STATE COMMISSION ASSESSMENT PANEL
A COMMITTEE OF THE STATE PLANNING COMMISSION

APPLICATION ON NOTIFICATION – CROWN DEVELOPMENT

Applicant:	Viva Energy Australia
Development Number:	040/V023/19 App 4083
Nature of Development:	New 30 mega litre petroleum storage tank, new bund wall and associated infrastructure to an existing petroleum storage facility
Type of development:	Public Infrastructure
Zone / Policy Area:	Industry Zone
Subject Land:	162-180, Victoria Road, Peterhead, 5016 (Allotment 2, D70924: CT 6040 Folio 730).
Contact Officer:	Sarah Elding
Phone Number:	08 7109 7006
Start Date:	12 June 2019
Close Date:	10 July 2019

During the notification period, hard copies of the application documentation can be viewed at the Department of Planning, Transport and Infrastructure, Level 5, 50 Flinders Street, Adelaide during normal business hours. Application documentation may also be viewed during normal business hours at the local Council office (if identified on the public notice).

Written representations must be received by the close date (indicated above) and can either be posted, hand-delivered, faxed or emailed to the State Commission Assessment Panel (SCAP). A representation form is provided as part of this pdf document.

Any representations received after the close date will not be considered.

Postal Address:
The Secretary
State Commission Assessment Panel
GPO Box 1815
ADELAIDE SA 5001

Street Address:
Development Division
Department of Planning, Transport and Infrastructure
Level 5, 50 Flinders Street
ADELAIDE

Email Address: scapadmin@sa.gov.au
Fax Number: (08) 8303 0753

DEVELOPMENT ACT, 1993
S49/S49A – CROWN DEVELOPMENT
REPRESENTATION ON APPLICATION

Applicant:	Viva Energy Australia
Development Number:	040/V023/19
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Contact Officer:	Sarah Elding
Phone Number:	08 7109 7006
Close Date:	10 July 2019

My name:____

My phone number: ____

PRIMARY METHOD(s) OF CONTACT: Email address: ____

Postal address:____

_____________________________________Postcode_____________

You may be contacted via your nominated PRIMARY METHOD(s) OF CONTACT if you indicate below that you wish to be heard by the State Commission Assessment Panel in support of your submission.

My interests are:
[ ] owner of local property
[ ] occupier of local property
[ ] a representative of a company/other organisation affected by the proposal
[ ] a private citizen

The address of the property affected is ....Postcode..................................

The specific aspects of the application to which I make comment on are: ....

....

....

....

....

....

....

I [ ] wish to be heard in support of my submission
[ ] do not wish to be heard in support of my submission
(Please tick one)

by [ ] appearing personally
[ ] being represented by the following person : ....
(Cross out whichever does not apply)

Date: .... Signature: ....

Return Address: The Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide, SA 5001 or
scapadmin@sa.gov.au

Government of South Australia

Department of Planning, Transport and Infrastructure

DEVELOPMENT ACT 1993

NOTICE OF APPLICATION FOR CONSENT TO DEVELOPMENT

SECTION 49 – PUBLIC INFRASTRUCTURE

Notice is hereby given that an application has been made by **Viva Energy Australia** (as previously sponsored for the purposes of public infrastructure by the Department for Energy and Mining under Section 49 of the Development Act 1993) to construct a new 30 mega litre petroleum storage tank, new bund wall and associated infrastructure to an existing petroleum storage facility. **Development Number 040/V023/19.**

The subject land is situated within the existing fuel terminal, located on the corner of Wills Street and Victoria Road, Peterhead (being Allotment 2, D70924; CT Volume 6040 Folio 730).

The development site is located within the Industry Zone of the Port Adelaide Enfield Council Development Plan (Consolidated 6 February 2018).

The application may be examined during normal office hours at the office of the State Commission Assessment Panel, Level 5, 50 Flinders Street, Adelaide and at the Port Adelaide Enfield Council Civic Centre, 163 St Vincent Street, Port Adelaide. Application documentation may also be viewed on the State Commission Assessment Panel (SCAP) website: www.saplanningcommission.sa.gov.au/scap/public_notices

Any person or body who desires to do so may make representations concerning the application by notice in writing delivered to the Secretary, State Commission Assessment Panel, GPO Box 1815, Adelaide 5001 by **NO LATER THAN 10 July 2019.** Submissions can also be emailed to: scapreps@sa.gov.au

Each person or body making a representation should state the reason for the representation and whether that person or body wishes to be given the opportunity to appear before the SCAP to further explain the representation.

Submissions may be made available for public inspection.

Should you wish to discuss the application and the public notification procedure please contact **Sarah Elding** on **(08) 7109 7006.**

Alison Gill
SECRETARY
STATE COMMISSION ASSESSMENT PANEL

PN3874

www.sa.gov.au

PN3874
21x2 (63mm)
Adelaide Advertiser
Westside Weekly Messenger
Wednesday 12 June 2019
APPROVAL REQUIRED BY 11AM FRIDAY 7 JUNE 2019

SECTION 49 & 49A – CROWN DEVELOPMENT
DEVELOPMENT APPLICATION FORM

PLEASE USE BLOCK LETTERS

COUNCIL: CITY OF PORT ADELAIDE ENFIELD

APPLICANT: VIVA ENERGY AUSTRALIA.

ADDRESS: C/- AURECON, LVL 10, 55 GRENFELL ST ADELAIDE

CROWN AGENCY: DEPARTMENT FOR ENERGY AND MINING

FOR OFFICE USE

DEVELOPMENT No: ____________________

PREVIOUS DEVELOPMENT No: ____________________

DATE RECEIVED: / /

CONTACT PERSON FOR FURTHER INFORMATION

Name: MICHAEL DAVIS

Telephone: 0414 357 276 [work] ____________ [Ah]

Fax: ____________ [work] ____________ [Ah]

Email: MICHAEL.DAVIS@AURECONGROUP.COM

☐ Complying	Decision: ____________
☐ Merit	Type: ____________
☐ Public Notification	Finalised: / /
☐ Referrals	

NOTE TO APPLICANTS:

(1) All sections of this form must be completed. The site of the development must be accurately identified and the nature of the proposal adequately described. If the expected development cost of this Section 49 or Section 49A application exceeds $100,000 (excl. fit-out) or the development involves the division of land (with the creation of additional allotments) it will be subject to those fees as outlined in Item 1 of Schedule 6 of the *Development Regulations 2008.* Proposals over $4 million (excl. fit-out) will be subject to public notification and advertising fees.
(2) Three copies of the application should also be provided.

	Decision required	Fees	Receipt No	Date
Planning:				
Land Division:				
Additional:				
Minister's Approval				

EXISTING USE: FUEL STORAGE DEPOT

DESCRIPTION OF PROPOSED DEVELOPMENT: NEW 30ML PETROLEUM STORAGE TANK, NEW BUND WALL AND ASSOCIATED INFRASTRUCTURE

LOCATION OF PROPOSED DEVELOPMENT: ____________________

House No: 62-180 Lot No: ____ Street: VICTORIA ROAD Town/Suburb: PETERHEAD

Section No [full/part] ____________ Hundred: ____________ Volume: 6040 Folio: 730

Section No [full/part] ____________ Hundred: ____________ Volume: ____________ Folio: ____________

LAND DIVISION:

Site Area [m²] ____________ Reserve Area [m²] ____________ No of existing allotments ____________

Number of additional allotments [excluding road and reserve]: ____________ Lease: **YES** ☐ **NO** ☐

DEVELOPMENT COST [do not include any fit-out costs]: $ 22 MILLION

POWERLINE SETBACKS: Pursuant to Schedule 5 (2a)(1) of the *Development Regulations 2008,* if this application is for a building it will be forwarded to the Office of the Technical Regulator for comment unless the applicant provides a declaration to confirm that the building meets the required setback distances from existing powerlines. The declaration form and further information on electricity infrastructure and clearance distances can be downloaded from the DPLG website (www.dac.sa.gov.au).

I acknowledge that copies of this application and supporting documentation may be provided to interested persons in accordance with the *Development Act 1993.*

SIGNATURE: [signature] Dated: 5 / 4 / 2019

DEVELOPMENT REGULATIONS 1993
Form of Declaration
(Schedule 5 clause 2A)

To: STATE COMMISSION ASSESSMENT PANEL

From: AURECON AUSTRALASIA ON BEHALF OF VIVA ENERGY AUSTRALIA

Date of Application: 5 / 4 / 2019

Location of Proposed Development: ....

House No: 62-180 Lot No: .... Street: VICTORIA ROAD Town/Suburb PETERHEAD

Section No (full/part): ....Hundred: ....

Volume: 6040.... Folio: 730.........

Nature of Proposed Development:

I MICHAEL DAVIS ....~~**being the applicant/**~~ **a person acting on behalf of the applicant (delete the inapplicable statement) for the development described above declare that the proposed development will involve the construction of a building which would, if constructed in accordance with the plans submitted, not be contrary to the regulations prescribed for the purposes of section 86 of the *Electricity Act 1996*. I make this declaration under clause 2A(1) of Schedule 5 of the *Development Regulations 1993*.**

Date: 5 / 4 / 2019

Signed: ....

Note 1
This declaration is only relevant to those development applications seeking authorisation for a form of development that involves the construction of a building (there is a definition of 'building' contained in section 4(1) of the *Development Act 1993*), other than where the development is limited to –

a) an internal alteration of a building; or
b) an alteration to the walls of a building but not so as to alter the shape of the building.

Note 2

The requirements of section 86 of the *Electricity Act 1996* do not apply in relation to:

a) a fence that is less than 2.0 m in height; or

b) a service line installed specifically to supply electricity to the building or structure by the operator of the transmission or distribution network from which the electricity is being supplied.

Note 3

Section 86 of the *Electricity Act 1996* refers to the erection of buildings in proximity to powerlines. The regulations under this Act prescribe minimum safe clearance distances that must be complied with.

Note 4

The majority of applications will not have any powerline issues, as normal residential setbacks often cause the building to comply with the prescribed powerline clearance distances. Buildings/renovations located far away from powerlines, for example towards the back of properties, will usually also comply.

Particular care needs to be taken where high voltage powerlines exist; where the development:

- is on a major road;
- commercial/industrial in nature; or
- built to the property boundary.

Note 5

Information brochures 'Powerline Clearance Declaration Guide' and 'Building Safely Near Powerlines' have been prepared by the Technical Regulator to assist applicants and other interested persons. Copies of these brochures are available from council and the Office of the Technical Regulator. The brochures and other relevant information can also be found at www.technicalregulator.sa.gov.au

Note 6

In cases where applicants have obtained a written approval from the Technical Regulator to build the development specified above in its current form within the prescribed clearance distances, the applicant is able to sign the form.

PLN/06/0024

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Level 10, 55 Grenfell Street
Adelaide SA 5000
Australia

T +61 8 8237 9777
F +61 8 8237 9778
E adelaide@aurecongroup.com
W aurecongroup.com

aurecon

2019-04-05

Presiding Member
State Commission Assessment Panel
GPO Box 1815
ADELAIDE SA 5001

Attention: Mr Robert Kleeman, Unit Manager Policy & Strategic Assessment

Dear Robert

Proposed Crown Development - 30ML Petroleum Storage Tank at Peterhead

Viva Energy Australia is seeking to develop a 30 megalitre (ML) petroleum storage tank at its existing fuel depot site at 62-180 Victoria Road, Peterhead. The proposed development has been sponsored by the Department for Energy and Mining (DEM) as a Crown Development for the purposes of public infrastructure in accordance with Section 49(2)(c) of the *Development Act 1993*.

Aurecon Australasia Pty Ltd has been engaged to prepare and lodge a development application for the proposal on behalf of Viva Energy. Please find attached the following documents forming the application:

- Development Application Form
- Electricity Act Declaration Form
- Planning Report with appendices including:
  - Crown Sponsorship Letter from DEM
  - Certificate of Title
  - Site Plan and Elevations
- Air Quality Assessment.

It would be appreciated if the State Commission Assessment Panel could please issue separate invoices for Lodgement and Assessment Fees to enable the former to be paid in the first instance.

Please do not hesitate to contact me via email at Michael.Davis@aurecongroup.com or call on 0414 357 276 if you have any questions in relation to the proposed development.

Yours faithfully

Michael Davis MPIA
SA Planning + Design Leader
Environment and Planning, Aurecon

Enc: Application documents

New Petroleum Storage Tank

Planning Report

Viva Energy

Reference: 501862

Revision: 0

2019-04-03

aurecon

Bringing ideas to life

Document control record

Document prepared by:

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Level 10, 55 Grenfell Street
Adelaide SA 5000
Australia

T +61 8 8237 9777
F +61 8 8237 9778
E adelaide@aurecongroup.com
W aurecongroup.com

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Client		Viva Energy				
Client contact		Michael Brown	**Client reference**			
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier** (if required)	**Approver**
0	2019-04-03	Final for submission	M Howard	M Davis		M Davis
Current revision		**0**				

Approval			
Author signature		Approver signature	
Name	Marcus Howard	Name	Michael Davis
Title	Manager, Program Advisory	Title	SA Planning + Design Leader

Contents

Appendices

Figures

Tables

1 Introduction

1.1 Purpose

This Planning Report has been prepared to support the Crown Development application (DA) for a new 30 million litre (ML) petroleum product storage tank on the subject land at 62-180 Victoria Road, Peterhead.

This report provides background to the Project, describes the Subject Land and its context, explains the proposed development activities and provides planning justification for the proposal having regard for relevant planning and environmental considerations.

The proposed development is located within the City of Port Adelaide Enfield and the locality of Peterhead, in the general vicinity of Birkenhead.

1.2 The Project

The proposed development is for the construction of a new 30 million litre petroleum storage tank on the subject land at 62-180 Victoria Road, Peterhead. This development also encompasses the construction of a new 3.6 metre to 4.3 metre high precast concrete wall around the subject land. This wall will act as a bund wall to ensure that should there be a loss of material from the tank that this can be retained on site.

The proposed development has been sponsored as Crown Development by the Department for Energy and Mining, as it meets the definition of public infrastructure, as outlined in Section 49(1)(a) of the *Development Act 1993*.

1.3 Scope

The scope of the Project (and the subject of this development application) is for the construction of the new 30ML petroleum storage tank, a bund/compound wall and associated infrastructure.

1.4 The Applicant

The applicant for the development application is Viva Energy Australia.

Viva Energy Australia

Formerly part of the Royal Dutch Shell group, the Australian business was acquired in 2014 by new owners led by the Vitol Group, and now trades as Viva Energy Australia. The business was offered publicly in 2018 and is listed as the Viva Energy Group on the Australian Stock Exchange. Viva Energy's business has operated in Australia for more than 110 years and today proudly supplies around 25 percent of the country's liquid fuel energy needs. They continue their long association with Shell as the exclusive licensee for Shell fuels and distributor of quality Shell lubricants in Australia.

Viva Energy supplies around a quarter of the country's total liquid fuel requirements. These include petrol, liquefied petroleum gas (LPG), diesel, aviation fuels, propylene, solvents and bitumen. Production at the Geelong Refinery is supplemented with products imported through the worlds' largest independent oil trader (the Vitol Group) and delivered safely and reliably nationwide through our network of more than twenty fuel import terminals around the country.

Vitol

The Vitol Group is the world's largest independent energy and commodities trading company. Physical trading, logistics and distribution are at the core of the business, but are complemented by refining, shipping, terminals, exploration and production, power generation, mining and retail businesses. Founded in Rotterdam in 1966, today the company has almost 40 offices worldwide and its largest operations are in Geneva, Houston, London and Singapore. Its turnover in 2016 was $152 billion.

Shell

One of the world's most recognised and respected brands, Shell's reputation for quality and technical innovation is reflected in products that combine performance, efficiency and reliability. Future advancements will come from Shell's annual global investment of more than $1.3 billion in research and development.

1.5 The Planning Report

This Planning Report has been prepared on behalf of Viva Energy in support of the proposed development of a new 30 ML petroleum storage tanks at Peterhead, South Australia.

The report includes the following components:

- A description of the site and the surrounding locality
- A description of the proposal
- An assessment of the proposal against the City of Port Adelaide Enfield Development Plan
- Conclusion and Recommendation

1.6 Stakeholder Engagement

As part of the preliminary design and development of the Project and in preparation for submitting this development application, discussions have been held with key State Agencies and Local Government authorities. The discussions provided the opportunity to brief key stakeholders on the Project and to gain an understanding of their requirements, expectations and their involvement in the assessment of the Project.

Table 1 below provides a record of the stakeholder engagement undertaken at the time of this application being lodged for assessment.

Table 1 Stakeholder Record

Name	Department / Agency	Nature of Stakeholder
Tim Hicks	City of Port Adelaide Enfield	Local Council
Ms Hayley Riggs	Environment Protection Authority	Referral Agency
Mr Lachlan Kinnear	Department of Energy and Mines	Crown Sponsor
Mr Robert Kleeman	Department of Planning, Transport and Infrastructure	Relevant Authority

2 Development Assessment Process

2.1 Nature of Development

This proposal involves the development of a new 30 ML petroleum storage tank, which is an extension of the existing fuel depot on the subject land.

2.2 Relevant Authority

The Department for Energy and Mining has sponsored the proposed development as public infrastructure in accordance with section 49(2)(c) of the Development Act. Therefore, the relevant planning authority for the assessment of the development application will be the Minister for Planning, with advice provided by the State Commission Assessment Panel (SCAP).

A copy of the letter from the Department for Energy and Mining confirming Crown Sponsorship is provided in **Appendix A**.

2.3 Referrals

The application will require formal referral to the City of Port Adelaide Enfield in accordance with section 49(4a) of the Development Act. Council has two months within which to provide comment on the application.

Pursuant to Schedule 8 of the *Development Regulations 2008* the application requires a referral to the Environment Protection Authority (EPA). Having regard for Schedule 22—Activities of Major Environmental Significance, the storage of 30ML of petroleum product establishes the requirement for the referral to the EPA. The EPA has six weeks within which to provide comment on the application.

The subject land is adjacent to a main road; however, a referral to the Commissioner of Highways is not considered to be required as the proposed development does not:

- alter an existing access;
- change the nature of movement through an existing access;
- create a new access; or
- encroach within a road widening setback.

2.4 Public Notification

The total construction cost of the proposed development is greater than $4 million, which requires public notification of the development application in accordance with section 49(7d) of the Development Act. Members of the public may make a written representation to SCAP for a period of 15 business days.

3 Site and Locality

3.1 Subject Land

The Subject Land is located on the Lefevre Peninsula at 162-180 Victoria Road, Peterhead. The subject land is approximately 2.40 ha in size, rectangular in shape and generally flat. The eastern half of the land contains Viva Energy's existing bitumen plant along with two existing petroleum storage tanks (each with a 7ML capacity). The western half of the land holding is currently undeveloped and where the new 30 ML hydrocarbon storage tank is proposed to be located.

Table 2 Property Address and Certificate of Title Details

Address	Volume	Folio
162-180 Victoria Road, Peterhead	6040	730

A copy of the Certificate of Title is provided in **Appendix B**.

Figure 1 Subject Land

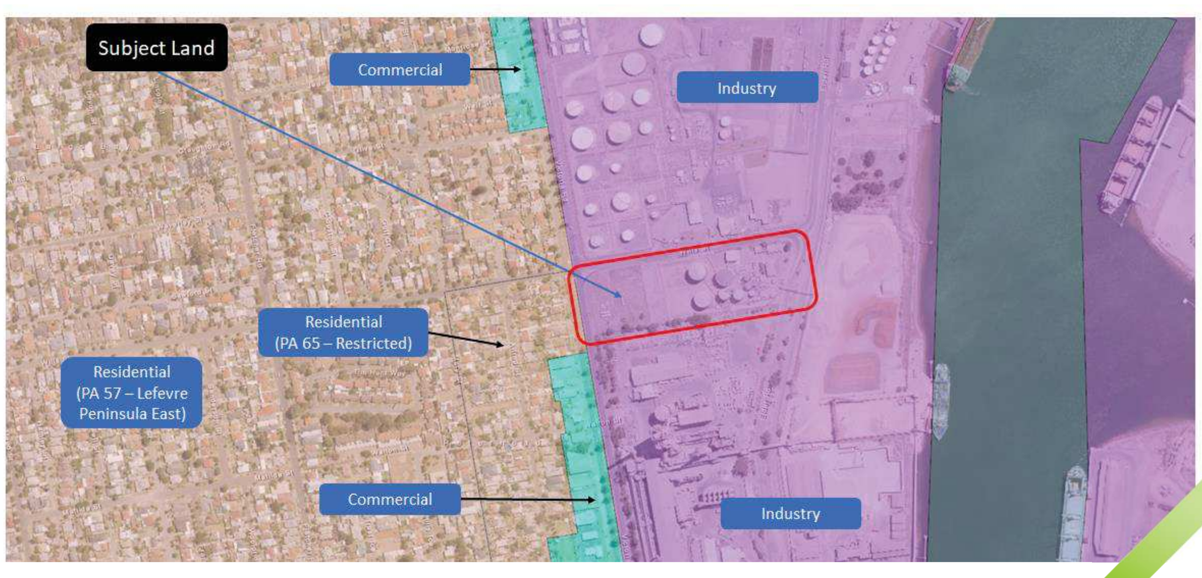


Figure 2 Land Use Zoning

3.2 Locality

The subject land at 62-180 Victoria Road, Peterhead is located within the Industry Zone as stated in the Port Adelaide Enfield (City) Development Plan – Consolidated 6 February 2018.

The subject land is on the western edge of the industry zone and on the western side of Victoria Road is the Residential zone and the suburbs of Largs Bay and Peterhead. These suburbs are long established residential areas and comprise predominantly single storey detached dwellings with some infill development in different residential configurations including semi-detached dwellings, residential flat buildings, and group dwellings.

To the southwest of the subject land on the western side of Victoria Road is a commercial precinct comprising a mix of small-scale commercial activities including a service trade premises (tyre sales) and a 24-hour gymnasium.

To the immediate north, south and east of the subject land is a range of industrial uses and activities. To the immediate south, abutting the subject land, is the Adelaide Brighton Cement Birkenhead plant. The Adelaide Brighton Cement plant extends for approximately 800 metres south of the subject land adjacent Victoria Road and is a significant heavy industry within the locality of the subject land.

To the north of the subject land (on the northern side of Wills Street) is the Mobil Fuel Storage Facility. This facility has been established on the subject land since 1925 and is a significant land use in the locality of the subject land.

The locality can be described as one that has two clearly distinct elements; industry to the east of Victoria Road and residential to the west of Victoria Road. This is reflected in Victoria Road being the zone boundary between the two longstanding residential and industrial zones on either side of the road. Victoria Road is a Primary Arterial Road and carries approximately 25,100 vehicles per day (2015).

A Locality Plan is provided in Figure 3 below.

Figure 3 Locality Plan

4 Project Description

4.1 Proposed Development

The proposed development is for the construction of a new 30 million litre (ML) hydrocarbon storage tank (diesel) on the subject land. This development also encompasses the construction of a new 4.0 metre high precast concrete bund wall around the subject land and associated supporting infrastructure. This concrete bund wall will act to ensure that should there be a loss of material from the tanks within the compound that this can be retained on site.

A copy of the site plans and elevations for the Project is located in **Appendix C**.

The specifications of the new works and storage tank is outlined in the table below:

Table 3 Key Project Specifications

Description	Details
Height	21.6 metres
Diameter	46.7 metres
Storage Capacity	30 million litres (30 ML)
Bund Wall	4.0m in height (ranges from 3.25m to 4.3m)

The proposed new tank is located within the western half of the subject land and the figure below identifies the location of the tank.

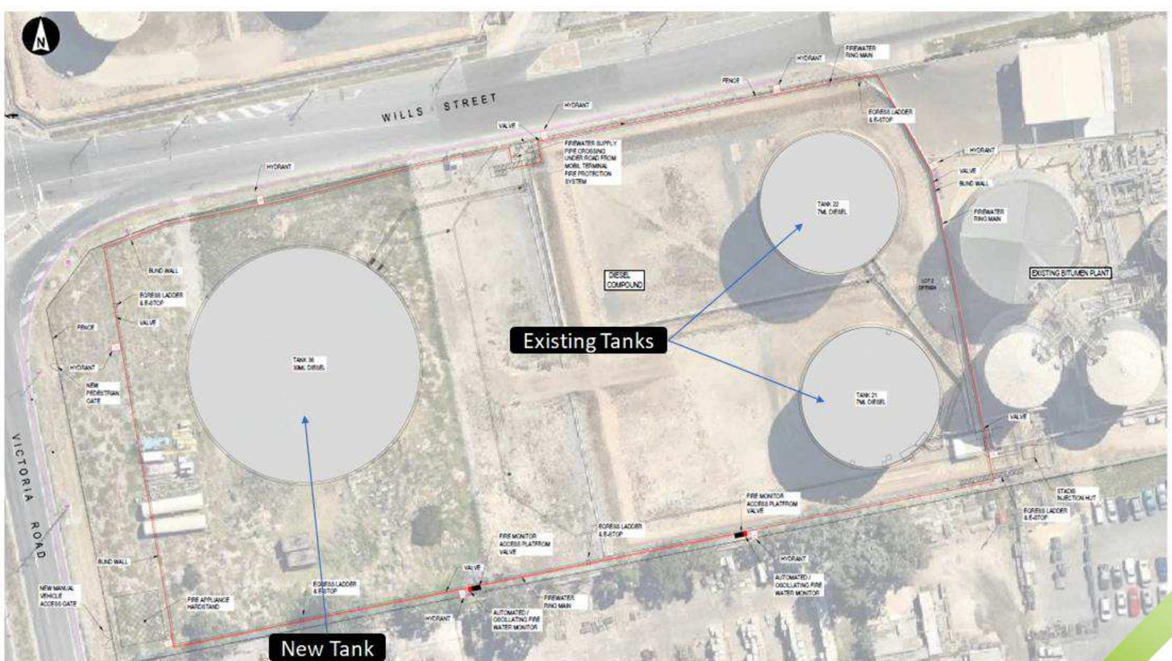


Figure 4 Site Plan

Figure 5 below provides an isometric view of the new storage tank, the new bund wall along with the two existing storage tanks on the eastern half of the site.

