Decision Report

Application for Licence

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

Licence Number	L9397/2023/1
Applicant	Andrew Harris
File number	DER2023/000254
Premises	Old Coast Road Brewery 88 West Break Road MYALUP WA 6220 Legal description - Lot 1238 on Deposited Plan 105028 As defined by the premises map attached to the issued licence
Date of report	7 August 2023
Decision	Licence granted

1. Decision summary

This decision report documents the assessment of potential risks to the environment and public health from emissions and discharges during the operation of the premises. As a result of this assessment, licence L9397/2023/1 has been granted.

2. Scope of assessment

2.1 Regulatory framework

In completing the assessment documented in this decision report, the Department of Water and Environmental Regulation (the department; DWER) 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.

2.2 Application summary and overview of premises

On 4 April 2023, Andrew Harris (the applicant) submitted an application under section 57 of the *Environmental Protection Act 1986* (EP Act) to licence alcoholic manufacturing operations at Old Coast Brewery, an existing brewery located about 5km north-east of Myalup.

The premises relates to category 25 – Alcoholic Beverage Manufacturing under Schedule 1 of the *Environmental Protection Regulations 1987* (EP Regulations) which are defined in licence L9397/2023/1. The infrastructure and equipment relating to the premises category and any associated activities which the department has considered in line with *Guideline: Risk Assessments* (DWER 2020) are outlined in licence L9397/2023/1.

2.3 Background

The Old Coast Road Brewery is situated on a rural 60-acre property located approximately 5km north-east of Myalup. The brewery opened in 2007 with brewing operations and hospitality currently co-located in one building. Existing brewing operations are conducted using a 1200L brew system comprising 1 mash tun, 1 kettle and four 2000L jacketed conical fermentation vessels and produce one 1,200L batch of beer/cider weekly (approximately 70kL per annum). Currently the brewery does not distil or produce any spirits.

The brewery is seeking to expand its operations through the construction and operation of an additional 500sqm brew house, with all brewing operations to be relocated to the new facility leaving only the bar and restaurant in the original building. The new brewhouse will also contain a 500L still to produce ~5000L of scotch whisky per year. Construction of the new building, a steel framed shed with concrete floor, has already commenced (prior to the issue of a works approval or licence) with construction expected to be completed by August 2023.

An on-site WWTP will treat brewery/distillery wastewater using sedimentation, filtration and pH adjustment prior to irrigation of treated wastewater to a 1.7ha irrigation area containing established olive trees.

2.4 Operational aspects (from application)

2.4.1 Production capacity

Current theoretical maximum production is 166,857kL, based on limitations of existing tank sizes and brewing times however actual production from the existing premises is currently approximately 70kL per annum (one 1,200L batch of beer/cider per week). Alcohol manufacturing operations in the original building will cease upon opening of the new facility, with the original building to be used solely as a bar and restaurant.

The new facility operations will include a new 1200L four vessel brew system comprising of a mash tun/lauter tun, kettle/whirlpool, hot liquor tank, as well as a 500L column still, four new 2400L fermenters and four existing relocated 2000L fermenters (total fermentation tank capacity of 17,600L). Anticipated production volume of alcohol (beer, cider and whisky) is 100kL in the first year, increasing to 180kL/year over five years. This includes one batch of whisky per month (five hundred 750ml bottles) which equates to 4,500L of whisky produced per annual period.

Beer, cider and whisky production are all limited by availability of fermentation tanks, as all processes include a fermentation stage. Product holding time for fermentation, chilling, settling, removal of trub (sediment material), filtering (if required), and aging can vary by product, but is typically 14-21 days. Therefore, each tank could produce a maximum of ~17-26 batches per annum, which would result in a theoretical maximum production rate of 299kL to 458kL, depending on fermentation time.

The applicant stated that the anticipated maximum volume of wastewater produced would be 792kL annually given the annual production capacity of 180kL/year with a ratio of 4.4L of waste produced per 1L of product. A detailed water balance summary provided by the applicant is outlined in Appendix 1 with a graphic summary of the wastewater treatment process shown in Figure 2. However, the delegated officer has noted that this calculation does not factor in the additional volumes of wastewater generated from distillation (approximately 15L per 1L alcohol produced) and as such, the total wastewater produced would likely be closer to 850kL per annual period. Wastewater from the production of 175kL of beer/cider could be expected to produce ~770kL of brewery wastewater, and the production of 5kL of whisky could expect to produce ~75kL of wastewater.

2.4.2 Water management

Stormwater

Stormwater will be collected from the roof of the new building and directed to a 250kL rainwater tank to provide a water source for the brewing process. No other reference to stormwater management is made in the application.

Wastewater

Around 448kL of water extracted from the on-site production bore will be filtered using reverse osmosis for use in the brewery. Filtered permeate water from the RO unit will be combined with the estimated 524kL of stormwater captured to provide water for both beverage production and final cleaning of equipment. Cleaning of equipment is the predominant source of wastewater from the premises. The RO reject water (brine) (approximately 224m^3/year) will be stored in a 5kL brine storage tank and used for general washdown and cleaning of equipment. The volume and salt concentrations of the RO reject water have been incorporated into the water balance provided by the applicant (Appendix 2)

