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Modular Brewery, 3/622 Newcastle St, Leederville WA, Odour Risk Assessment

Addressee(s):	**Modular Brewing Pty Ltd**
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Date:	**25 May 2017**

Disclaimer

Quality Control

Study	Status	Prepared:	Checked:	Authorised:
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THE PROJECT	Final	Northstar Air Quality	M Doyle, D Burt	G Graham
LEGISLATION, REGULATION AND GUIDANCE	Final	Northstar Air Quality	M Doyle, D Burt	G Graham
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Final Authority

This report must by regarded as draft and without prejudice until the above study components have been each marked as final, and the document has been signed and dated below.

G Graham 25th May 2017

Non-Technical Summary

Modular Brewing Pty Ltd (Modular Brewing) propose to operate a small (1,000 litres per week) micro-brewery at 3/622 Newcastle Street, Leederville (the Project site). Modular Brewing has requested Northstar Air Quality Pty Ltd to provide an odour risk assessment to support a change of use Development Approval for the Project.

The odour risk assessment presented in this report presents a risk assessment, conducted in general accordance with ISO 31000 through the assessment of the (i) magnitude of odour impacts associated with the various stages of the beer brewing process and (ii) the sensitivity of current and (likely) future land uses to potential odour impacts, and risk is assessed as the product of those considerations.

The objective of the risk assessment is to provide a systematic and transparent methodology to identify the requirement for odour controls and achieve an objective consistent with the requirements of the *Environmental Protection Act* (1986).

The risk assessment is performed in three stages:

- **Step 1: Pre-mitigated risk:** This is used to identify any significant risks and identify the need for control;
- **Step 2: Control and mitigation:** An examination of what constitutes best available technology (BAT) for odour control for that process; and,
- **Step 3: Post-mitigation risk:** This is used to identify the residual risks, based upon the application of control technologies and appropriate management practices.

Step 1: The pre-mitigation risk assessment determined the following risks:

- Vapours from wort boiling — intermediate risk
- Wastewater treatment — intermediate/minor risk
- Storage and handling of co- and by- products — intermediate/minor risk

Step 2: Using the pre-mitigated risk assessment from Stage 1, a range of odour control measures were identified, with reference to **Best Available Technology** (BAT) outlined in The Brewers of Europe (CBMC) (2002) - *Guidance Note for establishing BAT in the brewing industry*, including:

- Vapours from wort boiling: condensation of vapour from wort boiling
- Wastewater treatment: no on-site treatment, containment of run-off, Council policy(s)
- Storage and handling of co- and by- products: containerised storage, effective waste management, Council policy(s)
- Implementation of an odour complaint procedure

Step 3: The post-mitigation risk assessment determined the following risks:

- Vapours from wort boiling — neutral risk
- Wastewater treatment — neutral risk
- Storage and handling of co- and by- products — neutral risk

The potential for cumulative impacts with the bakery located at 626 Newcastle Street, Leederville was considered. The above odour controls have been designed to not give rise to unreasonable emissions of odour (as defined by the *Environmental Protection Act* [1986]) at or beyond the Project site boundary and as such the potential for cumulative odour impacts between the bakery and micro-brewery are not considered to be significant.

The assessment has been based upon a capacity and throughput of 1,000 litres per week, although the initial throughput will be limited to 400 litres per week. The initial limitation of 400 litres per week is determined by the anticipated demand for the product and the throughput capacity of the installed equipment (principally the volume of the fermentation vessel). The throughput of 1,000 liters per week would not be achievable until demand is sufficient to warrant additional production and the equipment volume is increased.

The initially lower capacity and throughput of 400 litres per week is considered to be beneficial to the Development Approval process, as it would allow a period of process settling-in, and demonstration that the microbrewery is capable of being operated and managed so as not to give rise to unreasonable odour emissions.

It is recommended that an odour complaints register is maintained to document receipt of odour complaints, which would be made available for inspection by Council upon request. To facilitate this a copy of the Northstar Air Quality Odour Complaint Record Sheet has been provided in **Appendix B** which may be used, or adapted, for this purpose.

Contents

Tables

Figures

Units Used in the Report

All units presented in the report follow the International System of Units (SI) conventions, unless derived from references using non-SI units.

In this report, units formed by the division of SI and non-SI units are expressed as a negative exponent, and do not use the solidus (/) symbol.

Common Abbreviations

Abbreviation	Term
BCA	Building Code of Australia
CO_2	carbon dioxide
L	litre
OU	odour unit
VOC	volatile organic compound

1. INTRODUCTION

Modular Brewing Pty Ltd (Modular Brewing) propose to operate a small micro-brewery at 3/622 Newcastle Street, Leederville (the Project site).

Modular Brewing has requested Northstar Air Quality Pty Ltd to provide an odour risk assessment to support a change of use Development Approval for the Project.

2. THE PROJECT

2.1. Environmental Setting

The location of the proposed micro-brewery is 3/622 Newcastle Street, Leederville (Lot 1 D/P 1057) (the Project site) and the proposed layout is presented in **Appendix A**. The Project site is located in Development Area 1 and zoned to accommodate commercial land uses, as per the City of Vincent Town Planning Scheme No. 1 (Oxford Centre Precinct – Scheme Map 4)[1].