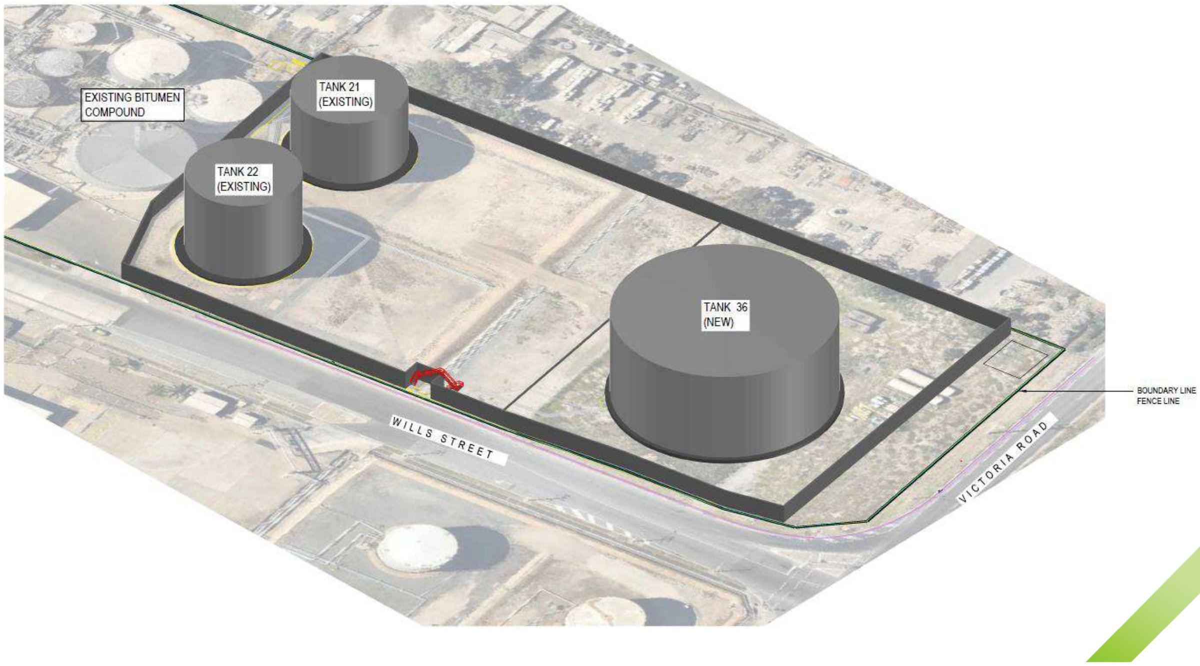


Figure 5 Isometric View of Terminal and Proposed New Storage Tank

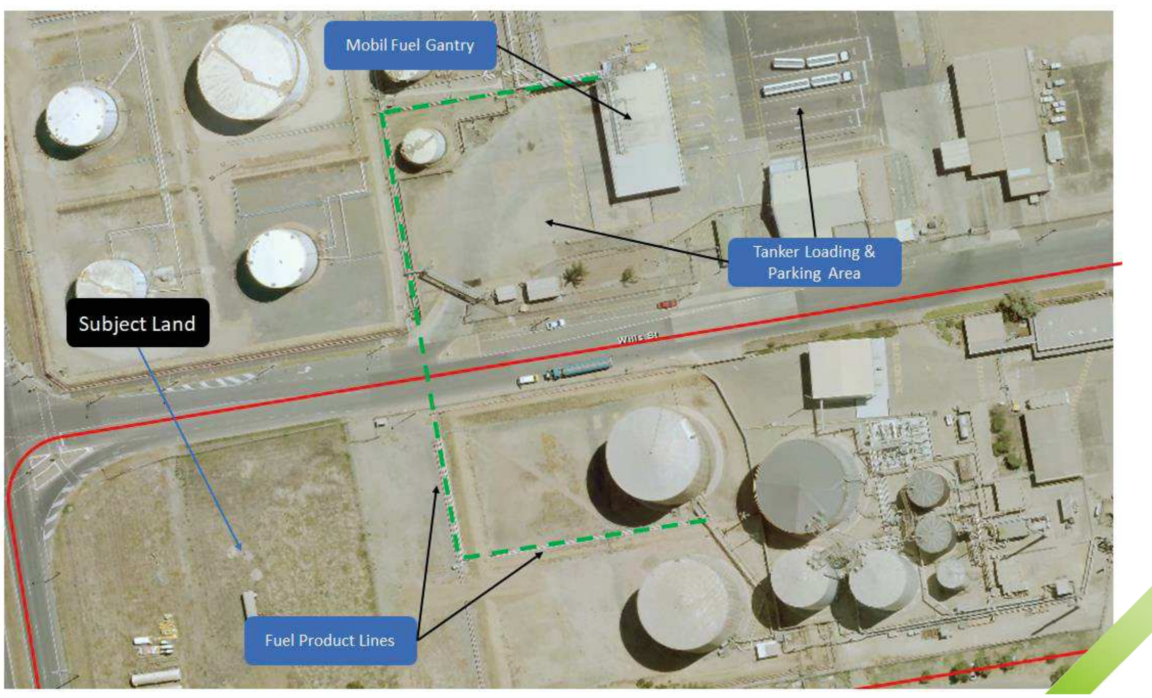


Figure 6 Location of Existing Fuel gantry, product lines and tanker loading area

4.2 Management Plans & Licences

The following management plans will be prepared as part of the development implementation for the Project:

- Construction Environmental Management Plan (CEMP)

  The purpose of the CEMP is to identify the environmental protection measures, systems and tools to be implemented by the Managing Contractor and its subcontractors during the development and construction works of the Project. These measures are aimed at preventing potentially adverse environmental impacts arising during project development and construction activities whilst achieving compliance with environmental regulatory requirements. In addition, the CEMP also outlines a system for hazard and risk identification and determines appropriate management strategies to be adopted by the Managing Contractor and its contractors to mitigate or eliminate these risks.

  The CEMP will be prepared (and endorsed) prior to commencement of any site works, having regard to the following legislation and guidelines.

  – Environment Protection Act 1993
  – Environment Protection (Water Quality) Policy 2003
  – Environment Protection (Noise) Policy 2007
  – Environment Protection (Waste to Resources) Policy 2010 (Waste Policy)
  – National Environment Protection (Ambient Air Quality) Measure 2003
  – National Environment Protection (Assessment of Site Contamination) Measure 1999
  – Stormwater Pollution Prevention Code of Practice for Local, State and Federal Government
  – EPA Standard for the Production and Use of Waste Derived Fill (January 2010)
  – EPA Guidelines: Construction environmental management plans (November 2016)
  – EPA Guidelines 080/07: Bunding and Spill Management (June 2007)

- Updated Facilities Operating Plan

  The Facilities Operating Plan includes the process for managing the environment, personnel and facilities safety, facilities asset integrity and emergency response management.

The following EPA Petroleum Storage and Processing Works Licenses are required to operate the facility and will be prepared subject to Development Plan Approval bring granted:

– Modification to the existing EPA Licence Application for Activities 1(5)(a) – Petroleum Storage and 3(4) – Activities producing listed waste should then be submitted for assessment and approval
– Dangerous Substances Licence.

4.3 Waste Management

The management of solid waste during construction and operation is addressed as follows:

4.3.1 Management of Construction Waste

Construction waste will be minimal; however, any off cuts of steel and surplus steel rod will be recycled, and any packaging waste and cardboard will be collected and recycled through recycle waste bins. Any other waste such as wooden boxing and other solid construction waste will be disposed of at an approved waste disposal company.

4.3.2 Management of Waste During Operation

Road tanker loading operates with a vapour recovery unit to recover petroleum waste and minimise waste discharging to atmosphere.

All water that is collected from the road ways and tank farms is processed via API oil separator (European class 1 interceptor), which separates any residual hydrocarbons and clean water is discharged to local stormwater system. Any contaminated water is minimised in this way and stored prior to disposal in an authorised waste treatment facility.

The Site will have an environmental management manual written which will be accredited to the ISO 14001 environmental management standard. The environmental manual will include all waste generating activities and their impacts as well as control measures through its Environmental Aspects Register.

Water that is removed from the storage tanks is treated to reduce waste and collected in the slops tank before being transported off site to an authorised waste treatment facility

4.4 Background Investigations

4.4.1 Air Quality

An independent report has been prepared by Aurecon on noise and odour impacts associated with the proposed development. Aurecon assessments have been based on what additional noise and odour would be generated by the proposed development, and the best ways in which to manage and mitigate against any adverse effects upon adjoining land uses.

The proposed facilities shall be designed to meet all EPA requirements for minimal disruption to neighbouring land users with respect to potential noise and air quality impact.

A copy of Aurecon's report is provided as part of the Development Application.

4.4.2 Groundwater

A series of groundwater monitoring wells have been installed around the perimeter of the site. A regular (annual or two-yearly) groundwater monitoring program by an independent environmental consultant of five key boundary monitoring wells around the facility will be scheduled as part of the Environmental Management System. Analytes will include total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene and xylene (BTEX). Three of these monitoring wells have been located down-gradient of the proposed storage compound.

5 Development Plan Assessment

5.1 Overview

The subject land is located within the Industry Zone of the City of Port Adelaide Enfield Development Plan (Consolidated –6 February 2018). This proposal is a development which must be considered on its merits within this zone and the respective Policy Area.

The following Development Plan Assessment has been prepared for the proposed early works development. Given the range of Development Plan provisions being considered, the planning assessment has been summarised within the following headings.

- Land Use
- Site Levels
- Stormwater Management
- Acoustic Management
- Air Quality Management.

5.2 Relevant Development Plan Provisions

In terms of Development Plan considerations, the following list identifies those provisions considered most relevant to the assessment of the proposed development. These provisions have been selected from the Port Adelaide Enfield Council Development Plan (Consolidated – 6 February 2018).

Table 4 Relevant Development Plan Provisions

Zone and Policy Area		
Industry Zone		
Desired Character Statement		
Objectives	1, 2, 3, 4.	
Principles of Development Control	1, 2, 3.	
Council Wide (General Section)		
Crime Prevention Objective: 1. PDC: 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16.	**Hazards** Objective: 1, 2, 4, 7, 8, 9, 10. PDC: 1, 3, 4, 5, 6, 7, 8, 9, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29.	**Orderly and Sustainable Development** Objective: 1, 2, 3, 4, 6. PDC: 1.
Coastal Areas Objective: 1 to 8. PDC:4, 5, 20, 21, 22, 23,	**Industrial Development** Objective: 1 to 5. PDC: 6, 7, 8, 9, 10, 11, 15, 16, 17, 18, 19.	**Transportation and Access** Objective: 2. PDC:1, 2, 13.
Crime Prevention Objective: 1. PDC: 1, 2, 3, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14, 15, 16.	**Interface Between Land Uses** Objective: 1, 2, 3. PDC: 1, 2, 6, 11, 12.	**Waste** Objective: 1, 2. PDC: 1, 2, 3, 4, 7, 10, 11.
Design and Appearance Objective: 1, 2, 3. PDC: 1, 2, 3, 4, 5.	**Landscaping, Fences and Walls** Objective: 1, 3. PDC: 1, 3, 7, 9.	

Table 5 Relevant Development Plan Maps

Maps
Location Map PAdE/11
Overlay Map PAdE/11 – Transport
Overlay Map PAdE/11 – Development Constraints
Overlay Map PAdE/11 – Heritage
Overlay Map PAdE/11 – Natural Resources
Zone Map PAdE/11
Policy Area Map PAdE/11
Precinct Map PAdE/11

An assessment of the development application against the key provisions of the Zone as well as Council Wide policies follows.

5.3 Land Use and Built Form

The proposed development of the new storage tank is a continuation and expansion of the use of the subject land for the storage of hydrocarbon products. This activity is consistent with the spirit and intent of the Industry Zone in which the development is located.

The Zone speaks to accommodating a wide range of industrial uses. The development of the additional storage tank is consistent with this and with the Desired Character Statement for the Industry Zone:

> *The zone is anticipated to accommodate a full range of industrial, warehousing, storage, transport and related activities with minimal restrictions on hours of operation. It is important that development in the zone is protected from any incursion of sensitive or other land uses that may impinge on the ability of industry or other appropriate uses to operate on a 24-hour basis.*

The eastern portion of the site is for bitumen storage and production and will continue to operate. The additional proposed storage tank will complement the activities within the wider industrial precinct, in particular the Mobil bulk liquid storage facility on the adjacent land on the northern side of Wills Street.

Given the nature and scale of the new tank it will be visible from beyond the subject land. The bund wall will also be visible, being a maximum of 4.3 metres in height (average of 4.0 metres). In an attempt to reduce the impacts of the proposed development beyond the site boundaries, none of the structures on site will incorporate highly reflective materials. Landscaping will be used to improve the appearance of the overall development when viewed from areas outside the site along the Victoria Road (western) frontage.

In the context of the nature of development on the subject land and more broadly on the eastern side of Victoria Road, the visual impact of the proposed development will be acceptable. This is not a first intrusion to the locality such that amenity will be diminished by the new tank or the bund wall. The introduction of the bund wall serves to improve the appearance to a degree by screening the structures and operations at ground level.

A key consideration for a development such as this is the way in which the site functions to allow for the safest and most efficient operating environment for all concerned. Any development dealing with hydrocarbons involves an element of risk and it is this consideration and the management of this risk that has a significant bearing on the way the site is arranged. The location of all the structures has been considered deliberately to allow the site to function in such a way that provides for the maximum level of safety for on-site personnel and for ongoing operations of the facility.

Lighting will be provided on the site to ensure that safe and efficient operation can occur at all times the site is being used. Given the site's location, the on-site lighting will not have a negative impact upon the amenity of surrounding activities. The lighting used on site will be designed in accordance with AS4282-1997 (Australian Standard – Control Of The Obtrusive Effects Of Outdoor Lighting).

We are of the opinion that the built form of the key structures and buildings forming part of the Viva Energy project will be consistent with the spirit and intent of the Objectives and Principles of Development Control relating to siting and visibility of development.

5.4 Site Security

Given the nature of the proposed development and the need to manage access to and from the subject land, the proponents will be incorporating security fencing around the site which will provide for secure limited access arrangements to the site for vehicles and visitors. The bund wall will act as a security fence around the perimeter of the site and will limit the movements of people and vehicles in and out of the site. CCTV will also be incorporated as part of the on-site security arrangements which will complement the arrangements across the wider Viva Energy operation.

The security protocols that are to be implemented for this development will be a continuation of those that are already established for the Viva Energy facility.

Access to the subject land will only be gained by security card authorisation. Internal and external patrols will be carried out after hours and over weekends. These arrangements will limit access to the site to only those individuals who should be there. This will ensure the safety and security of drivers and pedestrians using nearby roads or pedestrian networks.

Landscaping in front of the bund wall will be chosen and planted to meet the relevant provisions of the Development Plan related to crime prevention.

5.5 Stormwater Management

The management of stormwater during the early works stage will be undertaken to ensure no adverse stormwater pollution and/or impacts to receiving waters. A CEMP will establish a stormwater management strategy during the construction period which will encompass management of soil erosion and sediment control. The capture and management of stormwater will be undertaken to prevent or minimise the risk of downstream flooding, particularly in adjacent low-lying areas.

During construction, management practices will be implemented to restrict stormwater runoff generated on site from egressing into neighbouring properties and isolating sediment run-off. The quality of stormwater runoff through a diversion channel (or equivalent) to allow adequate containment of stormwater runoff generated from site will be implemented. The contractor will be required to implement sedimentation control to mitigate this potential impact by using such measures as sandbags, silt fences and or berms in areas that are prone to run-off and high sediment loads. Other considerations are the establishment of minor drainage lines to act as sediment traps.

Where soil stockpiles will be required during the segmented scraping of the site they will covered using an appropriate liner to avoid additional sedimentation and not be located in the vicinity of highly trafficked areas or areas prone to disturbance to minimise soil disturbance.

Drainage from the area immediately surrounding the tank will also be directed to a first flush pit. Sizing of the first flush pit will be based on a 3-month, 20-minute rainfall. The first flush retained will be tested and discharged via a separator while additional rain water will be directed automatically to stormwater.

The capture and reuse of stormwater is a key part of the design of the Project. The capture and management of stormwater is also very important for the management of the development. The bunded area will have a sump for the collection of rainwater and possible spills. Water collected in the sump will be sampled and inspected prior to release. Should the water be contaminated, it will be pumped to an approved waste treatment facility. If the water is not contaminated it will be released to stormwater via an oil/water separator by opening a manual valve.

This water will not be discharged to the adjacent stormwater system until it has met the required water standards for discharge. This is particularly important given the nature of the surrounding land uses and the proximity of the Port River.

In this regard, we are of the opinion that the proposed development is consistent with the relevant provisions relating to a development of this type, and in particular the management of the materials being stored, and the management of stormwater collected and managed on site prior to suitable disposal.

5.6 Noise Impacts

Noise generated on-site by the proposed development will be mitigated by the construction of the 4.0-metre-high bund. However, the activities from the development will not alter the noise characteristics of existing development on-site and within the locality.

The potential noise and vibration impact of the construction activities will be considered within a CEMP. Ongoing management of noise from the ongoing operation of the facility will be managed by Viva Energy through their suite of on-site activity management plans.

Mitigation measures include restrictions on working times, taking measures to limit accumulative noise, as well as engaging with surrounding properties. Every effort will be made to limit impact to their operations and to provide communication pathways to enable complaints to be made with resolution of complaints within a timely manner. Options that are currently being reviewed with nearby residents are to sequence the works (primarily on the northern area of the site) to cater for lower impact times of the day or month.

The bulk of construction noise will be associated with heavy machinery operation during the preparation of the site and the installation of concrete foundations to support the superstructure.

It is considered that the development's proposed management and mitigation measures in respect to noise quality meets the Council Wide Objectives and Principles of Development Control in respect to Industrial Development and Interface between Land Uses.

5.7 Air Quality Impact

The proposed works and ongoing operation of the facility will consider and implement air quality measures to avoid adverse impacts to residences and the surrounding environment through the application of the CEMP and operational management plans. Air quality analysis undertaken by Aurecon assessed the impacts of the proposed development and a second additional petroleum storage tank in the locality (not subject to this Development Application). The analysis indicates that while a new emissions source, given changes in the operations of the subject land, the new tank will "have less impact on the most adversely affected residential properties located nearby, and effectively 'subtract' from the existing impact.

The construction works may have an impact on air quality in the surrounding locality through higher than normal dust emissions and air-borne particulate matter.

The CEMP provides mitigation measures against dust from vehicular traffic, dust suppression activities and stockpiled materials. If in the event that odour-generating activities are impacting upon site personnel and neighbouring properties, the activity will be suspended and modified accordingly.

5.8 Hazard and Risk Management

Hazard and Risk Management is the single most important consideration made by Viva Energy in the site planning and configuration associated with this proposed development.

Much of the investigation to date has involved detailed consideration of the potential risks and hazards that the proposed development may give rise to and is also exposed to from surrounding land users and activities, and how best to manage potential risks. Extensive consultation with key agencies and regulatory bodies has been carried out on the initial project design to get it to this stage.

Viva Energy is a well-established operator in South Australia and is experienced in managing petroleum projects in accordance with the requirements of the SA Petroleum Act 2000. The processes established to manage the risks associated with this development are based on current best practice and this extensive experience in the SA petroleum industry.

The development will minimise adverse impacts on the site and on surrounding land uses through the use of the appropriate construction and operational management practices. The objective of these plans is to provide for safe and efficient operations during construction and operation of the facility, for those using and working on the facility and the surrounding land uses.

The location and size of the proposed storage tank (and bund wall) has been determined to be of adequate size and retain its own buffer area so that:

- The consequences of any hazardous event at the Viva Energy site are contained within the site boundary, so that risks imposed by the development on the public and external facilities are reduced to as low as reasonably practicable.
- The separation of the development from the surrounding land uses is sufficient so that risks to Viva Energy personnel and infrastructure associated with any hazardous event involving these facilities are reduced to as low as reasonably practicable.

The development's proposed management and mitigation measures are consistent with the spirit and intent of the Council Wide Objectives and Principles of Development Control for Hazard and Risk Management.

5.8.1 Flooding

The design of the development has undertaken investigations into the topography and geology of the subject land to understand the structural design of the storage tanks footings, new bund wall and associated infrastructure. Throughout the design team have had regard to the required finished site and building levels that would be necessary to ensure that the finished floor levels and building levels are above future predicted sea level rises and complement the level on the adjacent ship building land to the east of the subject land.

The new site levels have considered protection from coast flooding to the year 2050 and potential sea level rise to the year 2100 and meet relevant provisions of the Zone and General Sections.   The preliminary design and development of the Project has considered the need to build the site up to the required levels. This level will be achieved across the site and will ensure that the land is not subject to peak storm damage or tidal surge.

5.8.2 Acid Sulphate Soils and Site Contamination

Due regard will be made during construction and as part of the ongoing management of the development for contamination and the incidence of acid sulphate soils via the CEMP.

The Project will undertake initial site contamination investigations prior to commencing on site assessment and determine the potential impacts to construction and the land. This is currently being undertaken in accordance with Australian Standard AS 4482.

Therefore, the proposed development is consistent with the intended management and protection against release of acid water and protection of human health from contamination.

5.8.3 Containment of Chemical and Hazardous Materials

Hazardous materials will be stored and contained in accordance with the required national, state and local standards so that the risk to public health and safety and the potential for water, land or air contamination is minimised to the greatest extent possible. The hazardous materials used during the daily activities that will be occurring on the site will be stored in designated areas that are secure, readily accessible to emergency vehicles, impervious, protected from rain and stormwater intrusion and other measures necessary ensure no harm will occur to employees and the wider environment.

We are of the opinion that the Viva Energy Project and the management of chemical and hazardous materials will be consistent with the spirit and intent of the relevant Principles of Development Control.

5.9 Vehicle Movement and Traffic Impact

The additional storage tank will not directly result in additional vehicle movements in Wills Street via which tanker trucks will continue to travel to the adjacent Mobil site where the fuel products loading gantry for the subject land (and Mobil storage facility) is located. The key objective of the of the new tank is to provide greater diesel fuel stocks for Adelaide (i.e. robust supply chain) and to take advantage of improved freight economics of larger product parcels delivered in by ship. Aurecon is of the opinion that the Mobil gantry loading area and existing road network (Wills Street & Victoria Road) has adequate capacity to cater for any additional vehicle movements associated with his development.

The nature of these operations means that the proposed development will not alter any existing access to any arterial road, nor will it change the nature of movement onto an arterial road. In this regard, we believe that the proposed development is appropriate in regard to the relevant provisions of the Development Plan, and that a referral to the Commissioner of Highways is not warranted.

In considering the traffic management needs during the project works, Aurecon is of the view that the subject land is of a sufficient size to allow for all vehicles associated with the project works activity to be encompassed within the site boundary at all times. The subject land will be directly accessible via Wills Street. The subject land and the vehicle entrance points to the site during construction will be secured and managed during the early works activities to ensure that only those vehicles that need to enter the site can do so.

6 Conclusion

The subject land is a large consolidated site that presents the opportunity to expand the on-site storage capacity of Viva Energy's South Australian Operations. This Project will offer certainty for the supply of energy, through the distribution of liquid petroleum products by meeting the increasing fuel and energy requirements of Adelaide and South Australia.

The proposed development will be an efficient and viable extension of the use of the subject land and will achieve an acceptable standard of appearance and design within the context of the locality and the surrounding land uses and activities. The development has been designed to be as sympathetic to adjacent development as possible.

The proposed development is consistent with the intent of the applicable quantitative and qualitative standards and controls in the *Port Adelaide Enfield Council Development Plan* (consolidated – 6 February 2018) for the following reasons:

- The proposal will address an identified shortfall in the supply of energy in South Australia.
- The proposal will provide additional bulk liquid storage capacity in South Australia and within metropolitan Adelaide.
- The proposed development is considered be of an orderly design and will be constructed in an economic manner with minimal environmental risk to both the users and activities on the subject land and to the surrounding land uses.
- The location and size of the development has been determined so that the consequences of any hazardous event at the subject land are contained within the site boundary; therefore, risks imposed by the development on the public and external facilities are reduced to as low as reasonably practicable.
- The separation of the development from surrounding uses and activities is sufficient so that risks to Viva Energy personnel and infrastructure associated with any hazardous event involving these facilities are reduced to as low as reasonably practicable.
- The proposed development will not result in any unreasonable off-site impacts to the surrounding area, and as such, does not contravene the public interest.

We are of the opinion that the proposed development is not seriously at variance with the Development Plan and satisfies the general intent of the relevant Zone and General Section provisions and warrants Development Approval from the Minister for Planning.

A

Crown Sponsorship Letter

Government of South Australia
Department for Energy and Mining

Our Ref: 2019D0000155

Mr Michael Brown
Infrastructure Development Manager
Viva Energy Australia Pty Ltd
Level 16
720 Bourke Street
DOCKLANDS, VIC 3008

Dear Mr Brown

RE Proposed 30 million litre diesel storage tank at Peterhead, SA – Application for Crown Sponsorship, Section 49, Development Act 1993

Thank you for your letter and application seeking Crown Sponsorship for a proposed project including a diesel storage tank and associated infrastructure at your Peterhead facility in South Australia.

It is understood from the application the development of the new storage tank will provide increased diesel fuel capacity to cater for increased and seasonal surge demand for the community and industry, and increased security of supply for essential services within South Australia.

Given the proposed project meets the definition of public infrastructure, as outlined in Section 49 (1) (a) of the *Development Act 1993,* I am prepared to support and specifically endorse, pursuant to Section 49 (2) (c) of the *Development Act 1993*, detailed in your application:

1. The 30 million litre diesel storage tank.
2. Associated infrastructure (pipework, valves, bund walls and civil works).

A development application must be lodged by Viva Energy at its cost with the Development Assessment Commission, prior to 12 months from the date of this letter. If this is not achieved by that time, my support under Section 49 (2) (c) of the *Development Act 1993* for the project will lapse.

Chief Executive

Address Level 12, 11 Waymouth Street, Adelaide 5000 | GPO Box 320 Adelaide SA 5001 | DX452
Tel (+61) 08 8429 3216 | Email DEM.OCE@sa.gov.au | www.energymining.sa.gov.au | ABN 83 768 683 934

Government of South Australia

Department for Energy and Mining

The Department for Energy and Mining neither makes representations, nor gives warranties in relation to the outcome of the development application or time it takes to secure a planning outcome.

It is Viva Energy's responsibility to obtain all other statutory approvals, licences and permits from relevant authorities and funding of the project. The South Australian government makes no commitment to provide any funding for the project or to purchase any product or service related to the project.

Please contact Mr Lachlan Kinnear, Project Manager from the Department for Energy and Mining if you have any queries in relation to this advice or require further information. He can be contacted on telephone 8429 0923, mobile 0408 846 323or via email at Lachlan.Kinnear@sa.gov.au

Yours sincerely

Sam Crafter
A/CHIEF EXECUTIVE

03 / 01 / 2019

SOUTH AUSTRALIA

B

Certificates of Title

Product	Register Search (CT 6040/730)
Date/Time	23/08/2018 08:42AM
Customer Reference	501862 - Viva DA
Order ID	20180823000645
Cost	$28.75

REAL PROPERTY ACT, 1886
South Australia

The Registrar-General certifies that this Title Register Search displays the records maintained in the Register Book and other notations at the time of searching.

