Amendment Report

Application for Licence Amendment

Part V Division 3 of the *Environmental Protection Act 1986*

Licence Number	L8983/2016/1
Licence Holder	T & J.J Nominees Pty Ltd
ACN	165 696 908
File Number	DER2016/001332-1
Premises	White Lakes Brewing 1441 and 1447 Mandurah Road, BALDIVIS WA 6171 Legal description – Lot 71 on Diagram 90934 and Lot 2 on Diagram 31973.
Date of Report	14/02/2024
Decision	Revised licence granted

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Licence L8983/2016/1 is held by T & J.J Nominees Pty Ltd (the licence holder) for White Lakes Brewing (the premises), located at 1441 and 1447 Mandurah Rd, Baldivis, WA (being Lot 71 on Diagram 90934 and Lot 2 on Diagram 31973).

This Amendment Report documents the assessment of potential risks to the environment and public health from proposed changes to the emissions and discharges during the operation of the premises. As a result of this assessment, revised licence L8983/2016/1 has been granted.

2. Scope of assessment

Regulatory framework

In completing the assessment documented in this Amendment Report, the department has considered and given due regard to its Regulatory Framework and relevant policy documents which are available at https://dwer.wa.gov.au/regulatory-documents.

Application summary

On 19 September 2023, the licence holder submitted an application to the department to amend licence L8983/2016/1 under section 59 and 59B of the *Environmental Protection Act 1986* (EP Act) for White Lakes Brewing. The following amendments are being sought:

1. Increase production throughput of alcoholic beverage produced per annum from 1,000 kL to 1,800 kL.
2. The installation and operation of additional fermentation tanks (4 x 12,500 L) and bright beer tanks (2 x 15,000 L).
3. Establish a new irrigation area on Lot 2, changing the irrigation area from 0.3985 ha to 1 ha.
4. The installation of an additional 25,000 L treated effluent storage tank (located in series with the original 25,000 L effluent storage tank on Lot 71) and an additional 50,000 L irrigation tank (located on Lot 2 adjacent to the new irrigation area).

Background

White Lakes Brewing is currently situated on Lot 71 (10,882 m^2) and the newly acquired Lot 2 (20,230 m^2), located approximately 1 km west of the town of Baldivis. The brewery was constructed under works approval W5919/2015/1 issued on 11 January 2026, with a licence issued on 6 December 2016 and a licence amendment issued on 26 October 2016 to increase the irrigation area.

Current brewing operations are conducted using a 2,500 L brew system comprising of a lauter tun, kettle, whirlpool tank, brewing water storage tanks, ten 5,000 L fermenter tanks, four 2,000 L bright beer tanks.

The brewery is seeking to increase production through the addition and operation of additional fermentation tanks (4 x 12,500 L) and additional bright beer tanks (2 x 15,000 L). As per the application supporting document, these were installed prior to the submission of the amendment application. With the additional production tanks, the brewery is seeking to increase the assessed alcoholic beverage production throughput from 1,000 kL/annual period annum to 1,800 kL/annual period.

The premises has an on-site wastewater treatment plant (WWTP) which treats brewery wastewater using a Moving Bed Bioreactor (MBBR). The treated wastewater is then stored in a 25,000 L effluent tank to be irrigated to land via a pop-up sprinkler irrigation system. Previous amendments have seen the wastewater irrigation area increase from 1,025 m^2 to

3,985 m^2 and maximum daily irrigation to land flow from 3 kL/day to 15 kL/day to meet the increased wastewater generation from increasing beer production.

History of non-compliance and previous site inspections undertaken during the last 5 years are summarised below in Table 1.

Table 1: Summary of compliance inspections and history

Instrument	Event	Findings
L8983/2016/1	Alleged unlawful land clearing and unlicensed irrigation to land leading to a site visit 2022.	The premises was visited by DWER's compliance officers on 23/09/2022 in response to alleged land clearing of 0.256 ha on 1 ha of land and unlicensed wastewater irrigation to land. Native vegetation rated the complexity of environmental impacts as "high" risk due to the proximity with a Bush forever site. Aerial imagery found evidence of irrigation infrastructure being built on the adjacent lot to the tavern which had not been authorized. The investigation found no evidence of unlawful discharge. The investigation into alleged clearing is still ongoing.
	Annual Audit Compliance Report (AACR) 2018-2019	The following non-compliance were identified by the licence holder: • The soil monitoring data was not collected within the timeframe for the reporting period. Soil testing has been commissioned and the results will be provided as soon as analysis is complete.
	AACR and AER 2020-2021	The following non-compliance were identified by the licence holder: • A Winter Irrigation Management Plan, required by condition 3 of L8983/2016/1 was not submitted to the CEO by 28 February 2021. • Deterioration in bacterial health had reduced the denitrification capacity of the WWTP, resulting in Total Nitrogen concentration that exceeded the limit in Condition 2.
	AACR 2021-2022	The following non-compliance were identified by the licence holder: • Total inorganic nitrogen level was above the concentration limit for emission to land. .
	AACR 2022-2023	The following non-compliance were identified by the licence holder: • Exceedances of reactive phosphorous limits in November and December sampling and exceedances of inorganic nitrogen limits in December and January sampling.