Surrounding land includes commercial and residential uses including a bakery to the immediate southwest (approximately 12 m), residences to the immediate north (approximately 12 m) and northwest (approximately 16 m) and offices to the immediate west (approximately 15 m) of the Project site. Currently vacant land (zoned commercial) is located to the immediate east of the Project site (approximately 4 m).

Approval is sought for the micro-brewery with a weekly output of 1,000 litres (L) per week, however in the first instance it is envisaged that the throughput will be limited to 400 L per week.

This report assesses the odour risks and controls of the proposed microbrewery at a throughput of 1,000 L per week.

The initial limitation of 400 L per week is determined by the anticipated demand for the product and the throughput capacity of the installed equipment (principally the volume of the fermentation vessel). The throughput of 1,000 L per week would not be achievable until demand is sufficient to warrant additional production and the equipment volume is increased.

The initially lower throughput of 400 L per week is considered to be beneficial to the Development Approval process, as it would allow a period of process settling-in, and demonstration that the microbrewery is capable of being operated and managed so as not to give rise to unreasonable odour emissions.

[1] http://www.vincent.wa.gov.au/Services/Planning/Town_Planning_Scheme_Zoning_Information/Scheme_Maps (accessed 12/04/2017)

2.2. The Process

The brewing process typically involves a number of stages or processes, including the following.

- Raw materials storage and handling;
- Grain cracking and milling;
- Grain mashing;
- Boiling;
- Fermentation;
- Conditioning and maturation;
- Clarifying, kegging / bottling; and,
- Waste water and solid waste management.

Whilst the beer brewing process is relatively standardised, there are some variations between brewing processes in the composition of the grain bill, mashing and boiling temperature and duration, and the time and composition of the hops and adjuncts, depending upon the brewing style and the type of product intended.

Typically, the most significant potential source of odour from brewery operations is the evaporation of volatile organic compounds derived from wort boiling. Wort boiling occurs in brew kettles, during which the boil vapour may be discharged to atmosphere or recompressed and reused before being condensed, cooled and disposed of as a liquid effluent.

The fermentation and maturation stage of the process produces volatile organic compounds including ethanol and ethyl acetate.

Waste water diverted to trade waste has the potential for odour emissions where brewery effluent and spills are transported off-site via an on-site drainage network.

Odour emissions from all other processes are fugitive (uncontrolled) and not significant in nature and would be confined to the area of the building in which the relevant activity is being performed.

It is noted that the weekly brewing volume of the Modular Brewery is relatively small. Approval is sought for a capacity of 1,000 L per week with an initial anticipated production limit of 400 L per week.

3. LEGISLATION, REGULATION AND GUIDANCE

Often a pollutant may have a health-based criterion and an amenity-based criterion and typically these will be represented by different concentration values over different averaging periods to account for the mechanisms through which an air pollutant may affect health and amenity. The standards protecting amenity (odour) will usually be specified over short-duration averaging periods as the time required to register an odour that affects amenity, and which may give rise to a nuisance complaint, is typically very short.

The concentration values vary according to the threshold at which it may be typically detected as a human olfactometric response (i.e. the threshold of nasal detectability). This concentration is called the odour detection threshold (ODT) and defines 1 odour unit (1 OU) for that odorant. The actual mass/volume airborne concentration ($\mu g \cdot m^{-3}$) that equates to the ODT for each air pollutant will be different, even though they all have an equivalence to 1 OU.

Based on the literature available, in an outdoor environment, the odour concentration at which an odour is perceived to potentially be a nuisance typically ranges from around 2 OU to around 10 OU depending on the interaction of various factors including the composition of the odorants exposed, the sensitivity of the receiving environment, how offensive the odour is, the frequency, intensity and duration at which it is experienced etc.

Impacts from odorous air contaminants are often nuisance-related rather than health-related. Odour performance goals guide decisions on odour management, but are generally not intended to achieve "no odour".

An odour goal of less than 1 OU would theoretically result in no odour impact being detectable in laboratory conditions. In practice, the character of a particular odour can only be judged by the receiver's reaction to it, and preferably only compared to another odour under similar social and regional conditions.

3.1. Legislation

The defining legislation applicable in WA is provided under the *Environmental Protection Act* (1986). In relation to the potential emission of odour from premises that causes an off-site impact, the *Act* states the following:

Part V — Environmental regulation

Division 1 — Pollution and environmental harm offences

49. Causing pollution and unreasonable emissions

(1) In this section —

unreasonable emission *means an emission or transmission of noise,* ***odour*** *or electromagnetic radiation which unreasonably interferes with the health, welfare, convenience, comfort or amenity of any person.*

(2) A person who intentionally or with criminal negligence —

(a) causes pollution; or

(b) allows pollution to be caused,

commits an offence.

(3) A person who causes pollution or allows pollution to be caused commits an offence.

(4) A person who intentionally or with criminal negligence —

(a) emits an unreasonable emission from any premises; or

(b) causes an unreasonable emission to be emitted from any premises,

commits an offence.

(5) A person who —

(a) emits an unreasonable emission from any premises; or

(b) causes an unreasonable emission to be emitted from any premises,

commits an offence.

51. Occupiers of premises, duties as to emissions

The occupier of any premises who does not —

(a) comply with any prescribed standard for an emission; and

(b) take all reasonable and practicable measures to prevent or minimise emissions,

from those premises commits an offence.