Certificate of Title - Volume 6040 Folio 730

Parent Title(s) CT 5794/817

Creating Dealing(s) RTC 11180210

Title Issued 21/08/2009 **Edition** 1 **Edition Issued** 21/08/2009

Estate Type

FEE SIMPLE

Registered Proprietor

THE SHELL CO. OF AUSTRALIA LTD. (ACN: 004 610 459)
OF LEVEL 2/LS8 REDFERN ROAD HAWTHORN EAST VIC 3123

Description of Land

ALLOTMENT 2 DEPOSITED PLAN 70924
IN THE AREA NAMED PETERHEAD
HUNDRED OF PORT ADELAIDE

Easements

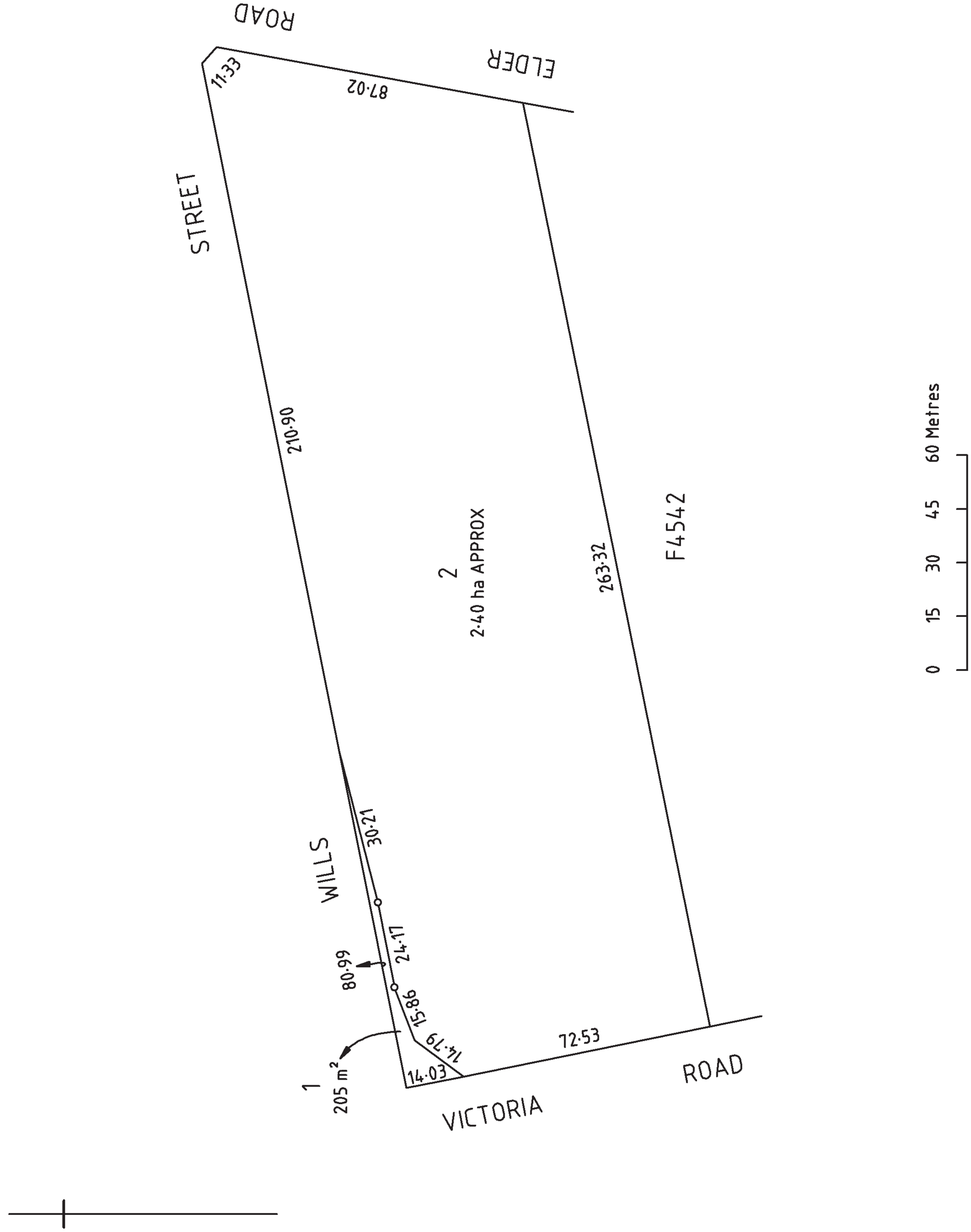
NIL

Schedule of Dealings

NIL

Notations

Dealings Affecting Title	NIL
Priority Notices	NIL
Notations on Plan	NIL
Registrar-General's Notes	NIL
Administrative Interests	NIL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STREET
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263·32
F4542
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15
0
WILLS
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24·17
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15·86
14·79
72·53
14·03
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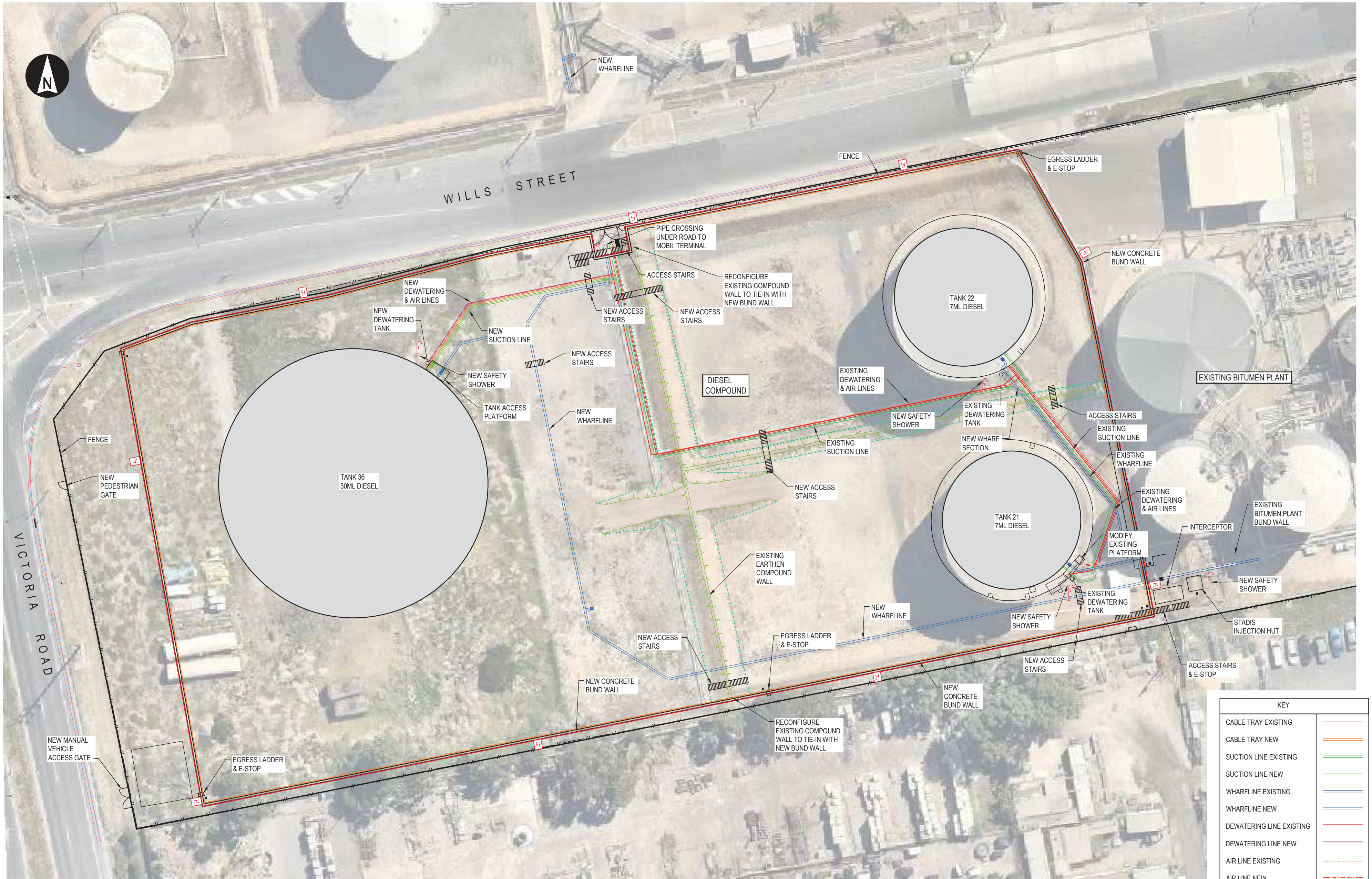
VICTORIA
ROAD

C

Site Plan & Elevations



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B	20/07/18	ISSUED FOR PRELIMINARY DESIGN	KRB	MB	MJK	AURECON	501682-0000-XRF-UU-0001-VIVA-2	.

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PROJ. ENG.	CHECKED BY	SCALE
Matt Bell	Matt Kemp	1:300

Viva Energy Australia Pty Ltd
ABN 46 004 610 459

PROJECT
VIVA BIRKENHEAD TERMINAL EXPANSION
PRELIMINARY DESIGN

TITLE
TERMINAL LAYOUT

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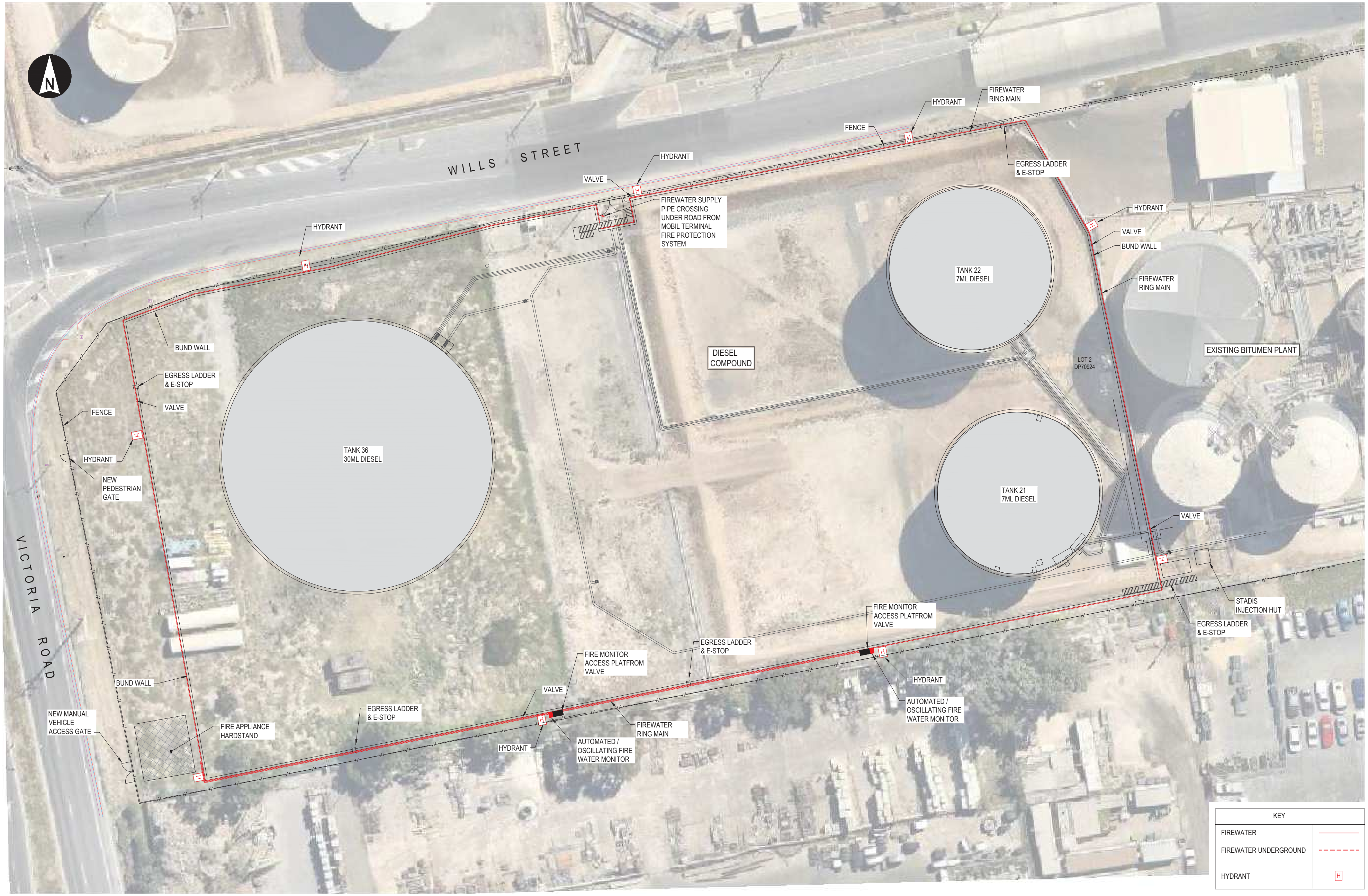

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VIVA Energy Australia

Viva Energy Australia Pty Ltd
ABN 46 004 610 459

PROJECT
VIVA BIRKENHEAD TERMINAL EXPANSION
PRELIMINARY DESIGN

TITLE
FIRE PROTECTION LAYOUT

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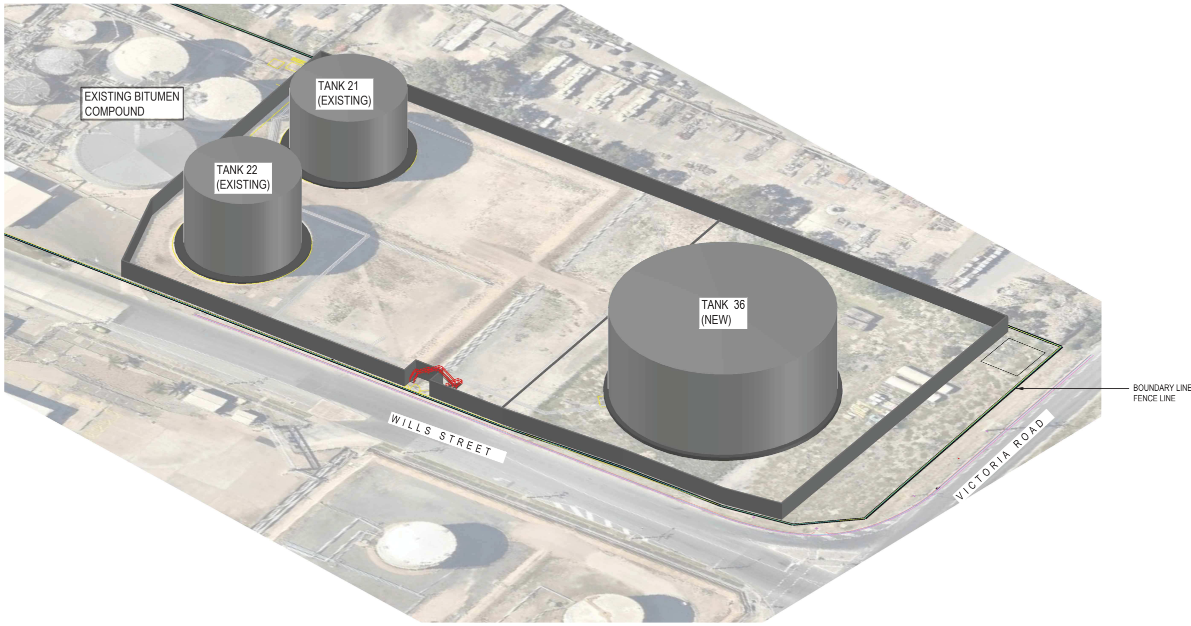

3D VIEW ON TERMINAL
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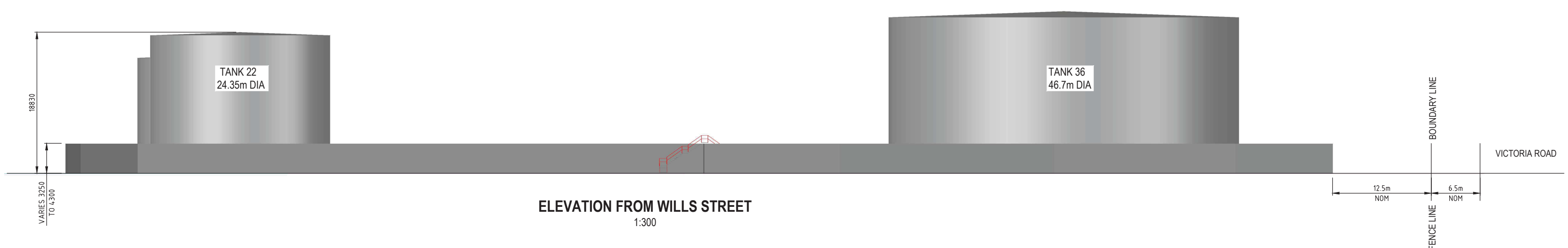

ELEVATION FROM WILLS STREET
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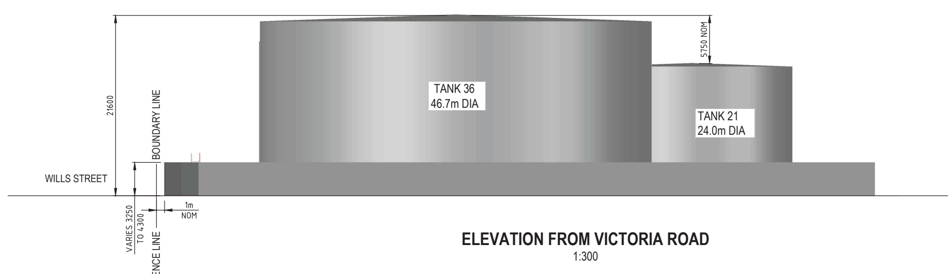

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VIVA Energy Australia

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ABN 46 004 610 459

PROJECT
VIVA BIRKENHEAD TERMINAL EXPANSION
PRELIMINARY DESIGN

TITLE
VIVA FACILITY ELEVATIONS

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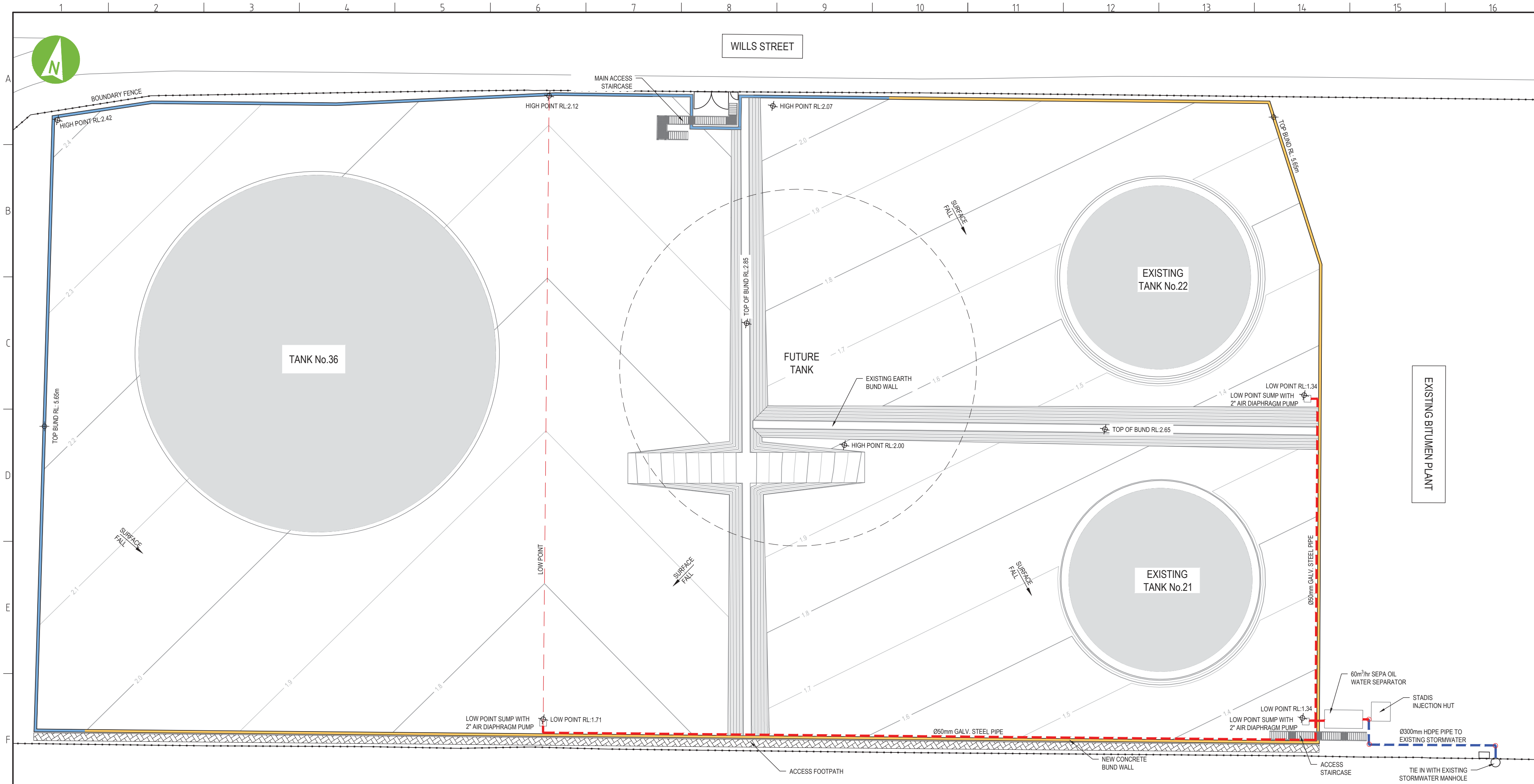

LEGEND:

- Ø50mm GALV. STEEL ABOVE GROUND PIPELINE TO OILY WATER SEPARATOR
- Ø300mm HDPE UNDER GROUND PIPELINE TO EXISTING STORMWATER MANHOLE
- BOUNDARY FENCE
- BUND WALL TYPE 1
- BUND WALL TYPE 2
- PRODUCT TANKS
- 600mm PRECAST CONCRETE MANHOLE (ROCLA OR SIMILAR APPROVED)

NOTES:

1. REFER TO DRAWING BX-03-12-02 FOR BUND WALL DETAILS.
2. REFER TO DRAWING BX-03-19-01 FOR TANK FOUNDATION DETAILS.
3. REFER TO DRAWING BX-03-19-02 FOR ACCESS WALKWAY AND STAIR DETAIL.

2.5 0 5 10m
SCALE 1:250

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Viva Energy Australia Pty Ltd
ABN 46 004 610 459

PROJECT
VIVA BIRKENHEAD TERMINAL EXPANSION
PRELIMINARY DESIGN

TITLE
CIVIL SITE LAYOUT

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CAD REF: BX-03-11-04.dwg

Document prepared by

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Level 10, 55 Grenfell Street
Adelaide SA 5000
Australia

T +61 8 8237 9777
F +61 8 8237 9778
E adelaide@aurecongroup.com
W aurecongroup.com

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Angola, Australia, Botswana, China, Ghana, Hong Kong, Indonesia, Kenya, Lesotho, Macau, Mozambique, Namibia, New Zealand, Nigeria, Philippines, Qatar, Singapore, South Africa, Swaziland, Tanzania, Thailand, Uganda, United Arab Emirates, Vietnam.

Joint Terminal Fuel Storage Expansion

Air Quality Assessment

Viva Energy

Reference: 501682

Revision: 2

2019-04-03

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Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Level 10, 55 Grenfell Street
Adelaide SA 5000
Australia

T +61 8 8237 9777
F +61 8 8237 9778
E adelaide@aurecongroup.com
W aurecongroup.com

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Client		Viva Energy				
Client contact			**Client reference**			
Rev	**Date**	**Revision details/status**	**Author**	**Reviewer**	**Verifier** (if required)	**Approver**
0	2018-07-27	Initial draft	KT	NCM	MB	
1	2019-02-14	Revised after client review	KT	TF	MB	
2	2019-04-03	Issued for Final Approval	KT	TF	MB	
Current revision		**2**				

Approval			
Author signature		Approver signature	
Name		Name	
Title		Title	

Contents

Appendices

Appendix B

Emission Estimate Information

Supporting information for the estimation of emissions.

Figures

Tables

1 Introduction

Viva Energy have fuel storage facilities located on adjacent properties in Birkenhead, South Australia. This site is known as the Joint Terminal site. Viva Energy propose to increase their fuel storage capabilities at the Joint Terminal site by adding two new fuel storage tanks – the first being a 30 ML capacity diesel tank, and the second a 25 ML capacity unleaded petrol tank (refer to Figure 1-1). Although operation of these fuel tanks will effectively add new emission sources of total volatile organic compounds (TVOCs) to the site, the site's annual fuel throughput will remain unchanged thus changing and, in some cases, reducing emissions from existing fuel storage tanks.

This report provides an air quality assessment of impacts due to the proposed development, with comparison against impacts due to existing operations to understand the significance of any changes in the site's emissions profile. This assessment considers the cumulative-impacts of fuel storage operations at the Joint Terminal site, as well as VOC emissions from on-site fuel loading gantries and Viva Energy bitumen plant operations.

Current fuel storage operations at the Joint Terminal site consist of storage of petrol (unleaded and premium unleaded), diesel, Jet-A1 fuel, and a number of fuel additives. Twenty-five storage tanks are currently used on the site, consisting of a mixture of vertical fixed roof (free-vented), internal floating roof and pressure/vacuum vented tanks. These tanks have capacities varying from 0.28 m^3 to 39 m^3 for fuel additives, and capacities of 97 m^3 to 8,630 m^3 for fuels.

Figure 1-1: Aerial image showing location of Joint Terminal site with surroundings (source: ArcGIS Earth).

1.1 Scope of Works

The following describes the scope of works for this assessment. A meeting involving SA EPA, Aurecon and Viva Energy was held on 2nd May 2018, where aspects of this scope of work were discussed and confirmed. This is noted below in the scope of works where applicable:

- Generate hourly annual meteorological data using the prognostic model WRF for the reference year of 2009, to be used as input into the CALPUFF meteorological pre-processor CALMET
- Refine site-specific meteorology using CALMET
- Purchase one year of hourly observations of wind speed and wind direction measured at the Bureau of Meteorology station located at RAAF Base Edinburgh (located 18 km north east of Viva Energy) for comparison and validation of WRF and CALMET data.
- Review concentrations of relevant VOCs monitored in Birkenhead between December 2003 and January 2005 and use data reported in the SA EPA document 'Air quality monitoring hot spot report no 6' to establish background concentrations. The monitoring site is located approximately 1.2 km south west of Viva Energy site.
  - *SA EPA confirmed this data should provide a sufficiently conservative estimate of background levels during a meeting held 2nd May 2018, such that individual emission sources from ships etc. do not need to be included in the model. Monitoring results for toluene, benzene, xylenes and formaldehyde were expected to be relevant.*
- Identify the species of VOCs emitted from the fuel storage tanks which is likely to cause most significant air quality impacts using fuel VOC speciation profiles detailed in the National Pollutant Inventory (NPI) Emission Estimation Technique Manual for Fuel and Organic Liquid Storage
- Establish an emissions inventory for the identified *worst-case VOC pollutant* using NPI emission factors and the US EPA model TANKS
  - *Use of only the worst-case VOC pollutant was confirmed to be appropriate by SA EPA during the meeting held 2nd May 2018.*
- Use of the dispersion model CAPUFF to predict concentrations of the identified *worst-case VOC pollutant* emitted from the fuel storage tanks at nearby sensitive receiver locations for
  - Scenario 1: existing conditions
  - Scenario 2: existing conditions with operation of the proposed 30 ML diesel tank
  - Scenario 3: existing conditions with operation of the proposed 30 ML diesel tank and the 25 ML unleaded petrol tank
  - Scenario 4: Scenario 3, with changes to fuel-types stored in existing tanks
- Assess predicted concentrations at sensitive receiver locations against assessment criteria stipulated in the South Australian Environment Protection (Air Quality) Policy (2016) [EPP(AQ)] for the *worst-case VOC pollutant*
- Detail the methodology and results (including ground-level concentration contours for the *worst-case VOC pollutant*) in a technical report suitable for inclusion in the development application
- Assessment of potential cumulative impacts for the identified worst-case VOC pollutant resulting from other VOC pollutant emission sources located on the Joint Terminal site, particularly the Viva Energy bitumen plant and Joint Terminal fuel loading gantry,
  - A simple desktop assessment to initially establish if emissions are significant, with modelling only to be completed if found to be significant. SA EPA confirmed that incorporating a pro-rata of results should be sufficient during the meeting held 2nd May 2018.

