P PO Box 454, Leederville WA 6903 | A Level 1 660 Newcastle St, Leederville WA 6007 | T 1300 251 070 | W www.talisconsultants.com.au

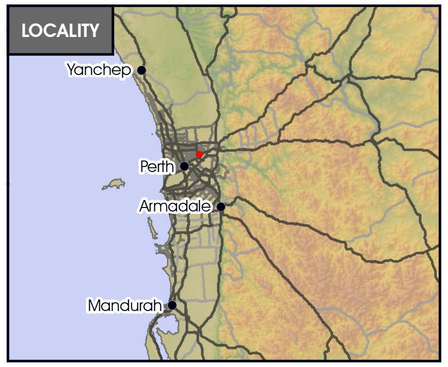
LEGEND

Site Boundary

Contaminated Sites

Contaminated - remediation required

Remediated for restricted use



CONTAMINATED SITES

Aurigen - Environmental Assessment and Management Plan

0 5 10 20 30 40 metres

Coordinate System: GDA 1994 MGA Zone 50
Projection: Transverse Mercator, Datum: GDA 1994
Scale @ A3:1:2,000

Prepared: RPC	Date: 22/06/2016
Checked: TM	Project No: TW15042
Reviewed: NK	Revision: A

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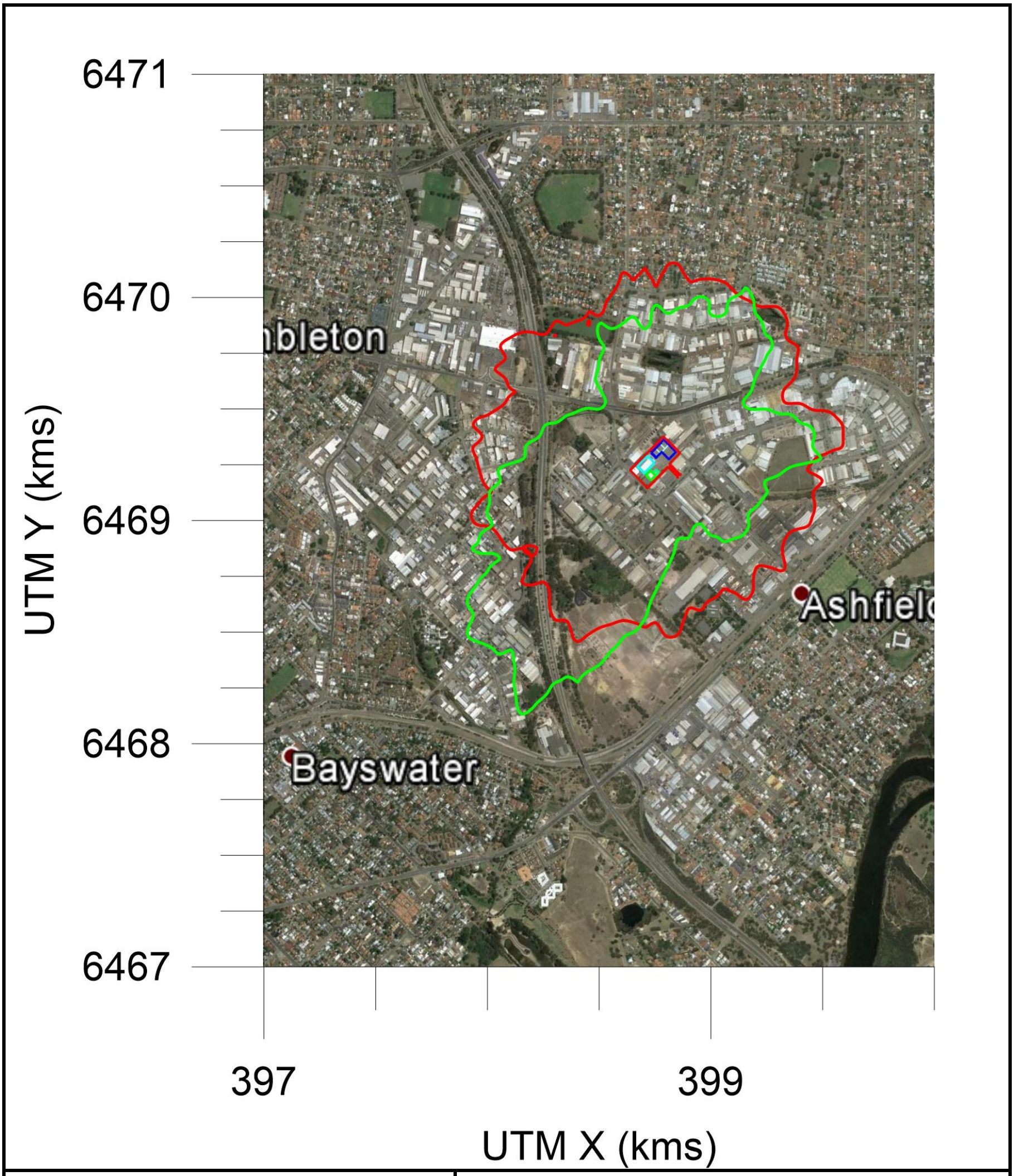
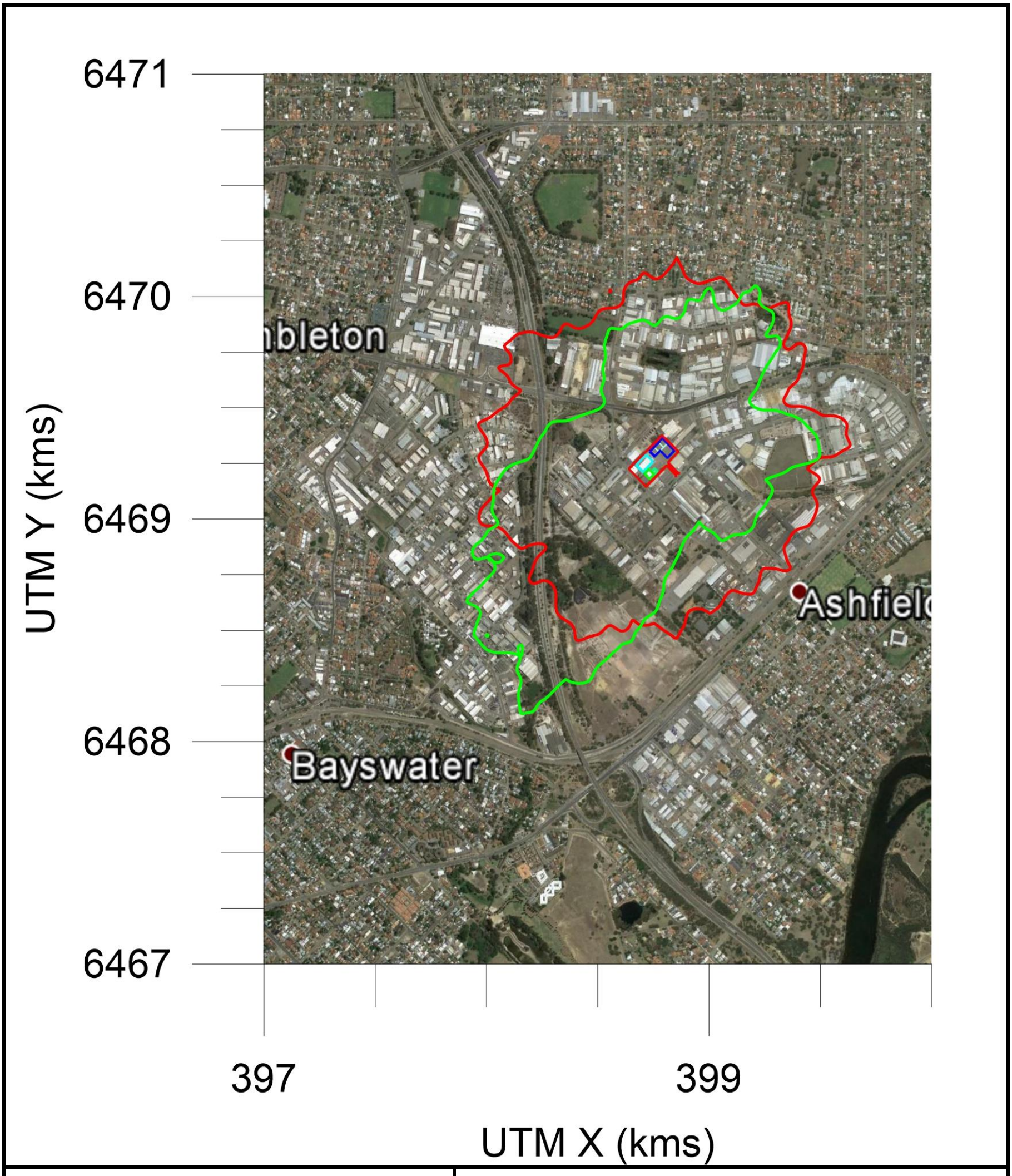
Figure 12



Odour Criterion: • **2.5ou (green contour)** • **8ou (red contour)** • Criterion Averaging Time: 1-hr • Criterion Assessment Percentile: 99.5th & 99.9th • **Emissions Type: VOLUME SOURCE Constant OER's**	Meteorological Data: • File: CALMETT PerthAP 2012 (Bassendean) • Meteorological Hours: 8,784 • Modelling Hours Assessed: 44; 9 • Coordinates: UTM

Figure 13: CALPUFF Ground Level Odour Impact Projections for Proposed Bassendean WTRRF (Non-Partitioned Building).



Odour Criterion: • **2.5ou (green contour)** • **8ou (red contour)** • Criterion Averaging Time: 1-hr • Criterion Assessment Percentile: 99.5th & 99.9th • **Emissions Type: VOLUME SOURCE Constant OER's**	Meteorological Data: • File: CALMETT PerthAP 2012 (Bassendean) • Meteorological Hours: 8,784 • Modelling Hours Assessed: 44; 9 • Coordinates: UTM

Figure 14: CALPUFF Ground Level Odour Impact Projections for Proposed Bassendean WTRRF (Partitioned Building).

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ASSET MANAGEMENT
CIVIL ENGINEERING
ENVIRONMENTAL SERVICES
SPATIAL INTELLIGENCE
WASTE MANAGEMENT

Level 1 660 Newcastle Street,
Leederville WA 6007
PO Box 454, Leederville WA 6903

Client: AURIGEN

NOTES

1. This drawing is the property of Talis Consultants Pty Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels refer to Australian Height Datum.
3. DO NOT SCALE, use figured dimensions only, if in doubt please contact Talis Consultants.

No.	Date	Drwn/Chk	Amendment / Issue	App.
D	20.06.16	PG/TM	RESIZE BAILER/SHREDDER	RC
C	07.06.16	PG/TM	AREA CHANGE (WTS, C&I)	RC
B	03.06.16	PG/TM	EXTRA DOORS, ADDED WEIGHBRIDGE, GLASS CRUSHER	RC
E	23.06.16	CDB/TM	LAYOUT AND NOTE FINALISATION	RC

Project: JACKSON STREET WASTE TRANSFER AND RESOURCE RECOVERY FACILITY

Title: CONCEPTUAL SITE PLAN

Drawn by:	CDB	Job No:	TW15042
Checked by:	TM	File No:	TW15042-G-001
Approved by:	RC	Drg. No:	G-001
Scale:	1:1000	Rev:	E
Date:	23.06.2016		

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Appendix A: **Certificate of Title**

WESTERN AUSTRALIA

REGISTER NUMBER	
2/D51806	
DUPLICATE EDITION	DATE DUPLICATE ISSUED
8	15/1/2016

RECORD OF CERTIFICATE OF TITLE

VOLUME 1463 FOLIO 950

UNDER THE TRANSFER OF LAND ACT 1893

The person described in the first schedule is the registered proprietor of an estate in fee simple in the land described below subject to the reservations, conditions and depth limit contained in the original grant (if a grant issued) and to the limitations, interests, encumbrances and notifications shown in the second schedule.