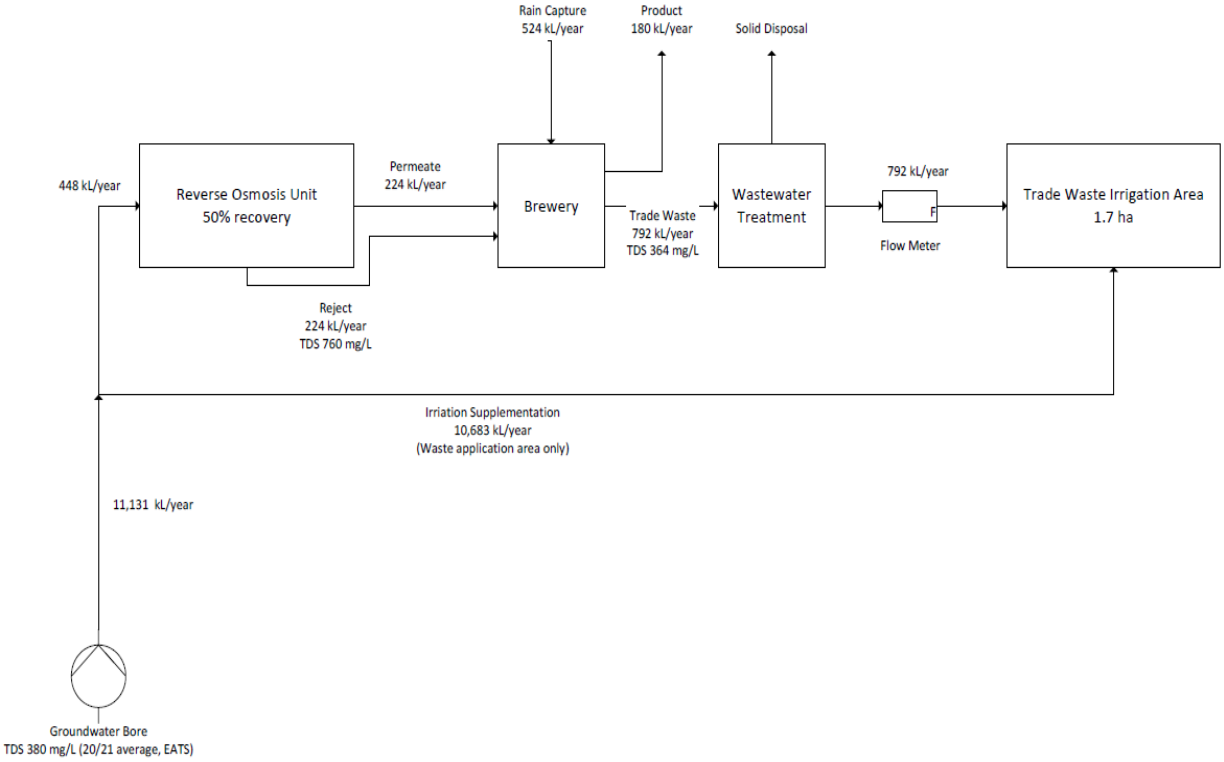

Figure 1: An overview of the on-site water management process and associated volumes

2.4.3 Wastewater quality

The applicant has provided wastewater quality results of five samples taken in November and December 2022. The average values of the sampling program are shown in Table 1 with the full results shown in Appendix 3.

The delegated officer has noted that the water quality of brewery wastewater is highly variable depending on the specifics of the brewing process. As the sampling program was conducted on wastewater produced during routine cleaning of existing infrastructure, the samples may not be entirely representative of wastewater produced from the expanded brewery and the operation of a still (whisky production) process. Distillation wastewater quality differs significantly to typical brewery wastewater (as shown in Table 1) and higher volumes of wastewater are produced per litre of alcohol manufactured.

Table 1: Expected raw and treated wastewater quality (applicant derived)

Analyte	Units	Raw wastewater quality[1]	Typical range of raw brewery wastewater[2]	Typical range of raw distillery wastewater[3]	Expected treated wastewater quality[4]	ANZECC 2000 trigger levels for primary industries[5]
BOD	mg/L	2388	1200 - 3600	13000 - 35000	2388	<15
TSS		191	200 - 1000	5000 - 30000	<80	<40
Total N		50	25 - 80	500 - 1700	50	25-125
Total P		13	10- 50	100 - 400	12.6	0.8-12[a]

EC	µS/cm	356	-	-	690	-
TDS	mg/L	227	-	1100 - 4500	442	3000
pH	-	4.5	4.6 - 7.3	3 - 5	6.5 - 7.5	6-8.5

[1] From sampling program undertaken by the licence holder, as described in section 2.4.3
[2] Kebede. 2018.
3 ANZECC 1998 Effluent Management Guidelines for Australian Wineries and Distilleries
[4]As per Clariance WWTP Proposal, 10 June 2023 – as provided by the applicant.
[5] ANZECC 2000, [a]Requires site specific assessment to determine actual value.

2.4.4 Wastewater treatment

As outlined in Figure 2, the initial treatment of raw wastewater will be through the sedimentation of suspended solids, including organic matter, inorganic compounds, silt, and other particulates. This will be achieved using various physical and chemical processes within a 2200L suspended solids arrester. Following sufficient retention time within the suspended solid arrester, the wastewater will be further filtered using a 400-micron bag filter and undergo pH correction to between 6.5 – 7.5 through dosing with acids (sulfuric or hydrochloric acid) or alkaline substances (lime or soda ash). Finally, an activated carbon filter will remove organic compounds, pesticides, pharmaceuticals, heavy metals, DBPs, and other substances. The design parameters of the installed WWTP are listed in Appendix 4. The WWTP is designed to operate with a +/- 15% variation tolerance in these raw wastewater parameters.

The 220kL of treated wastewater produced during winter months (May – Aug) will be stored in a 250kL storage tank, which has been calculated as sufficient storage capacity in the applicant-provided water balance, outlined in Appendix 2.