Operational aspects

2.1.1 Production throughput and additional infrastructure

The current assessed annual production throughput is <1,000kL of beer produced per annual period, however the licence holder anticipates an increase in demand and this application seeks to increase annual beverage production through the installation of additional brewery infrastructure. The licence holder seeks to amend the assessed annual production throughput to a maximum of 1,800kL of beer.

Operation of the brewery will continue in the current facility with only the addition of fermentation tanks (4 x 12,500L) and bright beer tanks (2 x 15,000L).

The licence holder anticipates that the proposed 1,800 kL per annum of beverage production will generate approximately 3,600 kL of associated wastewater. This is at a 2:1 wastewater to beer ratio which is based on the ratio reportedly achieved in the 2021-2022 production period. In the previous reporting period of 2020-2021 the ratio was at 3:1 (1,650 kL: 512 kL) and in 2022-2023 there was a ratio of 1.2:1 (757 kL: 627 kL) (Accendo 2023a; Accendo 2023b). This change may indicate increased efficiency in their wastewater practices. Based on this range of previous ratios achieved, at maximum production capacity the wastewater produced could

range from 2,160 kL to 5,400 kL.

2.1.2 Relocation of irrigation area to newly acquired property.

The proposed increase in wastewater generation is expected to raise the demands on the hydraulic and nutrient loading of the current irrigation area. To accommodate for the predicted increase in wastewater production, the licence holder has requested to move the irrigation area from Lot 71 (0.3985 ha) to Lot 2 (1 ha) increasing the available area for irrigation by ~0.6 ha. The irrigation field will be vegetated using Kikuyu grass which was chosen by the licence holder due to its appearance and ability to uptake nutrients.

Kikuyu grass has its lowest growth rates during mid-winter and highest during mid-summer. During winter the uptake of nutrients and water by kikuyu is significantly decreased from slower growth rates (Rumball 1991). The slow growth rates of kikuyu during winter will not mitigate the risk of nutrients migrating below the rootzone into the groundwater and leaching off-site. Thus, there is a requirement for sufficient winter storage of wastewater.

2.1.3 Wastewater management/storage

The Licence Holder has applied to increase annual production throughput from 1,000 kL to 1,800 kL increasing the annual volume of wastewater generated at the premises from 3,000 kL to 5,400 kL based on a 3:1 ratio of wastewater to beverage produced. The proposed increased wastewater volume is close to the maximum annual treatment capacity of the WWTP of 5,475 kL. With the addition of the proposed wastewater storage tanks, the premises will have 146 kL of storage (currently two existing 23 kL raw wastewater tanks, and 25 kL treated wastewater tank, with a proposed 50 kL treated wastewater irrigation tank and 25 kL treated wastewater tank). The licence holder states this can last a maximum of 8 days of production at a rate of 15 kL/day, as irrigation occurs in the morning and wastewater treatment throughout the day allowing at least 15 kL of treated wastewater in the storage.

In winter (June – August), Perth on average experiences ~ 15 days of rain in each month. In considering existing licence conditions, irrigation can only occur 15 days each month during June to August (BOM 2023a) when rain does not occur. In 2021, Perth recorded 17 consecutive days of rainfall which is more than double the days of proposed wastewater storage (BOM 2023b). To determine the amount of winter storage required, a review of the rainfall above 2 mm occurring from June to August between 2019-2023 was used to calculate the maximum amount of storage required. It was calculated that storage in 2021 and 2022 was insufficient with 2021 requiring 225 kL. Indicating that the existing storage of 146 kL is insufficient (see Appendix 3) and requires an additional 79 kL of wastewater storage.

The Delegated Officer considered the distance to the conservation Lake Walyungup, that irrigation is proposed during winter, that the licence holder only proposes 8 days' worth of storage, and that rainfall can occur at least 17 days consecutively, and determined that an additional 79 kL of winter storage for treated wastewater is required for the department to approve this application.

Licence holder to note that the approval of this amendment application (increase in production and relocated disposal area) is contingent on additional treated wastewater storage being installed. A minimum additional 79 kL is required to be installed before the winter rainfall period i.e by 30 June 2024.

2.1.4 Irrigation of brewery wastewater to land

The licence holder has proposed increasing the irrigation area would allow for higher irrigation volumes while not exceeding nutrient loading limits outlined in the existing licence. As total wastewater irrigation to land increases, so will the nutrient and water loading to soil, and if unmanaged can leach to groundwater. Exceeding the hydraulic loading of the soil can cause surface runoff into the nearby Lake Walyungup or to the nearby threatened ecological

community containing Tuart trees and other vulnerable flora and fauna.