REGISTRAR OF TITLES

REGISTRAR OF TITLES WESTERN AUSTRALIA

LAND DESCRIPTION:

LOT 2 ON DIAGRAM 51806

REGISTERED PROPRIETOR:
(FIRST SCHEDULE)

HARLAP BENEFICIARIES PTY LTD OF 132 FORREST STREET, PEPPERMINT GROVE
(T M724577) REGISTERED 1 AUGUST 2014

LIMITATIONS, INTERESTS, ENCUMBRANCES AND NOTIFICATIONS:
(SECOND SCHEDULE)

1. N184080 LEASE TO CITYSCORE PTY LTD OF 4C CONSULTING, UNIT 5, 145 WALCOTT STREET, MOUNT LAWLEY EXPIRES: SEE LEASE. REGISTERED 25.11.2015.

Warning: A current search of the sketch of the land should be obtained where detail of position, dimensions or area of the lot is required.
* Any entries preceded by an asterisk may not appear on the current edition of the duplicate certificate of title.
Lot as described in the land description may be a lot or location.

----------END OF CERTIFICATE OF TITLE----------

STATEMENTS:

The statements set out below are not intended to be nor should they be relied on as substitutes for inspection of the land and the relevant documents or for local government, legal, surveying or other professional advice.

SKETCH OF LAND: 1463-950 (2/D51806).
PREVIOUS TITLE: 1326-702.
PROPERTY STREET ADDRESS: 25 JACKSON ST, BASSENDEAN.
LOCAL GOVERNMENT AREA: TOWN OF BASSENDEAN.

NOTE 1: M733308 CORRECTION MADE ON ORIGINAL CERTIFICATE OF TITLE - BUT NOT SHOWN ON CURRENT EDITION OF THE DUPLICATE

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Appendix B: **NatureMap Species Report**

NatureMap
Mapping Western Australia's biodiversity

NatureMap Species Report

Created By Ross Cullen on 05/11/2015

Current Names Only Yes
Core Datasets Only Yes
Method 'By Circle'
Centre 115°55' 44" E,31°54' 29" S
Buffer 1km

	Name ID	Species Name	Naturalised	Conservation Code	[1]Endemic To Query Area
1.		*Allothereua maculata*			
2.	198	*Amphipogon laguroides*			
3.	199	*Amphipogon strictus (Greybeard Grass)*			
4.	24991	*Aprasia repens (Sand-plain Worm-lizard)*			
5.	1436	*Conostylis juncea*			
6.	25398	*Crinia georgiana (Quacking Frog)*			
7.	285	*Cynosurus echinatus (Rough Dogstail)*	Y		
8.		*Eriophora biapicata*			
9.		*Favonigobius sp.*			
10.		*Gambusia sp.*			
11.		*Idiommata blackwalli*			
12.	19957	*Lachnagrostis drummondiana*			
13.		*Lampona cylindrata*			
14.	25165	*Lerista praepedita*			
15.	11766	*Lolium temulentum forma arvense*	Y		
16.		*Lycoperdon sp.*			
17.		*Megachile rufolobata*			
18.		*Neurachne alopecuroides*			
19.		*Polyphrades laticollis*			
20.		*Pseudogobius olorum*			
21.	25259	*Pseudonaja affinis subsp. affinis (Dugite)*			
22.	25433	*Pseudophryne guentheri (Crawling Toadlet)*			
23.	7035	*Solanum sisymbriifolium (Viscid Nightshade)*	Y		
24.	8710	*Sporobolus africanus (Parramatta Grass)*	Y		
25.		*Steatoda grossa*			
26.		*Venator immansueta*			

Conservation Codes
T - Rare or likely to become extinct
X - Presumed extinct
IA - Protected under international agreement
S - Other specially protected fauna
1 - Priority 1
2 - Priority 2
3 - Priority 3
4 - Priority 4
5 - Priority 5

[1] For NatureMap's purposes, species flagged as endemic are those whose records are wholely contained within the search area. Note that only those records complying with the search criterion are included in the calculation. For example, if you limit records to those from a specific datasource, only records from that datasource are used to determine if a species is restricted to the query area.

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Appendix C: **EPBC Act Protected Matters Report**

Australian Government

Department of the Environment

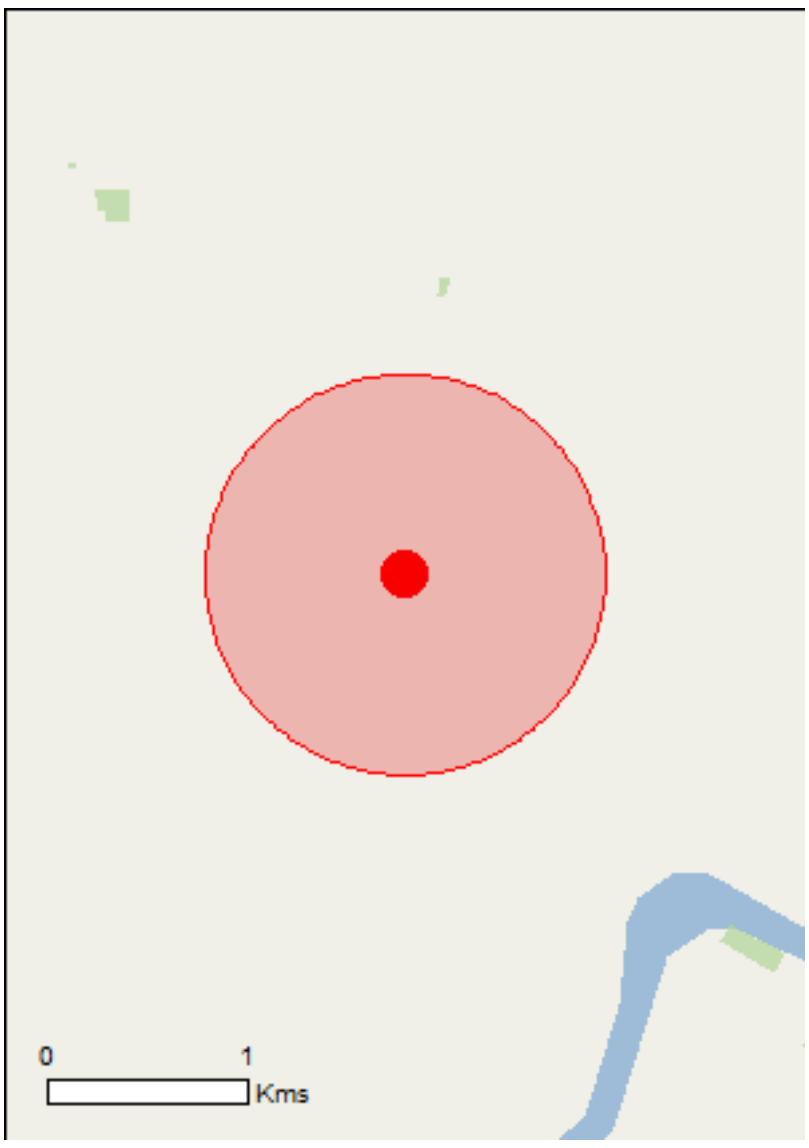
EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

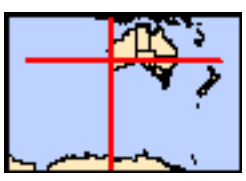
Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 04/11/15 18:53:13



Coordinates

Buffer: 1.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	15
Listed Migratory Species:	6

Other Matters Protected by the EPBC Act

This part of the report summarises other matters protected under the Act that may relate to the area you nominated. Approval may be required for a proposed activity that significantly affects the environment on Commonwealth land, when the action is outside the Commonwealth land, or the environment anywhere when the action is taken on Commonwealth land. Approval may also be required for the Commonwealth or Commonwealth agencies proposing to take an action that is likely to have a significant impact on the environment anywhere.

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at http://www.environment.gov.au/heritage

A permit may be required for activities in or on a Commonwealth area that may affect a member of a listed threatened species or ecological community, a member of a listed migratory species, whales and other cetaceans, or a member of a listed marine species.

Commonwealth Land:	1
Commonwealth Heritage Places:	None
Listed Marine Species:	9
Whales and Other Cetaceans:	None
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Commonwealth Reserves Marine:	None

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	41
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	None

Details

Matters of National Environmental Significance

Listed Threatened Species		[Resource Information]
Name	Status	Type of Presence
Birds		
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat may occur within area
Calyptorhynchus latirostris Carnaby's Black-Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Species or species habitat likely to occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat may occur within area
Mammals		
Dasyurus geoffroii Chuditch, Western Quoll [330]	Vulnerable	Species or species habitat likely to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat may occur within area
Anigozanthos viridis subsp. terraspectans Dwarf Green Kangaroo Paw [3435]	Vulnerable	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat likely to occur within area
Darwinia foetida Muchea Bell [83190]	Critically Endangered	Species or species habitat likely to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat may occur within area
Drakaea elastica Glossy-leafed Hammer-orchid, Praying Virgin [16753]	Endangered	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Lepidosperma rostratum Beaked Lepidosperma [14152]	Endangered	Species or species habitat likely to occur within area
Thelymitra dedmaniarum Cinnamon Sun Orchid [65105]	Endangered	Species or species habitat may occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Migratory Terrestrial Species		
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Migratory Wetlands Species		
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -

Listed Marine Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Birds		
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea alba Great Egret, White Egret [59541]		Breeding known to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat likely to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat may occur within area

Extra Information

Invasive Species	[Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Mammals		
Bos taurus Domestic Cattle [16]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat may occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Lantana camara Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
Olea europaea Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp. Prickly Pears [82753]		Species or species habitat likely to occur within area
Pinus radiata Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Protasparagus densiflorus Asparagus Fern, Plume Asparagus [5015]		Species or species habitat likely to occur within area
Protasparagus plumosus Climbing Asparagus-fern, Ferny Asparagus [11747]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Tamarix aphylla Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

For species where the distributions are well known, maps are digitised from sources such as recovery plans and detailed habitat studies. Where appropriate, core breeding, foraging and roosting areas are indicated under 'type of presence'. For species whose distributions are less well known, point locations are collated from government wildlife authorities, museums, and non-government organisations; bioclimatic distribution models are generated and these validated by experts. In some cases, the distribution maps are based solely on expert knowledge.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-31.90812 115.92922

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Parks and Wildlife Commission NT, Northern Territory Government
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Atherton and Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

Department of the Environment
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Appendix D: **Odour Impact Assessment**

AURIGEN

Calpuff Dispersion Modelling Assessment of Proposed Waste Transfer & Resource Recovery Facility

---

Bassendean, Western Australia

Final Report

June 2016

THE ODOUR UNIT (WA) PTY LTD
ABN 70 126 439 076
ACN 126 439 076
Showroom 1/16 Hulme Court
Myaree
Western Australia 6154
P: +61 8 9330 9476
F: +61 8 9330 1868
W: www.odourunit.com.au
E: jhurley@odourunit.com.au

Project Number: W2127R.01

Report Revision		
Report Version	**Date**	**Description**
Draft Report 1.0	10.06.2016	CALPUFF Modelling Report for Internal Review
Draft Report 1.0	13.06.2016	CALPUFF Modelling Report for AURIGEN Review
Draft Report 1.1	16.06.2016	Draft Report amended with Fact Checks completed by Aurigen
Final	23.06.2016	Final Report with updated Site Plan
Report Preparation		
Report Prepared By: J. Hurley		**Approved By:** T. Schulz
Report Title: Calpuff Dispersion Modelling Assessment of Bassendean WTRRF		

CONTENTS

1 INTRODUCTION & SCOPE OF WORKS

The Odour Unit WA Pty Limited (TOU) was commissioned by Aurigen to undertake a desktop Calpuff dispersion modelling assessment of a proposed Waste Transfer and Resource Recovery Facility (WTRRF), which is comprised of a putrescible waste transfer station and a materials recovery facility, to be located at Jackson Street, Bassendean Western Australia.