[Section 51 amended by No. 54 of 2003 s. 38.]

Correspondingly, under the Act, there is an obligation of an occupier of a premises, whether that is a prescribed premises or not, not to cause unreasonable emissions of odour that ***unreasonably interferes with the health, welfare, convenience, comfort or amenity of any person***. There is also an obligation to take reasonable and practicable measures to ***prevent or minimise emissions***.

3.2. Guidance

As previously discussed, the level at which an odour is perceived to be a nuisance can range from 2 OU to 10 OU (2 × to 10 × the odour detection threshold) to depending on a combination of the following factors:

- **Odour quality:** whether an odour results from a pure compound or from a mixture of compounds. Pure compounds tend to have a higher threshold (lower offensiveness) than a mixture of compounds.
- **Population sensitivity:** any given population contains individuals with a range of sensitivities to odour. The larger a population, the greater the number of sensitive individuals it contains.
- **Background level:** whether a given odour source, because of its location, is likely to contribute to a cumulative odour impact. In areas with more closely-located sources it may be necessary to apply a lower threshold to prevent offensive odour.

- **Public expectation:** whether a given community is tolerant of a particular type of odour and does not find it offensive, even at relatively high concentrations. For example, background agricultural odours may not be considered offensive until a higher threshold is reached than for odours from a landfill facility.
- **Source characteristics:** whether the odour is emitted from a stack (point source) or from an area (diffuse source). Generally, the components of point source emissions can be identified and treated more easily using control equipment than diffuse sources. Point sources tend to be located in urban areas, while diffuse sources are more prevalent in rural locations.
- **Health Effects:** whether a particular odour is likely to be associated with adverse health effects. In general, odours from agricultural activities are less likely to present a health risk than emissions from industrial facilities.

The WA Department of Environment Regulation (DER) has previously developed odour performance criteria for new and existing facilities which were published in the guidance document "*No. 47: Assessment of Odour Impacts from New Proposals*" dated 2002. However, at the time of writing this guidance has been withdrawn and WA DER has yet to publish a replacement guidance document.

In the absence of any current State specific guidance, a summary of the relevant regulations across all Australian jurisdictions is presented in **Table 1** with variation across each jurisdictions observed.

Table 1 Odour Concentration Limits in Ambient Air (Australia) - 2013

State	Odour Concentration Limits in Ambient Air	Averaging Period and Frequency of Perception
QLD	0.5 OU for tall stacks 2.5 OU for ground level sources and down-washed plumes from short stacks	1-hour average, 99.5th percentile
NSW	Varying from 2 OU (rural residence) to 7 OU (urban area)	Peak concentrations (1-second average), 99th percentile
SA	2 OU (2000 people or more), 4 OU (350-1999 people), 6 OU (60-349 people), 8 OU (12-59 people), 10 OU (less than 12 people)	3-minute average, 99.9th percentile
VIC	Offensive odours must not be discharged beyond the boundaries of the premises (1 OU)	3-minute average, 99.9th percentile
WA (withdrawn)	2 OU 4 OU	3-minute average, 99.5th percentile 3-minute average, 99.9th percentile

Source: Adapted from Lisboa, H.M., Sivert, E and Stuetz, R.M. (Odour Regulations – Experiences from Australia)[2]

[2] Lisboa, H.M., Sivert, E and Stuetz, R.M., *Odour Regulations – Experiences from Australia*, Chemical Engineering Transactions, Vol 40, 2014

It is noted that the odour assessment criteria in **Table 1** are a **design** tool rather than a **regulatory** tool. The benchmark for operational facilities is generally not the odour assessment criteria outlined above but whether the emission of odour is unreasonable, or being prevented or minimised using best management practices.

3.3. Odour Separation Distances

The WA EPA draft "*Environmental Assessment Guideline for Separation distances between industrial and sensitive land uses*" (September 2015)[3] includes a separation distance of between 200 m and 500 m for industries where alcoholic beverages are manufactured (brewery, distillery or winery) for the environmental risks of gas, noise dust and odour. Although the draft guideline does state that the separation distances are recommended for all industries, not just those above a specific production or design capacity, it is clear that emissions of odour would be related to the production capacity of the Project.

The function of the odour assessment is therefore to identify potential odour emissions from the brewing process, evaluate the potential to give rise to unreasonable odour impacts (including amenity) and to identify practical and reasonable steps to prevent or minimise those emissions.

[3] https://consultation.epa.wa.gov.au/policy-and-guideline-development-and-review/draft-separation-distances-eag/ (accessed 12/04/2017)

4. METHODOLOGY

As the proposed methodology is aimed at identifying practical odour management, it relies upon an element of judgement based upon the experience of the author.

To provide some clarity / transparency on how the conclusions have been derived, a risk assessment procedure has been adopted, based upon the definitions provided under ISO 31000.

The risk assessment is performed in three stages:

- **Step 1: Pre-mitigated risk:** This is used to identify any significant risks and identify the need to control;
- **Step 2: Control and mitigation:** An examination of what constitutes best available technology (BAT) for odour control for that process; and,
- **Step 3: Post-mitigation risk:** This is used to identify the residual risks, based upon the application of control technologies and appropriate management practices.

The risk assessment procedure adopted in this instance uses the determinations of:

- **sensitivity of receptors**; and
- **impact magnitude**; to derive
- **risk**.