The risks associated with the increase in production can be separated into the following three potential risk events: exceeding nutrient loading of soil, exceeding hydraulic loading of soil, and surface runoff of irrigated water.

How soil and groundwater will be affected by irrigation is dependent on its ability to withstand the increased loading of water and nutrients. The following will assess the risks associated with the new irrigation area based on the information provided by the licence holder and additional information.

Hydraulic loading

An important factor in determining if an area of land is sufficient for irrigation is by calculating the hydraulic load. This can indicate if the irrigation of wastewater is able to be adequately taken up by vegetation or meditated in the soil profile to a level in which it does not cause seepage into groundwater or surface runoff into nearby receptors. A hydraulic loading test can be used in determining the area of land suitable using the following equation (US EPA, 2006). Results are summarised in Appendix 2.

Two scenarios were calculated, one using a generic pasture hydraulic loading rate of 4 cm/week and a generic forest loading rate of 2.5 cm/week with an irrigation flow rate of 15 m^3/day. The period of irrigation is 35 weeks of the year which excludes periods in which rainfall exceeds evaporation (May to August). This formula can also be re-arranged to determine the maximum flow rate of treated wastewater that can be applied to the irrigation area (1 ha) without exceeding the carrying capacity from the hydraulic loading. Even under a conservative approach, the land required at the current irrigation flow rate is 0.626 ha and a maximum flow rate of 23.97 kL/day producing a maximum total annual irrigation of 6,233 kL. In a scenario using these assumptions the proposed land area and flow rate are deemed to be sufficient for hydraulic loading.

In Perth, Western Australia, most of the rainfall occurs between May to September each year. Notedly rainfall exceeds evaporation generally from May to August each year. When rainfall exceeds evaporation, less water is removed from the soil profile, eventually leading to saturated soils. During this period, the superficial groundwater rises and can become exposed to the surface, saturate the root zone or be close to the surface (within 1.5 m). Actively growing vegetation during winter may provide some uptake of water within the root zone, however, the proposed kikuyu pasture has low growth rates in winter with limited uptake of water and nutrients. Therefore, irrigation of wastewater during winter to a slow growing kikuyu pasture will not uptake most of the nutrients applied, allowing nutrients to be flushed and moved past the root zone and potentially contaminating groundwater.

The delegated officer has determined that irrigation restrictions for treated wastewater during winter and rainfall events will be applied to prevent the leaching of nutrients through the soil profile or overland flow to Lake Walyungup.

Nutrient loading and nutrient uptake

Calculations to determine the irrigation area required to accommodate the nutrient loading at maximum irrigation flow rate were undertaken. Calculations were completed using the formula outlined in the NSW guidelines for the irrigation of domestic wastewater (NSW EPA, 1998). The results are summarised in Appendix 2.

Calculations considered that wastewater processing occurs 5 days a week or 260 days annually throughout the year (this excludes Christmas shutdown where duration is unknown). At 15 kL/day of wastewater produced the maximum wastewater treatment is 3,900 kL. At the maximum beverage production throughput of 1,800 kL the ratio of wastewater to beverage is 2.17:1 (3,900 kL:1800 kL). If this ratio is exceeded, then the wastewater treatment facility will be overloaded and may produce higher nutrient concentrated wastewater.

The critical loading rate describes the ability of vegetation to uptake these nutrients before they leave the root zone which for perennial pastures for nitrogen varies between 18 to 36 mg/m^2/day and for phosphorous 2 to 4 mg/m^2/day. The nutrient concentration values used in the equation were annual averages based off the most recently submitted 2022 - 2023 annual environmental report (Accendo 2023a). Using these values and taking a conservative critical loading approach for nitrogen and phosphorous values of 18 mg/m^2/day and 2 mg/m^2/day respectively, the area of land required for nutrient loading was 0.72 ha for nitrogen and 0.59 ha for phosphorus making the area sufficient.

In determining the nutrient loading rate of the proposed irrigation lot, the formula can be rearranged. Two approaches were taken one using a conservative approach of annual maximum wastewater produced (5,475 kL) and one of the approximate “true maximum” wastewater processing using information provided by the licence holder (3,900 kL). The results for the total loading for nitrogen is 475.78 kg/ha/year and 338.91 kg/ha/year and for phosphorus is 43.25 kg/ha/year and 30.81 kg/ha/year respectively.

The licence holder stated kikuyu grass will be planted throughout the irrigation area for nutrient uptake. Calculations were undertaken to determine the potential annual nutrient uptake from the management of the kikuyu grass. Calculations were based on data provided by the licence holder, estimating an average percentage of nitrogen and phosphorous content to be 4.1% and 0.28% (Fulkerson et al. 2010). Studies into average biomass harvested per year was 12 t/ha, this data includes the entirety of Australia and may not be the most accurate representation of Western Australian conditions (Garcia et al. 2014). Additionally, these yield values were taken from pastures with proper management strategies, without these in place the annual weight harvested would be lower. Calculations found that the nutrient off-take for nitrogen and phosphorus was 500.2 kg/ha/year and 34.16 kg/ha/year.