The aim of the modelling is to determine the risk of odour impacts offsite, and assess compliance against the currently accepted Department of Environment Regulation (DER) odour concentration criterion which is in place in lieu of a formal guidance which is due in 2016.

Compliance with the criterion will be compared to the nearest sensitive receptor locations outside of the surrounding commercial/industrial area.

1.1 SCOPE OF WORK

The study was carried out as a Desktop Odour Modelling Assessment with odour emission rates (OER) compiled from TOU's own database and that of other relevant public domain assessments. The scope of works for the modelling assessment is as follows.

- Develop and run a site-specific odour dispersion model for the WTRRF projecting odour impacts from the site;
- Follow the requirements set by DER (formerly Department of Environment – DoE) for odour impact assessments [1], [2] as summarised below:
    - Identify and quantify all emissions to atmosphere (odour) with a potential to have a non-trivial impact on the environment. Emissions of potential concern include (among others) odorous gases to be considered explicitly, unless the proponent can demonstrate that the emission rates of these are insignificant;

[1] Department of Environment: Air Quality Modelling Guidance Notes, March 2006

[2] Department of Environment Regulation Guidance Statement: Separation Distances, Division 3, Part V, Environmental Protection Act 1986, Draft released for Consultation August 2015

- For all those odour sources that cannot be dismissed as being of no significance, the proponent must provide model predictions of the impact of emissions in the form of concentrations and/or rates of deposition over the range of averaging periods normally associated with relevant standards for each pollutant, and assess the magnitude of this impact against the relevant standards;
- Modelling results to be presented in the form of:
  - contour plots covering the region of interest (including population centres or isolated residences), with a grid density adequate to avoid significant loss of resolution, and
  - numerical values of concentrations at the point(s) of maximum impact (explain where this occurs) and other locations (receptors) of interest (e.g. places of human residence).
- When cumulative concentrations are modelled, in order for the contribution to be properly assessed, the modelling results are presented for:
  - the existing emissions plus background concentration (pre-proposal),
  - the proposed development in isolation (excluding existing emissions), and
  - the combined (existing plus proposed plus background) emissions.
- Any estimates of emissions employed in modelling assessments are realistic and that uncertainty is balanced by conservatism;
- The modelling must properly assess both emissions which are continuous in nature and emissions which are intermittent. Intermittent emissions which are insignificant in magnitude and/or very improbable in the lifetime of the plant may be screened out and the remaining emissions modelled together on a probabilistic basis to estimate the total plant impact;
- The models and/or worst case calculation procedures and data employed in the assessment must be demonstrably capable of simulating, or accounting for, all of the features which are important in

the context of determining the air quality impact of the project. The proponent is responsible for identifying and properly accommodating these;

- If using a conventional model, the proponent will need to obtain at least one (preferably two or more) year's data on the meteorology of the area, with high data recovery and verifiable data accuracy. In the simplest situations, the data may be limited to that necessary to provide reliable hourly average estimates, at a representative site, of:
  - wind speed,
  - wind direction,
  - air temperature,
  - mixing height, estimated or measured via methods acceptable to the DER, and
  - atmospheric stability, estimated by a method acceptable to the DER.

The proponent's report should include a description of the meteorological data used or alternatively a reference to a publicly available report which contains this information.

The Calpuff assessment was carried out against the following odour modelling criterion:

- The modeled odour concentrations at the "most exposed existing or likely future off-site sensitive receptors" should be compared with the following guideline values:
  - i. *0.5 ou, 1-hour average, 99.5th percentile for tall stacks;*
  - ii. *2.5 ou, 1-hour average, 99.5th percentile for ground-level sources and down-washed plumes from short stacks;*

  AND

  - *iii. For facilities that do not operate continuously, the 99.5th percentile must be applied to the actual hours of operation.*

The WA DEC also has a preference for the near-field criteria of:

- *iv. 8.0 ou, 1-hour average, 99.9th percentile.*

1.2 REGULATORY GUIDANCE FOR DETERMINING RISK

Regulatory authority guidelines for odorous impacts of gaseous process emissions are not designed to satisfy a 'zero odour impact criteria', but rather to minimise the nuisance effect to acceptable levels of these emissions to a large range of odour sensitive receptors within the local community.

The DER is undergoing significant environmental regulatory reform in developing a comprehensive risk-based approach to its regulatory functions under Part V Division 3 of the *Environmental Protection Act 1986. Consequently there has been a review and amendment for the determination of Separation Distances based on contributions from:*

i. Guidance for the Assessment of Environmental Factors - Separation Distances between Industrial and Sensitive Land Uses, No.3 (June 2005, Western Australia); and
ii. Environment Protection Authority Victoria's Guideline: Recommended separation distances for industrial residual air emissions (2013).

The current Draft Guidance for Separation Distances [2] (August, 2015) prescribes separation distances for:

- Category 61A (Solid waste facility: 1,000 tonnes or more per year; *Premises (other than premises within category 67A) on which solid waste produced on other premises is stored, reprocessed, treated, or discharged onto land*);
  - 500m from the nearest sensitive receptor, and
- Category 62 (Solid waste depot: 500 tonnes or more per year; *Premises on which waste is stored, or sorted, pending final disposal or re-use)*;
  - 200m from the nearest sensitive receptor.

The WTRRF will reside within the existing industrial/commercial industrial area and does satisfy a minimum recommended 500m separation distance (**refer Figure 1**). This assessment determines the projected odour buffer of the proposed WTRRF and compares it to the generic distance of 500m. The separation distance will be measured according to Method 1 [2] (urban method):

- Method 1 measures the separation distance from the activity boundary of the industry (odour source) to the property boundary of the nearest sensitive land use;
    - Method 1 should be applied where the nearest sensitive land use is either:
        - in an urban area or township; or
        - on a site less than 0.4 hectares, or in a zone allowing subdivision to be less than 0.4 hectares.

Figure 1: AURIGEN Waste Transfer Station Site (Jackson Street, Bassendean Western Australia) and surrounding Industrial/Commercial Land Uses.

2 WTRRF FACILITY (ODOUR SOURCE) OVERVIEW

The WTRRF comprises of primarily a putrescible Waste Transfer Station (WTS) and a Materials Recovery Facility (MRF), with a proposed capacity of 100,000 tonnes per annum (tpa) of putrescible and C&I waste streams for the WTS, and an additional 100,000 tpa of recyclables into the MRF.

A summary of the building design and layout (**refer Figure 2**) is as follows:

- An "L" shaped building of approximately 80m x 77m (longest sides) x 15m high (at apex), comprising;
  - the north, east and south faces of the building to have 5m high concrete push walls(estimated 230mm thick),
  - the remaining heights on the north, east and south faces to have zincalume wall cladding to roof height,
  - The interface between the 5m high push walls and the cladding to be sealed with an impervious seal, and
  - Proposed roof vents along the apex to allow for natural, passive ventilation.

The WTRRF will have six (6) 4m x 5m access doorways. The WTS area will have three (3) access doorways where only 2 are operational at any one time. The MRF will have two (2) access doorways. The sixth door is for maintenance and contingency and will remain shut otherwise.

An additional seventh doorway is also operational at the western end of the MRF building. This doorway is used to allow the transfer of sorted recyclables to other storage buildings on the site.

A summary of site operations is as follows:

1. Approximately 274 tonnes of putrescible waste daily (average) is expected (*based on 100,000 tpa with 365 days of waste acceptance/annum*);

   a. approximately 30 x 9 tonne incoming putrescible waste trucks daily,
   b. approximately 47 incoming MRF (comingled recyclables) waste trucks daily,
2. Waste is unloaded from trucks onto the WTS bunker area (24m x 18m) where there are 2 operational bays for unloading; it is then moved by front end loader into the hopper for compaction before removal from site;
   a. each outgoing compaction bulk haulage truck to carry 50 tonnes per truck movement,
   b. up to 120 tonnes of residual waste is expected to be left on the bunker floor each night,
3. No sorting of putrescible waste will be done at the site;
4. The WTS and MRF building will be fully enclosed (doors proposed to remain open during operational hours) with large truck access doors on one side of the building with the initial design to have passive ventilation at the roof apex;
5. Unloading time of incoming trucks is approximately 15 minutes per delivery;
   a. Outgoing bulk compaction trucks do not factor into timeframes into/out of WTRRF,
6. Peak delivery periods are expected twice daily for 2 hours each;
7. In the event of a malfunction or breakdown the total waste stream will be removed using bulk haulage; and
8. All site leachate generated within the WTS and MRF building is captured and treated onsite with residual discharged directly to sewer.

2.1. OPERATIONAL HOURS

Odour Source	Operational Days	Operational Hours
Putrescible WTS	7 days	0600hrs – 1830hrs
MRF	7 days	24 hours