These terms are defined and discussed in the following subsections.

4.1. Sensitivity of Receptors

Sensitivity terminology may vary depending upon the environmental effect, but generally this may be described in accordance with a scale from 'very high' to 'low', as defined in **Table 2**.

Table 2 Methodology - Sensitivity of Receptors

Sensitivity	Description	Examples
Very High	Receptors are highly sensitive to changes in the odour environment	Receptors of very high sensitivity to odour such as: hospitals and clinics, retirement homes and food processing.
High	Receptors have a high sensitivity to changes in the odour environment	Receptors of high sensitivity to odour, such as: schools, residential areas, food retailers, high-end office space (banking etc).
Medium	Receptors have a medium sensitivity to changes in the odour environment	Receptors of medium sensitivity to odour, such as: outdoor storage, light and heavy industry.
Low	Receptors have a low sensitivity to changes in the odour environment	All other air quality sensitive receptors not identified above.

4.2. Impact Magnitude

Impact magnitude is a descriptor for the predicted scale of change to the odour environment that may be attributed to the operation of the Project, and is evaluated on a scale from 'substantial' to 'negligible' as defined in **Table 3**.

Table 3 Methodology - Impact Magnitude

Magnitude	Description	Examples
Substantial	Impact is predicted to cause significant consequences on the receiving environment	Substantial risk that the impacts would generate nuisance complaints, resulting in regulatory action.
Moderate	Impact is predicted to possibly cause statutory objectives / standards to be exceeded	Moderate risk that the impacts would generate nuisance complaints, resulting in regulatory action.
Slight	Predicted impact may be tolerated.	Slight risk that the impacts would generate nuisance complaints, resulting in regulatory action.
Negligible	Impact is predicted to cause no significant consequences.	Negligible risk that the impacts would generate nuisance complaints, resulting in regulatory action.

4.3. Risk

The risk matrix provided in **Table 4** illustrates how the definition of the impact magnitude and sensitivity of receptors interact to produce impact risk (composite risk index). For example, an odour impact of *slight* magnitude at a *medium* sensitive receptor location would be determined to be of ***minor*** risk (significance).

Table 4 Methodology - Odour Risk Matrix

Magnitude / Sensitivity		[Defined by Table 3]			
		Substantial Magnitude	**Moderate Magnitude**	**Slight Magnitude**	**Negligible Magnitude**
[Defined by Table 2]	**Very High Sensitivity**	Major Significance	Major/ Intermediate Significance	Intermediate Significance	Neutral Significance
	High Sensitivity	Major/ Intermediate Significance	Intermediate Significance	Intermediate/Minor Significance	Neutral Significance
	Medium Sensitivity	Intermediate Significance	Intermediate/Minor Significance	Minor Significance	Neutral Significance
	Low Sensitivity	Intermediate/Minor Significance	Minor Significance	Minor/Neutral Significance	Neutral Significance

The 'risk' derived through this methodology is presented on a scale of *major* to *neutral* significance. The relative risk is provided as a dimensionless product of the defined values attributed to receptor sensitivity and impact magnitude.

The determined risk (significance) may be used to highlight the relative environmental risk and to highlight the general requirement for the application of controls and mitigation. It is noted that the above approach is designed to provide an overall impact risk, and is not intended to represent the defining determination for the requirement for mitigation and control. The determined risk methodology is not designed to exclude impacts with a lower determined significance from receiving mitigation and control treatments, in accordance with the principle of reducing environmental impacts to maximum extent practicable.

The approach may also underestimate the impact significance in environments which are assessed as having low sensitivity to impacts of a substantial or moderate magnitude, and therefore a pragmatic approach to the assessment significance should be applied.

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5. RISK ASSESSMENT

The risk assessment presented below follows the methodology outlined in **Section 4**. The risk assessment is presented in a number of stages:

- **Step 1: Pre-mitigated risk:** This is used to identify any significant risks and identify the need to control;
- **Step 2: Control and mitigation:** An examination of what constitutes best available technology (BAT) for odour control for that process; and,
- **Step 3: Post-mitigation risk:** This is used to identify the residual risks, based upon the application of control technologies and appropriate management practices.

5.1. Step 1: Pre-Mitigated Risk Assessment

The following represents the risk assessment that is used to identify the risks associated with operation without any supplementary mitigation, and identify the type and nature of controls that are required to be applied to avoid unreasonable emissions of odour.

5.1.1. Pre-Mitigated Sensitivity of Receptors

The proposed site of the micro-brewery is 3/622 Newcastle Road, Leederville. The proposed site is currently located amongst mixed land uses. With reference to Section 2.1 ("*Existing Land Uses*") of the Department for Planning and Infrastructure (2008) *Leederville Masterplan (Carr Place Residential Precinct Study)* [4] the land at 622 Newcastle Street is currently zoned for commercial use, as illustrated by the red colouration in the map on the left in **Figure 1**.