1.2 Exclusions

The following are excluded from this scope of works:

- VOC emissions from sources other than the Joint Terminal fuel storage tanks located in the vicinity – *use of a background concentration determined from the SA EPA 2006 Hot Spot Monitoring report is expected to address these other sources, including ships, as confirmed by SA EPA during meeting held 2nd May 2018*
- Assessment of all relevant EPP(AQ) VOCs – *this was* ***not considered necessary*** *by SA EPA during meeting held 2nd May 2018*.
- Ambient monitoring of TVOC and benzene concentrations, such as by short-term sampling conducted over three days in a one week period, to establish suitable background (existing) concentrations representative of existing exposure levels for nearby residents
  - It should be noted that this sampling would provide representative results only. Monitoring would be conducted using a real-time portable sensor which has a resolution of 33 µg/m^3. The proposed monitoring methodology is not consistent with Australian Standards. *This was* ***not considered necessary*** *by SA EPA during meeting held 2nd May 2018*.
- Scenarios 1, 2, 3 and 4 under conditions other than those considered typical/worst-case (e.g. assessment of emissions due to tank failure were not included in the scope of work).
- Air quality impacts for occupational health and safety purposes (not part of the EPA's remit)
- Detailed odour assessment (i.e. use of odour emission rates and prediction of odour concentration in terms of odour units). A general odour assessment will be carried out using "odour limits" for specific VOC species prescribed in the SA EPP(AQ) (see next bullet point also).
- Assessment of individual VOC species using assessment criteria other than the 3-minute averaging period maximum ground level concentrations (GLCs) specified under Schedule 2 of the SA EPP(AQ)
  - Where maximum GLCs for both toxicity and odour are provided for a single pollutant, the most stringent criteria will be adopted for assessment purposes. Use of this odour criteria is expected to address any potential odour issues.
- Detailed/quantitative assessment of construction air quality impacts
- Long-term monitoring using Australian Standard compliant techniques

2 Legislation

This Section describes the relevant criteria for the assessment of air quality impacts for this Project.

2.1 Evaluation Distance for Effective Air Quality Management

The South Australian Environment Protection Authority (SA EPA) has produced guidance tools which underpin advice on proposed new developments, and the type of information and assessment which needs to be provided to the EPA to facilitate smooth processing of applications and submissions. The "Evaluation distances for effective air quality and noise management" document (SA EPA, 2016) provides proposed evaluation distances – if sensitive receivers are located at distances beyond the evaluation distance, the EPA is unlikely to request specific evaluation of impacts for typical activities. Specific evaluation of impacts may be requested independent of the separation distance for pollutant sources located in areas of high sensitivity to air quality impacts and/or pollutant sources which are likely to generate excessive emissions of pollutants. Table 2-1 presents a summary of the relevant evaluation distances stipulated by the EPA.

Table 2-1: Summary of relevant EPA evaluation distances (SA EPA, 2016).

Activity	Additional activity notes	Evaluation distance (metres)
Chemical storage and warehousing facilities	Storage only	100
Petroleum production, storage or processing works or facilities	Production/processing	Individual assessment Recommended minimum distance 1,000
	Bulk storage	Individual assessment Recommended minimum distance 500

As mentioned above, understanding locations of sensitive receivers is essential in assessing compliance with evaluation distances for pollution sources. For assessment of air quality impacts, SA EPA considers sensitive land uses to include residential zones, residential dwellings and associated private outdoor recreational areas (including detached and semi-detached dwellings, multiple dwelling, flat/apartment buildings and row dwellings) and parklands, recreation areas and reserves (e.g. sporting fields).

For this Project, we consider that the nearest sensitive land use is the residential zone located west of the Project site, within 50 m (refer to Figure 1-1). With respect to these residential properties we note:

- The separation distance is much less than the recommended evaluation distance of 500 metres for bulk storage of petroleum products

As the nearest sensitive residential properties are located within the evaluation zone for environmental risk management, we have undertaken pollutant dispersion modelling of the bulk storage operations to assess impact on the residential properties.

2.2 Assessment Criteria

The South Australian Environment Protection (Air Quality) Policy 2016 [EPP(AQ)] provides assessment criteria for maximum allowable ground-level concentrations (GLCs) applicable to pollutant emissions from the proposed fuel storage expansion at Birkenhead (provided in Table 2-2), to ensure that adverse environmental impacts will not compromise amenity at nearby sensitive land uses. Atmospheric dispersion modelling is used to predict these maximum GLCs.

Table 2-2: Summary of relevant criteria obtained from the SA EPA EPP(AQ).

Pollutant	Classification*	Averaging time	Maximum concentration (mg/m^3)	Maximum concentration (ppm)
Benzene	Group 1 carcinogen	3 minutes	0.058	0.017
		12 months	0.01	0.003
Cumene	Odour	3 minutes	0.043	0.008
	Toxicity	3 minutes	8.8	1.6
Cyclohexane	Toxicity	3 minutes	38.2	10
Ethylbenzene	Toxicity	3 minutes	15.8	3.3
n-Hexane	Toxicity	3 minutes	6.4	1.7
Lead	Toxicity	12 months	0.0005	-
Toluene	Odour	3 minutes	0.71	0.17
	Toxicity	3 minutes	13.4	3.2
		24 hours	4.11	1.0
		12 months	0.41	0.1
Xylenes (as a total of ortho, meta and para isomers)	Odour	3 minutes	0.38	0.08
	Toxicity	3 minutes	12.4	2.7
		24 hours	1.18	0.25
		12 months	0.95	0.2

* Basis for defining threshold

It should be noted that assessment of impacts in terms of general odour, measured in units of odour units, or OU, was excluded from this assessment. The assessment of general odour impacts (in units of OU) would require odour sampling of each of the fuel tanks, which would pose unnecessary potential safety and financial impacts for such an assessment and is not common practice for air quality assessments of fuel storage tanks. Instead, use of pollutant-specific assessment criteria is considered most appropriate for fuel storage tanks and is common industry practice, as emission rate formulae are readily available (refer to Section 3). These criteria are also typically considered to capture potential odour impacts – where applicable pollutants have both odour and toxicity limits, with the odour limit being most stringent (as shown in Table 2-2).

3 Emissions Inventory

This Section describes the relevant data and methodologies adopted for estimation of emissions for the existing and proposed operations, primarily being air emissions caused by the storage and handling of volatile organic liquids.

3.1 Fuel Storage Emissions

Emissions of volatile organic compounds (VOCs) occur during storage of organic liquids via two mechanisms – standing and working losses. *Standing losses* occur through the expulsion of vapour from a tank due to the vapour expansion and contraction because of changes in temperature and barometric pressure. This loss occurs without any change in the liquid level in the tank. *Working losses* are the combined loss from filling and emptying a tank. As the liquid level increases, the pressure inside the tank increases and vapours are expelled from the tank. A loss during emptying occurs when air drawn into the tank becomes saturated with organic vapour and expands, thus exceeding capacity of the vapour space. For this assessment, emissions rates considered annual-averaged.

In Australia the National Pollutant Industry (NPI) requires emission calculations for storage of the following fuels:

- Crude oil
- Fuel oil
- Heating oil
- Jet kerosene
- Avgas 100 Avgas LL
- Diesel
- Leaded Petrol (LP)
- Unleaded petrol (ULP)
- Premium unleaded petrol (PULP)
- RON 98
- E10

A number of factors affect the quantity of emissions released as standing and working losses, particularly the type of fuel tank, tank dimensions, and fuel type. Emission rates considered in this assessment are based on annual average emissions. Key parameters used to estimate emissions from the site are discussed in subsequent sections, with emission estimates presented.

3.1.1 Tank Types

VOC emissions are released into the atmosphere via a range of mechanisms depending on the tank type. For this assessment all tanks are vertical and are either fixed roof (referred to as '*free*'), internal floating roof (referred to as '*IFR*'), or fixed roof with pressure/vacuum vented (referred to as '*PV*'). Leakage losses for these tanks occur through vents which are located in the roofs of the tanks.

Vertical Fixed Roof Tanks

Vertical fixed roof tanks have a permanent fixed roof with emissions typically allowed to vent freely to the atmosphere. Emissions are released through a single centre-breather vent, as shown in Figure 3-1.

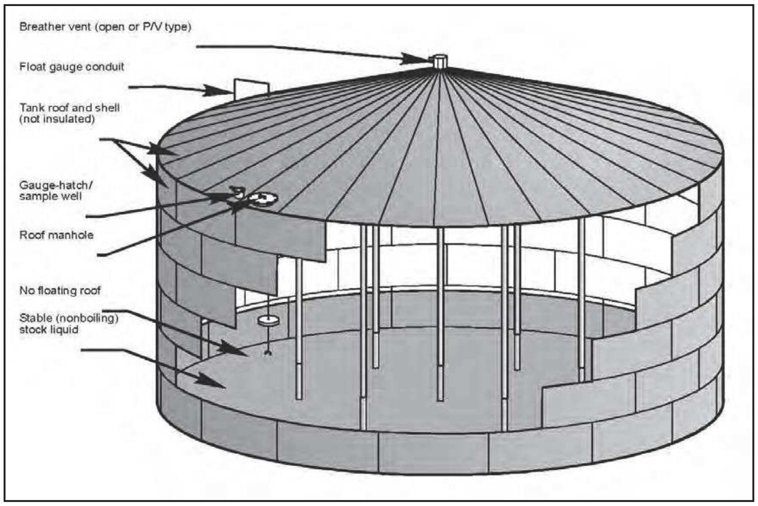


Figure 3-1: Image demonstrating a vertical fixed roof tank, the typical breather vent (US EPA, 2006).

Internal Floating Roof Tanks

Internal floating roof (IFR) tanks have a permanent fixed roof on the tank as well as a floating roof on top of the liquid. Circulation vents located at the top of the fixed roof allow emissions to be freely vented. However, emissions are reduced compared to those for fixed roof tanks. Internal floating roof tanks have both the centre and peripheral vents, as shown in Figure 3-2.

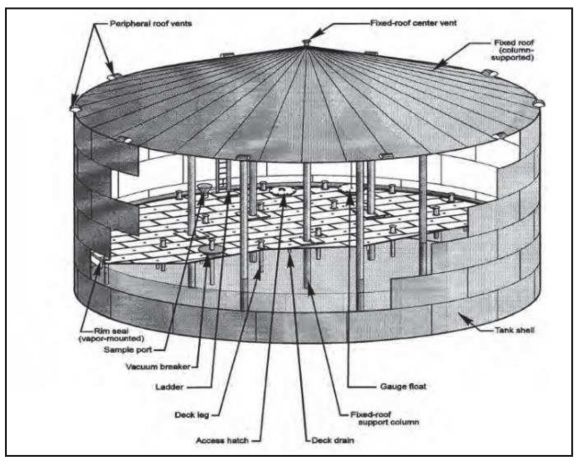


Figure 3-2: Image demonstrating an internal floating roof tank, and typical vent locations (US EPA, 2006).

Pressure/Vacuum Vented Tanks

Pressure/vacuum (PV) vented tanks are fixed roof tanks (refer to Figure 3-1) which have been fitted with specialised vents which prevent natural ventilation of the tanks, reducing emissions to the atmosphere. The PV vent adjusts the amount of air drawn into the tank depending on changes to the internal liquid level.

Emissions from PV vented tanks have been conservatively estimated assuming emissions are equivalent to those from free vented/fixed roof tanks.

3.1.2 VOC Speciation Profiles

VOC speciation profiles provide estimates of the chemical composition of emissions (providing the fraction of total VOCs, or TVOCs, as each compound) and enable development of an emissions inventory. For some of the fuels stored at the Joint Terminal site, site specific sampling was previously undertaken to establish speciation profiles. These site-specific speciation profiles were therefore adopted for this assessment and apply to the following fuel types:

- ULSD (ultra-low sulphur diesel)
- Jet A-1

For the remaining fuel types stored on the Joint Terminal site, default VOC speciation profiles were adopted as detailed in the *National Pollutant Inventory (NPI) Emission Estimation Technique Manual for Fuel and Organic Liquid Storage Version 3.3*. These fuels were:

- 98 PULP (premium unleaded petrol with an octane number of 98)
- 95 PULP (premium unleaded petrol with an octane number of 95)
- ULP (unleaded petrol)

In addition to the standard fuels which are stored on the Joint Terminal site listed above, the following non-standard fuels are also stored:

- Nemo-6101
- Nemo-6124
- Nemo-2010
- Di-methyl glysov
- NALCO 5403
- Hydrocarbon mix
- Hi-Tec 4691C
- Hi-Tec 6590C

VOC speciation profiles for these non-standard fuels were approximated by adopting those for relevant standard fuels, as described in Appendix B.

3.1.3 Emission Estimates

For all fuel storage tanks, the estimation methodology and equations outlined in the *United States Environment Protection Agency (US EPA) AP-42 Compilation of Emission Factors, Chapter 7.1* was adopted for emissions estimation. Detailed methodology for emission estimates using the US EPA AP-42 equations is provided in Appendix B, although main steps in estimating emissions are summarised below (noting imperial units were converted to metric to estimate emissions, and additional equations were required to estimate some parameters discussed below).

Although the annual throughput of fuel is a key parameter affecting annual average emissions of TVOCs, these values have not been detailed within this report as they are confidential.

For free vented/vertical fixed roof tanks and pressure/vacuum (PV) tanks:

1) Total VOC losses are estimated as

$$L_T = L_s + L_W$$

Where:

L_T is total losses, in lb/yr
L_s is standing storage losses, in lb/yr
L_W is working losses, in lb/yr

2) Standing losses are estimated as

$$L_S = 365\, V_V W_v K_E K_S$$

Where:

V_V is vapour space volume, ft^3
W_V is stock vapour density, lb/ft^3
K_E is vapour space expansion factor, dimensionless
K_S is vented vapour saturation factor, dimensionless
365 is a constant, the number of daily events in one year

3) Working losses are estimated as

$$L_W = 0.0010\, M_V P_{VA} Q K_N K_P$$

Where:

M_V is vapour molecular weight, lb-lb/mole
P_{VA} is vapour pressure at daily average liquid surface temperature, psia

Q is annual net throughput, bbl/year
K_N is working loss turnover (saturation) factor, dimensionless

For turnover > 36, K_N = (180 + N)/6N, where N is number of turnovers per year
For turnover ≤ 36, K_N = 1
Where N is the number of turnover per year (i.e., the number of times in a year that the tank is emptied and refilled)

K_P is working loss product factor, dimensionless = 1 for VOCs; = 0.75 for crude oils

For Internal Floating Roof Tanks (IFR):

1) Total VOC losses are estimated as:

$$L_T = L_R + L_{WD} + L_F + L_D$$

Where:

L_T is total losses, in lb/yr
L_R is rim seal loss, in lb/yr
L_{WD} is withdrawal loss, in lb/yr
L_F is deck fitting loss, in lb/yr
L_D is deck seam loss, in lb/yr

2) Rim seal losses are estimated as:

$$L_R = (K_{Ra} + K_{Rb}\, v^n)DP^*M_V\, K_c$$

Where:

K_{Ra} is zero wind speed rim seal loss factor, lb-mole/ft.yr
K_{Rb} is wind speed dependent rim seal loss factor, lb-mole/(mph)^{n}ft.yr
v is average ambient wind speed at tank site, in mph
n is seal-related wind speed exponent, dimensionless
P^* is vapor pressure function, dimensionless
D is tank diameter, ft
K_c is the product factor (0.4 for crude oils; 1 for all organic liquids)

3) Withdrawal losses are estimated as:

$$L_{WD} = \frac{0.943QC_sW_L}{D}\left[1 + \frac{N_CF_C}{D}\right]$$

Where:

C_s is shell clingage factor, bbl/1000ft^2
W_L is average organic liquid density, lb/gal
N_c is number of fixed roof support columns
F_C is effective column diameter, ft

4) Deck fitting losses are estimated as:

$$L_F = F_FP^*M_VK_C$$

Where:

F_F is total deck fitting loss factor, lb-mole/yr

5) Deck seam losses are estimated as:

$$L_D = K_DS_DD^2P^*M_VK_C$$

Where:

K_D is deck seam loss per unit seam length factor, lb-mole/ft-yr (0 for welded deck; 0.14 for bolted deck)
S_D is deck seam length factor, ft/ft^2

3.1.4 Critical Pollutant

Whilst a number of VOCs are emitted from the fuel storage tanks (most significant pollutants summarised in Table 3-2, in accordance with the NPI (2006) and US EPA (2012)), benzene was identified as being the most critical pollutant as it has the highest estimated value for ratio of emission quantities to pollutant assessment criterion (presented in Table 3-1, otherwise referred to as impact factor), in addition to benzene emissions being significantly higher than those for other pollutants. (For emission estimates, tank geometry and capacities detailed in Section 3.1.5 were used. Refer to Appendix B for method adopted to determine annual throughput for each tank).

Assessment of only the pollutant with the highest impact factor (benzene) is considered appropriate as compliance or exceedance of the assessment criterion for benzene indicates similar or better outcomes for other pollutants. As the annual throughput of each fuel type is not affected by operation of the two proposed additional storage tanks, meaning significant changes in predicted average emissions were also not expected, it was appropriate to assess benzene for all Scenarios. For this reason, only emissions and predicted impacts for benzene have been discussed further in this report.

Table 3-1: Summary of total emissions estimated for current operations, using US EPA estimation methods (2012), demonstrating benzene is the most significant pollutant for fuel storage.

Pollutant	Total emissions (kg/year)	Total average emissions (g/s)	Criteria (3 min, mg/m^3)	Impact Factor[1]
Benzene	274.9	8.7E-03	0.058	**1.5E-01**
Cumene	2.4	7.5E-05	0.043	1.7E-03
Cyclohexane	14.1	4.5E-03	38.2	1.2E-04
Ethylbenzene	25.2	8.0E-04	15.8	5.1E-05
n-hexane	25.4	8.0E-04	6.4	1.3E-04
Lead	n/a	n/a	n/a	n/a
Toluene	140	4.4E-03	0.71	6.2E-03
Xylenes	79.2	2.5E-03	0.38	6.6E-03

[1] Ratio of emission rate divided by ambient air quality assessment criterion - refer to Table 2-2 for assessment criterion definitions.

3.1.5 Current Operations

Key parameters for each tank currently utilised are detailed in Table 3-2. Parameters including venting type, tank height, diameter, capacity and throughput were critical in estimating emissions in accordance with the US EPA (2012), and also important for dispersion modelling (discussed in detail in Section 5).

As detailed in Section 3.1.4 benzene was identified as being the most critical pollutant as it has the highest impact factor (refer to Table 3-1). Therefore, benzene emission rates for each tank for current operations are presented in Table 3-2.

Table 3-2: Summary of fuel storage tanks which comprise current operations and resulting average emission rates.

Tank	Product	Venting	Diameter (m)	Height (m)	Capacity (m^3)	Estimation Method	Benzene emission rate (g/s)
1	JET-A1	Free	15.2	12.8	2,011	NPI	4.4E-07
2	98 PULP	IFR	15.2	12.8	1,752	NPI	6.8E-04
3	98 PULP	IFR	15.2	12.8	1,757	NPI	6.8E-04
4	JET-A1	PV	25	14.8	6,723	NPI	1.5E-06
7	98 PULP	IFR	10.7	12.8	739	NPI	5.5E-04
8	JET-A1	Free	21.3	14.6	4,341	NPI	9.7E-07
9	ULSD	Free	21.4	14.6	4,778	NPI	6.2E-07
10	98 PULP	IFR	11.9	10.7	879	NPI	5.8E-04
16	ULP	IFR	27.5	12.5	5,667	NPI	1.2E-03
17	ULP	IFR	29.2	14.2	7,573	NPI	1.3E-03
18	95 PULP	IFR	16.7	10.7	1,743	NPI	7.1E-04
19	95 PULP	IFR	22	12.5	3,606	NPI	8.8E-04
20	ULP	IFR	30.5	13.9	8,315	NPI	1.3E-03
21	ULSD	Free	24	15	6,662	NPI	8.5E-07
22	ULSD	Free	24	18	8,024	NPI	1.0E-06
23	NEMO-6101	Free	2.5	4.8	38.6	AP-42	1.5E-09
24	NEMO-6124	Free	2.5	7.5	38.6	AP-42	1.9E-09
25	DI-METHYL GLYSOV[1]	PV	1.2	1.2	1.6	AP-42	0.0E+00
26	NALCO 5403	Free	0.5	1.2	0.28	AP-42	1.4E-11
29	HYDROCARBON MIX	PV	5.5	7.1	97.3	AP-42	4.0E-04
30	HYDROCARBON MIX	PV	5.5	6.9	142.4	AP-42	4.3E-04
33	ULSD	Free	30.9	12.4	8,626	NPI	1.1E-06
35	NEMO-2010	Free	2.5	4.8	32	AP-42	1.2E-09
160	HI-TEC 4691C	Free	2.6	4.8	25.1	AP-42	1.3E-09
162	HI-TEC 6590C	Free	2.6	4.8	25.1	AP-42	1.3E-09
			Total				**0.0087**

[1] VOC emissions for Tank 25, storing Di-Methyl Glysov were assumed to be approximately zero due to its small dimensions and throughput[2]. In addition, the chemical composition specified in the product SDS[3] was reviewed and was found to consist of a mixture of non-hazardous ingredients and glycol ether which is rarely considered a toxic chemical, and could not be approximated by any typical organic fuels listed in the US EPA manual (US EPA, 2006).

[2] Although throughput quantities have not been included in this report as they are confidential, they were used in emission estimates.

[3] Product MSDS for fuel additives have not been included in this report as they are treated as confidential, however data regarding compound compositions were incorporated in emission estimates.

3.1.6 Interim Operations

The scenario 'interim operations' was considered the scenario whereby the new tanks are introduced, but no changes are made to fuel types stored in existing tanks. Interim operations were modelled as two separate scenarios:

- **Interim Operations A** consisted of the existing tanks, plus the proposed 30 ML diesel tank (referred to as Scenario 2 in Section 1.1)
- **Interim Operations B** consisted of the existing tanks, plus the proposed 30 ML diesel tank and 25 ML unleaded petrol tank (referred to as Scenario 3 in Section 1.1)

Tank parameters and the fuel stored in each tank is provided in Table 3-3.

Table 3-3: Summary of fuel storage tanks which comprise interim operations, additional tanks are highlighted.

Tank	Product	Venting	Diameter (m)	Height (m)	Capacity (m^3)	Benzene emission rate (g/s)
1	JET-A1	Free	15.2	12.8	2,011	4.4E-07
2	98 PULP	IFR	15.2	12.8	1,752	6.8E-04
3	98 PULP	IFR	15.2	12.8	1,757	6.8E-04
4	JET-A1	Free	25	14.8	6,723	1.5E-06
7	98 PULP	IFR	10.7	12.8	739	5.5E-04
8	JET-A1	Free	21.3	14.6	4,341	9.7E-07
9	ULSD	Free	21.4	14.6	4,778	3.5E-07
10	98 PULP	IFR	11.9	10.7	879	5.8E-04
16	ULP	IFR	27.5	12.5	5,667	1.2E-03
17	ULP	IFR	29.2	14.2	7,573	1.3E-03
18	95 PULP	IFR	16.7	10.7	1,743	7.1E-04
19	95 PULP	IFR	22	12.5	3,606	8.8E-04
20	ULP	IFR	30.5	13.9	8,315	1.3E-03
21	ULSD	Free	24	15	6,662	4.8E-07
22	ULSD	Free	24	18	8,024	5.7E-07
23	NEMO-6101	Free	2.5	4.8	38.6	1.5E-09
24	NEMO-6124	Free	2.5	7.5	38.6	1.9E-09
25	DI-METHYL GLYSOV	PV	1.2	1.2	1.6	0.0E+00
26	NALCO 5403	Free	0.5	1.2	0.28	1.4E-11
29	HYDROCARBON MIX	PV	5.5	7.1	97.3	4.0E-04
30	HYDROCARBON MIX	PV	5.5	6.9	142.4	4.3E-04
33	ULSD	Free	30.9	12.4	8,626	6.3E-07
35	NEMO-2010	Free	2.5	4.8	32	1.2E-09
160	HI-TEC 4691C	Free	2.6	4.8	25.1	1.3E-09
162	HI-TEC 6590C	Free	2.6	4.8	25.1	1.3E-09
NEW	ULSD	Free	46.7	20	30,800	2.3E-06
NEW	ULP	IFR	42	20	25,000	1.5E-03
		Total				**0.0102**

3.1.7 Future Operations

The future operations scenario consisted of the same tanks as Interim Operations B, however, it featured changes to fuel types stored in some of the existing storage tanks. The tanks for which the stored fuel type was changed are highlighted green in Table 3-4. This final configuration represents proposed future fuel storage operations at the Joint Terminal facilities and is summarised in Table 3-4.

Table 3-4: Summary of fuel storage conditions which comprise future operations.

