Delay sec	Level of Service	Average Back of Queue Pedestrian ped	Average Back of Queue Distance m	Prop. Queued	Effective Stop Rate
P2	East Full Crossing	22	40.4	LOS E	0.1	0.1	0.73	0.73
P3	North Full Crossing	20	59.9	LOS E	0.1	0.1	0.89	0.89
P4	West Full Crossing	5	32.0	LOS D	0.0	0.0	0.65	0.65
All Pedestrians		47	47.7	LOS E			0.79	0.79

Level of Service (LOS) Method: SIDRA Pedestrian LOS Method (Based on Average Delay)
Pedestrian movement LOS values are based on average delay per pedestrian movement.
Intersection LOS value for Pedestrians is based on average delay for all pedestrian movements.

Appendix D

Future locality traffic changes from the Westconnex project

Source: WRTM v2.3, 2017

Figure 8-1 Difference in AWT between 2023 'do minimum' and base year scenarios

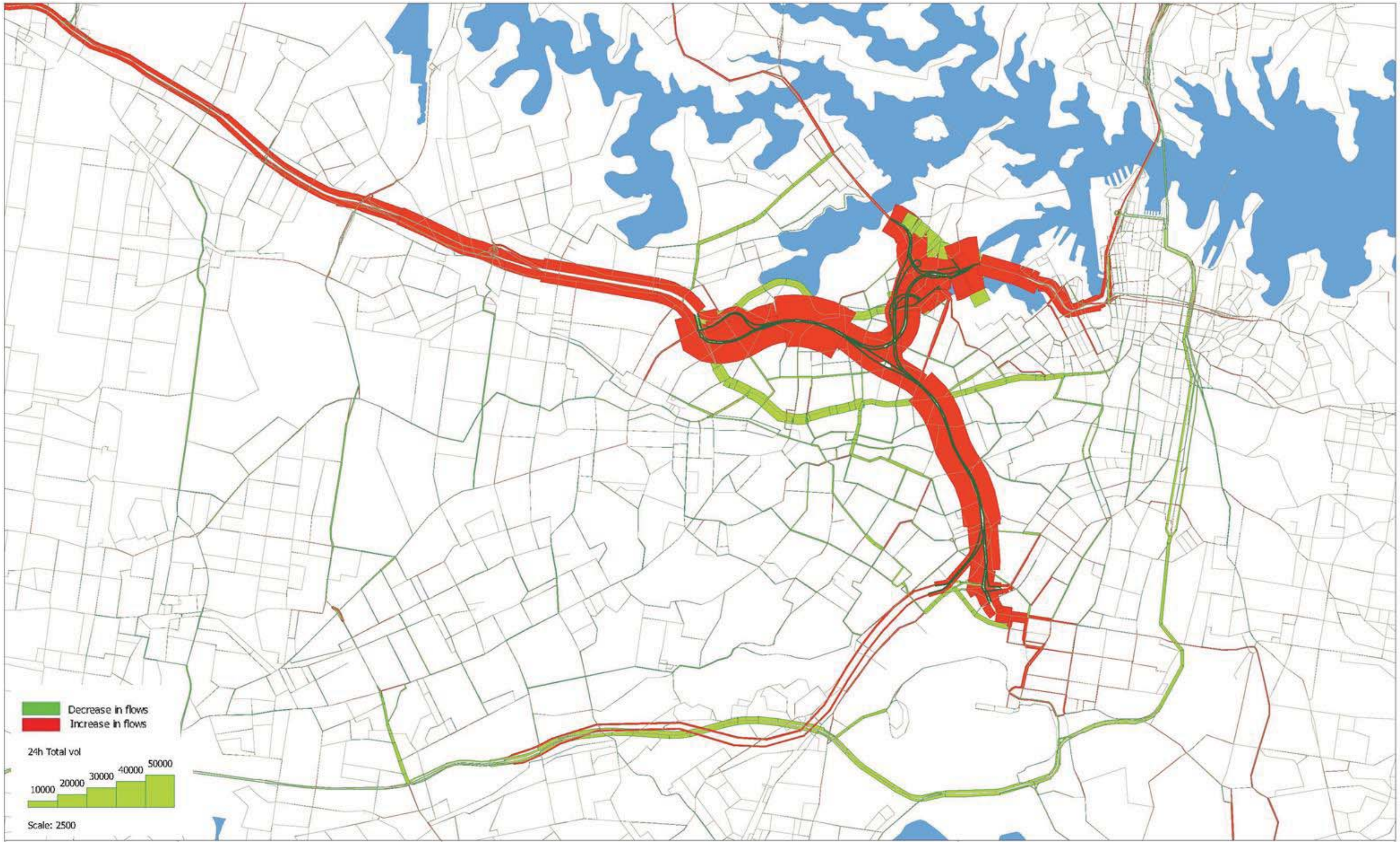


Figure 10-2 Difference in AWT between 2033 'with project' and 'without project' scenarios

Source: WRTM v2.3, 2017

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Appendix G

Surface water assessment

Surface water assessment

Modification 11 | Boral St Peters

Prepared for Boral Resources (NSW) Pty Ltd | 28 June 2018

Surface water assessment

Modification 11 | Boral St Peters

Prepared for Boral Resources (NSW) Pty Ltd | 28 June 2018

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Surface water assessment

Final

Report J16208RP1 | Prepared for Boral Resources (NSW) Pty Ltd | 28 June 2018

Prepared by	**Chris Kuczera and Patrick Finnerty**	Approved by	**Brett McLennan**
Position	Associate Water Resources Engineer	Position	Director
Signature		Signature	
Date	28 June 2018	Date	28 June 2018

This report has been prepared in accordance with the brief provided by the client and has relied upon the information collected at the time and under the conditions specified in the report. All findings, conclusions or recommendations contained in the report are based on the aforementioned circumstances. The report is for the use of the client and no responsibility will be taken for its use by other parties. The client may, at its discretion, use the report to inform regulators and the public.

Document Control

Version	Date	Prepared by	Reviewed by
V01	25.06.18	Chris Kuczera	Mike Shelly
V02	27.06.18	Chris Kuczera	Mike Shelly & Boral

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Appendices

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Photographs

1 Introduction

Boral Resources New South Wales (NSW) Pty Ltd (Boral) owns and operates a concrete batching plant (concrete plant) and construction materials handling facility (the handling facility) at 25 Burrows Road South, St Peters (the site).

A modification to the site's development consent (Modification 11) is proposed to:

- increase concrete production; and
- increase the throughput of the handling facility.

The approved production limit for concrete at the site is 280,000 cubic metres (m^3) per annum. A concrete production limit of 750,000 m^3 per annum is being sought for the site, which is an increase of 470,000 m^3 per annum. To achieve this increase, the existing concrete plant will be upgraded to include an additional two alleys, with an additional six silos for cement storage and widening of existing raw material storage.

It is proposed to increase the throughput of the handling facility to 1 million tonnes per annum (tpa), which is an increase of 240,000 tpa over the existing limit of 760,000 tpa. Some changes to the layout and function of the handling facility are proposed to facilitate the increase in throughput.

In addition to the above, it is proposed to construct a new aggregate reclaiming conveyor, upgrade the site's surface water management system, and install a second weighbridge.

This surface water assessment forms part of the Environmental Assessment (EA) that has been prepared for the project.

1.1 Report Overview

This report documents the Surface Water Assessment that has been prepared for the project. The report is structured as follows:

- Section 2 describes the existing concrete plant and handling facility and proposed modifications.
- Section 3 describes assessment requirements and provides an overview of relevant industry and government guidelines.
- Section 4 reviews the existing surface water environment at the site.
- Section 5 describes the proposed water management system and supporting water balance and water quality modelling.
- Section 6 addresses water licensing requirements.
- Section 7 details a surface water monitoring plan for the project.
- Section 8 provides a summary of this assessment.

1.2 Terminology

The following terminology is used to describe the existing and proposed water management system in this report:

- Stormwater harvesting area – refers to the contributing catchment to the stormwater harvesting system.
- Cementitious areas – refers to areas of the concrete plant where stormwater and yard cleaning/hosing runoff may become contaminated with admixtures or cementitious materials, which can result in high pH levels. Cementitious areas normally include cement and silo filling areas, loading bays, slump stands, truck washout areas and wastewater collection areas (CCAA, 2013).
- Stormwater – refers to runoff from all areas of the site that are not cementitious areas. Runoff from the stormwater areas may be laden with suspended sediments such as sand and aggregate materials that are used to produce concrete (CCAA, 2013).
- Process water - refers to water that is used by or produced by the concrete batching process.
- Potable or mains water – refers to water suitable for drinking.
- Return concrete – refers to unsold concrete that is returned to the concrete plant. Return concrete is discharged from the concrete agitators into a return concrete management system.
- Washout water – refers to water produced from washing out concrete agitators.
- Wastewater – refers to wastewater generated from the onsite amenities such as toilets and showers. Wastewater contains human waste and associated pathogens.

2 Existing and proposed facilities

This section describes the existing facility and proposed modifications.

2.1 Existing facility

The site has two uses; a concrete plant and a construction materials handling facility. Both uses predominantly receive bulk construction materials (aggregate, sand and cement) from Boral's Peppertree and Dunmore quarries, and Berrima Cement Works.

The majority of aggregates and sand is received by rail. Some bulk construction materials as well as fly ash, and special admixtures used in the concrete plant are delivered to the site by road.

All materials received are either used to make concrete at the concrete plant, or stored at the materials handling facility for subsequent distribution to other concrete plants and asphalt plants within the Sydney metropolitan area. Concrete from the concrete plant is despatched by road in concrete agitators. All construction materials are despatched from the site by road in trucks.

The existing site layout is shown in Figure 2.1. Refer to Chapter 2 of the EA for a detailed description of the existing concrete plant and materials handling facility.

2.2 Proposed modifications

2.2.1 Overview

A modification to the site's development consent (Modification 11) is proposed to:

- increase concrete production; and
- increase the throughput of the handling facility.

A concrete production limit of 750,000 m^3 per annum is being sought for the site, which is an increase of 470,000 m^3 per annum over the existing limit of 280,000 m^3. To achieve this increase, the existing concrete plant will be upgraded to include an additional two alleys, with an additional six silos for cement storage and widening of existing raw material storage.

It is proposed to increase the throughput of the handling facility to 1 million tpa, which is an increase of 240,000 tpa over the existing limit of 760,000 tpa. Some changes to the layout and function of the handling facility are proposed to facilitate the increase in throughput.

In addition to the above, it is proposed to construct a new concrete reclaiming machine, upgrade the site's surface water management system, and install a second weighbridge.

Details of the proposed modification are provided below.

Source: EMM (2017); DFSI (2017); LPI (2015); GA (2015)

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KEY

Site location

Concrete batching plant feature

Handling facility feature

Existing site layout

Environmental impact statement

Modification 11

Boral St Peters

Figure 2.1

2.2.2 Increased throughput of the materials handling facility

The layout of the handling facility will be modified to facilitate the construction of the concrete plant upgrades. This will include:

- a new dump station and conveyor that leads up to the existing elevated storage bins;
- new aggregate storage walls made of concrete to the north of the materials handling facility;
- new open aggregate storage bins to the south of the materials handling facility, these will be filled by trucks delivering aggregates and sand to the site;
- new larger open aggregate storage bins on the northern side of the materials handling facility, that will be filled via a new overhead conveyor with a tripper car. This conveyor will be connected to the existing conveyor from the materials handling facility train unloading area and will eliminate the need for the larger bins to be filled by front-end loaders and trucks, as currently occurs;
- new second weighbridge; and
- future tipper and drive over dump station.

The throughput of the handling facility will be increased from 760,000 tpa to 1 million tpa.

Figure 2.2 shows the proposed site layout and components associated with the materials handling facility.

2.2.3 Increase concrete production

To achieve a production limit of 750,000 m^3 per annum, it is proposed to widen the existing aggregate storage bins and install new silos and load bays around the existing concrete plant to increase the existing concrete plant's production capacity.

The operation would involve the same process as the existing concrete plant. That is, it would involve the dry and wet batching of aggregates, sand, cement, fly ash and admixtures with water. To increase the concrete production limit to 750,000 m^3, the proposed modification includes the following components:

- Aggregates, sand and cement will continue to be received at the site (primarily by rail) and stored at the existing elevated concrete plant aggregate storage bins, the proposed modification includes widening the aggregate storage bins at the existing location.
- Cement will be transferred pneumatically from the train to the elevated silos located above the batching plant.
- Aggregates, sand and cement will be transferred to the aggregate storage bins via a new aggregate incline conveyor from the materials handling facility's training unloading area (the existing conveyor becomes redundant and will be removed).
- Aggregates and sand, would then be dispensed via two new conveyors to new additional load bays that will be located directly north and south of the existing concrete batching plant.
- Fly ash would be received via truck and stored in new and existing silos at the existing concrete plant. These would be gravity dispensed or blown into the concrete plant below.