Following a conservative approach of maximum irrigation processed, the amount of phosphorous irrigated to land was found to be in excess of what could be exported from the site through the harvesting of kikuyu grass. This indicates that without additional nutrient removal occurring in the soil, the remaining nutrients will leach to groundwater. This risk is increased in the winter months when the uptake of water by kikuyu grass is lower as it enters a period of dormancy. Under a “true maximum” wastewater processing approach the uptake of nitrogen and phosphorous from kikuyu grass was found to be greater than the application from irrigation. This deems that at current nutrient values the load nutrients are insufficient for uptake.

Phosphorus retention index (PRI) data was submitted by the licence holder which showed soils along the 4 sampled transects all had PRI results described as weakly absorbing ranging from 0 – 0.489. This increases the risk of phosphorous infiltration through soil and leaching to groundwater. Kikuyu grass may act as a buffer in preventing phosphorus contamination via the uptake of wastewater, but considering the results above, leaching of phosphorous to groundwater is likely. This risk increases during the winter months when groundwater is closer to ground level and the grasses' water (and nutrient) uptake needs are satisfied by rainfall.

Surface runoff

The premises is located adjacent to the boundary of Lake Walyungup which makes the risk of surface runoff into the system a potential risk. The proposed irrigation lot is ~140m from the lake boundary. Upon analysis of the slope using elevation data there’s a max slope of ~20% towards the lake, which increases the potential risk of surface runoff. The soil composition being predominately sand decreases the risk of surface runoff in warm months due to a high infiltration rate, but in winter months when rainfall exceeds evaporation the risk increases.

In addition to Lake Walyunup is the nearby threatened ecological community containing Tuart trees and other native flora which may be sensitive to sudden changes in soil nutrient content. The licence holder stated they have up to 8 days of storage which may be sufficient in storing wastewater during winter months, but more storage would be needed in the likelihood of a

prolonged rainfall event.

The delegated officer considered:

- **the distance to conservation Lake Walyungup,**
- **the potential that groundwater will peak within 1.5 metres below ground level,**
- **that rainfall exceeds evaporation and pasture requirements from May to August,**
- **the dormancy of the proposed irrigated kikuyu pasture in winter, and**
- **the lack of treated wastewater storage over winter,**

and determined that treated wastewater must be stored, when rain is imminent, falling and 12 hours after a rainfall event greater than 2mm and/or when irrigation is waterlogged or has water pooling on the surface, and that an additional 79 kL of storage tank(s) must be installed for the storage of treated wastewater during periods of irrigation restriction.

3. Risk assessment

The department assesses the risks of emissions from prescribed premises and identifies the potential source, pathway and impact to receptors in accordance with the *Guideline: Risk assessments* (DWER 2020).

To establish a risk event there must be an emission, a receptor which may be exposed to that emission through an identified actual or likely pathway, and a potential adverse effect to the receptor from exposure to that emission.

Source-pathways and receptors

3.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operation which have been considered in this Amendment Report are detailed in Table 2 below.

Table 2 also details the proposed control measures the licence holder has proposed to assist in controlling these emissions, where necessary.

Table 2: Licence holder controls

Emission	Sources	Potential pathways	Proposed controls (from application)
Increase in volume of treated wastewater irrigated to land from increased beverage production resulting in an increased nutrient and hydraulic loading	Wastewater treatment system with maximum treatment capacity of 15 kL/day of wastewater	Direct discharge to land Infiltration to soil and groundwater Overland surface water runoff	• No irrigation of wastewater during days when rainfall occurs. Approximately 8.7 days' worth of wastewater storage is available on the event of multiple rainy days. • Using a pop up sprinkler system in a 10m by 10m grid, irrigated water will be spread evenly over the irrigation lot. Sprinklers located on the boundary of the premises are facing inwards to the property preventing irrigation does not occur off the site boundary. • A maximum of 15 kL will be irrigated to land each day. • Annual monitoring of soil along three transects within new irrigation area. • Two additional monitoring bores and groundwater monitoring to detect any significant changes in nutrient concentrations

Emission	Sources	Potential pathways	Proposed controls (from application)
			that may indicate contamination. • Planting and management of kikuyu grass on irrigation lot to take up water and nutrients. *Note: The licence holder has not provided detailed descriptions of the grass management or the tonnages of biomass that can be removed from the irrigation area*
Odour	Brewing and wastewater treatment and disposal (Irrigation)	Air/windborne pathway	• Wastewater is treated by an MBBR system decreasing the overall organic matter from the effluent. • MBBR is enclosed within a shipping container and effluent is transferred via pipes to storage tanks. • Production of alcoholic beverage occurs inside an enclosed building.
Spills, leaks or overtopping of wastewater tanks	Wastewater treatment storage	Infiltration to soil and groundwater	• The licence holder has not mentioned any controls to mitigate the risk of wastewater tanks overtopping • Tank in the WWTPs are on concrete/bitumen hardstand

3.1.2 Receptors

In accordance with the *Guideline: Risk assessments* (DWER 2020), the Delegated Officer has excluded employees, visitors and contractors of the licence holder's from its assessment. Protection of these parties often involves different exposure risks and prevention strategies and is provided for under other state legislation.