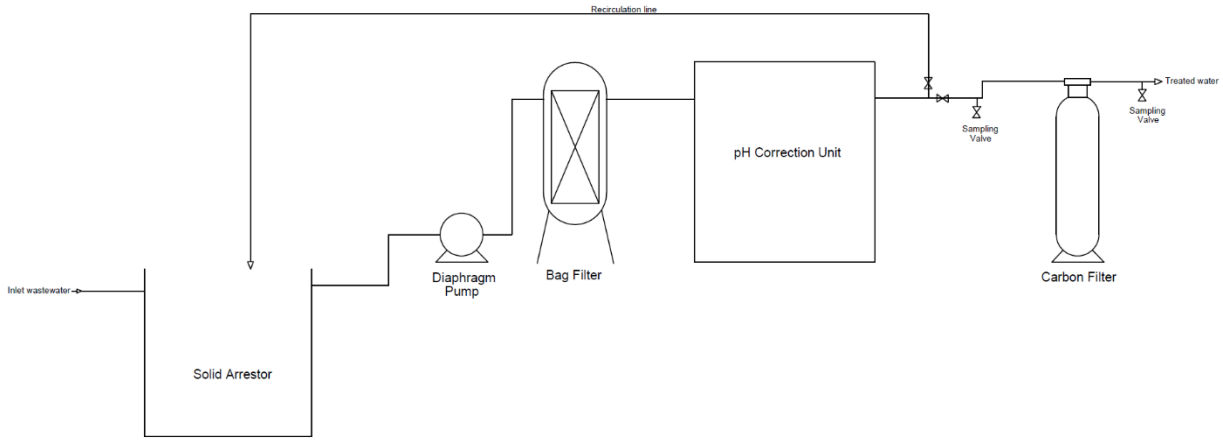

Figure 2: An overview of the proposed wastewater treatment process

2.4.5 Irrigation of treated wastewater

Treated wastewater from the WWTS will be pumped to a 1.7ha irrigation area via a manually operated controller system. The irrigation area contains approximately 550 established olive trees which will be irrigated in zones using 'butterfly' type sprinklers, with one sprinkler per tree. A flow meter is located downstream of the wastewater treatment system to measure the flow of treated wastewater prior to irrigation. The applicant submitted a Nutrient Irrigation Management Plan (NIMP) with the application and proposed an application frequency of once per month

(excluding winter months May – Sept inclusive) which would result in a peak irrigation rate as high as 469m^3/month.

Salinity values
The expected electrical conductivity value of the treated wastewater would be considered as 'low' salinity and suitable for moderately sensitive crops, as per ANZECC National Water Quality Guidelines. The salt tolerance of olive trees has been shown to be 'moderately tolerant' and olive trees can be irrigated with water containing as much as 3200mg/L of salt (Chartzoulakis, 2005). Therefore, the predicted wastewater salinity is well below the relevant salinity threshold for the proposed crop.

Wastewater produced by breweries often contains high concentrations of salts from cleaning chemicals and from source water. In this case, the addition of high salt reverse osmosis brine adds an additional source of salinity to the wastewater. Therefore, irrigation needs to be managed to minimise the potential for adverse impacts on the structure of the soil. Of particular concern is the risk of soils becoming sodic and dispersive due to the disproportionally high concentration of sodium ions compared to calcium and magnesium ions in the wastewater. This may cause the infiltration capacity of the soil to air and water to be reduced, which may limit crop growth and hence the ability to take up nutrients. The licence holder has not provided sodium, calcium, or magnesium ion concentration in the wastewater; therefore, there is insufficient information to determine whether there is potential for the soils to become sodic or dispersive at the irrigation site.

As the soils within the irrigation area are predominantly deep sands with a low clay content, the risk of soil structural issues due to clay mineral dispersity is reduced. Additionally, the applicant has stated that the existing olive grove has been irrigated with groundwater (TDS of 380mg/L) for 15 years with no observed impact to soil structure. However, the delegated officer has determined that a moderate TDS limit should be imposed given the lack of information provided on soil characteristics and wastewater quality as well as the potential for high salinity wastewater due to the inclusion of RO brine.

BOD loading
Where biological oxygen demand (BOD) loading rates are excessively high, pore spaces in soil profiles can become clogged with bacterial slimes that can limit the infiltration of water and air into the soil profile, and soils can become waterlogged and anaerobic. For this reason, wastewater irrigation systems are usually designed to ensure that there is sufficient time between irrigation events to allow soils to re-aerate, and the overall BOD loading rate is kept below the maximum organic loading rate of **1500 kg/hectare/month** (for most soils) (NSW DEC, 2004) to reduce the risk of soil clogging taking place.

Hydraulic loading impact analysis
A preliminary assessment[1] of the wastewater hydraulic loading at the premises indicates that the size of the irrigation area (1.7 ha) is more than sufficient (>18x required land area) to enable moisture to be taken up by vegetation or retained within the soil profile without excessive moisture seepage into groundwater from irrigation. Therefore, it is unlikely that any leaching, soil waterlogging, pooling or surface water runoff will occur during irrigation of treated wastewater.

[1] The preliminary assessment is based on US EPA guidance. Further information on this calculation has been provided in Appendix 2

Nutrient loading: nitrogen and phosphorus
Annual irrigation is estimated to result in a nitrogen loading rate of **23kg/ha** without factoring in nitrogen volatilization, which may reduce nitrogen loading by up to 20%. Given the expected annual yield and anticipated nitrogen uptake rate of olives, the nitrogen offtake would be approximately **29kg/ha.** Therefore, even using very conservative assumptions, the proposed irrigation area contains more than sufficient number of olive trees to remove the maximum amount of nitrogen which could be applied through irrigation.

Annual irrigation is estimated to result in a phosphorus loading rate of **5.9kg/ha** of phosphorus. Given the expected yield and phosphorus uptake of olive trees, plus phosphorus removal through pruning, the calculated expected phosphorus offtake is between **5.9kg/ha** and **8.2kg/ha.** Therefore, the number of olive trees present in the irrigation area are sufficient to remove the maximum amount of phosphorus which could be applied via irrigation of treated wastewater.

Further detail on the assumptions and calculation methods for all the above loading calculations have been provided in Appendix 3.

2.5 Exclusions to the premises

This assessment does not consider any noise, light or water emissions associated with the operation of the tavern or from traffic movements. The toilet facilities, underground septic tank and leach drain system that support the ablutions associated with the brewery operation are also excluded from the assessment.

3. Legislative context

Table 2 summarises approvals relevant to the assessment.

Table 2: Relevant approvals and tenure

Legislation	Reference	Approval
Rights in Water and Irrigation Act 1914	GWL159690	Approval for extraction of up to 100,000 kL for commercial purposes (unspecified), horticultural purposes, and irrigation of <0.8ha of lawns and gardens. Application pending for addition of ‘'Washdown for commercial purposes” as an authorised usage.
Planning and Development Act 2005	N/A	The Shire of Harvey granted development approval for the extension of the brewery on 19 July 2023 pursuant to the approved plans.
Health (Treatment of Sewage and Disposal of Effluent and Liquid Waste) Regulations 1974	Approval pending	N/A –pending

4. 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.