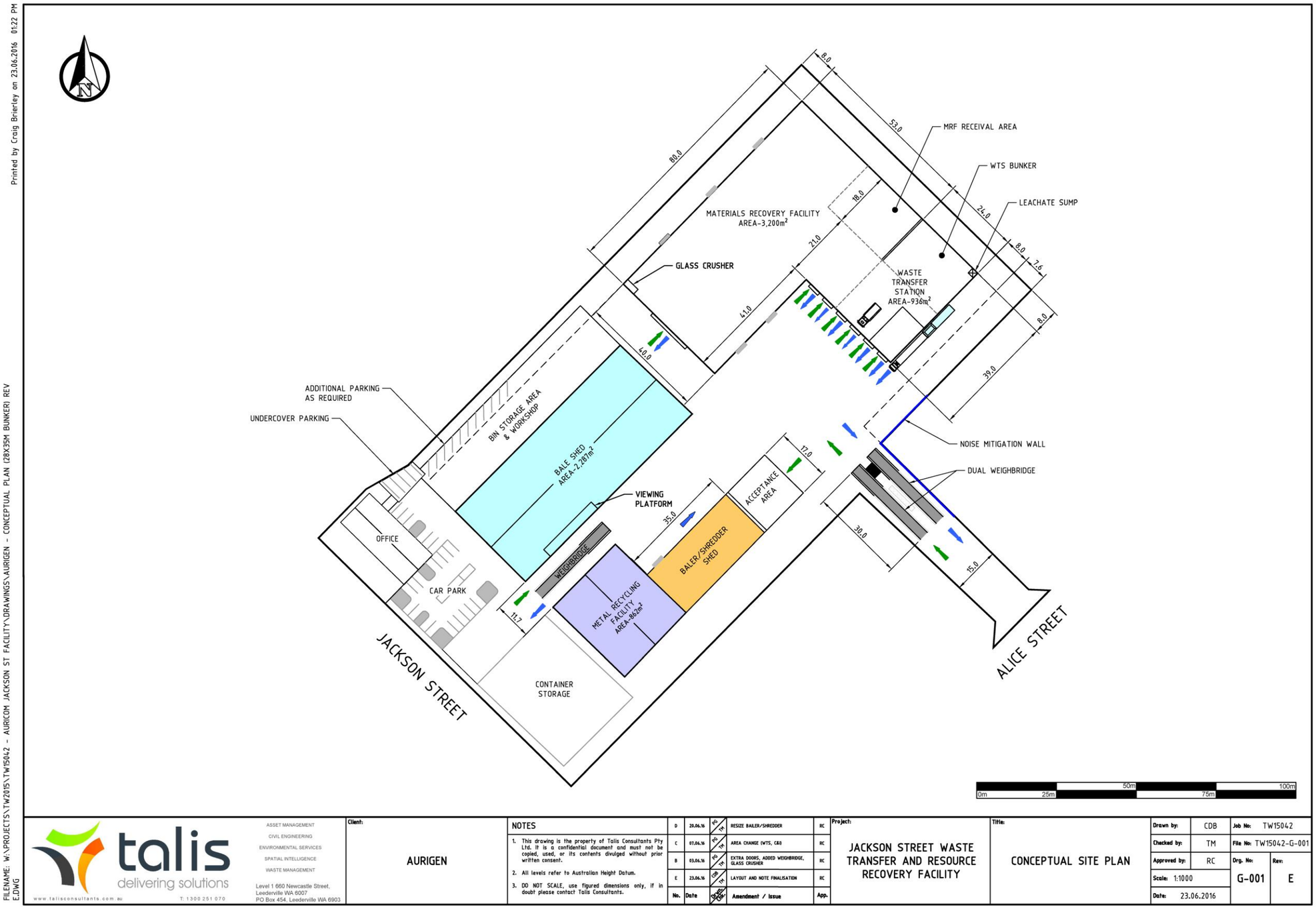


Figure 2: AURIGEN Waste Transfer Station (Jackson Street, Bassendean Western Australia).

3 AIR EMISSION ASSUMPTIONS & ODOUR EMISSION RATES

3.1 AIR EMISSION ASSUMPTIONS

The WTS and MRF "L" shaped building ("the building") initial design proposes to have roof vents allowing for passive airflow out of the building.

The total void area of these vents is assumed to be approximately 100m^2 comprising of, for example, a 80m longitudinal vent with a 0.5m void on each side along the length of the MRF; and a 20m longitudinal vent with a 0.5m void on each side along the length of the building, or a combination of roof top "whirly birds" or similar ventilation means.

Under any wind condition, the external building pressurisation under a heavy gust of high winds, and/or pressurisation of the building when the vehicle doors are opened would not cause a complete and instantaneous venting of the building. Given the internal air pressure is largely equalised with ambient conditions due to the passive roof vents, it is more likely that the turbulence created from opened doorways would shift the air within the building rather than induce an immediately exit flux of air.

a) It is proposed to have a number of access doorways remain open for the duration of daily activities which means that the entire building will undergo mixing of air;

   i. With doorways remaining open and ongoing mixing of the building the fugitive odour escaping would be dilute since the volume of MRF air (negligible odour) is able to mix and dilute the odorous air emanating from the putrescible waste stockpile within the waste bunker.

b) There is also scope to consider the partitioning of the WTS area from the MRF essentially confining odour to the WTS area alone;

   i. Under a partitioning scenario the bulk odour would be confined to the WTS area with only nominally a 10% carryover of the odour strength into the MRF area.

If it is assumed that ventilation would occur along the vent/void area commensurate with prevailing winds; then it can be assumed that at worst case the entire downwind total void would be an emission source at any one time, although this is unlikely.

Under a westerly (SW – NW) prevailing wind origin the downwind void area comprises of the five (5) access doorways, each of 20m^2 when opened. Easterly winds (NE – SE) would blow into the building and the downwind void area would be the roof vents of approximately 100m^2 in total void area. Therefore, under any wind condition the downwind void represents approximately 100m^2 of emissions interface.

The velocity of airflow through the entire downwind 100m^2 void at any one time is assumed as 1m/s accounting for a low wind speed, constant fugitive air emission. Doorways will be closed in the evenings and agitation/transfer of putrescible wastes will cease; however, the building is assumed to still be emitting fugitive air. The fugitive emission air volume is thus 100m^3/s, or 360,000m^3/hr. This represents approximately 6 air changes per hour (360,000m^3/hr / 62,000m^3) which is considerably overestimated where in TOU's experience typically naturally ventilated waste transfer stations exhibit 2-4 air changes per hour depending on design.

c) These air changes represent the entire WTS and MRF building volume of 62,000m^3.

d) Where the building is partitioned, the volume within the WTS area is 21,645m^3. If the downwind void still represents 100m^2, then the air changes therein are >16/hr for the WTS area where the bulk odour is contained.

3.2 COMPILING & DETERMINING ODOUR EMISSION RATES

TOU has undertaken numerous site-specific odour assessments of putrescible waste transfer stations throughout Australia. Additionally, there are many public domain assessment reports where odour strengths were measured for the purposes of dispersion modelling. The concentrations of odour strengths sampled from some of these sites are listed in **Table 3.2.1** below.

Table 3.2.1: Odour Sampling & Testing Results from Waste Transfer Stations.

Sample Location	Data Year	Minimum Odour Concentration (ou)	Maximum Odour Concentration (ou)	Average Odour Concentration (ou)
TOU - NSW (400,000tpa)	2005 -2008	395	2400	824
TOU - Shenton Park: naturally ventilated	2010	90	256	128
TOU - Bibra Lake: (similar design)	2015	609	790	693
Pacific Environment Limited (PEL): Energy From Waste Facility – Odour Assessment (AUS)	2015	-	-	558
SLR Consulting: High Heavens Waste Transfer Station (UK)	2011	123	2439	-

The range of odour concentrations listed in **Table 3.2.1** represent off-peak and peak time periods where waste volumes are changing. The average odour concentration from the first 4 data points is 550ou.

TOU has chosen the average value of 550ou to represent the continuous odour strength within the WTS and MRF building. This value effectively smooths the odour concentrations throughout each operational day by accounting for the range of odour strengths emitted during off peak and peak periods.

3.2.1 Odour Emission Rates for a Contiguous (non-partitioned) Building

Applying the average derived odour concentration to the fugitive air emission rate of 100m^3/s gives an odour emission rate of 55,000ou/s throughout the building. When the operational periods have ceased inside the WTS area, and the MRF remains operational but no putrescible waste is being processed/transported, it is assumed that only 5% of the total odour emission rate will be emitted.

3.2.2 Odour Emission Rates for a Partitioned Building

When partitioned, the WTS area will contain the bulk of the odour emission of 55,000ou/s. TOU estimates that 90% of this bulk rate will be assigned to the WTS area, whilst the partitioned MRF is estimated to contain 10% of the bulk emission rate due to some diffusion between the partitioning curtains. When the operational periods have ceased inside the WTS area, and the MRF remains operational but no putrescible waste is being processed/transported, it is assumed that 5% of the odour emission rate will be passively emitted from the WTS area, but no odour will permeate into the MRF area since the partitioning curtains are static.

3.3 ODOUR EMISSION RATES MODELLED

Source	Odour Source	Emission Days	Emission Hours	Odour Emission Rate (ou/s)
Contiguous Building	Entire Building	7 days	0600hrs – 1830hrs	55,000
			After hours	2,750
Partitioned Building	Putrescible Waste		0600hrs – 1830hrs	49,500
			After hours	2,475
	MRF		0600hrs – 1830hrs	5,500
			After hours	nil

4 ODOUR DISPERSION MODELLING METHODOLOGY

4.1 THE CALPUFF ODOUR DISPERSION MODEL

The odour dispersion modelling assessment was carried out using the CALPUFF System (Version 7). The main system programs are:

- CALPUFF - Version 7.2.1 - Level 150618
- CALMET - Version 6.5.0 - Level 150223
- CALPOST - Version 7.1.0 - Level 141010

CALPUFF is a multi-layer, multi-species, non-steady-state puff dispersion model that is able to simulate the effects of time- and space-varying meteorological conditions on pollutant transport (USEPA). CALMET is a meteorological model that produces three dimensional gridded wind and temperature fields to be fed into CALPUFF [3]. The primary output from CALPUFF is hourly pollutant concentrations evaluated at gridded and/or discrete receptor locations. CALPOST processes the hourly pollutant concentration output to produce tables at each receptor and contour plots across the modelling domain. The result is a summary of pollutant concentrations at various time averages and percentiles or a tally of hours where a pollutant has exceeded a pre-determined concentration [3]. For further technical information about the CALPUFF modelling system refer to the document *CALPUFF Modeling System Version 6 User Instructions* [3].

The CALPUFF system can account for a variety of effects such as non-steady-state meteorological conditions, complex terrain, varying land uses, plume fumigation and low wind speed dispersion (USEPA). CALPUFF is considered an appropriate dispersion model for impact assessment in one or more of the following applications:

- complex terrain, non-steady-state conditions,
- buoyant line plumes,

[3] Atmospheric Studies Group, 2011. *CALPUFF Modeling System Version 6 User Instructions..* Lowell: TRC Environmental Corporation.

- coastal effects such as fumigation,
- high frequency of stable calm night-time conditions,
- high frequency of calm conditions,
- inversion break-up fumigation conditions
- long-range transport, and
- close-field assessments.

For this study, the air contaminant was odour and ground level concentrations in odour units (ou) have been projected.

4.2 GEOPHYSICAL AND METEOROLOGICAL CONFIGURATION

A CALMET hybrid three-dimensional meteorological data file for Bassendean, Perth Western Australia was produced that incorporated gridded numerical meteorological data supplemented by surface observation data, topography and land use over the domain area.

4.2.1 Terrain configuration

Terrain elevations were sourced from 1 Second Shuttle Radar Topography Mission (SRTM) Derived Smoothed Digital Elevation Model (DEM-S). The SRTM data has been treated with several processes including but not limited to removal of stripes, void filling, tree offset removal and adaptive smoothing [4]. The DEM-S was used as input into TERREL processor to produce a 39km^2 grid at 0.25km resolution. Coastline data was sourced from USGS Global Self-consistent Hierarchical High-resolution Shoreline (GSHHS) Database [5]. A map of the terrain is illustrated in **Figure 4.1.**

[4] Gallant, J. C. et al., 2011. *1 second SRTM Derived Digital Elevation Models User Guide,* Canberra: Geoscience Australia.

[5] Wessel, P. & Smith, W. H. F., 2015. *Global Self-consistent Hierarchical High-resolution Geography,* s.l.: National Oceanic and Atmospheric Administration - National Centers for Environmental Information.

4.2.2 Land use configuration

Land use was sourced from the United States Geological Survey (USGS) Global Land Cover Characteristics Data Base for the Australia-Pacific Region [6]. The data was used as input into CTGPROC processor to produce a 39 km^2 grid at 0.25 km resolution.

4.2.3 Geophysical configuration

The geophysical data file was created using the MAKEGEO processor. Land use data from CTGPROC and terrain data from TERREL was used as input to produce a 39 km^2 geophysical grid at 0.25 km resolution.