Table 3 below provides a summary of potential human and environmental receptors that may be impacted because of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental siting* (DWER 2020)).

Table 3: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	Distance from prescribed activity
Residential premises	Immediately adjacent to the premises boundary
Environmental receptors	**Distance from prescribed activity**
Lake Walyungup (salt lake) - Conservation category wetland, located within the boundary of a threatened ecological sites buffer	Eastern edge of lake bed is approximately 200 m west of proposed irrigation area Remnant wetland fringing vegetation is approximately <100m west of the premises boundary.
Groundwater	Monitoring of the premises with two groundwater bores on 9 December 2019 recorded standing water levels of 2.16 metres below ground level (m bgl) along the western perimeter (bore MB2) and 9.46 m bgl along the eastern perimeter (bore MB1), indicating a groundwater flow west toward Lake Walyungup. Groundwater is likely to peak in September and be within 1.5

	metres of the surface.
Rights in Water and Irrigation Act 1914 (RIWI Act) proclaimed Rockingham – Stakehill groundwater area	The premises is located within the defined Outridge subarea, immediately adjacent to the Cooloongup subarea, of the proclaimed Rockingham - Stakehill groundwater area. These subareas include several large lakes and other swamps and wetlands, including Lake Walyungup.
TEC/PEC	The wastewater disposal area is located on land listed as a threatened ecological community containing Tuart Trees or other vulnerable flora/fauna.
Soil	Site investigations in the Lot 2 irrigation area have identified fine to medium grained sands up to 1.5 m bgl with a high infiltration rate and weak phosphorus-adsorbing capacity (STATS 2022). Across all test pits in and outside the irrigation area found soil to be consistent with fine to medium grained sand from 0 – 1.5 mbgl. From monitoring at bore log for MB1 reported sand from 0 – 6 m bgl and tamala limestone from 6 – 14 m bgl, while the bore log for MB2 identified fine sand to 4 m bgl with grey clay from 1 – 4 m bgl and limestone from 4 m bgl. The licence holder has commissioned soil testing to identify phosphorus retention index (PRI) values and in-situ soil permeability tests to investigate the ability of the soils to limit leaching of phosphorus to groundwater. The results indicated that soils beneath the proposed irrigation area are 'weakly absorbing' (PRI values from 0 – 0.489). Infiltration was calculated to be 3.67 m/day which may result in water reaching the groundwater table of approximately 9.5 m bgl in less than three days at the proposed irrigation site. Based on a root zone depth of 1.5m for kikuyu grass, it would take approximately 0.4 days for wastewater to leave the root zone.

Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for those emission sources which are proposed to change and takes into account potential source-pathway and receptor linkages as identified in Section 0.1 Where linkages are in-complete they have not been considered further in the risk assessment.

Where the licence holder has proposed mitigation measures/controls (as detailed in Section 0.1), these have been considered when determining the final risk rating. Where the Delegated Officer considers the licence holder's proposed controls to be critical to maintaining an acceptable level of risk, these will be incorporated into the licence as regulatory controls.

Additional regulatory controls may be imposed where the licence holder's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 4.

Table 4. Risk assessment of potential emissions and discharges from the premises during operation.