- Admixtures would continue to be delivered by road tanker and stored in tanks prior to discharge as required by the batching plant;

- Similar to the current operations, the concrete agitators are filled with dry materials and water at the load bay and mixed. The agitators then proceed to the slump stands where an additional two double position slump stands will be built; and

- A new concrete reclaimer with dewatering plate-press to substantially improve the management of returned/waste concrete and the cement slurry water generated through cleaning agitator barrels.

Figure 2.2 shows the proposed site layout and components associated with the concrete plant.

2.2.4 Office, amenities and car park

There are no proposed changes to the existing office and amenity facilities on the site as part of this modification.

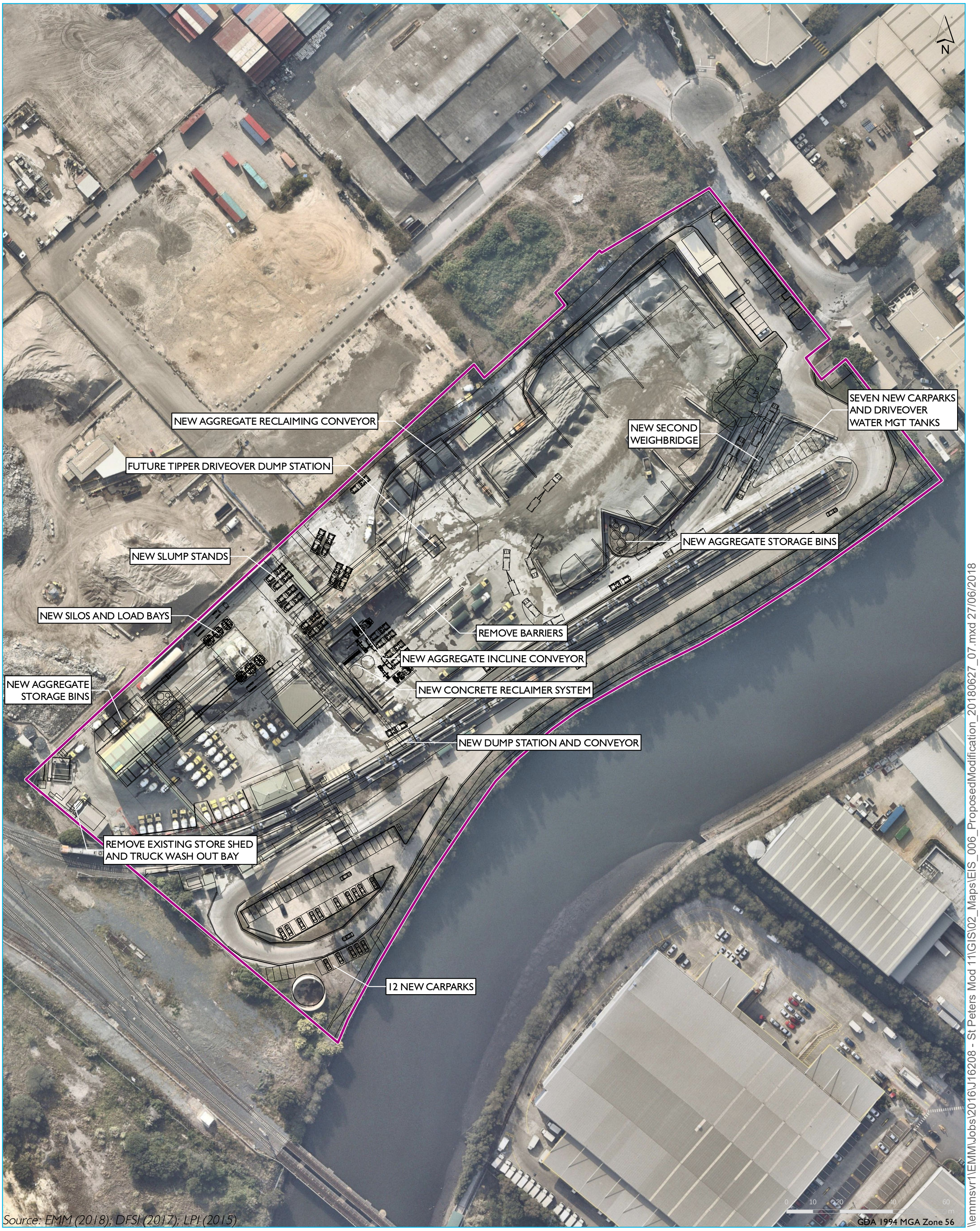
The proposed modification includes 19 new car park spaces, comprising:

- seven new car parks in the south-east corner of the site.

- 12 new car parks south of the existing 40 car parks in the south-west corner of the site.

2.2.5 Construction of the proposed modification

Overall the construction period will be approximately nine months, with works staggered in stages to reduce overall disruption to production.



KEY

—— Proposed modification

▭ Site location

Proposed modification

Environmental assessment

Modification 11

Boral St Peters

Figure 2.2

3 Assessment Framework

This surface water assessment has been prepared in accordance with the Secretary's Environmental Assessment Requirements (SEARs) that were issued on 21 December 2017, as well as relevant agency assessment requirements, guidelines and polices. This section provides a summary of relevant assessment requirements, guidelines, plans and policies that have been considered in this assessment.

3.1 Assessment requirements

3.1.1 SEARs

Table 3.1 lists the SEARs that are relevant to this surface water assessment and provides a reference to relevant sections of this report, or the EA.

Table 3.1 Assessment requirements

Assessment Requirement	Relevant Report Section
An assessment of potential surface water, flooding and groundwater impacts, including impacts on nearby waterbodies (including the Alexandra Canal), surrounding properties, waterfront land (as defined under the Water Management Act 2000) and the Botany Sands groundwater source.	Sections 5 Section 10.1 of the EA
Details of the surface water and stormwater management system(s) including on-site detention systems and measures to treat, reuse or dispose of water.	Section 5
A detailed site water balance.	Section 5.3
Details of proposed erosion and sediment controls during construction.	Section 5.5 Section 10.1 of the EA
Details of proposed mitigation, management and monitoring measures.	Section 8

3.1.2 Agency Assessment Requirements

A number of agency submissions were made to DP&E. Submissions from the Inner West Council (Council), NSW Environment Protection Authority (EPA) and the Department of Industries – Water (DoI- Water) are relevant to this water assessment. Table 3.2 summarises relevant agency assessment requirements and provides a section reference to relevant sections of this report.

Table 3.2 Agency assessment requirements

Agency Assessment Requirements	Relevant Report Section
Inner West Council (paraphrased)	
The water assessment should reference information on Alexandra Canal flood characteristics that is documented in the Alexandra Canal Flood Study (WMAwater, 2017).	Section 4.3
The water assessment should provide information on the existing water management system and operational protocols.	Section 5
The water assessment should provide information on stormwater harvesting potential and potable water use profiles.	Section 5
The water assessment should address the Botany Bay Water Quality Improvement Criteria.	Section 5.4

Table 3.2 Agency assessment requirements

Agency Assessment Requirements	Relevant Report Section
DoI - Water	
Assessment of potential impacts to waterfront land as defined under the Water Management Act 2000 (WMA). The assessment should demonstrate consistency with the provisions of the EMA, the Water Management (General Regulation 2011 and DPI Water's Guidelines for Controlled Activities on Waterfront Land (2012).	Section 6
Assessment of impacts on groundwater sources (both quality and quantity) as well as measures to reduce and mitigate these potential impacts. The site is located within the Botany Sand groundwater source and the hydrogeological settings to be assessed as part of the EA.	Section 10.1 of the EA
Assessment of any volumetric licensing requirements, identification of an adequate and secure water supply for the life of the project, and confirmation that water can be sourced from an appropriately authorised and reliable supply. This is to include an assessment of the current water market where water entitlement is required to be purchased.	Section 6
EPA	
A description of the water demands and a breakdown of water supplies for the construction and operational phase.	Section 5
A description of the measures to minimise water use for the construction and operational phase.	Section 5
A description of the construction erosion and sediment controls.	Section 5.5 Section 10.1 of the EA
A description of the surface and stormwater management systems measures to treat or reuse water for the construction and operational phase.	Section 5 Section 10.1 of the EA
An assessment of potential surface water impacts associated with the development.	Section 5
Details of impact mitigation, management and monitoring measures.	Section 8

3.2 Relevant plans and guidelines

There are a number of legislative and guidance documents for water resource management and assessment in NSW. The following policies, plans and guidelines have been considered in this assessment.

3.2.1 Water Plans and Statutory Provisions

i Water Sharing Plan for the Greater Metropolitan Region Unregulated Water Sources 2011

Water Access Licences (WALs) in the St Peters area are administered by the Water Sharing Plan for the Greater Metropolitan Unregulated Water Sources 2011. The licensing provisions of the Water Management Act 2000 are also applicable to the plan area. The Water Sharing Plan is administered by DoI-Water.

ii Protection of the Environment Operation Act 1997

The Protection of the Environment Operations (POEO) Act 1997 establishes the NSW environmental regulatory framework and includes licensing requirements for certain activities. In 2009, Schedule 1 of the POEO Act 1997 was modified to remove the licence requirements for concrete batching works.

3.2.2 Relevant Plans

i Botany Bay & Catchment Water Quality Improvement Plan

The Botany Bay & Catchment Water Quality Improvement Plan was developed by the Sydney Metropolitan Catchment Management Authority. The main objective of the plan is to set pollutant load reduction targets for contributing catchment areas to Botany Bay. Table 8 from the plan recommends the following pollutant load reduction targets are applied to large redevelopments:

- 85% reduction in the post development mean annual load of Total Suspended Solids (TSS);
- 60% reduction in the post development mean annual load of Total Phosphorous (TP); and
- 45% reduction in the post development mean annual load of Total Nitrogen (TN).

3.2.3 Relevant Studies

i Alexandra Canal Flood Study

The Alexandra Canal Flood Study was prepared by WMAwater on behalf of Council. The study was adopted by Council in 2017 and provides information on flooding at the site. Section 4.3 of this Surface Water Assessment describes existing flood characteristics at the site, referencing information from this flood study.

3.2.4 Industry Guidelines

i Australian Rainfall and Runoff

Australian Rainfall and Runoff (Commonwealth of Australia, 2016) provides practitioners with the best available information on design flood estimation and is widely accepted as a design guideline for all flood and stormwater related investigation and design in Australia.

ii Bunding and Spill Management Guidelines

The following NSW Government guidelines detail best practice storage, handling and spill management procedures for liquid chemicals:

- Liquid Chemical Storage, Handling and Spill Management: Review of Best Practice Regulation (DECC, 2005).
- Storing and Handling Liquids: Environmental Protection: Participant's Manual (DECC, 2007).

iii Cement Concrete & Aggregates Australia Guidelines

Cement Concrete & Aggregates Australia (CCAA) is a peak industry body and has produced the following guidelines to inform members in the design of water management systems at concrete batching plants:

- First Flush and Water Management Systems: Guide and Principles (CCAA, 2013).
- Concrete By-products Recycling and Disposal Industry Guidelines (CCAA, 2014).

The above guidelines are generally consistent with relevant guidelines published by government agencies.

iv Australian Guidelines for Water Quality Monitoring and Reporting – ANZECC, 2000

These guidelines are the benchmark documents of the National Water Quality Management Strategy which is used for comparison of water quality monitoring data throughout Australia.

v Draft MUSIC modelling guidelines

The *Draft NSW MUSIC Modelling Guideline* (BMT WBM, 2010) provides guidance on MUSIC modelling methods and assumptions.

4 Existing Environment

This section provides information on the existing environment at the site, as relevant to this surface water assessment.

4.1 Rainfall Data

There are a number of Bureau of Meteorology (BoM) operated rainfall gauges that provide representative records for the St Peters area. Table 4.1 presents key information and statistical data from three local gauges that have long term records.

Table 4.1 Rainfall statistics

Rainfall Statistics (annualised)		**Sydney Airport AMO (66037)**	**Randwick Racecourse (66073)**	**Ashfield Bowling Club (66000)**
Rainfall Record		1929 - present	1937 - present	1894 - present
Distance from the site	(km)	2 km to the south	6 km to the east	5 km to the north-west
Elevation (m AHD)	(m AHD)	6	25	25
Average Rainfall	(mm/year)	1083	1324	1070
Lowest Rainfall	(mm/year)	523	627	453
5^{th} Percentile Rainfall	(mm/year)	663	812	641
10^{th} Percentile rainfall	(mm/year)	745	871	734
Median rainfall	(mm/year)	1046	1290	1049
90^{th} Percentile rainfall	(mm/year)	1483	1842	1455
95^{th} Percentile rainfall	(mm/year)	1721	2106	1656
Highest rainfall	(mm/year)	2025	2361	2102

Source: BoM website (climate data online)

The rainfall statistics presented in Table 4.1 from the Sydney Airport AMO and Ashfield Bowling Club gauges correlate well, while statistics from the Randwick gauge indicate that that the Randwick area receives generally higher rainfall than the Sydney Airport and Ashfield areas.