4.1 Source-pathways and receptors

4.1.1 Emissions and controls

The key emissions and associated actual or likely pathway during premises operation which have been considered in this decision report are detailed in Table 3 below. Table 3 also details the control measures the applicant has proposed to assist in controlling these emissions, where necessary.

Table 3: Proposed applicant controls

Emission	Sources	Potential pathways	Proposed controls
Operation			
Wastewater with elevated levels of nutrients, salts (TDS), sediments or chemicals	Brewing and distilling process including washdown and liquid waste management		Beverage production is conducted within an enclosed building with concrete flooring. Floor is sloped to an in-floor drainage system to direct wastewater to the WWTP. All feints produced are reincorporated into the distilling process.
	WWTP and irrigation of treated wastewater	Direct application to land (olive grove) via irrigation	Wastewater will be treated using a primary treatment system as outlined in Section 2.4.4 WWTP is sealed and skid-mounted on a concrete or bluestone pad with a visual level indicator. Treated wastewater will be stored in a 250kL tank with zincalume housing and a plastic liner. No irrigation during higher rainfall/winter months (May to Aug inclusive) Irrigation will occur once per week with a minimum rest period of 24 hours, during which time no freshwater irrigation will occur to maximise contact time of the nutrients in the root zone and nitrogen volatisation by microbial activity. Irrigation of treated wastewater will only be a maximum of 30% of total water irrigation required, as defined by the DPIRD irrigation calculator for olives. Irrigation system is split into 13 irrigation stations across 3.4ha of olive grove, each receiving a maximum flow of 12m^3/hour with a peak irrigation rate of 4.6mm/hour. Only 1.7ha will be irrigated with treated wastewater.
Odour	Storage and irrigation of wastewater with elevated BOD/nutrients.	Air / windborne pathways	Raw wastewater will be treated through sedimentation to reduce solid organic matter, as outlined in section 2.4.4. The WWTP is a sealed system to reduce odour.

4.1.2 Receptors

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

Table 4 and Figure 4 below provides a summary of potential human and environmental receptors that may be impacted as a result of activities upon or emission and discharges from the prescribed premises *(Guideline: Environmental Siting* (DWER 2020)).

Table 4: Sensitive human and environmental receptors and distance from prescribed activity

Human receptors	**Distance from prescribed activity**
Residential premises	Nearest residential lot is directly adjacent to northern premises boundary, with the residence approximately 600 m from premises boundary.
Environmental receptors	**Distance from prescribed activity**
Rivers, lakes, oceans, and other bodies of surface water, etc.	165 m separation distance from irrigation area to nearest surface water (unnamed creek and dam within premises boundary) Nearest major watercourse is Harvey River Diversion Drain, approximately 1.3km from premises boundary. Lake Preston (internationally recognised Ramsar wetland site) is ~3km west of premises boundary.
Groundwater	Ongoing 2.7 m year-round groundwater separation at the irrigation site. The premises is within the Southwest Coastal Groundwater Water Area, proclaimed under the Rights in Water and Irrigation Act 1914 (RIWI Act).
Geomorphic Wetland	Multi-use sumpland (seasonally inundated wetland) is located within premises boundary and <10 m from irrigation area.
Soil	As per DPIRD Soil Landscape Mapping (van Gool, 2005) there are four soil types within the premises boundary, but the predominant soil type is **Spearwood S1c phase** (Dune ridges with deep bleached grey sands with yellow-brown subsoils, and slopes up to 15%)
Threatened Ecological Communities (TECs)	Banksia Dominated Woodlands (Priority 3 - Endangered) and Tuart woodlands (Priority 3- Critically Endangered) directly adjacent to the northern boundary of the premises with minor overlap into the premises boundary and irrigation area. Several Carnaby's Cockatoo (Priority 3 – Endangered) identified ~80m from WWTP outside of premises boundary.
DBCA Legislated Tenure: Myalup State Forest	Directly adjacent to eastern premises boundary, located <100 m from irrigation area.