Figure 1 Current (left) and Preferred (right) Land Uses (DPI, 2008)

[4] https://www.planning.wa.gov.au/dop_pub_pdf/planning_leederville_carr.pdf

Section 2.1 of DPI, 2008 also provides the following descriptors of that zoning:

"- *Commercial developments are predominantly on the southern side of Carr Place.*

- *Business types include showrooms, real estate agents, furniture manufacturing and vehicle repair workshops.*

- *A recent 3 storey (plus loft) mixed use development is on the corner of Carr Place and Newcastle Street.*

- *The majority of commercial buildings are single storey and semi-industrial in appearance with some modern developments.*"

Section 3.1 ("*Preferred Land Uses*") shows the land at 622 Newcastle Street as preferentially zoned for 'mixed use', as illustrated in the yellow coloration in the map on the right in **Figure 1**.

It is noted that the preferential land use map also shows an increase in the spread of 'high density residential use' south of Carr Street, which is located to the north of the proposed Project site.

Both the current and preferential land use maps show residential land uses to the east of the proposed development site along Loftus Street.

A desktop mapping exercise has been undertaken to identify proximate locations that might be considered to be sensitive to potential odour impacts. The following is not intended to represent a fully inclusive list of all locations, but provides a reasonable overview of the surrounding land uses. Corresponding with each land-use the sensitivity is provided on a scale of '*very high*' to '*negligible*', as defined in **Table 2**.

Table 5 Sensitivity of Receptors (Unmitigated)

Property	Address	Land use	Distance	Sensitivity
Sime Darby Australia Ltd	628 Newcastle Street	Serviced accommodation	20 m	High
Trinity Theological College	632 Newcastle Street	Education facility	50 m	High
Airspace	626 Newcastle Street	Education facility	<10 m	High
Central Kimberly Diamonds Ltd	1/620 Newcastle Street	Commercial premises	15 m	Medium
O'Connors Café	629 Newcastle Street	Food retail	50 m	High
Water Corporation	629 Newcastle Street	Offices	140 m	High
Residential property	11 Bold Close	Residential	35 m	High
Principal Academy of Dance and Theatre Arts	187 Carr Place	Education facility	45 m	High

5.1.2. Pre-Mitigated Impact Magnitude

In the context of the risk assessment methodology, the impact magnitude relates to the definitions presented in **Table 3**, and is described on a scale from *substantial* to *negligible*. The key considerations in the assessment of potential impact magnitude are:

- Assessing the potential odour emissions from the process to give rise to off-site impacts;
- Assessing the scale, frequency and duration of those process emissions.

The typical brewing process is briefly described in **Section 2.2**, and more detail may be derived from The Brewers of Europe (CBMC) (2002) - *Guidance Note for establishing BAT in the brewing industry*[5]. CBMC, 2002 addresses various environmental impacts from the brewing process, including odour:

> *"The largest source of odour emission from a brewery is the evaporation from the wort boiling.*
>
> *The main potential odour sources are:*
>
> - *Vapours from wort boiling*
> - *Wastewater treatment*
> - *Storage and handling of co- and by- products.*
> - *Oil storage.*
> - *Ventilation of beer cellars and packaging lines.*
> - *Stack emissions from the boiler house.*
>
> *The main reasons for odour nuisance are:*
>
> - *Location toward neighbouring areas.*
> - *No vapour condensing from work boiling.*
> - *Mal-operation of heat recovery system for the work boiling.*
> - *Storage of by-product during summer periods.*
> - *Content of sulphate in wastewater, which will cause malodours if the wastewater becomes anaerobic.*

The above appraisal is consistent with our own observations of odour emission potential from breweries in Australia, including odour management and assessment work on behalf of Schwartz Brewery at World Square, Sydney, Newcastle and the Hunter Valley. In all assessment works, the most significant source of odour generation was assessed as being from wort boiling.

The odour from wort boiling is typically not considered to be noxious, and is generally described as exhibiting a bread-like odour. In terms of the perception of the hedonic tone of odour from the work brewing process (the relative pleasantness-unpleasantness quality), Dravnieks, A., Masurat, T., & Lamm, R. (1984) *Hedonics of Odors and Odor Descriptors, Journal of the Air Pollution Control Association*, 34:7, 752-755, DOI: 10.1080/00022470.1984.10465810[6] describes a scale from *+4* (pleasant) through *0* (neutral) to *-4* (unpleasant).

[5] http://www.cerveceros.org/pdf/cbmcguidance-note.pdf

[6] http://dx.doi.org/10.1080/00022470.1984.10465810

The hedonic tone value (also called Dravnieks) associated with wort brewing is similar to that of a bakery, with a value of *+3.53* and correspondingly, the odour from wort brewing is generally considered to be pleasant in hedonic tone, relative to a range of other odours. However, it is noted that odour nuisance may be generated by the other factors described in **Section 3**, such as its frequency, duration and intensity.

Based upon the above, and our experience in assessing and managing odour from breweries, the following is considered to represent the potential for odour to be generated from the process. Given the proximity of current (and potential future sensitive land uses) the assessment has been performed on the assumption that odour must be controlled to not give rise to unreasonable odour at or beyond the site boundary:

Table 6 Impact Magnitude (Unmitigated)

Process	Comments and Application	Unmitigated Magnitude
Vapours from wort boiling	Unmitigated	Moderate
Wastewater treatment	Unmitigated	Slight
Storage and handling of co- and by- products.	Unmitigated	Slight
Oil storage.	Not applicable – no oil storage	Negligible
Ventilation of beer cellars and packaging lines.	Not applicable	Negligible
Stack emissions from the boiler house	Not applicable – no boiler house	Negligible