Tank	Current Product	Venting	Diameter (m)	Height (m)	Capacity (m^3)	Benzene emission rate (g/s)
1	JET-A1	Free	15.2	12.8	2,011	3.0E-07
2	JET-A1	Free	15.2	12.8	1,752	2.6E-07
3	98 PULP	IFR	15.2	12.8	1,757	6.8E-04
4	JET-A1	Free	25	14.8	6,723	9.8E-07
7	95 PULP	IFR	10.7	12.8	739	5.5E-04
8	JET-A1	Free	21.3	14.6	4,341	6.5E-07
9	ULSD	Free	21.4	14.6	4,778	3.5E-07
10	98 PULP	IFR	11.9	10.7	879	5.8E-04
16	ULP	IFR	27.5	12.5	5,667	1.2E-03
17	ULP	IFR	29.2	14.2	7,573	1.3E-03
18	95 PULP	IFR	16.7	10.7	1,743	7.1E-04
19	98 PULP	IFR	22	12.5	3,606	8.9E-04
20	JET-A1	Free	30.5	13.9	8,315	1.0E-06
21	ULSD	Free	24	15	6,662	4.7E-07
22	ULSD	Free	24	18	8,024	5.7E-07
23	NEMO-6101	Free	2.5	4.8	38.5	1.5E-09
24	NEMO-6124	Free	2.5	7.5	38.5	1.9E-09
25	DI-METHYL GLYSOV	PV	1.2	1.2	1.6	0.0E+00
26	NALCO 5403	Free	0.5	1.2	0.28	1.4E-11
29	HYDROCARBON MIX	PV	5.5	7.1	97.3	4.0E-04
30	HYDROCARBON MIX	PV	5.5	6.9	142.4	4.3E-04
33	ULSD	Free	30.9	12.4	8,626	6.3E-07
35	NEMO-2010	Free	2.5	4.8	32	1.2E-09
160	HI-TEC 4691C	Free	2.6	4.8	25.2	1.3E-09
162	HI-TEC 6590C	Free	2.6	4.8	25.2	1.3E-09
NEW	ULP	IFR	42	20	25,000	1.5E-03
NEW	ULSD	Free	46.7	20	30,800	2.3E-06
		Total				**0.0082**

3.2 Fuel Loading Gantry Emissions

3.2.1 Emission Estimates

Loading gantries are an essential aspect of operations at bulk fuel storage facilities. The gantries allow transport of fuel via truck and rail, which is necessary for transportation of fuel to outlets. During the loading process fugitive emissions of VOCs occur due to tank internal pressure changes. Methods for estimation of these loading losses are detailed in the US EPA's AP-42 Chapter 5 Section 2 '*Transportation and marketing of petroleum liquids*', and have been adopted for this assessment. This document defines loading losses, L_L, by the following equation (in units of lb/10^3 gal)

$$L_L = 12.46 \times \frac{SPM}{T} \times (1 - \frac{eff}{100})$$

Where,

- S is a saturation factor, which is dependent on the loading mode of operation, which has a *value of 1* for use of a vapour balance service and a *value of 0.6* for submerged loading via a dedicated service (as per Table 5.2-1, US EPA (2008)).
- P is the true vapour pressure of liquid loaded, in units pounds per square inch absolute (psia) (as per Table 7.1-2, US EPA (2006)). This *value is 0.0074 psia* for diesel and was adopted for this assessment as diesel is the fuel with the highest throughput.
- M is the molecular weight of vapours, in units pounds per mole (lb/lb-mole) (as per Table 7.1-2, US EPA (2006)). Similarly to P, the *molecular weight of diesel is 130 lb/lb-mole* and was adopted for this assessment.
- T is the temperature of bulk liquid loaded in units Rankine (°R), assumed to be the daily average ambient temperature at the project site using CALMET-generated data (*17°C/ 522°R/ 63°F*).
- eff is the control efficiency of any vapour recovery system which is implemented. Default values according to the US EPA (2008) are a collection efficiency of 98.7% and a recovery efficiency of 95%, giving an overall removal efficiency of 94%. The *value of 94%* was adopted for this assessment.

3.2.2 Intensity of Emissions

On the Joint Terminal site it is understood that for loading of fuels, there is both a rail and road gantry (locations shown in Figure 4-1). There is an additional loading gantry for bitumen but this gantry is discussed separately in Section 3.3. Only the fuel gantries are discussed in this Section.

It is understood that majority of the annual fuel throughput is loaded via the road gantry which utilises a vapour recovery unit (VRU). The VRU's purpose is to collect and recover majority of the VOCs generated during gantry loading. A small portion of the diesel throughput (5% of the annual diesel throughput) is loaded via the rail gantry which vents direct to the atmosphere. The method of rail loading is understood to be submerged and is a dedicated service.

Rail loading activities are understood to be relatively routine, simplifying emission estimates from the rail loading gantry. However, road tanker loading activities are variable which makes emissions hard to estimate. As loading gantry emissions are not the focus of this assessment, and they are not expected to change between modelled Scenarios, road tanker emissions were estimated assuming an equivalent proportion of the gantry's throughput is loaded at any one loading over the same duration as what the rail loading gantry would experience. Predicted impacts for this assessment are not expected to be sensitive to this assumption as these emissions are constant between scenarios.

The following information was provided by Viva regarding the intensity of rail loading activities which was used for TVOC and benzene emission estimates:

- Rail tankers have a capacity of 62 kL, and are dedicated to fill with diesel
- Six rail tankers are typically filled simultaneously
- Filling duration is approximately four hours
- Approximately two rail loadings per week are completed, based on the capacity of each loading activity and the annual throughput for rail loading

It should be noted that because annual throughputs are not expected to change due to the proposed additional fuel storage tank, the emissions presented in Table 3-5 are applicable for all modelled scenarios.

Table 3-5: Summary of estimated loading losses from fuel gantry loading.

Type of loading	Saturation factor	Loading loss (kg/L)	TVOC emissions (kg/year)	TVOC emissions per loading (g/s)	Benzene emissions per loading (g/s)	Frequency of emissions
Rail	0.6	1.6E-06	58.7	0.04	2.4E-06	4.7%
Road	1.0	2.7E-06	3,330	0.15[1]	1.6E-04[2]	4.7%[3]

[1] Throughput per road loading was assumed to be the same proportion of the annual throughput as that for rail loading (1% of annual throughput).

[2] Benzene emission estimates based on most conservative possible scenario of 100% loading of 98PULP.

[3] Frequency of loading was assumed to be the same as that for rail loading (twice weekly, 4 hours per loading).

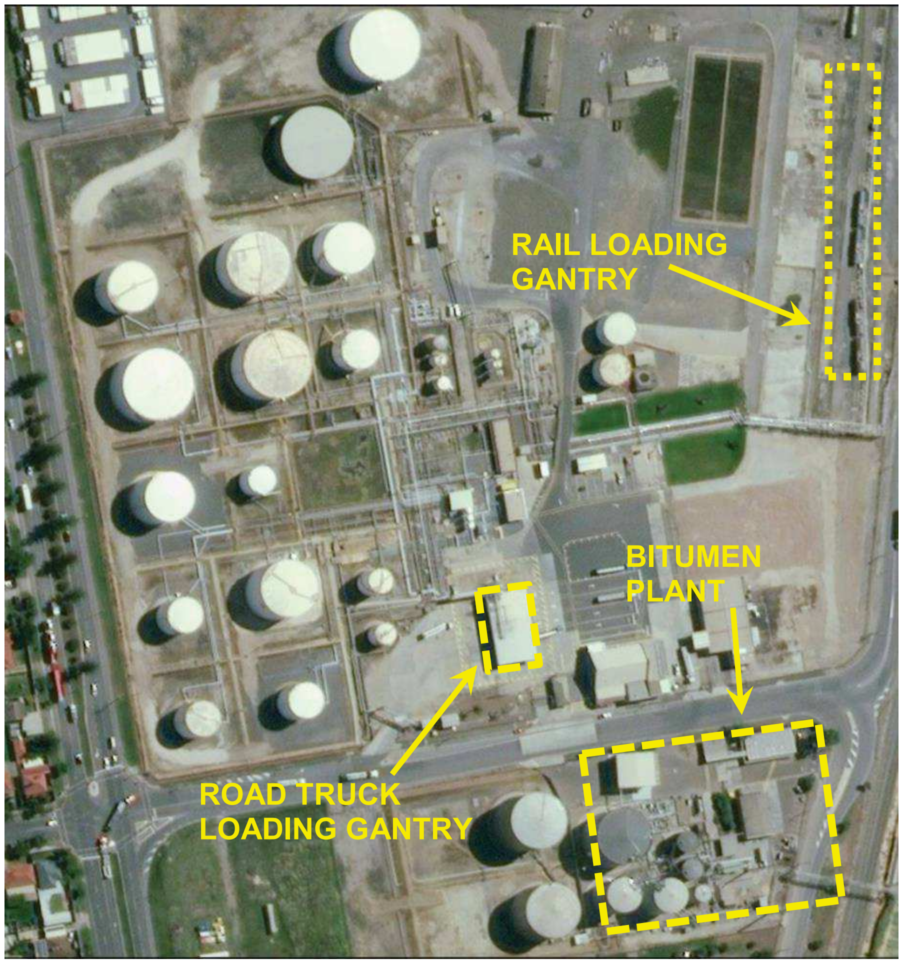


Figure 3-3: Aerial image showing location of fuel loading gantries and bitumen plant (source: ArcGIS Earth).

3.3 Bitumen Plant Emissions

3.3.1 Emission Sources

Bitumen plant operations are located within the Joint Terminal Birkenhead site (refer to Figure 3-3), and are summarised in Table 3-6 and Table 3-7. As these operations occur simultaneously with the fuel storage operations and are located in proximity, emissions of VOCs from the bitumen plant have potential to create a cumulative impact at nearby sensitive receivers.

A variety of air quality assessments have been completed previously for the bitumen plant. These reports focussed on odour impacts and are summarised in Table 3-8. From reviewing these reports, it is evident that the following comprise the bitumen plant's key odour and TVOC emission sources:

- Ship unloading of bitumen
- Storage of bitumen in tanks (referred to as the tank farm)
- Gantry loading of road trucks with bitumen

Details on how these emissions are released to the atmosphere are provided in Table 3-6.

Table 3-6: Description of release of emissions to atmosphere due to bitumen plant activities.

Bitumen handling emission source	Estimated frequency of activity	Method of emission release
Ship unloading	■ 2.4% of the year[1]	■ Regenerative thermal oxidiser (RTO) treated[2] ■ Released from stack at – 25 m above ground level (AGL) – Velocity of 15 – 20 m/s – Temperature of approx. 25°C
Tank farm	■ 2.4% of the year	■ RTO treated during ship unloading
	■ 97.6% of the year	■ Bypasses RTO – emitted to atmosphere from same stack but without treatment – 25 m AGL – Exhaust cross-sectional area of 0.082 m^2[3] – Velocity of approx. 13.4 m/s – Ambient temperature
Loading gantry	■ 12% of the year[4]	■ 6% of the year, 1 truck loading ■ 6% of the year, 2 trucks loading
	■ 88% of the year	■ Emitted without treatment from stack at – 15 m AGL – Velocity of approximately 7.5 m/s – Ambient temperature

[1] Obtained from report KMH4010112 – Tank farm (refer to Table 3-8).
[2] VOC and odour destruction efficiencies of 88-97% and 98-99%, respectively, according to report 4666 SEMA – Final Report (refer to Table 3-8)
[3] Obtained from report 4718 Draft 18 Feb 2011
[4] Obtained from report KMH4010112 – Gantry (refer to Table 3-8).

3.3.2 Emission Estimates

The 4666 SEMA – Final Report (refer to Table 3-8) details results of stack testing and establishes regenerative thermal oxidiser (RTO) outlet odour and VOC concentrations. The following information from the report was used to understand potential cumulative impacts from the bitumen plant and fuel storage operations:

- Maximum measured RTO outlet concentration for benzene was 0.11 mg/m^3
- Applying outlet conditions outlined in Table 3-6 to the above concentration results in an RTO emission rate of 0.00016 g/s for benzene
- Total RTO in-flow rate was 1.35 m^3/s, with density of 1.29 kg/m^3, and benzene concentration of 2.6 mg/m^3
  - Benzene mass rate at RTO inlet is 0.0035 g/s
  - Total mass flow rate at RTO inlet is 1.7 kg/s
- From the total mass flow rate and benzene rate at the inlet, it is evident that benzene accounts for approximately 0.0002% of the total flow before RTO treatment

The above percentage is assumed applicable to (untreated) emissions for the gantry and tank farm, for which the relevant stack exhaust parameters are detailed in report 4718 Draft 18 Feb 2011 (refer to Table 3-8). Based on the above, benzene emissions for the bitumen plant were estimated and summarised in Table 3-7.

It should be noted that only the tank farm *or* the RTO emission rate is applicable at any one time. Considering the RTO only operates 2.4% of the time, and the loading gantry emissions are applicable only 12% of the time, emissions most representative of typical operating conditions are those for the tank farm.

As the proposed changes to the fuel storage tanks have no impact on bitumen plant operations, the emissions presented in Table 3-7 are applicable for all modelled scenarios.

Table 3-7: Summary of outlet flow conditions and estimated emission rates of benzene for the bitumen plant.

Emission source	Outlet total flow rate (m^3/s)	Outlet dry gas density (kg/m^3)	Outlet total mass flow rate (kg/s)	% of inlet mass as benzene	Benzene emission rate (g/s)
RTO	1.5	1.29	1.97	0.0002%	0.00016
Tank farm	1.1	1.29	1.4	0.0002%	0.003
Loading gantry	0.2	1.29	0.3	0.0002%	0.0006

Table 3-8: Summary of bitumen plant emission/odour reports reviewed for this assessment.

Subject of Assessment	Report title	Year assessment completed	Summary of assessment
Impact of odour from shipping being released without RTO in operation	KMH4010112 – Tank farm	4 August 2010	▪ Tank farm emissions modelling using RTO testing from June 2010 ▪ Ausplume model ▪ Ship unloading only occurs 2.4% of the year ▪ For RTO operation at 90% destruction efficiency maximum impacts during ship unloading whilst gantry loading is occurring (with tank farm emissions bypassed) are 4 OU, and 2 OU without gantry loading ▪ Frequency plots suggest maximum of 100 instances of 3 minutes (0.06% and 0.01% of the time), without considering actual frequency of ship loading ▪ During ship unloading, tank farm emissions fed through RTO, otherwise bypassed through tank farm stack
Impact of varying gantry stack height and flow rate on odour ground-level concentrations, identifying locations and frequency of exceedance of 2 OU criterion	KMH4010112 – Gantry	4 August 2010	▪ Gantry emissions modelling using RTO testing from February 2010 ▪ Ausplume model ▪ Tanker loading at the gantry averages only 12% of the day, with half of this time 1 tanker loading, the remaining time being 2 tankers ▪ Predicted impacts show on average total time per annum during which 2 OU may be exceeded is 18 minutes (6 instances of 3 minutes) ▪ GLC max incidents likely to occur late evening/early morning – during these times tanker filling is unlikely ▪ Gantry emissions ducted to gantry stack
Determine optimum relationship between gantry height and flowrate to achieve ground-level concentrations less than 2 OU from combined tank farm and gantry emissions	KMH401057	31 August 2010	▪ Ausplume model ▪ A gantry stack height of 25 m with exit diameter of 287 mm with minimum flow rate of 3,000 m^3/hr will result in less than 2 OU at sensitive receptors at all times ▪ For the above flow rate and internal diameter, the minimum required height is 25 m ▪ Maximum predicted odour concentrations at sensitive receivers were between 1.5 OU and 2 OU
Odour impact of constant RTO operation during ship unloading AND static tank farm conditions	KMH4010174	September 2010	▪ Ausplume model ▪ 50 three-minute periods in a year where 2 OU criteria is expected to be exceeded for the scenario of tank farm emissions treated by RTO with emissions from 2 trucks loading at gantry ▪ 50 three-minute periods in a year where 2 OU criteria is expected to be exceeded for the scenario of tank farm emissions treated by RTO during ship unloading. with emissions from 2 trucks loading at gantry ▪ No exceedances of 2 OU limit expected when emissions are from tank farm only and emissions are bypassed through RTO.
RTO efficiency test results	4666 SEMA – Final Report	2010	▪ 6 hours of testing to determine odour destruction efficiency of the RTO ▪ Odour destruction efficiencies ranged between 98% and 99% ▪ VOC destruction efficiencies ranged between 88% and 97% ▪ Outlet odour emission rates ranged between 336 OU m^3/s and 1,225 OU m^3/s ▪ Outlet concentrations for individual VOC species specified, including – Benzene, ranged between 0.04 mg/m^3 and 0.11 mg/m^3 – Xylenes, ranged between 0.14 mg/m^3 and 0.36 mg/m^3 ▪ Outlet flow conditions for the RTO stack include flow rate of 1.5 m^3/s, gas density of 1.29 kg/m^3, 90°C exhaust temperature, exhaust velocity of 18.6 m/s, outlet area and diameter of 0.082 m^2 and 0.32 m, respectively
Efficiency test results for the RTO, odour emissions from the bitumen tank farm without shipping activity with RTO in bypass mode, and emissions from the road gantry during filling of bitumen road tankers	4718 Draft 18 Feb 2011	2011	▪ Outlet odour emission rates ranged between 235 OU m^3/s and 489 OU m^3/s ▪ Odour emissions from the RTO stack for tank farms were 3,460 OU m^3/s and 3,909 OU m^3/s ▪ Odour emissions from the RTO stack for loading gantries were 1,016 OU m^3/s and 3,080 OU m^3/s ▪ Outlet flow conditions for the gantry stack include flow rate of 0.2 m^3/s, gas density of 1.29 kg/m^3, ambient exhaust temperature, exhaust velocity of 7.5 m/s, outlet area and diameter of 0.082 m^2 and 0.32 m, respectively ▪ Outlet flow conditions for the tank farm RTO bypass stack include flow rate of 1.1 m^3/s, gas density of 1.29 kg/m^3, ambient exhaust temperature, exhaust velocity of 13.4 m/s, outlet area and diameter of 0.031 m^2 and 0.2 m, respectively ▪ Outlet flow conditions for the RTO stack include flow rate of 1.3 m^3/s, gas density of 1.29 kg/m^3, 90°C exhaust temperature, exhaust velocity of 15.3 m/s, outlet area and diameter of 0.082 m^2 and 0.32 m, respectively

3.4 Summary of Emissions

A summary of estimated emissions of benzene from fuel storage and loading operations, and typical bitumen plant operations is provided in Table 3-9. It is evident that majority of emissions are due to fuel storage, with a minor contribution due to bitumen operations (bitumen storage tanks) and negligible contribution due to fuel loading gantries. Emissions from fuel storage account for more than 70% of overall emissions and are the only emission source affected by the proposed new fuel tanks.

Table 3-9: Summary of estimated average emissions from all relevant emission sources.

Emission source	Detail of source	Benzene emission rates for each modelled scenario (g/s)					
		Current	*% of total*	Interim	*% of total*	Future	*% of total*
Fuel storage	All storage tanks	0.0087	*73.3%*	0.0102	*76.3%*	0.0082	*72.2%*
Fuel loading gantry	Rail	0.0000024	*1.4%*	0.0000024	*1.2%*	0.0000024	*1.4%*
	Road	0.00016		0.00016		0.00016	
Bitumen operations	Tank farm	0.003	*25.3%*	0.003	*22.5%*	0.003	*26.4%*
Total emissions		0.012	*100%*	0.013	*100%*	0.011	*100%*

4 Existing Environment

4.1 Background Concentrations

Whilst Section 3 of this report describes expected air emissions resulting from site operations at the Joint Terminal facility at Birkenhead, it is important to consider air quality of the existing environment due to other pollution-generating activities within the airshed.

Aurecon understands that a number of VOC emission sources exist within the airshed of the Lefevre Peninsula, including the activities undertaken within the Joint Terminal. As part of understanding the impacts of these sources, SA EPA conducted a short-term monitoring campaign from 11 December 2003 through 3 January 2005 at Jenkins Street, Birkenhead, located approximately 1.3 km south of the assessment site (refer to Figure 4-1). As part of this study the pollutants PM_{10}, benzene, toluene, nitrogen dioxide, ozone, carbon monoxide, sulphur dioxide, formaldehyde and naphthalene were monitored (SA EPA, 2006).

Although the benzene assessment criteria stipulated by the EPP(AQ) (detailed in Table 2-2) are for 3-minute and annual averaging periods, only 1-hour and annual averaging periods were reported by SA EPA. To establish a 3-minute average background concentration it was therefore necessary to convert reported 1-hour average concentrations using the following equation as prescribed by the Environment Protection Authority Victoria (EPAV, 2013), resulting in a peak-to-mean ratio of 1.82:

$$c(t) = c(t_o)\ (t_o/t)^{0.2}$$

where

$c(t)$ = 3-minute average concentration (to be calculated)

$c(t_o)$ = 1-hour average concentration (obtained from monitoring observation data)

t_o = averaging time consistent with the monitoring data (60 minutes in this instance)

t = averaging time of interest (3 minutes in this instance)

A comprehensive summary of percentiles of monitored concentrations was not detailed within the SA EPA report, only the highest concentrations were available. It should be noted that maximum concentrations are typically considered overly conservative for background concentrations, with the 70^{th} percentile concentration typically considered most suitable (Brisbane City Council, 2016)(EPA Tasmania, 2016)(Gov. of Vic., 2001).

Of the five highest 1-hour average benzene concentrations reported, only one 3-minute converted concentration complied with the assessment criteria, which is shown in Table 4-1, alongside the reported annual average concentration. It is evident that whilst these background levels comply with assessment criteria, the 3-minute average background concentrations is very close (within 20% of the criterion). As such, and considering the discussion in the following paragraph, we have considered it more appropriate to use the annual average concentration as the representative 3-minute averaging period background level. It is unlikely that a high background level such as that of the three-minute converted concentration (50 $\mu g/m^3$) would coincide with the maximum predicted concentration for the Joint Terminal current and future operations – among other reasons, the monitoring report states that future ambient concentrations/background levels are expected to reduce due to introduction of the national fuel quality standard (SA EPA, 2006).

To further support use of the annual average monitored concentration for the 3-minute average background level, it should also be considered that these monitored values include some contribution from the Joint Terminal operations, where operations at the time of monitoring did not reflect those current operations (i.e. vapour recovery units, VRUs, and internal floating roof tanks, IFRs, have since been installed). Another consideration for this monitoring data is that it is more than 10 years old – due to improvements to legislation and emission control requirements since the monitoring was completed current background levels have potentially reduced, although changes to emission sources in the airshed are unknown. In any case, the 3-minute averaging period background level of 50 $\mu g/m^3$ in Table 4-1 represents one of the highest monitored values during the monitoring period and is not considered representative of typical levels. As such, the annual average level of 8 $\mu g/m^3$ was also adopted as the background level for the 3-minute averaging period criterion.

Table 4-1: Summary of EPP(AQ) criteria and concentrations monitored by SA EPA (2006).

Pollutant	Averaging time	EPP(AQ) Criterion (mg/m^3)	Monitored concentration (mg/m^3)	Concentration as percentage of EPP(AQ) criterion
Benzene	3 minutes	0.058	0.050	86%
	12 months	0.01	0.008[1]	80%

[1] Annual average for 2004. 3-minute average converted from the lowest 1-hour average concentration presented in Table 3, based on EPA Victoria prescribed methods (EPAV, 2013).

4.2 Victorian Air Toxics Monitoring Results

To further demonstrate the appropriateness of adopting the annual average value of SA EPA monitored data (Table 4-1, 8 $\mu g/m^3$), benzene monitoring completed by the Victorian EPA was also considered. Between 2006 and 2007 benzene monitoring was completed in Newport and Spotswood, near fuel storage facilities and an industrial area, respectively. These results are therefore considered representative of the residents located near the Joint Terminal site. 24-hour average values were recorded for the duration of this monitoring, with a summary of monitored concentrations provided in Table 4-2. It is evident that the reported concentrations monitored in Victoria are significantly lower than those reported for the monitoring in SA, with maximum 3-minute average concentrations for Victoria being approximately half of those reported from SA measurements. Victorian annual average concentrations were also significantly lower.

It is unclear as to why the SA EPA monitored concentrations are so much higher than those monitored in Victoria, although a contributing factor could be that the Victorian monitoring was completed after implementation of fuel standards which reduced benzene content. Nonetheless, this data supports the fact that a background concentration of 50 $\mu g/m^3$ is overly conservative, whilst a concentration of 8 $\mu g/m^3$ is appropriate for ambient short-term (3 minute) concentrations of benzene. Noting that whilst maximum concentrations are shown in Table 4-2 as they are most comparable to those reported by SA EPA (refer to Table 4-1), a more typical percentile used for background concentrations is the 70th percentile (Brisbane City Council, 2016)(EPA Tasmania, 2016)(Gov. of Vic., 2001).

Table 4-2: Summary of Victorian EPA benzene monitoring results (EPAV, 2014).

Monitoring location	Monitored concentrations		
	Maximum 24-hour averaging period	Annual averaging period	Max. 3-minute converted concentration[1]
Newport	2.6 ppb (8 $\mu g/m^3$)	1 ppb (3.2 $\mu g/m^3$)	27 $\mu g/m^3$
Spotswood	2.5 ppb (8 $\mu g/m^3$)	0.8 ppb (2.6 $\mu g/m^3$)	27 $\mu g/m^3$

[1] Converted from the maximum reported 24-hour average concentration.

Figure 4-1: Aerial image showing location of Jenkins Street monitoring site relative to the Joint Terminal site (source: ArcGIS Earth).

5 Modelling

5.1 Model Selection

This Section describes modelling methods adopted for this assessment. Dispersion modelling was completed using the US EPA-approved dispersion model CALPUFF, with the proprietary user interface designed by Lakes Environmental. CALPUFF consists of three main components: CALMET (the diagnostic, 3-dimensional meteorological model), CALPUFF (the air quality dispersion model), and CALPOST (the post-processing package). Geophysical data including land use and terrain elevations are also processed and introduced into the wind field.

CALPUFF is a multi-layer, multi-species non-steady-state puff dispersion model which simulates the effect of time and space-varying meteorological conditions in pollutant transport. In comparison to steady state plume models such as AERMOD, CALPUFF is better able to simulate dispersion under calm conditions and typically provides more accurate predictions of ground-level concentrations for the following reasons:

- allows variable/curved trajectories;
- meteorological conditions are variable and not assumed steady-state, and;
- allows calm and low wind speed conditions.

5.2 Model Meteorology

A range of parameters influence pollutant dispersion, particularly terrain and meteorology (most importantly wind speed and wind direction and mixing height). Weather Research and Forecasting (WRF) model generated prognostic meteorological data was purchased from Lakes Environmental with key input parameters summarised in Table 5-1. The reference year of 2009 was selected based on advice provided by the South Australian Environment Protection Authority (SA EPA).

A geophysical dataset was used as input into CALMET which included terrain and land use data to simulate the effects of the land surface on plume dispersion. SRTM (Shuttle Radar Topography Mission) terrain data with a resolution of approximately 30 m was used, and a land use file was created manually based on aerial photography obtained from Location SA MapViewer.

The geophysical dataset and WRF-generated meteorology (4 km resolution, over a 50 km x 50 km grid) were combined within CALMET to further refine the hourly three-dimensional meteorological data. Key parameters for CALMET are summarised in Table 5-2. The WRF and CALMET domains are shown in Figure 5-1. These domain sizes and grid resolutions allow surrounding topography to be captured to enable relevant local impacts on meteorology to be captured,

As wind plays a significant role in pollutant dispersion it is good practise to compare the wind rose obtained from model-generated meteorological data against that obtained from observation data. This check confirms if model-generated data reasonably reflects local site conditions. A wind rose is a graphical representation of local wind speeds and wind directions:

- Direction of each spoke indicates the direction from which the wind is blowing from
- Length of spokes (and sub-segments) describe frequency of occurrence for each wind direction
- Width of each spoke segment describes wind speed in that direction

The most representative observation data is available from the Bureau of Meteorology (BoM) station located at the Edinburgh RAAF base (located approximately 17 km north east of the assessment site). Accordingly, the annual wind rose for the reference year of 2009 was generated using BoM hourly observations for comparison against WRF and CALMET-generated hourly data. These wind roses are presented in Table 5-3. It is evident that:

- Model-generated data typically under-predicted wind speeds, and frequency of calms
- Model-generated data over-predicted frequency of northerly, easterly and westerly winds
- All annual wind roses demonstrate prevailing north-east and south-west winds
- Although differences are observed between BoM observations and model generated data, the model generated data is considered conservative as wind speeds are typically lower and have a higher frequency in the direction of sensitive receivers.