4.2.4 Meteorological configuration

4.2.4.1 Input data

Five years of the latest one-hour average observed meteorological surface data was sourced from the Perth International Airport Automatic Weather Station (AWS) maintained by the Bureau of Meteorology (BoM). The location of Perth Airport surface station and other metadata are available in **Appendix A**. Once reviewed the data was sorted and processed using the *chi-x test* algorithm to define the most representative year out of the last five years of data. The representative year was 2012. The BoM data was formatted into generic format and was processed with SMERGE to produce a surface meteorological data file.

A 3D data tile from TAPM was developed for numerical meteorological data and processed with CALTAPM into a suitable format. TAPM was run using multiple nested grids, at least three nests and 35 vertical levels. TAPM innermost nest was 40km^2 at 1 km resolution. The nested grid resolutions were close to a ratio of three as possible.

[6] United States Geological Survey, 1997. *Global Land Cover Characteristics Data Base,* s.l.: s.n.

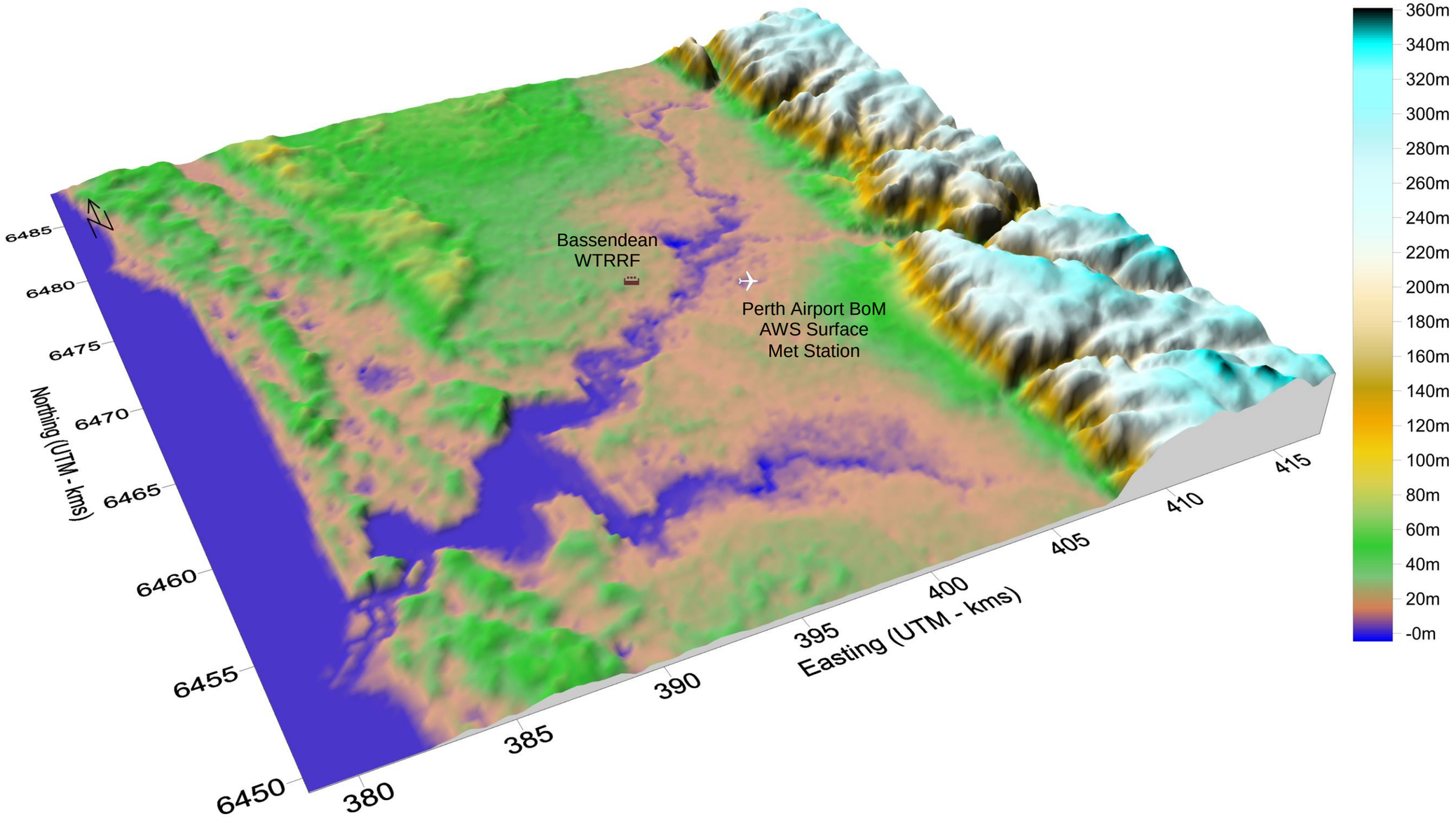


Figure 4.1: Terrain Map of Bassendean and greater Perth area.

4.2.4.2 CALMET meteorological model configuration

CALMET was run using the hybrid option that uses geophysical data, surface station data from Perth Airport and upper air data from the TAPM 3D data tile. The data was used to initialise the diagnostic functions of the CALMET module to produce a full 3D meteorology data for input into CALPUFF. **Table 4.1** shows key variable fields selected.

Table 4.1: CALMETT Key Variables (Grid Configuration WGS-84 UTM Zone 50S)

156												**NX Cells**
156												**NY Cells**
0.25												**Cell Size (km)**
378.380				6449.253								**SW Corner (km)**
11												**Vertical Layers**
ZFACE (m)	0	20	40	80	160	320	640	1000	1500	2000	2500	3000
LAYER	1	2	3	4	5	6	7	8	9	10	11	
MID-PT (m)	10	30	60	120	240	480	820	1250	1750	2250	2750	

Critical Wind Field Settings			
Value	**Found**	**Typical**	**Values**
TERRAD	3	None	Terrain scale (km) for terrain effects
IEXTRP	-4	4,-4	Similarity extrap. of wind (-4 ignore upper stn sfc)
ICALM	0	0	Do Not extrapolate calm winds
RMAX1	4	None	MAX radius of influence over land in layer 1 (km)
RMAX2	5	None	MAX radius of influence over land aloft (km)
R1	4	None	Distance (km) where OBS wt = IGF wt in layer 1
R2	5	None	Distance (km) where OBS wt = IGF wt aloft

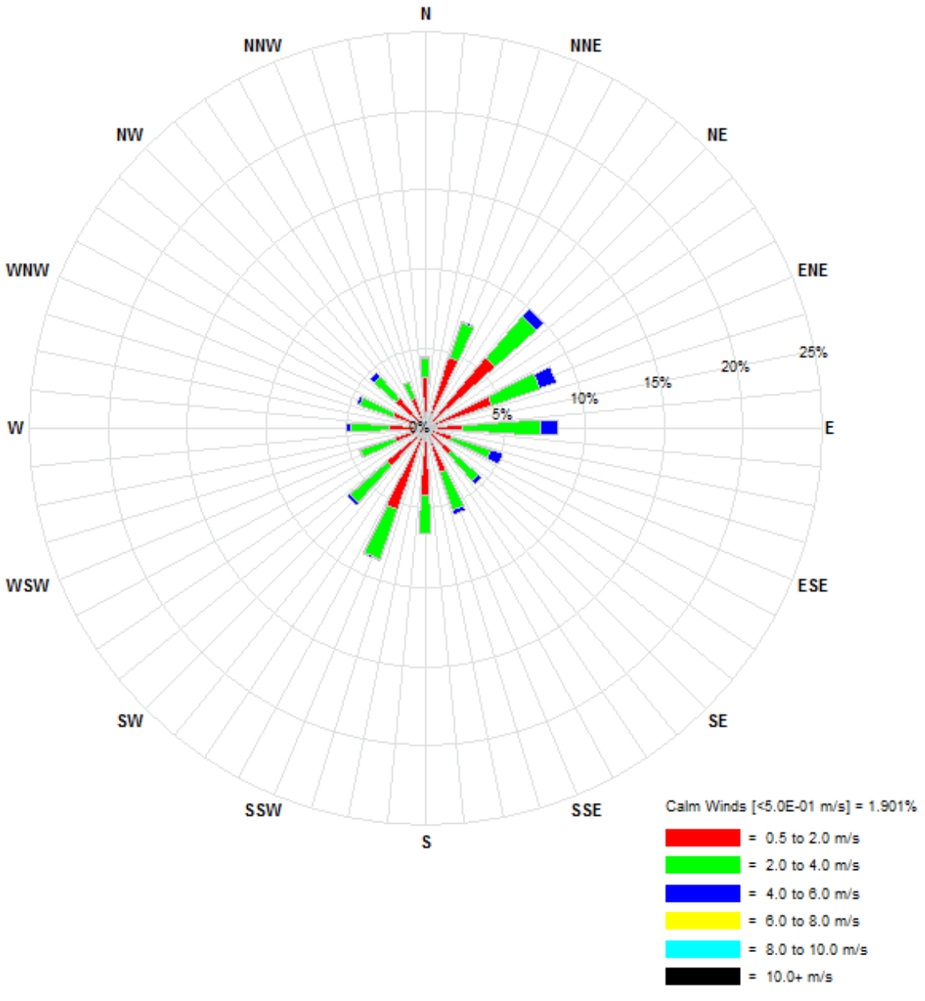
4.2.4.3 Meteorological data analysis

Observed 2012 BOM surface data was compared with longer term climate (2010 – 2015) from Perth Airport to gauge how representative and suitable the year is for the purpose of air quality dispersion modelling. The *chi-squared test* algorithm was used to determine this representative year. For reference, meteorological data was also extracted from the CALMET model for the location directly nearby the proposed Bassendean WTRRF site.

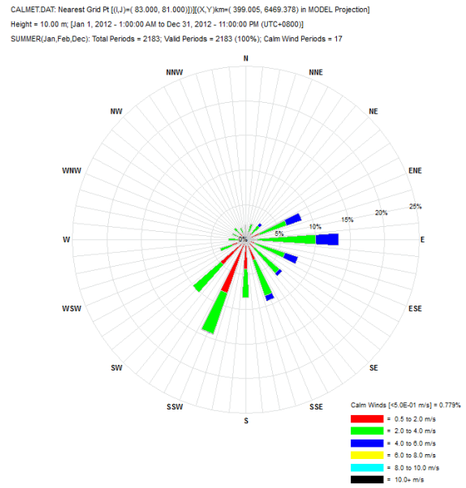
The 2012 Annual Windroses **(Figure 4.2)** show bias to easterly winds, likely due to the close proximity to the Darling Scarp with the sea breeze effects dominant from the south-west.

Autumn and Winter seasons show a strong dominance of north-easterly winds with sea breeze effects in the Summer and Spring months.

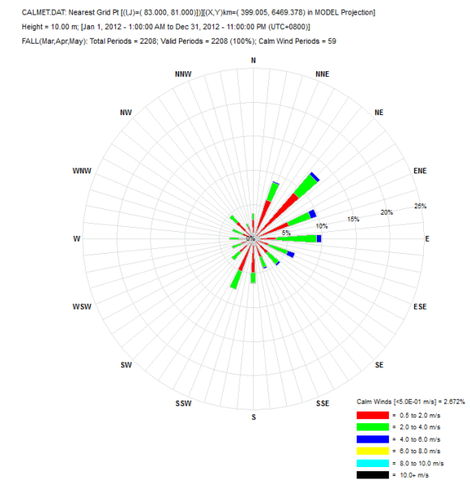
Dominant light winds occur between the hours of 1900hrs – 0600hrs as expected **(Figure 4.3).** Under light wind conditions the odour dispersion is poor and impacts are at their greatest.