5.1.3. Pre-Mitigated Risk

Based upon the above, the pre-mitigated risk may be determined as:

Table 7 Risk (Unmitigated)

Sensitivity of Receptors		Impact Magnitude		Risk
Location	Assessment	Process	Assessment	
Various locations at and beyond site boundary	High	Vapours from wort boiling	Moderate	Intermediate
		Wastewater treatment	Slight	Intermediate / Minor
		Storage and handling of co- and by-products	Slight	Intermediate / Minor
		Oil storage	Negligible	Neutral
		Ventilation of beer cellars and packaging lines	Negligible	Neutral
		Stack emissions from the boiler house	Negligible	Neutral

Based upon the above, the most significant odour risk is determined to be from wort boiling vapours with an ***intermediate*** risk. As there is potential for residential land use encroachment towards the boundary of the site, the assessment has been determined at any location at or beyond the site boundary, and hence is assessed as being a *high* sensitivity location representing residential land uses.

Other less significant odour risks (assessed as being ***intermediate/minor***) are associated with:

- Wastewater treatment; and
- Storage and handling of co- and by- products.

5.2. Step 2: Odour Control and Management

5.2.1. Vapours from Wort Boiling

Reference is made to The Brewers of Europe (CBMC) (2002) - *Guidance Note for establishing BAT in the brewing industry*[7]. CBMC, 2002 makes the following recommendations for odour control:

> *"**5.6 Odour***
>
> ***5.6.1 Selection of Priorities***
>
> *The following subjects have been identified as being of priority in order to minimise the environmental impact of odour from the brewery:*
> - *Registration and follow up of odour complaints.*
> - *Assessment of activities that might cause odours e.g. by-product storage during the summer period.*
> - *Regular inspection and maintenance of containment measures in area that can cause odours e.g. oil tanks and wastewater installations*
>
> ***5.6.2 Potential BAT's***
>
> ***5.6.2.1 Heat Recovery from Wort Boiling***
>
> *By the condensation of vapours from the wort boiling the most significant odour source from the brewing process will be eliminated."*

If implemented and operated appropriately, the impact magnitude would be reduced from *moderate* to *negligible*. This is consistent with the recommendations for BAT as outlined above to eliminate the potential for odour, that is, control the potential emissions to derive a *negligible* magnitude generating a ***neutral*** risk irrespective of the sensitivity of the receiving environment. This is consistent with odour controls intended to derive no unreasonable odour beyond the site boundary.

[7] http://www.cerveceros.org/pdf/cbmcguidance-note.pdf

5.2.2. Wastewater Treatment

The brewing process often requires a significant volume of water as an ingredient in the brewing process. There is also a requirement for wash-down water which will require disposal. There will be no wastewater treatment on-site, but there will be a requirement for discharge to sewer. The connection and operation of discharge to sewer will be performed in accordance with the relevant City of Vincent policy(s).

From an odour control perspective, the discharge point will be controlled and direct, eliminating any potential for surface water pooling or run-off. Where the potential for spillages is significant, the transfer area will be appropriately bunded with adequate and appropriate drainage provided to eliminate surface pooling.

The drains will be maintained appropriately and in accordance with the requirements of the City of Vincent policy(s). If implemented and operated appropriately, the impact magnitude would be reduced from *slight* to *negligible*.

5.2.3. Storage and Handling of Co- and By- Products

The brewing process will generate a variety of co-products and by-products. A range of co-products will be generated that will include brewers grain and surplus yeast, packaging materials and general solid wastes, which may include:

- Malt and adjuncts
- Grains
- Carbon dioxide
- Yeast
- Glass cullets
- Waste products including
  - Kieselguhr sludge
  - Plastic containers
  - Paper

All raw materials will be stored in appropriate and suitable storage drums / containers, and spilled materials will be contained and cleaned up immediately.

In terms of waste materials, recyclable materials (including plastics, glass, paper etc.) will be separated from the waste stream for recycling. Some co-products and by-products may be re-used directly, including waste malt, malt dust, brewers grain and surplus yeast which may be used as animal fodder.

The handling and storage of raw materials, co-products and by-products will be performed in accordance with the relevant City of Vincent policy(s) and waste materials will be appropriately managed by an appropriate commercial waste contractor. If implemented and operated appropriately, the impact magnitude would be reduced from *slight* to *negligible*.

5.2.4. Odour Management

Modular Brewing will operate an odour complaints procedures which will, as a minimum, record the number and details of complaints received regarding the environmental impacts and any action taken in response to the complaint.

The odour complaint procedure and associated complaint forms will be maintained in a proper fashion by Modular Brewing, and will be made available for inspection by Council upon request.

An example odour complaint record form is provided in **Appendix B**.

5.3. Step 3: Post-Mitigated Risk Assessment

The post-mitigated risk assessment represents the assessment of the operation of the microbrewery with the implemented odour controls and management procedures outlined above in **Section 5.2**. Based upon the above, the post-mitigated risk (sometimes termed the 'residual risk') may be determined as follows:

Table 8 Risk (Mitigated)

Sensitivity of Receptors		Impact Magnitude		Risk
Location	Assessment	Process	Assessment	
Various locations at and beyond site boundary	High	Vapours from wort boiling	Negligible	Neutral
		Wastewater treatment	Negligible	Neutral
		Storage and handling of co- and by-products	Negligible	Neutral
		Oil storage	Negligible	Neutral
		Ventilation of beer cellars and packaging lines	Negligible	Neutral
		Stack emissions from the boiler house	Negligible	Neutral

On the assumption that the odour control measures and odour management practices outlined above in **Section 5.2** are implemented, the pre-mitigated risks are reduced by controls associated with the impact magnitude. For all operations, the impact magnitude may be reduced to negligible with appropriate controls, and the resultant risks are determined as ***neutral***.