The Sydney Airport AMO gauge is the closest to the site and is considered to be representative of site conditions. Figure 4.1 plots the 10^{th}, 50^{th} and 90th percentile monthly rainfall totals that have been calculated from the Sydney Airport AMO gauge record. The chart clearly demonstrates the high variability in monthly rainfall across all seasons.

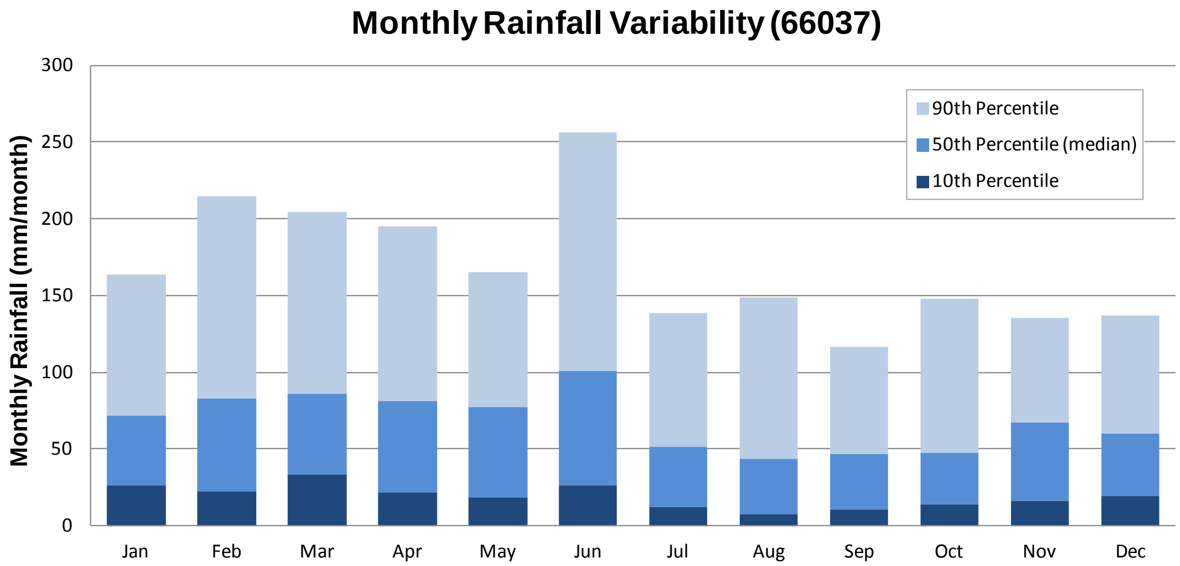


Figure 4.1 Monthly rainfall statistics at Sydney Airport AMO – 66037 (Source: BoM)

4.2 External drainage

This section describes existing drainage infrastructure near the site.

i Alexandra Canal

Alexandra Canal is located to the south of the site and is a concrete lined channel that receives tidal flows as well as surface runoff. The contributing catchment has an area of approximately 1,565 ha which includes the suburbs of Alexandria, Rosebery, Erskineville, Beaconsfield, Zetland, Waterloo, Redfern, Newtown, Surry Hills and Moore Park (WMA, 2017). The catchment is characterised by predominantly high density urban and industrial land uses. The canal joins the Cooks River approximately 1.8 km to the west of the site. Cooks River flows into Botany Bay.

All runoff from the site drains either directly into the canal or into piped drainage systems that drain into the canal. Hence, the Alexandra Canal is the primary receiving water.

Photograph 1 shows the Alexandra Canal, looking downstream.

Photograph 1 Alexandra Canal (looking downstream)

ii Burrows road drainage

Burrows Road is located to the east of the site. Information provided by a Dial before you Dig inquiry indicates that Burrows Road drains into the Alexandra Canal via a piped drainage system. The alignment of this drainage system is indicated in Figure 4.2.

iii Other drainage

A large culvert is located under the south-western portion of the site. The culvert receives runoff from the industrial area that is located to the north of the site. The alignment of this culvert is indicated in Figure 4.2. Survey commissioned by Boral indicates that this culvert has a diameter of 1300 mm.

4.3 Flooding

The Alexandra Canal Flood Study (WMAwater, 2017) was adopted by Council in 2017. Council provided the flood model and results to EMM for use in this assessment. Model results indicate that the Alexandra Canal, Burrows Road and low lying land to the north of the site are prone to flooding in the 1% Annual Exceedance Probability (AEP) and lower magnitude events. Table 4.2 presents peak flood levels in these areas that were extracted from the model results that were provided by Council.

Table 4.2 Peak flood levels on land adjoining the site

	Flood Level (m AHD)[1]		
	Alexandra Canal	**Area to the north of the site**	**Burrows Road**
20% AEP	1.68	2.22	2.51
5% AEP	1.93	2.34	2.56
1% AEP	2.02	2.46	2.59
PMF	3.27	3.42	3.43

Notes: 1.Peak flood levels were extracted from model results provided by Council at locations adjacent to the site.

A topographic survey of the existing site is provided in Appendix A. The majority of the site is established above 2.7 m AHD, with the only exception being the northern and southern driveways that have levels between 2.3 and 2.4 m AHD at the interface with Burrows Road. With reference to Table 4.2, the 1% AEP flood levels on land adjacent to the site range from 2.02 to 2.59 m AHD. Hence, the site (except for the entrance driveways) is not prone to flooding during 1% AEP and lower magnitude flood events. Hence, the proposed modifications will not impact flooding during a 1% AEP event.

Model results indicate that the site is prone to flooding during a Probable Maximum Flood (PMF) event. With reference to Table 4.2, PMF levels are approximately 3.4 m AHD, indicating that flood depths of up to 0.7 m would occur within low lying portions of the site. Flood hazard maps provided in the Alexandra Canal Flood Study (WMAwater, 2017) identify the majority of the site as having low hydraulic hazard during PMF conditions.

4.4 Existing water management system

Modification 11 proposes to upgrade the existing water management system. A review of the existing system was undertaken to assess its adequacy and identify opportunities to integrate the proposed upgrades into the existing system. This review was informed by:

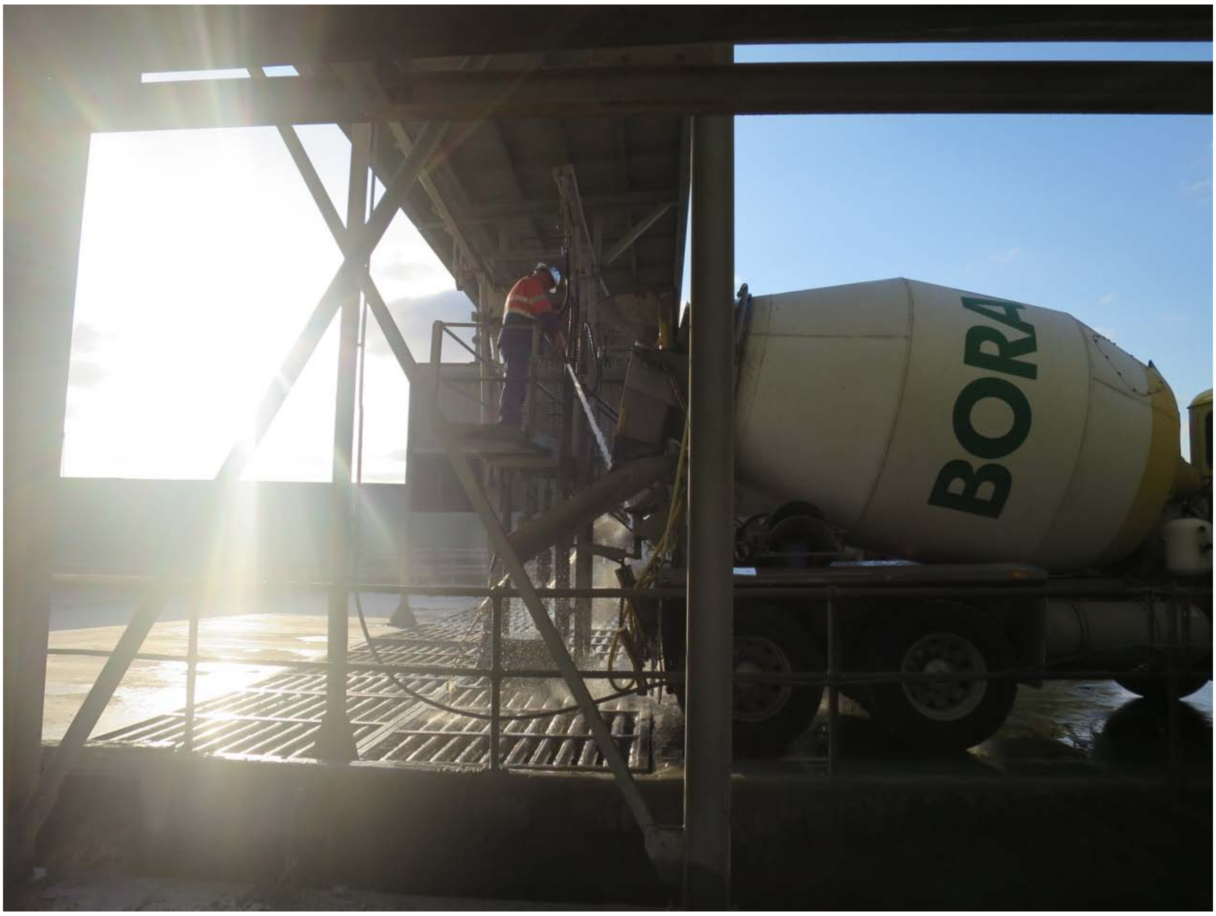
- site inspections;
- topographic survey of site levels and the drainage system; and
- information on the existing water management system that was provided by Boral.

The following sections describe the existing process water and stormwater systems.

4.4.1 Existing process water system

The process water system receives all concrete washout water and any other water produced from cementitious areas. The system is bunded to prevent stormwater ingress and comprises a number of continuously stirred tanks that hold process water prior to use. Photograph 2 shows a concrete agitator being washed out at the slump stand and Photograph 3 shows the continuously stirred tanks.

The system supplies water to the wash out facility and the concrete plant for concrete production and wash out. The system requires constant top-up. Top-up water is preferentially sourced from two first flush pits (when water is available) and then from mains water.



Photograph 2 Washout water entering the process water system at the slump stands.

Photograph 3 Continuously stirred process water tanks

4.4.2 Existing stormwater system

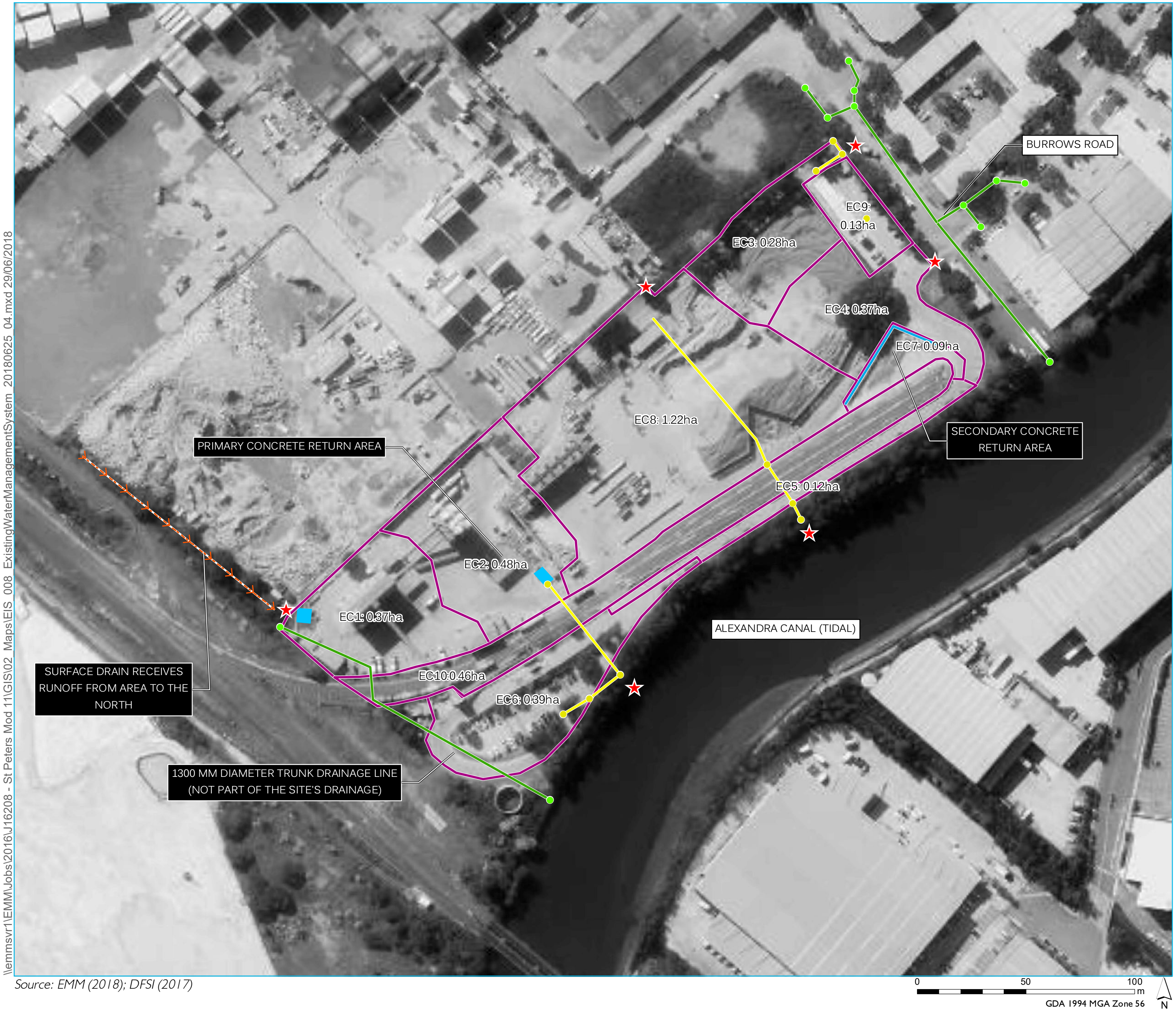
Figure 4.2 shows existing catchment areas, first flush pits, piped drainage systems and offsite discharge locations. Table 4.3 provides additional information on the drainage functionality and water management controls in each catchment. Photograph 4 shows the aggregate storage and handling area (catchment EC8) and Photograph 5 shows the first flush pit in catchment EC2.