Table 5-1: Summary of WRF input parameters for generation of annual hourly 3D gridded prognostic data.

Parameter	Values
Grid centre coordinates	Clat: 34.8°S; Clon: 138.5°E
Synoptic year	2009
Domain size	50 x 50 km
Resolution	4 km
Number of vertical levels	35

Table 5-2: Summary of CALMET input parameters.

Parameter	Values
Prognostic data	4 km resolution, 50 km x 50 km
Grid centre	271.599 km E, 6143.252 km S
Grid length	30 km x 30 km
Grid spacing	0.2 km
Vertical cells	11 (0, 20, 40, 80, 160, 320, 480, 640, 1000, 1500, 2200, 3000)
Run mode	No-obs
TERRAD	10 km

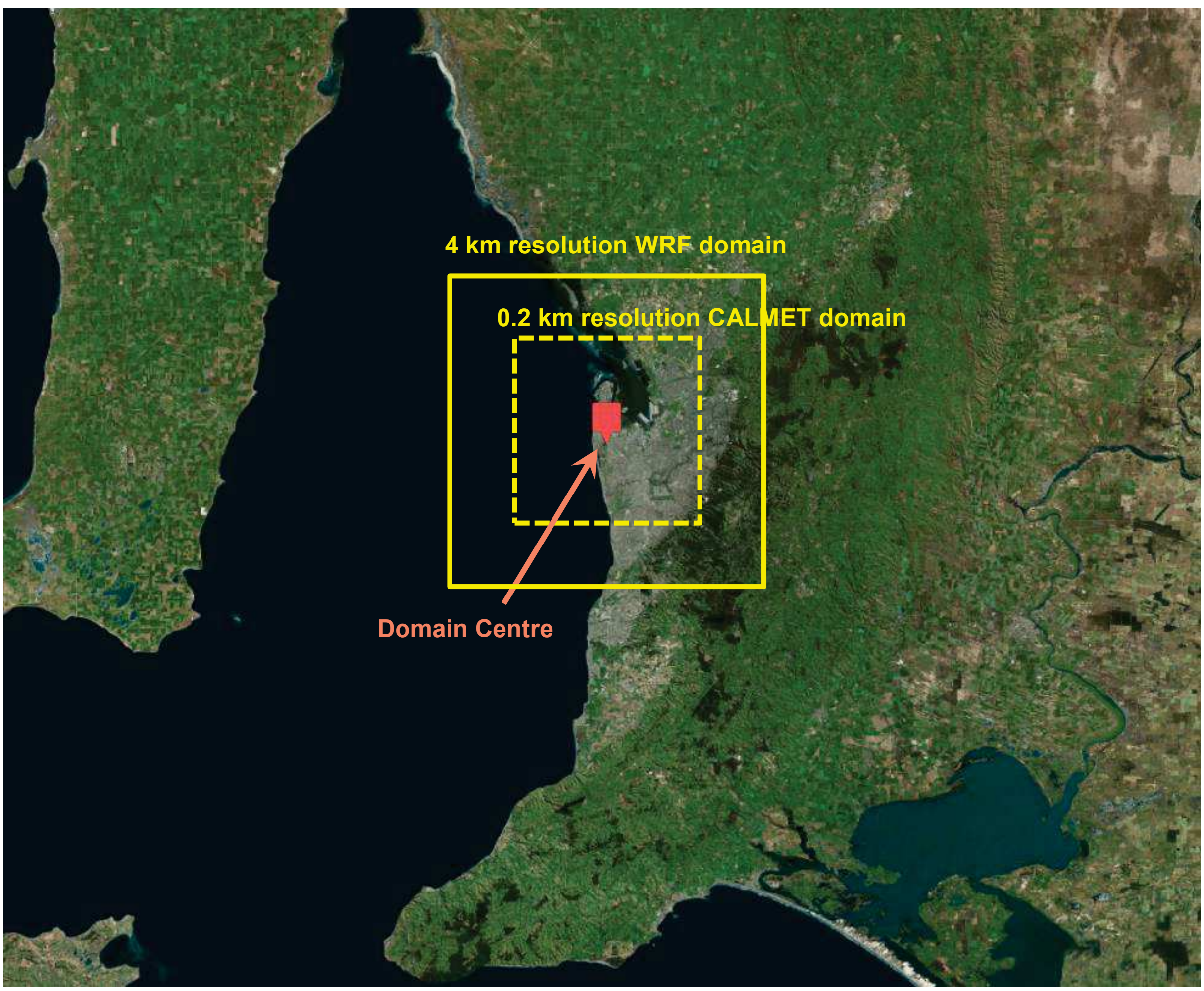
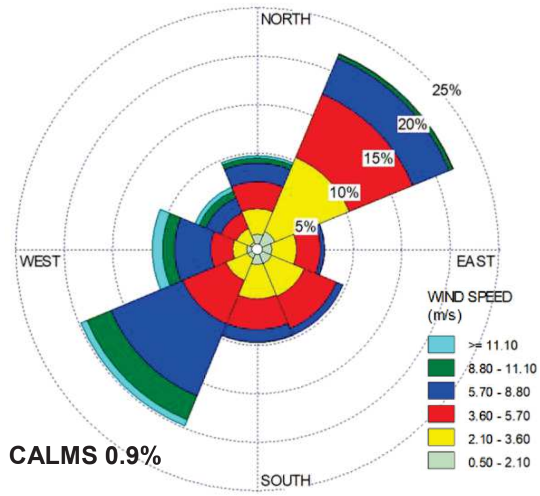


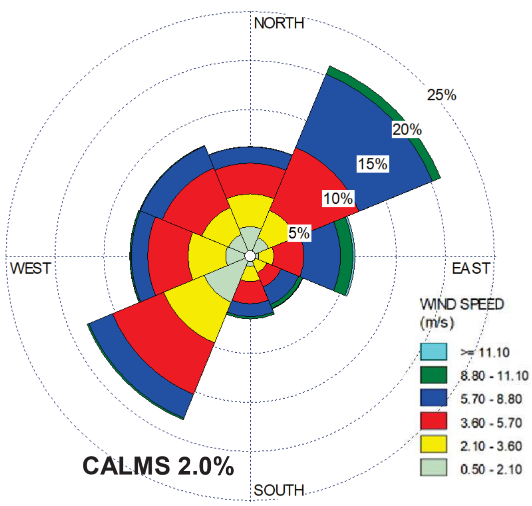
Figure 5-1: Aerial image showing WRF and CALMET domains adopted for this assessment (source: ArcGIS Earth).

Table 5-3: Annual wind roses for the RAAF Edinburgh BoM station site for the year 2009, generated from1-hour average BoM observation data and WRF-CALMET-generated prognostic data.

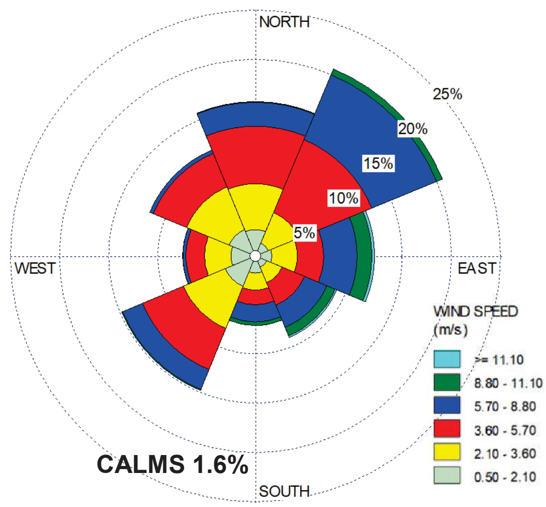
Annual, RAAF Edinburgh BoM observations 2009



Annual, RAAF Edinburgh, WRF-CALMET 2009



Annual, Joint Terminal site, WRF-CALMET 2009



The level of stability in the atmosphere affects the dispersion of emissions from a source. The Pasquill-Gifford (P-G) stability category scheme is used to denote atmospheric stability. Stability class under this scheme is designated a letter from A-F (and sometimes G), ranging from highly unstable (class A) to extremely stable (G).

Atmospheric movement is characterised by four basic conditions that describe the general stability of the atmosphere. In stable conditions, vertical movement is discouraged, whereas in unstable conditions the air tends to move upward or downward and continue in that movement. When conditions neither encourage nor discourage vertical movement, beyond the rate of adiabatic heating or cooling, they are considered neutral (class D). When conditions are extremely stable, cooler air near the surface becomes trapped by a layer of warmer air above it. Under these conditions, called an inversion, virtually no vertical air motion occurs.

The frequency distribution of stability classes is presented in Figure 5-2. It is evident that extremely unstable conditions (class A) are infrequent (occur 0.6% of the time), whilst neutral conditions (class D) are most common (occur 32.9% of the time). These findings are consistent with typical meteorological patterns.

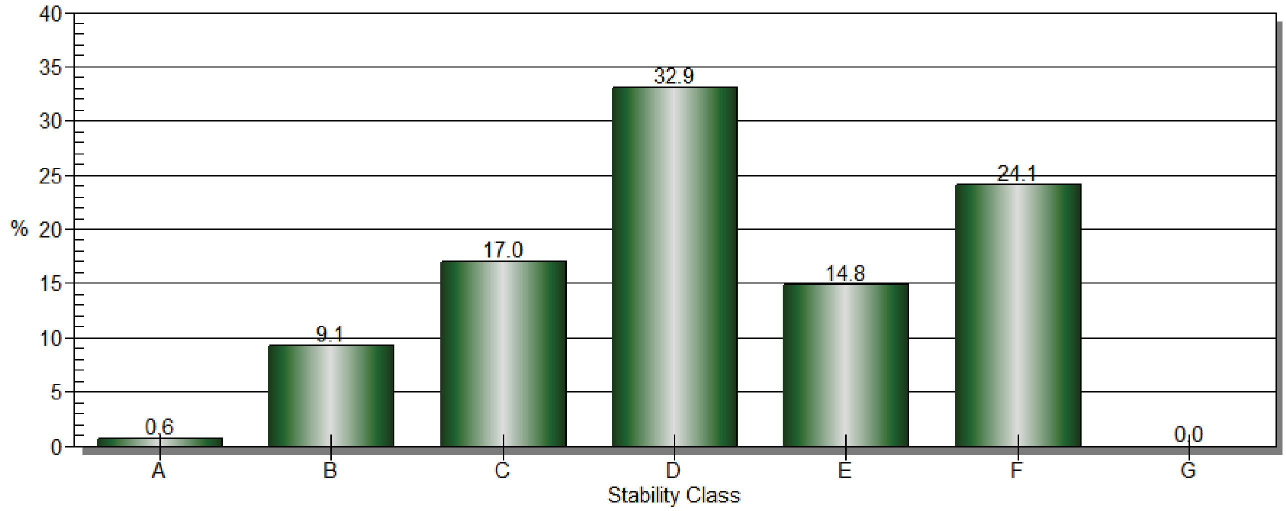


Figure 5-2: Frequency distribution of stability classes for generated meteorological file, at the Joint Terminal.

5.3 Fuel Storage Tank Emissions

As detailed earlier in this report, only benzene emissions from the fuel tanks were modelled. All tank emissions were modelled as point sources, at the specified tank height. PV and free vented tanks were modelled with one point source at the centre of the tank roof, whilst IFR tanks were modelled with eight point sources located around the circumference of the tank roof, at roof height. All sources were modelled with rain caps, preventing vertical momentum of the emissions. Emission outlet conditions are summarised in Table 5-4.

Table 5-4: Summary of modelled emission source parameters applied to all fuel storage tanks.

Parameter	Unit	Value
Exhaust temperature	°C	17[1]
Exhaust velocity	m/s	0.001[2]
Stack/Outlet diameter	m	0.001[2]

[1] Temperature adopted is the average temperature from CALMET-generated data for the Joint Terminal site.
[2] Adopted velocity and diameter are considered conservative and representative of fugitive emissions. Adopted values for velocity and diameter are based on advice provided by Lakes Environmental:
https://www.weblakes.com/Newsletter/2010/August2010.html

5.4 Assessment of Cumulative Impacts

As discussed in Sections 3.2, 3.3 and 4.1, in addition to assessing air quality impacts due to emissions of benzene from the fuel storage tanks, it is important to consider cumulative impacts resulting from background levels of benzene, as well as benzene emissions from other significant VOC pollutant sources located on the Joint Terminal site, namely the fuel loading gantries and bitumen plant operations.

Emissions of benzene from alternative VOC pollutant sources located on the Joint Terminal site (fuel loading gantries and bitumen plant operations) were accounted for by adopting the following approach:

- Referring to the emission rates for each Joint Terminal site benzene pollutant source (refer to Table 3-9), the fraction of total emissions corresponding to the fuel storage tanks, F, was established for each scenario, where
  - $E_{Storage} = F.E_{Joint}$
  - $E_{Storage}$ is the emission rate (g/s) for benzene corresponding to the fuel storage tanks
  - E_{Joint} is the total emission rate of benzene produced by the Joint Terminal site
- This fraction of total benzene emissions corresponding to the fuel storage tanks, F, was assumed equivalent for ground-level concentrations (i.e. it was assumed the same fraction represents the portion of total ground-level concentrations attributed to the fuel storage tanks) where:

- $C_{Joint} = C_{Storage}/F$
- $C_{Storage}$ is the model predicted ground-level concentration (µg/m^3) for benzene corresponding to the fuel storage tanks
- C_{Joint} is the estimated total ground-level concentration for benzene produced by the Joint Terminal site

Background levels of benzene were accounted for by summing the benzene concentration resulting from all VOC pollutant sources located on the Joint Terminal site, C_{Joint}, with the background concentration, providing the total cumulative impact.

5.5 Modelled Scenarios

For this assessment a variety of concentration types for the most significant pollutant (benzene) were predicted and assessed against the criteria. The different scenarios and concentration types are outlined in Table 5-5.

Table 5-5: Summary of scenarios and concentration types assessed and modelled.

Concentration type	Scenario	Emission source		
		Fuel storage tanks	Loading gantry and bitumen storage tanks	Background concentration
Incremental	Current	✓	×	×
	Interim – A: new diesel tank	✓	×	×
	Interim – B: new diesel and unleaded petrol tanks	✓	×	×
	Future	✓	×	×
All Joint Terminal emissions	Current	✓	✓	×
	Interim – A: new diesel tank	✓	✓	×
	Interim – B: new diesel and unleaded petrol tanks	✓	✓	×
	Future	✓	✓	×
Cumulative	Current	✓	✓	✓
	Interim – A: new diesel tank	✓	✓	✓
	Interim – B: new diesel and unleaded petrol tanks	✓	✓	✓
	Future	✓	✓	✓

6 Impact Assessment

Ground-level concentration (GLC) contours for all benzene averaging periods and all scenarios detailed in Table 5-5 (incremental impacts) were generated and are presented in Appendix A. Maximum predicted (rank 1) concentrations at the most adversely impacted residential property are presented in Table 6-1 for assessment against the criterion.

This Section describes the assessment of predicted incremental and cumulative concentrations against relevant criteria for each modelled scenario.

For concentration predictions of the benzene short-term averaging period (3-minute) typical CALPUFF/CALPOST generated 1-hour average concentrations were converted to the 3-minute averaging period using the following formula prescribed by EPAV (EPAV, 2013), detailed in Section 4.1:

$$c(t) = c(t_o)\ (t_o/t)^{0.2}$$

where

$c(t)$ = 3-minute average concentration (to be calculated)

$c(t_o)$ = 1-hour average concentration (obtained from CALPUFF/CALPOST)

t_o = averaging time consistent with the dispersion model (60 minutes in this instance)

t = averaging time of interest/to be converted to (3 minutes in this instance)

Table 6-1: Summary of maximum (rank 1) predicted 3-minute averaging period concentrations of benzene at the most adversely affected residential property. An assessment criterion of 58 µg/m³ is applicable for the 3-minute averaging period, and a criterion of 10 µg/m³ for the annual averaging period.

Concentration type	Scenario	3-minute concentration (µg/m³)	Annual average concentration (µg/m³)
	Criterion	**58**	**10**
Incremental	Current	7.8	0.14
	Interim – A: new diesel tank	7.8	0.14
	Interim – B: new diesel and unleaded petrol tanks	7.8	0.15
	Future	7.0	0.13
All Joint Terminal emissions	Current	10.7	0.19
	Interim – A: new diesel tank	10.2	0.18
	Interim – B: new diesel and unleaded petrol tanks	10.2	0.20
	Future	9.6	0.18
Cumulative[1]	Current	**18.7**	8.2
	Interim – A: new diesel tank	**18.2**	8.2
	Interim – B: new diesel and unleaded petrol tanks	**18.2**	8.2
	Future	**17.6**	8.2

[1] A background concentration of 8 µg/m3 was adopted for both the 3-minute and annual averaging periods as discussed in Section 4.1.

6.1 Current operations

From Table 6-1 it is evident that for current operations, all benzene concentrations for the annual and 3-minute averaging period comply with the criterion, including cumulative impacts. The concentrations presented in Table 6-1 are those for the most adversely affected sensitive receiver. Thus, concentrations at all sensitive receivers for all concentration types comply with the criteria.

Based on the estimated maximum concentration for 'all joint terminal emissions', ground-level concentrations would comply with the 3-minute averaging period criterion for background levels as high as 47 µg/m^3 (equivalent to 81% of the assessment criterion).

6.2 Interim operations

Similar to current operations, all concentration types for both the annual and 3-minute averaging periods comply with the criteria at all sensitive receiver locations, for both Interim – A and Interim – B (refer to Table 6-1).

It should be noted that negligible differences are observed between predicted concentrations for Scenarios Interim – A and Interim – B, and for current operations. This is likely because of the following reasons:

- Although additional fuel storage tanks have been added to the site, the overall fuel throughput has not been affected;
- The fuel throughput for the new tanks results in reduced fuel throughput for some existing tanks, also reducing in reduced benzene emissions from these existing tanks.

Based on the estimated maximum concentration for 'all joint terminal emissions', ground-level concentrations would comply with the 3-minute averaging period criterion for background levels as high as 47 µg/m^3 (equivalent to 81% of the assessment criterion).

6.3 Future operations

Considering all Scenarios, predicted concentrations for both the 3-minute and annual averaging period are lowest for future operations (refer to Table 6-1). All predicted annual and 3-minute averaging period concentrations comply with the assessment criteria of 10 µg/m^3 and 58 µg/m^3, respectively, at all sensitive receiver locations. Maximum predicted 3-minute average cumulative concentrations of benzene account for approximately 30% of the criterion.

As already mentioned, it is important to note that modelling results indicate that operation of the two new fuel storage tanks and the redistribution of fuels in existing tanks is likely to reduce emissions of benzene to the atmosphere, indicating that emissions of other VOCs will also likely reduce, when compared to current operations. This outcome is because implementation of the two new tanks will not affect the overall site's annual fuel throughput – the throughput for the new tanks reduces throughput for the existing tanks, reducing VOC emissions from these tanks. Although the two new fuel tanks will act as two new emission sources, they are located such that emissions from these tanks have less impact on the most adversely affected residential properties (located to the west of the Joint Terminal), resulting in a favourable outcome.

Based on the estimated maximum concentration for 'all joint terminal emissions', ground-level concentrations would comply with the 3-minute averaging period criterion for background levels as high as 48 µg/m^3 (equivalent to 83% of the assessment criterion).

7 Conclusion

This report details the air quality assessment of the proposed development at the adjacent Joint Terminal fuel storage facilities at Birkenhead, South Australia. A new 30 ML diesel fuel storage tank and a 25 ML capacity unleaded petrol fuel storage tank is proposed for the Joint Terminal site. Once in operation these additional tanks will have no impact on current annual throughputs of the facilities, allowing Viva to change how they store their fuels such that it is more efficient.

As storage of organic liquids results in the release of emissions of volatile organic chemicals (VOCs) to the atmosphere, these additional storage tanks will act as additional emission sources, and so it was necessary to complete an emissions assessment and dispersion modelling to understand the likely impact on the local environment.

Whilst the focus of this assessment was to consider the current emissions profile of the Joint Terminal fuel storage facilities due to the current fuel storage tank facility and establish the impact due to the additional two proposed tanks, VOC emissions from the site's fuel loading gantry and the Viva bitumen plant were also established to understand cumulative impacts on nearby residential properties.

Fuel storage tank emissions were estimated following the United States Environment Protection Agency (US EPA) AP-42 Compilation of Emission Factors, Chapter 7.1. Emissions were estimated for Scenarios representing current operations, interim operations with the new diesel tank, and with both the new diesel and unleaded petrol tanks, and future operations with both new tanks and changes to fuels stored in existing tanks. From these estimates it was evident that benzene was the pollutant emitted in most significant quantities relative to the criterion as specified in the South Australian Environment Protection (Air Quality) Policy 2016.

As benzene was identified as the most significant pollutant for this assessment, only emissions and ground level concentrations of benzene were assessed in this report, as it was considered benzene would be treated as an indicator of compliance for other VOCs.

Emissions from the fuel rail and road loading gantries were estimated using the US EPA's AP-42 Chapter 5 Section 2, and emissions from the bitumen plant obtained from historical air quality reports which have assessed impacts of the plant's operations. There is no existing dispersion modelling showing resultant predicted ground-level concentrations (GLCs) of benzene for these operations, but these operations and therefore their impact on benzene GLCs are consistent between scenarios. As such the cumulative impact of these operations was accounted for by applying a scaling factor to predicted ground-level concentrations for fuel storage tanks. In addition to Joint Terminal cumulative impacts, benzene background levels were established from SA EPA monitoring data (SA EPA, 2006) and incorporated in the assessment.

WRF-generated meteorological prognostic data for the reference year 2009 was obtained from Lakes Environmental and refined using the CALPUFF meteorological pre-processor CALMET. Fuel tank emissions were modelled in the dispersion model CALPUFF as point sources at the height of the tank, with the fuel tank dimensions modelled and building downwash effects incorporated.

Maximum predicted concentrations were obtained from the model at the most adversely affected residential property for Scenarios representing current, interim and future operations for 3-minute and annual averaging periods. A multiplication factor was applied to the incremental concentration to account for emissions from fuel loading gantry and bitumen plant activities, and the background level summed to determine cumulative impacts.

All predicted annual and 3-minute averaging period concentrations for all Scenarios complied with the criteria with concentrations lowest for the Scenario of future operations.

In all Scenarios the site annual fuel throughput remains the same. As the throughput for the new tanks reduces the throughput of existing tanks, their emissions of VOCs and benzene also reduce. Although the two new tanks effectively act as two additional emission sources, they are located such that they have less impact on the most adversely affected residential properties located nearby, and effectively 'subtract' from the existing impact.

8 References

Brisbane City Council (2016), '*Schedule 6.2 – Air quality planning scheme policy*', [online], accessed 19 May 2017, available: https://www.brisbane.qld.gov.au/planning-building/planning-guidelines-tools/brisbane-city-plan-2014/document/schedule-6

EPA Tasmania (2016), '*Draft Tasmanian atmospheric dispersion modelling guidelines*', Environment Protection Authority of Tasmania.

EPAV (2013), '*Guidance notes for using the regulatory air pollution model AERMOD in Victoria'*, Environment Protection Authority Victoria, Publication 1551.

EPAV (2014), '*Newport and Spotswood 2006-07 air monitoring results'*, [online], accessed 26 July 2018, available: **https://www.epa.vic.gov.au/our-work/monitoring-the-environment/monitoring-victorias-air/monitoring-results/newport-and-spotswood-2006-07-air-monitoring-results**

Gov. of Vic. (2001), '*State Environment Protection Policy (Air Quality Management)*', Environment Protection Act 1970, Victoria Government Gazette, No. S 240 Friday 21 December 2001.

NPI (2012), '*Emission Estimation Technique Manual for Fuel ad Organic Liquid Storage'*, National Pollutant Inventory, version 3.3, issued May 2012, [online], accessed 12 June 2018, available: **www.npi.gov.au/system/files/resources/5d886b0c-d392-4c04-c91d-a3a099bc0988/files/fols.pdf**

SA EPA (2006), '*Air quality monitoring hot spot report no. 6: Jenkins St, Birkenhead'*, South Australian Environment Protection Authority.

SA EPA (2016), '*Evaluation Distances for Effective Air Quality and Noise Management'*, South Australian Environment Protection Authority, published August 2016.