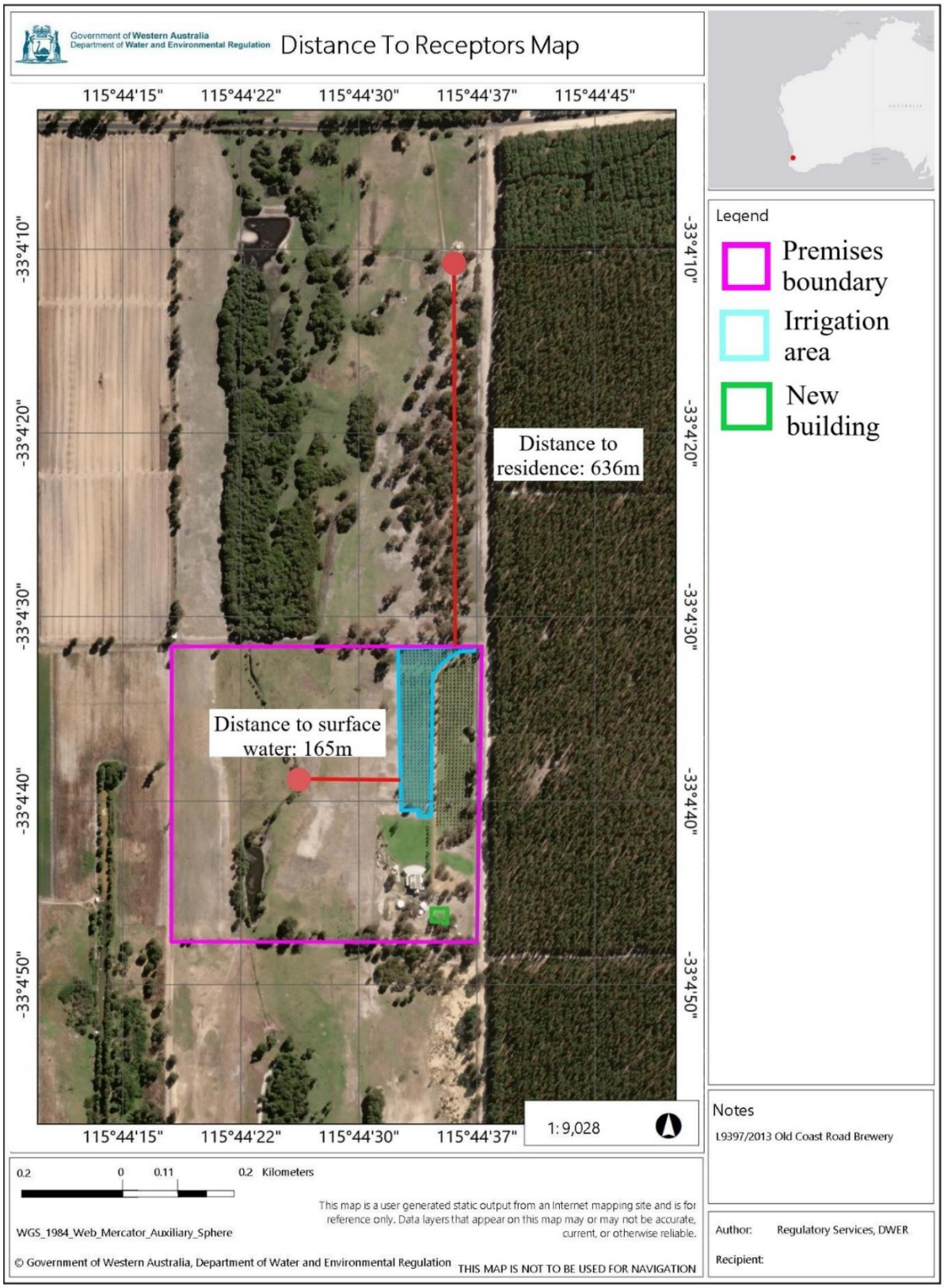

Figure 3: Distance to sensitive receptors

4.2 Risk ratings

Risk ratings have been assessed in accordance with the *Guideline: Risk Assessments* (DWER 2020) for each identified emission source and takes into account potential source-pathway and receptor linkages as identified in Section 4.1. Where linkages are in-complete they have not been considered further in the risk assessment.

Where the applicant has proposed mitigation measures/controls (as detailed in Section 4.1), these have been considered when determining the final risk rating. Where the delegated officer considers the applicant'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 applicant's controls are not deemed sufficient. Where this is the case the need for additional controls will be documented and justified in Table 5.

Licence L9397/2023/1 that accompanies this decision report authorises emissions associated with the operation of the premises i.e. manufacturing of beer, cider and spirits.

The conditions in the issued licence, as outlined in Table 5, have been determined in accordance with *Guidance Statement: Setting Conditions* (DER 2015).

Table 5: Risk assessment of potential emissions and discharges from the premises during operation

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of licence	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
Brewery operations: • beverage manufacturing and storage, • wastewater production (process and washdown water) • storage and use of cleaning chemicals	Untreated brewery wastewater with elevated concentrations of chemicals, nutrients, salts (TDS) and BOD	Discharge from overtopping, spills or leaks of tanks and pipe, or direct irrigation to land causing: • Excessive hydraulic loading causing seepage of wastewater past the root zone to groundwater. • Excessive nutrient loading causing soil and groundwater contamination. • Migration of contaminated groundwater off-site • Overland runoff causing contamination of nearby surface waters. Contamination of soil, surface water or groundwater could result in adverse impacts to ecosystem health.	Surface water located 165m from irrigation area and ~280m from WWTP. Geomorphic seasonally inundated wetland <10m from irrigation area and ~70m from WWTP. Surrounding flora and fauna including: • TEC: Banksia Dominated Woodlands and Tuart woodlands located directly adjacent to irrigation area • TEC: Carnaby's Cockatoo located <100m from WWTP. • DBCA Legislated Tenure, (Myalup State Forest) located 70m from WWTP.	Refer to Section 3.1	*C = Moderate* *L = Rare* ***Low Risk***	Y	Condition 2: Infrastructure and operational requirements	The delegated officer has determined that the proposed applicant infrastructure controls, including the operation of all brewing processes within the brewery building, are sufficient to reduce the risk of any discharge of untreated wastewater to an acceptable level. As such, applicant proposed infrastructure controls have been included on the licence.
Treatment and irrigation of wastewater: • Transfer, storage and treatment of wastewater • Storage and disposal of waste solids • Irrigation of treated wastewater	Treated wastewater with elevated concentrations of chemicals, nutrients, salts (TDS) and BOD				*C = Moderate* *L = Possible* ***Medium Risk***	N	Condition 1: Throughput limit. Condition 2: Infrastructure and operational requirements Condition 3: Authorised discharge of treated wastewater **Condition 4: Emissions and discharge limits** **Condition 5: Waste containment and disposal** Condition 7: Emissions to land monitoring	Applicant controls including infrastructure, nutrient loading and irrigation volume have been included as controls in the licence as the delegated officer has determined those controls are necessary to maintain an acceptable level of risk from the discharge of treated wastewater. The delegated officer has also imposed additional water quality parameters for irrigation, including pH and TDS limit, due to the limited information provided on soil characteristics, wastewater quality from both brewing and distilling processes, and the potential for high salinity wastewater from RO brine. As there is limited winter storage capacity for treated wastewater and the volume of wastewater produced is largely dependent on alcohol manufacturing throughput, the delegated officer has imposed the applicant's requested annual throughput limit of 180kL per annum alcohol manufactured as a licence condition to manage risks associated with exceeding winter storage capacity. The delegated officer has further clarified that the 180kL limit is to consist of a maximum of 175kL of beer or cider produced and 5kL of whisky or spirits produced. This is due to the significant differences in wastewater quality and volume produced from distillation and the higher risks associated with the treatment and irrigation of distillation wastewater. As the nutrient and hydraulic loading calculations are based predominantly on brewery wastewater parameters, it is imperative that distillation wastewater remains a small percentage (<10%) of total wastewater produced for those calculations to remain valid. As the applicant's water balance calculations provided do not factor in the higher wastewater volume produced by distillation, the delegated officer has also determined that any wastewater produced in excess of the site's treated wastewater storage capacity is to be removed offsite and disposed of to an appropriate licensed waste facility to reduce the risks of overtopping from overfilling storage tanks, or irrigation during winter months when the irrigation area is unsuitable Ongoing monitoring of wastewater volume and quality has been required to confirm wastewater water quality parameters and allow calculation and reporting of annual nutrient and hydraulic loading rates.