Risk Event					Risk rating C = consequence L = likelihood	Licence holder controls sufficient?	Conditions of licence	Reasoning	Additional regulatory controls
Source/ Activities	**Potential emissions**	**Potential pathways and impact**	**Receptors**	**Licence holder controls**					
Operation of additional WWTP storage and processing tanks: • 25,000L treated effluent storage tank • 50,000L treated effluent irrigation tank	Odour	Air / wind dispersal of odour interfering with the welfare, convenience, comfort, or amenity of nearby residents.	Residential premises immediately adjacent to premises boundary and surrounding areas	*No specific controls proposed*	***C = Minor*** ***L = Rare*** ***Low risk***	*Yes*	*Conditions:* *1-2.*	Due to the lack of historical complaints from nearby residents no additional controls are required.	- Addition of a high-level alarms in all wastewater tanks to prevent overfill.
	Treated wastewater with elevated concentrations of chemicals, nutrients, salts (TDS) and BOD	Discharge from tanks or pipes because of overtopping, spills or leaks: • Excessive hydraulic loading causing seepage of wastewater past the root zone to groundwater. • Excessive nutrient loading causing soil and groundwater contamination. Soil and groundwater contamination may result in adverse impacts to TEC health. Migration of contaminated groundwater off-site causing adverse impacts to ecosystem health at Lake Walyungup.	Groundwater (approx. 2 to 9.5 m bgl beneath premises area) Lake Walyungup (fringing vegetation ~30 m west of premises boundary)	*Refer to section 3.1*	***C = Minor*** ***L = Unlikely*** ***Medium risk***	*No*		The Delegated Officer considered the distance to the sensitive environmental receptors, the high groundwater table, the location of the WWTP tanks on a concrete/bitumen hardstand on Lot 71 and the irrigation tank on Lot 2 and that the Licence Holder has not provided controls to management overtopping events. The delegated officer considers the Licence Holder controls to be insufficient, determining that the risk of spills, leaks and overtopping events contaminating soils and environmental receptors is medium. The Delegated Officer has determined the lack of controls for the prevention of spills, leaks, and overtopping and considered it necessary to specify the following: • High level alarms to be installed in all wastewater storage tanks.	
Increased irrigation to land due to increased maximum production throughput from 1000 kL to 1800 kL Movement of Irrigation area from Lot 71 to Lot 2.	Increased volume (up to 15 kL/day) of treated wastewater with elevated nutrient content irrigated to lawn.	Direct discharge to land: • Excessive hydraulic loading causing seepage of wastewater past the root zone to groundwater. • Excessive nutrient loading causing soil and groundwater contamination. Soil and groundwater contamination may result in adverse impacts to TEC health. Migration of contaminated groundwater off-site causing adverse impacts to ecosystem health at Lake Walyungup.	Lake Walyungup (fringing vegetation ~30 m west of premises boundary) Possible TEC (Tuart - *Eucalyptus gomphocephala)* within premises boundary covering irrigation area	*Refer to section 3.1*	***C = Moderate*** ***L = Possible*** ***Medium risk***	*No*	*Conditions:* *1 – 12. 18.*	The Delegated Officer has considered that irrigated wastewater uptake by the proposed kikuyu pasture during winter is minimal, rainfall exceeds evaporation from May to August, soil properties have high infiltration rates and low phosphorous retention, and the groundwater is likely to peak within 1.5 metres below the surface and that the Licence Holder has insufficient treated wastewater storage. The Delegate Officer considers the current controls proposed by the Licence Holder to be insufficient to mitigate the risk of excessive winter hydraulic and nutrient loading and assesses the risk as medium. The Delegated Officer determined that the current and proposed effluent storage is insufficient to manage irrigation in winter rainfall periods and determined to add additional storage as a regulatory control to manage the risk of excessive hydraulic loading and leaching of nutrients to sensitive environments. An additional 79 kL of winter storage is required. Furthermore, the Delegated officer has determined to add irrigation restrictions including no irrigation around rainfall events greater than 2 mm, and when water logging is visible, with wastewater exceeding storage and irrigation requirements being transported offsite by a licensed wastewater carrier. The Licence Holder did not provide details (plan) of pasture management to demonstrate that adequate nutrient removal is occurring. The Delegated Officer determined to condition the requirement for monthly harvesting and recording of biomass to demonstrate nutrient removal throughout the year. The Delegated Officer revised the wastewater and soil monitoring adding additional parameters to monitor for soil health and wastewater quality impact on receiving environments. This includes revision of annual loads, and wastewater quality limits The Delegated Officer notes the Licence Holder has proposed two locations for wells monitoring one in the irrigation area on the eastern premises boundary and one directly in line with that on the western side of the premises boundary. The Delegated Officer considers these well locations to be acceptable, however, has determined to condition the installation and monitoring of additional two wells. One on the southern side of the irrigation boundary and one on the western side. The southern monitoring well is due to the existing premises being on or near a TEC containing threatened flora and fauna. The western monitoring well is to determine the direct effect of irrigation on groundwater quality. To ensure monitoring wells are installed to meet operational requirements installation requirements have been added to the licence. Due to the high slope and nearby sensitive receptors, irrigation should not be undertaken during winter rainfall or at a rate where wastewater runs off the disposal area either by surface runoff or through percolating below the root zone into groundwater.	- 79 kL treated wastewater storage. - Excess wastewater to storage/ irriigation requirements is trucked offsite. - Two additional monitoring bores. - pH, and SAR and EC added to limit emissions to land. - Electrical conductivity, total suspended solids, and potassium parameters added to emission to land monitoring. - Soil sampling for SAR Installation requirements and compliance reporting for proposed infrastructure and monitoring wells.

Note: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk assessments* (DWER 2020).

4. Consultation

Table 5 provides a summary of the consultation undertaken by the department.