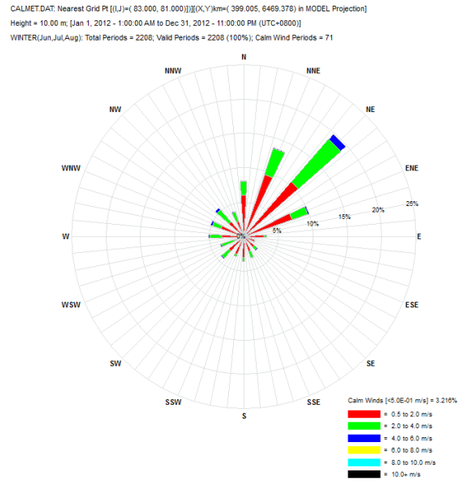
2012 Annual Windrose



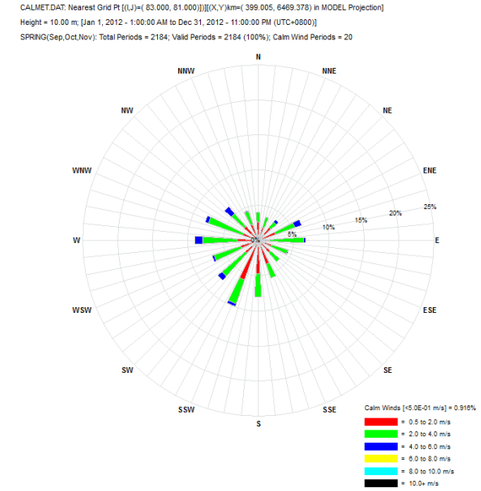
Summer



Autumn

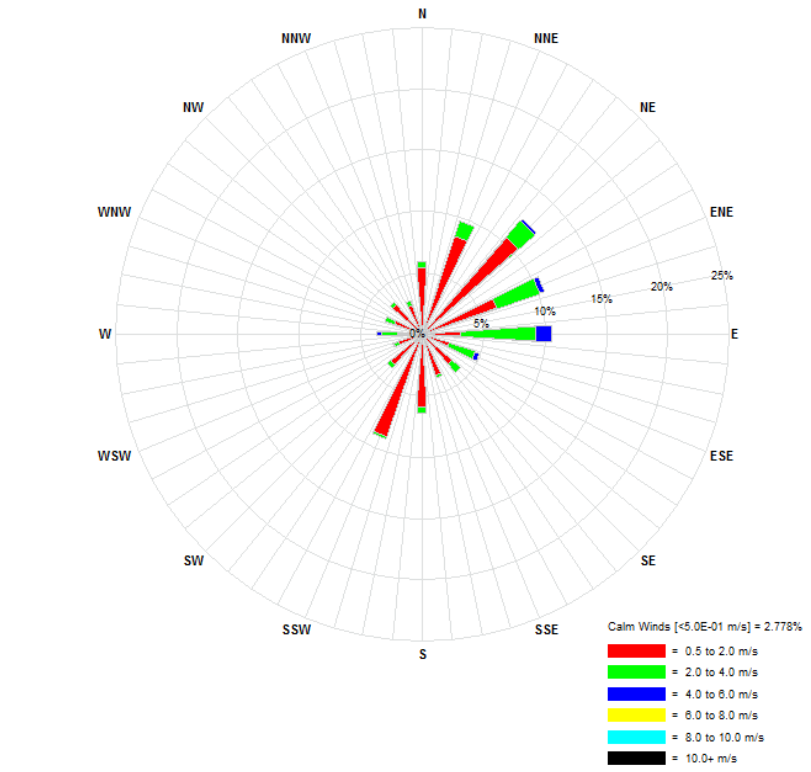


Winter

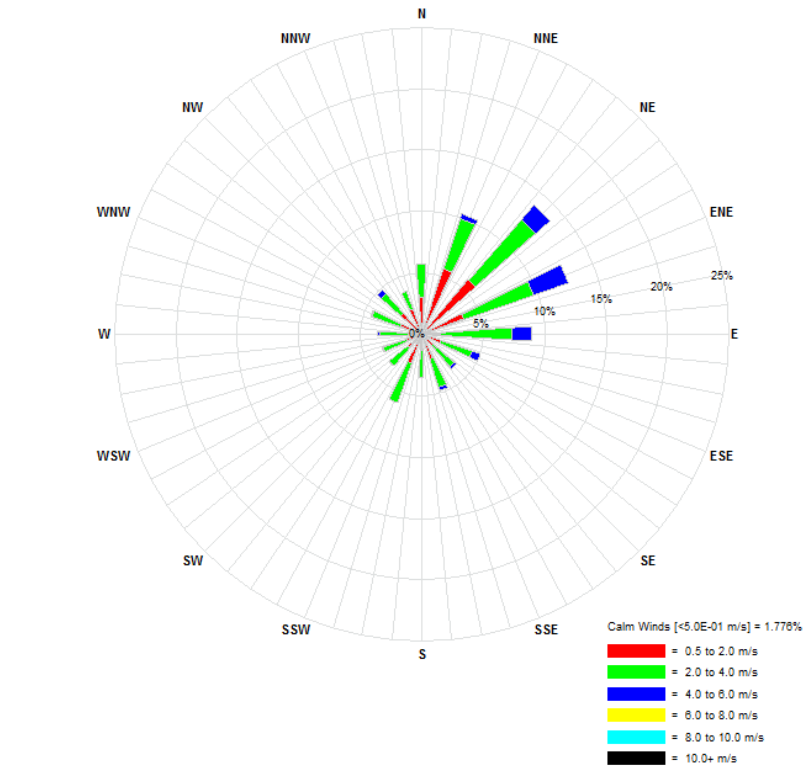


Spring

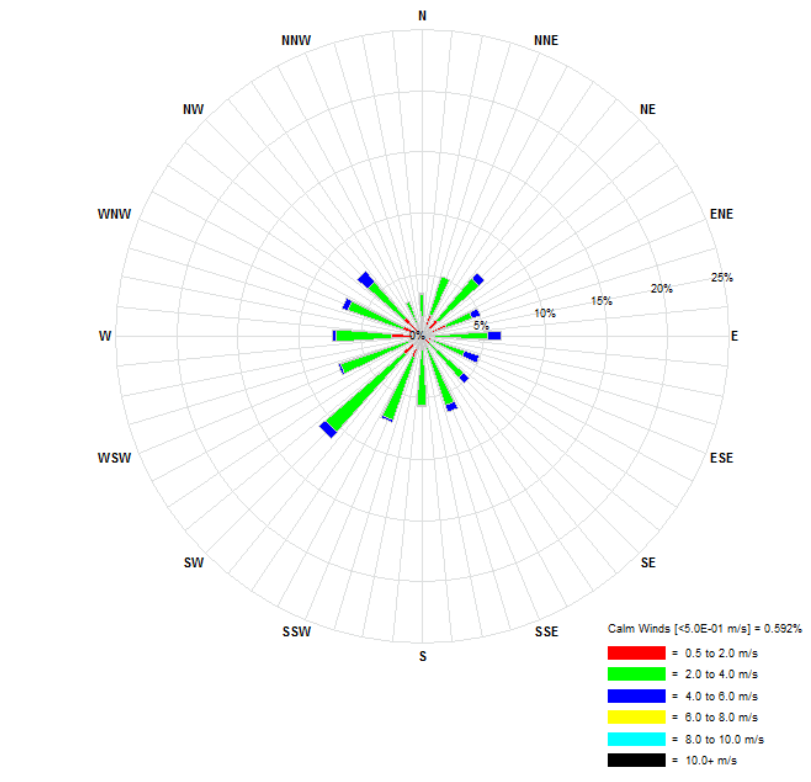
Figure 4.2: Annual and Seasonal Windroses for Jackson Street, Bassendean WTRRF, Western Australia (modelled).



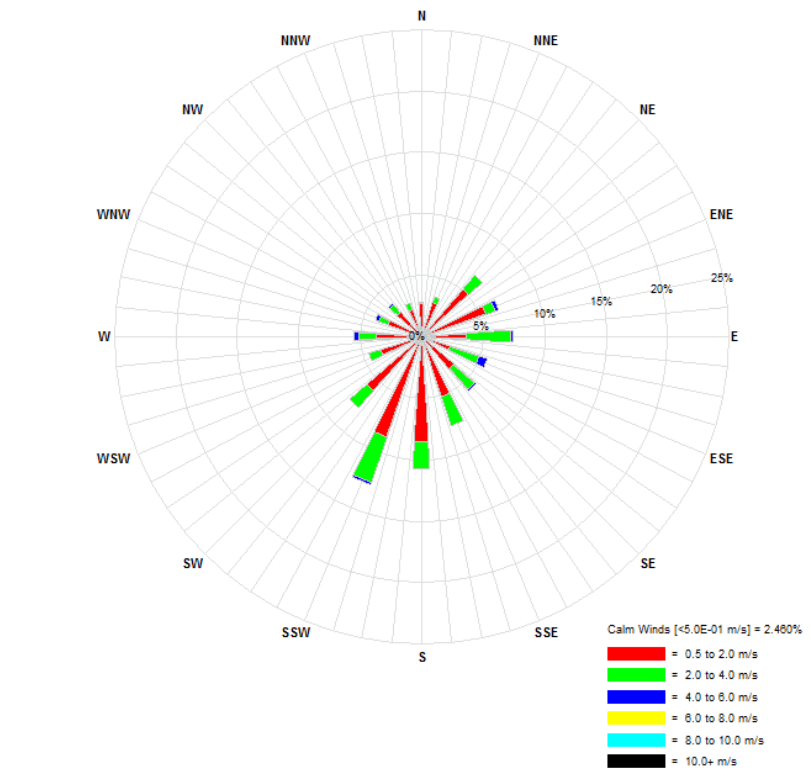
0100hrs – 0600hrs



0700hrs – 1200hrs



1300hrs – 1800hrs



1900hrs – 0000hrs

Figure 4.3: Time of Day Windroses for Jackson Street, Bassendean WTRRF, Western Australia (modelled).