Risk events					Risk rating [1] C = consequence L = likelihood	Applicant controls sufficient?	Conditions [2] of licence	Justification for additional regulatory controls
Sources / activities	Potential emission	Potential pathways and impact	Receptors	Applicant controls				
	Odour	Air / wind dispersal of odour interfering with the welfare, convenience, comfort, or amenity of nearby residents	Nearest residential receptor 600m north of premises boundary		*C = Minor* *L = Unlikely* ***Medium Risk***	Y	N/A	The premises has been operational for 15 years prior to the date of submission of the licence application. DWER is not aware of odour complaints associated with the premises to date. The delegated officer has determined that the applicant's infrastructure controls and limited throughput are sufficient to manage risk of odour impacts to the limited number of nearby residential receptors.

Note 1: Consequence ratings, likelihood ratings and risk descriptions are detailed in the *Guideline: Risk Assessments* (DWER 2020).

Note 2: Proposed applicant controls are depicted by standard text. **Bold and underline text** depicts additional regulatory controls imposed by department.

5. Consultation

Table 1 provides a summary of the consultation undertaken by the department.

Table 1: Consultation

Consultation method	Comments received	Department response
Application advertised on the department's website on 17 July 2023	None received.	N/A
Local Government Authority advised of proposal on *14 July 2023*	None received.	N/A
Department of Health advised of proposal on *14 July 2023*	None received.	N/A
Applicant was provided with draft documents on 1 August 2023	Applicant response received 3 August 2023 and was limited to clarification of minor process details.	Decision report and licence updated to incorporate additional information provided.

6. Decision

The delegated officer has carefully evaluated the risk posed by the beverage manufacturing operations, considering the relatively low throughput of the premises. It has been determined that a combination of infrastructure and management controls will effectively manage these risks. These controls encompass a wastewater treatment system and irrigation of a limited volume of treated wastewater of specific quality onto a designated area of land. The chosen land area is of adequate size to ensure that the water, along with its dissolved constituents, can be effectively absorbed by vegetation or retained within the soil profile without causing excessive seepage into groundwater or surface water runoff. The applicant's Nutrient Irrigation Management Plan (NIMP), which includes the proposed irrigation and crop harvesting, has been assessed and deemed sufficient to manage the risks associated with the application of treated brewery wastewater to the land, provided throughput limits and discharge limits are not exceeded.

To manage any risks associated with exceeding winter storage capacity for treated wastewater during winter months when the land is unsuitable for irrigation, the delegated officer has imposed conditions relating to alcohol throughput and waste disposal, as outlined in Table 5.

When considering potential risks from irrigation of wastewater, the delegated officer has considered the limited information provided for both soil characteristics and wastewater quality (including distillery wastewater), as well as the potential for high salinity wastewater from RO brine. As the irrigation area soil is predominantly deep sands with a low clay content and has historically been irrigated with groundwater with no noted adverse effects, the delegated officer has imposed a moderate limit of 2000mg/L TDS for wastewater irrigated, in line with EPA Victoria's risk assessment for medium risk of soil salinity build up in sand (EPA Vic, 2022)

7. Conclusion

Based on the assessment in this decision report, the delegated officer has determined that a licence be granted, subject to conditions commensurate with the determined controls and necessary for administration and reporting requirements.

References

1. ANZECC and ARMCANZ, 2000. *National Water Quality Management Strategy Paper No. 4 – Australian and New Zealand Guidelines for Fresh and Marine Water Quality, Volume 3 Primary Industries*
2. Chartzoulakis, K.S., 2005. *Salinity and olive: growth, salt tolerance, photosynthesis and yield.* Agricultural Water Management, *78*(1-2), pp.108-121.
3. Clariance Technique International Pty Ltd *Wastewater Treatment Plant Proposal for Ocean Coast Road Brewery (10 June 2023).*
4. Department of Environment Regulation (DER) 2015, *Guidance Statement: Setting Conditions*, Perth, Western Australia.
5. Department of Water and Environmental Regulation (DWER) 2020, *Guideline: Decision making*, Perth, Western Australia.
6. DWER 2020, *Guideline: Environmental Siting*, Perth, Western Australia
7. DWER 2020, *Guideline: Risk Assessments*, Perth, Western Australia.
8. Kebede, T. B. 2018. *Wastewater treatment in brewery industry, review*. International Journal of Engineering Development and Research
9. Old Coast Road Brewery *Nutrient Irrigation Management Plan*, 15 June 2023
10. van Gool, D, Tille, P J, and Moore, G A. (2005), *Land evaluation standards for land resource mapping : assessing land qualities and determining land capability in south-western Australia.* Department of Primary Industries and Regional Development, Western Australia, Perth. Report 298.
11. US EPA, 2006, *Process design manual, land treatment of municipal wastewater effluent*, Report EPA/625/R-06/016