Photograph 4 Aggregate storage and handling area (catchment EC8)

Photograph 5 First flush pit in catchment EC2

Table 4.3 Description of existing water management system

Catchment	Area	Current Use	Stormwater system
EC1	0.37 ha	• Truck parking • Aggregate storage bins	• Aggregate storage bins are covered to prevent rainfall ingress. • The catchment drains to a first flush pit which has a volume of 62KL, equivalent to 17mm of runoff from the contributing catchment area. Captured water is used for concrete production. • Bypass flow is discharged offsite into an external drainage system.
EC2	0.48 ha	• Cement silos and batching plant • Slump stands • Concrete washout pits • Aggregate storage bins • Water management system	• Slump stands are partially covered to prevent rainfall ingress. • Concrete washout pits are covered to prevent rainfall ingress. • The catchment drains to a first flush storage which has a volume of 74KL, equivalent to 15mm of runoff from the contributing catchment area. Captured water is used for concrete production. • Bypass flow is discharged into the Alexandra Canal via a piped drainage system.
EC3	0.28 ha	• Aggregate and sand stockpiles • Access roads	• Runoff from the aggregate and sand stockpiles seeps through the barrier wall. • All runoff from the catchment discharges to external drainage on Burrows Road as either piped or overland flows. No water quality treatment is provided.
EC4	0.37 ha	• Aggregate and sand stockpiles • Access roads	• Runoff from the aggregate and sand stockpiles seeps through the barrier wall. • All runoff from the catchment discharges to drainage on Burrows Road as overland flows. No water quality treatment is provided.
EC5	0.12 ha	• Access roads	• All runoff from the catchment discharges into the Alexandra Canal via a piped drainage system. No water quality treatment is provided.
EC6	0.39 ha	• Access roads • Staff parking	• All runoff from the catchment discharges into the Alexandra Canal via a piped drainage system. No water quality treatment is provided.
EC7	0.09 ha	• Secondary return concrete area	• Runoff from this catchment is retained behind a bund (indicated in Figure 4.2). Captured water is pumped into the process water system and is used for concrete production.
EC8	1.22 ha	• Aggregate and sand stockpiles • Truck standing area	• The majority of runoff from the catchment discharges into the Alexandra Canal via a piped drainage system. During and following intense rainfall, some overland flows may spill into the property to the north (as indicated in Figure 4.2). No water quality treatment is provided.
EC9	0.13 ha	• Administration buildings • Staff parking	• Runoff from this catchment drains to a sump which is pumped into the process water system for use in concrete production.
EC10	0.46 ha	• Rail sidings	• All stormwater is expected to infiltrate into the underlying Botany Sands aquifer.



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Source: EMM (2018); DFSI (2017)

Existing water management system

Modification 11
Boral St Peters
Figure 4.2

EMM

5 Proposed Water Management System

5.1 Overview

Modification 11 proposes to upgrade the existing water management system. Key changes include:

- **Drainage modifications** – including:
  - The aggregate storage and handling area will be regraded to prevent runoff from this area draining to the west and onto Burrows Road.
  - Additional stormwater drainage will be constructed to improve stormwater capture and prevent the discharge of untreated stormwater flows from the site during frequently occurring rainfall events.
- **Water quality control modifications** – including:
  - Cementitious areas will be covered and bunded (where possible) to isolate them from the stormwater system.
  - The secondary return concrete area will be decommissioned and replaced with a reclaim facility.
  - Sedimentation basins will be established to treat runoff from the aggregate storage and handling area.
  - Bioretention systems will be established to treat runoff from access roads and car parking areas.
- **Stormwater harvesting modifications** – including:
  - The existing stormwater harvesting system will be expanded to capture runoff from 72% of the site area.
  - The large steel tank that is located in the southern corner of the site will be modified to provide 500 KL of storage.
  - Collectively, the stormwater harvesting system will provide 1,106 KL of storage, equivalent to 53 mm of runoff from the harvesting area. The storage volume will provide water for 3 to 4 days of concrete production.

This section describes the proposed water management system and is structured as follows:

- Section 5.2 describes the functionality of the proposed water management system.
- Section 5.3 details water balance modelling that was undertaken for the project.
- Section 5.4 details water quality modelling that was undertaken for the project.
- Section 5.5 describes the water management approach during construction.

- Section 5.6 provides a summary of additional design development that will occur at detailed design.

5.2 Proposed water management system

This section discusses the water management objectives and the proposed water management system.

5.2.1 Water Management Objectives

Table 5.1 summarises the water management objectives and approach that has been applied to establishing the extent and nature of the proposed water management system.

Table 5.1 Water management objectives and approach

Water Management Objectives	Approach
1. Where practical, separate stormwater and cementitious areas of the site	• Cementitious areas will be covered and bunded (where possible) to isolate them from the stormwater system.
2. Improve the management of return concrete	• A concrete reclaim machine will be constructed to manage return concrete and washout water. The reclaim machine will separate the slurry from the sand and aggregates. Slurry will be recycled into the process water system. Sand and aggregates will be transported to a Boral waste management facility where they will be used to produce road base material. • The secondary concrete return area (as indicated in Figure 4.2) will be decommissioned.
3. Improve site drainage	• The aggregate storage area will be regraded to avoid runoff from this area draining to the east, onto Burrows Road. • The piped drainage system will be upgraded to improve general site drainage and prevent the discharge of untreated stormwater during frequently occurring events.
4. Provide water quality treatment of all site runoff to meet the pollutant load reductions recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011)	The water quality controls and stormwater harvesting system will be designed to collectively achieve the following pollutant load reductions: • 85% reduction in total suspended solids; • 60% reduction in total phosphorous; and • 45% reduction in total nitrogen.
5. Increase the stormwater harvesting to reduce stormwater discharge and potable water consumption	• The existing stormwater harvesting system will be significantly expanded to increase the capture of stormwater runoff and the use of captured stormwater in concrete production.

5.2.2 Water Management Plan

The functionality of the proposed water management system is diagrammatically described in Figure 5.1. Figure 5.2 presents a Water Management Plan (WMP) which locates the proposed surface water infrastructure and Table 5.2 provides information on the proposed use and water management controls in each catchment that is indicated in Figure 5.2. Key aspects of the WMP are discussed below the figures.

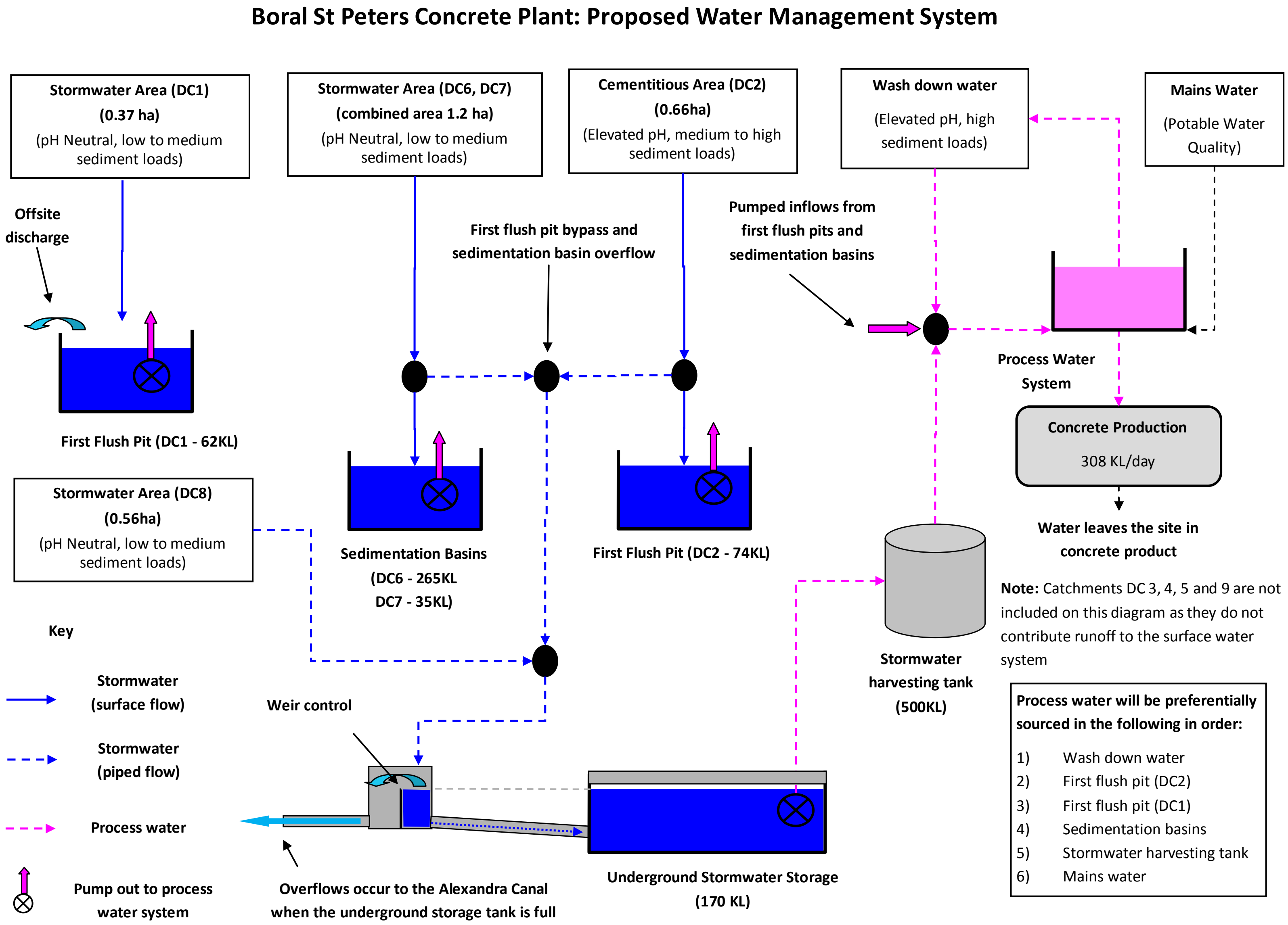

Figure 5.1 Water management system functionality

Table 5.2 Proposed changes to catchment areas and the stormwater system

Catchment	Area	Proposed use	Proposed changes
DC1	0.37 ha	• Truck parking • Aggregate storage bins	The existing stormwater management system will be maintained and includes the following controls: • Aggregate storage bins are covered to prevent rainfall ingress. • The catchment will continue to drain the existing first flush pit which has a volume of 62KL. Captured water will be used for concrete production. • Bypass flow is discharged offsite (the discharge location is indicated in Figure 5.2).
DC2	0.66 ha	• Cement silos and batching plant (increased footprint) • Slump stands (increased footprint) • Concrete washout and reclaim facility • Aggregate conveyors • Process water system	• The catchment area is expected to increase from 0.48 to 0.66ha due to site regrading. • Slump stands will be fully covered to prevent rainfall ingress. • Concrete washout and reclaim area will be fully covered to prevent rainfall ingress. • Where possible, all runoff from roofed areas will drain directly into the piped drainage to reduce clean water inflows into the first flush pit. • The catchment will continue to drain to the existing first flush pit which has a volume of 74KL. Captured water will be used for concrete production. • Bypass flow will drain to the underground stormwater storage that will be dewatered via pumping to the stormwater harvesting tank.
DC3	0.09 ha	• Access roads	• Regrading the aggregate storage area will reduce the catchment area from 0.28ha to 0.09ha. • All runoff from this catchment will be treated in a bio-retention area. Treated runoff will be discharged into the existing drainage on Burrows Road. Bioretention systems are discussed further in Section 5.2.5.
DC4	0.12ha	• Access roads	• All runoff from this catchment will be treated in a bio-retention system. Bioretention systems are discussed further in Section 5.2.5. • Treated runoff will be discharged into the Alexandra Canal via a piped drainage system.
DC5	0.39 ha	• Access roads • Staff parking	• All runoff from this catchment will be treated in a bio-retention system. Bioretention systems are discussed further in Section 5.2.5. • Treated runoff will be discharged into the Alexandra Canal via a piped drainage system.
DC6	1.06 ha	• Aggregate storage and handling	• The aggregate storage and handling area will be regraded to drain to a sedimentation basin that will be located in the south-eastern portion of the catchment. All drainage will be via surface drains. • The surface drains will drain into a sediment wedge pit that will overflow into a sedimentation basin. Sedimentation basins are discussed further in Section 5.2.4. • All basin overflows will drain to the underground stormwater storage that will be dewatered via pumping to the stormwater harvesting tank.