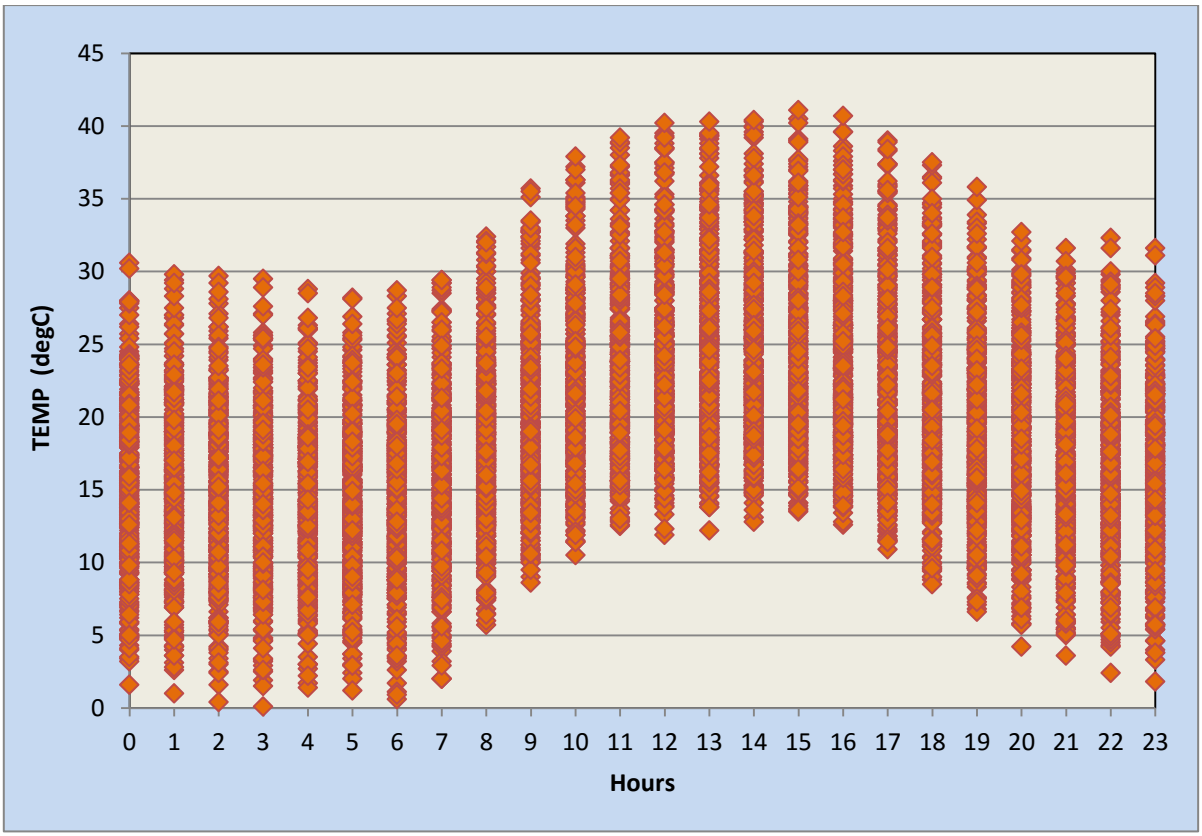


Figure 4.4: Annual X-Y scatter plot diurnal temperatures for 2012 (modelled)

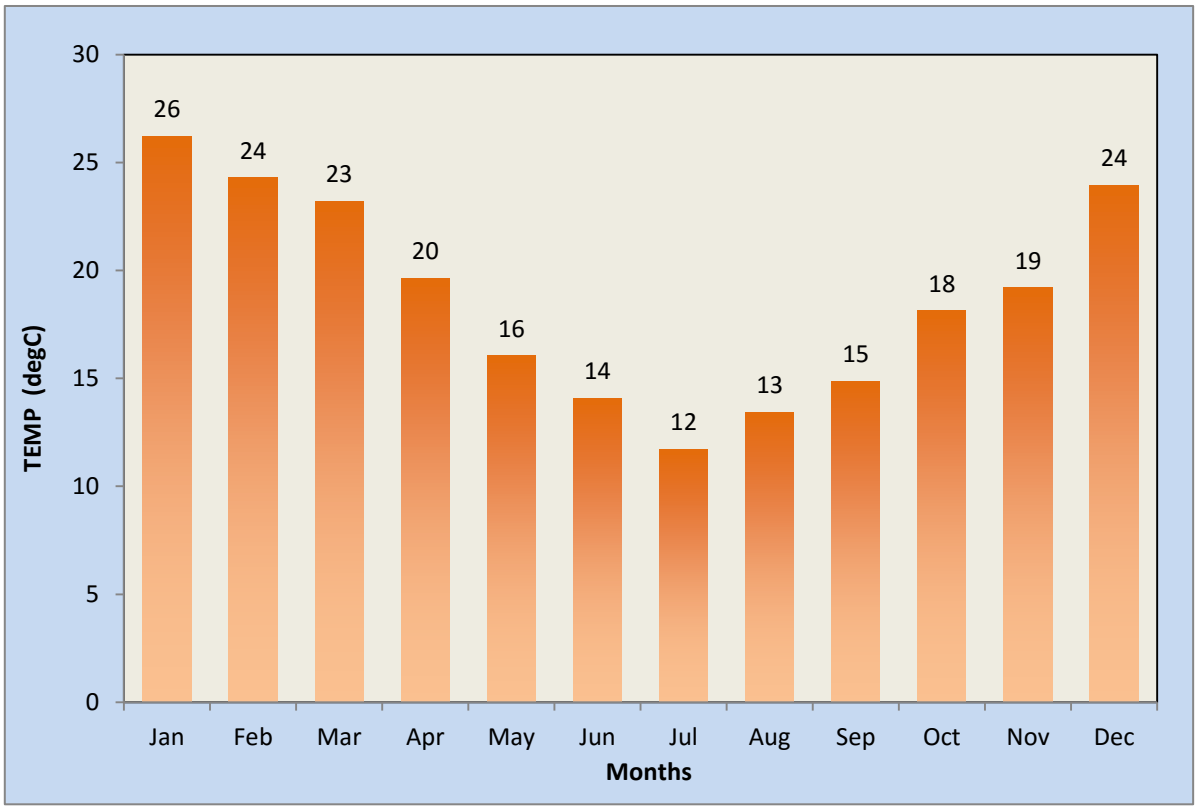


Figure 4.5: Average Monthly temperatures for 2012 (modelled)

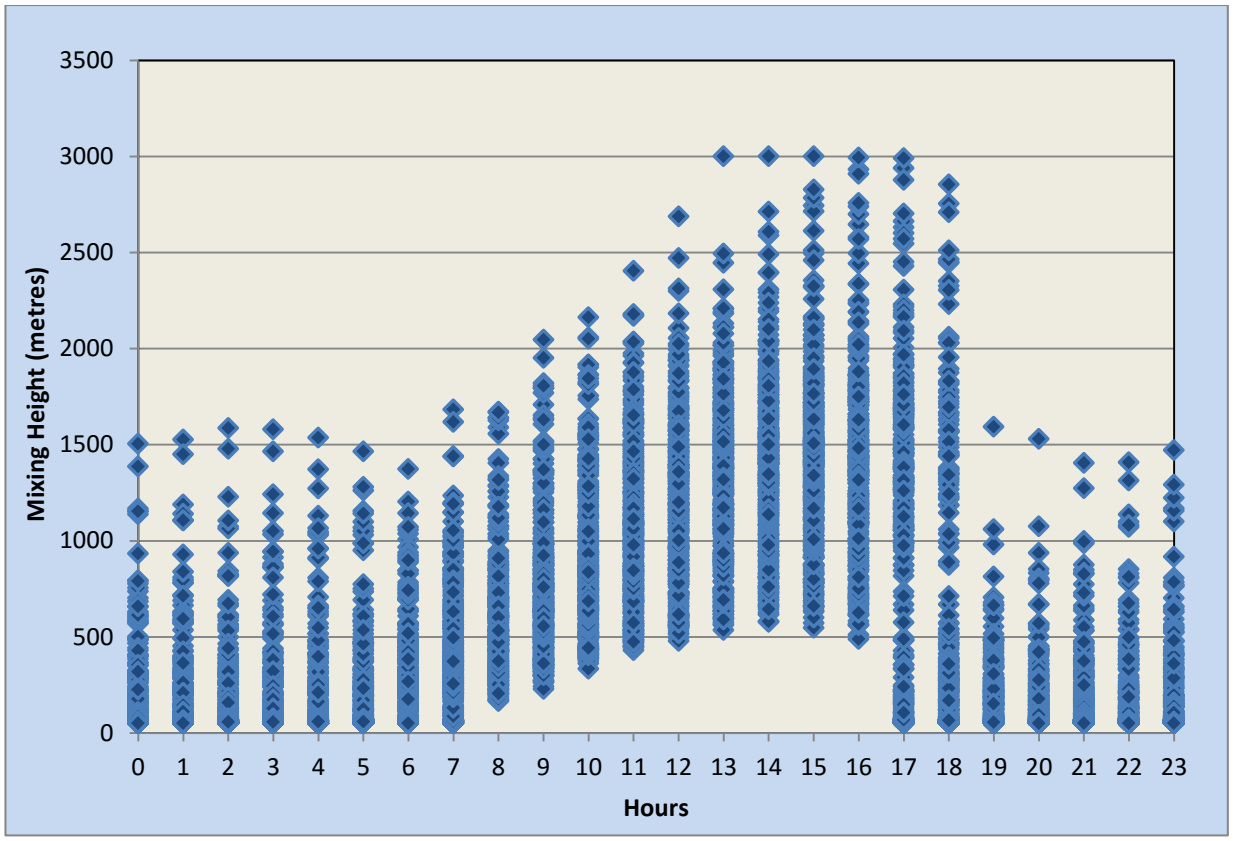


Figure 4.6: Annual X-Y scatter plot diurnal mixing height for Bassendean (modelled)

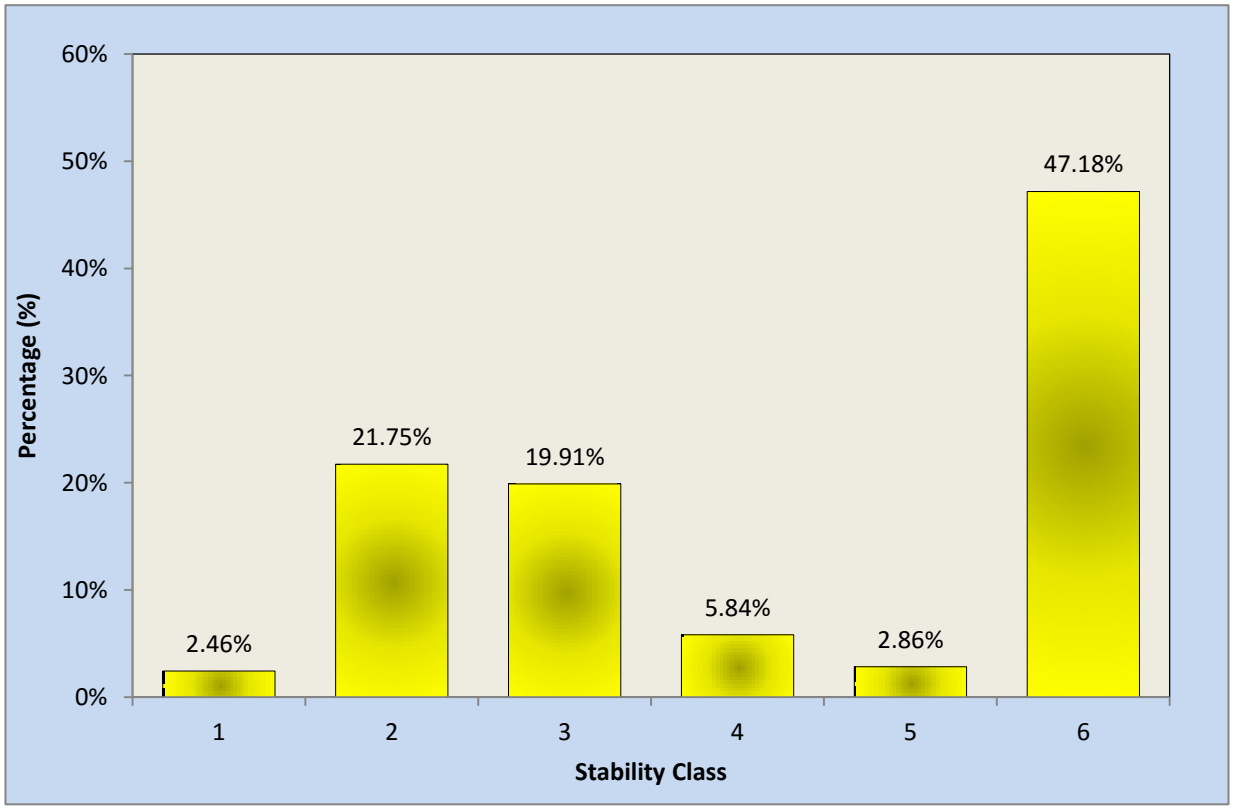


Figure 4.7: Annual stability class frequency for Bassendean (modelled)

4.3 CALPUFF DISPERSION MODEL CONFIGURATION

4.3.1 Computational domain

The computational domain was set to the same parameters as the meteorological domain.