Of note, the above assessment has been considered on a small-scale micro-brewery with a capacity of 1,000 L per week. As discussed, the initial capacity will be limited to 400 L per week, and it is considered this would offer Council further confidence that effective odour controls may be demonstrated to be achieved at a lower capacity.

5.4. Cumulative Impacts

An important consideration for odour assessment is the consideration of cumulative impacts, that is, how the emissions may combine with other off-site emissions to create a combined effect. In terms of odour management, odour can only be considered to have a cumulative effect when the odour emissions are sufficiently similar to be undifferentiable as an off-site observation.

It is noted that the Project site is located proximate to the Strange Grains Gluten Free Bakery. The location of the Project site and that of the bakery is illustrated in **Figure 2**.

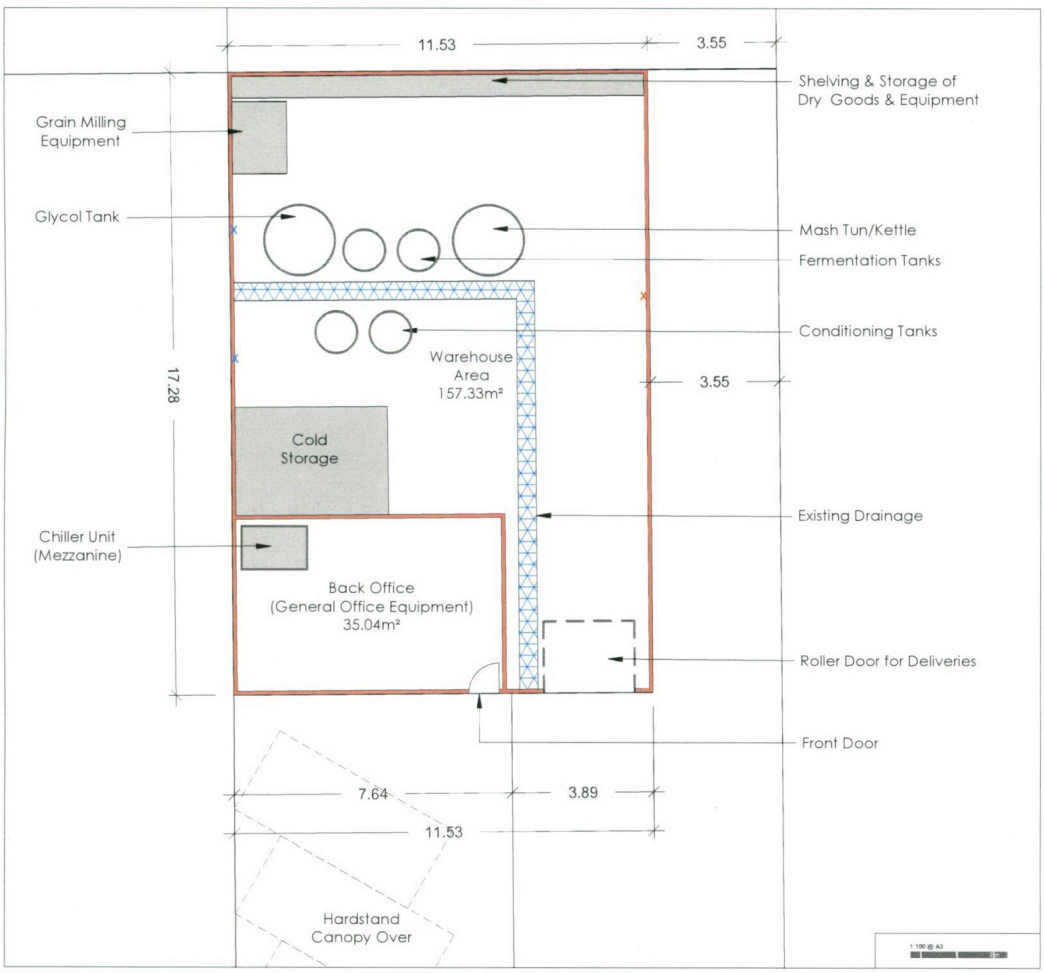
Figure 2 Proximity of the Bakery

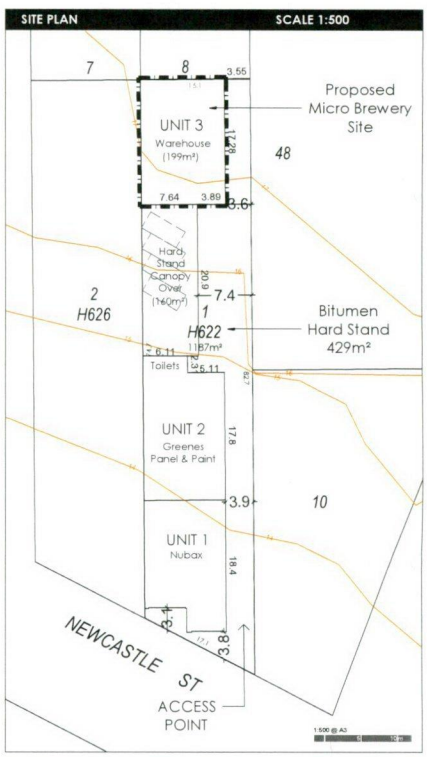
As discussed previously (see **Section 5.1.2**), odour from the brewing process is often described as exhibiting similar qualities to a bakery and as such it is reasonable to conclude that the two commercial properties may give rise to cumulative odour impacts.