Table 5: Consultation

Consultation method	Comments received	Department response
Joondalup City Local Government Authority advised of proposal on 17 October 2023.	None received.	N/A
Department of Health advised of proposal on 17 October 2023.	The Department of Health responded on 2 November 2023 and stated there was no issues with the proposed amendment.	N/A
Licence holder was provided with draft amendment on 21 December 2023 and 24 January 2024	The licence holder responded on 16 January 2024 and on 12 February 2024 requesting that the amendment be granted.	Refer to Appendix 1

5. Decision

Based on the assessment in this Amendment Report, the Delegated Officer has determined that a revised licence to grant amendments to increase alcoholic beverage production to 1,800 kL, install and operate fermentation and bright beer tanks, establish a new 1 ha irrigation area and treated effluent storage and irrigation tank to L8983/2016/1 does not pose an unacceptable risk of impacts to sensitive receptors. This determination is based on the following:

- High quality treated wastewater by the wastewater treatment plant.
- Concrete below the newly installed fermentation, bright beer, and treated effluent storage tanks preventing direct infiltration to soil if leaks or overtopping occurs.
- Monitoring of wastewater, soil and groundwater to detect any significant changes in nutrient concentrations that may indicate contamination.
- Low loading of wastewater to land at a maximum of 15 kL/ day over 1 ha.

To address the potential for impacts to sensitive water resources from irrigation of nutrient enriched wastewater, and to enable proactive management to protect the downgradient Lake Walyungup, several regulatory controls in additional to the licence holders derived controls have been imposed on the revised licence. They are:

- Installation of additional storage tank(s) to increase the treated wastewater storage by no less than 79 kL. (Provide at least 225 kL/day of effluent storage for approximately 15 days of wastewater production storage).
- Record the kilograms of grass (biomass) cut and removed from the irrigation area in wet or dry weight.

  The delegated officer also notes that due to the dormancy period of kikuyu grass over winter it's recommended for the planting and maintenance of a grass that has an active growth period during winter (such as ryegrass), will allow for the maximum uptake of nutrients and water over the annual period.

- Changes to annual loading and concentration limits and frequency of sampling for emissions to land including pH, and Sodium Absorption Ratio, and BOD.
- Additional wastewater sampling parameters electrical conductivity, total suspended solids, and potassium for land monitoring requirements.

- The addition of two monitoring bores (MB1, MB2)).
- The addition of soil sampling parameter SAR within the new irrigation area.
- High level alarms to be installed on all wastewater tanks.

Summary of amendments

Table 6 provides a summary of the proposed amendments and will act as record of implemented changes. All proposed changes have been incorporated into the revised licence as part of the amendment process.

Table 6: Summary of licence amendments

Old condition no.	New condition no.	Proposed amendments
Assessed production throughput	-	Changed production throughput from 1,000 kL to 1,800 kL of beer and cider produced per annual period
1	-	Changed wording for improved clarity and updated premises details Row column added for reporting clarity Addition of relevant site infrastructure in Column 1 including additional regulatory control of 100,000L treated wastewater storage tank(s) Addition of additional operational requirements to column 2
2, 3, 4	-	Conditions now redundant
-	2, 3, 4, 5	Added installation requirements for proposed infrastructure and reporting requirements to be submitted before operation commences.
5	6	Changed wording for improved clarity Addition of pH, and SAR and EC requirements in column 2 and 3
6	7	Changed wording for improved clarity Added parameters to column 3 electrical conductivity, total suspended solids and potassium
7	8	Changes to requirements for well installation Updated monitoring bores, location and added timeframe in columns 1,2,3 respectively.
-	9,10	Added requirements to submit a report to provide proof of groundwater monitoring wells.
8	11	Added new monitoring well references to column 1
9	12	Changed wording for improved clarity Added Sodium Absorption Ration (SAR) as a parameter.
10, 11, 12, 13	13, 14, 15, 16	-
14	17	Added a due date for Annual Audit Compliance Report
15	18	Changed wording for improved clarity Added additional reporting requirements
Definitions	-	Added relevant and removed redundant definitions

Schedule 1: Map 1, 2, 3, 4	Schedule 1: Map 1	Removed all previous maps and condensed amendment information into the one map
-	Schedule 1: Figure 1 and 2	Added figures for SAR and EC requirements and monitoring well installation.

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Appendix 1: Summary of licence holder's comments on draft documents

Condition	Summary of licence holder's comment	Department's response
8	Amend the proposed position of monitoring bore MB4 to the already installed monitoring bore on the premises.	Position of MB4 was amended as per licence holder's request.
2	Licence holder requested winter storage be recalculated to >2mm per day rainfall.	The department recalculated the winter storage (see Appendix 2) and determined from the calculations that additional storage requirements are still needed.
18	Clarification on an acceptable method of measurement for tonnage of grass removed monthly.	The department considered that an estimate of the kilograms of cut grass removed from the irrigation area each month is sufficient. Weight to be recorded as cut (wet) removed weight.
Decision Report	Amendment to the wording in Table 1: Summary of compliance inspections and history detailing the outcome of the site visit that activities were not unlawful, and no brewery waste was irrigated to land.	The delegate officer agreed on the investigation into unlawful discharge was closed but the investigation into the alleged clearing of native vegetation was still ongoing.