4.3.2 Receptor configuration

Receptors were spaced at 50m x 50m (250m; 5 x nesting factor) over a 3.5km x 4.75km domain centred over the Bassendean WTRRF site. Sensitive receptors were placed at three of the nearest offsite industrial locations as well as two at the nearest north-west and south-east sensitive receptors. The coordinates of sensitive receptors are presented in **Table 4.2**.

Table 4.2: Sensitive & Industrial (Ind) Receptor Locations

Receptor	Name	Coordinate X (kms)	Coordinate Y (kms)	Ground Elevation (m)	Height above Ground (m)
1	NW-Business (Ind)	398.720	6469.321	28	1.5
2	SE-Business (Ind)	398.861	6469.248	21	1.5
3	S-Business (Ind)	398.798	6469.163	21	1.5
4	SE-House	399.368	6468.634	17	1.5
5	NW-House	398.574	6469.888	21	1.5

4.3.3 Building Profile Input Program

Building Profile Input Program (BPIP) was not utilised for the dispersion modelling assessment since emission characteristics were volume sources.

4.3.4 Source Configuration and Odour Emission Rates

The Odour Sources and their individual configurations and emissions data are presented in **Table 4.3** below.

Table 4.3: Bassendean WTRRF Odour Emissions Inventory

NON-PARTITIONED BUILDING (WTS & MRF UNIFORM MIXING)							
Odour Source	**Coordinate X (kms)**	**Coordinate Y (kms)**	**Effective Height**	**Base Elevation (m)**	**Initial Sigma Y (m)**	**Initial Sigma Z (m)**	**Odour Emission Rate (ou/s)**
Waste Depot Bunker	398.814	6469.296	3	26	17.91	7.04	12,650
MRF Section 1	398.756	6469.292	3	26	12.56	7.04	14,117
MRF Section 2	398.776	6469.311	3	26	12.56	7.04	14,117
MRF Section 3	398.793	6469.329	3	26	12.56	7.04	14,117
PARTITIONED BUILDING (WTS SEPARATE TO MRF)							
Odour Source	**Coordinate X (kms)**	**Coordinate Y (kms)**	**Effective Height**	**Base Elevation (m)**	**Initial Sigma Y (m)**	**Initial Sigma Z (m)**	**Odour Emission Rate (ou/s)**
Waste Depot Bunker	398.814	6469.296	3	26	17.91	7.04	49,500
MRF Section 1	398.756	6469.292	3	26	12.56	7.04	1,834
MRF Section 2	398.776	6469.311	3	26	12.56	7.04	1,834
MRF Section 3	398.793	6469.329	3	26	12.56	7.04	1,834

4.3.5 CALPUFF Model Options

CALPUFF default model options were set except for the following as recommended in *Table A-4* contained and explained within *Barclay and Scire* [7]**:**

- Dispersion coefficients (MDISP) = dispersion coefficients from internally calculated sigma v, sigma w using micrometeorological variables (2);
- Probability Density Function used for dispersion under convective conditions (MPDF) = Yes (1); and
- Minimum turbulence velocities sigma v for each stability class over land and water (SVMIN) = 0.2 m/s for A, B, C, D, E, F (0.200, 0.200, … , 0.200).

4.4 ODOUR DISPERSION MODELLING SCENARIOS & ODOUR EMISSION RATES

The following scenario/s were simulated with CALPUFF:

i. **Non-Partitioned** building representing mixing of air throughout. Total Odour Emission Rate (OER) of 55,000ou/s emitted continuously during daily operational hours with the percentage of odour assigned as follows:
   - WTS assigned 23% of Total OER based on operational surface area;
   - MRF assigned 77% of Total OER; and
   - After Hours the continuous OER emitted was 5% of the Total OER.

ii. **Partitioned** building representing mixing of air throughout. Total Odour Emission Rate (OER) of 55,000ou/s emitted continuously during daily operational hours with the percentage of odour assigned as follows:
   - WTS assigned 90% of Total OER;
   - MRF assigned 10% of Total OER; and
   - After Hours the continuous OER emitted was 5% of the Total WTS OER.

[7] Barclay, J. & Scire, J., 2011. Generic Guidance and Optimum Model Settings for the CALPUFF Modeling System for Inclusion into the 'Approved Methods for the Modeling and Assessments of Air Pollutants in NSW, Australia'

4.4.1 Modelling Assumptions

The entire WTS and MRF building is an “L” shaped building where the WTS has an operational area of approximately 23% (952m^2) of the entire surface area. Under the scenario where there is no partitioning of the WTS and MRF the building is assumed to have uniform mixing of the total OER. Where partitioning is assumed, 90% of the total OER is assigned to the WTS area.

The OER is considered to be a constant odour emission during all hours; however, in the evening periods outside of operational hours only 10% of the total OER is emitted for the non-partitioned scenario, and 5% for the partitioned scenario. This is because the WTS is a discrete source when partitioned and access doorways are closed outside of operational hours. The MRF however is proposed to operate 24hrs so their doorways are still operational outside of daily operational hours.

Tonnage throughputs although affecting the bulk OER at any one time have been “smoothed’ by considering an average constant OER which accounts for peak loads as well as those timeframes where waste is minimal to negligible in the WTS.

5 ODOUR DISPERSION MODELLING RESULTS

The non-partitioned scenario shows that for an odour criterion of:

- 2.5ou; 99.5th percentile with 1-hour averaging times

The model projections demonstrate a "PASS" with respect to the nearest sensitive receptor locations. There is a slight projection into the open-space north-west of the site but not impacting housing.

For an odour criterion of:

- 8ou; 99.9th percentile with 1-hour averaging times

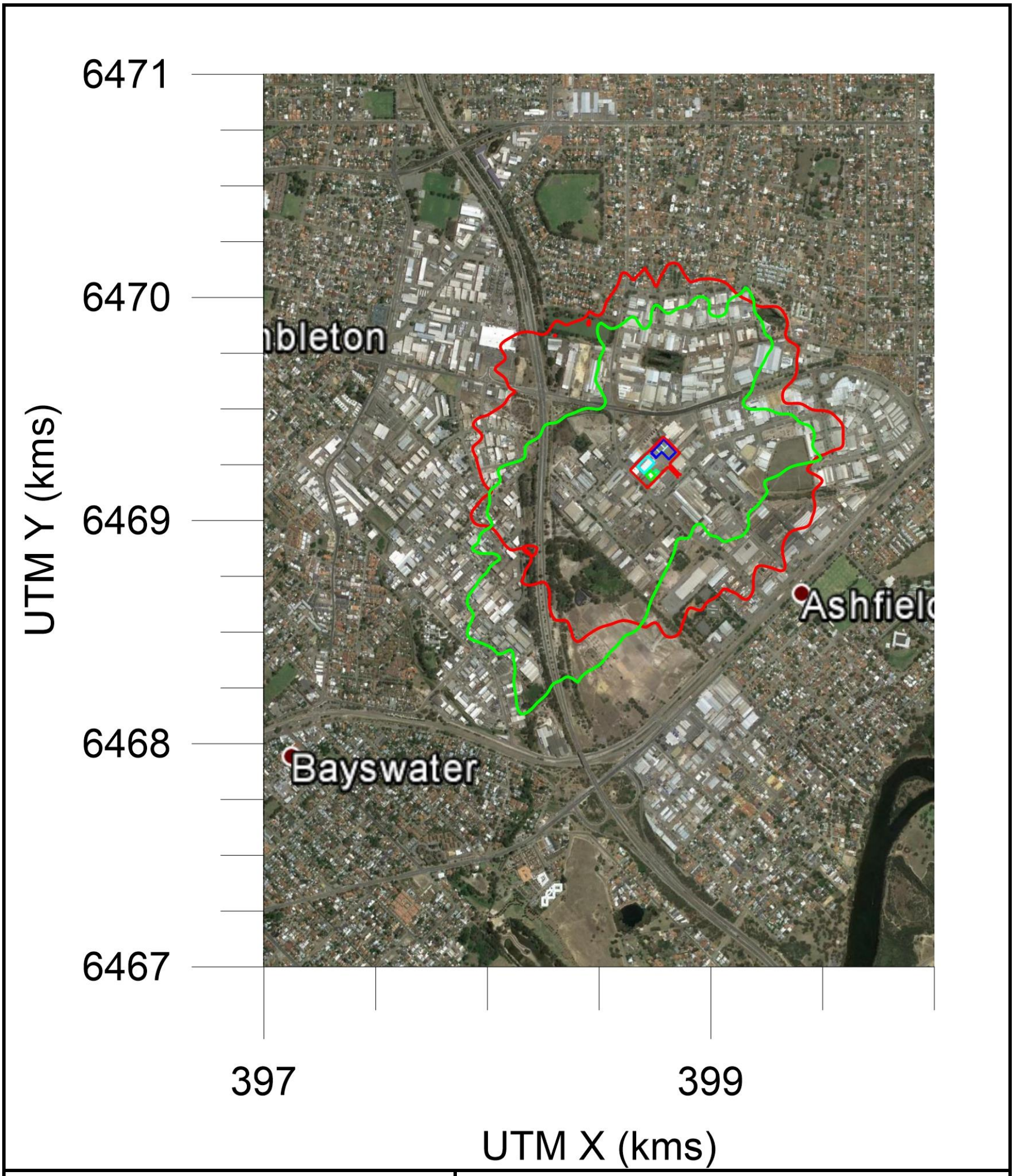
The model shows minor impacts on receptors north of the WTRRF site; however, these projections represent an "upset" condition such as:

- a transient peak odour emission when waste is held too long due to breakdown of outgoing truck movements;
- uncontrolled loss of emissions in the morning start-up periods when doorways are opened and there is decomposed residual waste that has been held on in the bunker over a weekend etc.

The partitioned scenario also shows a "PASS" with respect to the nearest sensitive receptor locations. The partitioning of the building shifts the origin of the bulk odour emission rate slightly to the east as it is centred within the WTS. The shape of the offsite odour impact is therefore only marginally changed to reflect a change in the emission centre.

The partitioned scenario does not reflect the betterment of odour control, rather it depicts the containment of the odour centred over the WTS rather than mixed throughout the entire building. Under this scenario there is a greater opportunity to maintain the bulk odour emission within a discrete area rather than allowing it to permeate throughout the entire building.

The odour dispersion modelling results have been visually illustrated as odour impact contours superimposed on a gridded aerial map, specifically, the 2.5ou and 8ou isopleths for each modelled scenario. A complement of these odour isopleths are presented in the **Figures below.**



Odour Criterion: • **2.5ou (green contour)** • **8ou (red contour)** • Criterion Averaging Time: 1-hr • Criterion Assessment Percentile: 99.5th & 99.9th • **Emissions Type: VOLUME SOURCE Constant OER's**	Meteorological Data: • File: CALMETT PerthAP 2012 (Bassendean) • Meteorological Hours: 8,784 • Modelling Hours Assessed: 44; 9 • Coordinates: UTM

Figure 5.1: CALPUFF Ground Level Odour Impact Projections for Proposed Bassendean WTRRF (Non-Partitioned Building).