Table 5.2 Proposed changes to catchment areas and the stormwater system

Catchment	Area	Proposed use	Proposed changes
DC7	0.14 ha	• Access roads	• All runoff from this catchment will drain into a sedimentation basin. Sedimentation basins are discussed further in Section 5.2.4. • All basin overflows will drain to the underground stormwater storage that will be dewatered via pumping to the stormwater harvesting tank.
DC8	0.56 ha	• Access roads • Administration buildings • Staff parking	• A new piped stormwater drainage system will be constructed in south-eastern portion of the site. This drainage system will capture runoff this portion of the site that currently flows onto Burrows Road as overland flow. • The piped drainage system will drain the underground stormwater storage that will be dewatered via pumping to the stormwater harvesting tank.
DC9	0.46 ha	• Rail sidings	• All stormwater from the rail siding is expected to infiltrate into the underlying Botany Sands aquifer.

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Source: EMM (2018); DFSI (2017)

KEY
- Discharge locations
- Surface drainage (internal)
- Surface drainage (external)
- Existing piped drainage (to be maintained)
- Proposed pipe drainage
- External piped drainage
- Proposed Layout
- Catchment area
- Proposed bioretention system
- Proposed sediment wedge pits
- Proposed sedimentation basin
- Proposed underground stormwater storage
- First flush pit

Proposed water management system

Modification 11
Boral St Peters
Figure 5.2

EMM

5.2.3 Drainage modifications

The drainage system will be modified to improve general site drainage and prevent the discharge of untreated stormwater from the site during frequently occurring rainfall events. The proposed modifications are described in the following sections.

i Site regrading

The aggregate storage and handling area (catchment DC6) will be regraded so that it drains centrally to a sediment wedge pit. The sediment wedge pit will overflow to sedimentation basin DC6.

ii Piped drainage

A piped drainage system will be constructed in the south-eastern portion of the site (catchment DC8). This drainage system will collect stormwater runoff from catchment DC8 and receive overflows from the sedimentation basins in catchments DC6 and DC7 and bypass flows from catchment DC2. All runoff will drain to an underground stormwater storage, the location of which is shown in Figure 5.2. This underground stormwater storage will be progressively dewatered via pumping to the 500 KL stormwater harvesting tank that is located in Figure 5.2.

The piped drainage system will overflow into the Alexandra Canal when the underground stormwater storage is full. Overflows will be controlled by a bypass pit (shown in Figure 5.2) that will comprise an internal weir set at the full storage level of the underground storage. Overflows will only occur when the underground stormwater storage is full, which will occur when:

- the 500 KL stormwater harvesting tank is full and cannot receive any additional water; or
- the collective capacity of the underground stormwater storage and pump-out system is exceeded during intense rainfall.

The capacity of the overflow drainage will be constrained by the existing drainage system that is located under the rail sidings (located in Figure 5.2). The existing pipe under the rail siding is a 600 mm conduit. It is expected that this pipe will have a 20% AEP capacity (based on the contributing catchment area and assuming all upstream storages are full). When the pipe capacity is exceeded it is expected that:

- all surplus runoff in catchments DC2, DC6, DC7 and the western portion of DC8 will be retained on site; and
- surplus runoff from the eastern portion of catchment DC8 will drain to Burrows Road as overland flows.

5.2.4 Stormwater basins

The proposed water management system will include the following stormwater basins:

- The existing first flush pits located in catchments DC 1 and DC 2 will be maintained. These first flush pits are configured to capture initial runoff. Once full, all additional runoff bypasses the pit.
- Sedimentation basins will be constructed in catchments DC6 and DC7. The sedimentation basins will receive all runoff from the catchment and will overflow into the piped drainage system.

- The underground stormwater storage will be located in catchment DC8. The functionality of this storage is described in Section 5.2.3.

Table 5.3 provides the contributing catchment area, basin volume and capacity (in terms of mm of runoff) and overflow arrangements for each of the basins. The volumes of the sedimentation basins and underground stormwater storage have been established using water quality modelling that is documented in Section 5.4. This modelling has demonstrated that the proposed basin size combined with stormwater harvesting will achieve the pollutant load reductions recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011).

Table 5.3 Stormwater basins

Storage ID	Catchment area	Volume	Capacity	Overflow arrangement
First flush pits				
DC1	0.37 ha	62KL	17 mm of runoff	Bypass flows are discharged offsite
DC2	0.66 ha	74KL	14 mm of runoff[1]	Bypass flows drain to the underground storage
Sedimentation basins				
DC6	1.06 ha	265KL	25 mm of runoff	Overflows to the underground storage
DC7	0.14 ha	35KL	25 mm of runoff	Overflows to the underground storage
Underground stormwater storage				
DC8	Direct – 0.56 ha Overflows – 1.86ha Total – 2.42ha	170KL	Capacity is a function of the storage and pump out capacity.	Overflows to Alexandra Canal

Notes: 1. Runoff from roofed areas, approximately 20% of the catchment area will be diverted around the first flush pit.

5.2.5 Bioretention systems

Bioretention systems will be established to treat runoff from catchments DC3, DC4 and DC5 which comprise access roads and car parking areas. In each catchment, the existing drainage system will be modified so that gutter flows drain into the bio-retention systems. The bioretention systems will be unlined allowing for infiltration into the underlying sand aquifer. Bioretention systems will be sized to meet the pollutant load reductions recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011). Table 5.4 provides the required filter area in each catchment.

Table 5.4 Bioretention areas

Catchment	Catchment Area	Filter Area
DC3	0.09 ha	12 m^2
DC4	0.12 ha	16 m^2
DC5	0.39 ha	52 m^2

5.2.6 Stormwater harvesting system

i Overview

Concrete production requires approximately 150 litres of water per cubic metre of concrete. Hence, a concrete plant capacity of 750,000 m^3/pa will require 112,500 KL/pa of water. This equates to an average daily water use of 308 KL/day. Accordingly, there is an opportunity to harvest stormwater to supply water for concrete production. This will reduce mains water demands and the volume and frequency of stormwater discharge from the site.

ii Proposed system

It is proposed to expand the existing stormwater harvesting system to capture runoff from 72% of the site area (catchments DC1, DC2, DC6, DC7 and DC8). Water will be harvested directly from the first flush pits and the sedimentation basins. As described in Section 5.2.3, the underground stormwater storage will receive stormwater runoff from catchment DC8 and overflows from the sedimentation basins in catchments DC6 and DC7 and bypass flows from catchment DC2. Water in the underground storage will be pumped to the stormwater harvesting tank, which will supply water top-up water to the process water system. The functionality of the stormwater harvesting system is described diagrammatically in Figure 5.1.

Collectively, the stormwater harvesting system will provide 1,106 KL of storage, equivalent to 53 mm of runoff from the harvesting area. The storage volume will provide water for 3 to 4 days of concrete production.

Section 5.3 describes a water balance that has been undertaken for the proposed system.

5.2.7 Process water system

The process water system will receive water from the concrete reclaim facility and any other wash out and wash down water. The system will supply water for concrete production and will therefore require constant top-up. Top-up water will be preferentially sourced from storages that are more likely to have poorer water quality and/or have lower storage capacity. As described in Figure 5.1, top-up water will preferentially be sourced as follows:

1) water from the reclaim facility;
2) first flush pit (DC2);
3) first flush pit (DC1);
4) sedimentation basins;
5) stormwater harvesting tank; then
6) mains water.

5.2.8 Potable water supply

The project will be connected to mains water supply. Mains water will be used to top-up the process water system when stormwater storages are empty.

5.2.9 Waste water management

The existing waste water management system will continue to be operated.

5.2.10 Waste management measures

Boral will implement a Waste Management Plan that will reduce the risk of waste products entering the stormwater system. The waste management measures are described in Section 10.4 of the EA.

5.3 Water Balance

A water balance model was developed for the proposed stormwater harvesting scheme. The objectives of the model are to estimate:

- the volume of surface water that is captured and used for process water;
- site discharge volumes; and
- the volume of mains water that will be imported to meet process water demands.

This section details the modelling approach, assumptions and results.

5.3.1 Modelling Approach

The water balance model was developed using a Visual-Basics Programme that has been developed independently by EMM. The model applies a continuous simulation methodology that assesses the performance of the proposed system under a range of rainfall sequences. Model assumptions are discussed in Section 5.3.2 and results are presented in flow chart format for typical dry (10th Percentile), median and wet (90th Percentile) years in Section 4.3.3.

5.3.2 Model framework

The water balance model was developed for the proposed stormwater harvesting scheme and includes all contributing catchments and storages that are shown in Figure 5.1. Catchments DC3, DC4, DC5 and DC9 were not included as these catchments will not contribute runoff to the stormwater harvesting scheme.

5.3.3 Model Assumptions

This section details the assumptions applied to the water balance model.

i Climatic Data

A 38 year simulation period was adopted for the water balance model using daily rainfall data from the Sydney Airport AMO (BoM 66037) between 1980 and 2017.

ii Calculation of Runoff

All catchments within the stormwater harvesting area are expected to be 100% impervious (predominantly concrete hardstand and roof areas) except for catchment DC6, which will comprise aggregate stockpiles (approximately 40% of the catchment area).

The SIMHYD rainfall-runoff model was applied to simulate the rainfall runoff from stormwater harvesting area. SIMHYD is a conceptual rainfall-runoff model that estimates daily runoff from daily rainfall and potential evaporation data. The SIMHYD model was parameterised to achieve the following long-term average volumetric runoff coefficients (Cv), based on typical values:

- Impervious surfaces (concrete hardstand or roof area) – Cv 0.78 or 78% or rainfall (equivalent to a 2.5mm initial loss).

- Aggregate stockpiles - Cv 0.30 or 30% or rainfall.

iii Process Water Demands

As established in Section 5.2.6, 112,500 KL/year of water will be used for concrete production. This equates to a daily water use of 308 KL/day. This daily use rate has been applied to the water balance. The water balance sources water by applying the preferences described in Section 5.2.7.

5.3.4 Water Balance Results

Water balance results are presented in flow chart format in Figure 5.3, Figure 5.4 and Figure 5.5 for dry, average and wet rainfall years respectively. Results indicate that harvesting stormwater for process water use will:

- reduce site discharge volumes from the stormwater harvesting area by between 67% (wet year) to 91% (dry year) of total runoff; and

- reduce mains water consumption by between 12% (dry year) to 17% (wet year).