Appendix 2: Nutrient and hydraulic loading calculations.

Nutrient loading calculations

Nitrogen and phosphorous land area required calculations.

	Nitrogen	Phosphorus
Formula	Land area = (Nutrient concentration * Irrigation flowrate) / Critical loading rate	
Nutrient concentration (mg/L)	8.69	0.79
Irrigation flowrate (L/day)	15000	
Critical loading rate (mg/m^2/day)	18	2
= Land area (m^2) / (ha)	**7242 / 0.72**	**5925 / 0.59**

Nitrogen and phosphorous loading rate calculations

	Nitrogen	Phosphorus
Formula	Loading rate (kg/ha) = (Nutrient concentration (kg/kL) * Irrigation volume (kL)) / Irrigation area (ha)	
Nutrient concentration (kg/kL)	0.0869	0.0079
Irrigation volume (kL)	5475[1]	
	3900[2]	
Irrigation area (ha)	1	
= Loading rate (kg/ha)	**475.78[1]**	**43.25[1]**
	338.91[2]	**30.81[2]**

[1]Theoritcal maximum irrigation volume [2]"True maximum" wastewater production

Nitrogen and phosphorus offtake calculations

	Nitrogen	Phosphorus
Formula	Nutrient offtake = Average annual total yield (kg/ha/year) x nutrient concentration (%)	
Average annual total yield (kg/ha/year)[1]	12200	
Nutrient concentration (% biomass)[1]	4.1	0.28
= Nutrient offtake (kg/ha/year)	**500.2**	**34.16**

[1]Values are based off academic sources.

Hydraulic loading calculation

Formula	$A = (3.65 \times Q) / (L \times T_{app})$ [1] Where A = land area Q = flow rate of wastewater L = wastewater hydraulic loading to soil T_{app} = period of wastewater application per year	
	$Q = (A \times L \times T_{app}) / 3.65$ [2]	
Flow rate of wastewater (kL/day)	15	
Wastewater hydraulic loading to soil (cm/week)	4	2.5

Period of wastewater application per year (weeks)	35	
Land area (ha)	1	
A = Land area (ha) [1]	**0.391**	**0.626**
Q = Flow rate (kL/day) [2]	**38.36**	**23.97**

BOD loading calculations

average BOD concentration:	103 mg/L = 0.000103 kg/L
Total applied via irrigation:	0.000103 x 5475000L = 564kg
Per hectare:	564 / 1 = 564 kg/ha/year
Per month (8 months):	70.5kg/ha/month

Appendix 3: Winter storage calculations.

The rainfall data used is based on 2021 rainfall in Perth (Hopelands station (BOM 20)), where the 2021 rainfall year has the highest rainfall for June – August over the last 5 years (2019 – 2023). The calculations were based on if a day of rainfall was >2mm meaning that treated wastewater irrigation could not occur during that day this would increase the storage required by 15 kL which is the amount of wastewater treated daily. The calculation does not consider the possibility of waterlogging of soils from a heavy rainfall event. This calculation is conservative and likely to underestimate the likely requirement in a high rainfall year.

It is noted that the licence holder has existing and proposed 146 kL (2x 23 kL raw wastewater tanks, 2x 25 kL treated wastewater storage tanks, 1x 50 kL treated wastewater irrigation tank). The highest winter storage requirement was 225 kL. The licence holder requires an additional 79 kL (225 – 146 kL) of storage.

Winter storage results

Date	Rainfall (mm)	Storage required	Sufficient storage
14 July	0	0	Yes
15 July	15	15	Yes
16 July	15	30	Yes
17 July	10.8	45	Yes
18 July	3.6	60	Yes
19 July	3	75	Yes
20 July	0	60	Yes
21 July	0	45	Yes
22 July	28.6	60	Yes
23 July	2.6	75	Yes
24 July	12	90	Yes
25 July	22	105	Yes
26 July	0.4	90	Yes
27 July	10.2	105	Yes
28 July	2.8	120	Yes
29 July	0	105	Yes
30 July	14	120	Yes
31 July	4.2	135	Yes

1 August	4	150	No
2 August	1.6	135	Yes
3 August	12	150	No
4 August	5.8	165	No
5 August	17.2	180	No
6 August	0.4	165	No
7 August	17.6	180	No
8 August	17.6	195	No
9 August	6.2	210	No
10 August	17	225	No
11 August	0	210	No
12 August	0	195	No
13 August	0	180	No
14 August	1.8	165	No
15 August	6.2	180	No
16 August	0	165	No
17 August	30.4	180	No
18 August	19.6	195	No
19 August	13.6	210	No
20 August	1	195	No
21 August	0	180	No
22 August	0	165	No
23 August	0	150	No
24 August	0	135	Yes
25 August	0	120	Yes
26 August	0	105	Yes
27 August	0	90	Yes