South Australia Environment Protection (Air Quality) Policy 2016, Environment Protection Act 1993

US EPA (2006), '*AP-42: Compilation of Emission Factors*', Chapter 7 Section 1: Liquid Storage Tanks, Volume 1, [online], accessed 12 June 2018, available: **https://www3.epa.gov/ttn/chief/ap42/ch07/final/c07s01.pdf**

US EPA (2008), '*AP-42: Compilation of Emission Factors*', Chapter 5 Section 2: Petroleum transportation and marketing, Volume 1, [online], accessed 12 June 2018, available: **https://www3.epa.gov/ttn/chief/old/ap42/ch05/s02/draft/d05s02_jun2008.pdf**

A

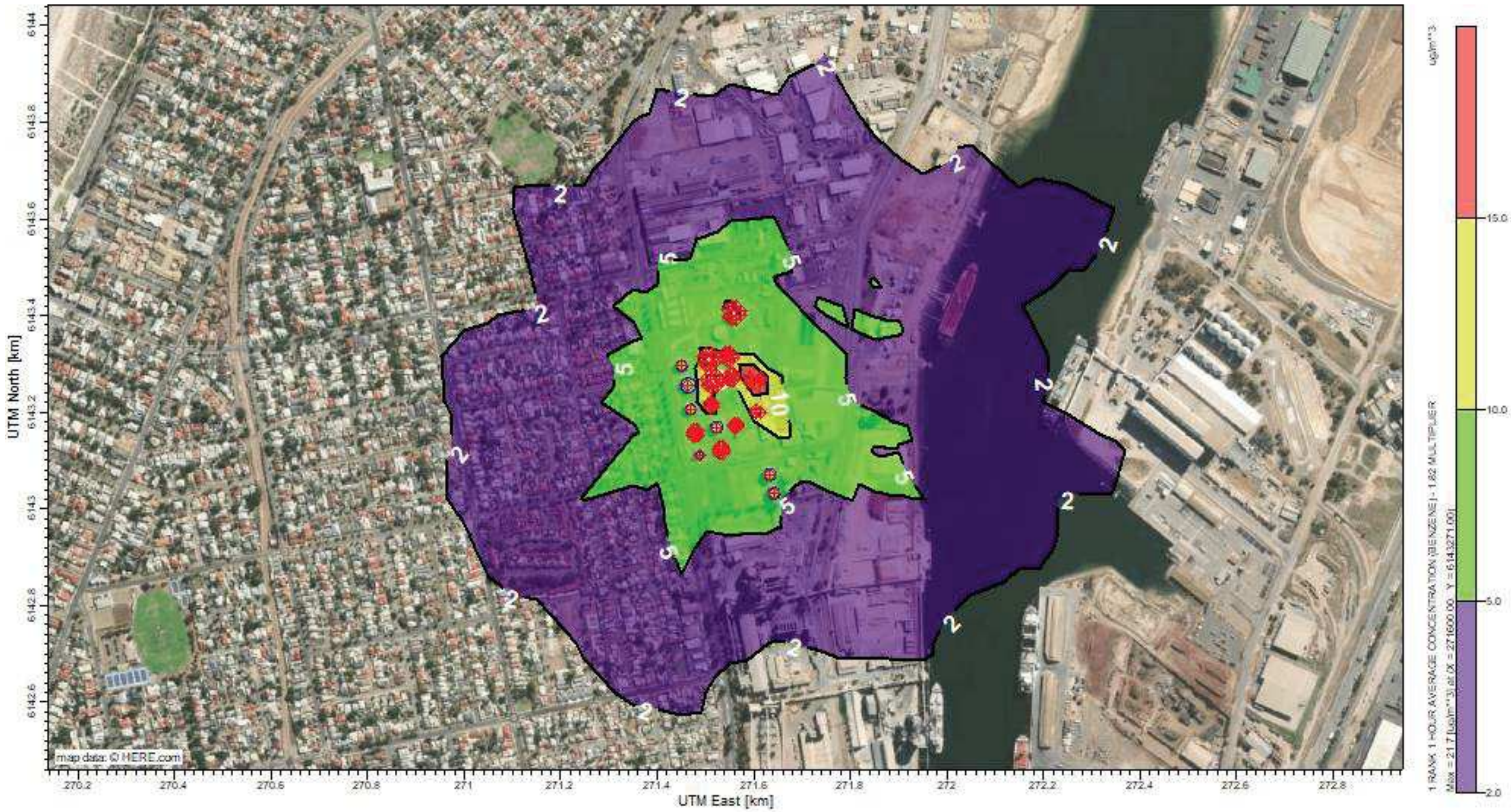
GLC Contours

Appendix A
GLC Contours

Benzene Ground-level concentration (GLC) contours

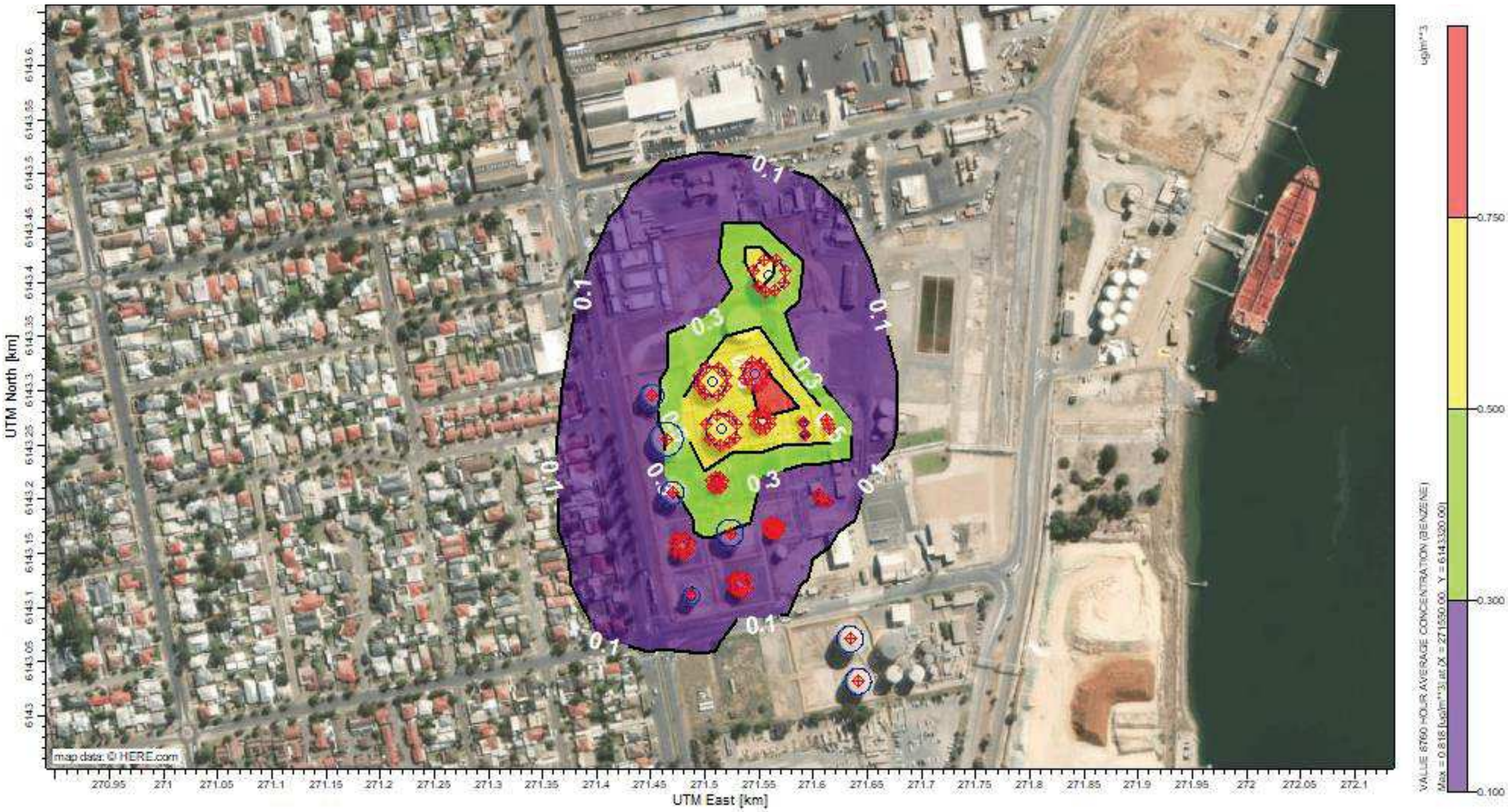
Current Operations

3-minute averaging period



Benzene GLC – 3-minute averaging period – Criterion of 58 µg/m³ – emissions from fuel tanks only. *Current operations.*

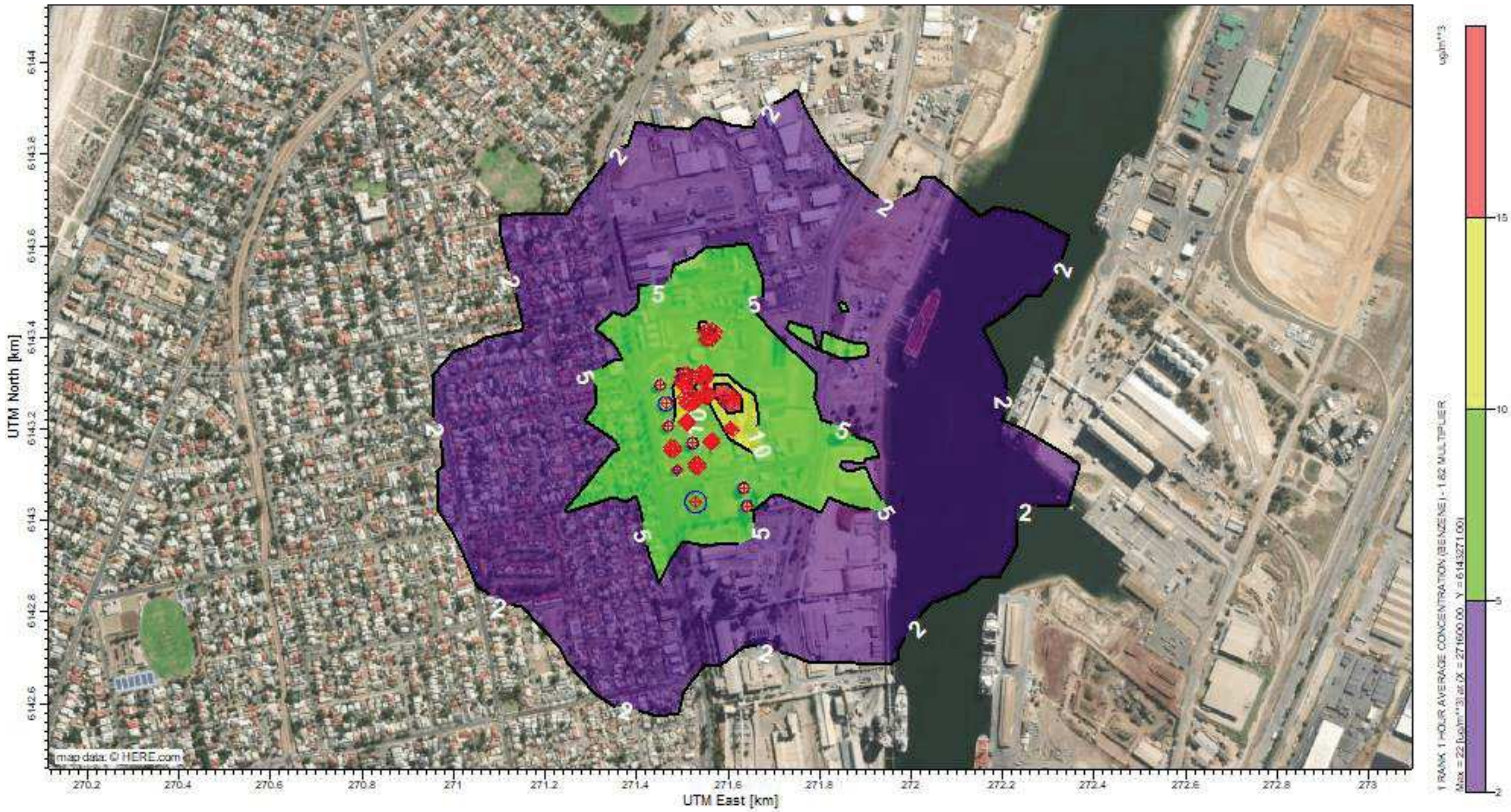
Annual averaging period



Benzene GLC – Annual averaging period – Criterion of 10 μg/m³ – emissions from fuel tanks only. *Current operations.*

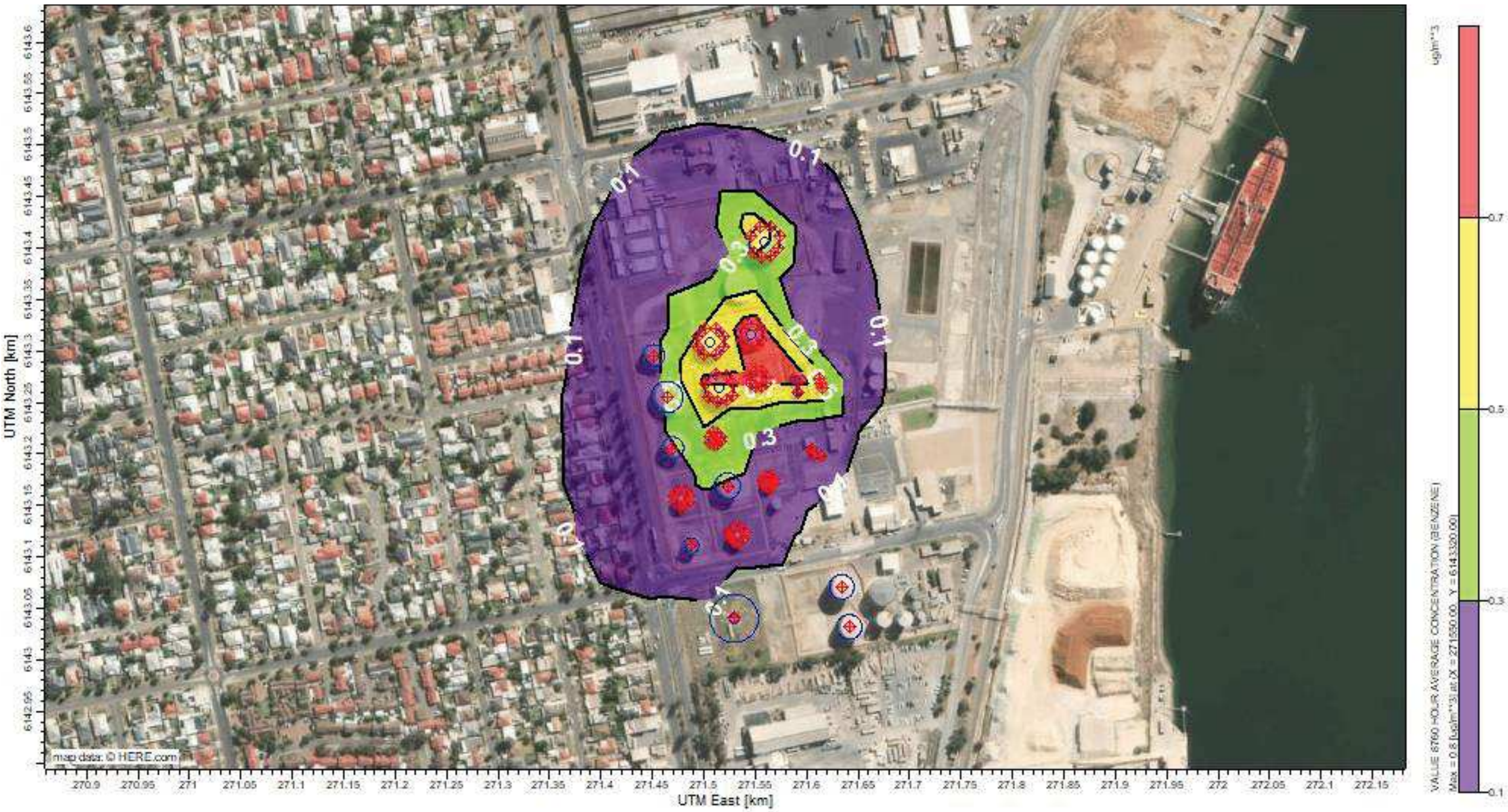
Interim Operations A

3-minute averaging period



Benzene GLC – 3-minute averaging period – Criterion of 58 µg/m³ – emissions from fuel tanks only. *Interim operations A.*

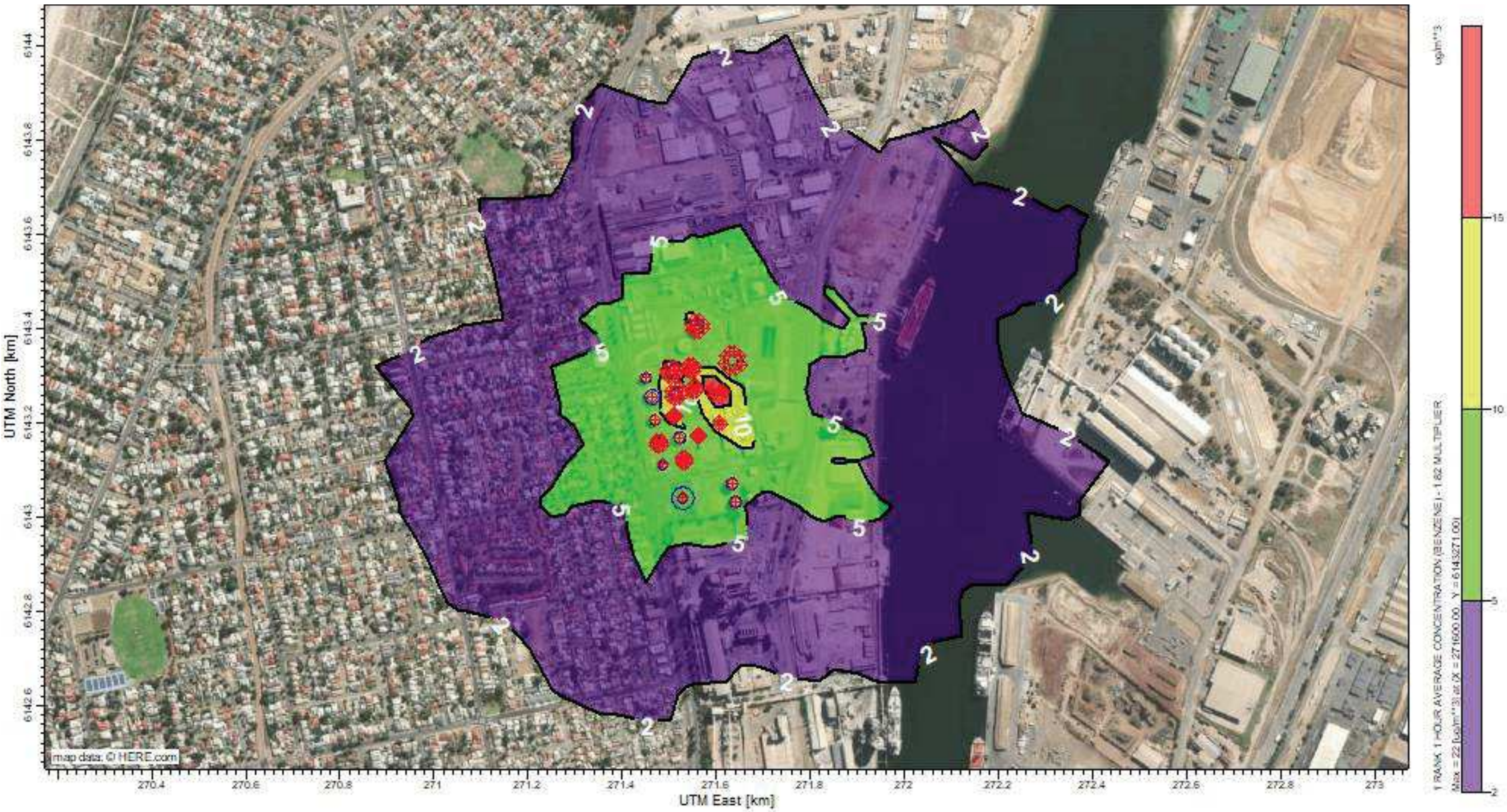
Annual averaging period



Benzene GLC – Annual averaging period – Criterion of 10 µg/m³ – emissions from fuel tanks only. *Interim operations A.*

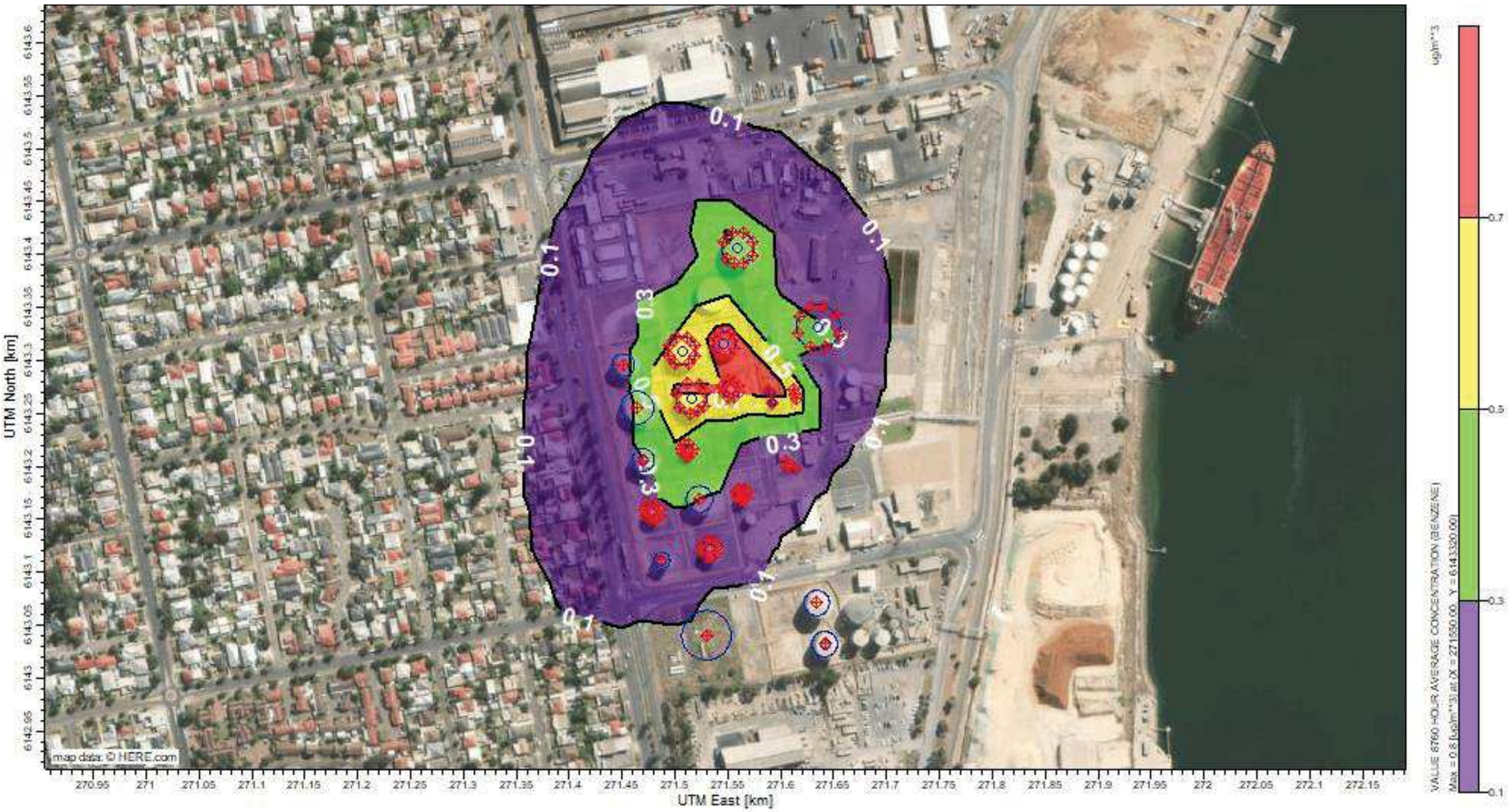
Interim Operations B

3-minute averaging period



Benzene GLC – 3-minute averaging period – Criterion of 58 μg/m^3 – emissions from fuel tanks only. *Interim operations B.*

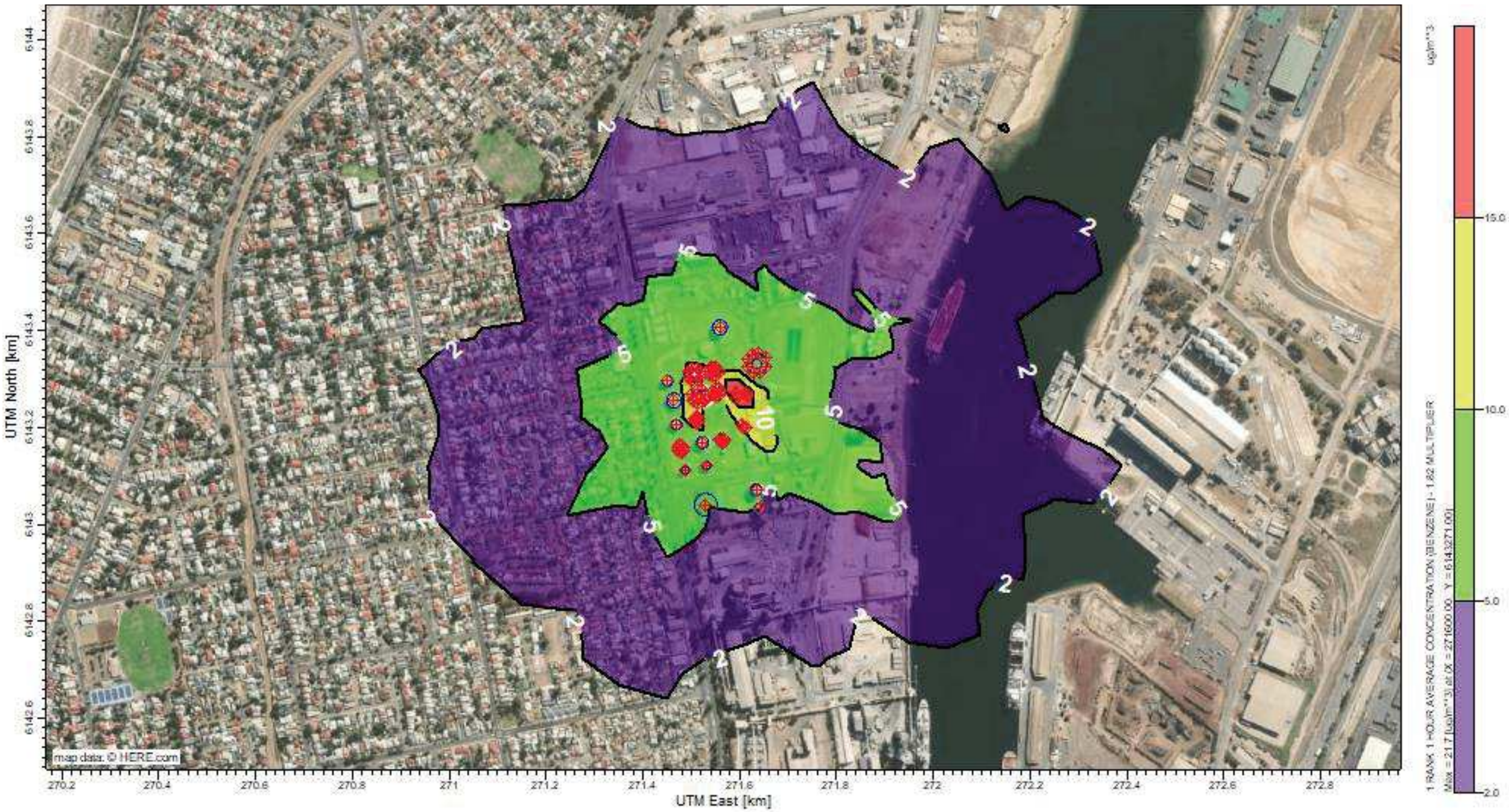
Annual averaging period



Benzene GLC – Annual averaging period – Criterion of 10 µg/m³ – emissions from fuel tanks only. *Interim operations B.*

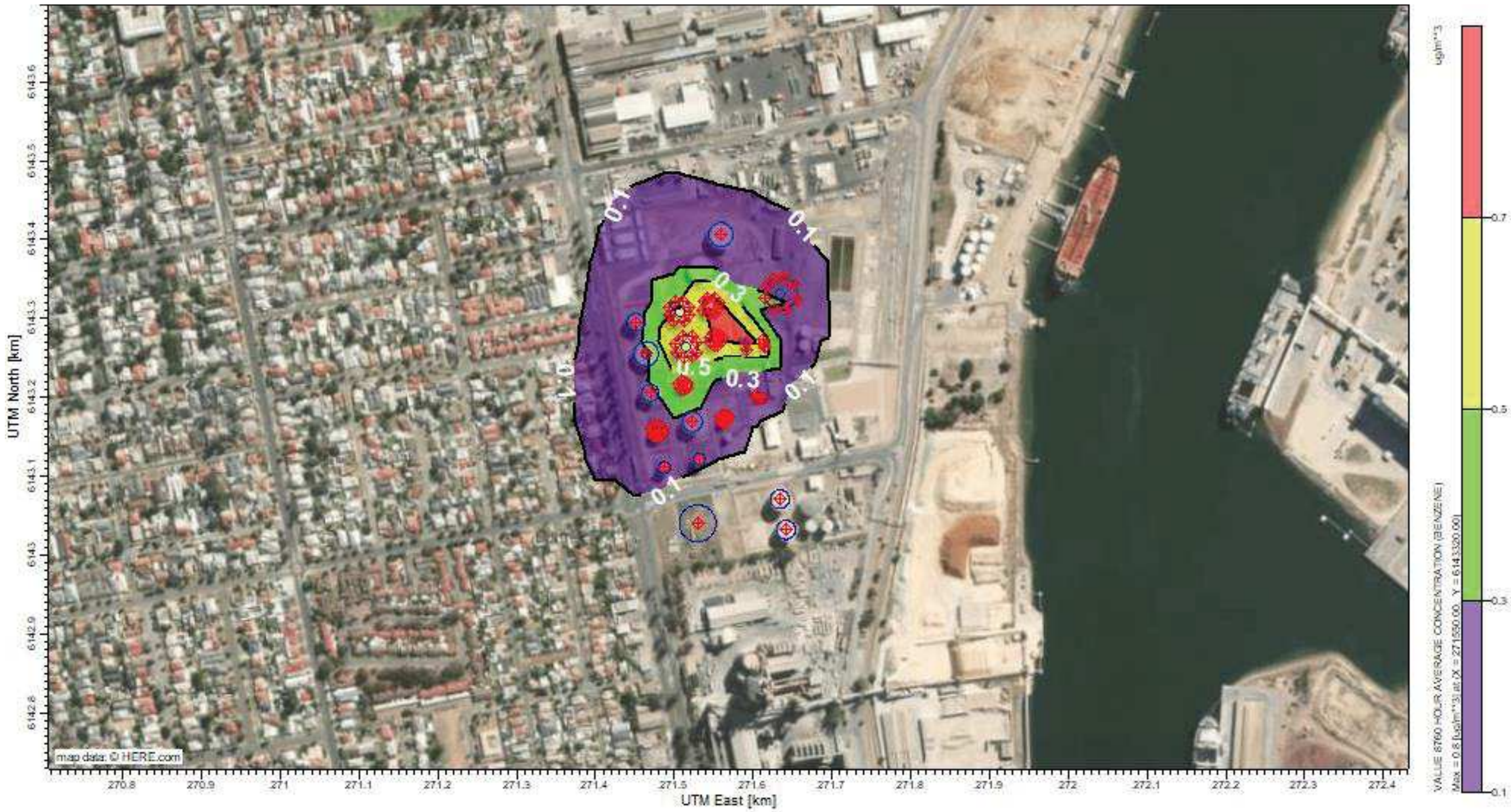
Future Operations

3-minute averaging period



Benzene GLC – 3-minute averaging period – Criterion of 58 µg/m³ – emissions from fuel tanks only. *Future operations.*

Annual averaging period



Benzene GLC – Annual averaging period – Criterion of 10 µg/m³ – emissions from fuel tanks only. *Future operations.*

B

Emission Estimate Info.