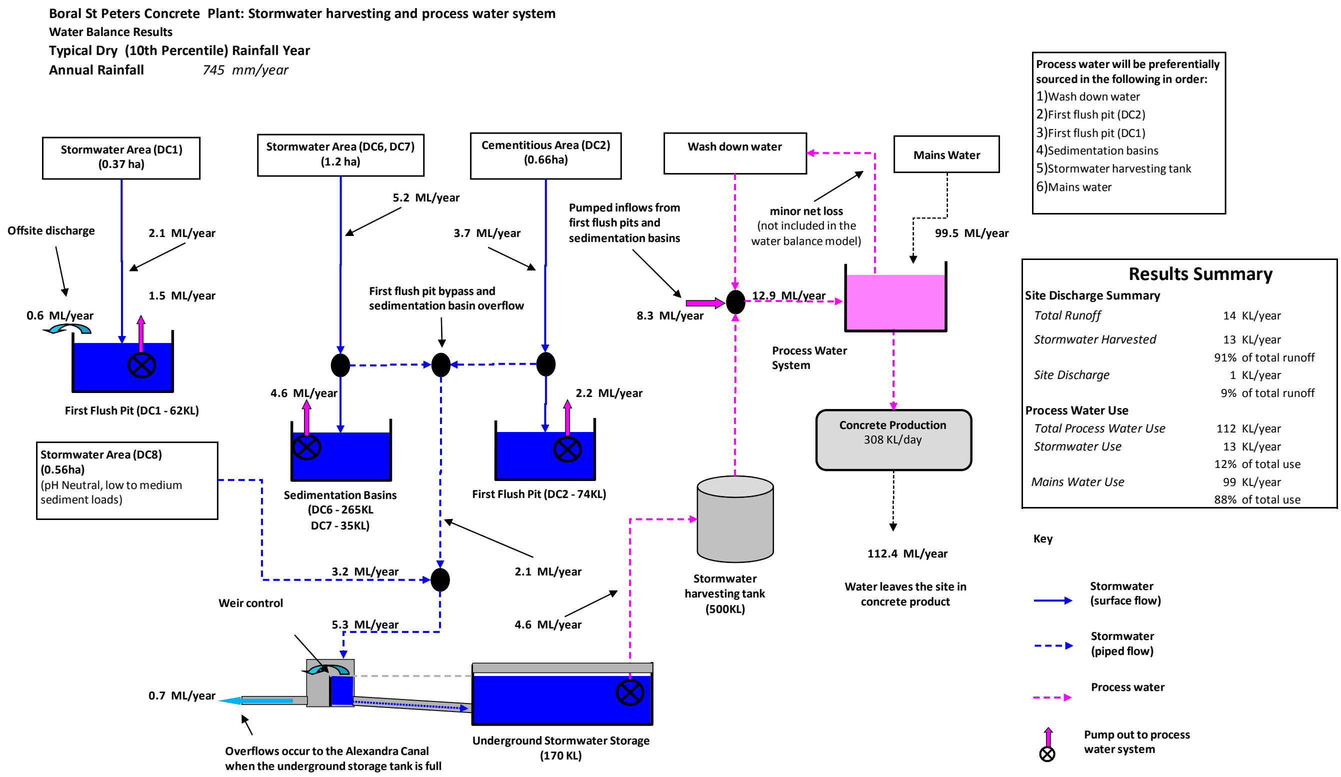


Figure 5.3 Water balance results for a typical dry year

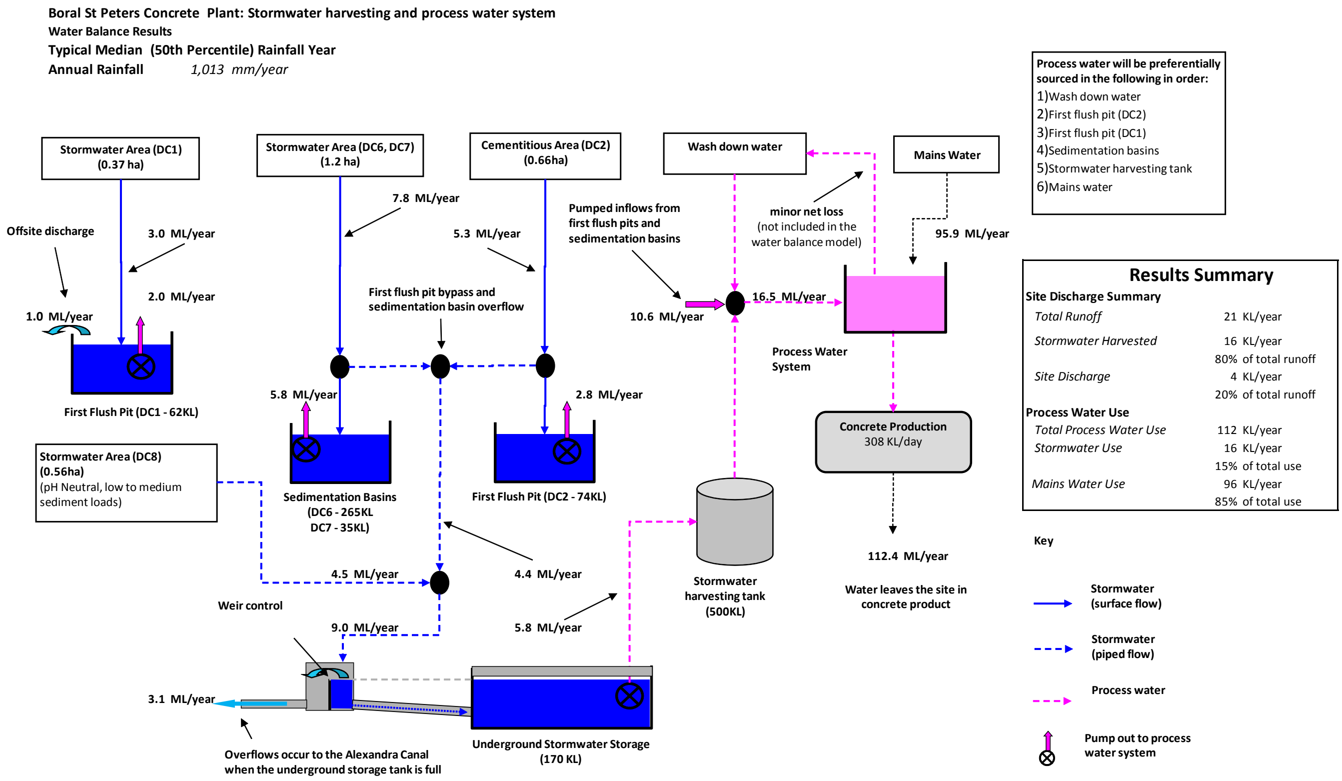


Figure 5.4 Water balance results for a typical median rainfall Year

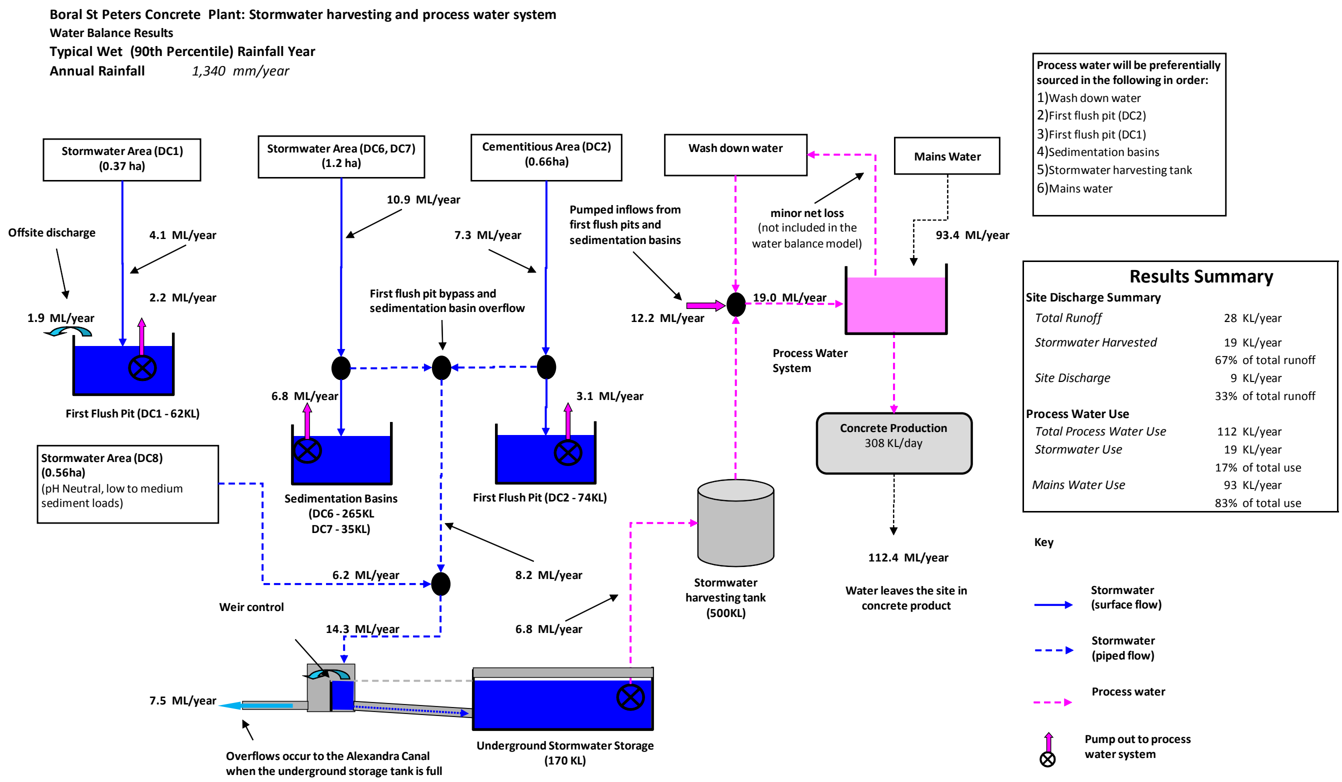


Figure 5.5 Water Balance Results for a Typical Wet Year

5.4 Water quality modelling

The MUSIC water quality model was applied to simulate the volume and quality of runoff from the site and assess the effectiveness of the proposed water quality controls. Specifically, the model results are compared to the pollution reduction targets that are recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011).

This section documents the modelling assumptions and results.

5.4.1 Model Assumptions

The MUSIC water quality model was developed in accordance with the *Draft NSW MUSIC Modelling Guideline* (BMT WBM, 2010). This section details the assumptions applied to the MUSIC water quality model.

5.4.2 Rainfall Data

The *Draft NSW MUSIC Modelling Guideline* (BMT WBM, 2010) recommends that pluivo rainfall data is used for water quality simulations. The nearest pulivo rainfall record is from the Sydney Airport AMO gauge (BoM 66037), which is located 2 km to the south of the site. The rainfall record from this gauge between 1987 to 1997 was adopted as the average rainfall over this period (1,108 mm/year) is similar to the average rainfall calculated from the full gauge record (1,083 mm/year).

5.4.3 Stormwater runoff

The catchment areas and rainfall runoff parameters adopted for the water balance modelling (as described in Section 5.3) were applied to the MUSIC model. The model includes all catchments except DC9 (rail sidings) which was not included as all stormwater is expected to infiltrate into the underlying sand aquifer.

5.4.4 Stormwater harvesting

The model incorporates stormwater harvesting from the first flush pits and sedimentation basins and stormwater harvesting tank. An average harvesting rate of 308 KL/day was applied to the model. This is consistent with the water balance modelling approach that is described in Section 5.3.

5.4.5 Treatment controls

The model includes the following treatment controls:

i Stormwater basins

The first flush pits, sedimentation basins and the underground stormwater storage were applied to the model using the ‘sedimentation basin’ treatment node. The following parameters were adopted:

- Basin volume (also referred to as permanent pool volume) – The volumes provided in Table 5.3 were applied to the model;
- Surface area – was calculated based on the basin volume and an assumed depth of 2 m; and
- Extended detention depth – 0.2 m (above the basin outlet).

Stormwater harvesting was applied to each basin using the secondary drainage link.

ii Stormwater harvesting tank

The 500 KL stormwater harvesting tank was applied to the model using the rainwater tank node. The model was configured so that the tank only receives inflows from the stormwater basins via the secondary drainage links. Stormwater extraction was applied from the tank at a rate of 308 KL/day.

iii Bioretention systems

Bioretention systems were applied to the model using the bioretention node. The following parameters were adopted:

- Filter areas – The filter areas provided in Table 5.4 were applied to the model.
- Surface area – 150% of the filter area
- Extended detention depth – 0.2 m (above the filter).

The bioretention systems were assumed to be unlined and an exfiltration rate of 15 mm/hr was assumed. This is conservative given the likely high permeability of the underlying shallow sand aquifer.

5.4.6 Pollutant Concentrations

MUSIC applies a stochastic approach to simulating pollutant concentrations in runoff using a mean and standard deviation value for each pollutant. Typical values for industrial land-use that are recommended in the *Draft NSW MUSIC Modelling Guideline* (BMT WBM, 2010) were adopted. These values are reproduced in Table 5.5.

Table 5.5 Adopted pollutant generation parameters

		Base Flow			Stormwater Runoff		
	Units	**Mean**	**Std Dev (log)**	**Mean (log)**	**Mean**	**Std Dev (log)**	**Mean (log)**
Total Suspended Solids (TSS)	mg/l	15.8	0.17	1.2	141	0.32	2.15
Total Phosphorous (TP)	mg/l	0.14	0.19	0.85	0.25	0.25	-0.60
Total Nitrogen (TN)	mg/l	1.29	0.12	0.11	2.0	0.19	0.30

5.4.7 Model Results

Table 5.6 presents the following model results (as annualised averages):

- runoff volume / pollutant load generated from the concrete plant area. This is referred to as source loads;
- the residual runoff volume / pollutant load after stormwater controls; and
- the percentage reduction achieved by stormwater controls.

Predicted pollutant load reductions are also compared to the above-mentioned Council targets.

Table 5.6 MUSIC Model Results

		Annual Volume / Load		Volume / Load reduction		
	Units	Source	Residual	Reduction	Council Target	Target Achieved
Runoff Volume[1]	ML/yr	26.7	10.0	63%	N/A	N/A
Total Suspended Solids (TSS)	Kg/yr	5,020	612	88%	85%	Yes
Total Phosphorous (TP)	Kg/yr	7.9	2.0	75%	60%	Yes
Total Nitrogen (TN)	Kg/yr	58.7	20.5	65%	45%	Yes

Notes: 1. Runoff volumes are greater than the volumes presented in the water balance results due to the inclusion of catchments DC3, DC4 and DC5 in the water quality model. These catchments were not included in the water balance model which assessed the stormwater harvesting area only.