The risk assessment conducted has sought to offer effective odour management at the site boundary. This has been performed as there is potential for future changes in land use to bring residential properties closer to the Project site, and as such unreasonable emissions of odour must be contained on site through design and operational control.

Based upon the implementation of the above odour controls, it is therefore considered that the cumulative odour impacts with the bakery are minimal. Notwithstanding the above, due to the similarity of emissions between the brewery and the bakery, it is imperative that the micro-brewery housekeeping standards are adequately implemented and the odour complaint procedure is implemented effectively.

APPENDIX A – PROPOSED MICROBREWERY LAYOUT





LEGEND

- PROPOSED MICRO BREWERY SITE
- HARDSTAND
- X WATER SOURCE
- X 3 PHASE POWER SOURCE
- OFF STREET PARKING BAYS (4) (Exclusive Use)
- EXISTING FLOOR PLAN

URBIS

PROPOSED MICRO-BREWERY LAYOUT

LOT1 (622) NEWCASTLE STREET, LEEDERVILLE

Level 14, The Quadrant, 1 William Street | Perth WA 6000 Australia | +61 8 9346 0500 | URBIS Pty Ltd | ABN 50 105 256 228

DATA SOURCE: WATER CORPORATION
PROJECTION: MGA94, Zone 50

REV DESCRIPTION | DWN CHK DATE

DISCLAIMER

CLIENT

PROJECT NO: PA1394
DATE: 12.05.17
DRAWING NO: 01
REVISION: a
SET DRAWING SCALE

APPENDIX B – ODOUR COMPLAINT FORM

Odour Complaint Form

northstar
Air Quality

Contact details	
Date and time complaint received:	
Name & address of complainant:	
Telephone number of complainant:	

Complaint details			
Odour start date & time:	/ / : am pm		
Odour stop date & time:	/ / : am pm		
Location of the odour:			
Description of the odour:			
Persistence: *see note 1*	☐ Constant ☐ Intermittent		
Intensity: *see note 2* ☐ generally ☐ at its worst	☐ 6 Extremely strong ☐ 5 Very strong	☐ 4 Strong ☐ 3 Distinct	☐ Weak ☐ Very weak

Prevailing weather conditions at the time of the complaint	
Description: (dry, rain, windy, still etc)	
Temperature:	
Wind direction: *see note 3*	
Wind strength: *see note 4*	

Operational details, actions and resolution	
Operations during odour complaint:	☐ Operating ☐ Not operating
Identified causes:	
Actions taken:	
Cause resolved:	☐ Yes ☐ No
Follow up required:	☐ Yes ☐ No
Complainant informed of outcome:	☐ Yes ☐ No
Signed:	
Date:	/ /

northstar air quality pty ltd
level 40 | 100 miller street | north sydney | nsw 2060 abn: 52 609 741 728
phone: +61 (02) 9931 7870 | fax: +61 (02) 9931 6888 www.northstarairquality.com

Odour Complaint Form (notes)

1. **Persistence**. Please record the descriptor value that best describes the extent of the observation

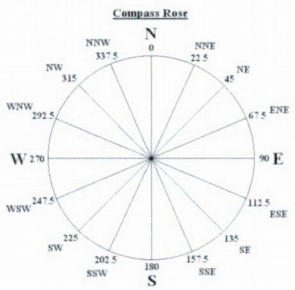
   A. Constantly between the specified times

   B. Intermittently between the specified times

2. **Odour Intensity**. Using the provided scale, estimate how intense the odour was generally or at its worst:

6	Extremely strong	3	Distinct – this is the recognition threshold
5	Very strong	2	Weak
4	Strong	1	Very week

3. **Wind Direction.** Please record the predominant wind direction ('blowing to') during the specified times.



4. **Wind Strength**. Please note the numerical value (Beaufort Scale) representing wind strength, or record the wind speed if known.

Description		Observation	kph	$m \cdot s^{-1}$
0	Calm	Smoke rises vertically	<1	0.45
1	Light air	Direction of wind shown by smoke drift, but not wind vane	1-5	0.45-1.34
2	Light breeze	Wind felt on face; leaves rustle, ordinary vane moved by wind	6-11	1.79-3.13
3	Gentle breeze	Leaves and small twigs in constant motion	12-19	3.58-5.36
4	Moderate breeze	Raises dust and loose paper; small branches are moved	20-28	5.91-8.05
5	Fresh breeze	Small trees in leaf begin to sway, small branches are moved	29-38	8.49-10.73
6	Strong breeze	Large branches in motion; umbrellas used with difficulty	39-49	11.18-13.86
7	Near gale	Whole trees in motion; inconvenience felt when walking against wind	50-61	14.30-16.99

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