Appendix B
Emission Estimate Information

Supporting information for the estimation of emissions.

1 Tank throughputs

Although annual throughputs for each fuel type were provided, annual throughputs for individual tanks were not provided. To determine the approximate annual throughput for each fuel storage tank, the following method was adopted as agreed with the client:

$$Q_{f,i} = Q_{f,t} \cdot \frac{C_i}{C_{f,t}}$$

Where,

$Q_{f,i}$ is the annual throughput for fuel storage Tank i (of fuel type f)

$Q_{f,t}$ is the total annual throughput of fuel type f

C_i is the capacity of fuel storage Tank i

C_t is the total capacity of all fuel storage tanks which are storing fuel type f

Annual throughput data was provided by the client in units ML, or megalitres. The following density values were used for conversion to mass.

Fuel type	Density (kg/L)	Source
Jet-A1	0.837	NPI FOLS Estimation Manual
ULP	0.735	NPI FOLS Estimation Manual
PULP	0.75	NPI FOLS Estimation Manual
98 PULP	0.75	NPI FOLS Estimation Manual
Diesel	0.836	NPI FOLS Estimation Manual
NEMO-6101	0.879	Product SDS
NEMO-6124	0.880	Product SDS
DI-METHYL GLYSOV	1.020	Product SDS
NALCO 5403	0.930	Product SDS
HYDROCARBON MIX(29)	0.794	Product SDS
HYDROCARBON MIX(30)	0.796	Product SDS
NEMO-2010	0.91	Product SDS
HI-TEC 4691C	0.908	Product SDS
HI-TEC 6590C	0.913	Product SDS

NPI (2012), '*Emission Estimation Technique Manual for Fuel ad Organic Liquid Storage*', National Pollutant Inventory, version 3.3, issued May 2012, [online], accessed 12 June 2018, available: **www.npi.gov.au/system/files/resources/5d886b0c-d392-4c04-c91d-a3a099bc0988/files/fols.pdf**

2 Input values for US EPA AP-42 Equations

As discussed in the report, TVOC emissions for fuel additives were estimated following the United States Environment Protection Agency (US EPA) AP-42 Compilation of Emission Factors, Chapter 7.1. Key assumptions are discussed in this Section.

Meteorological parameters required for the calculations were obtained from the NPI TANKS database for Adelaide, available for download here: **http://npi.gov.au/resource/emission-estimation-technique-manual-fuel-and-organic-liquid-storage-version-33**

This included the following parameters:

- T_{AX}, daily maximum ambient temperature, °R (530°R)
- T_{AN}, daily minimum ambient temperature, °R (512°R)
- I, daily total solar insolation on a horizontal surface, Btu/(ft^2 day) (1,520 Btu/(ft^2 day))

Values for other parameters are summarised below

Symbol	Description	Units	Value	Source
α	Tank paint solar absorptance	Dimensionless	0.17	Table 7.2.6, (US EPA, 2006)
H_L	Tank liquid height	ft	70% of tank height	Conservatively adopted
H_{RO}	Roof outage	ft	(1/3)x(Roof height)	All fuel additive tanks are free or PV vented – according to the NPI manual, the default roof type is therefore 'cone' which is calculated using this formula as per equation 1-16 (US EPA, 2006).
S_R	Cone roof slope	Ft/ft	0.0625	Standard value (US EPA, 2006)
P_{VA}	Vapour pressure at daily liquid surface temperature	psia	Between 0.015 and 0.105	Where the vapor pressure was provided in the product SDS, this value was used. Otherwise a maximum value of 0.105 was conservatively adopted.
M_V	Vapour molecular weight	Lb/lb-mole	130 (NEMO-6101, NEMO-6124, NALCO 5403, NEMO-2010, HI-TEC 4691C, HI-TEC 6590C) 66 (95PULP, 98PULP, HYDROCARBON MIX)	Table 7.1-2 (US EPA, 2006) used as reference, and product SDS of each additive reviewed to understand compositions. Each additive was shown to contain significant proportions of either kerosene or gasoline and was therefore approximated as having a chemical composition (including speciation profile) of either Jet Kerosene or gasoline as RVP 10, respectively. Therefore, the reported molecular weight of 130 lb/lb-mole for jet kerosene and 66 lb/lb-mole for gasoline RVP 10 were adopted.
K_N	Working loss turnover	Dimensionless	1	According to US EPA (2006)

	(saturation) factor			For turnover > 36, Kn = (180 + N)/6N For turnover ≤ 36, KN = 1 It was assumed that for the fuel additives, turnovers are less than 36.
K_P	Working loss product factor	Dimensionless	0.75	According to US EPA (2006) For crude oils K_P = 0.75 For all other organic liquids K_P = 1
RVP	Reid Vapor Pressure	kPa	67.5	Based on NPI/TANKS data and table 7.1-2 (US EPA, 2006).
K_{Ra}	Zero wind speed rim seal loss factor	lb-mole/ft.yr	6.7	According to US EPA (2006), Table 7.1-8, default value used.
K_{Rb}	Wind speed dependent rim seal loss factor	lb-mole/(mph)^{n}ft.yr	n/a	In equation (2-2) (US EPA, 2006) value is multiplied by ***v*** (equal to zero) and so is not relevant.
v	Average ambient wind speed at tank site	mph	0	According to US EPA (2006), Note 1 of equation (2-2) specifies that a wind speed of 0 is appropriate for internal floating roof tank.
n	Seal-related wind speed exponent	Dimensionless	n/a	In equation (2-2) (US EPA, 2006) value is applied to ***v*** (equal to zero) and so is not relevant.
P*	Vapour pressure function	Dimensionless	0.1087	According to US EPA (2006), the value is calculated from equation (2-3).
K_c	Product factor	Dimensionless	1	According to US EPA (2006) K_C = 0.4 for crude oils K_C = 1 for all other organic liquids
C_s	Shell clingage factor	bbl/1000ft^2	0.0015	According to US EPA (2006) Table 7.1-10, value for gasoline stored in a shell with light-rust assumed.
W_L	Average organic liquid density	lb/gal	7 (jet kerosene) 7.1 (diesel) 5.6 (ULP, 95PULP, 98PULP)	According to US EPA (2006) values are provided in Table 7.1-2
N_c	Number of fixed roof support columns	Dimensionless	Various values	According to US EPA (2006) values are provided in Table 7.1-11 and are dependent on tank diameter.
F_c	Effective column diameter	ft	1	According to US EPA (2006) Note 3 for equation (2-4), default value adopted.
F_F	Total deck fitting loss factor	lb-mole/yr	Various values	According to US EPA (2006), value is calculated as per equation (2-6).
K_D	Deck seam loss per unit seam length factor	lb-mole/ft-yr	0	According to US EPA (2006), value for welded deck assumed (in accordance with the NPI 2012).

S_D	Deck seam length factor	ft/ft^2	0.2	According to US EPA (2006) in the notes for equation (2-9), the value for the most common bolted decks in use was assumed.

For estimation of benzene emissions from the tanks storing the hydrocarbon mix (otherwise termed ‘slops’), the only piece of information available was the density. After review of the density values, it was found that these densities were approximately the midpoint between that of PULP and RON98, and Diesel and JetA1. A conservative assumption was therefore made that the slops contains the same proportion of benzene as PULP (1.003% according to Table 2 of the NPI manual).

NPI (2012), ‘*Emission Estimation Technique Manual for Fuel ad Organic Liquid Storage’*, National Pollutant Inventory, version 3.3, issued May 2012, [online], accessed 12 June 2018, available: **www.npi.gov.au/system/files/resources/5d886b0c-d392-4c04-c91d-a3a099bc0988/files/fols.pdf**

US EPA (2006), ‘*AP-42: Compilation of Emission Factors*’, Chapter 7 Section 1: Liquid Storage Tanks, Volume 1, [online], accessed 12 June 2018, available: **https://www3.epa.gov/ttn/chief/ap42/ch07/final/c07s01.pdf**

Document prepared by

Aurecon Australasia Pty Ltd
ABN 54 005 139 873
Level 10, 55 Grenfell Street
Adelaide SA 5000
Australia

T +61 8 8237 9777
F +61 8 8237 9778
E adelaide@aurecongroup.com
W aurecongroup.com

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United Arab Emirates, Vietnam, Zambia,

From: Michael Davis
Sent: Thursday, 30 May 2019 1:41 PM
To: Elding, Sarah (DPTI) <Sarah.Elding@sa.gov.au>
Subject: DA 040/V023/19 - Viva Energy 30ML Fuel Storage Tank

Hi Sarah

Please find attached a landscaping plan for the abovementioned development application. A separate lighting plan is being prepared and will be supplied in due course. However, as discussed this should not impede the public notification of the application.

Our plan for landscaping is tempered by a requirement to limit the height of landscaping to the height of the bund wall so as to avoid leaves and branches falling into the bund wall and to avoid obstruction for firefighting appliances in the event of an emergency. In this regard, the emphasis has been placed on screening the 4.0 metre high concrete bund wall, rather than attempting to screen the tank. The reality is that even if a larger tree species could be chosen, no screening of the tank would practically occur for many years as a trees matured.

The plant species have been chosen to be drought hardy and require little maintenance. There is no proposed treatment to the concrete wall.

Please let me know if you have any questions.

Cheers

Michael Davis MPIA
SA Planning + Design Leader
Environment & Planning, Aurecon
T +61 8 8237 9643 **M** +61 414 357 276
Michael.Davis@aurecongroup.com
Level 10, 55 Grenfell Street, Adelaide Australia 5000
aurecongroup.com

THE LANDSCAPE SOLUTION FOR THE SITE IS BASED ON THE FOLLOWING OUTCOMES:

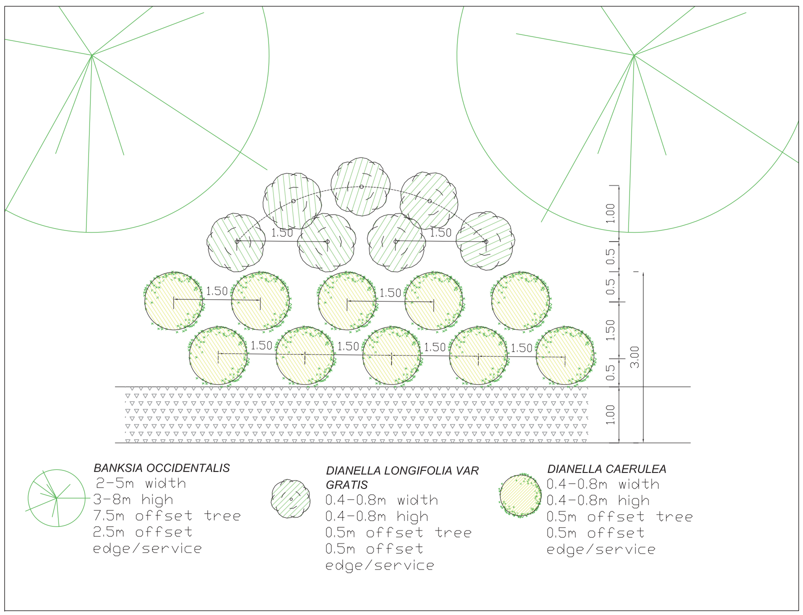
1. PROVISION OF A ROW OF SHRUBS WITH MATURE HEIGHTS SIMILAR TO BUND WALL HEIGHT. THESE SHRUBS WILL PROVIDE VISUAL INTEREST AND BREAK UP THE BULK OF THE BUND WALL AS SEEN FROM VICTORIA ROAD AND THE RESIDENTIAL AREA TO THE WEST. SPACING WILL ALLOW SOME VISIBILITY THROUGH TO THE BUND WALL FOR SECURITY.

2.PROVISION OF OPEN, INFORMAL PLANTING OF LOW GROUNDCOVERS, GRASSES AND LILIES.

3.USE OF NATIVE PLANTS SPECIES THAT ARE LOW-MAINTENANCE AND DROUGHT TOLERANT.

4.PROVISION OF MULCH THROUGHOUT THE LANDSCAPE AREA TO MINIMISE MAINTENANCE .

5.PROVISION OF 1m MINIMUM GRAVEL STRIPS ALONG THE BUND WALL, BOUNDARY FENCE AND AROUND HYDRANTS AND EGRESS LADDERS TO ENABLE ACCESS FROM MAINTENANCE AND EMERGENCIES, AS WELL AS PROVIDE LINES OF SIGHT FOR SECURITY.



TREES LAYOUT

INDICATIVE PLANTING SCHEDULE

CODE	BOTANICAL NAME	COMMON NAME	MATURE HEIGHT	POT SIZE	QUANTITY
RS	BANKSIA OCCIDENTALIS	RED SWAMP BANKSIA	3-8m	25L POT	10
LJ	DIANELLA CAERULEA	LITTLE JESS	0.4m	140mm	94
DL	DIANELLA LONGIFOLIA VAR GRATIS	PALE FLAX LILY	0.4m	140mm	101
ML	MULCHED BED	-	-	-	744m2
GR	STABILISED GRAVEL	-	-	-	120m2

REV	DATE	REVISION DETAILS	APPROVED
A	22.05.2019	PRELIMINARY ISSUE	
B	30.05.2019	CLIENT REVIEW	

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Aurecon Australia Pty Ltd ABN 54 005 139 873

CLIENT: VIVA Energy Australia

SCALE	NTS
SIZE	A1
DRAWN	B.Perez-Torres
DESIGNED	B.Perez-Torres
CHECKED	J. Addison
CONCEPT	
APPROVED	
DATE	
PROJECT	VIVA ENERGY AUSTRALIA PROPOSED PETROLEUM STORAGE TANK BUND WALL AND ASSOCIATED INFRASTRUCTURE 162-180 VICTORIA ROAD, BIRKENHEAD SA
TITLE	LANDSCAPE PLAN
DRAWING No.	PROJECT No. 501682 – WBS 3000 – TYPE DRG – DISC UD – NUMBER 0001 – REV B

GENERAL NOTES

1. SOURCE PLANTS FROM LOCAL NURSERIES WHICH GROWN INDIGENOUS SPECIES. CONSULT LOCAL COUNCIL FOR LIST OF NURSERIES
2. THIS DRAWING IS BASED UPON ENGINEERING DRAWINGS PROVIDED BY VIVA ENERGY AUSTRALIA AND AURECON AUSTRALIA. REFER TO ENGINEERING DRAWINGS FOR DETAILS OF PROPOSED BUND WALL, LOCATIONS AND DETAILS OF SERVICES, DRAINAGE, FENCING, ACCESS AND LIGHTING.
3.LOCATION OF SERVICES TO BE DETERMINED BY THE CONTRACTOR PRIOR TO ANY EXCAVATION OR ON THESE DRAWINGS OR THAT THE SERVICES SHOWN ARE IN THE CORRECT LOCATION.

SOIL PREPARATION

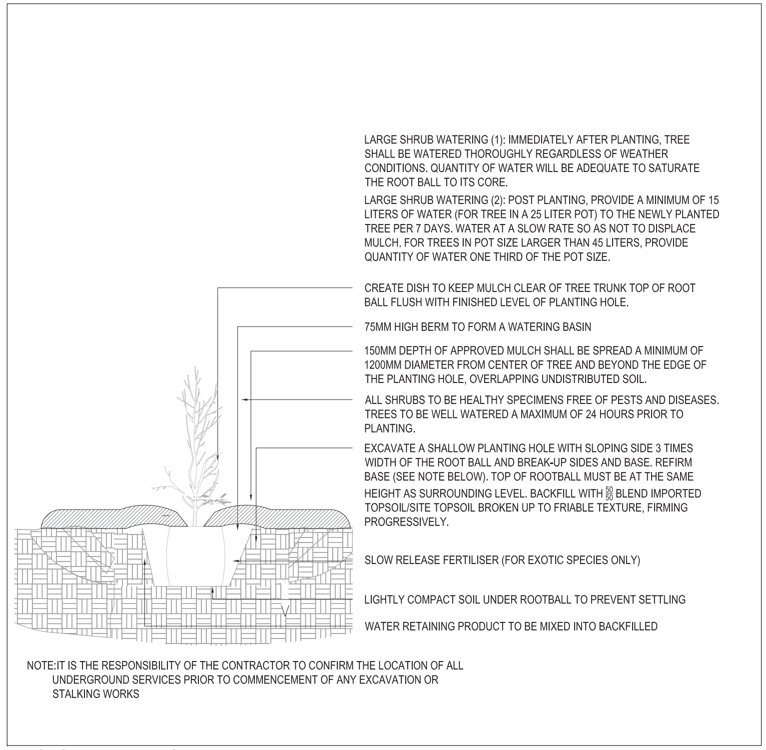
1. ALL AREAS DESIGNATED FOR PLANTING ARE TO BE SPRAYED WITH A NON-RESIDUAL CONTACT HERBICIDE (IN ACCORDANCE WITH MANUFACTURERS INSTRUCTIONS) TO KILL ALL ANNUAL AND PERENNIAL WEEDS.ALL PLANTS TO BE HEALTHY, DISEASE FREE SPECIMENS. FERTILIZER TO BE APPLIED TO PLANTS IF REQUIRED TO ASSIST SITE ESTABLISHMENT. ALL PLANTS TO BE WATERED FOLLOWING PLANTING IN ACCORDANCE TO SPECIFICATION.
2. ENSURE ALL TREATED AREAS ARE FREE OF WEED BEFORE SOIL PREPARATION BEGINS.
3.IMPORTED GARDEN SOILS TO BE GARDEN SOIL

PLANTING

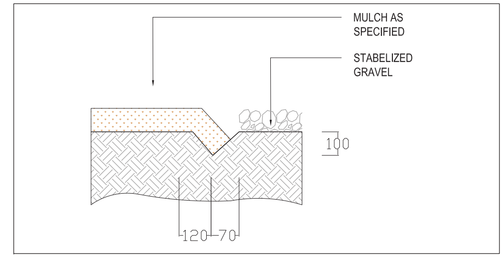
1. PLANTING SOIL SHALL COMPLY WITH AS 4419-1998 GARDEN SOILS FOR LANDSCAPING AND GARDEN USE WITH 50%BLACK SOIL 20% COARSE SAND AND 30% ORGANIC SPREAD TO 200MM DEPTH FOR GARDEN BED AND 100MM DEPTH FOR ALL OTHER AREAS
2. OSMOCOTE LOW PHOSPHORUS FERTILIZER SHALL BE SPREAD OVER ENTIRE PLANTING BED, AT MANUFACTURERS RECOMMENDED RATES FOR NATIVE SHRUBS, PRIOR TO MULCHING.
3. MULCH SHALL BE 75MM DEPTH OF HARDWOOD CHIPS AND IN ACCORDANCE WITH AS 4454-1999 COMPOST SOIL CONDITIONERS AND MULCHES MUST SHALL BE APPROVED BY COUNCIL PRIOR TO DELIVERY ON SITE. THIS CONSTITUTE A HOLD POINT.
4.IF LOCATIONS OF NEW PLANTS CONFLICT WITH EXISTING PLANTS, THEN ADJUST NEW PLANTS LOCATIONS AS NECESSARY ON SITE
5.CENTRES OF ALL NEW PLANTS SHALL BE MINIMUM 300MM FROM BURIED SERVICES SUCH AS POWER, EARTHING AND ANTENNA FEEDERS CABLES
6. MATURE HEIGHTS STATED IN PLAN SCHEDULE ARE FOR OPTIMUM GROWING CONDITIONS.WEED CONTROL OF THE IDENTIFIED SERIOUS THREAT ENVIRONMENTAL WEEDS AND ALL NOXIOUS WEEDS SPECIFIES MUST OCCUR PRIOR TO ANY DEVELOPMENT AND REMOVAL/RELOCATION OF SOILS. SUCH AS WEEDS (AND ANY COLONIES IN THE EVENT OF SOIL DISTURBANCE OR IMPORTATION OF SOILS AND OTHER ACTIONS) AS WELL AS ANY REGROWTH OF PREVIOUS CONTROLLED WEEDS ARE TO BE CONTROLLED THOUGHT THE DEVELOPMENT PROCESS AND MAINTENANCE PERIOD.

ESTABLISHMENT PERIOD

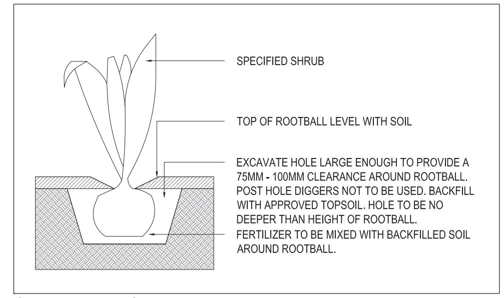
1. A MINIMUM OF 13 WEEKS ESTABLISHMENT PERIOD FROM DATE OF PRACTICAL COMPLETION.REFER TO WYNDHAM CITY COUNCIL LANDSCAPE WORKS STANDARDS AND SPECIFICATION FOR MORE INFORMATION.



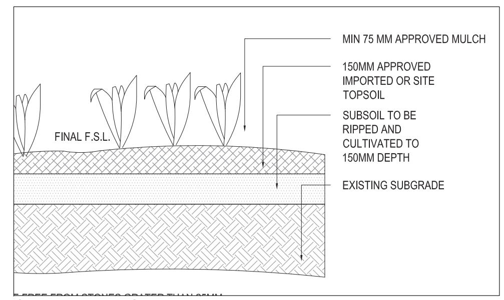
LARGE SHRUB PLANTING DETAIL



SPADE EDGE DETAIL



SHRUB PLANTING DETAIL



SHRUB PLANTING DETAIL

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NTS	A1

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DESIGNED: B.Perez-Torres
CHECKED: J. Addison

CONCEPT
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DATE

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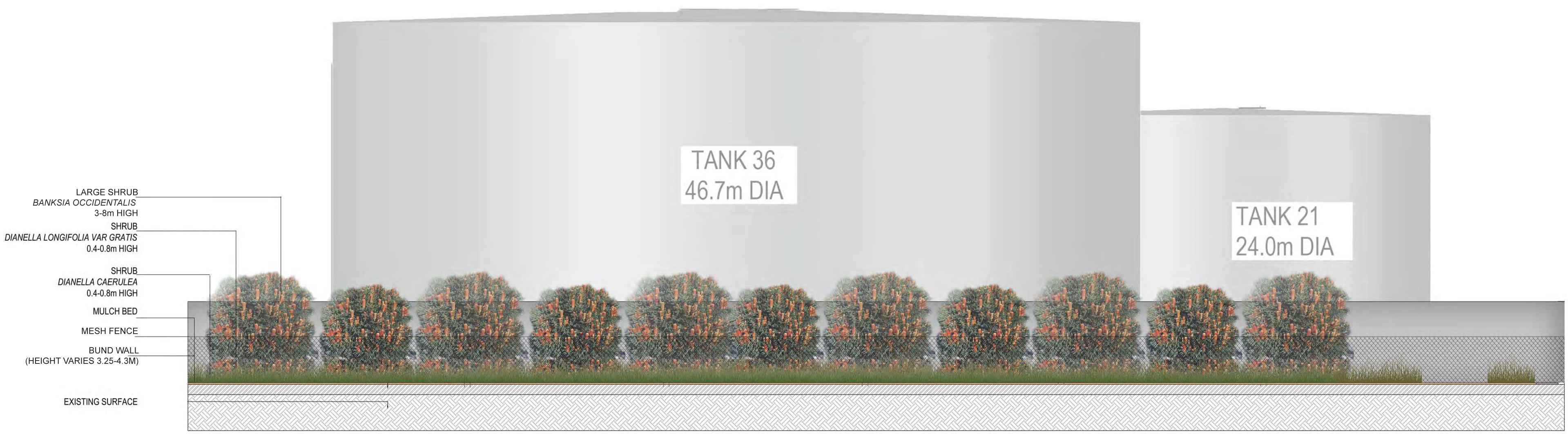
BUND WALL AND ASSOCIATED INFRASTRUCTURE 162-180 VICTORIA ROAD, BIRKENHEAD SA

TITLE: LANDSCAPE PLAN

DRAWING No.	PROJECT No.	WBS	TYPE	DISC	NUMBER	REV
	501682	3000	DRG	UD	0002	B



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