Model results presented in Table 5.6 indicate that the pollutant load reductions for TSS, TN and TP meet the targets recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011). This indicates that the proposed water management system is appropriately configured.

5.5 Water management during construction

Construction of the proposed modifications will be undertaken in a staged manner over a nine month period. Erosion and sediment control plans will be prepared for each construction stage as part of the detailed design documentation. The erosion and sediment control plans will be prepared in accordance with the methods recommended in Managing Urban Stormwater: Soils and Construction (Landcom, 2004).

Some phases of the construction will require excavations that will intercept groundwater. Dewatering requirements and management methods are discussed in Section 10.1 of the EA.

5.6 Additional design development

The following additional design development will be undertaken as part of the detailed design phase of the project:

- a site grading plan will be prepared for all portions of the site that will be regraded;
- hydraulic analysis of the proposed drainage system will be undertaken;
- detailed designs of all stormwater infrastructure will be prepared; and
- sediment and erosion control plans will be prepared for each construction stage.

6 Water licensing and impacts to waterfront land

6.1 Water licensing

Stormwater will be extracted from the existing first flush pits and proposed sedimentation basins and underground stormwater storage. Extracted water will be either directly reticulated into the process water system or reticulated to the stormwater harvesting tank.

Water extraction (or water take) from the existing first flush pits and proposed sedimentation basins and underground stormwater storage is excluded works under Water Management (General) Regulation 2011, Schedule 1, item 3 (dams solely for the capture, containment or recirculation of drainage). Accordingly, the project is expected to have no requirements for water licensing.

6.2 Impacts to waterfront land

The proposed works will be undertaken with the existing site area. Works within 40m of the Alexandra Canal will be limited to:

- construction of bioretention systems in Catchment DC4 and DC 5; and
- modifications to the car park in catchment DC 5.

These works are not expected to impact the canal.

7 Monitoring and inspection plan

7.1 Overview

This section describes a surface water monitoring program that will implement by Boral. The objectives of the monitoring program are to collect sufficient data to:

- enable the effectiveness of water quality controls to be assessed;
- identify and quantify water quality impacts; and
- enable compliance with relevant consent and licence conditions to be assessed.

The following sections describe the monitoring locations, monitoring plan and methods.

7.2 Monitoring locations

Monitoring will be undertaken from the following site discharge locations:

- SW 1 – will monitor the combined discharge from the catchments DC2, DC4, DC6, DC7 and DC8. Discharge will only occur when the underground stormwater storage is full and by-pass flow occurs.
- SW 2 – will monitor discharge from catchment DC1. Discharge will occur when the first flush pit is full and bypass flows occur.

Monitoring locations are indicated in Figure 5.2.

7.3 Monitoring plan

The monitoring program will comprise:

- inspection of the condition and functionality of stormwater infrastructure;
- daily monitoring of pH during discharge; and
- biannual monitoring of a range of analytes during discharge conditions.

Table 7.1 describes the monitoring plan further.

Table 7.1 Monitoring plan

Aspect	Objective	Description
Inspection	To inspect the condition and functionality of stormwater infrastructure	To be undertaken informally on an ongoing basis and formally on a quarterly basis.
Daily monitoring	To progressively monitor the pH of site discharge.	Analysis of pH using a hand held meter during discharge. Monitoring will be undertaken from two monitoring locations (SW1 and SW2) on a daily basis when discharge is occurring.
Biannual comprehensive monitoring.	To monitor the water quality of site discharge.	Comprehensive monitoring will be undertaken from two monitoring locations (SW1 and SW2) on two occasions every year when discharge is occurring. Refer to Table 7-2 for a description of the proposed analytes and monitoring methods.

Table 7.2 details the proposed comprehensive analytes and monitoring methods. Boral will keep a record of all monitoring results.

Table 7.2 Comprehensive monitoring analytes

Category	Proposed sampling analytes	Analysis method
Physiochemical Properties	pH, electrical conductivity (EC) and turbidity.	To be measured using a portable water quality meter in the field
	total suspended solids, total dissolved solids, total hardness, total hydrocarbons	Analysis to be undertaken by a NATA certified laboratory
Nutrients	total nitrogen, ammonia, nitrate, nitrite , total Kjeldahl nitrogen, total phosphorus and reactive phosphorous	Analysis to be undertaken by a NATA certified laboratory

8 Summary

8.1 Project context

Boral owns and operates a concrete batching plant (concrete plant) and construction materials handling facility (the handling facility) at 25 Burrows Road South, St Peters.

A modification to the site's development consent (Modification 11) is proposed to:

- increase concrete production; and
- increase the throughput of the handling facility.

The approved production limit for concrete at the site is 280,000 m^3 per annum. A concrete production limit of 750,000 m^3 per annum is being sought for the site, which is an increase of 470,000 m^3 per annum. To achieve this increase, the existing concrete plant will be upgraded to include an additional two alleys, with an additional six silos for cement storage and widening of existing raw material storage.

It is proposed to increase the throughput of the handling facility to 1 million tpa, which is an increase of 240,000 tpa over the existing limit of 760,000 tpa. Some changes to the layout and function of the handling facility are proposed to facilitate the increase in throughput.

8.2 Proposed water management system

i Objectives

Modification 11 proposes to upgrade the existing water management system to achieve the following objectives:

- improve the management of runoff from cementitious areas of the site;
- improve the management of return concrete;
- improve site drainage to prevent the discharge of untreated stormwater from the site during frequently occurring rainfall events;
- provide water quality treatment of all site runoff to meet the pollutant load reductions recommended in the Botany Bay & Catchment Water Quality Improvement Plan (CMA, 2011); and
- increase stormwater harvesting to reduce stormwater discharge and potable water consumption.

ii Proposed modifications

Proposed changes include:

- **Drainage modifications** – including:
  - The aggregate storage and handling area will be regraded to prevent runoff from this area draining to the west and onto Burrows Road.

- Additional stormwater drainage will be constructed to improve stormwater capture and prevent the discharge of untreated stormwater flows from the site during frequently occurring rainfall events.

- **Water quality control modifications** – including:
  - Cementitious areas will be covered and bunded (where possible) to isolate them from the stormwater system.
  - The secondary return concrete area will be decommissioned and replaced with a reclaim facility.
  - Sedimentation basins will be established to treat runoff from the aggregate storage and handling area.
  - Bioretention systems will be established to treat runoff from access roads and car parking areas.

- **Stormwater harvesting modifications** – including:
  - The existing stormwater harvesting system will be expanded to capture runoff from 72% of the site area.
  - The large steel tank that is located in the southern corner of the site will be modified to provide 500 KL of storage.
  - Collectively, the stormwater harvesting system will provide 1,106 KL of storage, equivalent to 53 mm of runoff from the harvesting area. The storage volume will provide water for 3 to 4 days of concrete production. The stormwater harvesting system will reduce site discharge volumes from the stormwater harvesting area by between 67% (wet year) to 91% (dry year) of total runoff.

iii Expected outcomes

The proposed water management system is expected to achieve the above-mentioned objectives and will result in significantly improved water quality management relative the existing facility.

8.3 Additional design development

The following additional design development will be undertaken as part of the detailed design phase of the project:

- a site grading plan will be prepared for all portions of the site that will be regraded;
- hydraulic analysis of the proposed drainage system will be undertaken;
- detailed designs of all stormwater infrastructure will be prepared; and
- sediment and erosion control plans will be prepared for each construction stage.

9 References

Australian and New Zealand Environment Consultation Council (2000), 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality'

BMT WMB (2010), 'Draft NSW MUSIC Modelling Guideline'

Catchment Management Authority Sydney Metropolitan (2011), Botany Bay & Catchment Water Quality Improvement Plan

Cement and Concrete & Aggregates Australia (2013), 'First Flush and Water Management Systems: Guide and Principles'

Cement and Concrete & Aggregates Australia (2013), 'Concrete by-products Recycling and Disposal Industry Guidelines'

Commonwealth of Australia (2016), 'Australian Rainfall and Runoff – A Guide to Flood Estimation'

Department of Environment and Conservation NSW (2005), 'Environmental Compliance Report: Liquid Chemical Storage, Handling and Spill Management: Part B Review of Best Practice and Regulation'

Department of Environment and Climate Change NSW (2007), 'Storing and Handling Liquids: Environmental Protection: Participant's Manual'

Department of Infrastructure, Planning and Natural Resources (2005), 'Floodplain Development Manual: the management of flood liable land'

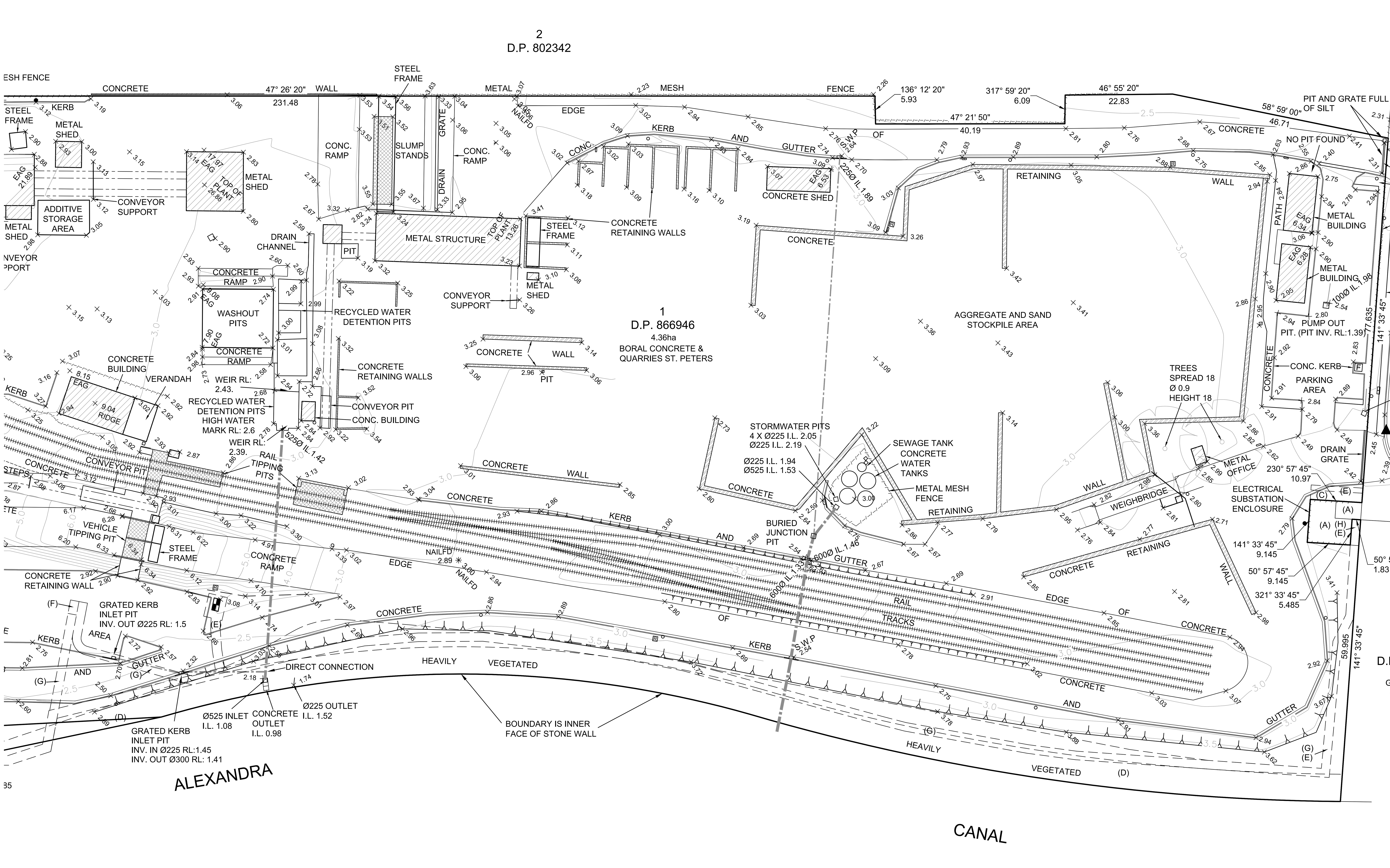
Landcom (2004), 'Managing Urban Stormwater: Soils and Construction Volume 1 4th Edition'.