Appendix 1: Licence holder nutrient loading calculator

Irrigation areas[1]: size, volume irrigated, irrigation days				Annual period (as defined by your licence)[2]												Volume irrigated during annual period (kL)[3]
	Size (ha)			January	February	March	April	May	June	July	August	September	October	November	December	
EXAMPLE irrigation area:	*25*	*volume irrigated*	*kL*	*20,000*	*20,000*	*18,000*	*15,000*	*0*	*0*	*0*	*0*	*15,000*	*18,000*	*20,000*	*25,000*	*151,000*
		days of irrigation	*days/month*	*29*	*28*	*30*	*25*	*0*	*0*	*0*	*0*	*20*	*25*	*30*	*27*	
Irrigation Area 1:		volume irrigated	kL													
		days of irrigation	days/month													
Irrigation Area 2:		volume irrigated	kL													
		days of irrigation	days/month													
Irrigation Area 3:		volume irrigated	kL													
		days of irrigation	days/month													
Wastewater quality[4]	*EXAMPLE sampling date:*			*20/01/2022*	*15/02/2022*	*17/03/2022*	*19/04/2022*	*12/05/2022*	*12/06/2022*	*9/07/2022*	*15/08/2022*	*12/09/2022*	*15/10/2022*	*13/11/2022*	*7/12/2022*	
	EXAMPLE total nitrogen		*mg/L*	*13.2*	*21.3*	*17.6*	*19.2*	*42.4*	*25.1*	*30.4*	*40.3*	*34.8*	*38.7*	*44.6*	*47.3*	
	EXAMPLE BOD		*mg/L*	*4.8*	*12.1*	*6.1*	*4.9*	*4.8*	*4.1*	*3.3*	*5.2*	*4.4*	*5.2*	*5.1*	*7.5*	
	Sampling date:															
	For wineries to indicate sampling period:[5]															
	Total nitrogen		mg/L													
	Total phosphorus		mg/L													
	Biochemical oxygen demand		mg/L													

Nutrient and BOD loadings[6]			January	February	March	April	May	June	July	August	September	October	November	December	kg/ha/annual period[7]
EXAMPLE total nitrogen loadings			*10.6*	*17.0*	*12.7*	*11.5*					*20.9*	*27.9*	*35.7*	*47.3*	*183.5*
EXAMPLE BOD loadings		*kg/ha/month*	*3.8*	*9.7*	*4.4*	*2.9*					*2.6*	*3.7*	*4.1*	*7.5*	*38.8*
		kg/ha/day	*0.13*	*0.35*	*0.15*	*0.12*					*0.13*	*0.15*	*0.14*	*0.28*	
Irrigation Area 1	Total nitrogen	kg/ha/month													
	Total phosphorus	kg/ha/month													
	Biochemical oxygen demand	kg/ha/month													
		kg/ha/day													
Irrigation Area 2	Total nitrogen	kg/ha/month													
	Total phosphorus	kg/ha/month													
	Biochemical oxygen demand	kg/ha/month													
		kg/ha/day													
Irrigation Area 3	Total nitrogen	kg/ha/month													
	Total phosphorus	kg/ha/month													
	Biochemical oxygen demand	kg/ha/month													
		kg/ha/day													

Explanatory notes and calculations:

White cells should be filled in where applicable.

NOTE 1 - Where there is irrigation to more than 3 areas, additional copies of this sheet should be completed.

NOTE 2 - This sheet should be completed for your annual period as defined by your licence.
E.g. If your annual period is from 1 October to the 30 September in the following year, for the 2022-2023 annual period, you should include data from January - September 2023, and October - December 2022.

NOTE 3 - Volume irrigated during the annual period (kL), for each irrigation area is the sum of the monthly volumes irrigated to that area.
E.g. For the example shown: Volume irrigated during annual period = 20,000 (Jan) + 20,000 (Feb) + 18,000 (Mar) + 15,000 (Apr) + 15,000 (Sep) + 18,000 (Oct) + 20,000 (Nov) + 25,000 (Dec) = 151,000 kL. Noting that for the example there was no irrigation during the months of May, June, July or August.

NOTE 4 - The sampling and analysis of your wastewater quality should be undertaken in accordance with your licence conditions.
For sampling less often than monthly, i.e. quarterly, 6-monthly, or annually: for months where no sampling is required, wastewater quality should be taken to be equivalent to the most recent sample taken.
E.g. Quarterly sampling during Feb, May, Aug and Nov - total nitrogen concentrations were analysed to be 7, 11, 8 and 13 mg/L respectively in the wastewater. For March and April, as February was the most recent sample taken, total nitrogen concentration is estimated to be 7 mg/L. Similarly, for June and July, as May was the most recent sample, total nitrogen concentration is estimated to be 11 mg/L. There will be no sampling date associated with non-sampling months.
If your licence requires you to monitor loading rates for additional parameters (e.g. inorganic nitrogen, reactive phosphorus etc.) additional copies of this sheet should be completed for the additional parameters.

NOTE 5 - For wineries to indicate sampling period - this row is only required to be completed if your licence condition specifies a sampling period e.g. pre-vinatge, peak vintage, late vintage, post vintage, non-vintage. Indicate which sampling date corresponds with which period.

NOTE 6 - Parameter loading (TN, TP or BOD) each month per hectare for each irrigation area (kg/ha/month): $\frac{\text{monthly concentration of parameter (TN, TP or BOD) in mg/L} \ * \ \text{monthly volume of wastewater irrigated to irrigation area (kL)} \ \div \ 1000}{\text{size of irrigation area}}$

*E.g. Using the example shown, for total nitrogen for January: 13.2 mg/L * 20,000 kL / 1,000 = 264 kg/month. 264 / 25 ha = 10.6 kg/ha/month (for January).*

Loading of parameter (BOD) each day per hectare for each irrigation area (kg/ha/day): BOD loading (kg/ha/month) ÷ number of days of irrigation during that month.
E.g. Using the example shown, for BOD for October: 3.7 kg/ha/month / 25 days of irrigation during October = 0.15 kg/ha/day (for October)

NOTE 7 - To calculate annual loading of parameter (TN, TP or BOD) per hectare (kg/ha/annual period): sum of monthly loadings (kg/ha/month). You should calculate an annual loading (kg/ha/annual period) for each parameter for each irrigation area.
E.g. Using the example shown, for total nitrogen: 10.6 (Jan) + 17 (Feb) + 12.7 (Mar) + 11.5 (Apr) + 20.9 (Sep) + 27.9 (Oct) + 35.7 (Nov) + 47.3 (Dec) kg/ha/month = 183.5 kg/ha/annual period

* To request an electronic copy of this spreadsheet please contact info@dwer.wa.gov.au

Appendix 2: Water balance calculations

Water balance calculations (from application)

		Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Total
Rainfall	**mm/month**	124	61	44	16	17	18	24	52	135	174	224	158	**1047**
Mean evaporation	**mm/month**	80	118	162	214	238	198	167	97	65	48	51	62	**1500**
Beverage production	**m^3/month**	16.3	16.3	16.3	16.3	16.3	16.3	12.5	12.5	12.5	12.5	12.5	12.5	**180**
Brewery water demand	**m^3/month**	87.8	87.8	87.8	87.8	87.8	87.8	87.8	67.5	67.5	67.5	67.5	67.5	**972**
Wastewater produced	**m^3/month**	71.5	71.5	71.5	71.5	71.5	71.5	71.5	55	55	55	55	55	**792**
Rainwater capture	**m^3/month**	62	31	22	8	8	9	12	26	67	87	112	79	**523.5**
Rainwater use	**m^3/month**	32	32	32	32	32	32	32	32	68	68	68	68	**524**
Volume of rainwater stored	**Year 1**	30	29	19	0	0	0	0	0	0	19	64	75	**250m^3 capacity**
	Year 2	106	105	95	71	48	25	5	0	0	19	64	75	**250m^3 capacity**
RO feed water	**m^3/month**	56	56	56	56	56	56	56	56	0	0	0	0	**448**
Olive water requirement	**ML/ha/month**	0.12	0.5	0.92	1.27	1.58	1.23	0.82	0.31	0	0	0	0	**6.75**
Irrigation rate	**mm/month**	12	50	92	127	158	123	82	31	0	0	0	0	**675**
Total irrigation demand	**m^3/month**	204	850	1564	2159	2686	2091	1394	527	0	0	0	0	**11475**
Maximum irrigation rate	**m^3/month**	61	255	469	648	806	627	418	158	0	0	0	0	**3442.5**
Actual irrigation rate	**m^3/month**	61	110	110	110	110	110	109	72	0	0	0	0	**792**
	mm/month	3.6	6.5	6.5	6.5	6.5	6.5	6.4	4.2	0	0	0	0	**46.6**
Wastewater produced – wastewater irrigated	**m^3/month**	11	-39	-39	-39	-39	-39	-38	-1	55	55	55	55	**0**
Volume of treated water stored	**Year 1**	0	0	0	0	0	0	0	0	55	110	165	220	**250m^3 capacity**
	Year 2	231	192	154	115	77	38	1	0	55	110	165	220	**250m^3 capacity**

Appendix 3: Nutrient and hydraulic loading calculations

Nitrogen and phosphorus loading calculations

	Nitrogen	Phosphorus
Formula	Loading rate (kg/ha) = (Nutrient concentration (kg/kL) * Irrigation volume (kL)) / Irrigation area (ha)	
Nutrient conc.	50mg/L or 0.05kg/kL	12.6mg/L or 0.0126kg/kL
Irrigation vol.	792kL	
Irrigation area	1.7ha	
Calculation	(0.05kg per kL x 792kL) / 1.7ha = **23.3kg/ha**	(0.0126kg per kL x 792 kL) / 1.7ha = **5.9kg/ha**

Nitrogen and phosphorus offtake calculations

	Nitrogen	Phosphorus
Formula	Nutrient offtake = Nutrient concentration of olive yield (kg/kg) * total annual olive yield per ha (kg/ha/year)	
Average yield	20kg/tree/year	
Number of trees	313trees/ha	
Total olive yield	20*313 = 6260kg/ha/year	
Nutrient concentration in yield (kg/kg)	0.00389kg/kg[1]	0.78kg/ton or 0.00078kg/kg[1]
Nutrient offtake (fruit only)	0.00389kg/kg * 6260 kg/ha/year = **24.4kg/ha/year**	0.00078kg/kg * 6260 kg/ha/year = 4.9kg/ha/year
Nutrient offtake (fruit and pruning)[2]	Not considered	4.88kg/ha/year from fruit alone With pruning as 17% of total: **5.9kg/ha/year** With pruning as 41% of total: **8.3kg/ha/year**

[1] The average nutrient concentrations as taken from three published academic sources, as cited by applicant's NIMP and verified.
[2] The proportion of total phosphorus removed which can be attributed to pruning varies from 17-41% across various publications, as cited by applicant's NIMP and verified.

Hydraulic loading calculations:

The preliminary assessment of hydraulic loading can be calculated using the following equation (US EPA, 2006): **$A = (3.65 \times Q) / (L \times T_{app})$**

Where:
- A = land area required (hectares)
- Q = flow rate of wastewater (m3 /day) – ***2.2m3/day*** *as per WWTP proposal*
- L = wastewater hydraulic loading to soil (cm/week) – *assumed to be* ***2.5 cm/week*** *(Table 5-3 - US EPA, 2006)*
- T_{app} = period of wastewater application each year (weeks) – *irrigation will occur* ***34.6 weeks*** *of the year (excl. May – Aug inclusive)*

A = (3.65 x 2.2) / (2.5 x 34.6)
= 8.03 / 86.5
= **0.093ha**

BOD loading calculation:

BOD in treated wastewater: 2388mgL = 0.002388kg/L
Total applied via irrigation: 0.002388*792000L = 1891kg total
Per hectare: 1891kg **/** 1.7ha = 1112.5kg/ha/year
Per month (8 months irrigation): **139kg/hectare/month**

Appendix 4: Supplementary information

WWTP design parameters

Parameter	Unit	Inlet	Outlet
Flowrate	m^3/day	2.2	2.2
pH	-	3.0 – 8.4	6.5 – 7.5
Total suspended solids (TSS)	mg/L	200-250	<80

Raw wastewater quality sampling program results

		Sample number					
Analyte	**Units**	**1**	**2**	**3**	**4**	**5**	**Average**
BOD	mg/L	1700	600	1400	8100	140	**2388**
TSS		99	44	32	690	92	**191**
Total N		27	22	26	130	45	**50**
Total P		5.8	7.5	6.5	31	12	**13**
Potassium		21	17	23	100	24	**37**
Hardness		25	20	26	73	65	**42**
Electrical conductivity	µS/cm	170	150	200	850	410	**356**
TDS (calculated)		108.8	96	128	544	260	**227**
pH	-	5.4	4.7	4.6	3	4.6	**4.5**