Sydney Metropolitan Catchment Management Authority (2011), 'Botany Bay & Catchment Water Quality Improvement Plan'

WMAwater (2017), 'Alexandra Canal Flood Study'

Appendix A

Survey



AUSGRID SUB-STATION SITE, LOT 1 D.P. 109101 & LOT 1 D.P. 339419
DRAINAGE EASEMENT 3.05 WIDE - C588175
EASEMENT FOR ELECTRICITY PURPOSES 0.915 WIDE - N242491
EASEMENT FOR ACCESS 5.79 WIDE - C588175
RIGHT OF WAY & EASEMENT FOR ELECTRICITY PURPOSES 1.83, 2 & 4 WIDE & VARIABLE - AJ71566
EASEMENT FOR ELECTRICITY PURPOSES 1.83, 0.425 & 0.075 WIDE - N242491
EASEMENT FOR ELECTRICITY PURPOSES 1.83 WIDE - N242491
EASEMENT FOR TRANSMISSION LINE - G226822

SYMBOL LEGEND

- BENCHMARK
- BIN
- BOLLARD
- CLOTHES LINE
- ELECTRICAL PILLAR
- ELECTRICAL SUBSTATION
- FLAG POLE
- GAS MAIN MARKER
- GAS METER
- GAS VALVE
- HYDRANT POTABLE
- HYDRANT RECYCLE
- FIRE HYDRANT
- LIGHTPOLE
- PHONE BOX
- POWER POLE
- PVC RISER
- SEWER INSPECTION POINT
- SEWER MANHOLE
- SEWER VENT
- SEWER MAINTENANCE SHAFT
- SIGN
- STOP VALVE POTABLE
- STOP VALVE RECYCLE
- TELSTRA PILLAR
- TELSTRA PIT SINGLE
- TELSTRA PIT DOUBLE
- TRAFFIC LIGHTS
- TRAFFIC LIGHTS CONTROL BOX
- TREE STUMP
- WATER AIR VALVE
- WATER METER
- SUBSOIL FLUSHING POINT
- SURVEY MARK (CONC. BLOCK)
- SURVEY MARK (D.H. & W.)
- SURVEY MARK (G.I.P.)
- SURVEY MARK (PEG)
- SURVEY MARK (S.S.M. & P.M.)
- SURVEY MARK (TRAVERSE STATION)
- TOP OF GUTTER LEVEL
- RIDGE LEVEL
- FLOOR LEVEL
- CHIMNEY LEVEL
- PARAPET LEVEL
- TOP OF BATTER

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Designed:	Scale: 1:500	Principal: BORAL	Drg. No. 5444-DET1_C
Drawn: B.W.	Datum: A.H.D.	Project: PLAN OF DETAIL & LEVELS OVER LOT 1 IN D.P. 866946 KNOWN AS No. 25-27 BURROWS ROAD SOUTH, ST. PETERS.	Sheet No. 1 of 1 sheets
Checked: C.P.	Date: 5/04/16		Our Ref: 5444
L.G.A: MARRICKVILLE	A1		

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Appendix H

Existing conditions of consent and compliance

Existing conditions of consent and compliance

Condition no.	Condition summary	Complied with (Yes/No)
Obligation to minimise harm to the environment.		
1	This consent is granted under section 91 (1) of the Environmental Planning and Assessment Act, 1979 for the operation of a concrete batching plant and associated materials handling facilities at Burrows Road South, St Peters.	Yes
2	The development shall be carried out in accordance with: (items a) to n)).	Yes
3	If there is any inconsistency between the plans and documentation listed under condition 2 above, the most recent document shall prevail to the extent of the inconsistency. However, conditions of this consent prevail to the extent of any inconsistency.	Yes
4	The applicant shall ensure that employees, contractors and sub-contractors are aware of, and comply with, the conditions of this consent, relevant to their respective activities.	Yes
Limits of consent		
5	The annual production of the concrete batching plant must not exceed 280,000 cubic metres and the annual throughput of the materials handling facility must not exceed 760,000 tonnes.	Partially – The concrete plant produced ~286,055 cubic metres of concrete during the reporting period, which was marginally higher than the allowable production limit. This exceedance equates to 2.16% of the annual limit or approximately two days of concrete production. This was mainly the result of above average production in the months of September and October 2017 due to the unforeseen closure of the Concrite Alexandria concrete batching plant due to a WHS incident. During the Alexandria plant shutdown, all concrete deliveries were re-directed and facilitated through the St Peters concrete plant, resulting in an unexpected spike in production at the end of the reporting period. The throughput of the materials handling facility by road transport was 655,906 tonnes which was within the 760,000 tonne consent limit. The annual tonnage shortfall at the terminal (104,094 tonnes) equates to approximately 3,250 truck movements. In contrast, the minor exceedance in volumes at the concrete plant equates to approximately 1,010 truck movements. Therefore, as the majority concerns regarding volumes relate to vehicle movements there are minimal to no environmental impacts as a result of the unforeseen exceedance.
Construction and maintenance		
6	Condition deleted.	N/A

Condition no.	Condition summary	Complied with (Yes/No)
7	Lighting from the site shall not cause hazard to aircraft using Sydney Kingsford Smith Airport. Any change in lighting must be undertaken in consultation with and to the approval of SACL.	Yes
8	Condition deleted.	N/A
9	The applicant shall ensure that the rail siding and ancillary works are maintained to a standard which facilitates their use for materials handling at all times.	Yes
Roads, traffic and parking		
10	Condition deleted.	N/A
11	The applicant shall meet the full cost of any works required to be carried out by Council, DPI, Sydney Water or the RMS in connection with drainage, crossing, alterations to kerb and guttering, footpath and roads that may be needed as a result of the development in addition to any such works specified in other conditions.	Yes
12	The applicant shall meet and provide and maintain off street car and truck parking spaces to cater for peak parking demands.	Yes
13	All loading and unloading associated with the development shall be carried out wholly within the property.	Yes
14	All parking spaces and turning areas shall be used exclusively for parking and not for storage or any other purpose.	Yes
15	All vehicles entering and leaving the development shall do so in a forward direction.	Yes
16	All vehicles associated with the development shall be accommodated wholly within the property and not be parked on the adjoining roads or footpaths.	Yes
17	All vehicles carrying materials to or from the site must have their loads covered by tarpaulins or similar covers to prevent discharge of materials onto public roads.	Yes
18	Condition deleted.	N/A
18a	Condition deleted.	N/A
Landscaping		
19	Condition deleted.	N/A
20	The landscaping of the site should be maintained at all times to the satisfaction of Council. This includes suitable perimeter landscaping adjacent to Burrows Road South and a 10 metre wide landscaped buffer strip adjacent to the Alexandra Canal.	Yes

Condition no.	Condition summary	Complied with (Yes/No)
Remediation		
21	Condition deleted.	N/A
Hydrology		
22	The applicant shall ensure that all roof and surface storm water from the site and any catchment external to the site that presently drains into the site drainage shall be collected in a system of pits, pipes, channels and surface flow paths and directed into a Sydney Water controlled drainage system prior to discharge.	Yes
23	Condition deleted.	N/A
24	Condition deleted.	N/A
25	Condition deleted.	N/A
26	All buildings, plant, equipment and material storage shall be set at a minimum height of 500 mm above the 1% Annual Exceedance Probability (AEP) flood event for the Alexandra Canal.	Yes
27	Condition deleted.	N/A
Demolition and Construction		
28	Condition deleted.	N/A
28a	Condition deleted.	N/A
28b	Condition deleted.	N/A
Plant operations		
29	Garbage shall be stored in a location approved by the Council and be disposed of in an approved manner. All liquid wastes (other than storm water) shall be discharged to the sewer in accordance with the requirements of the Sydney Water Corporation.	Yes
30	All vehicles exiting the site must pass through an operational and efficient wheel wash and / or vibration grid.	Yes- All concrete agitators are washed at the slump stand along with an appropriate vibration grid. In order to address this condition for tipper vehicles transporting aggregates from the terminal to external customers, an appropriate system has been designed for installation prior to the existing weighbridge. Due to its location, installation requires a period when the site can be shut down. Boral had originally identified to install a wheel wash over the 2017 Christmas shutdown, however due to high throughput activity at the terminal, this was not possible. Installation will be attempted during the 2018 Christmas shutdown period, or during upgrade works as a part of Modification 11 (whichever is sooner).

Condition no.	Condition summary	Complied with (Yes/No)
31	All wash down areas, truck wash facilities and other areas likely to be contaminated shall be isolated from the storm water drainage system.	Yes
32	Prior to any increase in production at the concrete batching plant (as approved under Mod 10 to this consent) the applicant shall submit to the Secretary for approval evidence of best practice refuelling procedures for the refuelling of site based mobile plant to ensure appropriate containment and management of spills.	Yes - Boral's standard operating procedure for Spill Management was included in the 2017 annual review provided to DP&E.
33	All materials associated with the operation shall be stored in suitably constructed and enclosed containers or similar facilities in a neat and tidy manner at all times.	Yes
Dust		
33a	Prior to any increase in production at the concrete batching plant (as approved under Mod 10 to this consent) the applicant shall review and improve existing dust control measures on the site to ensure: The premises is maintained in a condition that minimises the emission of dust and silt loading on paved surfaces; and All reasonable and feasible best practice measures are implemented to minimise dust generated during operations.	Yes
33b	No stockpile on site should exceed a height of 4 m above ground level or the combined height of the concrete barrier and green mesh fence, whichever is the lesser.	Yes
Noise		
33c	The applicant shall ensure that the noise from the development should not exceed the development noise limits.	Yes
Public utilities		
34	Condition deleted.	N/A
Section 94		
35	Condition deleted.	N/A
Environmental Management and Monitoring		
36	The applicant shall update the existing Environmental Management and Monitoring Plan (EMMP) for the site. The updated Plan shall show how odour, dust noise and water impacts will be measured, monitored, managed and mitigated. The plan is to include, but not be limited to the following: The management of dust impacts, including the impacts of operation of the	Yes

Condition no.	Condition summary	Complied with (Yes/No)
	development; Baseline background dust data; A contingency plan to manage any unpredicted impacts and their consequences; The management of any vibration transmitted to a place of another land user and any sound level at any point of the boundary of the site greater than the levels specified in the NSW EPAs Industrial Noise Policy; The management of polluted waters including the details of the pollution control systems, silt arrestors and separator pits intended to collect and dispose of any polluted water; The management of storm water collection and discharge from the plant including details of first flush tanks from the designated 'dirty' area; and A maintenance program for cleaning oil skimmer pits, storm water pits and traps.	
36a	Prior to any increase in production at the concrete batching plant (as approved under Mod 10 to this consent), an off-site dust deposition monitor shall be established on Burrows Road South in the vicinity of sensitive receptors R3 and R4. The location of the monitor shall be approved by the EPA.	N/A- It is noted that the existing monitors are located on site, close to dust generating activities. The EPA assessment criterion is intended for application to off-site sensitive receptors (eg residences, schools, child care centres etc.). Accordingly, the recorded fallout rates are not representative of off-site dust concentrations. An assessment of accessible areas in the vicinity of receptors R3 and R4 was undertaken by Boral site staff, however no feasible locations were found that comply with the Australian Standards AS/NZS 3580.10.1 for establishing a dust deposition monitor (not within 5 metres of a building, 1 metre of a fence line and within the shadow of an overhanging tree with less than 120° sky visibility). In addition, the availability of the land on private landholdings is scarce, with landholders along Burrows Road South generally unwilling to surrender space for dust monitoring. Given the above, it is considered impractical to monitor dust in the vicinity of receptors R3 and R4.
Environmental Monitoring and Auditing		
36b	Within 12 months of the approval of Mod 10, and each subsequent year, the applicant shall review the environmental performance of the development to the satisfaction of the Secretary. The review must; Describe the development that was carried out in the previous calendar year, and the development that is proposed to be carried out over the next year; Include a comprehensive review of the monitoring results and complaints records of the development over the previous calendar year, which includes a	Yes

Condition no.	Condition summary	Complied with (Yes/No)
	comparison of these results against the: Relevant statutory requirements, limits or performance measures/criteria; Requirements of any plan or program required under this consent; The monitoring results of previous years; and The relevant predictions of the EIS. Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance; Identify any trends in the monitoring data over the life of the development; Identify any discrepancies between the predicted and actual impacts of the development, and analyse the potential cause of any significant discrepancies; and Describe what measures will be implemented over the next year to improve the environmental performance of the development.	
Emergency procedures		
37	Condition deleted	N/A
Signage		
38	Condition deleted	N/A
Rail quarry product delivery		
39	The applicant shall maximise the use of rail freight for quarry product delivery wherever reasonably practicable.	Yes
40	The Department may require, at the applicant's expense, an independent audit of rail use for quarry product delivery if it considers that rail use has not been used wherever reasonably practicable.	Yes
41	Condition deleted	N/A
Safety studies		
42	Condition deleted	N/A
43	Condition deleted	N/A
Hazard audit		
44	Condition deleted	N/A
45	Within three months of the approval of a modification, an annual review (under condition 36b), an independent audit of rail use (under condition 40) or the submission of an incident report (under condition 48), the applicant shall review, and if necessary revise, the strategies, plans and programs required	Yes

Condition no.	Condition summary	Complied with (Yes/No)
	under this consent to the satisfaction of the Secretary.	
46	The applicant shall obtain all relevant Part 4A certificates as described under section 109C of the Act for relevant structures and buildings on the site.	Yes
47	Condition deleted.	N/A
Incident Reporting		
48	The applicant shall notify the Secretary and any other relevant agencies of any incident or potential incident with actual or potential significant off-site impacts on people or the biophysical environment associated with the development after the applicant becomes aware of the incident. Within 7 days of this incident, the applicant shall provide the Secretary and any relevant agencies with a detailed report on the incident.	Yes

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